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Preliminary results from the ecosystemic survey in August 2021 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 northern Gulf of St. Lawrence. The objectives of this survey are varied; assess the biodiversity of species found near the bottom; estimate the abundance of groundfish and invertebrates; assess physical and biological (phytoplankton and zooplankton) oceanographic conditions; monitor the pelagic ecosystem; and collect samples for various research projects. In 2021, the survey was conducted between July 25 and August 26 on board the CCGS *Teleost*. The survey successfully carried out 149 trawl tows as well as 74 CTD water column casts, and 57 zooplankton samples.

This report presents the results of the 149 tows. In total, 82 fish taxa and 214 invertebrate taxa were identified during the mission. Historical perspectives (catch rates, spatial distribution and length frequency) are presented for 25 taxa. These commercial fishery-independent data will be used in several stock assessments including cod (*Gadus morhua*), redfish (*Sebastes spp.*), Greenland halibut (*Reinhardtius hippoglossoides*), Atlantic halibut (*Hippoglossus hippoglossus*), witch flounder (*Glyptocephalus cynoglossus*) and northern shrimp (*Pandalus borealis*).

A preliminary analysis of water temperature data collected in 2021 shows that conditions have warmed at 150 m and deeper, reaching new records since 1915 at 150, 200 and 300 m. The August cold intermediate layer (CIL) minimum temperature was much warmer in 2021 than in 2020, reaching the highest values of the modern CTD era. Surface waters temperatures were near normal in July-August.

INTRODUCTION

Fisheries and Oceans Canada conducts an annual bottom trawl survey in the Estuary and the northern Gulf of St. Lawrence. This is a multi-species, commercial fishery-independent survey. 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 to:

1. assess groundfish and Northern Shrimp population abundance and condition;
2. assess environmental conditions;
3. conduct a biodiversity inventory of benthic and demersal megafauna;
4. assess phytoplankton and mesozooplankton abundance;
5. monitor the pelagic ecosystem;
6. conduct an inventory of marine mammals (cancelled in 2020 and 2021);
7. conduct an inventory of seabirds (cancelled in 2019, 2020 and 2021);
8. collect samples for various research projects.

In 2021, the survey was conducted between July 25 and August 26 onboard the CCGS *Teleost* (mission IML-2021-030). This mission took place in the context of the Covid-19 pandemic. Sanitary measures had to be put in place so that the mission could be carried out. The science crew was reduced from 15 to 11 scientists. Observers for marine mammals and seabirds did not participate in the survey, so the inventorying objectives for these species could not be achieved. The number of scientists on each fishing team was reduced from 5 to 4 people. This reduction resulted in a review of the fish and invertebrate sampling protocols. Finally, the shrimp samples were not measured during the mission but were transported to the laboratory and analyzed in the fall.

SURVEY DESCRIPTION

The survey covers the waters of the Laurentian Channel and north of it, from the Lower 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 part of the Lower Estuary in order to sample the depths between 37 and 183 m. The study area is 118 587 km^2.

A stratified random sampling strategy was used for this survey. This technique consists in subdividing the study area into homogeneous strata. The area was divided into 54 strata, which were divided based on depth, NAFO division and substrate type (Figure 2). An initial allocation of 200 trawl stations was distributed in the study area proportionally to the stratum surface, with a minimum of two stations per stratum. The tow positions were chosen randomly within each stratum. Since 2014, a new rule was added so as to respect a minimum distance of 10 km between stations in the same stratum.

The fishing gear used on the CCGS *Teleost* is a four-sided Campelen 1800 shrimp trawl equipped with a Rockhopper footgear (“bicycle”) (McCallum and Walsh 2002). The trawl lengthening and codend are equipped with a 12.7-mm knotless nylon lining. Standard trawling tows last 15 minutes, starting from the time the trawl touches the sea floor as determined by the

Scanmar™ hydroacoustic system. Towing speed is 3 knots. Information on trawl geometry (horizontal spread of the doors and wings, vertical opening of the trawl, depth) was recorded for each tow using *Scanmar*™ hydroacoustic sensors mounted on the fishing gear.

In 2021, 149 fishing stations were successfully completed (41 in 4R, 69 in 4S and 39 in 4T), which represent 40 stations less than what has been achieved on average since 1990 (Table 1). The decrease in the number of stations completed is due to the fact that the ship had to go to the wharf three times for medical or mechanical reasons. A lot of effort was expended to cover the entire study area. Six strata were not sampled with a minimum of two stations, two of which were not visited (Figure 3, Table 1). These partially or uncovered strata were distributed throughout the study area and not located in a particular sector.

For each fishing tow, the catch was sorted and weighed by taxa; biological data were then collected on a sub-sample. For fish, crab and squid, size and weight were gathered by individual. For some species, sex, maturity, and the weight of certain organs (stomach, liver, gonads) were also evaluated. Count of soft rays of the anal fin for redfish was conducted to separate the two species. Cod, Atlantic halibut and witch flounder otoliths were saved to determine age of fish. A sample of approximately 2 kg of shrimp was frozen for laboratory analysis at the Maurice Lamontagne Institute, where the sample was later sorted and weighed by species and by maturity stage for the northern shrimp. The shrimps were measured individually. The other invertebrates were counted (no individual measurements) and photographed. The photos are archived in a photo catalogue with associated keywords (taxonomic identification, station description, date, etc.).

Since 2001, digital photos have supported an increased effort in the identification of species. 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 a guide for invertebrates (Nozères and Archambault 2014) were used during the mission to identify most taxa. The taxon codes and their names follow the list of Miller and Chabot (2014), with annual updates according to the World Register of Marine Species (WoRMS).

Additional samples were taken for various scientific projects:

1. Water samples for genetic analysis of environmental DNA;
2. Samples of herring, capelin and mackerel for maturity determination;
3. Beluga and marine mammal preys (several fish species and northern shrimp) in order to follow the evolution of isotopic signatures of key species in the St. Lawrence ecosystem;
4. Stomachs of several fish species in order to describe their diet;
5. Samples of small demersal fish;
6. Rays and dogfish specimens for structural development studies, including inference of age from vertebrae and other structures (spines, etc);
7. Blood samples from Atlantic halibut and Greenland halibut to characterize the ecosystem health from molecular markers;
8. Small redfish (<11 cm) for genetic identification of the species (*Sebastes fasciatus* and *S. mentella*) and the population of new cohorts observed in the Gulf;
9. Monitoring redfish growth from the 2011 cohort;
10. Redfish samples to study the aging process, health and stress management in aquatic ectotherms;

11. Atlantic halibut and Greenland halibut gonad samples to determine the maturity stage;

12. Squid samples to study its trophic role in the ecosystem;

13. Sponges (Porifera) to identify the different species present.

Oceanographic conditions such as temperature, conductivity (salinity), turbidity, dissolved oxygen, luminosity and fluorescence were sampled during this survey. A total of 62 vertical profiles of the water column were done at the fishing stations and 12 more on extra stations that fall under the Atlantic Zone Monitoring Program (AZMP). The various sampling devices, *CTD SeaBird 911Plus*™, dissolved oxygen sensor (*SBE 43*), photometer (*Biospherical*) and fluorometer (*Eco-FLNTU Wetlabs*) were coupled to a 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 149 fishing tows.

In order to study the distribution and biomass of zooplankton in the study area, a component of the sampling program consisted of harvesting organisms using a zooplankton net (202 µm) towed vertically from the sea floor to the surface at 57 stations.

Hydroacoustic data for the water column were continuously recorded at four frequencies (38, 70, 120 and 200 kHz) using a *SIMRAD*™ *EK60* echosounder during the entirety of the mission. These data will be used to develop a three-dimensional database to map the pelagic ecosystem.

DATA ANALYSIS

The analysis of 2021 abundance and biomass data was integrated into the combined annual summer survey series initiated in 1990. These combined series were developed following a comparative study between the two vessel-gear tandems (1990–2005: CCGS *Alfred Needler—URI 81'/114'* trawl; 2004–2021: CCGS *Teleost—Campelen 1800* trawl) to establish specific correction factors for about twenty captured species (Bourdages et al. 2007). Results from this study led to the adjustment of *Needler* catches in *Teleost* equivalent catches.

The annual catch rate indexes, in terms of mean number and weight per standardized tow (15 minutes tow, i.e. a swept area of 0.75 nautical miles with an average wingspread of 16.94 m), and their confidence interval were estimated using the standard estimators for stratified random sampling (Appendix). Given that over the years, some strata were not sampled by a minimum of two successful tows (Table 1), a multiplicative model of the form:

$$\log(\text{catch rate} + 0.01) \sim \text{stratum} + \text{year},$$

was used to estimate their catch rate indexes. This model provided a predicted value for strata with less than two tows based on 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 all strata. In addition, reference points were also added to the catch rate figures. The solid line represents the 1990–2020 period average (long-term average). The two dotted lines represent the long term mean ±0.5 standard deviation and correspond to the upper and lower reference limits respectively.

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 count and the depth of capture of individuals (Senay et al. 2021).

Length frequency distributions are presented in two different formats. A first figure shows the distribution for the last two years of the series plus the average distribution for the 1990–2020 period (long-term average distribution). Frequency values are expressed as the average number of individuals caught per tow in 1 cm increments, except for the northern shrimp (0.5 mm) and Atlantic halibut (3 cm). The second figure represents the length frequency distributions as mean number per length class for each year of the historical surveys series (1990 to 2021).

The geographical distribution of catch rates (CPUE), presented as weight (kg) per 15 minute tow for all species (except sea pens: number of specimens/15 minute tow) was aggregated for periods of five or six years. The interpolation of CPUE (catch per unit of effort) was performed on a grid covering the study area using a ponderation inversely proportional to the distance (R version 2.13.0, Rgeos library; R Development Core Team 2011). The isoline contours were then plotted for four CPUE levels which approximate the 20^{th}, 40^{th}, 60^{th} and 80^{th} percentiles of the non-zero values. The catch rate distribution for the 2021 survey is 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 25 taxa are presented in figures 5 to 62. These results are preliminary and must be considered as such until validations and laboratory analyses have been completed.

The distribution of total species richness and of 3 taxonomic groupings are presented in figures 63 to 66. Species richness is expressed as the number of species collected, total or per grouping, at each station in 2021. Taxonomic groupings were created to observe more specifically the distribution of species richness for species with similar ecological characteristics: fishes, shrimps and invertebrates (excluding shrimps).

The average weight per tow for 57 fish taxa and 99 invertebrate taxa is given in figures 67 and 68. In these figures, a color code is used to represent the difference between the CPUE in a given year and the average CPUE of the time series for a given taxon divided by the standard deviation of this average.

The 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 149 successful tows achieved during the 2021 survey. The occurrence, defined as the number of tows where the species was identified, as well as total catch, by weight and number of specimens, are also presented. The number of specimens measured per taxon and some descriptive statistics for the length parameter are also presented in Table 3.

RESULTS

Warning: The bottom trawl survey is designed to sample demersal species. However, catches may also include pelagic species and 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 trawl net. Caution is required when interpreting the results obtained for these taxa.

BIODIVERSITY

In total, 82 fish taxa and 214 invertebrate taxa were identified in 2021 (Table 2).

In 2021, the biomass of the two redfish species combined accounted for 82% of the biomass of all captured organisms in the survey (e.g., invertebrates, pelagic fish, demersal fish and groundfish), while it averaged 15% between 1995 and 2012 (Figure 4). The Atlantic redfish (*Sebastes mentella*) constituted, alone, 70% of the catches made during the survey, indicating that they actually dominate the GSL bottom ecosystem.

Species richness is generally higher near the coasts such as the north and west of Anticosti Island, near the Strait of Belle Isle and in the southwest of Newfoundland (Figure 63). The northwest coast of Anticosti Island stands out this year for the diversity of shrimp (Figure 66) and other invertebrates (Figure 65). Species characteristic of shallow bottoms were observed at these stations. Fish richness this year is relatively similar across the northern GSL with some more diverse regions such as the west coast of Newfoundland (Figure 64).

Fish

The abundance and the biomass of the **black dogfish** (*Centroscyllium fabricii*) have been above average for the past ten years (Figures 5 to 7).

Capelin (*Mallotus villosus*) was mainly distributed in the Estuary, along the North Shore and north of the west coast of Newfoundland (Figure 8).

For the past twelve years, abundance and biomass of **Atlantic halibut** (*Hippoglossus hippoglossus*) has remained above the series average (Figures 9 to 11). The 2021 value is the highest observed for biomass and one of the five highest for abundance.

The abundance of **Greenland halibut** (*Reinhardtius hippoglossoides*) in 2021 is lower than the 2020 estimate and is slightly below the series average. Biomass increased in 2021 with regards to 2020 and is slightly above average. Size frequency distributions indicate that the 2020 cohort (16 cm mode) and the 22 cm-32 cm fish abundance are lower than the average, while the 32–45 cm fish abundance is above average (Figures 12–14).

The **lumpfish** (*Cyclopterus lumpus*) was a rare but regular catch in this survey. Abundance and biomass have been above the series average for many years (Figures 15 to 17).

Atlantic herring (*Clupea harengus*) was a frequent catch in this survey and was distributed throughout the northern Gulf of St. Lawrence with the exception of the depths of the Laurentian Channel. The highest catches were observed along the west coast of Newfoundland (Figure 18).

Atlantic wolffish (*Anarhichas lupus*) and **spotted wolffish** (*Anarhichas minor*) were caught on 29 and 6 occasions, respectively, in 2021. These catches were mainly distributed in the northern eastern part of the Gulf of St. Lawrence (Figures 19 and 20).

Since 2007, **silver hake** (*Merluccius bilinearis*) is more common in the northern Gulf, while it was only occasionally observed before (Figures 21 to 23).

The abundance and biomass of the **longfin hake** (*Phycis chesteri*) have been near average for five years (Figures 24 to 26).

The abundance and biomass of **white hake** (*Urophycis tenuis*) have been above average for seven years (Figures 27 to 29).

In 2021, the abundance and biomass indices of **cod** (*Gadus morhua*) have increased, these indices are above the average of their respective series. A length frequency mode is observed from 28 to 38 cm (juvenile cod). The geographic distribution of catches in 2021 is comparable to previous years (Figures 30 to 32).

American plaice (*Hippoglossoides platessoides*) was frequently caught and its abundance is stable and above average and its biomass is increasing (Figures 33 to 35).

Witch flounder (*Glyptocephalus cynoglossus*) was frequently caught. The strong cohorts from 2007 and 2009 have contributed to the increase in biomass; these fish are now larger than 30 cm (Figures 36 to 38).

Thorny skate (*Amblyraja radiata*) and **smooth skate** (*Malacoraja senta*) were both very frequently caught. The abundance of thorny skate is stable and near the average. The abundance is decreasing below the average for smooth skate (Figures 39 to 44).

Arctic cod (*Boreogadus saida*) is a small cold water demersal fish. Catches in recent years have been made in the Estuary, along the North Shore and on the west coast of Newfoundland (Figures 45 to 46).

Acadian redfish abundance and biomass (*Sebastes fasciatus*) are above the averages of the time series (Figures 47 to 49).

Three strong cohorts (2011, 2012 and 2013) of **Atlantic redfish** (*Sebastes mentella*) have contributed to the increase in abundance and biomass since 2013. The 2011 cohort, which is the most abundant, now has a modal size of 24 cm. These redfish are distributed throughout the channels of the northern Gulf of St. Lawrence (Figures 50 to 52).

Invertebrates

The three most abundant **shrimp** species in the deep waters of the northern Gulf of St. Lawrence, namely northern shrimp (*Pandalus borealis*), striped pink shrimp (*Pandalus montagui*) and pink glass shrimp (*Pasiphaea multidentata*), have been declining for several years (Figure 68).

The abundance and biomass of the **northern shrimp** (*Pandalus borealis*) have declined significantly since 2003 and reached the lowest values in the historical series since 2017 (Figures 53 to 55).

Northern shortfin squid (*Illex illecebrosus*), a seasonal pelagic species from the south, has been present in over 50% of the tows since 2017 in all areas except the estuary and Strait of Belle Isle. This strong squid presence had not been observed for several years (Figures 59 to 61).

Four species of **sea pens** were present in the northern Gulf of St. Lawrence. The larger sea pens (*Anthoptilum grandiflorum, Halipteris finmarchica, Ptilella grandis*) are distributed in the deeper areas of the Laurentian Channel, while the spiny sea pen (*Pennatula aculeata*) has a more widespread distribution (Figures 59 to 62).

Several observations of the **sepiole** *Stoloteuthis leucoptera* were made this year during the survey. This species was recorded at 12 different stations for a total of 51 individuals captured (Table 2). The first observation of this sepiole was made in 2019 where 10 individuals were observed. No individual had been captured in 2020. This species is commonly found in the northeast Atlantic and appears to occasionally enter the Gulf of St. Lawrence through the Cabot Strait.

A single species of **hard coral** lives in the northern Gulf of St. Lawrence, *Flabellum alabastrum*. This year, a record biomass of 1.23 kg was caught. The average annual total capture weight is approximately 0.33 kg. The highest concentrations of this coral are found near the southwestern tip of Newfoundland in the depths of the Laurentian Channel. *Flabellum alabastrum* is slow-growing, as many other cold-water corals are, and lives at least fifty years.

PHYSICAL OCEANOGRAPHIC CONDITIONS

A preliminary analysis of water temperature data collected in 2021 (Figures 69 and 70) shows that conditions have warmed at 150 m and deeper, reaching new records since 1915 at 150 m, 200 m, 250 m (not shown) and 300 m (note that these annual records may change with the addition of data sampled during the fall). Compared to conditions observed in August 2020, waters have warmed by about 0.5 °C at 150 m, by 0.3 °C at 200 m, by 0.1 °C at 250 but by only 0.03 °C at 300 m because of a 0.3 °C cooling at Cabot Strait. The August cold intermediate layer (CIL) minimum temperature was much warmer in 2021 than in 2020, reaching the highest values of the modern CTD era. Surface water temperatures were near normal in July-August (+0.3 standard deviation [SD]; +0.2 °C).

Air temperatures over the Gulf were above normal in April 2021, June and August, near normal in May and below normal in July. This led to above normal average surface water temperatures for the period of May–August (+0.7 SD relative to the 1991–2020 climatology and +0.5 °C) but near normal for July–August (+0.3 SD; +0.2 °C).

At the end of winter 2021, the volume of water of the surface layer with temperatures lower than 0 °C was the lowest in the history of the March survey (since 1996), forecasting the warmest summer cold intermediate layer (CIL) since the 1980s. Its seasonal average minimum temperature (the Gilbert & Pettigrew index), estimated for 2021 using only data from the August survey, would potentially be the warmest since 1980 at 0.7 °C (+2.6 SD; Figure 70). The volume of the CIL T <1 °C) was also at its lowest level since the beginning of the continuous time series beginning in 1985.

Beneath the cold intermediate layer, the estuarine flow that carries water from the depths to the channel heads has carried the increasingly warm waters that had been transitioning for several years through Cabot Strait, central Gulf and Esquiman Channel further upstream. Consequently, deep water temperatures in August have increased since 2020 below 150 m in all regions except Cabot Strait (Figure 69). Considering all the data recorded in different months of the year, the three regions along the deep Laurentian Channel north of Cabot Strait, i.e., the Estuary, northwestern Gulf, and Central Gulf, are all experiencing record temperatures at 300 m (6.1 °C, 6.5 °C, 6.9 °C). The annual mean exceeded 6° C in the estuary for the first time. The Gulf-wide average temperature at 300 m has reached a record level since 1915 at 6.87 °C, an increase of only 0.03 °C since 2020 (Figure 70). This near stability was caused by a decrease in temperature of 0.3 °C in Cabot Strait, passing from 7.2 °C to 6.9 °C. The temperature reduction observed last year at the mouth of the Laurentian Channel having transited to Cabot Strait.

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REFERENCES CITED

Bourdages, H., Savard, L., Archambault, D. and Valois, S. 2007. Results from the August 2004 and 2005 comparative fishing experiments in the northern Gulf of St. Lawrence between the *CCGS Alfred Needler* and the *CCGS Teleost*. Can. Tech. Rep. Fish. Aquat. Sci. 2750: ix + 57 p.

Dutil, J.-D., Nozères, C., Scallon-Chouinard, P.-M., Van Guelpen, L., Bernier, D., Proulx, S., Miller, R. and Savenkoff, C. 2009. Poissons connus et méconnus des fonds marins du Saint-Laurent. Le naturaliste canadien 133: 70-82.

McCallum, B. and Walsh, S. J. 2002. An update on the performance of the Campelen 1800 during bottom trawl surveys in NAFO subareas 2 and 3 in 2001. NAFO SCR Doc. 02/36. 16 p.

Miller, R. and Chabot, D. 2014. Code List of Marine Plants, Invertebrates and Vertebrates Used by the Quebec Region of DFO. Can. Data Rep. Fish. Aquat. Sci. 1254:iv + 115 p.

Nozères, C., Archambault, D., Chouinard, P.-M., Gauthier, J., Miller, R., Parent, E., Schwab, P., Savard, L., and Dutil, J.-D. 2010. Identification guide for marine fishes of the estuary and northern Gulf of St. Lawrence and sampling protocols used during trawl surveys between 2004 and 2008. Can. Tech. Rep. Fish. Aquat. Sci. 2866: xi + 243 p.

Nozères, C. and Archambault, D. 2014. Portfolio pour l'identification rapide d'invertébrés capturés au chalut dans l'estuaire et le nord du golfe du Saint-Laurent. Rapp. manus. can. sci. halieut. aquat. 3033:iv + 30 p.

Nozères C., Archambault, D. and Miller, R. 2014. Photocatalogue of invertebrates of the Estuary and northern Gulf of St. Lawrence from trawl surveys (2005–2013). Can. Manuscr. Rep. Fish. Aquat. Sci. 3035:iv + 221 p.

R Development Core Team. 2011. R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. (Accessed November 30th 2017).

Savard, L. and Nozères, C. 2012. Atlas of shrimp species of the Estuary and northern Gulf of St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. 3007:vi + 67 p.

Senay, C., Ouellette-Plante, J., Bourdages, H., Bermingham, T., Gauthier, J., Parent, G., Chabot, D., and Duplisea, D. 2021. Unit 1 Redfish (*Sebastes mentella* and *S. fasciatus*) stock status in 2019 and updated information on population structure, biology, ecology, and current fishery closures. DFO Can. Sci. Advis. Sec. Res. Doc. 2021/015. xi + 119 p.

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
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
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
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
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
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
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
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
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
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
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	2	2	3	3	3
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	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
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	1	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
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	2	3	3	3	2	2
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	2	2	2	2	2	1	2	0
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
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
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
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
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
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	3	4	0	2	3
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
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
830	4S	1917	3	3	4	3	3	3	2	2	3	3	3	2	1	1	0	6	3	3	3	3	3	2	3	2	4	4	3	3	3	3	2	2
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
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
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
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
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
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
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
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
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
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
Total		116 115	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
851	4T	456	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3	3	3	2	2	2	2	2	1	1	2
852	4T	427	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3	2	3	2	2	2	1	2	2	1	2
854	4T	465	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	3	2	2	2	2	2	2	2	2	0	1	1
855	4T	928	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	3	2	3	3	2	2	2	2	2	1	1	2

Table 2. Occurrences and total catches, in weight and number, by taxon during the 2021 survey (147 successful tows). Taxonomic codes (STRAP) follow Miller and Chabot (2014), with scientific name updates by the World Marine Species Registry (WoRMS 2018, http://www.marinespecies.org).

