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National Oceanic and Atmospheric Administration
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Alaska Fisheries Science Center

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Abstract

In 2022, the Resource Assessment and Conservation Engineering (RACE) Division of the National Marine Fisheries Service's (NMFS) Alaska Fisheries Science Center (AFSC) conducted the 40th eastern Bering Sea (EBS) Crab/Groundfish Bottom Trawl Survey and 5th northern Bering Sea (NBS) Crab/Groundfish Bottom Trawl Survey. The survey covered the eastern Bering Sea continental shelf (bottom depths between approximately 20 and 200 m) from the Alaska mainland coast to the U.S.-Russia Maritime Boundary between the Alaska Peninsula and the Bering Strait. Survey sampling was conducted using two chartered commercial stern trawlers, the 43.9-m FV *Alaska Knight* and 37.8-m FV *Vesteraalen*. 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, sex, length-frequency composition, and age structure samples were collected from ecologically and commercially important fish species.

Environmental data, including temperature, salinity, and irradiance were collected at every survey station. The 2022 mean bottom and surface temperatures in the EBS (2.6°C and 7.5°C) were near the 2.5°C and 6.8°C time-series average in 2022, respectively.

The estimated total biomass in the EBS increased from 13.2 million metric tons (t) in 2021 to 15.9 million t in 2022. The estimated total biomass in the NBS increased from 3 million t in 2021 to 3.5 million t in 2022. A total of 124 species of fish and 242 invertebrate taxa were identified during the EBS and NBS surveys.

This report compares the distribution and relative abundance of 37 fish species and two invertebrate taxa with side-by-side maps from the 2021 and 2022 EBS and NBS shelf bottom trawl surveys. For common fish species, abundance-at-length plots comparing the 2021 and 2022 EBS and NBS surveys are also presented. Survey results reported herein include estimates of biomass for most fishes and invertebrates, and estimates of population size, geographic distributions, and abundance-at-length of select fish species. Tables in the appendix list population estimates by sex and size group for principal fish species and species encountered during the surveys.

Changes in the abundance of some species between 2021 and 2022 surveys likely represent distributional shifts, as mobile species may be more abundant in the NBS during recent warm years, but may have shifted farther south again as the seasonal sea ice cover during the winters of 2020-21 and 2021-22 was more extensive than in the other recent years. This annual variation underscores the need for continuing EBS and NBS surveys on a regular basis, to continue monitoring the response of fish and invertebrate populations to a changing climate.

Contents

Introduction

In 2022, the Resource Assessment and Conservation Engineering (RACE) Division of National Marine Fisheries Service's (NMFS') Alaska Fisheries Science Center (AFSC) conducted the 40th Eastern Bering Sea (EBS) Crab/Groundfish Bottom Trawl Survey from May to July 2022 and 5th Northern Bering Sea (NBS) Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extension from July to August 2022. The EBS and NBS shelf bottom trawl surveys collect information about fish and invertebrate populations and environmental conditions to support fisheries stock assessment and management. The EBS survey has occurred annually (except in 2020 due to the COVID-19 pandemic) 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 (Lauth, 2011) has only been conducted in 2010, 2017, 2019, and 2021.

The data collected during the EBS and NBS 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 use 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).

This Technical Memorandum compares results from the 2022 survey with results from the prior year's surveys in the same regions (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). Specifically, the 2022 EBS survey results are compared with those from the 2021 EBS shelf bottom trawl survey and the 2022 NBS survey results are compared with those from the 2021 NBS shelf bottom trawl survey (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). For data referenced from previous surveys, refer to the AFSC Technical Memoranda cited 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 eastern 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, groundfishes such as walleye pollock (*Gadus chalcogrammus*), Pacific cod (*Gadus macrocephalus*) and yellowfin sole (*Limanda aspera*) have been the primary targets of commercial fisheries. Walleye pollock is the most abundant of the Bering Sea's commercially harvested species, with catches ranging from 0.8 million metric tons (t) in 2009 to 1.5 million t from 2003 to 2006 per year over the history 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*), which are detailed in Lang et al. (2019).

Federal government agencies have 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 United States 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 meter (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 the continental slope and area 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 (Stauffer, 2004; Hoff and Britt, 2011; Hoff, 2016). 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. **1** and **2**; 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. **1**) were added to monitor more northerly distributions of snow crab and walleye pollock. Annual sampling has continued since 1982 because the region encompasses major portions of the commercially exploited Bering Sea groundfish and crab populations that require management actions under the BSAI FMP.

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; Stabeno, Kachel, et al., 2012; Stevenson and Lauth, 2012, 2019). Although LOSI funding for the NBS extension was discontinued after the 2010 NBS survey, the survey resumed as a biennial survey in 2017 due to effects of changing ocean conditions on fish and crab distributions (Sigler et al., 2015). The NBS survey consists of 144 bottom trawl stations that 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**). In addition to the EBS shelf, the NBS shelf was also surveyed in 2010, 2017, 2019, 2021, and 2022 (Lauth, 2011; Lauth et al., 2019; Markowitz, Dawson, Charriere, Prohaska, Rohan, Haehn, et al., 2022; Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022a, 2022b). In 2018, a rapid response survey was conducted in the NBS using a different sampling design than the standard NBS survey. Therefore, the survey results from the 2018 NBS rapid response survey are not directly comparable to the results from the

2010, 2017, 2019, 2021, and 2022 NBS surveys. In 2020, no Bering Sea bottom trawl surveys were conducted due to the COVID-19 pandemic.

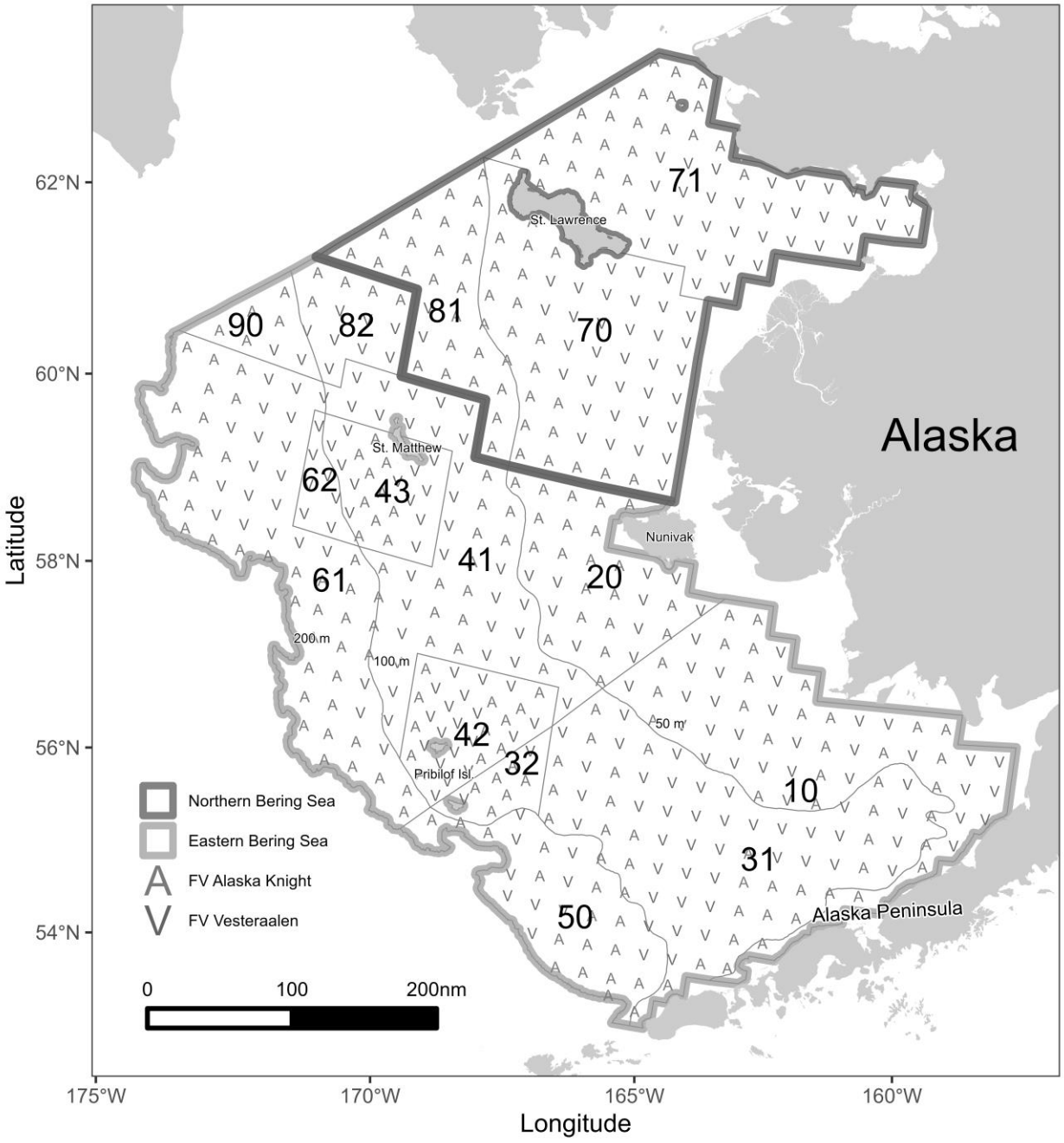

Figure 1. -- Stratification scheme used for data analysis of the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. The map also depicts the stations sampled by the FV *Alaska Knight* (A) and FV *Vesteraalen* (V).

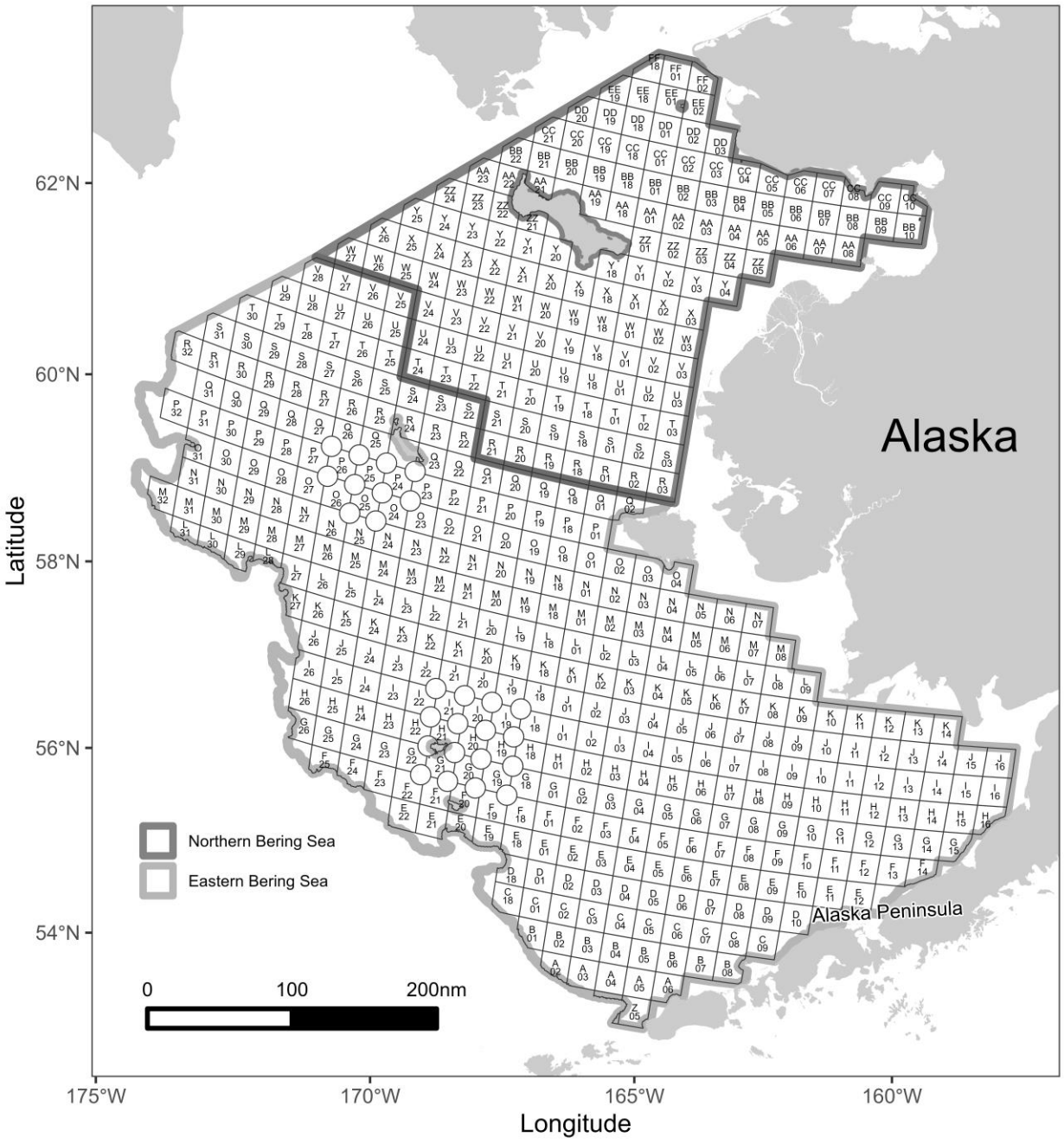

Figure 2. -- Sampling grid and station identifiers for the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. Corner stations (denoted by circles) are not labeled for legibility.

Methods

Survey Area and Sampling Design

The standardized eastern and northern Bering Sea bottom trawl surveys use a systematic design with 376 fixed sampling stations in the EBS and 144 fixed sampling stations in the NBS arranged on a regularly-spaced 37.04 × 37.04 km grid (20 × 20 nautical mile; Fig. **2**). Additional stations, called "corner stations", were added to the survey 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 grid cells. In addition to the EBS shelf bottom trawl survey, the 2022 NBS shelf bottom trawl survey was conducted using the same systematic sampling design for stations bounded by the U.S.-Russian Maritime Boundary and the Bering Strait, including Norton Sound.

Survey Vessels and Sampling Gear

The 2022 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 conduct the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

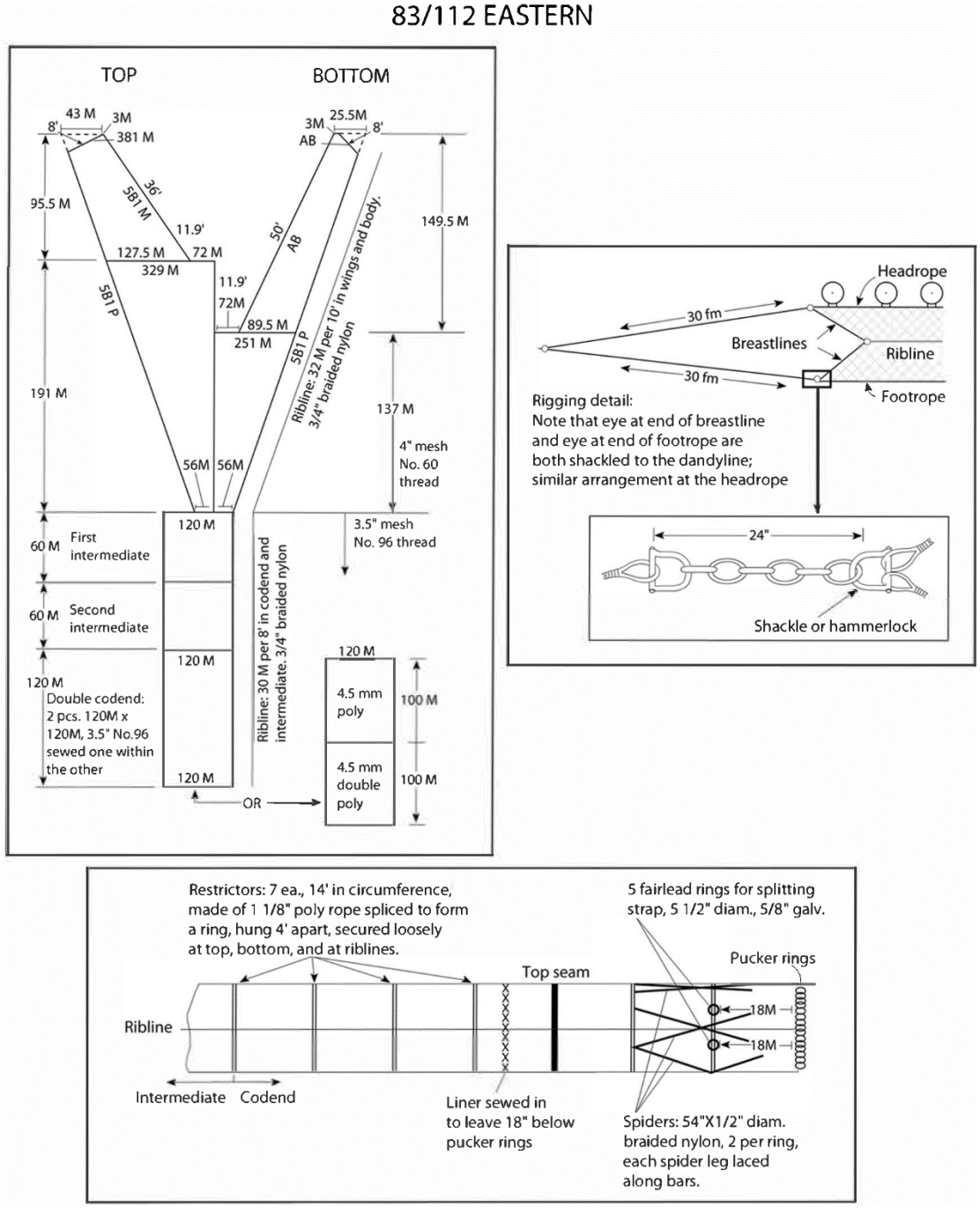

Figure 4. -- Schematic diagram of the 83-112 eastern otter trawl gear used during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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 customized Onset HOBO Pendant G Data Logger (accelerometer) in custom-made housing was attached to the center of the footrope and used as a bottom contact sensor 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 while the net was in contact with the seafloor.

In the EBS, the net mensuration system failed to record data for 20 tows on the FV *Vesteraalen*. In the NBS, the net mensuration system failed to record data for three tows on the FV *Alaska Knight*. To estimate missing net width values, the *mgcv* R package (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 based on an understanding of historical trends in fish movement and 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 (Nichol et al., 2019; Smith and Bakkala, 1982). In the EBS, the FV *Vesteraalen* started sampling on May 30, 2022, and ended on July 29, 2022 and the FV *Alaska Knight* started sampling on May 31, 2022, and ended on July 28, 2022.

The survey footprint included bathymetry between 20 m and 200 m. For design-based index catch analysis, this footprint was separated into 12 strata by the 50 m and 100 m isobaths and a biogeographic boundary line running from the southwest to the northeast (Fig. **1**; Halliday and Sassano (1988)). The stratum boundaries correspond with different oceanographic domains and biological communities (Coachman, 1986). 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). Overall sampling density across the EBS shelf was one station per 1,311 km^2, and within-stratum sampling density ranged from one station per 778 km^2 (Stratum 42) to one per 1,496 km^2 (Stratum 82; Table **1**). For some analyses (e.g., abundance-at-length), each high-density

stratum was combined with its respective depth-region stratum, 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 began sampling survey stations in the southwest corner of the NBS survey region. In the NBS, both vessels started sampling on July 29, 2022. Sampling ended on August 19, 2022 for the FV *Vesteraalen* and on August 20, 2022 for the FV *Alaska Knight*. 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. Overall sampling density for the NBS survey area was 1,381 km^2/station (Table **1**).

Table 1. -- Stratum areas and sampling densities used during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. Stratum area calculations were updated in 2022.

	Stratum	Representative area (km^2)	Stations successfully sampled	Sampling density (km^2/Stations successfully sampled)
EBS				
Inner Shelf	10	78,706	58	1,357
	20	41,193	31	1,329
Middle Shelf	31	94,978	69	1,376
	32	8,847	8	1,106
	41	62,310	44	1,416
	42	24,122	31	778
	43	21,064	22	957
	82	17,954	12	1,496
Outer Shelf	50	38,039	26	1,463
	61	87,777	60	1,463
	62	6,462	7	923
	90	11,539	8	1,442
Total		492,990	376	1,311
NBS				
Shelf	70	79,260	58	1,367
	71	81,255	58	1,401
	81	38,352	28	1,370
Total		198,867	144	1,381
EBS and NBS				
Total		691,857	520	1,330

Catch Sampling Procedures

Standard catch sampling procedures used in these Bering Sea bottom trawl 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, contained debris (e.g., derelict crab pots), or had visible changes in net mensuration data during the haul were redeployed to obtain a successful sample.

Catches estimated to be less than approximately 1,200 kg (2,650 lbs) were fully sorted and enumerated, while larger catches were weighed in aggregate or volumetrically measured and subsampled before sorting. The goal of subsampling was to obtain a representative sample, which required some variation in catch processing methods among hauls. Specific methods used for subsampling were dependent on the overall size and species composition of the catches. After sorting subsampled catches, individual species were weighed and counted in aggregate. 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 sorted from the entire catch and weighed. 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. 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 100 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, 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 11 fish species in the EBS and NBS (Table **2**). Otolith samples were collected following random-by-haul sampling method in both the EBS and NBS. 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. Weight and length 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 from four fish species and preserved in 10% formalin for later laboratory diet analysis (Table **3**). Arrowtooth flounder and Kamchatka flounder (*Atheresthes* spp.) stomachs were collected as one genus because they occupy a similar trophic niche in the Bering Sea (Yang and Livingston, 1986).

Table 2. -- Otolith collection types and counts during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Common name	Target collection number per haul	Collect when ≥ n individuals caught in each haul
EBS		
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 adults and 1 juvenile	4
yellowfin sole	3 individuals	10
northern rock sole	5 individuals	10
flathead sole	3 individuals	10
Bering flounder	3 individuals	10
Alaska plaice	2 individuals	1
Greenland turbot	8 adults and 1 juvenile	1
arrowtooth flounder	3 individuals	10
Kamchatka flounder	8 individuals	10
Pacific halibut	100% of individuals caught on the FV *AK Knight*	1
NBS		
random-by-haul		
walleye pollock	3 adults and 1 juvenile	20
Pacific cod	4 adults and 1 juvenile	4
yellowfin sole	3 individuals	10
northern rock sole	3 individuals	10
flathead sole	3 individuals	10
Bering flounder	3 individuals	10
Alaska plaice	2 individuals	1
Greenland turbot	3 individuals	10
arrowtooth flounder	3 individuals	10
Kamchatka flounder	1 individual	10
Pacific halibut	100% of individuals caught on the FV *AK Knight*	1

Table 3. -- Stomach collection targets during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Common name	EBS	NBS
Pacific halibut	600	150
arrowtooth flounder and Kamchatka flounder	1250	-
Pacific cod	1750	600
walleye pollock	2500	1200

Catch Data Analysis

Estimates of biomass, population, and size structure of fishes and invertebrate species were calculated from EBS and NBS survey data. Standard sampling procedures used are described in detail by Wakabayashi et al. (1985) and Stauffer (2004). A brief description of the procedures used in the analysis of Bering Sea survey data is presented below. 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 (100 hectares (ha) = 1 km^2) and number of fish per hectare for each stratum (Alverson and Pereyra, 1969; Lauth and Kotwicki, 2014). Area swept (ha) 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 errors during sample processing.

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.

Age estimates were obtained from otolith samples by the AFSC's Age and Growth Program 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 2022 NPFMC Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region (The Plan Team for the Groundfish Fisheries of the Bering Sea and Aleutian Islands, 2022a).

Additional Research Projects

In addition to standard survey operations, 22 additional research projects were undertaken in both the EBS and NBS, 6 additional research projects were undertaken in only the EBS and 2 additional research projects were undertaken in only the NBS during the 2022 survey season (Table **4**). A request for research proposals was issued on January 28, 2022. Project requests were prioritized and modified based on their potential support of AFSC Strategic Science Plans and mission and the feasibility of proposed projects given available survey resources and time. Some of the approved projects were new for 2022, 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) identified in Table **4**.

Table 4. -- Special projects and collections undertaken during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys, sorted by principal investigator and agency.

Project title	Principal investigator	Agency[1]
EBS & NBS		
Shark population genetics and age structure sampling	Cindy Tribuzio	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
MML Food Habits Reference Collection	Katie Luxa	AFSC-MML
Shellfish Photo Documentation Refresh	Allie Conrad	AFSC-RACE
Fish Condition Index-Pollock/Cod	Bianca Prohaska	AFSC-RACE
Bitter Crab Syndrome Monitoring	Erin Fedewa	AFSC-RACE
Snow Crab Condition	Erin Fedewa	AFSC-RACE
Length and Weight Collection for Arctic Cod, saffron Cod, Rex Sole, and Starry Flounder	Liz Dawson	AFSC-RACE
Specimen Collection for Outreach Events	Liz Dawson	AFSC-RACE
Morphological and Genetic Identification of Larval Stages of Sand Lance Species, *Ammodytes hexapterus* and *A. personatus*	Melanie Paquin	AFSC-RACE
Light Meter Calibration	Ned Laman	AFSC-RACE
CTD Data Collection	RACE	AFSC-RACE
Pacific Cod Tagging	Susanne McDermott	AFSC-RACE
Flatfish Genomics	Ingrid Spies	AFSC-REFM
Arctic and Saffron Cod Growth	Tom Helser	AFSC-REFM
Black Eye Syndrome: Eyestalk Collection	Maya Groner	BLOS
Black Eye Syndrome: Live Collection	Maya Groner	BLOS
IPHC Pacific Halibut Data Collection on NOAA Fisheries Groundfish Trawl Surveys	Kayla Ualesi	IPHC
Harmful Algal Bloom (HAB) Toxins in Alaskan Food Webs	Kathi Lefebvre	NWFSC
Forensic and eDNA Voucher Collection	Abigail Wells	NWFSC & UW Ichth. Collection
Population Genetics of Herring in the Bering Sea	Andrés López	UAF
Marine Ecology of Arctic and Pacific Lampreys	Trent Sutton	UAF
EBS		
Observer Collection	Sarah Friedman	AFSC-FMA
Blood Collection for Stress Physiology	Bianca Prohaska	AFSC-RACE
Tanner and Snow OA Collections	Chris Long	AFSC-RACE
Bitter Crab Live Collections	Erin Fedewa	AFSC-RACE
Crab Tagging	Leah Zacher	AFSC-RACE
15/30 Bottom Trawl Tow Duration Comparison	Lukas DeFilippo	AFSC-RACE
NBS		
Ongoing Mollusk Collection (Gastropods/Chitons)	Roger Clark	SBMNH & LACMNH
Investigation the Foraging Habits of Beluga in the Bering Sea	Mi-Ling Li	UD

[1]AFSC-FMA - Alaska Fisheries Science Center's Fisheries Monitoring & Assessment Division; IPHC - International Pacific Halibut Commission; NWFSC - Northwest Fisheries Science Center; AFSC-RACE - Alaska Fisheries Science Center's Resource Assessment & Conservation Engineering Division; AFSC-REFM - Alaska Fisheries Science Center's Resource Ecology & Fisheries Management Division; UAF - University of Alaska Fairbanks; AFSC-MML - Alaska Fisheries Science Center's Marine Mammal Laboratory; AFSC-ABL - Alaska Fisheries Science Center's Auke Bay Laboratories; SBMNH - Santa Barbara Museum of Natural History; BLOS - Bigelow Laboratory for Ocean Sciences; UW Ichth. Collection - University of Washington Ichthyology Collection; UD - University of Delaware; LACMNH - Natural History Museum of Los Angeles County; AFSC-MACE - Alaska Fisheries Science Center's Midwater Assessment & Conservation Engineering Division

Results and Discussion

A total of 376 EBS stations and 144 NBS stations were successfully sampled in 2022 (Fig. **1**). Haul and catch data from successfully trawled stations that were used for analyses in this section are available for download from the Fisheries One Stop Shop (NOAA Fisheries, Alaska Fisheries Science Center, 2023).

Ocean Temperatures and the Cold Pool

Water temperatures near the bottom (Figs. **5** and **6**) and near the surface (Figs. **7** and **8**) varied over space and among years due to variation in atmospheric and oceanic conditions that influence temperature patterns in the EBS (Stabeno, Farley Jr., et al., 2012). Within years, the warmest bottom temperatures were observed in the inner domain (bottom depths <50 m) along the Alaska mainland where the water column is fully mixed throughout the summer, which allows solar heating throughout the water column (Coachman, 1986). The coldest bottom temperatures typically occurred in the middle domain (50–100 m bottom depth) where strong two-layer stratification during summer inhibits heat transfer to the bottom layer, which allows a seasonal 'cold pool' (bottom temperatures ≤ 2°C) to persist from spring though the end of fall. In the southeastern Bering Sea, surface temperatures generally increased from the interior of Bristol Bay to the northwestern outer shelf and into Norton Sound. These temperature patterns reflect seasonal warming that occurs over the duration of the survey (Cokelet, 2016).

The mean EBS shelf bottom temperature was 2.6°C in 2022, which was near the 2.5°C time-series average from 1982 to 2022 (Fig. **9**). The near-average bottom temperature in 2022 represents a departure from recent years (2016–2021), which included four of the five warmest years in the 40-year time series. Over the 40-year time series (1982–2022) of the EBS shelf bottom trawl survey, annual mean summer bottom temperatures have ranged from 0.7°C to 4.4°C. The 2022 mean EBS shelf surface temperature (7.5°C) was warmer than the times-series average surface temperature (6.8°C) and mean surface temperature in 2021 (7.2°C). During the last 16 years, bottom temperatures from 2006-2013 were colder than average ("cold stanza"), while 2014-2019 and 2021 were warmer than average ("warm stanza").

Water temperatures observed in the NBS in 2022 were similar to those observed in 2021. The mean NBS bottom temperature in 2022 was 3.9°C, which was within 0.01°C of mean bottom temperature in 2021 (Fig. **9**). The mean NBS surface temperature was 8.1°C, slightly cooler than the mean surface temperature in 2021 (8.4°C).

The cold pool area is defined as the extent (in square kilometers) of the eastern Bering Sea bottom trawl survey area with bottom temperatures ≤ 2°C (Rohan et al., 2022). The size and location of the cold pool is primarily influenced by the extent of seasonal sea ice cover during the preceding winter and spring and the timing of sea ice retreat during spring (Stabeno and Bell, 2019). The cold pool is primarily found in the middle domain (50–100 m bottom depth), which is fully mixed during the winter and has two-layer stratification during the summer. Years with extensive sea ice that persists into spring have a larger cold pool that can extend into Bristol Bay and as far south as the Alaska Peninsula. Years with smaller sea ice extent result in smaller cold pools that are limited to the northern edge of the EBS shelf survey area. Cold pool area is strongly correlated (r^2 = 0.94) with mean bottom temperature on the EBS shelf.

The cold pool covered nearly the entire middle domain north of 57°N in 2022 and was larger than in 2021 (12.0%; 58,975 km^2; Fig. **5**). The spatial footprint of the cold pool was similar to the most recent near-

average year in 2017 (34.2%; 169,150 km^2). In 2022, the cold pool covered 36.2% (178,625 km^2) of the EBS shelf survey area and was near the time series mean (36.6%; 181,018 km^2; Fig. **10**). During the 40-year time series, cold pool area has ranged from a minimum of 6,150 km^2 in 2018 to a maximum of 385,975 km^2 in 1999, respectively comprising 1.2% to 78.2% of the total EBS shelf area.

Interannual variation in bottom temperature and cold pool area influences the distribution (Kotwicki and Lauth, 2013; Stevenson et al., 2022; Stevenson and Lauth, 2019; Thorson et al., 2020), migration (Nichol et al., 2019), recruitment (Cooper et al., 2020), and biological productivity (Grüss et al., 2021) of fishes and crabs in the Bering Sea. The size of the cold pool influences availability of demersal species to bottom-trawl surveys by mediating migration between the EBS shelf, NBS, western Bering Sea, and EBS continental slope (O'Leary et al., 2022; Zador et al., 2011). Subarctic fish species tend to avoid areas with bottom temperatures below 0°C or 1°C, depending on the species (Baker, 2021; Eisner et al., 2020). Meanwhile, colder temperatures may also provide a habitat refuge for cold-adapted species (Fedewa et al., 2020). Similar to 2017, the cold pool likely did not pose a major temperature barrier to the northward migration of mobile subarctic species from the EBS shelf to the NBS, such as walleye pollock and Pacific cod.

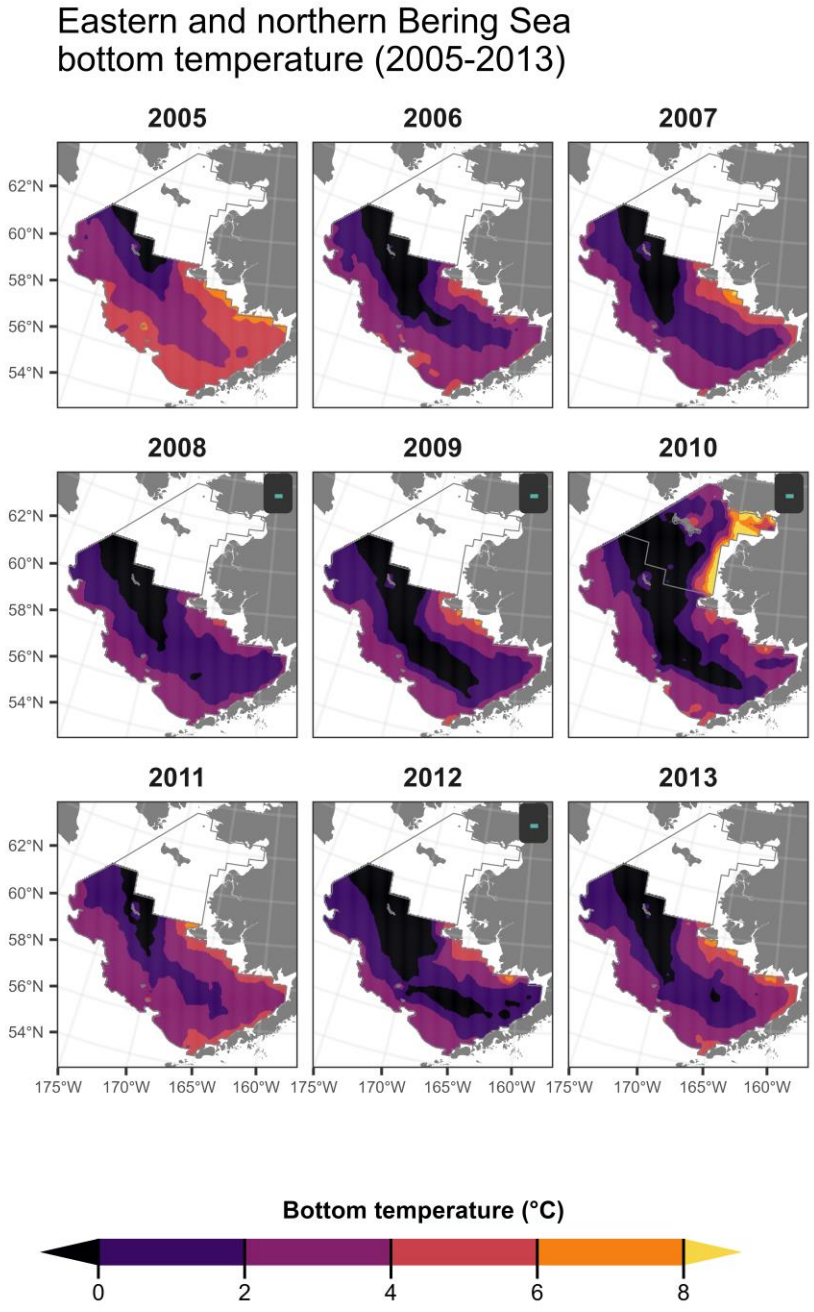

Figure 5. -- Bottom temperatures (°C) during the 2005-2013 eastern and northern Bering Sea shelf bottom trawl surveys. Years in which the mean bottom temperature is 1 or more standard deviations above or below the time-series mean bottom temperature are denoted with '+' and '-' in the upper right-hand corner of each subplot, respectively.

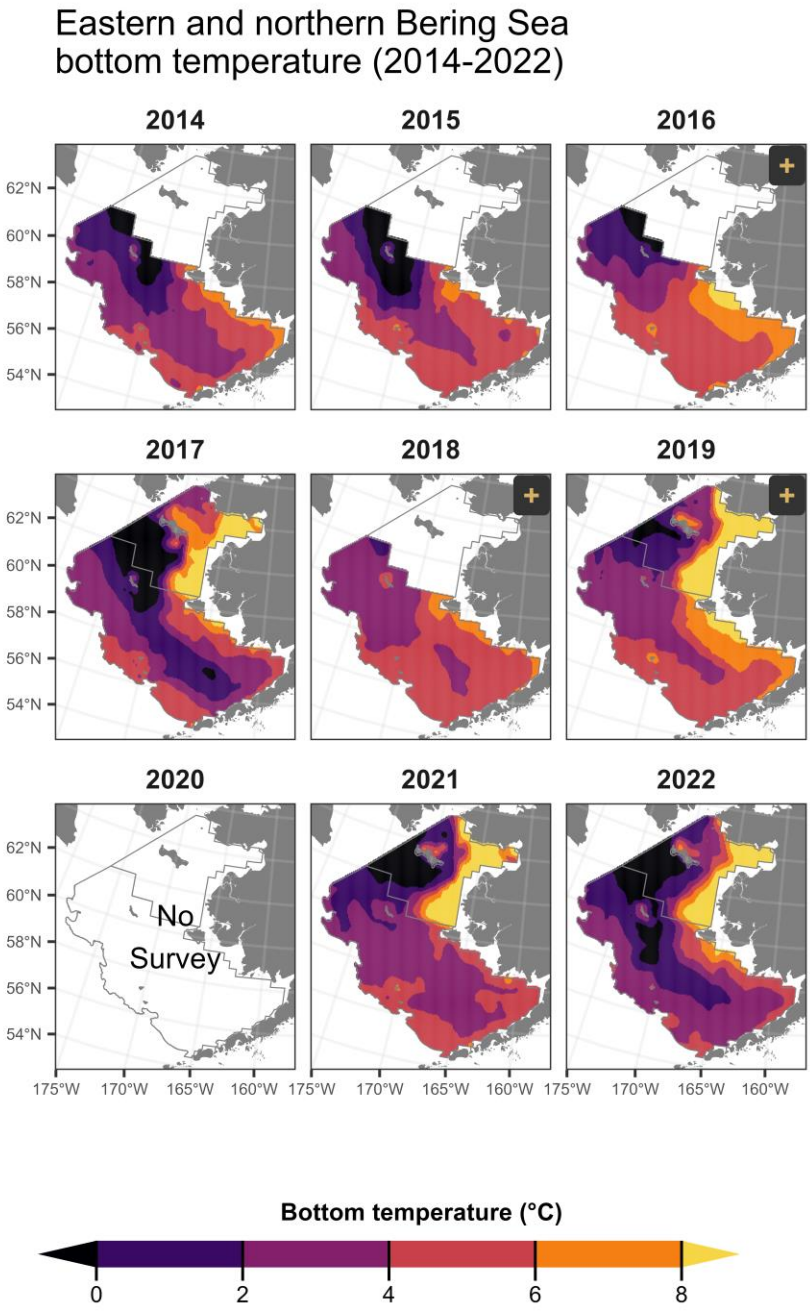

Figure 6. -- Bottom temperatures (°C) during the 2014-2022 eastern and northern Bering Sea shelf bottom trawl surveys. Years in which the mean bottom temperature is 1 or more standard deviations above or below the time-series mean bottom temperature are denoted with '+' and '-' in the upper right-hand corner of each subplot, respectively.

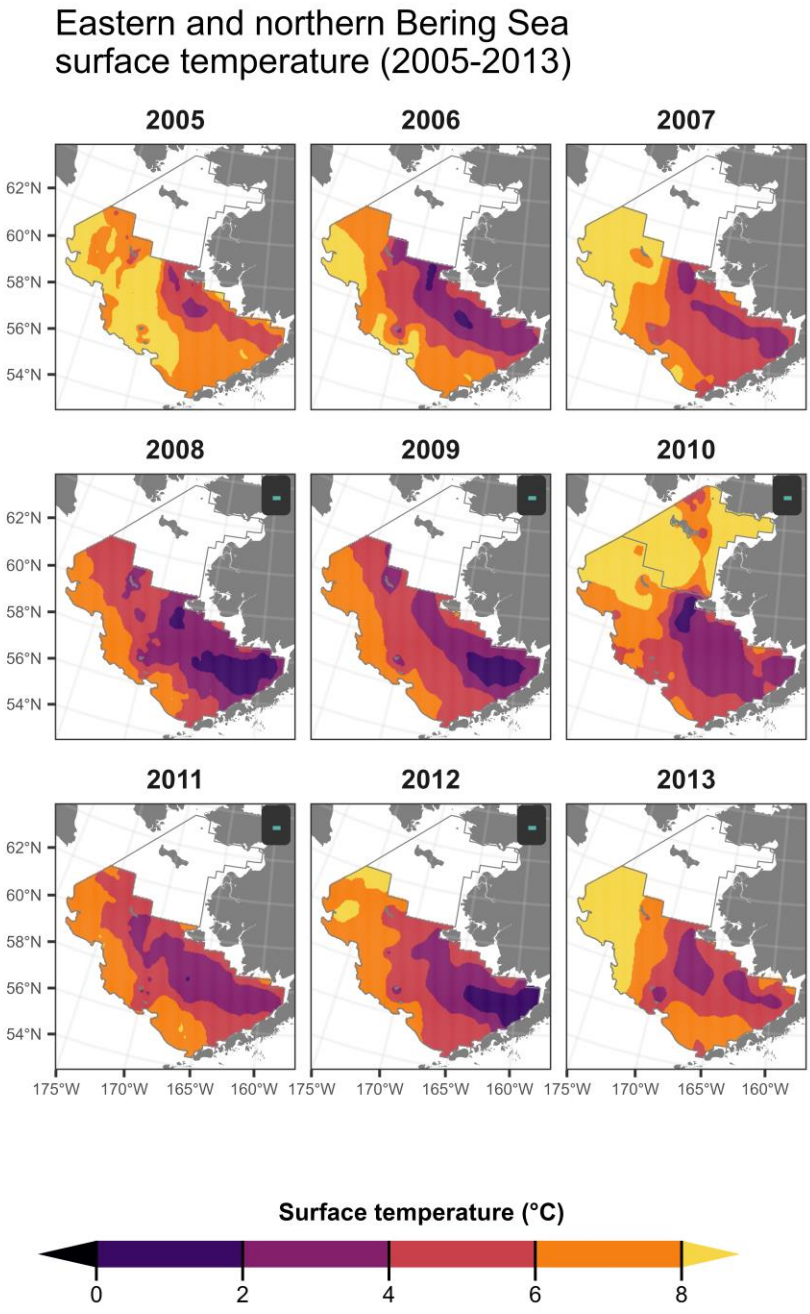

Figure 7. -- Surface temperatures (°C) during the 2005-2013 eastern and northern Bering Sea shelf bottom trawl surveys. Years in which the mean surface temperature is 1 or more standard deviations above or below the time-series mean surface temperature are denoted with '+' and '-' in the upper right-hand corner of each subplot, respectively.

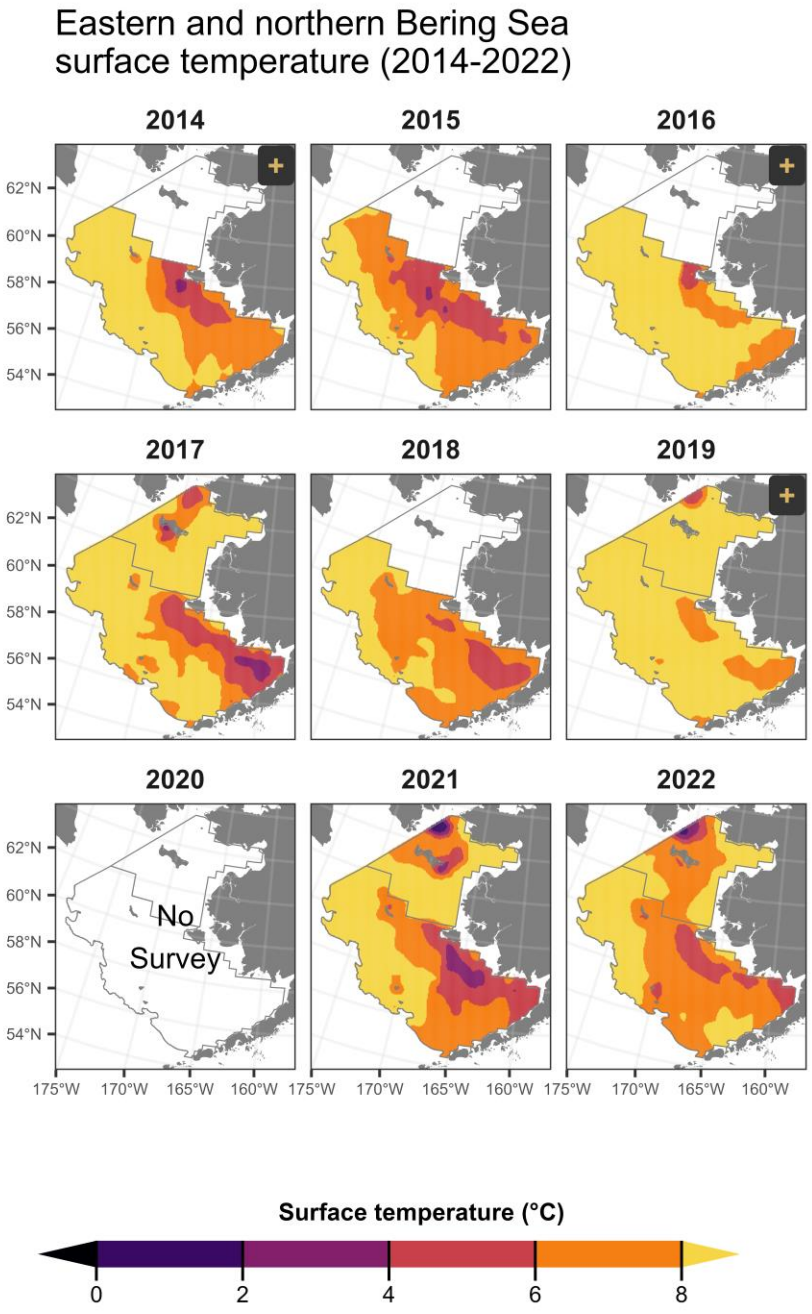

Figure 8. -- Surface temperatures (°C) during the 2014-2022 eastern and northern Bering Sea shelf bottom trawl surveys. Years in which the mean surface temperature is 1 or more standard deviations above or below the time-series mean surface temperature are denoted with '+' and '-' in the upper right-hand corner of each subplot, respectively.

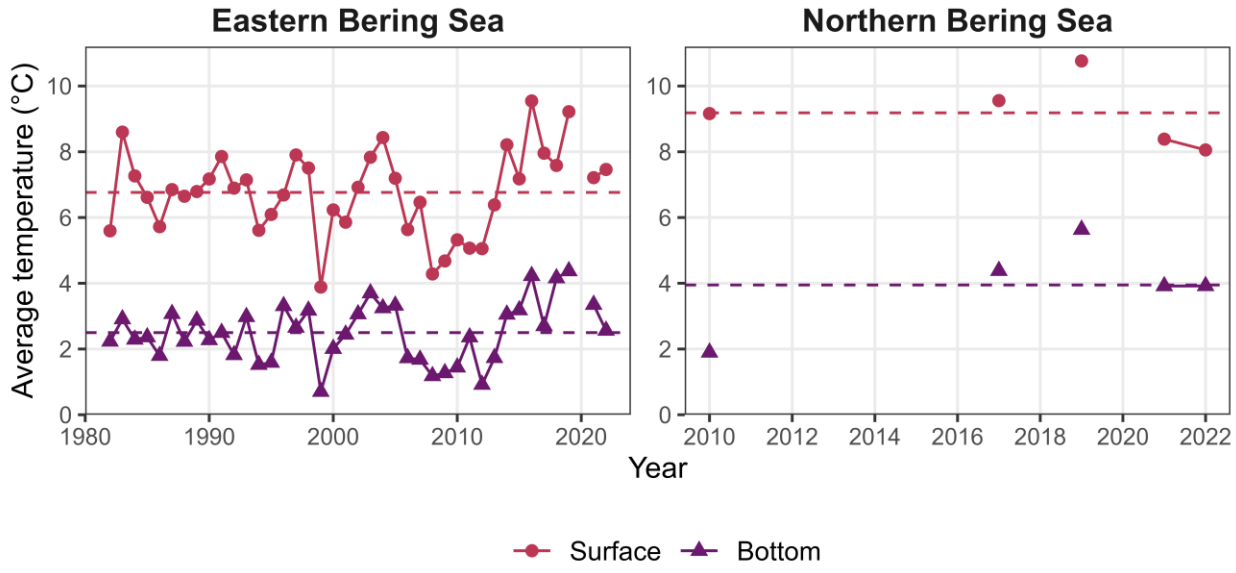

Figure 9. -- Average summer surface and bottom and time-series average surface and bottom (dashed lines) temperatures (°C) on the eastern Bering Sea shelf, based on data collected during standardized summer bottom trawl surveys from 1982–2022 (left), and northern Bering Sea shelf (right) based on data collected during standardized summer bottom trawl surveys.

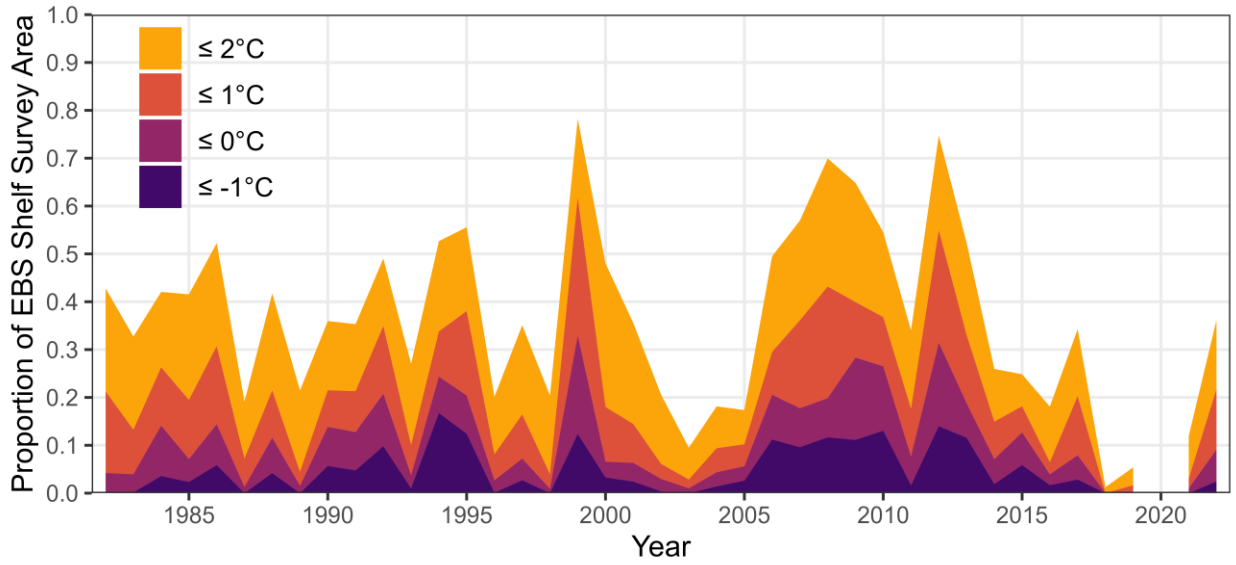

Figure 10. -- Annual summer cold pool extent on the eastern Bering Sea shelf, based on observations from the eastern Bering Sea bottom trawl survey. The extent of the cold pool is shown as a percentage of the total southern eastern Bering Sea shelf survey area. Shading denotes near-bottom temperatures ≤ 2°C, ≤ 1°C, ≤ 0°C, and ≤ -1°C.

Survey Data and Specimen Collections

Specimens collected during the 2022 EBS and NBS shelf trawl survey are shown in Tables **5** and **6**. Other special collections are listed in Table **4**.

Table 5. -- Biological data collected during the 2022 eastern Bering Sea shelf bottom trawl survey. The annual crab technical memorandum produced by the shellfish assessment program summarizes crab samples collected during the survey.

EBS	Length measurements	Otolith age structure samples	Stomach samples	Stress physiology samples	Antifreeze blood samples	Fat-meter condition samples	Genetic samples	Genetic fin clip samples
Alaska plaice	8,116	459	-	-	-	-	-	-
Alaska skate	3,783	-	-	-	-	-	-	-
Aleutian skate	58	-	-	-	-	-	-	-
Arctic cod	57	-	-	-	-	-	-	-
arrowtooth flounder	10,165	482	-	-	-	-	-	-
arrowtooth flounder and Kamchatka flounder	-	-	630	-	-	-	-	40
Atka mackerel	7	-	-	-	-	-	-	-
Bering flounder	1,107	84	-	-	-	-	-	-
Bering skate	201	-	-	-	-	-	-	-
big skate	24	-	-	-	-	-	-	-
bigmouth sculpin	149	-	-	-	-	-	-	-
blackspotted rockfish	36	-	-	-	-	-	-	-
butter sole	532	-	-	-	-	-	-	-
chinook salmon	2	-	-	-	-	-	-	-
chum salmon	2	-	-	-	-	-	-	-
Dover sole	37	-	-	-	-	-	-	-
dusky rockfish	1	-	-	-	-	-	-	-
flathead sole	17,625	748	-	-	-	-	-	-
great sculpin	813	-	-	-	-	-	-	-
Greenland turbot	73	70	-	-	-	-	-	-
Kamchatka flounder	1,159	318	-	-	-	-	-	-
longhead dab	2,127	-	-	-	-	-	-	-
longnose skate	1	-	-	-	-	-	-	-
mud skate	4	-	-	-	-	-	-	-
northern rock sole	20,244	866	-	-	-	-	-	-
northern rockfish	105	-	-	-	-	-	-	-
Pacific cod	12,375	1,456	1,013	-	85	102	-	-
Pacific halibut	3,248	-	441	60	-	-	-	-
Pacific ocean perch	439	-	-	-	-	-	-	-
Pacific sleeper shark	2	-	-	-	-	-	2	-
plain sculpin	1,734	-	-	-	-	-	-	-
rex sole	1,787	-	-	-	-	-	-	-
rougheye rockfish	1	-	-	-	-	-	-	-
sablefish	139	-	-	-	-	-	-	-
saffron cod	18	-	-	-	-	-	-	-
Sakhalin sole	79	-	-	-	-	-	-	-
shorthorn sculpin	15	-	-	-	-	-	-	-

EBS	Length measurements	Otolith age structure samples	Stomach samples	Stress physiology samples	Antifreeze blood samples	Fat-meter condition samples	Genetic samples	Genetic fin clip samples
southern rock sole	230	-	-	-	-	-	-	-
spiny dogfish	2	-	-	-	-	-	-	-
starry flounder	922	-	-	-	-	-	-	-
walleye pollock	36,687	1,614	1,581	-	-	110	-	-
whiteblotched skate	1	-	-	-	-	-	-	-
yellow Irish lord	1,000	-	-	-	-	-	-	-
yellowfin sole	16,765	589	-	-	-	-	-	30
Total	**141,872**	**6,686**	**3,665**	**60**	**85**	**212**	**2**	**70**

Table 6. -- Biological data collected during the 2022 northern Bering Sea shelf bottom trawl survey. The annual crab technical memorandum produced by the shellfish assessment program summarizes crab samples collected during the survey.

NBS	Length measurements	Otolith age structure samples	Stomach samples	Fat-meter condition samples	Genetic fin clip samples
Alaska plaice	8,754	262	-	-	-
Alaska skate	373	-	-	-	-
Arctic cod	410	-	-	-	-
arrowtooth flounder	2	-	-	-	-
Bering flounder	1,696	127	-	-	34
butterfly sculpin	1	-	-	-	-
chum salmon	1	-	-	-	-
flathead sole	5	-	-	-	-
great sculpin	53	-	-	-	-
longhead dab	749	-	-	-	-
northern rock sole	2,584	138	-	-	-
Pacific cod	2,450	350	303	53	-
Pacific halibut	332	-	50	-	-
plain sculpin	1,024	-	-	-	-
saffron cod	4,422	-	-	-	-
Sakhalin sole	511	-	-	-	-
shorthorn sculpin	165	-	-	-	-
starry flounder	1,445	-	-	-	-
walleye pollock	7,583	410	215	83	-
yellow Irish lord	2	-	-	-	-
yellowfin sole	12,534	365	-	-	-
Total	**45,096**	**1,652**	**568**	**136**	**34**

Species Composition

A total of 124 different fish species representing 23 families and 70 genera were identified during the 2022 EBS and NBS surveys (Appendix Tables **A-82** and **B-84**). In 2022, the EBS survey recorded 95 total taxa, of which 84 were identified to the species level and the NBS survey recorded 70 total taxa, of which 59 were identified to the species level. The remaining fish taxa in each survey area were identified to the genus level or higher. Of the 95 fish species found in the EBS, 49 did not occur in the NBS (Table **7**). In comparison, 22 of the 70 fish species encountered in the NBS were not encountered in EBS (Table **7**). In 2022, seven flatfish species were encountered in the EBS but not in the NBS (butter sole (*Isopsetta isolepis*), Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), Greenland turbot (*Reinhardtius hippoglossoides*), Kamchatka flounder (*Atheresthes evermanni*), rex sole (*Glyptocephalus zachirus*), and southern rock sole (*Lepidopsetta bilineata*)) and one flatfish species was encountered in the NBS but not in the EBS (Arctic flounder (*Liopsetta glacialis*); Table **7**).

Two-hundred and forty-two different invertebrate taxa representing 14 phyla were identified during the 2022 EBS and NBS surveys (Appendix Tables **A-83** and **B-85**). In 2022, 219 invertebrate taxa were recorded in the EBS survey, of which 119 were identified to the species level and 140 invertebrate taxa were recorded in the NBS survey, of which 80 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 7. -- Composition of fish taxa encountered in the catches of the eastern and northern Bering Sea shelf bottom trawl surveys.

Encountered in EBS but not in NBS **Common Name *(Scientific Name)***	**Encountered in NBS but not 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)*
Atka mackerel *(Pleurogrammus monopterygius)*	Arctic sculpin *(Myoxocephalus scorpioides)*
Bering skate *(Bathyraja interrupta)*	Arctic shanny *(Stichaeus punctatus)*
big skate *(Beringraja binoculata)*	Arctic staghorn sculpin *(Gymnocanthus tricuspis)*
bigmouth sculpin *(Hemitripterus bolini)*	bearded warbonnet *(Chirolophis snyderi)*
blackfin poacher *(Bathyagonus nigripinnis)*	belligerent sculpin *(Megalocottus platycephalus)*
blackspotted rockfish *(Sebastes melanostictus)*	butterfly sculpin *(Hemilepidotus papilio)*
blotched snailfish *(Crystallichthys cyclospilus)*	eyeshade sculpin *(Nautichthys pribilovius)*
butter sole *(Isopsetta isolepis)*	fourhorn sculpin *(Myoxocephalus quadricornis)*
darkfin sculpin *(Malacocottus zonurus)*	hairhead sculpin *(Trichocottus brashnikovi)*
Dover sole *(Microstomus pacificus)*	hamecon *(Artediellus scaber)*
dragon poacher *(Percis japonicus)*	Irish lord *(Hemilepidotus sp.)*
dusky rockfish *(Sebastes variabilis)*	kelp snailfish *(Liparis tunicatus)*
English sole *(Parophrys vetulus)*	longsnout prickleback *(Lumpenella longirostris)*
eulachon *(Thaleichthys pacificus)*	marbled eelpout *(Lycodes raridens)*
fish doctor *(Gymnelus viridis)*	nebulous snailfish *(Liparis bathyarcticus)*
fourline snakeblenny *(Eumesogrammus praecisus)*	polar eelpout *(Lycodes turneri)*
gray starsnout *(Bathyagonus alascanus)*	saddled eelpout *(Lycodes mucosus)*
Greenland turbot *(Reinhardtius hippoglossoides)*	shortmast sculpin *(Nautichthys robustus)*
hookhorn sculpin *(Artediellus pacificus)*	veteran poacher *(Podothecus veternus)*
Kamchatka flounder *(Atheresthes evermanni)*	

Encountered in EBS but not in NBS **Common Name *(Scientific Name)***	**Encountered in NBS but not in EBS** **Common Name *(Scientific Name)***
kelp greenling *(Hexagrammos decagrammus)*	
longnose poacher *(Leptagonus leptorhynchus)*	
longnose skate *(Raja rhina)*	
mud skate *(Bathyraja taranetzi)*	
northern rockfish *(Sebastes polyspinis)*	
Pacific ocean perch *(Sebastes alutus)*	
Pacific sandfish *(Trichodon trichodon)*	
Pacific sleeper shark *(Somniosus pacificus)*	
Pacific tomcod *(Microgadus proximus)*	
peachskin snailfish *(Careproctus scottae)*	
prowfish *(Zaprora silenus)*	
rex sole *(Glyptocephalus zachirus)*	
rougheye rockfish *(Sebastes aleutianus)*	
roughspine sculpin *(Triglops macellus)*	
sablefish *(Anoplopoma fimbria)*	
sawback poacher *(Leptagonus frenatus)*	
searcher *(Bathymaster signatus)*	
shortfin eelpout *(Lycodes brevipes)*	
slim sculpin *(Radulinus asprellus)*	
southern rock sole *(Lepidopsetta bilineata)*	
spectacled sculpin *(Triglops scepticus)*	
spiny dogfish *(Squalus suckleyi)*	
spinyhead sculpin *(Dasycottus setiger)*	
thorny sculpin *(Icelus spiniger)*	
whitebarred prickleback *(Poroclinus rothrocki)*	
whiteblotched skate *(Bathyraja maculata)*	

Biomass, Abundance, and Catch per Unit Effort

The total demersal animal biomass for the EBS was estimated at 14.5 million t and total demersal animal biomass for the NBS was estimated at 3.3 million t. In the EBS, the proportion of fishes (78%; Table **8**) was higher than invertebrates (22%; Table **9**) and in the NBS, the proportion of fishes (50%; Table **10**) was about the same as invertebrates (50%; Table **11**). The lower relative fish biomass in the NBS than in the EBS is consistent with results of a broader analysis of all survey years presented by Stevenson and Lauth (2012) which showed decreasing fish biomass with increasing latitude on the eastern Bering Sea continental shelf.

