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Preliminary Results from the 2024 August Ecosystem Survey in the Estuary and Northern Gulf of St. Lawrence

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Fisheries and Oceans Canada conducts an annual multidisciplinary survey in the Estuary and the northern Gulf of St. Lawrence. The objectives of this survey are varied: estimate the abundance of groundfish and invertebrates; assess physical, chemical and biological (phytoplankton and zooplankton) oceanographic conditions; assess the biodiversity of species found in the demersal zone; monitor the pelagic ecosystem; and collect samples for various research projects. In 2024, the survey was conducted between August 2 and September 4 on board the Canadian Coast Guard Ship (CCGS) *John Cabot*. During this survey, 163 trawl tows were completed. In addition, 79 vertical profiles of the water column were carried out to characterize oceanographic conditions and 41 zooplankton samples were also collected.

This report presents the results of catches of the successful tows. In total, 79 fish taxa and 212 invertebrate taxa were identified during the survey. Historical perspectives (catch rates, spatial distribution and length frequency) are presented for 26 taxa. These commercial fishery-independent data will be used in several stock assessments including Atlantic Cod (*Gadus morhua*), Redfish (*Sebastes spp.*), Greenland Halibut (*Reinhardtius hippoglossoides*), Atlantic Halibut (*Hippoglossus hippoglossus*), Witch Flounder (*Glyptocephalus cynoglossus*), and Northern Shrimp (*Pandalus borealis*).

The preliminary analysis of water temperature measurements in 2024 shows conditions that have slightly cooled at depths of 150 m and more for a second consecutive year, since the centennial records reached in 2022. The summer temperature of the cold intermediate layer was similar to that of 2023; it would be the 4th warmest that has been measured with modern instruments since 1985. The surface water temperature was above normal during the periods of July-August and May-August, close to record values.

INTRODUCTION

Fisheries and Oceans Canada (DFO) conducts an annual bottom trawl survey in the Estuary and the northern Gulf of St. Lawrence (hereafter NGSL survey). This ecosystem survey is fishery-independent. Its purpose is to assess the ecosystem with consistent and standardized protocols. This survey examines, among other things, spatial and temporal changes in the distribution and relative abundance of fish and their assemblages. It also aims to gather information on the biological parameters of commercial species.

The main objectives are:

1. Assess groundfish and Northern Shrimp population abundances and conditions;
2. Assess environmental conditions;
3. Conduct a biodiversity inventory of benthic and demersal megafauna;
4. Assess phytoplankton and mesozooplankton abundances;
5. Monitor the pelagic ecosystem;
6. Collect samples for various research projects.

In 2024, the survey was conducted between August 2 and September 4 onboard the CCGS *John Cabot* (survey IML-2024-033).

SURVEY DESCRIPTION

The NGSL survey covers the waters of the Laurentian Channel and the area north of it, from the Maritime Estuary in the west to the Strait of Belle Isle and the Cabot Strait in the east, namely, the Northwest Atlantic Fisheries Organization (NAFO) divisions 4R, 4S, and the northern part of 4T (Figure 1). Since 2008, the coverage of division 4T has been increased in the upstream portion of the Maritime Estuary to sample the depths between 37 and 183 m (i.e., strata 851, 852, 854, and 855). The study area covers 118,587 km^2.

This survey follows a random stratified sampling design where the study area is composed of 56 strata similar in depth and substrate type, while respecting the NAFO divisions (Figure 2). Before 2013, the initial allocation was 200 trawling stations with a minimum of 3 and a maximum of 8 stations per stratum. From 2013 to 2022, this initial allocation remained the same, but the minimum number of stations per stratum was reduced to two. Starting in 2023, the initial station allocation was reduced to 180 with a minimum of 2 and a maximum of 7 stations per stratum, which is a more realistic target that limits modifications to the sampling plan during the survey. The positions of the tows are determined randomly within each stratum. Since 2014, a new rule was added to the survey design to respect a minimum distance of 10 km among stations of the same stratum and, starting in 2023, this constraint has been extended to all stations regardless of their stratum.

The fishing gear used on the CCGS *John Cabot* is a four-sided modified Campelen 1800 shrimp trawl equipped with Rockhopper footgear (McCallum and Walsh 2002). The trawl lengthening and codend are equipped with a 12.7 mm knotless nylon lining (Benoît et al. 2024).

The duration of a standard tow was set at 15 minutes at 3 knots and was calculated from the time the trawl contacted the bottom, determined using the *Scanmar*™ hydroacoustic system. For each tow, information on the geometry of the trawl while in operation (horizontal openings of the doors and wings, vertical opening of the trawl, and depth) was recorded using *Scanmar*™ hydroacoustic probes attached to the fishing gear.

For each fishing tow on board the CCGS *John Cabot*, the catch was sorted and weighed by taxa and sub-samples of biological data were then collected. For fish, squids and sea pens, size and weight were individually measured. For some species, sex, maturity, and the weight of certain organs (*e.g.,* stomach, liver, gonads) were also evaluated. Counts of soft anal fin rays for redfish (*Sebastes sp.*) were conducted to distinguish between the two species present in the NGSL (Senay et al. 2022). Otoliths were collected for Atlantic Cod, Atlantic Halibut, Greenland Halibut, Witch Flounder, and Redfish to determine the age of the fish. A sample of approximately 2 kg of shrimps was sorted and weighed by species as well as by maturity stage for Northern Shrimp. Shrimps were measured individually. Crabs were measured and sexed individually. Other invertebrates were weighed and counted (no individual measurements) by taxon. All taxa are photographed and the photographs are archived in a photo-catalog with keywords (taxonomic identification, station metadata, date, etc.).

Since 2022 on the CCGS John Cabot, the data entry software was replaced by the Andes[1] system developed by the Gulf region of DFO (Ricard et al. 2024) and adapted for the NGSL survey. The application, which relies on open source software and uses a shared code development platform, allows for features such as length-stratified biological sampling that were not easily implemented in the old system[2]. In 2024, individual weight, sex, and maturity measurements were made according to a length-stratified sampling for Atlantic cod (1/cm/station) rather than on a random basis (measurements taken on the first 30 individuals). Similarly, weight and maturity measurements were taken according to a length and sex-stratified sampling design for Greenland Halibut (1/cm/sex/station).

Since 2001, an increased effort in the identification of species has been aided through the use of digital photos. These additional efforts have targeted fish since 2004 (Dutil et al. 2009) and invertebrates since 2005 (Nozères et al. 2014). An identification guide for marine fishes in the estuary and northern Gulf of St. Lawrence (Nozères et al. 2010), a shrimp atlas (Savard and Nozères 2012), and two identification guides for invertebrates (Nozères and Archambault 2014, Isabel et al. 2024) were used during the survey to identify most taxa. The taxon codes and their names followed Miller and Chabot (2014) and have been updated annually according to the World Register of Marine Species (WoRMS).

Additional samples were collected for various scientific projects:

1. Stomachs of several fish species to describe their diet;
2. Samples of herring (*Clupea harengus*), capelin (*Mallotus villosus*), and mackerel (*Scomber scombrus*) to determine maturity at age;
3. Blood samples from herring (molecular markers);
4. Genetic analyses targeting Atlantic cod, Atlantic Halibut, Northern Shrimp, Winter Skate, and other species;
5. Genetic and microbiome analyses of White Hake (*Urophycis tenuis*);
6. Small redfish (< 11 cm) for genetic identification of the species (*S. fasciatus* or *S. mentella*) and the population of new cohorts observed in the NGSL;
7. Monitoring the growth of redfish from the 2011 cohort;

[1] Another Data Entry System

[2] A Visual Basic application relying on an Access database.

8. Histology of fish gonads (White Hake, Yellowtail Flounder (*Limanda ferruginea*), and Witch Flounder);
9. Age, stable isotopes, and genetic analyses of the Black Dogfish (*Centroscyllium fabricii*);
10. Prey of Belugas and marine mammals (several species of fish and Northern Shrimp) to monitor the evolution of isotopic signatures of key NGSL species;
11. Samples of small demersal fish;
12. Maturity of the Northern Shortfin Squid (*Illex illecebrosus*);
13. Collection of tunicate species to identify the presence of potentially invasive species;
14. Collection of sponges (*Porifera spp.*) to document the different species present;
15. Collection of sea pens and associated taxa;
16. Water samples for environmental DNA analyses;
17. Image collections by baited stereoscopic video cameras.;

Oceanographic data such as temperature, conductivity (i.e., salinity), turbidity, dissolved oxygen, luminosity, and fluorescence were collected during this survey. A total of 69 vertical profiles of the water column were done at the fishing stations. In addition, 10 additional profiles were carried out at stations sampled exclusively for the Atlantic Zone Monitoring Program (AZMP). The various equipment, *CTD SeaBird 911Plus*™, dissolved oxygen sensor (*SBE 43*), photometer (*Biospherical*) and fluorometer (*Eco-FLNTU Wetlabs*) were coupled to the rosette of Niskin bottles. For each profile obtained using the rosette, water samples were also taken at several depths to determine their salinity, pH, dissolved oxygen concentration (Winkler titration), nutritive salt content (nitrite, nitrate, phosphate, silicate), and chlorophyll content. In addition, a *CTD SBE 19Plus*™ device (temperature and salinity), coupled to a dissolved oxygen sensor (*SBE 63*), was also installed on the back of the trawl, thereby allowing oceanographic data to be collected for the 163 fishing tows on the CCGS *John Cabot*.

To study the distribution and biomass of zooplankton for the entire surveyed area, a part of the sampling program consisted of collecting organisms at 41 stations using a zooplankton net (202 µm) drawn vertically, from the bottom to the surface.

Water column hydroacoustic data were recorded at four frequencies (38, 70, 120 and 200 kHz) using a *SIMRAD*™ *EK60* echosounder during the entirety of the survey. These data will be used to characterize the pelagic ecosystem.

DATA ANALYSIS

Abundance and biomass data collected on species caught in 2024 were integrated into the series of annual summer survey series initiated in 1990. During this period, three vessel-gear tandems were used (1990-2005: CCGS *Alfred Needler* – *URI 81'/114'* trawl; 2004-2022: CCGS *Teleost* – *Campelen 1800* trawl; 2022-2024: CCGS *John Cabot* – modified *Campelen 1800* trawl). The integrity of the time series has been preserved thanks to these comparative fishing studies to quantify the difference in catchability between vessel-gear tandems. The first study took place in 2004-2005 between the *Needler* and the *Teleost* (Bourdages et al. 2007) and the second study in 2021-2022 between the *Teleost* and the *John Cabot* (Benoît et al. 2024). Conversion factors for taxa were therefore applied to catches and length frequencies for taxa where the difference in catchability was significant. The results presented in this document are expressed as the equivalent of the most recent vessel used, the CCGS John Cabot with a modified *Campelen* 1800 trawl.

During comparative fishing experiments, several stations were successfully fished at the same time by two vessels. To avoid pseudo-replicates at comparative stations (information from two trawl hauls at the same station and at the same time), only the stations from the most recent vessel-gear tandem were retained for the analyses.

The annual catch rate indices, in terms of the mean number and weight (kg) per standardized tow (15 minutes tow, i.e., a swept area of 0.75 nautical miles with an average wingspread of 16.71 m (wingspread average for the *Campelen* trawl on the *John Cabot*)), and their confidence intervals were estimated using the estimators for stratified random sampling (Appendix 1). Given that over the years, some strata were not sampled with a minimum of two successful tows (Table 1), a multiplicative model of the form:

log(catch + 0.01) ~ stratum + year,

was used to estimate the indices of these missing strata. This model provided a predicted value for strata with less than two tows using the data of the current year and the previous three years, or from the current year and the three adjacent years for missing strata in the first three years of the series. Thus, indicators presented for the series are representative of a standard total area of 116 115 km^2, the sum of the area of the strata sampled since 1990. Fishing stations in the strata added in 2008 are not used for the calculations of indices. In addition, reference levels were also added to the catch rate figures. Solid lines represent the 1990-2023 period average (long-term average) and the two dotted lines associated with the mean ±0.5 standard deviation correspond respectively to the upper and lower reference limits.

Note that the distinction between the two redfish species, *S. fasciatus and S. mentella*, is based on the analysis of the soft anal fin rays counts and the depth of capture of individuals (Senay et al. 2022).

Length frequency distributions for each species presented come in two different forms. The first figure shows distributions for the last two years of the time series and the mean distribution for the 1990-2023 period (long-term average distribution). Frequency values are expressed as the average number of individuals caught per tow in increments of 1 cm, except for northern shrimp (0.5 mm) and Atlantic halibut (3 cm). The second figure represents the length frequency distribution in mean number per tow for each year of the historical surveys series (1990 to 2024).

The geographical distribution of catch rates (or catch per unit of effort, CPUE), in kg per 15 minute tow (except for sea pens, number/15 minute tow) was made for periods of five or six years. The interpolation of CPUE was performed on a grid covering the study area using inverse distance weighed interpolation (R version 4.3.2, Rgeos library; R Development Core Team 2023). The isoline contours were then plotted for four CPUE levels which approximate the 20th, 40th, 60th and 80th percentiles of the non-zero values. The catch rate distributions for the 2024 survey are also presented in a bubble map.

The preliminary results for the abundance and biomass indices, the catch rate distribution maps, and the size-frequency distributions for 26 taxa are presented in Figures 5 to 66. These results are preliminary and must be considered as such until validations and laboratory analyses have been completed.

Two indicators based on thermal preferences have been calculated in order to track changes in the community of species sampled in the survey in response to environmental changes. The indicators are based on the annual biomass values of non-commercial species with a close association with the cold and warm waters of the estuary and Gulf of St. Lawrence. The species composition of the two thermal guilds was determined by combining expert knowledge and an empirical approach based on catch and temperature data collected in the survey. Species

targeted by commercial fishing in the estuary and Gulf of St. Lawrence were excluded from the analyses. The cold guild is composed of a species associated with cold, oxygenated waters of the Labrador Current, the Arctic Cod (*Boreogadus saïda*), and species for which 80% or more of the catch over the entire series (1990-2024) were found at temperatures of 3 degrees Celsius or lower, namely the Atlantic Spiny Lumpsucker (*Eumicrotremus terraenovae*) and the shrimps *Eualus macilentus* and *Argis dentata*. The warm guild is composed of species associated with the warm waters of the Gulf Stream and/or species for which 80% or more of the catch in the survey is found at temperatures of 6 degrees Celsius or higher, namely the silver hake (*Merluccius bilinearis*), the Northern Shortfin Squid, the Atlantic Argentine (*Argentina silus*), and the shrimps *Pontophilus norvegicus* and *Atlantopandalus propinqvus*. Note that for shrimp species, systematic identification has only been carried out since 2006. Therefore, results before this date should be interpreted with caution. The variation of indicators based on thermal guilds is presented in Figure 67 in the form of a sum of anomalies. The anomalies for each taxon correspond to the difference between the CPUE of a given year and the average CPUE of the time series, divided by the standard deviation of this average.

The average weight per tow for 57 taxa of fish and 99 taxa of invertebrates are given in Figures 68 and 69. In these figures, a color code was used to represent the anomalies.

Data on catches per tow for fish taxa are available on the St. Lawrence Global Observatory (SLGO).

Finally, Table 2 provides a list of all taxa, vertebrates and invertebrates, caught among the 163 successful tows achieved during the 2024 survey. The occurrence (the number of tows where the taxa was identified), as well as the total catch, by weight and numbers, are also presented. The number of specimens measured per taxon and some descriptive statistics for the length are presented in Table 3.

RESULTS

Warning: this bottom trawl survey was designed to sample demersal and benthic species. However, catches may also include pelagic species and/or species associated with coastal or rocky habitats which are more difficult to trawl. Although these taxa are found in catches, they have a low catchability by the bottom trawl net. The results for these taxa should therefore be interpreted with caution.

In 2023, the time at sea for the NGSL survey was reduced by a third and the study area could not be fully covered due to operational issues with the NGCC *John Cabot*. Therefore, a total of 107 stations were fished and two sectors were not sampled, namely the Strait of Belle Isle and the St. Lawrence Estuary west of Pointe-des-Monts (Figure 3). The reliability of the multiplicative model for imputing values to large unsampled areas is unknown (except for 2 size classes of Greenland halibut, DFO 2024). The 2023 indices therefore include this additional uncertainty. The rest of the document focuses on the results of the survey conducted in 2024.

Out of 180 planned stations, 163 were successfully fished in 2024, with 50 in 4R, 70 in 4S, and 43 in 4T. All strata were sampled with a minimum of two stations except for strata 414, 821, 824, and 841 for which 1 station was completed. (Figure 4, Table 1).

BIODIVERSITY

In total, 79 fish taxa and 212 invertebrate taxa were identified in 2024 (Table 2).

In 2024, the biomass of the two redfish species combined accounted for 81% of the biomass of all captured organisms in the survey (e.g., invertebrates, pelagic fish, demersal fish and groundfish), while it averaged 15% of the biomass between 1995 and 2012 (Figure 5). The

Atlantic redfish (*Sebastes mentella*) constituted, alone 73% of the trawlable biomass during the survey, indicating that it dominates the demersal ecosystem of the NGSL.

In 2024, the biomass of the two combined redfish species accounted for 81% of the biomass of all organisms captured in the survey (*e.g.*, invertebrates, pelagic, demersal, and bottom fish) while it averaged 15% between 1995 and 2012 (Figure 5). The Atlantic Redfish (*Sebastes mentella*) alone made up 73% of the trawlable biomass during the survey, indicating that it dominates the demersal ecosystem of the NGSL.

The indicator for warm water species has been increasing since 2017 and has reached values never before observed since 2020 (Figure 67 A). Silver Hake and the *Atlantopandalus* shrimp have been strongly increasing since 2022. Atlantic Argentine has been increasing since 2021 (Figure 67 A). Northern Shortfin Squid has been decreasing since 2022, after reaching a peak in 2020. However, the biomass of this species remains higher than before 2015 (Figure 60). The indicator for cold water species has consistently been below average since 2013 (Figure 67 B). These results suggest that the warming of the waters of the NGSL has already begun to affect the composition of marine communities.

Fish

The abundance and biomass of the Black Dogfish (*Centroscyllium fabricii*) were above average in 2024, a general trend that has been maintained since 2012. (Figures 6 to 8).

Capelin (*Mallotus villosus*) was mainly distributed in the estuary and the west of the gulf, with some catches north of Anticosti, on the west coast of Newfoundland, and in the Strait of Belle Isle (Figure 8).

For the past eleven years, the abundance and biomass of Atlantic Halibut (*Hippoglossus hippoglossus*) have remained above the series average (Figures 10 à 12). The species is distributed throughout the NGSL.

The abundance of Greenland Halibut (*Reinhardtius hippoglossoides*) has been decreasing since the mid-2000s. In 2024, these indicators were significantly below average. The length frequency distributions suggest that the 2023 cohort (with a mode at 18 cm) had an intermediate abundance, situated between the strong and weak recruitments observed throughout the chronological series. The abundance of individuals over 30 cm has decreased compared to that estimated in 2023 (Figures 13 to 15).

Lumpfish (*Cyclopterus lumpus*) is species that is not abundant in the catches but regularly observed in this survey. The abundance and biomass for this species were below the series average since 2022 (Figures 16 to 18).

Atlantic Herring (*Clupea harengus*) is frequently caught in this survey and was distributed throughout the NGSL except for the deeper stations in the Laurentian Channel. The highest catches were observed along the west coast of Newfoundland and in the Strait of Belle Isle (Figure 19).

Atlantic Wolffish (*Anarhichas lupus*) and Spotted Wolffish (*Anarhichas minor*) were caught on 25 and 3 occasions, respectively, in 2024. These catches were mainly distributed in the eastern part of the NGSL (Figures 20 and 21).

Since 2007, Silver Hake (*Merluccius bilinearis*) has been more frequent in the NGSL, while it had only been observed occasionally in the 1990s and early 2000s (Figures 22 to 24).

The abundance and biomass of Longfin Hake (*Phycis chesteri*) were below the series average in 2024 (Figures 25 to 27).

The abundance and biomass of White Hake (*Urophycis tenuis*) were below the series average in 2024 (Figures 28 to 30).

In 2024, the abundance and biomass indices of Atlantic Cod (*Gadus morhua*) stabilized below the average of their respective time series. No signs of strong recruitment were detected in 2024. The geographical distribution of catches in 2024 was mainly concentrated along the west coast of Newfoundland and in the Strait of Belle Isle. (Figures 31 to 33).

Girard's Hagfish (*Myxine limosa*) is a species associated with the depths of the Laurentian Channel. The abundance and biomass indices have varied without an observable long-term trend since the early 1990s. In 2023 and 2024, these indices reached the lowest values observed since 1990. The majority of individuals captured measured between 30 and 45 cm (Figures 34 to 36).

American Plaice (*Hippoglossoides platessoides*) is very common in catches. Its abundance and biomass in 2024 were below their historical average. (Figures 37 to 39).

Witch Flounder (*Glyptocephalus cynoglossus*) was frequently caught. The strong cohorts from 2007 and 2009 contributed to the increase in biomass; these fish are now larger than 30 cm (Figures 40 to 42).

Thorny Skate (*Amblyraja radiata*) and Smooth Skate (*Malacoraja senta*) are both caught frequently. The abundance and biomass of Thorny Skate were slightly below their respective averages in 2024. For the Smooth Skate, these indices were decreasing and were well below their average in 2024. (Figures 43 to 48).

Arctic Cod (*Boreogadus saida*) is a small cold water demersal fish. Catches in recent years were made in the Estuary, along the North Shore and on the west coast of Newfoundland (Figures 49 to 50).

Acadian redfish abundance and biomass (*Sebastes fasciatus*) were close to the averages of their respective time series in 2024 (Figures 51 to 53).

Three strong cohorts (2011, 2012, and 2013) of Atlantic Redfish (*Sebastes mentella*) have contributed to the increase in abundance and biomass observed between 2013 and 2019. Although still at historically high levels, the indices have been decreasing since 2020. The 2011 cohort, which was the most abundant, has a modal size of 25 cm, indicating a significant slowdown in growth. These redfish were distributed throughout the channels of the NGSL (Figures 54 to 56).

Invertebrates

The three most abundant shrimp species in the deep waters of the northern Gulf of St. Lawrence, northern shrimp (*Pandalus borealis*), striped pink shrimp (*Pandalus montagui*) and pink glass shrimp (*Pasiphaea multidentata*), have been declining for several years (Figure 69).

The abundance and biomass of Northern Shrimp (*Pandalus borealis*) have declined substantially since 2003 to reach the lowest values in the series since 2022 (Figures 57 to 59).

Northern Shortfin Squid (*Illex illecebrosus*), a pelagic species visiting the NGSL seasonally, was present in more than 50% of the tows from 2017 to 2021, except for the estuary and the Strait of Belle Isle sectors. The species was much less present in 2022, 2023, and 2024 (Figures 60 to 62).

Five species of sea pens, a type of soft coral, are found in the NGSL. The large sea pens (*Anthoptilum grandiflorum, Balticina finmarchica*, and *Ptilella grandis*) were distributed in the

depths of the Laurentian Channel while the thorny sea pen (*Pennatula aculeata*) was more widely distributed (Figures 59 to 62). Another species of small sea pen (*Kophobelemnon stelliferum*) was first identified in 2020 and then seen again in 2022 and 2024. This species is found exclusively in the depths of the Laurentian Channel in the Cabot Strait. A retrospective review of sea pen identifications using the invertebrate photo-catalogue allowed us to identify a specimen of this species collected in 2018. It had previously been classified as debris of a thorny sea pen.

PHYSICAL OCEANOGRAPHIC CONDITIONS

Preliminary analyses of water temperature data collected in 2022 (Figures 70 and 71) showed that temperatures have cooled slightly at depths greater than 150 m for a second consecutive year, following the centennial records reached in 2022. Compared to the conditions observed in 2023, the waters have cooled on average by about 0.15 °C at 150 m, 0.1 °C at 200 m, and 0.3 °C at 300 m. However, they remain largely above the 1991-2020 climatological average. The minimum temperature of the cold intermediate layer in 2024 was similar to that of 2022 and 2023 and would be the 4th warmest that has been measured with modern instruments, since 1985, although the 2024 value is estimated here only from the data of the August (NGSL) and September (southern GSL) 2024 surveys. The surface water temperature was on average above the normal by + 1.6 °C during the July-August and May-August periods, close to record values.

The monthly averages of air temperature over the gulf were above normal for all months between December 2023 and August 2024, which resulted in surface water temperatures significantly above normal for the May-August average (+ 2.1 standard deviations compared to the 1991-2020 climatology and + 1.6 °C) and July-August (+ 1.8 standard deviation; + 1.6 °C). These values are close to the records of the series.

At the end of winter 2022, the volume of water in the surface mixed layer with temperatures lower than 0°C was lower than normal, forecasting a slightly warmer than normal summer Cold Intermediate Layer (CIL) of 0.10 °C. However, the CIL seasonal average minimum temperature (the Gilbert and Pettigrew index) was estimated for 2022 using only data from the August survey until a full season analysis is made, and it would potentially be only slightly cooler than the modern era record of 2021, going from 0.63 °C to 0.59 °C.

At the end of winter 2024, the volumes of water in the surface layer with a temperature lower than -1 °C and lower than 0 °C were below normal. This suggested a warmer than normal summer cold intermediate layer (CIL) similar to 2022 and 2023 (Galbraith et al. 2024). The seasonal average of the minimum temperature of the CIL (the Gilbert and Pettigrew 1997 index) was estimated for 2024 only from the data of the August survey until a full season analysis is completed. The latter would remain similar to 2023, going from 0.24 °C to 0.31 °C, and would be the 4th warmest since 1985.

Beneath the cold intermediate layer, the estuarine flow that carries deep waters to the heads of the channels has carried the increasingly warm waters that have been transitioning through Cabot Strait, central Gulf and Esquiman Channel for the past several years further upstream (Galbraith et al. 2024). However, the average temperature across the entire gulf reached a maximum in 2022 at 150, 200, and 300 m and has been decreasing since (Figure 71). Cooler waters were present in the Cabot Strait in August-September 2024, even approaching the 1991-2020 climatological normal, while the warm waters finished their transit towards the Saint Lawrence estuary, where the temperature still increased in 2024. Cooler waters should reach the estuary by 2025. Considering all the data taken at different months of the year 2024 before the fall, the average across the entire gulf at 150, 200, and 300 m was respectively 3.6 °C,

5.7 °C, and 6.6 °C (Figure 71). No deep water with a temperature > 6.9 °C was measured in the gulf in August-September 2024.

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TABLES

Table 1. Number of successful stations per stratum for the DFO survey.

Stratum	NAFO	Surface (km^2)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
401	4T	545	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	6	3	3	3	3	0	3	3	2	2	3	2	2	2	2	1	2	2
402	4T	909	3	5	5	3	3	1	3	2	3	5	3	3	3	2	0	3	3	3	3	3	3	3	3	3	2	3	2	2	2	2	2	2	3
403	4T	1190	3	3	3	3	3	3	10	10	3	5	3	3	3	3	6	4	3	3	3	3	3	3	3	2	2	3	2	2	1	2	2	1	2
404	4T	792	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	6	3	3	3	3	0	3	3	3	2	3	2	2	2	2	2	2	2
405	4T	1478	3	3	3	3	3	3	3	2	4	4	4	3	3	3	2	9	3	3	3	3	3	3	3	3	2	3	2	2	2	2	2	2	3
406	4T	2579	5	3	3	3	3	3	5	5	3	5	3	4	5	3	5	6	4	4	4	3	3	3	4	3	3	4	4	4	3	3	4	4	4
407	4T	2336	5	3	3	3	3	3	3	3	2	3	3	3	3	5	3	5	3	3	3	3	0	3	3	2	4	4	2	3	4	3	3	3	4
408	4T	2734	4	5	5	3	2	3	3	2	5	5	4	3	3	3	2	11	4	4	4	4	3	3	4	3	4	4	2	4	3	2	2	2	5
409	4T	909	3	3	3	3	0	3	4	3	3	4	4	4	3	3	3	4	3	3	3	3	3	3	2	3	2	2	2	2	2	2	2	2	2
410	4T	1818	2	3	3	3	4	6	10	6	5	4	4	4	5	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2
411	4T	1859	3	3	3	3	4	7	9	7	6	9	5	9	4	3	5	8	3	3	3	3	3	3	3	3	3	3	2	3	3	3	2	3	3
412	4T	1283	3	3	3	3	4	5	3	3	3	4	4	4	3	3	2	5	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2
413	4T	731	3	4	3	3	0	3	3	4	3	4	4	4	3	3	1	5	3	3	3	3	3	3	3	2	2	2	2	2	2	2	1	2	2
414	4T	388	3	2	3	3	1	3	3	3	3	4	4	4	3	3	3	6	3	3	2	1	3	3	2	3	2	2	2	0	2	1	0	2	2
801	4R	1214	3	3	3	4	3	3	3	3	4	5	5	5	2	3	3	4	3	3	3	3	2	3	3	3	3	3	3	2	3	3	3	2	4
802	4R	1369	3	3	3	3	3	3	3	3	3	3	3	3	2	8	3	8	2	3	3	3	0	3	3	3	3	3	2	3	3	3	2	2	2
803	4S	6976	14	3	2	4	3	3	3	3	4	5	3	4	6	2	1	14	6	8	8	7	3	6	7	3	10	8	5	8	8	4	4	5	8
804	4S	2490	5	4	3	3	4	3	3	3	3	3	3	6	3	2	3	10	3	3	3	3	3	3	3	3	4	4	4	4	3	3	3	3	4
805	4S	5762	14	7	4	4	6	4	11	8	4	5	5	5	12	8	4	10	8	7	7	6	4	5	7	5	7	7	9	7	5	6	6	8	7
806	4S	2127	4	4	3	3	3	3	3	3	3	3	3	3	3	3	5	4	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2
807	4S	2370	3	12	11	10	5	5	4	4	3	3	4	3	2	1	0	7	3	3	3	3	3	2	3	3	4	4	4	4	3	2	3	2	5
808	4S	2428	4	7	6	4	5	4	3	3	2	4	3	3	3	3	0	3	3	3	3	3	2	3	3	2	4	4	4	4	4	0	2	3	4
809	4R	1547	3	9	7	6	4	3	3	3	3	3	3	3	3	3	1	5	3	3	3	3	3	3	2	3	3	3	4	3	3	0	3	2	3
810	4R	765	3	4	5	4	3	3	3	3	4	4	4	4	6	5	3	8	3	3	4	3	0	3	3	2	3	2	2	2	2	1	1	2	2
811	4R	1506	3	4	4	4	5	3	8	6	3	3	3	3	3	3	3	7	3	3	3	2	2	2	3	2	2	2	2	2	2	0	2	2	2
812	4R	4648	7	9	8	11	4	3	3	3	3	3	3	3	3	3	4	5	5	4	5	4	5	3	5	3	8	7	6	6	5	6	5	5	9
813	4R	3958	6	6	5	9	3	4	6	5	7	4	6	8	2	5	3	9	5	3	5	3	4	4	6	3	6	6	4	3	5	5	6	4	5
814	4S	1029	3	4	4	4	3	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2
815	4S	4407	9	15	11	8	5	4	3	3	8	9	9	2	6	3	3	14	5	5	6	5	5	3	6	4	6	7	6	6	5	6	4	7	7
816	4S	5032	9	11	9	9	6	6	17	17	20	21	21	1	6	4	4	11	7	7	7	6	4	4	3	6	6	8	7	7	5	6	4	6	7
817	4S	3646	7	18	11	7	9	10	9	5	11	17	13	14	8	5	2	7	5	5	4	5	3	3	4	4	5	4	6	6	5	5	6	5	6
818	4S	2774	4	7	5	4	3	3	3	4	4	4	4	5	7	5	1	6	4	4	2	4	3	4	3	3	4	5	4	5	4	4	5	1	5
819	4S	1441	3	7	9	5	4	5	3	2	3	3	4	1	1	3	0	8	2	3	3	2	3	3	3	3	3	2	2	2	2	2	1	2	0	3
820	4R	1358	3	3	3	3	3	3	7	5	6	5	5	3	2	3	3	14	3	3	3	3	0	2	3	3	3	3	2	3	3	0	2	3	2
821	4R	1272	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3	7	3	3	3	3	2	4	3	3	3	2	2	3	3	0	2	1	3
822	4R	3245	6	4	3	2	3	3	6	4	10	8	10	9	3	3	3	8	4	4	4	3	4	2	4	2	5	3	4	2	3	4	5	4	5
823	4R	556	3	3	3	3	2	3	2	3	1	3	2	3	2	5	2	10	3	3	3	3	2	3	3	3	3	3	2	2	3	3	2	2	3
824	4R	837	3	1	3	1	3	3	3	3	3	3	2	3	2	2	3	6	3	3	3	3	2	3	3	2	2	2	1	2	2	2	2	2	2
827	4S	3231	0	1	1	1	3	3	0	2	3	1	3	0	2	2	3	6	4	4	3	3	3	2	3	2	2	3	3	4	0	2	3	5
828	4S	2435	4	1	2	2	3	3	3	3	3	1	0	1	0	3	3	1	3	3	3	3	3	2	2	2	2	2	2	4	4	3	2	3	5
829	4S	2692	3	2	3	3	3	3	3	0	3	3	2	0	2	1	0	8	4	4	3	2	3	2	2	3	2	4	3	2	3	1	2	3	3
830	4S	1917	3	3	4	3	3	3	2	2	3	3	3	2	1	1	0	6	3	3	3	3	3	3	2	3	2	4	4	3	3	3	2	2	3
831	4S	1204	3	0	2	3	3	3	3	2	3	4	3	3	1	3	3	4	3	3	3	3	3	3	3	2	2	2	2	2	2	1	2	2	2
832	4S	3962	4	12	11	7	7	9	8	5	3	3	3	3	2	3	4	8	4	5	5	3	4	3	6	4	4	4	3	5	5	4	5	4	5
833	4S	559	3	1	3	3	3	3	3	3	3	3	3	0	3	3	2	6	3	3	3	3	3	3	3	1	2	2	2	2	2	2	1	2	2
835	4R	2641	0	6	7	6	3	3	3	3	6	5	6	5	6	3	3	8	5	5	5	4	0	4	5	2	4	3	3	4	4	0	3	1	2
836	4R	3149	0	7	8	6	3	3	3	3	3	3	3	3	3	2	4	10	5	3	5	4	3	4	4	3	5	5	2	3	4	3	5	3	4
837	4R	2668	0	5	6	3	2	3	4	4	3	3	3	3	5	5	2	4	4	3	5	3	3	2	5	1	4	4	3	3	2	3	3	3	3
838	4R	3378	0	9	8	7	5	5	0	0	0	2	0	4	4	0	3	10	6	3	6	0	0	3	5	0	6	4	5	3	5	3	5	3	4
839	4S	4390	0	2	5	5	3	2	2	1	2	3	3	0	0	3	2	3	6	5	4	3	3	2	2	3	2	3	2	2	2	1	1	3	4
840	4R	765	0	3	3	1	1	0	0	0	0	0	0	2	0	0	0	5	3	0	3	0	0	1	3	0	2	3	2	0	1	0	2	0	2
841	4S	816	0	0	1	3	3	3	3	0	2	1	2	3	2	3	3	3	3	3	2	3	3	3	2	3	2	2	2	2	1	2	1	2	2
Total		116115	191	250	239	214	175	182	217	185	204	224	209	183	171	163	133	354	192	183	189	164	132	156	178	141	177	182	159	163	160	124	143	142	186
851	4T	456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3	3	3	2	2	2	2	2	1	1	2	2
852	4T	427	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3	2	3	2	2	2	1	2	2	1	2	2
854	4T	465	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	2	2	2	2	2	2	2	2	0	1	1	2
855	4T	928	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	3	2	3	3	2	2	2	2	2	1	1	2	2

Table 1. (continued)

Stratum	NAFO	Surface (km^2)	2023	2024
401	4T	545	0	2
402	4T	909	2	2
403	4T	1190	1	2
404	4T	792	0	2
405	4T	1478	2	2
406	4T	2579	2	4
407	4T	2336	1	2
408	4T	2734	2	3
409	4T	909	2	2
410	4T	1818	3	2
411	4T	1859	0	3
412	4T	1283	0	2
413	4T	731	0	2
414	4T	388	0	1
801	4R	1214	3	2
802	4R	1369	2	2
803	4S	6976	3	6
804	4S	2490	2	2
805	4S	5762	5	8
806	4S	2127	2	3
807	4S	2370	2	3
808	4S	2428	2	2
809	4R	1547	2	2
810	4R	765	1	2
811	4R	1506	2	2
812	4R	4648	5	6
813	4R	3958	4	6
814	4S	1029	2	2
815	4S	4407	5	6
816	4S	5032	6	7
817	4S	3646	5	5
818	4S	2774	3	4
819	4S	1441	2	2
820	4R	1358	2	2
821	4R	1272	2	1
822	4R	3245	2	5
823	4R	556	2	2
824	4R	837	2	1
827	4S	3231	2	3
828	4S	2435	2	2
829	4S	2692	3	3
830	4S	1917	2	3
831	4S	1204	1	2
832	4S	3962	4	6
833	4S	559	1	2
835	4R	2641	2	3
836	4R	3149	3	4
837	4R	2668	2	3
838	4R	3378	0	5
839	4S	4390	1	2
840	4R	765	0	2
841	4S	816	1	1
Total		116115	107	155
851	4T	456	0	2
852	4T	427	0	2
854	4T	465	0	2
855	4T	928	0	2

Table 2. Occurrences and total catches, in weight and number, by taxon during the 2022 survey (194 successful tows). Taxonomic codes (STRAP) follow Miller and Chabot (2014), with scientific name updates by the World Marine Species Registry (WoRMS 2022). Values for redfish (Code STRAP 792) are computed for both redfish species (Code STRAP 794 and 796).

Vertebrates

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
151	*Alosa pseudoharengus*	Gaspareau	Alewife	1	0.0	1
90	*Amblyraja radiata*	Raie épineuse	Thorny Skate	120	534.0	985
696	*Ammodytes*	Lançons	Sand Lances	24	0.2	140
700	*Anarhichas lupus*	Loup atlantique	Atlantic Wolffish	25	137.1	281
701	*Anarhichas minor*	Loup tacheté	Spotted Wolffish	3	5.3	7
320	*Arctozenus risso*	Lussion blanc	White Barracudina	79	9.0	684
193	*Argentina silus*	Grande argentine	Atlantic Argentine	34	66.8	840
810	*Artediellus*	Hameçons	Hookear Sculpins	9	0.1	32
811	*Artediellus atlanticus*	Hameçon atlantique	Atlantic Hookear Sculpin	27	0.5	110
812	*Artediellus uncinatus*	Hameçon neigeux	Arctic Hookear Sculpin	6	0.8	136
838	*Aspidophoroides monopterygius*	Poisson-alligator atlantique	Alligatorfish	15	0.2	45
837	*Aspidophoroides olrikii*	Poisson-alligator arctique	Arctic Alligatorfish	1	0.0	1
102	*Bathyraja spinicauda*	Raie à queue épineuse	Spinytail Skate	2	11.8	2
451	*Boreogadus saida*	Saïda franc	Arctic Cod	5	0.2	16
865	*Careproctus reinhardti*	Petite limace de mer	Sea Tadpole	4	0.1	5
27	*Centroscyllium fabricii*	Aiguillat noir	Black Dogfish	28	869.4	1313
227	*Chauliodus sloani*	Chauliode très lumineux	Sloane's Viperfish	1	0.0	1
150	*Clupea harengus*	Hareng atlantique	Atlantic Herring	71	4327.3	29129
721	*Cryptacanthodes maculatus*	Terrassier tacheté	Wrymouth	7	3.5	28
849	*Cyclopterus lumpus*	Grosse poule de mer	Lumpfish	14	0.5	14
208	*Cyclothone microdon*	Cyclothone à petites dents	Veiled Anglemouth	1	0.0	2
461	*Enchelyopus cimbrius*	Motelle à quatre barbillons	Fourbeard Rockling	100	32.7	934
618	*Epigonus pandionis*	Cardinal	Big Eye	2	0.1	2
711	*Eumesogrammus praecisus*	Quatre-lignes atlantique	Fourline Snakeblenny	16	7.1	314
847	*Eumicrotremus terraenovae*	Petite poule Terre-Neuve	Newfoundland Spiny Lumpsucker	18	3.9	185
438	*Gadus morhua*	Morue franche	Atlantic Cod	63	2103.5	3519
439	*Gadus ogac*	Ogac, morue ogac	Greenland Cod	1	0.1	1
426	*Gasterosteus aculeatus*	Épinoche à trois épines	Threespine Stickleback	1	0.0	1
890	*Glyptocephalus cynoglossus*	Plie grise	Witch Flounder	119	475.2	3261
746	*Gymnelus viridis*	Unernak caméléon	Fish Doctor	4	0.1	14
823	*Gymnocanthus tricuspis*	Tricorne arctique	Arctic Staghorn Sculpin	21	3.8	76

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
797	*Helicolenus dactylopterus*	Chèvre impériale	Blackbelly Rosefish	5	0.4	5
889	*Hippoglossoides platessoides*	Plie canadienne	American Plaice	141	612.7	7497
893	*Hippoglossus hippoglossus*	Flétan atlantique	Atlantic Halibut	57	895.2	99
832	*Icelus spatula*	Icèle spatulée	Spatulate Sculpin	4	0.0	9
836	*Leptagonus decagonus*	Agone atlantique	Atlantic Poacher	7	0.8	44
717	*Leptoclinus maculatus*	Lompénie tachetée	Daubed Shanny	38	2.4	479
868	*Liparis bathyarcticus*	Limace nébuleuse	Nebulous Snailfish	7	1.2	28
966	*Lophius americanus*	Baudroie d'Amérique	Monkfish, Goosefish	16	117.4	19
716	*Lumpenus lampretaeformis*	Lompénie-serpent	Snakeblenny	24	2.3	87
752	*Lycenchelys verrillii*	Lycode à tête longue	Wolf Eelpout	3	0.0	3
726	*Lycodes*	Lycodes	Eelpouts	1	0.0	1
728	*Lycodes lavalaei*	Lycode du Labrador	Newfoundland Eelpout	15	12.8	137
734	*Lycodes terraenovae*	Lycode atlantique	Atlantic Eelpout	1	0.3	1
730	*Lycodes vahlii*	Lycode à carreaux	Vahl's Eelpout	26	12.1	277
91	*Malacoraja senta*	Raie lisse	Smooth Skate	82	46.3	202
187	*Mallotus villosus*	Capelan	Capelin	73	387.2	30535
441	*Melanogrammus aeglefinus*	Aiglefin	Haddock	2	2.6	2
745	*Melanostigma atlanticum*	Molasse atlantique	Atlantic Soft Pout	33	0.9	244
449	*Merluccius bilinearis*	Merlu argenté	Silver Hake	95	242.3	1311
272	*Myctophidae*	Poissons-lanterne	Lanternfishes	15	0.4	90
271	*Myctophiformes*	Poissons des profondeurs	Deepwater Fishes	2	0.3	20
281	*Myctophum punctatum*	Lanterne ponctuée	Spotted Lanternfish	1	0.0	2
817	*Myoxocephalus*	Chaboisseaux	Sculpins	1	0.0	2
820	*Myoxocephalus octodecemspinosus*	Chaboisseau à dix-huit-épines	Longhorn Sculpin, Gray Sculpin	1	1.0	4
819	*Myoxocephalus scorpius*	Chaboisseau à épines courtes	Shorthorn Sculpin	14	13.7	71
13	*Myxine limosa*	myxine de vase	Girard's Hagfish	93	46.5	877
891	*Myzopsetta ferruginea*	Limande à queue jaune	Yellowtail Flounder	2	0.1	2
278	*Neoscopelus macrolepidotus*	Lanterne à grandes écailles	Glowingfish	4	0.2	4
478	*Nezumia bairdii*	Grenadier du grand Banc	Common Grenadier	75	31.0	740
275	*Notoscopelus kroyeri*	Lanterne-voilière nordique	Kroyer's Lanternfish	17	1.1	61
874	*Paraliparis calidus*	Limace ardente	Lowfin Snailfish	1	0.0	1
783	*Peprilus triacanthus*	Stromatée à fossette	Butterfish	1	0.0	1
15	*Petromyzon marinus*	Lamproie marine	Sea Lamprey	1	0.6	1
444	*Phycis chesteri*	Merluche a longues nageoires	Longfin Hake	29	23.8	202
443	*Pollachius virens*	Goberge	Pollock	3	18.7	5
80	*Rajiformes*	Raie	Skate	1	0.0	4
892	Reinhardtius hippoglossoides	Flétan du Groenland, turbot	Greeenland Halibut, Turbot	112	1323.2	6345

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
572	*Scomber scombrus*	Maquereau bleu	Atlantic Mackerel	26	9.6	230
792	*Sebastes*	Sébastes	Rockfishes	144	59088.4	293352
796	*Sebastes fasciatus*	Sébaste acadien	Acadian Redfish	72	6023.8	33028
794	*Sebastes mentella*	Sébaste atlantique	Deepwater Redfish	127	53064.5	260324
24	*Squalus acanthias*	Aiguillat commun	Spiny Dogfish	2	7.0	3
230	*Stomias ferox*	Dragon-boa	Boa Dragonfish	1	0.0	1
373	*Synaphobranchus kaupii*	Anguille égorgée bécue	Northern Cutthroat Eel	1	0.1	1
814	*Triglops murrayi*	Faux-trigle armé	Moustache Sculpin	32	11.5	1215
815	*Triglops nybelini*	Faux-trigle à grands yeux	Bigeye Sculpin	1	0.0	1
446	*Urophycis regia*	Merluche tachetée	Spotted Hake	1	0.1	1
447	*Urophycis tenuis*	Merluche blanche	White Hake	69	150.1	228
	Total	**Vertébrés**	**Vertebrates**		71,658	386,523