Vertebrates

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
90	*Amblyraja radiata*	Raie épineuse	Thorny Skate	124	816.8	1326
696	*Ammodytes* sp.	Lançons	Sand Lances	10	4.4	385
700	*Anarhichas lupus*	Loup atlantique	Atlantic Wolffish	29	123.7	347
701	*Anarhichas minor*	Loup tacheté	Spotted Wolffish	6	45	9
718	*Anisarchus medius*	Lompénie naine	Stout Eelblenny	2	1.7	221
320	*Arctozenus risso*	Lussion blanc	White Barracudina	74	9.5	481
193	*Argentina silus*	Grande argentine	Atlantic Argentine	16	24.4	289
811	*Artediellus atlanticus*	Hameçon atlantique	Atlantic Hookear Sculpin	26	1	203
810	*Artediellus* sp.	Hameçons	Hookear Sculpins	12	1.1	64
812	*Artediellus uncinatus*	Hameçon neigeux	Arctic Hookear Sculpin	3	<0.1	8
838	*Aspidophoroides monopterygius*	Poisson-alligator atlantique	Alligatorfish	33	0.6	150
102	*Bathyraja spinicauda*	Raie à queue épineuse	Spinytail Skate	2	26.7	3
451	*Boreogadus saida*	Saïda franc	Arctic Cod	7	2.1	38
865	*Careproctus reinhardti*	Petite limace de mer	Sea Tadpole	8	0.6	26
27	*Centroscyllium fabricii*	Aiguillat noir	Black Dogfish	25	2452.6	2933
150	*Clupea harengus*	Hareng atlantique	Atlantic Herring	61	1251.6	5793
721	*Cryptacanthodes maculatus*	Terrassier tacheté	Wrymouth	6	3.4	11
849	*Cyclopterus lumpus*	Grosse poule de mer	Lumpfish	34	45.6	85
461	*Enchelyopus cimbrius*	Motelle à quatre barbillons	Fourbeard Rockling	102	46.6	1490
618	*Epigonus pandionis*	Cardinal	Big Eye	1	0.1	1
711	*Eumesogrammus praecisus*	Quatre-lignes atlantique	Fourline Snakeblenny	25	6.1	216
847	*Eumicrotremus terraenovae*	Petite poule Terre-Neuve	Newfoundland Spiny Lumpsucker	27	3.8	239
438	*Gadus morhua*	Morue franche	Atlantic Cod	80	6974.1	13 743
439	*Gadus ogac*	Ogac, morue ogac	Greenland Cod	1	0.6	1
454	*Gaidropsarus ensis*	Mustèle arctique à trois barbillons	Threebeard Rockling	1	<0.1	1
890	*Glyptocephalus cynoglossus*	Plie grise	Witch Flounder	122	463	2758
205	Gonostomatidae	Cyclothones	Bristlemouths	3	<0.1	3
746	*Gymnelus viridis*	Unernak caméléon	Fish Doctor	1	<0.1	1
823	*Gymnocanthus tricuspis*	Tricorne arctique	Arctic Staghorn Sculpin	27	13.2	197
797	*Helicolenus dactylopterus*	Chèvre impériale	Blackbelly Rosefish	1	0.1	1
809	*Hemitripterus americanus*	Hémitriptère atlantique	Sea Sculpin	1	0.8	1
889	*Hippoglossoides platessoides*	Plie canadienne	American Plaice	138	1315.1	12 901

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
893	*Hippoglossus hippoglossus*	Flétan atlantique	Atlantic Halibut	54	1419.8	126
830	*Icelus* sp.	Icèles	Spatulate and Twohorn Sculpin	2	<0.1	2
832	*Icelus spatula*	Icèle spatulée	Spatulate Sculpin	7	0.1	11
836	*Leptagonus decagonus*	Agone atlantique	Atlantic Poacher	15	4.6	266
717	*Leptoclinus maculatus*	Lompénie tachetée	Daubed Shanny	33	6.7	966
100	*Leucoraja ocellata*	Raie tachetée	Winter Skate	2	4.2	2
891	*Limanda ferruginea*	Limande à queue jaune	Yellowtail Flounder	5	77.3	619
868	*Liparis bathyarcticus*	Limace nébuleuse	Nebulous Snailfish	4	0.7	7
966	*Lophius americanus*	Baudroie d'Amérique	Monkfish, Goosefish	15	96.9	16
716	*Lumpenus lampretaeformis*	Lompénie-serpent	Snakeblenny	20	10.8	392
750	*Lycenchelys paxillus*	Lycode commune	Common Wolf Eel	1	<0.1	1
752	*Lycenchelys verrillii*	Lycode à tête longue	Wolf Eelpout	5	0.1	14
727	*Lycodes esmarkii*	Lycode d'Esmark	Esmark's Eelpout	8	2.4	9
728	*Lycodes lavalaei*	Lycode du Labrador	Newfoundland Eelpout	24	22.5	156
733	*Lycodes polaris*	Lycode polaire	Canadian Eelpout	1	0.7	18
726	*Lycodes* sp.	Lycodes	Eelpouts	2	0.5	10
734	*Lycodes terraenovae*	Lycode atlantique	Atlantic Eelpout	2	0.7	2
730	*Lycodes vahlii*	Lycode à carreaux	Vahl's Eelpout	27	18.6	491
91	*Malacoraja senta*	Raie lisse	Smooth Skate	87	86.8	287
187	*Mallotus villosus*	Capelan	Capelin	87	1438.1	123 987
441	*Melanogrammus aeglefinus*	Aiglefin	Haddock	4	4.1	6
745	*Melanostigma atlanticum*	Molasse atlantique	Atlantic Soft Pout	42	1.7	465
449	*Merluccius bilinearis*	Merlu argenté	Silver Hake	66	51.1	612
272	Myctophidae	Poissons-lanterne	Lanternfishes	29	0.4	118
271	Myctophiformes	Poissons des profondeurs	Deepwater Fishes	10	1.9	78
281	*Myctophum punctatum*	Lanterne ponctuée	Spotted Lanternfish	2	<0.1	2
820	*Myoxocephalus octodecemspinosus*	Chaboisseau à dix-huit-épines	Longhorn Sculpin	2	5.7	48
819	*Myoxocephalus scorpius*	Chaboisseau à épines courtes	Shorthorn Sculpin	28	55	182
13	*Myxine limosa*	Myxine du nord	Northern Hagfish	85	261	3452
368	*Nemichthys scolopaceus*	Avocette ruban	Atlantic Snipe Eel	2	<0.1	2
278	*Neoscopelus macrolepidotus*	Lanterne à grandes écailles	Glowingfish	3	0.1	3
478	*Nezumia bairdii*	Grenadier du grand Banc	Common Grenadier	90	123.4	3194
275	*Notoscopelus kroyeri*	Lanterne-voilière nordique	Kroyer's Lanternfish	9	0.7	33
188	*Osmerus mordax mordax*	Éperlan arc-en-ciel	Rainbow Smelt	1	0.1	1
874	*Paraliparis calidus*	Limace ardente	Lowfin Snailfish	7	0.1	12
856	*Paraliparis copei copei*	Limace à museau noir	Blacksnout Seasnail	3	<0.1	4
854	*Paraliparis* sp.	Limaces	Snailfishes	1	<0.1	1
15	*Petromyzon marinus*	Lamproie marine	Sea Lamprey	1	<0.1	1

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
444	*Phycis chesteri*	Merluche à longues nageoires	Longfin Hake	33	89.5	505
443	*Pollachius virens*	Goberge	Pollock	5	25.1	11
222	*Polyipnus clarus*	Hache	Slope Hachetfish	2	<0.1	2
244	*Polymetme thaeocoryla*	Poisson lumineux	Ligthfishes	1	<0.1	
94	*Rajella fyllae*	Raie ronde	Round Skate	1	<0.1	1
892	*Reinhardtius hippoglossoides*	Flétan du Groenland, turbot	Greeenland Halibut, Turbot	115	4040.4	10 691
572	*Scomber scombrus*	Maquereau bleu	Atlantic Mackerel	31	1.1	110
796	*Sebastes fasciatus*	Sébaste acadien	Acadian Redfish	80	12 944.5	68 848
794	*Sebastes mentella*	Sébaste atlantique	Deepwater Redfish	122	79796	418 479
369	*Serrivomer beanii*	Serrivomer trapu	Stout Sawpalate	1	<0.1	1
814	*Triglops murrayi*	Faux-trigle armé	Moustache Sculpin	36	22	2086
447	*Urophycis tenuis*	Merluche blanche	White Hake	75	413.1	665
	Total	**Vertébrés**	**Vertebrates**		114 663	680 920

Invertebrates

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
1100		Invertébrés	Invertebrates	10	0.2	35
2296		Capsule d'œuf de Fecampiidae	Fecampiidae Egg Capsule	9	<0.1	10
2182	*Actinauge cristata*	Anémone de mer	Anemone	38	57.1	6348
2165	Actiniaria	Actinies et Anémones	Sea Anemones	18	0.4	66
2162	*Actinostola callosa*	Anémones de mer	Anemone	60	354	5161
6771	*Aega psora*	Isopode	Isopod	15	<0.1	18
2676	*Alcyonidium gelatinosum*	Bryozoaire marin	Marine bryozoans	1	0.1	-
2675	*Alcyonidium* sp.	Bryozoaire	Bryozoan	1	<0.1	2
3164	*Amicula vestita*	Chiton	Chiton	2	<0.1	2
6930	Amphipoda	Amphipodes	Amphipods	1	<0.1	1
8593	*Amphiura* sp.	Ophiures	Brittle star	2	<0.1	5
4218	Anomiidae	Pétoncle	Scallop	1	<0.1	1
7389	*Anonyx* sp.	Gammarides	Gammarids	4	<0.1	9
2218	*Anthoptilum grandiflorum*	Plume de mer	Sea pen	39	37.7	2992
5002	*Aphrodita hastata*	Souris de mer	Sea Mouse	21	1.5	49
6594	*Arcoscalpellum michelottianum*	Balane	Barnacle	5	0.1	7
8138	*Argis dentata*	Crevette verte	Arctic Argid	33	6.2	1549
3418	*Arrhoges occidentalis*	Pied-de-pélican	American Pelicanfoot	17	1.3	143
8742	*Ascidia* sp.	Ascidie	Sea squirts	72	8.7	1705

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
8680	Ascidiacea	Ascidies, tuniqués sessiles	Ascidians, Sessile Tunicates	12	<0.1	19
1120	*Asconema foliatum*	Éponge	Sponge	3	1.1	-
4231	*Astarte borealis*	Astarte	Boreal Astarte	1	<0.1	1
4227	*Astarte* sp.	Astartes	Astartes	22	0.1	38
8396	*Asterias rubens*	Astérie boréale commune	Purple Seastar	3	<0.1	3
8390	Asteroidea	Étoiles de mer	Sea Stars	2	<0.1	2
8113	*Atlantopandalus propinqvus*	Crevette	Shrimp	16	0.9	219
2097	*Atolla wyvillei*	Méduse	Jellyfish	1	<0.1	1
3583	*Aulacofusus brevicauda*	Buccin	Whelk	2	<0.1	3
2085	*Aurelia aurita*	Méduse de lune	Moon Jelly	3	0.3	3
2084	*Aurelia* sp.	Méduse	Jelly fish	1	0.1	1
6595	Balanidae	Balanes	Barnacles	1	<0.1	1
4102	*Bathyarca* sp.	Bivalves	Bathyarks	1	<0.1	1
4904	*Bathypolypus bairdii*	Poulpe	North Atlantic Octopus	65	7.4	169
3519	*Beringius turtoni*	Buccin	Whelk	2	0.1	3
3995	Bivalvia	Bivalves	Bivalves	2	0.1	2
2158	*Bolocera tuediae*	Anémone de mer	Anemone	64	43.3	921
8793	*Boltenia echinata*	Cactus de mer	Cactus Sea Squirt	5	<0.1	15
8792	*Boltenia ovifera*	Patate de mer	Sea Potato	16	32.4	581
3488	*Boreotrophon* sp.	Murex	Murex	5	<0.1	6
8798	*Botrylloides* sp.	Ascidie	Tunicate	2	<0.1	5
5755	*Brada inhabilis*	Polychète	Flabelligerid worm	12	<0.1	30
8378	*Brisaster fragilis*	Oursin cœur	Heart Urchin	70	315.9	34203
2670	Bryozoa	Bryozoaires	Bryozoans	15	0.1	60
3520	*Buccinum cyaneum*	Buccin bleu	Bluish Whelk	9	0.3	25
3523	*Buccinum scalariforme*	Buccin	Ladder Whelk	5	0.1	13
3516	*Buccinum* sp.	Buccins	Whelk	14	0.7	38
3517	*Buccinum undatum*	Buccin commun	Waved Whelk	15	0.3	25
8173	*Calocaris templemani*	Crevette fouisseuse	Lobster Shrimp	3	<0.1	7
8429	*Ceramaster granularis*	Étoile de mer	Sea Star	19	0.8	39
8213	*Chionoecetes opilio*	Crabe des neiges	Snow Crab	91	205.2	1607
6593	*Chirona hameri*	Balane turbané	Turban Barnacle	3	3.4	-
4167	*Chlamys islandica*	Pétoncle d'Islande	Iceland Scallop	15	9.5	342
4351	*Ciliatocardium ciliatum*	Coque d'Islande	Iceland Cockle	5	0.7	24
6580	Cirripedia	Balanes	Barnacles	1	0.1	-
3908	*Colga villosa*	Nudibranche	Nudibranch	5	<0.1	11
3577	*Colus pubescens*	Buccin	Hairy Whelk	3	0.1	5
3575	*Colus* sp.	Buccins	Whelks	5	0.2	9

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
3576	*Colus stimpsoni*	Buccin	Whelk	4	0.2	8
8125	*Crangon septemspinosa*	Crevette sable	Sand Shrimp	1	<0.1	1
2151	*Cribrinopsis similis*	Anémone de mer	Sea Anemone	1	<0.1	1
8447	*Crossaster papposus*	Soleil de mer épineux	Spiny Sun Star	28	3.2	171
3422	*Cryptonatica affinis*	Lunaties	Arctic moonsnail	8	<0.1	9
8407	*Ctenodiscus crispatus*	Étoile de mer	Mud Star	85	194	57 730
2250	Ctenophora	Cténophores	Comb-Jellies	2	0.1	41
8312	*Cucumaria frondosa*	Concombre de mer	Orange Footed Sea Cucumber	7	16.2	53
4526	*Cuspidaria glacialis*	Mye	Gacial Dipperclam	24	0.1	86
4525	*Cuspidaria* sp.	Myes	Dipperclams	1	<0.1	2
2080	*Cyanea capillata*	Crinière de lion	Lion's Mane	104	155.3	420
8408	*Diplopteraster multipes*	Étoile de mer	Sea Star	5	0.8	10
3965	*Doridoxa ingolfiana*	Nudibranche	Nudibranch	1	<0.1	1
2191	*Drifa glomerata*	Corail mou	Soft coral	30	0.7	176
2183	*Duva florida*	Corail mou	Sea Cauliflower	20	0.8	53
8373	*Echinarachnius parma*	Dollar de sable	Common Sand Dollar	1	<0.1	1
8316	*Ekmania barthii*	Concombre de mer	Sea Cucumber	1	<0.1	1
7383	*Epimeria loricata*	Gammaride	Gammarid	8	<0.1	29
2157	*Epizoanthus* sp.	Anémone de mer	Sea Anemone	14	<0.1	61
8081	*Eualus belcheri*	Bouc	Circumpolar Eualid	1	<0.1	-
8075	*Eualus fabricii*	Bouc Arctique	Arctic Eualid	15	0.1	144
8079	*Eualus gaimardii*	Bouc	Circumpolar Eualid	1	<0.1	1
8080	*Eualus gaimardii gaimardii*	Bouc	Circumpolar Eualid	3	<0.1	6
8077	*Eualus macilentus*	Bouc du Groenland	Greenland Shrimp	12	2.2	2164
8074	*Eualus* sp.	Bouc	Eualid	8	<0.1	58
8778	*Eudistoma vitreum*	Ascidie	Tunicate	11	0.2	59
5045	*Eunoe nodosa*	Polychète	Seaworm	1	<0.1	1
5461	*Euphrosine borealis*	Polychète	Seaworm	2	<0.1	2
7195	*Eusirus cuspidatus*	Gammaride	Gammarid	6	<0.1	17
3437	*Euspira pallida*	Lunatie du Groenland	Pale Moonsnail	9	0.1	30
2295	Fecampiidae	Vers flats	Flatworms	1	<0.1	1
2224	*Flabellum alabastrum*	Madrépore	Cup coral	12	1.2	186
3175	Gastropoda	Gastéropodes	Gastropods	1	<0.1	1
2184	*Gersemia rubiformis*	Corail mou	Sea Strawberry	19	0.5	190
5902	*Golfingia margaritacea*	Sipunculide	Sipunculid	6	0.1	46
8540	*Gorgonocephalus* sp.	Gorgonocéphales	Basket Stars	31	88.6	423
2217	*Halipteris finmarchica*	Plume de mer	Sea pen	17	3.3	178
8797	*Halocynthia pyriformis*	Pêche de mer	Sea Peach	3	0.3	19

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
5934	*Hamingia arctica*	Échiure	Echiurid	1	<0.1	1
8263	*Heliometra glacialis*	Lis de mer	Feather star	4	0.2	87
1131	*Hemigellius arcofer*	Éponge	Sponge	1	1	-
3090	*Hemithiris psittacea*	Brachiopode	Lamp Shell	4	<0.1	33
8483	*Henricia* sp.	Étoiles de mer	Sea Stars	57	0.7	196
4437	*Hiatella arctica*	Saxicave arctique	Arctic Saxicave	1	<0.1	2
8431	*Hippasteria phrygiana*	Étoile de mer	Sea Star	42	14.8	69
8290	Holothuroidea	Cocombres de mer	Sea Cucumbers	3	0.1	6
2150	*Hormathia digitata*	Anémone	Anemone	25	0.4	116
2167	*Hormathia nodosa*	Anémone noduleuse	Rugose Anemone	4	0.2	8
8219	*Hyas alutaceus*	Crabe lyre	Arctic Lyre Crab	30	9.4	754
8217	*Hyas araneus*	Crabe lyre	Atlantic Lyre Crab	14	4.6	234
1341	Hydrozoa	Hydrozoaires	Hydrozoans	26	0.2	56
4753	*Illex illecebrosus*	Encornet rouge nordique	Northern Shortfin Squid	96	133.5	894
3255	*Lacuna vincta*	Gastropode	Northern Lacuna	1	<0.1	4
5003	*Laetmonice filicornis*	Polychète	Seaworm	36	0.4	192
8092	*Lebbeus groenlandicus*	Bouc	Spiny Lebbeid	8	1.2	264
8095	*Lebbeus microceros*	Bouc	Shrimp	3	<0.1	4
8093	*Lebbeus polaris*	Bouc	Polar Lebbeid	46	0.7	450
8091	*Lebbeus* sp.	Boucs	Lebbeids	7	<0.1	-
8511	*Leptasterias polaris*	Étoile de mer polaire	Polar Sea Star	10	3.9	27
8513	*Leptasterias groenlandica*	Étoile de mer du Groenland	Greenland Sea Star	14	0.1	25
8510	*Leptasterias* sp.	Étoiles de mer	Sea Stars	2	<0.1	8
8521	*Leptychaster arcticus*	Stelléridé	Sea Star	2	<0.1	2
3459	*Limneria undata*	Veloutée rayée	Wavy Lamellaria	2	<0.1	2
2207	*Liponema multicorne*	Anémone	Sea anemone	12	2.5	97
8196	*Lithodes maja*	Crabe épineux du Nord	Norway King Crab	50	57.4	161
4395	*Macoma calcarea*	Bivalve	Chalky Macoma	9	0.1	17
3219	*Margarites costalis*	Margarite rosé du Nord	Boreal Rosy Margarite	11	<0.1	34
3216	*Margarites groenlandicus*	Troque	Greenland marguerite	3	<0.1	3
4025	*Megayoldia thraciaeformis*	Bivalve	Broad Yoldia	34	5.2	3408
8322	*Molpadia oolitica*	Holothurie	Sea Cucumber	4	1.7	26
8164	*Munidopsis curvirostra*	Munidopsis curvirostra	Squat Lobster	20	<0.1	37
4121	*Mytilus* sp.	Moules	Mussels	11	0.1	13
3000	Nemertea	Némerte	Ribbon Worm	1	<0.1	1
2219	Nephtheidae	Coraux mous	Soft corals	12	0.2	33
3565	*Neptunea* sp.	Buccins	Whelks	8	0.3	11
4019	*Nuculana* sp.	Bivalves	Nutclams	6	<0.1	12

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
5961	*Nymphon* sp.	Araignées de mer	Sea Spiders	23	<0.1	52
8575	*Ophiacantha bidentata*	Ophiure épineuse	Brittle Star	20	0.1	162
8583	*Ophiopholis aculeata*	Ophiure paquerette	Daisy Brittle Star	47	15.6	11 042
8585	*Ophioscolex glacialis*	Ophiure	Brittle star	9	<0.1	14
8552	*Ophiura robusta*	Ophiure	Brittle Star	3	<0.1	8
8553	*Ophiura sarsii*	Ophiure	Brittle Star	62	178.1	58 439
8530	Ophiuroidea	Ophiures	Brittle Stars	1	<0.1	1
8178	*Pagurus* sp.	Bernard hermite droitier	Hermit Crab	21	0.2	52
8111	*Pandalus borealis*	Crevette nordique	Northern Shrimp	126	2328.1	398 241
8112	*Pandalus montagui*	Crevette ésope	Striped Pink Shrimp	65	60.7	25023
8110	*Pandalus* sp.	Crevette	Boreal Red Shrimp	7	0.4	-
4438	*Panomya norvegica*	Saxicave	Arctic Roughmya	2	0.1	4
7586	*Paramphithoe hystrix*	Gammaride	Gammarid	6	<0.1	6
8057	*Pasiphaea multidentata*	Sivade rose, Crevette blanche	Pink Glass Shrimp	80	82.3	26 179
8781	*Pelonaia corrugata*	Ascidie	Tunicate	1	<0.1	4
2203	*Pennatula aculeata*	Plume de mer	Sea Pen	98	5.4	2205
2096	*Periphylla periphylla*	Méduse à coronne	Crown jellyfish	31	49.3	48
1116	*Phakellia* sp.	Éponge	Sponge	3	4.3	-
5907	*Phascolion strombus strombus*	Sipunculide	Hermit Sipunculid	4	<0.1	10
4955	*Phyllodoce groenlandica*	Polychète	Paddle Worm	2	<0.1	2
8114	*Plesionika martia*	Crevette	Golden shrimp	1	<0.1	1
2255	*Pleurobrachia pileus*	Groseille de mer ronde	Sea Gooseberry	27	0.3	190
3578	*Plicifusus kroyeri*	Colus	Arctic Whelk	2	<0.1	3
8783	*Polycarpa fibrosa*	Ascidie	Tunicate	3	0.5	363
4950	Polychaeta	Polychètes	Polychaetes	59	0.2	145
1123	*Polymastia grimaldii*	Éponge	Sponge	1	<0.1	1
1109	*Polymastia* sp.	Éponge	Sponge	22	2	193
5007	Polynoidae	Polychète errante	Fifteen-Scaled Worm	18	0.1	61
5264	*Polyphysia crassa*	Polychète	Sea worm	6	0.3	64
8135	*Pontophilus norvegicus*	Crevette	Norwegian Shrimp	75	3.9	2255
8435	*Poraniomorpha* sp.	Étoile de mer	Sea star	6	0.2	8
1101	Porifera	Éponges	Sponges	107	77.8	-
8433	*Pseudarchaster parelii*	Étoile de mer	Sea Star	17	0.4	47
8520	*Psilaster andromeda*	Étoile de mer	Sea Star	21	5.7	2609
8295	*Psolus fabricii*	Psolus écarlate	Scarlet Psolus	1	0.1	1
8294	*Psolus phantapus*	Holothurie	Sea Cucumber	2	<0.1	2
8410	*Pteraster militaris*	Étoile de mer	Sea Star	13	0.4	56
8411	*Pteraster pulvillus*	Étoile de mer	Sea Star	12	0.1	28

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
2210	*Ptilella grandis*	Plume de mer	Sea Pen	36	147.2	4521
2153	*Ptychodactis patula*	Anémone beige évasée	Anemone	5	<0.1	5
1353	*Ptychogena lactea*	Méduse	Jellyfish	13	0.3	27
5951	Pycnogonida	Araignées de mer	Sea Spiders	3	<0.1	4
1107	*Radiella hemisphaerica*	Éponge	Sponge	15	0.5	80
7211	*Rhachotropis aculeata*	Gammaride	Gammarid	14	<0.1	54
1380	Rhodaliidae	Siphonophore	blabla	7	0.1	19
4557	*Rossia* sp.	Sépioles	Bobtails	28	0.5	35
8129	*Sabinea sarsii*	Crevette	Sars Shrimp	7	0.1	44
8128	*Sabinea septemcarinata*	Crevette	Sevenline Shrimp	28	0.8	404
3491	*Scabrotrophon fabricii*	Murex	Murex	4	<0.1	4
3715	*Scaphander punctostriatus*	Céphalaspide	Giant Canoe Bubble	25	0.2	87
8119	*Sclerocrangon boreas*	Crevette de roche	Scultured Shrimp	15	20	2277
2040	Scyphozoa	Scyphozoaires	Scyphozoans	36	2	93
2679	*Securiflustra securifrons*	Bryozoaires marins	Marine bryozoans	2	<0.1	1
4352	*Serripes groenlandicus*	Coque du Groenland	Greenland Smoothcockle	1	<0.1	1
4191	*Similipecten greenlandicus*	Pétoncle	Greenland Glass-Scallop	1	<0.1	1
3225	*Solariella* sp.	Gastéropes	Topsnail	1	<0.1	1
8445	*Solaster endeca*	Soleil de mer pourpre	Purple Sunstar	5	0.1	8
8087	*Spirontocaris liljeborgii*	Bouc épineux	Friendly Blade Shrimp	17	0.1	55
8086	*Spirontocaris phippsii*	Bouc	Punctate Blade Shrimp	3	<0.1	9
8084	*Spirontocaris* sp.	Bouc	Blade Shrimp	27	0.1	-
8085	*Spirontocaris spinus*	Bouc perroquet	Parrot Shrimp	23	0.4	238
1352	*Staurostoma mertensii*	Méduse à croix blanche	Whitecross Jellyfish	9	0.3	29
7750	*Stegocephalus inflatus*	Gammaride	Gammarid	5	<0.1	5
8515	*Stephanasterias albula*	Étoile de mer	Sea star	4	<0.1	9
2159	*Stephanauge nexilis*	Anémone de mer	Sea anemone	13	0.6	77
4587	*Stoloteuthis leucoptera*	Sépiole	Butterfly Squid	12	0.3	51
2173	*Stomphia coccinea*	Anémone marbrée	Anemone	32	2	142
8363	*Strongylocentrotus* sp.	Oursins	Sea Urchins	53	43	4253
1112	*Stylocordyla borealis*	Éponge	Sponge	8	<0.1	73
1113	*Sycon* sp.	Éponge	Sponge	1	<0.1	13
8776	*Synoicum pulmonaria*	Ascidie	Tunicate	2	1.7	4
6791	*Syscenus infelix*	Isopode	Isopod	60	1	649
3310	*Tachyrhynchus erosus*	Gastropode	Eroded Turritsnail	1	<0.1	1
1108	*Tentorium semisuberites*	Éponge	Sponge	15	0.1	93
3101	*Terebratulina septentrionalis*	Térébratule du Nord	Northern Lamp Shell	7	<0.1	18
6972	*Themisto libellula*	Hypéride	Hyperiid	1	<0.1	2

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
1114	*Thenea muricata*	Éponge	Sponge	3	0.1	11
1357	*Thuiaria thuja*	Hydrozoaire	Bottlebrush Hydroid	19	<0.1	89
8516	*Urasterias lincki*	Étoile de mer	Sea Star	1	0.3	1
2152	*Urticina crassicornis*	Anémone de mer	Sea Anemone	5	0.3	13
4451	*Xylophaga atlantica*	Bivalve	Atlantic Woodeater	1	<0.1	-
	Total	**Invertebrés**	**Invertebrates**		4 836	667 222

Others

Code STRAP	Scientific Name	French Name	English Name	Occurrence	Weight (kg)	Number
9965	-	Capsule de raie lisse	Smooth Skate egg	19	0.3	40
9966	-	Capsule de raie épineuse	Thorny Skate egg	23	0.5	38

Table 3. Number of measured and weighed specimens and length descriptive statistics in 2021. Taxonomic codes (STRAP) follow Miller and Chabot (2014), with scientific name updates by the World Marine Species Registry (WoRMS 2018, http://www.marinespecies.org).