Pleuronectidae (flatfishes) and Gadidae (cods) were the fish families with highest biomass in both the EBS (36.7% and 33.2% of the total biomass, respectively), and the NBS (29.7% and 17.7% of the total biomass, respectively; Tables **8** and **10**). In the EBS, the family Gadidae was primarily comprised of walleye pollock (*Gadus chalcogrammus*, 28.7%) and Pacific cod (*Gadus macrocephalus*, 4.5%); the family Pleuronectidae was primarily comprised of yellowfin sole (*Limanda aspera*, 14.1%), northern rock sole (*Lepidopsetta polyxystra*, 9%), and flathead sole (*Hippoglossoides elassodon*, 4.9%). In the NBS, the family Gadidae was primarily comprised of walleye pollock (*Gadus chalcogrammus*, 12.1%), Pacific cod (*Gadus macrocephalus*, 4.7%), and other cods (0.9%); the family Pleuronectidae was primarily comprised of yellowfin sole (*Limanda aspera*, 16.8%) and northern rock sole (*Lepidopsetta polyxystra*, 1.4%).

Noticeable changes were observed in the EBS and NBS the benthic communities between 2021 and 2022. The total estimated biomass in the EBS increased from 12 million t in 2021 to 14.5 million t in 2022. Taxa that significantly increased in biomass in the EBS included saffron cod (705%), Pacific herring (237%), Arctic cod (100%), all sea anemones (71%), and corals (41%; Table **12**). Large decreases in EBS biomass were observed for Kamchatka flounder (-10%), northern Neptune whelk (-12%), Greenland turbot (-26%), Bering flounder (-34%), and shorthorn sculpin (-74%; Table **12**). The total estimated biomass in the NBS increased from 2.9 million t in 2021 to 3.3 million t in 2022. Taxa that significantly increased in biomass in the NBS included all sea anemones (679%), Arctic cod (367%), saffron cod (178%), all shrimps (176%), and other crabs (93%; Table **13**). Large decreases in NBS biomass were observed for shorthorn sculpin (-52%), arrowtooth flounder (-77%), Pacific herring (-80%), great sculpin (-83%), and Kamchatka flounder (-100%; Table **13**). While exhaustive efforts are made to standardize catch processing and data collection, some inconsistencies may exist between years, vessels, and crews which may affect the interpretation of these differences.

The 10 most abundant fish taxa in the EBS accounted for 66.7% (an average of 212.7 kg/ha per station) of total mean fish and invertebrate CPUE (an average of 319.0 kg/ha per station) and 73.7% of total mean fish CPUE (an average of 288.5 kg/ha per station; Tables **14** and **15**).The 10 most abundant fish taxa in the NBS accounted for 48.6% (an average of 80.3 kg/ha per station) of total mean fish and invertebrate CPUE (an average of 165.3 kg/ha per station) and 98.1% of total mean fish CPUE (an average of 81.9 kg/ha per station; Tables **14** and **15**).

Table 8. -- Biomass estimates (t) for major fish taxa collected during the 2022 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)		19,936 ±	4,914	0.0014	5,362	1,991	5,823	4,536	2,151	73	0	0
Cottidae (sculpins)		155,681 ±	41,435	0.0108	34,825	9,260	20,711	39,129	1,627	43,876	2,444	3,808
Gadidae (cods)	Pacific cod	647,400 ±	85,213	0.0448	109,014	22,024	119,180	214,634	40,333	119,379	9,261	13,575
	walleye pollock	4,153,971 ±	666,477	0.2872	201,951	55,243	831,816	1,501,998	139,276	1,275,864	47,372	100,451
	other cods	95 ±	57	<0.0001	6	21	16	0	0	0	51	0
	total Gadidae	4,801,466 ±	655,276	0.3320	310,972	77,288	951,012	1,716,633	179,609	1,395,243	56,684	114,026
Hexagrammidae (greenlings)		439 ±	271	<0.0001	72	79	79	39	86	84	0	0
Liparidae (snailfishes)		630 ±	321	<0.0001	120	2	5	129	59	136	99	80
Osmeridae (smelts)		561 ±	347	<0.0001	110	9	20	26	393	0	2	0
Pleuronectidae (flatfishes)	Alaska plaice	385,294 ±	85,293	0.0266	103,346	63,788	92,925	114,696	42	2,008	7,163	1,326
	arrowtooth flounder	521,615 ±	123,028	0.0361	1,865	141	191,766	34,938	195,258	96,413	74	1,160
	Bering flounder	6,237 ±	2,282	0.0004	0	26	26	2,522	0	37	1,901	1,726
	flathead sole	703,375 ±	261,126	0.0486	27,726	687	165,216	100,018	58,153	345,496	2,883	3,196
	Kamchatka flounder	29,699 ±	5,256	0.0021	0	0	3,225	4,144	5,023	15,605	12	1,690
	northern rock sole	1,294,581 ±	224,604	0.0895	565,470	100,907	271,115	344,649	1,487	5,605	2,887	2,460
	Pacific halibut	149,064 ±	39,445	0.0103	40,678	28,073	24,461	34,341	6,256	14,811	272	172
	yellowfin sole	2,039,968 ±	271,288	0.1410	1,077,410	359,428	366,347	234,401	0	13	2,362	7
	other flatfish	183,086 ±	44,251	0.0127	107,430	13,239	27,033	143	20,469	14,596	176	0
	total Pleuronectidae	5,312,918 ±	455,185	0.3673	1,923,924	566,290	1,142,113	869,851	286,688	494,584	17,730	11,737
Rajidae (skates)	Alaska skate	463,017 ±	52,237	0.0320	91,396	55,494	74,385	83,852	29,217	108,876	7,369	12,429
	other skates	45,934 ±	15,413	0.0032	542	6	16,623	822	15,249	12,425	5	263
	total Rajidae	508,951 ±	53,253	0.0352	91,939	55,500	91,007	84,674	44,466	121,301	7,374	12,692
Scorpaenidae (rockfishes)	Pacific ocean perch	126,805 ±	241,004	0.0088	0	0	0	4	1,448	125,353	0	0
	other rockfish	3,973 ±	4,166	0.0003	0	0	0	0	1,703	2,270	0	0
	total Scorpaenidae	130,778 ±	241,496	0.0090	0	0	0	4	3,151	127,623	0	0
Stichaeidae (blennies)		26 ±	16	<0.0001	2	2	12	6	0	3	0	1
Zoarcidae (eelpouts)		45,571 ±	14,501	0.0032	29	0	2,690	3,980	203	34,293	219	4,156
Other		252,611 ±	113,586	0.0175	96,214	39,693	34,202	49,697	12,570	11,379	3,911	4,946
Total		**11,229,567 ±**	**843,970**	**0.7764**	**2,463,570**	**750,113**	**2,247,674**	**2,768,704**	**531,003**	**2,228,595**	**88,463**	**151,446**

[1]Total estimated biomass is 14,463,090 t for fish and invertebrates in the EBS bottom trawl survey.

Table 9. -- Biomass estimates (t) for major invertebrate taxa collected during the 2022 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
Ascidiacea		142,339 ±	53,078	0.0098	6,123	3,251	48,014	84,913	25	13	0	0
Coelenterata		226,699 ±	41,022	0.0157	8,649	771	83,310	83,753	17,064	22,806	6,769	3,578
Crustacea	shrimps	4,940 ±	2,198	0.0003	114	52	79	191	398	3,693	12	402
	other crustaceans	3,084 ±	3,182	0.0002	431	7	0	1,113	17	1,517	0	0
	total Crustacea	8,025 ±	3,866	0.0006	546	59	79	1,304	415	5,209	12	402
Echinodermata	Asteroidea (sea stars)	1,289,718 ±	153,017	0.0892	532,889	141,141	230,495	185,260	1,372	166,712	4,780	27,069
	Echinoidea (sea urchins)	43,295 ±	39,951	0.0030	134	0	20,906	2,189	18,568	1,499	0	0
	Holothuroidea (sea cucumbers)	13,267 ±	13,402	0.0009	5,440	0	6,862	912	18	18	15	0
	Ophiuroidea (brittle stars)	319,120 ±	94,586	0.0221	11,341	2,697	78,667	66,113	5,103	151,562	2,718	917
	total Echinodermata	1,665,400 ±	184,562	0.1151	549,805	143,839	336,931	254,474	25,061	319,791	7,514	27,987
Mollusca	Gastropoda (snails)	478,656 ±	89,236	0.0331	13,137	6,385	159,010	137,729	9,276	135,438	3,638	14,042
	octopuses	4,941 ±	2,545	0.0003	0	0	827	283	0	3,827	0	3
	Pelecypoda (bivalves)	14,259 ±	7,455	0.0010	2,085	192	9,868	1,383	372	347	9	5
	squids	39 ±	40	<0.0001	0	0	2	0	24	13	0	0
	total Mollusca	497,895 ±	89,592	0.0344	15,222	6,578	169,707	139,396	9,671	139,625	3,646	14,050
Porifera (sponges)		14,644 ±	11,103	0.0010	757	380	12,366	270	665	207	0	0
Other		674,997 ±	73,606	0.0467	44,004	15,376	244,499	235,262	17,594	78,924	30,926	8,411
Total		**3,229,999 ±**	**228,878**	**0.2233**	**625,105**	**170,253**	**894,906**	**799,371**	**70,495**	**566,575**	**48,867**	**54,427**

[1]Total estimated biomass is 14,463,090 t for fish and invertebrates in the EBS bottom trawl survey.

Table 10. -- Biomass estimates (t) for major fish taxa collected during the 2022 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)		770 ±	296	0.0002	600	155	16
Cottidae (sculpins)		20,780 ±	5,174	0.0064	9,035	10,558	1,187
Gadidae (cods)	Pacific cod	153,735 ±	40,157	0.0472	96,501	26,747	30,487
	walleye pollock	394,585 ±	132,050	0.1212	169,217	135,688	89,680
	other cods	28,125 ±	9,499	0.0086	8,658	19,293	174
	total Gadidae	576,445 ±	135,230	0.1771	274,376	181,728	120,342
Hexagrammidae (greenlings)		316 ±	220	<0.0001	179	138	0
Liparidae (snailfishes)		630 ±	361	0.0002	182	362	86
Osmeridae (smelts)		1,439 ±	672	0.0004	399	1,011	29
Pleuronectidae (flatfishes)	Alaska plaice	299,028 ±	81,323	0.0919	191,270	47,786	59,972
	arrowtooth flounder	409 ±	822	0.0001	409	0	0
	Bering flounder	5,913 ±	1,823	0.0018	776	968	4,169
	flathead sole	126 ±	169	<0.0001	75	0	51
	northern rock sole	46,443 ±	21,982	0.0143	20,082	4,196	22,165
	Pacific halibut	22,940 ±	11,288	0.0070	17,538	4,899	504
	yellowfin sole	548,027 ±	183,235	0.1684	372,366	120,148	55,512
	other flatfish	43,463 ±	18,851	0.0134	8,178	34,520	765
	total Pleuronectidae	966,348 ±	198,029	0.2969	610,692	212,517	143,138
Rajidae (skates)	Alaska skate	48,920 ±	13,351	0.0150	38,194	3,157	7,569
	other skates	66 ±	38	<0.0001	34	27	5
	total Rajidae	48,986 ±	13,191	0.0151	38,228	3,184	7,574
Stichaeidae (blennies)		617 ±	278	0.0002	26	588	3
Zoarcidae (eelpouts)		417 ±	211	0.0001	23	295	100
Other		12,609 ±	12,916	0.0039	1,498	9,980	1,130
Total		**1,629,358 ±**	**242,098**	**0.5007**	**935,237**	**420,516**	**273,605**

[1]Total estimated biomass is 3,254,451 t for fish and invertebrates in the NBS bottom trawl survey.

Table 11. -- Biomass estimates (t) for major invertebrate taxa collected during the 2022 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
Ascidiacea		97,141 ±	74,967	0.0298	9,074	86,488	1,578
Coelenterata		101,417 ±	111,844	0.0312	15,080	75,872	10,465
Crustacea	shrimps	12,576 ±	15,246	0.0039	1,335	11,131	110
	other crustaceans	14,487 ±	15,433	0.0045	451	14,026	10
	total Crustacea	27,063 ±	21,734	0.0083	1,786	25,157	120
Echinodermata	Asteroidea (sea stars)	420,171 ±	94,267	0.1291	154,983	249,260	15,928
	Echinoidea (sea urchins)	156,032 ±	135,608	0.0479	584	155,448	0
	Holothuroidea (sea cucumbers)	3,573 ±	3,067	0.0011	90	3,482	0
	Ophiuroidea (brittle stars)	49,848 ±	32,255	0.0153	3,469	41,539	4,841
	total Echinodermata	629,624 ±	168,141	0.1935	159,126	449,729	20,769
Mollusca	Gastropoda (snails)	218,445 ±	109,030	0.0671	84,016	112,716	21,714
	octopuses	4 ±	8	<0.0001	0	0	4
	Pelecypoda (bivalves)	6,348 ±	5,844	0.0020	774	5,485	88
	other mollusks	677 ±	1,053	0.0002	9	669	0
	total Mollusca	225,474 ±	109,357	0.0693	84,799	118,870	21,806
Porifera (sponges)		15,558 ±	16,588	0.0048	1,286	14,272	0
Other		535,376 ±	164,999	0.1645	82,185	365,909	87,282
Total		**1,631,653 ±**	**295,894**	**0.5014**	**353,337**	**1,136,296**	**142,021**

[1]Total estimated biomass is 3,254,451 t for fish and invertebrates in the NBS bottom trawl survey.

Table 12. -- Total estimated biomass in metric tons (t) and the percent change between the 2021 and 2022 eastern Bering Sea shelf bottom trawl surveys for predominant fish and invertebrate taxa. Crab data are summarized under other crabs and discussed in detail in the annual crab Technical Memorandum produced by the Shellfish Assessment Program.

Fish taxon	2021	2022	Change (2022, 2021)	Invertebrate taxon	2021	2022	Change (2022, 2021)
saffron cod	3	21	705.2%	all sea anemones	55,967	95,790	71.2%
Pacific herring	67,886	228,447	236.5%	corals	943	1,328	40.8%
Arctic cod	0	51	100.0%	all tunicates	111,352	142,339	27.8%
walleye pollock	3,030,988	4,153,971	37.1%	hermit crabs	381,438	460,462	20.7%
great sculpin	51,319	69,097	34.6%	other snails	397,589	416,964	4.9%
other flatfishes	69,923	90,434	29.3%	purple-orange sea star	971,398	1,018,067	4.8%
yellowfin sole	1,633,968	2,039,968	24.8%	all worms	8,084	8,307	2.8%
northern rock sole	1,041,169	1,294,581	24.3%	other crabs	205,979	206,208	0.1%
eelpouts	37,776	45,571	20.6%	all shrimps	5,138	4,940	-3.8%
Alaska plaice	335,034	385,294	15.0%	other sea stars	282,839	271,651	-4.0%
arrowtooth flounder	457,569	521,615	14.0%	basket sea stars	286,345	265,984	-7.1%
Pacific halibut	131,864	149,064	13.0%	northern Neptune whelk	69,953	61,692	-11.8%
all poachers	17,824	19,936	11.9%				
starry flounder	83,295	92,652	11.2%				
plain sculpin	37,180	39,123	5.2%				
Pacific cod	616,380	647,400	5.0%				
flathead sole	674,745	703,375	4.2%				
Alaska skate	468,113	463,017	-1.1%				
other sculpins	48,194	46,901	-2.7%				
Kamchatka flounder	32,856	29,699	-9.6%				
Greenland turbot	10,690	7,869	-26.4%				
Bering flounder	9,511	6,237	-34.4%				
shorthorn sculpin	2,180	560	-74.3%				

Table 13. -- Total estimated biomass in metric tons (t) and the percent change between the 2021 and 2022 northern Bering Sea shelf bottom trawl surveys for predominant fish and invertebrate taxa. Crab data are summarized under other crabs and discussed in detail in the annual crab Technical Memorandum produced by the Shellfish Assessment Program.

Fish taxon	2021	2022	Change (2022, 2021)
Arctic cod	83	387	366.7%
saffron cod	9,974	27,738	178.1%
other sculpins	738	1,201	62.8%
yellowfin sole	496,045	548,027	10.5%
starry flounder	39,014	41,075	5.3%
Greenland turbot	0	0	0.0%
all poachers	779	770	-1.2%
eelpouts	425	417	-1.8%
flathead sole	138	126	-8.6%
Pacific halibut	25,995	22,940	-11.8%
Alaska plaice	344,581	299,028	-13.2%
walleye pollock	474,467	394,585	-16.8%
plain sculpin	20,652	15,392	-25.5%
other flatfishes	3,260	2,387	-26.8%
Bering flounder	8,384	5,913	-29.5%
Pacific cod	227,582	153,735	-32.4%
Alaska skate	80,207	48,920	-39.0%
northern rock sole	76,631	46,443	-39.4%
shorthorn sculpin	7,627	3,664	-52.0%
arrowtooth flounder	1,740	409	-76.5%
Pacific herring	60,931	12,178	-80.0%
great sculpin	2,988	523	-82.5%
Kamchatka flounder	33	0	-100.0%

Invertebrate taxon	2021	2022	Change (2022, 2021)
all sea anemones	8,711	67,867	679.1%
all shrimps	4,562	12,576	175.7%
other crabs	132,883	256,302	92.9%
all worms	60,122	115,939	92.8%
basket sea stars	30,084	48,441	61.0%
northern Neptune whelk	114,183	166,181	45.5%
hermit crabs	107,059	153,983	43.8%
all tunicates	71,514	97,141	35.8%
other sea stars	79,318	107,545	35.6%
other snails	44,473	52,265	17.5%
purple-orange sea star	270,646	312,625	15.5%
corals	5,776	5,032	-12.9%

Table 14. -- 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 common groundfish species for the 2022 eastern and northern Bering Sea shelf bottom 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	84.26	6.72	4,153,971	331,104	3,498,386	4,809,557	374	374	374
	NBS	19.84	3.30	394,585	65,640	263,306	525,864	136	136	136
Pacific cod	EBS	13.13	0.86	647,400	42,333	563,580	731,220	373	373	373
	NBS	7.73	1.00	153,735	19,961	113,812	193,658	108	108	108
yellowfin sole	EBS	41.38	2.73	2,039,968	134,775	1,773,114	2,306,822	238	238	238
	NBS	27.56	4.58	548,027	91,083	365,861	730,192	136	135	135
northern rock sole	EBS	26.26	2.26	1,294,581	111,582	1,073,647	1,515,514	313	313	313
	NBS	2.34	0.55	46,443	10,927	24,359	68,526	97	97	97
flathead sole	EBS	14.27	2.63	703,375	129,727	443,922	962,828	315	314	314
	NBS	0.01	0.00	126	84	0	296	3	3	3
Bering flounder	EBS	0.13	0.02	6,237	1,133	3,970	8,504	58	58	58
	NBS	0.30	0.05	5,913	906	4,082	7,744	90	90	90
Alaska plaice	EBS	7.82	0.86	385,294	42,373	301,395	469,193	253	253	252
	NBS	15.04	2.03	299,028	40,424	218,180	379,876	138	138	138
Greenland turbot	EBS	0.16	0.03	7,869	1,349	5,197	10,540	38	38	38
arrowtooth flounder	EBS	10.58	1.24	521,615	61,120	399,375	643,854	228	228	228
	NBS	0.02	0.02	409	409	0	1,226	1	1	1
Kamchatka flounder	EBS	0.60	0.05	29,699	2,611	24,529	34,869	154	154	154
Pacific halibut	EBS	3.02	0.40	149,064	19,596	109,872	188,257	278	278	278
	NBS	1.15	0.28	22,940	5,611	11,718	34,162	56	56	56
Bering skate	EBS	0.26	0.04	12,803	1,831	9,178	16,429	80	80	78
Alaska skate	EBS	9.39	0.53	463,017	25,951	411,634	514,400	365	365	364
	NBS	2.46	0.33	48,920	6,636	35,647	62,193	72	72	71
longhead dab	EBS	0.41	0.12	20,421	5,924	8,573	32,270	53	53	53
	NBS	0.06	0.01	1,232	298	624	1,841	50	50	50
starry flounder	EBS	1.88	0.35	92,652	17,308	58,035	127,268	65	65	64
	NBS	2.07	0.48	41,075	9,581	21,711	60,439	79	79	79
yellow Irish lord	EBS	0.52	0.18	25,858	8,780	7,332	44,383	79	79	78
	NBS	0.00	0.00	28	21	0	70	2	2	2
plain sculpin	EBS	0.79	0.10	39,123	5,042	29,040	49,207	100	100	99
	NBS	0.77	0.12	15,392	2,323	10,746	20,037	87	87	86
great sculpin	EBS	1.40	0.37	69,097	18,388	32,320	105,873	179	179	179

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	0.03	0.01	523	199	125	921	16	16	15
shorthorn sculpin	EBS	0.01	0.01	560	326	0	1,205	6	6	6
	NBS	0.18	0.06	3,664	1,200	1,240	6,089	23	23	23
Pacific ocean perch	EBS	2.57	2.43	126,805	119,730	0	368,779	24	24	23
rex sole	EBS	0.84	0.18	41,406	8,947	23,324	59,487	92	92	90
Sakhalin sole	EBS	0.00	0.00	176	171	0	511	2	2	2
	NBS	0.05	0.01	1,019	280	447	1,592	65	65	65
butterfly sculpin	NBS	0.00	0.00	4	4	0	12	1	1	1
bigmouth sculpin	EBS	0.38	0.05	18,546	2,314	14,011	23,081	74	74	73
Arctic cod	EBS	0.00	0.00	51	19	14	89	8	8	8
	NBS	0.02	0.00	387	74	239	534	78	78	78
saffron cod	EBS	0.00	0.00	21	18	0	57	2	2	2
	NBS	1.39	0.24	27,738	4,805	18,128	37,349	59	59	59

Table 15. -- 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 2022 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	153.42	12.29	7,563,348,339	606,071,491	6,363,326,788	8,763,369,891	374	374	374
	NBS	34.92	3.96	694,455,669	78,754,639	536,946,392	851,964,947	136	136	136
Pacific cod	EBS	8.62	0.62	425,156,403	30,471,830	364,822,180	485,490,626	373	373	373
	NBS	4.33	0.63	86,038,334	12,542,904	60,952,527	111,124,141	108	108	108
yellowfin sole	EBS	175.67	11.03	8,660,406,531	543,981,411	7,583,323,337	9,737,489,725	238	238	238
	NBS	132.51	16.86	2,635,200,661	335,205,891	1,964,788,880	3,305,612,443	136	135	135
northern rock sole	EBS	150.28	11.37	7,408,457,839	560,386,858	6,298,891,861	8,518,023,817	313	313	313
	NBS	8.00	1.63	159,158,527	32,369,068	93,740,640	224,576,414	97	97	97
flathead sole	EBS	49.55	4.83	2,442,797,142	237,935,364	1,966,926,413	2,918,667,871	315	314	314
	NBS	0.04	0.04	860,015	781,932	0	2,440,299	3	3	3
Bering flounder	EBS	0.73	0.13	36,006,822	6,592,318	22,822,186	49,191,458	58	58	58
	NBS	3.10	0.34	61,583,243	6,709,162	48,024,027	75,142,460	90	90	90
Alaska plaice	EBS	13.39	1.24	660,306,512	60,895,290	539,733,837	780,879,186	253	253	252
	NBS	27.10	2.50	538,883,633	49,688,570	439,506,493	638,260,772	138	138	138
Greenland turbot	EBS	0.04	0.01	1,988,411	298,030	1,398,312	2,578,511	38	38	38
arrowtooth flounder	EBS	20.32	2.50	1,001,554,312	123,023,787	755,506,738	1,247,601,886	228	228	228
	NBS	0.03	0.03	519,806	519,806	0	1,559,419	1	1	1
Kamchatka flounder	EBS	0.92	0.07	45,293,284	3,352,591	38,655,154	51,931,414	154	154	154
Pacific halibut	EBS	1.86	0.27	91,473,542	13,223,025	65,027,492	117,919,592	278	278	278
	NBS	0.52	0.13	10,316,955	2,554,596	5,207,764	15,426,147	56	56	56
Bering skate	EBS	0.12	0.02	5,889,737	854,716	4,197,400	7,582,073	80	80	78
Alaska skate	EBS	2.09	0.11	102,817,010	5,232,266	92,457,123	113,176,896	365	365	364
	NBS	0.58	0.08	11,590,035	1,679,275	8,231,484	14,948,586	72	72	71
longhead dab	EBS	5.35	1.62	263,508,458	79,645,921	104,216,616	422,800,300	53	53	53
	NBS	1.34	0.34	26,590,881	6,768,159	12,770,301	40,411,461	50	50	50
starry flounder	EBS	1.35	0.29	66,599,103	14,228,207	38,142,689	95,055,517	65	65	64
	NBS	3.85	1.04	76,517,777	20,771,669	34,538,234	118,497,321	79	79	79
yellow Irish lord	EBS	0.77	0.28	37,906,080	13,957,739	8,455,250	67,356,909	79	79	78
	NBS	0.00	0.00	56,600	40,090	0	137,623	2	2	2
plain sculpin	EBS	1.15	0.16	56,450,902	7,664,959	41,120,985	71,780,819	100	100	99
	NBS	1.69	0.27	33,569,902	5,324,392	22,921,119	44,218,686	87	87	86

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
great sculpin	EBS	0.47	0.13	23,201,577	6,225,363	10,750,851	35,652,303	179	179	179
	NBS	0.13	0.07	2,602,637	1,445,045	0	5,492,728	16	16	15
shorthorn sculpin	EBS	0.01	0.01	431,766	304,850	0	1,035,370	6	6	6
	NBS	0.33	0.10	6,603,067	2,007,652	2,545,602	10,660,532	23	23	23
Pacific ocean perch	EBS	4.92	4.71	242,638,391	232,369,880	0	712,257,919	24	24	23
rex sole	EBS	1.91	0.37	94,143,938	18,224,688	57,311,843	130,976,032	92	92	90
Sakhalin sole	EBS	0.05	0.05	2,432,201	2,334,277	0	7,007,385	2	2	2
	NBS	1.24	0.36	24,738,301	7,253,985	9,925,663	39,550,938	65	65	65
butterfly sculpin	NBS	0.00	0.00	44,303	44,303	0	132,910	1	1	1
bigmouth sculpin	EBS	0.07	0.01	3,624,233	448,351	2,745,465	4,503,000	74	74	73
Arctic cod	EBS	0.03	0.01	1,640,062	649,191	367,648	2,912,476	8	8	8
	NBS	0.79	0.15	15,792,132	2,947,246	9,897,640	21,686,625	78	78	78
saffron cod	EBS	0.01	0.01	506,475	429,495	0	1,348,286	2	2	2
	NBS	27.94	5.46	555,615,860	108,616,534	338,382,792	772,848,927	59	59	59

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

An interactive map of species CPUE is available through the NOAA Distribution Mapping and Analysis Portal (https://apps-st.fisheries.noaa.gov/dismap/; NOAA Fisheries (2023)). 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; NOAA Fisheries Alaska Fisheries Science Center (2023)). Users can interactively select, view, and download data on the platform for this survey and others.

The spatial distribution maps below illustrate where species were found during the surveys. The distributions are presented as inverse distance weighted interpolations, and assumes that data from stations that are closer to one another are more alike than those that are farther apart.

Selected Fish Species Estimates

Plots of the spatial distribution, abundance-at-length estimates, and tables of CPUE (kg/hectare and no./hectare) for 37 major fish species caught during the EBS and NBS continental shelf survey are presented in Figs. **11** to **62** and Tables **16** to **81**. Differences in estimates and totals may be due to rounding.

Selected Invertebrates Estimates

Plots of spatial distribution and tables of CPUE (kg/hectare and no./hectare) for the 2 major invertebrate species caught during the EBS and NBS continental shelf surveys, purple-orange sea star (Fig. **61** and Tables **80** and **81**) and northern Neptune whelk (Fig. **62**), are presented below. Differences in estimates and totals may be due to rounding.

Detailed information on bottom trawl survey results for commercial crab species are discussed and analyzed in the AFSC Shellfish Assessment Program's annual data report (Zacher et al., 2023). 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, 2022b).

Walleye Pollock (*Gadus chalcogrammus*)

During the 2022 survey, walleye pollock were present at 374 of 376 (99.5%) EBS survey stations, and 136 of 144 (94.4%) survey stations in the NBS. In the EBS, walleye pollock were found at bottom depths between 22 m and 183 m, and bottom temperatures between -1.6°C and 8.4°C. In the NBS, walleye pollock were found at bottom depths between 11 m and 78 m, and bottom temperatures between -1.7°C and 11.4°C.

The estimated biomass of walleye pollock in the EBS for 2022 was 4.2 million t (29% of the total biomass; Tables **12** and **16**) and the estimated abundance was 7.6 billion fish (Table **17**). Previously in 2021, walleye pollock biomass was estimated to be 3 million t (25% of the total biomass; Table **12**) and the estimated abundance was 5.9 billion fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of walleye pollock in the NBS was 394,585 t (12% of the total biomass; Tables **13** and **16**) and the estimated abundance was 694.5 million fish (Table **17**). Previously in 2021, walleye pollock biomass was estimated to be 474,467 t (16% of the total biomass; Table **13**) and the estimated abundance was 679.3 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

In 2022, walleye pollock biomass in the EBS was concentrated in the middle domain with additional clusters in the outer domain, to the north of the Alaska Peninsula, and to the east of St. Matthew Island (Fig. **11**). Walleye pollock were rare throughout the NBS survey area, with a small area of higher density in the Chirikov Basin just south of the Bering Strait. The range of fork lengths for walleye pollock measured in 2022 was 8–78 cm in the EBS, and 5–86 cm in the NBS (Fig. **12**).

Since 2002, the EBS shelf survey biomass estimate for walleye pollock has varied dramatically. Spatial patterns of pollock distribution during the summer trawl survey have varied considerably in response to cold and warm stanzas (Figs. **5** and **6**). During the colder years (2006 to 2013), the highest densities of pollock were along the outer half of the EBS shelf (> 70 m), and the lowest densities of pollock were along the inner shelf. Low densities were also observed throughout the NBS when it was first surveyed in 2010. During the recent warm stanza (2014 to the present) 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 shelf survey area. These distribution patterns are consistent with shoreward and northward feeding migrations typical of pollock during the spring and summer (Kotwicki et al., 2005).

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, 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. **12**) because they typically occupy a position much higher in the water column where they are unavailable to the survey trawl (Kotwicki et al., 2015).

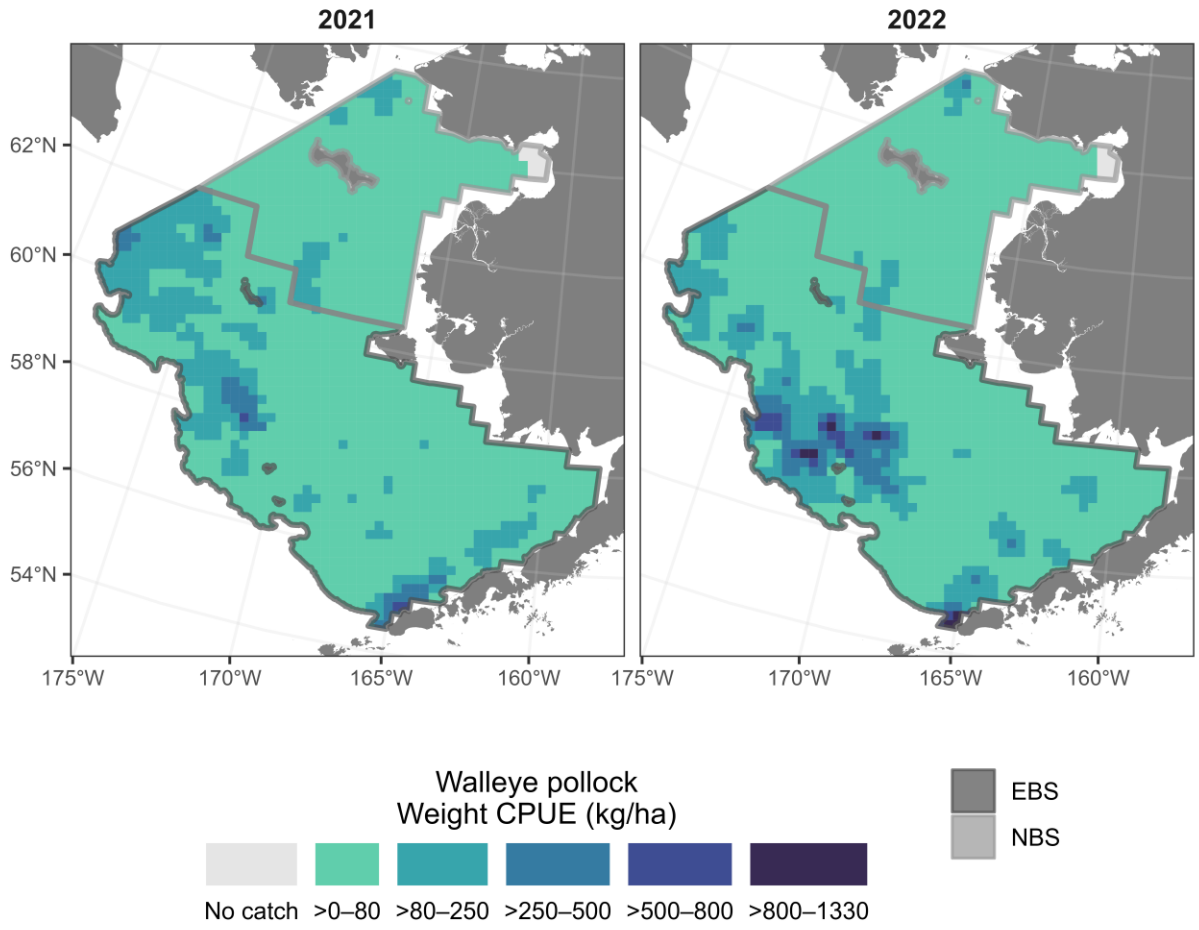

Figure 11. -- The distribution (weight CPUE (kg/ha)) of walleye pollock (*Gadus chalcogrammus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

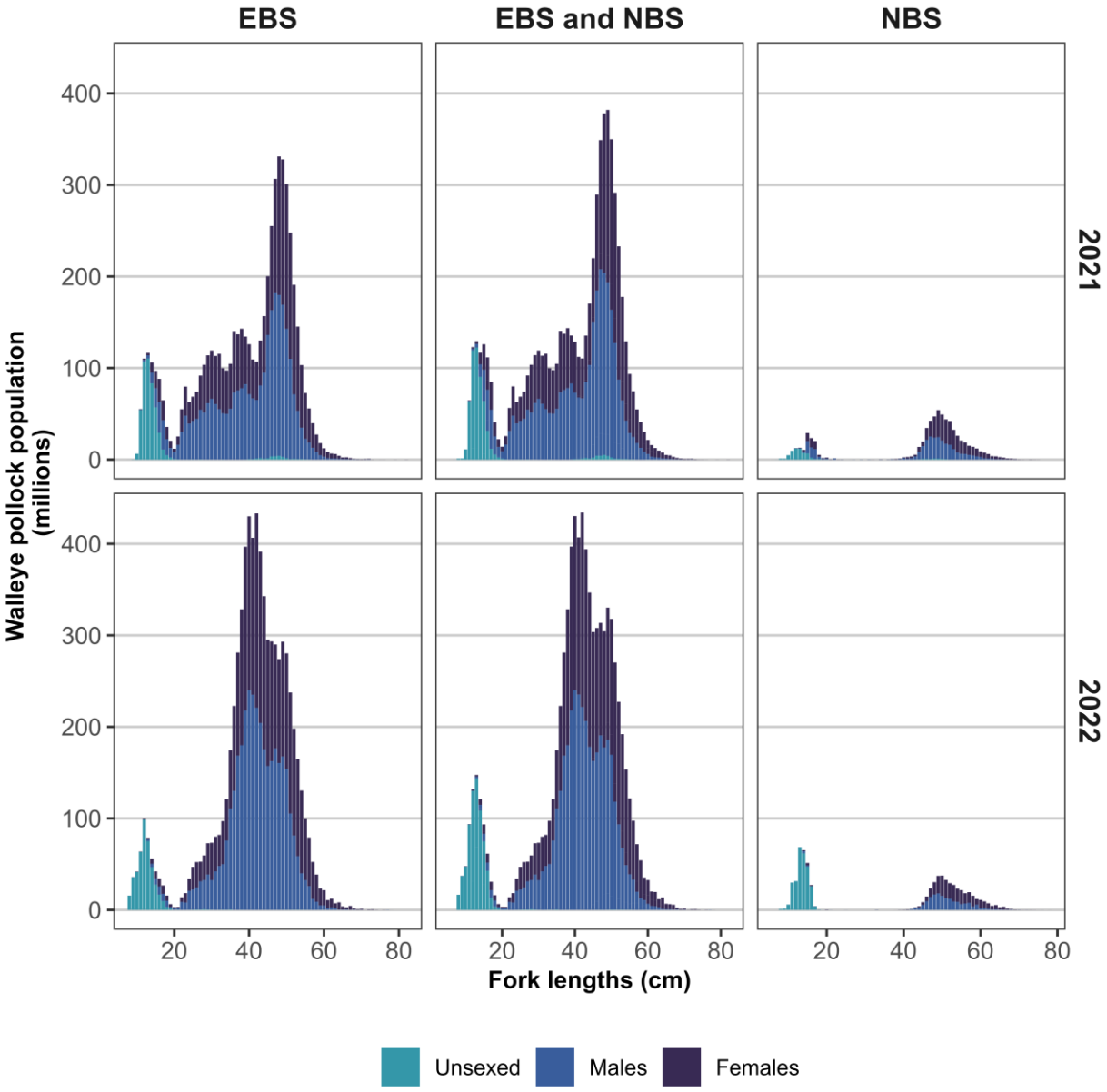

Figure 12. -- Total abundance-at-length estimates of walleye pollock (*Gadus chalcogrammus*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 16. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand mt) with standard deviation (thousands) and 95% lower (LCL; thousand mt) and upper (UCL; thousand mt) confidence limits for walleye pollock (*Gadus chalcogrammus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand mt)	SD biomass (thousands)	95% LCL (thousand mt)	95% UCL (thousand mt)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	25.66	4.24	201.95	33.40	134.46	269.44	58	58	58
20	13.41	2.49	55.24	10.24	34.32	76.16	31	31	31
31	72.11	20.24	684.88	192.28	300.31	1,069.44	69	69	69
32	166.10	50.55	146.94	44.72	41.18	252.70	8	8	8
41	100.82	23.07	628.20	143.78	337.62	918.78	44	44	44
42	320.99	48.88	774.30	117.91	533.52	1,015.08	30	30	30
43	47.24	8.40	99.50	17.70	62.69	136.31	22	22	22
50	36.61	14.35	139.28	54.60	26.79	251.76	25	25	25
61	141.05	19.95	1,238.06	175.12	884.14	1,591.98	60	60	60
62	58.51	4.20	37.80	2.72	31.16	44.45	7	7	7
82	26.39	5.81	47.37	10.43	24.41	70.33	12	12	12
90	87.05	24.24	100.45	27.97	34.30	166.60	8	8	8
Total	**84.26**	**6.72**	**4,153.97**	**331.10**	**3,498.39**	**4,809.56**	**374**	**374**	**374**
NBS									
70	21.35	3.81	169.22	30.18	108.23	230.21	58	58	58
71	16.70	6.74	135.69	54.73	25.07	246.31	50	50	50
81	23.38	5.23	89.68	20.05	48.54	130.82	28	28	28
Total	**19.84**	**3.30**	**394.58**	**65.64**	**263.31**	**525.86**	**136**	**136**	**136**

Table 17. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	51.11	13.65	402.25	107.44	185.12	619.39	58	58	58
20	19.55	3.61	80.52	14.85	50.20	110.85	31	31	31
31	121.64	32.98	1,155.27	313.22	528.84	1,781.71	69	69	69
32	329.74	142.10	291.72	125.71	0.00	589.02	8	8	8
41	173.26	44.13	1,079.58	274.97	523.87	1,635.29	44	44	44
42	526.97	85.15	1,271.16	205.39	851.75	1,690.56	30	30	30
43	127.19	22.81	267.91	48.05	167.97	367.85	22	22	22
50	43.29	17.56	164.68	66.80	27.06	302.30	25	25	25
61	271.83	38.04	2,386.04	333.90	1,711.23	3,060.86	60	60	60
62	140.86	22.91	91.02	14.80	54.79	127.24	7	7	7
82	56.87	14.84	102.11	26.64	43.48	160.74	12	12	12
90	234.93	59.20	271.09	68.31	109.53	432.64	8	8	8
Total	**153.42**	**12.29**	**7,563.35**	**606.07**	**6,363.33**	**8,763.37**	**374**	**374**	**374**
NBS									
70	51.46	7.18	407.85	56.88	292.90	522.80	58	58	58
71	20.38	5.92	165.60	48.09	68.41	262.80	50	50	50
81	31.55	6.67	121.00	25.58	68.51	173.49	28	28	28
Total	**34.92**	**3.96**	**694.46**	**78.75**	**536.95**	**851.96**	**136**	**136**	**136**

Pacific Cod (*Gadus macrocephalus*)

In 2022, Pacific cod were present at 373 of 376 (99.2%) EBS survey stations, and 108 of 144 (75%) survey stations in the NBS. In the EBS, Pacific cod were found at bottom depths between 22 m and 183 m, and bottom temperatures between -1.6°C and 8.4°C. In the NBS, Pacific cod were found at bottom depths between 18 m and 78 m, and bottom temperatures between -1.6°C and 11°C.

The estimated biomass of Pacific cod in the EBS for 2022 was 647,400 t (4% of the total biomass; Tables **12** and **18**) and the estimated abundance was 425.2 million fish (Table **19**). Previously in 2021, Pacific cod biomass was estimated to be 616,380 t (5% of the total biomass; Table **12**), and the estimated abundance was 421.8 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of Pacific cod in the NBS was 153,735 t (5% of the total biomass; Tables **13** and **18**) and the estimated abundance was 86 million fish (Table **19**). Previously in 2021, Pacific cod biomass was estimated to be 227,582 t (8% of the total biomass; Table **13**), and the estimated abundance was 129.7 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

In 2022, Pacific cod biomass was spread throughout both regions. In the EBS, higher concentrations were encountered around St. Matthew Island, and the north of the Nelson Lagoon on the Alaskan Peninsula. Pacific cod in the NBS was concentrated to the south of St. Lawrence Island (Fig. **13**). The range of fork lengths for Pacific cod measured in 2022 was 10–110 cm in the EBS, and 7–101 cm in the NBS (Fig. **14**).

Pacific cod are highly mobile, semi-pelagic fish whose spatial distribution can vary with bottom temperature and abundance (Kotwicki and Lauth, 2013). During the previous warm stanza from 2002 to 2005, the highest densities of Pacific cod were observed in the northern EBS surrounding the Pribilof Island and St. Matthew Island, and the lowest densities were in the southeastern EBS. A similar pattern was observed from 2017 to 2021. 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. During the latter warm stanza (2014-present) 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. 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. Pacific cod were generally absent from the northern middle domain during the cold stanza (2006-2013) and concentrated along the perimeter of the cold pool, where bottom temperatures were greater than 0°C. During the cold stanza in 2010, Pacific cod were caught at 44% of the NBS stations, with frequency of occurrences relatively low compared to the warm stanza in 2017, when Pacific cod were caught at 78% of the NBS stations.

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 (2014–15) and 1.1 trillion cod (2014). However, in 2017 both biomass and abundance sharply declined to 0.64 million t and 364 billion cod. This sudden decline in the EBS biomass was accompanied by an order of magnitude increase in the NBS survey biomass (0.3 million t) and abundance (133 million) compared to 2010. Moreover, unlike 2010, the NBS population in 2017 had almost an identical size composition to that of the EBS. 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.

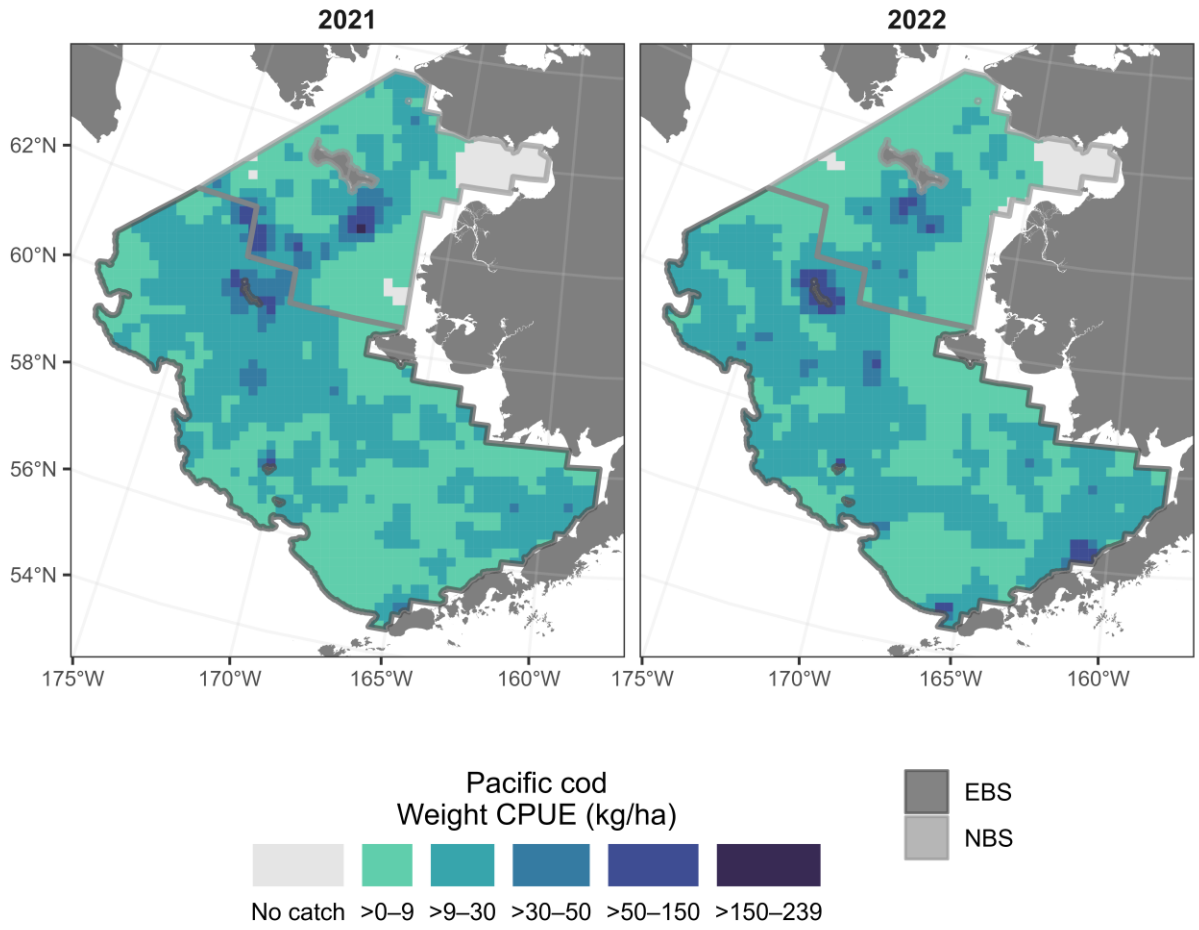

Figure 13. -- The distribution (weight CPUE (kg/ha)) of Pacific cod (*Gadus macrocephalus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

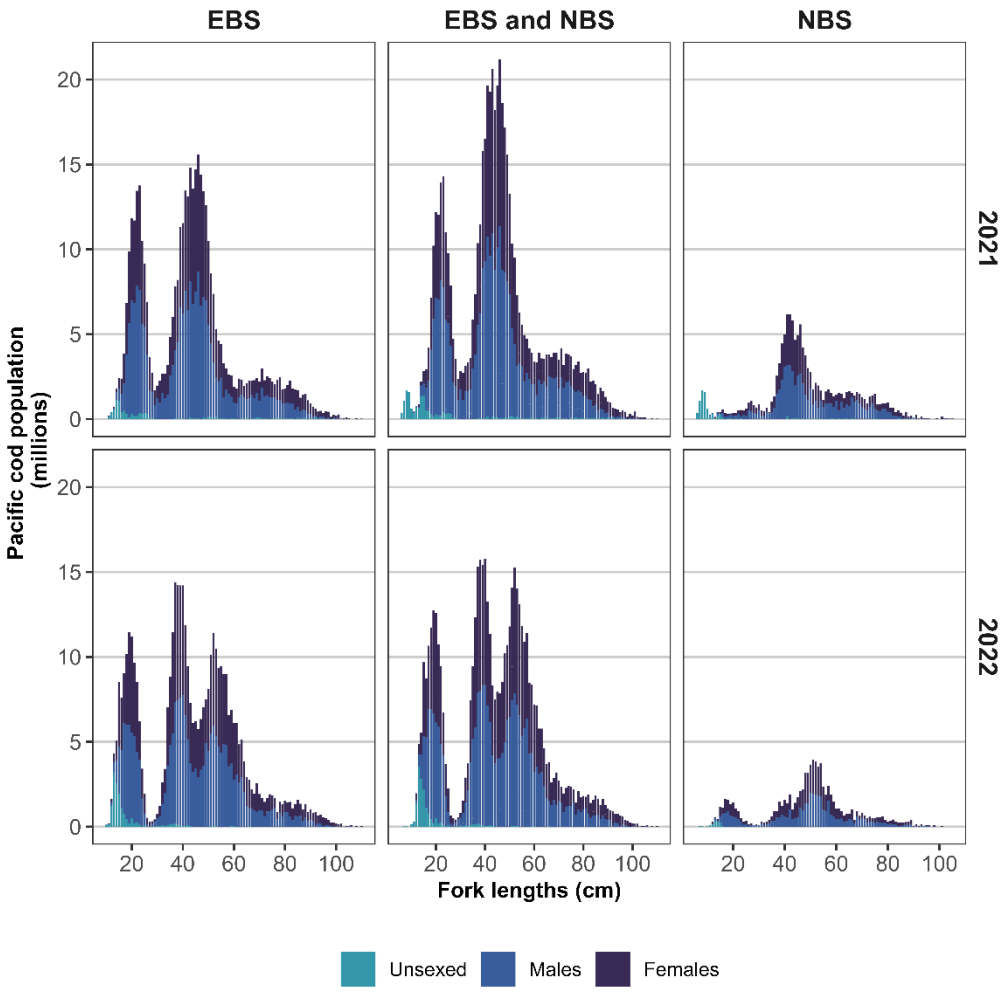

Figure 14. -- Total abundance-at-length estimates of Pacific cod (*Gadus macrocephalus*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 18. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand mt) with standard deviation (thousands) and 95% lower (LCL; thousand mt) and upper (UCL; thousand mt) confidence limits for Pacific cod (*Gadus macrocephalus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand mt)	SD biomass (thousands)	95% LCL (thousand mt)	95% UCL (thousand mt)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	13.85	2.71	109.01	21.34	65.88	152.15	58	58	58
20	5.35	1.16	22.02	4.79	12.25	31.80	31	31	31
31	11.17	0.93	106.07	8.80	88.46	123.68	69	69	69
32	14.82	3.06	13.11	2.71	6.71	19.51	8	8	8
41	21.98	4.43	136.96	27.59	81.20	192.72	44	44	44
42	14.58	1.96	35.16	4.72	25.53	44.80	31	31	31
43	20.18	4.70	42.51	9.90	21.92	63.10	22	22	22
50	10.60	4.16	40.33	15.82	7.74	72.93	25	25	25
61	12.09	0.97	106.13	8.50	88.95	123.30	60	60	60
62	20.51	4.25	13.25	2.74	6.54	19.96	7	7	7
82	5.16	1.91	9.26	3.42	1.72	16.80	10	10	10
90	11.76	2.02	13.58	2.34	8.05	19.10	8	8	8
Total	**13.13**	**0.86**	**647.40**	**42.33**	**563.58**	**731.22**	**373**	**373**	**373**
NBS									
70	12.18	2.18	96.50	17.25	61.64	131.36	48	48	48
71	3.29	0.67	26.75	5.46	15.71	37.79	37	37	37
81	7.95	2.20	30.49	8.43	13.19	47.79	23	23	23
Total	**7.73**	**1.00**	**153.74**	**19.96**	**113.81**	**193.66**	**108**	**108**	**108**

Table 19. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	15.49	2.30	121.88	18,110.85	85.28	158.49	58	58	58
20	4.48	0.80	18.47	3,312.25	11.71	25.24	31	31	31
31	10.46	1.40	99.31	13,328.82	72.65	125.97	69	69	69
32	6.06	1.23	5.37	1,085.23	2.80	7.93	8	8	8
41	12.29	2.61	76.56	16,264.12	43.69	109.43	44	44	44
42	6.64	1.65	16.03	3,989.89	7.88	24.17	31	31	31
43	13.78	4.35	29.03	9,153.24	9.99	48.06	22	22	22
50	4.16	1.60	15.84	6,097.04	3.28	28.39	25	25	25
61	3.32	0.27	29.18	2,327.50	24.47	33.88	60	60	60
62	6.57	1.47	4.25	952.10	1.92	6.58	7	7	7
82	2.33	0.87	4.18	1,560.06	0.75	7.61	10	10	10
90	4.40	0.65	5.08	754.41	3.29	6.86	8	8	8
Total	**8.62**	**0.62**	**425.16**	**30,471.83**	**364.82**	**485.49**	**373**	**373**	**373**
NBS									
70	7.62	1.46	60.43	11,605.33	36.98	83.89	48	48	48
71	1.29	0.24	10.45	1,924.47	6.56	14.34	37	37	37
81	3.95	1.13	15.16	4,351.67	6.23	24.09	23	23	23
Total	**4.33**	**0.63**	**86.04**	**12,542.90**	**60.95**	**111.12**	**108**	**108**	**108**

Yellowfin Sole (*Limanda aspera*)

In 2022, yellowfin sole were present at 238 of 376 (63.3%) of EBS survey stations, and 136 of 144 (94.4%) survey stations in the NBS. In the EBS, yellowfin sole were found at bottom depths between 22 m and 128 m, and bottom temperatures between -1.4°C and 8.4°C. In the NBS, yellowfin sole were found at bottom depths between 11 m and 78 m, and bottom temperatures between -1.6°C and 12°C.

The estimated biomass of yellowfin sole in the EBS for 2022 was 2 million t (14% of the total biomass; Tables **12** and **20**) and the estimated abundance was 8.7 billion fish (Table **21**). Previously in 2021, yellowfin sole biomass was estimated to be 1.6 million t (14% of the total biomass; Table **12**), and the estimated abundance was 7.6 billion fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of yellowfin sole in the NBS was 548,027 t (17% of the total biomass; Tables **13** and **20**) and the estimated abundance was 2.6 billion fish (Table **21**). Previously in 2021, yellowfin sole biomass was estimated to be 496,045 t (17% of the total biomass; Table **13**), and the estimated abundance was 2 billion fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

In 2022, the yellowfin sole population in the EBS was distributed along the inner and middle domain of the Bering Sea between Norton Sound and the Alaska Peninsula. The highest densities were observed along the Alaska coast south of Nunivak Island and along the Alaska Peninsula (Fig. **15**). High densities continue to be observed near Togiak Bay and the spawning grounds in Kuskokwim Bay and Bristol Bay. In the NBS, the spatial distribution of yellowfin sole was similar to 2010 and 2017, with the densest aggregations east of St. Matthew Island, and to the east and south of St. Lawrence Island (Fig. **15**). The range of fork lengths for yellowfin sole measured in 2022 was 7–46 cm in the EBS, and 5–49 cm in the NBS (Fig. **16**).

Yellowfin sole is a target of the largest commercial flatfish fishery in the world (Wilderbuer et al., 2018) and is the most abundant flatfish species in the EBS (Table **8**) and NBS (Table **10**). 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). Most spawning activity occurs at bottom depths less than 30 m (Nichol, 1995). 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. The bottom temperature and the survey start date are both used in the stock assessment model to adjust the catchability (q) parameter (Nichol et al., 2019; Wilderbuer et al., 2018).