Invertebrates

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
2182	Actinauge cristata	Anémone de mer	Anemone	39	7.4	1124
2165	Actiniaria	Actinies et Anémones	Sea Anemones	10	0.1	16
2162	Actinostola callosa	Anémones de mer	Anemone	53	59.7	1139
6771	Aega psora	Isopode	Isopod	9	0.0	9
3164	Amicula vestita	Chiton	Chiton	1	0.0	1
6930	Amphipoda	Amphipodes	Amphipods	1	0.0	1
8593	Amphiura	Ophiures	Brittle star	5	0.7	-
7389	Anonyx	Gammaridés	Gammarids	4	0.0	4
3978	Antalis occidentalis	Scaphopode	occidental tuskshell	2	0.1	308
2218	Anthoptilum grandiflorum	Plume de mer	Sea pen	19	1.1	142
5002	Aphrodita hastata	Souris de mer	Sea Mouse	13	0.2	7
6594	Arcoscalpellum michelottianum	Balane	Barnacle	4	0.0	4
8138	Argis dentata	Crevette verte	Arctic Argid	31	6.8	1430
3418	Arrhoges occidentalis	Pied-de-pélican	American Pelicanfoot	21	5.7	525
1128	Artemisina arcigera	Éponge	Sponge	13	0.3	56
8742	Ascidia	Ascidie	Sea squirts	65	7.4	2091
8680	Ascidiacea	Ascidies, tuniques sessiles	Ascidians, Sessile Tunicates	10	0.0	20
1120	Asconema foliatum	Éponge	Sponge	1	0.1	-
4227	Astarte	Astartes	Astartes	9	0.0	6
4226	Astartidae	Astartidé	Astarte	19	2.3	2197

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
8396	Asterias rubens	Astérie boréale commune	Purple Seastar	1	0.0	1
8113	Atlantopandalus propinqvus	Crevette	Shrimp	61	12.3	4610
2097	Atolla wyvillei	Méduse	Jellyfish	3	0.1	5
2085	Aurelia aurita	Méduse de lune	Moon Jelly	1	0.1	1
6595	Balanidae	Balanes	Barnacles	1	0.0	1
6592	Balanus	Balane	Barnacle	1	0.0	-
2217	Balticina finmarchica	Plume de mer	Sea pen	15	1.4	55
4904	Bathypolypus bairdii	Poulpe	North Atlantic Octopus	46	3.4	78
3995	Bivalvia	Bivalves	Bivalves	1	0.0	-
2158	Bolocera tuediae	Anémone de mer	Anemone	54	3.2	96
8793	Boltenia echinata	Cactus de mer	Cactus Sea Squirt	4	0.1	23
8792	Boltenia ovifera	Patate de mer	Sea Potato	8	24.6	263
3487	Boreotrophon clathratus	Murex	Clathrate Trophon	1	0.0	1
8798	Botrylloides	Ascidie	Tunicate	1	0.0	-
5755	Brada inhabilis	Polychète	Flabelligerid worm	5	0.0	2
1171	Brattegardia nanseni	Éponge	Sponge	2	0.0	73
8378	Brisaster fragilis	Oursin coeur	Heart Urchin	68	108.0	9958
2670	Bryozoa	Bryozoaires	Bryozoans	6	0.0	-
3516	Buccinum	Buccins	Whelk	25	0.3	34
3520	Buccinum cyaneum	Buccin bleu	Bluish Whelk	5	0.0	5
3514	Buccinum terraenovae	Buccin	Whelk	2	0.0	2
3517	Buccinum undatum	Buccin commun	Waved Whelk	2	0.0	1
8173	Calocaris templemani	Crevette fouisseuse	Lobster Shrimp	6	0.1	182
2214	Capnellidae	Anthozoaire	Anthozoa	1	0.0	1
8429	Ceramaster granularis	Etoile de mer	Sea Star	20	1.2	104
8213	Chionoecetes opilio	Crabe des neiges	Snow Crab	73	68.5	773
6593	Chirona hameri	Balane turbane	Turban Barnacle	6	0.7	-
4167	Chlamys islandica	Pétoncle d' Islande	Iceland Scallop	11	0.5	23
4351	Ciliatocardium ciliatum	Coque d'Islande	Iceland Cockle	2	0.4	21
1150	Cladocroce spatula	Éponge	Sponge	1	0.0	-
3908	Colga villosa	Nudibranche	Nudibranch	2	0.0	2
3577	Colus pubescens	Buccin	Hairy Whelk	4	0.1	5
3576	Colus stimpsoni	Buccin	Whelk	1	0.0	1
1130	Craniella polyura	Éponge	Sponge	11	0.2	-
1165	Crella	Éponges	Sponges	2	0.1	-
1172	Crella (Pytheas) cutis	Éponge	Sponge	7	0.3	-
2151	Cribrinopsis similis	Anémone de mer	Sea Anemone	1	0.0	1
8447	Crossaster papposus	Soleil de mer épineux	Spiny Sun Star	22	2.0	52

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
3422	Cryptonatica affinis	Lunaties	Arctic moonsnail	5	0.0	3
8407	Ctenodiscus crispatus	Étoile de mer	Mud Star	83	42.0	13419
8312	Cucumaria frondosa	Concombre de mer	Orange Footed Sea Cucumber	4	2.1	4
4526	Cuspidaria glacialis	Bivalve	Gacial Dipperclam	15	0.0	48
2080	Cyanea capillata	Crinière de lion	Lion's Mane	59	68.7	118
4268	Cyclocardia borealis	Vénéricarde boréale	Northern Cyclocardia	3	0.0	7
8761	Dendrodoa pulchella	Ascidie	Tunicate	1	0.0	3
3894	Dendronotus frondosus	Nudibranche	Nudibranch	1	0.0	1
8408	Diplopteraster multipes	Étoile de mer	Sea Star	1	0.1	1
3965	Doridoxa walteri	Nudibranche	Nudibranch	2	0.0	2
2191	Drifa glomerata	Corail mou	Soft coral	18	0.4	-
2183	Duva florida	Corail mou	Sea Cauliflower	2	0.0	1
8373	Echinarachnius parma	Dollar de sable	Common Sand Dollar	2	0.6	37
7383	Epimeria (Epimeria) loricata	Gammaridé	Gammarid	6	0.0	105
2156	Epizoanthus erdmanni	Zoanthide	Zoanthid	24	0.0	-
8074	Eualus	Bouc	Eualid	1	0.0	2
8075	Eualus fabricii	Bouc Arctique	Arctic Eualid	8	0.3	284
8080	Eualus gaimardii gaimardii	Bouc	Circumpolar Eualid	9	0.1	103
8077	Eualus macilentus	Bouc du Groenland	Greenland Shrimp	15	30.2	21048
8778	Eudistoma vitreum	Ascidie	Tunicate	14	0.1	32
5461	Euphrosine borealis	Polychète	Seaworm	1	0.0	0
8033	Eusergestes arcticus	Crevette	Shrimp	12	0.1	64
3437	Euspira pallida	Lunatie du Groenland	Pale Moonsnail	6	0.0	8
2224	Flabellum (Ulocyathus) alabastrum	Madrépore	Cup coral	12	1.7	184
2212	Gersemia fruticosa	Corail frutescent	hedge carnation coral	4	0.1	18
2184	Gersemia rubiformis	Framboise de mer	Sea Strawberry	15	0.2	-
5902	Golfingia (Golfingia) margaritacea	Sipunculide	Sipunculid	6	0.1	15
8540	Gorgonocephalus	Gorgonocéphales	Basket Stars	3	11.1	41
8541	Gorgonocephalus arcticus	Gorgonocéphale	Northen Basket Star	22	42.6	305
8797	Halocynthia pyriformis	Pêche de mer	Sea Peach	2	0.1	2
8263	Heliometra glacialis	Lis de mer	Feather star	3	0.0	-
1131	Hemigellius arcofer	Éponge	Sponge	11	13.8	-
3090	Hemithiris psittacea	Brachiopode	Lamp Shell	4	0.1	23
8483	Henricia	Étoiles de mer	Sea Stars	41	0.3	77
3964	Heterodoris robusta	Nudibranche	Nudibranch	1	0.0	1

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
4437	Hiatella arctica	Saxicave arctique	Arctic Saxicave	3	0.0	4
8431	Hippasteria phrygiana	Étoile de mer	Sea Star	30	11.4	35
8290	Holothuroidea	Concombres de mer	Sea Cucumbers	1	0.0	3
8154	Homarus americanus	Homard américain	American Lobster	3	5.6	3
2150	Hormathia digitata	Anémone	Anemone	18	0.1	31
2167	Hormathia nodosa	Anémone noduleuse	Rugose Anemone	7	0.6	16
8219	Hyas alutaceus	Crabe lyre	Arctic Lyre Crab	27	2.4	209
8217	Hyas araneus	Crabe lyre	Atlantic Lyre Crab	11	1.7	45
1341	Hydrozoa	Hydrozoaires	Hydrozoans	4	0.1	-
8028	Hymenopenaeus debilis	Crevette	Shrimp	1	0.0	-
6977	Hyperia galba	Hypéride	Hyperiid	2	0.0	2
4753	Illex illecebrosus	Encornet rouge nordique	Northern Shortfin Squid	25	7.1	75
1154	Iophon	Éponges	Sponges	5	0.1	-
2213	Kophobelemnon stelliferum	Plume de mer	Sea pen	2	0.0	4
5003	Laetmonice filicornis	Polychète	Seaworm	29	0.0	27
8092	Lebbeus groenlandicus	Bouc	Spiny Lebbeid	7	0.9	131
8095	Lebbeus microceros	Bouc	Shrimp	1	0.0	1
8093	Lebbeus polaris	Bouc	Polar Lebbeid	28	0.2	170
8511	Leptasterias (Hexasterias) polaris	Étoile de mer polaire	Polar Sea Star	13	2.8	28
8513	Leptasterias groenlandica	Étoile de mer du Groenland	Greenland Sea Star	7	0.0	10
2207	Liponema multicorne	Anémone	Sea anemone	9	0.9	26
8196	Lithodes maja	Crabe épineux du Nord	Norway King Crab	57	66.4	220
4395	Macoma calcarea	Bivalve	Chalky Macoma	3	0.1	31
3219	Margarites costalis	Margarite rose du Nord	Boreal Rosy Margarite	9	0.0	35
3216	Margarites groenlandicus	Troque	Greenland marguerite	1	0.0	1
4025	Megayoldia thraciaeformis	Bivalve	Broad Yoldia	27	0.5	66
1355	Modeeria rotunda	Hydrozoaires	Hydrozoans	3	0.2	19
8322	Molpadia oolitica	Holothurie	Sea Cucumber	3	0.0	6
8164	Munidopsis curvirostra	Munidopsis curvirostra	Squat Lobster	5	0.0	18
1143	Mycale	Éponge	Sponge	1	0.1	-
1117	Mycale (Mycale) lingua	Éponge	Sponge	21	3.0	-
1144	Mycale (Mycale) lorea	Éponge	Sponge	2	1.2	-
4121	Mytilus	Moules	Mussels	13	0.1	22
1160	Myxilla (Myxilla) incrustans	Éponge	Sponge	1	0.0	1
2585	Nematoda	Nématode	Nematode	1	0.0	-
3567	Neptunea despecta	Neptunée commune du nord	Lader Whelk	7	0.3	8
4019	Nuculana	Bivalves	Nutclams	4	0.0	6

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
5961	Nymphon	Araignée de mer	Sea Spiders	14	0.0	15
8575	Ophiacantha bidentata	Ophiure épineuse	Brittle Star	6	0.0	21
8583	Ophiopholis aculeata	Ophiure paquerette	Daisy Brittle Star	46	1.6	1012
8585	Ophioscolex glacialis	Ophiure	Brittle star	11	0.0	16
8553	Ophiura sarsii	Ophiure	Brittle Star	83	4.0	2804
8178	Pagurus	Bernard hermite droitier	Hermit Crab	15	0.1	31
8111	Pandalus borealis	Crevette nordique	Northern Shrimp	131	1623.2	242106
8112	Pandalus montagui	Crevette ésope	Striped Pink Shrimp, Aesop Shrimp	62	94.7	54454
4438	Panomya norvegica	Saxicave	Arctic Roughmya	1	0.0	1
7594	Pardalisca abyssi	Gammaridé	Gammarid	1	0.0	1
8057	Pasiphaea multidentata	Sivade rose, Crevette blanche	Pink Glass Shrimp	66	18.9	6166
8056	Pasiphaea tarda	Sivade	Crimson Pasiphaeid	1	0.0	1
2203	Pennatula aculeata	Plume de mer	Sea Pen	86	2.1	1497
2096	Periphylla periphylla	Méduse a coronne	Crown jellyfish	41	50.6	69
5907	Phascolion (Phascolion) strombus strombus	Sipunculide	Hermit Sipunculid	3	0.0	-
8114	Plesionika martia	Crevette	Golden shrimp	2	0.0	2
2255	Pleurobrachia pileus	Groseille de mer ronde	Sea Gooseberry	14	0.1	55
3578	Plicifusus kroyeri	Colus	Arctic Whelk	1	0.0	1
8783	Polycarpa fibrosa	Ascidie	Tunicate	11	0.2	195
4950	Polychaeta	Polychètes	Polychaetes	54	0.3	-
1109	Polymastia	Éponge	Sponge	5	0.2	35
1122	Polymastia andrica	Éponge	Sponge	8	0.0	9
1123	Polymastia grimaldii	Éponge	Sponge	1	0.1	-
1107	Polymastia hemisphaerica	Éponge	Sponge	17	0.6	138
1125	Polymastia thielei	Éponge	Sponge	1	0.0	1
1126	Polymastia uberrima	Éponge	Sponge	11	0.2	38
5007	Polynoidae	Polychète errante	Fifteen-Scaled Worm	23	0.0	25
5264	Polyphysia crassa	Polychète	Sea worm	4	0.0	2
8135	Pontophilus norvegicus	Crevette	Norwegian Shrimp	107	4.6	3042
8435	Poraniomorpha	Étoile de mer	Sea star	6	0.3	9
1101	Porifera	Éponges	Sponges	72	9.1	-
8433	Pseudarchaster parelii	Étoile de mer	Sea Star	11	0.2	17
8520	Psilaster andromeda	Étoile de mer	Sea Star	18	2.4	745
8295	Psolus fabricii	Psolus écarlate	Scarlet Psolus	1	0.0	1
8294	Psolus phantapus	Holothurie	Sea Cucumber	6	0.1	12
8410	Pteraster militaris	Étoile de mer	Sea Star	3	0.0	3

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
8411	Pteraster pulvillus	Étoile de mer	Sea Star	6	0.0	9
2210	Ptilella grandis	Plume de mer	Sea Pen	21	17.9	643
1353	Ptychogena lactea	Méduse	Jellyfish	1	0.0	1
5951	Pycnogonida	Araignées de mer	Sea Spiders	1	0.0	1
7211	Rhachotropis aculeata	Gammaridé	Gammarid	7	0.0	11
4557	Rossia	Sépioles	Bobtails	13	0.1	16
8127	Sabinea	Crevette	Shrimp	1	0.0	-
8129	Sabinea sarsii	Crevette	Sars Shrimp	11	0.1	76
8128	Sabinea septemcarinata	Crevette	Sevenline Shrimp	21	0.6	296
3491	Scabrotrophon fabricii	Murex	Murex	5	0.0	6
3715	Scaphander punctostriatus	Céphalaspide	Giant Canoe Bubble	38	0.4	184
8119	Sclerocrangon boreas	Crevette de roche	Scultured Shrimp	11	11.3	1110
2040	Scyphozoa	Scyphozoaires	Scyphozoans	10	0.5	38
1151	Semisuberites cribrosa	Éponge	Sponge	2	0.1	1
4352	Serripes groenlandicus	Coque du Groenland	Greenland Smoothcockle	1	0.1	1
5900	Sipuncula	Sipunculides	Sipunculids	1	0.0	-
8445	Solaster endeca	Soleil de mer pourpre	Purple Sunstar	6	0.6	6
1168	Sphaerotylus capitatus	Éponge	Sponge	4	0.4	8
8084	Spirontocaris	Bouc	Blade Shrimp	5	0.0	-
8087	Spirontocaris liljeborgii	Bouc épineux	Friendly Blade Shrimp	32	0.1	80
8086	Spirontocaris phippsii	Bouc	Punctate Blade Shrimp	1	0.0	1
8085	Spirontocaris spinus	Bouc perroquet	Parrot Shrimp	13	0.6	277
1352	Staurostoma mertensii	Méduse a croix blanche	Whitecross Jellyfish	1	0.0	2
7750	Stegocephalus inflatus	Gammaridé	Gammarid	1	0.0	2
1381	Stephalia corona	Stephalia corona	Stephalia corona	13	0.4	123
2159	Stephanauge nexilis	Anémone de mer	Sea anemone	15	0.6	108
4587	Stoloteuthis leucoptera	Sépiole	Butterfly Squid	11	0.1	32
2173	Stomphia coccinea	Anémone marbrée	Anemone	17	0.5	38
8363	Strongylocentrotus	Oursins	Sea Urchins	47	64.5	3253
1112	Stylocordyla borealis	Éponge	Sponge	7	0.0	10
1115	Suberites ficus	Éponge	Fig sponge	1	0.0	4
1158	Suberites montiniger	Éponge	Sponge	1	0.0	2
1153	Suberitida	Éponges	Sponges	7	0.8	-
1113	Sycon	Éponge	Sponge	1	0.0	1
6791	Syscenus infelix	Isopode	Isopod	41	0.1	85
1134	Tedania (Tedania) suctoria	Éponge	Sponge	19	0.7	-
1108	Tentorium semisuberites	Éponge	Sponge	13	0.1	77
3101	Terebratulina septentrionalis	Térébratule du Nord	Northern Lamp Shell	7	0.0	8

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
6972	Themisto libellula	Hypéride	Hyperiid	25	0.1	338
1114	Thenea muricata	Éponge	Sponge	5	0.2	-
1357	Thuiaria thuja	Hydrozoaire	Bottlebrush Hydroid	4	0.0	6
4301	Thyasira	bivalve	cleftclam	1	0.0	6
1176	Trachyteleia hispida	Éponge hirsute	Bristly horny sponge	12	1.0	76
4231	Tridonta borealis	Astarte	Boreal Astarte	1	0.0	1
2152	Urticina crassicornis	Anémone de mer	Sea Anemone	7	1.1	15
1127	Weberella bursa	Éponge	Sponge	2	0.1	7
	Total	**Invertébrés**	**Invertebrates**		2 557	382 146

Others

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
9967	-	Capsule de raie à queue épineuse	Egg case Spinytail Skate	1	0,0	1
9966	-	Capsule de raie épineuse	Egg case Thorny Skate	17	0,4	31
9965	-	Capsule de raie lisse	Egg case Smooth Skate	12	0,1	17
2296	-	Capsule d'oeuf de Fecampiidae	Fecampiidae Egg Capsule	1	0,0	-

Table 3. Number of measured and weighed specimens and descriptive length statistics in 2024. Taxonomic codes (STRAP) follow Miller and Chabot (2014), with scientific name updates by the World Marine Species Registry (WoRMS 2022). P1 : 1st percentile, P99 : 99th percentile

Vertebrates

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1	Median	P99	Max
151	*Alosa pseudoharengus*	1	1	18.6	18.6	18.6	18.6	18.6
90	*Amblyraja radiata*	905	460	8.5	10	33	61	66.5
696	*Ammodytes*	135	61	4.8	5.3	7.5	12.4	12.6
700	*Anarhichas lupus*	281	88	6.2	6.9	30.5	64	68.9
701	*Anarhichas minor*	7	7	15.1	15.1	37.5	67	67
320	*Arctozenus risso*	654	342	7.9	17.3	21.9	26.6	27.1
193	*Argentina silus*	420	127	7.9	9.3	19.75	34.6	37.4
810	*Artediellus*	32	22	5	5	6.15	9.8	9.8
811	*Artediellus atlanticus*	110	75	4.8	5.1	7	10.3	10.9
812	*Artediellus uncinatus*	52	23	6	6	6.95	8.3	8.3
838	*Aspidophoroides monopterygius*	45	39	8.4	8.4	12.6	14.7	14.7
837	*Aspidophoroides olrikii*	1	1	8	8	8	8	8
102	*Bathyraja spinicauda*	2	2	26.8	26.8	76.9	127	127
451	*Boreogadus saida*	16	16	9.2	9.2	10.4	14.4	14.4
865	*Careproctus reinhardti*	5	5	8	8	9.5	10.2	10.2
27	*Centroscyllium fabricii*	498	114	12.7	14.4	38.2	65.3	71.1
150	*Clupea harengus*	855	558	8.8	13.2	27.6	34.3	38.4
721	*Cryptacanthodes maculatus*	28	17	13	13	28.9	88.7	88.7
849	*Cyclopterus lumpus*	24	24	3.8	3.8	7.5	13.4	13.4
461	*Enchelyopus cimbrius*	881	364	3.4	12.5	19.7	27.2	29.6
618	*Epigonus pandionis*	2	1	14.2	14.2	14.6	15	15
711	*Eumesogrammus praecisus*	165	61	9.2	9.4	15.4	20.8	22.1
847	*Eumicrotremus terraenovae*	105	48	3.3	3.4	6.5	12.4	12.9
438	*Gadus morhua*	2913	1160	4.1	13.2	31.7	68.2	94
439	*Gadus ogac*	1	1	19.1	19.1	19.1	19.1	19.1
426	*Gasterosteus aculeatus*	1	1	3.1	3.1	3.1	3.1	3.1
890	*Glyptocephalus cynoglossus*	3013	1768	5.5	12.7	26.2	44	48.5
746	*Gymnelus viridis*	14	12	11.8	11.8	14.2	20.7	20.7
823	*Gymnocanthus tricuspis*	76	55	9.3	9.3	15.95	24.5	24.5
797	*Helicolenus dactylopterus*	5	5	15.4	15.4	15.9	19.5	19.5
889	*Hippoglossoides platessoides*	5658	2764	4.2	7.8	20.5	40.5	48.9
893	*Hippoglossus hippoglossus*	99	99	19.1	19.1	65	168	168
832	*Icelus spatula*	9	9	6.1	6.1	8.3	9.7	9.7
836	*Leptagonus decagonus*	44	22	2	2	17.35	22.4	22.4
717	*Leptoclinus maculatus*	340	133	6.4	9.3	11.5	17.6	18.9
868	*Liparis bathyarcticus*	28	13	2.8	2.8	12.35	23.5	23.5
966	*Lophius americanus*	19	19	38.1	38.1	65	96	96
716	*Lumpenus lampretaeformis*	87	56	13.3	13.3	30.6	41.1	41.1
752	*Lycenchelys verrillii*	3	3	11.9	11.9	11.9	13.3	13.3
726	*Lycodes*	1	1	8.9	8.9	8.9	8.9	8.9
728	*Lycodes lavalaei*	121	50	7	7.1	17.6	51	57.2
734	*Lycodes terraenovae*	1	1	40.1	40.1	40.1	40.1	40.1
730	*Lycodes vahlii*	207	76	9	9.2	21.4	34.4	46.2
91	*Malacoraja senta*	261	208	7.2	8.5	30.6	56.9	58.3
187	*Mallotus villosus*	1966	1082	5	7.5	13.3	16.5	18.1
441	*Melanogrammus aeglefinus*	2	2	32	32	45.6	59.2	59.2
745	*Melanostigma atlanticum*	244	122	7.9	8.2	11.3	14.2	14.8
449	*Merluccius bilinearis*	1122	832	17.6	21.1	29.6	36	53.5
272	*Myctophidae*	5	2	8	8	8.2	9.9	9.9
271	*Myctophiformes*	17	5	6.5	6.5	13.7	16.2	16.2
281	*Myctophum punctatum*	2	0	9.2	9.2	9.2	9.2	9.2
817	*Myoxocephalus*	2	2	4.1	4.1	4.4	4.7	4.7

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1	Median	P99	Max
820	*Myoxocephalus octodecemspinosus*	4	4	14.6	14.6	17.2	19.9	19.9
819	*Myoxocephalus scorpius*	71	37	10.4	10.4	21.1	32.7	32.7
13	*Myxine limosa*	760	361	20.5	22.5	37.7	49.4	54
891	*Myzopsetta ferruginea*	2	2	16.6	16.6	19	21.4	21.4
278	*Neoscopelus macrolepidotus*	4	4	12.3	12.3	16.55	20.2	20.2
478	*Nezumia bairdii*	731	298	6.4	7.5	24.4	31.7	33.8
275	*Notoscopelus kroyeri*	61	37	10.1	10.1	14	17.5	17.5
874	*Paraliparis calidus*	1	1	10.7	10.7	10.7	10.7	10.7
783	*Peprilus triacanthus*	1	1	12.9	12.9	12.9	12.9	12.9
15	*Petromyzon marinus*	1	1	73.4	73.4	73.4	73.4	73.4
444	*Phycis chesteri*	202	89	15.2	15.8	25.2	37.1	39.6
443	*Pollachius virens*	5	5	44.4	44.4	67.5	80.3	80.3
80	*Rajiformes*	4	4	9.7	9.7	11.6	15.3	15.3
892	*Reinhardtius hippoglossoides*	3813	1563	6.3	15.4	24.5	46.5	65.5
572	*Scomber scombrus*	230	147	11.3	12.4	15.25	31.8	32.8
792	*Sebastes*	11225	3832	3.4	7	24.5	31.9	43.6
796	*Sebastes fasciatus*	4712	1824	3.5	5.3	24.3	34	39.8
794	*Sebastes mentella*	10300	3430	3.4	7.6	24.5	30.85	43.6
24	*Squalus acanthias*	3	3	70	70	82.1	89.1	89.1
230	*Stomias ferox*	1	1	24.8	24.8	24.8	24.8	24.8
373	*Synaphobranchus kaupii*	1	1	49.6	49.6	49.6	49.6	49.6
814	*Triglops murrayi*	531	135	6.8	7.3	10.7	15.4	16.2
815	*Triglops nybelini*	1	1	11.1	11.1	11.1	11.1	11.1
446	*Urophycis regia*	1	0	29.3	29.3	29.3	29.3	29.3
447	*Urophycis tenuis*	226	226	23.1	24.6	40.8	68.3	84.3

Invertebrates

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1	Median	P99	Max
2218	*Anthoptilum grandiflorum*	160	156	25.6	27.5	45.3	57.2	59
8138	*Argis dentata*	574	0	0.74	1	1.61	2.27	2.65
8113	*Atlantopandalus propinqvus*	546	0	0.96	1.15	1.46	2.16	2.24
2217	*Balticina finmarchica*	109	108	13.5	23.7	56.2	99.6	133
8213	*Chionoecetes opilio*	714	0	1	1.2	4	11.9	12.9
8074	*Eualus*	2	0	0.72	0.72	0.75	0.78	0.78
8075	*Eualus fabricii*	52	0	0.55	0.55	0.9	1.18	1.18
8080	*Eualus gaimardii gaimardii*	30	0	0.71	0.71	0.95	1.15	1.15
8077	*Eualus macilentus*	244	0	0.6	0.73	1	1.34	1.38
8033	*Eusergestes arcticus*	43	0	1.22	1.22	1.86	2.2	2.2
8154	*Homarus americanus*	3	0	10	10	11.6	15.1	15.1
8219	*Hyas alutaceus*	209	0	0.7	0.8	2.2	4.8	6.8
8217	*Hyas araneus*	45	0	0.9	0.9	2.8	7.4	7.4
4753	*Illex illecebrosus*	75	75	3.8	3.8	17	20.6	20.6
2213	*Kophobelemnon stelliferum*	1	1	5.9	5.9	5.9	5.9	5.9
8092	*Lebbeus groenlandicus*	42	0	0.85	0.85	1.38	2.61	2.61
8095	*Lebbeus microceros*	1	0	1.23	1.23	1.23	1.23	1.23
8093	*Lebbeus polaris*	84	0	0.67	0.67	1.02	1.35	1.35
8196	*Lithodes maja*	219	0	2.3	3.7	7.6	11.2	12.1
8111	*Pandalus borealis*	15697	1014	0.2	1.09	2.05	2.7	3
8112	*Pandalus montagui*	1639	0	0.64	0.84	1.33	2.05	2.26
8057	*Pasiphaea multidentata*	2247	0	0.99	1.37	2.41	3.13	3.48
8056	*Pasiphaea tarda*	1	0	3.73	3.73	3.73	3.73	3.73
2203	*Pennatula aculeata*	449	444	1.4	4.3	12	24.9	27.7
8114	*Plesionika martia*	2	0	1.57	1.57	1.765	1.96	1.96
8135	*Pontophilus norvegicus*	1354	0	0.63	0.86	1.22	1.55	1.75
2210	*Ptilella grandis*	153	154	4.3	11.5	35.4	49.2	52.2
8129	*Sabinea sarsii*	72	0	0.71	0.71	1.06	1.58	1.58

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1	Median	P99	Max
8128	*Sabinea septemcarinata*	241	0	0.55	0.79	1.19	1.66	1.7
8119	*Sclerocrangon boreas*	300	0	0.91	0.985	1.7	2.78	2.89
8084	*Spirontocaris*	4	0	0.92	0.92	1.125	1.35	1.35
8087	*Spirontocaris liljeborgii*	52	0	0.71	0.71	1.125	1.42	1.42
8086	*Spirontocaris phippsii*	1	0	0.82	0.82	0.82	0.82	0.82
8085	*Spirontocaris spinus*	114	0	0.6	0.65	1.24	1.54	1.58
2159	*Stephanauge nexilis*	1	0	0.1	0.1	0.1	0.1	0.1
1357	*Thuiaria thuja*	1	0	1.1	1.1	1.1	1.1	1.1

FIGURES

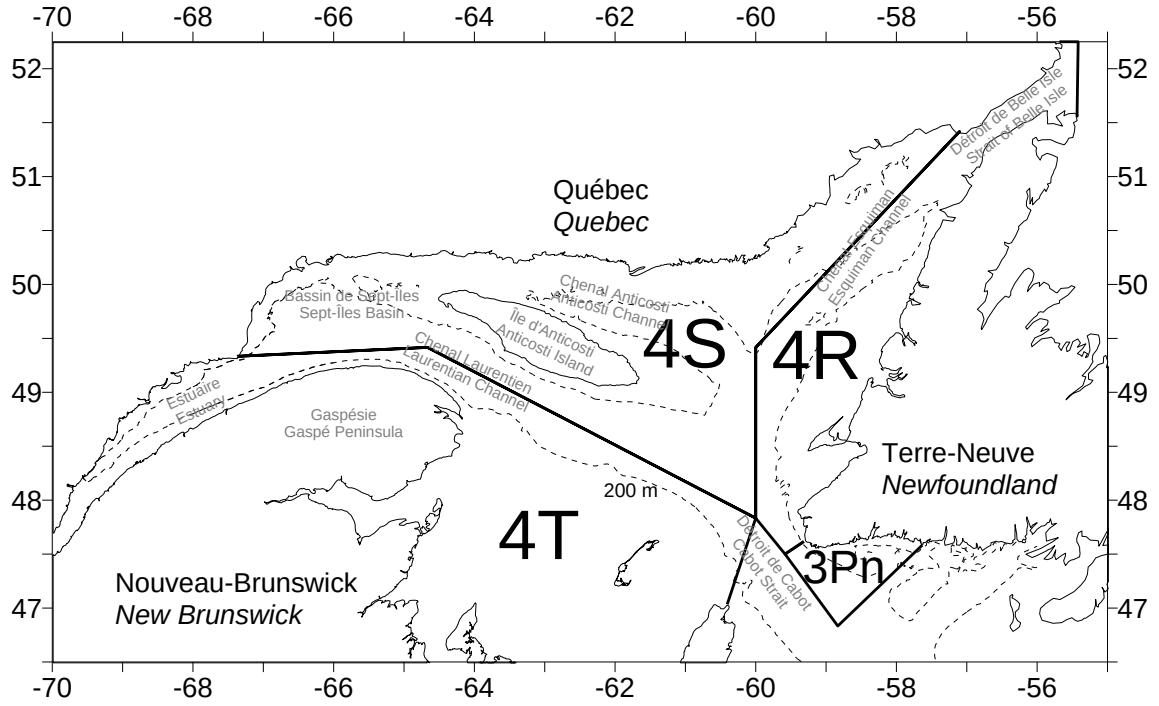

Figure 1. NAFO Divisions of the Estuary and Gulf of St. Lawrence and the names of locations mentioned in the text.

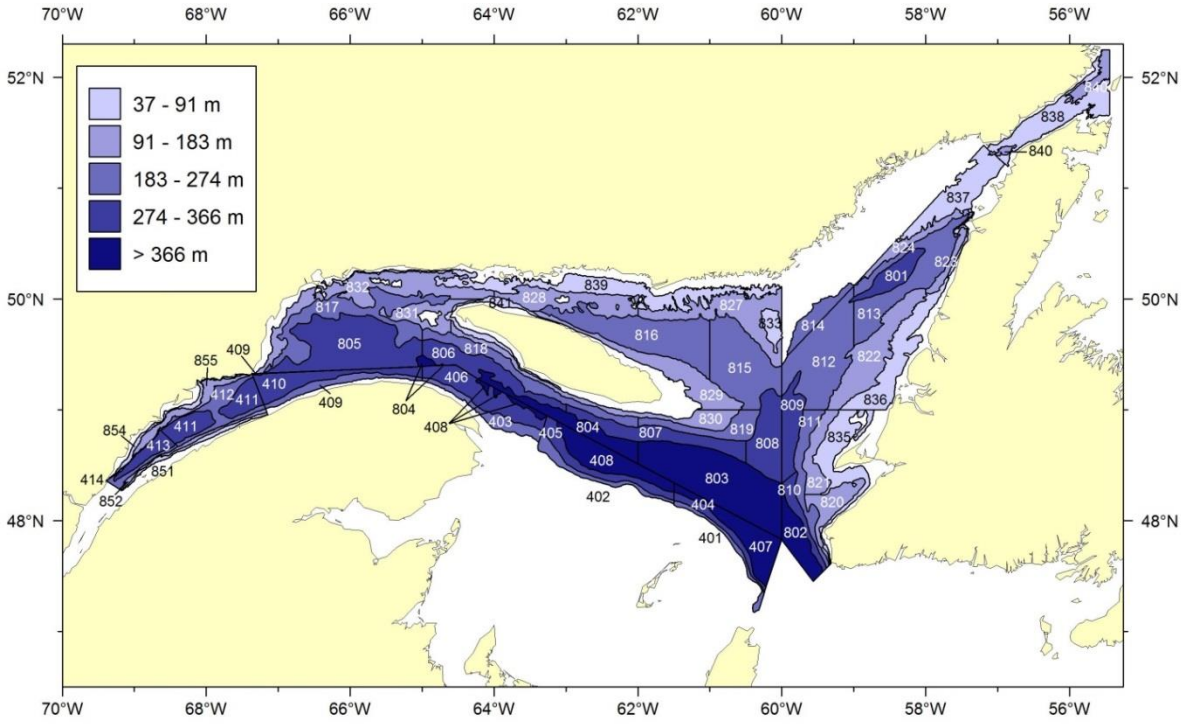

Figure 2. Stratification scheme used for the groundfish and shrimp research survey in the Estuary and the northern Gulf of St. Lawrence.

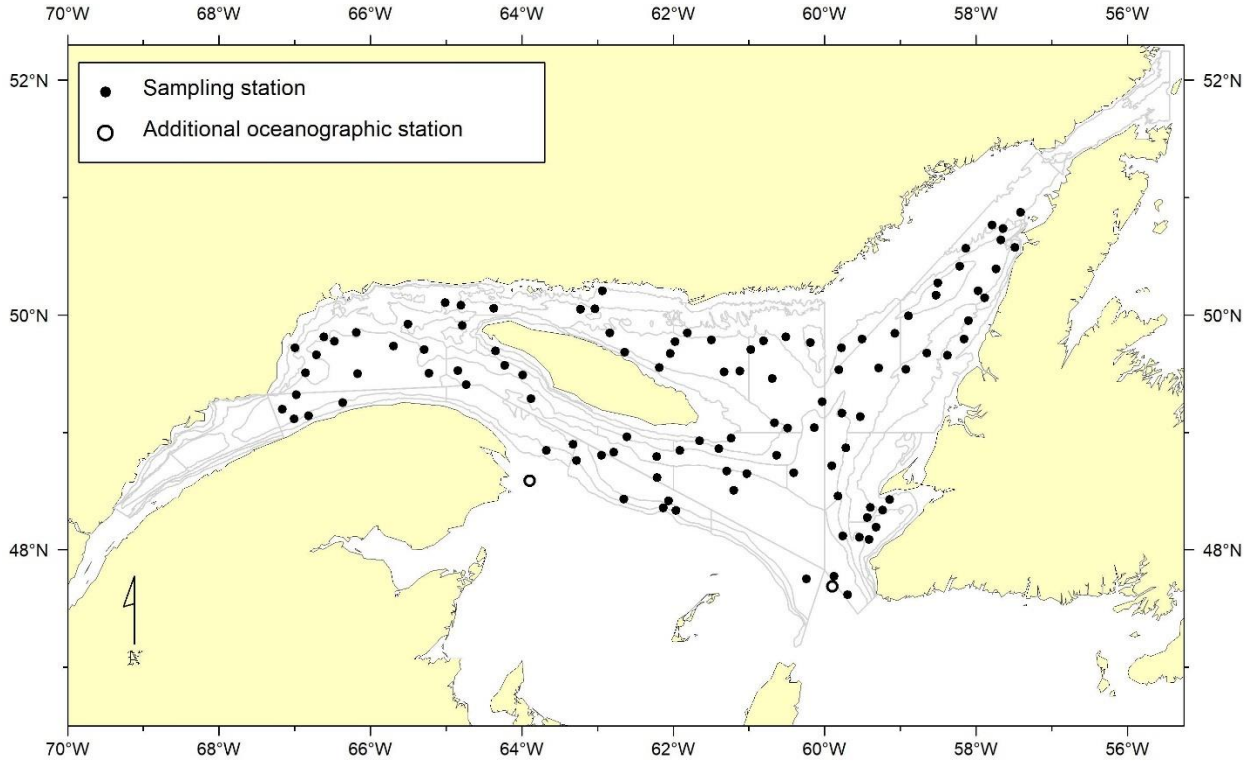

Figure 3. Locations of successful sampling stations (trawl and oceanography) and additional oceanographic stations for the 2023 survey.

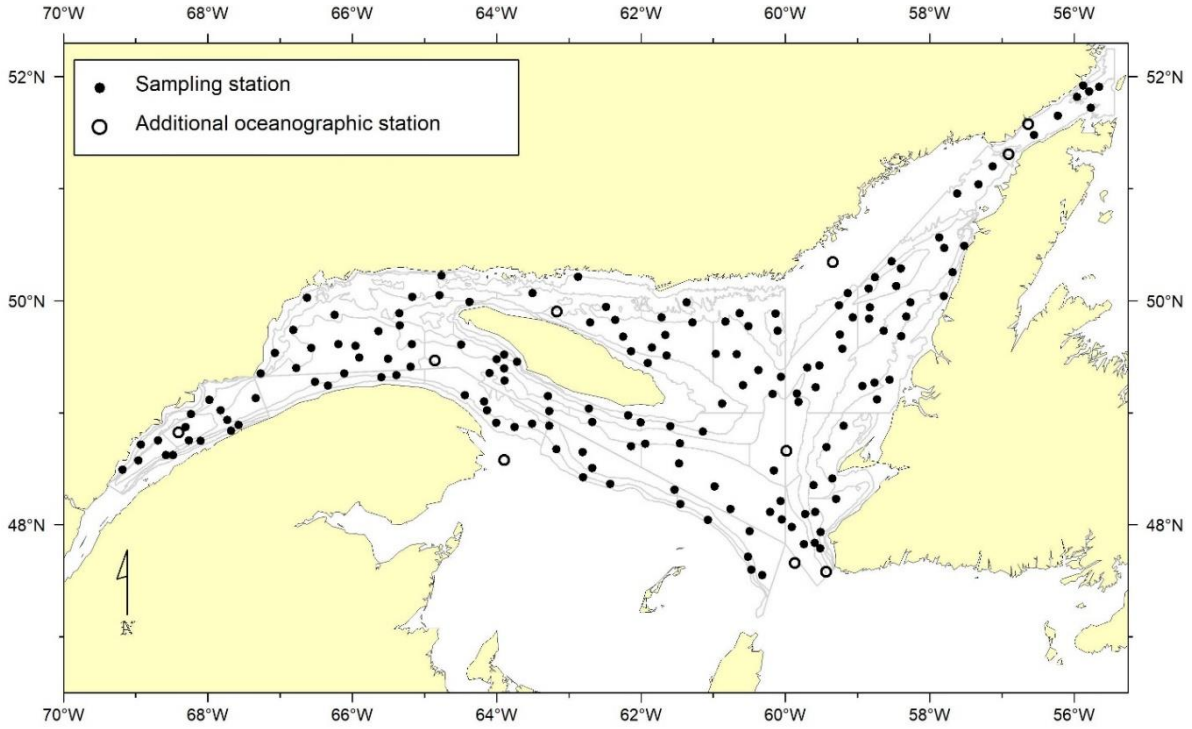

Figure 4. Locations of successful sampling stations (trawl and oceanography) and additional oceanographic stations for the 2023 survey.

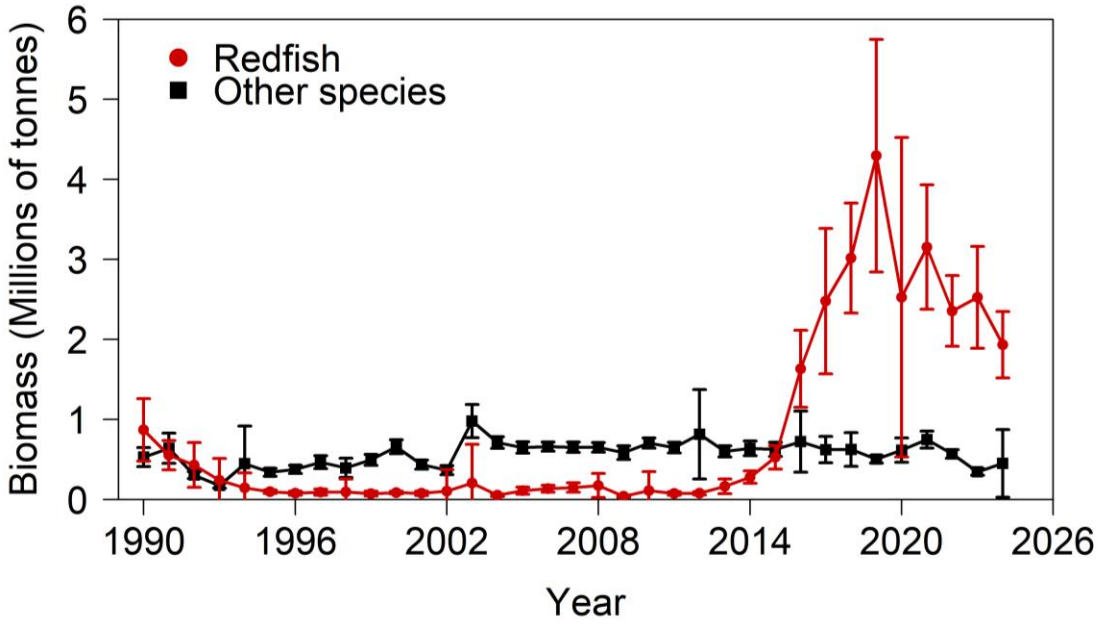

Figure 5. Biomass estimates (millions of tons) of redfish spp. and all other species sampled in the study area. Error bars represent 95% confidence intervals.