Vertebrates

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1*	Median	P99*	Max
90	*Amblyraja radiata*	1151	1046	9.3	11.8	36.2	65.0	78.0
696	*Ammodytes* sp.	58	27	7.8	7.8	16.3	23.5	23.5
700	*Anarhichas lupus*	297	123	6.6	6.6	29.1	64.6	73.7
701	*Anarhichas minor*	7	7	9.6	9.6	85.5	94.0	94.0
718	*Anisarchus medius*	45	10	10.6	10.6	14.0	15.5	15.5
320	*Arctozenus risso*	474	274	16.4	18.6	24.7	28.2	28.9
193	*Argentina silus*	221	102	9.2	9.6	21.7	34.0	35.4
811	*Artediellus atlanticus*	181	103	3.8	3.8	7.6	10.2	11.6
810	*Artediellus* sp.	64	42	3.7	3.7	6.0	8.5	8.5
812	*Artediellus uncinatus*	8	8	6.2	6.2	6.4	7.1	7.1
838	*Aspidophoroides monopterygius*	142	80	4.0	6.4	12.7	16.2	16.4
102	*Bathyraja spinicauda*	3	3	44.2	44.2	130.0	137.0	137.0
451	*Boreogadus saida*	38	29	11.0	11.0	19.1	27.5	27.5
865	*Careproctus reinhardti*	26	18	8.0	8.0	11.3	17.0	17.0
27	*Centroscyllium fabricii*	628	181	13.9	14.7	39.2	67.1	73.0
150	*Clupea harengus*	1705	759	12.5	21.8	31.0	38.0	39.7
721	*Cryptacanthodes maculatus*	11	11	22.2	22.2	37.7	76.8	76.8
849	*Cyclopterus lumpus*	83	73	8.9	8.9	12.7	44.8	44.8
461	*Enchelyopus cimbrius*	1289	409	2.3	5.4	19.1	27.2	29.4
618	*Epigonus pandionis*	1	1	17.2	17.2	17.2	17.2	17.2
711	*Eumesogrammus praecisus*	205	88	5.8	8.4	15.2	21.5	24.0
847	*Eumicrotremus terraenovae*	195	102	2.3	2.4	4.7	13.2	15.4
438	*Gadus morhua*	4400	1758	5.1	15.0	33.3	62.3	94.6
439	*Gadus ogac*	1	1	37.6	37.6	37.6	37.6	37.6
454	*Gaidropsarus ensis*	1	1	6.8	6.8	6.8	6.8	6.8
890	*Glyptocephalus cynoglossus*	2716	1850	6.5	8.9	28.2	43.9	50.0
205	*Gonostomatidae*	2	2	15.7	15.7	16.6	17.5	17.5
746	*Gymnelus viridis*	1	1	14.9	14.9	14.9	14.9	14.9
823	*Gymnocanthus tricuspis*	152	80	9.9	10.7	17.4	22.7	23.4
797	*Helicolenus dactylopterus*	1	1	21.6	21.6	21.6	21.6	21.6
809	*Hemitripterus americanus*	1	1	35.2	35.2	35.2	35.2	35.2
889	*Hippoglossoides platessoides*	5623	2462	2.6	10.6	21.5	43.0	56.5
893	*Hippoglossus hippoglossus*	126	126	28.0	28.2	83.3	174.0	178.0
830	*Icelus* sp.	2	2	3.9	3.9	3.9	3.9	3.9
832	*Icelus spatula*	11	11	5.9	5.9	10.0	14.1	14.1
836	*Leptagonus decagonus*	166	49	10.3	10.4	17.5	21.4	21.9
717	*Leptoclinus maculatus*	242	94	8.6	8.9	12.9	18.0	18.9
100	*Leucoraja ocellata*	2	2	46.5	46.5	59.3	72.0	72.0
891	*Limanda ferruginea*	107	37	12.7	13.8	23.1	34.4	37.4
868	*Liparis bathyarcticus*	7	7	7.0	7.0	9.8	30.9	30.9
966	*Lophius americanus*	16	16	32.2	32.2	66.3	104.2	104.2
716	*Lumpenus lampretaeformis*	205	84	13.7	15.7	30.4	40.4	41.5
750	*Lycenchelys paxillus*	1	1	22.7	22.7	22.7	22.7	22.7
752	*Lycenchelys verrillii*	14	14	9.5	9.5	12.4	17.8	17.8
727	*Lycodes esmarkii*	9	9	6.1	6.1	41.2	51.5	51.5
728	*Lycodes lavalaei*	141	81	7.6	8.6	23.0	52.7	56.7
733	*Lycodes polaris*	18	5	9.1	9.1	15.4	31.6	31.6
726	*Lycodes* sp.	10	10	9.2	9.2	11.4	37.5	37.5
734	*Lycodes terraenovae*	2	2	39.5	39.5	42.5	45.4	45.4
730	*Lycodes vahlii*	204	73	8.9	9.3	20.9	36.9	37.3
91	*Malacoraja senta*	287	275	8.5	8.9	23.8	60.2	62.1
187	*Mallotus villosus*	1443	364	7.4	9.1	14.5	16.5	19.5
441	*Melanogrammus aeglefinus*	6	6	20.6	20.6	36.4	52.5	52.5

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1*	Median	P99*	Max
745	*Melanostigma atlanticum*	427	153	6.3	7.5	10.8	13.7	15.0
449	*Merluccius bilinearis*	468	346	10.5	13.4	20.3	40.7	45.3
272	Myctophidae	3	3	8.0	8.0	8.6	12.2	12.2
271	Myctophiformes	70	31	13.0	13.0	14.8	17.4	17.4
281	*Myctophum punctatum*	1	1	13.5	13.5	13.5	13.5	13.5
820	*Myoxocephalus octodecemspinosus*	35	6	11.5	11.5	19.2	35.5	35.5
819	*Myoxocephalus scorpius*	153	92	8.6	8.8	25.5	38.8	39.9
13	*Myxine limosa*	1595	415	13.2	21.1	37.3	49.2	58.3
368	*Nemichthys scolopaceus*	1	1	74.4	74.4	74.4	74.4	74.4
278	*Neoscopelus macrolepidotus*	1	1	15.4	15.4	15.4	15.4	15.4
478	*Nezumia bairdii*	1796	473	2.8	9.0	23.5	31.9	34.2
188	*Osmerus mordax mordax*	1	1	22.9	22.9	22.9	22.9	22.9
874	*Paraliparis calidus*	12	12	6.1	6.1	9.8	11.9	11.9
856	*Paraliparis copei copei*	4	4	9.1	9.1	9.6	11.1	11.1
15	*Petromyzon marinus*	1	1	24.1	24.1	24.1	24.1	24.1
444	*Phycis chesteri*	467	322	15.5	16.5	30.4	39.0	53.4
443	*Pollachius virens*	11	11	52.6	52.6	56.5	74.0	74.0
222	*Polyipnus clarus*	1	1	5.0	5.0	5.0	5.0	5.0
94	*Rajella fyllae*	1	1	9.4	9.4	9.4	9.4	9.4
892	*Reinhardtius hippoglossoides*	4566	2250	3.3	14.5	34.4	52.4	75.2
572	*Scomber scombrus*	107	85	5.2	5.2	7.8	14.3	35.5
792	*Sebastes* sp.	13 569	5188	4.7	7.9	23.3	33.5	43.4
814	*Triglops murrayi*	600	185	7.0	7.2	11.1	16.9	18.0
447	*Urophycis tenuis*	663	596	20.7	22.8	39.2	66.8	92.0

Invertebrates

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1*	Median	P99*	Max
2218	*Anthoptilum grandiflorum*	37	4	32.4	32.4	42.5	59.3	59.3
8138	*Argis dentata*	614	0	0.7	0.8	1.6	2.3	2.5
8113	*Atlantopandalus propinqvus*	122	0	0.9	0.9	1.7	2.3	2.3
8213	*Chionoecetes opilio*	884	19	0.7	1.1	3.7	12.4	15.6
8125	*Crangon septemspinosa*	1	0	1.8	1.8	1.8	1.8	1.8
8075	*Eualus fabricii*	77	0	0.6	0.6	0.8	1.1	1.1
8079	*Eualus gaimardii*	1	0	0.9	0.9	0.9	0.9	0.9
8080	*Eualus gaimardii gaimardii*	4	0	0.9	0.9	0.9	1.1	1.1
8077	*Eualus macilentus*	112	0	0.6	0.6	1.0	1.3	1.3
8074	*Eualus* sp.	9	0	0.8	0.8	0.8	1.0	1.0
2217	*Halipteris finmarchica*	10	1	29.8	29.8	54.0	83.5	83.5
8219	*Hyas alutaceus*	359	6	0.5	0.8	2.4	5.9	7.8
8217	*Hyas araneus*	122	0	0.7	0.7	2.3	8.6	8.6
4753	*Illex illecebrosus*	749	369	12.0	14.1	19.5	23.0	26.1
8092	*Lebbeus groenlandicus*	91	0	0.7	0.7	1.4	2.4	2.4
8095	*Lebbeus microceros*	4	0	1.0	1.0	1.1	1.2	1.2
8093	*Lebbeus polaris*	245	0	0.5	0.6	1.1	1.5	1.6
8091	*Lebbeus* sp.	2	0	0.7	0.7	0.8	1.0	1.0
8196	*Lithodes maja*	161	27	1.4	1.5	8.0	11.5	11.5
8111	*Pandalus borealis*	17 147	20	0.6	1.2	2.1	2.7	3.0
8112	*Pandalus montagui*	2093	0	0.6	0.7	1.4	2.1	2.3
8057	*Pasiphaea multidentata*	2385	0	1.0	1.6	2.5	3.2	3.5
2203	*Pennatula aculeata*	172	4	5.5	5.8	12.5	20.9	21.4
8114	*Plesionika martia*	1	0	2.0	2.0	2.0	2.0	2.0
8135	*Pontophilus norvegicus*	1100	0	0.5	0.8	1.3	1.6	1.7
2210	*Ptilella grandis*	77	0	12.0	12.0	29.5	46.7	46.7
8129	*Sabinea sarsii*	38	0	0.6	0.6	1.0	1.5	1.5
8128	*Sabinea septemcarinata*	318	0	0.7	0.8	1.2	1.7	1.9
8119	*Sclerocrangon boreas*	483	0	0.7	0.8	1.6	3.0	3.6
8087	*Spirontocaris liljeborgii*	37	0	0.7	0.7	1.1	1.4	1.4

Code STRAP	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1*	Median	P99*	Max
8086	*Spirontocaris phippsii*	6	0	0.6	0.6	0.8	1.1	1.1
8084	*Spirontocaris* sp.	24	0	0.6	0.6	1.0	1.4	1.4
8085	*Spirontocaris spinus*	123	0	0.6	0.6	1.1	1.4	1.5

* *P1: 1er centile P99: 99e centile*

FIGURES

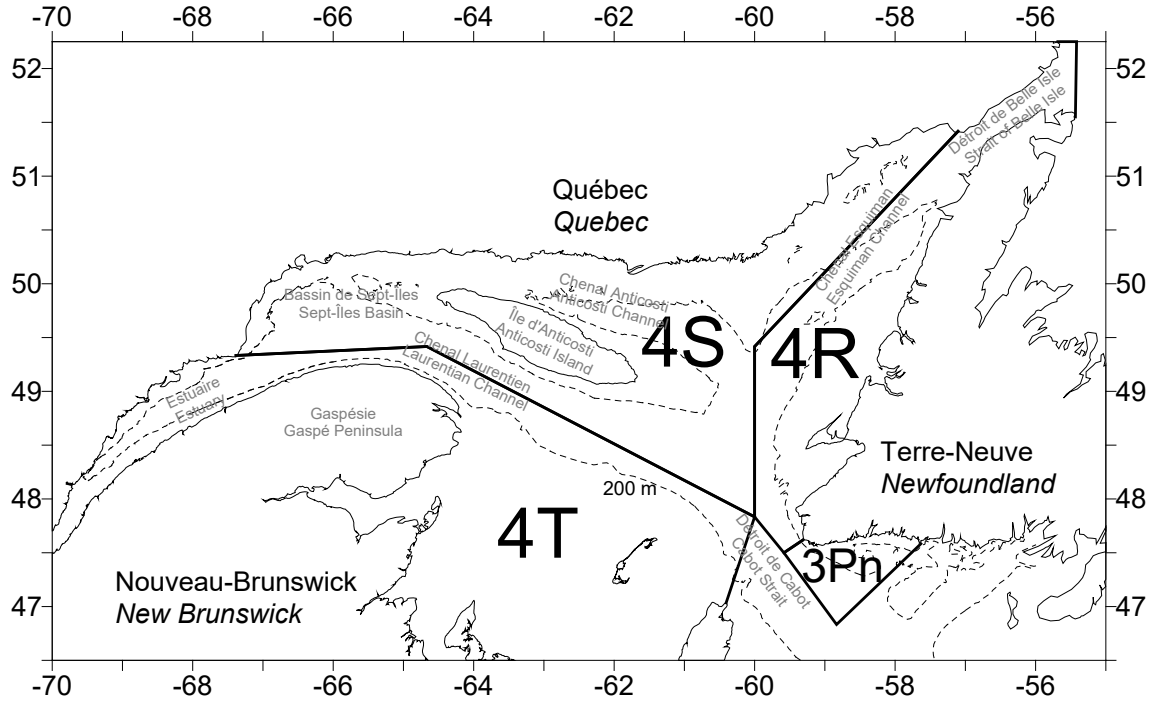

Figure 1. NAFO Divisions of the Estuary and Gulf of St. Lawrence and names of locations mentioned in the text.

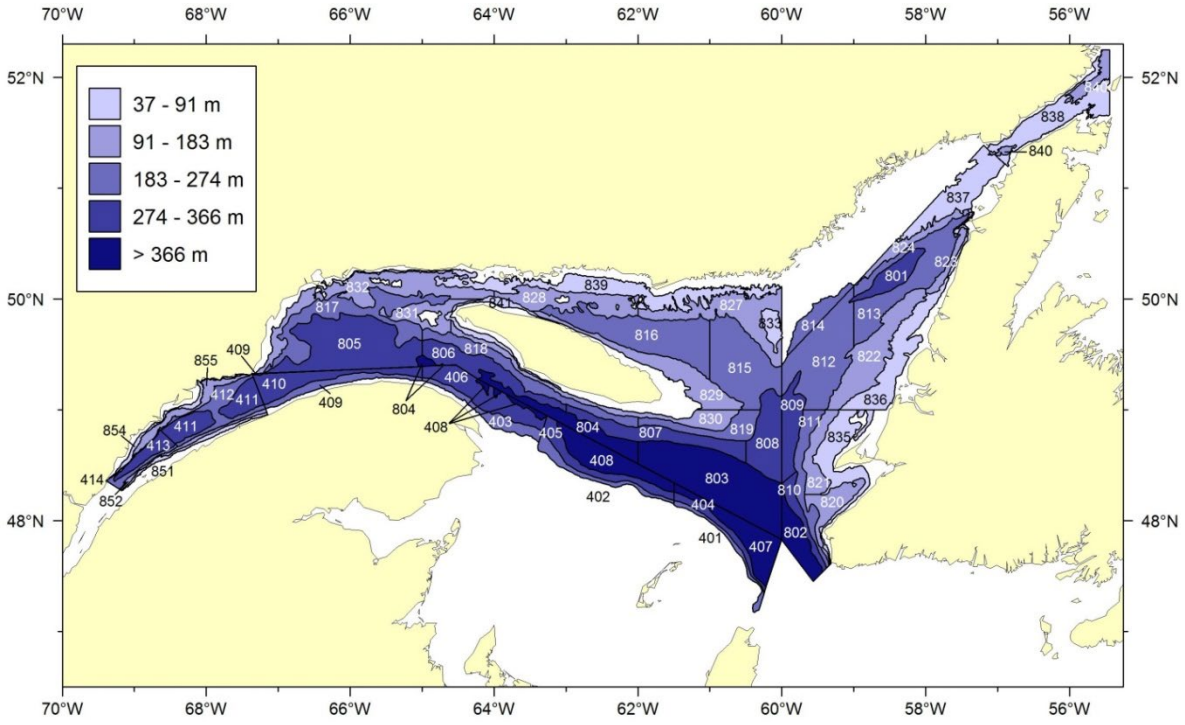

Figure 2. Stratification scheme used for the groundfish and shrimp research survey in the Estuary and northern Gulf of St. Lawrence.

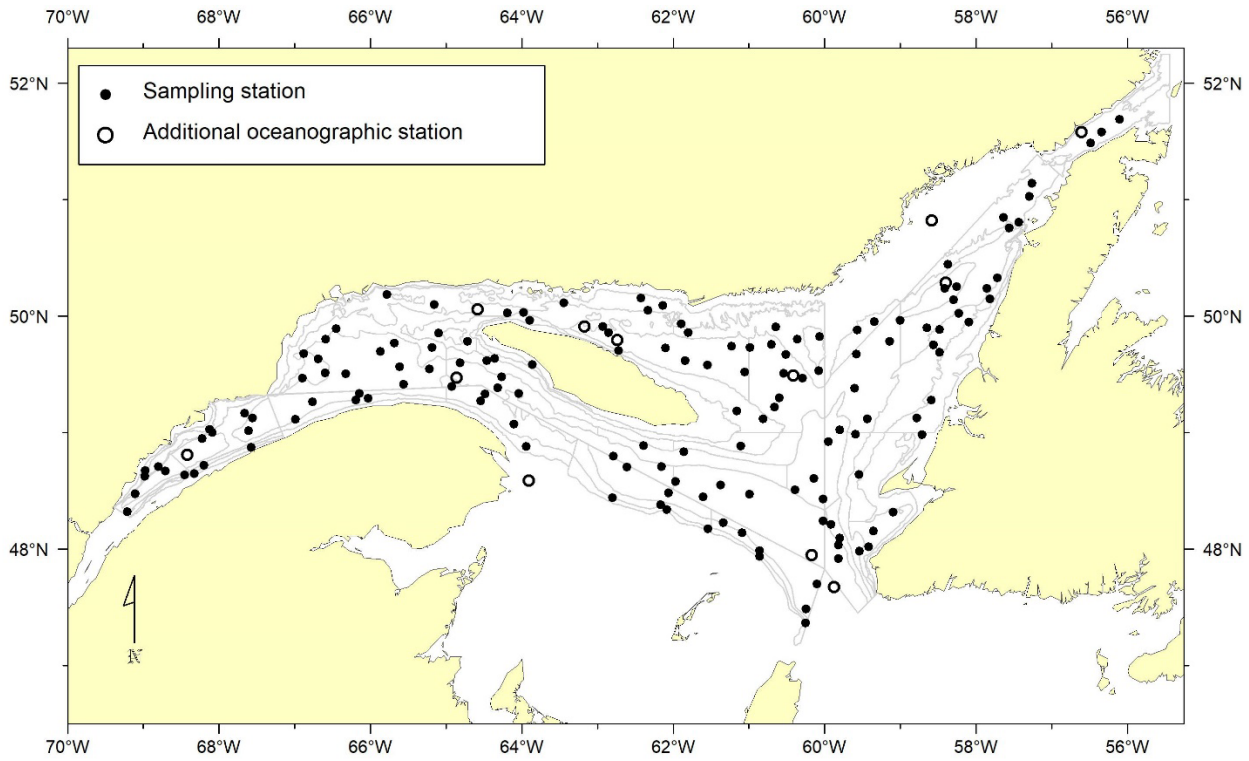

Figure 3. Locations of successful sampling stations (trawl and oceanography) and additional oceanographic stations for the 2021 survey.

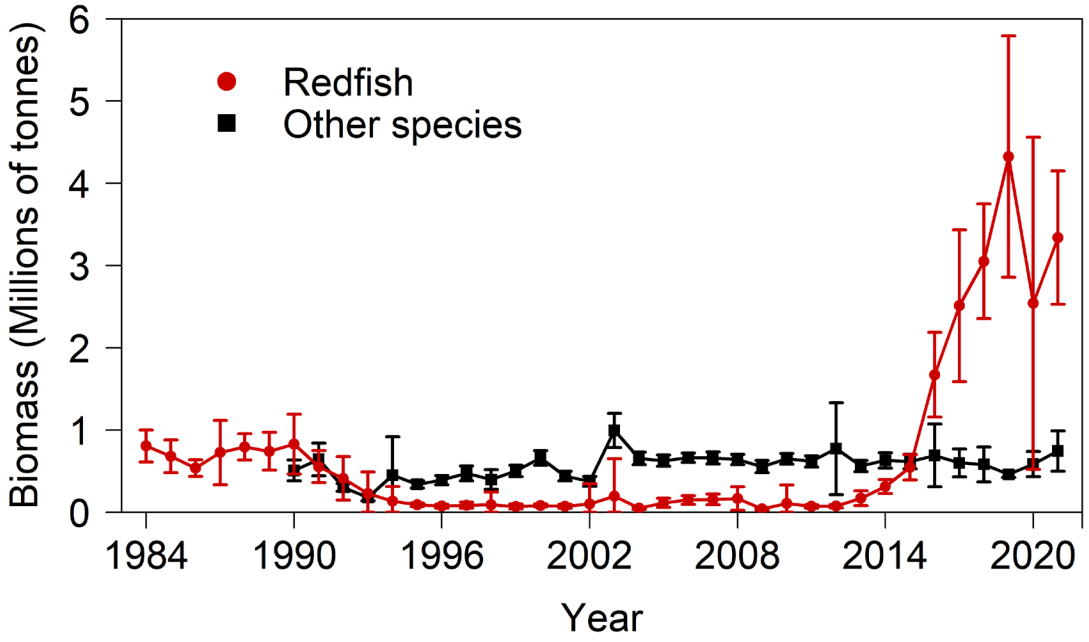

Figure 4. Biomass (1 000 000 tons) of redfish spp. and all other species sampled during the survey in 4RST. Error bars represent 95% confidence intervals.