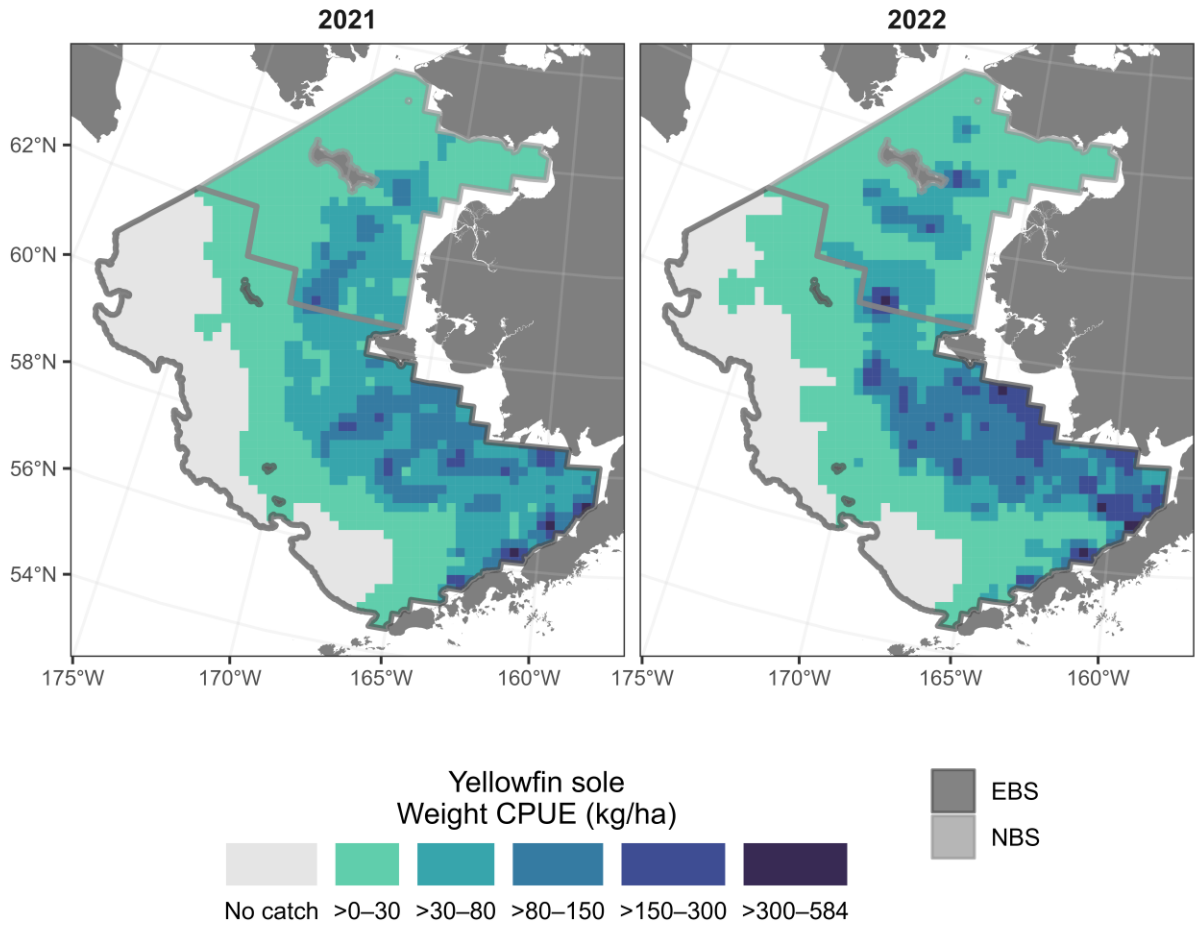

Figure 15. -- The distribution (weight CPUE (kg/ha)) of yellowfin sole (*Limanda aspera*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

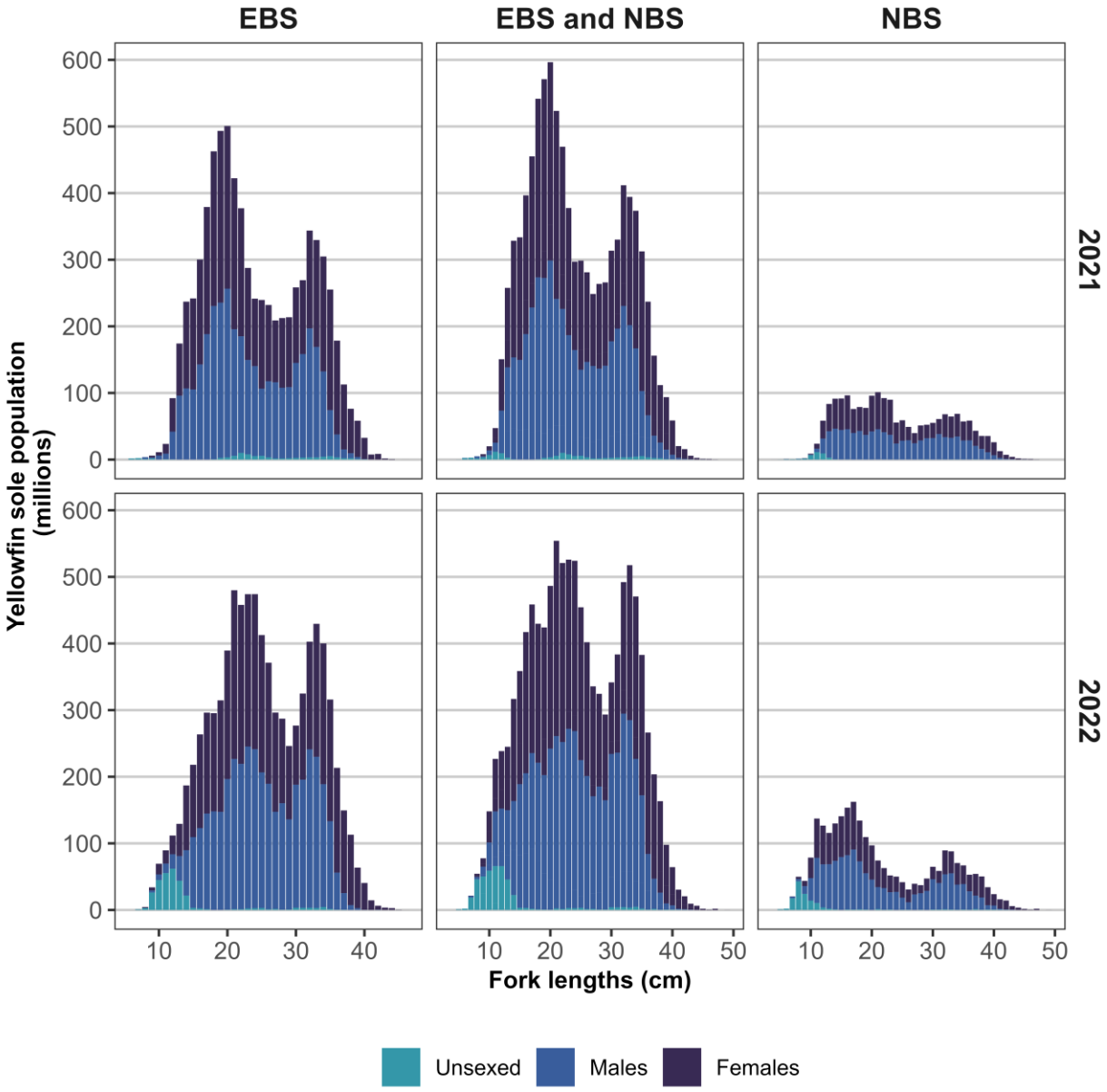

Figure 16. -- Total abundance-at-length estimates of yellowfin sole (*Limanda aspera*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 20. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for yellowfin sole (*Limanda aspera*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	136.89	10.80	1,077,410	84,983	905,660	1,249,160	58	58	58
20	87.25	9.47	359,428	38,994	279,803	439,054	31	31	31
31	37.95	7.79	360,459	73,955	212,549	508,369	59	59	59
32	6.66	2.25	5,889	1,987	1,190	10,587	7	7	7
41	33.47	10.04	208,537	62,553	82,118	334,956	36	36	36
42	8.90	2.01	21,475	4,838	11,597	31,354	25	25	25
43	2.08	1.39	4,388	2,928	0	10,478	14	14	14
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	13	13	0	39	1	1	1
62	0.00	0.00	0	0	0	0	0	0	0
82	1.32	1.06	2,362	1,900	0	6,543	6	6	6
90	0.01	0.01	7	7	0	24	1	1	1
Total	**41.38**	**2.73**	**2,039,968**	**134,775**	**1,773,114**	**2,306,822**	**238**	**238**	**238**
NBS									
70	46.98	10.41	372,366	82,533	205,567	539,165	58	57	57
71	14.79	4.35	120,148	35,350	48,706	191,590	54	54	54
81	14.47	4.00	55,512	15,322	24,072	86,953	24	24	24
Total	**27.56**	**4.58**	**548,027**	**91,083**	**365,861**	**730,192**	**136**	**135**	**135**

Table 21. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	635.70	52.84	5,003,328.41	415,851.19	4,162,893.15	5,843,763.66	58	58	58
20	461.55	48.41	1,901,276.62	199,432.81	1,494,034.82	2,308,518.42	31	31	31
31	120.74	25.63	1,146,782.38	243,391.82	659,998.75	1,633,566.01	59	59	59
32	12.13	5.12	10,726.92	4,533.43	5.35	21,448.49	7	7	7
41	85.86	24.72	534,999.87	154,020.86	223,723.71	846,276.03	36	36	36
42	20.28	5.51	48,931.16	13,291.23	21,790.48	76,071.85	25	25	25
43	4.87	3.05	10,252.16	6,426.80	0.00	23,619.90	14	14	14
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	29.06	29.06	0.00	87.78	1	1	1
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	2.26	1.73	4,052.99	3,098.61	0.00	10,873.04	6	6	6
90	0.02	0.02	26.96	26.96	0.00	90.73	1	1	1
Total	**175.67**	**11.03**	**8,660,406.53**	**543,981.41**	**7,583,323.34**	**9,737,489.72**	**238**	**238**	**238**
NBS									
70	236.74	38.55	1,876,424.13	305,570.57	1,258,866.01	2,493,982.25	58	57	57
71	77.16	16.41	626,989.40	133,360.34	357,468.14	896,510.66	54	54	54
81	34.36	9.05	131,787.13	34,707.84	60,566.64	203,007.63	24	24	24
Total	**132.51**	**16.86**	**2,635,200.66**	**335,205.89**	**1,964,788.88**	**3,305,612.44**	**136**	**135**	**135**

Northern Rock Sole (*Lepidopsetta polyxystra*)

During the 2022 survey, northern rock sole were present at 313 of 376 (83.2%) EBS survey stations and 97 of 144 (67.4%) survey stations in the NBS. In the EBS, northern rock sole were found at bottom depths between 22 m and 170 m, and bottom temperatures between -1.6°C and 8.4°C. In the NBS, northern rock sole were found at bottom depths between 15 m and 73 m, and bottom temperatures between -1.6°C and 11.1°C.

The estimated biomass of northern rock sole in the EBS for 2022 was 1.3 million t (9% of the total biomass; Tables **12** and **22**) and the estimated abundance was 7.4 billion fish (Table **23**). Previously in 2021, northern rock sole biomass was estimated to be 1 million t (9% of the total biomass; Table **12**), and the estimated abundance was 6.4 billion fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of northern rock sole in the NBS was 46,443 t (1% of the total biomass; Tables **13** and **22**) and the estimated abundance was 159.2 million fish (Table **23**). Previously in 2021, northern rock sole biomass was estimated to be 76,631 t (3% of the total biomass; Table **13**), and the estimated abundance was 240.7 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

In 2022, 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. **17**). Relatively low densities of northern rock sole were observed where bottom temperatures were < 1°C in the middle and outer domains (Fig. **17** and Tables **22** and **23**). In colder years, such as 2010, when the cold pool was large and touched the western tip of Nunivak Island (Figs. **5** and **6**), the highest concentrations of rock sole were in the southwest EBS shelf. Northern rock sole were observed throughout the NBS with a slightly higher density northeast of St. Matthew Island (Fig. **17**). The range of fork lengths for northern rock sole measured in 2022 was 5–47 cm in the EBS, and 5–48 cm in the NBS (Fig. **18**).

The increase in northern rock sole biomass the NBS between 2010 and 2022 may be attributed to the presence of small 2 to 5 year-old northern rock sole at sizes 12-16 cm (Wilderbuer et al., 2018) in the inner domain. This higher density of juvenile northern rock sole in the NBS may represent recruitment during the warm stanza starting in 2014 (Stevenson and Lauth, 2019). Warmer bottom temperatures during the settlement phase are correlated with more northerly spatial distributions of 2 to 3 year-old rock sole (Cooper and Nichol, 2016). Thus, the warmer temperatures in the inner domain observed from 2014 to 2021 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, they 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 (Kotwicki and Lauth, 2013; Spencer, 2008).

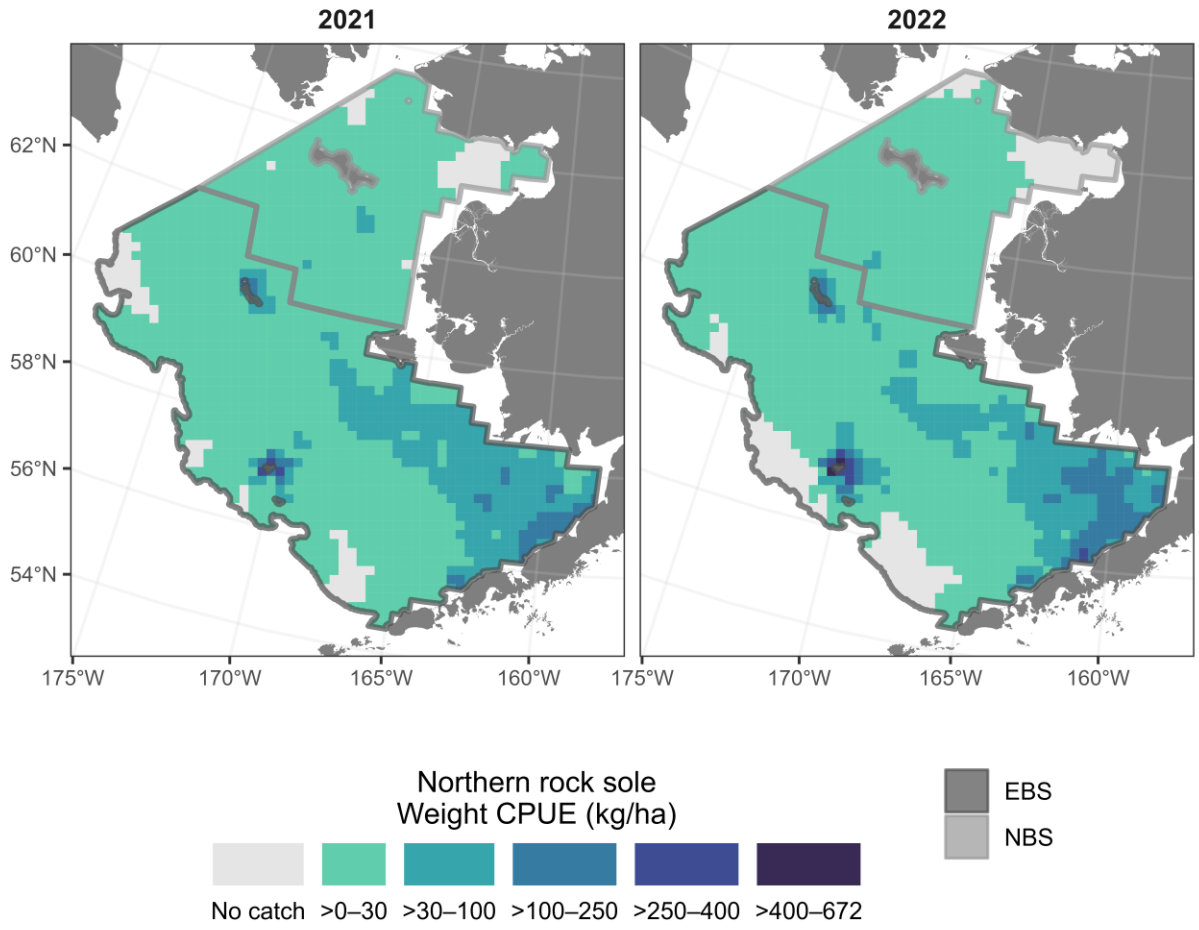

Figure 17. -- The distribution (weight CPUE (kg/ha)) of northern rock sole (*Lepidopsetta polyxystra*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

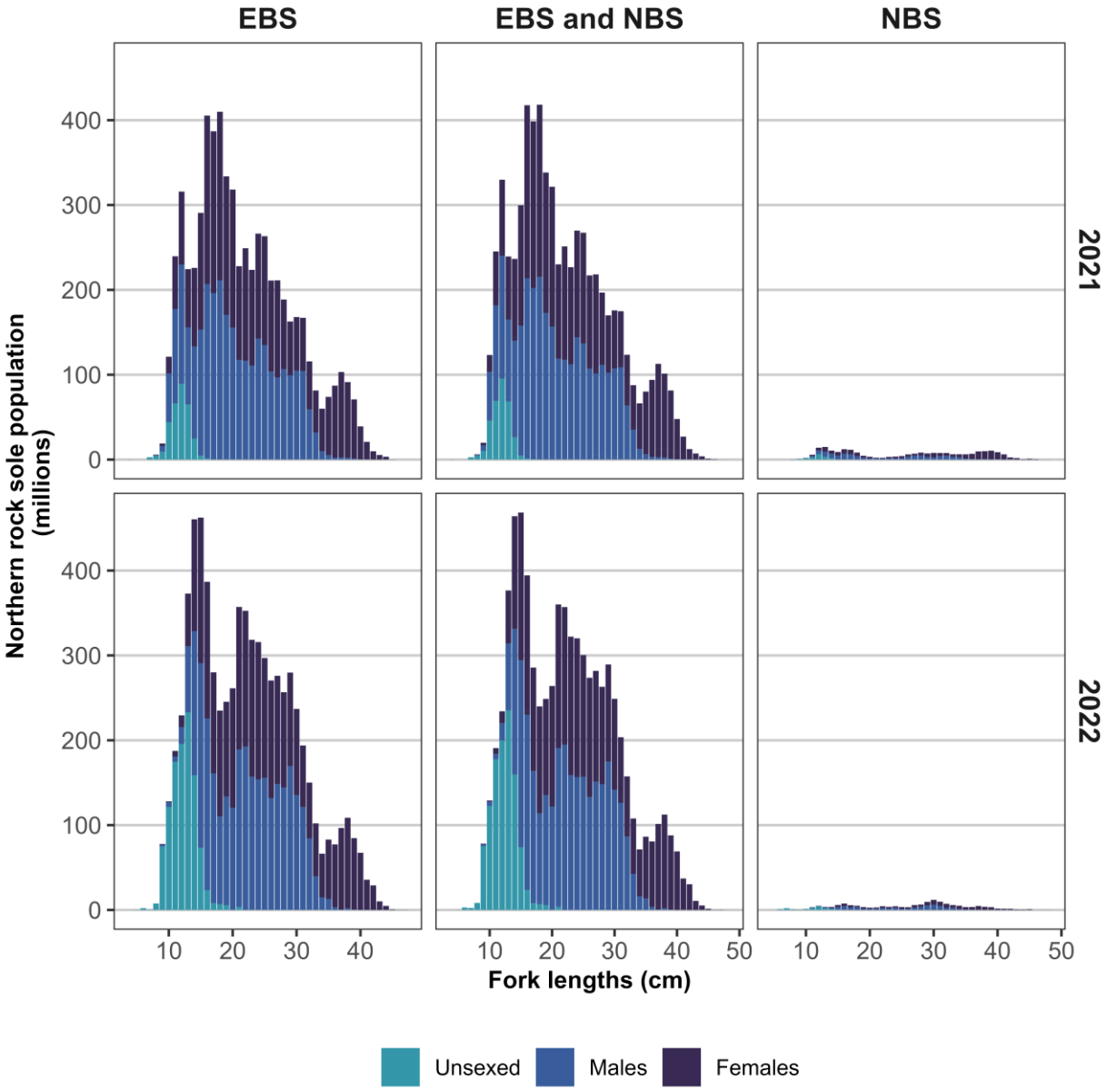

Figure 18. -- Total abundance-at-length estimates of northern rock sole (*Lepidopsetta polyxystra*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 22. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for northern rock sole (*Lepidopsetta polyxystra*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	71.85	7.61	565,470	59,857	444,499	686,440	58	58	58
20	24.50	3.84	100,907	15,801	68,642	133,172	31	31	31
31	25.92	5.56	246,192	52,837	140,518	351,866	67	67	67
32	28.17	9.58	24,924	8,474	4,883	44,964	8	8	8
41	12.23	3.40	76,184	21,210	33,319	119,048	43	43	43
42	97.77	28.96	235,851	69,854	93,208	378,493	29	29	29
43	15.48	9.71	32,614	20,460	0	75,172	22	22	22
50	0.39	0.24	1,487	908	0	3,358	3	3	3
61	0.58	0.16	5,050	1,440	2,141	7,960	27	27	27
62	0.86	0.40	555	257	0	1,182	6	6	6
82	1.61	0.78	2,887	1,407	0	5,985	11	11	11
90	2.13	1.07	2,460	1,233	0	5,376	8	8	8
Total	**26.26**	**2.26**	**1,294,581**	**111,582**	**1,073,647**	**1,515,514**	**313**	**313**	**313**
NBS									
70	2.53	0.50	20,082	3,990	12,017	28,146	53	53	53
71	0.52	0.30	4,196	2,439	0	9,125	20	20	20
81	5.78	2.58	22,165	9,876	1,900	42,430	24	24	24
Total	**2.34**	**0.55**	**46,443**	**10,927**	**24,359**	**68,526**	**97**	**97**	**97**

Table 23. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	539.68	52.95	4,247.60	416,770.81	3,405.31	5,089.90	58	58	58
20	166.44	29.21	685.61	120,308.29	439.94	931.28	31	31	31
31	148.39	32.85	1,409.38	312,022.74	785.34	2,033.43	67	67	67
32	104.56	32.35	92.50	28,622.66	24.81	160.19	8	8	8
41	38.13	8.57	237.61	53,411.26	129.67	345.56	43	43	43
42	266.79	63.18	643.56	152,409.61	332.34	954.78	29	29	29
43	31.43	18.85	66.21	39,714.46	0.00	148.82	22	22	22
50	0.73	0.43	2.78	1,629.70	0.00	6.14	3	3	3
61	1.24	0.33	10.89	2,931.30	4.97	16.82	27	27	27
62	1.61	0.64	1.04	411.75	0.03	2.05	6	6	6
82	3.45	1.55	6.19	2,787.68	0.06	12.33	11	11	11
90	4.39	2.14	5.07	2,471.38	0.00	10.91	8	8	8
Total	**150.28**	**11.37**	**7,408.46**	**560,386.86**	**6,298.89**	**8,518.02**	**313**	**313**	**313**
NBS									
70	11.71	2.42	92.84	19,194.21	54.05	131.64	53	53	53
71	0.60	0.34	4.86	2,778.46	0.00	10.48	20	20	20
81	16.02	6.76	61.45	25,915.61	8.27	114.63	24	24	24
Total	**8.00**	**1.63**	**159.16**	**32,369.07**	**93.74**	**224.58**	**97**	**97**	**97**

Flathead Sole (*Hippoglossoides elassodon*)

During the 2022 survey, flathead sole were present at 315 of 376 (83.8%) EBS survey stations and 3 of 144 (2.1%) survey stations in the NBS. In the EBS, flathead sole were found at bottom depths between 31 m and 183 m, and bottom temperatures between -1.6°C and 5.1°C. In the NBS, flathead sole were found at bottom depths between 50 m and 68 m, and bottom temperatures between -0.5°C and 4.3°C.

The estimated biomass of flathead sole in the EBS for 2022 was 703,375 t (5% of the total biomass; Tables **12** and **24**) and the estimated abundance was 2.4 billion fish (Table **25**). Previously in 2021, flathead sole biomass was estimated to be 674,745 t (6% of the total biomass; Table **12**), and the estimated abundance was 2.6 billion fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of flathead sole in the NBS was 126 t (Tables **13** and **24**) and the estimated abundance was 860,015 fish (Table **25**). Previously in 2021, flathead sole biomass was estimated to be 138 t (Table **13**) and the estimated abundance was 370,872 fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Flathead sole were found in higher densities in the deeper water of the outer shelf. The highest concentration was found west of St. Matthew Island, and to the north and the east of the Pribilof Islands. The range of fork lengths for flathead sole measured in 2022 was 5–56 cm in the EBS, and 19–40 cm in the NBS (Fig. **20**).

Flathead sole and Bering flounder (*Hippoglossoides robustus*) are congeners and can be difficult to distinguish in the field based on morphology. 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. **19**; compared with Bering flounder in Fig. **21**). Bering flounder tend to occupy arctic regions and shallow waters, while flathead sole are more subarctic/boreal and found in deeper waters (Baker and Hollowed, 2014).

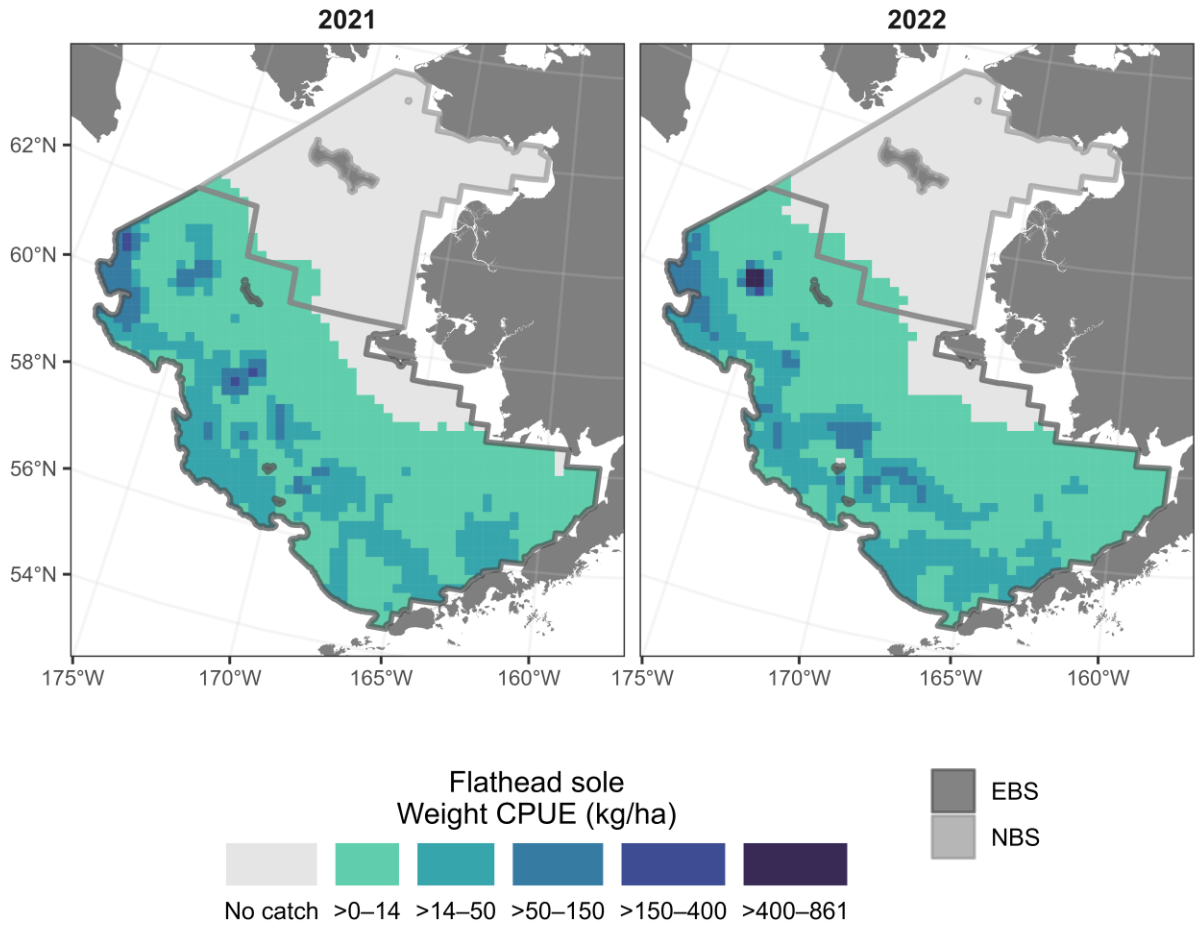

Figure 19. -- The distribution (weight CPUE (kg/ha)) of flathead sole (*Hippoglossoides elassodon*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

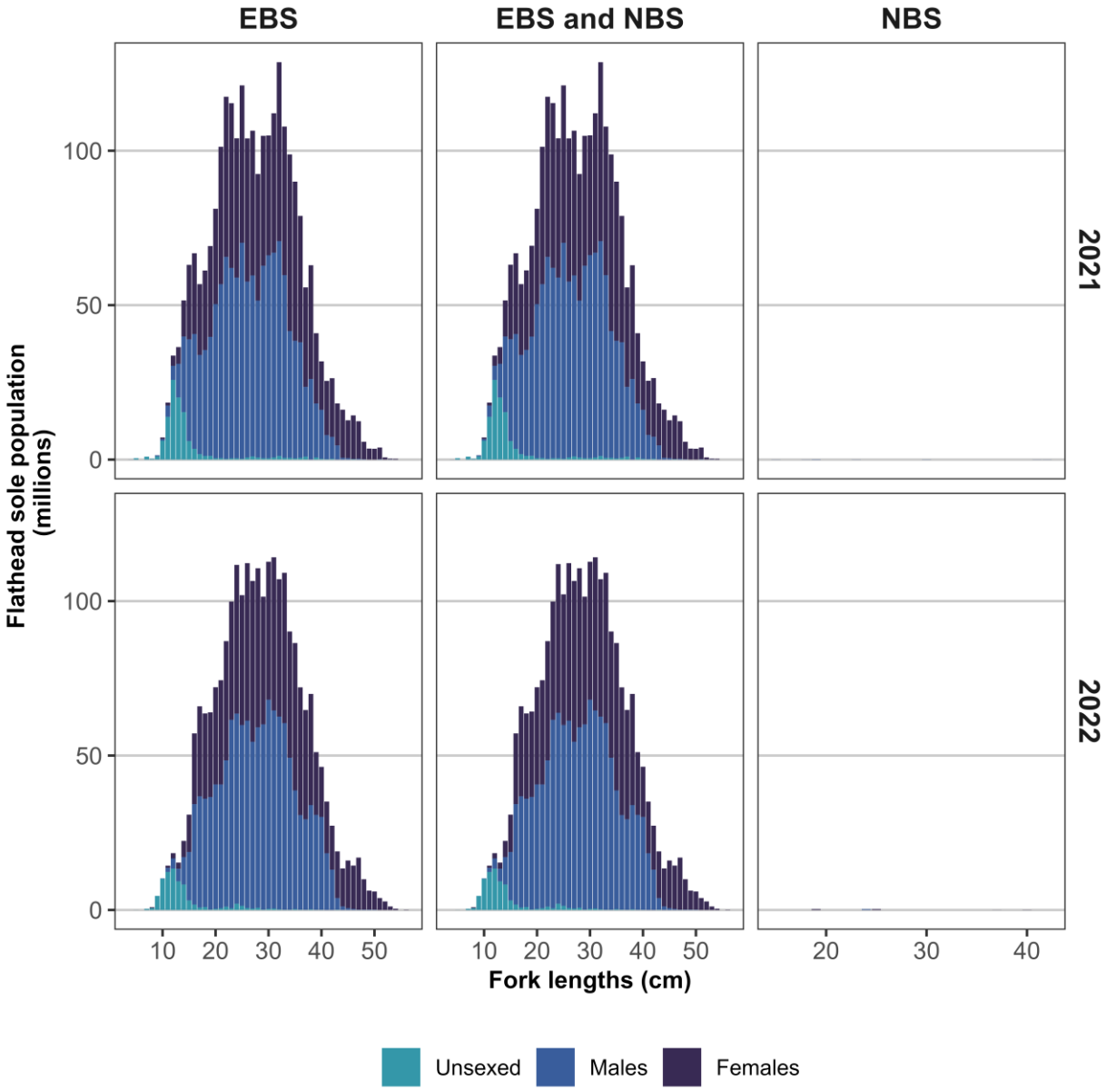

Figure 20. -- Total abundance-at-length estimates of flathead sole (*Hippoglossoides elassodon*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 24. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for flathead sole (*Hippoglossoides elassodon*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	3.52	0.79	27,726	6,192	15,213	40,240	39	39	39
20	0.17	0.10	687	416	0	1,536	8	8	8
31	13.73	1.69	130,453	16,035	98,384	162,522	69	69	69
32	39.29	16.22	34,763	14,352	820	68,705	8	8	8
41	3.97	1.10	24,766	6,881	10,860	38,672	39	38	38
42	27.75	6.67	66,938	16,089	34,084	99,793	27	27	27
43	3.95	1.50	8,314	3,167	1,727	14,901	21	21	21
50	15.29	1.82	58,153	6,931	43,875	72,431	25	25	25
61	39.00	14.39	342,309	126,311	87,034	597,584	60	60	60
62	4.93	2.30	3,186	1,489	0	6,831	7	7	7
82	1.61	1.32	2,883	2,374	0	8,109	4	4	4
90	2.77	0.76	3,196	874	1,128	5,263	8	8	8
Total	**14.27**	**2.63**	**703,375**	**129,727**	**443,922**	**962,828**	**315**	**314**	**314**
NBS									
70	0.01	0.01	75	75	0	226	1	1	1
71	0.00	0.00	0	0	0	0	0	0	0
81	0.01	0.01	51	38	0	130	2	2	2
Total	**0.01**	**0.00**	**126**	**84**	**0**	**296**	**3**	**3**	**3**

Table 25. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	8.07	2.00	63,555.16	15,713.83	31,797.52	95,312.81	39	39	39
20	0.40	0.28	1,660.22	1,141.81	0.00	3,991.80	8	8	8
31	48.51	5.17	460,709.52	49,083.85	362,541.83	558,877.21	69	69	69
32	74.28	22.05	65,709.04	19,508.77	19,570.80	111,847.29	8	8	8
41	8.22	2.24	51,202.84	13,970.25	22,968.96	79,436.72	39	38	38
42	59.09	13.30	142,546.79	32,089.65	77,019.72	208,073.86	27	27	27
43	10.40	3.70	21,900.82	7,783.80	5,710.52	38,091.11	21	21	21
50	114.35	14.95	434,986.47	56,869.67	317,834.95	552,138.00	25	25	25
61	133.55	25.22	1,172,232.64	221,362.20	724,859.63	1,619,605.64	60	60	60
62	19.36	8.39	12,506.64	5,421.49	0.00	25,773.02	7	7	7
82	2.71	2.23	4,861.65	3,998.12	0.00	13,661.51	4	4	4
90	9.47	2.59	10,925.35	2,988.68	3,857.13	17,993.57	8	8	8
Total	**49.55**	**4.83**	**2,442,797.14**	**237,935.36**	**1,966,926.41**	**2,918,667.87**	**315**	**314**	**314**
NBS									
70	0.10	0.10	779.71	779.71	0.00	2,355.50	1	1	1
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.02	0.02	80.31	58.91	0.00	201.19	2	2	2
Total	**0.04**	**0.04**	**860.01**	**781.93**	**0.00**	**2,440.30**	**3**	**3**	**3**

Bering Flounder (*Hippoglossoides robustus*)

During the 2022 survey, Bering flounder were present at 58 of 376 (15.4%) EBS survey stations and 90 of 144 (62.5%) survey stations in the NBS. In the EBS, Bering flounder were found at bottom depths between 53 m and 122 m, and bottom temperatures between -1.6°C and 3.8°C. In the NBS, Bering flounder were found at bottom depths between 22 m and 78 m, and bottom temperatures between -1.7°C and 11.4°C.

The estimated biomass of Bering flounder in the EBS for 2022 was 6,237 t (Tables **12** and **26**) and the estimated abundance was 36 million fish (Table **27**). Previously in 2021, Bering flounder biomass was estimated to be 9,511 t (Table **12**) and the estimated abundance was 42.2 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of Bering flounder in the NBS was 5,913 t (Tables **13** and **26**) and the estimated abundance was 61.6 million fish (Table **27**). Previously in 2021, Bering flounder biomass was estimated to be 8,384 t (Table **13**) and the estimated abundance was 61.9 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Bering flounder were most concentrated to the north and northwest of St. Matthew Island (Fig. **21**). The range of fork lengths for Bering flounder measured in 2022 was 10–43 cm in the EBS, and 6–42 cm in the NBS (Fig. **22**).

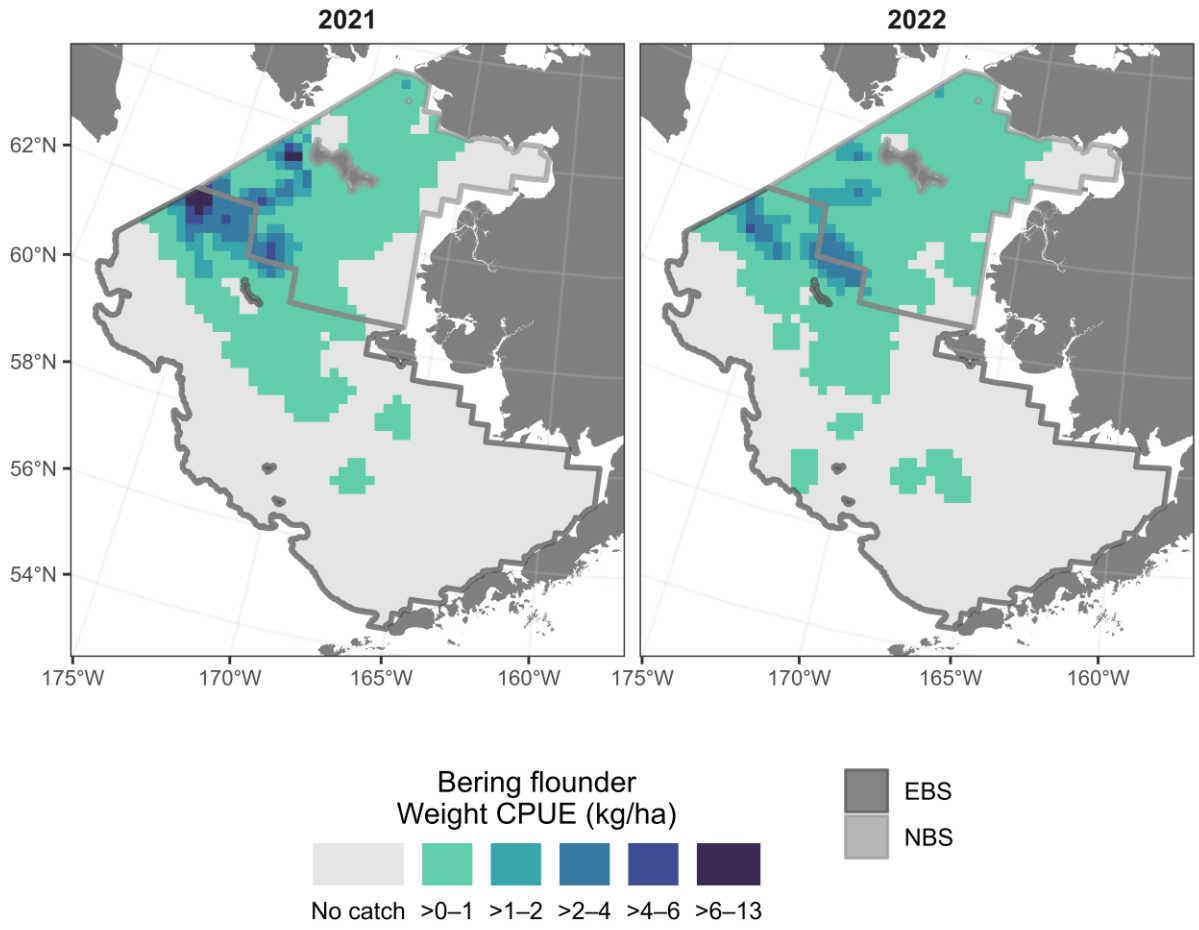

Figure 21. -- The distribution (weight CPUE (kg/ha)) of Bering flounder (*Hippoglossoides robustus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

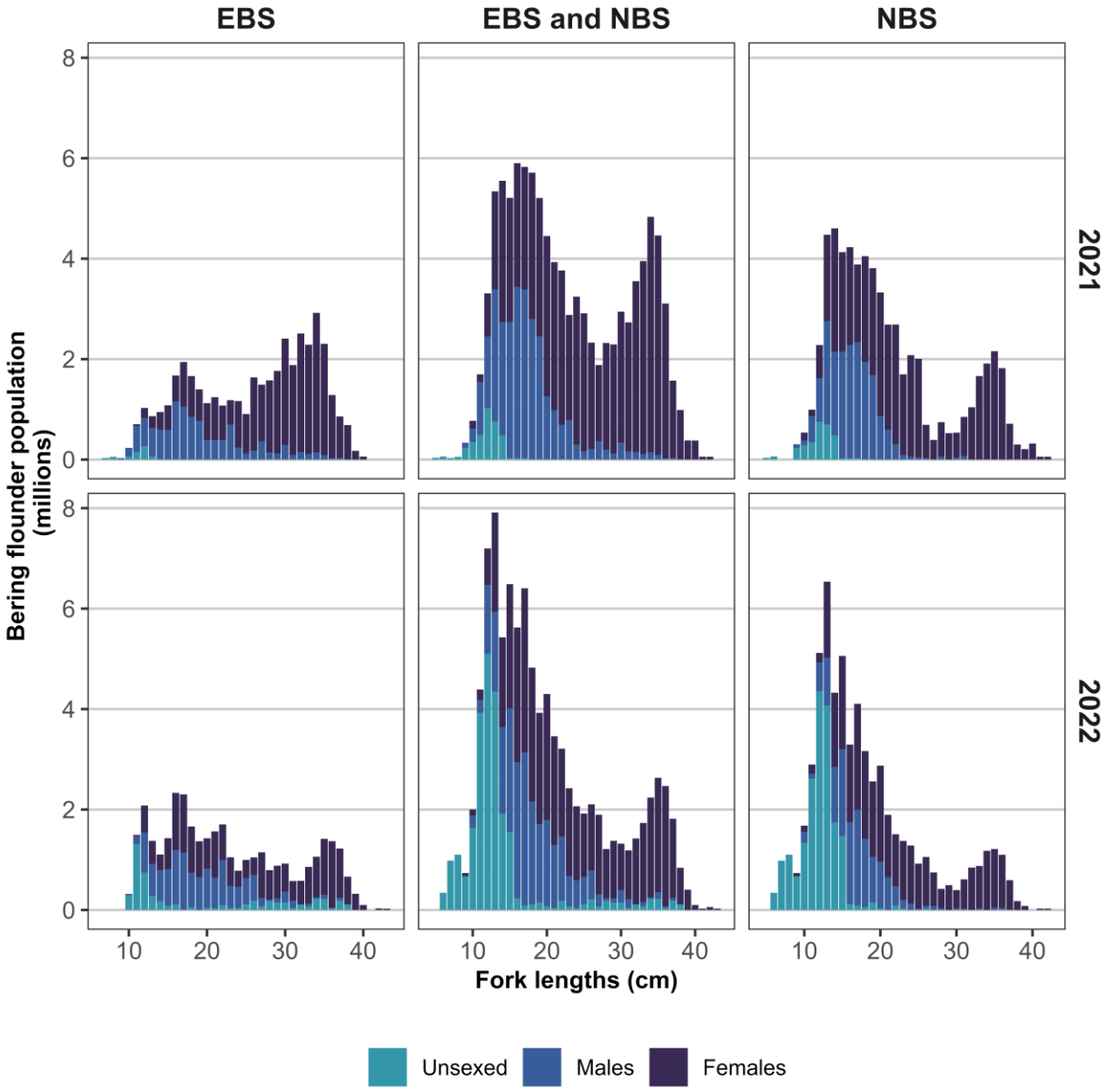

Figure 22. -- Total abundance-at-length estimates of Bering flounder (*Hippoglossoides robustus*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 26. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Bering flounder (*Hippoglossoides robustus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.01	0.01	26	26	0	79	1	1	1
31	0.00	0.00	26	15	0	56	3	3	3
32	0.00	0.00	0	0	0	0	0	0	0
41	0.38	0.12	2,376	719	924	3,829	22	22	22
42	0.00	0.00	5	5	0	15	1	1	1
43	0.07	0.02	141	50	37	244	9	9	9
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	32	26	0	84	3	3	3
62	0.01	0.01	5	5	0	17	1	1	1
82	1.06	0.27	1,901	485	833	2,968	12	12	12
90	1.50	0.63	1,726	727	6	3,447	6	6	6
Total	**0.13**	**0.02**	**6,237**	**1,133**	**3,970**	**8,504**	**58**	**58**	**58**
NBS									
70	0.10	0.04	776	280	210	1,341	27	27	27
71	0.12	0.03	968	256	450	1,486	36	36	36
81	1.09	0.21	4,169	823	2,478	5,860	27	27	27
Total	**0.30**	**0.05**	**5,913**	**906**	**4,082**	**7,744**	**90**	**90**	**90**

Table 27. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.09	0.09	351.87	351.87	0.00	1,070.39	1	1	1
31	0.03	0.02	252.01	148.11	0.00	548.23	3	3	3
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	3.08	0.93	19,193.97	5,797.05	7,478.14	30,909.80	22	22	22
42	0.01	0.01	31.61	31.61	0.00	96.15	1	1	1
43	0.45	0.17	952.64	351.76	220.98	1,684.30	9	9	9
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.07	0.05	625.05	457.40	0.00	1,549.45	3	3	3
62	0.06	0.06	36.71	36.71	0.00	126.53	1	1	1
82	4.56	1.05	8,191.58	1,877.88	4,058.37	12,324.80	12	12	12
90	5.52	2.10	6,371.38	2,417.73	653.45	12,089.31	6	6	6
Total	**0.73**	**0.13**	**36,006.82**	**6,592.32**	**22,822.19**	**49,191.46**	**58**	**58**	**58**
NBS									
70	1.05	0.25	8,310.43	2,001.20	4,266.00	12,354.85	27	27	27
71	2.83	0.59	23,034.15	4,797.81	13,337.78	32,730.52	36	36	36
81	7.88	1.11	30,238.67	4,241.35	21,518.44	38,958.90	27	27	27
Total	**3.10**	**0.34**	**61,583.24**	**6,709.16**	**48,024.03**	**75,142.46**	**90**	**90**	**90**

Alaska Plaice (*Pleuronectes quadrituberculatus*)

During the 2022 survey, Alaska plaice were present at 253 of 376 (67.3%) EBS survey stations and 138 of 144 (95.8%) survey stations in the NBS. In the EBS, Alaska plaice were found at bottom depths between 22 m and 135 m, and bottom temperatures between -1.6°C and 8.4°C. In the NBS, Alaska plaice were found at bottom depths between 11 m and 74 m, and bottom temperatures between -1.7°C and 12°C.

The estimated biomass of Alaska plaice in the EBS for 2022 was 385,294 t (3% of the total biomass; Tables **12** and **28**) and the estimated abundance was 660.3 million fish (Table **29**). Previously in 2021, Alaska plaice biomass was estimated to be 335,034 t (3% of the total biomass; Table **12**) and the estimated abundance was 582 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of Alaska plaice in the NBS was 299,028 t (9% of the total biomass; Tables **13** and **28**) and the estimated abundance was 538.9 million fish (Table **29**). Previously in 2021, Alaska plaice biomass was estimated to be 344,581 t (12% of the total biomass; Table **13**) and the estimated abundance was 570.8 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Alaska plaice were present throughout the inner and middle domain of the survey area (Fig. **23**). The highest concentration in the EBS for 2022 was located on the northern edge of St. Matthew Island. The highest densities of Alaska plaice in the NBS occurred just south of St. Lawrence Island. The range of fork lengths for Alaska plaice measured in 2022 was 8–58 cm in the EBS, and 7–61 cm in the NBS (Fig. **24**).

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 and increasing in average size with depth (Zhang et al., 1998).

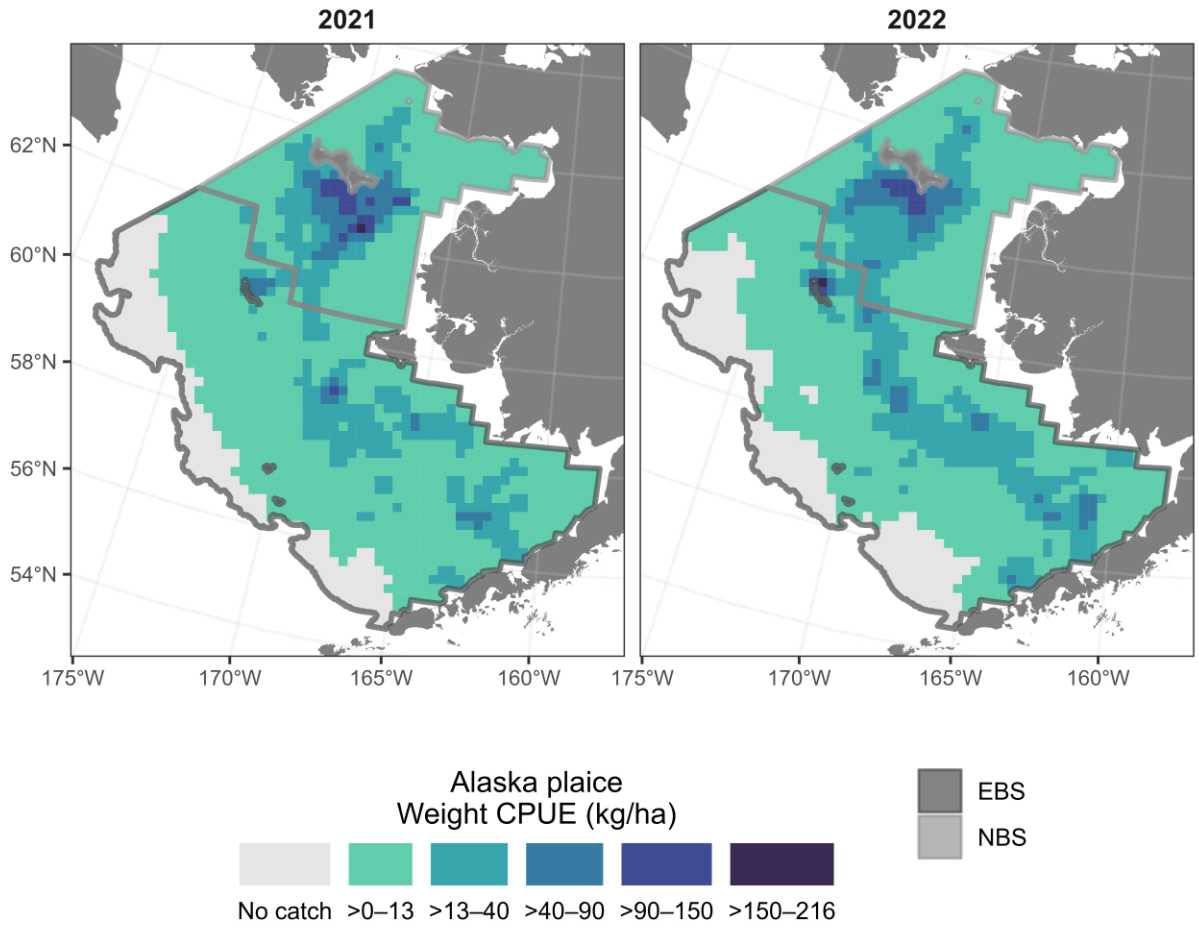

Figure 23. -- The distribution (weight CPUE (kg/ha)) of Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

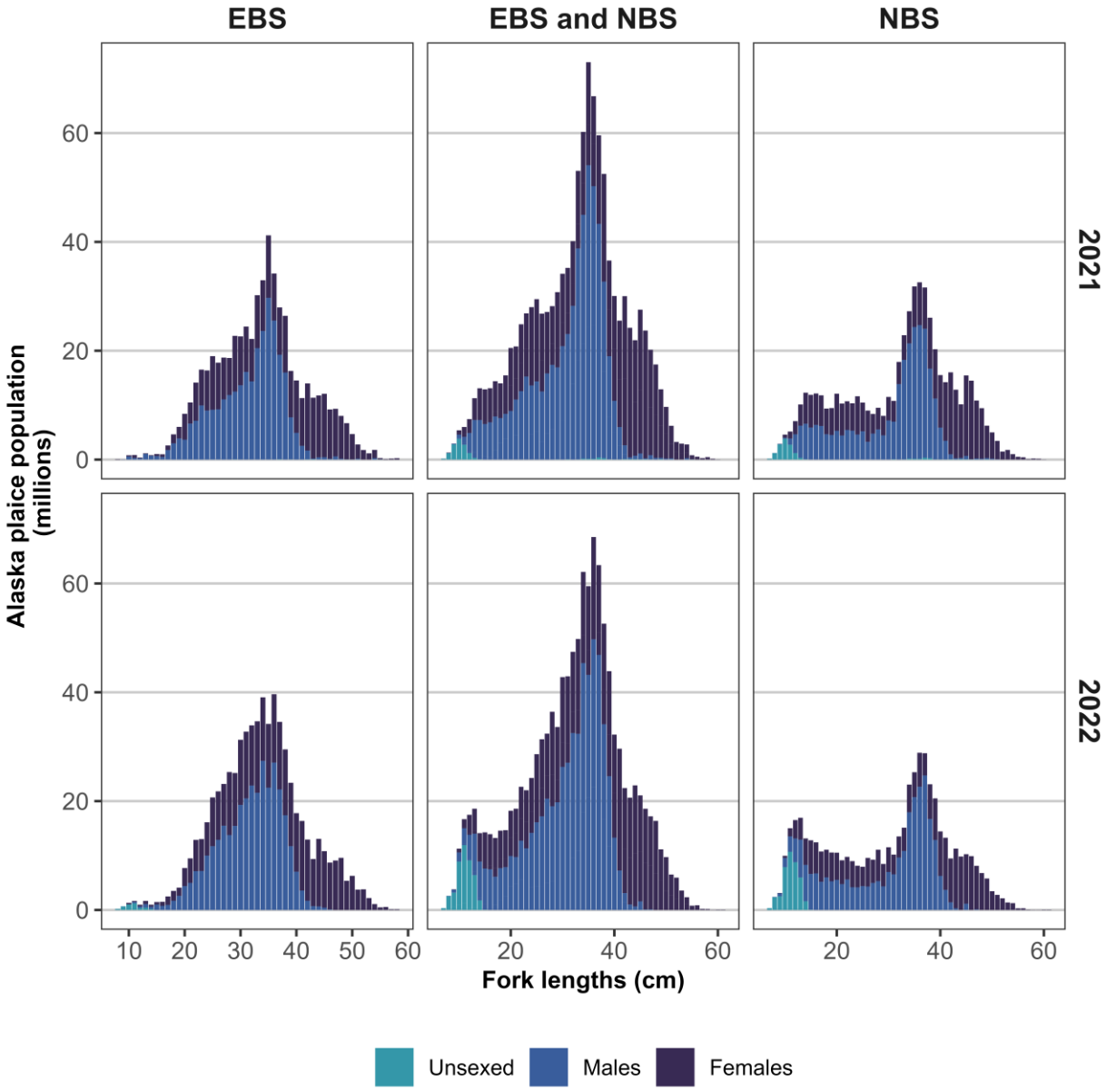

Figure 24. -- Total abundance-at-length estimates of Alaska plaice (*Pleuronectes quadrituberculatus*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 28. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Alaska plaice (*Pleuronectes quadrituberculatus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	13.13	2.01	103,346	15,815	71,384	135,308	58	58	57
20	15.49	3.27	63,788	13,473	36,276	91,301	31	31	31
31	9.43	2.07	89,562	19,645	50,272	128,851	56	56	56
32	3.80	0.93	3,364	820	1,425	5,303	7	7	7
41	15.67	4.90	97,621	30,524	35,933	159,310	38	38	38
42	4.15	1.06	10,015	2,558	4,791	15,238	18	18	18
43	3.35	1.98	7,059	4,178	0	15,750	20	20	20
50	0.01	0.01	42	42	0	129	1	1	1
61	0.20	0.09	1,761	754	237	3,285	6	6	6
62	0.38	0.17	247	112	0	520	4	4	4
82	3.99	2.48	7,163	4,459	0	16,978	9	9	9
90	1.15	0.90	1,326	1,042	0	3,790	5	5	5
Total	**7.82**	**0.86**	**385,294**	**42,373**	**301,395**	**469,193**	**253**	**253**	**252**
NBS									
70	24.13	4.68	191,270	37,072	116,347	266,193	58	58	58
71	5.88	1.22	47,786	9,936	27,706	67,866	56	56	56
81	15.64	3.31	59,972	12,689	33,883	86,062	24	24	24
Total	**15.04**	**2.03**	**299,028**	**40,424**	**218,180**	**379,876**	**138**	**138**	**138**

Table 29. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	36.65	5.34	288,445.42	41,998.56	203,566.32	373,324.51	58	58	57
20	32.12	4.95	132,332.77	20,379.20	90,718.45	173,947.09	31	31	31
31	10.27	2.06	97,552.25	19,581.15	58,389.96	136,714.55	56	56	56
32	3.13	0.89	2,772.78	785.66	914.69	4,630.86	7	7	7
41	18.40	5.33	114,632.93	33,203.79	47,528.07	181,737.79	38	38	38
42	4.00	1.00	9,654.88	2,408.59	4,736.53	14,573.23	18	18	18
43	3.46	2.31	7,295.54	4,863.72	0.00	17,412.07	20	20	20
50	0.01	0.01	25.61	25.61	0.00	78.36	1	1	1
61	0.11	0.04	969.37	388.83	183.55	1,755.19	6	6	6
62	0.24	0.10	154.77	65.64	0.00	315.40	4	4	4
82	3.12	1.96	5,606.19	3,525.49	0.00	13,365.79	9	9	9
90	0.75	0.60	864.00	687.67	0.00	2,490.35	5	5	5
Total	**13.39**	**1.24**	**660,306.51**	**60,895.29**	**539,733.84**	**780,879.19**	**253**	**253**	**252**
NBS									
70	41.24	5.18	326,839.00	41,086.80	243,802.57	409,875.43	58	58	58
71	17.36	2.78	141,021.85	22,555.17	95,437.85	186,605.84	56	56	56
81	18.52	4.30	71,022.79	16,495.24	37,108.57	104,937.00	24	24	24
Total	**27.10**	**2.50**	**538,883.63**	**49,688.57**	**439,506.49**	**638,260.77**	**138**	**138**	**138**

Greenland Turbot (*Reinhardtius hippoglossoides*)

During the 2022 survey, Greenland turbot were present at 38 of 376 (10.1%) EBS survey stations and were not encountered in the NBS. In the EBS, Greenland turbot were found at bottom depths between 86 m and 183 m, and bottom temperatures between -0.6°C and 3.6°C.

The estimated biomass of Greenland turbot in the EBS for 2022 was 7,869 t (Tables **12** and **30**) and the estimated abundance was 2 million fish (Table **31**). Previously in 2021, Greenland turbot biomass was estimated to be 10,690 t (Table **12**), and the estimated abundance was 2.7 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Greenland turbot were distributed primarily in the northwest portion of the middle and outer domains from U.S.-Russia Maritime Boundary south to the Pribilof Islands (Fig. **25**) The range of fork lengths for Greenland turbot measured in 2022 was 42–85 cm in the NBS (Fig. **26**).

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). The order of magnitude decrease in estimated population since 2010 may be attributed to the ontogenetic movement of the strong 2010 year class out of the survey area and into the upper continental slope waters (Alton et al., 1998).

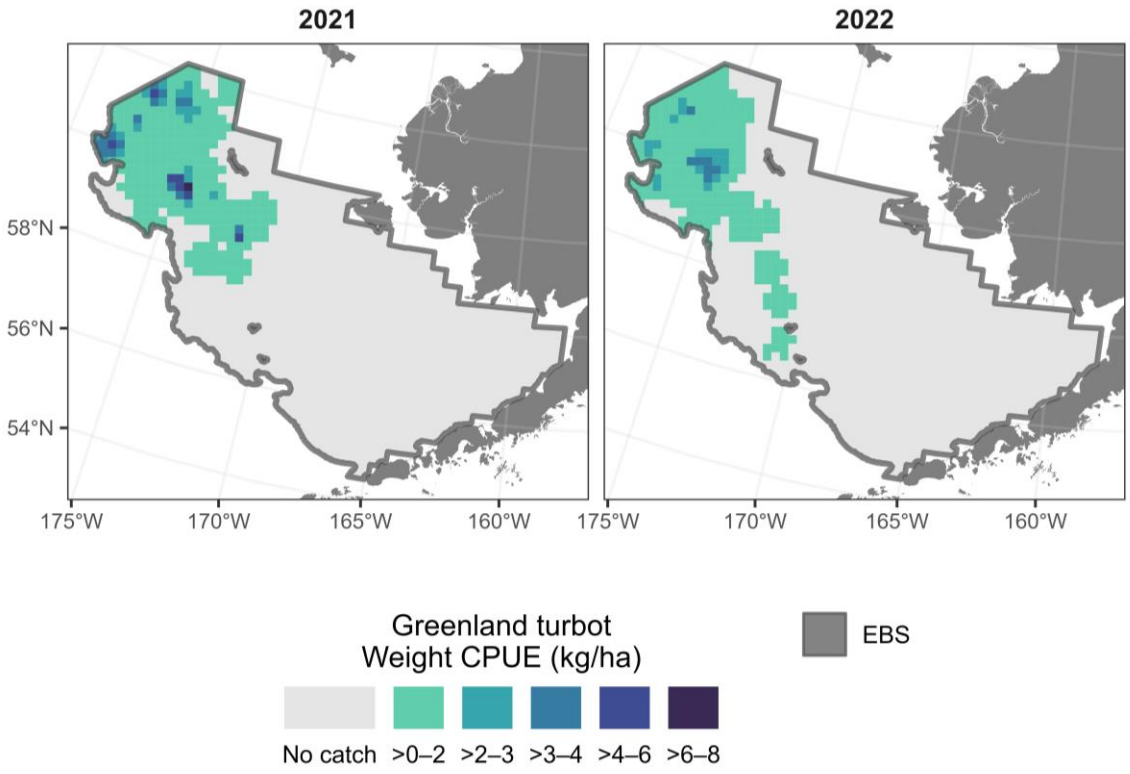

Figure 25. -- The distribution (weight CPUE (kg/ha)) of Greenland turbot (*Reinhardtius hippoglossoides*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

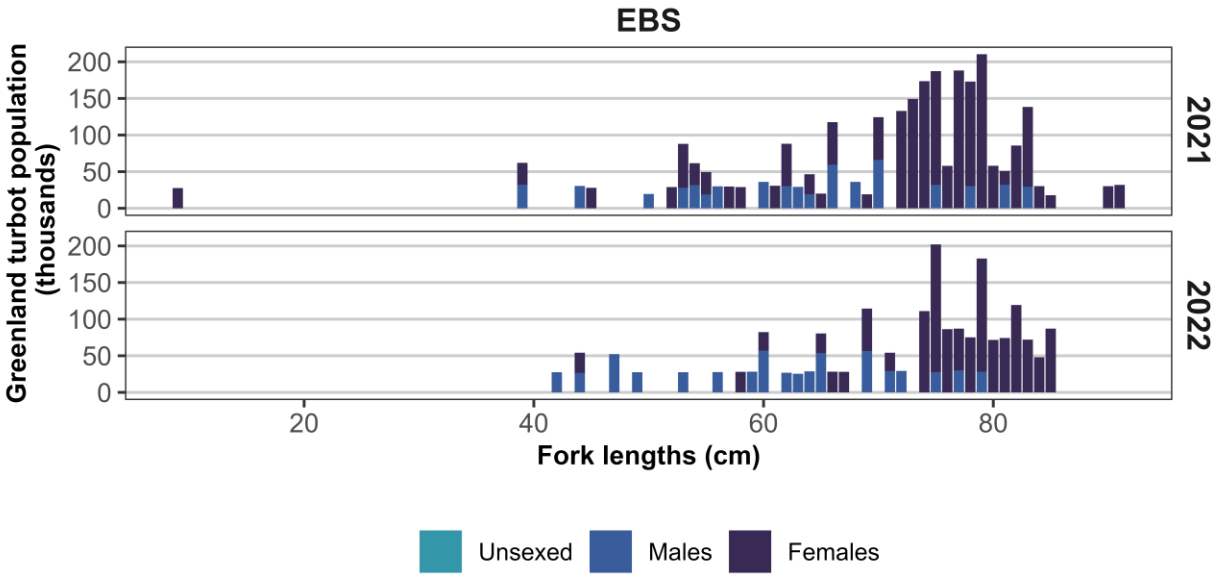

Figure 26. -- Total abundance-at-length estimates of Greenland turbot (*Reinhardtius hippoglossoides*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS) shelf bottom trawl surveys. There were no lengths collected for this species in the 2021-2022 northern Bering Sea shelf trawl surveys. Length distributions scaled up to the total estimated population size.