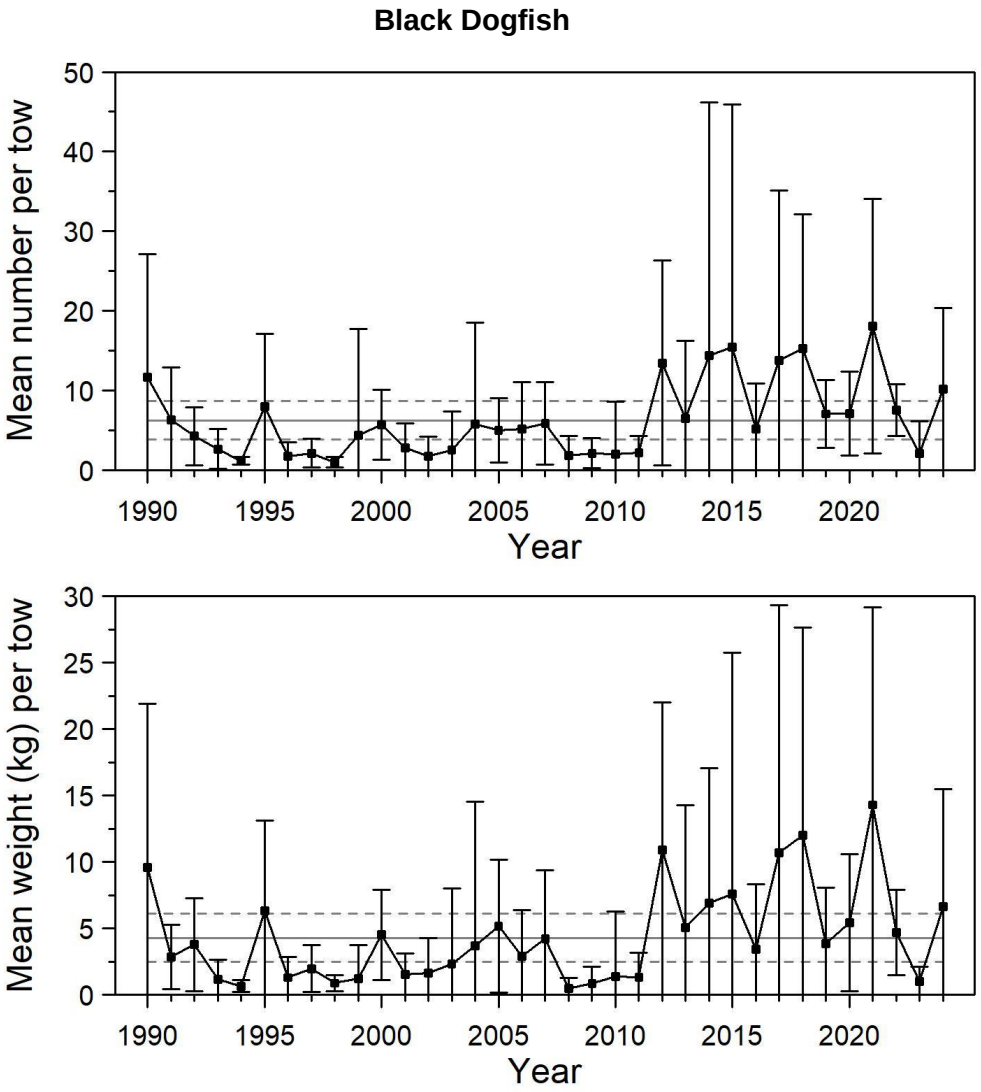

Figure 6. Mean numbers and mean weights per 15-minute tow observed during the survey for black dogfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

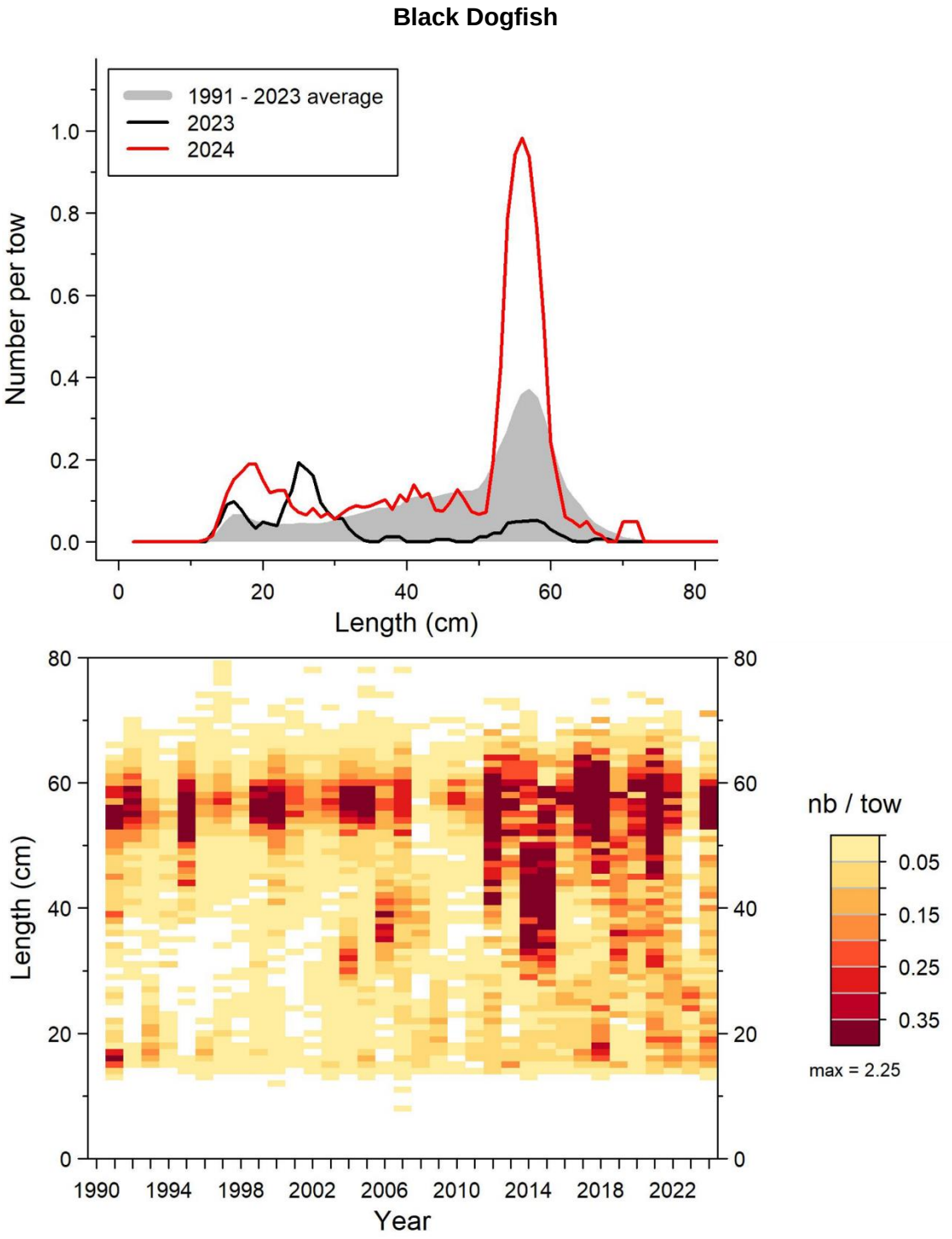

Figure 7. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Black Dogfish in 4RST.

Black Dogfish

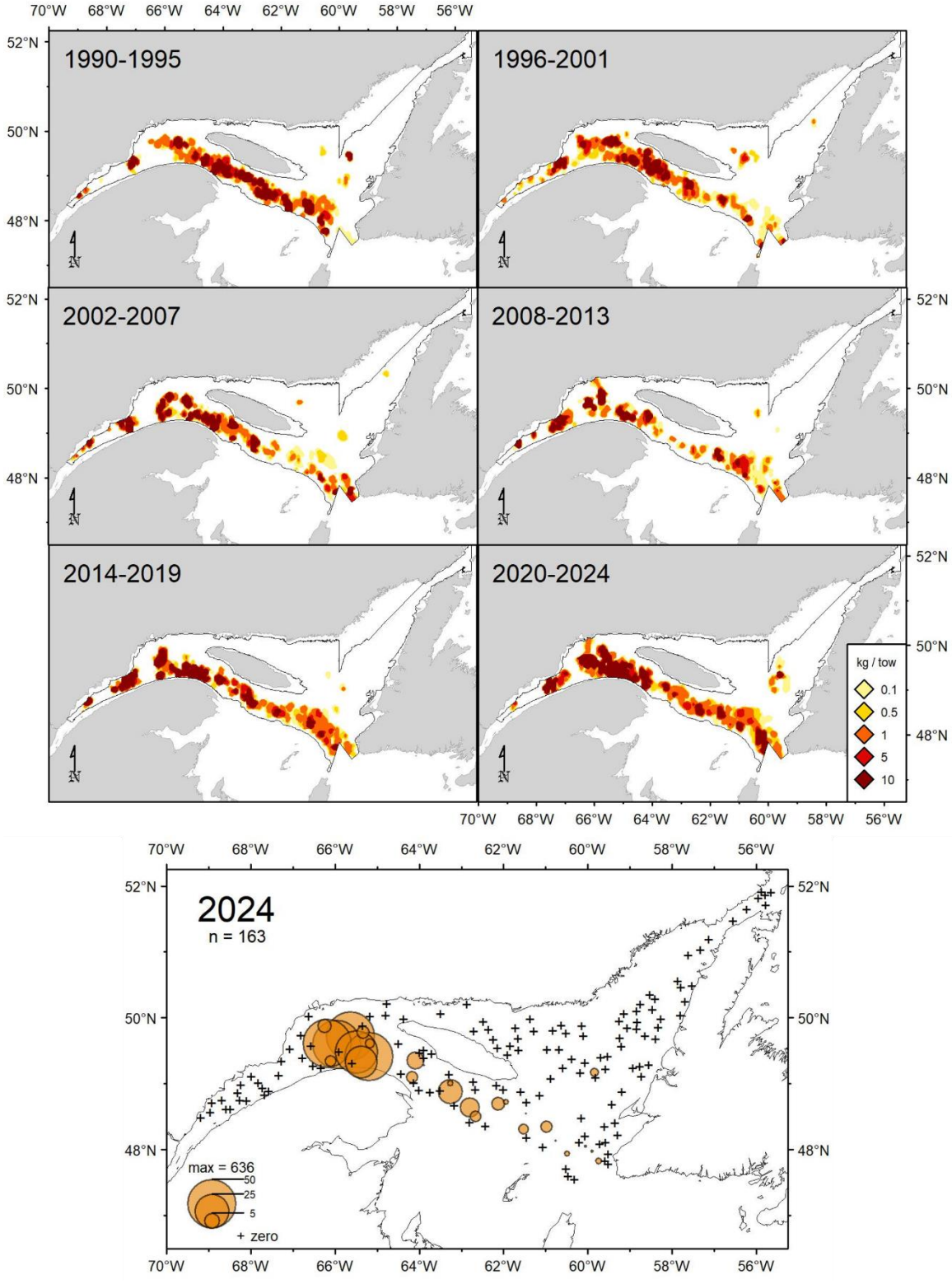

Figure 8. Black Dogfish catch rate (kg/15-minute tow) distributions.

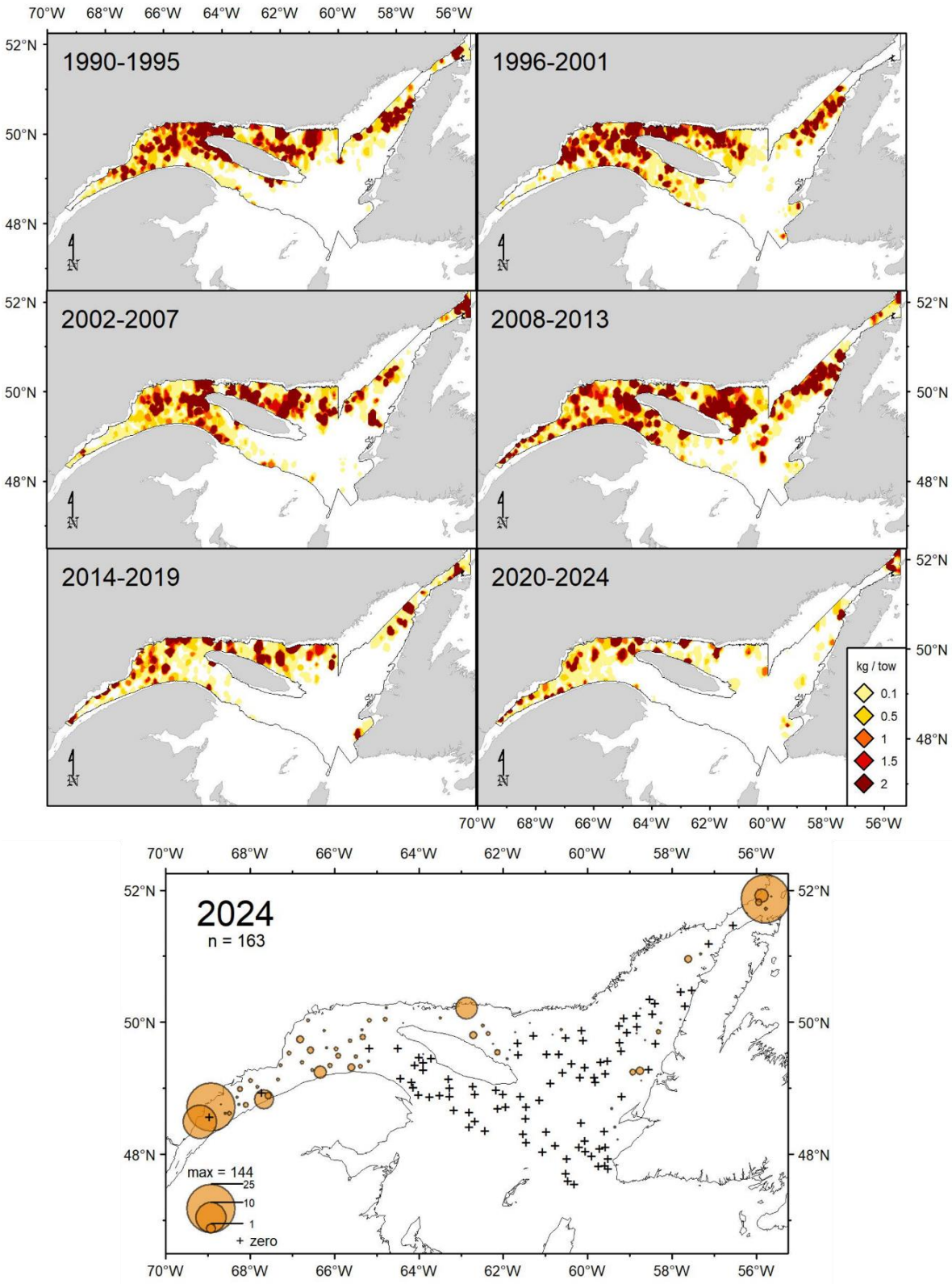

Figure 9. Capelin catch rate (kg/15-minute tow) distributions.

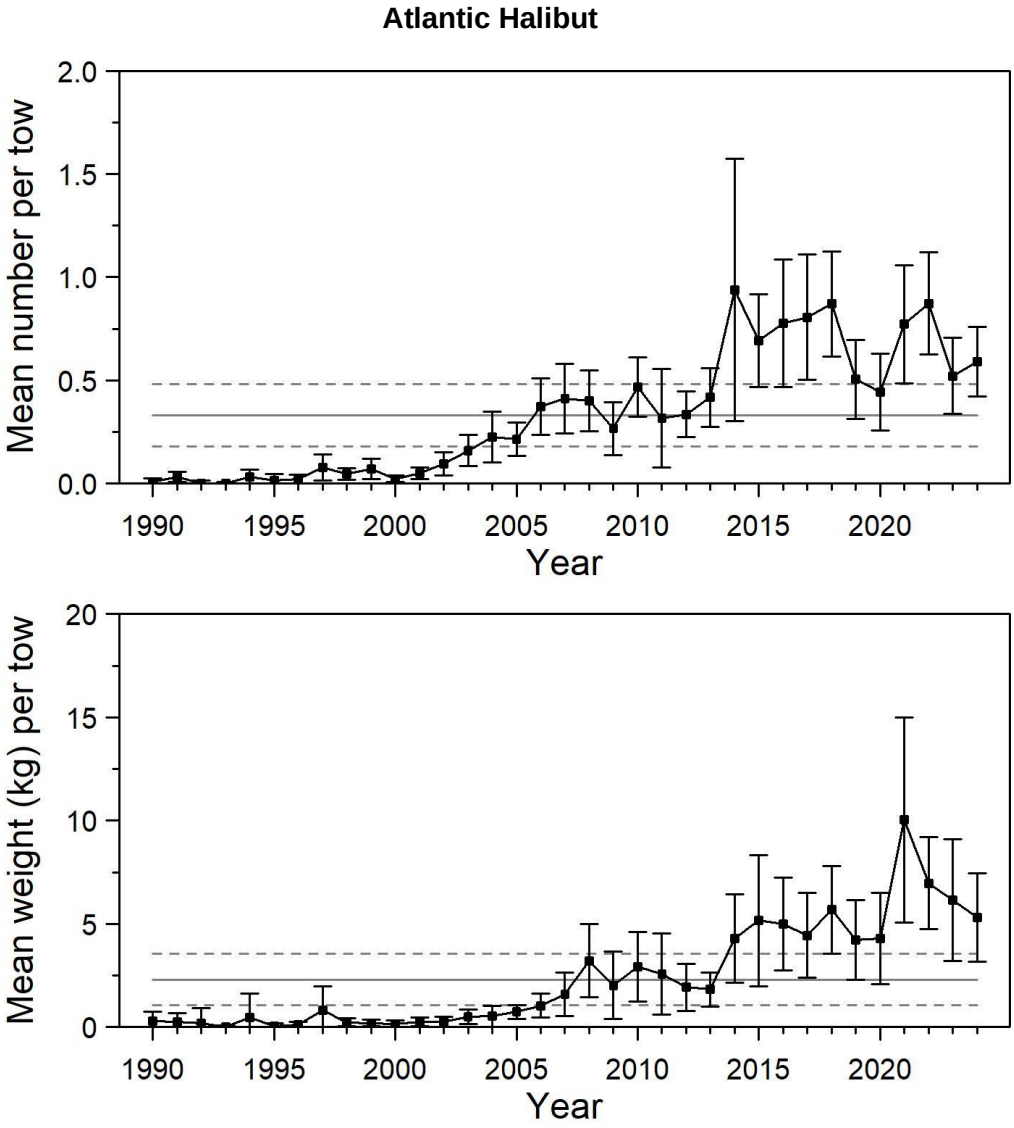

Figure 10. Mean numbers and mean weights per 15-minute tow observed during the survey for Atlantic Halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

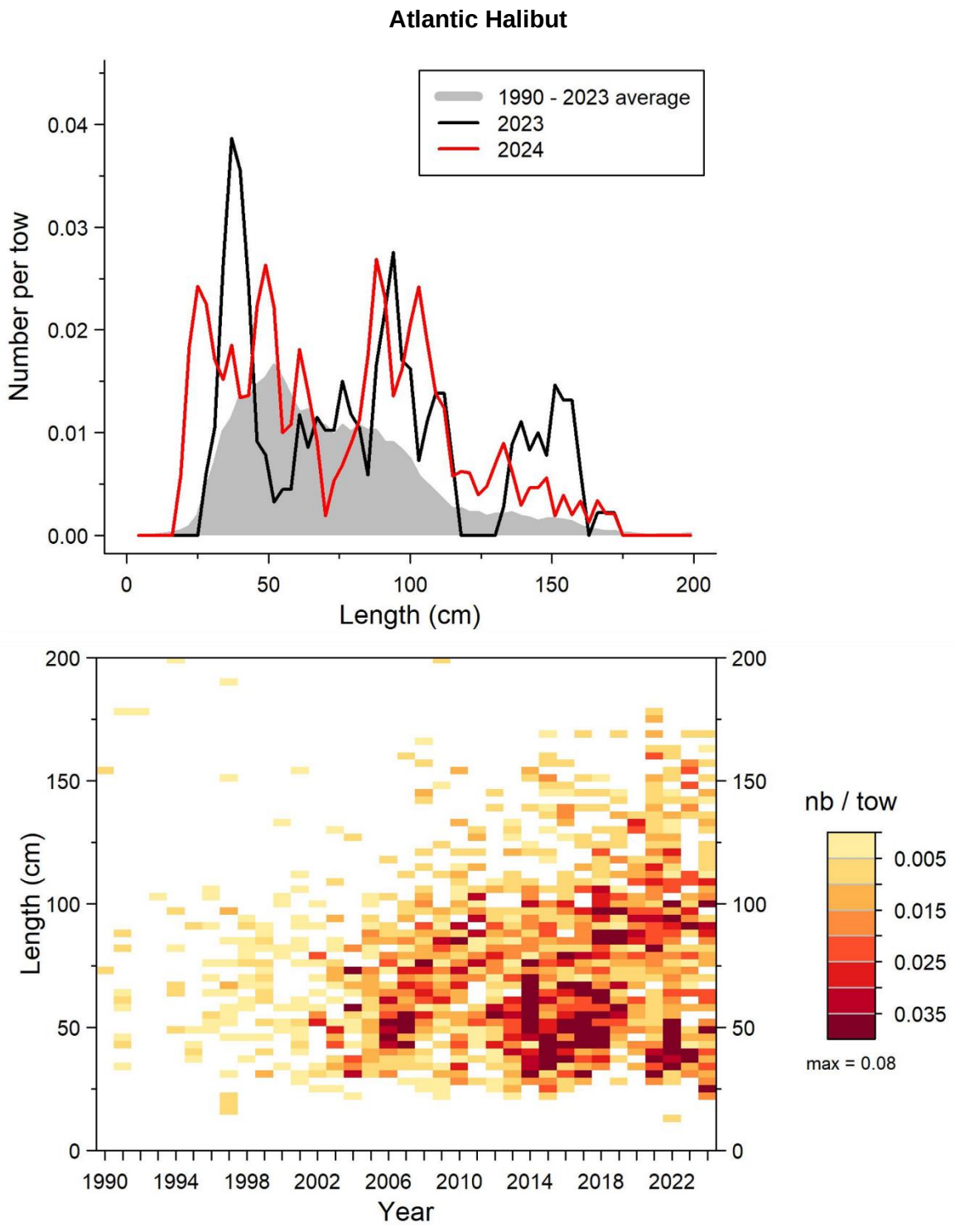

Figure 11. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Atlantic Halibut in 4RST.

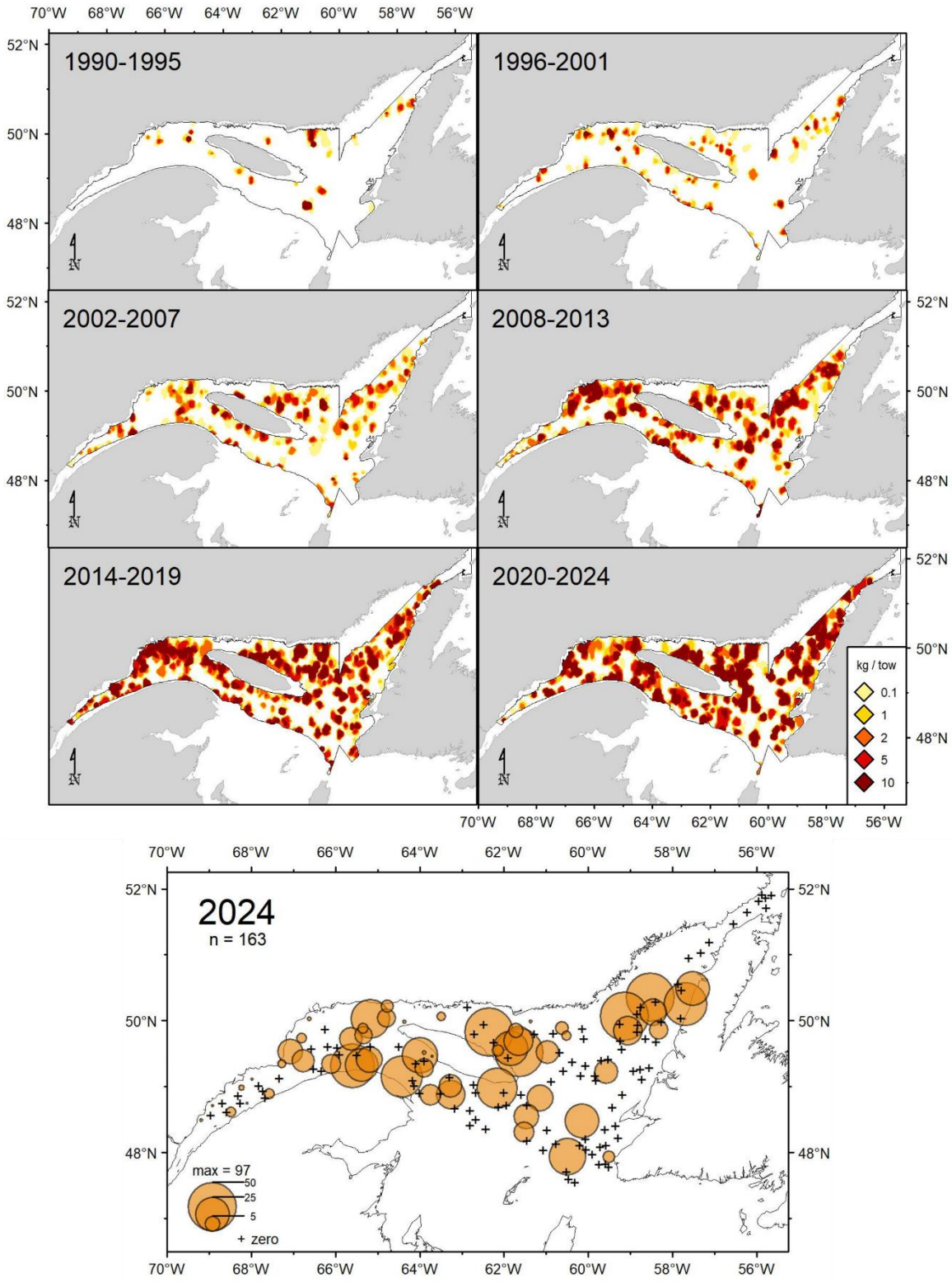

Figure 12. Atlantic Halibut catch rate (kg/15-minute tow) distributions.

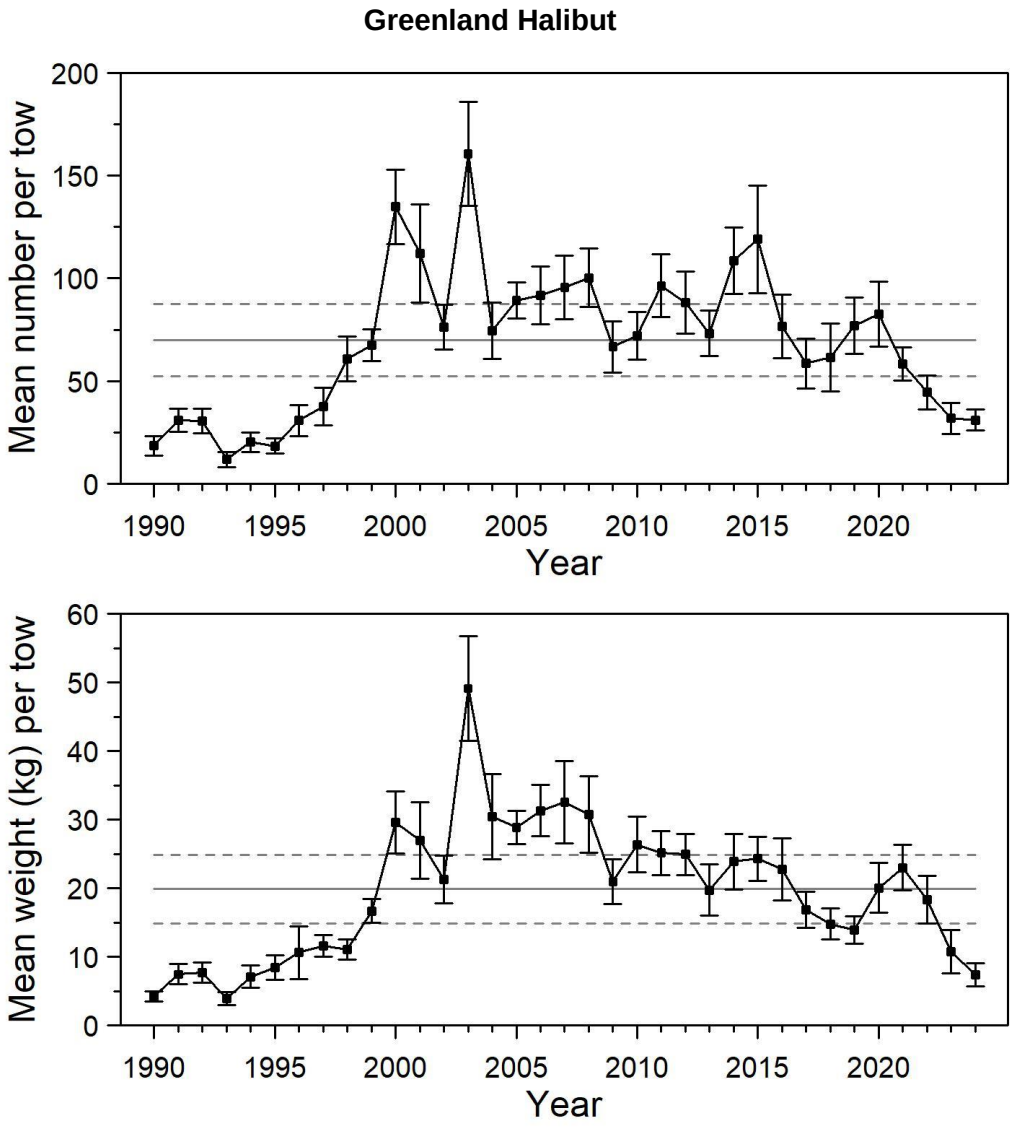

Figure 13. Mean numbers and mean weights per 15-minute tow observed during the survey for Greenland halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

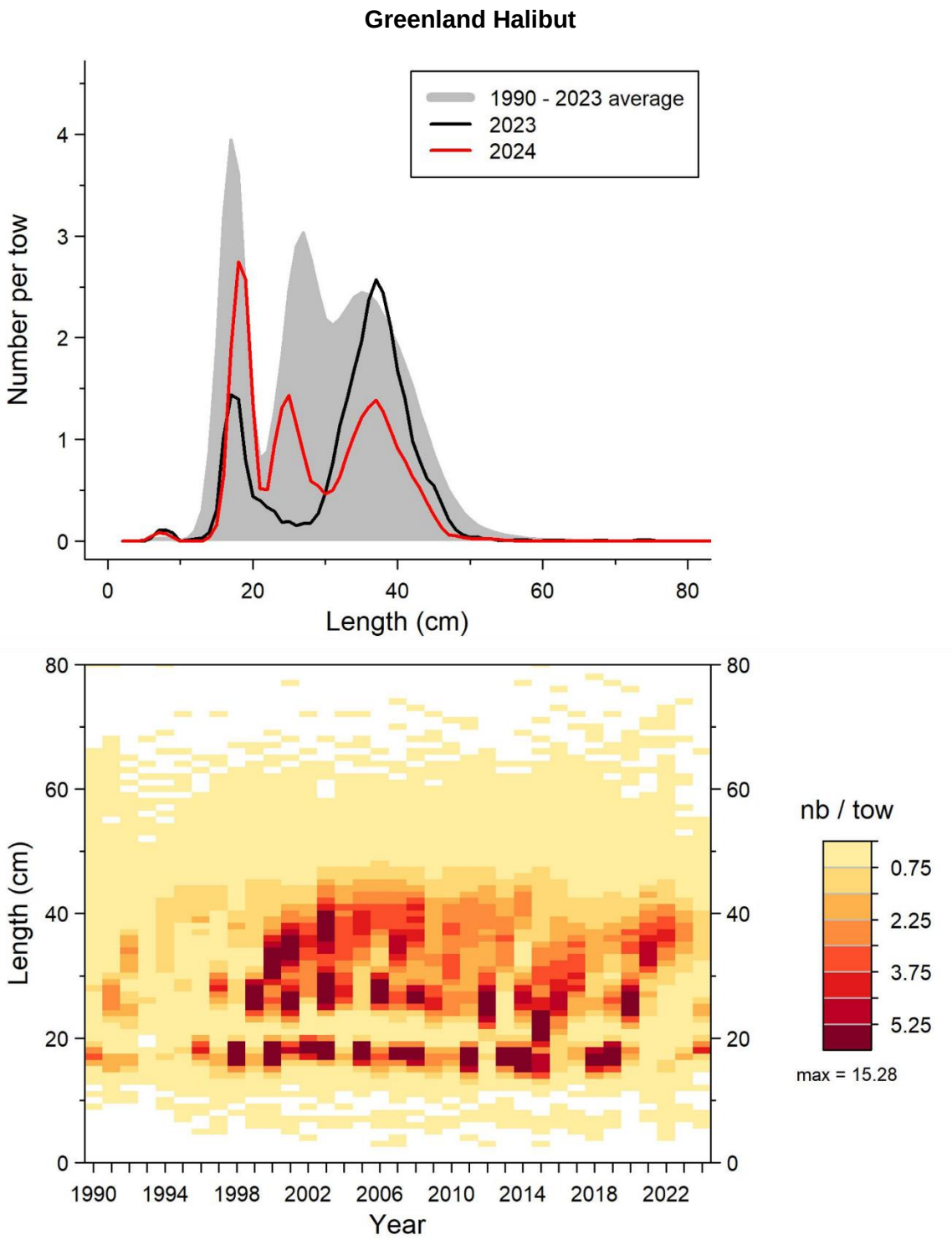

Figure 14. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Greenland halibut in 4RST.

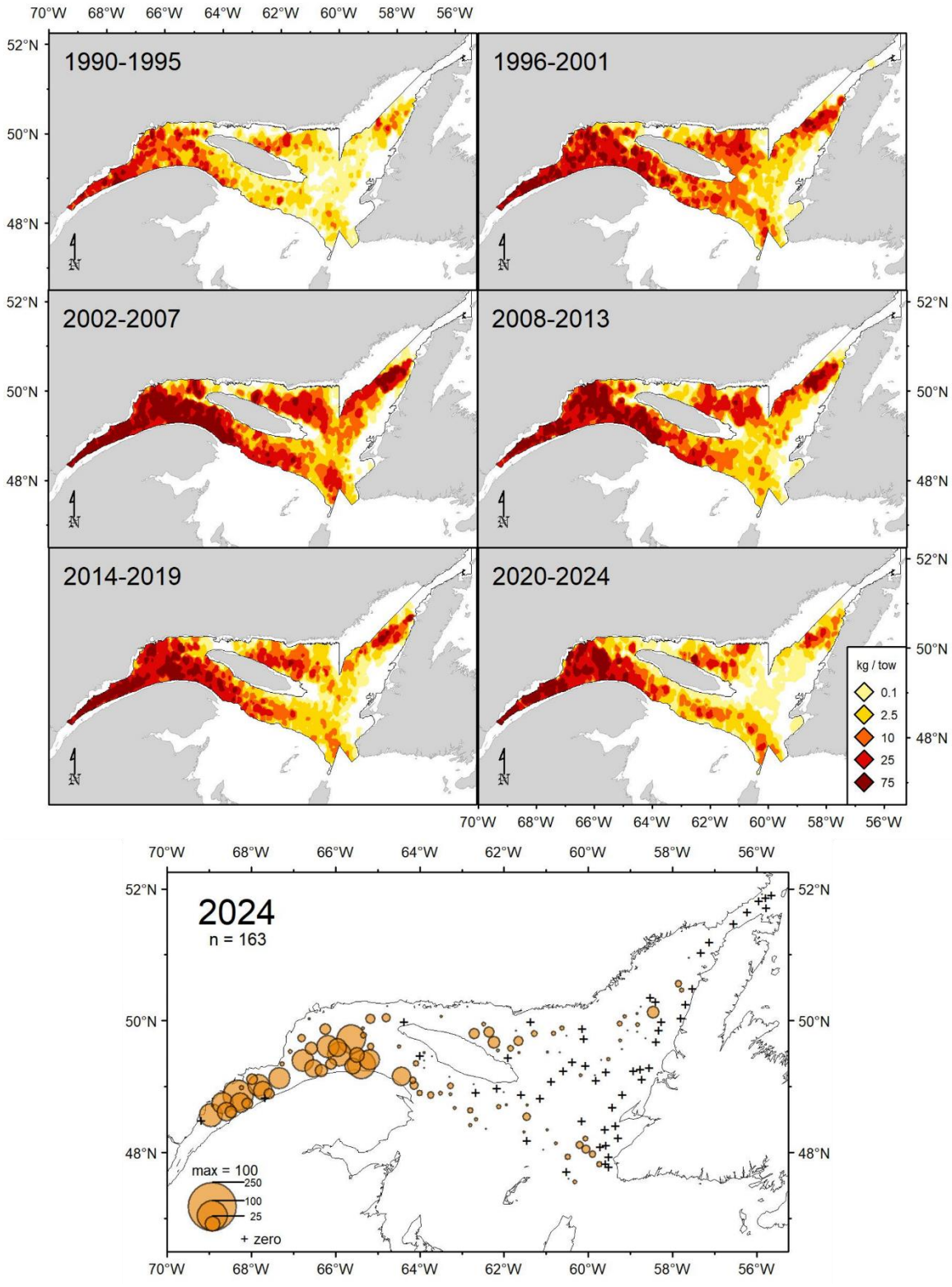

Figure 15. Greenland halibut catch rate (kg/15-minute tow) distributions.

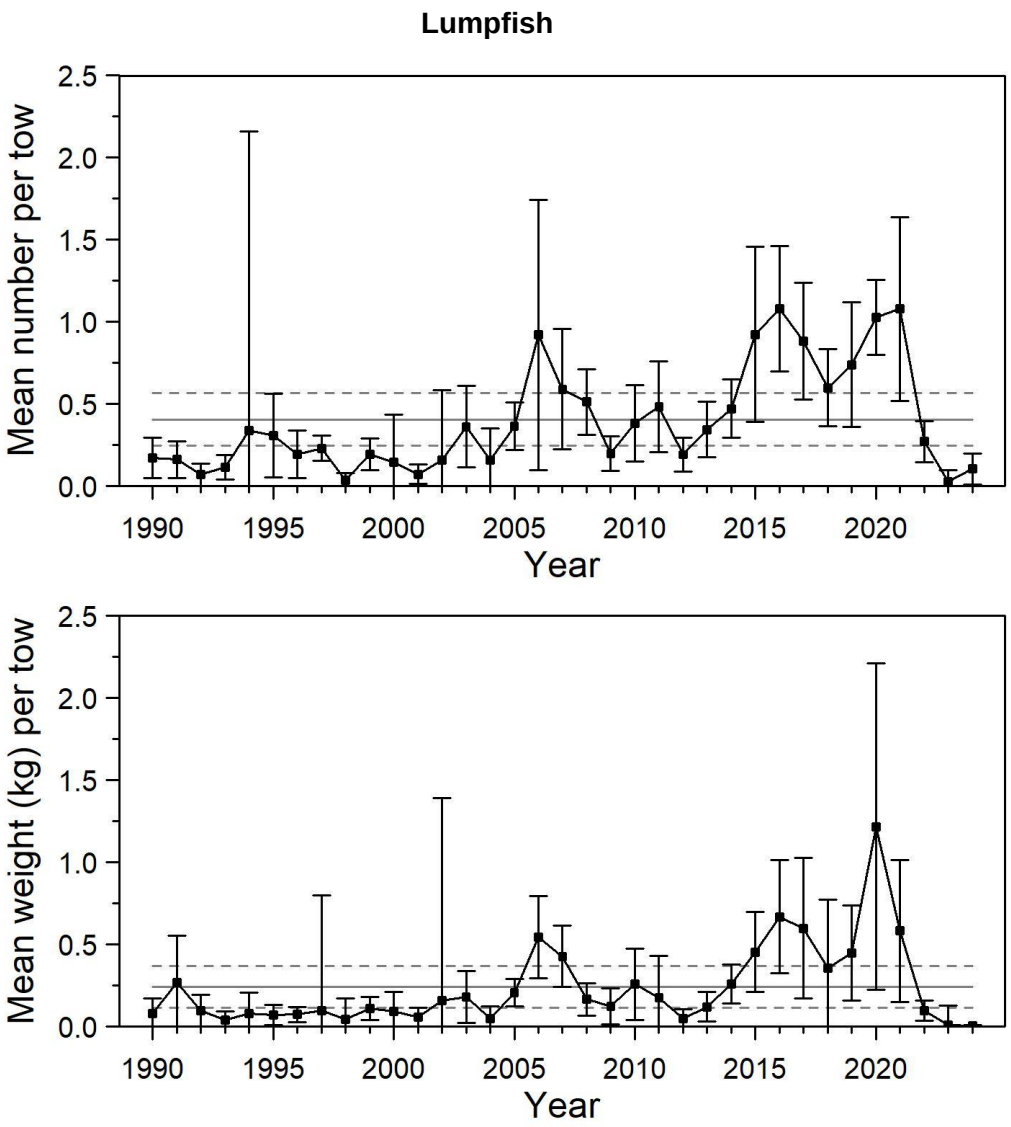

Figure 16. Mean numbers and mean weights per 15-minute tow observed during the survey for Lumpfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

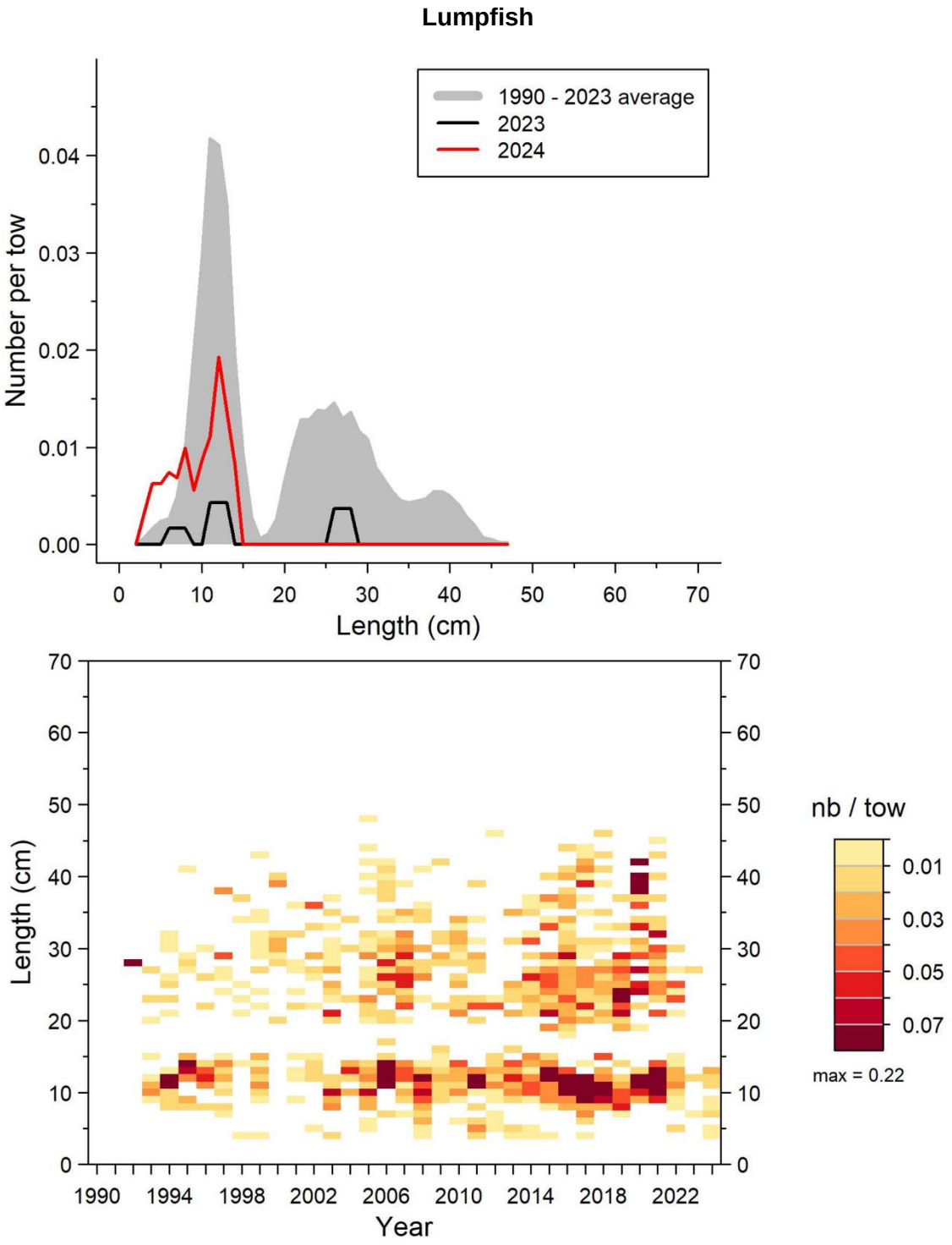

Figure 17. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Lumpfish in 4RST.

Lumpfish

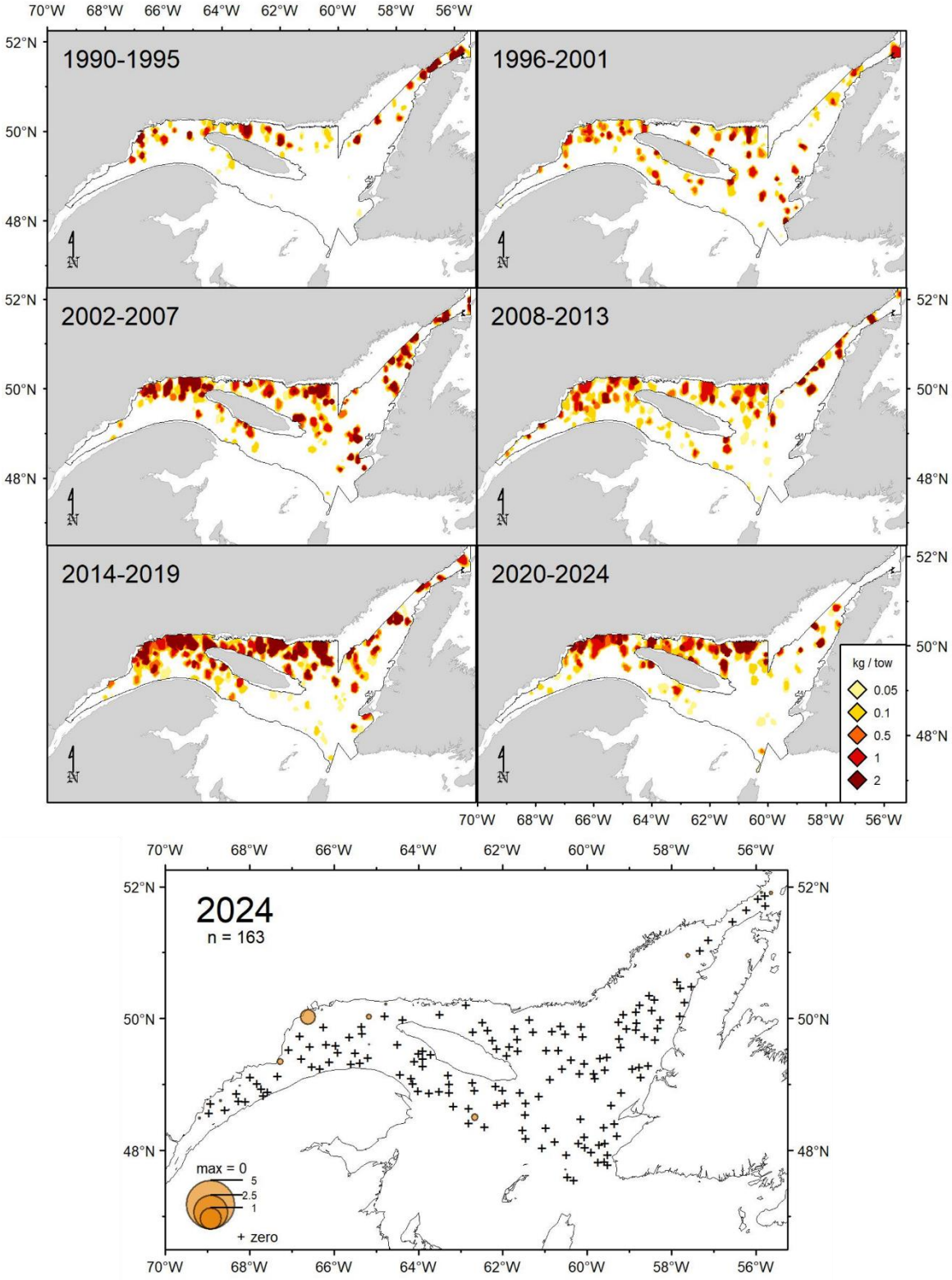

Figure 18. Lumpfish catch rate (kg/15-minute tow) distributions.