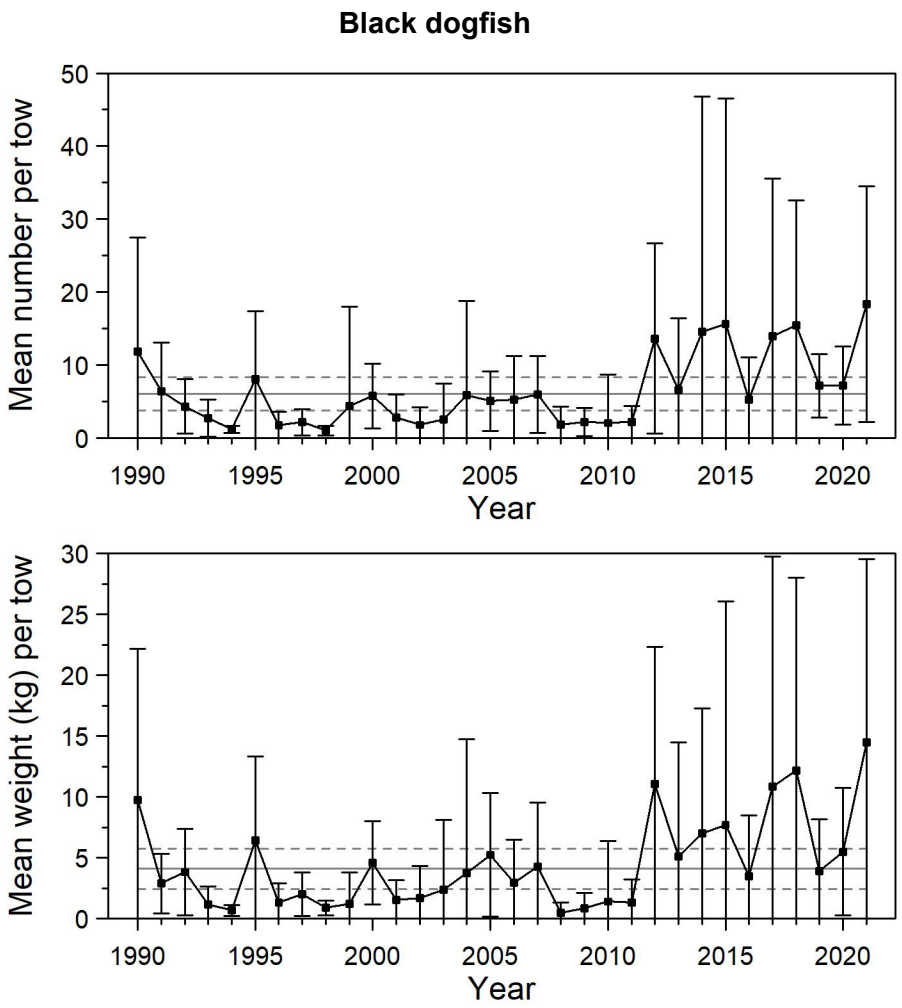

Figure 5. Mean numbers and mean weights per 15 minute tow observed during the survey for black dogfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

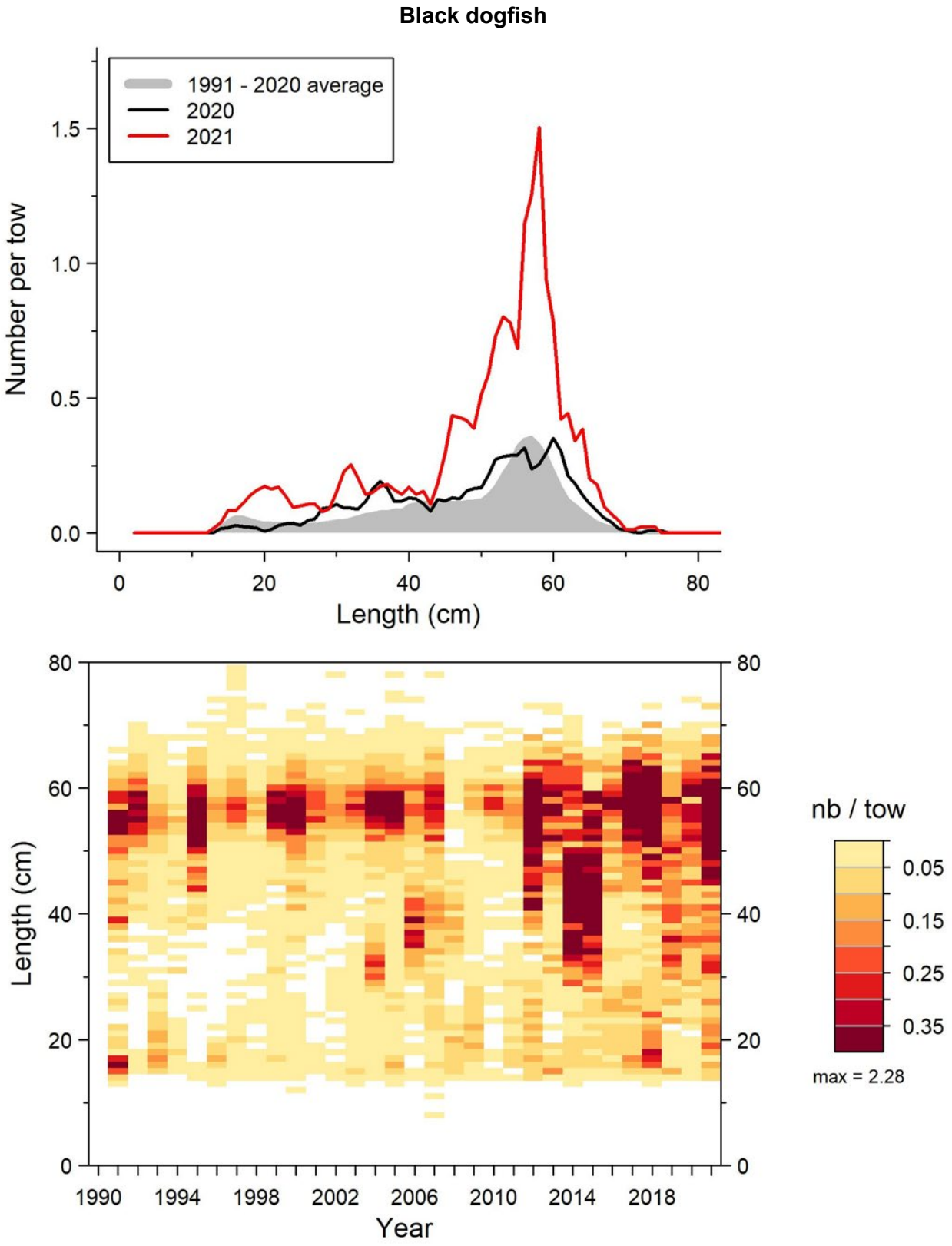

Figure 6. Length frequency distributions (mean number per 15 minute tow) observed during the survey for black dogfish in 4RST.

Black dogfish

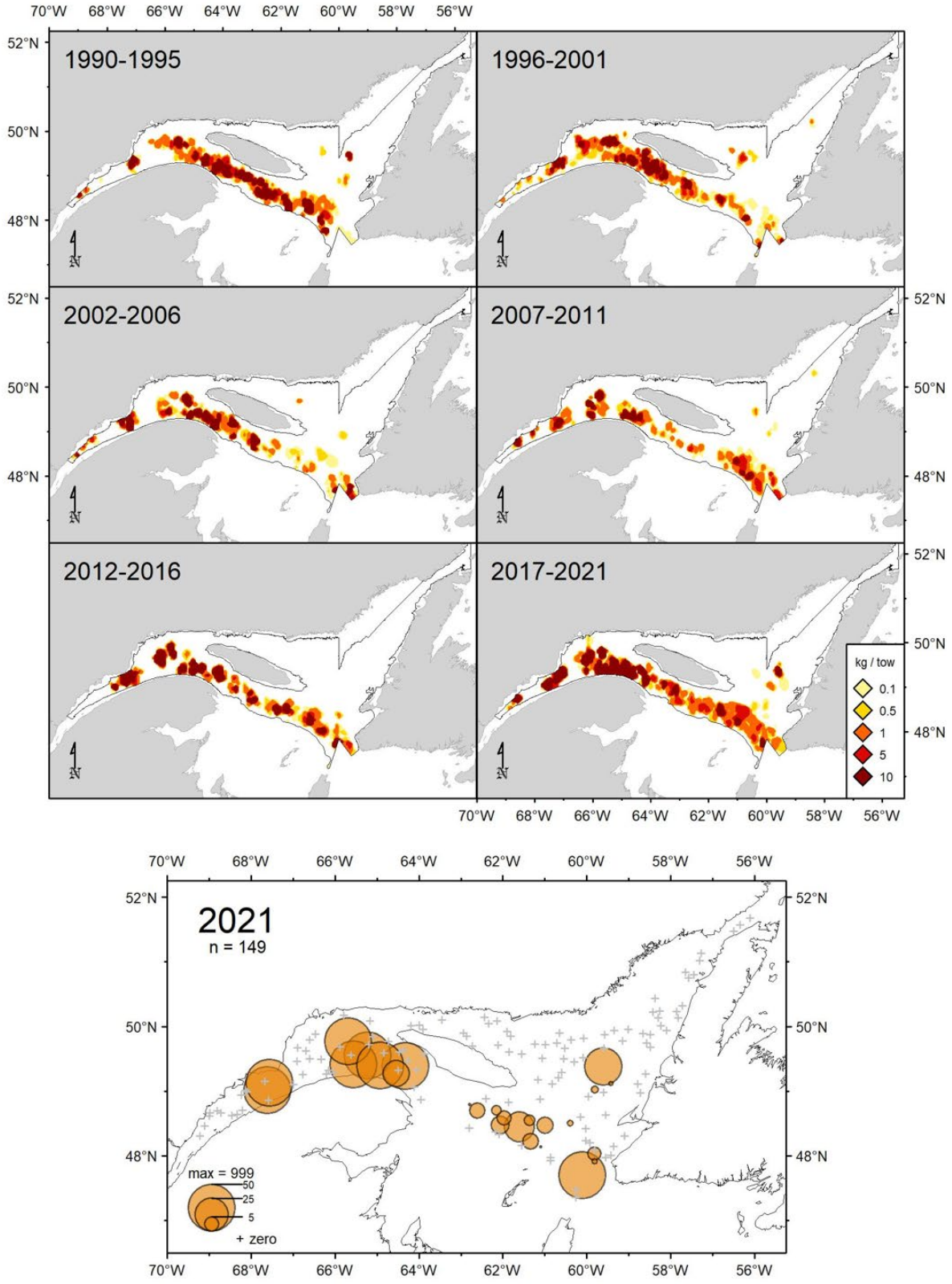

Figure 7. Black dogfish catch rates (kg/15 minute tow) distribution.

Capelin

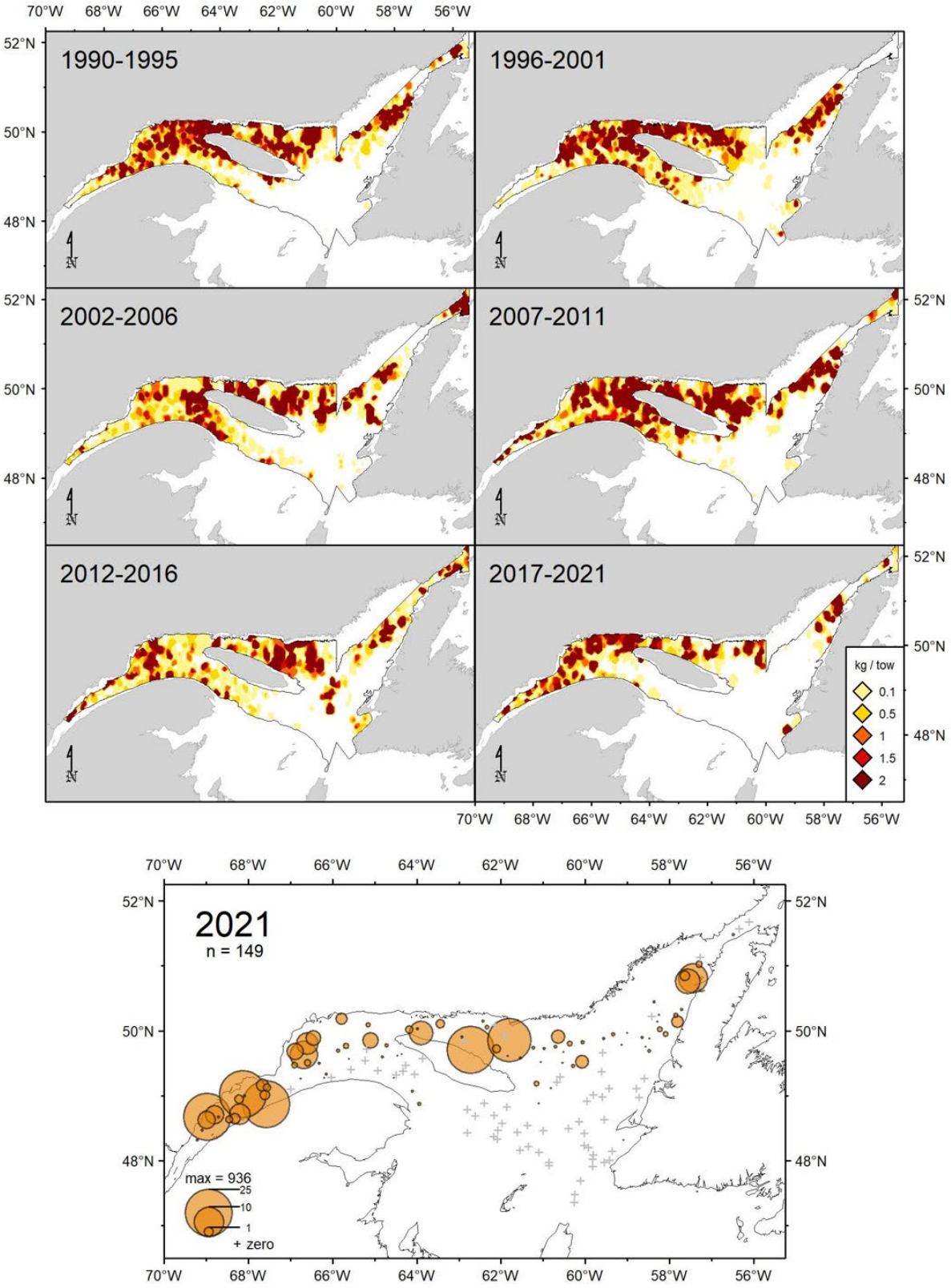

Figure 8. Capelin catch rates (kg/15 minute tow) distribution.

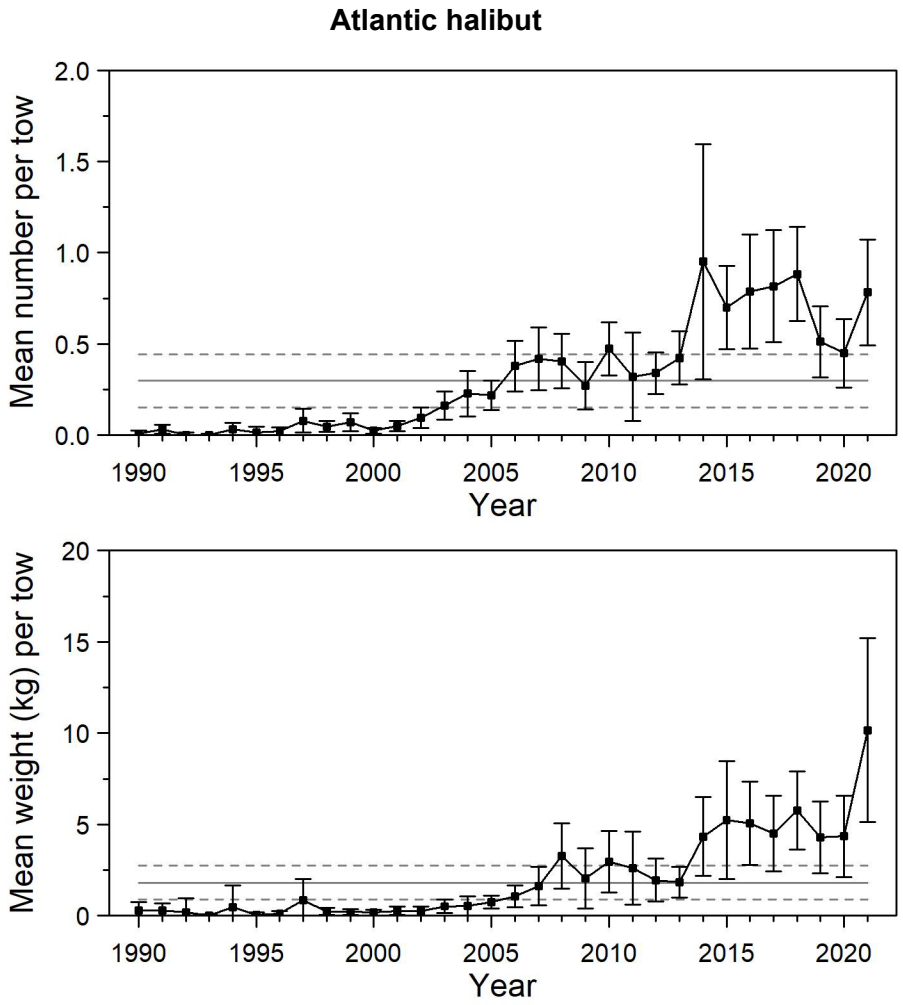

Figure 9. Mean numbers and mean weights per 15 minute tow observed during the survey for Atlantic halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

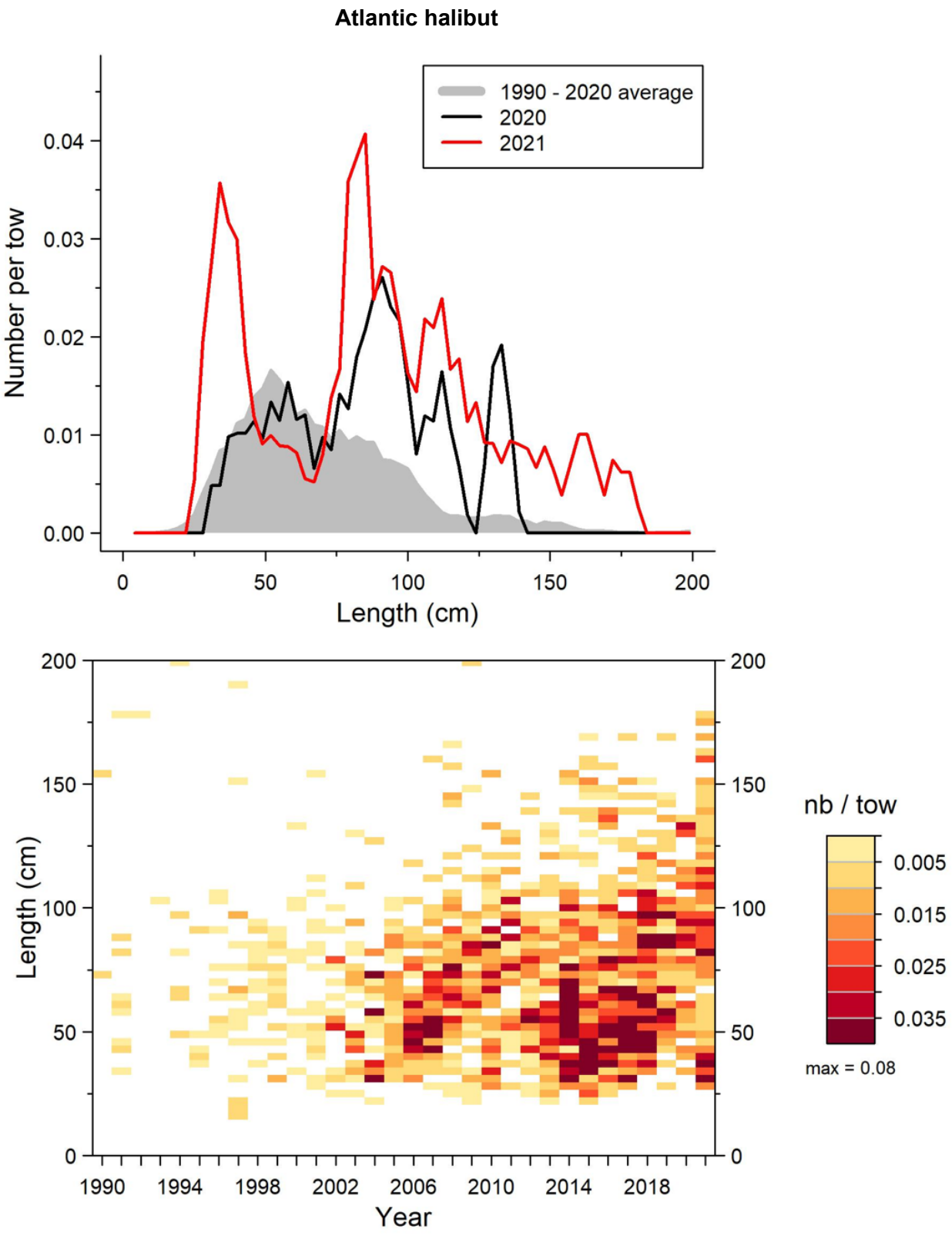

Figure 10. Length frequency distributions (mean number per 15 minute tow) observed during the survey for Atlantic halibut in 4RST.

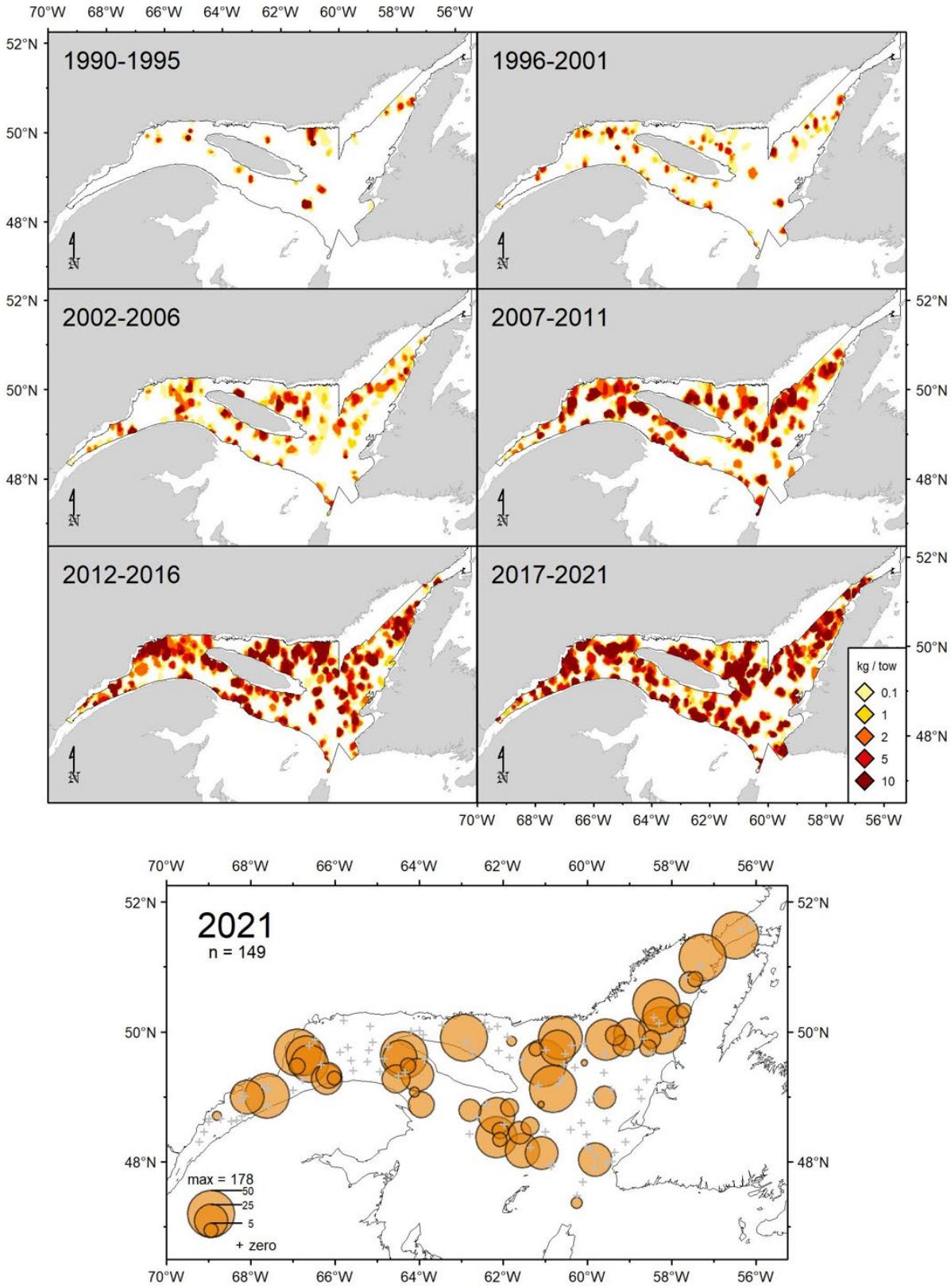

Figure 11. Atlantic halibut catch rates (kg/15 minute tow) distribution.