Table 30. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Greenland turbot (*Reinhardtius hippoglossoides*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.04	0.03	270	189	0	651	2	2	2
42	0.08	0.06	200	139	0	485	2	2	2
43	0.13	0.07	282	157	0	608	3	3	3
50	0.00	0.00	0	0	0	0	0	0	0
61	0.59	0.14	5,190	1,218	2,728	7,652	19	19	19
62	0.71	0.38	462	246	0	1,062	3	3	3
82	0.11	0.08	197	147	0	521	2	2	2
90	1.10	0.36	1,268	419	278	2,258	7	7	7
Total	**0.16**	**0.03**	**7,869**	**1,349**	**5,197**	**10,540**	**38**	**38**	**38**

Table 31. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.00	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	57.31	40.06	0.00	138.26	2	2	2
42	0.01	0.01	30.32	21.08	0.00	73.36	2	2	2
43	0.03	0.01	56.82	31.23	0.00	121.77	3	3	3
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.13	0.03	1,159.71	261.92	630.37	1,689.05	19	19	19
62	0.14	0.07	89.28	45.72	0.00	201.15	3	3	3
82	0.03	0.02	55.70	37.58	0.00	138.41	2	2	2
90	0.47	0.10	539.29	117.02	262.53	816.04	7	7	7
Total	**0.04**	**0.01**	**1,988.41**	**298.03**	**1,398.31**	**2,578.51**	**38**	**38**	**38**

Arrowtooth Flounder (*Atheresthes stomias*)

During the 2022 survey, arrowtooth flounder were present at 228 of 376 (60.6%) EBS survey stations and 1 of 144 (0.7 %) survey stations in the NBS. In the EBS, arrowtooth flounder were found at bottom depths between 38 m and 183 m, and bottom temperatures between -0.7°C and 5.1°C. In the NBS, arrowtooth flounder were found at 50 m depth, and a bottom temperature of 4.3°C.

The estimated biomass of arrowtooth flounder in the EBS for 2022 was 521,615 t (4% of the total biomass; Tables **12** and **32**) and estimated abundance was 1 billion fish (Table **33**). Previously in 2021, arrowtooth flounder biomass was estimated to be 457,569 t (4% of the total biomass; Table **12**) and the estimated abundance was 937 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of arrowtooth flounder in the NBS was 409 t (Tables **13** and **32**) and the estimated abundance was 519,806 fish (Table **33**). Previously in 2021, arrowtooth flounder biomass was estimated to be 1,740 t (Table **13**) and the estimated abundance was 2.3 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

In 2022, arrowtooth flounder appear to occupy similar areas as Kamchatka flounder (Fig. **27** and **29**), although arrowtooth flounder are much more abundant than Kamchatka flounder. The range of fork lengths for arrowtooth flounder measured in 2022 was 8–75 cm in the EBS, and 41–44 cm in the NBS (Fig. **28**).

Arrowtooth flounder generally inhabit deeper waters 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 mostly 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. **27**). As with all previous years, females outnumbered males, at a rate of approximately 2:1, with females attaining larger average sizes (Fig. **28**). This disparity in sex ratio has been attributed to sex-specific differences in natural mortality rates, but the issue requires further research (Spies et al., 2018; Zimmermann and Goddard, 1996).

Arrowtooth flounder are morphologically similar to the congeneric Kamchatka flounder (Yang, 1988), and methods to reliably distinguish between the two species were not adopted on AFSC bottom trawl surveys until 1994.

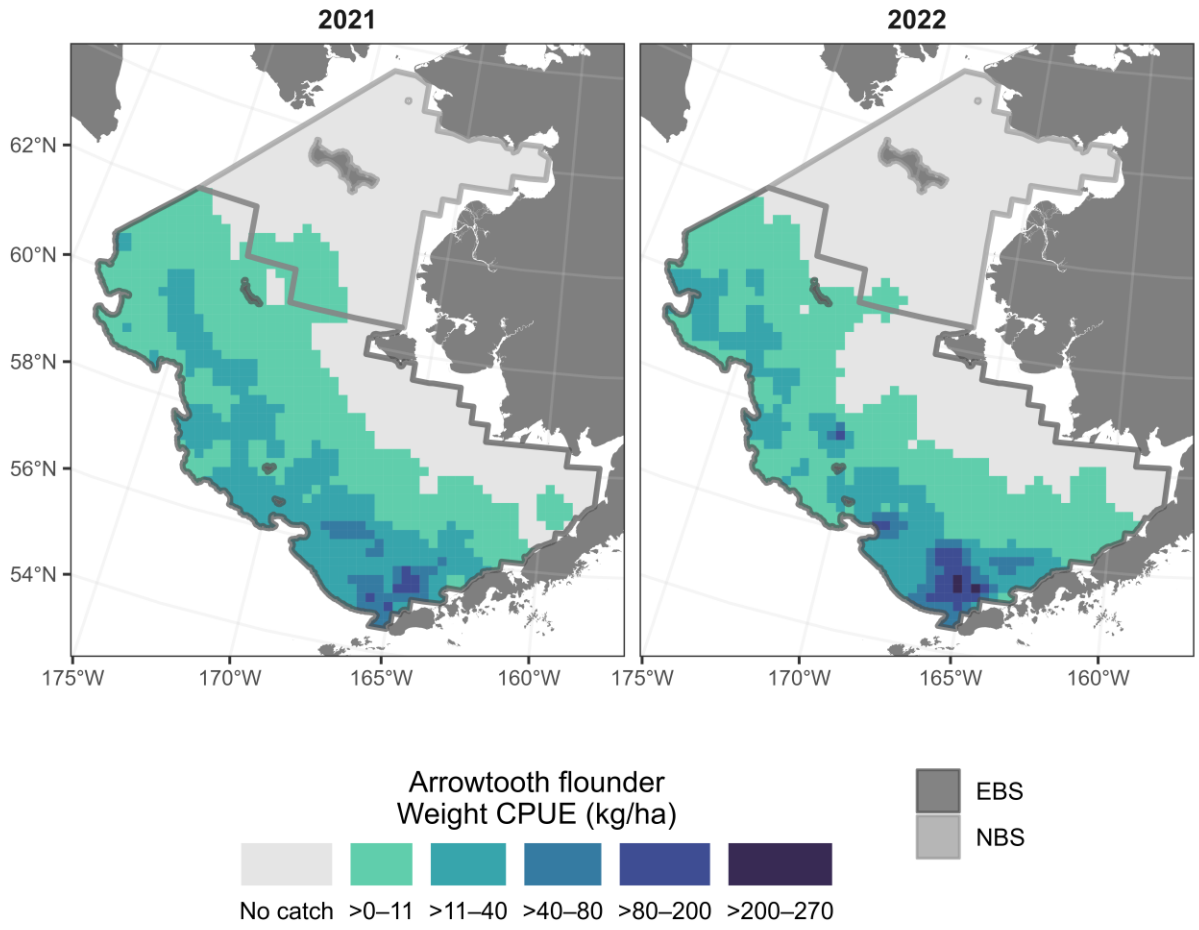

Figure 27. -- The distribution (weight CPUE (kg/ha)) of arrowtooth flounder (*Atheresthes stomias*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

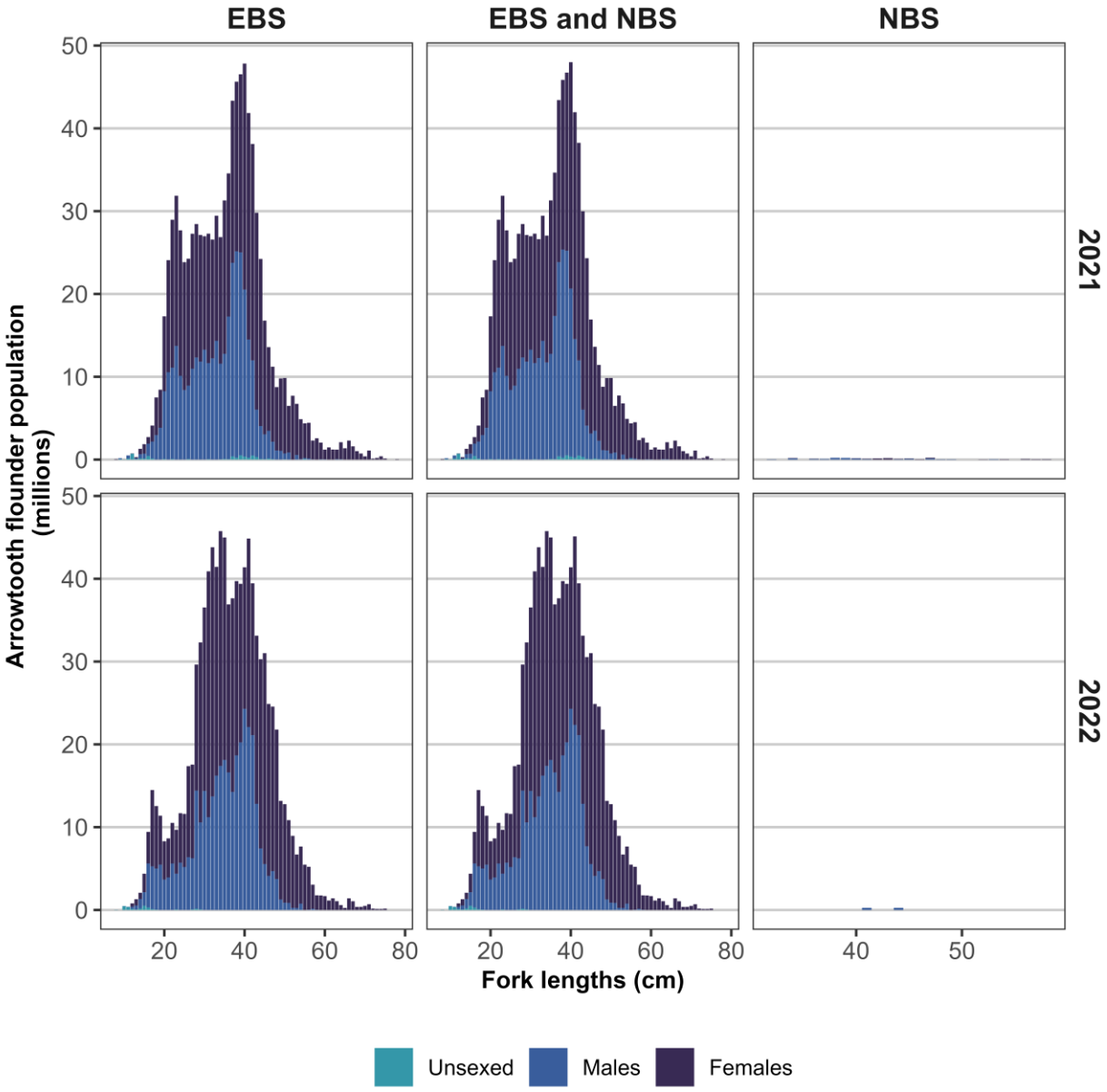

Figure 28. -- Total abundance-at-length estimates of arrowtooth flounder (*Atheresthes stomias*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 32. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for arrowtooth flounder (*Atheresthes stomias*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.24	0.14	1,865	1,125	0	4,138	5	5	5
20	0.03	0.03	141	141	0	429	1	1	1
31	17.91	4.58	170,116	43,466	83,184	257,049	59	59	59
32	24.47	3.92	21,649	3,468	13,448	29,851	8	8	8
41	0.81	0.51	5,060	3,154	0	11,434	11	11	11
42	12.09	3.50	29,170	8,442	11,932	46,408	28	28	28
43	0.34	0.09	708	196	300	1,117	15	15	15
50	51.33	10.71	195,258	40,751	111,311	279,205	26	26	26
61	10.09	1.02	88,541	8,959	70,435	106,647	60	60	60
62	12.18	5.06	7,872	3,269	0	15,872	7	7	7
82	0.04	0.03	74	58	0	202	2	2	2
90	1.01	0.35	1,160	400	215	2,106	6	6	6
Total	**10.58**	**1.24**	**521,615**	**61,120**	**399,375**	**643,854**	**228**	**228**	**228**
NBS									
70	0.05	0.05	409	409	0	1,235	1	1	1
71	0.00	0.00	0	0	0	0	0	0	0
81	0.00	0.00	0	0	0	0	0	0	0
Total	**0.02**	**0.02**	**409**	**409**	**0**	**1,226**	**1**	**1**	**1**

Table 33. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	1.24	1.07	9,779.03	8,414.28	0.00	26,784.30	5	5	5
20	0.04	0.03	144.06	144.06	0.00	438.23	1	1	1
31	38.41	10.39	364,781.25	98,694.13	167,392.99	562,169.51	59	59	59
32	59.84	11.46	52,936.76	10,135.84	28,965.49	76,908.02	8	8	8
41	1.67	1.02	10,415.96	6,347.92	0.00	23,245.12	11	11	11
42	27.96	8.65	67,454.26	20,877.54	24,822.32	110,086.21	28	28	28
43	0.41	0.09	866.54	197.71	455.30	1,277.78	15	15	15
50	90.68	17.73	344,927.97	67,432.41	206,017.21	483,838.74	26	26	26
61	15.79	1.52	138,594.72	13,385.14	111,543.35	165,646.09	60	60	60
62	15.34	6.56	9,910.03	4,237.33	0.00	20,278.78	7	7	7
82	0.06	0.05	113.19	87.99	0.00	306.85	2	2	2
90	1.41	0.48	1,630.53	550.61	328.34	2,932.71	6	6	6
Total	**20.32**	**2.50**	**1,001,554.31**	**123,023.79**	**755,506.74**	**1,247,601.89**	**228**	**228**	**228**
NBS									
70	0.07	0.07	519.81	519.81	0.00	1,570.33	1	1	1
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.03**	**0.03**	**519.81**	**519.81**	**0.00**	**1,559.42**	**1**	**1**	**1**

Kamchatka Flounder (*Atheresthes evermanni*)

During the 2022 survey, Kamchatka flounder were present at 154 of 376 (41%) EBS survey stations and were not encountered in the NBS. In the EBS, Kamchatka flounder were found at bottom depths between 51 m and 183 m, and bottom temperatures between 0°C and 4.6°C.

The estimated biomass of Kamchatka flounder in the EBS for 2022 was 29,699 t (Tables **12** and **34**) and the estimated abundance was 45.3 million fish (Table **35**). Previously in 2021, Kamchatka flounder biomass was estimated to be 32,856 t (Table **12**), and the estimated abundance was 60 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Similar to arrowtooth flounder, Kamchatka flounder occupied areas in the middle and outer domain in 2022, although Kamchatka flounder were much less abundant than arrowtooth flounder in the Bering Sea (Figs. **27** and **29**). The Kamchatka flounder sex ratio was roughly 1:1 (Fig. **30**). The range of fork lengths for Kamchatka flounder measured in 2022 was 11–77 cm in the EBS (Fig. **30**).

As previously mentioned, Kamchatka flounder and Arrowtooth flounder are congeneric (Yang, 1988), and methods to reliably distinguish between the two species were not adopted on AFSC bottom trawl surveys until 1994.

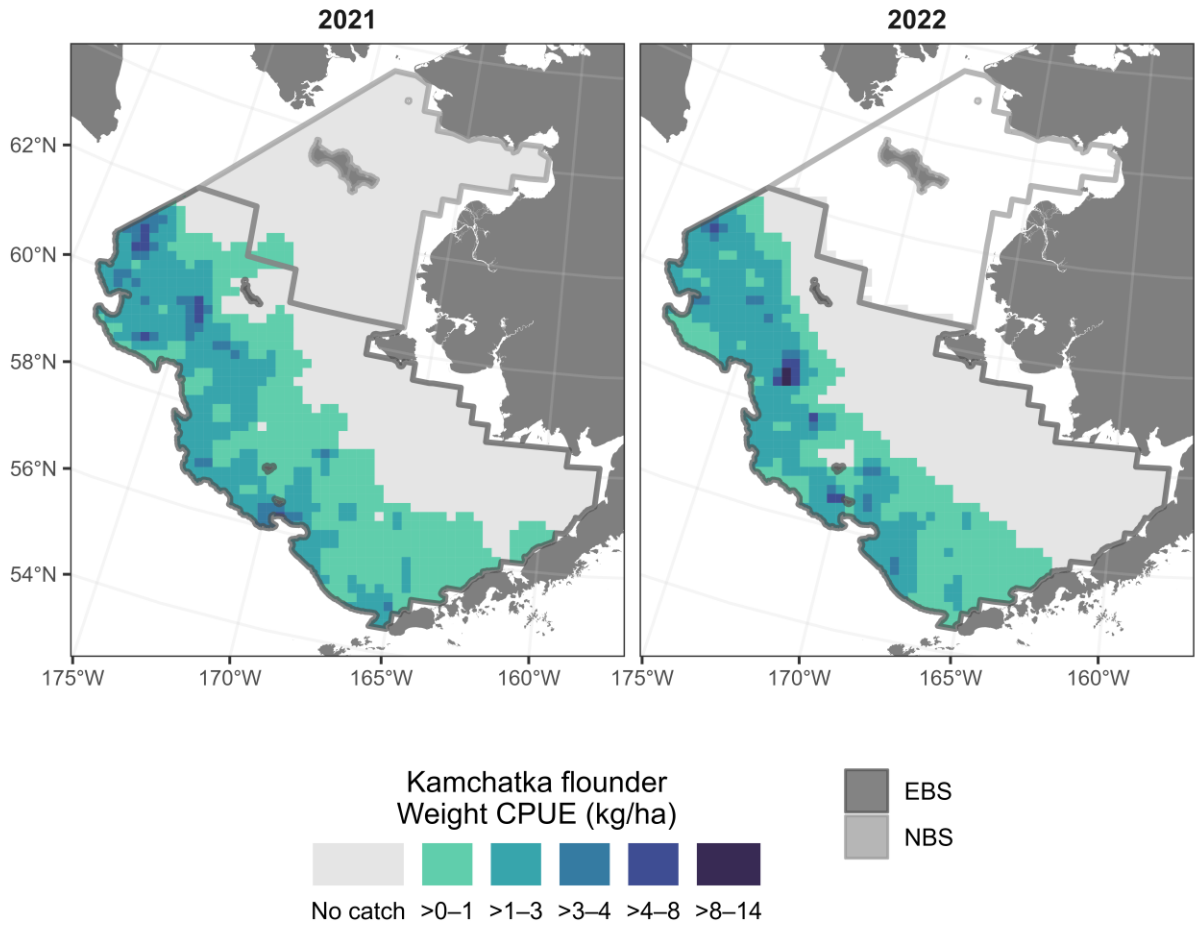

Figure 29. -- The distribution (weight CPUE (kg/ha)) of Kamchatka flounder (*Atheresthes evermanni*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

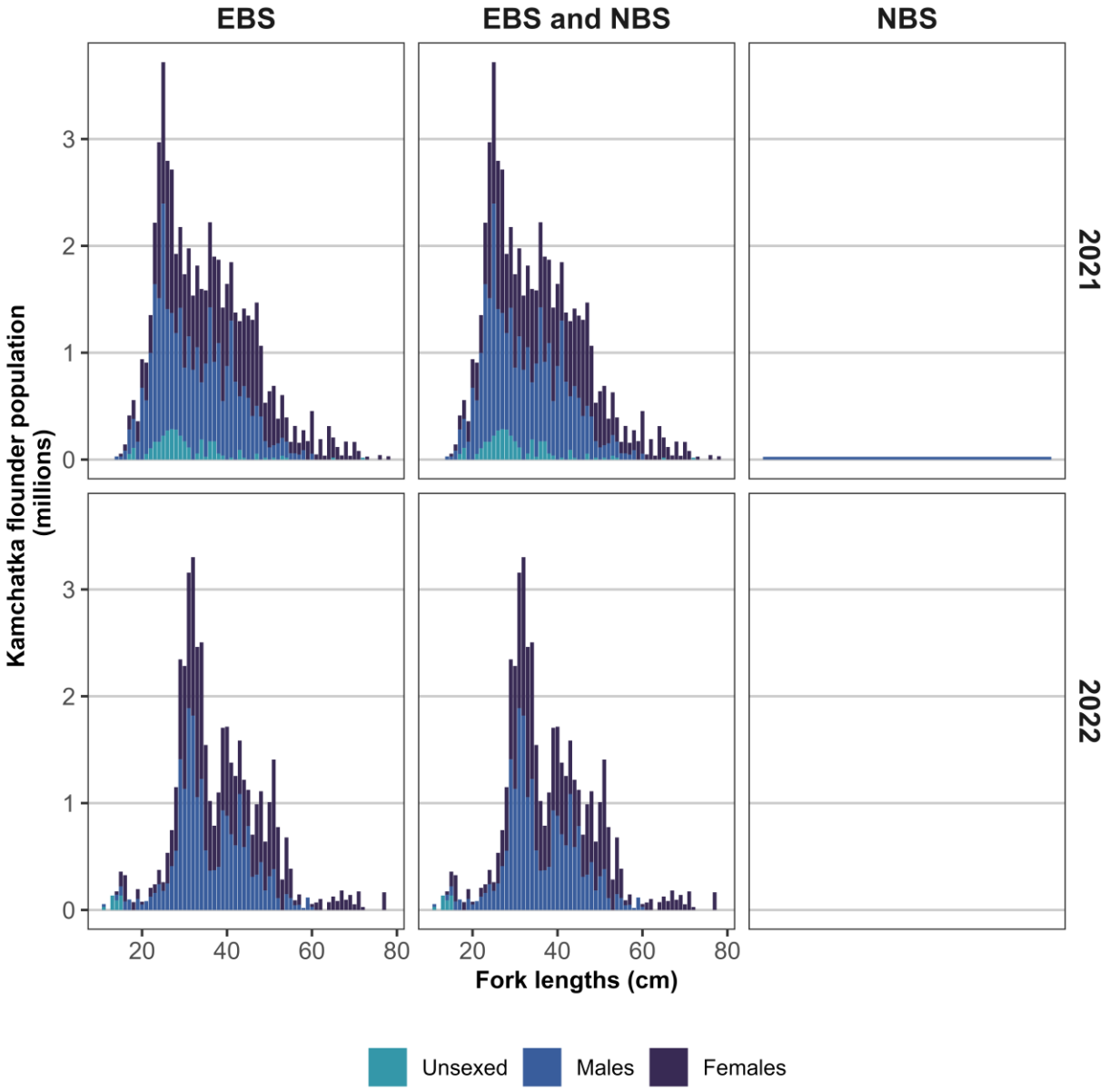

Figure 30. -- Total abundance-at-length estimates of Kamchatka flounder (*Atheresthes evermanni*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 34. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Kamchatka flounder (*Atheresthes evermanni*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.20	0.04	1,907	402	1,102	2,711	25	25	25
32	1.49	0.44	1,318	387	402	2,234	8	8	8
41	0.23	0.12	1,418	750	0	2,933	5	5	5
42	0.80	0.30	1,932	723	455	3,409	14	14	14
43	0.38	0.15	794	323	123	1,465	7	7	7
50	1.32	0.19	5,023	740	3,498	6,547	26	26	26
61	1.62	0.24	14,224	2,070	10,040	18,408	56	56	56
62	2.14	0.35	1,381	227	825	1,937	7	7	7
82	0.01	0.01	12	12	0	39	1	1	1
90	1.46	0.57	1,690	656	138	3,242	5	5	5
Total	**0.60**	**0.05**	**29,699**	**2,611**	**24,529**	**34,869**	**154**	**154**	**154**

Table 35. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.41	0.08	3,869.51	788.22	2,293.06	5,445.95	25	25	25
32	3.56	1.32	3,145.98	1,163.36	394.65	5,897.32	8	8	8
41	0.14	0.07	848.88	413.24	13.73	1,684.04	5	5	5
42	0.90	0.27	2,174.67	644.19	859.23	3,490.10	14	14	14
43	0.34	0.13	726.72	271.83	161.32	1,292.13	7	7	7
50	2.77	0.46	10,536.48	1,766.86	6,896.73	14,176.22	26	26	26
61	2.36	0.25	20,725.55	2,205.76	16,267.72	25,183.39	56	56	56
62	2.25	0.53	1,453.20	340.51	619.97	2,286.43	7	7	7
82	0.02	0.02	28.75	28.75	0.00	92.02	1	1	1
90	1.55	0.61	1,783.55	708.23	108.59	3,458.50	5	5	5
Total	**0.92**	**0.07**	**45,293.28**	**3,352.59**	**38,655.15**	**51,931.41**	**154**	**154**	**154**

Pacific Halibut (*Hippoglossus stenolepis*)

During the 2022 survey, Pacific halibut were present at 278 of 376 (73.9%) EBS survey stations, and 56 of 144 (38.9%) survey stations in the NBS. In the EBS, Pacific halibut were found at bottom depths between 22 m and 183 m, and bottom temperatures between -0.6°C and 8.4°C. In the NBS, Pacific halibut were found at bottom depths between 14 m and 57 m, and bottom temperatures between -1.3°C and 11.4°C.

The estimated biomass of Pacific halibut in the EBS for 2022 was 149,064 t (1% of the total biomass; Tables **12** and **36**) and the estimated abundance was 91.5 million fish (Table **37**). Previously in 2021, Pacific halibut biomass was estimated to be 131,864 t (1% of the total biomass; Table **12**), and the estimated abundance was 101.4 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b). The estimated biomass of Pacific halibut in the NBS was 22,940 t (Tables **13** and **36**) and the estimated abundance was 10.3 million fish (Table **37**). Previously in 2021, Pacific halibut biomass was estimated to be 25,995 t (Table **13**), and the estimated abundance was 14.1 million fish (Markowitz, Dawson, Charriere, Prohaska, Rohan, Stevenson, et al., 2022b).

Pacific halibut were widely distributed across the shelf. The highest density catches of Pacific halibut in 2022 were around St. Matthew and St. Paul islands, and northwest and south of Nunivak Island (Fig. **31**). The fork length range for Pacific halibut was 11–145 cm in the EBS, and 23–130 cm in the NBS (Fig. **32**).

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 International Pacific Halibut Commission, 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. 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 also categorized as unsexed.

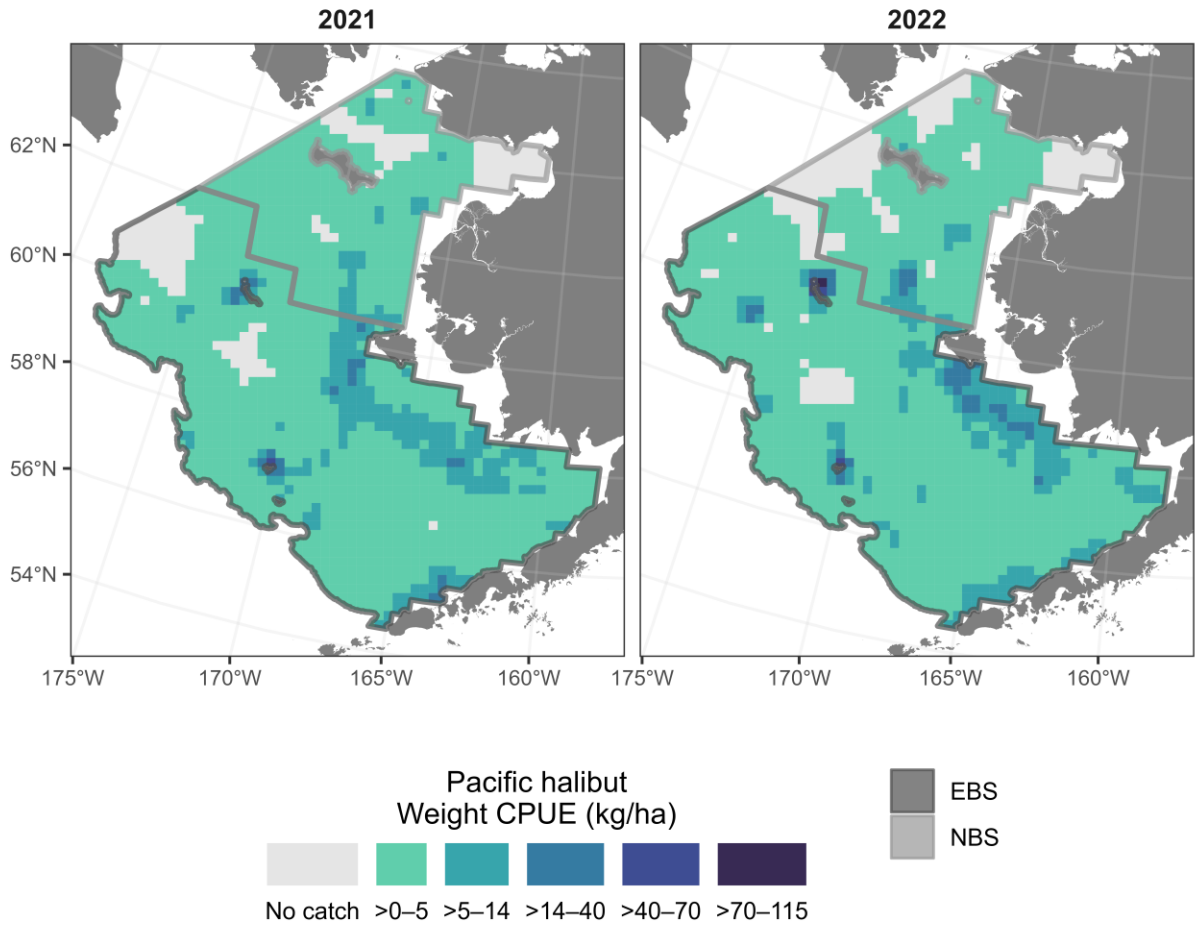

Figure 31. -- The distribution (weight CPUE (kg/ha)) of Pacific halibut (*Hippoglossus stenolepis*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

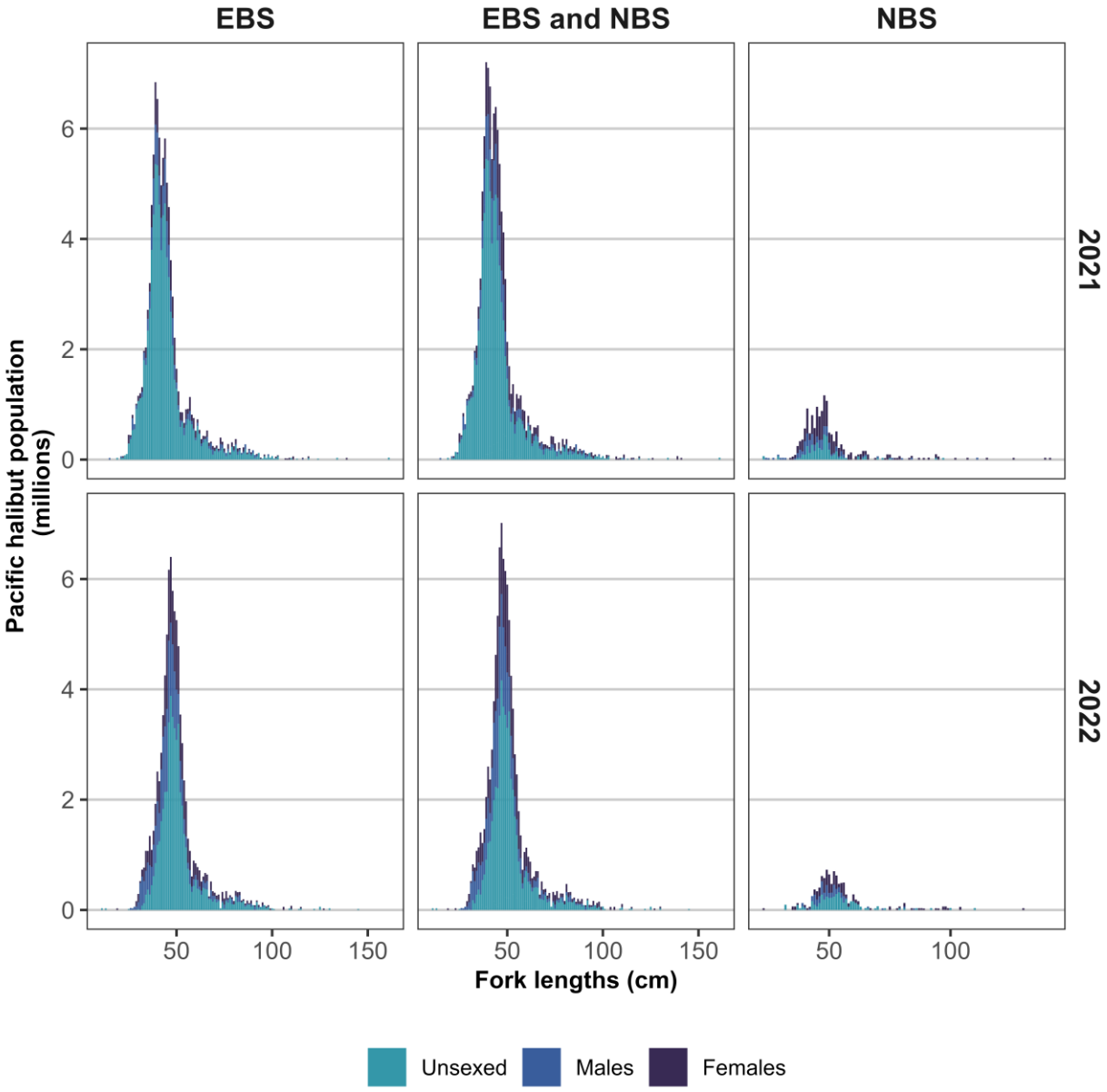

Figure 32. -- Total abundance-at-length estimates of Pacific halibut (*Hippoglossus stenolepis*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 36. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Pacific halibut (*Hippoglossus stenolepis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	5.17	0.65	40,678	5,148	30,274	51,082	57	57	57
20	6.81	1.19	28,073	4,910	18,047	38,099	31	31	31
31	2.33	0.33	22,122	3,132	15,857	28,387	58	58	58
32	2.64	0.92	2,338	818	404	4,273	7	7	7
41	3.12	2.59	19,444	16,133	0	52,048	25	25	25
42	4.93	1.62	11,884	3,916	3,887	19,881	25	25	25
43	1.43	0.65	3,013	1,363	177	5,848	11	11	11
50	1.64	0.39	6,256	1,485	3,198	9,315	19	19	19
61	1.68	0.75	14,791	6,573	1,506	28,075	39	39	39
62	0.03	0.03	21	21	0	71	1	1	1
82	0.15	0.12	272	214	0	744	2	2	2
90	0.15	0.09	172	102	0	413	3	3	3
Total	**3.02**	**0.40**	**149,064**	**19,596**	**109,872**	**188,257**	**278**	**278**	**278**
NBS									
70	2.21	0.68	17,538	5,416	6,593	28,482	30	30	30
71	0.60	0.18	4,899	1,451	1,967	7,830	19	19	19
81	0.13	0.06	504	224	45	963	7	7	7
Total	**1.15**	**0.28**	**22,940**	**5,611**	**11,718**	**34,162**	**56**	**56**	**56**

Table 37. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	4.15	0.59	32,661.02	4,647.37	23,268.69	42,053.36	57	57	57
20	4.73	0.93	19,481.18	3,824.08	11,672.41	27,289.96	31	31	31
31	1.34	0.30	12,737.66	2,829.73	7,078.20	18,397.13	58	58	58
32	1.11	0.48	982.82	420.60	0.00	1,977.53	7	7	7
41	2.02	1.78	12,555.45	11,082.82	0.00	34,953.83	25	25	25
42	2.95	1.05	7,121.50	2,543.76	1,927.15	12,315.85	25	25	25
43	0.48	0.27	1,010.01	558.71	0.00	2,172.13	11	11	11
50	0.37	0.08	1,397.17	308.77	761.11	2,033.23	19	19	19
61	0.38	0.10	3,371.30	855.60	1,642.13	5,100.47	39	39	39
62	0.03	0.03	17.83	17.83	0.00	61.46	1	1	1
82	0.03	0.02	55.70	37.58	0.00	138.41	2	2	2
90	0.07	0.03	81.89	40.01	0.00	176.51	3	3	3
Total	**1.86**	**0.27**	**91,473.54**	**13,223.03**	**65,027.49**	**117,919.59**	**278**	**278**	**278**
NBS									
70	1.10	0.32	8,756.30	2,535.36	3,632.34	13,880.26	30	30	30
71	0.15	0.03	1,212.12	281.88	642.45	1,781.80	19	19	19
81	0.09	0.04	348.53	135.86	69.75	627.31	7	7	7
Total	**0.52**	**0.13**	**10,316.95**	**2,554.60**	**5,207.76**	**15,426.15**	**56**	**56**	**56**

Bering Skate (*Bathyraja interrupta*)

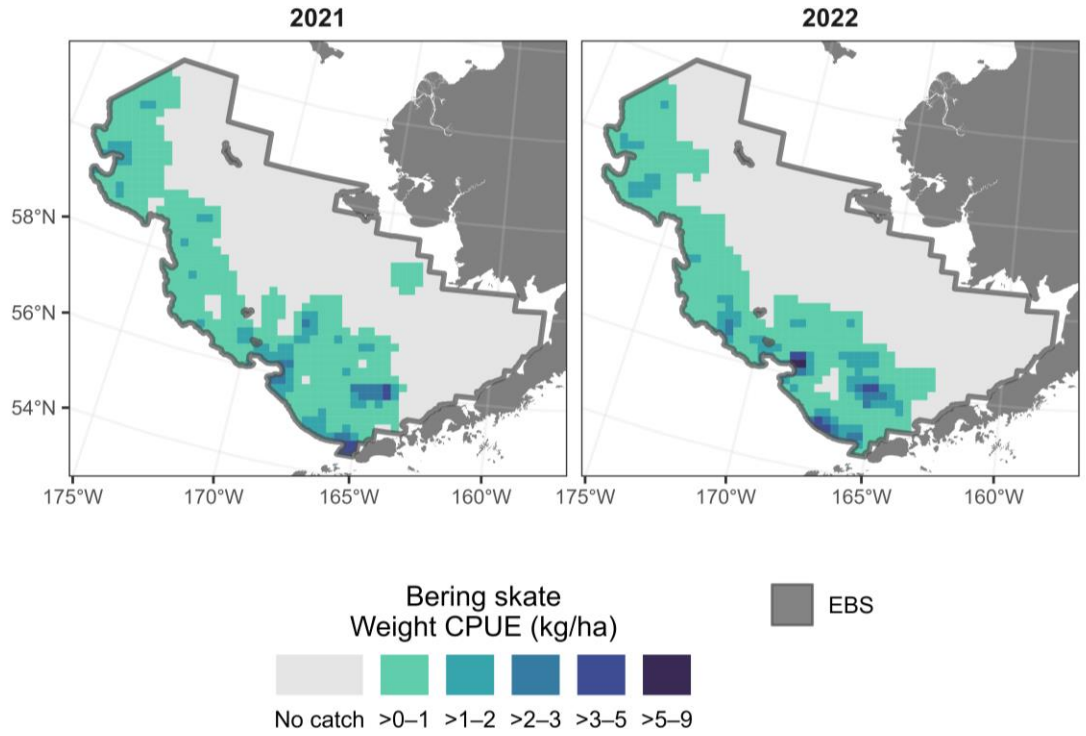

Figure 33. -- The distribution (weight CPUE (kg/ha)) of Bering skate (*Bathyraja interrupta*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

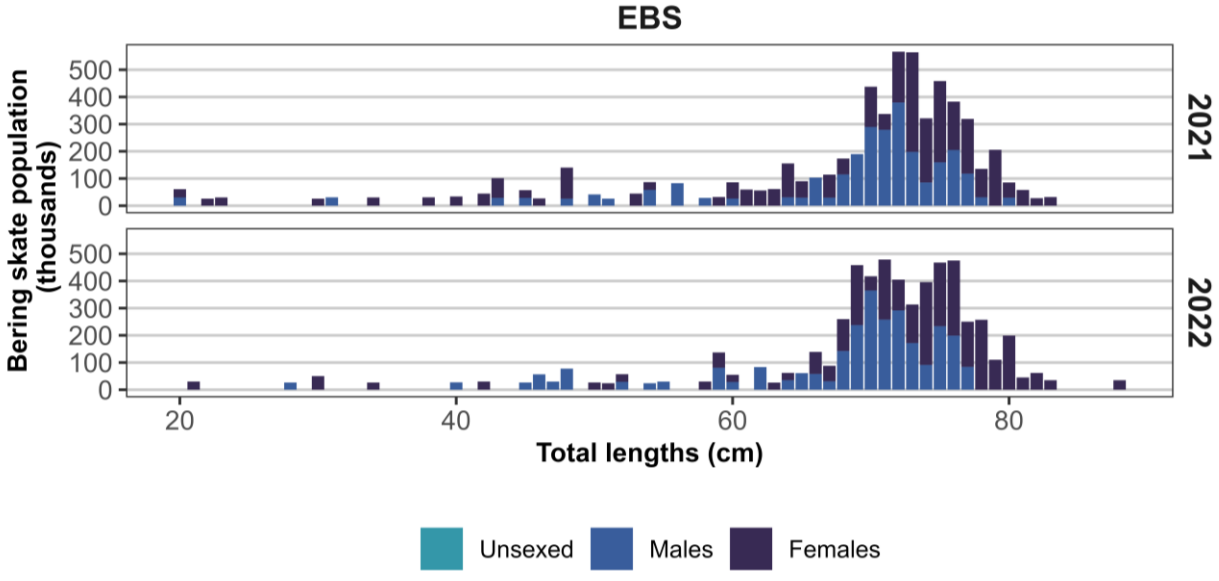

Figure 34. -- Total abundance-at-length estimates of Bering skate (*Bathyraja interrupta*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS) shelf bottom trawl surveys. There were no lengths collected for this species in the 2021-2022 northern Bering Sea shelf trawl surveys. Length distributions scaled up to the total estimated population size.

Table 38. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Bering skate (*Bathyraja interrupta*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.35	0.09	3,279	864	1,551	5,008	17	17	17
32	0.53	0.22	472	193	16	928	5	5	5
41	0.03	0.02	196	151	0	501	2	2	2
42	0.13	0.06	304	146	6	602	5	5	5
43	0.00	0.00	0	0	0	0	0	0	0
50	1.11	0.38	4,208	1,430	1,263	7,154	15	15	15
61	0.46	0.08	4,022	666	2,675	5,368	33	33	31
62	0.09	0.09	59	59	0	205	1	1	1
82	0.00	0.00	0	0	0	0	0	0	0
90	0.23	0.16	263	182	0	692	2	2	2
Total	**0.26**	**0.04**	**12,803**	**1,831**	**9,178**	**16,429**	**80**	**80**	**78**

Table 39. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.16	0.04	1,491.74	411.79	668.16	2,315.32	17	17	17
32	0.22	0.09	195.78	77.63	12.20	379.37	5	5	5
41	0.01	0.01	86.93	63.60	0.00	215.48	2	2	2
42	0.05	0.02	122.20	58.02	3.72	240.69	5	5	5
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.54	0.18	2,072.49	676.86	678.15	3,466.83	15	15	15
61	0.20	0.03	1,771.62	284.94	1,195.75	2,347.49	33	33	31
62	0.03	0.03	18.16	18.16	0.00	62.58	1	1	1
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.11	0.08	130.81	88.67	0.00	340.51	2	2	2
Total	**0.12**	**0.02**	**5,889.74**	**854.72**	**4,197.40**	**7,582.07**	**80**	**80**	**78**

Alaska Skate (*Bathyraja parmifera*)

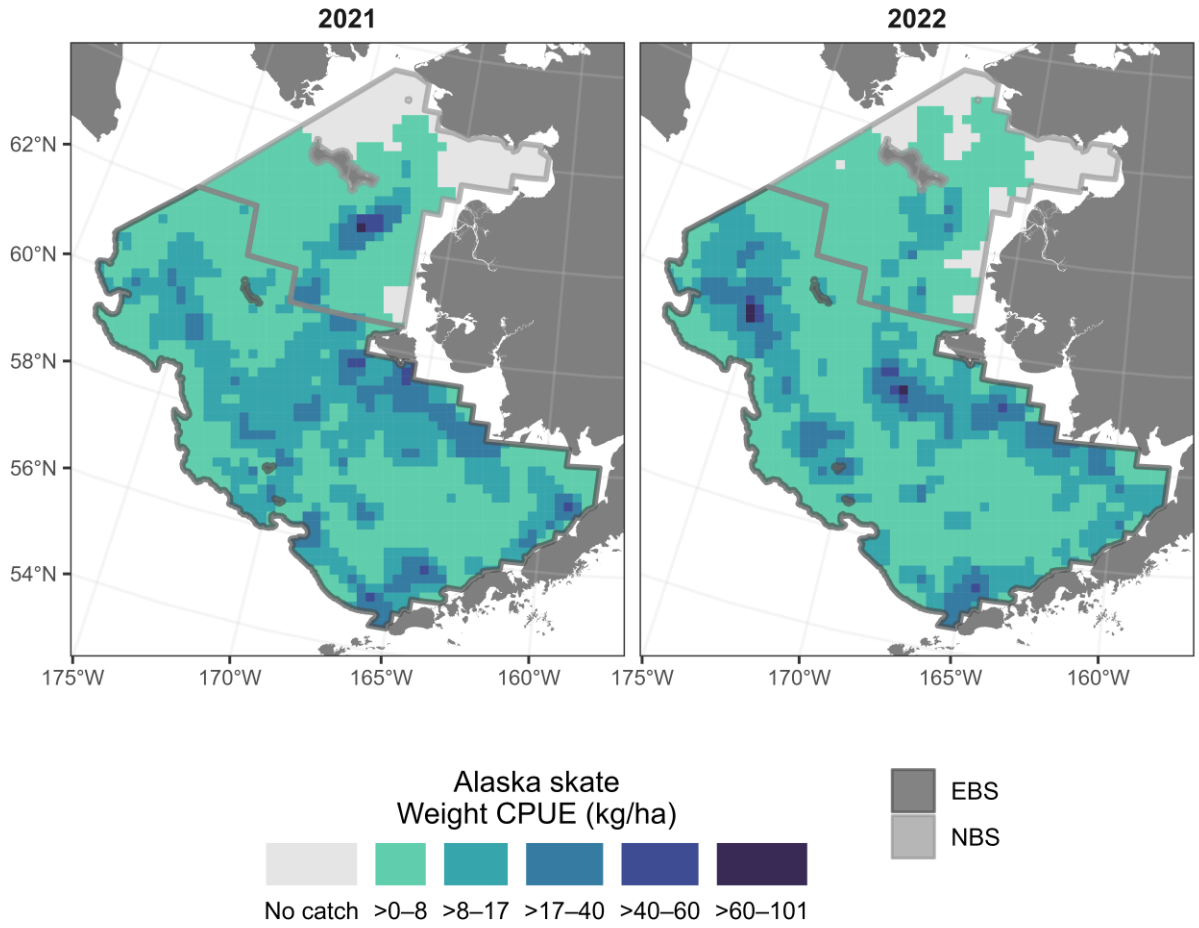

Figure 35. -- The distribution (weight CPUE (kg/ha)) of Alaska skate (*Bathyraja parmifera*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

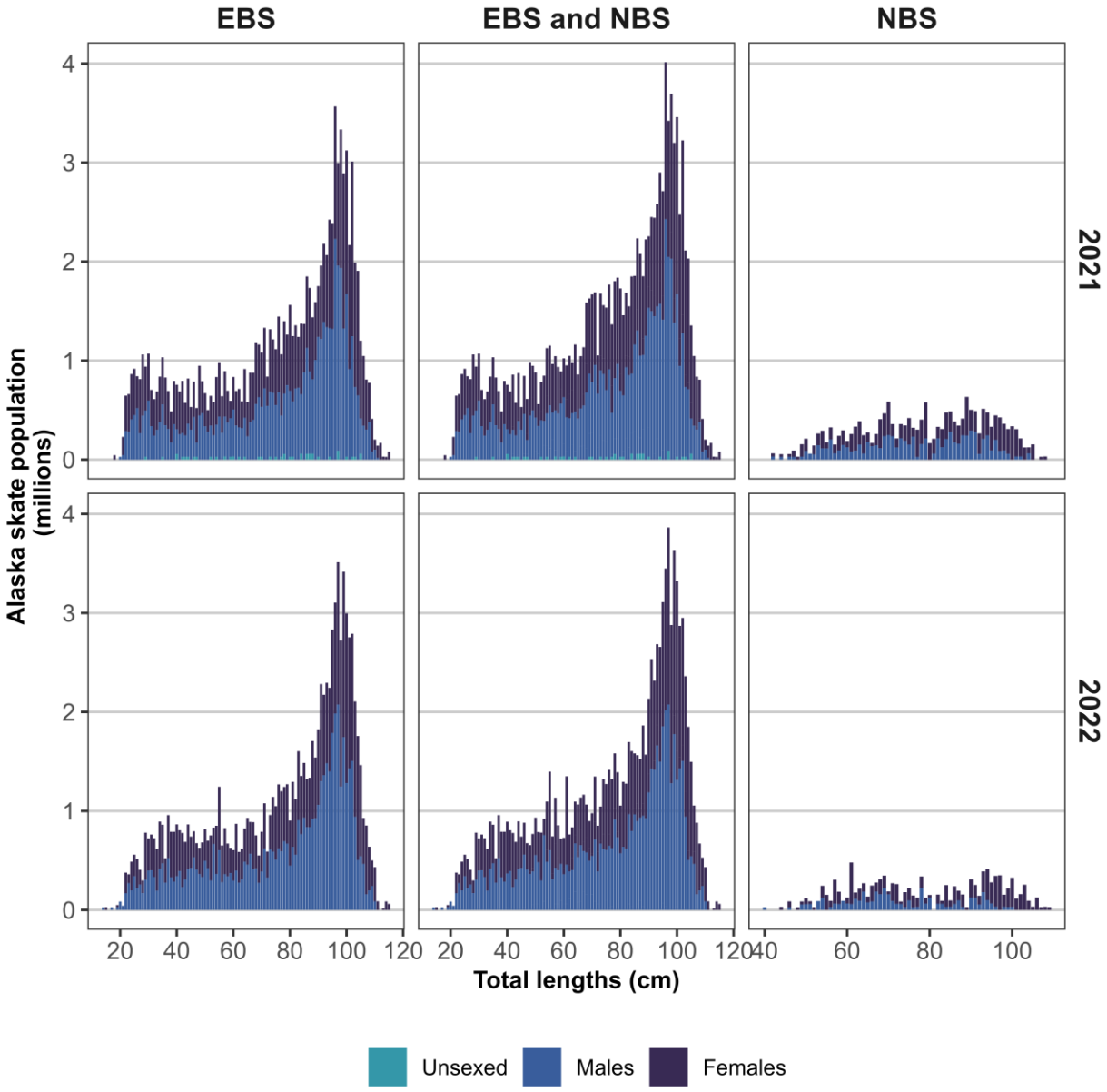

Figure 36. -- Total abundance-at-length estimates of Alaska skate (*Bathyraja parmifera*) by sex (unsexed, males, and females) in centimeters (cm) encountered during the 2021-2022 eastern Bering Sea (EBS), northern Bering Sea (NBS), and combined eastern and northern Bering Sea (EBS and NBS) shelf bottom trawl surveys. Length distributions scaled up to the total estimated population size.