Herring

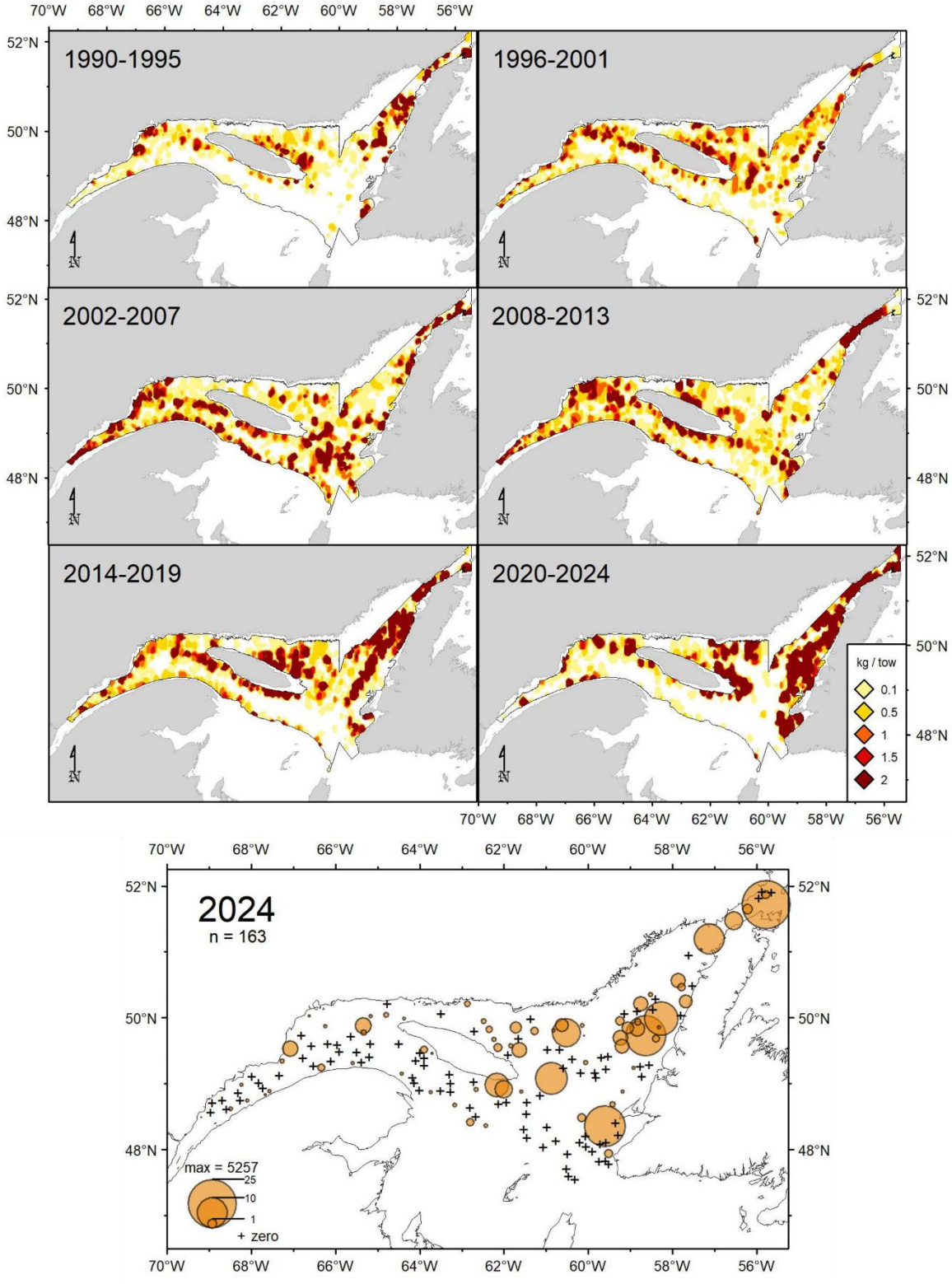

Figure 19. Herring catch rate (kg/15-minute tow) distributions.

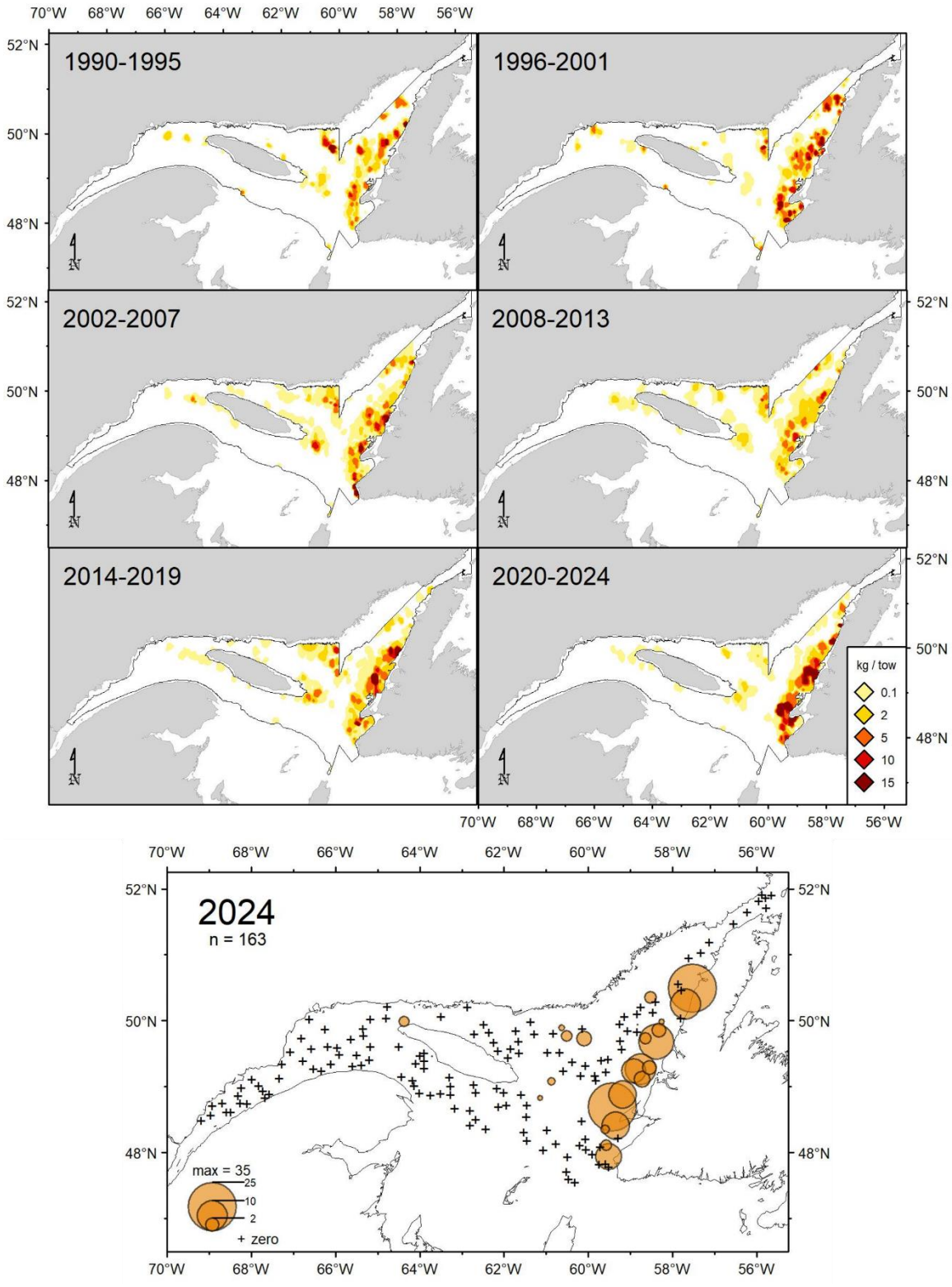

Figure 20. Atlantic Wolffish catch rate (kg/15-minute tow) distributions.

Spotted Wolffish

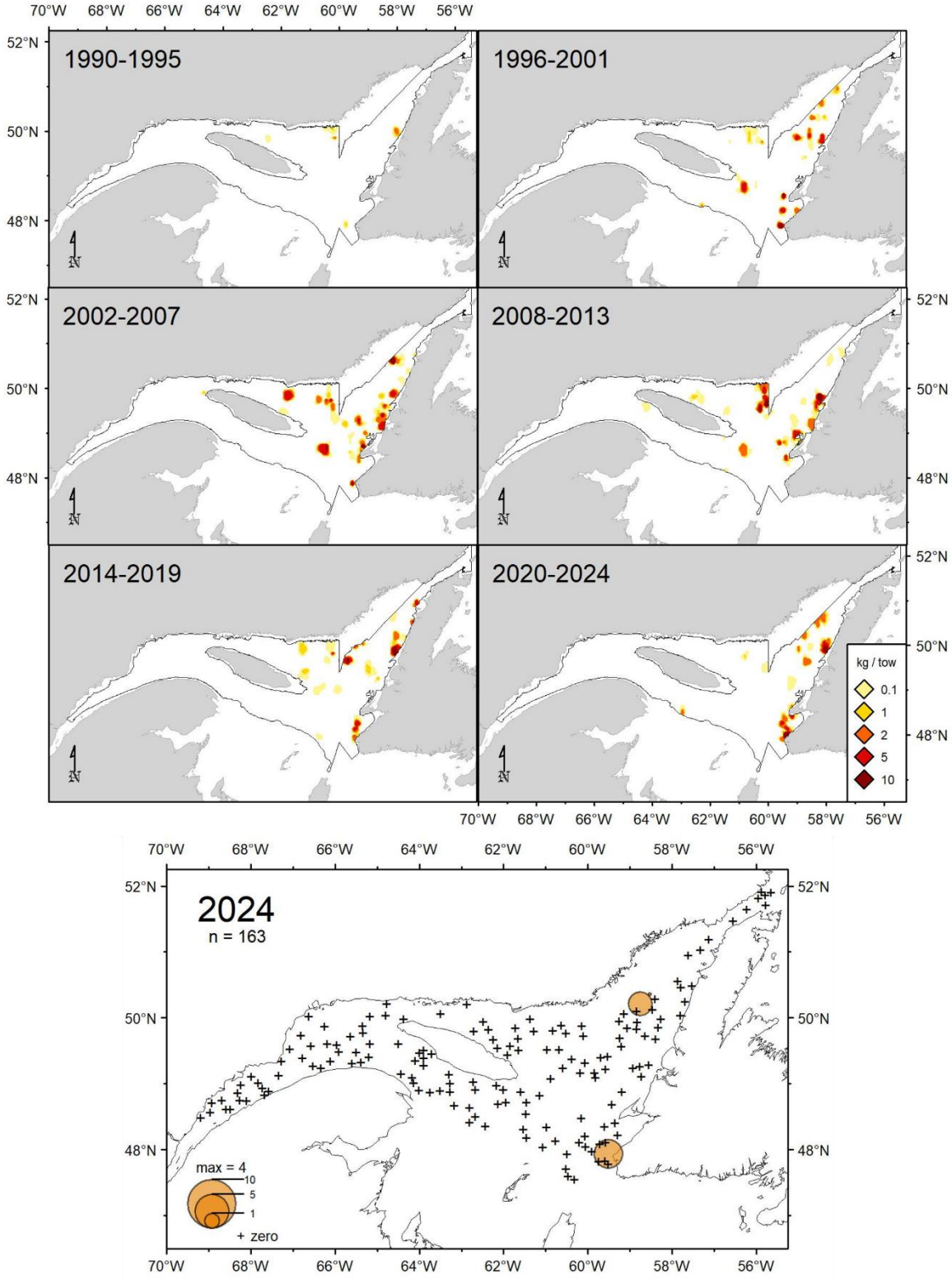

Figure 21. Spotted Wolffish catch rate (kg/15-minute tow) distributions.

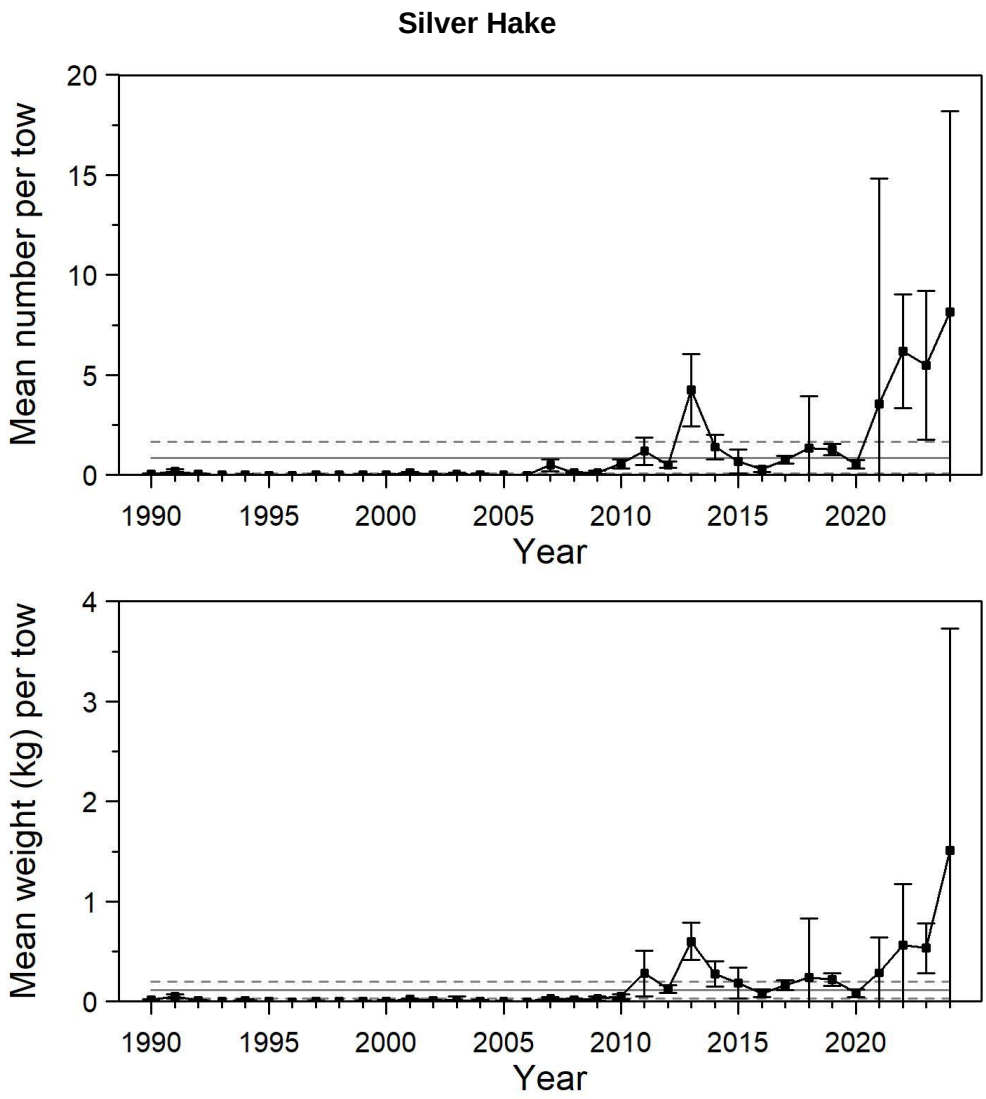

Figure 22. Mean numbers and mean weights per 15-minute tow observed during the survey for Silver Hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

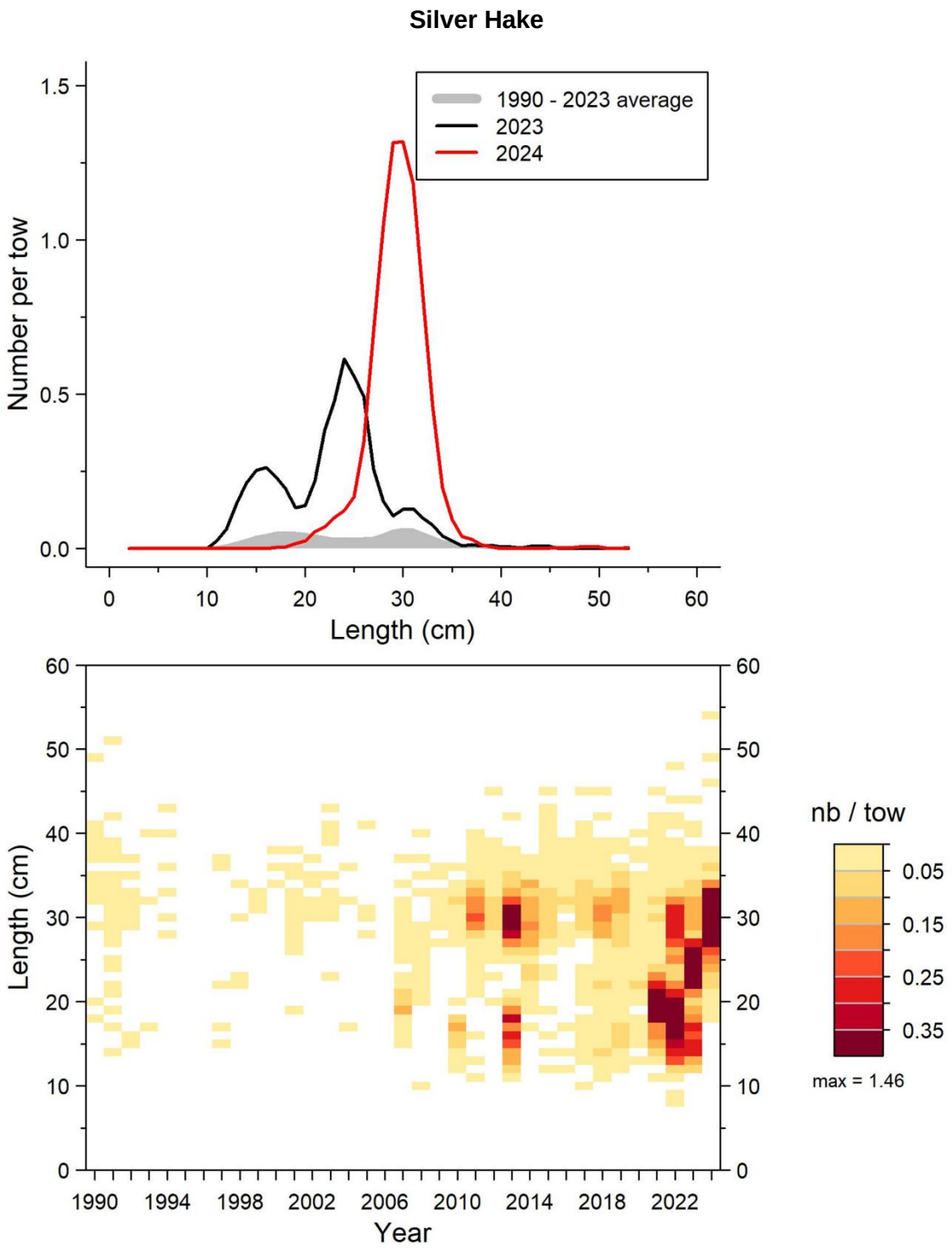

Figure 23. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Silver Hake in 4RST.

Silver hake

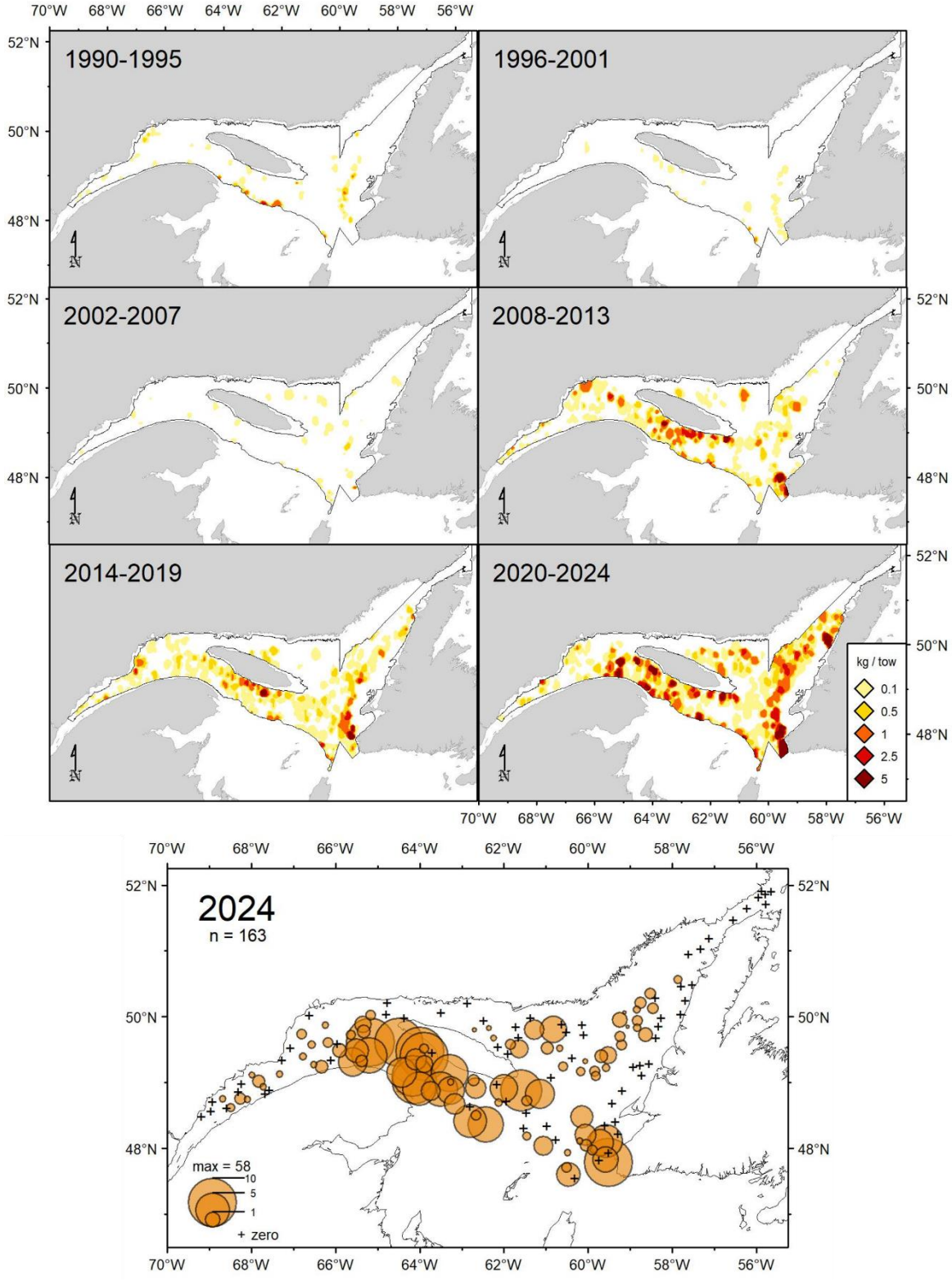

Figure 24. Silver hake catch rate (kg/15-minute tow) distributions.

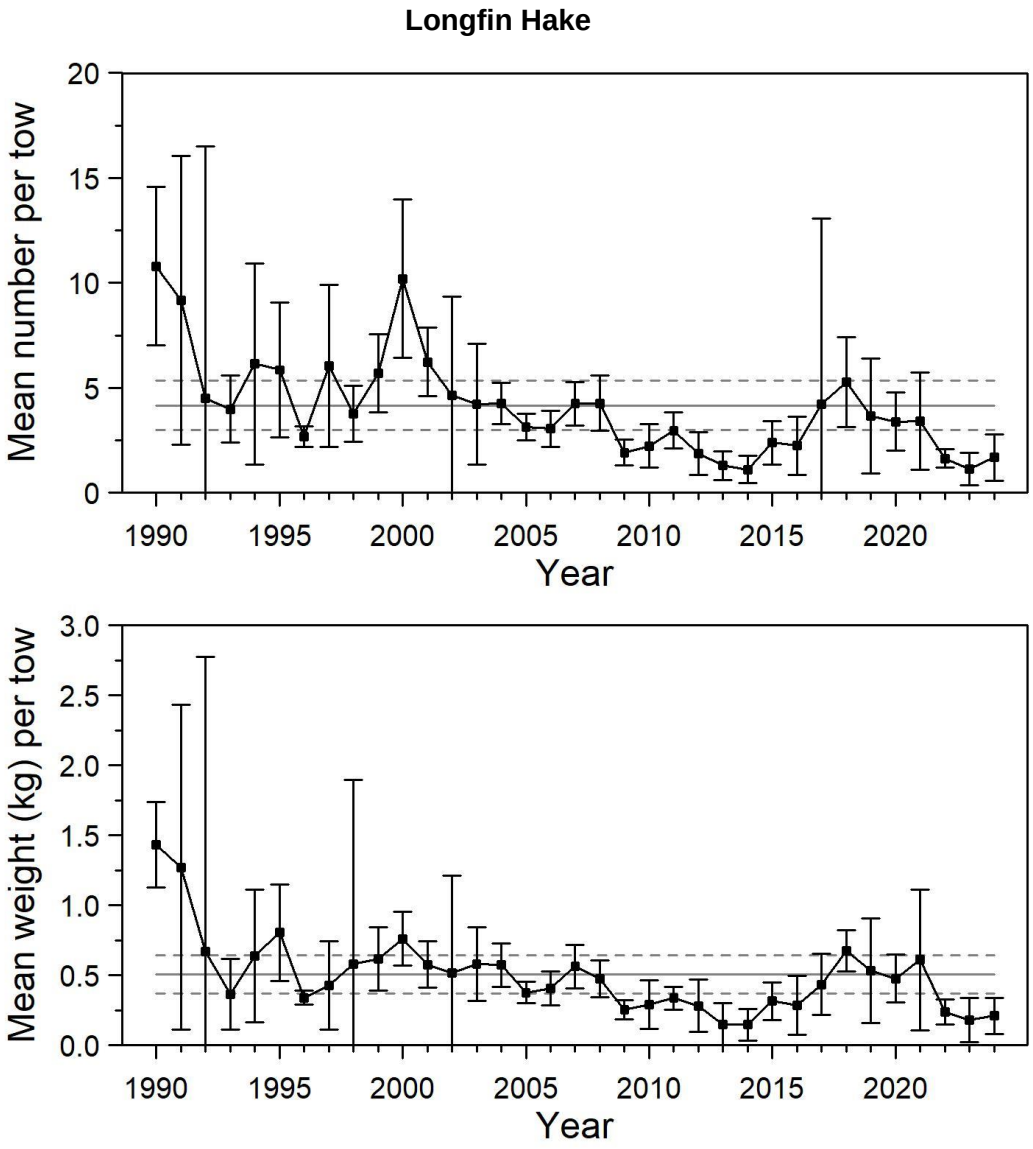

Figure 25. Mean numbers and mean weights per 15-minute tow observed during the survey for longfin hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

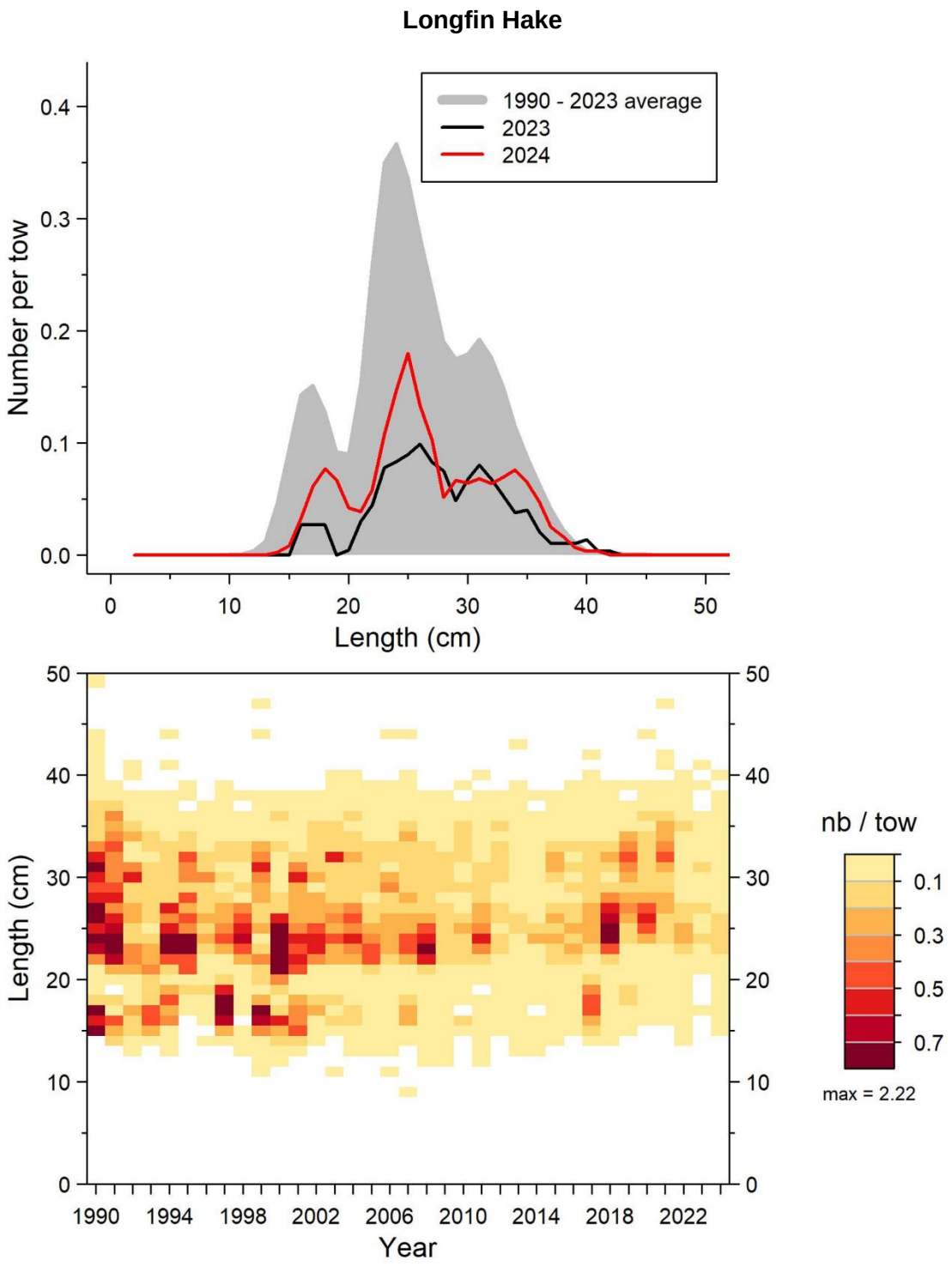

Figure 26. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Longfin Hake in 4RST.

Longfin Hake

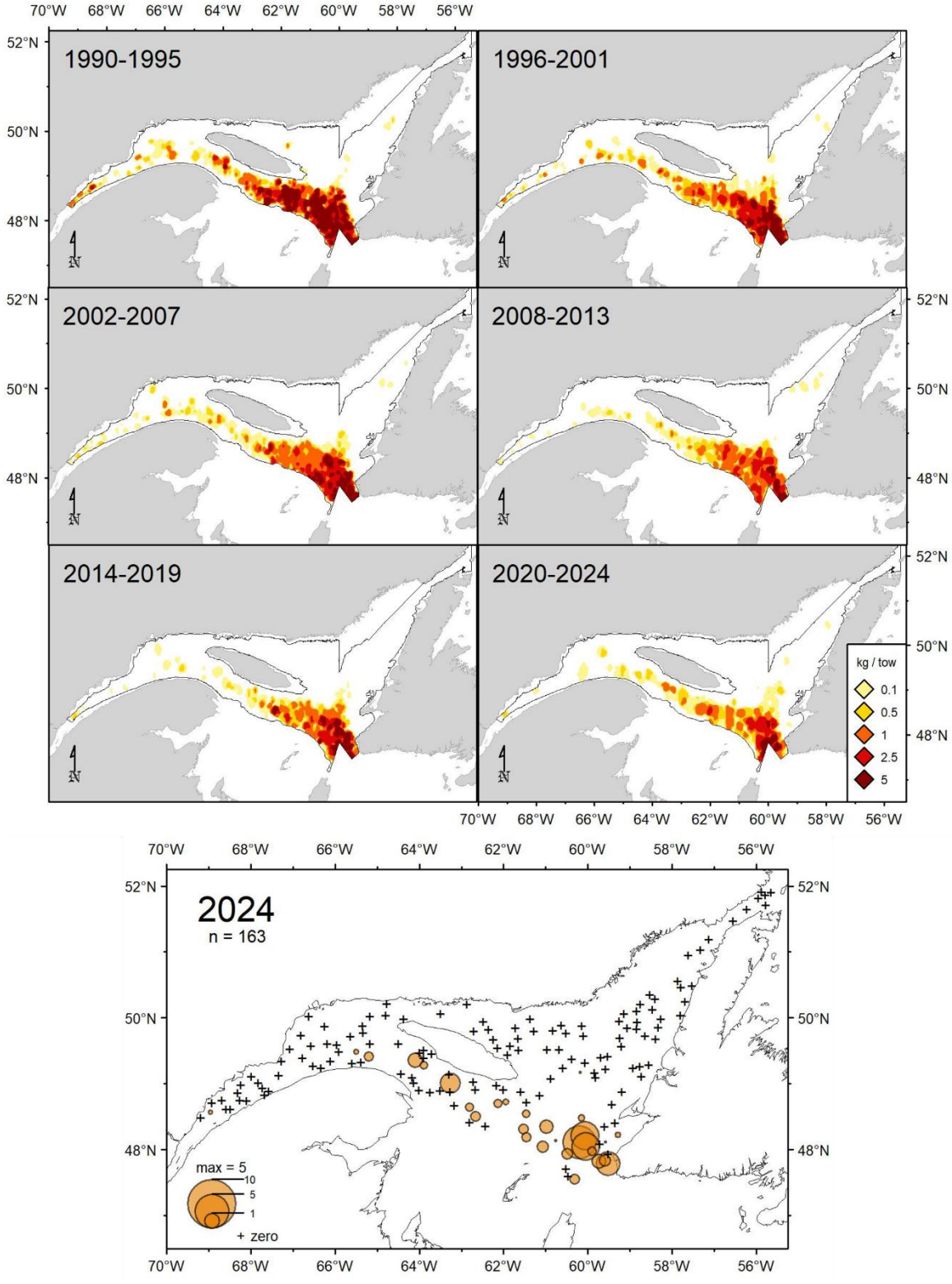

Figure 27. Longfin Hake catch rate (kg/15-minute tow) distributions.

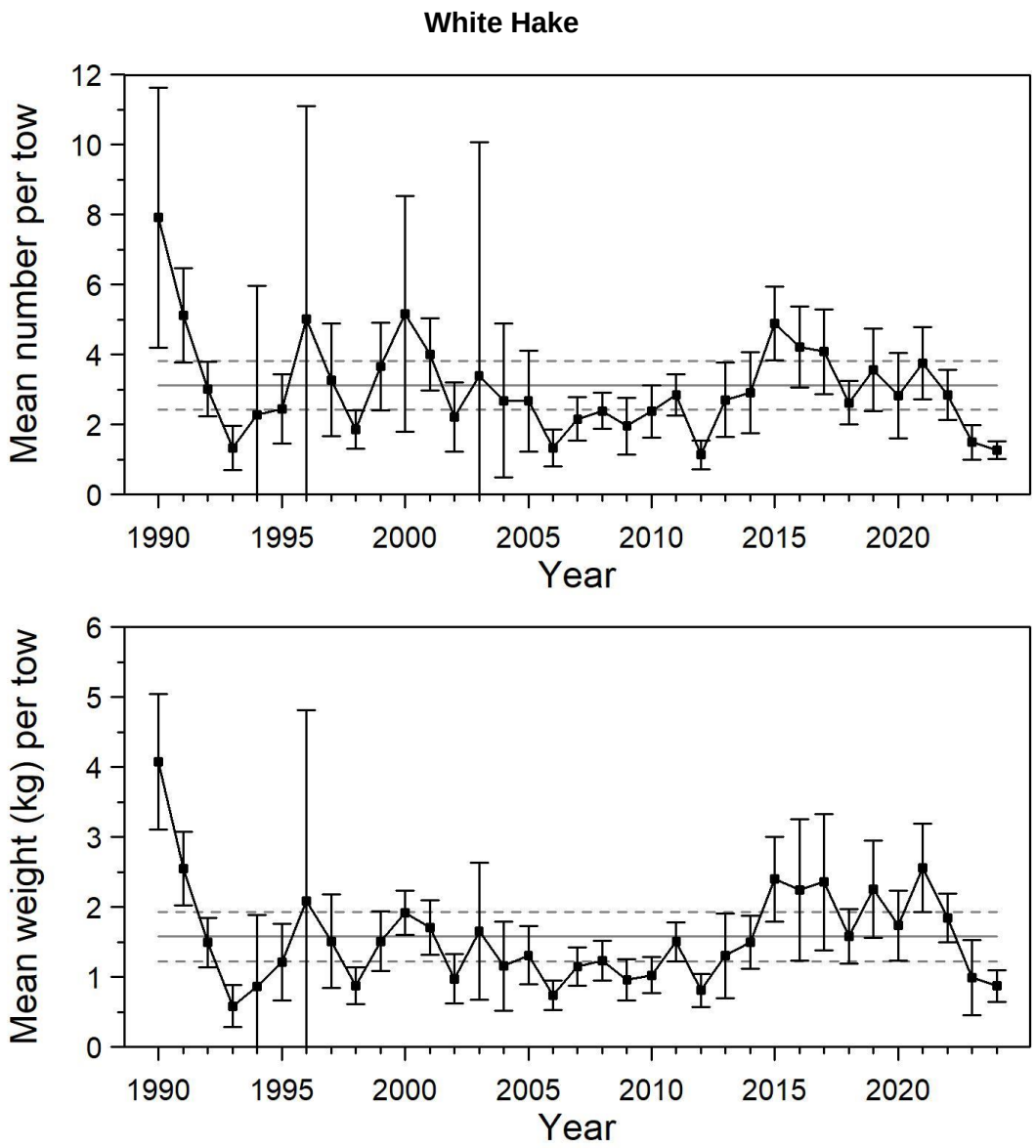

Figure 28. Mean numbers and mean weights per 15-minute tow observed during the survey for white hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

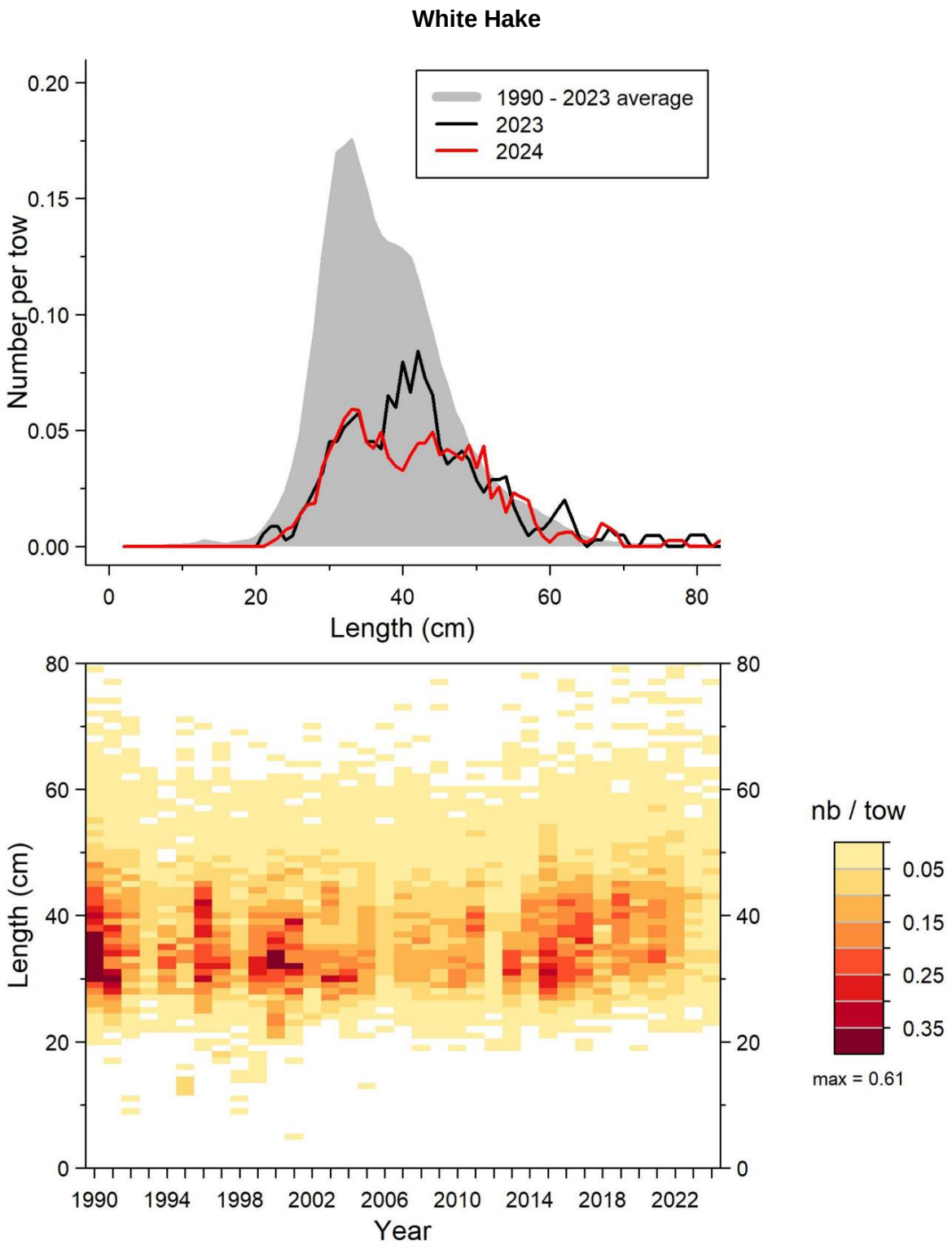

Figure 29. Length frequency distributions (mean number per 15-minute tow) observed during the survey for White Hake in 4RST.

White Hake

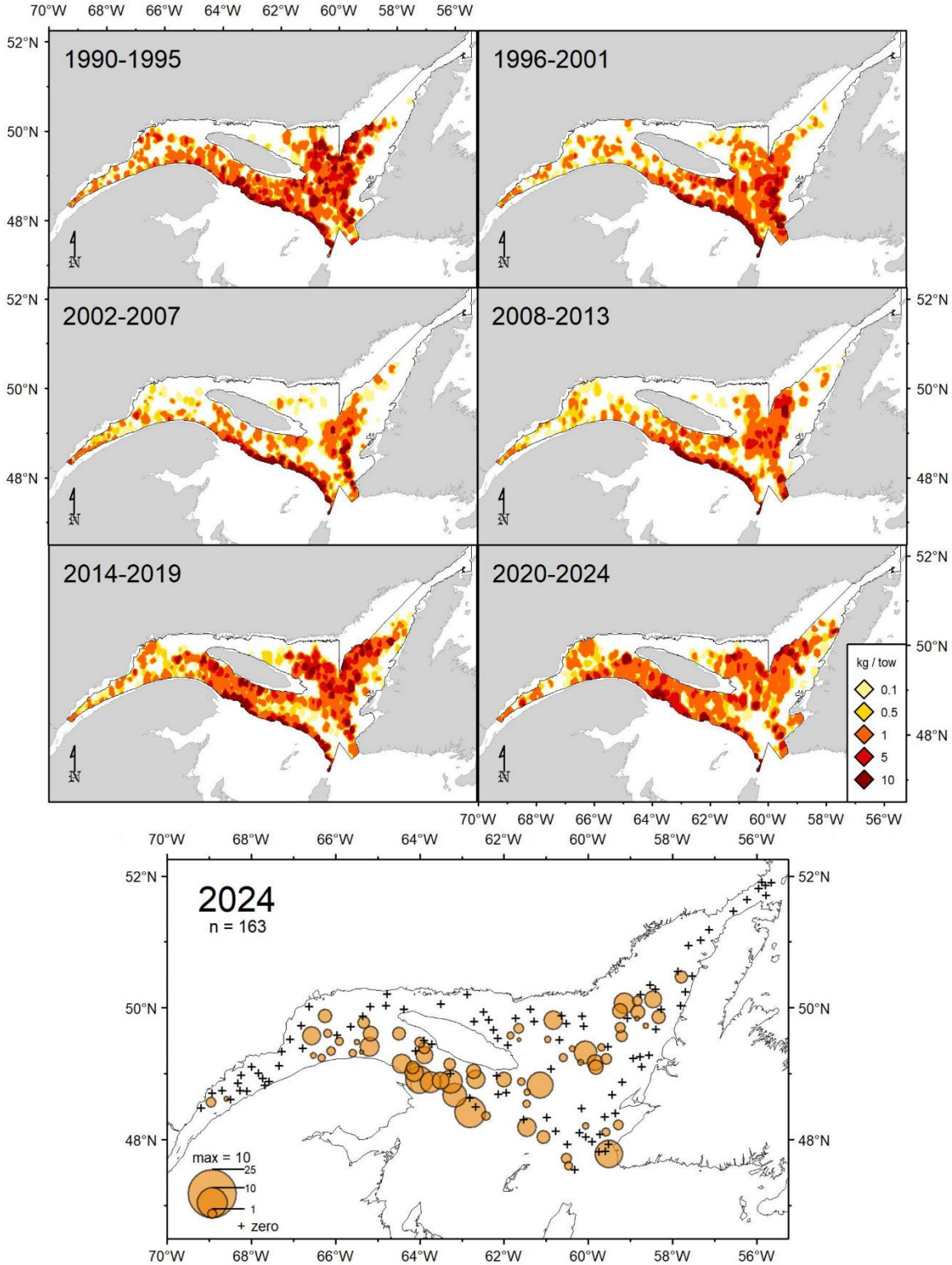

Figure 30. White hake catch rate (kg/15-minute tow) distributions.