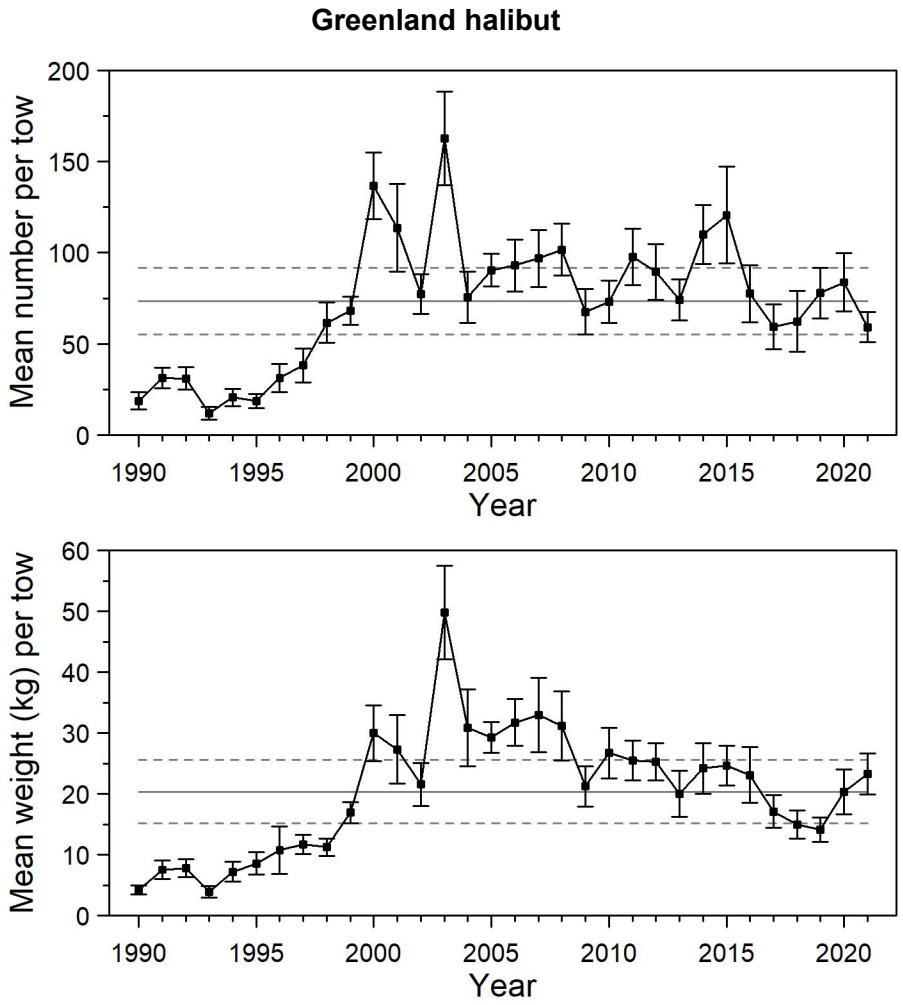

Figure 12. Mean numbers and mean weights per 15 minute tow observed during the survey for Greenland halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

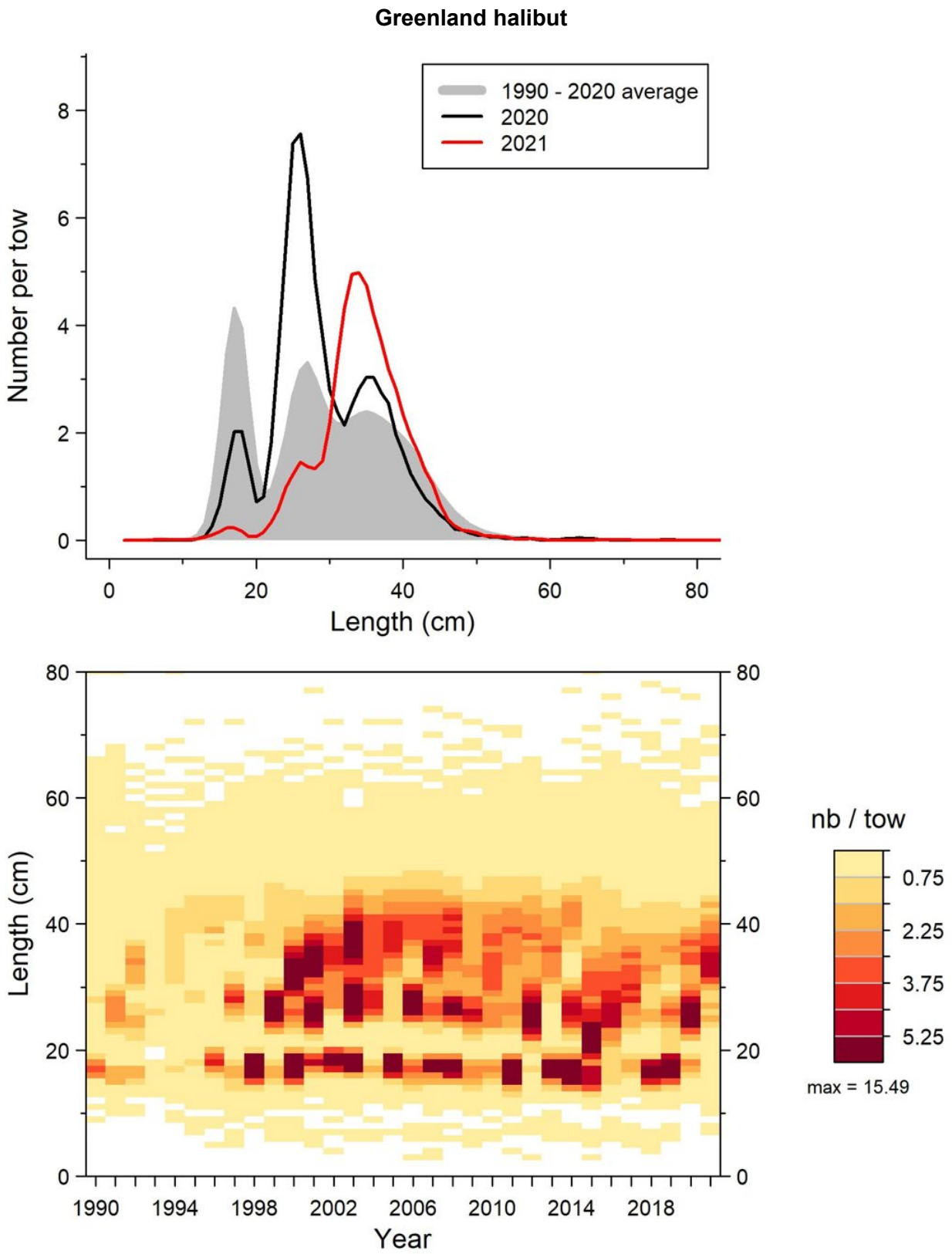

Figure 13. Length frequency distributions (mean number per 15 minute tow) observed during the survey for Greenland halibut in 4RST.

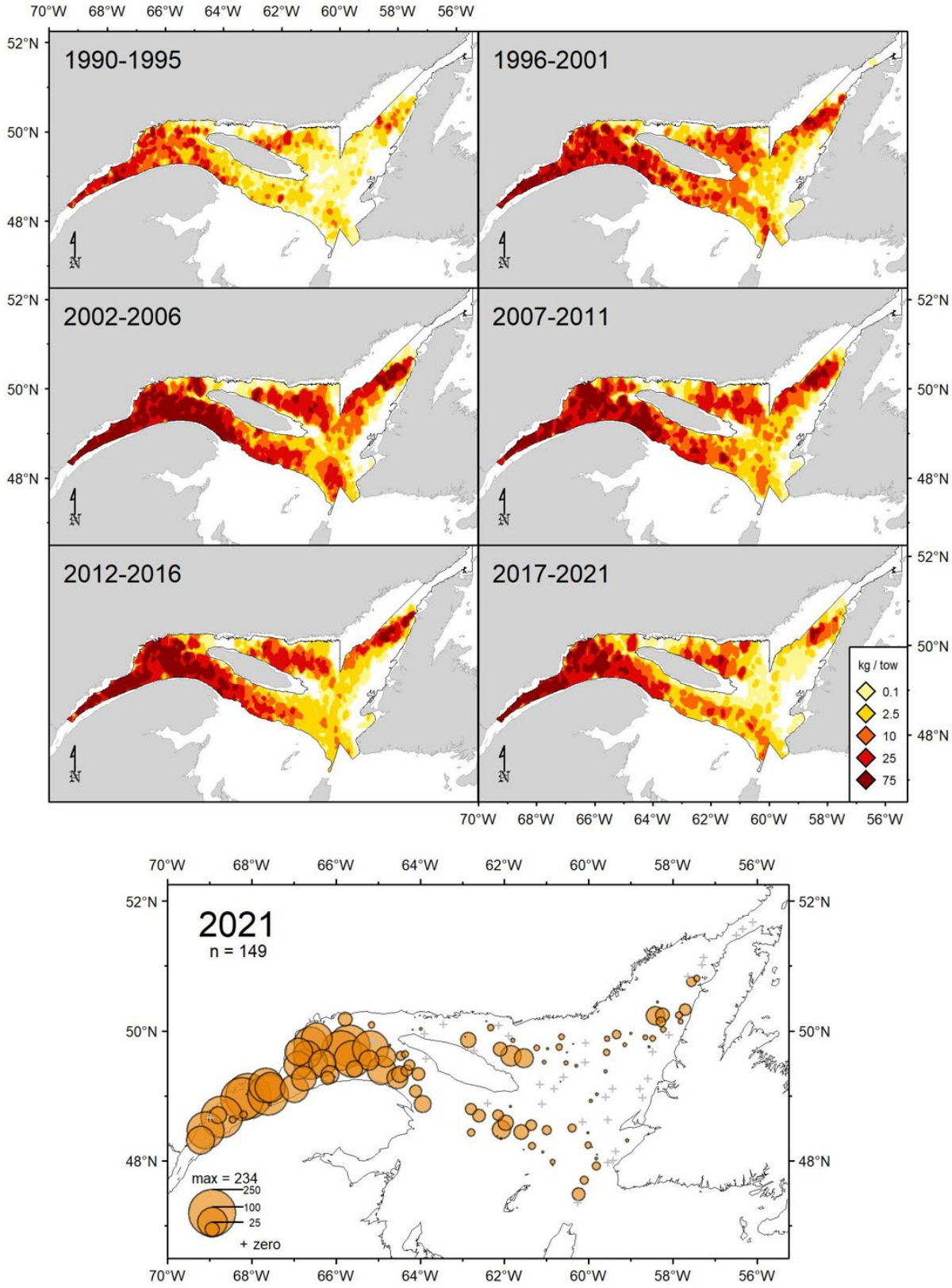

Figure 14. Greenland halibut catch rates (kg/15 minute tow) distribution.

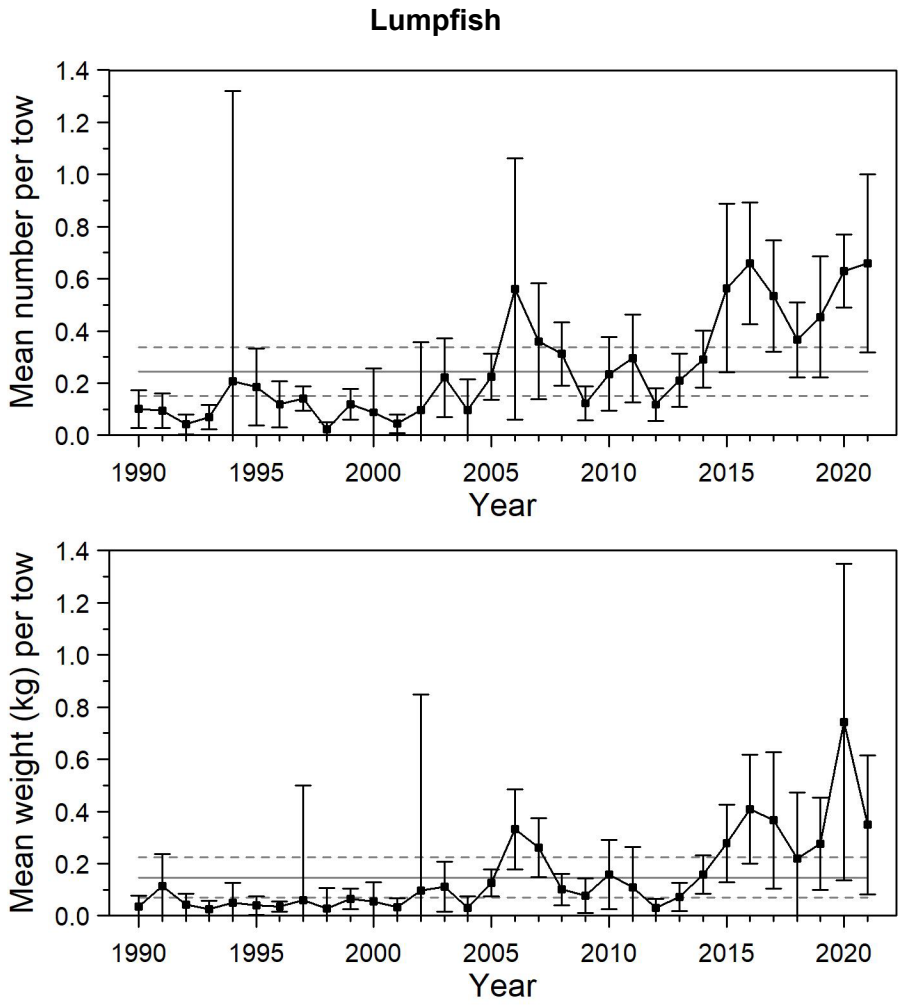

Figure 15. Mean numbers and mean weights per 15 minute tow observed during the survey for lumpfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

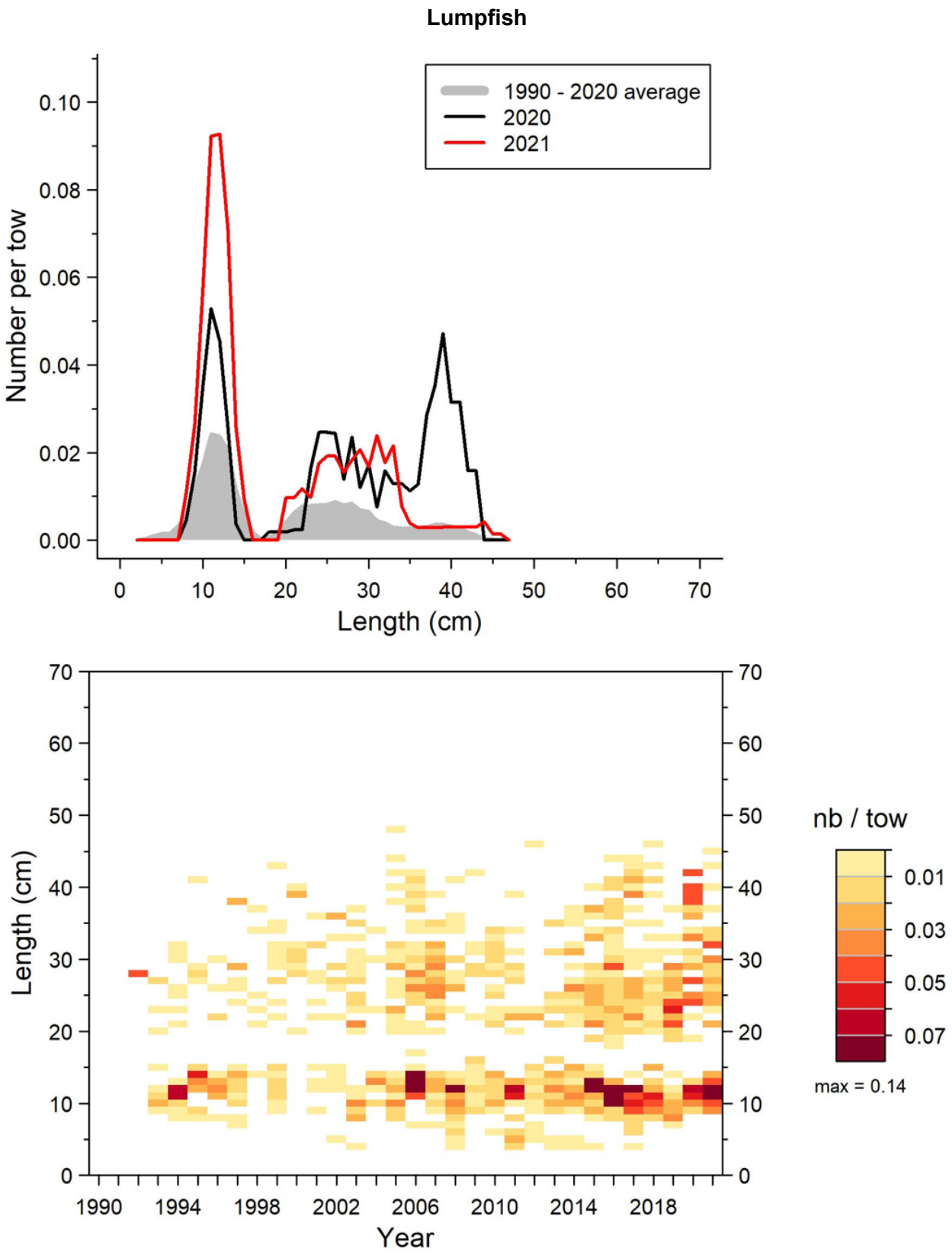

Figure 16. Length frequency distributions (mean number per 15 minute tow) observed during the survey for lumpfish in 4RST.

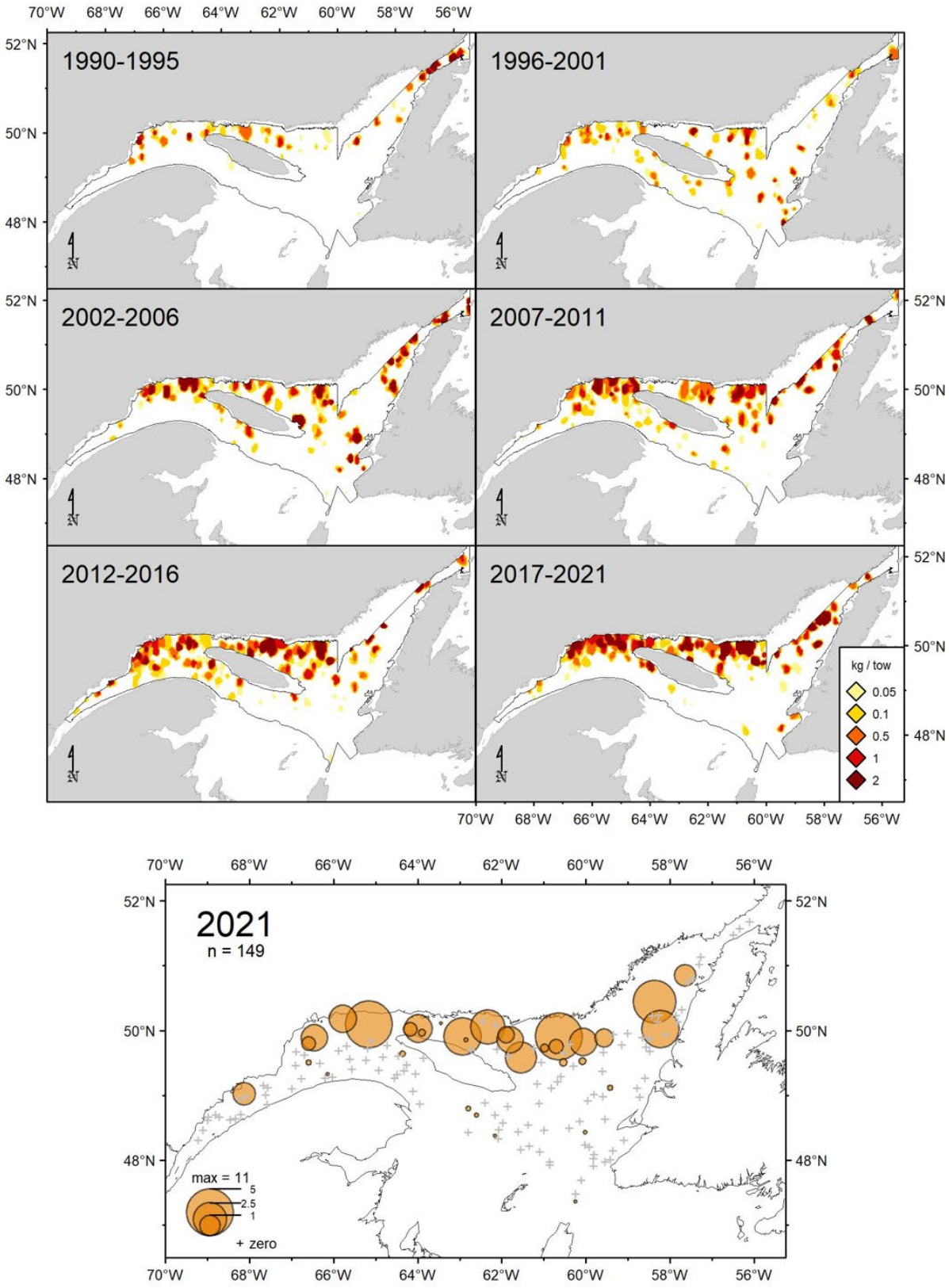

Figure 17. Lumpfish catch rates (kg/15 minute tow) distribution.

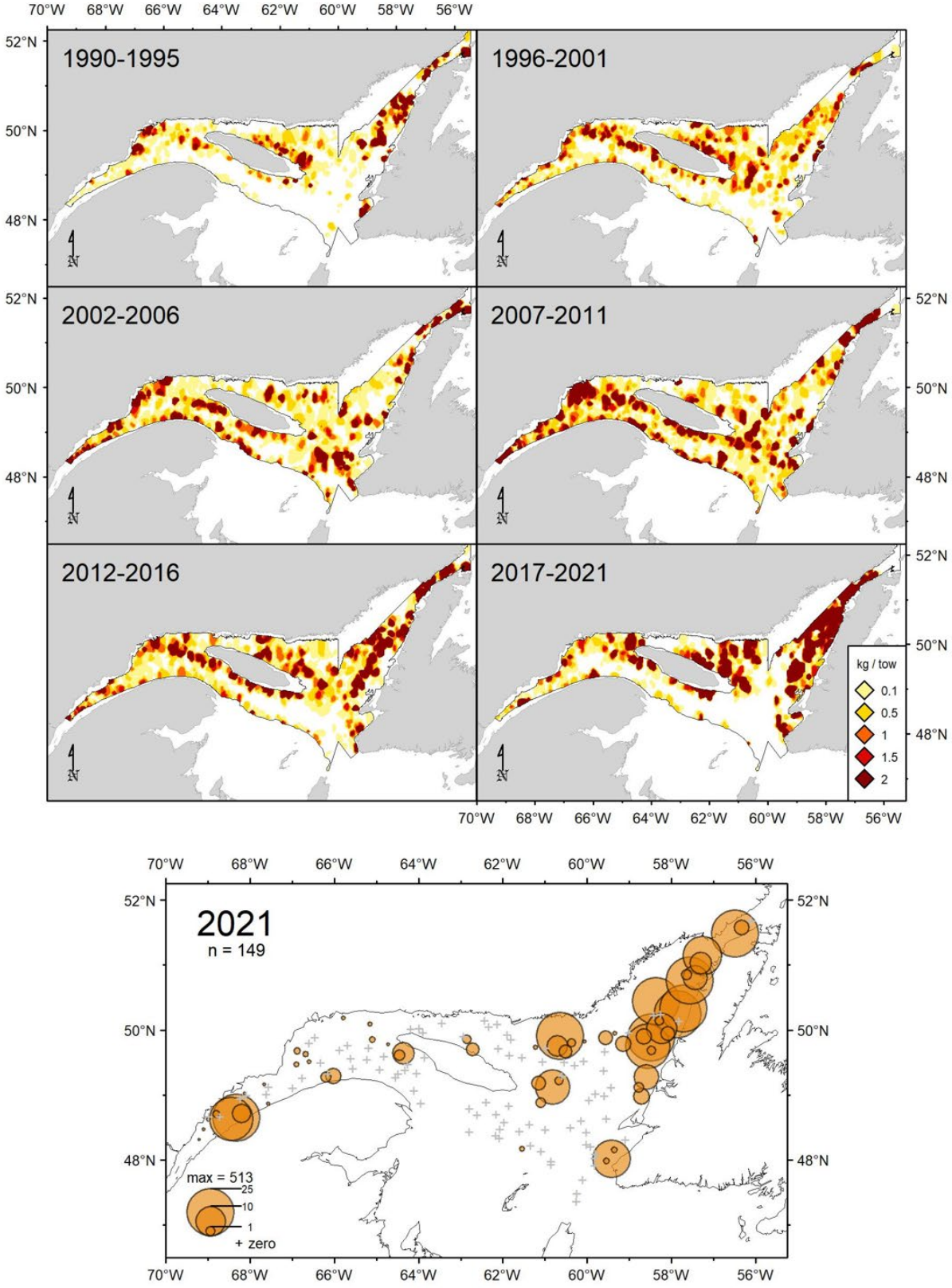

Figure 18. Herring catch rates (kg/15 minute tow) distribution.

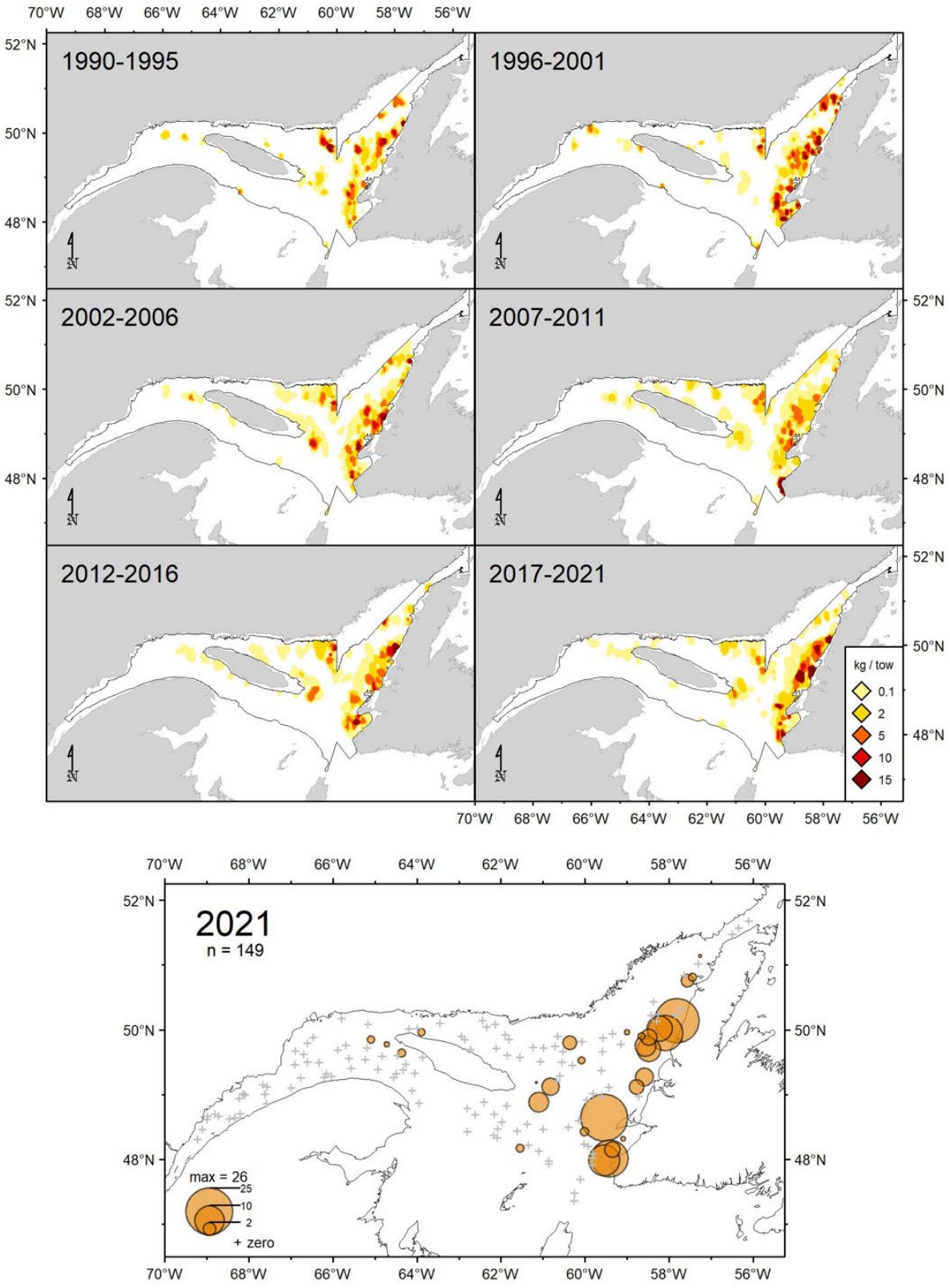

Figure 19. Atlantic wolffish catch rates (kg/15 minute tow) distribution.