Table 40. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand mt) with standard deviation (thousands) and 95% lower (LCL; thousand mt) and upper (UCL; thousand mt) confidence limits for Alaska skate (*Bathyraja parmifera*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand mt)	SD biomass (thousands)	95% LCL (thousand mt)	95% UCL (thousand mt)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	11.61	1.32	91.40	10.35	70.48	112.32	55	55	55
20	13.47	2.67	55.49	10.99	33.06	77.93	31	31	31
31	7.16	0.86	68.05	8.21	51.63	84.47	69	69	68
32	7.16	2.14	6.33	1.90	1.85	10.82	8	8	8
41	7.57	1.20	47.15	7.45	32.09	62.21	43	43	43
42	10.38	1.62	25.04	3.91	17.06	33.03	29	29	29
43	5.53	1.06	11.66	2.24	7.00	16.32	21	21	21
50	7.68	1.55	29.22	5.89	17.07	41.36	25	25	25
61	11.12	1.81	97.63	15.92	65.45	129.81	57	57	57
62	17.41	1.63	11.25	1.05	8.67	13.83	7	7	7
82	4.10	1.02	7.37	1.83	3.34	11.40	12	12	12
90	10.77	2.11	12.43	2.44	6.67	18.19	8	8	8
Total	**9.39**	**0.53**	**463.02**	**25.95**	**411.63**	**514.40**	**365**	**365**	**364**
NBS									
70	4.82	0.80	38.19	6.35	25.37	51.02	40	40	39
71	0.39	0.13	3.16	1.06	1.02	5.30	10	10	10
81	1.97	0.42	7.57	1.63	4.23	10.90	22	22	22
Total	**2.46**	**0.33**	**48.92**	**6.64**	**35.65**	**62.19**	**72**	**72**	**71**

Table 41. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	2.22	0.24	17,481.43	1,853.78	13,734.94	21,227.93	55	55	55
20	2.87	0.59	11,810.05	2,449.91	6,807.34	16,812.76	31	31	31
31	1.79	0.14	17,022.16	1,313.34	14,395.48	19,648.83	69	69	68
32	1.49	0.36	1,316.13	318.98	561.74	2,070.53	8	8	8
41	2.14	0.39	13,305.51	2,408.52	8,437.91	18,173.12	43	43	43
42	1.92	0.28	4,628.21	683.65	3,232.20	6,024.23	29	29	29
43	2.01	0.37	4,241.98	784.36	2,610.52	5,873.44	21	21	21
50	1.18	0.24	4,503.12	924.58	2,598.49	6,407.75	25	25	25
61	2.35	0.32	20,606.00	2,773.91	14,999.93	26,212.08	57	57	57
62	3.93	0.38	2,539.94	243.75	1,943.48	3,136.39	7	7	7
82	1.18	0.26	2,116.24	467.84	1,086.52	3,145.96	12	12	12
90	2.81	0.55	3,246.23	632.61	1,750.11	4,742.36	8	8	8
Total	**2.09**	**0.11**	**102,817.01**	**5,232.27**	**92,457.12**	**113,176.90**	**365**	**365**	**364**
NBS									
70	1.09	0.20	8,664.64	1,593.07	5,445.05	11,884.23	40	40	39
71	0.06	0.02	450.35	146.93	153.41	747.29	10	10	10
81	0.65	0.13	2,475.05	510.40	1,427.70	3,522.40	22	22	22
Total	**0.58**	**0.08**	**11,590.03**	**1,679.28**	**8,231.48**	**14,948.59**	**72**	**72**	**71**

Longhead Dab (*Limanda proboscidea*)

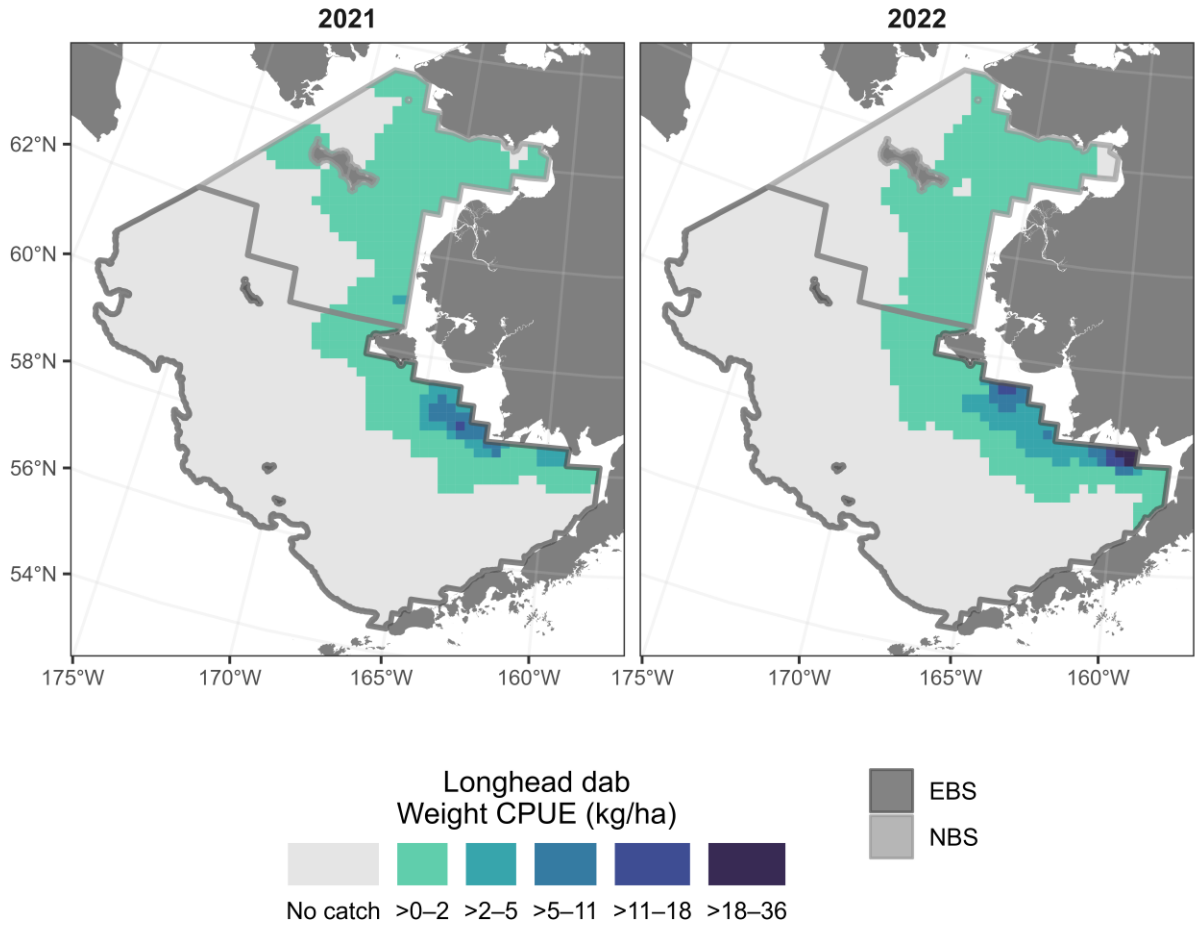

Figure 37. -- The distribution (weight CPUE (kg/ha)) of longhead dab (*Limanda proboscidea*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 42. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for longhead dab (*Limanda proboscidea*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	2.39	0.75	18,807	5,898	6,886	30,727	31	31	31
20	0.39	0.13	1,615	553	486	2,743	22	22	22
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	**0.41**	**0.12**	**20,421**	**5,924**	**8,573**	**32,270**	**53**	**53**	**53**
NBS									
70	0.13	0.04	1,036	282	465	1,607	29	29	29
71	0.02	0.01	196	95	5	388	21	21	21
81	0.00	0.00	0	0	0	0	0	0	0
Total	**0.06**	**0.01**	**1,232**	**298**	**624**	**1,841**	**50**	**50**	**50**

Table 43. -- 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 longhead dab (*Limanda proboscidea*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	30.66	10.09	241.33	79.39	80.88	401.77	31	31	31
20	5.38	1.55	22.18	6.38	9.15	35.21	22	22	22
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	**5.35**	**1.62**	**263.51**	**79.65**	**104.22**	**422.80**	**53**	**53**	**53**
NBS									
70	2.78	0.81	22.03	6.42	9.06	35.00	29	29	29
71	0.56	0.26	4.56	2.14	0.23	8.89	21	21	21
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**1.34**	**0.34**	**26.59**	**6.77**	**12.77**	**40.41**	**50**	**50**	**50**

Starry Flounder (*Platichthys stellatus*)

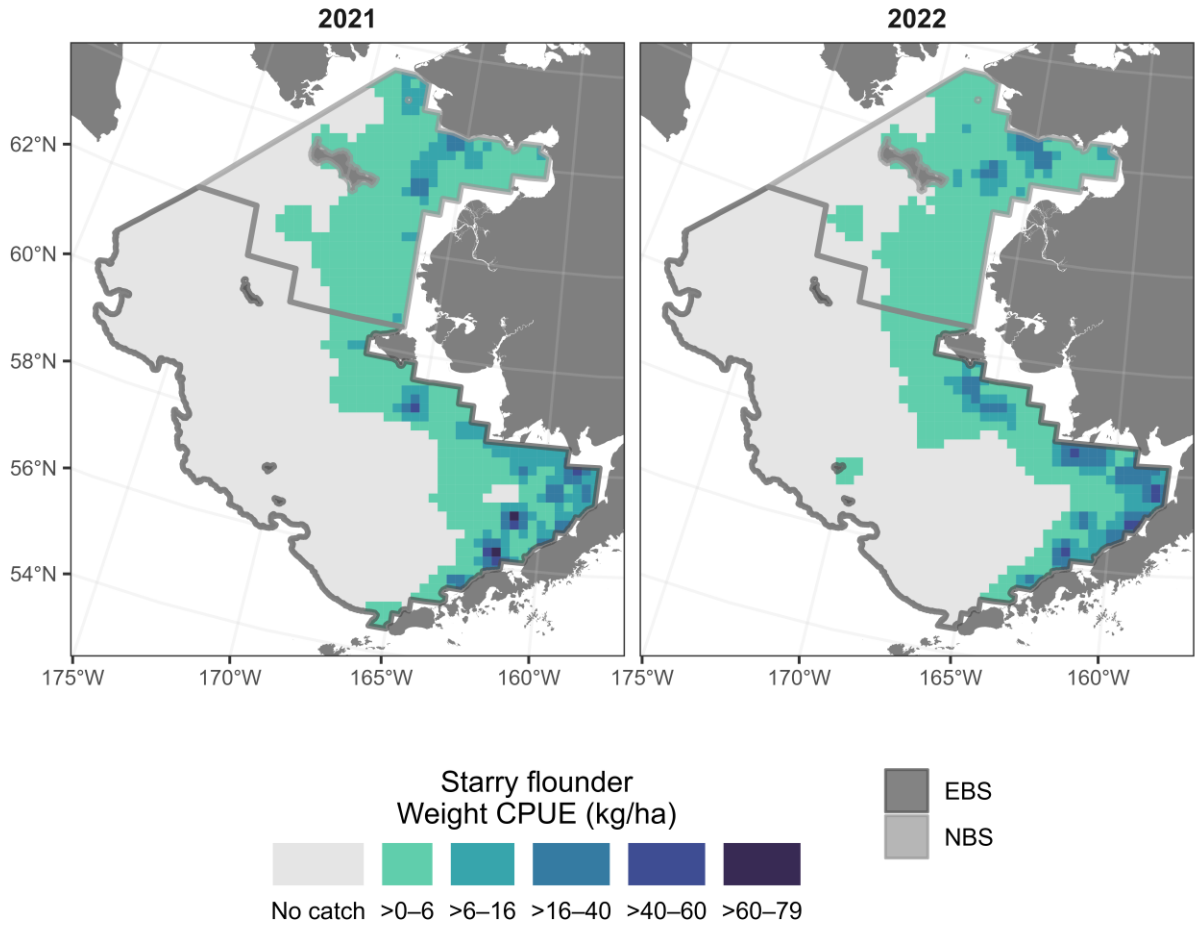

Figure 38. -- The distribution (weight CPUE (kg/ha)) of starry flounder (*Platichthys stellatus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 44. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for starry flounder (*Platichthys stellatus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	9.38	2.02	73,826	15,922	41,648	106,003	35	35	35
20	2.82	1.35	11,625	5,545	301	22,948	19	19	18
31	0.75	0.41	7,151	3,914	0	14,980	10	10	10
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	0.02	0.02	51	51	0	155	1	1	1
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	**1.88**	**0.35**	**92,652**	**17,308**	**58,035**	**127,268**	**65**	**65**	**64**
NBS									
70	0.88	0.15	6,965	1,220	4,500	9,431	34	34	34
71	4.19	1.17	34,072	9,503	14,865	53,278	44	44	44
81	0.01	0.01	38	38	0	116	1	1	1
Total	**2.07**	**0.48**	**41,075**	**9,581**	**21,711**	**60,439**	**79**	**79**	**79**

Table 45. -- 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 starry flounder (*Platichthys stellatus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	6.96	1.73	54,773.05	13,600.53	27,286.37	82,259.73	35	35	35
20	1.88	0.88	7,744.57	3,640.32	311.04	15,178.10	19	19	18
31	0.42	0.22	4,019.70	2,052.23	0.00	8,124.15	10	10	10
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	0.03	0.03	61.78	61.79	0.00	187.95	1	1	1
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	**1.35**	**0.29**	**66,599.10**	**14,228.21**	**38,142.69**	**95,055.52**	**65**	**65**	**64**
NBS									
70	1.78	0.37	14,123.39	2,900.61	8,261.27	19,985.52	34	34	34
71	7.67	2.53	62,363.20	20,568.12	20,795.02	103,931.38	44	44	44
81	0.01	0.01	31.18	31.18	0.00	95.29	1	1	1
Total	**3.85**	**1.04**	**76,517.78**	**20,771.67**	**34,538.23**	**118,497.32**	**79**	**79**	**79**

Yellow Irish Lord (*Hemilepidotus jordani*)

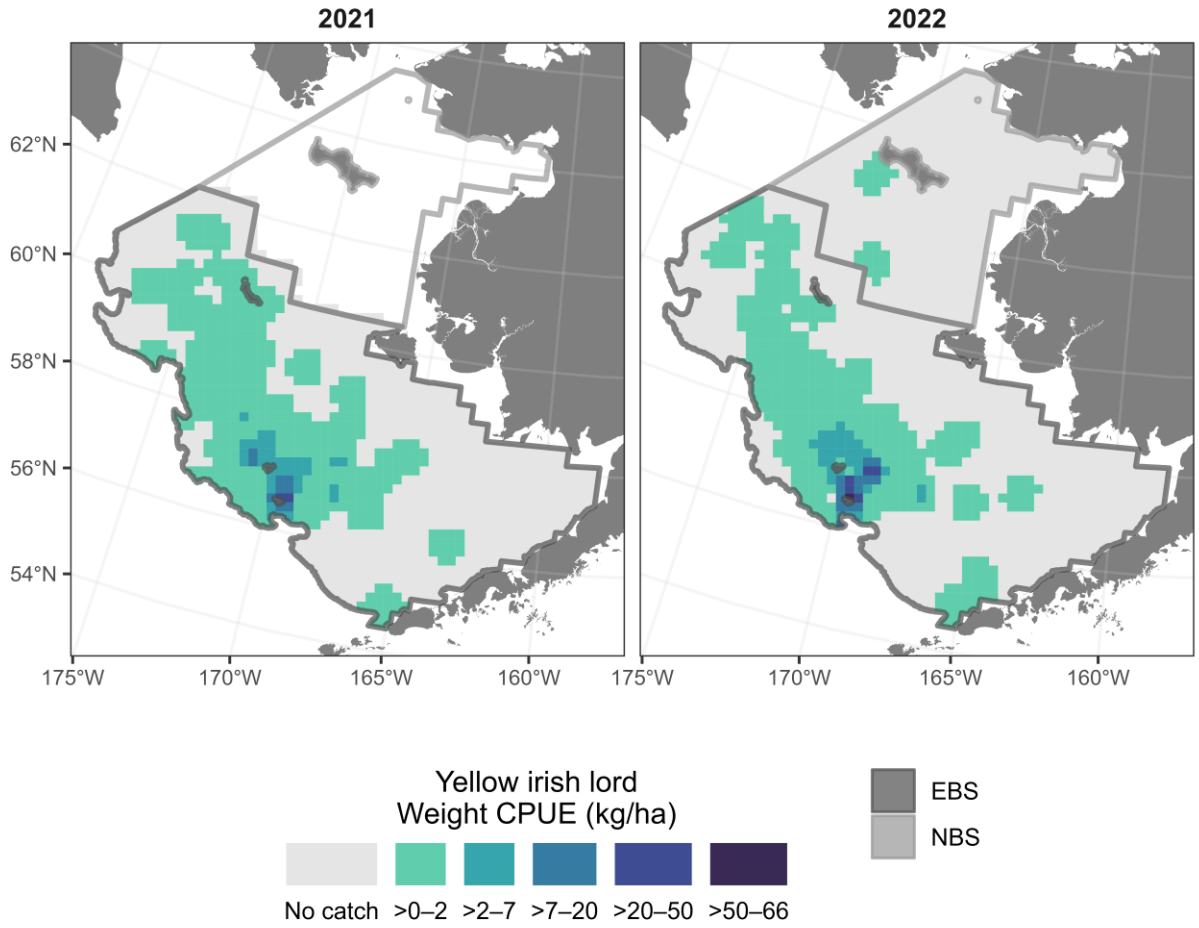

Figure 39. -- The distribution (weight CPUE (kg/ha)) of yellow Irish lord (*Hemilepidotus jordani*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 46. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for yellow Irish lord (*Hemilepidotus jordani*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.01	0.00	42	32	0	107	2	2	2
20	0.00	0.00	0	0	0	0	0	0	0
31	0.12	0.06	1,175	610	0	2,394	8	8	8
32	10.40	7.90	9,199	6,987	0	25,723	8	8	8
41	0.11	0.06	686	353	0	1,400	9	9	9
42	5.73	2.18	13,827	5,258	3,089	24,564	27	27	27
43	0.03	0.02	56	32	0	122	4	4	3
50	0.10	0.09	393	330	0	1,074	2	2	2
61	0.04	0.01	366	117	129	603	11	11	11
62	0.11	0.04	74	29	4	144	5	5	5
82	0.01	0.01	18	12	0	44	2	2	2
90	0.02	0.02	22	22	0	72	1	1	1
Total	**0.52**	**0.18**	**25,858**	**8,780**	**7,332**	**44,383**	**79**	**79**	**78**
NBS									
70	0.00	0.00	9	9	0	26	1	1	1
71	0.00	0.00	0	0	0	0	0	0	0
81	0.00	0.00	19	19	0	58	1	1	1
Total	**0.00**	**0.00**	**28**	**21**	**0**	**70**	**2**	**2**	**2**

Table 47. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.01	0.01	59.47	41.69	0.00	143.73	2	2	2
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.13	0.07	1,255.90	644.43	0.00	2,544.76	8	8	8
32	15.75	12.43	13,933.93	10,996.80	0.00	39,941.36	8	8	8
41	0.20	0.11	1,215.51	691.00	0.00	2,612.01	9	9	9
42	8.25	3.54	19,904.68	8,529.71	2,487.01	37,322.34	27	27	27
43	0.09	0.07	196.96	140.13	0.00	488.42	4	4	3
50	0.13	0.11	498.45	413.98	0.00	1,351.25	2	2	2
61	0.07	0.02	597.79	204.15	185.21	1,010.37	11	11	11
62	0.25	0.09	159.93	59.38	14.63	305.24	5	5	5
82	0.03	0.02	55.70	37.58	0.00	138.41	2	2	2
90	0.02	0.02	27.75	27.75	0.00	93.38	1	1	1
Total	**0.77**	**0.28**	**37,906.08**	**13,957.74**	**8,455.25**	**67,356.91**	**79**	**79**	**78**
NBS									
70	0.00	0.00	26.65	26.65	0.00	80.52	1	1	1
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.01	0.01	29.95	29.95	0.00	91.40	1	1	1
Total	**0.00**	**0.00**	**56.60**	**40.09**	**0.00**	**137.62**	**2**	**2**	**2**

Plain Sculpin (*Myoxocephalus jaok*)

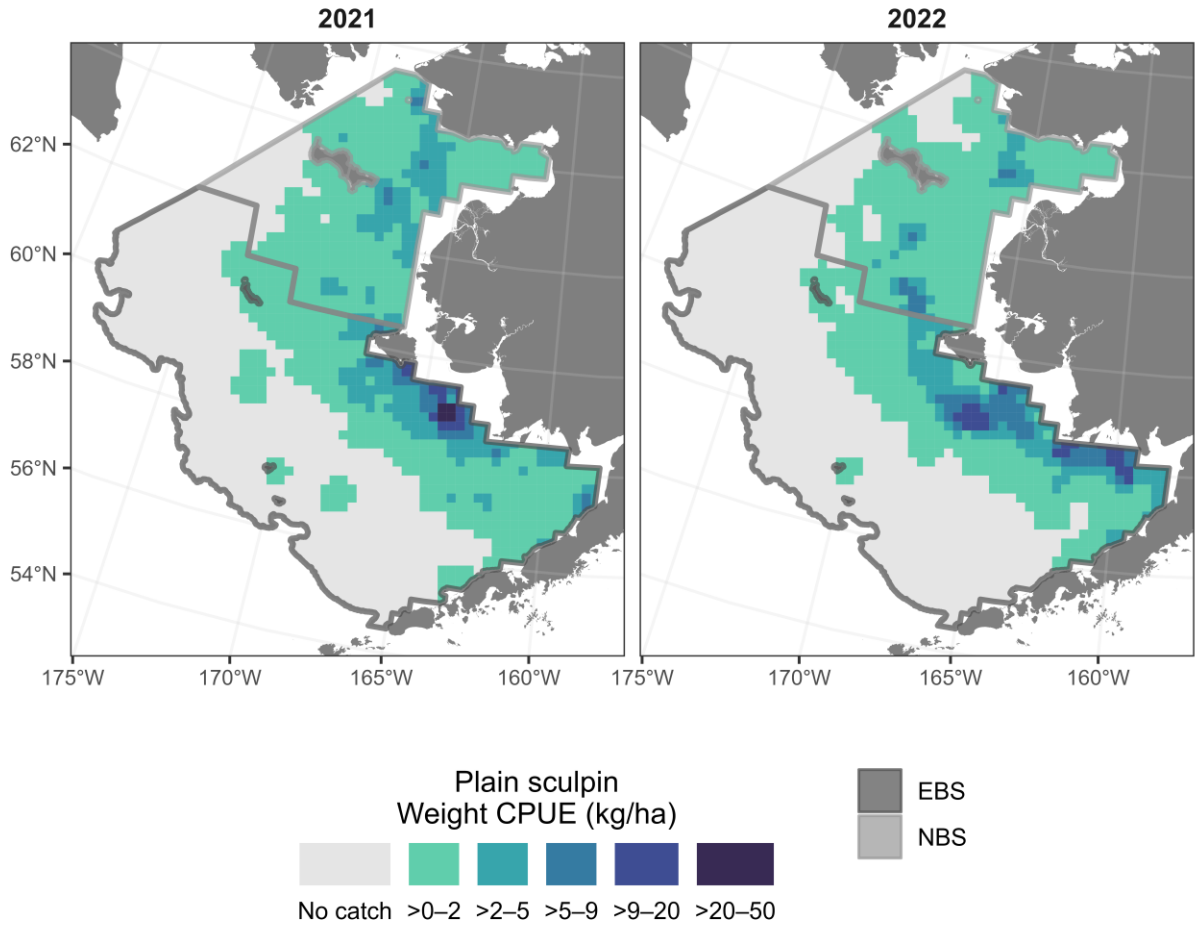

Figure 40. -- The distribution (weight CPUE (kg/ha)) of plain sculpin (*Myoxocephalus jaok*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 48. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for plain sculpin (*Myoxocephalus jaok*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	3.71	0.61	29,230	4,787	19,556	38,904	52	52	52
20	2.19	0.38	9,008	1,564	5,814	12,201	30	30	30
31	0.03	0.01	289	130	29	550	6	6	6
32	0.00	0.00	0	0	0	0	0	0	0
41	0.08	0.03	491	191	104	878	10	10	9
42	0.01	0.01	20	20	0	61	1	1	1
43	0.04	0.04	86	86	0	264	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	**0.79**	**0.10**	**39,123**	**5,042**	**29,040**	**49,207**	**100**	**100**	**99**
NBS									
70	1.08	0.22	8,550	1,726	5,062	12,037	47	47	47
71	0.76	0.18	6,158	1,485	3,158	9,158	36	36	35
81	0.18	0.12	684	462	0	1,633	4	4	4
Total	**0.77**	**0.12**	**15,392**	**2,323**	**10,746**	**20,037**	**87**	**87**	**86**

Table 49. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	5.48	0.93	43,143.23	7,330.03	28,329.25	57,957.22	52	52	52
20	3.07	0.54	12,641.29	2,233.94	8,079.58	17,203.00	30	30	30
31	0.02	0.01	213.85	88.43	36.99	390.71	6	6	6
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.06	0.02	375.25	141.07	90.15	660.34	10	10	9
42	0.01	0.01	15.45	15.45	0.00	46.99	1	1	1
43	0.03	0.03	61.83	61.83	0.00	190.45	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	**1.15**	**0.16**	**56,450.90**	**7,664.96**	**41,120.99**	**71,780.82**	**100**	**100**	**99**
NBS									
70	2.16	0.45	17,130.82	3,602.90	9,849.37	24,412.28	47	47	47
71	1.96	0.48	15,964.65	3,907.43	8,067.74	23,861.57	36	36	35
81	0.12	0.08	474.43	316.63	0.00	1,125.42	4	4	4
Total	**1.69**	**0.27**	**33,569.90**	**5,324.39**	**22,921.12**	**44,218.69**	**87**	**87**	**86**

Great Sculpin (*Myoxocephalus polyacanthocephalus*)

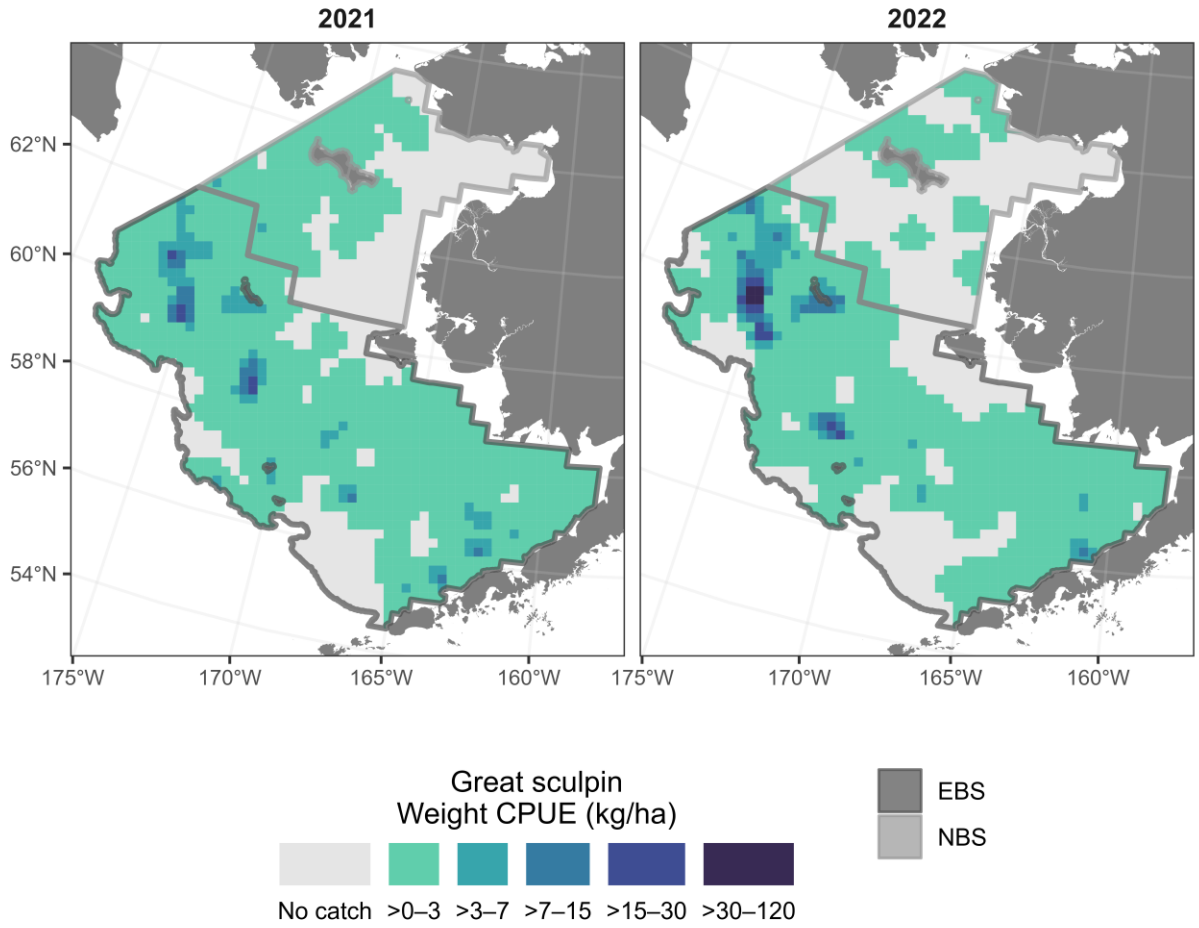

Figure 41. -- The distribution (weight CPUE (kg/ha)) of great sculpin (*Myoxocephalus polyacanthocephalus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 50. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for great sculpin (*Myoxocephalus polyacanthocephalus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.66	0.18	5,195	1,388	2,389	8,000	33	33	33
20	0.06	0.03	235	106	18	452	5	5	5
31	0.77	0.14	7,316	1,326	4,663	9,969	31	31	31
32	0.00	0.00	0	0	0	0	0	0	0
41	0.91	0.19	5,646	1,183	3,255	8,036	25	25	25
42	2.49	0.94	5,999	2,263	1,379	10,620	24	24	24
43	3.20	0.96	6,735	2,016	2,542	10,929	18	18	18
50	0.08	0.05	290	208	0	719	2	2	2
61	3.21	2.02	28,217	17,754	0	64,098	23	23	23
62	5.09	2.87	3,289	1,855	0	7,828	7	7	7
82	1.35	0.95	2,426	1,705	0	6,178	5	5	5
90	3.25	1.30	3,748	1,501	199	7,297	6	6	6
Total	**1.40**	**0.37**	**69,097**	**18,388**	**32,320**	**105,873**	**179**	**179**	**179**
NBS									
70	0.00	0.00	28	19	0	67	4	4	4
71	0.03	0.01	210	116	0	444	8	8	7
81	0.07	0.04	285	161	0	615	4	4	4
Total	**0.03**	**0.01**	**523**	**199**	**125**	**921**	**16**	**16**	**15**

Table 51. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.44	0.13	3,473.78	1,002.90	1,446.92	5,500.64	33	33	33
20	0.04	0.02	170.55	76.16	15.04	326.06	5	5	5
31	0.23	0.04	2,202.19	398.01	1,406.17	2,998.21	31	31	31
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.30	0.06	1,900.06	353.08	1,186.47	2,613.64	25	25	25
42	0.64	0.21	1,547.29	517.93	489.68	2,604.90	24	24	24
43	0.82	0.20	1,730.67	419.02	859.12	2,602.22	18	18	18
50	0.01	0.01	54.95	38.07	0.00	133.38	2	2	2
61	1.05	0.69	9,237.34	6,028.30	0.00	21,420.54	23	23	23
62	1.26	0.57	813.86	370.42	0.00	1,720.27	7	7	7
82	0.41	0.30	735.85	533.54	0.00	1,910.17	5	5	5
90	1.16	0.44	1,335.06	502.86	145.80	2,524.32	6	6	6
Total	**0.47**	**0.13**	**23,201.58**	**6,225.36**	**10,750.85**	**35,652.30**	**179**	**179**	**179**
NBS									
70	0.03	0.02	215.83	130.69	0.00	479.95	4	4	4
71	0.28	0.18	2,272.94	1,438.12	0.00	5,179.38	8	8	7
81	0.03	0.01	113.87	53.72	3.63	224.11	4	4	4
Total	**0.13**	**0.07**	**2,602.64**	**1,445.05**	**0.00**	**5,492.73**	**16**	**16**	**15**

Shorthorn Sculpin (*Myoxocephalus scorpius*)

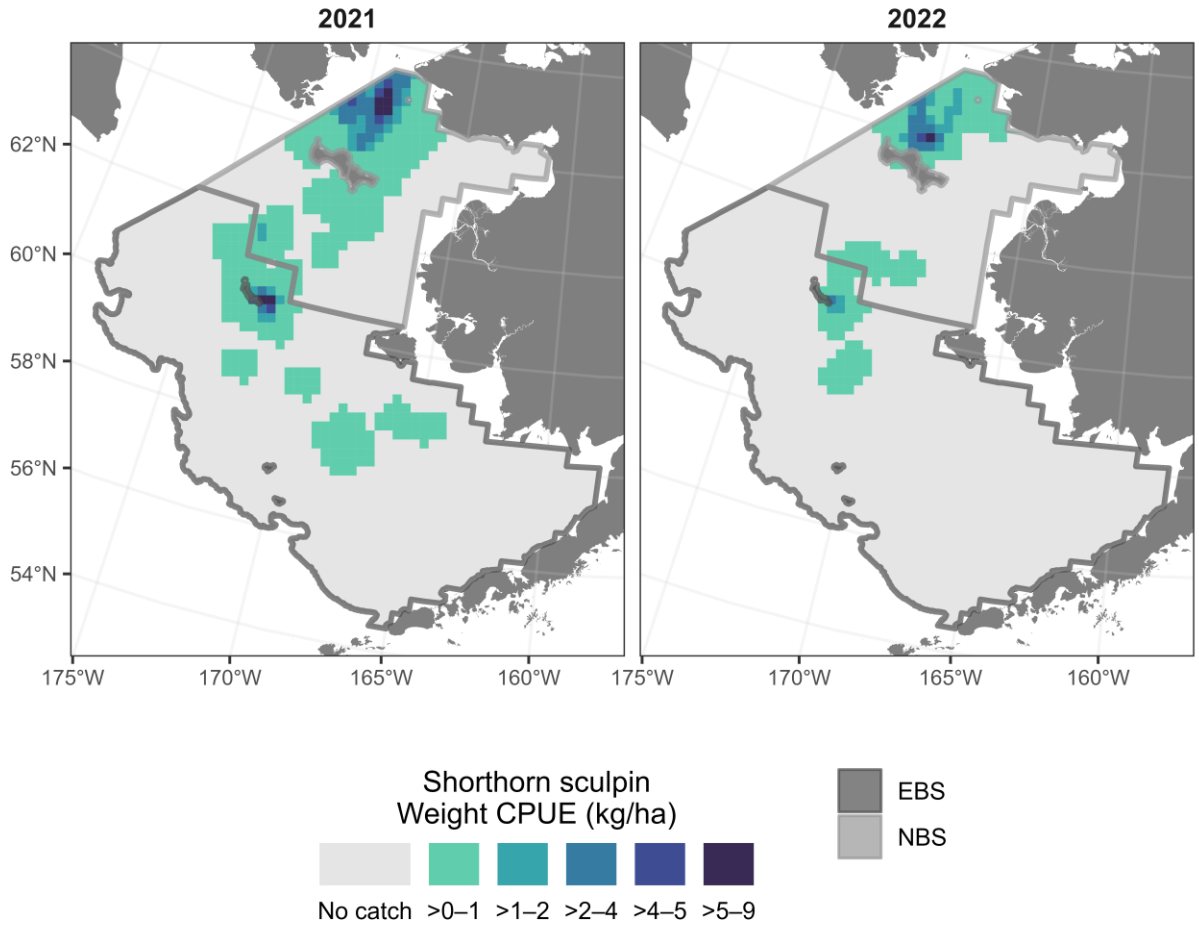

Figure 42. -- The distribution (weight CPUE (kg/ha)) of shorthorn sculpin (*Myoxocephalus scorpius*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 52. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for shorthorn sculpin (*Myoxocephalus scorpius*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.04	0.02	228	113	1	455	4	4	4
42	0.00	0.00	0	0	0	0	0	0	0
43	0.16	0.15	332	306	0	968	2	2	2
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	**0.01**	**0.01**	**560**	**326**	**0**	**1,205**	**6**	**6**	**6**
NBS									
70	0.01	0.01	62	62	0	187	1	1	1
71	0.42	0.15	3,408	1,190	1,002	5,813	20	20	20
81	0.05	0.04	195	136	0	475	2	2	2
Total	**0.18**	**0.06**	**3,664**	**1,200**	**1,240**	**6,089**	**23**	**23**	**23**

Table 53. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.02	0.01	111.90	54.11	2.54	221.26	4	4	4
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.15	0.14	319.86	300.01	0.00	943.88	2	2	2
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	**0.01**	**0.01**	**431.77**	**304.85**	**0.00**	**1,035.37**	**6**	**6**	**6**
NBS									
70	0.00	0.00	31.95	31.95	0.00	96.52	1	1	1
71	0.79	0.25	6,453.73	2,005.74	2,400.12	10,507.34	20	20	20
81	0.03	0.02	117.39	81.47	0.00	284.89	2	2	2
Total	**0.33**	**0.10**	**6,603.07**	**2,007.65**	**2,545.60**	**10,660.53**	**23**	**23**	**23**

Pacific Ocean Perch (*Sebastes alutus*)

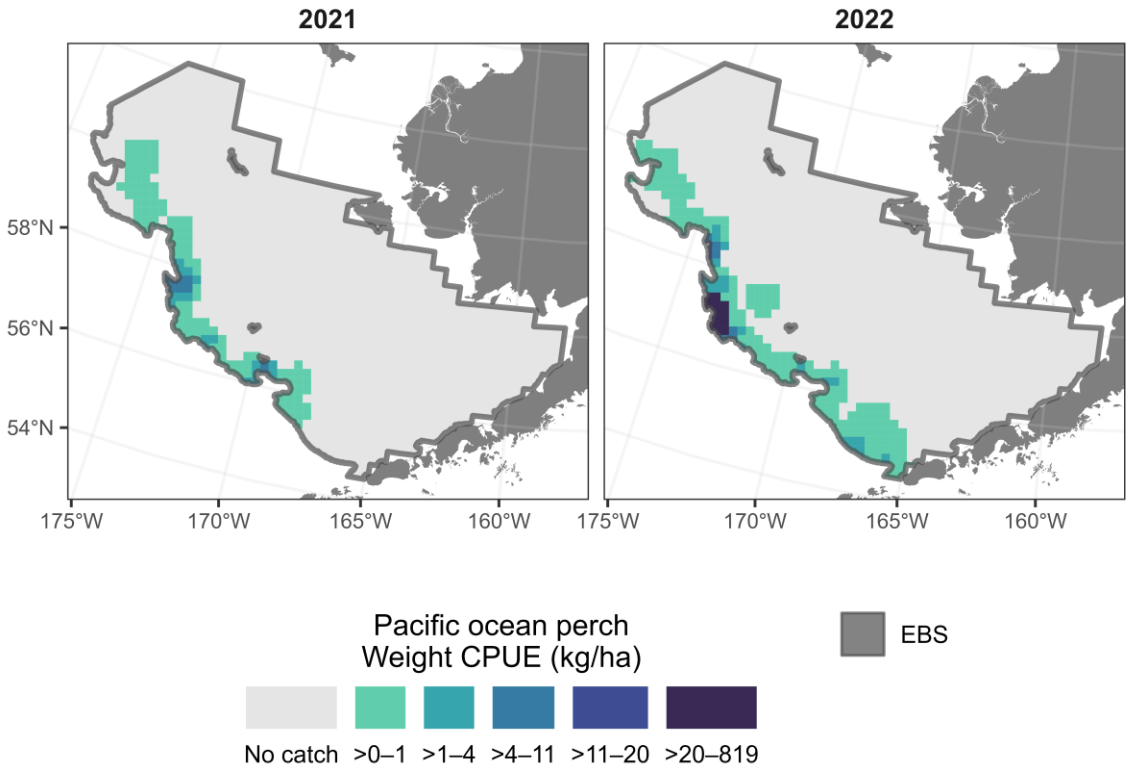

Figure 43. -- The distribution (weight CPUE (kg/ha)) of Pacific ocean perch (*Sebastes alutus*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

Table 54. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Pacific ocean perch (*Sebastes alutus*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	4	4	0	12	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	0.38	0.16	1,448	605	202	2,694	10	10	10
61	14.28	13.64	125,353	119,728	0	367,324	13	13	12
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	**2.57**	**2.43**	**126,805**	**119,730**	**0**	**368,779**	**24**	**24**	**23**

Table 55. -- 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 ocean perch (*Sebastes alutus*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.00	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	30.30	30.30	0.00	91.54	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	0.55	0.26	2,104.33	999.00	46.40	4,162.26	10	10	10
61	27.40	26.47	240,503.76	232,367.73	0.00	710,118.95	13	13	12
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	**4.92**	**4.71**	**242,638.39**	**232,369.88**	**0.00**	**712,257.92**	**24**	**24**	**23**

Rex Sole (*Glyptocephalus zachirus*)

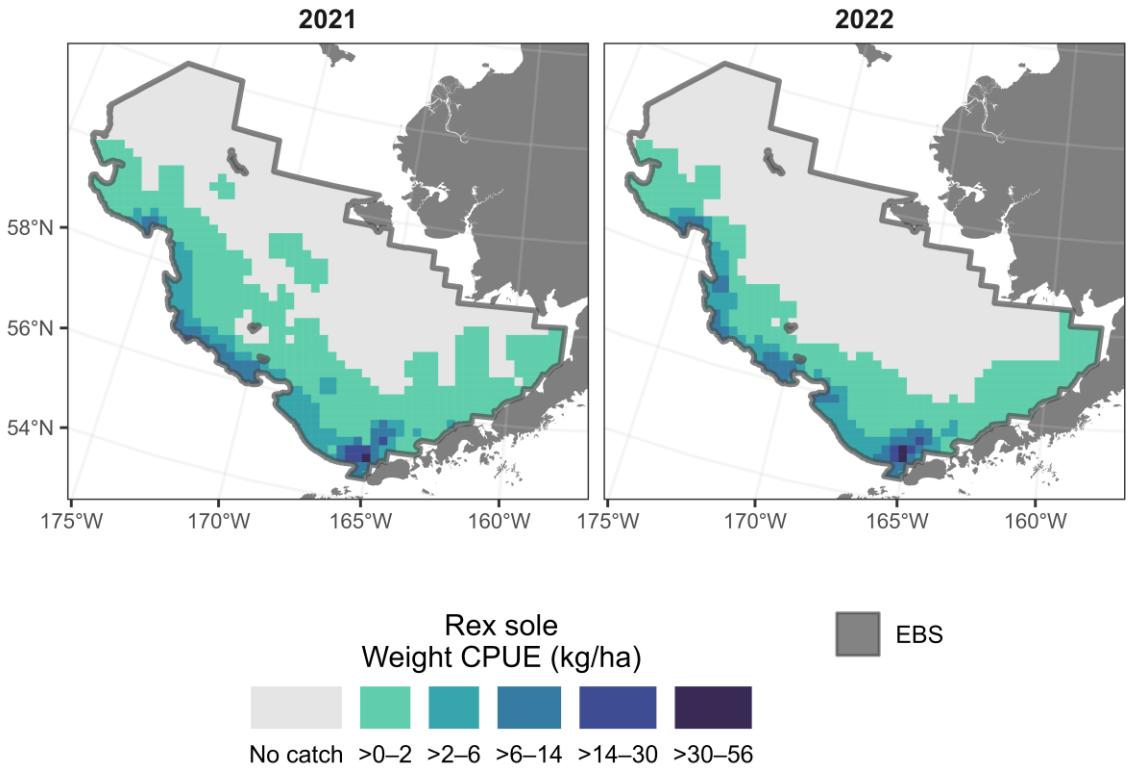

Figure 44. -- The distribution (weight CPUE (kg/ha)) of rex sole (*Glyptocephalus zachirus*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

Table 56. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for rex sole (*Glyptocephalus zachirus*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.07	0.04	585	317	0	1,226	6	6	6
20	0.00	0.00	0	0	0	0	0	0	0
31	0.67	0.37	6,408	3,557	0	13,523	23	23	23
32	0.02	0.01	17	13	0	47	3	3	3
41	0.01	0.01	33	33	0	100	1	1	1
42	0.01	0.01	32	22	0	76	2	2	1
43	0.00	0.00	0	0	0	0	0	0	0
50	5.19	1.93	19,753	7,360	4,592	34,914	26	26	26
61	1.66	0.41	14,578	3,623	7,256	21,900	31	31	30
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	**0.84**	**0.18**	**41,406**	**8,947**	**23,324**	**59,487**	**92**	**92**	**90**

Table 57. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.14	0.07	1,074.84	526.36	11.07	2,138.62	6	6	6
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	1.13	0.53	10,712.48	5,034.50	643.48	20,781.49	23	23	23
32	0.21	0.14	188.84	125.35	0.00	485.29	3	3	3
41	0.01	0.01	60.60	60.60	0.00	183.08	1	1	1
42	0.03	0.02	75.53	53.50	0.00	184.79	2	2	1
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	12.81	4.06	48,744.93	15,454.63	16,908.38	80,581.47	26	26	26
61	3.79	0.94	33,286.71	8,224.84	16,664.31	49,909.12	31	31	30
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	**1.91**	**0.37**	**94,143.94**	**18,224.69**	**57,311.84**	**130,976.03**	**92**	**92**	**90**

Sakhalin Sole (*Limanda sakhalinensis*)

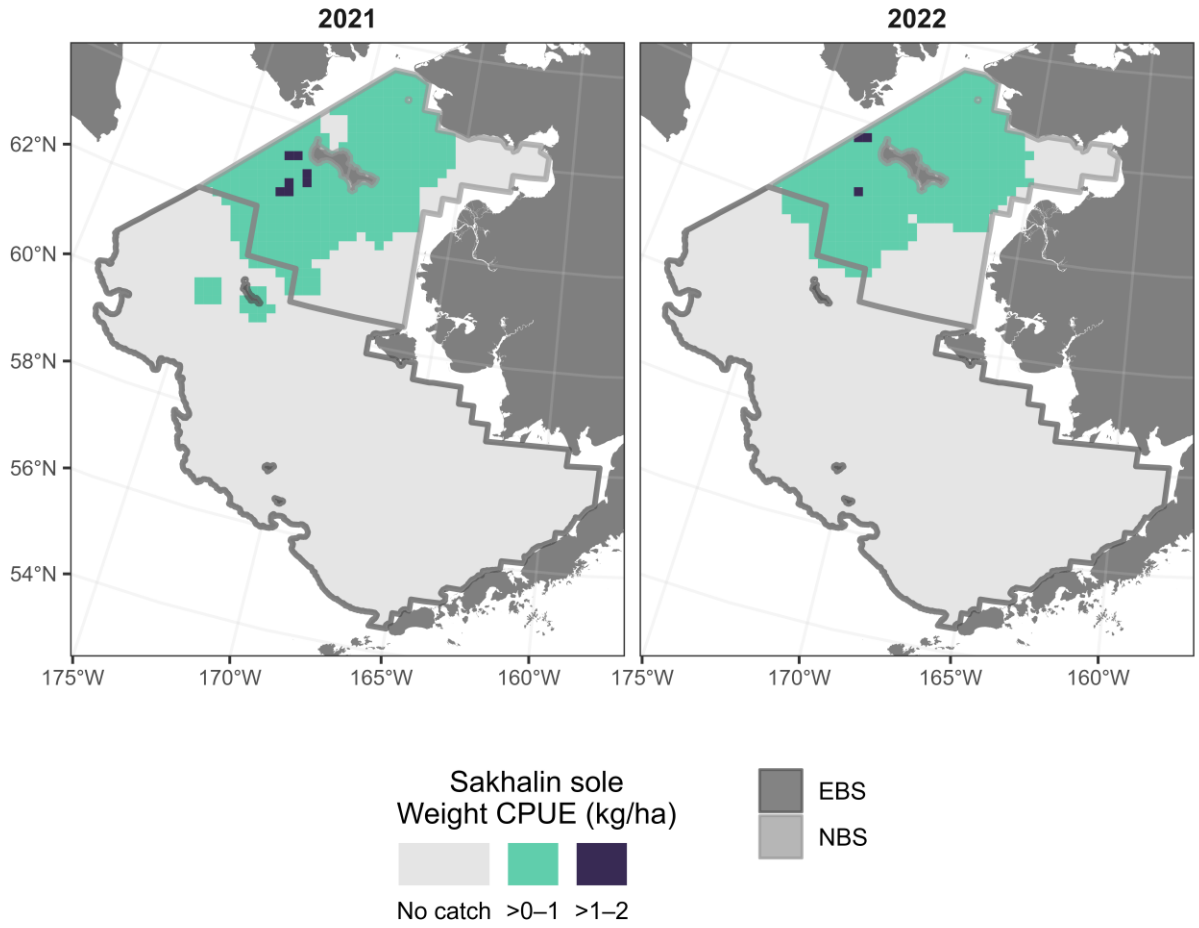

Figure 45. -- The distribution (weight CPUE (kg/ha)) of Sakhalin sole (*Limanda sakhalinensis*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 58. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Sakhalin sole (*Limanda sakhalinensis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	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	0.10	0.10	176	171	0	552	2	2	2
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**176**	**171**	**0**	**511**	**2**	**2**	**2**
NBS									
70	0.02	0.01	176	62	50	301	15	15	15
71	0.01	0.00	117	34	49	185	27	27	27
81	0.19	0.07	727	271	170	1,283	23	23	23
Total	**0.05**	**0.01**	**1,019**	**280**	**447**	**1,592**	**65**	**65**	**65**

Table 59. -- 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 Sakhalin sole (*Limanda sakhalinensis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	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	0.00	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	1.35	1.30	2.43	2,334.28	0.00	7.57	2	2	2
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.05**	**0.05**	**2.43**	**2,334.28**	**0.00**	**7.01**	**2**	**2**	**2**
NBS									
70	0.58	0.19	4.62	1,525.55	1.54	7.70	15	15	15
71	0.47	0.11	3.82	905.25	1.99	5.65	27	27	27
81	4.25	1.83	16.30	7,033.74	1.87	30.73	23	23	23
Total	**1.24**	**0.36**	**24.74**	**7,253.98**	**9.93**	**39.55**	**65**	**65**	**65**

Antlered Sculpin (*Enophrys diceraus*)

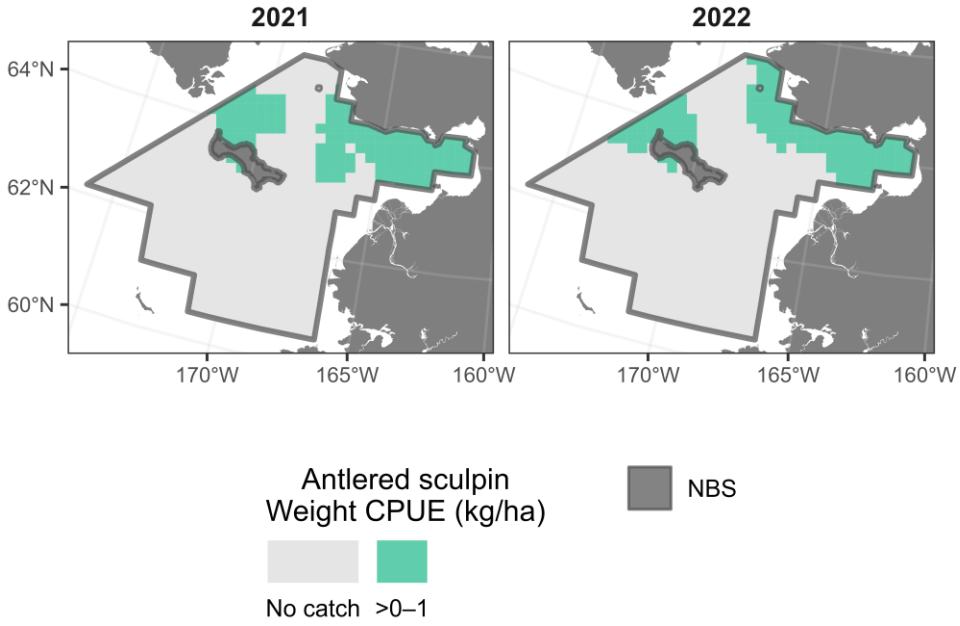

Figure 46. -- The distribution (weight CPUE (kg/ha)) of antlered sculpin (*Enophrys diceraus*) from the 2021-2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 eastern Bering Sea shelf bottom trawl surveys.

Table 60. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for antlered sculpin (*Enophrys diceraus*) by stratum encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea 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
70	0.00	0.00	0	0	0	0	0	0
71	0.01	0.01	122	56	9	235	13	13
81	0.00	0.00	1	1	0	2	1	1
Total	**0.01**	**0.00**	**123**	**56**	**10**	**236**	**14**	**14**

Table 61. -- 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 antlered sculpin (*Enophrys diceraus*) by stratum encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea 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
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0
71	0.19	0.08	1,576.85	625.08	313.55	2,840.14	13	13
81	0.01	0.01	29.63	29.63	0.00	90.43	1	1
Total	**0.08**	**0.03**	**1,606.47**	**625.79**	**341.76**	**2,871.19**	**14**	**14**

Arctic Staghorn Sculpin (*Gymnocanthus tricuspis*)

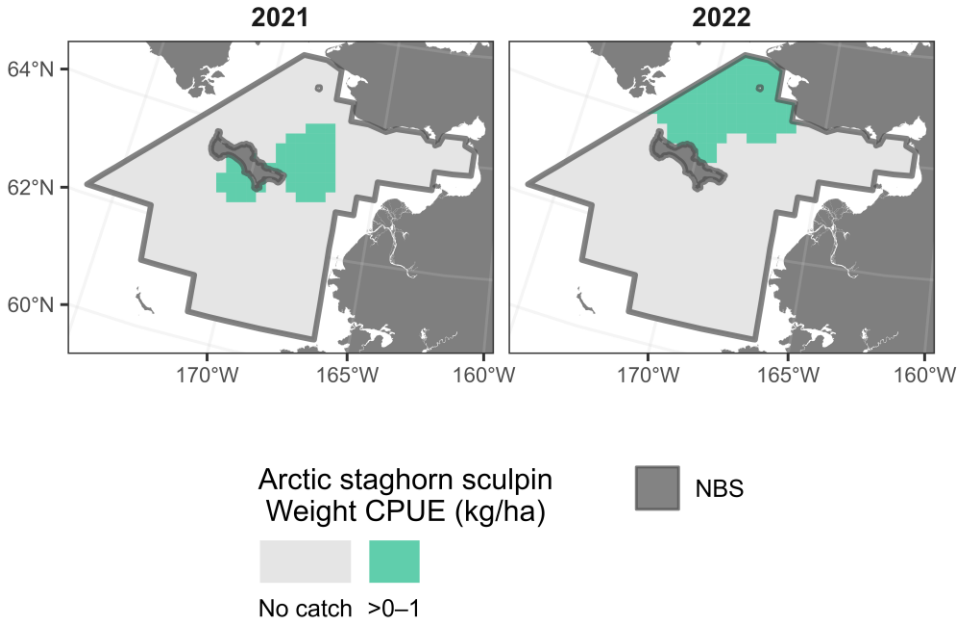

Figure 47. -- The distribution (weight CPUE (kg/ha)) of Arctic staghorn sculpin (*Gymnocanthus tricuspis*) from the 2021-2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 eastern Bering Sea shelf bottom trawl surveys.

Table 62. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Arctic staghorn sculpin (*Gymnocanthus tricuspis*) by stratum encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea 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
70	0.00	0.00	0	0	0	0	0	0
71	0.02	0.01	165	81	1	329	18	18
81	0.00	0.00	0	0	0	0	0	0
Total	**0.01**	**0.00**	**165**	**81**	**2**	**327**	**18**	**18**

Table 63. -- 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 Arctic staghorn sculpin (*Gymnocanthus tricuspis*) by stratum encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea shelf trawl survey. No lengths were collected for this taxon.

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
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0
71	0.53	0.27	4.33	2.16	0.00	8.69	18	18
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**0.22**	**0.11**	**4.33**	**2.16**	**0.02**	**8.64**	**18**	**18**

Butterfly Sculpin (*Hemilepidotus papilio*)

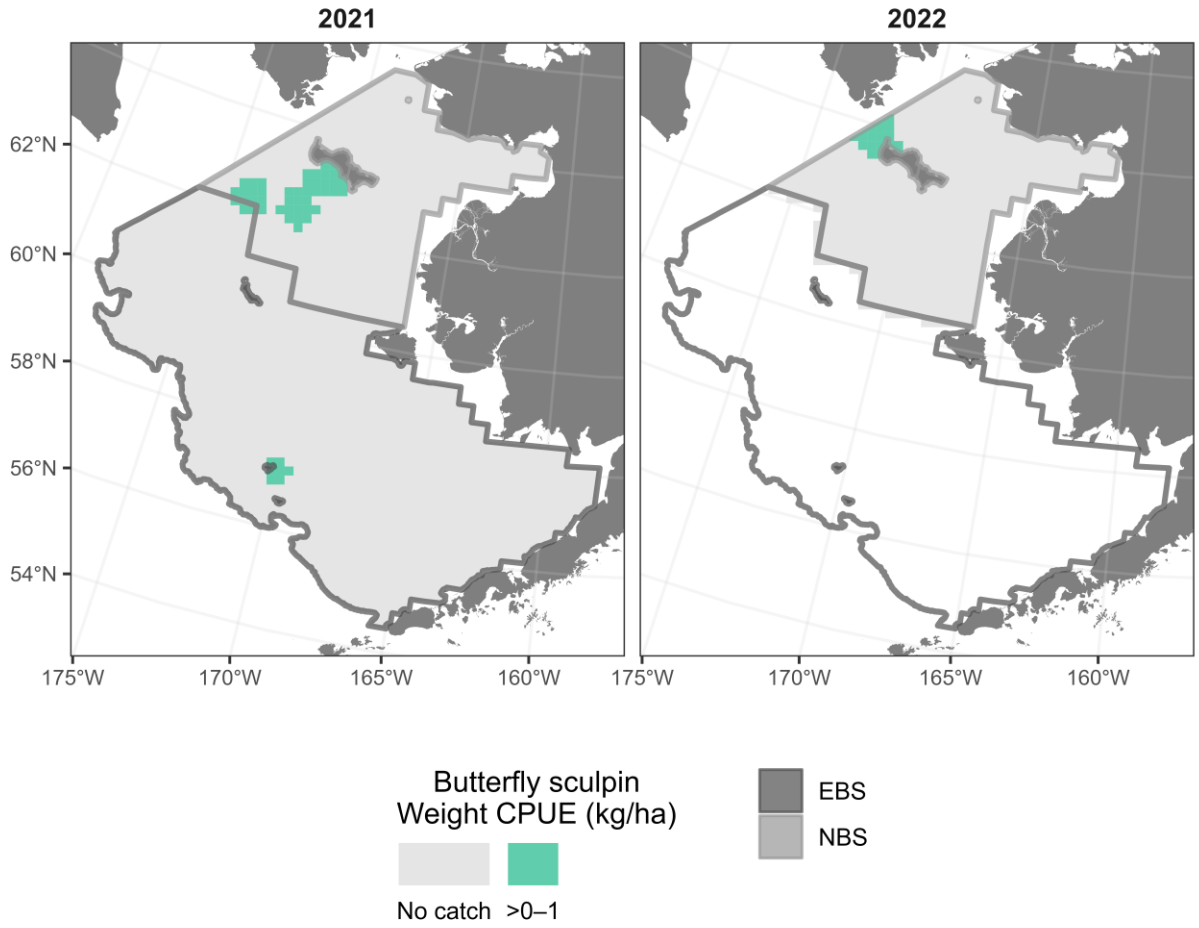

Figure 48. -- The distribution (weight CPUE (kg/ha)) of butterfly sculpin (*Hemilepidotus papilio*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 64. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for butterfly sculpin (*Hemilepidotus papilio*) by stratum encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea 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
70	0.00	0.00	4	4	0	12	1	1	1
71	0.00	0.00	0	0	0	0	0	0	0
81	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**4**	**4**	**0**	**12**	**1**	**1**	**1**

Table 65. -- 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 encountered during the 2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 eastern Bering Sea 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
70	0.01	0.01	44.30	44.30	0.00	133.84	1	1	1
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.00**	**0.00**	**44.30**	**44.30**	**0.00**	**132.91**	**1**	**1**	**1**

Bigmouth Sculpin (*Hemitripterus bolini*)

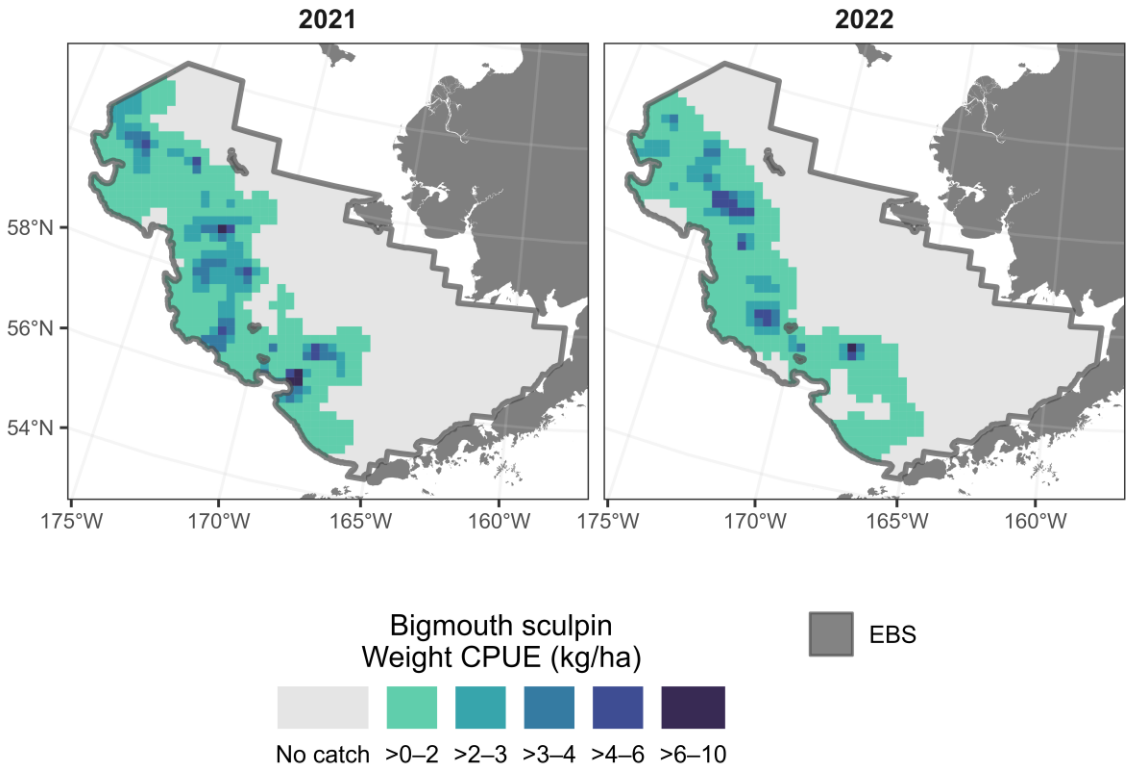

Figure 49. -- The distribution (weight CPUE (kg/ha)) of bigmouth sculpin (*Hemitripterus bolini*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

Table 66. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for bigmouth sculpin (*Hemitripterus bolini*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.16	0.12	1,508	1,094	0	3,695	5	5	5
32	0.78	0.23	694	206	206	1,181	5	5	5
41	0.31	0.16	1,935	1,014	0	3,984	5	5	5
42	0.64	0.23	1,550	553	420	2,679	8	8	8
43	0.65	0.27	1,361	566	184	2,539	7	7	7
50	0.12	0.06	441	219	0	892	5	5	4
61	1.05	0.16	9,241	1,433	6,345	12,136	33	33	33
62	2.81	0.93	1,816	601	346	3,287	6	6	6
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	**0.38**	**0.05**	**18,546**	**2,314**	**14,011**	**23,081**	**74**	**74**	**73**

Table 67. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.03	0.02	304.52	199.64	0.00	703.80	5	5	5
32	0.12	0.04	107.91	31.66	33.03	182.79	5	5	5
41	0.06	0.03	370.18	189.33	0.00	752.83	5	5	5
42	0.11	0.04	277.15	97.84	77.35	476.95	8	8	8
43	0.11	0.05	237.76	99.52	30.76	444.76	7	7	7
50	0.04	0.02	148.38	61.17	22.37	274.38	5	5	4
61	0.21	0.03	1,852.14	296.05	1,253.82	2,450.46	33	33	33
62	0.50	0.18	326.19	115.96	42.44	609.95	6	6	6
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	**0.07**	**0.01**	**3,624.23**	**448.35**	**2,745.47**	**4,503.00**	**74**	**74**	**73**

Arctic Cod (*Boreogadus saida*)

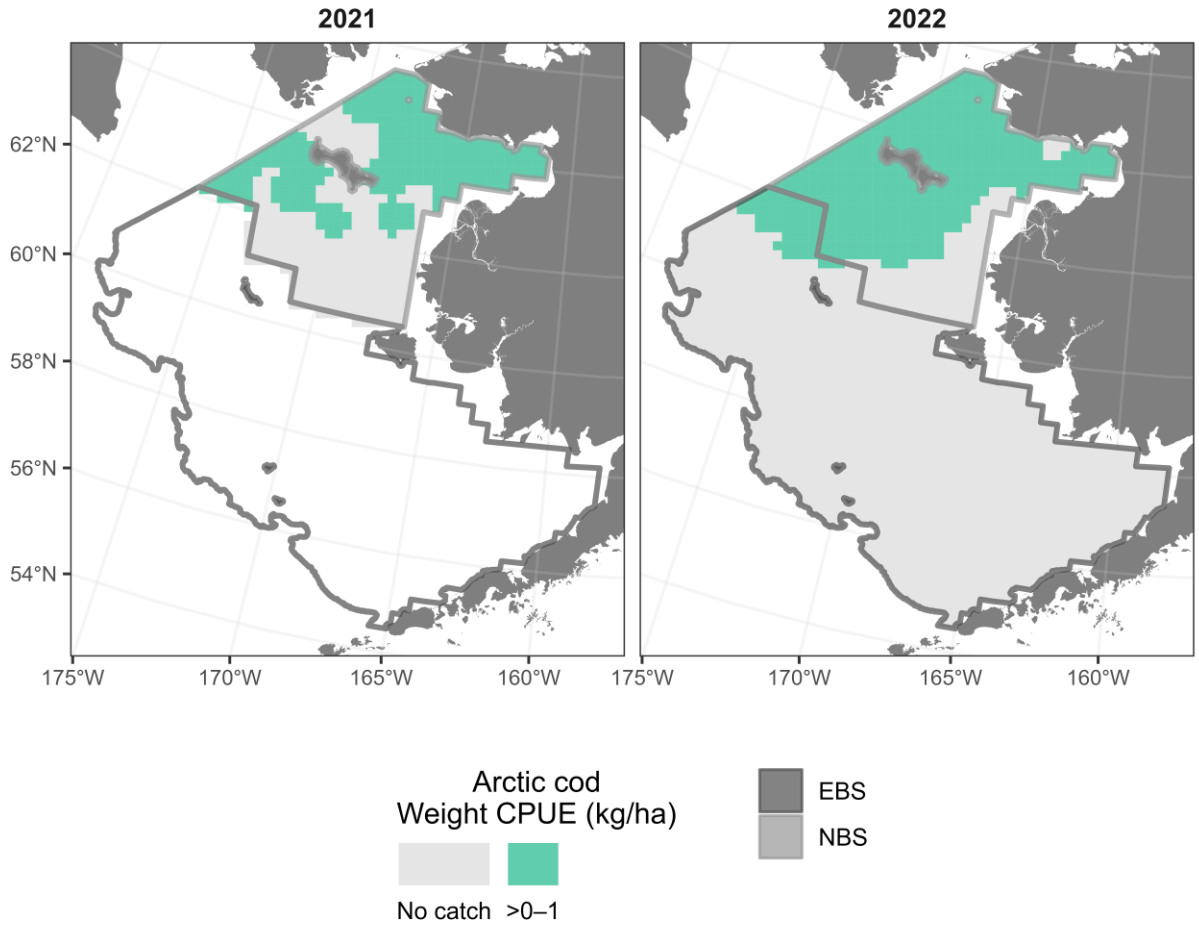

Figure 50. -- The distribution (weight CPUE (kg/ha)) of Arctic cod (*Boreogadus saida*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 68. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Arctic cod (*Boreogadus saida*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	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	0.01	51	19	9	93	8	8	8
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**51**	**19**	**14**	**89**	**8**	**8**	**8**
NBS									
70	0.01	0.00	74	24	25	122	19	19	19
71	0.02	0.00	139	37	64	214	37	37	37
81	0.05	0.02	174	59	53	295	22	22	22
Total	**0.02**	**0.00**	**387**	**74**	**239**	**534**	**78**	**78**	**78**

Table 69. -- 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 Arctic cod (*Boreogadus saida*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	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	0.00	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	0.91	0.36	1.64	649.19	0.21	3.07	8	8	8
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.03**	**0.01**	**1.64**	**649.19**	**0.37**	**2.91**	**8**	**8**	**8**
NBS									
70	0.40	0.13	3.14	1,004.94	1.11	5.17	19	19	19
71	0.78	0.23	6.32	1,869.04	2.54	10.10	37	37	37
81	1.65	0.53	6.33	2,045.25	2.14	10.53	22	22	22
Total	**0.79**	**0.15**	**15.79**	**2,947.25**	**9.90**	**21.69**	**78**	**78**	**78**

Saffron Cod (*Eleginus gracilis*)

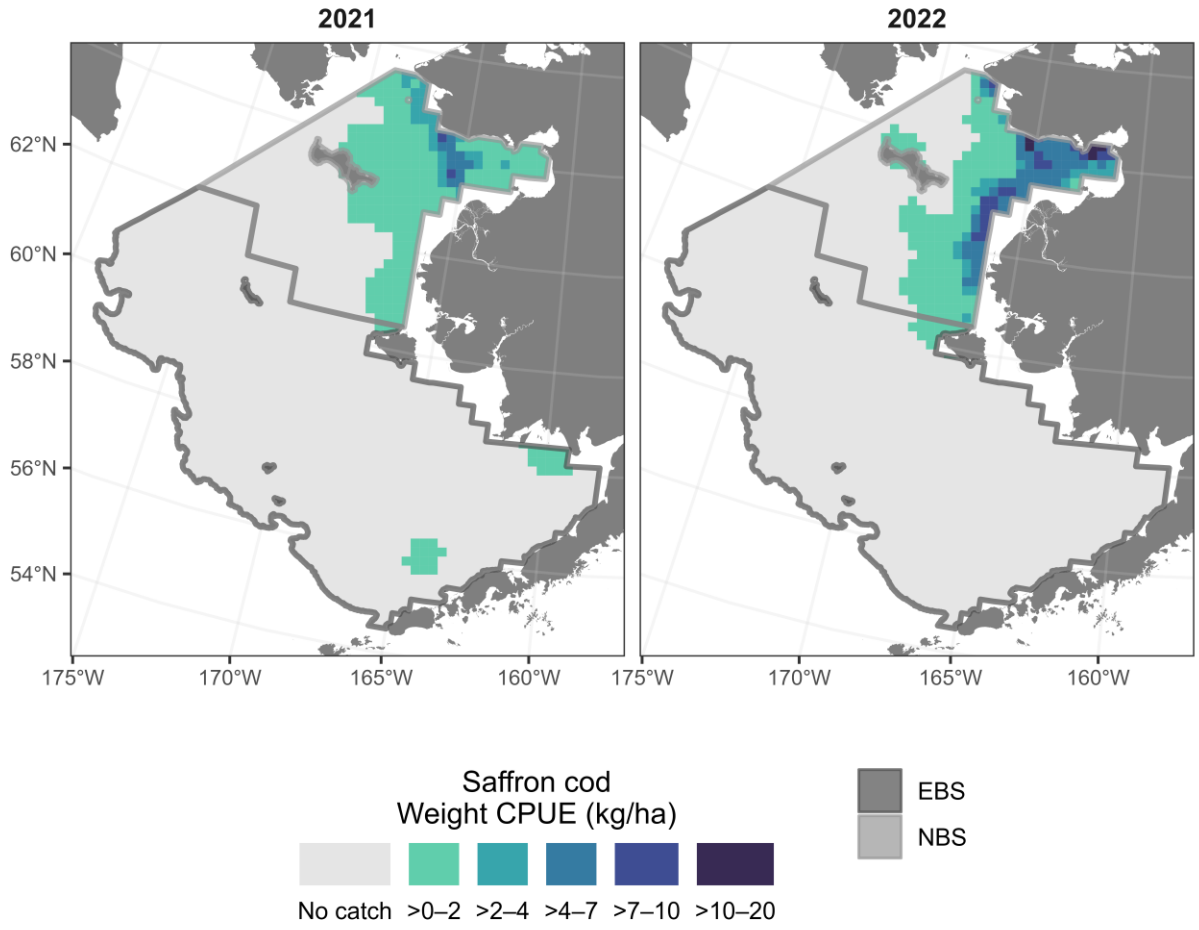

Figure 51. -- The distribution (weight CPUE (kg/ha)) of saffron cod (*Eleginus gracilis*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 70. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for saffron cod (*Eleginus gracilis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.01	0.00	21	18	0	58	2	2	2
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	**0.00**	**0.00**	**21**	**18**	**0**	**57**	**2**	**2**	**2**
NBS									
70	1.08	0.31	8,584	2,491	3,550	13,618	27	27	27
71	2.36	0.51	19,154	4,109	10,850	27,459	32	32	32
81	0.00	0.00	0	0	0	0	0	0	0
Total	**1.39**	**0.24**	**27,738**	**4,805**	**18,128**	**37,349**	**59**	**59**	**59**

Table 71. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys.