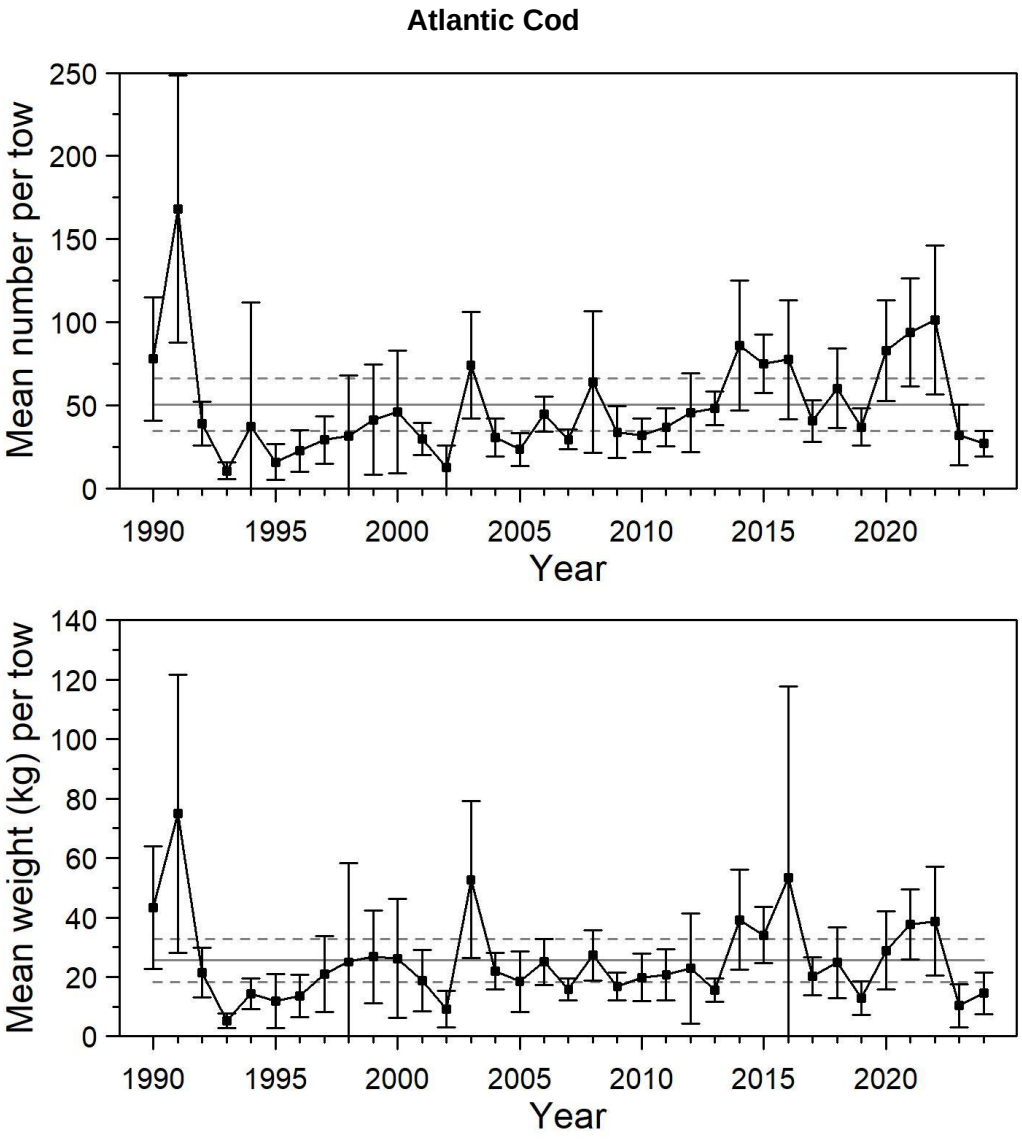

Figure 31. Mean numbers and mean weights per 15-minute tow observed during the survey for Atlantic cod in 4RS. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

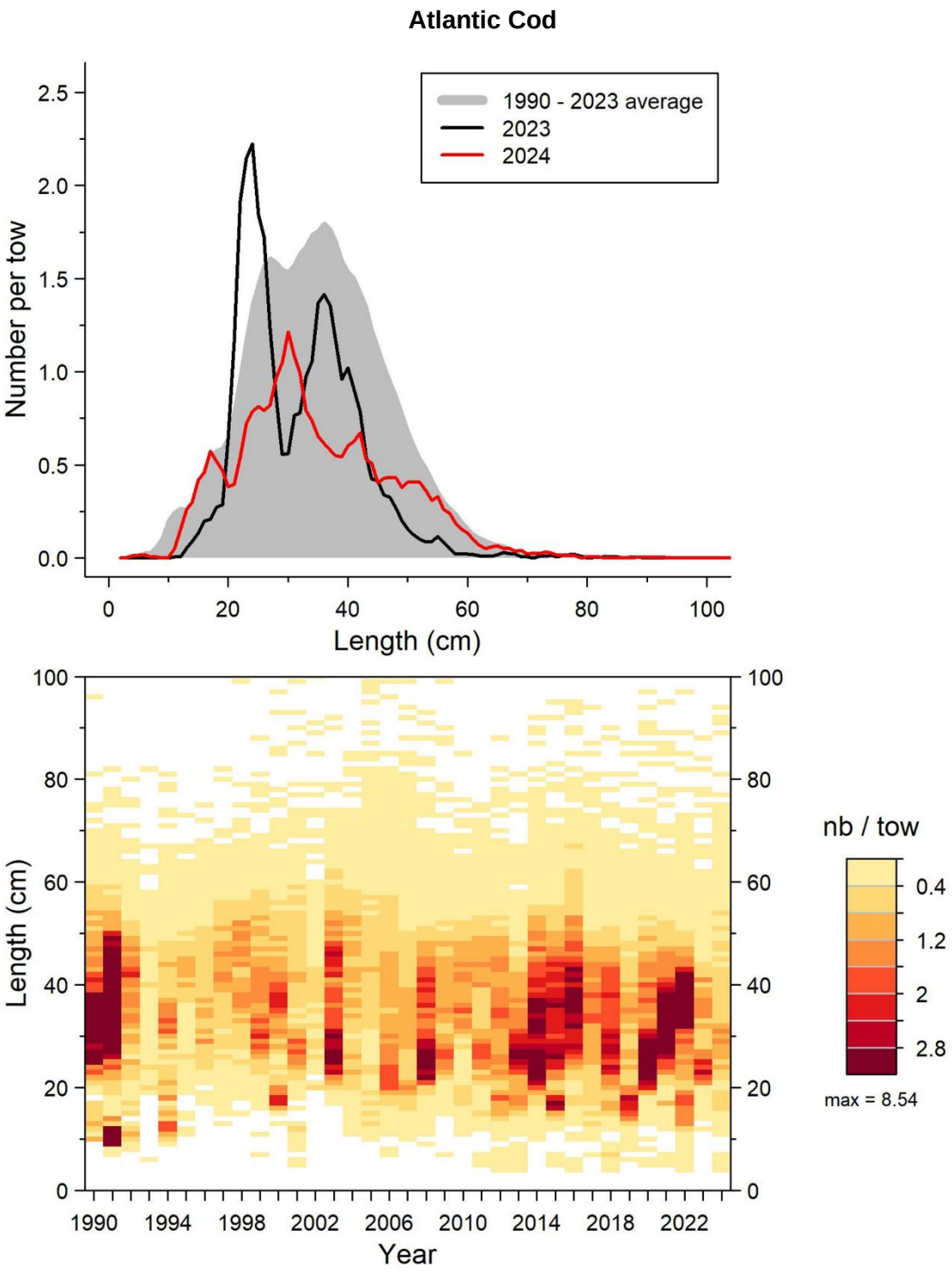

Figure 32. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Atlantic Cod in 4RS.

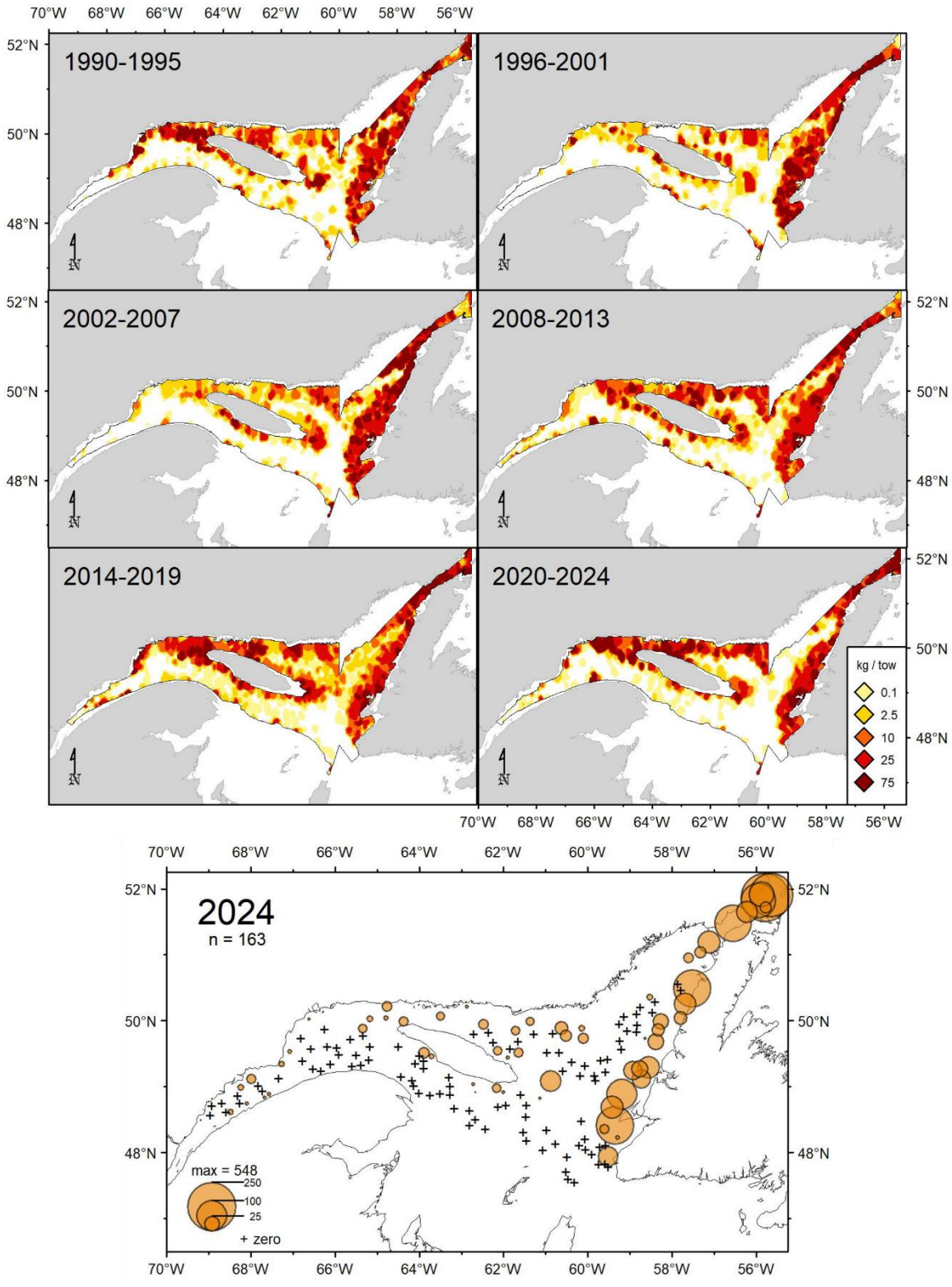

Figure 33. Atlantic Cod catch rate (kg/15-minute tow) distributions.

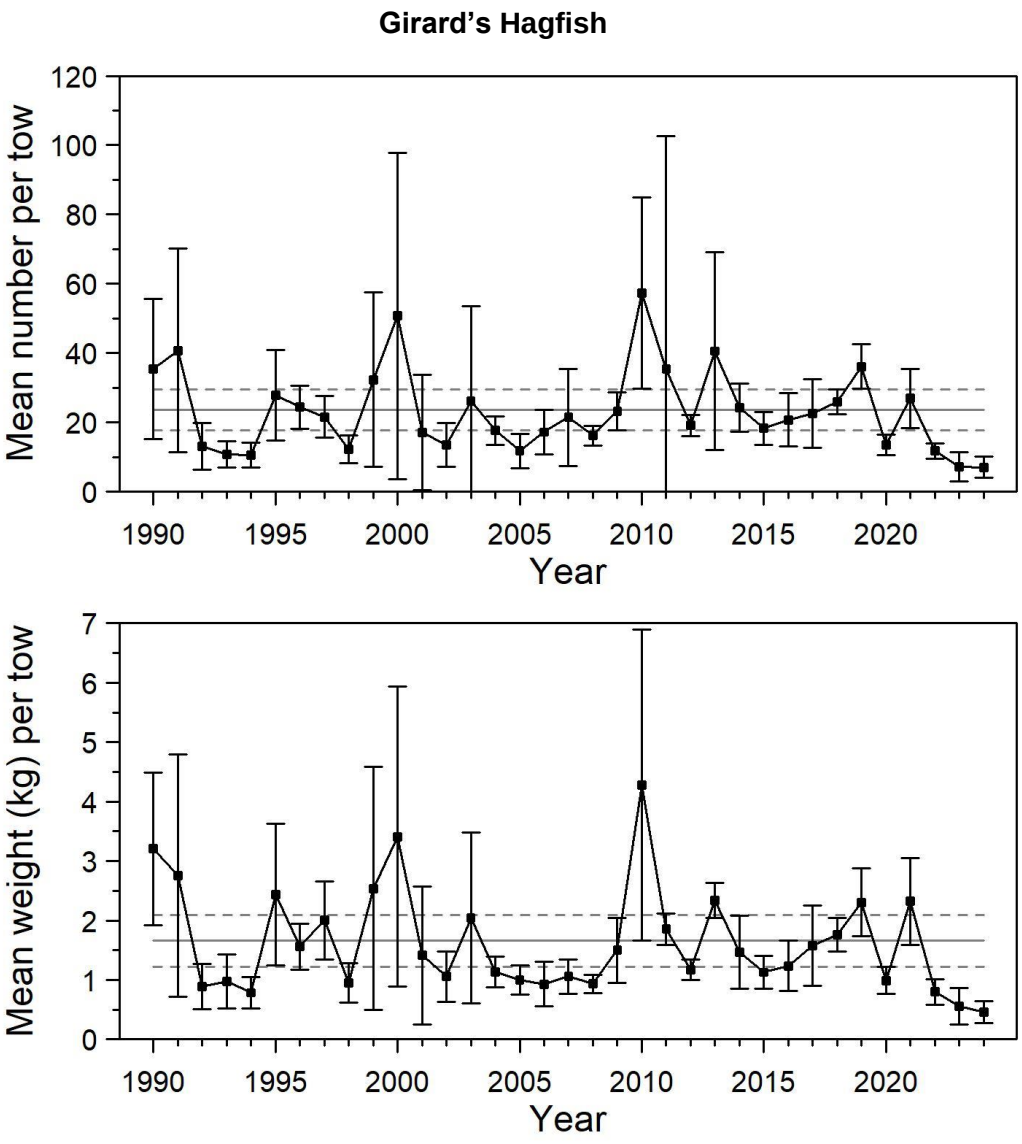

Figure 34. Mean numbers and mean weights per 15-minute tow observed during the survey for Girard's Hagfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

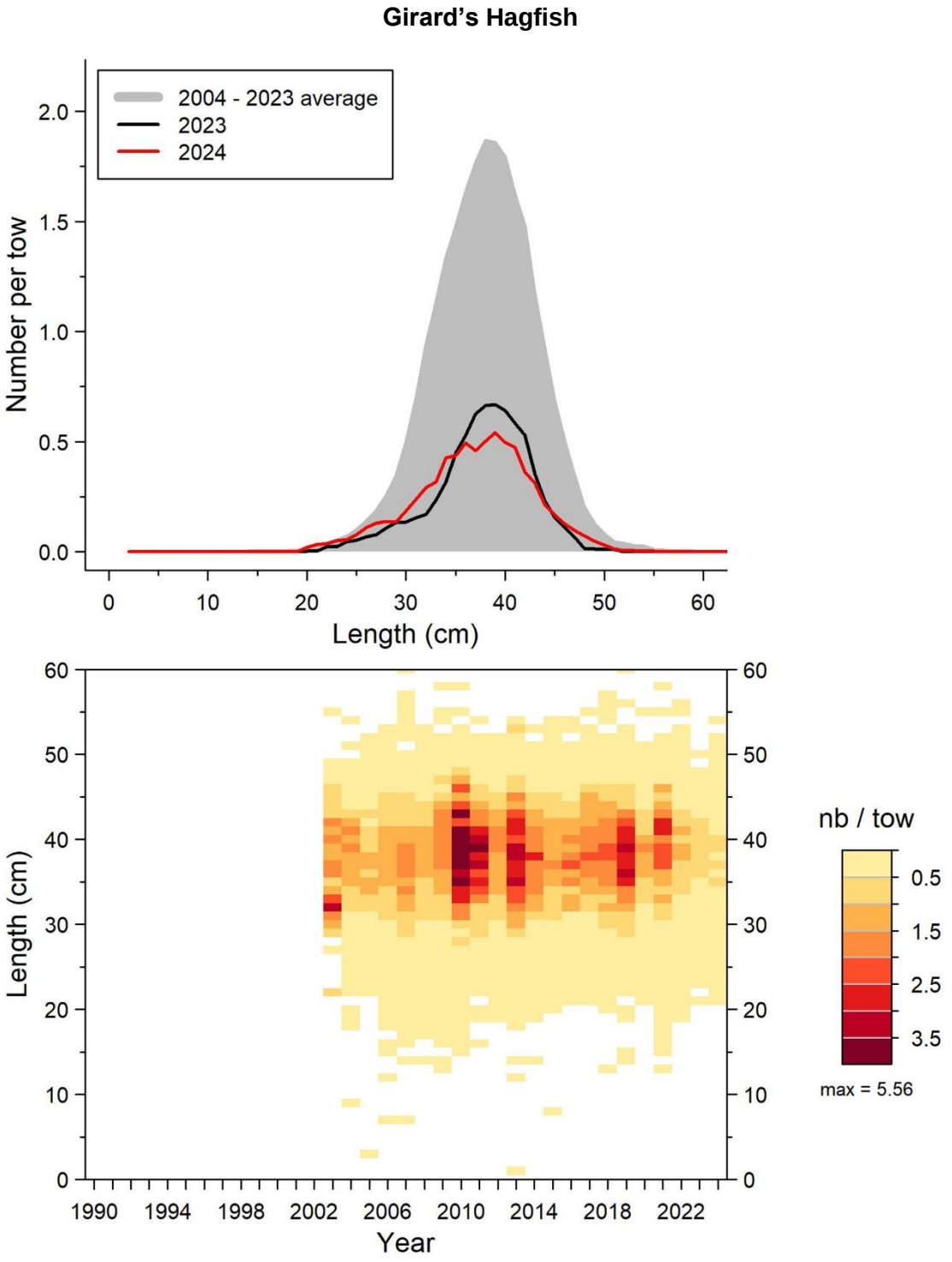

Figure 35. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Girard's Hagfish in 4RST.

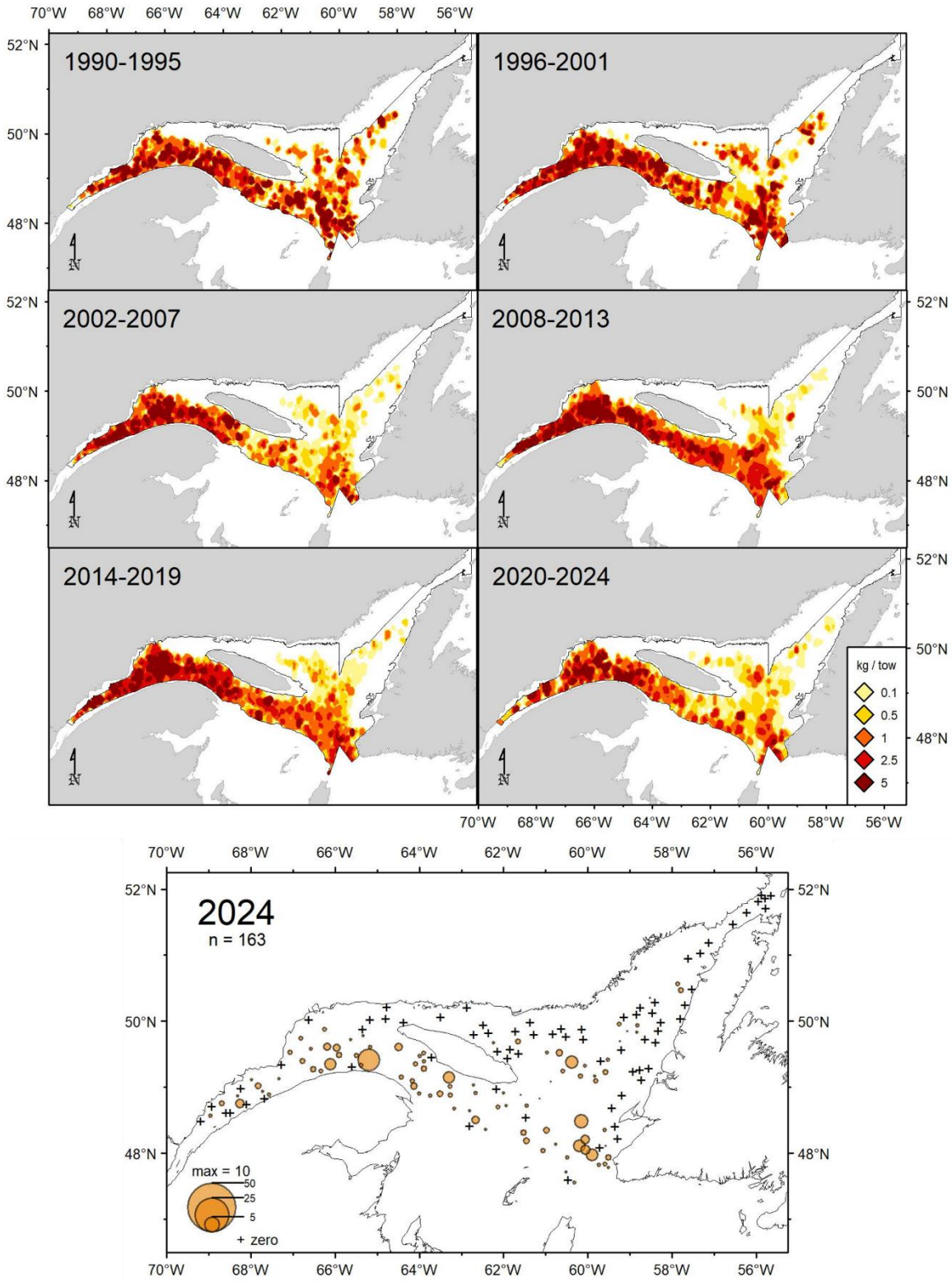

Figure 36. Girard's Hagfish catch rate (kg/15-minute tow) distributions.

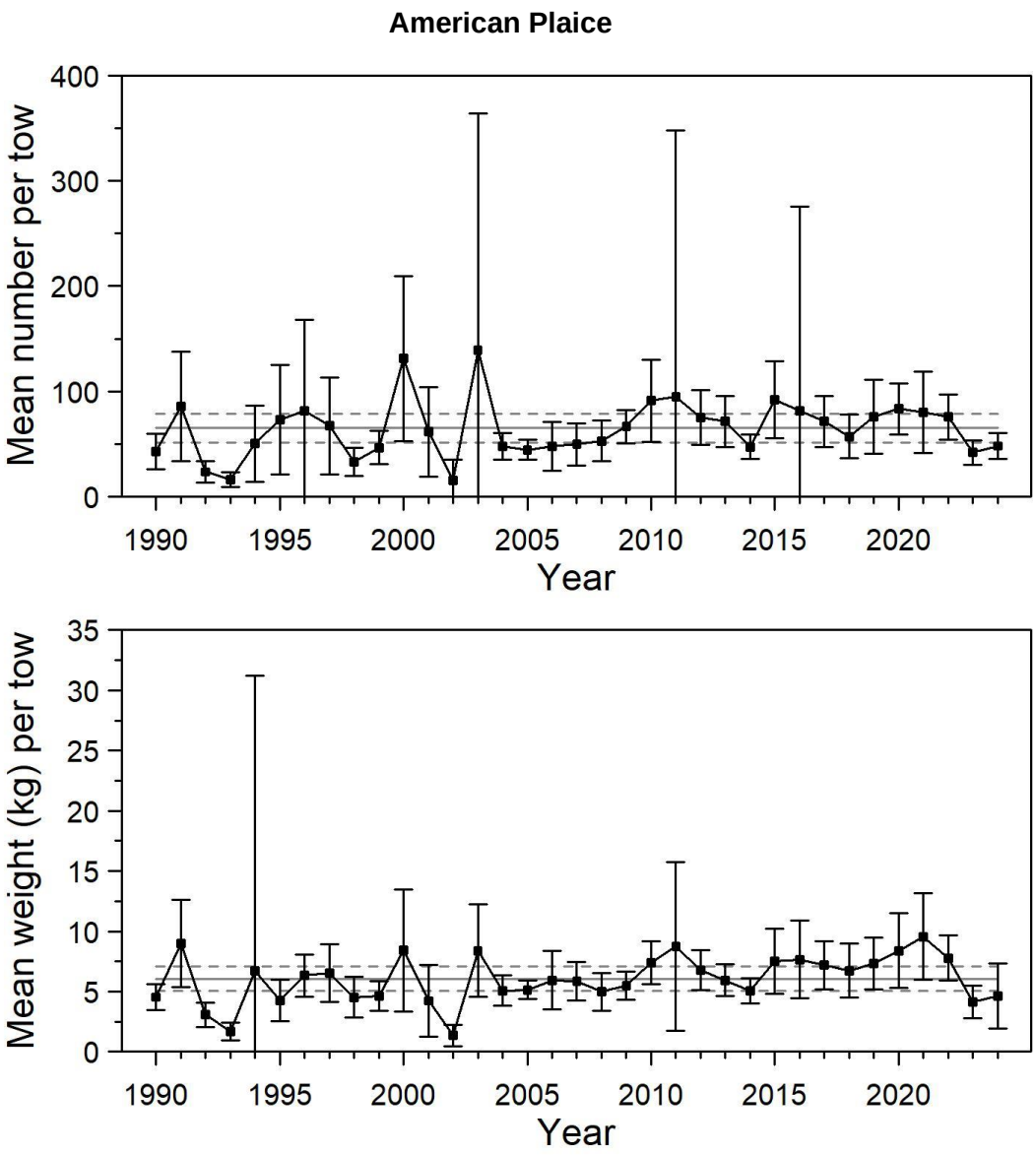

Figure 37. Mean numbers and mean weights per 15-minute tow observed during the survey for American Plaice in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

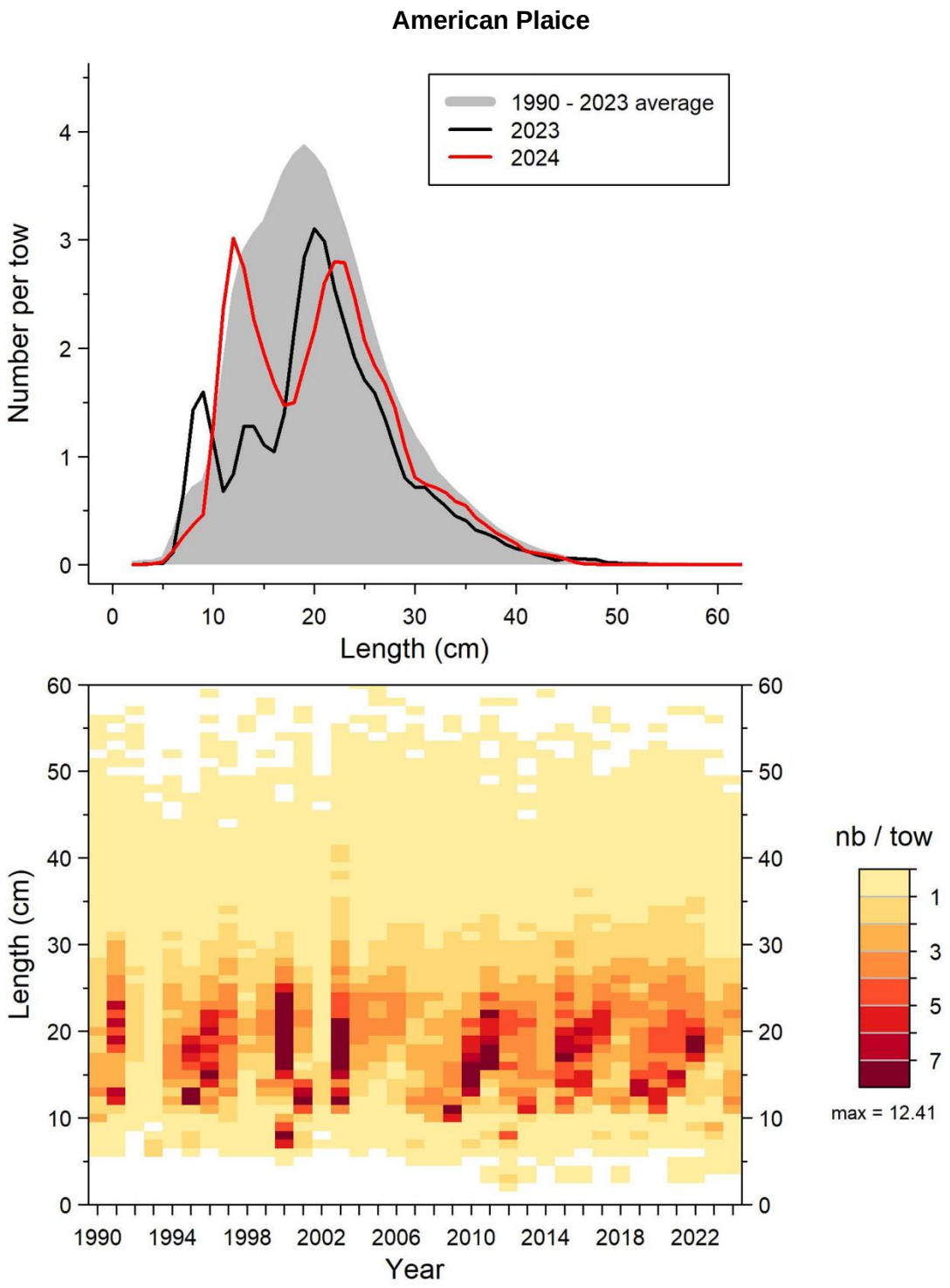

Figure 38. Length frequency distributions (mean number per 15-minute tow) observed during the survey for American Plaice in 4RST.

American Plaice

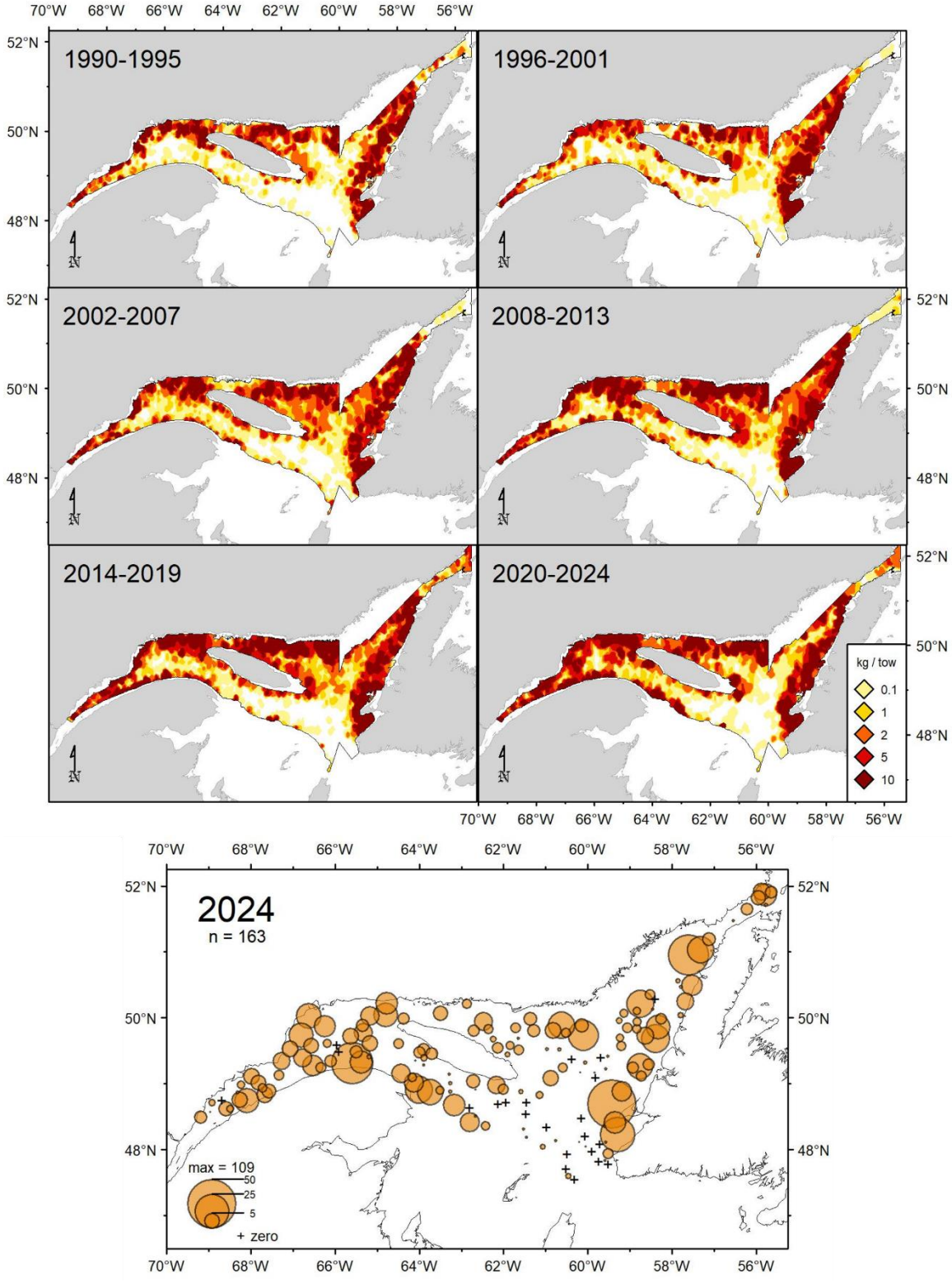

Figure 39. American Plaice catch rate (kg/15-minute tow) distributions.

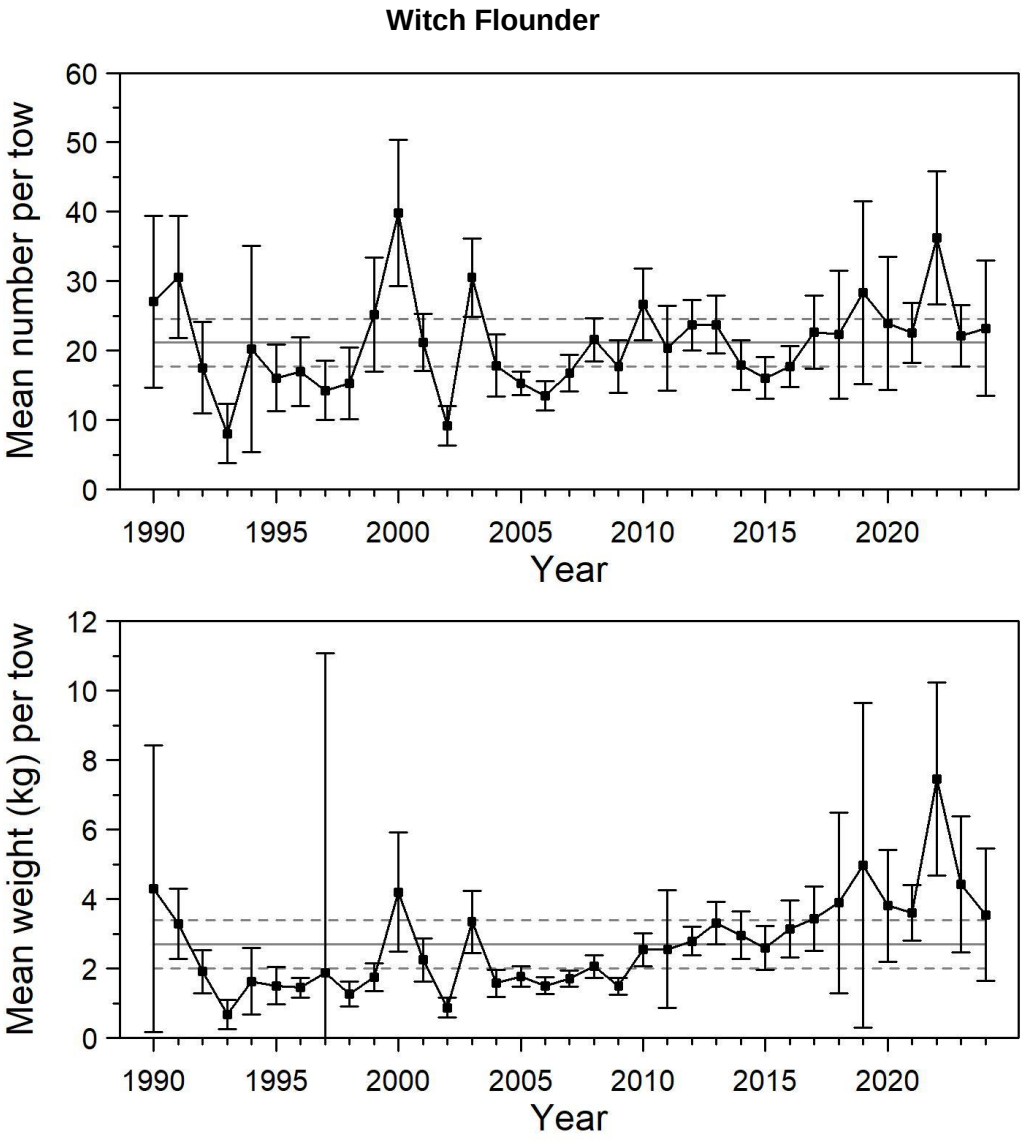

Figure 40. Mean numbers and mean weights per 15-minute tow observed during the survey for Witch Flounder in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

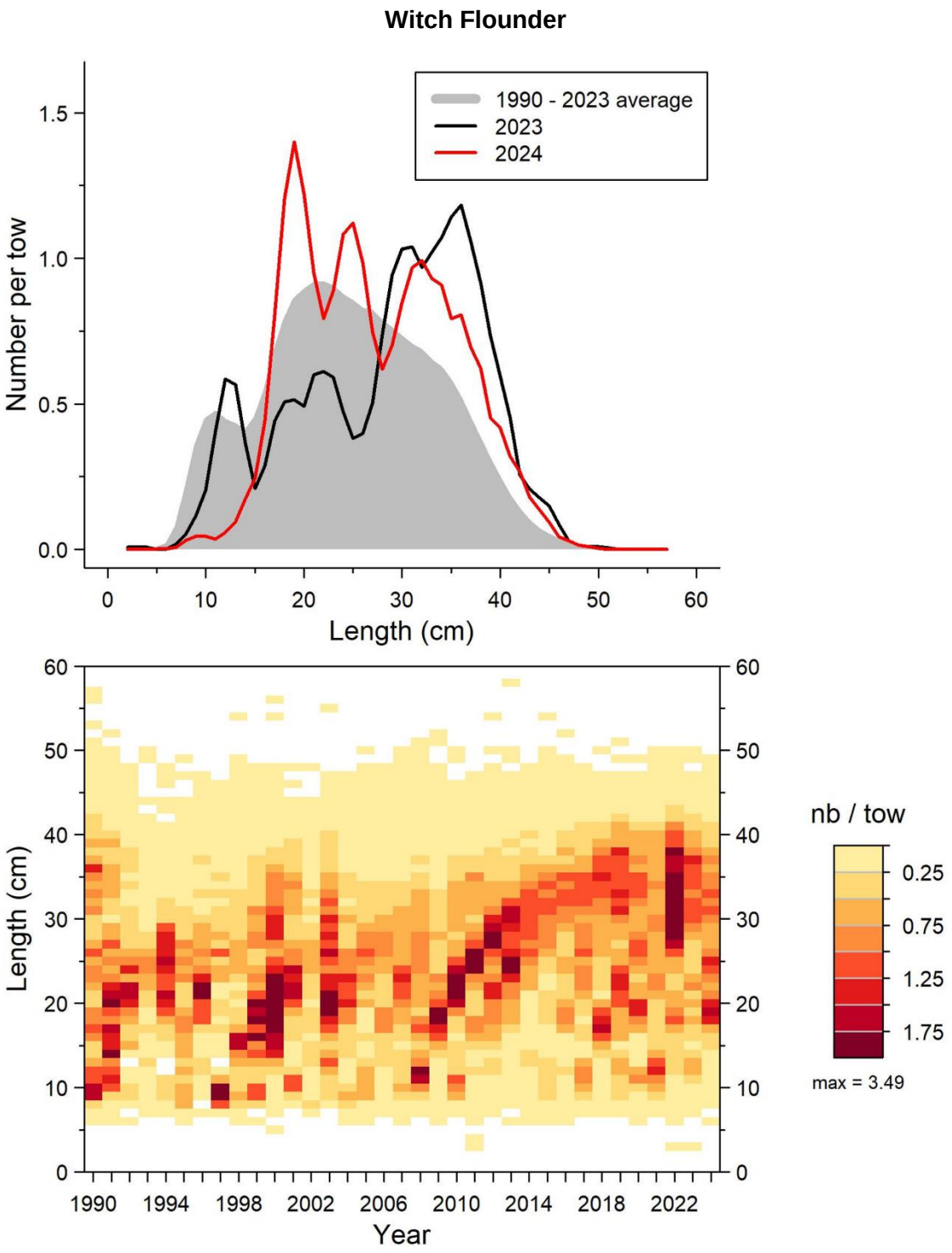

Figure 41. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Witch Flounder in 4RST.

Witch Flounder

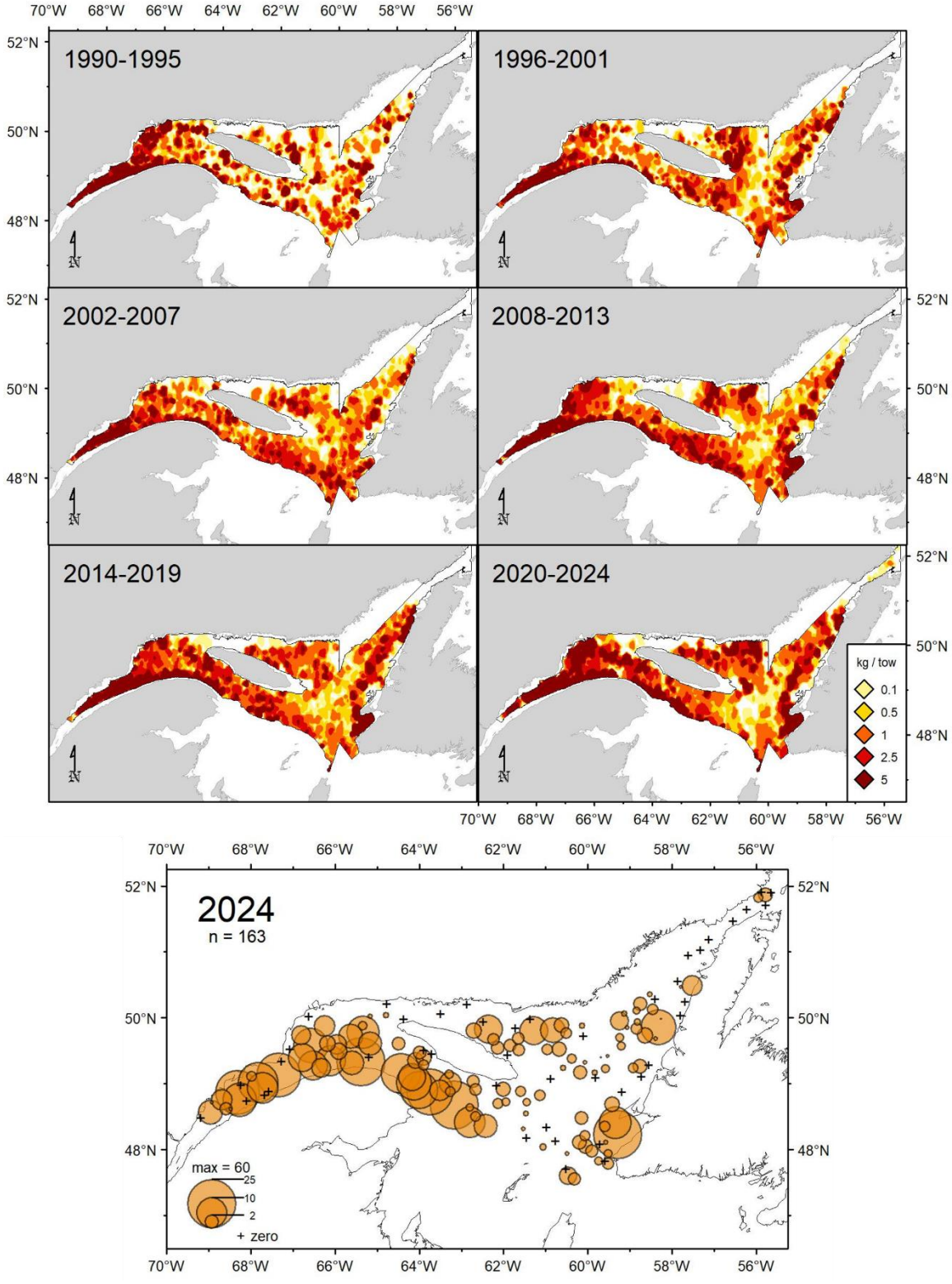

Figure 42. Witch Flounder catch rate (kg/15-minute tow) distributions.