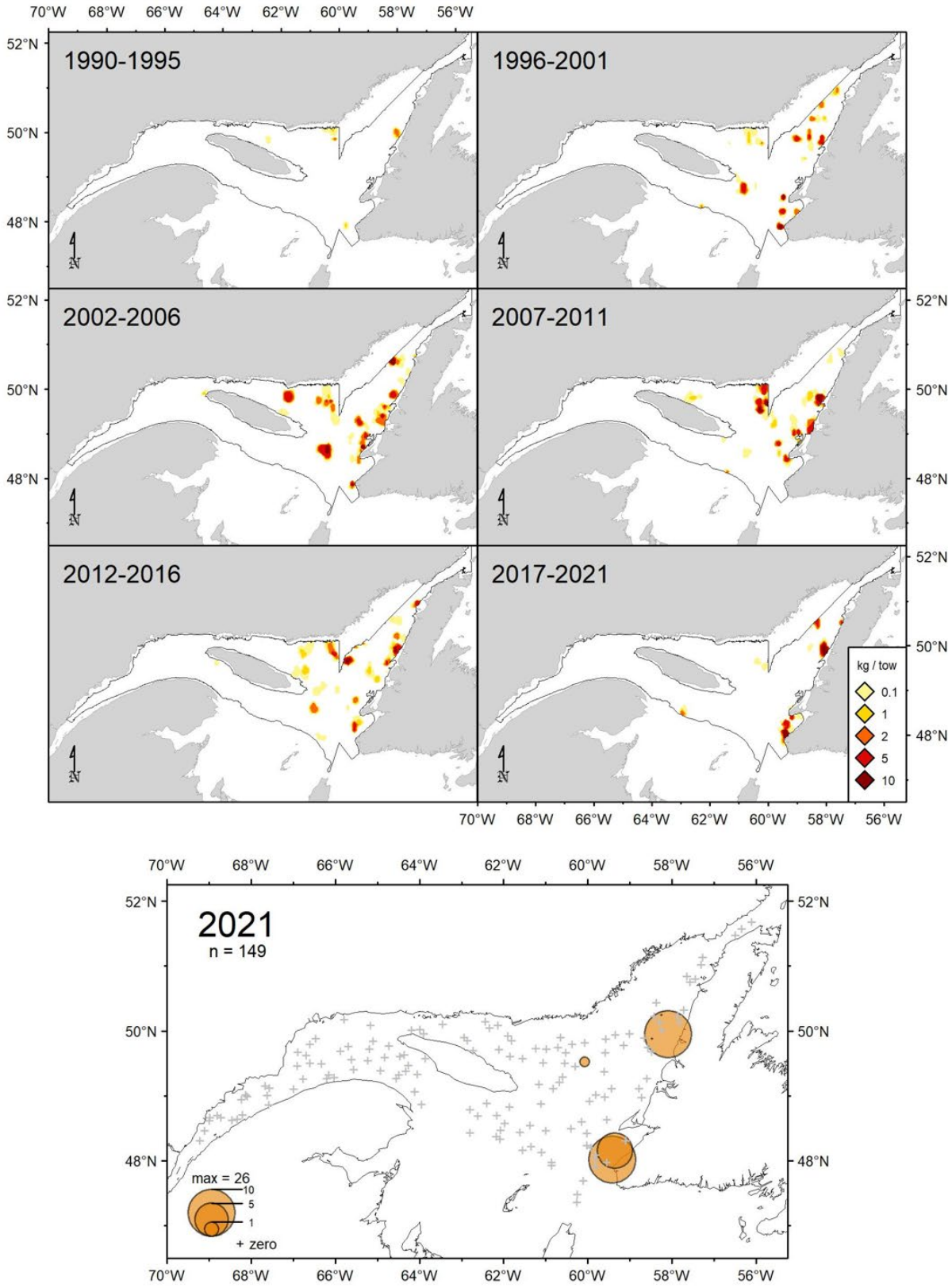

Figure 20. Spotted wolffish catch rates (kg/15 minute tow) distribution.

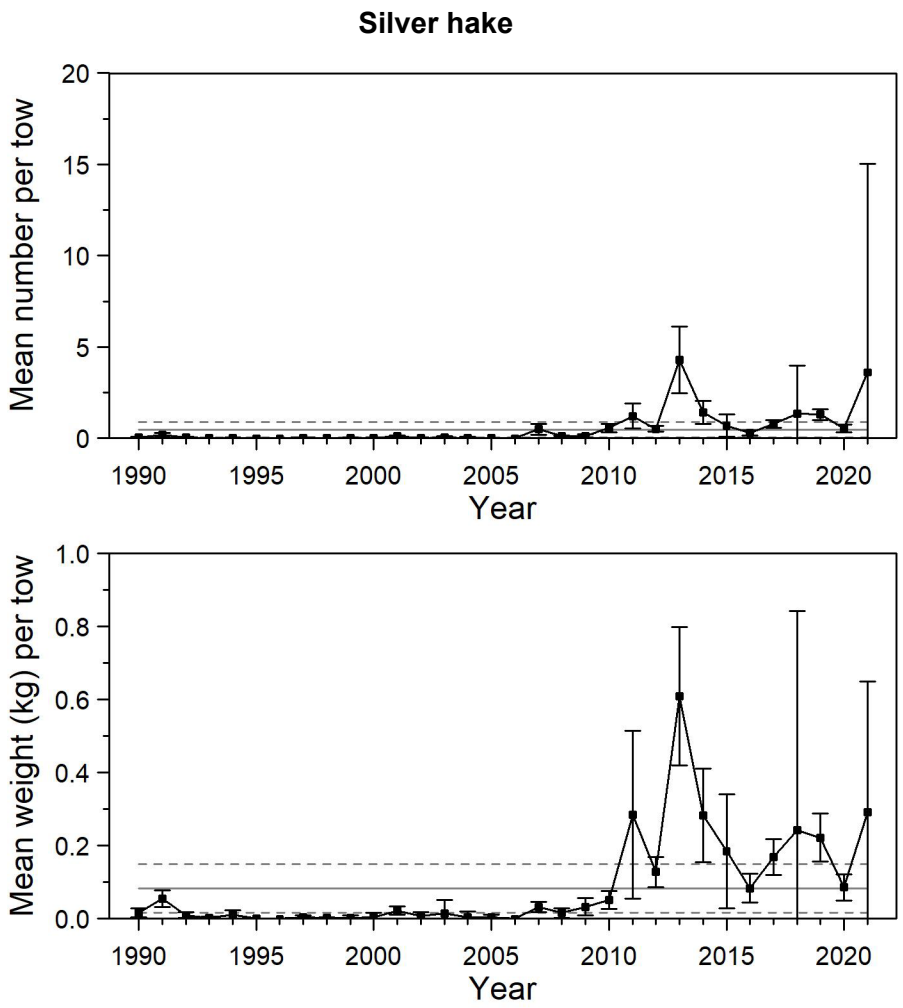

Figure 21. Mean numbers and mean weights per 15 minute tow observed during the survey for silver hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

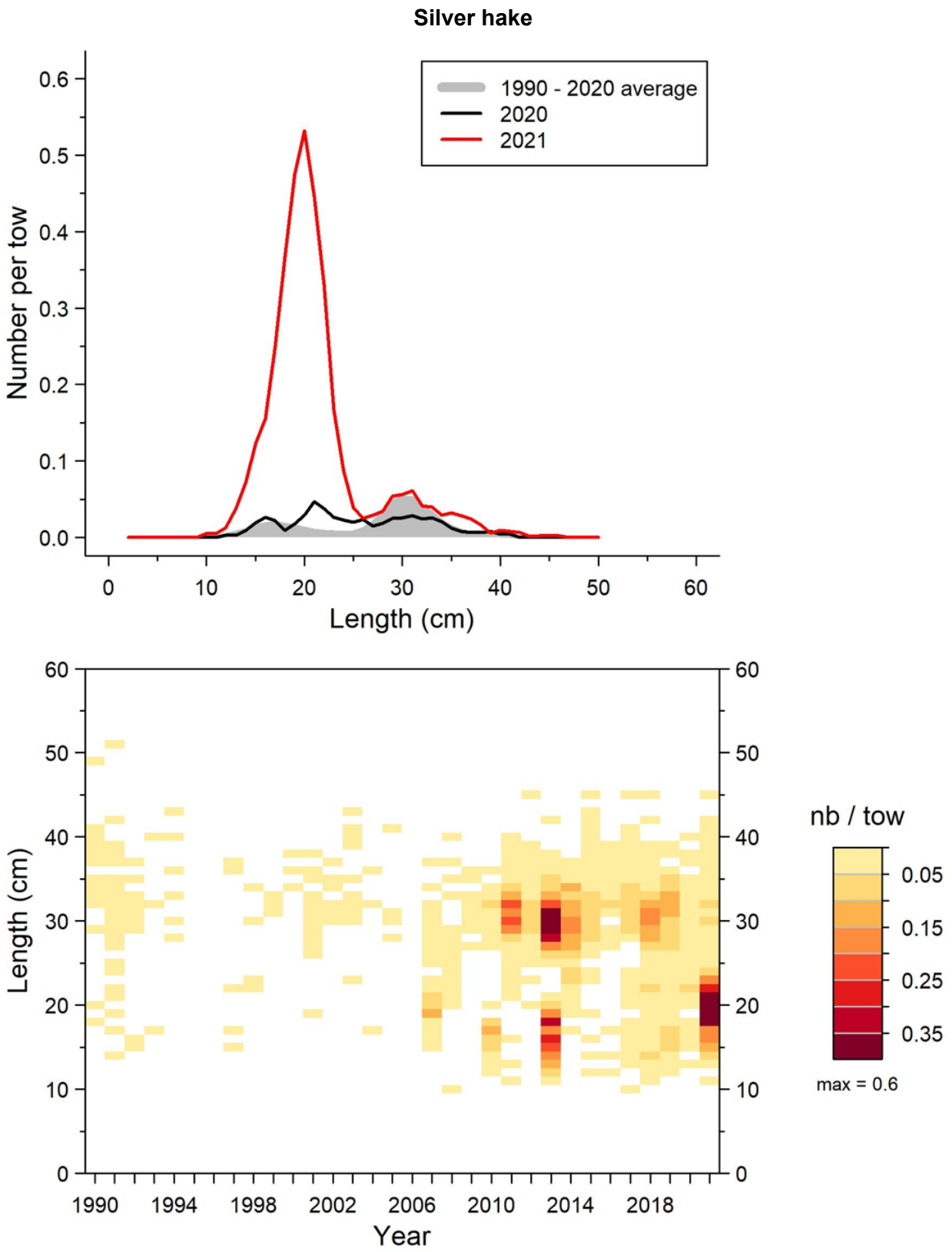

Figure 22. Length frequency distributions (mean number per 15 minute tow) observed during the survey for silver hake in 4RST.

Silver hake

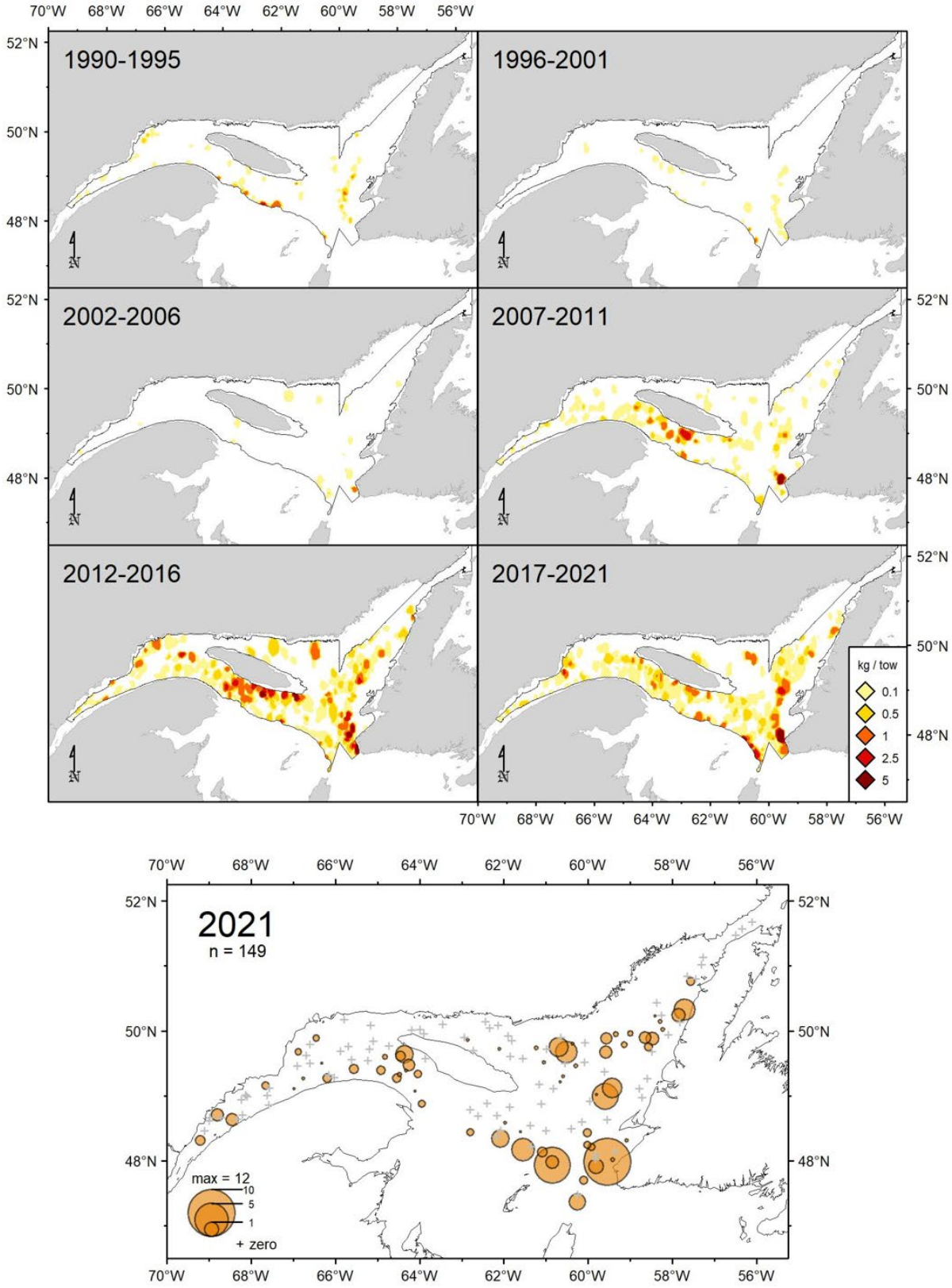

Figure 23. Silver hake catch rates (kg/15 minute tow) distribution.

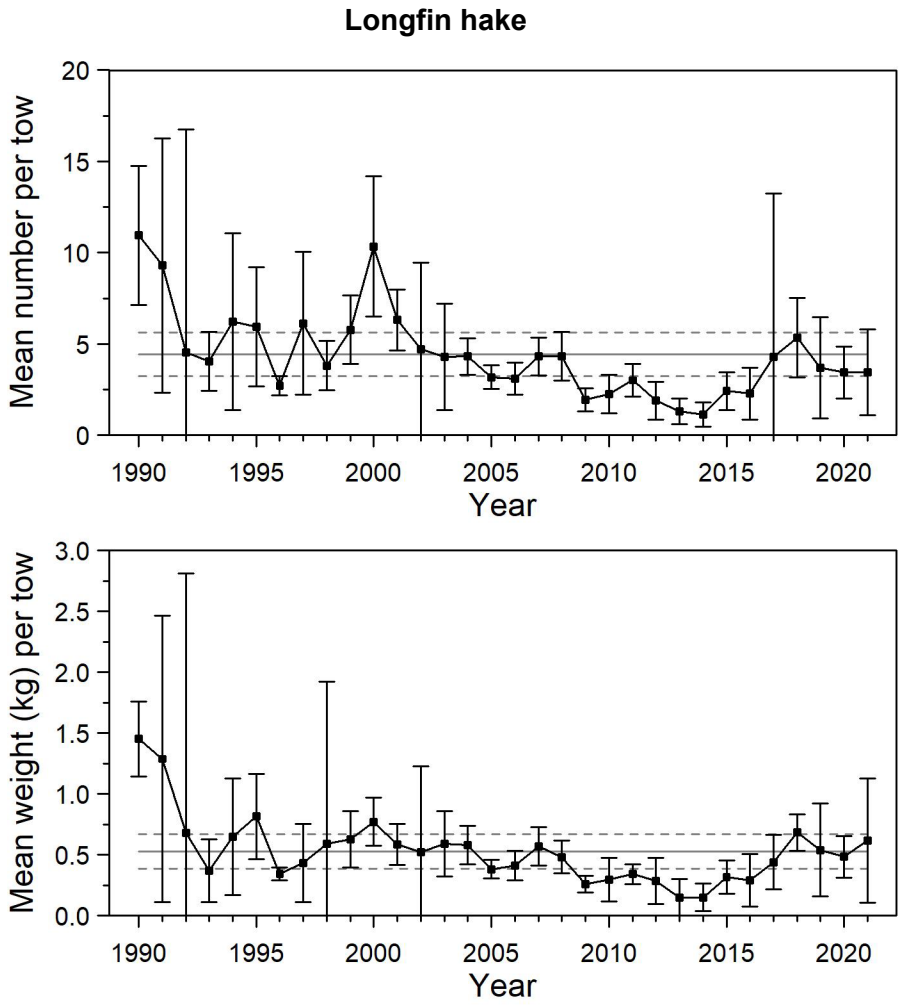

Figure 24. Mean numbers and mean weights per 15 minute tow observed during the survey for longfin hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

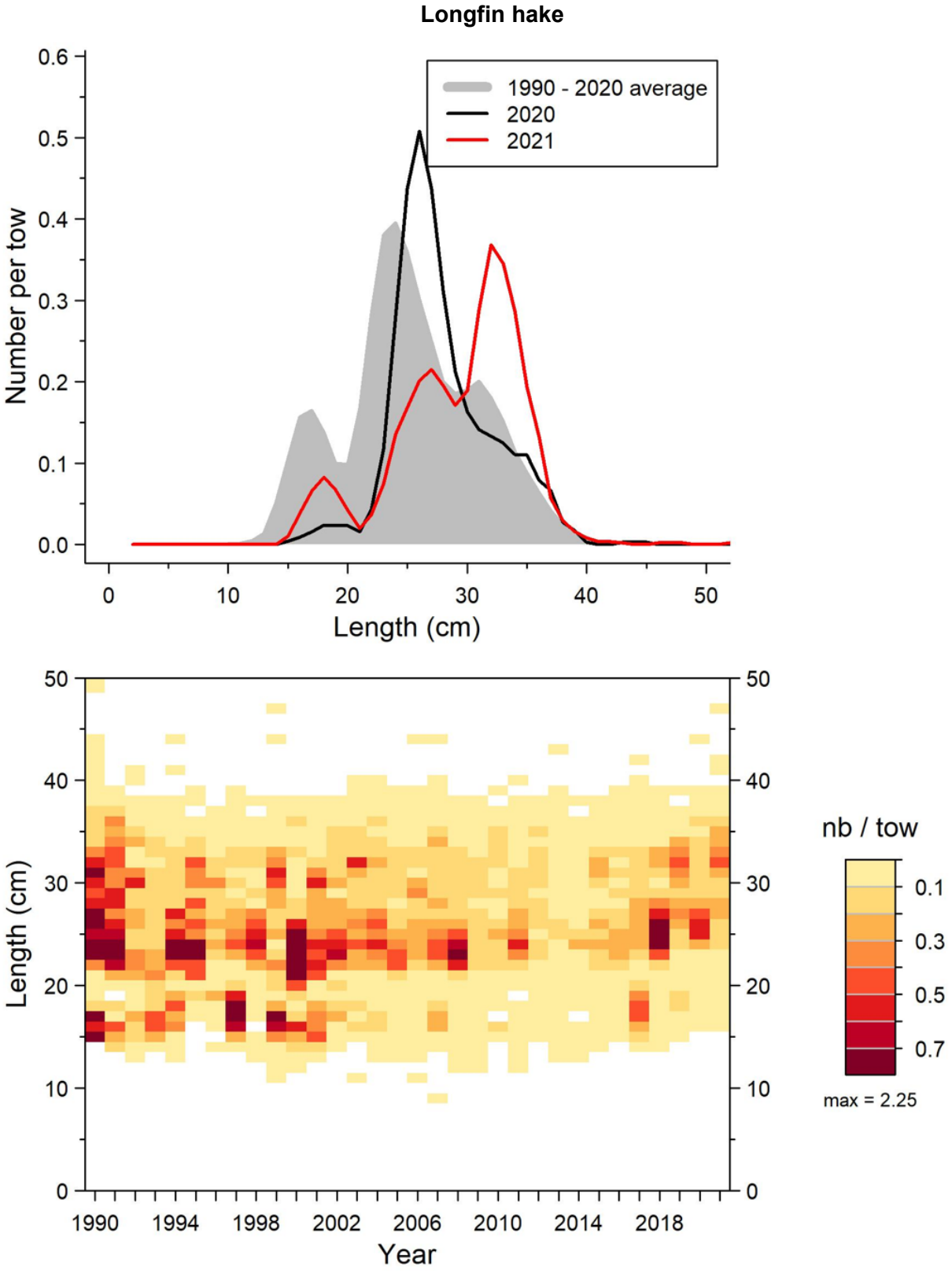

Figure 25. Length frequency distributions (mean number per 15 minute tow) observed during the survey for longfin hake in 4RST.

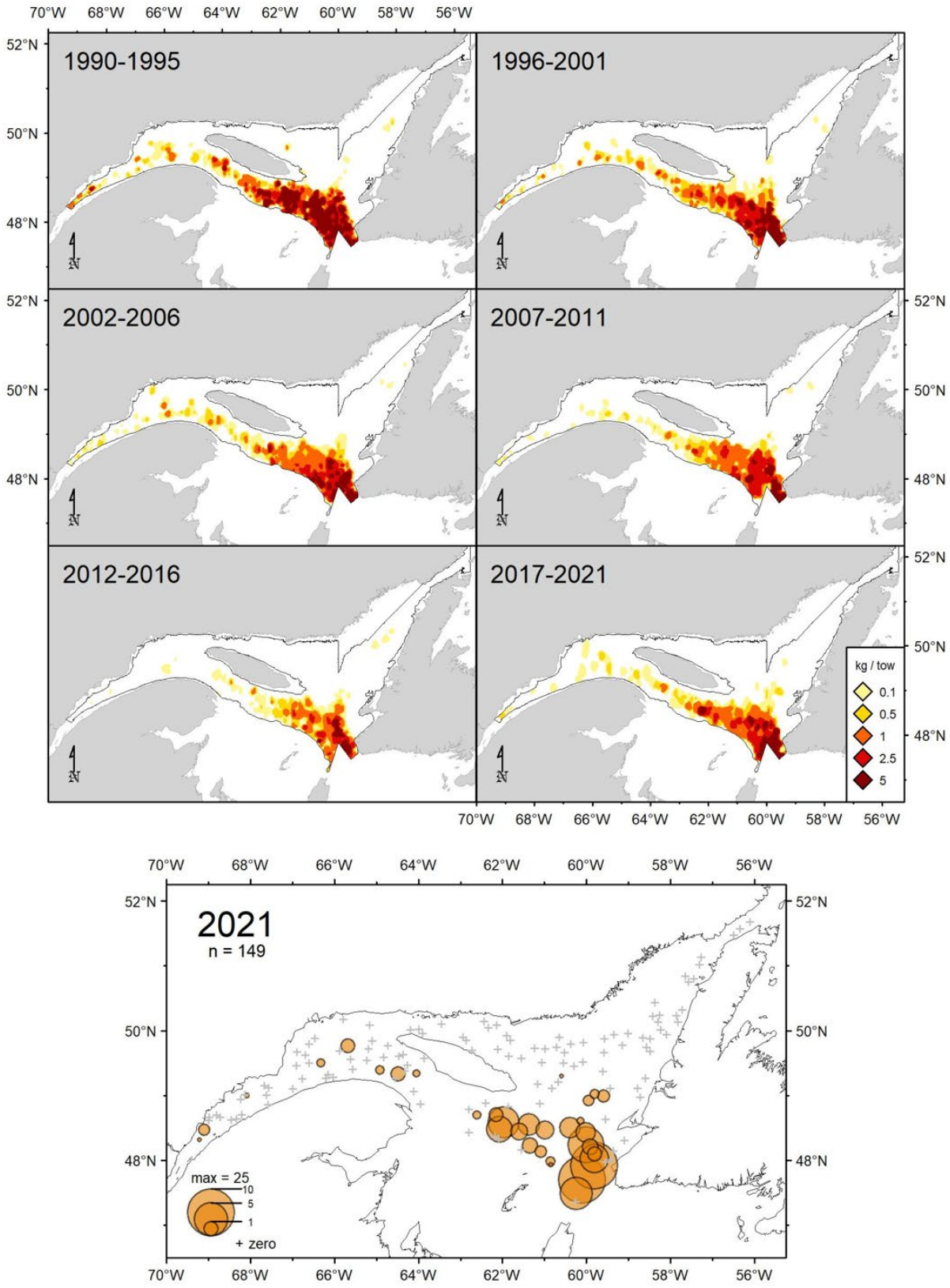

Figure 26. Longfin hake catch rates (kg/15 minute tow) distribution.