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	0.12	0.10	506.48	429.50	0.00	1,383.51	2	2	2
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	**0.01**	**0.01**	**506.48**	**429.50**	**0.00**	**1,348.29**	**2**	**2**	**2**
NBS									
70	27.41	9.95	217,242.56	78,830.20	57,926.74	376,558.39	27	27	27
71	41.64	9.20	338,373.30	74,721.83	187,360.48	489,386.12	32	32	32
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**27.94**	**5.46**	**555,615.86**	**108,616.53**	**338,382.79**	**772,848.93**	**59**	**59**	**59**

Pacific Herring (*Clupea pallasii*)

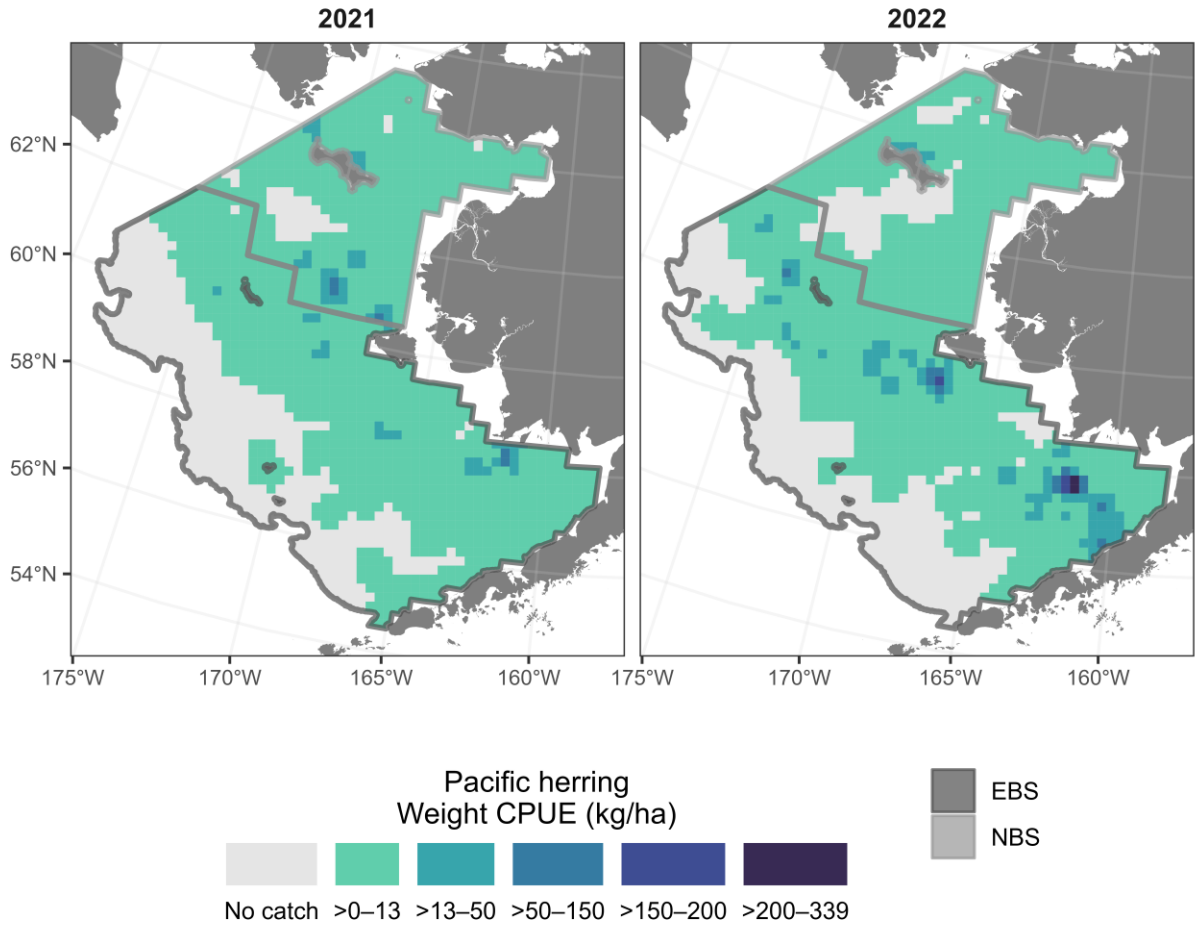

Figure 52. -- The distribution (weight CPUE (kg/ha)) of Pacific herring (*Clupea pallasii*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 72. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Pacific herring (*Clupea pallasii*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	12.21	6.12	96,091	48,181	0	193,464	33	33
20	9.52	5.81	39,211	23,938	0	88,092	30	30
31	3.50	1.48	33,253	14,011	5,232	61,275	29	29
32	0.28	0.14	245	128	0	547	3	3
41	5.66	2.09	35,240	13,042	8,882	61,599	33	33
42	1.06	0.54	2,549	1,296	0	5,196	8	8
43	5.18	1.58	10,911	3,334	3,977	17,845	19	19
50	0.00	0.00	0	0	0	0	0	0
61	0.09	0.07	789	625	0	2,052	3	3
62	4.28	2.47	2,765	1,599	0	6,677	4	4
82	2.07	1.23	3,714	2,212	0	8,582	7	7
90	3.19	2.48	3,678	2,862	0	10,446	5	5
Total	**4.63**	**1.16**	**228,447**	**57,355**	**113,736**	**343,158**	**174**	**174**
NBS								
70	0.16	0.07	1,302	553	184	2,419	29	29
71	1.20	0.80	9,746	6,526	0	22,935	32	32
81	0.29	0.15	1,130	561	0	2,284	9	9
Total	**0.61**	**0.33**	**12,178**	**6,573**	**0**	**25,462**	**70**	**70**

Table 73. -- 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 herring (*Clupea pallasii*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	64.35	29.29	506.48	230,554.31	40.53	972.43	33	33
20	63.05	36.90	259.71	151,998.01	0.00	570.09	30	30
31	18.18	7.70	172.71	73,148.04	26.41	319.00	29	29
32	1.72	0.87	1.52	771.11	0.00	3.34	3	3
41	36.23	13.89	225.74	86,557.90	50.80	400.67	33	33
42	6.58	3.37	15.87	8,135.02	0.00	32.48	8	8
43	26.42	8.02	55.66	16,884.61	20.54	90.78	19	19
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0
61	0.37	0.28	3.27	2,473.86	0.00	8.27	3	3
62	23.29	13.26	15.05	8,568.28	0.00	36.02	4	4
82	12.88	7.78	23.13	13,964.49	0.00	53.86	7	7
90	19.34	14.74	22.31	17,012.58	0.00	62.55	5	5
Total	**26.40**	**6.09**	**1,301.44**	**300,029.04**	**701.38**	**1,901.50**	**174**	**174**
NBS								
70	3.53	1.93	28.00	15,330.53	0.00	58.99	29	29
71	7.13	4.43	57.96	35,979.85	0.00	130.67	32	32
81	1.93	0.94	7.41	3,606.35	0.00	14.83	9	9
Total	**4.70**	**1.97**	**93.37**	**39,275.70**	**14.00**	**172.75**	**70**	**70**

Pacific Capelin (*Mallotus villosus*)

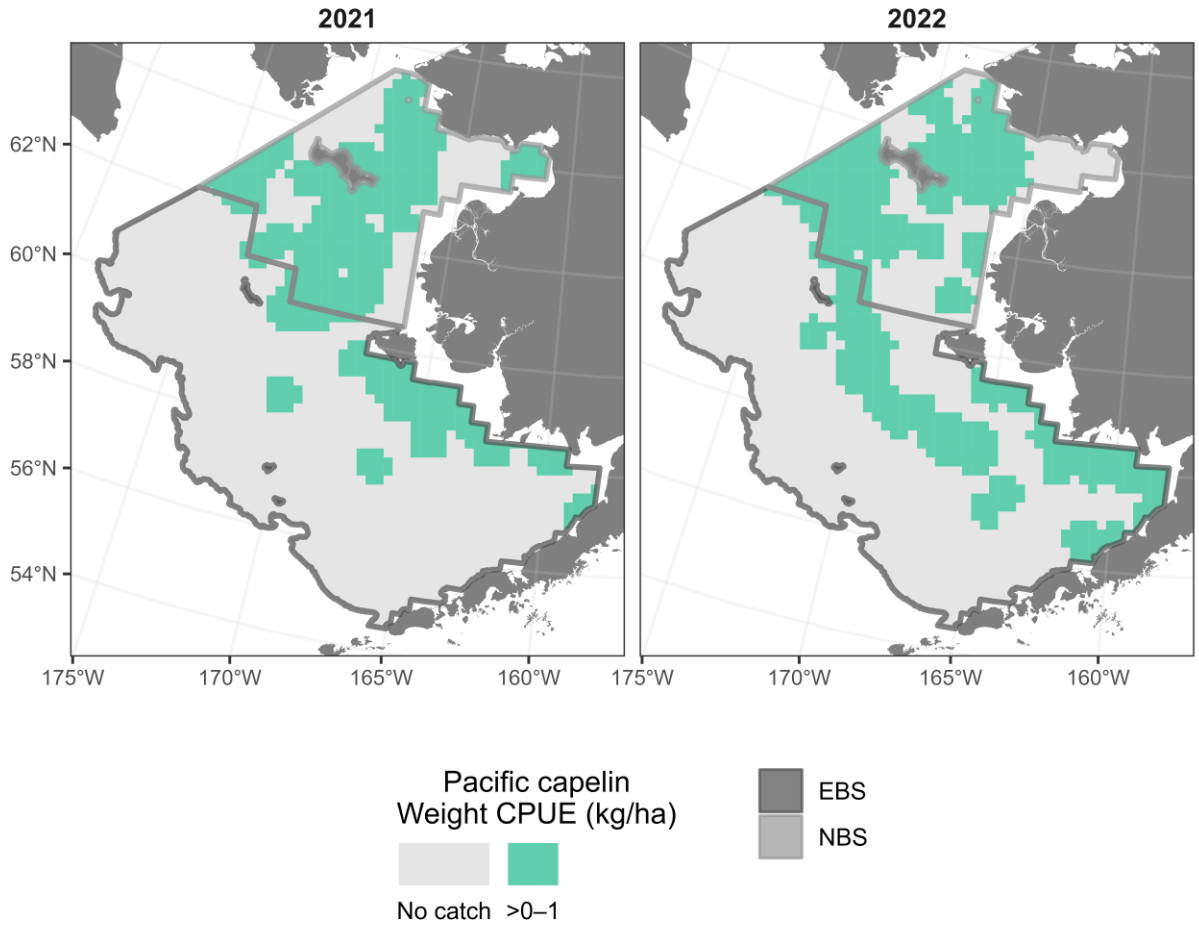

Figure 53. -- The distribution (weight CPUE (kg/ha)) of Pacific capelin (*Mallotus villosus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 74. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for Pacific capelin (*Mallotus villosus*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	80	22	35	124	18	18
20	0.00	0.00	9	6	0	21	4	4
31	0.00	0.00	11	8	0	27	4	4
32	0.00	0.00	0	0	0	0	0	0
41	0.00	0.00	16	5	5	26	12	12
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	2	2	0	6	1	1
90	0.00	0.00	0	0	0	0	0	0
Total	**0.00**	**0.00**	**118**	**25**	**68**	**168**	**40**	**40**
NBS								
70	0.00	0.00	7	2	2	11	9	9
71	0.00	0.00	36	14	8	64	14	14
81	0.01	0.00	29	11	8	51	16	16
Total	**0.00**	**0.00**	**72**	**18**	**37**	**107**	**39**	**39**

Table 75. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	0.55	0.14	4,330.72	1,098.06	2,111.55	6,549.90	18	18
20	0.14	0.09	573.16	358.05	0.00	1,304.29	4	4
31	0.09	0.06	839.43	558.99	0.00	1,957.42	4	4
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	0.19	0.07	1,154.86	408.40	329.48	1,980.24	12	12
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0
43	0.01	0.01	18.69	18.69	0.00	57.56	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	0.07	0.07	123.20	123.20	0.00	394.37	1	1
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**0.14**	**0.03**	**7,040.06**	**1,352.30**	**4,335.46**	**9,744.67**	**40**	**40**
NBS								
70	0.06	0.02	511.60	196.83	113.82	909.39	9	9
71	0.62	0.27	5,069.02	2,184.59	653.97	9,484.07	14	14
81	0.59	0.25	2,267.22	947.32	323.32	4,211.12	16	16
Total	**0.39**	**0.12**	**7,847.85**	**2,389.26**	**3,069.32**	**12,626.37**	**39**	**39**

Rainbow Smelt (*Osmerus mordax*)

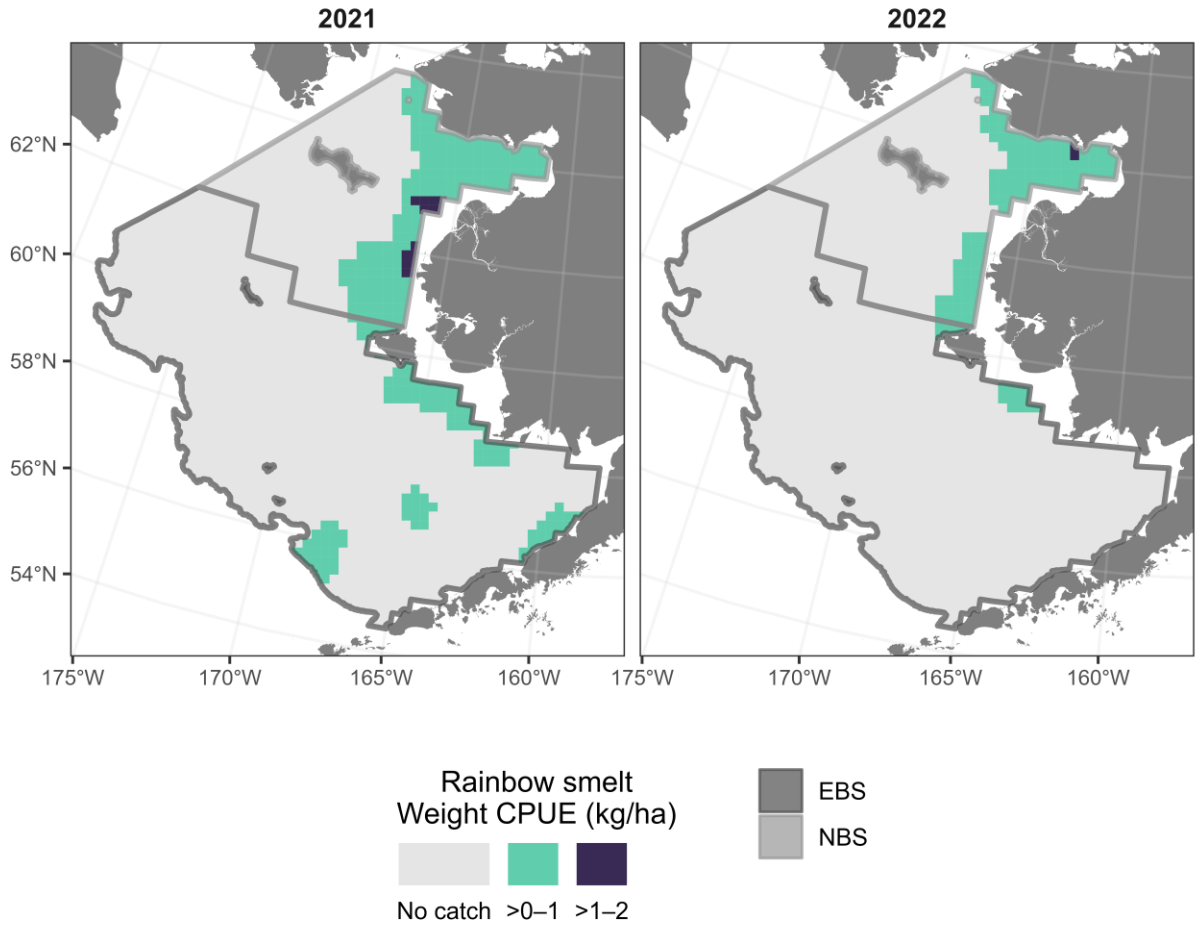

Figure 54. -- The distribution (weight CPUE (kg/ha)) of rainbow smelt (*Osmerus mordax*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 76. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for rainbow smelt (*Osmerus mordax*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	13	13	0	39	1	1
20	0.00	0.00	0	0	0	0	0	0
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**	**13**	**13**	**0**	**38**	**1**	**1**
NBS								
70	0.05	0.02	392	187	14	770	6	6
71	0.12	0.03	975	283	403	1,548	21	21
81	0.00	0.00	0	0	0	0	0	0
Total	**0.07**	**0.02**	**1,367**	**340**	**681**	**2,053**	**27**	**27**

Table 77. -- 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 encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	0.03	0.03	198.17	198.17	0.00	598.66	1	1
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0
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	**0.00**	**0.00**	**198.17**	**198.17**	**0.00**	**590.53**	**1**	**1**
NBS								
70	1.19	0.56	9,458.19	4,425.47	514.32	18,402.07	6	6
71	5.62	1.89	45,701.71	15,369.13	14,640.69	76,762.73	21	21
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**2.77**	**0.80**	**55,159.91**	**15,993.60**	**22,836.85**	**87,482.96**	**27**	**27**

Eulachon (*Thaleichthys pacificus*)

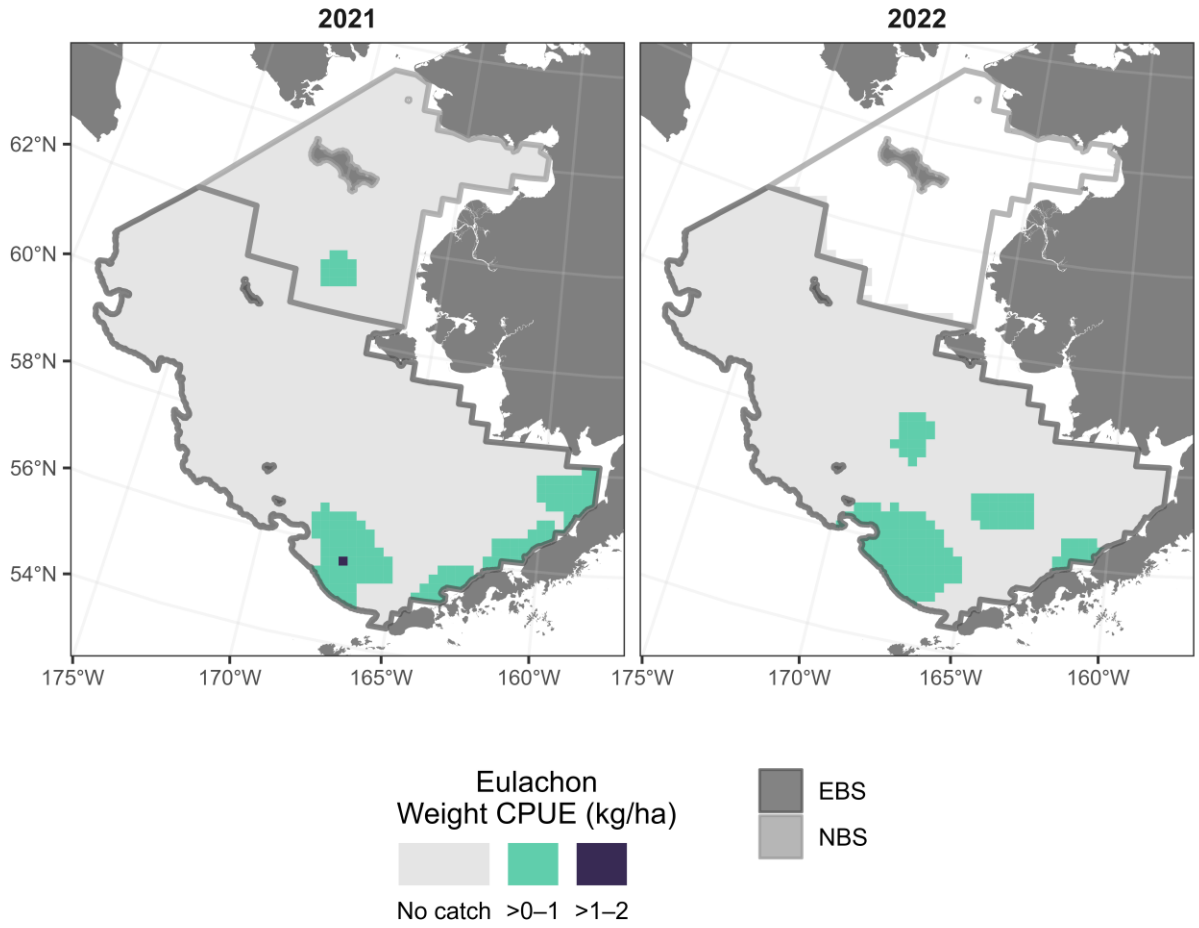

Figure 55. -- The distribution (weight CPUE (kg/ha)) of eulachon (*Thaleichthys pacificus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 78. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for eulachon (*Thaleichthys pacificus*) by stratum encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	17	17	0	52	1	1
20	0.00	0.00	0	0	0	0	0	0
31	0.00	0.00	9	6	0	20	3	3
32	0.00	0.00	0	0	0	0	0	0
41	0.00	0.00	10	7	0	25	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	0.10	0.05	393	172	39	748	13	13
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	**0.01**	**0.00**	**430**	**173**	**87**	**773**	**19**	**19**

Table 79. -- 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 encountered during the 2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2022 northern Bering Sea 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	0.03	0.03	221.55	221.55	0.00	669.31	1	1
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0
31	0.01	0.01	110.89	67.55	0.00	246.00	3	3
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	0.11	0.08	712.73	498.51	0.00	1,720.22	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	2.74	1.30	10,431.74	4,960.56	212.99	20,650.49	13	13
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	**0.23**	**0.10**	**11,476.91**	**4,990.92**	**1,594.88**	**21,358.94**	**19**	**19**

Shortfin Eelpout (*Lycodes brevipes*)

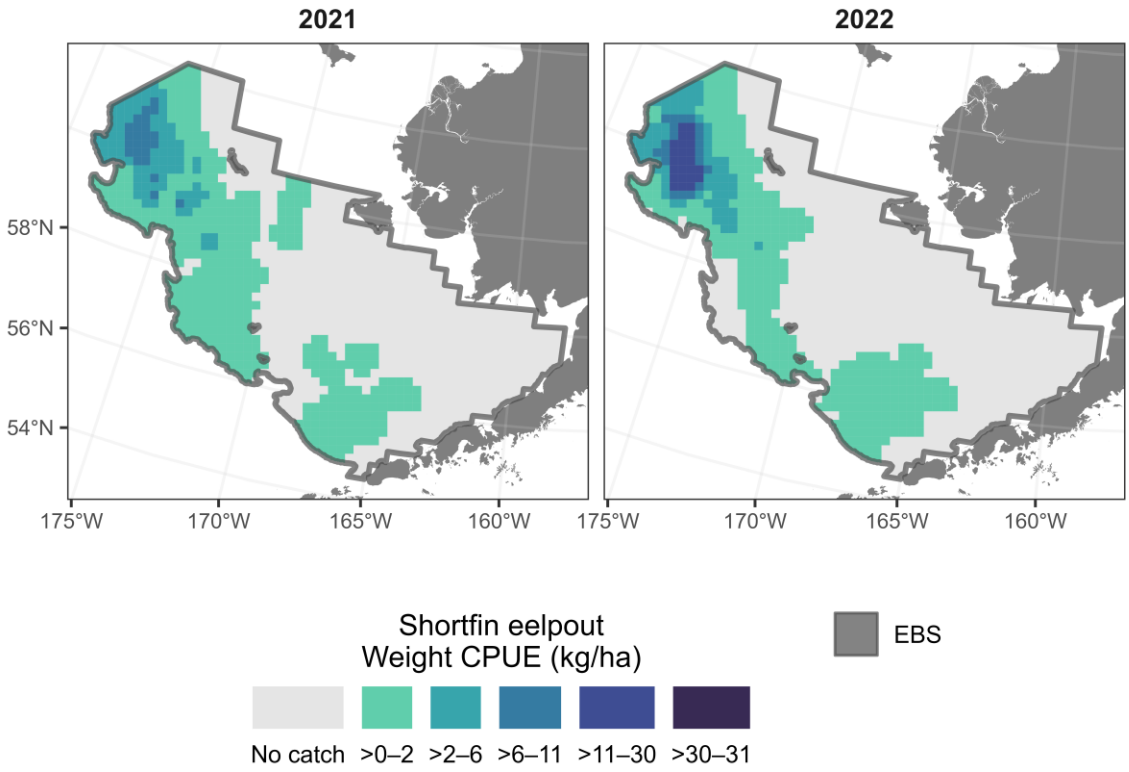

Figure 56. -- The distribution (weight CPUE (kg/ha)) of shortfin eelpout (*Lycodes brevipes*) from the 2021-2022 eastern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 northern Bering Sea shelf bottom trawl surveys.

Wattled Eelpout (*Lycodes palearis*)

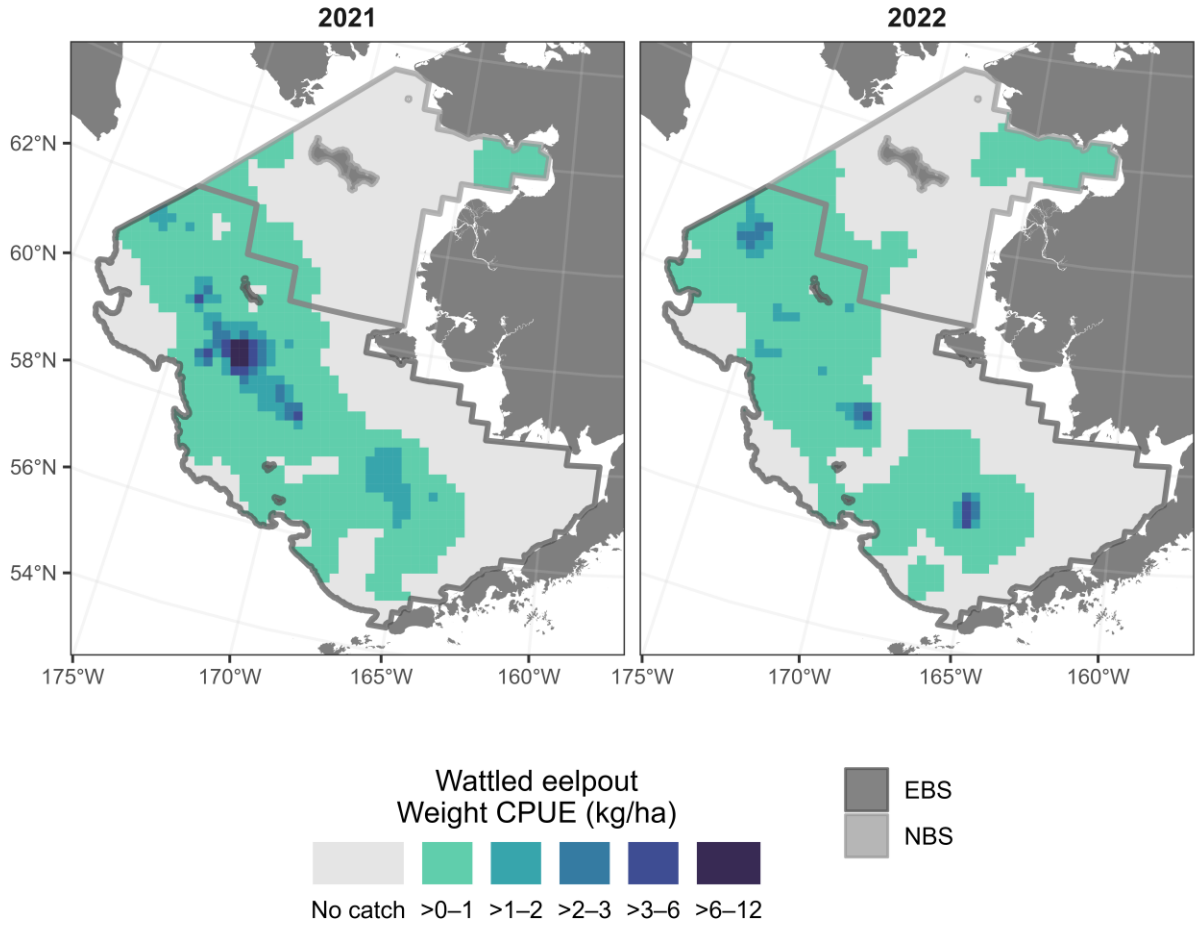

Figure 57. -- The distribution (weight CPUE (kg/ha)) of wattled eelpout (*Lycodes palearis*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Marbled Eelpout (*Lycodes raridens*)

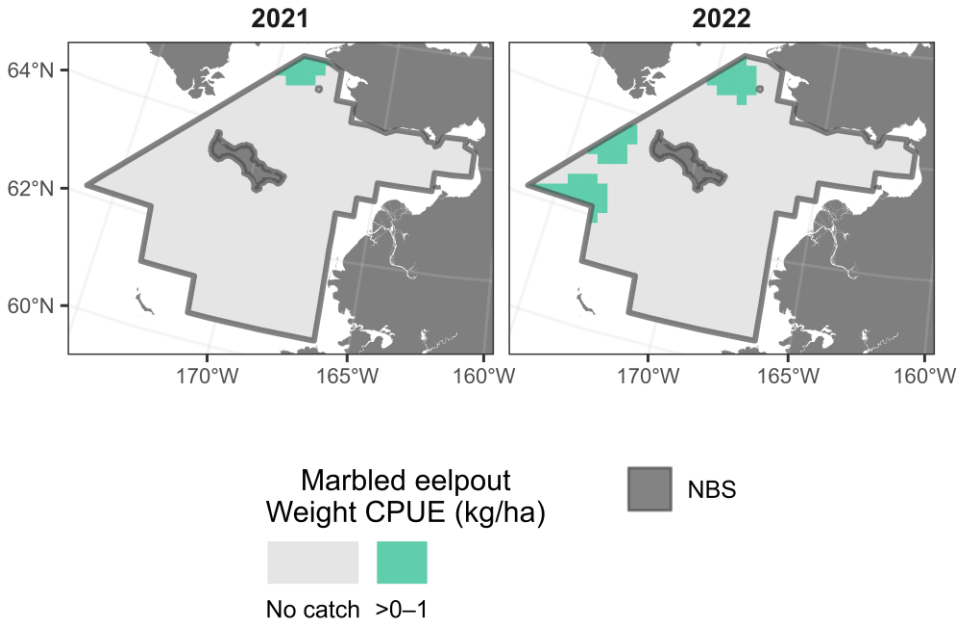

Figure 58. -- The distribution (weight CPUE (kg/ha)) of marbled eelpout (*Lycodes raridens*) from the 2021-2022 northern Bering Sea shelf bottom trawl survey. This species was not encountered in the 2021-2022 eastern Bering Sea shelf bottom trawl surveys.

Sturgeon Poacher (*Podothecus accipenserinus*)

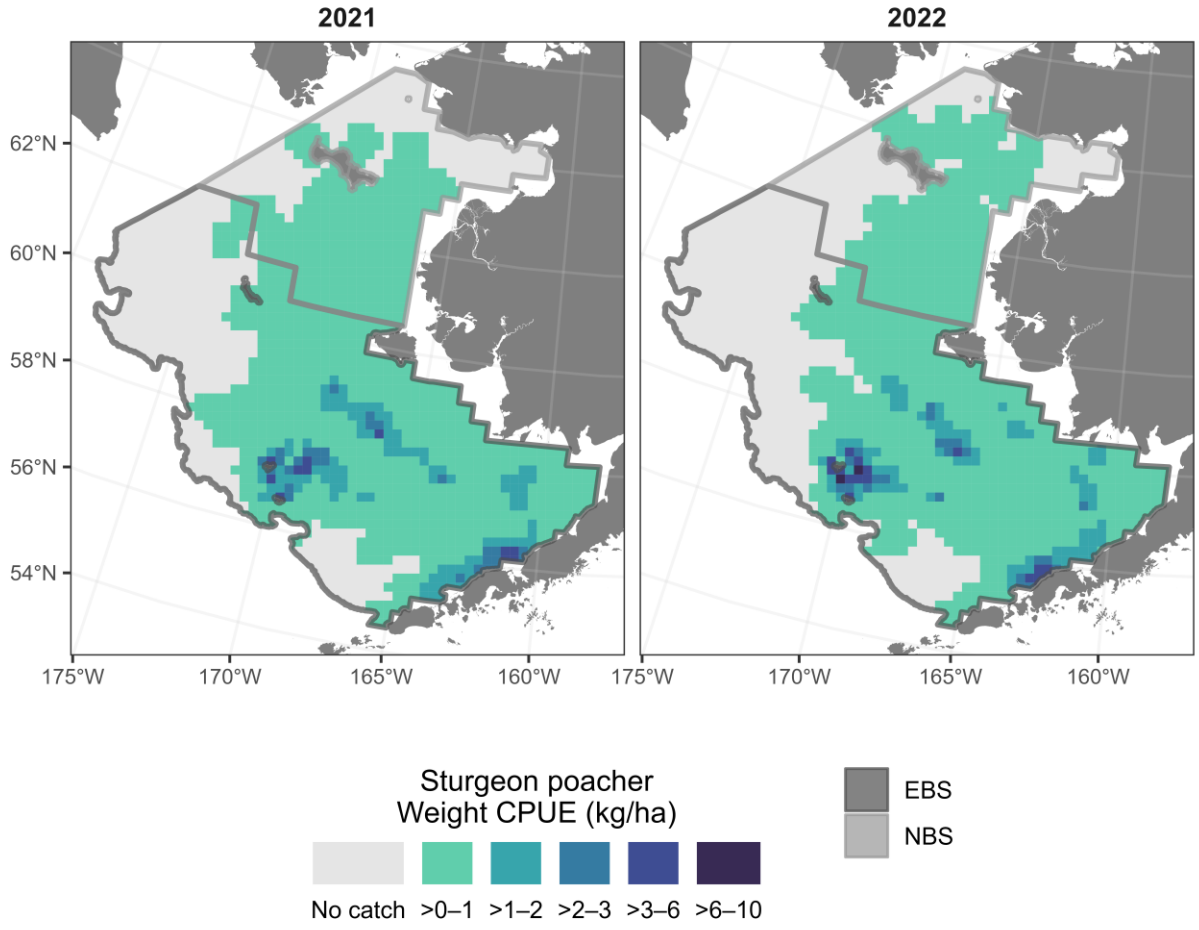

Figure 59. -- The distribution (weight CPUE (kg/ha)) of sturgeon poacher (*Podothecus accipenserinus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Variegated Snailfish (*Liparis gibbus*)

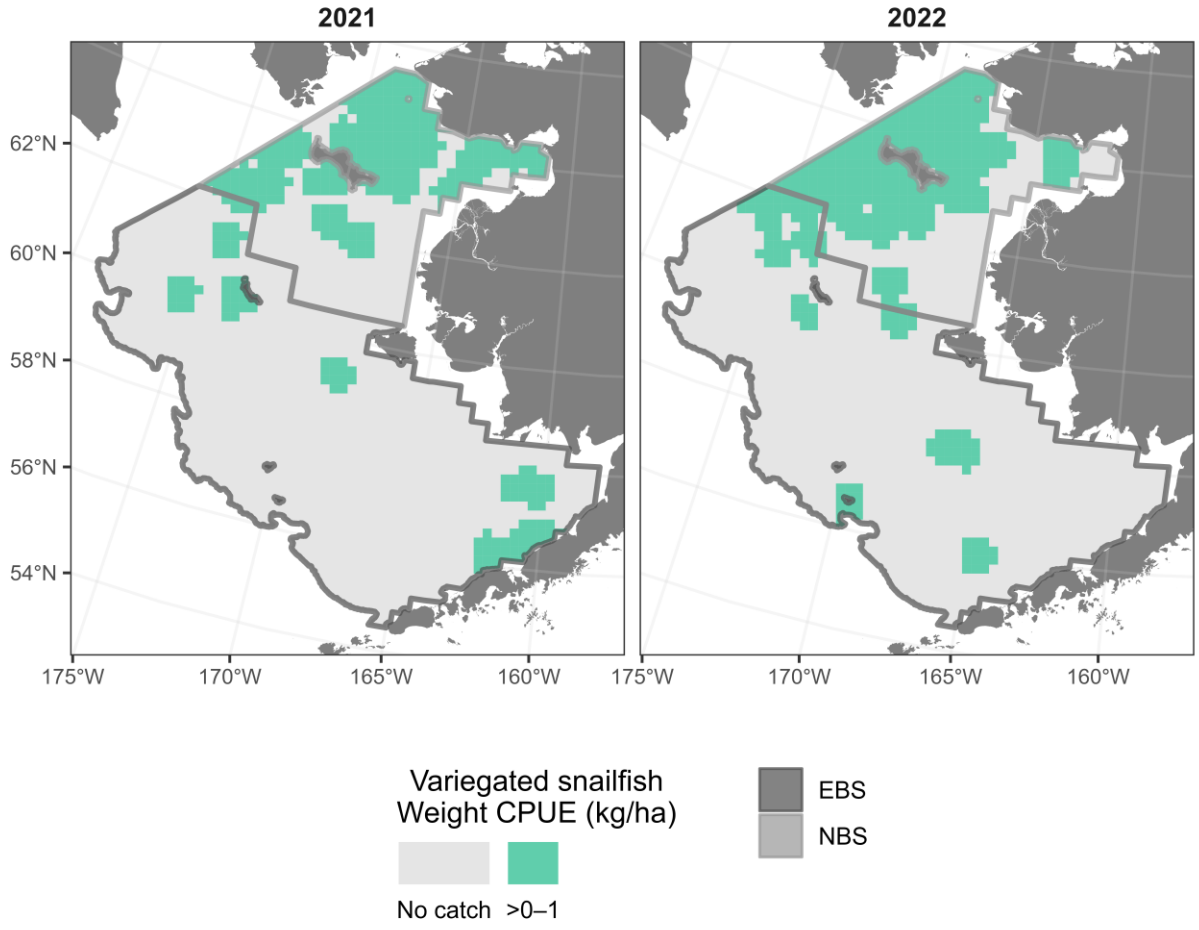

Figure 60. -- The distribution (weight CPUE (kg/ha)) of variegated snailfish (*Liparis gibbus*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Purple-Orange Sea Star (*Asterias amurensis*)

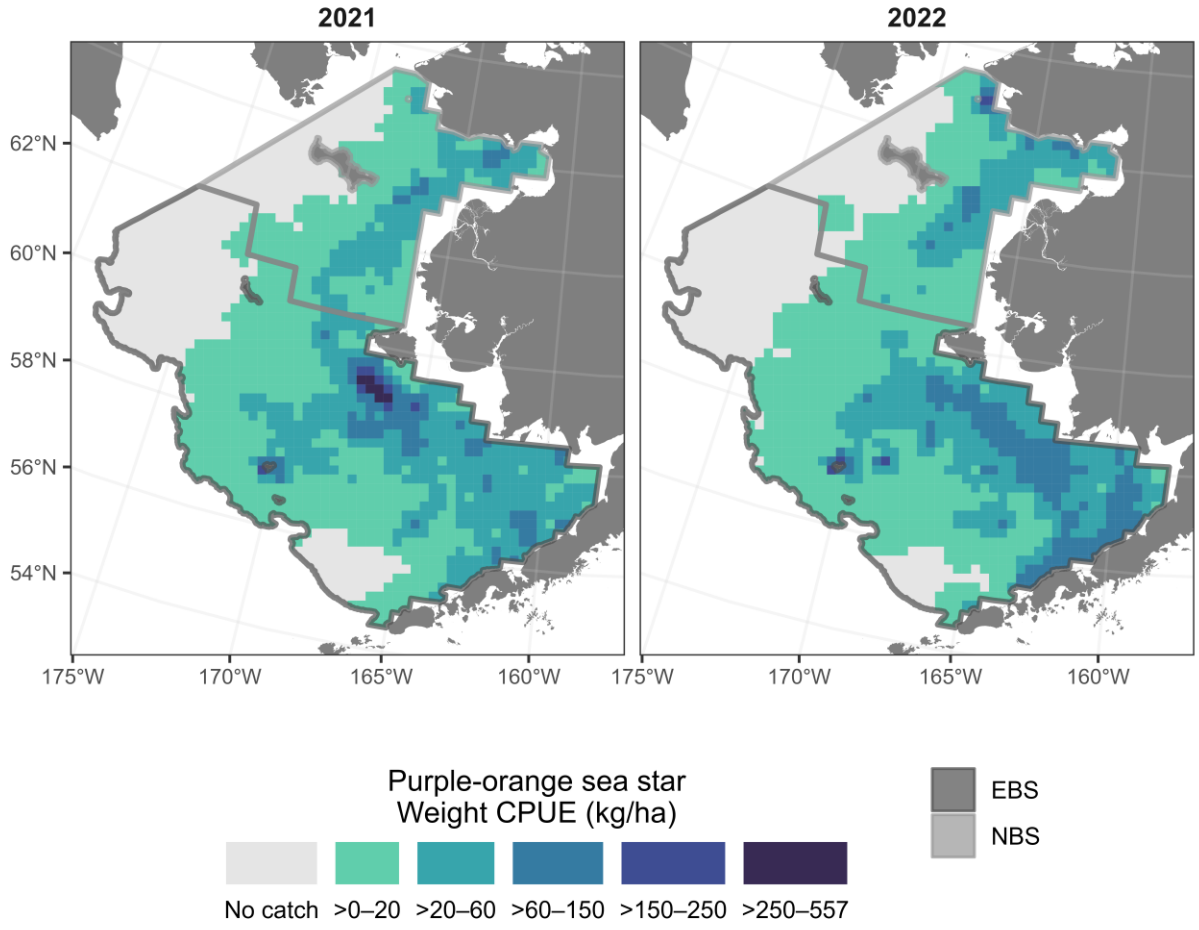

Figure 61. -- The distribution (weight CPUE (kg/ha)) of purple-orange sea star (*Asterias amurensis*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Table 80. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; mt) and upper (UCL; mt) confidence limits for purple-orange sea star (*Asterias amurensis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. 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	67.17	5.24	528,646	41,225	445,329	611,962	58	58
20	34.26	5.25	141,126	21,630	96,957	185,295	31	31
31	19.62	2.87	186,364	27,247	131,871	240,857	60	60
32	8.95	2.90	7,914	2,564	1,851	13,977	7	7
41	9.77	2.19	60,873	13,667	33,253	88,494	35	35
42	37.01	10.49	89,277	25,313	37,587	140,967	31	31
43	0.25	0.11	536	239	38	1,034	10	10
50	0.10	0.07	362	277	0	932	6	6
61	0.34	0.31	2,968	2,678	0	8,381	11	11
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	**20.65**	**1.24**	**1,018,067**	**61,247**	**896,798**	**1,139,336**	**249**	**249**
NBS								
70	18.18	3.68	144,075	29,201	85,061	203,090	42	42
71	20.30	4.41	164,920	35,823	92,521	237,319	38	38
81	0.95	0.76	3,630	2,908	0	9,597	6	6
Total	**15.72**	**2.33**	**312,625**	**46,308**	**220,009**	**405,242**	**86**	**86**

Table 81. -- 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 purple-orange sea star (*Asterias amurensis*) by stratum encountered during the 2022 eastern and northern Bering Sea shelf bottom trawl surveys. No lengths were collected for this taxon.

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
EBS								
10	1,320.80	544.60	10,395.45	4,286.31	1,732.82	19,058.08	58	58
20	325.04	55.48	1,338.95	228.56	872.23	1,805.66	31	31
31	177.07	29.95	1,681.77	284.50	1,112.76	2,250.77	60	60
32	93.64	30.01	82.84	26.55	20.05	145.63	7	7
41	58.86	12.51	366.78	77.96	209.24	524.33	35	35
42	490.90	204.39	1,184.15	493.04	177.36	2,190.93	31	31
43	1.73	0.98	3.65	2.07	0.00	7.94	10	10
50	1.18	0.81	4.48	3.09	0.00	10.84	6	6
61	2.41	2.22	21.15	19.47	0.00	60.49	11	11
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	**305.87**	**87.85**	**15,079.21**	**4,330.81**	**6,504.21**	**23,654.21**	**249**	**249**
NBS								
70	157.59	27.19	1,249.02	215.49	813.51	1,684.54	42	42
71	230.71	54.95	1,874.64	446.52	972.23	2,777.05	38	38
81	8.51	6.37	32.64	24.44	0.00	82.80	6	6
Total	**158.71**	**24.96**	**3,156.31**	**496.40**	**2,163.51**	**4,149.10**	**86**	**86**

Northern Neptune Whelk (*Neptunea heros*)

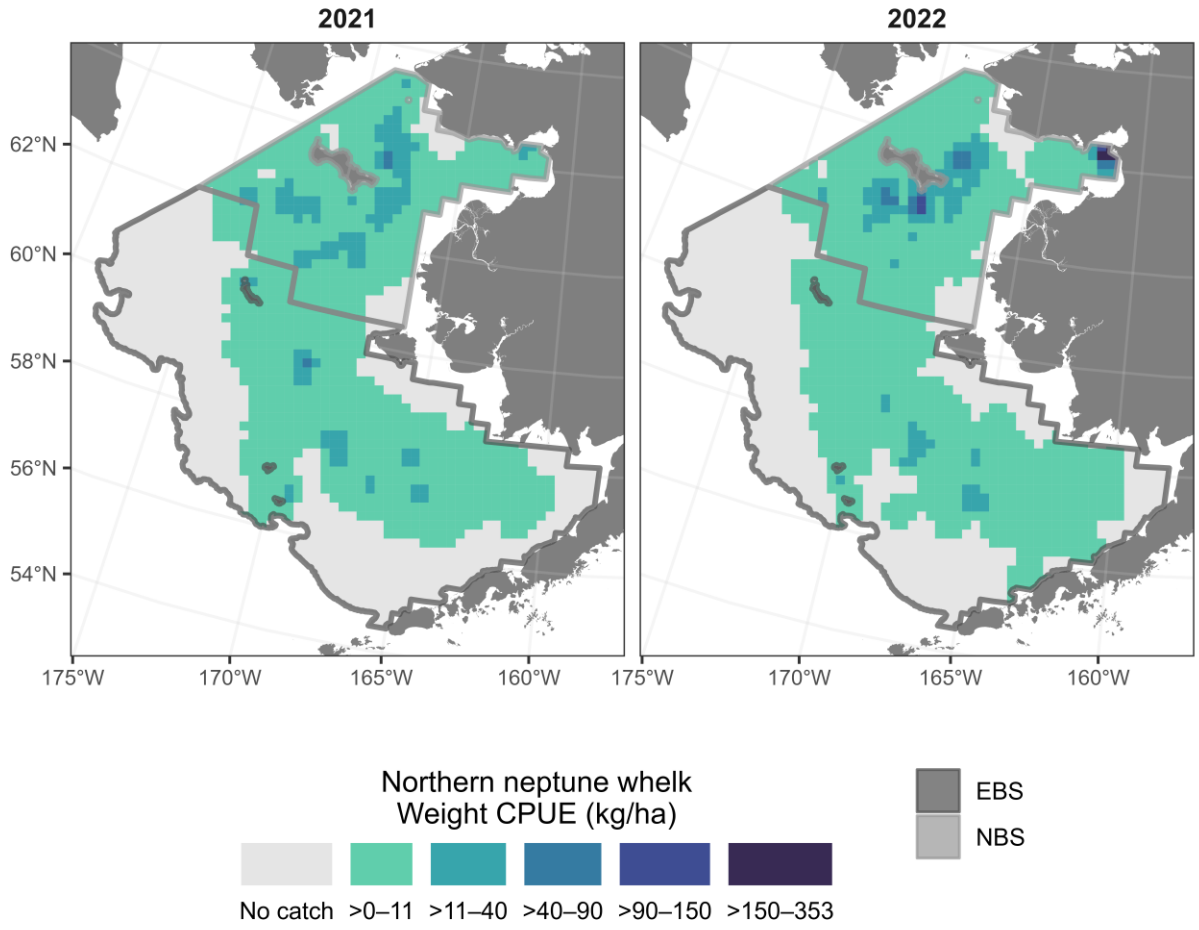

Figure 62. -- The distribution (weight CPUE (kg/ha)) of northern Neptune whelk (*Neptunea heros*) from the 2021-2022 eastern and northern Bering Sea shelf bottom trawl surveys.

Data Sources

The Groundfish Assessment Program's Bering Sea Team and the Shellfish Assessment Program conduct the Bering Sea bottom trawl survey each summer. The data collected from the survey are then extrapolated to catch-per-unit-effort (CPUE), population-level abundance, population-level abundance by size class, and population-level biomass estimates.

This document was generated using R and R Markdown. R is a coding language and environment for statistical computing and graphics. R Markdown provides a framework for reproducible, transparent, and documentable report writing.

Many of the data sources and tools used to develop the plots and content of this document have been developed by members across the AFSC's Groundfish Assessment Program. These tools and public-serving data products aim 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 other maps in this document. 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 (Rohan et al., 2022).

The catch, environmental, and location data collected and calculated from the survey can be accessed directly and downloaded from the Fisheries One Stop Shop data webportal (NOAA Fisheries Alaska Fisheries Science Center, 2023). Users can interactively select, view, and download data for this and other surveys conducted by AFSC's RACE Division. Data from this and other fisheries-independent surveys are also used in the NOAA Fisheries Distribution Mapping and Analysis Portal (DisMAP), which provides easy access to information to track and understand distributions of marine species in U.S. Marine Ecosystems (NOAA Fisheries (2023), https://apps-st.fisheries.noaa.gov/dismap/).

Acknowledgments

Recognition and appreciation are extended to the captains and crew of the FV *Alaska Knight* and FV *Vesteraalen*. Without their expertise, goodwill, and sacrifice, this survey would not be possible. Thank you to United States Seafoods and Vesteraalen LLC for making the vessels available and always maintaining safety as a top priority. Great appreciation is also extended to all the scientists, researchers, contractors, interns, and volunteers who worked tirelessly aboard each vessel to complete the survey in a safe and successful manner. Thanks also to Norton Sound Economic Development Corporation and Kawerak, Inc. The survey would not have been possible without the major contributions from other AFSC groups including the Net Shed, Research Survey Support Team, Data Management Group, and the Administrative Team. Finally, appreciation is extended to Bianca Prohaska, Thaddaeus Buser, Leah Zacher, and Sean Rohan for reviewing this document. Their excellent comments and suggestions greatly improved it.

We would like to thank the many communities of the Bering Strait region and their members who have helped contribute to this document. 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 their insights, including the local names used for the species covered by this document, identifying species of interest or concern that should be included in this document, and participation in an open dialog about how we can improve our collective knowledge of the ecosystem and the region.

Citations

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Appendix A: List of taxa encountered in the eastern Bering Sea

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

List of Tables

- Appendix **A-82**: Fish taxa encountered during the 2022 eastern Bering Sea bottom trawl survey listed alphabetically by family.
- Appendix **A-83**: Invertebrate taxa encountered during the 2022 eastern Bering Sea bottom trawl survey listed alphabetically by phylum.