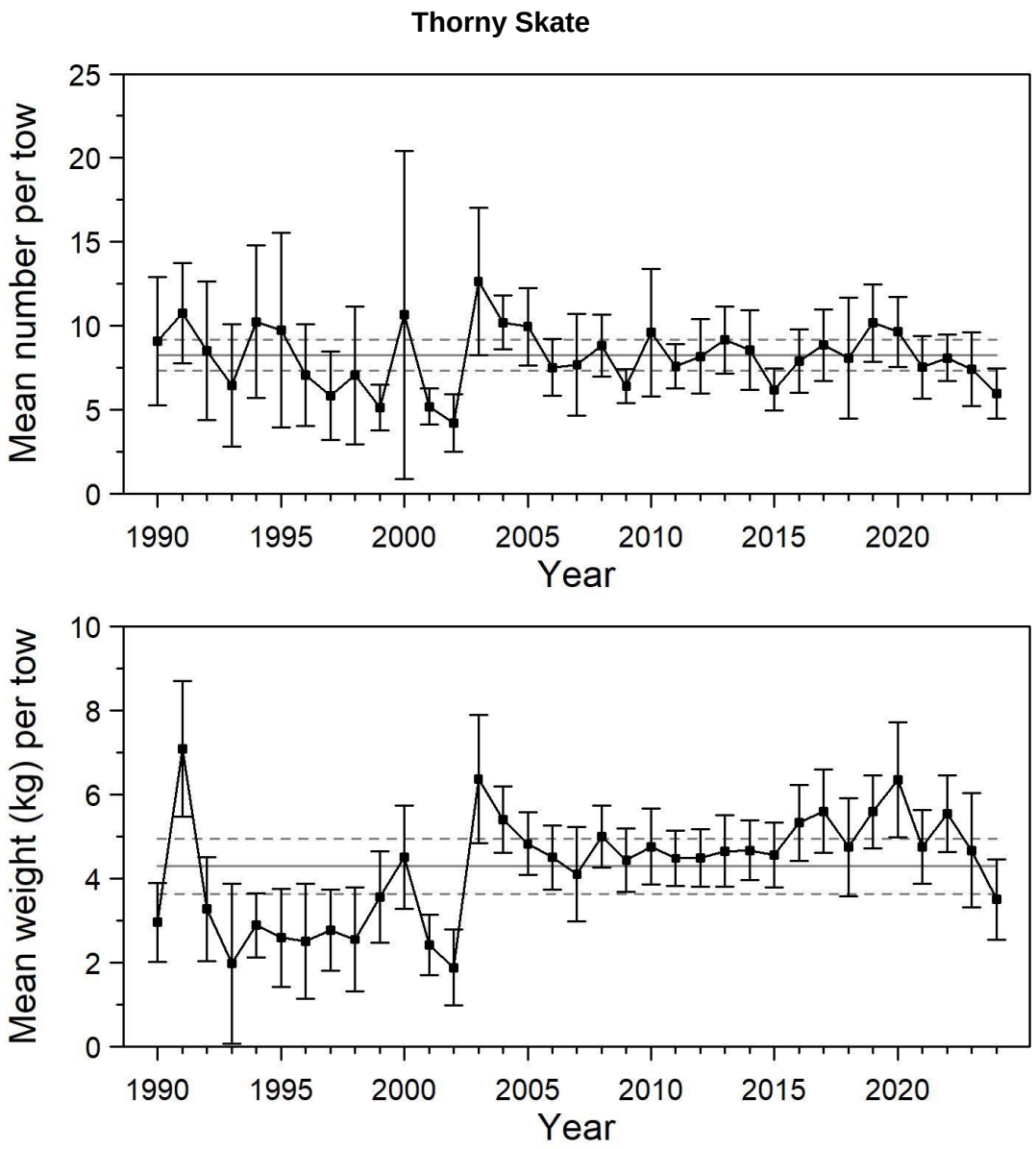

Figure 43. Mean numbers and mean weights per 15-minute tow observed during the survey for Thorny Skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

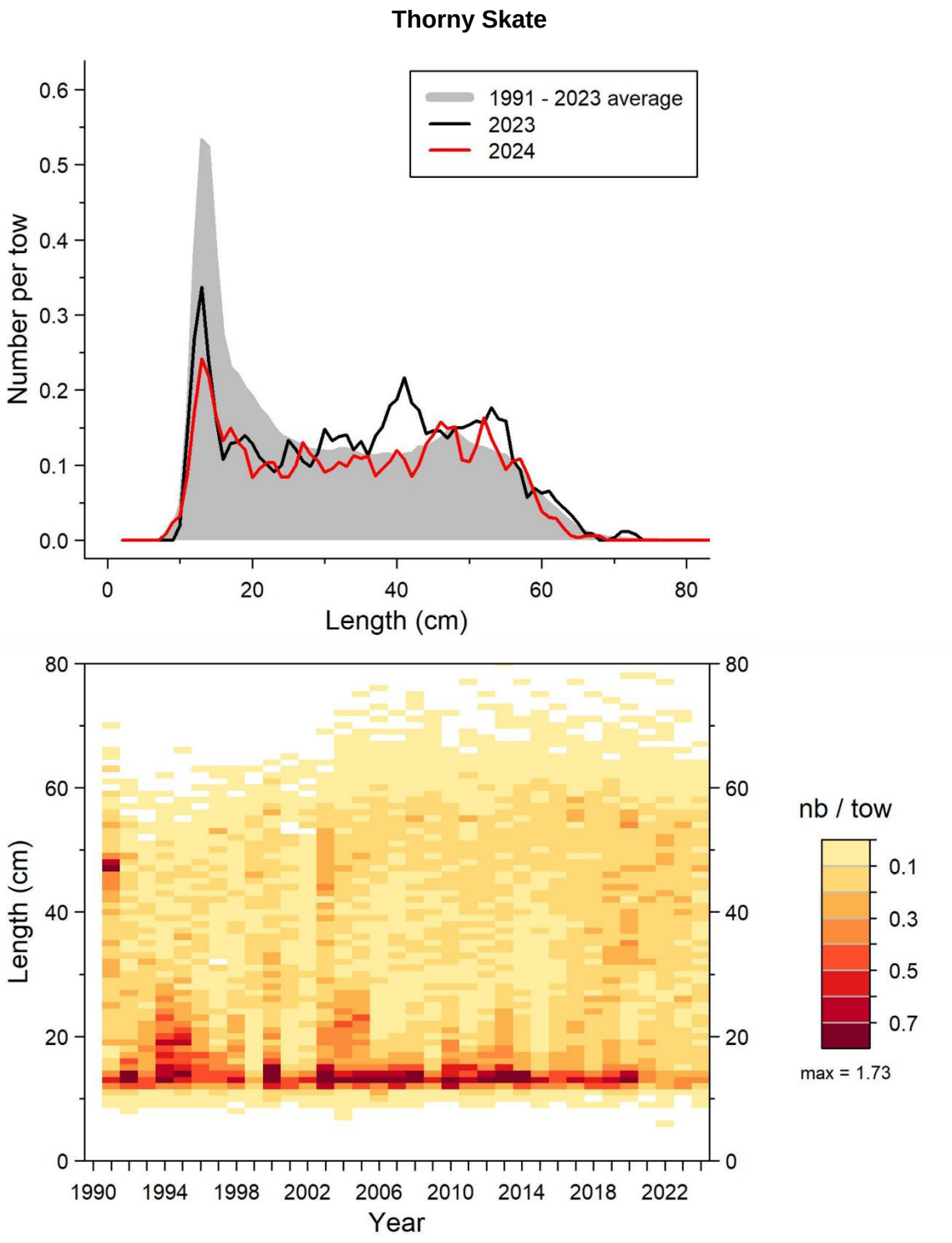

Figure 44. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Thorny Skate in 4RST.

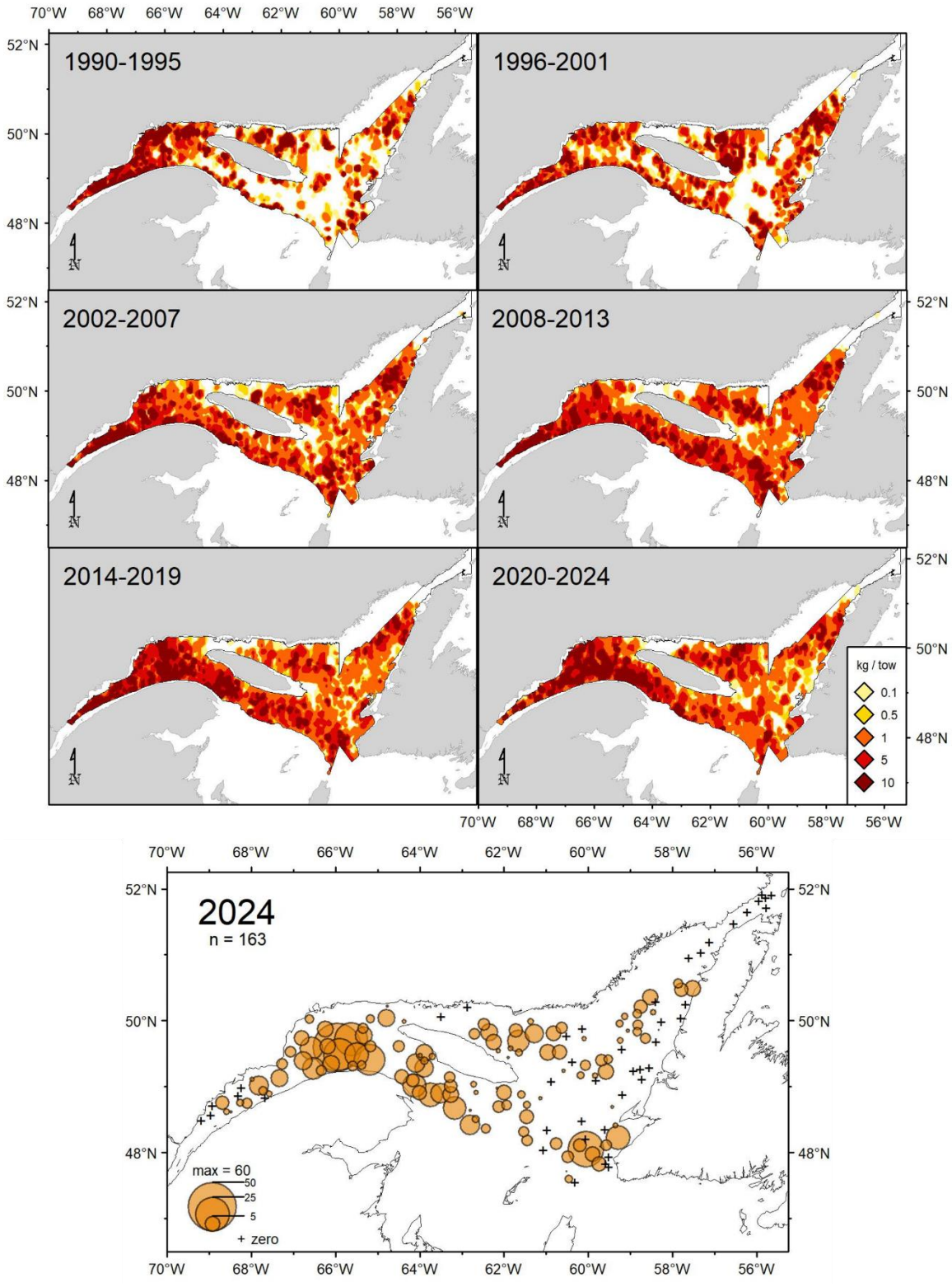

Figure 45. Thorny Skate catch rate (kg/15-minute tow) distributions.

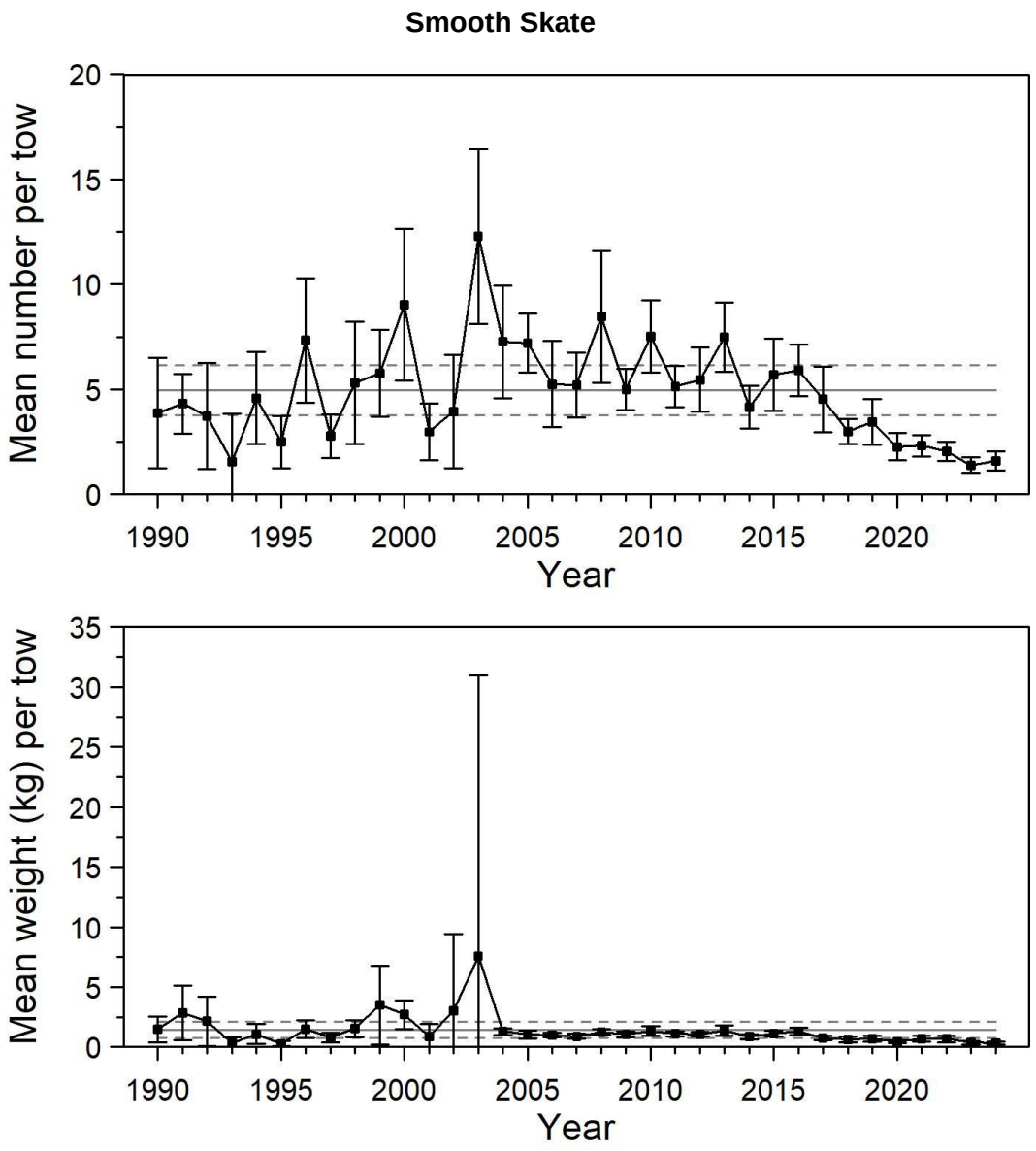

Figure 46. Mean numbers and mean weights per 15-minute tow observed during the survey for Smooth Skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

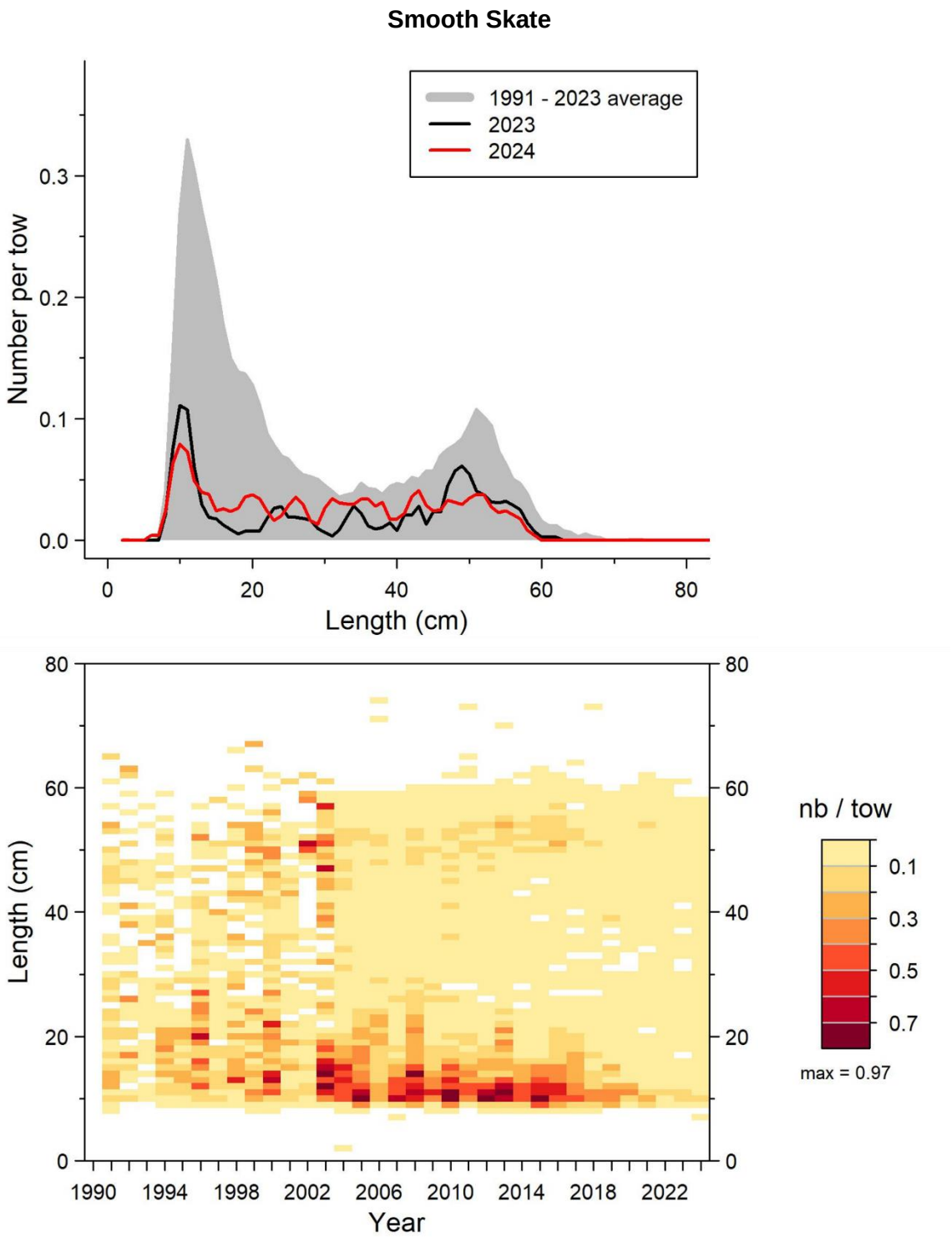

Figure 47. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Smooth Skate in 4RST.

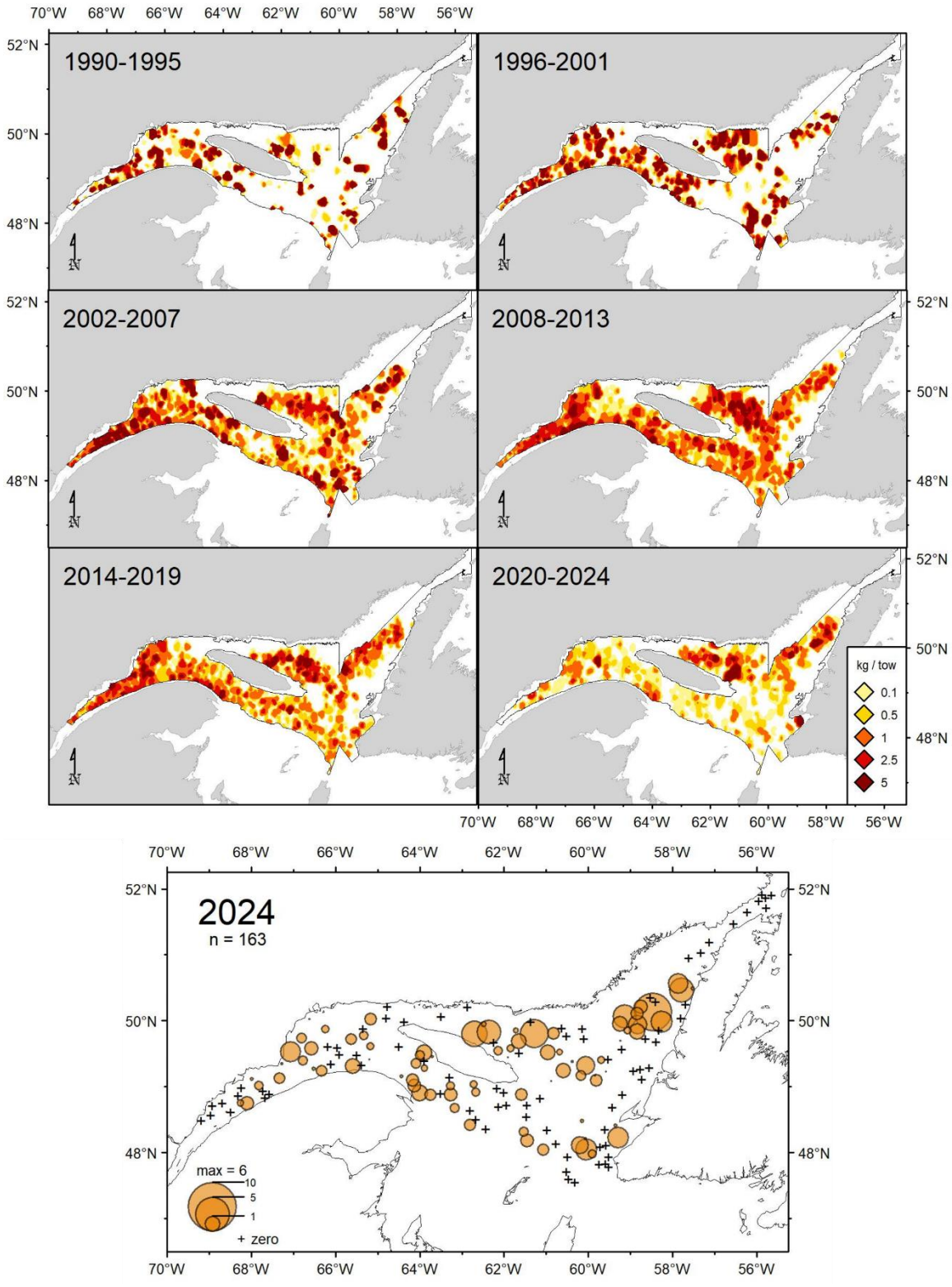

Figure 48. Smooth Skate catch rate (kg/15-minute tow) distributions.

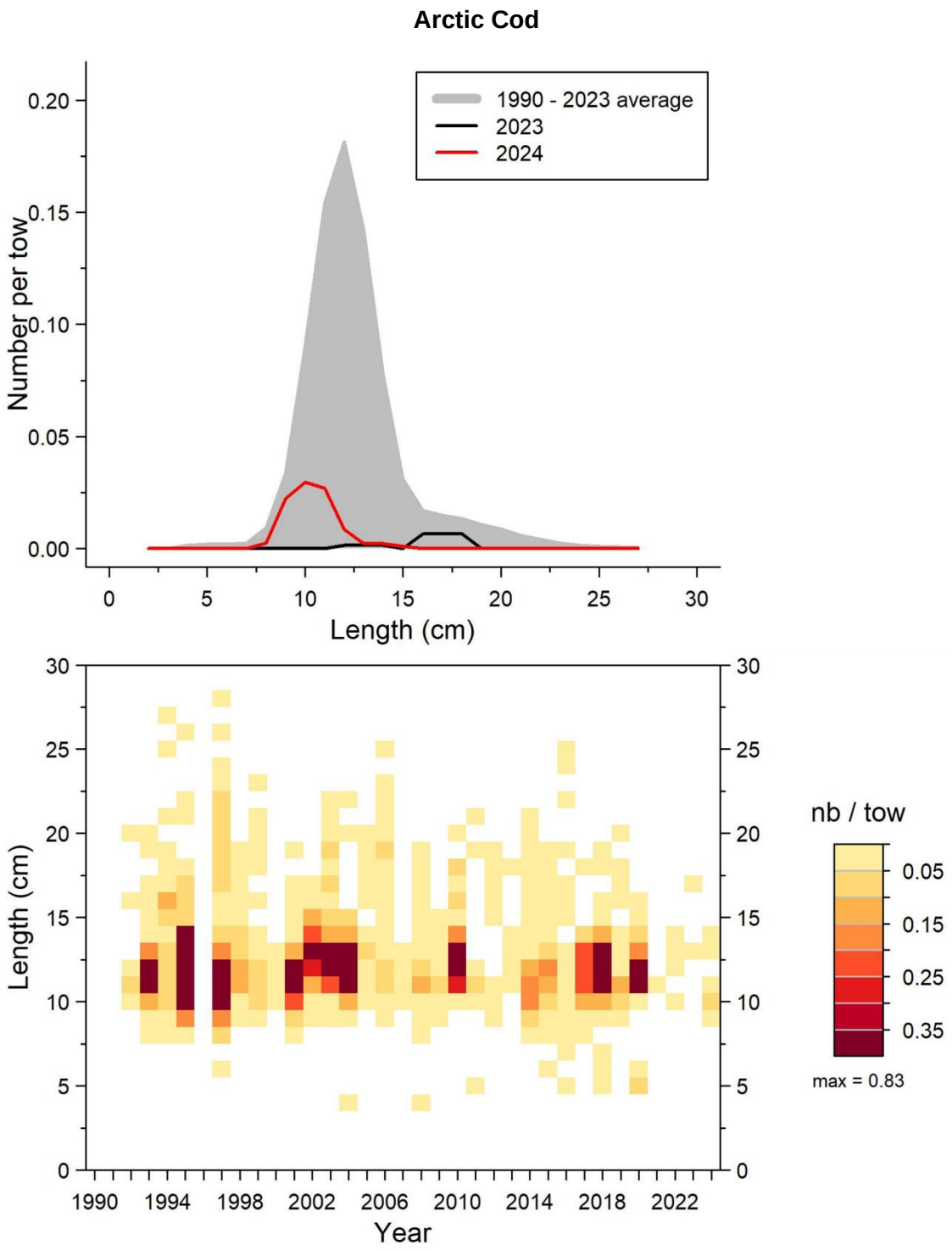

Figure 49. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Arctic Cod in 4RST.

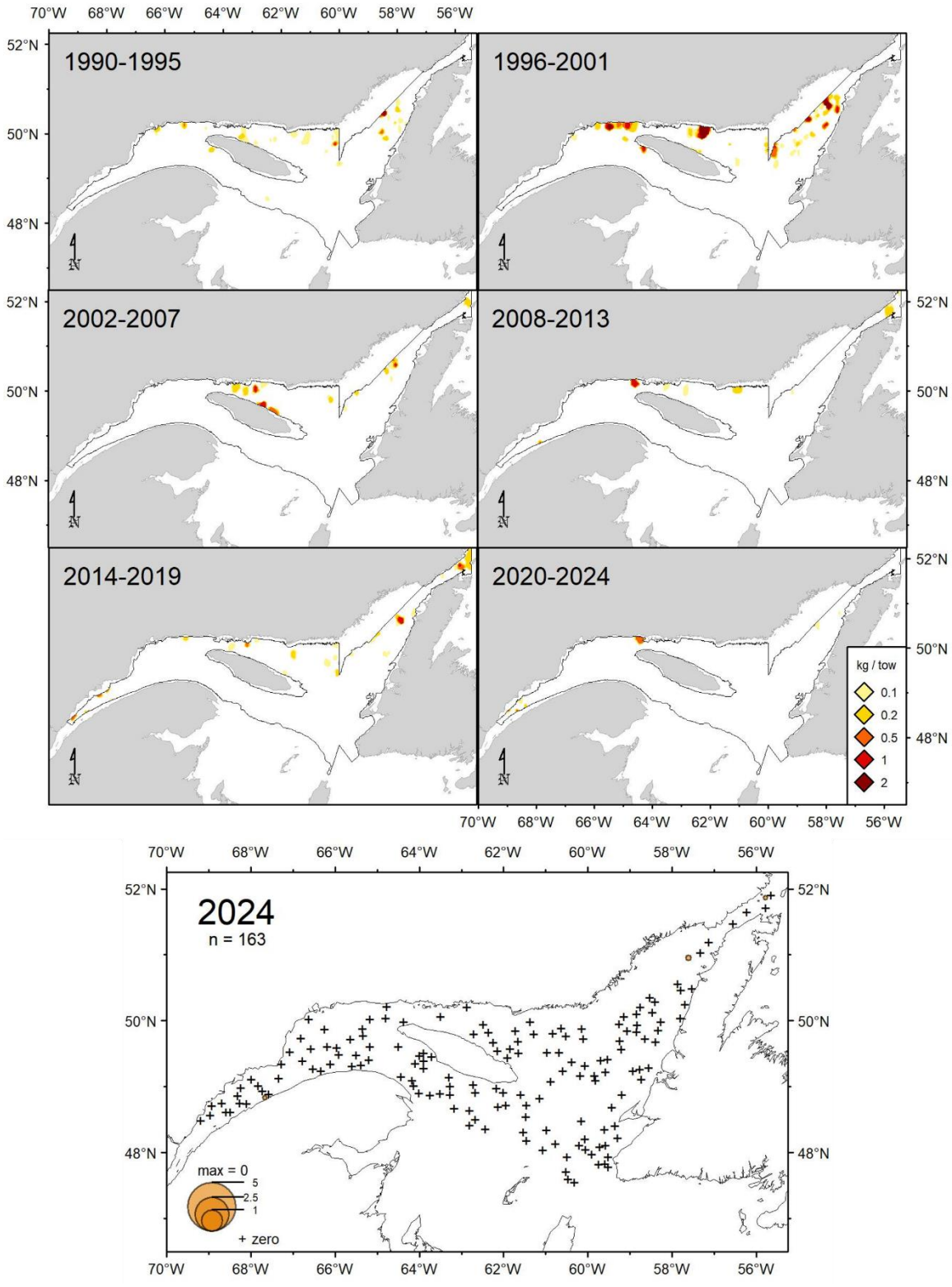

Figure 50. Arctic Cod catch rate (kg/15-minute tow) distributions.

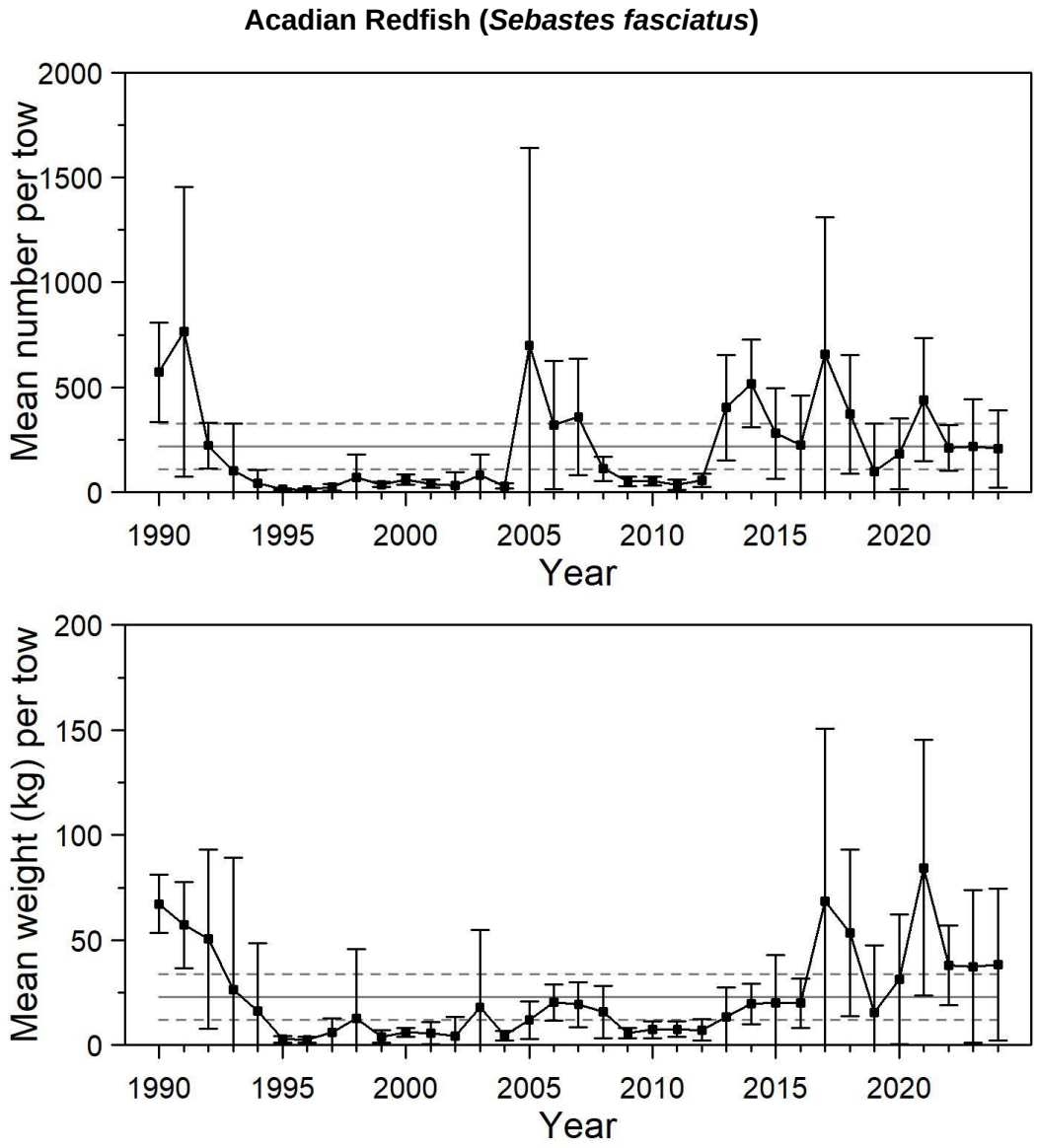

Figure 51. Mean numbers and mean weights per 15-minute tow observed during the survey for Acadian Redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

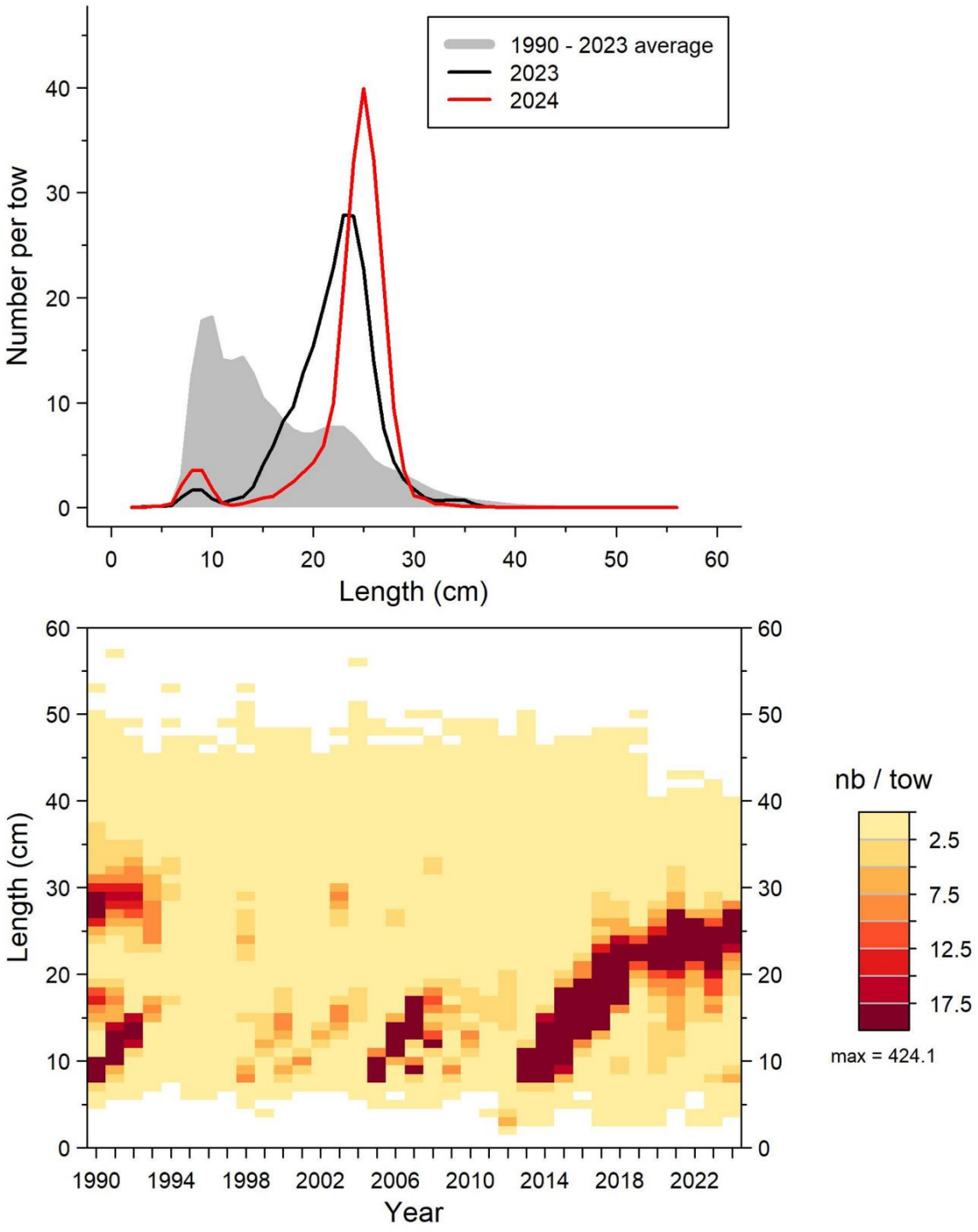

Figure 52. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Acadian Redfish in 4RST.

Acadian redfish (*Sebastes fasciatus*)

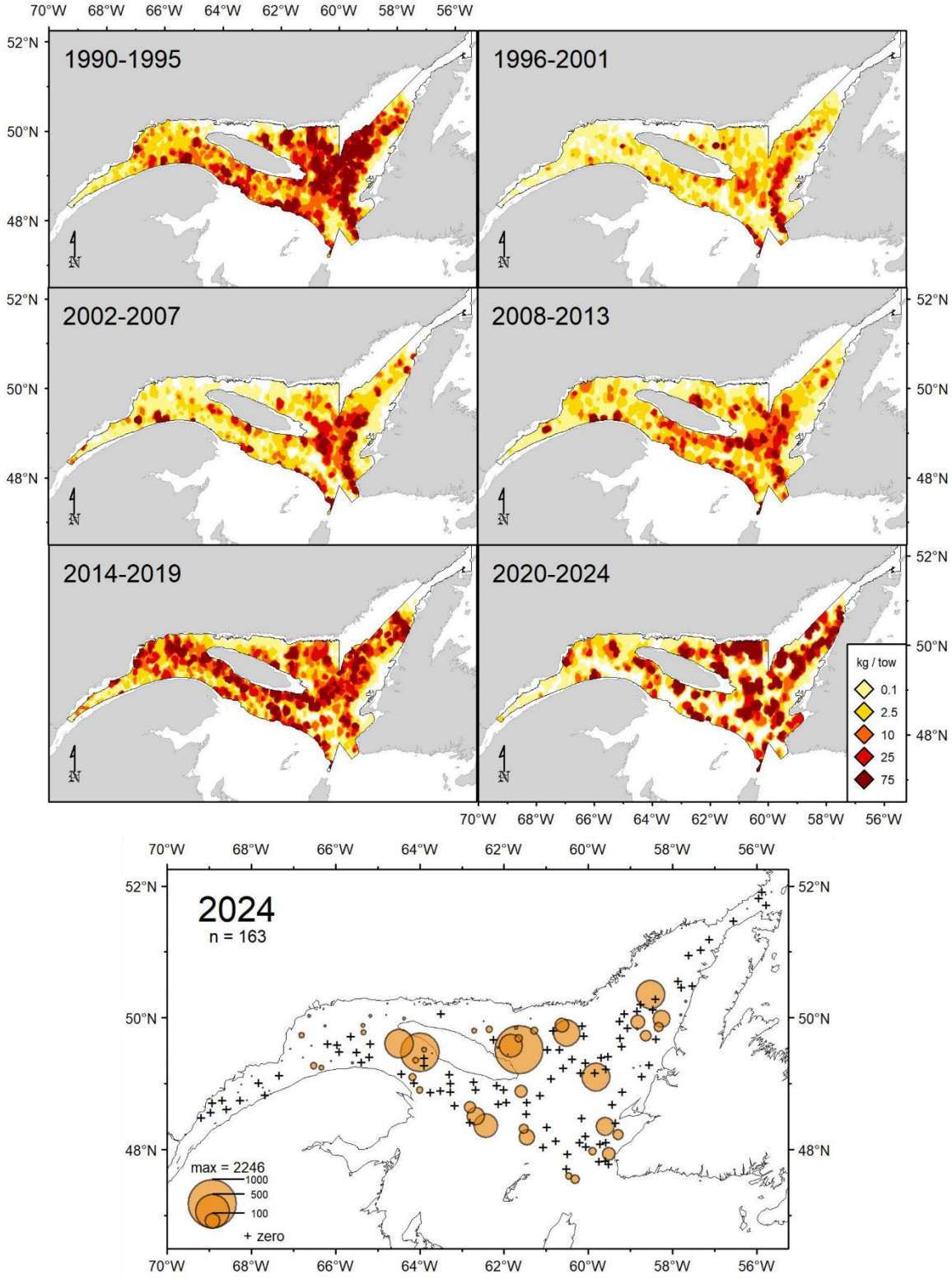

Figure 53. Acadian Redfish catch rate (kg/15-minute tow) distributions.

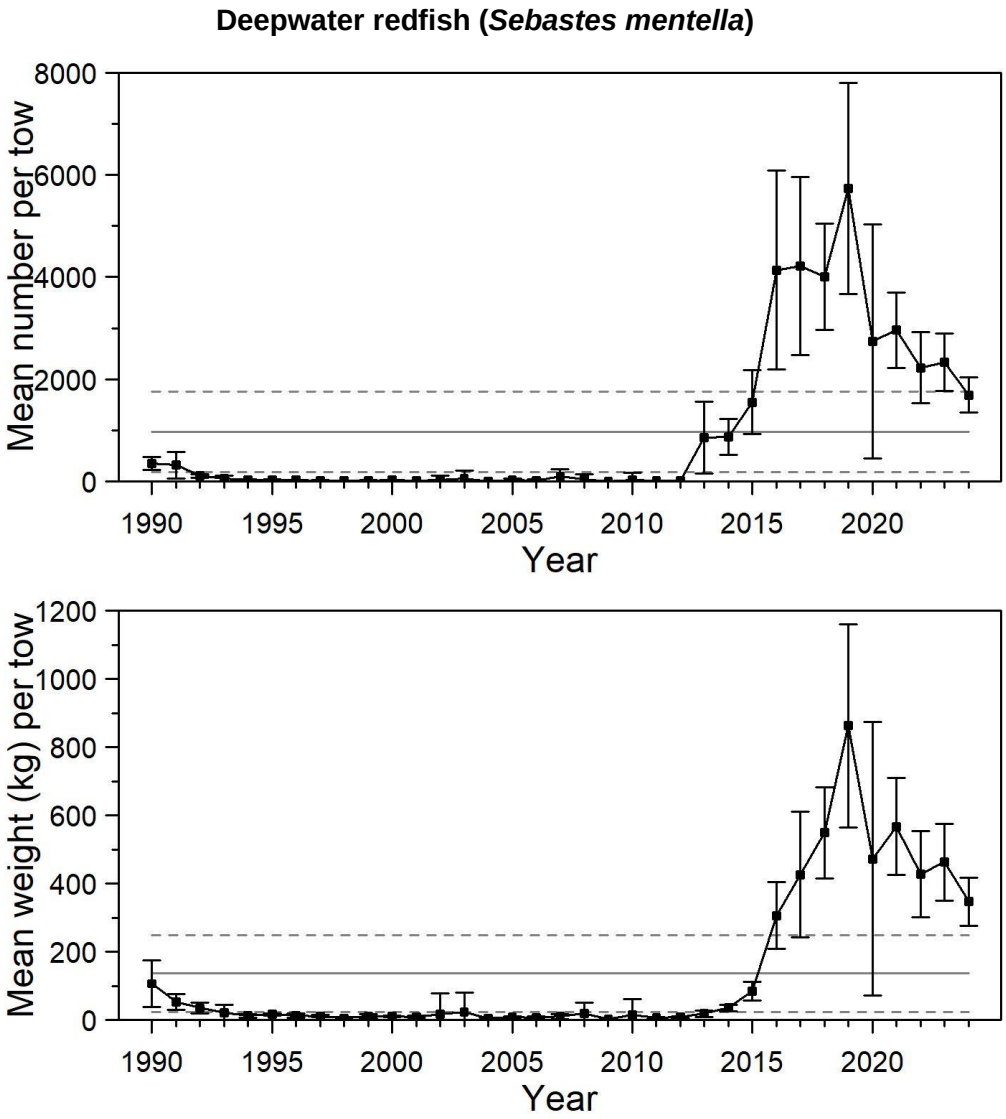

Figure 54. Mean numbers and mean weights per 15-minute tow observed during the survey for Deepwater Redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

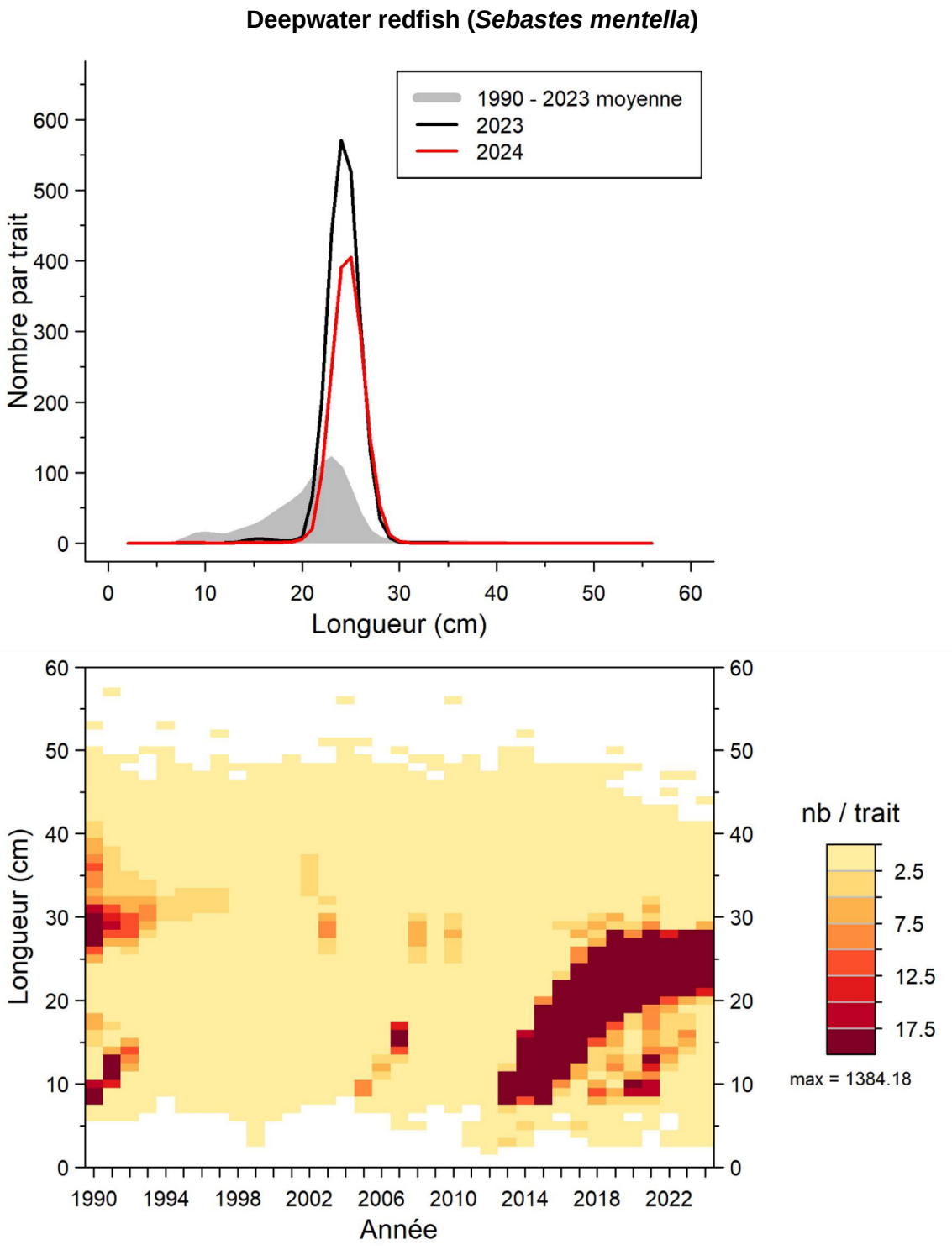

Figure 55. Length frequency distributions (mean number per 15-minute tow) observed during the survey for Deepwater Redfish in 4RST.