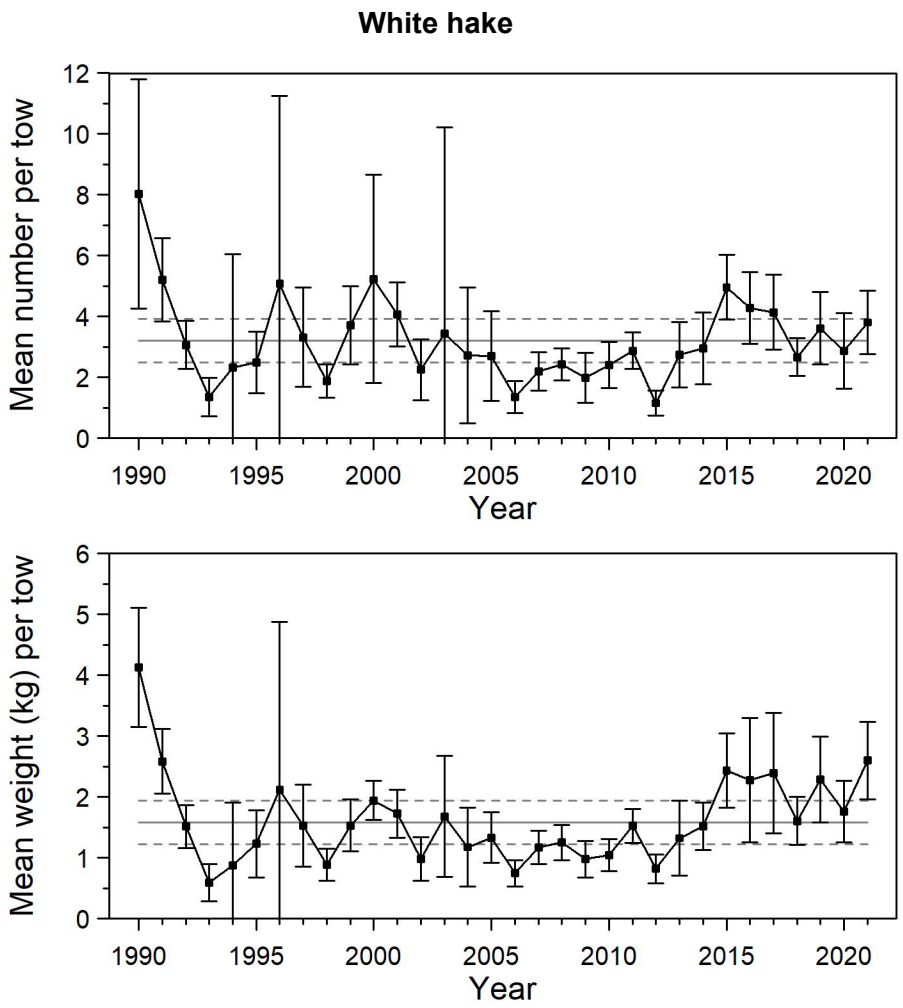

Figure 27. Mean numbers and mean weights per 15 minute tow observed during the survey for white hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

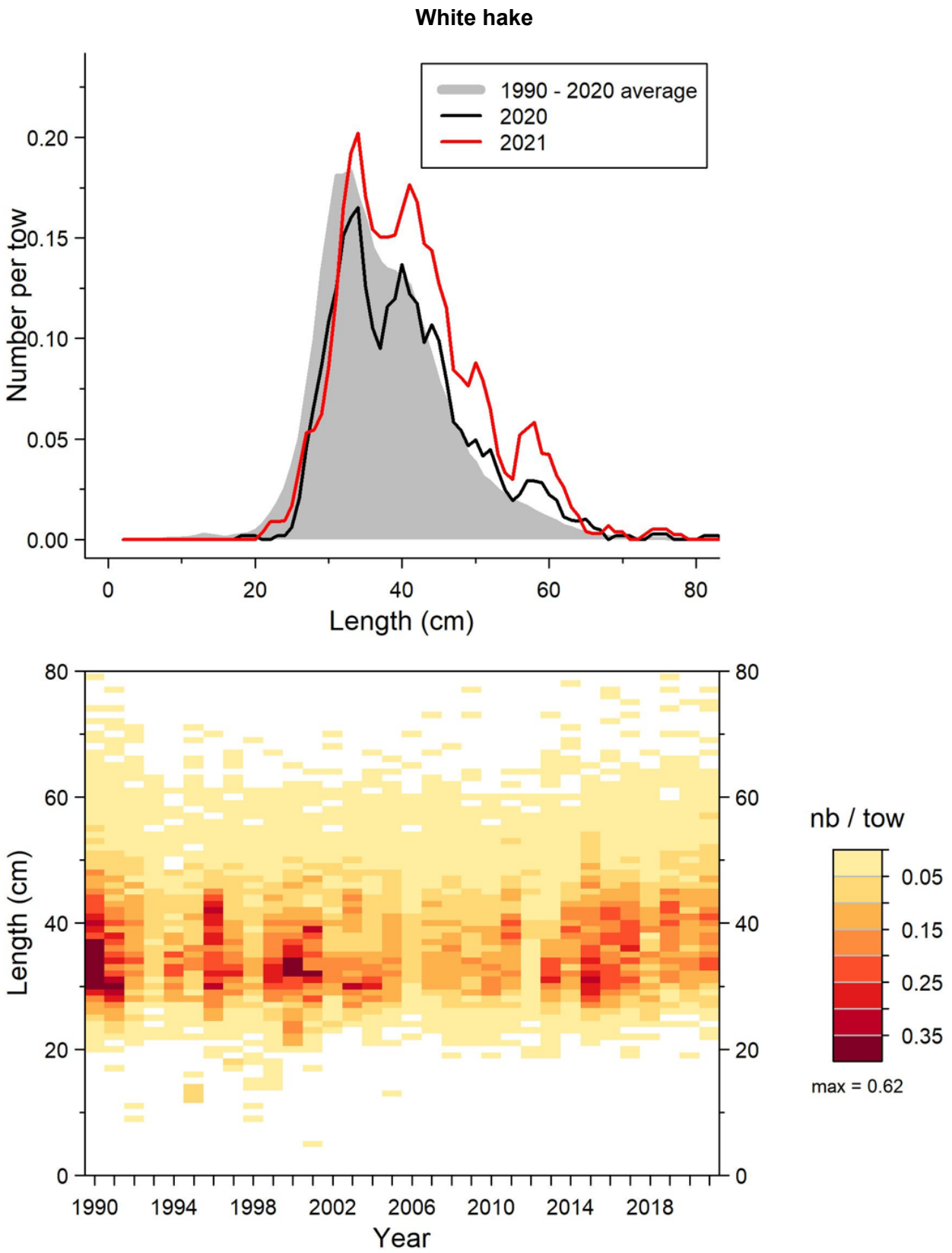

Figure 28. Length frequency distributions (mean number per 15 minute tow) observed during the survey for white hake in 4RST.

White hake

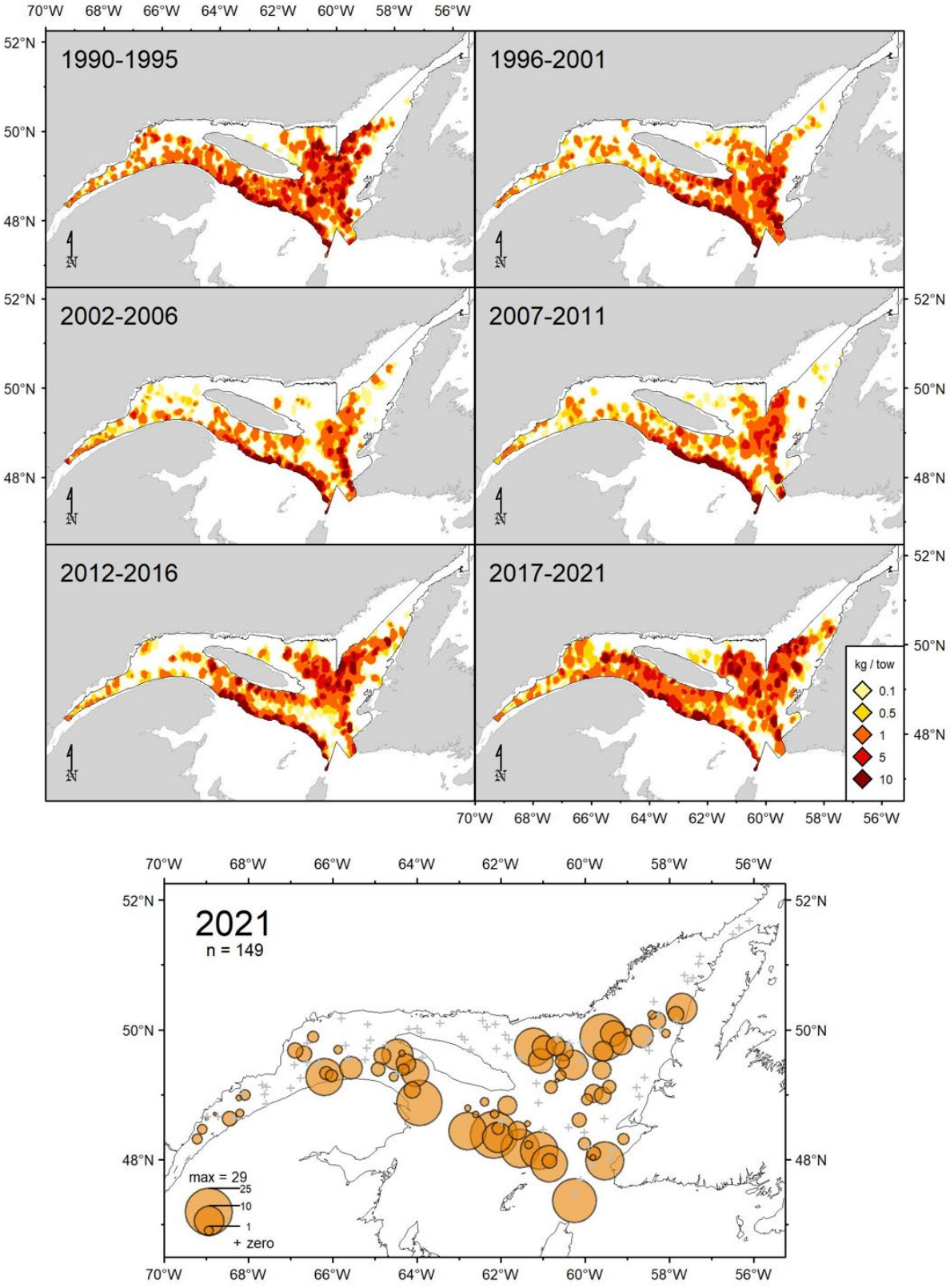

Figure 29. White hake catch rates (kg/15 minute tow) distribution.

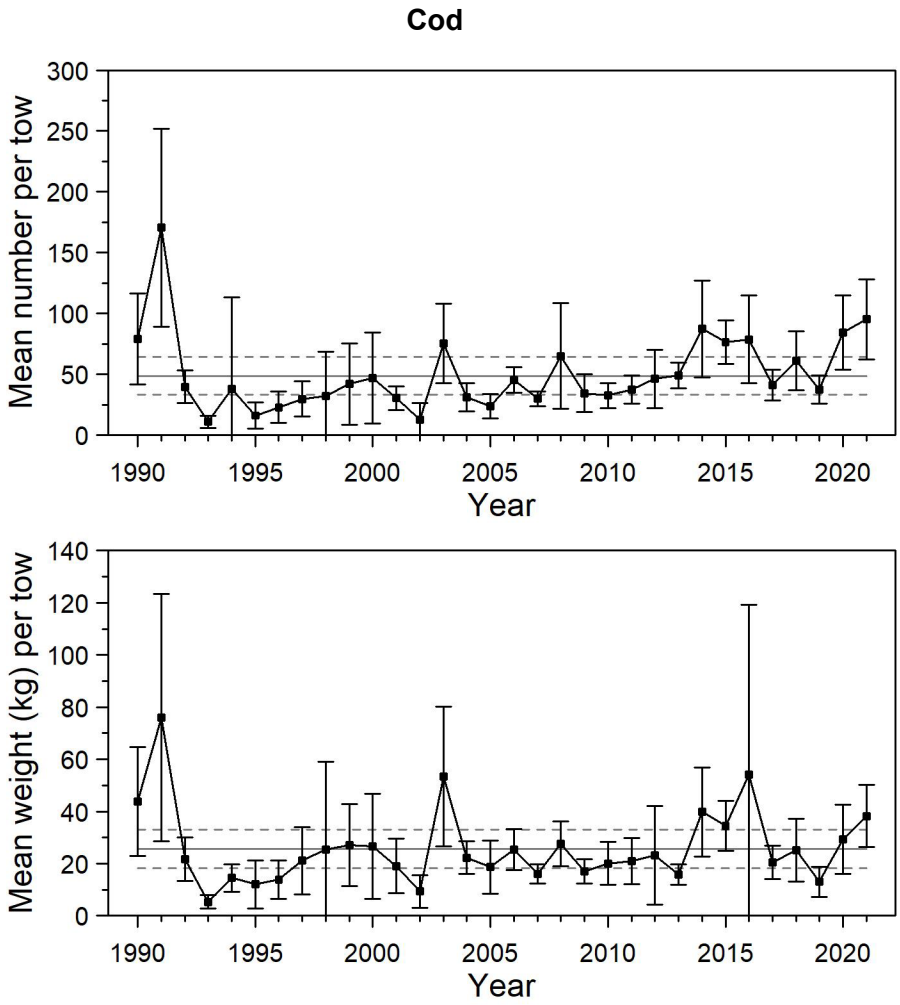

Figure 30. Mean numbers and mean weights per 15 minute tow observed during the survey for cod in 4RS. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

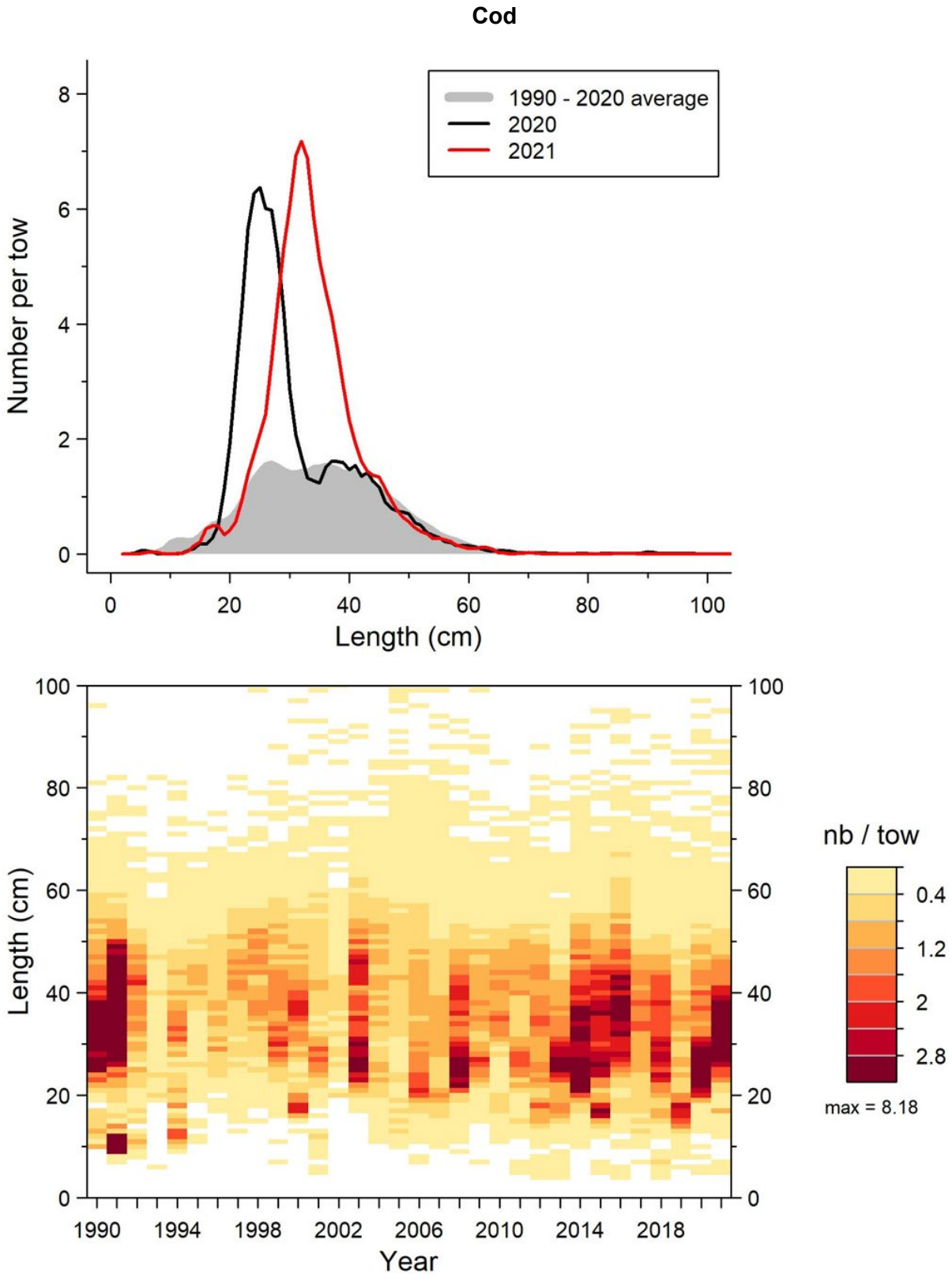

Figure 31. Length frequency distributions (mean number per 15 minute tow) observed during the survey for cod in 4RS.

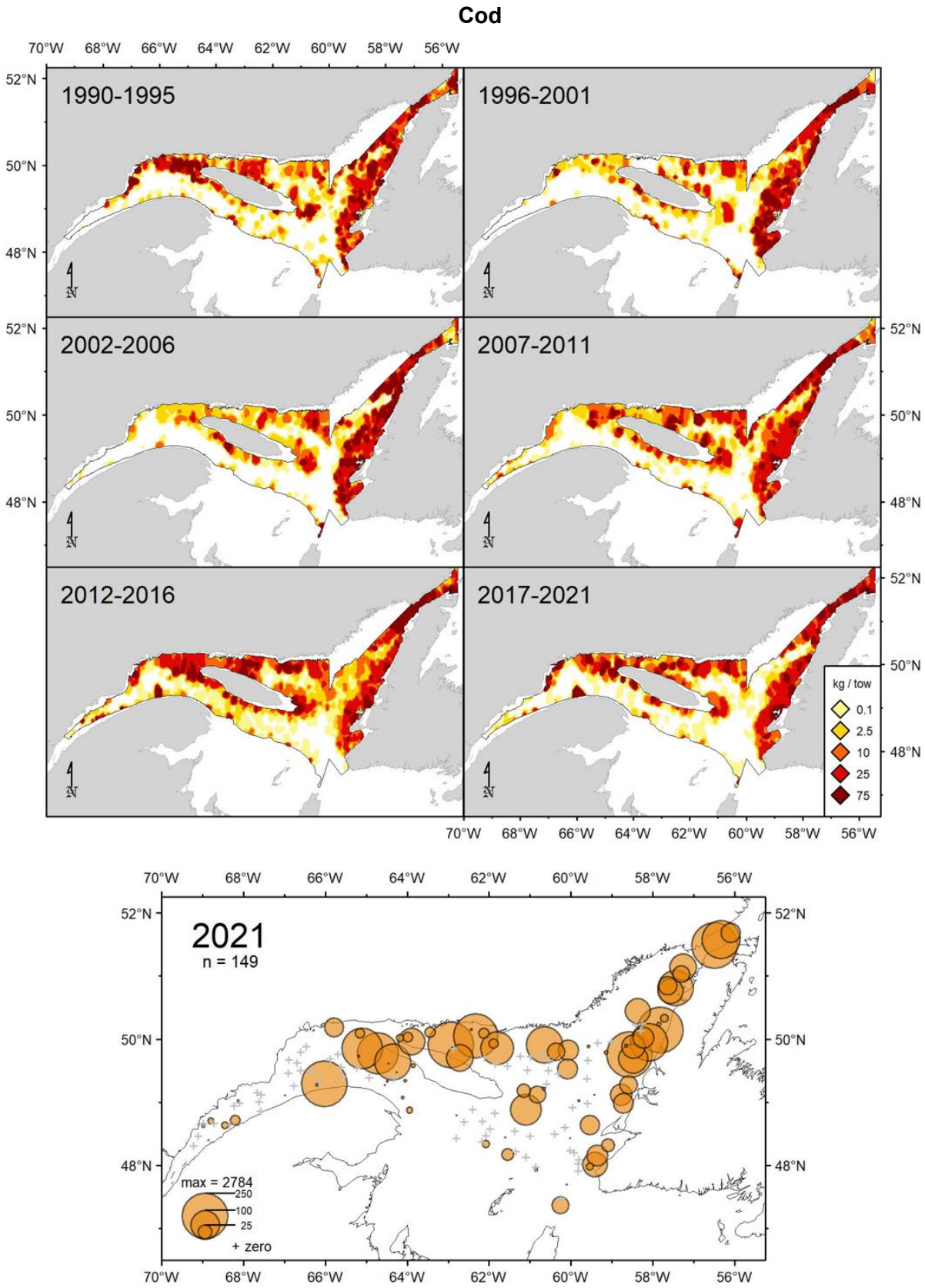

Figure 32. Cod catch rates (kg/15 minute tow) distribution.