Appendix Table A-82. -- Fish taxa encountered during the 2022 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	31	47	135	75.0	56.3	60.0
	Bathyagonus alascanus	gray starsnout	3	88	94	90.7	56.0	56.3
	Bathyagonus nigripinnis	blackfin poacher	1	96	96	96.0	58.0	58.0
	Bathyagonus sp.	starsnout poacher unid.	1	117	117	117.0	58.0	58.0
	Leptagonus frenatus	sawback poacher	52	65	183	108.0	54.8	61.0
	Leptagonus leptorhynchus	longnose poacher	1	120	120	120.0	56.3	56.3
	Leptagonus sp.		1	93	93	93.0	62.0	62.0
	Occella dodecaedron	Bering poacher	36	22	63	38.4	56.7	60.3
	Pallasina barbata	tubenose poacher	4	23	38	30.0	58.3	59.0
	Percis japonicus	dragon poacher	1	149	149	149.0	60.3	60.3
	Podothecus accipenserinus	sturgeon poacher	203	22	133	59.0	54.7	61.0
Ammodytidae	*Ammodytes* sp.	sand lance unid.	4	22	45	33.8	57.7	59.3
Anarhichadidae	*Anarhichas orientalis*	Bering wolffish	3	32	59	42.7	60.2	60.3
Anoplopomatidae	*Anoplopoma fimbria*	sablefish	22	95	183	128.1	54.8	58.7
Bathymasteridae	*Bathymaster signatus*	searcher	36	79	183	132.0	54.8	60.7
Clupeidae	*Clupea pallasii*	Pacific herring	174	22	135	64.1	55.3	62.0
Cottidae	*Artediellus pacificus*	hookhorn sculpin	3	68	130	105.0	57.3	59.0
	Gymnocanthus galeatus	armorhead sculpin	2	62	79	70.5	55.0	56.7
	Gymnocanthus pistilliger	threaded sculpin	38	22	79	36.6	56.7	60.3
	Hemilepidotus jordani	yellow Irish lord	79	44	156	85.5	55.0	61.3
	Icelus spatula	spatulate sculpin	23	26	124	76.5	56.6	60.4
	Icelus spiniger	thorny sculpin	58	75	183	123.3	55.3	61.3
	Myoxocephalus jaok	plain sculpin	100	22	71	43.2	56.3	61.0
	Myoxocephalus polyacanthocephalus	great sculpin	179	24	170	76.6	55.0	62.0
	Myoxocephalus scorpius	shorthorn (=warty) sculpin	6	59	78	66.3	59.0	61.0
	Radulinus asprellus	slim sculpin	2	96	109	102.5	55.7	56.0
	Triglops macellus	roughspine sculpin	18	68	147	97.1	55.0	57.5
	Triglops pingeli	ribbed sculpin	9	32	100	64.6	55.4	60.4
	Triglops scepticus	spectacled sculpin	7	132	183	155.1	54.8	58.7
Gadidae	*Boreogadus saida*	Arctic cod	8	62	95	78.2	61.4	62.0
	Eleginus gracilis	saffron cod	2	32	32	32.0	60.3	60.3
	Gadus chalcogrammus	walleye pollock	374	22	183	80.9	54.7	62.0
	Gadus macrocephalus	Pacific cod	373	22	183	80.9	54.7	62.0
	Microgadus proximus	Pacific tomcod	6	38	70	55.5	56.7	57.7
Hemitripteridae	*Hemitripterus bolini*	bigmouth sculpin	74	54	170	109.6	55.0	60.7

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Hexagrammidae	*Hexagrammos decagrammus*	kelp greenling	3	36	128	72.7	56.4	57.7
	Hexagrammos stelleri	whitespotted greenling	14	22	73	33.9	56.7	60.3
	Pleurogrammus monopterygius	Atka mackerel	7	49	141	89.9	54.7	60.0
Liparidae	*Careproctus phasma*	monster snailfish	38	73	161	110.3	56.3	62.0
	Careproctus scottae	peachskin snailfish	11	76	149	114.2	60.0	62.0
	Crystallichthys cyclospilus	blotched snailfish	3	51	132	104.3	55.0	55.4
	Liparis gibbus	variegated snailfish	12	44	95	76.2	56.0	62.0
	Liparis sp.		1	59	59	59.0	60.4	60.4
Osmeridae	*Mallotus catervarius (=villosus)*	Pacific capelin	40	22	84	51.5	56.7	62.0
	Osmerus mordax	rainbow smelt	1	22	22	22.0	59.3	59.3
	Thaleichthys pacificus	eulachon	19	53	147	109.5	55.3	58.3
Pleuronectidae	*Atheresthes evermanni*	Kamchatka flounder	154	51	183	111.2	54.7	61.3
	Atheresthes stomias	arrowtooth flounder	228	38	183	99.2	54.7	61.3
	Glyptocephalus zachirus	rex sole	92	36	183	111.1	54.7	59.7
	Hippoglossoides elassodon	flathead sole	315	31	183	87.9	54.7	62.0
	Hippoglossoides robustus	Bering flounder	58	53	122	79.8	57.0	62.0
	Hippoglossus stenolepis	Pacific halibut	278	22	183	75.7	54.7	61.7
	Isopsetta isolepis	butter sole	30	32	82	61.3	54.7	58.0
	Lepidopsetta bilineata	southern rock sole	7	50	89	70.4	54.7	56.0
	Lepidopsetta polyxystra	northern rock sole	313	22	170	71.6	54.7	62.0
	Limanda aspera	yellowfin sole	238	22	128	60.2	54.7	62.0
	Limanda proboscidea	longhead dab	53	22	49	35.8	57.3	60.3
	Limanda sakhalinensis	Sakhalin sole	2	62	73	67.5	62.0	62.0
	Microstomus pacificus	Dover sole	13	50	147	100.9	55.0	57.0
	Parophrys vetulus	English sole	1	75	75	75.0	56.3	56.3
	Platichthys stellatus	starry flounder	65	22	86	42.2	55.3	60.3
	Pleuronectes quadrituberculatus	Alaska plaice	253	22	135	63.9	55.3	62.0
	Reinhardtius hippoglossoides	Greenland turbot	38	86	183	118.4	56.8	61.7
Psychrolutidae	*Dasycottus setiger*	spinyhead sculpin	65	74	183	117.6	55.0	60.7
	Malacocottus zonurus	darkfin sculpin	4	75	161	128.8	56.3	60.7
Rajidae	*Bathyraja aleutica*	Aleutian skate	27	99	158	129.2	54.8	59.0
	Bathyraja aleutica egg case	Aleutian skate egg case	3	130	150	138.3	55.0	59.3
	Bathyraja interrupta	Bering skate	80	70	183	116.2	54.8	61.0
	Bathyraja interrupta egg case	Bering skate egg case	19	74	158	135.3	54.8	59.0

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Bathyraja maculata	whiteblotched skate	1	134	134	134.0	59.0	59.0
	Bathyraja parmifera	Alaska skate	365	22	183	80.7	54.7	62.0
	Bathyraja parmifera egg case	Alaska skate egg case	33	39	183	109.9	54.8	61.4
	Bathyraja taranetzi	mud skate	2	134	135	134.5	59.0	59.0
	Beringraja binoculata	big skate	13	50	158	78.2	54.7	56.7
	Raja rhina	longnose skate	1	148	148	148.0	56.0	56.0
	Rajiformes egg case	skate egg case unid.	4	68	109	79.8	57.0	60.0
Salmonidae	*Oncorhynchus keta*	chum salmon	2	78	116	97.0	57.3	57.9
	Oncorhynchus tshawytscha	chinook salmon	1	55	55	55.0	57.3	57.3
Scorpaenidae	*Sebastes aleutianus*	rougheye rockfish	2	144	156	150.0	55.0	55.0
	Sebastes alutus	Pacific ocean perch	24	99	183	138.0	54.8	59.7
	Sebastes melanostictus	blackspotted rockfish	8	127	156	136.0	55.0	56.7
	Sebastes polyspinis	northern rockfish	10	117	156	134.2	55.0	58.0
	Sebastes variabilis	dusky rockfish	1	135	135	135.0	56.7	56.7
Somniosidae	*Somniosus pacificus*	Pacific sleeper shark	2	110	140	125.0	55.0	55.3
Squalidae	*Squalus suckleyi*	spiny dogfish	2	100	158	129.0	54.8	55.4
Stichaeidae	*Acantholumpenus mackayi*	pighead prickleback	1	32	32	32.0	60.3	60.3
	Eumesogrammus praecisus	fourline snakeblenny	1	75	75	75.0	60.0	60.0
	Leptoclinus maculatus	daubed shanny	17	23	136	82.5	56.3	61.0
	Lumpenus fabricii	slender eelblenny	7	36	104	71.3	56.3	59.7
	Lumpenus sagitta	snake prickleback	1	95	95	95.0	55.7	55.7
	Lumpenus sp.		1	93	93	93.0	62.0	62.0
	Poroclinus rothrocki	whitebarred prickleback	2	109	109	109.0	55.7	56.0
Trichodontidae	*Trichodon trichodon*	Pacific sandfish	3	38	43	39.7	56.7	58.0
Zaproridae	*Zaprora silenus*	prowfish	1	135	135	135.0	56.7	56.7
Zoarcidae	*Gymnelus* sp.		2	76	96	86.0	56.7	61.4
	Gymnelus viridis	fish doctor	1	103	103	103.0	59.7	59.7
	Lycodes brevipes	shortfin eelpout	89	72	170	112.5	55.0	61.7
	Lycodes palearis	wattled eelpout	131	56	141	88.6	55.4	62.0
	Lycodes sp.		1	95	95	95.0	60.0	60.0
Other		fish egg unid.	2	65	103	84.0	59.7	60.0

Appendix Table A-83. --Invertebrate taxa encountered during the 2022 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	Annelida	worm unid.	1	97	97	97.0	56.8	56.8
	Aphrodita negligens		21	67	183	129.0	56.3	61.0
	Aphroditidae	sea mouse unid.	14	101	136	123.4	59.0	60.7
	Eunoe depressa	depressed scale worm	27	60	143	98.9	56.7	61.0
	Eunoe nodosa	giant scale worm	31	45	141	97.8	57.7	61.4
	Eunoe sp.		75	32	128	67.5	55.4	60.3
	Hirudinea	leech unid.	3	57	71	63.7	59.0	60.3
	Maldanidae	bamboo worm unid.	1	81	81	81.0	61.0	61.0
	Notostomum cyclostomum	striped sea leech	12	62	141	91.3	57.6	61.3
	Polychaeta	polychaete worm unid.	1	67	67	67.0	57.7	57.7
	Polychaete tubes		16	32	148	103.4	55.4	61.0
		tube worm unid.	9	34	149	98.6	57.7	61.7
Arthropoda	*Argis* sp.		47	27	161	103.9	54.7	62.0
	Balanus sp.		1	158	158	158.0	54.8	54.8
	Chionoecetes bairdi	Tanner crab	249	41	183	92.4	54.7	61.3
	Chionoecetes hybrid	hybrid Tanner crab	101	46	161	85.7	55.0	61.0
	Chionoecetes opilio	snow crab	248	42	170	90.1	55.0	62.0
	Chirona evermanni	giant barnacle	8	24	183	81.2	57.3	60.0
	Crangon sp.		119	22	170	77.1	55.0	62.0
	Elassochirus cavimanus	purple hermit	19	76	183	126.8	55.0	59.0
	Elassochirus tenuimanus	widehand hermit crab	12	50	158	70.8	54.8	57.3
	Erimacrus isenbeckii	horsehair crab	43	36	151	63.7	56.3	60.3
	Eualus suckleyi	shortscale eualid	1	99	99	99.0	56.7	56.7
	Glebocarcinus oregonensis	Oregon rock crab	27	51	100	77.1	55.3	57.5
	Hyas coarctatus	circumboreal toad crab	72	32	95	58.4	57.0	62.0
	Hyas lyratus	Pacific lyre crab	117	31	183	84.3	54.8	60.3
	Isopoda	isopod unid.	2	130	158	144.0	54.8	55.0
	Labidochirus splendescens	splendid hermit	161	36	170	79.8	54.7	62.0
	Metacarcinus magister	Dungeness crab	1	51	51	51.0	55.3	55.3
	Oregonia gracilis	graceful decorator crab	29	38	82	59.6	55.7	58.4
	Pagurus aleuticus	Aleutian hermit	137	51	158	99.3	54.8	60.3
	Pagurus capillatus	hairy hermit crab	144	26	156	77.6	55.0	60.3
	Pagurus confragosus	knobbyhand hermit	93	62	183	107.1	54.7	59.7
	Pagurus ochotensis	Alaskan hermit	113	22	104	48.2	54.7	60.3

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Pagurus rathbuni	longfinger hermit	106	54	170	101.7	56.0	62.0
	Pagurus trigonocheirus	fuzzy hermit crab	188	22	170	83.9	55.4	62.0
	Pandalus eous	Alaskan pink shrimp	92	60	183	117.8	54.8	61.4
	Pandalus goniurus	humpy shrimp	8	32	106	77.9	56.4	61.7
	Pandalus jordani	ocean shrimp	13	68	156	118.1	55.0	57.5
	Paralithodes camtschaticus	red king crab	116	26	86	55.5	55.7	60.0
	Paralithodes platypus	blue king crab	16	42	99	70.1	56.8	61.0
	Telmessus cheiragonus	helmet crab	20	22	48	30.9	57.3	60.0
	Thoracica	barnacle unid.	8	33	109	59.0	57.0	60.4
		empty barnacle shells	2	65	87	76.0	59.0	60.3
Bryozoa	Bryozoa	bryozoan unid.	46	22	135	63.3	55.0	60.3
Chordata	*Aplidium* sp.		11	41	134	69.4	57.0	60.4
	Ascidiacea	tunicate unid.	2	75	133	104.0	57.3	59.0
	Boltenia ovifera	sea onion	51	37	88	56.0	56.7	60.3
	Boltenia sp.		9	50	71	60.4	56.7	58.0
	Halocynthia aurantium	sea peach	28	45	75	66.3	57.0	59.4
	Halocynthia sp.	sea peach unid.	21	46	74	65.0	57.2	60.3
	Styela rustica	sea potato	74	31	87	60.9	57.0	61.0
	Thaliacea	salp unid.	3	128	156	141.3	55.0	56.4
		compound ascidian unid.	38	37	135	60.2	56.7	60.3
Cnidaria	Actiniaria	sea anemone unid.	82	32	183	99.2	55.0	62.0
	Actiniidae	actinid sea anemones unid.	1	148	148	148.0	56.0	56.0
	Aequorea sp.		8	85	128	107.1	60.0	61.7
	Aurelia labiata		1	68	68	68.0	57.0	57.0
	Aurelia limbata	brown rimmed jelly	9	62	81	72.3	59.3	61.7
	Aurelia sp.		12	44	128	69.5	56.7	60.3
	Chrysaora melanaster		287	28	183	86.5	54.8	62.0
	Chrysaora sp.	chrysaora jelly	3	51	56	53.7	57.4	58.0
	Gersemia rubiformis		3	50	88	63.7	56.3	57.7
	Gersemia sp.	sea raspberry	57	31	113	61.4	56.6	61.7
	Halipteris sp.		9	82	156	107.6	55.0	57.0
	Halipteris willemoesi		5	117	135	123.0	56.3	57.3
	Hydroidolina	hydroid unid.	45	24	144	67.4	55.0	60.3
	Hydrozoa		1	61	61	61.0	57.3	57.3
	Liponema brevicorne	tentacle-shedding anemone	43	79	183	125.2	55.0	60.7
	Metridium farcimen	gigantic anemone	36	41	135	77.7	55.0	58.7
	Metridium sp.		64	32	133	67.1	55.4	60.3
	Pennatulacea	sea whip or sea pen unid.	5	95	148	114.8	55.6	56.6

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Phacellophora camtschatica	egg yolk jelly	9	116	183	140.9	56.0	59.3
	Scyphozoa	jellyfish unid.	18	109	158	135.7	55.3	61.0
	Stomphia sp.		40	56	143	106.7	55.0	62.0
	Urticina crassicornis	mottled anemone	10	53	89	73.5	55.7	60.0
	Urticina sp.		37	57	136	102.5	56.3	61.4
Echinodermata	*Allocentrotus fragilis*	orange-pink sea urchin	2	148	151	149.5	56.0	56.3
	Amphiuridae	burrowing brittle star unid.	2	107	115	111.0	57.3	58.3
	Asterias amurensis	purple-orange sea star	249	22	133	64.6	55.0	61.0
	Asteroidea	sea star unid.	1	158	158	158.0	54.8	54.8
	Asteronyx loveni	serpent sea star	1	135	135	135.0	56.7	56.7
	Bathyplotes sp.		1	151	151	151.0	56.3	56.3
	Ceramaster sp.		2	140	158	149.0	54.8	55.3
	Crossaster borealis	grooved sea star	1	161	161	161.0	60.7	60.7
	Crossaster papposus	rose sea star	26	42	158	80.8	54.8	61.0
	Ctenodiscus crispatus	common mud star	87	73	183	118.7	55.0	61.7
	Cucumaria fallax	sea football	16	56	95	73.4	55.7	57.3
	Cucumaria sp.		5	51	86	66.4	56.7	58.0
	Diplopteraster multipes	pincushion sea star	3	135	183	158.7	56.7	58.7
	Dipsacaster borealis	northern sea star	2	142	158	150.0	57.0	58.3
	Echinacea	sea urchin unid.	7	24	79	54.9	55.3	58.3
	Echinarachnius parma	parma sand dollar	17	22	128	79.5	54.7	61.0
	Evasterias echinosoma	giant sea star	24	31	97	64.0	56.0	58.0
	Evasterias sp.		1	94	94	94.0	59.5	59.5
	Gorgonocephalus eucnemis	basketstar	246	31	161	83.9	55.0	62.0
	Henricia sp.		38	53	183	104.0	54.8	60.7
	Holothuroidea	sea cucumber unid.	11	55	143	89.5	55.6	61.7
	Leptasterias arctica		69	42	161	76.3	56.6	62.0
	Leptasterias groenlandica		2	79	87	83.0	59.0	59.3
	Leptasterias polaris		135	42	170	93.7	56.3	62.0
	Leptasterias sp.		2	75	94	84.5	58.3	59.8
	Leptychaster anomalus		8	101	148	123.2	55.0	59.5
	Lethasterias nanimensis	blackspined sea star	97	49	183	86.2	56.0	61.7
	Ophiura sarsii	notched brittlestar	75	60	122	84.2	56.3	62.0
	Ophiura sp.		32	53	158	78.3	54.8	60.3
	Ophiuroidea	brittlestar unid.	4	36	71	61.0	57.0	59.7
	Pseudarchaster parelii	scarlet sea star	10	79	183	128.6	55.0	58.7
	Pseudarchaster sp.		3	135	139	136.3	58.7	58.7

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Psolus fabricii	brownscaled sea cucumber	1	59	59	59.0	60.4	60.4
	Psolus sp.		1	75	75	75.0	60.0	60.0
	Pteraster jordani		4	130	136	132.8	59.0	59.4
	Pteraster obscurus	obscure sea star	50	63	161	104.1	56.7	62.0
	Pteraster sp.		3	107	183	147.0	56.3	58.7
	Pteraster tesselatus		4	110	158	131.0	54.8	56.4
	Pycnopodia helianthoides	sunflower sea star	3	51	77	63.3	55.0	55.3
	Solaster sp.		4	59	158	89.8	54.8	60.3
	Strongylocentrotus droebachiensis	green sea urchin	36	33	183	110.3	54.8	60.7
	Strongylocentrotus pallidus	white sea urchin	3	62	158	110.0	54.8	55.0
	Strongylocentrotus sp.		17	43	142	86.1	55.7	59.0
Echiura	Echiura	echiuroid worm unid.	1	36	36	36.0	59.7	59.7
Ectoprocta	*Alcyonidium disciforme*	disc bryozoan	2	57	65	61.0	60.0	60.2
	Alcyonidium pedunculatum	fruit leather bryozoan	3	42	76	59.0	60.4	61.7
	Alcyonidium sp.		1	94	94	94.0	59.8	59.8
	Bugula pacifica		5	65	87	73.8	59.0	61.6
	Flustra serrulata	leafy bryozoan	1	65	65	65.0	60.0	60.0
	Rhamphostomella costata	ribbed bryozoan	7	59	95	76.1	55.7	60.4
Mollusca	*Aforia circinata*	keeled Aforia	45	81	170	119.0	55.0	61.3
	Aforia sp.		3	104	134	115.7	56.3	59.0
	Arctomelon borealis		1	158	158	158.0	54.8	54.8
	Arctomelon stearnsii	Alaska volute	1	183	183	183.0	58.7	58.7
	Astarte sp.		1	128	128	128.0	56.3	56.3
	Benthoctopus leioderma	smoothskin octopus	9	116	183	134.4	57.3	61.0
	Benthoctopus oregonensis		5	102	128	116.0	60.0	61.0
	Benthoctopus sp.		6	102	149	125.3	56.7	61.0
	Beringius behringi	Bering beringius	29	47	141	107.1	55.0	61.0
	Beringius sp.		46	41	161	97.3	55.0	60.7
	Berryteuthis magister	magistrate armhook squid	1	128	128	128.0	56.3	56.3
	Bivalvia	bivalve unid.	1	68	68	68.0	57.0	57.0
	Boreotrophon sp.		1	51	51	51.0	55.3	55.3
	Buccinum angulosum	angular whelk	76	47	149	92.6	56.7	62.0
	Buccinum oedematum	swollen whelk	4	87	108	99.0	58.0	60.0
	Buccinum plectrum	sinuous whelk	40	31	141	79.9	57.6	61.7
	Buccinum polare	polar whelk	64	59	149	79.8	56.0	62.0
	Buccinum scalariforme	ladder whelk	145	52	170	96.0	54.7	62.0

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Buccinum sp.		18	41	149	101.8	56.7	61.3
	Chlamylla sp.		1	89	89	89.0	56.0	56.0
	Chlamys sp.		8	63	151	93.2	56.3	60.3
	Ciliatoclinocardium ciliatum	hairy cockle	13	59	111	79.9	59.0	61.0
	Clinocardium sp.		15	69	135	85.3	56.0	60.1
	Clinopegma magnum	helmet whelk	54	66	149	94.9	56.7	62.0
	Colus sp.		40	53	170	109.0	54.8	62.0
	Cryptonatica aleutica	Aleutian moonsnail	2	51	141	96.0	58.0	60.0
	Cryptonatica russa	rusty moonsnail	17	59	108	82.8	59.3	61.7
	Cryptonatica sp.		11	32	149	98.3	55.0	62.0
	Cyclocardia sp.		4	41	56	47.8	57.0	58.6
	Dendronotus dalli	Dall dendronotid	5	65	87	73.2	59.0	60.0
	Dendronotus sp.		1	103	103	103.0	59.7	59.7
	Enteroctopus dofleini	giant octopus	24	75	158	120.2	54.7	60.3
	Euspira sp.		2	84	88	86.0	59.7	60.1
	Fusitriton oregonensis	Oregon triton	113	51	183	109.4	54.7	59.7
	gastropod egg	snail egg	167	22	183	81.6	55.3	62.0
	Gastropoda	snail unid.	1	75	75	75.0	56.7	56.7
	Grandicrepidula grandis	great slippersnail	5	65	78	69.4	57.0	58.0
	Hiatella arctica	Arctic Hiatella	5	42	69	54.2	57.7	60.0
	Lamellariidae	lamellarid unid.	1	69	69	69.0	57.3	57.3
	Lunatia pallida	pale moonsnail	14	59	95	77.1	60.0	61.7
	Macoma nasuta	bent-nose Macoma	2	59	88	73.5	60.1	60.2
	Macoma sp.		31	27	97	54.7	55.7	60.6
	Mactromeris polynyma	Arctic surfclam	16	31	73	51.1	56.7	60.0
	Mactromeris sp.		3	47	60	54.0	57.0	59.0
	Modiolus modiolus	northern horsemussel	4	62	78	69.5	55.0	57.3
	Musculus discors	discordant mussel	11	42	72	64.4	57.0	60.0
	Musculus niger	black mussel	2	62	74	68.0	61.0	61.0
	Mytilus sp.		1	86	86	86.0	56.7	56.7
	Neoberingius frielei		4	96	130	115.0	56.7	59.0
	Neptunea alexeyevi	sinuous neptune	1	127	127	127.0	59.0	59.0
	Neptunea borealis		26	43	149	74.6	57.7	62.0
	Neptunea heros		130	37	102	62.0	55.7	62.0
	Neptunea lyrata	lyre whelk	103	41	170	95.2	54.7	60.7
	Neptunea pribiloffensis	Pribilof whelk	123	60	183	110.3	55.0	61.3
	Neptunea sp.		26	45	158	78.5	55.0	60.3
	Neptunea ventricosa	fat whelk	151	26	144	71.5	55.0	61.0
	Nodulotrophon coronatus		2	87	100	93.5	58.0	61.0
	Nuculana pernula	northern nutclam	1	111	111	111.0	60.4	60.4

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Nudibranchia	nudibranch unid.	5	65	136	95.2	55.7	60.0
	Octopodidae	octopus unid.	1	96	96	96.0	58.0	58.0
	Octopus sp.		1	120	120	120.0	56.3	56.3
	Onchidiopsis sp.		5	64	86	73.0	59.8	60.7
	Patinopecten caurinus	weathervane scallop	20	79	136	103.5	55.4	57.3
	Plicifusus kroyeri		38	59	150	98.6	56.8	60.7
	Plicifusus sp.		1	99	99	99.0	56.7	56.7
	Pododesmus macrochisma	Alaska falsejingle	4	71	75	72.5	57.2	60.0
	Pyrulofusus deformis	warped whelk	49	55	158	96.8	55.0	60.4
	Pyrulofusus melonis		38	63	148	111.9	55.0	61.0
	Rossia pacifica	eastern Pacific bobtail	10	97	183	136.4	55.7	59.0
	Saxidomus gigantea	butter clam	1	72	72	72.0	57.2	57.2
	Serripes notabilis	oblique smoothcockle	48	27	183	75.7	55.7	61.7
	Serripes sp.		10	31	110	54.5	55.0	60.7
	Siliqua alta	Alaska razor	17	22	46	31.8	58.0	60.0
	Tachyrhynchus sp.		1	48	48	48.0	57.7	57.7
	Tellina lutea	Alaska great-tellin	36	22	72	40.4	56.7	59.7
	Trichotropis bicarinata	two-keel hairysnail	1	63	63	63.0	60.3	60.3
	Tritonia diomedea	rosy Tritonia	11	63	149	109.5	59.5	62.0
	Tritonia sp.		5	67	83	74.2	58.7	59.7
	Volutopsius fragilis	fragile whelk	34	50	113	73.7	56.3	59.7
	Volutopsius simplex	simple whelk	1	120	120	120.0	55.3	55.3
	Volutopsius sp.		26	59	158	118.0	54.8	61.3
	Volutopsius stefanssoni	shouldered whelk	1	65	65	65.0	60.0	60.0
	Yoldia hyperborea	northern Yoldia	1	42	42	42.0	60.7	60.7
	Yoldia sp.		4	52	125	79.5	56.0	58.3
		empty bivalve shells	274	22	170	76.8	55.0	62.0
		empty gastropod shells	331	22	183	82.1	54.8	62.0
Nemertea	*Tubulanus polymorphus*	orange ribbon worm	1	133	133	133.0	59.0	59.0
Platyhelminthes	Platyhelminthes	flatworm unid.	2	126	134	130.0	58.7	59.0
Porifera	*Aphrocallistes vastus*	clay pipe sponge	1	151	151	151.0	56.3	56.3
	Echinoclathria beringensis	hat sponge	1	42	42	42.0	60.7	60.7
	Porifera	sponge unid.	56	32	183	81.4	55.0	60.3
	Suberites montalbidus	stinky sponge	10	51	158	84.7	54.8	57.7
	Suberites sp.		1	73	73	73.0	56.0	56.0
	Tethya sp.	ball sponge	1	158	158	158.0	54.8	54.8
Sipuncula	Sipuncula	peanut worm unid.	5	59	128	98.4	56.4	61.0

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Other		invertebrate unid.	1	95	95	95.0	59.7	59.7
		unsorted catch and debris	9	22	158	89.0	54.8	59.3

Appendix B: List of taxa encountered in the northern Bering Sea

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

List of Tables

- Appendix **B-84**: Fish taxa encountered during the 2022 northern Bering Sea bottom trawl survey listed alphabetically by family.
- Appendix **B-85**: Invertebrate taxa encountered during the 2022 northern Bering Sea bottom trawl survey listed alphabetically by phylum.

Appendix Table B-84. -- Fish taxa encountered during the 2022 northern 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	Agonidae	poacher unid.	1	37	37	37.0	61.0	61.0
	Aspidophoroides olrikii	Arctic alligatorfish	13	36	71	50.0	62.3	65.3
	Occella dodecaedron	Bering poacher	35	11	37	23.1	60.7	64.3
	Pallasina barbata	tubenose poacher	14	14	39	22.4	60.7	65.3
	Podothecus accipenserinus	sturgeon poacher	49	15	59	34.4	60.7	64.6
	Podothecus veternus	veteran poacher	19	18	39	30.1	63.4	65.3
Ammodytidae	*Ammodytes* sp.	sand lance unid.	3	28	55	38.3	63.7	65.0
Anarhichadidae	*Anarhichas orientalis*	Bering wolffish	5	14	25	19.2	60.7	64.6
Clupeidae	*Clupea pallasii*	Pacific herring	70	11	78	33.4	60.7	65.3
Cottidae	*Artediellus scaber*	hamecon	1	31	31	31.0	64.4	64.4
	Artediellus sp.		2	25	28	26.5	64.3	64.6
	Cottidae	sculpin unid.	2	40	44	42.0	64.7	65.0
	Enophrys diceraus	antlered sculpin	14	15	55	26.4	63.7	65.3
	Gymnocanthus pistilliger	threaded sculpin	37	14	55	24.8	60.7	65.2
	Gymnocanthus sp.		1	68	68	68.0	61.3	61.3
	Gymnocanthus tricuspis	Arctic staghorn sculpin	18	25	53	40.2	64.0	65.3
	Hemilepidotus jordani	yellow Irish lord	2	49	54	51.5	61.4	63.0
	Hemilepidotus papilio	butterfly sculpin	1	38	38	38.0	63.7	63.7
	Hemilepidotus sp.	Irish lord	1	36	36	36.0	64.0	64.0
	Icelus spatula	spatulate sculpin	2	36	44	40.0	64.0	64.7
	Megalocottus platycephalus	belligerent sculpin	2	14	14	14.0	63.7	64.3
	Myoxocephalus jaok	plain sculpin	87	11	56	30.2	60.7	65.3
	Myoxocephalus polyacanthocephalus	great sculpin	16	22	59	38.2	60.7	65.2
	Myoxocephalus quadricornis	fourhorn sculpin	1	42	42	42.0	62.7	62.7
	Myoxocephalus scorpioides	Arctic sculpin	1	14	14	14.0	64.3	64.3
	Myoxocephalus scorpius	shorthorn (=warty) sculpin	23	22	55	39.6	61.3	65.3
	Myoxocephalus sp.		5	18	37	26.8	63.7	65.0
	Trichocottus brashnikovi	hairhead sculpin	1	31	31	31.0	64.4	64.4
	Triglops pingeli	ribbed sculpin	19	15	54	32.7	60.7	65.2
	Triglops sp.		1	46	46	46.0	64.3	64.3
Gadidae	*Boreogadus saida*	Arctic cod	78	13	78	44.2	61.3	65.3
	Eleginus gracilis	saffron cod	59	11	39	24.2	60.7	65.3
	Gadus chalcogrammus	walleye pollock	136	11	78	39.5	60.7	65.3
	Gadus macrocephalus	Pacific cod	108	18	78	41.4	60.7	65.3

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Hemitripteridae	*Nautichthys pribilovius*	eyeshade sculpin	3	17	39	30.3	64.0	64.4
	Nautichthys robustus	shortmast sculpin	1	36	36	36.0	64.0	64.0
Hexagrammidae	*Hexagrammos stelleri*	whitespotted greenling	23	14	35	22.2	60.7	64.3
Liparidae	*Careproctus phasma*	monster snailfish	1	78	78	78.0	62.3	62.3
	Liparis bathyarcticus	nebulous snailfish	1	37	37	37.0	61.0	61.0
	Liparis gibbus	variegated snailfish	45	17	78	46.3	61.0	65.3
	Liparis sp.		5	32	53	42.6	62.9	65.3
	Liparis tunicatus	kelp snailfish	6	28	39	34.2	62.4	64.3
Osmeridae	*Mallotus catervarius (=villosus)*	Pacific capelin	39	22	78	46.8	61.0	65.0
	Osmerus mordax	rainbow smelt	27	11	39	19.2	60.7	65.3
Pleuronectidae	*Atheresthes stomias*	arrowtooth flounder	1	50	50	50.0	60.7	60.7
	Hippoglossoides elassodon	flathead sole	3	50	68	59.0	60.7	61.3
	Hippoglossoides robustus	Bering flounder	90	22	78	45.0	60.7	65.3
	Hippoglossus stenolepis	Pacific halibut	56	14	57	34.0	60.7	65.3
	Lepidopsetta polyxystra	northern rock sole	97	15	73	41.4	60.7	65.0
	Limanda aspera	yellowfin sole	136	11	78	37.2	60.7	65.3
	Limanda proboscidea	longhead dab	50	14	42	26.8	60.7	65.3
	Limanda sakhalinensis	Sakhalin sole	65	22	74	47.5	61.3	65.3
	Liopsetta glacialis	Arctic flounder	4	13	18	14.8	63.7	64.3
	Platichthys stellatus	starry flounder	79	11	56	28.3	60.7	65.3
	Pleuronectes quadrituberculatus	Alaska plaice	138	11	74	37.2	60.7	65.3
Rajidae	*Bathyraja aleutica* egg case	Aleutian skate egg case	1	61	61	61.0	61.7	61.7
	Bathyraja interrupta egg case	Bering skate egg case	1	22	22	22.0	63.7	63.7
	Bathyraja parmifera	Alaska skate	72	22	78	44.4	60.7	64.7
	Bathyraja parmifera egg case	Alaska skate egg case	15	26	64	40.4	61.6	64.7
Salmonidae	*Oncorhynchus keta*	chum salmon	1	35	35	35.0	64.0	64.0
	Oncorhynchus tshawytscha	chinook salmon	1	13	13	13.0	63.7	63.7
Stichaeidae	*Acantholumpenus mackayi*	pighead prickleback	22	11	30	18.5	61.0	64.6
	Chirolophis snyderi	bearded warbonnet	1	25	25	25.0	64.6	64.6
	Leptoclinus maculatus	daubed shanny	3	39	47	41.7	63.6	64.6
	Lumpenella longirostris	longsnout prickleback	1	71	71	71.0	62.3	62.3
	Lumpenus fabricii	slender eelblenny	35	13	37	23.0	60.7	64.3
	Lumpenus sagitta	snake prickleback	11	24	64	43.7	60.7	65.3
	Stichaeidae	prickleback unid.	1	71	71	71.0	62.3	62.3
	Stichaeus punctatus	Arctic shanny	7	17	53	28.3	64.0	64.6

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Zoarcidae	*Lycodes mucosus*	saddled eelpout	12	11	38	19.4	63.7	64.4
	Lycodes palearis	wattled eelpout	24	15	78	42.4	60.7	64.3
	Lycodes raridens	marbled eelpout	3	48	71	61.0	62.3	65.0
	Lycodes turneri	polar eelpout	8	17	39	26.6	63.6	65.3
Other		fish egg unid.	7	22	48	34.1	61.4	65.0

Appendix Table B-85. --Invertebrate taxa encountered during the 2022 northern 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	Annelida	worm unid.	3	32	55	44.3	63.7	65.0
	Eunoe depressa	depressed scale worm	25	14	54	39.2	61.0	64.6
	Eunoe nodosa	giant scale worm	22	25	74	52.5	61.4	65.0
	Maldanidae	bamboo worm unid.	1	46	46	46.0	64.3	64.3
	Notostomum cyclostomum	striped sea leech	1	57	57	57.0	62.0	62.0
	Polychaeta	polychaete worm unid.	8	28	74	48.5	61.7	65.0
	Polychaete tubes		14	15	54	30.6	61.0	65.3
Arthropoda	Amphipoda	amphipod unid.	1	71	71	71.0	63.3	63.3
	Argis sp.		77	14	74	37.7	60.7	65.3
	Chionoecetes bairdi	Tanner crab	7	22	65	38.1	61.7	64.0
	Chionoecetes hybrid	hybrid Tanner crab	1	35	35	35.0	61.4	61.4
	Chionoecetes opilio	snow crab	108	14	78	43.8	60.7	65.3
	Chirona evermanni	giant barnacle	10	25	53	36.0	61.7	65.0
	Crangon sp.		68	11	74	32.6	60.7	65.3
	Erimacrus isenbeckii	horsehair crab	18	28	63	40.9	60.7	62.7
	Hapalogaster grebnitzkii	soft crab	1	25	25	25.0	64.6	64.6
	Hyas coarctatus	circumboreal toad crab	76	26	71	41.6	60.7	65.3
	Hyas lyratus	Pacific lyre crab	1	25	25	25.0	62.6	62.6
	Hyas sp.		1	28	28	28.0	60.7	60.7
	Isopoda	isopod unid.	2	11	14	12.5	63.3	63.7
	Labidochirus splendescens	splendid hermit	65	13	71	36.0	61.0	65.0
	Lebbeus groenlandicus	spiny lebbeid	1	38	38	38.0	63.7	63.7
	Oregonia gracilis	graceful decorator crab	1	23	23	23.0	61.7	61.7
	Oregonia sp.		1	37	37	37.0	60.7	60.7
	Pagurus capillatus	hairy hermit crab	51	13	56	29.2	60.7	64.7

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Pagurus ochotensis	Alaskan hermit	48	11	65	26.1	60.7	64.3
	Pagurus rathbuni	longfinger hermit	34	35	78	56.4	60.7	65.0
	Pagurus trigonocheirus	fuzzy hermit crab	88	13	68	42.1	60.7	65.3
	Pandalus goniurus	humpy shrimp	35	17	74	40.3	61.0	65.3
	Paralithodes brevipes	Hanasaki king crab	1	22	22	22.0	64.0	64.0
	Paralithodes camtschaticus	red king crab	25	14	65	26.1	61.0	65.3
	Paralithodes platypus	blue king crab	23	22	71	41.3	63.0	65.3
	Pasiphaeidae	pasiphaeid shrimp unid.	4	61	74	66.8	63.0	63.3
	Sclerocrangon boreas	sculptured shrimp	9	17	53	30.1	64.0	65.2
	Telmessus cheiragonus	helmet crab	30	14	39	22.4	60.7	65.3
	Thoracica	barnacle unid.	4	28	54	42.8	61.0	64.0
		crab unid.	1	25	25	25.0	64.6	64.6
		empty barnacle shells	8	14	28	18.0	63.3	64.3
		shrimp unid.	4	34	73	46.5	62.7	64.7
Bryozoa	Bryozoa	bryozoan unid.	24	17	63	39.8	60.7	65.0
Chordata	*Aplidium* sp.		24	11	37	26.7	61.0	64.4
	Ascidiacea	tunicate unid.	7	24	44	36.1	60.7	65.0
	Boltenia ovifera	sea onion	19	23	55	40.0	60.7	65.0
	Halocynthia aurantium	sea peach	3	36	59	45.3	60.7	64.0
	Styela rustica	sea potato	77	17	56	37.0	60.7	65.3
		compound ascidian unid.	16	25	64	40.7	60.7	65.3
Cnidaria	Actiniaria	sea anemone unid.	34	25	73	50.9	61.0	65.3
	Aequorea sp.		4	35	71	50.8	63.3	64.3
	Chrysaora melanaster		109	11	78	39.1	60.7	65.3
	Cyanea capillata	lion's mane jelly	2	18	24	21.0	60.7	61.0
	Gersemia sp.	sea raspberry	73	14	71	37.8	60.7	65.3
	Metridium farcimen	gigantic anemone	4	25	43	33.2	60.7	64.6
	Metridium sp.		24	11	37	21.3	60.7	64.3
	Phacellophora camtschatica	egg yolk jelly	5	28	39	33.6	63.7	64.3
	Scyphozoa	jellyfish unid.	1	73	73	73.0	62.7	62.7
	Sertulariidae	Sertulariid hydroid	5	14	26	21.6	61.0	63.3
	Staurostoma mertensii	whitecross jelly	1	15	15	15.0	64.3	64.3
	Stomphia sp.		21	30	78	57.7	62.3	65.3
	Urticina sp.		20	15	65	29.6	61.7	64.4
Echinodermata	*Asterias amurensis*	purple-orange sea star	86	11	59	30.5	60.7	65.3
	Bathyplotes sp.		4	40	53	47.5	64.7	65.3
	Crossaster papposus	rose sea star	10	18	53	33.3	64.0	65.3
	Crossaster sp.		5	15	28	20.0	63.7	64.3

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Ctenodiscus crispatus	common mud star	3	59	71	66.7	62.3	62.7
	Cucumaria fallax	sea football	2	25	39	32.0	64.6	65.3
	Echinarachnius parma	parma sand dollar	8	27	39	33.4	62.7	64.4
	Evasterias echinosoma	giant sea star	20	11	53	23.8	63.7	65.3
	Gorgonocephalus eucnemis	basketstar	84	14	78	40.7	60.7	65.3
	Henricia sp.		22	15	40	27.5	62.3	65.0
	Holothuroidea	sea cucumber unid.	1	39	39	39.0	64.4	64.4
	Leptasterias arctica		79	14	78	41.7	60.7	65.3
	Leptasterias groenlandica		3	17	57	30.3	62.0	64.0
	Leptasterias polaris		96	17	78	43.9	60.7	65.3
	Lethasterias nanimensis	blackspined sea star	37	14	53	28.0	63.0	65.3
	Ophiura sarsii	notched brittlestar	29	23	78	56.8	60.7	64.3
	Ophiuroidea	brittlestar unid.	1	46	46	46.0	64.3	64.3
	Psolus fabricii	brownscaled sea cucumber	2	28	31	29.5	64.3	64.4
	Psolus sp.		8	25	53	36.6	63.3	64.7
	Pteraster obscurus	obscure sea star	2	36	71	53.5	62.3	64.0
	Pteraster octaster		4	25	39	33.5	63.3	65.3
	Pteraster sp.		1	46	46	46.0	64.3	64.3
	Pteraster tesselatus		1	25	25	25.0	64.6	64.6
	Solaster sp.		2	38	53	45.5	63.7	64.0
	Strongylocentrotus droebachiensis	green sea urchin	35	11	53	30.6	63.3	65.3
Ectoprocta	*Alcyonidium disciforme*	disc bryozoan	7	13	39	25.0	62.7	64.4
	Alcyonidium enteromorpha	noodle bryozoan	11	28	53	38.8	63.7	65.2
	Bugula pacifica		1	57	57	57.0	62.0	62.0
	Dendrobeania sp.		4	25	28	27.0	61.7	62.6
	Flustra serrulata	leafy bryozoan	1	20	20	20.0	63.0	63.0
	Rhamphostomella costata	ribbed bryozoan	2	25	28	26.5	62.0	63.7
Mollusca	*Astarte* sp.		2	20	23	21.5	64.2	64.3
	Benthoctopus leioderma	smoothskin octopus	1	71	71	71.0	63.3	63.3
	Beringius behringi	Bering beringius	6	14	22	17.3	63.0	64.3
	Beringius sp.		7	22	58	39.7	63.3	65.3
	Bivalvia	bivalve unid.	3	34	46	38.7	63.0	64.3
	Buccinum angulosum	angular whelk	15	26	68	48.3	61.3	65.2
	Buccinum plectrum	sinuous whelk	5	26	42	34.6	61.6	63.0
	Buccinum polare	polar whelk	59	26	78	49.4	60.7	65.3
	Buccinum scalariforme	ladder whelk	40	30	78	49.8	60.7	65.2
	Buccinum sp.		8	22	63	44.8	62.0	64.0

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Ciliatoclinocardium ciliatum	hairy cockle	3	54	55	54.3	61.0	63.0
	Clinocardium sp.		1	39	39	39.0	64.3	64.3
	Clinopegma magnum	helmet whelk	2	13	55	34.0	61.3	63.7
	Colus sp.		3	47	53	49.7	61.3	64.0
	Cryptonatica aleutica	Aleutian moonsnail	1	42	42	42.0	62.7	62.7
	Cryptonatica russa	rusty moonsnail	2	35	65	50.0	61.7	62.4
	Cryptonatica sp.		24	35	78	59.6	61.0	64.0
	gastropod egg	snail egg	109	13	78	42.1	60.7	65.3
	Gastropoda	snail unid.	2	22	46	34.0	63.3	64.3
	Grandicrepidula grandis	great slippersnail	3	28	53	43.0	63.0	64.7
	Hiatella arctica	Arctic Hiatella	13	20	37	28.5	60.7	63.7
	Lunatia pallida	pale moonsnail	9	27	73	49.7	61.7	63.4
	Macoma inquinata	pointed Macoma	3	28	35	32.7	61.4	62.0
	Macoma nasuta	bent-nose Macoma	3	18	25	22.3	60.7	61.0
	Macoma sp.		7	15	54	40.4	60.7	64.7
	Mactromeris polynyma	Arctic surfclam	2	30	35	32.5	62.7	64.7
	Mollusca	mollusk unid.	1	30	30	30.0	62.3	62.3
	Musculus discors	discordant mussel	25	20	63	39.6	60.7	64.3
	Mytilidae	mussel unid.	1	54	54	54.0	63.0	63.0
	Neptunea borealis		19	39	73	54.3	60.7	63.3
	Neptunea heros		96	13	71	40.8	60.7	65.3
	Neptunea sp.		4	18	33	21.8	63.3	64.3
	Neptunea ventricosa	fat whelk	58	13	65	35.4	61.0	65.3
	Nuculana pernula	northern nutclam	1	69	69	69.0	63.0	63.0
	Nudibranchia	nudibranch unid.	11	35	73	57.6	62.3	65.3
	Pectinidae	scallop unid.	1	53	53	53.0	64.0	64.0
	Polyplacophora	chiton unid.	4	30	40	35.0	63.3	64.7
	Pyrulofusus deformis	warped whelk	5	17	30	22.0	64.0	64.7
	Serripes groenlandicus	Greenland cockle	2	20	25	22.5	62.6	63.0
	Serripes notabilis	oblique smoothcockle	33	14	74	37.4	61.3	65.3
	Serripes sp.		1	35	35	35.0	62.0	62.0
	Siliqua alta	Alaska razor	1	18	18	18.0	61.0	61.0
	Tellina lutea	Alaska great-tellin	1	25	25	25.0	62.6	62.6
	Trichotropis bicarinata	two-keel hairysnail	2	36	39	37.5	64.0	64.3
	Tritonia diomedea	rosy Tritonia	1	74	74	74.0	63.0	63.0
	Tritonia sp.		1	68	68	68.0	61.3	61.3
	Volutopsius sp.		3	48	58	52.3	62.0	65.0
	Yoldia sp.		1	35	35	35.0	63.7	63.7
		empty bivalve shells	107	13	74	35.8	60.7	65.3
		empty gastropod shells	119	13	78	37.8	60.7	65.3

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Platyhelminthes	Platyhelminthes	flatworm unid.	1	73	73	73.0	62.7	62.7
Porifera	Porifera	sponge unid.	19	14	55	32.4	60.7	65.3
Sipuncula	Sipuncula	peanut worm unid.	12	28	74	56.2	60.7	64.6
Other		invertebrate unid.	1	37	37	37.0	64.3	64.3
		unsorted catch and debris	2	30	39	34.5	64.0	65.3
		unsorted shab	1	34	34	34.0	62.3	62.3

Appendix C: List of population estimates by sex and size group for principal fish species in the eastern Bering Sea

Appendix C presents population estimates by sex and size group from the 2022 eastern Bering Sea bottom trawl survey for principal fish species.

List of Tables

Appendix Table C-86. --Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
8	0	0	192,186	192,186	0.0003	0.0003
9	27,942	0	647,947	675,889	0.0010	0.0013
10	0	287,799	1,019,106	1,306,905	0.0020	0.0033
11	261,859	167,224	1,230,018	1,659,101	0.0025	0.0058
12	333,966	284,412	348,209	966,587	0.0015	0.0073
13	658,598	568,891	435,803	1,663,292	0.0025	0.0098
14	440,321	356,370	174,104	970,795	0.0015	0.0113
15	1,001,020	456,069	0	1,457,089	0.0022	0.0135
16	760,249	739,387	0	1,499,636	0.0023	0.0157
17	932,385	1,552,861	0	2,485,246	0.0038	0.0195
18	1,692,012	1,812,340	0	3,504,352	0.0053	0.0248
19	2,597,182	1,510,210	0	4,107,392	0.0062	0.0310
20	4,382,788	3,324,866	0	7,707,654	0.0117	0.0427
21	4,980,344	4,501,870	0	9,482,214	0.0144	0.0571
22	7,123,630	5,754,082	0	12,877,712	0.0195	0.0766
23	7,157,801	5,867,660	0	13,025,461	0.0197	0.0963
24	10,004,074	6,114,134	0	16,118,208	0.0244	0.1207
25	11,724,214	8,959,652	0	20,683,866	0.0313	0.1520
26	12,892,134	8,906,974	0	21,799,108	0.0330	0.1850
27	15,487,918	7,670,544	0	23,158,462	0.0351	0.2201
28	13,770,887	11,573,552	0	25,344,439	0.0384	0.2585
29	15,443,092	9,725,692	0	25,168,784	0.0381	0.2966
30	19,308,117	11,965,149	0	31,273,266	0.0474	0.3440
31	20,505,994	12,258,702	0	32,764,696	0.0496	0.3936
32	22,873,530	11,052,795	0	33,926,325	0.0514	0.4450
33	21,527,934	13,147,841	0	34,675,775	0.0525	0.4975
34	27,408,377	11,670,091	0	39,078,468	0.0592	0.5567
35	22,479,387	11,713,143	0	34,192,530	0.0518	0.6085
36	27,085,412	12,560,866	0	39,646,278	0.0600	0.6685
37	22,156,551	12,410,615	0	34,567,166	0.0524	0.7208
38	17,404,060	12,108,083	0	29,512,143	0.0447	0.7655
39	11,723,788	11,649,937	0	23,373,725	0.0354	0.8009
40	7,029,014	10,761,265	0	17,790,279	0.0269	0.8279
41	3,568,163	12,793,209	0	16,361,372	0.0248	0.8527
42	1,690,516	11,251,038	0	12,941,554	0.0196	0.8723
43	712,608	8,653,715	0	9,366,323	0.0142	0.8864
44	645,550	12,425,731	0	13,071,281	0.0198	0.9062
45	440,787	10,366,983	0	10,807,770	0.0164	0.9226
46	100,062	8,610,215	0	8,710,277	0.0132	0.9358
47	0	9,090,698	0	9,090,698	0.0138	0.9496
48	0	9,584,950	0	9,584,950	0.0145	0.9641
49	0	5,360,491	0	5,360,491	0.0081	0.9722
50	0	6,271,671	0	6,271,671	0.0095	0.9817
51	0	3,734,397	0	3,734,397	0.0057	0.9874
52	0	3,797,130	0	3,797,130	0.0058	0.9931
53	0	2,194,507	0	2,194,507	0.0033	0.9964
54	0	1,089,893	0	1,089,893	0.0017	0.9981
55	0	483,661	0	483,661	0.0007	0.9988
56	0	554,310	0	554,310	0.0008	0.9996
57	0	115,597	0	115,597	0.0002	0.9998
58	0	115,597	0	115,597	0.0002	1.0000

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
Total	**338,332,266**	**317,926,869**	**4,047,373**	**660,306,508**	**1.0000**	**1.0000**

Appendix Table C-87. --Population estimates by sex and size for arrowtooth flounder (*Atheresthes stomias*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
8	0	0	28,598	28,598	0.0000	0.0000
10	25,610	0	449,069	474,679	0.0005	0.0005
11	28,688	0	358,745	387,433	0.0004	0.0009
12	267,567	398,610	130,197	796,374	0.0008	0.0017
13	479,300	759,837	58,628	1,297,765	0.0013	0.0030
14	1,133,205	759,886	186,446	2,079,537	0.0021	0.0051
15	1,635,019	2,234,319	510,612	4,379,950	0.0044	0.0094
16	5,312,939	3,821,125	299,004	9,433,068	0.0094	0.0188
17	5,166,963	9,218,059	99,668	14,484,690	0.0145	0.0333
18	4,964,608	7,542,205	44,575	12,551,388	0.0125	0.0458
19	5,475,052	5,910,394	0	11,385,446	0.0114	0.0572
20	3,670,895	4,631,765	0	8,302,660	0.0083	0.0655
21	3,926,370	4,717,828	0	8,644,198	0.0086	0.0741
22	5,607,647	4,910,485	0	10,518,132	0.0105	0.0846
23	4,314,609	5,303,659	71,374	9,689,642	0.0097	0.0943
24	5,705,730	5,983,224	0	11,688,954	0.0117	0.1060
25	5,187,464	6,415,851	0	11,603,315	0.0116	0.1176
26	6,375,631	10,996,353	0	17,371,984	0.0173	0.1349
27	6,167,561	11,319,383	71,374	17,558,318	0.0175	0.1524
28	14,272,436	15,226,338	142,747	29,641,521	0.0296	0.1820
29	10,508,576	21,737,134	71,374	32,317,084	0.0323	0.2143
30	14,375,748	22,159,865	0	36,535,613	0.0365	0.2508
31	11,207,141	29,691,215	0	40,898,356	0.0408	0.2916
32	13,711,988	30,097,611	0	43,809,599	0.0437	0.3354
33	16,226,372	25,213,199	0	41,439,571	0.0414	0.3767
34	17,397,892	28,354,328	0	45,752,220	0.0457	0.4224
35	18,120,573	26,866,399	0	44,986,972	0.0449	0.4673
36	16,617,896	20,286,870	0	36,904,766	0.0368	0.5042
37	14,255,670	23,387,495	0	37,643,165	0.0376	0.5418
38	18,671,004	21,050,650	0	39,721,654	0.0397	0.5814
39	20,245,896	19,146,667	0	39,392,563	0.0393	0.6208
40	24,296,014	17,092,685	0	41,388,699	0.0413	0.6621
41	22,097,424	22,760,745	0	44,858,169	0.0448	0.7069
42	21,114,193	18,340,022	0	39,454,215	0.0394	0.7463
43	12,822,177	20,303,202	0	33,125,379	0.0331	0.7793
44	7,436,443	22,847,382	0	30,283,825	0.0302	0.8096
45	5,545,765	25,470,014	0	31,015,779	0.0310	0.8405
46	4,109,412	20,771,758	0	24,881,170	0.0248	0.8654
47	4,693,174	19,870,599	0	24,563,773	0.0245	0.8899
48	3,735,734	18,052,279	0	21,788,013	0.0218	0.9117
49	1,265,504	11,910,639	0	13,176,143	0.0132	0.9248
50	880,110	11,897,996	0	12,778,106	0.0128	0.9376
51	853,879	9,994,252	0	10,848,131	0.0108	0.9484
52	255,578	8,697,230	0	8,952,808	0.0089	0.9573
53	238,531	6,459,201	0	6,697,732	0.0067	0.9640

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
54	761,851	6,898,960	0	7,660,811	0.0076	0.9717
55	0	5,473,623	0	5,473,623	0.0055	0.9771
56	34,792	5,180,210	0	5,215,002	0.0052	0.9824
57	146,329	2,910,511	0	3,056,840	0.0031	0.9854
58	26,314	1,741,800	0	1,768,114	0.0018	0.9872
59	0	1,753,624	0	1,753,624	0.0018	0.9889
60	0	1,674,774	0	1,674,774	0.0017	0.9906
61	0	1,142,346	0	1,142,346	0.0011	0.9917
62	0	1,408,159	0	1,408,159	0.0014	0.9931
63	0	1,060,093	0	1,060,093	0.0011	0.9942
64	0	590,681	0	590,681	0.0006	0.9948
65	0	246,683	0	246,683	0.0002	0.9950
66	0	1,404,539	0	1,404,539	0.0014	0.9964
67	0	1,052,574	0	1,052,574	0.0011	0.9975
68	0	373,887	0	373,887	0.0004	0.9979
69	0	379,975	0	379,975	0.0004	0.9982
70	0	494,704	0	494,704	0.0005	0.9987
71	0	694,938	0	694,938	0.0007	0.9994
72	0	171,448	0	171,448	0.0002	0.9996
73	0	114,737	0	114,737	0.0001	0.9997
74	0	115,179	0	115,179	0.0001	0.9998
75	0	170,424	0	170,424	0.0002	1.0000
Total	**361,369,274**	**637,662,627**	**2,522,411**	**1,001,554,312**	**1.0000**	**1.0000**

Appendix Table C-88. --Population estimates by sex and size for Bering flounder (*Hippoglossoides robustus*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
10	26,444	0	294,486	320,930	0.0089	0.0089
11	157,092	26,781	1,310,116	1,493,989	0.0415	0.0504
12	800,478	536,457	743,102	2,080,037	0.0578	0.1082
13	639,717	457,603	278,368	1,375,688	0.0382	0.1464
14	621,566	310,834	171,378	1,103,778	0.0307	0.1770
15	726,787	618,076	84,446	1,429,309	0.0397	0.2167
16	1,080,131	1,138,517	112,595	2,331,243	0.0647	0.2815
17	1,139,881	1,160,949	0	2,300,830	0.0639	0.3454
18	694,040	920,227	48,081	1,662,348	0.0462	0.3915
19	655,803	711,788	0	1,367,591	0.0380	0.4295
20	783,261	603,754	39,864	1,426,879	0.0396	0.4692
21	609,896	916,909	36,831	1,563,636	0.0434	0.5126
22	897,496	711,904	93,593	1,702,993	0.0473	0.5599
23	440,952	571,716	36,831	1,049,499	0.0291	0.5890
24	423,977	320,646	36,831	781,454	0.0217	0.6107
25	524,992	360,814	110,492	996,298	0.0277	0.6384
26	513,065	350,127	184,153	1,047,345	0.0291	0.6675
27	163,066	911,288	73,661	1,148,015	0.0319	0.6994
28	19,558	589,349	184,153	793,060	0.0220	0.7214
29	80,954	654,032	147,322	882,308	0.0245	0.7459
30	219,120	556,763	147,322	923,205	0.0256	0.7715
31	147,766	392,359	36,831	576,956	0.0160	0.7876
32	0	470,394	110,492	580,886	0.0161	0.8037

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
33	56,081	727,457	73,661	857,199	0.0238	0.8275
34	29,680	809,866	220,983	1,060,529	0.0295	0.8569
35	80,561	1,115,306	220,983	1,416,850	0.0393	0.8963
36	0	1,332,739	36,831	1,369,570	0.0380	0.9343
37	58,428	980,305	184,153	1,222,886	0.0340	0.9683
38	0	552,328	110,492	662,820	0.0184	0.9867
39	0	322,234	0	322,234	0.0089	0.9957
40	0	99,575	0	99,575	0.0028	0.9984
42	0	31,035	0	31,035	0.0009	0.9993
43	0	25,848	0	25,848	0.0007	1.0000
Total	**11,590,792**	**19,287,980**	**5,128,051**	**36,006,823**	**1.0000**	**1.0000**

Appendix Table C-89. --Population estimates by sex and size for flathead sole (*Hippoglossoides elassodon*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	25,778	25,778	0.0000	0.0000
7	0	0	370,758	370,758	0.0002	0.0002
8	0	285,692	611,034	896,726	0.0004	0.0005
9	0	0	4,564,336	4,564,336	0.0019	0.0024
10	121,596	0	10,117,848	10,239,444	0.0042	0.0066
11	1,326,270	708,083	12,318,479	14,352,832	0.0059	0.0125
12	3,285,599	1,705,487	13,401,137	18,392,223	0.0075	0.0200
13	4,090,119	1,974,743	9,274,756	15,339,618	0.0063	0.0263
14	8,866,567	5,234,103	8,265,795	22,366,465	0.0092	0.0354
15	15,677,269	12,090,462	3,099,576	30,867,307	0.0126	0.0481
16	32,504,448	22,904,294	1,761,677	57,170,419	0.0234	0.0715
17	36,014,868	29,144,525	784,595	65,943,988	0.0270	0.0985
18	35,058,741	27,609,835	963,960	63,632,536	0.0260	0.1245
19	36,419,300	27,404,882	158,456	63,982,638	0.0262	0.1507
20	40,290,281	31,464,727	363,138	72,118,146	0.0295	0.1802
21	40,098,206	33,736,149	554,597	74,388,952	0.0305	0.2107
22	47,373,244	38,595,498	1,076,191	87,044,933	0.0356	0.2463
23	61,045,421	38,273,136	521,594	99,840,151	0.0409	0.2872
24	61,555,509	48,145,130	2,026,928	111,727,567	0.0457	0.3329
25	58,532,732	42,054,570	1,346,878	101,934,180	0.0417	0.3747
26	60,666,563	50,998,030	633,825	112,298,418	0.0460	0.4206
27	54,024,338	52,067,299	442,366	106,534,003	0.0436	0.4642
28	58,436,393	51,497,815	713,053	110,647,261	0.0453	0.5095
29	59,984,683	41,348,213	125,454	101,458,350	0.0415	0.5511
30	67,730,018	44,660,488	363,138	112,753,644	0.0462	0.5972
31	64,157,794	49,597,146	442,366	114,197,306	0.0467	0.6440
32	62,416,400	44,470,372	204,682	107,091,454	0.0438	0.6878
33	60,426,865	48,655,604	79,228	109,161,697	0.0447	0.7325
34	49,193,945	40,897,178	79,228	90,170,351	0.0369	0.7694
35	38,459,458	47,720,270	250,908	86,430,636	0.0354	0.8048
36	30,642,857	41,344,996	92,451	72,080,304	0.0295	0.8343
37	29,321,798	35,368,748	46,226	64,736,772	0.0265	0.8608
38	33,773,884	35,991,757	184,903	69,950,544	0.0286	0.8894
39	30,747,030	20,315,682	46,226	51,108,938	0.0209	0.9104
40	30,084,797	16,202,165	46,226	46,333,188	0.0190	0.9293

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
41	18,367,921	16,723,053	0	35,090,974	0.0144	0.9437
42	13,050,608	14,241,613	0	27,292,221	0.0112	0.9549
43	3,773,792	15,106,830	92,451	18,973,073	0.0078	0.9626
44	1,157,433	12,301,313	0	13,458,746	0.0055	0.9681
45	576,820	15,441,023	0	16,017,843	0.0066	0.9747
46	322,103	14,058,130	0	14,380,233	0.0059	0.9806
47	114,379	16,844,762	0	16,959,141	0.0069	0.9875
48	149,399	9,808,641	0	9,958,040	0.0041	0.9916
49	137,935	6,123,184	0	6,261,119	0.0026	0.9942
50	138,263	5,841,501	0	5,979,764	0.0024	0.9966
51	0	3,872,889	0	3,872,889	0.0016	0.9982
52	0	2,766,176	0	2,766,176	0.0011	0.9993
53	0	1,130,618	0	1,130,618	0.0005	0.9998
54	0	406,115	0	406,115	0.0002	1.0000
56	0	98,327	0	98,327	0.0000	1.0000
Total	**1,250,115,646**	**1,117,231,254**	**75,450,242**	**2,442,797,142**	**1.0000**	**1.0000**