Deepwater redfish (*Sebastes mentella*)

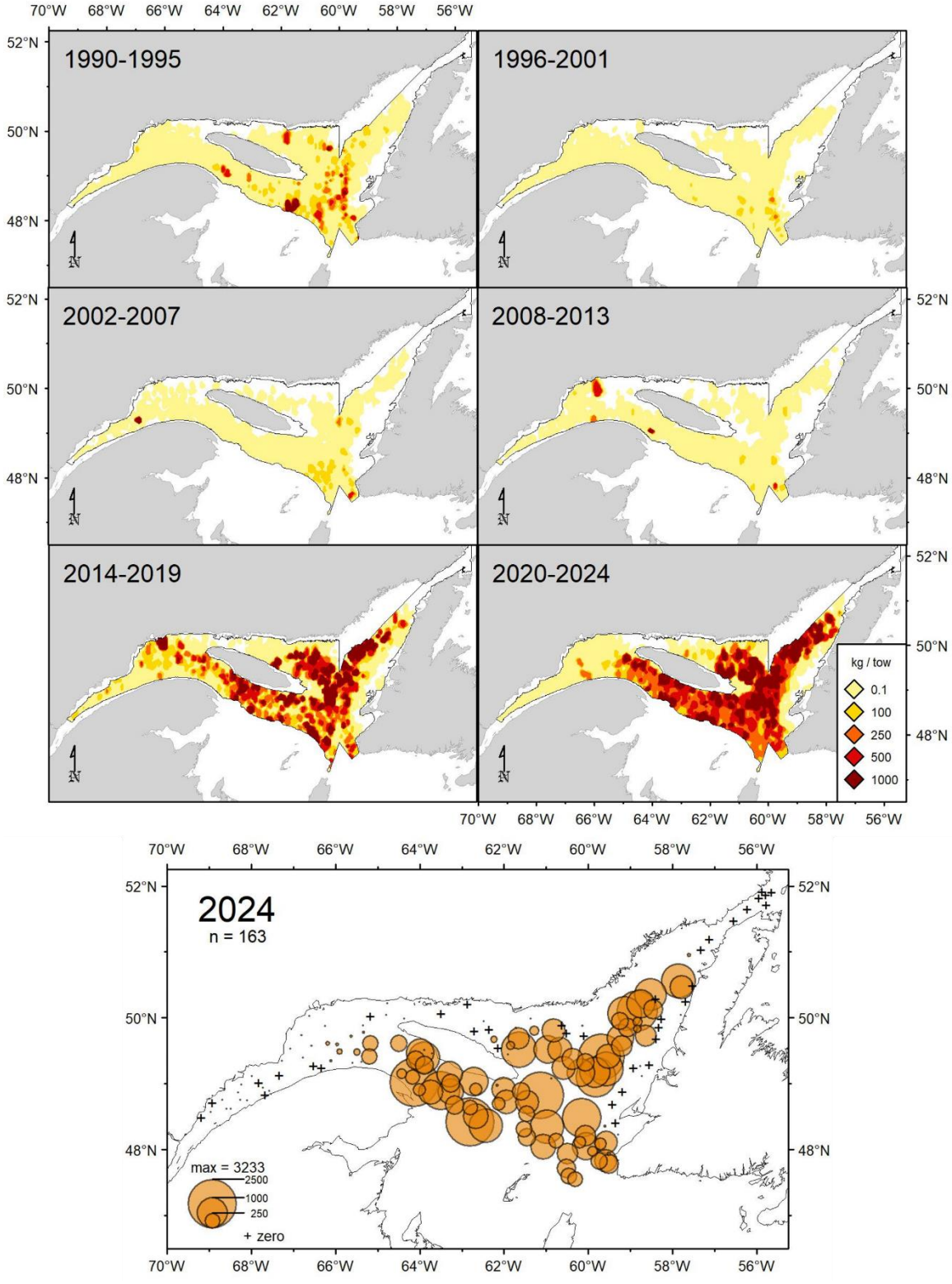

Figure 56. Deepwater Redfish catch rate (kg/15-minute tow) distributions.

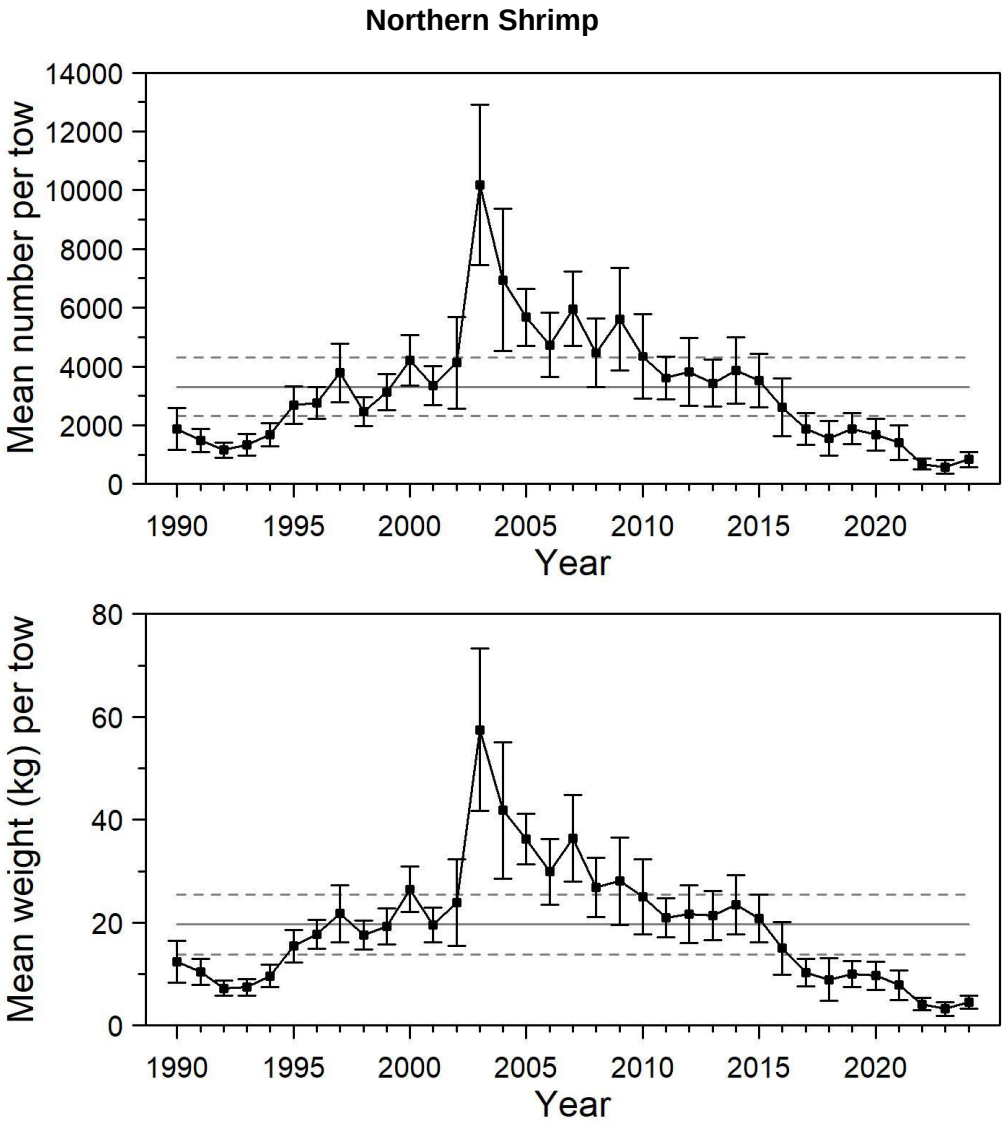

Figure 57. Mean numbers and mean weights per 15-minute tow observed during the survey for Northern Shrimp in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

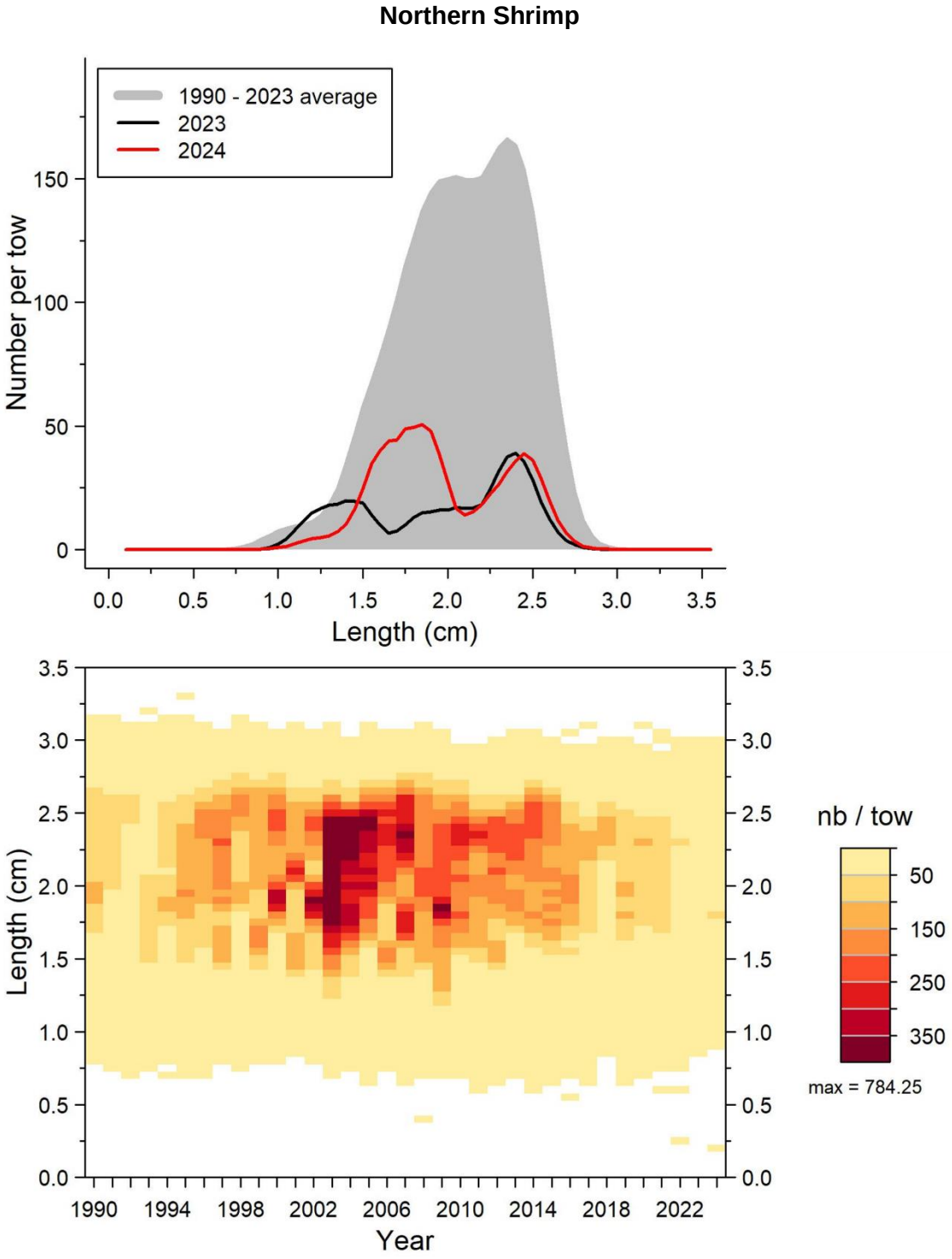

Figure 58. Carapace length frequency distributions (mean number per 15-minute tow) observed during the survey for Northern Shrimp in 4RST.

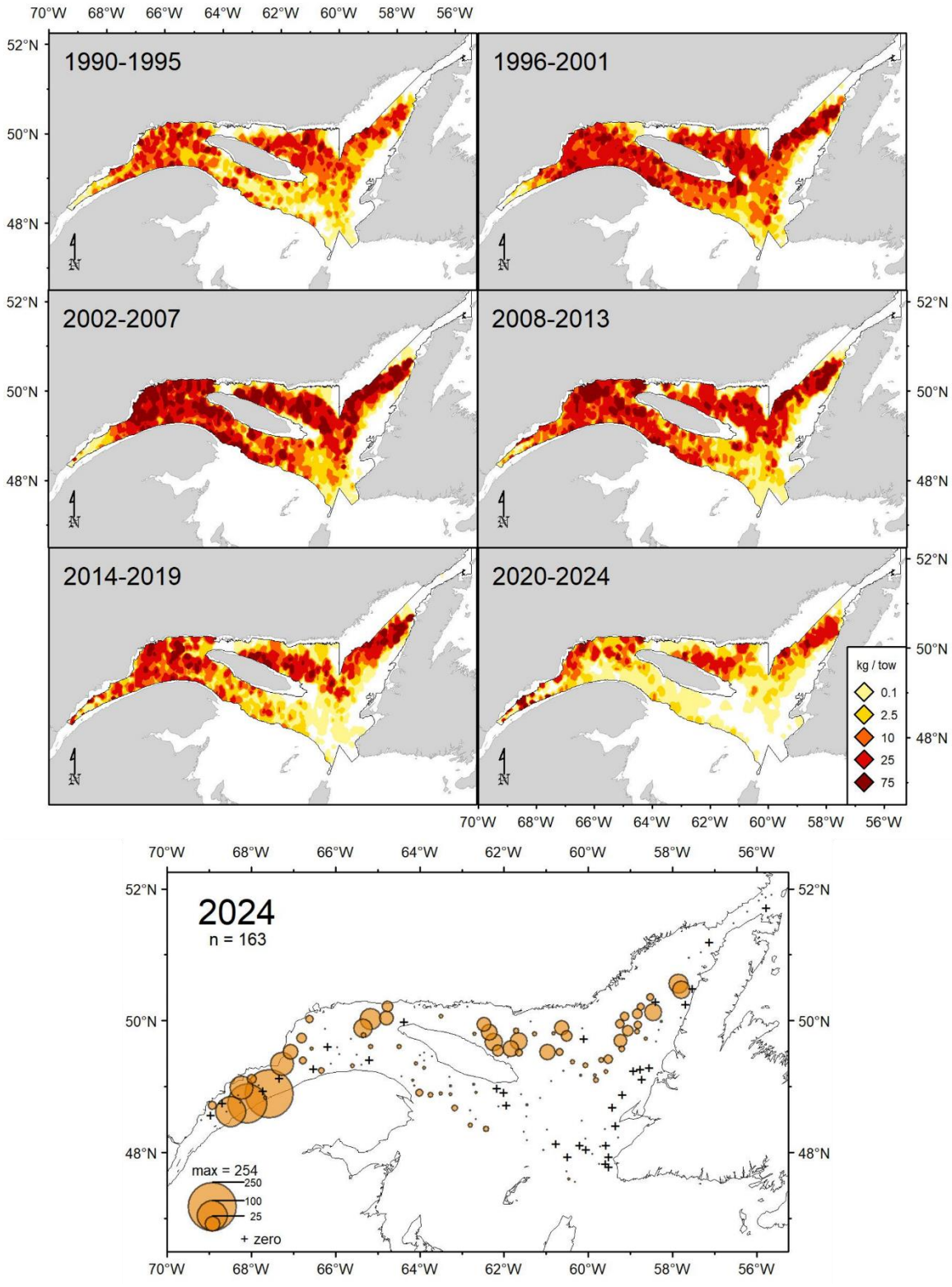

Figure 59. Northern Shrimp catch rate (kg/15-minute tow) distributions.

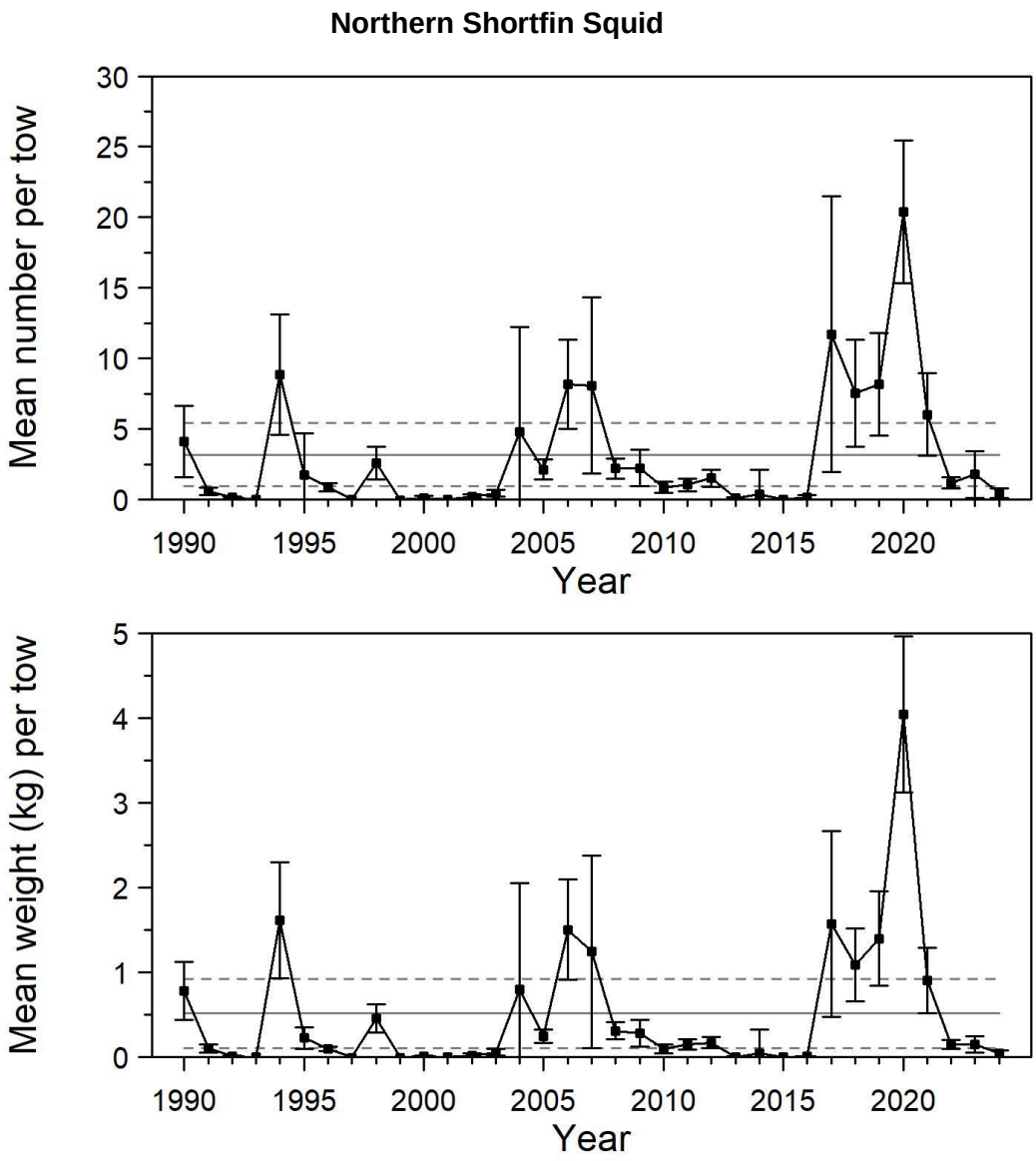

Figure 60. Mean numbers and mean weights per 15-minute tow observed during the survey for Northern Shortfin Squid in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2021 period (solid line) and upper and lower reference (see text) limits (dashed lines).

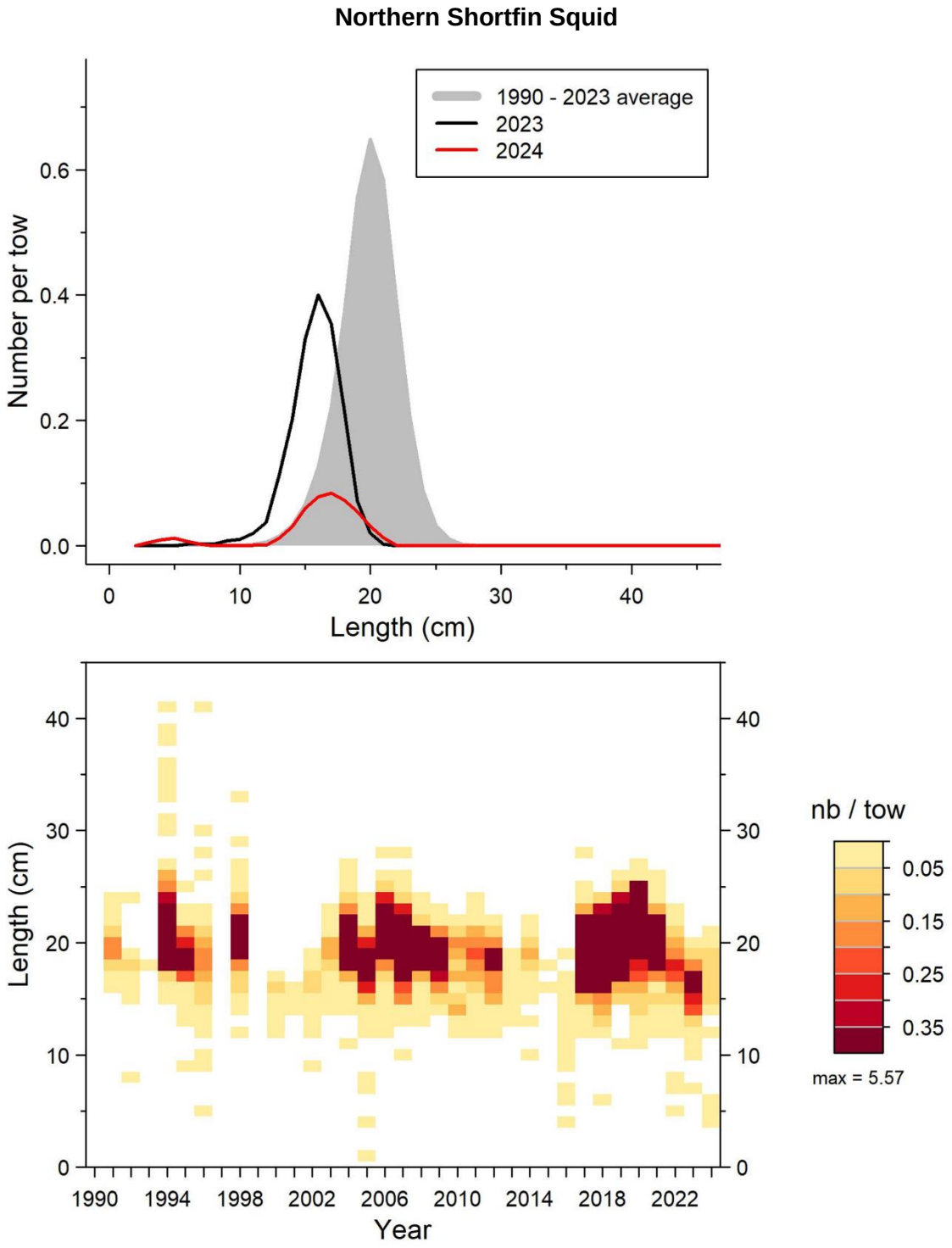

Figure 61. Mantle length frequency distributions (mean number per 15-minute tow) observed during the survey for Northern Shortfin Squid in 4RST.

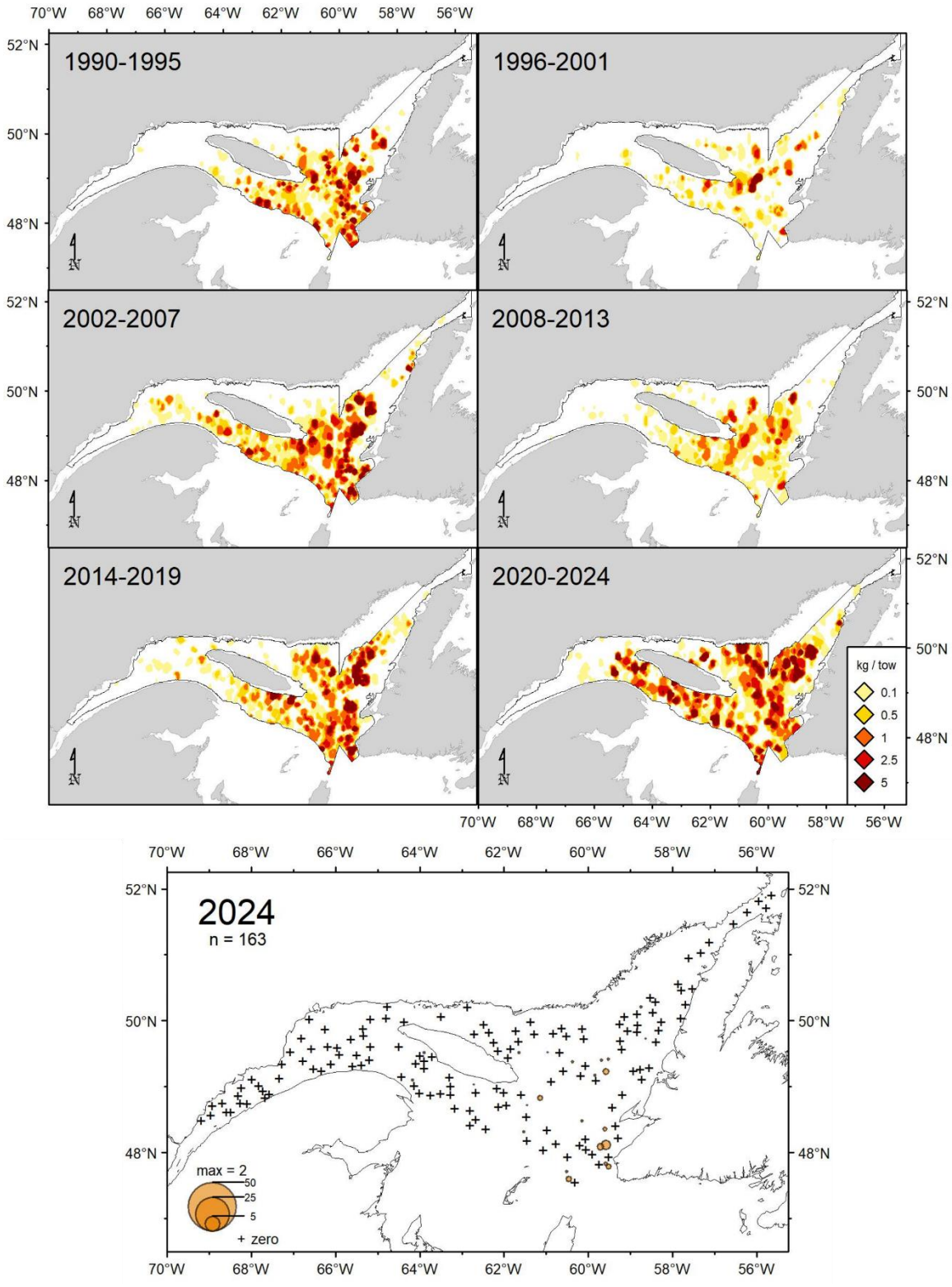

Figure 62. Northern Shortfin Squid catch rate (kg/15-minute tow) distributions.

Sea pen (*Anthoptilum grandiflorum*)

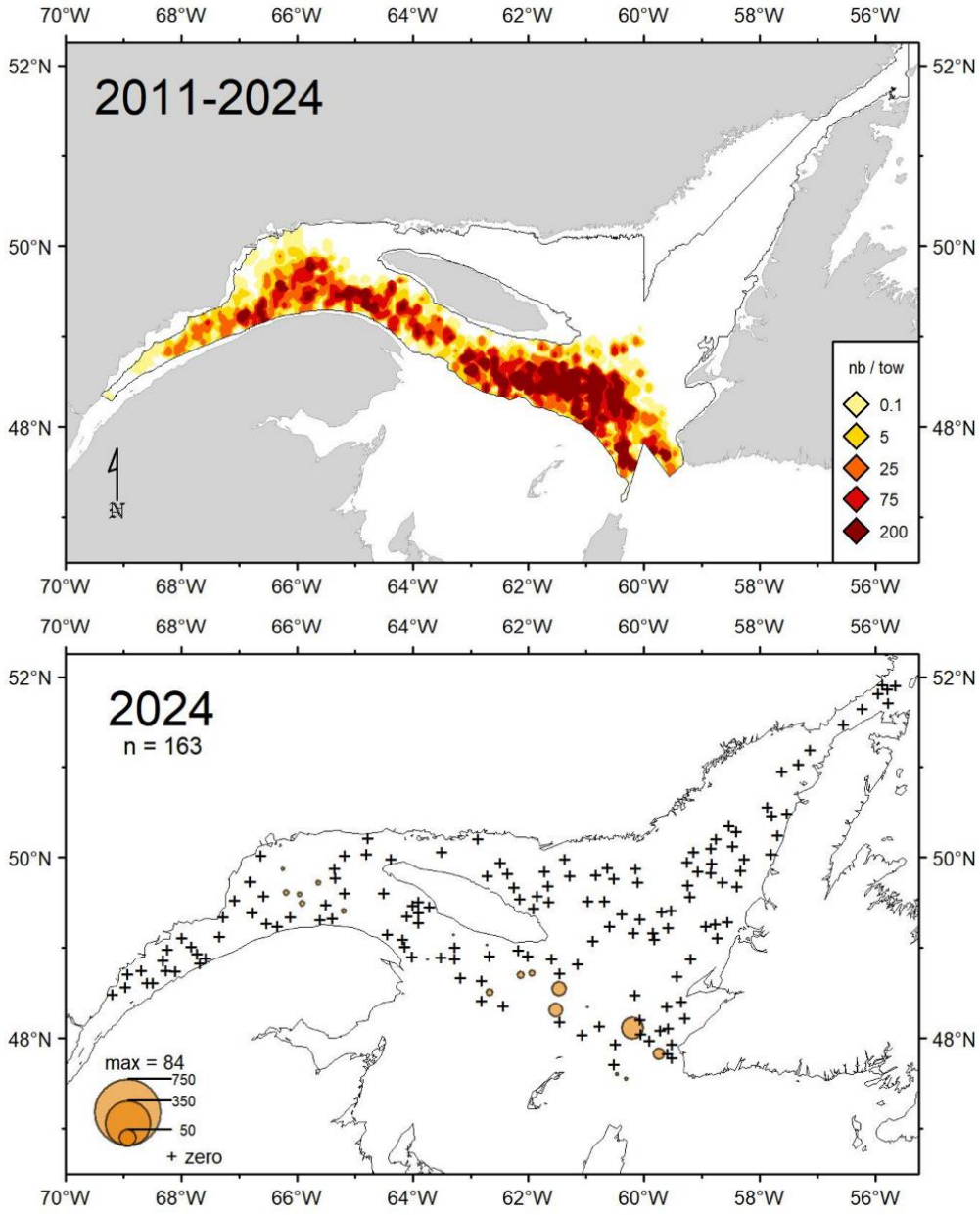

Figure 63. Sea pen (Anthoptilum grandiflorum) catch rates (nb/15-minute tow) distribution.

Sea pen (Balticina *finmarchica*)

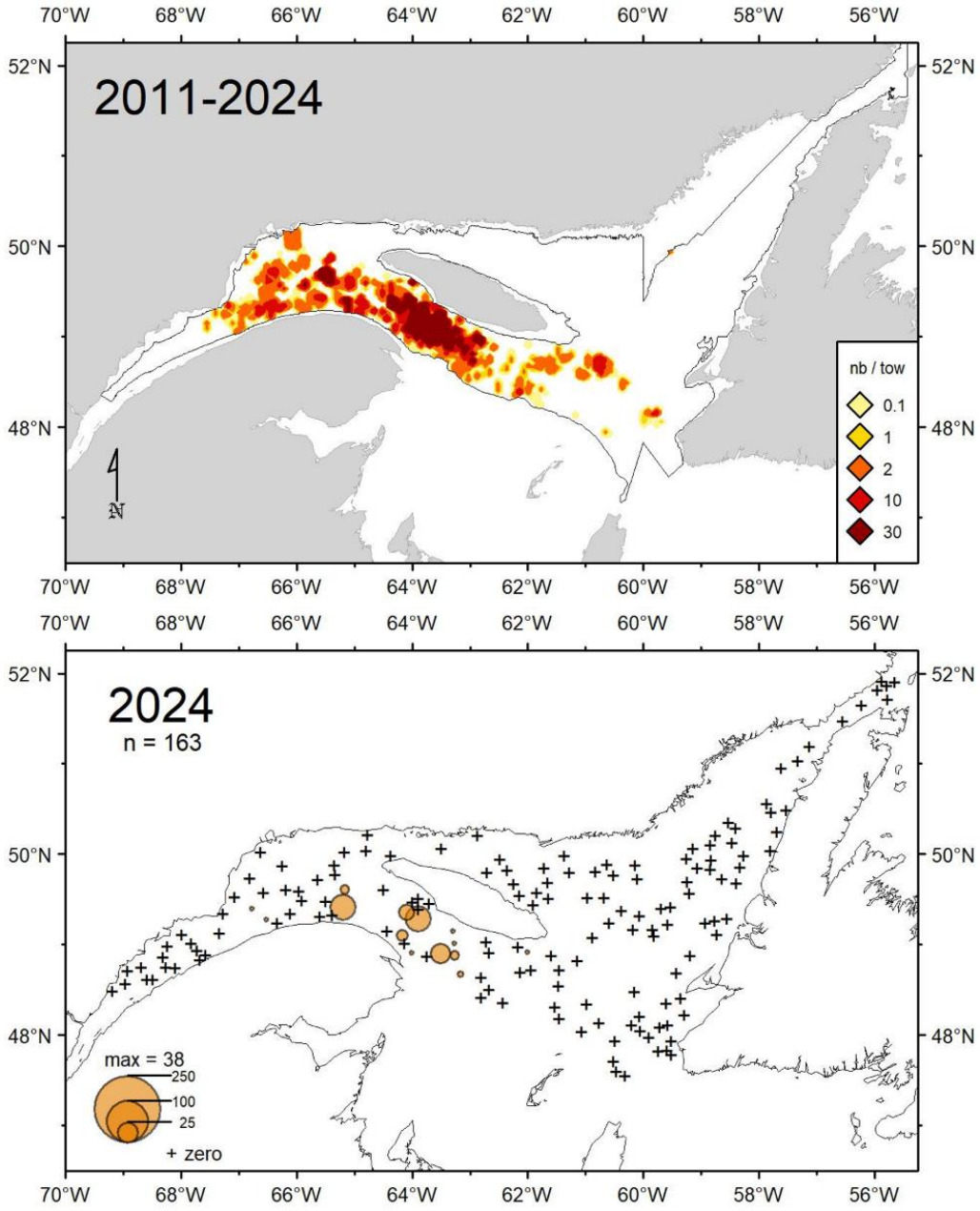

Figure 64. Sea pen (Balticina finmarchica) catch rates (nb/15-minute tow) distribution.

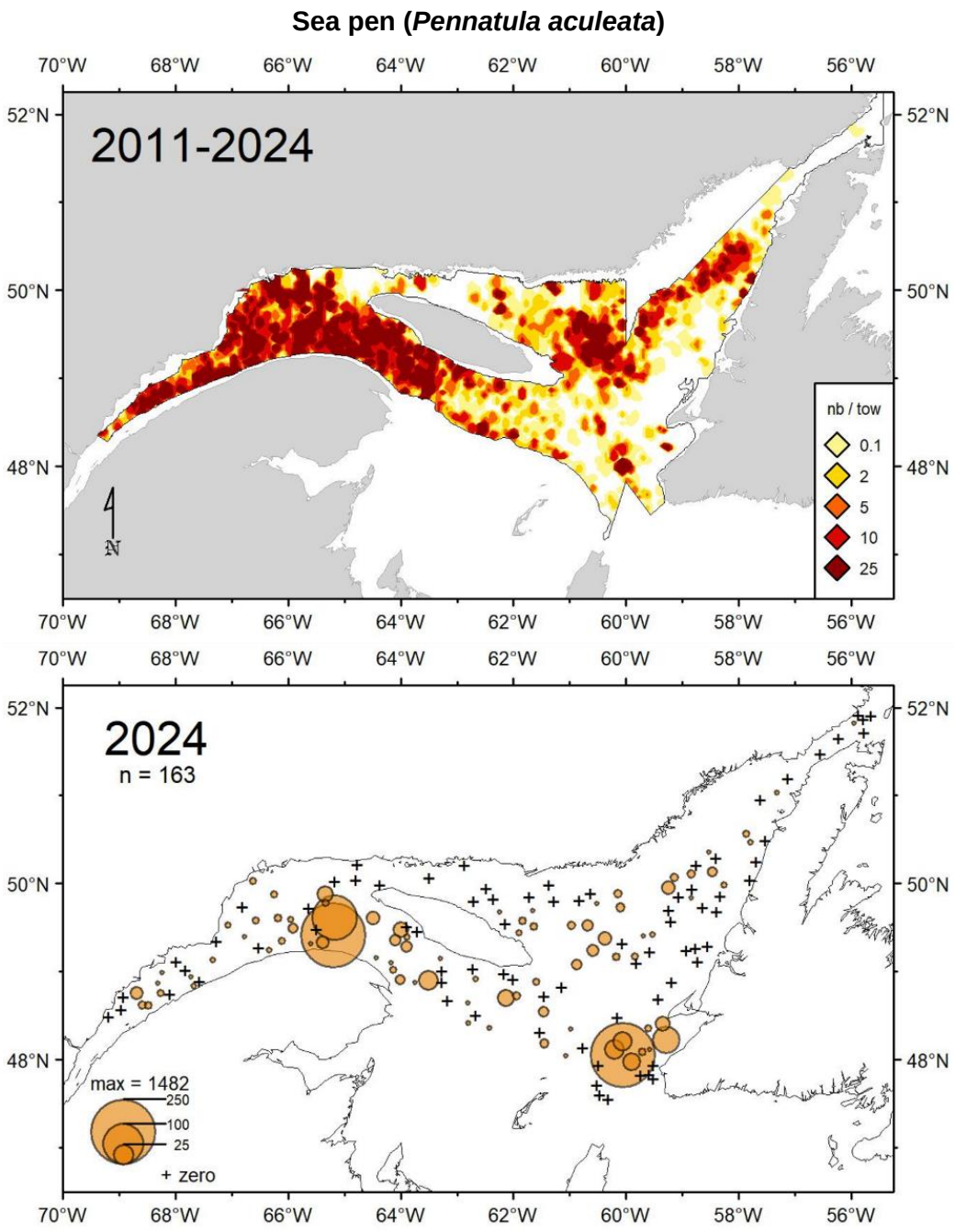

Figure 65. Sea pen (Pennatula aculeate) catch rates (nb/15-minute tow) distribution.

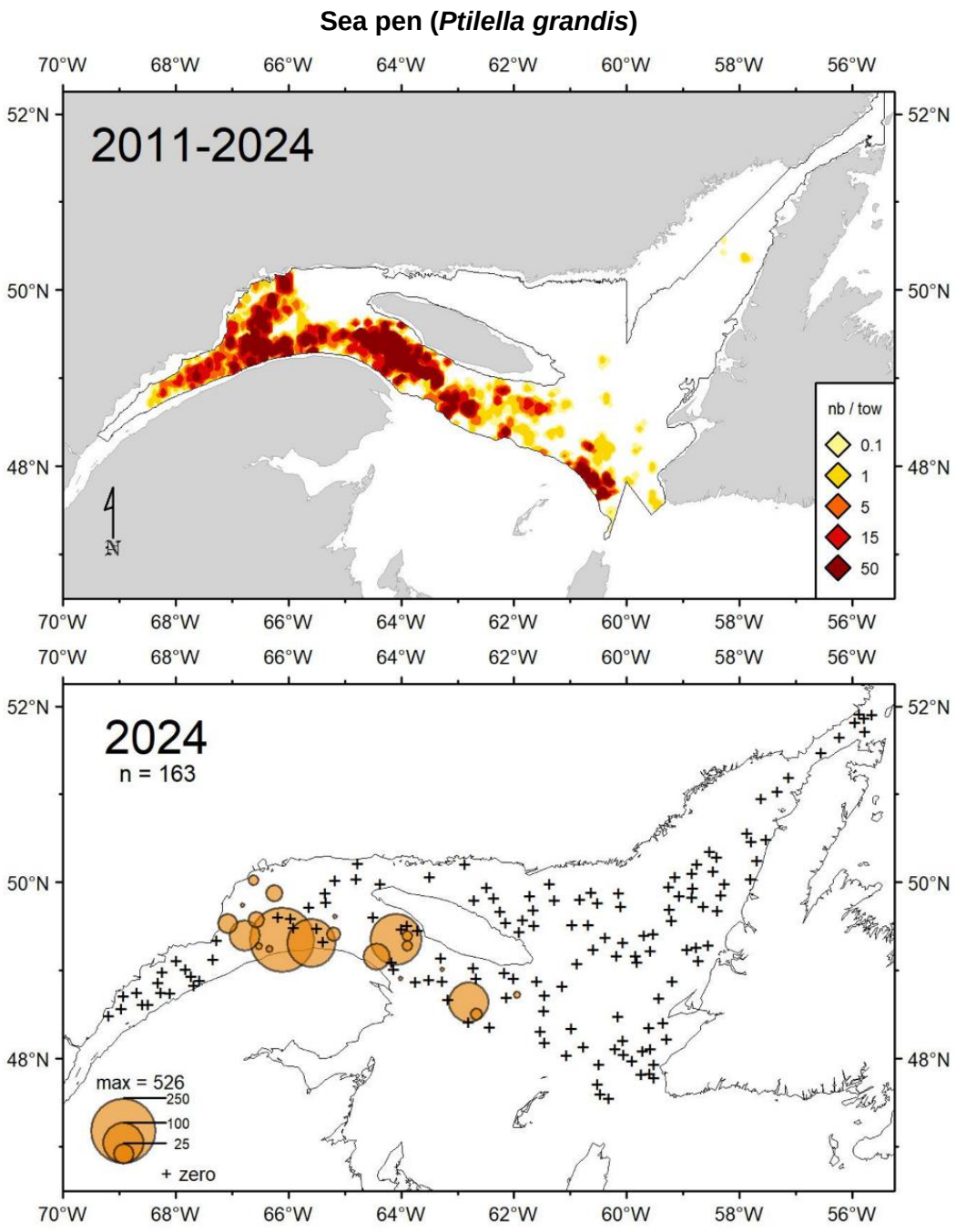

Figure 66. Sea pen (Ptilella grandis) catch rates (nb/15-minute tow) distribution.

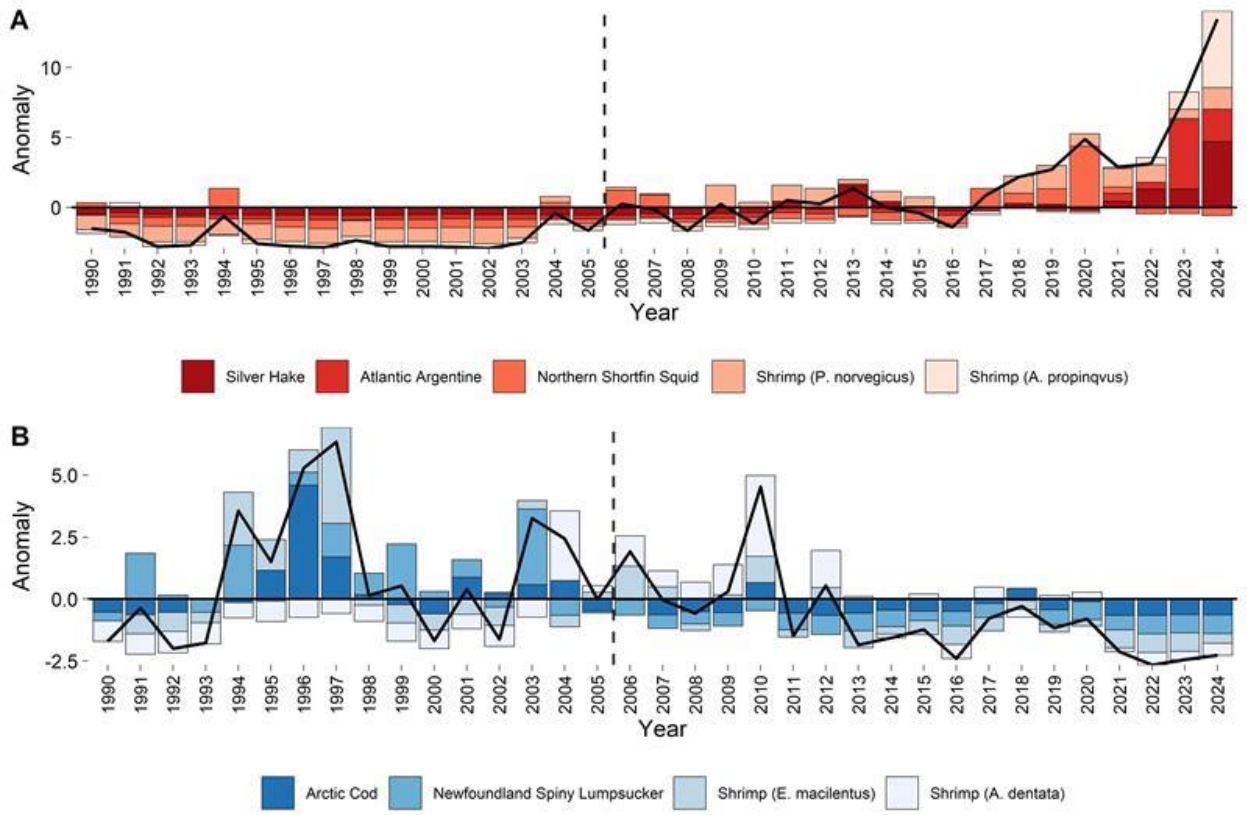

Figure 67. Anomalies of ecological indicators based on the annual biomass of two thermal guilds for the 1990 to 2024 period for (A) warm water species (Merluccius bilinearis, Illex illecebrosus, Argentina silus, Pontophilus norvegicus, Atlantopandalus propinqvus) and (B) cold water species (Boreogadus saida, Eumicrotremus terraenovae, Argis dentata, Eualus macilentus). The black line represents the annual sum of anomalies for each species. The dotted vertical line corresponds to the beginning of the systematic identification of shrimp species.

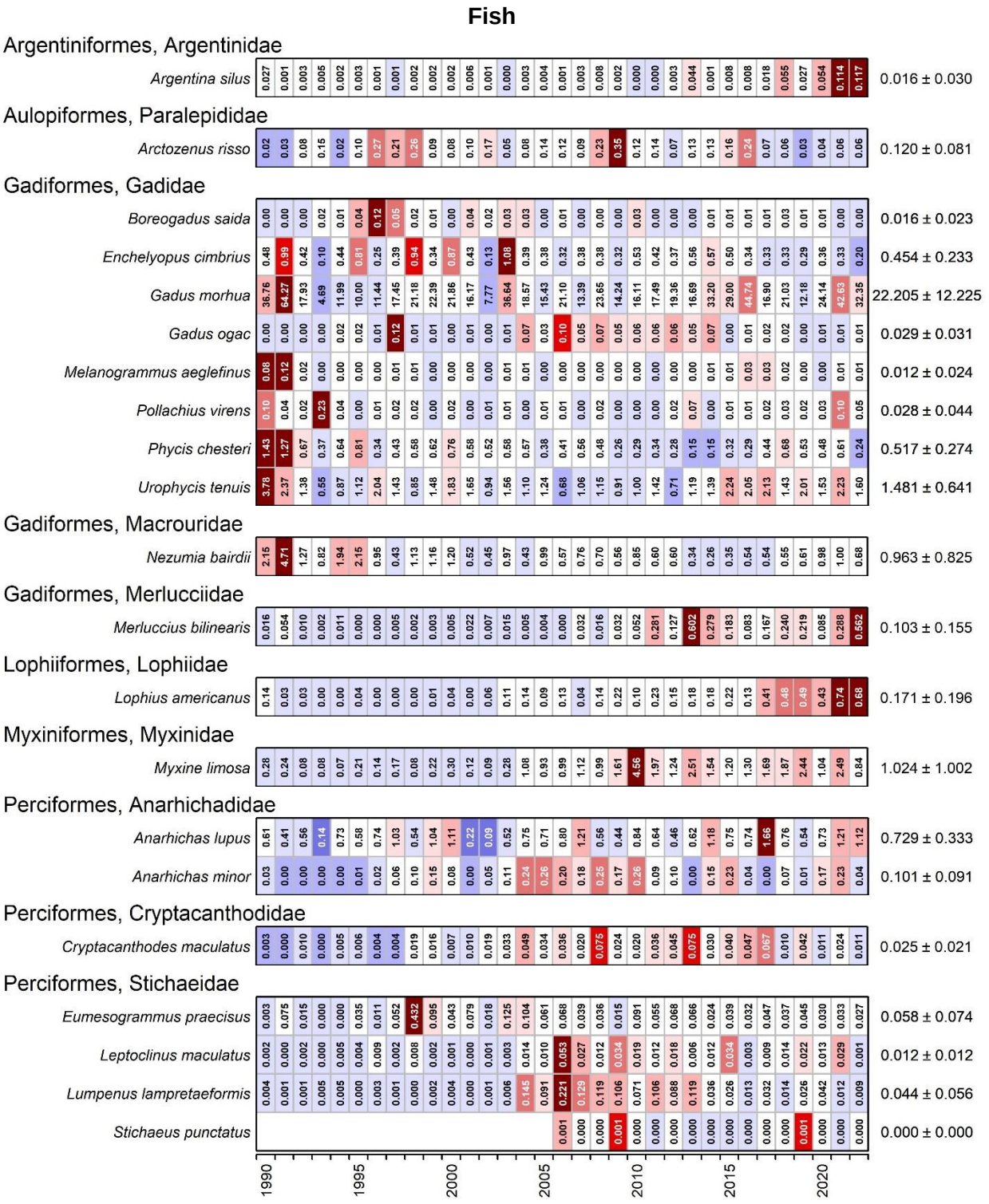

Figure 68. Average weight per 15-minute tow during the fish taxa survey. The colour code represents the anomaly value of the difference between the CPUE in a given year and the average CPUE in the time series divided by the standard deviation of this average for each taxon.

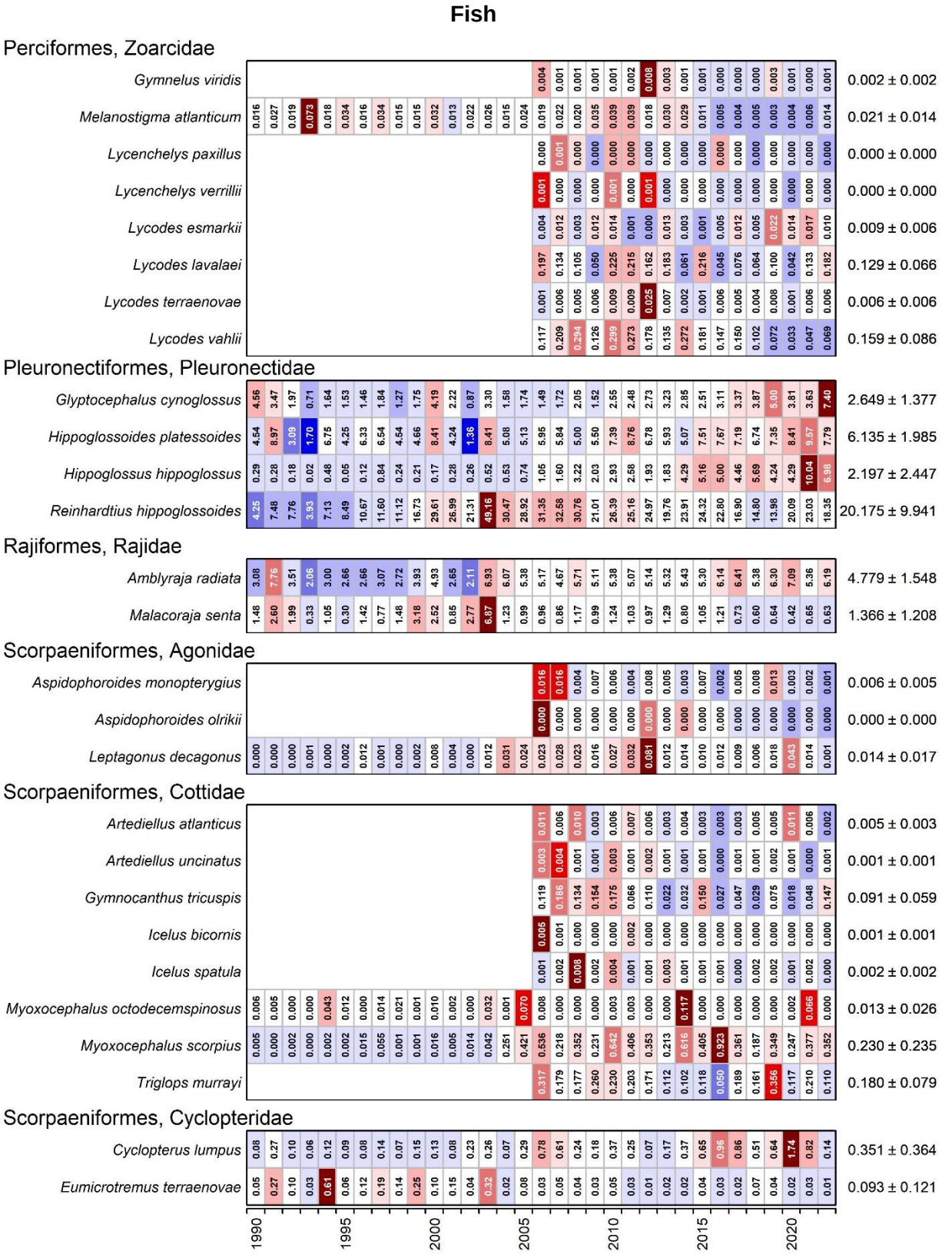

Figure 68. Continued.

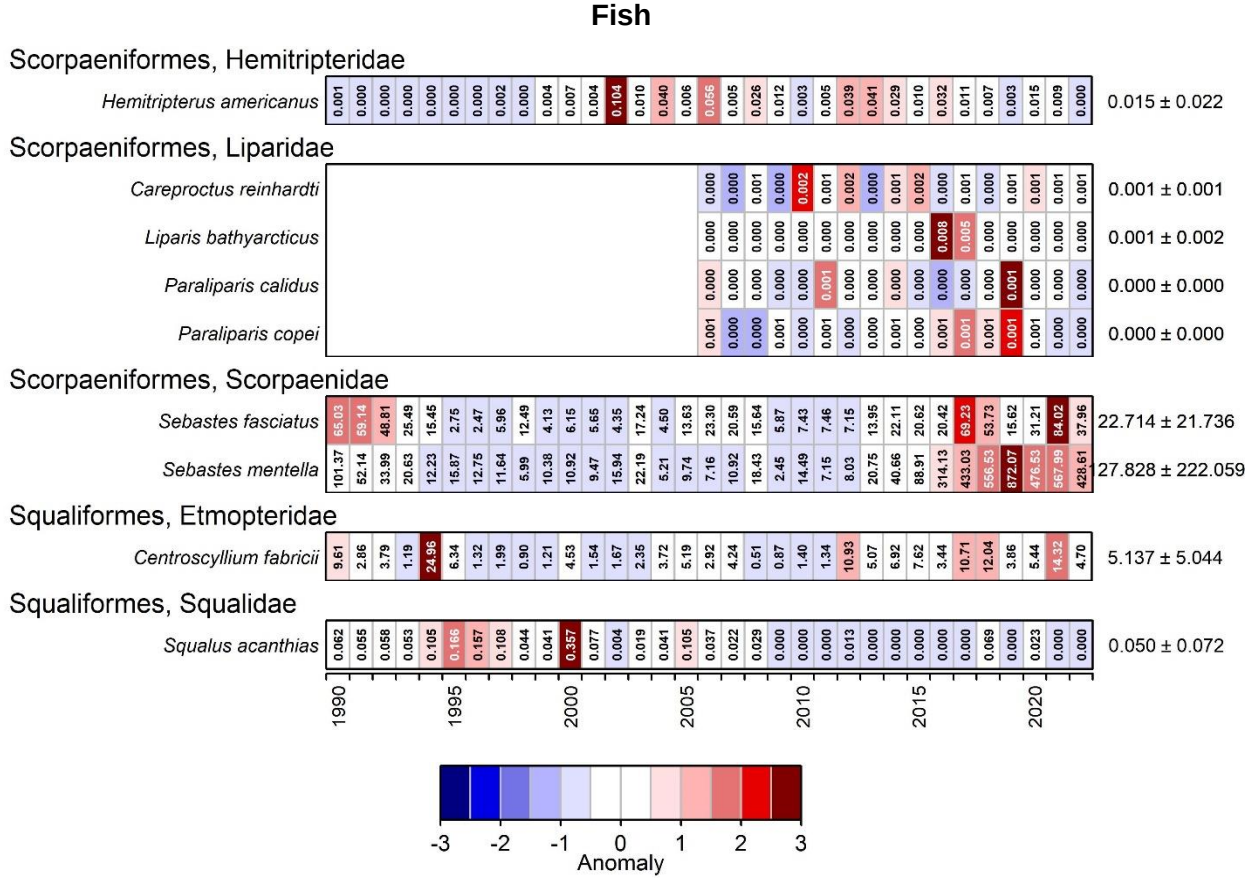

Figure 68. Continued.

Invertebrates

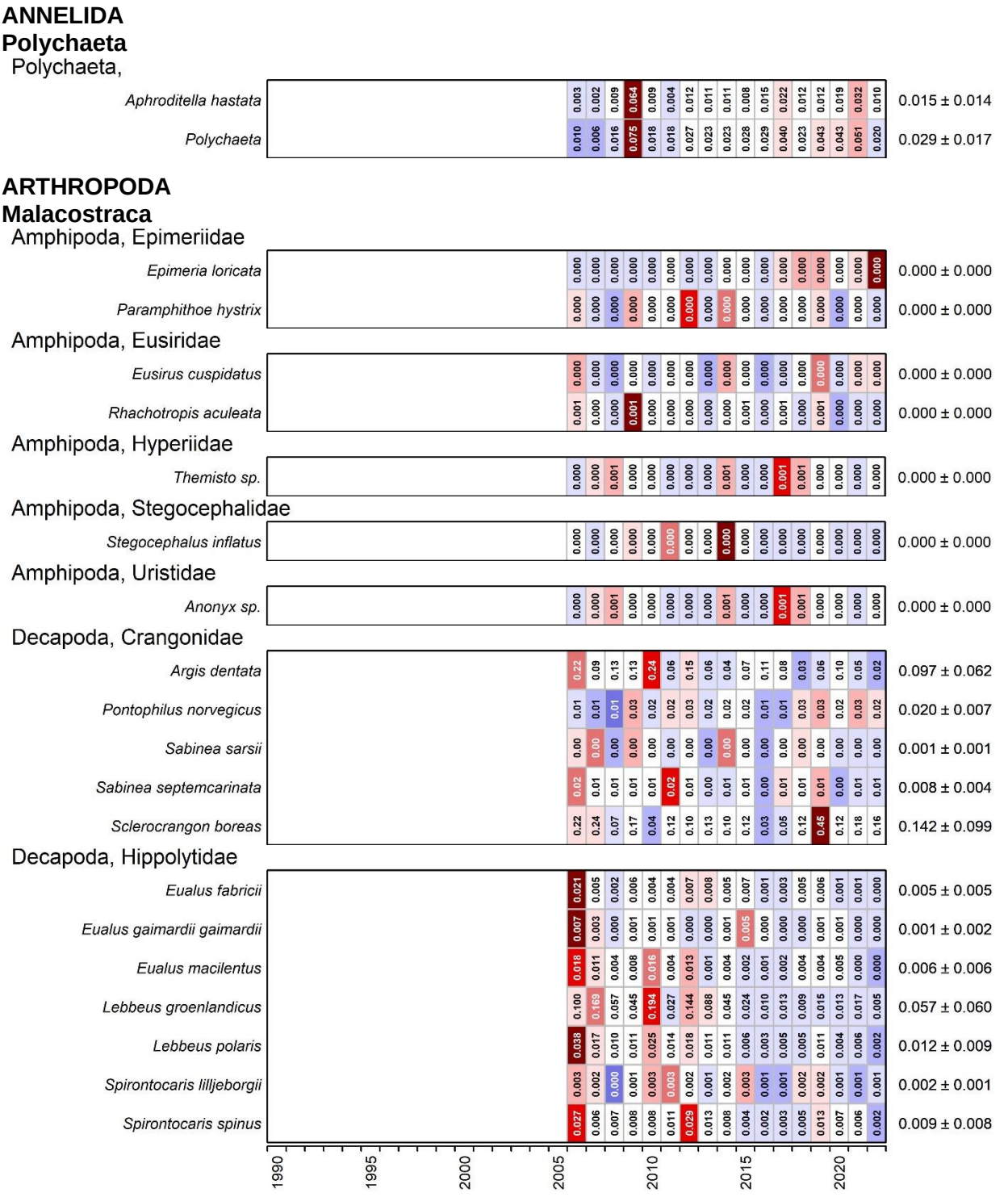

Figure 69. Average weight per 15-minute tow during the invertebrates. The colour code represents the anomaly value of the difference between the CPUE in a given year and the average CPUE in the time series divided by the standard deviation of this average for each taxon.

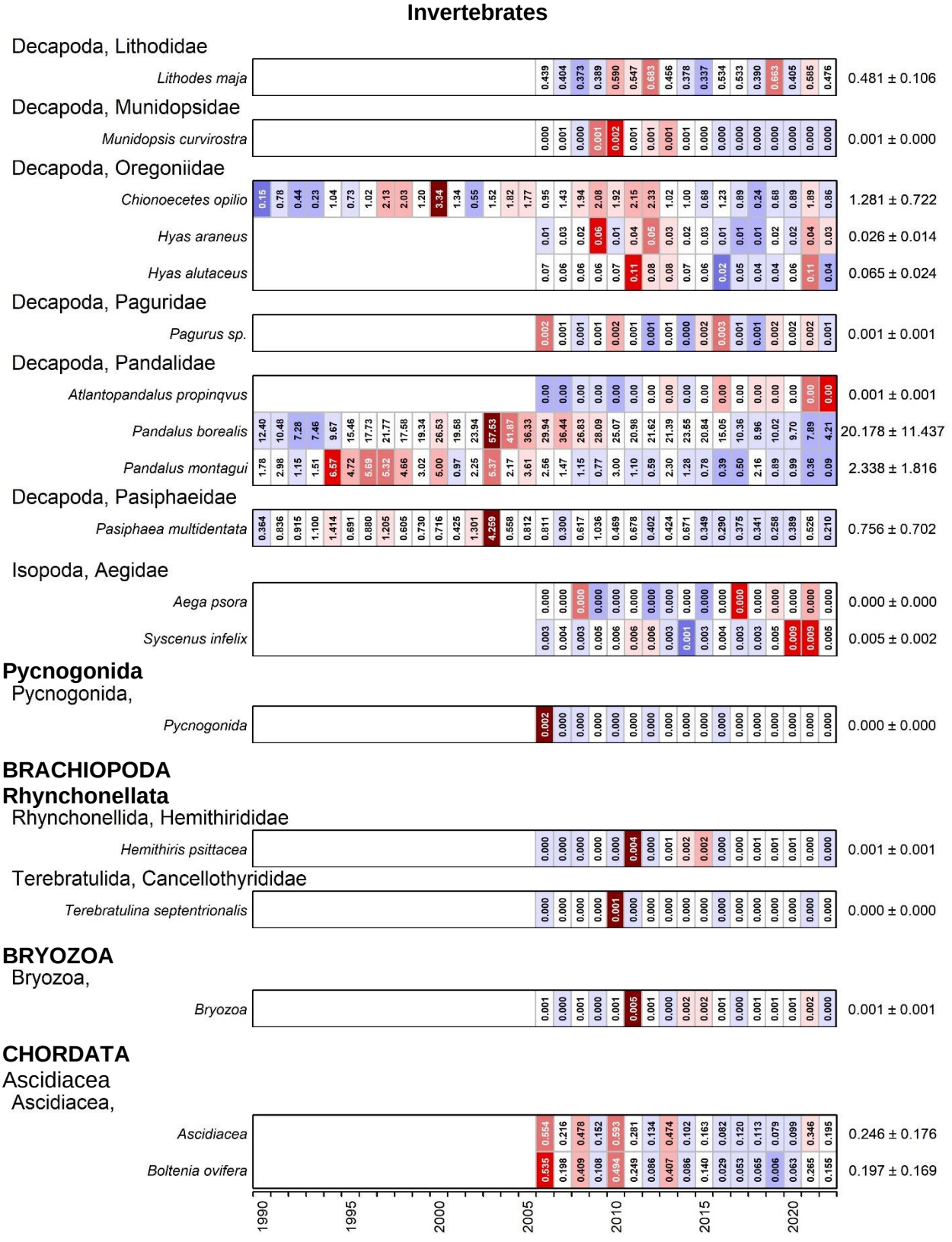

Figure 69. Continued.

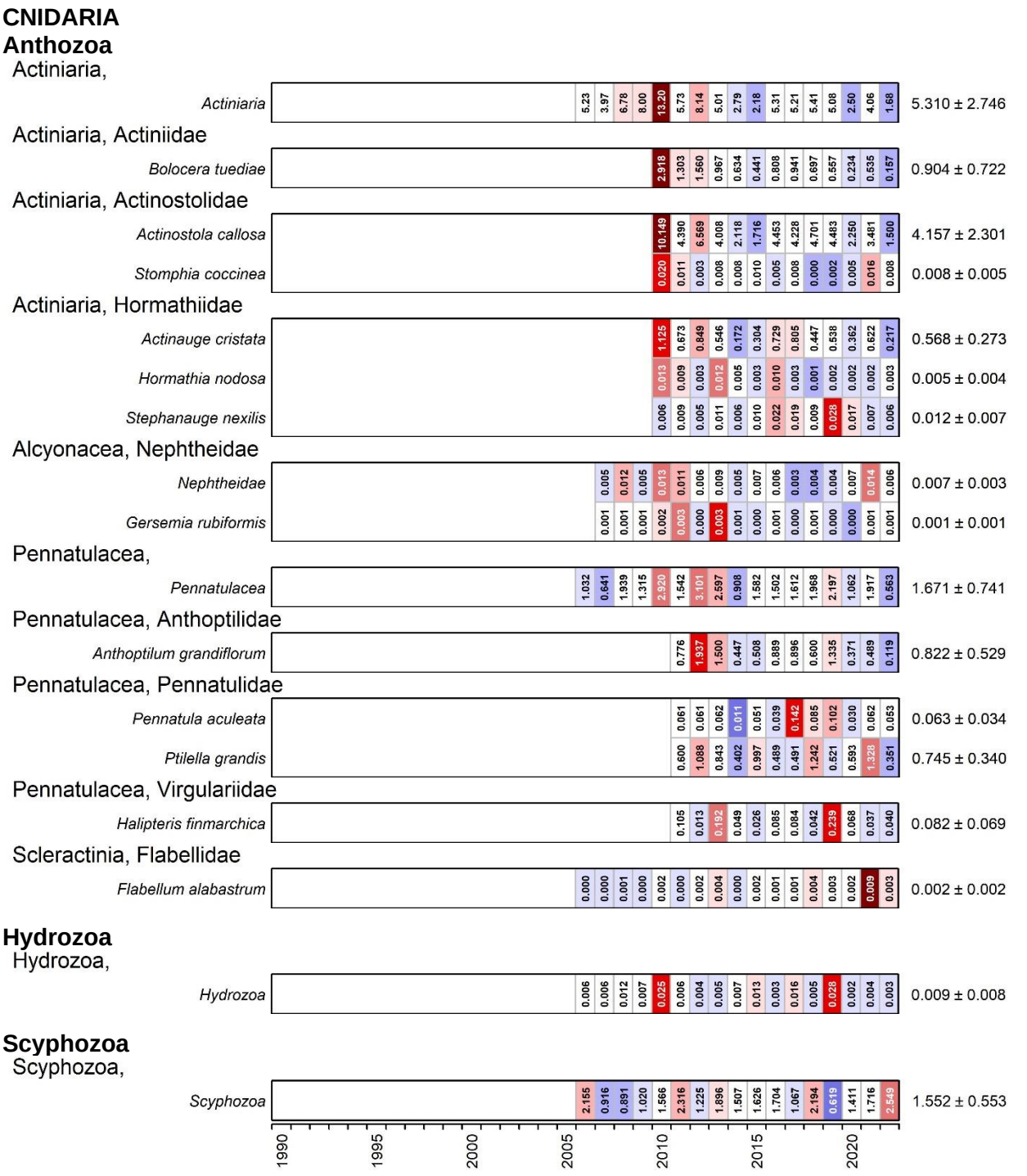

Figure 69. Continued.

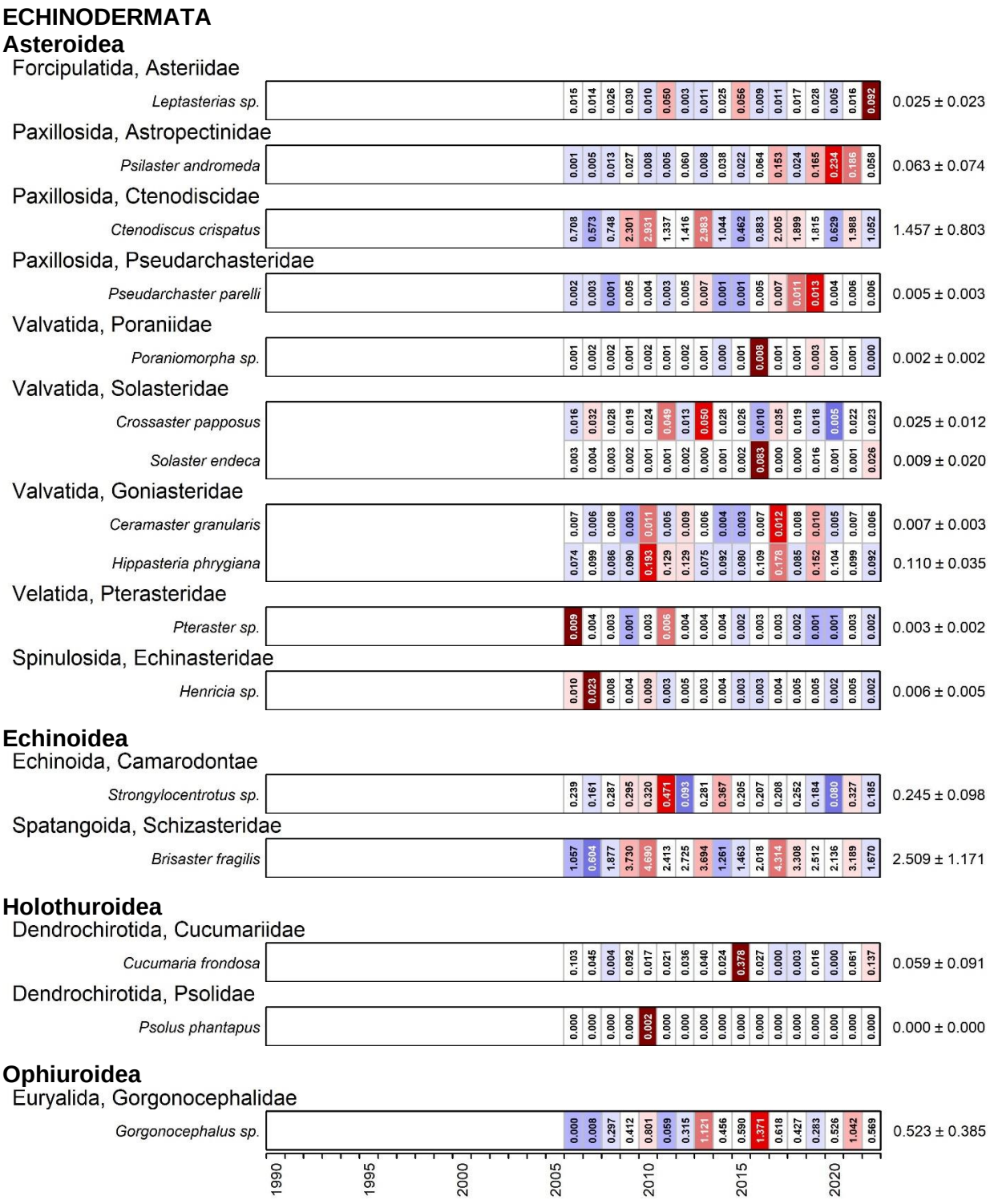

Figure 69. Continued.

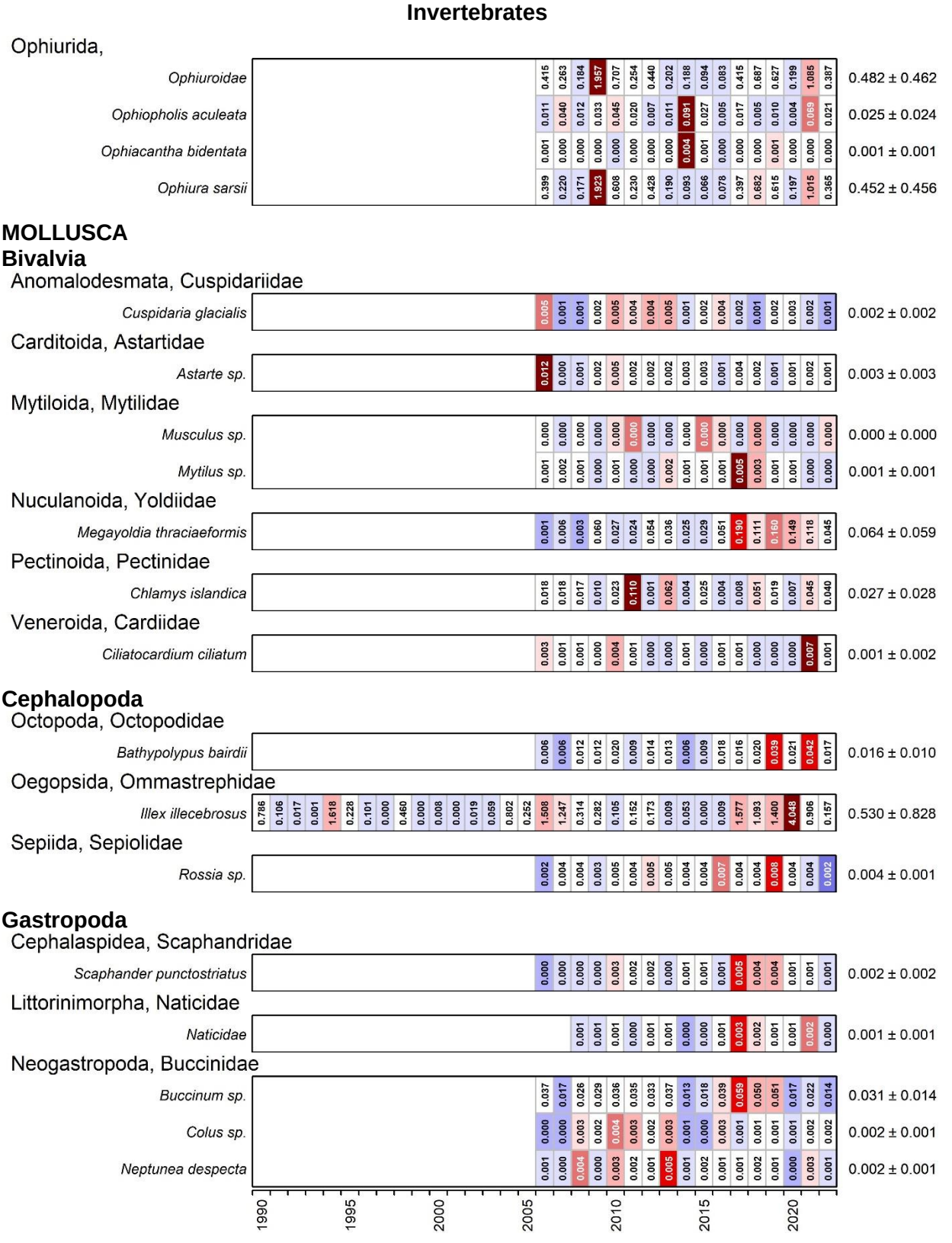

Figure 69. Continued.

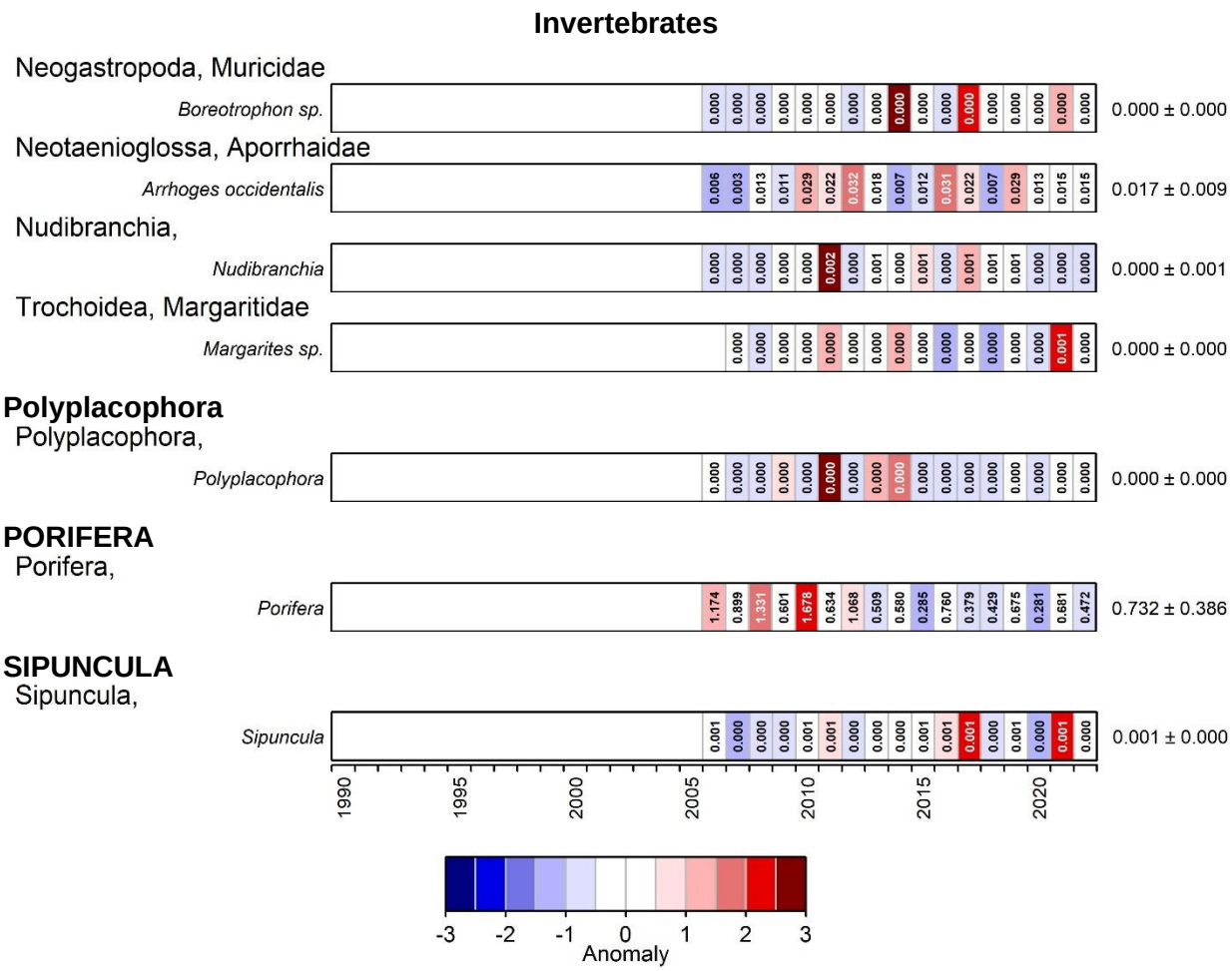

Figure 69. Continued.

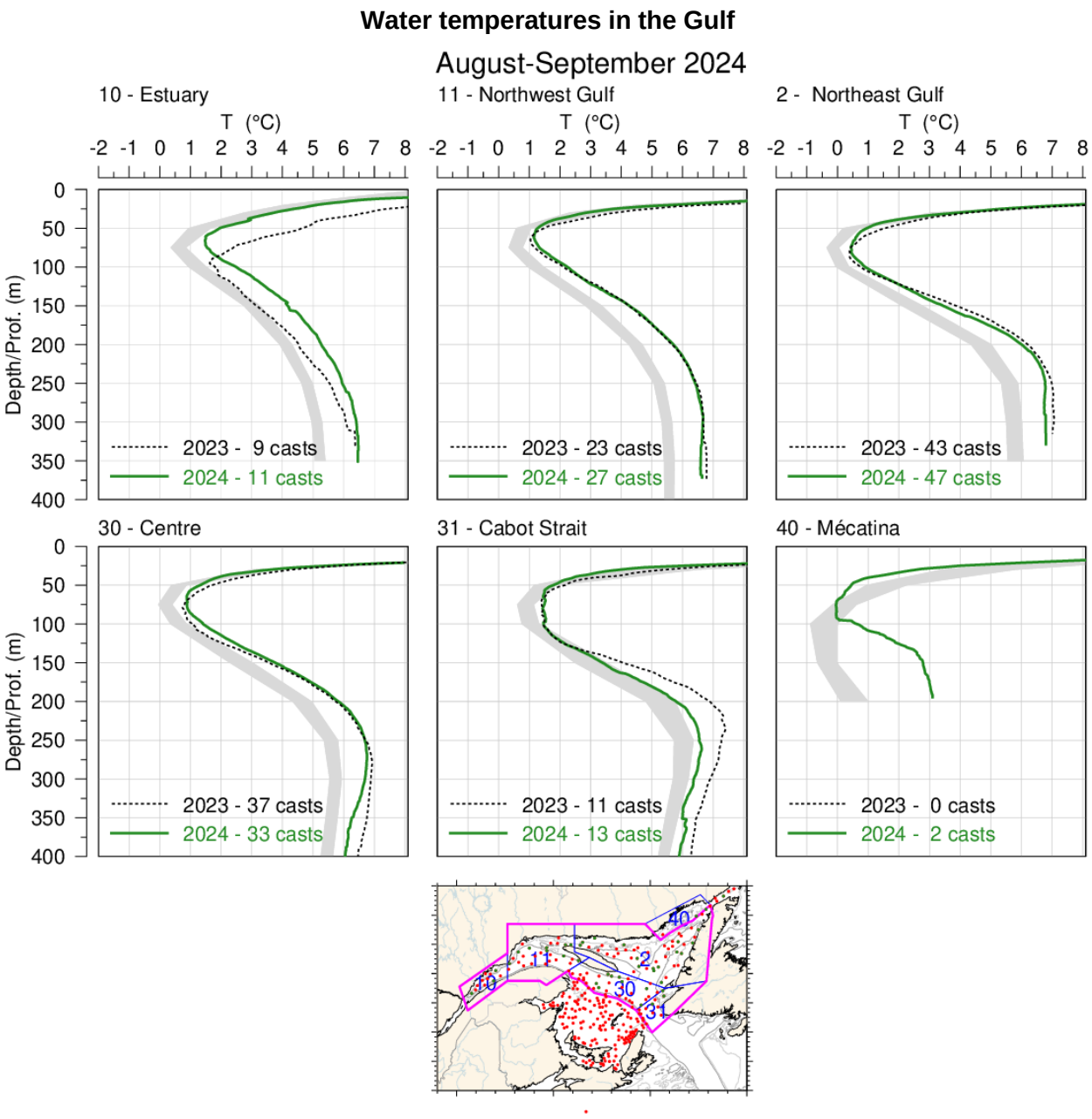

Figure 70. Mean temperature profiles observed in each region of the Gulf during August 2024 obtained from rosette profiles (red dots on the map) as well as from the trawl-mounted instrument when no rosettes were sampled within a 10 nautical mile radius (green dots). The shaded area represents the 1991–2020 climatological monthly mean ± 0.5 SD for August. Mean profiles for August and September 2023 are also shown for comparison. The violet outline on the map shows the area over which sea surface temperature is averaged for Figure 71.

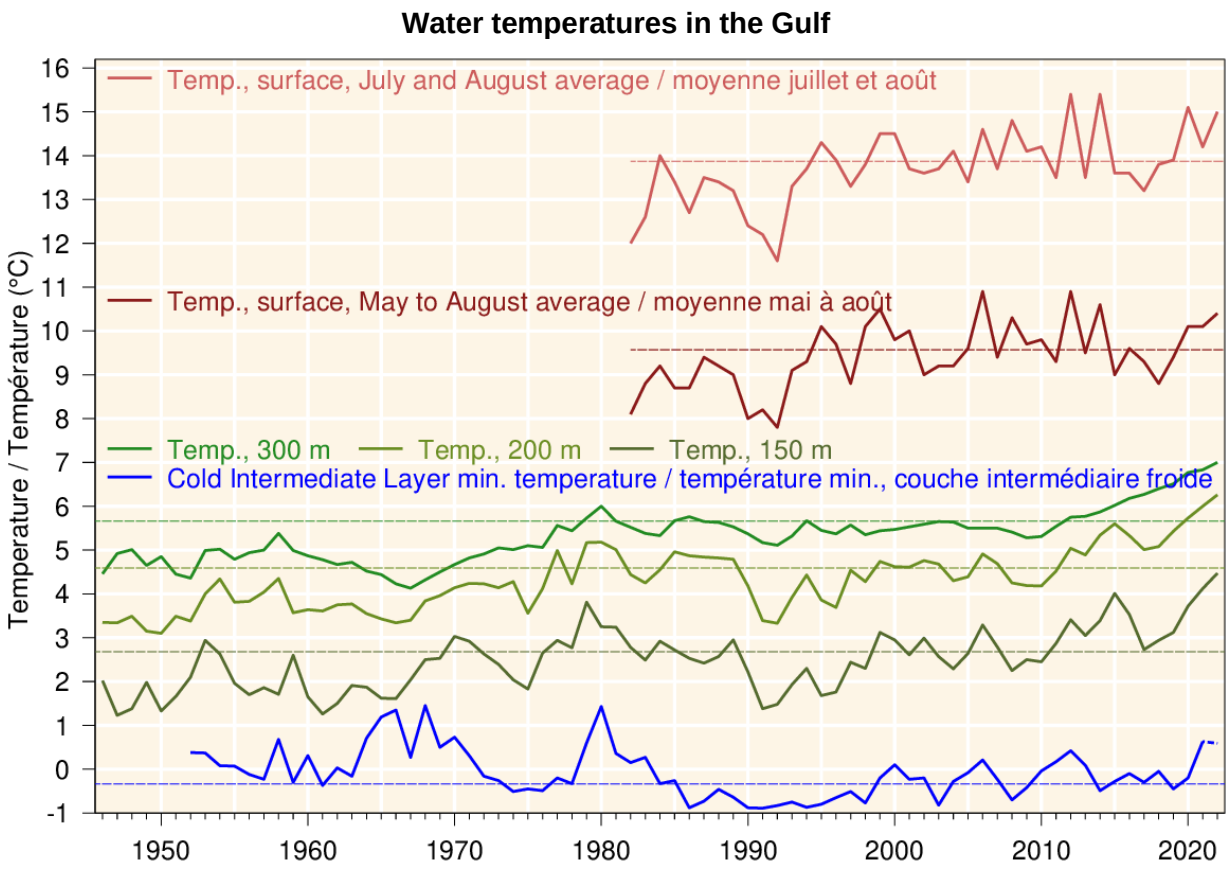

Figure 71. Water temperatures in the Gulf. Sea-surface temperature averaged over the Estuary and the northern Gulf (see violet outline on map of Figure 70) for July–August and May-August (1982–2024) (red lines). Layer-averaged temperature for the Gulf of St. Lawrence at 150, 200 and 300 m (green lines). The values for 2024 are preliminary as the data from the PMZA autumn survey have not yet been included Cold intermediate layer minimum temperature index in the Gulf of St. Lawrence adjusted to July 15, with 2022 value estimated only from August survey data (blue line).

APPENDIX

Equations of estimators of the mean, variance and confidence intervals for random stratified sampling (Cochran 1977) used for computing annual indices.

$$N = \sum_{h=1}^{L} N_h$$

$$f_h = \frac{n_h}{N_h}$$

$$W_h = \frac{N_h}{N}$$

$$\bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{hi}}{n_h}$$

$$s_h^2 = \frac{\sum_{i=1}^{n_h} (y_{hi} - \bar{y}_h)^2}{n_h - 1}$$

$$\bar{y} = \sum_{h=1}^{L} W_h \bar{y}_h)$$

$$s_{\bar{y}}^2 = \sum_{h=1}^{L} \frac{W_h^2 s_h^2 (1 - f_h)}{n_h}$$

Where

L : Total number of strata (h = 1, 2, …, L)

n_h : Stratum h sample size, that is total number of sampled units

N_h : Stratum h size (here expressed as the number of trawlable units)

N : Survey area size

f_h : Sampling fraction in stratum h

W_h : Weight of stratum h (proportion of survey area in stratum h)

y_{hi} : Observation i of stratum h

$\bar{y}_h$: Mean of stratum h

s_h^2 : Variance of stratum h

$\bar{y}$: Annual estimate of the mean

$s_{\bar{y}}^2$: Estimated variance of $\bar{y}$

With confidence intervals and degrees of freedom given by

$$\bar{y} - t_{(\alpha/2,d)}\, s_{\bar{y}} < \bar{Y} < \bar{y} + t_{(\alpha/2,d)}\, s_{\bar{y}} \text{ and}$$

$$d = \left(\sum_{h=1}^{L} a_h s_h^2 \right) \Big/ \left[\sum_{h=1}^{L} \left(a_h s_h^2 \right)^2 / (n_h - 1) \right]$$

where $a_h = N_h (N_h - n_h)/n_h$