Appendix Table C-90. --Population estimates by sex and size for Greenland turbot (*Reinhardtius hippoglossoides*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
42	27,567	0	0	27,567	0.0139	0.0139
44	26,465	27,749	0	54,214	0.0273	0.0411
47	52,313	0	0	52,313	0.0263	0.0674
49	27,567	0	0	27,567	0.0139	0.0813
53	27,567	0	0	27,567	0.0139	0.0952
56	27,749	0	0	27,749	0.0140	0.1091
58	0	28,104	0	28,104	0.0141	0.1233
59	28,296	0	0	28,296	0.0142	0.1375
60	56,898	25,427	0	82,325	0.0414	0.1789
62	26,870	0	0	26,870	0.0135	0.1924
63	25,427	0	0	25,427	0.0128	0.2052
64	28,747	0	0	28,747	0.0145	0.2196
65	53,597	26,870	0	80,467	0.0405	0.2601
66	0	28,296	0	28,296	0.0142	0.2743
67	0	28,104	0	28,104	0.0141	0.2885
69	56,480	57,952	0	114,432	0.0575	0.3460
71	29,058	25,102	0	54,160	0.0272	0.3733
72	29,330	0	0	29,330	0.0148	0.3880
74	0	111,011	0	111,011	0.0558	0.4438
75	27,588	174,484	0	202,072	0.1016	0.5455
76	0	86,365	0	86,365	0.0434	0.5889
77	30,037	57,034	0	87,071	0.0438	0.6327
78	0	75,175	0	75,175	0.0378	0.6705
79	28,266	154,538	0	182,804	0.0919	0.7624
80	0	71,671	0	71,671	0.0360	0.7985
81	0	74,262	0	74,262	0.0373	0.8358
82	0	119,346	0	119,346	0.0600	0.8958
83	0	72,045	0	72,045	0.0362	0.9321
84	0	47,964	0	47,964	0.0241	0.9562
85	0	87,091	0	87,091	0.0438	1.0000

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
Total	**609,822**	**1,378,590**	**0**	**1,988,412**	**1.0000**	**1.0000**

Appendix Table C-91. --Population estimates by sex and size for Kamchatka flounder (*Atheresthes evermanni*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
11	26,672	0	28,564	55,236	0.0012	0.0012
13	0	0	135,286	135,286	0.0030	0.0042
14	53,384	30,412	90,191	173,987	0.0038	0.0080
15	85,114	138,660	135,286	359,060	0.0079	0.0160
16	80,039	245,621	0	325,660	0.0072	0.0232
17	98,308	0	0	98,308	0.0022	0.0253
18	0	73,614	0	73,614	0.0016	0.0270
19	104,222	90,927	0	195,149	0.0043	0.0313
20	50,941	26,612	0	77,553	0.0017	0.0330
21	83,001	0	0	83,001	0.0018	0.0348
22	124,128	83,063	0	207,191	0.0046	0.0394
23	159,781	80,456	0	240,237	0.0053	0.0447
24	240,749	134,205	0	374,954	0.0083	0.0530
25	178,486	81,671	0	260,157	0.0057	0.0587
26	248,402	286,539	0	534,941	0.0118	0.0705
27	410,170	337,328	0	747,498	0.0165	0.0870
28	554,570	594,992	0	1,149,562	0.0254	0.1124
29	1,410,714	934,705	0	2,345,419	0.0518	0.1642
30	1,133,600	1,150,079	0	2,283,679	0.0504	0.2146
31	1,888,633	1,268,429	0	3,157,062	0.0697	0.2843
32	1,819,445	1,482,371	0	3,301,816	0.0729	0.3572
33	1,056,141	1,405,630	0	2,461,771	0.0544	0.4116
34	1,226,154	1,278,641	0	2,504,795	0.0553	0.4669
35	557,511	986,582	0	1,544,093	0.0341	0.5010
36	368,183	651,880	0	1,020,063	0.0225	0.5235
37	371,748	417,121	0	788,869	0.0174	0.5409
38	402,866	696,980	0	1,099,846	0.0243	0.5652
39	931,641	773,835	0	1,705,476	0.0377	0.6028
40	882,116	833,177	0	1,715,293	0.0379	0.6407
41	709,148	669,876	0	1,379,024	0.0304	0.6712
42	605,208	649,085	0	1,254,293	0.0277	0.6988
43	1,084,991	500,871	0	1,585,862	0.0350	0.7339
44	588,731	629,653	0	1,218,384	0.0269	0.7608
45	785,035	339,263	0	1,124,298	0.0248	0.7856
46	310,716	394,232	0	704,948	0.0156	0.8011
47	330,706	658,295	0	989,001	0.0218	0.8230
48	447,449	663,619	0	1,111,068	0.0245	0.8475
49	182,586	457,353	0	639,939	0.0141	0.8616
50	315,810	693,585	0	1,009,395	0.0223	0.8839
51	382,802	1,024,933	0	1,407,735	0.0311	0.9150
52	111,260	664,319	0	775,579	0.0171	0.9321
53	0	285,470	0	285,470	0.0063	0.9384
54	148,725	530,138	0	678,863	0.0150	0.9534
55	112,381	273,743	0	386,124	0.0085	0.9619
56	44,575	46,335	0	90,910	0.0020	0.9640

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
57	48,587	97,104	0	145,691	0.0032	0.9672
58	19,029	0	0	19,029	0.0004	0.9676
59	116,553	0	0	116,553	0.0026	0.9702
60	29,116	26,999	0	56,115	0.0012	0.9714
61	0	70,210	0	70,210	0.0016	0.9729
62	0	103,349	0	103,349	0.0023	0.9752
64	0	73,258	0	73,258	0.0016	0.9768
65	0	125,812	0	125,812	0.0028	0.9796
66	0	84,034	0	84,034	0.0019	0.9815
67	0	182,251	0	182,251	0.0040	0.9855
68	0	95,787	0	95,787	0.0021	0.9876
69	0	140,693	0	140,693	0.0031	0.9907
70	0	53,369	0	53,369	0.0012	0.9919
71	0	173,643	0	173,643	0.0038	0.9957
72	0	27,644	0	27,644	0.0006	0.9963
77	0	165,381	0	165,381	0.0037	1.0000
Total	**20,920,127**	**23,983,834**	**389,327**	**45,293,288**	**1.0000**	**1.0000**

Appendix Table C-92. --Population estimates by sex and size for northern rock sole (*Lepidopsetta polyxystra*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	121,365	121,365	0.0000	0.0000
6	0	0	2,090,433	2,090,433	0.0003	0.0003
7	0	0	364,192	364,192	0.0000	0.0003
8	0	0	7,661,584	7,661,584	0.0010	0.0014
9	1,950,505	849,011	74,979,689	77,779,205	0.0105	0.0119
10	5,425,229	1,044,432	121,542,621	128,012,282	0.0173	0.0292
11	6,216,661	6,605,581	174,619,939	187,442,181	0.0253	0.0545
12	19,920,545	13,741,459	195,703,718	229,365,722	0.0310	0.0854
13	78,023,294	61,938,450	232,948,282	372,910,026	0.0503	0.1358
14	169,949,888	131,801,484	158,702,159	460,453,531	0.0622	0.1979
15	217,472,978	171,611,767	73,361,428	462,446,173	0.0624	0.2603
16	202,334,776	161,031,848	23,396,844	386,763,468	0.0522	0.3125
17	152,800,115	119,258,081	8,031,845	280,090,041	0.0378	0.3503
18	103,469,983	124,548,643	6,945,374	234,964,000	0.0317	0.3821
19	128,024,886	111,672,817	5,709,724	245,407,427	0.0331	0.4152
20	120,489,805	140,748,912	36,704	261,275,421	0.0353	0.4505
21	185,580,082	167,968,425	3,579,372	357,127,879	0.0482	0.4987
22	192,481,494	160,107,267	47,723	352,636,484	0.0476	0.5463
23	157,063,124	161,300,179	58,743	318,422,046	0.0430	0.5892
24	153,762,769	161,890,399	117,486	315,770,654	0.0426	0.6319
25	155,907,545	141,064,690	29,371	297,001,606	0.0401	0.6719
26	131,801,748	138,582,671	58,743	270,443,162	0.0365	0.7085
27	148,337,108	127,472,026	194,580	276,003,714	0.0373	0.7457
28	144,168,410	112,247,686	231,285	256,647,381	0.0346	0.7804
29	169,496,551	110,154,225	143,170	279,793,946	0.0378	0.8181
30	135,468,476	101,461,772	0	236,930,248	0.0320	0.8501
31	121,371,656	72,401,281	77,095	193,850,032	0.0262	0.8763
32	84,289,501	65,740,087	102,780	150,132,368	0.0203	0.8965
33	39,593,235	62,337,016	95,447	102,025,698	0.0138	0.9103

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
34	14,948,139	51,368,922	18,352	66,335,413	0.0090	0.9193
35	13,073,120	69,885,451	18,352	82,976,923	0.0112	0.9305
36	3,218,578	74,006,994	55,056	77,280,628	0.0104	0.9409
37	368,468	96,301,990	18,352	96,688,810	0.0131	0.9539
38	2,018,573	106,643,625	18,352	108,680,550	0.0147	0.9686
39	487,509	84,168,410	0	84,655,919	0.0114	0.9800
40	72,873	67,339,606	0	67,412,479	0.0091	0.9891
41	0	35,641,097	36,704	35,677,801	0.0048	0.9940
42	0	28,997,574	0	28,997,574	0.0039	0.9979
43	0	10,127,520	0	10,127,520	0.0014	0.9992
44	29,624	4,802,689	0	4,832,313	0.0007	0.9999
45	0	580,134	0	580,134	0.0001	1.0000
46	0	125,241	0	125,241	0.0000	1.0000
47	0	154,266	0	154,266	0.0000	1.0000
Total	**3,059,617,248**	**3,257,723,728**	**1,091,116,864**	**7,408,457,840**	**1.0000**	**1.0000**

Appendix Table C-93. --Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
10	0	0	123,262	123,262	0.0003	0.0003
11	0	25,440	164,780	190,220	0.0004	0.0007
12	210,601	235,798	1,208,629	1,655,028	0.0039	0.0046
13	575,952	546,837	3,201,855	4,324,644	0.0102	0.0148
14	1,329,427	1,212,048	2,549,059	5,090,534	0.0120	0.0268
15	2,788,170	3,794,410	1,947,307	8,529,887	0.0201	0.0468
16	3,408,527	3,106,846	1,091,547	7,606,920	0.0179	0.0647
17	5,327,134	2,954,993	761,898	9,044,025	0.0213	0.0860
18	5,546,564	4,170,735	443,339	10,160,638	0.0239	0.1099
19	5,827,033	5,445,445	174,232	11,446,710	0.0269	0.1368
20	5,044,841	5,653,118	492,595	11,190,554	0.0263	0.1631
21	5,134,619	4,338,015	206,340	9,678,974	0.0228	0.1859
22	4,167,946	4,132,493	233,934	8,534,373	0.0201	0.2060
23	3,808,423	2,296,043	118,049	6,222,515	0.0146	0.2206
24	1,659,890	1,752,484	0	3,412,374	0.0080	0.2286
25	653,110	1,181,771	89,038	1,923,919	0.0045	0.2332
26	133,144	394,404	0	527,548	0.0012	0.2344
27	27,722	268,714	0	296,436	0.0007	0.2351
28	151,122	173,215	0	324,337	0.0008	0.2359
29	301,309	128,248	0	429,557	0.0010	0.2369
30	457,262	253,157	28,971	739,390	0.0017	0.2386
31	585,662	616,607	28,971	1,231,240	0.0029	0.2415
32	1,264,542	1,276,324	86,914	2,627,780	0.0062	0.2477
33	1,981,836	1,395,940	28,971	3,406,747	0.0080	0.2557
34	3,502,103	3,447,344	86,914	7,036,361	0.0166	0.2723
35	4,691,153	4,002,235	144,857	8,838,245	0.0208	0.2931
36	5,343,237	5,958,040	144,857	11,446,134	0.0269	0.3200
37	7,144,620	7,060,843	202,800	14,408,263	0.0339	0.3539
38	7,318,850	6,795,693	115,886	14,230,429	0.0335	0.3873
39	7,520,388	6,604,022	86,914	14,211,324	0.0334	0.4208
40	7,691,335	6,461,347	57,943	14,210,625	0.0334	0.4542

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
41	6,536,209	5,293,381	57,943	11,887,533	0.0280	0.4821
42	5,069,170	4,295,797	86,914	9,451,881	0.0222	0.5044
43	3,726,257	3,554,026	28,971	7,309,254	0.0172	0.5216
44	3,237,500	2,855,345	0	6,092,845	0.0143	0.5359
45	3,451,612	2,756,836	0	6,208,448	0.0146	0.5505
46	2,932,776	2,824,238	0	5,757,014	0.0135	0.5640
47	3,359,132	2,982,581	0	6,341,713	0.0149	0.5790
48	3,587,735	3,451,741	0	7,039,476	0.0166	0.5955
49	4,932,164	2,583,225	0	7,515,389	0.0177	0.6132
50	4,474,923	3,654,485	0	8,129,408	0.0191	0.6323
51	5,459,582	4,653,314	28,971	10,141,867	0.0239	0.6562
52	5,905,413	5,428,704	57,943	11,392,060	0.0268	0.6830
53	5,315,956	5,127,047	28,971	10,471,974	0.0246	0.7076
54	4,742,229	4,613,607	0	9,355,836	0.0220	0.7296
55	4,363,739	5,097,855	0	9,461,594	0.0223	0.7519
56	4,857,922	4,148,921	0	9,006,843	0.0212	0.7730
57	4,831,169	4,165,458	0	8,996,627	0.0212	0.7942
58	3,560,825	3,033,829	0	6,594,654	0.0155	0.8097
59	3,696,013	3,131,741	57,253	6,885,007	0.0162	0.8259
60	2,710,274	3,351,643	57,943	6,119,860	0.0144	0.8403
61	3,066,901	3,025,416	0	6,092,317	0.0143	0.8546
62	2,629,544	2,224,742	0	4,854,286	0.0114	0.8660
63	2,931,192	2,204,787	0	5,135,979	0.0121	0.8781
64	2,051,336	1,784,619	0	3,835,955	0.0090	0.8871
65	1,239,538	1,693,838	0	2,933,376	0.0069	0.8940
66	1,086,311	1,634,879	28,971	2,750,161	0.0065	0.9005
67	1,090,358	1,122,874	0	2,213,232	0.0052	0.9057
68	971,157	992,419	0	1,963,576	0.0046	0.9103
69	887,309	1,674,896	0	2,562,205	0.0060	0.9164
70	981,912	940,431	0	1,922,343	0.0045	0.9209
71	962,293	735,415	0	1,697,708	0.0040	0.9249
72	631,095	826,775	0	1,457,870	0.0034	0.9283
73	890,486	806,752	0	1,697,238	0.0040	0.9323
74	900,608	1,017,414	0	1,918,022	0.0045	0.9368
75	1,012,880	838,590	0	1,851,470	0.0044	0.9412
76	1,131,162	538,469	0	1,669,631	0.0039	0.9451
77	448,874	407,311	0	856,185	0.0020	0.9471
78	802,224	679,342	0	1,481,566	0.0035	0.9506
79	608,725	734,661	0	1,343,386	0.0032	0.9538
80	849,164	679,459	0	1,528,623	0.0036	0.9573
81	857,630	556,001	0	1,413,631	0.0033	0.9607
82	611,908	845,546	0	1,457,454	0.0034	0.9641
83	410,688	681,169	0	1,091,857	0.0026	0.9667
84	632,680	685,003	0	1,317,683	0.0031	0.9698
85	592,416	1,004,004	0	1,596,420	0.0038	0.9735
86	636,216	716,774	0	1,352,990	0.0032	0.9767
87	351,965	658,128	0	1,010,093	0.0024	0.9791
88	571,291	774,237	0	1,345,528	0.0032	0.9822
89	329,618	545,515	0	875,133	0.0021	0.9843
90	381,683	620,047	0	1,001,730	0.0024	0.9867
91	357,442	450,617	0	808,059	0.0019	0.9886
92	80,780	768,614	0	849,394	0.0020	0.9906
93	182,802	457,250	0	640,052	0.0015	0.9921
94	187,826	524,798	0	712,624	0.0017	0.9937

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
95	26,582	522,009	0	548,591	0.0013	0.9950
96	92,503	406,674	0	499,177	0.0012	0.9962
97	84,492	300,241	0	384,733	0.0009	0.9971
98	59,514	181,352	0	240,866	0.0006	0.9977
99	0	239,532	0	239,532	0.0006	0.9982
100	16,237	194,720	0	210,957	0.0005	0.9987
101	26,314	109,429	0	135,743	0.0003	0.9991
102	0	172,871	0	172,871	0.0004	0.9995
103	15,612	0	0	15,612	0.0000	0.9995
104	0	53,302	0	53,302	0.0001	0.9996
105	0	18,532	0	18,532	0.0000	0.9997
106	27,563	59,051	0	86,614	0.0002	0.9999
108	0	25,897	0	25,897	0.0001	0.9999
110	0	27,918	0	27,918	0.0001	1.0000
Total	**212,053,953**	**198,848,703**	**14,253,742**	**425,156,398**	**1.0000**	**1.0000**

Appendix Table C-94. --Population estimates by sex and size for Pacific halibut (*Hippoglossus stenolepis*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
11	0	0	29,892	29,892	0.0003	0.0003
13	0	0	29,314	29,314	0.0003	0.0006
19	0	28,864	0	28,864	0.0003	0.0010
25	0	0	16,387	16,387	0.0002	0.0011
26	34,742	0	0	34,742	0.0004	0.0015
27	30,412	0	0	30,412	0.0003	0.0019
28	58,478	0	0	58,478	0.0006	0.0025
29	63,066	95,996	0	159,062	0.0017	0.0042
30	123,889	150,511	16,387	290,787	0.0032	0.0074
31	491,735	30,688	0	522,423	0.0057	0.0131
32	524,659	126,215	80,739	731,613	0.0080	0.0211
33	399,167	247,900	122,551	769,618	0.0084	0.0295
34	432,020	362,287	278,069	1,072,376	0.0117	0.0413
35	491,330	209,598	370,179	1,071,107	0.0117	0.0530
36	529,438	532,781	280,318	1,342,537	0.0147	0.0676
37	331,971	308,745	449,230	1,089,946	0.0119	0.0796
38	571,233	252,777	612,853	1,436,863	0.0157	0.0953
39	678,890	396,651	848,794	1,924,335	0.0210	0.1163
40	789,785	539,992	1,180,010	2,509,787	0.0274	0.1437
41	511,134	577,936	1,245,314	2,334,384	0.0255	0.1693
42	941,140	300,999	1,608,040	2,850,179	0.0312	0.2004
43	1,309,615	389,362	1,833,073	3,532,050	0.0386	0.2390
44	1,190,421	924,964	2,138,136	4,253,521	0.0465	0.2855
45	1,499,314	1,349,014	2,146,156	4,994,484	0.0546	0.3401
46	1,483,604	1,284,441	3,400,238	6,168,283	0.0674	0.4076
47	1,324,456	1,193,236	3,882,933	6,400,625	0.0700	0.4775
48	1,316,138	970,345	3,499,557	5,786,040	0.0633	0.5408
49	1,030,299	1,091,647	3,294,608	5,416,554	0.0592	0.6000
50	914,144	1,256,420	3,084,260	5,254,824	0.0574	0.6575
51	539,044	867,800	3,375,955	4,782,799	0.0523	0.7097
52	569,125	839,913	2,133,741	3,542,779	0.0387	0.7485

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
53	479,877	651,921	1,892,612	3,024,410	0.0331	0.7815
54	269,586	702,917	1,376,295	2,348,798	0.0257	0.8072
55	195,422	637,896	1,135,708	1,969,026	0.0215	0.8287
56	109,633	438,929	745,343	1,293,905	0.0141	0.8429
57	252,321	349,244	469,631	1,071,196	0.0117	0.8546
58	96,848	183,218	328,423	608,489	0.0067	0.8612
59	121,831	337,923	435,239	894,993	0.0098	0.8710
60	88,279	211,105	547,493	846,877	0.0093	0.8803
61	160,156	231,966	385,378	777,500	0.0085	0.8888
62	56,789	293,433	367,566	717,788	0.0078	0.8966
63	72,247	167,415	276,115	515,777	0.0056	0.9023
64	135,130	67,862	402,655	605,647	0.0066	0.9089
65	108,312	181,987	380,685	670,984	0.0073	0.9162
66	153,113	119,062	370,249	642,424	0.0070	0.9232
67	28,088	26,508	192,213	246,809	0.0027	0.9259
68	160,809	159,091	197,234	517,134	0.0057	0.9316
69	105,609	84,669	150,276	340,554	0.0037	0.9353
70	61,133	59,821	192,252	313,206	0.0034	0.9387
71	59,816	63,029	138,825	261,670	0.0029	0.9416
72	29,978	92,163	157,556	279,697	0.0031	0.9447
73	0	0	29,610	29,610	0.0003	0.9450
74	28,611	165,346	133,402	327,359	0.0036	0.9486
75	71,346	109,256	26,899	207,501	0.0023	0.9508
76	28,395	154,140	159,662	342,197	0.0037	0.9546
77	56,182	28,489	132,794	217,465	0.0024	0.9570
78	30,446	29,622	208,005	268,073	0.0029	0.9599
79	94,776	31,100	106,678	232,554	0.0025	0.9624
80	0	57,648	104,110	161,758	0.0018	0.9642
81	27,644	82,396	235,224	345,264	0.0038	0.9680
82	91,327	86,792	143,065	321,184	0.0035	0.9715
83	119,906	60,139	146,820	326,865	0.0036	0.9751
84	0	30,326	141,223	171,549	0.0019	0.9769
85	0	32,134	161,843	193,977	0.0021	0.9791
86	28,329	30,675	58,244	117,248	0.0013	0.9803
87	29,416	52,615	88,857	170,888	0.0019	0.9822
88	0	21,288	102,726	124,014	0.0014	0.9836
89	57,207	57,089	59,220	173,516	0.0019	0.9855
90	0	0	88,861	88,861	0.0010	0.9864
91	58,746	28,092	0	86,838	0.0009	0.9874
92	0	27,788	144,175	171,963	0.0019	0.9893
93	27,644	31,651	32,450	91,745	0.0010	0.9903
94	0	0	56,283	56,283	0.0006	0.9909
95	27,211	56,325	53,756	137,292	0.0015	0.9924
96	0	0	87,691	87,691	0.0010	0.9933
97	0	28,177	36,046	64,223	0.0007	0.9940
98	0	28,701	59,211	87,912	0.0010	0.9950
99	0	28,489	0	28,489	0.0003	0.9953
100	0	0	27,850	27,850	0.0003	0.9956
101	0	0	15,931	15,931	0.0002	0.9958
106	0	57,559	0	57,559	0.0006	0.9964
109	0	0	27,732	27,732	0.0003	0.9967
110	0	59,238	16,431	75,669	0.0008	0.9975
114	0	0	16,297	16,297	0.0002	0.9977
115	0	29,146	27,283	56,429	0.0006	0.9983

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
122	0	0	19,558	19,558	0.0002	0.9986
125	0	0	59,220	59,220	0.0006	0.9992
127	0	27,025	0	27,025	0.0003	0.9995
130	0	0	29,610	29,610	0.0003	0.9998
145	0	0	16,387	16,387	0.0002	1.0000
Total	**21,701,412**	**20,820,487**	**48,951,636**	**91,473,535**	**1.0000**	**1.0000**

Appendix Table C-95. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
8	0	0	15,696,510	15,696,510	0.0021	0.0021
9	0	164,329	35,846,015	36,010,344	0.0048	0.0068
10	77,933	383,433	41,527,833	41,989,199	0.0056	0.0124
11	18,653	301,269	63,518,234	63,838,156	0.0084	0.0208
12	236,214	1,525,283	98,572,749	100,334,246	0.0133	0.0341
13	1,971,376	1,723,492	75,125,486	78,820,354	0.0104	0.0445
14	3,657,415	5,530,465	46,777,418	55,965,298	0.0074	0.0519
15	6,990,781	7,531,951	27,621,512	42,144,244	0.0056	0.0575
16	8,854,366	8,709,528	16,767,911	34,331,805	0.0045	0.0620
17	7,971,831	9,078,031	9,686,779	26,736,641	0.0035	0.0656
18	6,712,950	5,685,568	3,312,760	15,711,278	0.0021	0.0676
19	1,992,862	3,004,140	1,304,476	6,301,478	0.0008	0.0685
20	1,497,867	1,376,785	113,851	2,988,503	0.0004	0.0689
21	1,537,102	1,463,676	219,059	3,219,837	0.0004	0.0693
22	8,759,920	5,140,557	0	13,900,477	0.0018	0.0711
23	8,173,667	10,171,473	30,208	18,375,348	0.0024	0.0736
24	20,698,603	13,256,009	129,048	34,083,660	0.0045	0.0781
25	21,999,409	24,808,788	224,999	47,033,196	0.0062	0.0843
26	24,177,566	27,751,320	370,655	52,299,541	0.0069	0.0912
27	30,925,932	21,403,745	357,239	52,686,916	0.0070	0.0982
28	31,923,528	26,891,640	741,310	59,556,478	0.0079	0.1060
29	38,356,375	34,124,997	383,687	72,865,059	0.0096	0.1157
30	32,477,318	40,775,576	132,239	73,385,133	0.0097	0.1254
31	42,110,342	37,887,693	26,448	80,024,483	0.0106	0.1360
32	47,854,627	34,033,742	105,792	81,994,161	0.0108	0.1468
33	49,806,908	47,084,683	172,104	97,063,695	0.0128	0.1596
34	75,651,154	45,474,486	145,656	121,271,296	0.0160	0.1757
35	110,556,081	63,697,606	436,967	174,690,654	0.0231	0.1988
36	130,086,371	92,803,919	0	222,890,290	0.0295	0.2282
37	168,609,876	112,548,027	0	281,157,903	0.0372	0.2654
38	179,908,604	148,510,952	79,344	328,498,900	0.0434	0.3088
39	217,740,618	179,083,836	0	396,824,454	0.0525	0.3613
40	240,250,163	189,799,802	0	430,049,965	0.0569	0.4182
41	235,193,265	171,339,352	0	406,532,617	0.0538	0.4719
42	220,965,515	212,222,278	0	433,187,793	0.0573	0.5292
43	204,295,618	187,114,647	0	391,410,265	0.0518	0.5809
44	175,541,699	167,220,752	0	342,762,451	0.0453	0.6263
45	157,261,945	137,880,327	26,448	295,168,720	0.0390	0.6653
46	162,565,549	130,777,809	0	293,343,358	0.0388	0.7041
47	176,521,686	113,466,259	26,448	290,014,393	0.0383	0.7424

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
48	160,581,725	113,446,665	26,448	274,054,838	0.0362	0.7787
49	167,660,779	125,316,442	26,448	293,003,669	0.0387	0.8174
50	154,001,536	126,244,406	79,344	280,325,286	0.0371	0.8545
51	105,302,095	132,158,130	105,792	237,566,017	0.0314	0.8859
52	81,162,720	116,761,155	158,687	198,082,562	0.0262	0.9121
53	58,624,494	105,834,766	211,583	164,670,843	0.0218	0.9338
54	39,974,461	90,381,187	79,344	130,434,992	0.0172	0.9511
55	32,488,716	67,605,608	79,344	100,173,668	0.0132	0.9643
56	25,999,240	53,091,216	52,896	79,143,352	0.0105	0.9748
57	12,081,571	40,373,784	0	52,455,355	0.0069	0.9817
58	8,957,682	29,695,070	26,448	38,679,200	0.0051	0.9868
59	4,906,668	18,425,945	52,896	23,385,509	0.0031	0.9899
60	4,813,362	16,756,897	26,448	21,596,707	0.0029	0.9928
61	2,042,063	8,684,287	0	10,726,350	0.0014	0.9942
62	2,758,918	9,585,313	0	12,344,231	0.0016	0.9958
63	2,294,425	4,979,104	0	7,273,529	0.0010	0.9968
64	340,148	7,952,711	26,448	8,319,307	0.0011	0.9979
65	337,243	3,486,863	0	3,824,106	0.0005	0.9984
66	558,960	2,222,195	0	2,781,155	0.0004	0.9988
67	121,267	4,282,817	0	4,404,084	0.0006	0.9993
68	299,437	1,291,397	0	1,590,834	0.0002	0.9996
69	66,999	580,278	0	647,277	0.0001	0.9996
70	132,919	898,996	0	1,031,915	0.0001	0.9998
71	0	98,557	0	98,557	0.0000	0.9998
72	0	435,704	0	435,704	0.0001	0.9998
73	30,177	526,653	0	556,830	0.0001	0.9999
74	26,289	150,122	0	176,411	0.0000	0.9999
75	0	33,028	0	33,028	0.0000	1.0000
76	0	146,274	0	146,274	0.0000	1.0000
77	198,645	0	0	198,645	0.0000	1.0000
78	0	29,011	0	29,011	0.0000	1.0000
Total	**3,719,694,228**	**3,403,222,806**	**440,431,311**	**7,563,348,345**	**1.0000**	**1.0000**

Appendix Table C-96. -- Population estimates by sex and size for yellowfin sole (*Limanda aspera*) from the 2022 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
7	0	0	1,038,390	1,038,390	0.0001	0.0001
8	195,866	1,382,867	2,910,828	4,489,561	0.0005	0.0006
9	3,055,456	4,743,554	26,165,849	33,964,859	0.0039	0.0046
10	8,490,076	16,034,540	44,882,086	69,406,702	0.0080	0.0126
11	14,221,411	19,923,997	55,399,614	89,545,022	0.0103	0.0229
12	21,592,980	28,120,190	62,034,068	111,747,238	0.0129	0.0358
13	37,170,798	48,321,155	43,804,803	129,296,756	0.0149	0.0507
14	68,143,346	97,185,075	21,610,064	186,938,485	0.0216	0.0723
15	106,177,751	108,515,504	3,241,894	217,935,149	0.0252	0.0975
16	120,624,257	140,601,426	2,332,540	263,558,223	0.0304	0.1279
17	143,540,320	151,486,347	1,175,203	296,201,870	0.0342	0.1621
18	148,012,728	147,412,629	0	295,425,357	0.0341	0.1962
19	147,325,857	167,330,319	0	314,656,176	0.0363	0.2326
20	196,186,697	192,894,909	363,763	389,445,369	0.0450	0.2775
21	225,575,128	253,222,747	1,091,288	479,889,163	0.0554	0.3330
22	218,186,410	238,614,280	1,120,446	457,921,136	0.0529	0.3858
23	243,105,090	228,668,441	2,240,892	474,014,423	0.0547	0.4406
24	238,745,844	232,731,090	2,575,497	474,052,431	0.0547	0.4953
25	203,500,017	206,180,496	2,968,417	412,648,930	0.0476	0.5430
26	188,406,842	181,638,267	1,091,288	371,136,397	0.0429	0.5858
27	145,835,418	148,927,215	1,542,524	296,305,157	0.0342	0.6200
28	159,791,969	126,998,207	392,921	287,183,097	0.0332	0.6532
29	135,310,051	110,095,513	756,683	246,162,247	0.0284	0.6816
30	184,663,462	88,739,029	3,390,496	276,792,987	0.0320	0.7136
31	192,273,697	129,309,779	3,273,864	324,857,340	0.0375	0.7511
32	237,806,011	161,548,367	3,361,338	402,715,716	0.0465	0.7976
33	227,058,277	199,494,058	2,968,417	429,520,752	0.0496	0.8472
34	184,262,241	211,325,070	4,481,784	400,069,095	0.0462	0.8934
35	131,707,422	182,638,544	1,542,524	315,888,490	0.0365	0.9298
36	55,664,833	157,308,390	392,921	213,366,144	0.0246	0.9545
37	24,982,884	124,116,913	363,763	149,463,560	0.0173	0.9717
38	7,353,430	105,627,452	0	112,980,882	0.0130	0.9848
39	2,668,753	60,940,292	0	63,609,045	0.0073	0.9921
40	274,980	40,257,916	0	40,532,896	0.0047	0.9968
41	103,546	14,378,441	0	14,481,987	0.0017	0.9985
42	332,609	6,061,326	0	6,393,935	0.0007	0.9992
43	0	3,598,376	0	3,598,376	0.0004	0.9996
44	0	2,809,109	0	2,809,109	0.0003	1.0000
45	0	334,401	0	334,401	0.0000	1.0000
46	0	29,680	0	29,680	0.0000	1.0000
Total	**4,022,346,457**	**4,339,545,911**	**298,514,165**	**8,660,406,533**	**1.0000**	**1.0000**

Appendix D: List of population estimates by sex and size group for principal fish species in the northern Bering Sea

Appendix D presents population estimates by sex and size group from the 2022 northern Bering Sea bottom trawl survey for principal fish species.

List of Tables

Appendix Table D-97. --Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
7	0	0	332,328	332,328	0.0006	0.0006
8	67,452	0	2,341,758	2,409,210	0.0045	0.0051
9	530,009	67,674	2,527,198	3,124,881	0.0058	0.0109
10	1,689,413	396,164	7,870,852	9,956,429	0.0185	0.0294
11	2,837,456	1,492,183	10,695,989	15,025,628	0.0279	0.0572
12	4,359,737	3,380,739	8,781,691	16,522,167	0.0307	0.0879
13	6,944,856	4,025,438	5,977,542	16,947,836	0.0314	0.1194
14	6,687,795	4,862,715	1,599,196	13,149,706	0.0244	0.1438
15	6,576,501	6,178,447	47,887	12,802,835	0.0238	0.1675
16	6,720,090	5,712,826	0	12,432,916	0.0231	0.1906
17	5,182,968	5,567,333	0	10,750,301	0.0199	0.2105
18	5,994,981	5,080,530	0	11,075,511	0.0206	0.2311
19	5,276,738	5,282,440	0	10,559,178	0.0196	0.2507
20	5,536,498	4,994,348	0	10,530,846	0.0195	0.2702
21	4,752,168	4,379,570	0	9,131,738	0.0169	0.2872
22	5,607,343	4,155,573	0	9,762,916	0.0181	0.3053
23	4,181,011	4,793,523	0	8,974,534	0.0167	0.3219
24	4,159,567	3,975,413	0	8,134,980	0.0151	0.3370
25	4,387,839	3,558,553	0	7,946,392	0.0147	0.3518
26	4,316,006	5,255,283	0	9,571,289	0.0178	0.3695
27	4,967,719	4,275,670	0	9,243,389	0.0172	0.3867
28	5,290,399	5,784,553	0	11,074,952	0.0206	0.4072
29	4,339,276	4,122,143	0	8,461,419	0.0157	0.4230
30	6,985,642	4,536,288	0	11,521,930	0.0214	0.4443
31	6,556,847	3,620,252	0	10,177,099	0.0189	0.4632
32	9,635,567	3,877,039	0	13,512,606	0.0251	0.4883
33	10,843,530	4,279,186	0	15,122,716	0.0281	0.5164
34	17,955,005	5,086,853	0	23,041,858	0.0428	0.5591
35	20,728,675	4,586,469	0	25,315,144	0.0470	0.6061
36	22,652,928	6,235,815	0	28,888,743	0.0536	0.6597
37	24,711,023	4,092,443	0	28,803,466	0.0535	0.7132
38	16,726,723	6,373,407	0	23,100,130	0.0429	0.7560
39	12,857,084	7,653,610	0	20,510,694	0.0381	0.7941
40	6,262,968	8,174,962	0	14,437,930	0.0268	0.8209
41	3,687,457	9,588,154	0	13,275,611	0.0246	0.8455
42	1,411,227	8,056,153	0	9,467,380	0.0176	0.8631
43	302,960	10,972,918	0	11,275,878	0.0209	0.8840
44	0	9,825,152	0	9,825,152	0.0182	0.9022
45	1,144,656	9,103,501	0	10,248,157	0.0190	0.9212
46	0	9,893,352	0	9,893,352	0.0184	0.9396
47	120,390	7,996,612	0	8,117,002	0.0151	0.9547
48	0	6,784,910	0	6,784,910	0.0126	0.9673
49	0	5,784,082	0	5,784,082	0.0107	0.9780
50	0	3,448,396	0	3,448,396	0.0064	0.9844
51	0	2,777,640	0	2,777,640	0.0052	0.9895
52	0	2,144,568	0	2,144,568	0.0040	0.9935
53	0	1,375,309	0	1,375,309	0.0026	0.9961

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
54	0	1,256,194	0	1,256,194	0.0023	0.9984
55	0	303,131	0	303,131	0.0006	0.9990
56	0	310,085	0	310,085	0.0006	0.9995
57	0	61,962	0	61,962	0.0001	0.9997
58	0	32,870	0	32,870	0.0001	0.9997
59	0	29,515	0	29,515	0.0001	0.9998
60	0	60,134	0	60,134	0.0001	0.9999
61	0	58,606	0	58,606	0.0001	1.0000
Total	**262,988,504**	**235,720,686**	**40,174,441**	**538,883,631**	**1.0000**	**1.0000**

Appendix Table D-98. --Population estimates by sex and size for arrowtooth flounder (*Atheresthes stomias*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
41	259,903	0	0	259,903	0.5000	0.5000
44	259,903	0	0	259,903	0.5000	1.0000
Total	**519,806**	**0**	**0**	**519,806**	**1.0000**	**1.0000**

Appendix Table D-99. --Population estimates by sex and size for Bering flounder (*Hippoglossoides robustus*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
6	0	0	342,311	342,311	0.0056	0.0056
7	0	0	981,367	981,367	0.0159	0.0215
8	0	0	1,100,534	1,100,534	0.0179	0.0394
9	0	63,854	671,251	735,105	0.0119	0.0513
10	214,564	124,406	1,340,078	1,679,048	0.0273	0.0786
11	96,958	184,330	2,614,448	2,895,736	0.0470	0.1256
12	568,318	192,695	4,356,596	5,117,609	0.0831	0.2087
13	952,298	1,514,174	4,069,345	6,535,817	0.1061	0.3148
14	1,104,617	1,477,114	1,742,957	4,324,688	0.0702	0.3850
15	1,731,617	1,854,852	1,471,047	5,057,516	0.0821	0.4672
16	1,631,933	1,544,998	116,021	3,292,952	0.0535	0.5206
17	1,907,677	2,107,737	88,544	4,103,958	0.0666	0.5873
18	1,360,419	1,744,128	59,029	3,163,576	0.0514	0.6387
19	908,869	1,501,663	147,573	2,558,105	0.0415	0.6802
20	935,748	1,908,507	29,515	2,873,770	0.0467	0.7269
21	651,139	1,243,621	0	1,894,760	0.0308	0.7576
22	383,038	1,036,423	88,544	1,508,005	0.0245	0.7821
23	174,247	1,170,989	29,515	1,374,751	0.0223	0.8044
24	129,159	1,154,777	0	1,283,936	0.0208	0.8253
25	25,886	896,695	0	922,581	0.0150	0.8403
26	58,209	967,829	29,515	1,055,553	0.0171	0.8574
27	77,167	670,742	0	747,909	0.0121	0.8695
28	30,609	389,909	0	420,518	0.0068	0.8764
29	0	494,190	0	494,190	0.0080	0.8844
30	31,346	365,171	0	396,517	0.0064	0.8908

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
31	27,671	581,517	0	609,188	0.0099	0.9007
32	0	842,561	0	842,561	0.0137	0.9144
33	28,889	846,373	0	875,262	0.0142	0.9286
34	0	1,178,177	0	1,178,177	0.0191	0.9478
35	50,304	1,163,564	0	1,213,868	0.0197	0.9675
36	35,504	1,062,982	0	1,098,486	0.0178	0.9853
37	0	593,145	0	593,145	0.0096	0.9949
38	0	176,236	0	176,236	0.0029	0.9978
39	0	81,024	0	81,024	0.0013	0.9991
41	0	27,671	0	27,671	0.0004	0.9996
42	0	26,815	0	26,815	0.0004	1.0000
Total	**13,116,186**	**29,188,869**	**19,278,190**	**61,583,245**	**1.0000**	**1.0000**

Appendix Table D-100. -- Population estimates by sex and size for flathead sole (*Hippoglossoides elassodon*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
19	0	259,903	0	259,903	0.3022	0.3022
24	259,903	0	0	259,903	0.3022	0.6044
25	0	259,903	0	259,903	0.3022	0.9066
37	0	26,874	0	26,874	0.0312	0.9379
40	0	53,431	0	53,431	0.0621	1.0000
Total	**259,903**	**600,111**	**0**	**860,014**	**1.0000**	**1.0000**

Appendix Table D-101. -- Population estimates by sex and size for northern rock sole (*Lepidopsetta polyxystra*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	29,231	29,231	0.0002	0.0002
6	0	0	852,787	852,787	0.0054	0.0055
7	0	0	2,027,030	2,027,030	0.0127	0.0183
8	0	0	646,032	646,032	0.0041	0.0223
9	0	31,707	337,214	368,921	0.0023	0.0247
10	92,456	63,156	920,224	1,075,836	0.0068	0.0314
11	191,368	239,503	2,956,665	3,387,536	0.0213	0.0527
12	469,340	304,723	4,056,206	4,830,269	0.0303	0.0830
13	958,800	450,240	2,223,022	3,632,062	0.0228	0.1059
14	1,640,242	926,435	1,025,973	3,592,650	0.0226	0.1284
15	2,868,436	2,418,247	609,317	5,896,000	0.0370	0.1655
16	4,322,382	3,136,872	124,633	7,583,887	0.0476	0.2131
17	3,160,526	2,475,679	0	5,636,205	0.0354	0.2485
18	3,485,718	1,491,908	0	4,977,626	0.0313	0.2798
19	1,635,552	1,757,337	0	3,392,889	0.0213	0.3011
20	1,330,924	1,386,336	0	2,717,260	0.0171	0.3182
21	1,722,296	1,244,563	0	2,966,859	0.0186	0.3369
22	2,495,665	1,885,240	0	4,380,905	0.0275	0.3644
23	1,941,858	1,759,956	0	3,701,814	0.0233	0.3876

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
24	2,767,353	1,602,170	0	4,369,523	0.0275	0.4151
25	1,239,234	2,177,606	0	3,416,840	0.0215	0.4366
26	1,410,939	1,819,410	0	3,230,349	0.0203	0.4569
27	2,774,372	3,042,966	0	5,817,338	0.0366	0.4934
28	3,751,068	2,661,674	0	6,412,742	0.0403	0.5337
29	5,337,384	4,185,363	0	9,522,747	0.0598	0.5935
30	6,250,028	5,699,763	0	11,949,791	0.0751	0.6686
31	4,887,510	4,864,383	0	9,751,893	0.0613	0.7299
32	2,393,442	4,889,419	0	7,282,861	0.0458	0.7756
33	2,871,511	2,939,872	0	5,811,383	0.0365	0.8122
34	1,167,322	3,846,918	0	5,014,240	0.0315	0.8437
35	449,592	2,951,587	0	3,401,179	0.0214	0.8650
36	369,320	3,115,791	0	3,485,111	0.0219	0.8869
37	177,011	4,539,966	0	4,716,977	0.0296	0.9166
38	156,796	3,591,223	0	3,748,019	0.0235	0.9401
39	26,874	3,260,619	0	3,287,493	0.0207	0.9608
40	0	1,588,247	0	1,588,247	0.0100	0.9707
41	112,905	1,298,666	0	1,411,571	0.0089	0.9796
42	0	1,295,428	0	1,295,428	0.0081	0.9878
43	0	559,139	0	559,139	0.0035	0.9913
44	0	478,445	0	478,445	0.0030	0.9943
45	0	759,539	0	759,539	0.0048	0.9990
46	0	30,519	0	30,519	0.0002	0.9992
47	0	60,679	0	60,679	0.0004	0.9996
48	0	60,679	0	60,679	0.0004	1.0000
Total	**62,458,224**	**80,891,973**	**15,808,334**	**159,158,531**	**1.0000**	**1.0000**

Appendix Table D-102. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
7	0	0	30,670	30,670	0.0004	0.0004
8	0	0	26,800	26,800	0.0003	0.0007
10	0	0	32,193	32,193	0.0004	0.0010
11	0	0	111,459	111,459	0.0013	0.0023
12	0	164,180	150,516	314,696	0.0037	0.0060
13	144,880	61,391	345,212	551,483	0.0064	0.0124
14	90,073	94,433	284,857	469,363	0.0055	0.0179
15	375,600	537,340	244,075	1,157,015	0.0134	0.0313
16	726,406	373,832	32,190	1,132,428	0.0132	0.0445
17	830,335	785,531	0	1,615,866	0.0188	0.0633
18	931,511	643,691	0	1,575,202	0.0183	0.0816
19	666,135	645,186	0	1,311,321	0.0152	0.0968
20	617,450	794,171	0	1,411,621	0.0164	0.1132
21	561,032	498,850	0	1,059,882	0.0123	0.1255
22	462,004	470,083	0	932,087	0.0108	0.1364
23	274,560	242,453	0	517,013	0.0060	0.1424
24	120,262	161,770	0	282,032	0.0033	0.1456
25	132,373	208,011	0	340,384	0.0040	0.1496
26	58,820	71,075	0	129,895	0.0015	0.1511
27	88,600	105,190	0	193,790	0.0023	0.1534

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
28	100,459	0	0	100,459	0.0012	0.1545
29	89,292	35,535	0	124,827	0.0015	0.1560
30	40,468	29,731	0	70,199	0.0008	0.1568
31	196,095	99,341	0	295,436	0.0034	0.1602
32	98,434	168,955	0	267,389	0.0031	0.1633
33	138,763	176,266	0	315,029	0.0037	0.1670
34	206,373	208,598	0	414,971	0.0048	0.1718
35	333,963	263,501	0	597,464	0.0069	0.1788
36	352,513	544,168	0	896,681	0.0104	0.1892
37	553,671	364,090	0	917,761	0.0107	0.1999
38	550,160	944,064	0	1,494,224	0.0174	0.2172
39	716,547	490,452	0	1,206,999	0.0140	0.2313
40	604,379	960,615	0	1,564,994	0.0182	0.2494
41	567,273	808,129	0	1,375,402	0.0160	0.2654
42	1,021,560	892,085	0	1,913,645	0.0222	0.2877
43	437,130	581,476	0	1,018,606	0.0118	0.2995
44	524,137	881,144	0	1,405,281	0.0163	0.3158
45	536,489	1,197,893	0	1,734,382	0.0202	0.3360
46	1,100,318	997,122	0	2,097,440	0.0244	0.3604
47	976,112	1,203,802	0	2,179,914	0.0253	0.3857
48	1,396,570	1,800,987	0	3,197,557	0.0372	0.4229
49	1,363,957	1,826,418	0	3,190,375	0.0371	0.4600
50	2,008,602	1,654,297	0	3,662,899	0.0426	0.5025
51	1,949,293	1,989,967	0	3,939,260	0.0458	0.5483
52	1,899,134	1,966,738	0	3,865,872	0.0449	0.5933
53	1,857,540	1,689,784	0	3,547,324	0.0412	0.6345
54	1,804,761	1,932,844	0	3,737,605	0.0434	0.6779
55	994,296	1,380,099	0	2,374,395	0.0276	0.7055
56	938,895	933,855	0	1,872,750	0.0218	0.7273
57	1,540,562	859,041	0	2,399,603	0.0279	0.7552
58	723,673	1,153,015	0	1,876,688	0.0218	0.7770
59	626,072	843,079	0	1,469,151	0.0171	0.7941
60	452,323	607,227	0	1,059,550	0.0123	0.8064
61	464,061	590,680	0	1,054,741	0.0123	0.8186
62	518,353	405,092	0	923,445	0.0107	0.8294
63	277,808	362,718	0	640,526	0.0074	0.8368
64	356,186	419,155	0	775,341	0.0090	0.8458
65	452,429	303,943	0	756,372	0.0088	0.8546
66	411,034	618,825	0	1,029,859	0.0120	0.8666
67	193,728	190,084	0	383,812	0.0045	0.8710
68	592,808	332,729	0	925,537	0.0108	0.8818
69	402,000	235,149	0	637,149	0.0074	0.8892
70	525,941	268,900	0	794,841	0.0092	0.8984
71	463,308	198,503	0	661,811	0.0077	0.9061
72	246,341	261,825	0	508,166	0.0059	0.9120
73	297,054	287,620	0	584,674	0.0068	0.9188
74	306,112	186,225	0	492,337	0.0057	0.9246
75	216,147	280,372	0	496,519	0.0058	0.9303
76	316,359	225,045	0	541,404	0.0063	0.9366
77	251,684	303,402	0	555,086	0.0065	0.9431
78	220,036	389,712	0	609,748	0.0071	0.9502
79	257,411	151,236	0	408,647	0.0047	0.9549
80	152,915	132,437	0	285,352	0.0033	0.9582
81	196,133	153,436	0	349,569	0.0041	0.9623

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
82	143,739	280,662	0	424,401	0.0049	0.9672
83	117,979	192,929	0	310,908	0.0036	0.9708
84	36,096	220,733	0	256,829	0.0030	0.9738
85	64,280	172,416	0	236,696	0.0028	0.9766
86	87,973	174,843	0	262,816	0.0031	0.9796
87	123,378	151,430	0	274,808	0.0032	0.9828
88	107,145	184,037	0	291,182	0.0034	0.9862
89	125,121	280,980	0	406,101	0.0047	0.9909
90	0	60,885	0	60,885	0.0007	0.9916
91	31,703	125,546	0	157,249	0.0018	0.9935
92	0	63,313	0	63,313	0.0007	0.9942
93	64,173	63,488	0	127,661	0.0015	0.9957
94	26,874	32,211	0	59,085	0.0007	0.9964
95	32,211	60,919	0	93,130	0.0011	0.9975
96	28,288	61,140	0	89,428	0.0010	0.9985
98	0	93,479	0	93,479	0.0011	0.9996
101	0	36,096	0	36,096	0.0004	1.0000
Total	**40,886,663**	**43,893,700**	**1,257,972**	**86,038,335**	**1.0000**	**1.0000**

Appendix Table D-103. -- Population estimates by sex and size for Pacific halibut (*Hippoglossus stenolepis*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
23	0	30,670	0	30,670	0.0030	0.0030
32	0	0	95,416	95,416	0.0092	0.0122
35	0	63,897	0	63,897	0.0062	0.0184
36	0	63,315	0	63,315	0.0061	0.0246
37	0	31,948	92,898	124,846	0.0121	0.0367
38	0	0	30,966	30,966	0.0030	0.0397
39	63,315	0	62,914	126,229	0.0122	0.0519
40	26,800	31,948	31,499	90,247	0.0087	0.0606
41	0	31,366	0	31,366	0.0030	0.0637
42	26,800	31,948	0	58,748	0.0057	0.0694
43	94,099	0	158,641	252,740	0.0245	0.0939
44	183,537	93,833	94,659	372,029	0.0361	0.1299
45	123,661	151,702	63,693	339,056	0.0329	0.1628
46	127,211	154,668	124,386	406,265	0.0394	0.2022
47	241,545	95,845	278,338	615,728	0.0597	0.2619
48	122,320	268,661	188,634	579,615	0.0562	0.3180
49	209,845	276,639	243,249	729,733	0.0707	0.3888
50	90,851	335,456	218,373	644,680	0.0625	0.4513
51	91,611	157,689	223,254	472,554	0.0458	0.4971
52	212,272	246,592	243,850	702,714	0.0681	0.5652
53	93,366	245,258	287,119	625,743	0.0607	0.6258
54	92,193	61,973	319,721	473,887	0.0459	0.6718
55	93,403	176,341	219,159	488,903	0.0474	0.7191
56	117,019	246,645	133,227	496,891	0.0482	0.7673
57	26,800	62,733	191,355	280,888	0.0272	0.7945
58	0	60,244	60,651	120,895	0.0117	0.8062
59	0	0	157,161	157,161	0.0152	0.8215
60	0	126,905	155,683	282,588	0.0274	0.8489

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
61	0	60,244	127,501	187,745	0.0182	0.8671
62	0	58,749	99,114	157,863	0.0153	0.8824
63	0	0	59,812	59,812	0.0058	0.8882
65	0	0	34,033	34,033	0.0033	0.8915
66	26,800	0	34,033	60,833	0.0059	0.8974
67	0	32,211	0	32,211	0.0031	0.9005
69	0	0	30,071	30,071	0.0029	0.9034
70	0	0	67,798	67,798	0.0066	0.9100
72	28,778	0	0	28,778	0.0028	0.9128
73	0	0	30,799	30,799	0.0030	0.9157
75	0	63,315	0	63,315	0.0061	0.9219
78	0	31,064	0	31,064	0.0030	0.9249
79	0	31,948	32,148	64,096	0.0062	0.9311
81	31,064	63,008	32,148	126,220	0.0122	0.9433
84	0	31,366	0	31,366	0.0030	0.9464
85	28,878	0	0	28,878	0.0028	0.9492
86	0	0	30,799	30,799	0.0030	0.9522
87	0	31,366	0	31,366	0.0030	0.9552
88	0	31,948	0	31,948	0.0031	0.9583
89	0	26,800	0	26,800	0.0026	0.9609
92	0	0	32,625	32,625	0.0032	0.9641
94	0	30,024	0	30,024	0.0029	0.9670
95	0	27,487	0	27,487	0.0027	0.9696
97	0	63,012	0	63,012	0.0061	0.9757
98	0	63,590	0	63,590	0.0062	0.9819
99	0	31,366	0	31,366	0.0030	0.9849
100	0	0	34,331	34,331	0.0033	0.9883
104	0	56,190	0	56,190	0.0054	0.9937
110	0	0	33,395	33,395	0.0032	0.9970
130	0	31,366	0	31,366	0.0030	1.0000
Total	**2,152,168**	**3,811,330**	**4,353,453**	**10,316,951**	**1.0000**	**1.0000**

Appendix Table D-104. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
8	0	0	880,663	880,663	0.0013	0.0013
9	31,538	0	1,300,985	1,332,523	0.0019	0.0032
10	63,076	0	5,798,185	5,861,261	0.0084	0.0116
11	126,153	0	29,778,012	29,904,165	0.0431	0.0547
12	94,615	0	31,436,107	31,530,722	0.0454	0.1001
13	93,101	0	68,577,875	68,670,976	0.0989	0.1990
14	2,467,736	945,774	61,898,709	65,312,219	0.0940	0.2930
15	1,234,420	2,748,792	47,326,929	51,310,141	0.0739	0.3669
16	120,169	1,168,173	25,884,058	27,172,400	0.0391	0.4060
17	152,062	176,188	3,729,070	4,057,320	0.0058	0.4119
18	66,772	32,290	278,807	377,869	0.0005	0.4124
19	0	30,945	60,474	91,419	0.0001	0.4126
20	59,097	308,682	0	367,779	0.0005	0.4131
21	94,106	0	0	94,106	0.0001	0.4132
25	62,567	0	0	62,567	0.0001	0.4133

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
33	185,646	85,588	0	271,234	0.0004	0.4137
38	0	26,184	0	26,184	0.0000	0.4137
39	26,815	144,399	0	171,214	0.0002	0.4140
40	28,776	211,830	0	240,606	0.0003	0.4143
41	129,579	364,062	0	493,641	0.0007	0.4150
42	744,689	163,069	0	907,758	0.0013	0.4164
43	2,139,361	557,037	0	2,696,398	0.0039	0.4202
44	2,601,404	1,391,471	0	3,992,875	0.0057	0.4260
45	5,539,041	2,936,043	0	8,475,084	0.0122	0.4382
46	9,424,381	5,188,069	106,380	14,718,830	0.0212	0.4594
47	14,116,001	9,408,551	53,190	23,577,742	0.0340	0.4933
48	16,900,563	13,455,632	0	30,356,195	0.0437	0.5370
49	17,996,166	19,170,353	106,380	37,272,899	0.0537	0.5907
50	15,277,927	22,136,282	159,570	37,573,779	0.0541	0.6448
51	12,633,671	19,959,947	159,570	32,753,188	0.0472	0.6920
52	12,204,763	17,069,009	0	29,273,772	0.0422	0.7341
53	9,191,602	18,121,423	53,190	27,366,215	0.0394	0.7735
54	8,807,038	14,315,559	53,190	23,175,787	0.0334	0.8069
55	6,335,313	15,196,495	106,380	21,638,188	0.0312	0.8381
56	7,076,807	11,210,691	0	18,287,498	0.0263	0.8644
57	7,736,184	11,647,117	0	19,383,301	0.0279	0.8923
58	3,682,263	11,850,808	0	15,533,071	0.0224	0.9147
59	5,822,985	6,173,749	0	11,996,734	0.0173	0.9320
60	1,833,541	9,137,843	53,190	11,024,574	0.0159	0.9478
61	2,380,960	6,992,287	0	9,373,247	0.0135	0.9613
62	1,262,439	6,019,361	0	7,281,800	0.0105	0.9718
63	599,854	3,885,647	0	4,485,501	0.0065	0.9783
64	712,751	4,627,203	0	5,339,954	0.0077	0.9860
65	418,788	2,468,221	0	2,887,009	0.0042	0.9901
66	216,584	3,310,128	0	3,526,712	0.0051	0.9952
67	209,662	1,064,751	0	1,274,413	0.0018	0.9970
68	300,371	564,058	0	864,429	0.0012	0.9983
69	0	292,250	32,870	325,120	0.0005	0.9988
70	127,460	155,305	0	282,765	0.0004	0.9992
71	0	109,829	0	109,829	0.0002	0.9993
72	62,477	94,874	0	157,351	0.0002	0.9995
73	0	118,361	0	118,361	0.0002	0.9997
74	0	79,721	0	79,721	0.0001	0.9998
75	0	27,961	0	27,961	0.0000	0.9999
76	30,067	27,961	0	58,028	0.0001	1.0000
78	0	30,574	0	30,574	0.0000	1.0000
Total	**171,421,341**	**245,200,547**	**277,833,784**	**694,455,672**	**1.0000**	**1.0000**

Appendix Table D-105. -- Population estimates by sex and size for yellowfin sole (*Limanda aspera*) from the 2022 northern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	1,059,930	1,059,930	0.0004	0.0004
6	0	0	2,050,457	2,050,457	0.0008	0.0012
7	2,380,694	396,087	17,637,929	20,414,710	0.0077	0.0089
8	3,666,413	3,262,980	42,948,817	49,878,210	0.0189	0.0279
9	11,612,427	7,809,854	24,194,102	43,616,383	0.0166	0.0444
10	33,814,210	30,756,722	14,069,271	78,640,203	0.0298	0.0742
11	67,782,198	58,970,595	10,493,095	137,245,888	0.0521	0.1263
12	64,708,107	58,189,801	3,795,762	126,693,670	0.0481	0.1744
13	66,794,542	46,912,698	1,964,799	115,672,039	0.0439	0.2183
14	72,881,438	56,137,582	844,929	129,863,949	0.0493	0.2676
15	79,443,794	61,256,312	0	140,700,106	0.0534	0.3210
16	81,521,028	71,331,094	739,273	153,591,395	0.0583	0.3793
17	90,106,841	71,641,659	614,545	162,363,045	0.0616	0.4409
18	72,087,802	61,188,200	921,818	134,197,820	0.0509	0.4918
19	54,530,983	54,306,368	614,545	109,451,896	0.0415	0.5333
20	45,612,830	51,385,606	0	96,998,436	0.0368	0.5701
21	33,137,514	39,905,334	1,229,090	74,271,938	0.0282	0.5983
22	32,515,890	30,095,465	307,273	62,918,628	0.0239	0.6222
23	26,037,470	25,187,703	614,545	51,839,718	0.0197	0.6419
24	27,128,157	22,965,673	0	50,093,830	0.0190	0.6609
25	18,168,185	23,235,705	307,273	41,711,163	0.0158	0.6767
26	11,354,466	19,117,452	307,273	30,779,191	0.0117	0.6884
27	23,336,982	16,031,178	0	39,368,160	0.0149	0.7033
28	24,840,651	12,121,161	307,273	37,269,085	0.0141	0.7175
29	28,600,585	18,603,173	0	47,203,758	0.0179	0.7354
30	45,533,244	18,694,292	614,545	64,842,081	0.0246	0.7600
31	39,882,452	18,174,213	614,545	58,671,210	0.0223	0.7823
32	52,592,219	35,918,869	921,818	89,432,906	0.0339	0.8162
33	54,388,768	33,008,930	614,545	88,012,243	0.0334	0.8496
34	37,756,971	32,444,023	307,273	70,508,267	0.0268	0.8764
35	38,273,521	28,055,368	614,545	66,943,434	0.0254	0.9018
36	27,681,974	24,944,980	307,273	52,934,227	0.0201	0.9218
37	20,327,726	32,589,995	1,229,090	54,146,811	0.0205	0.9424
38	18,377,157	31,643,937	307,273	50,328,367	0.0191	0.9615
39	6,568,538	27,009,218	614,545	34,192,301	0.0130	0.9745
40	6,055,411	17,096,132	614,545	23,766,088	0.0090	0.9835
41	1,457,383	14,230,612	307,273	15,995,268	0.0061	0.9896
42	477,176	13,421,142	307,273	14,205,591	0.0054	0.9949
43	559,654	5,262,973	0	5,822,627	0.0022	0.9972
44	102,717	3,487,593	0	3,590,310	0.0014	0.9985
45	0	1,523,635	0	1,523,635	0.0006	0.9991
46	0	484,346	0	484,346	0.0002	0.9993
47	0	1,825,154	0	1,825,154	0.0007	1.0000
49	0	82,192	0	82,192	0.0000	1.0000
Total	**1,322,098,118**	**1,180,706,006**	**132,396,542**	**2,635,200,666**	**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
Janet Coit

April 2023

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