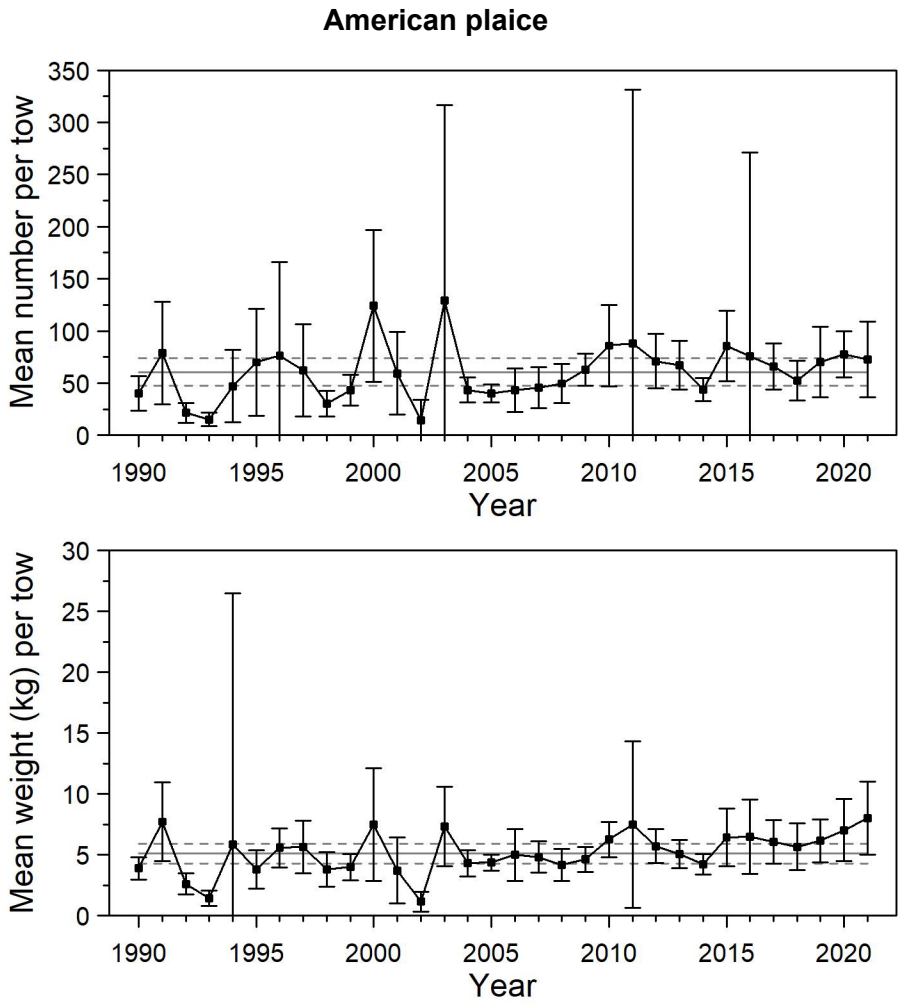

Figure 33. Mean numbers and mean weights per 15 minute tow observed during the survey for American plaice in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

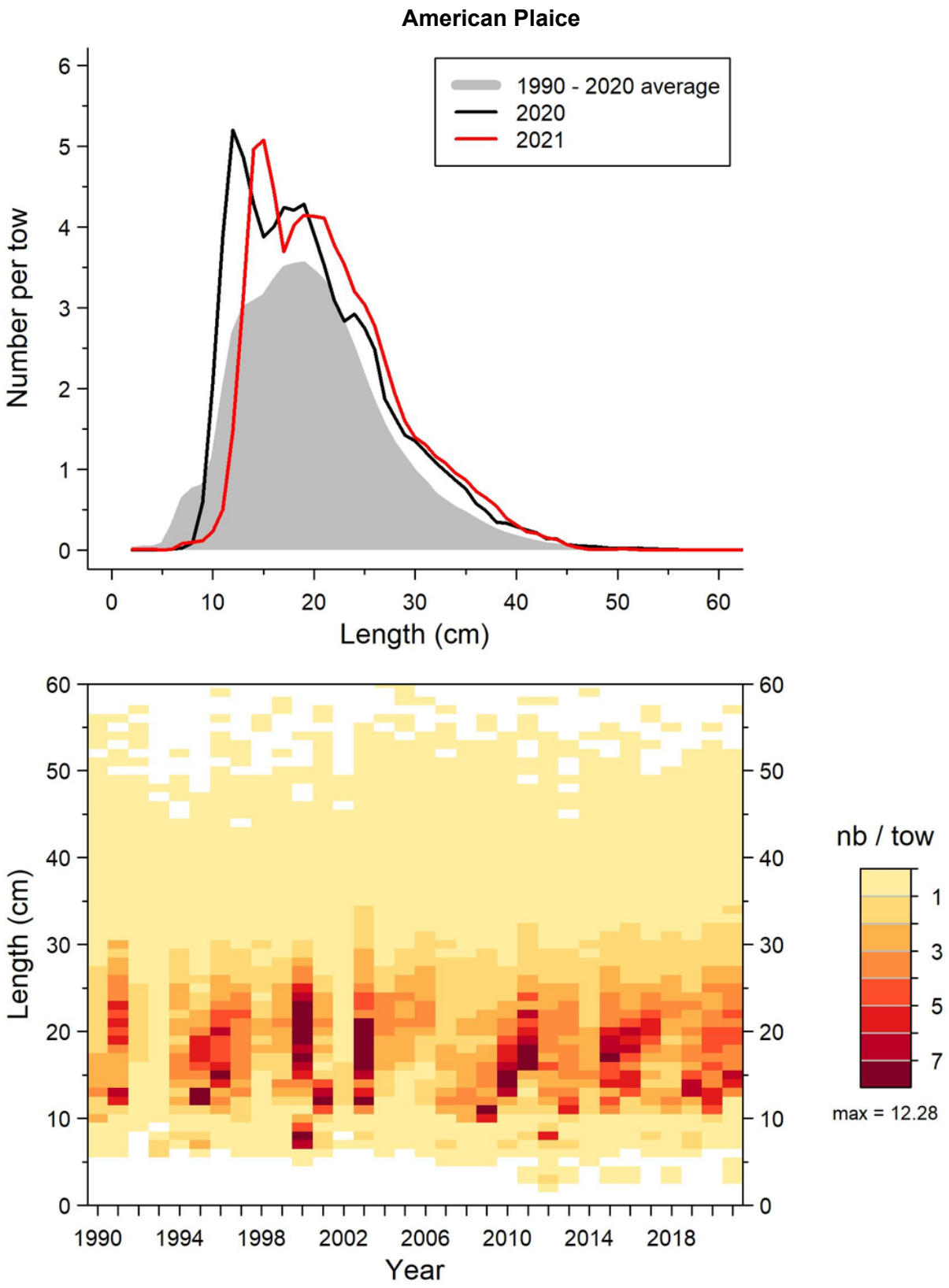

Figure 34. Length frequency distributions (mean number per 15 minute tow) observed during the survey for American plaice in 4RST.

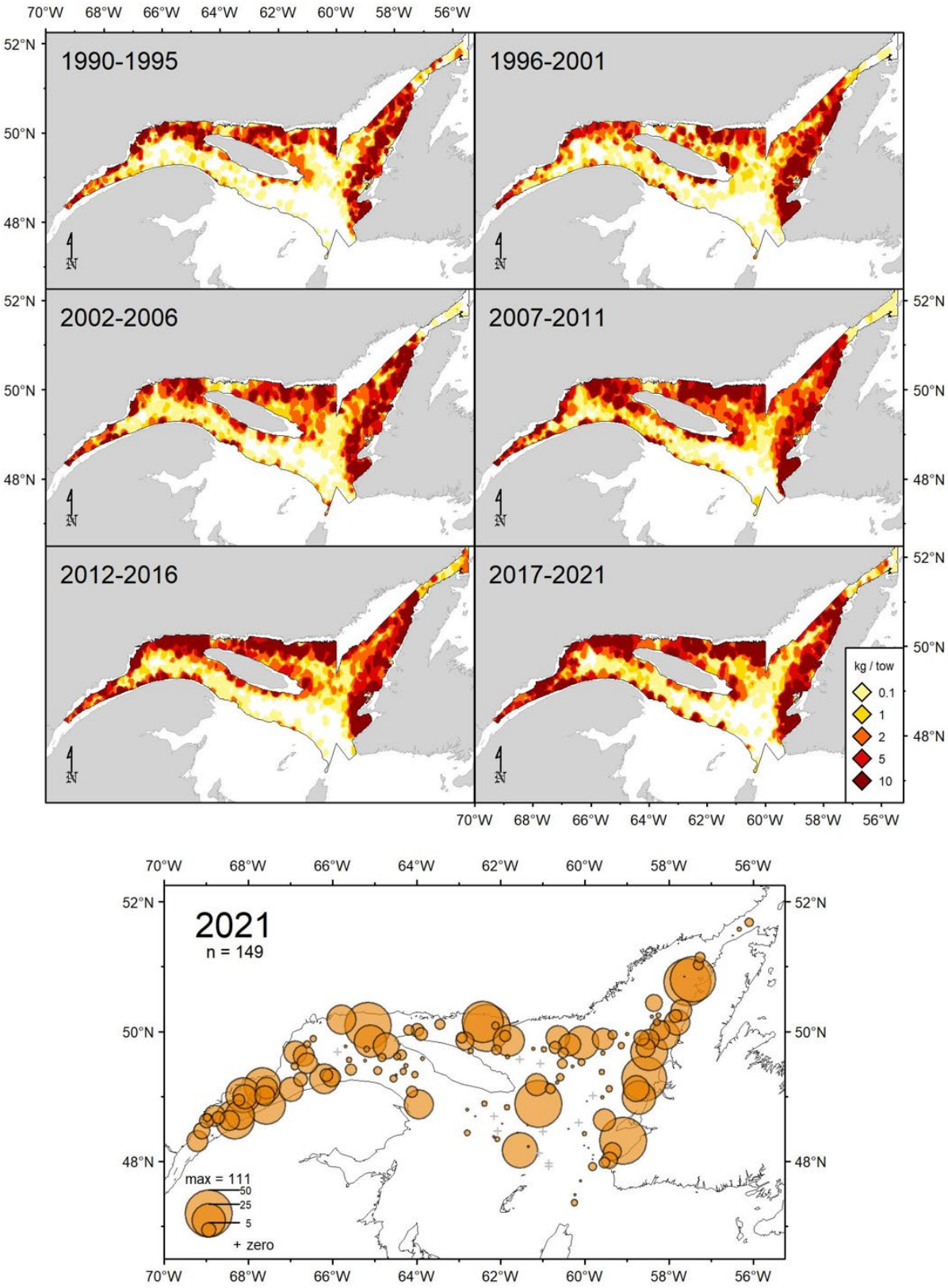

Figure 35. American plaice catch rates (kg/15 minute tow) distribution.

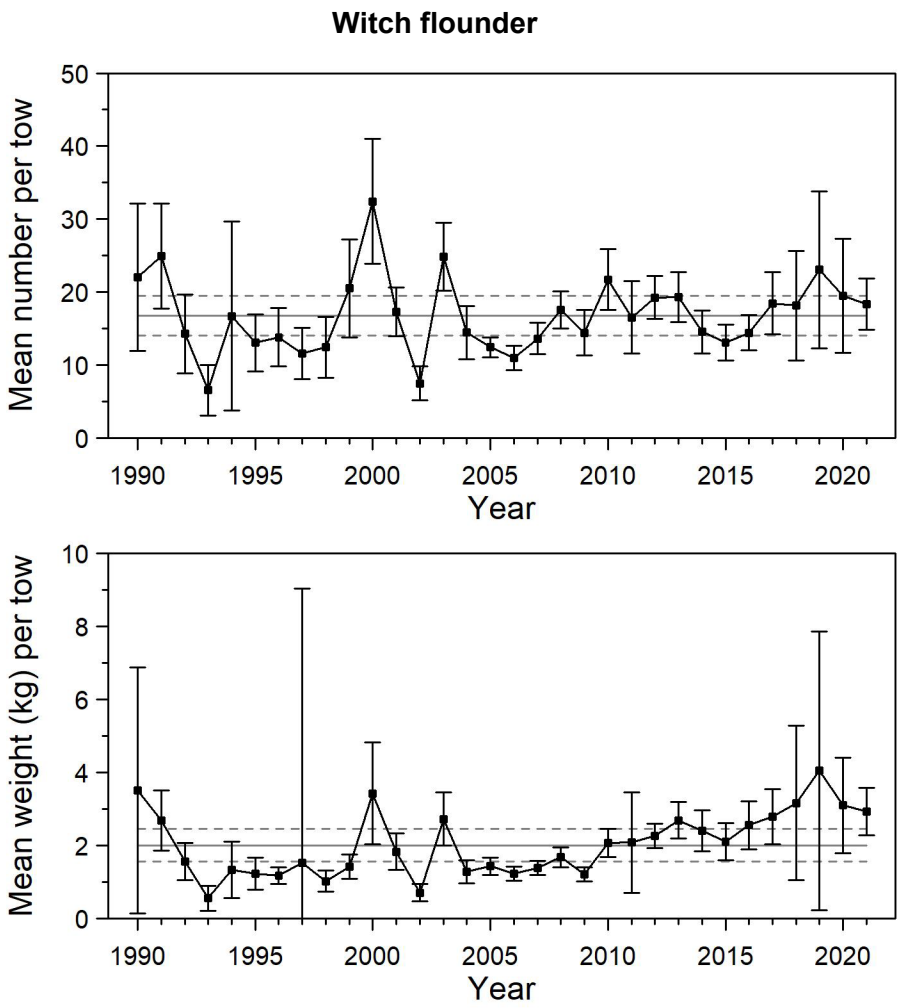

Figure 36. Mean numbers and mean weights per 15 minute tow observed during the survey for witch flounder in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

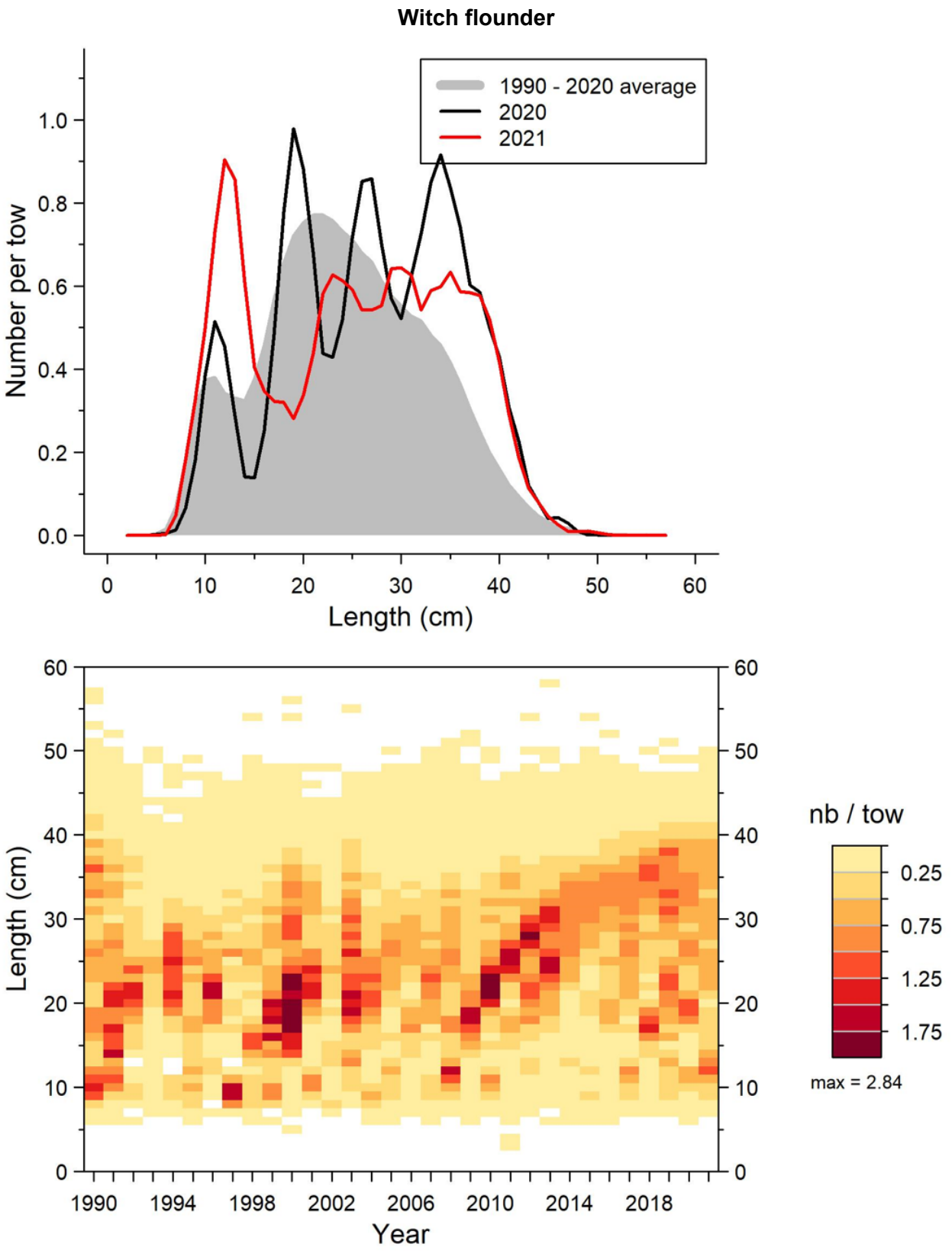

Figure 37. Length frequency distributions (mean number per 15 minute tow) observed during the survey for witch flounder in 4RST.

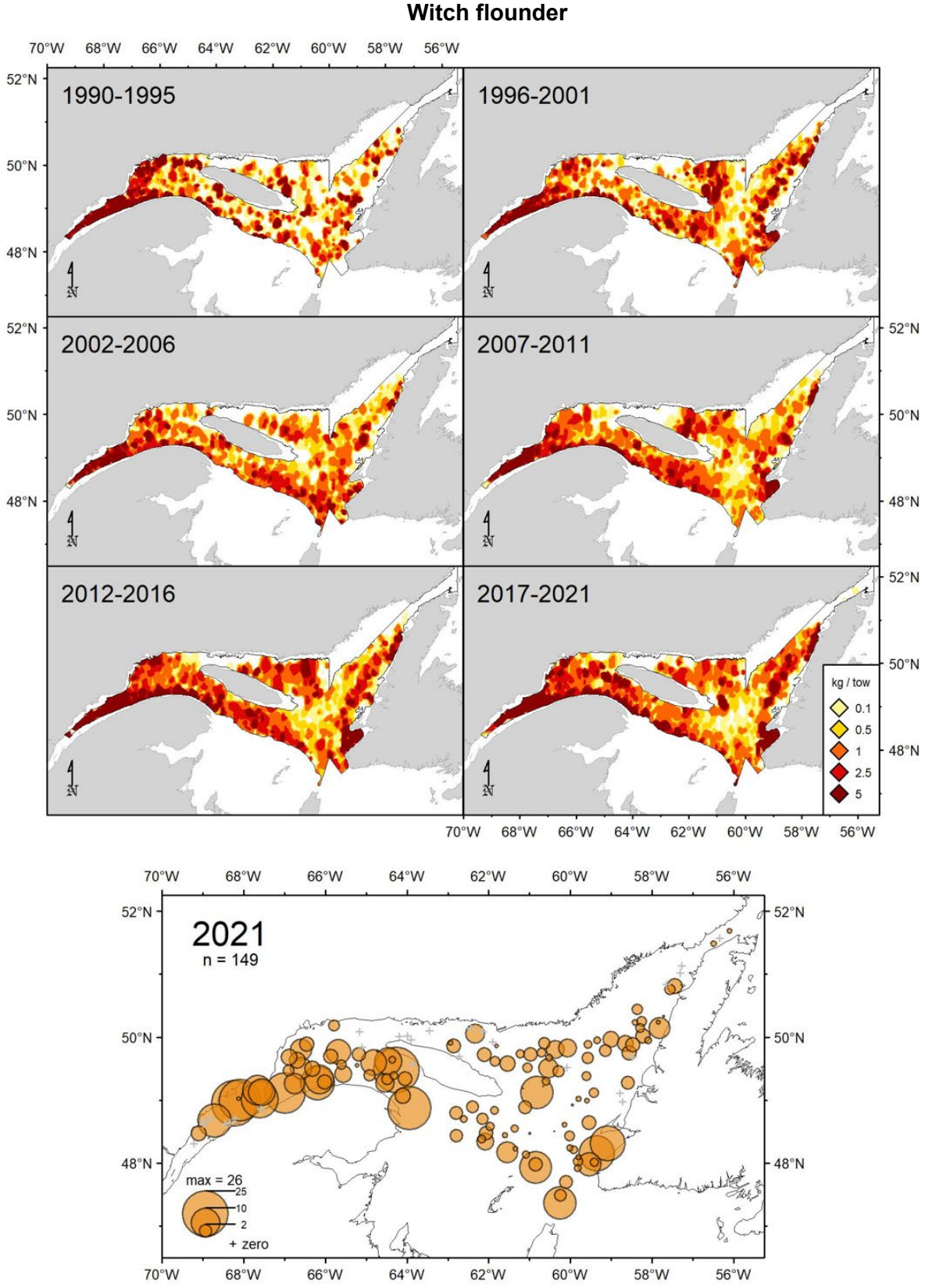

Figure 38. Witch flounder catch rates (kg/15 minute tow) distribution.

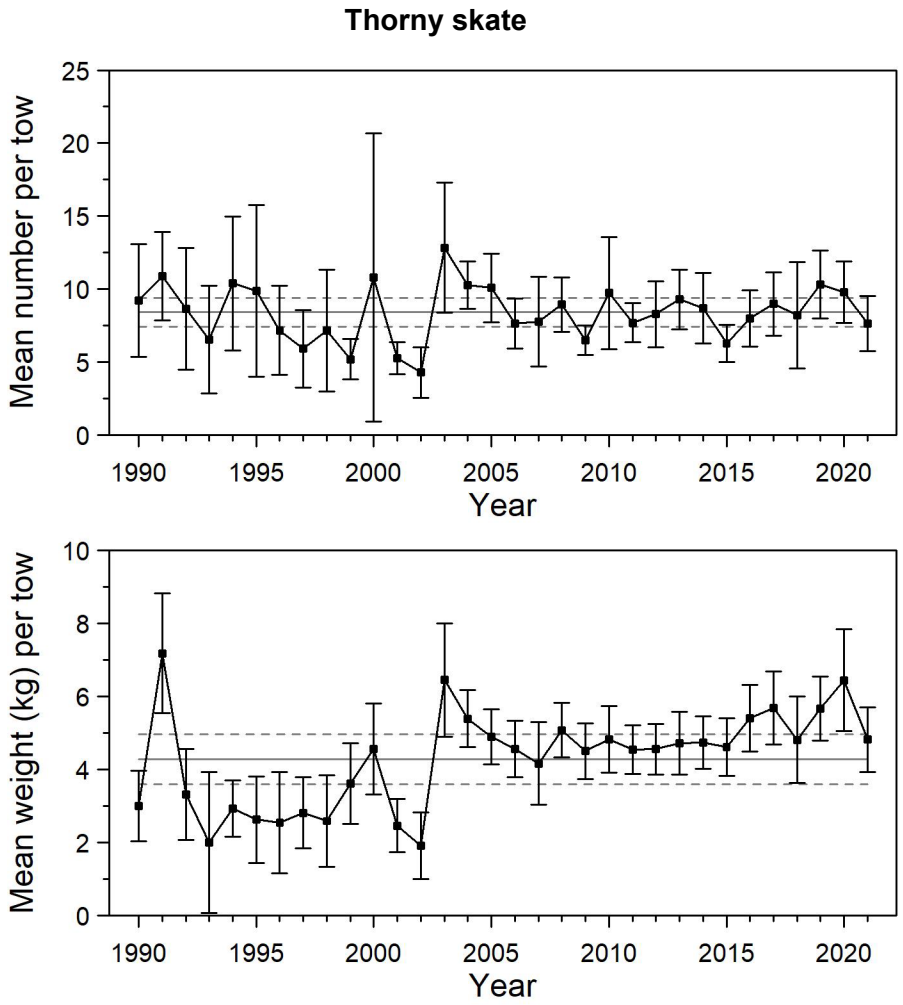

Figure 39. Mean numbers and mean weights per 15 minute tow observed during the survey for thorny skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

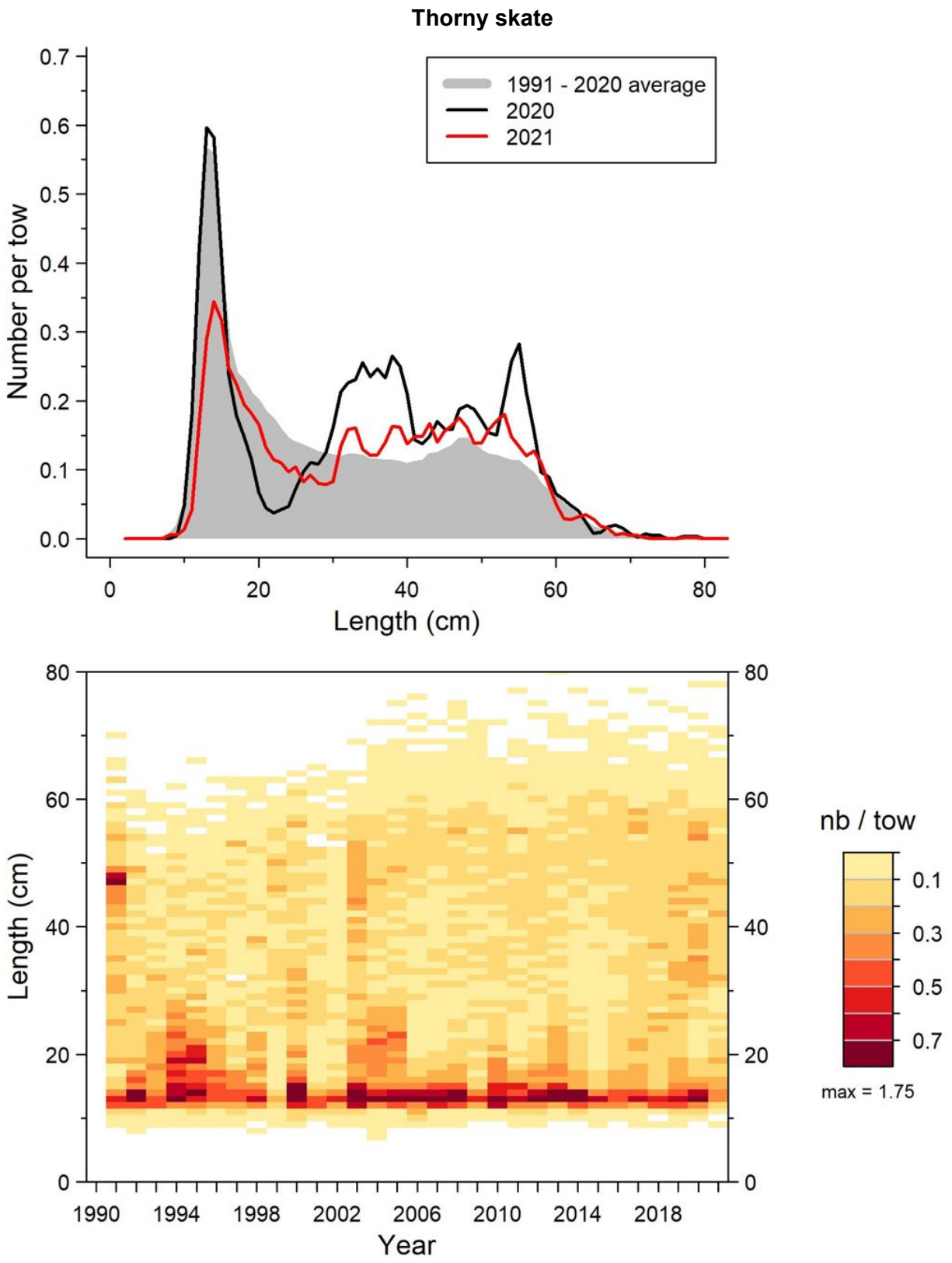

Figure 40. Length frequency distributions (mean number per 15 minute tow) observed during the survey for thorny skate in 4RST.

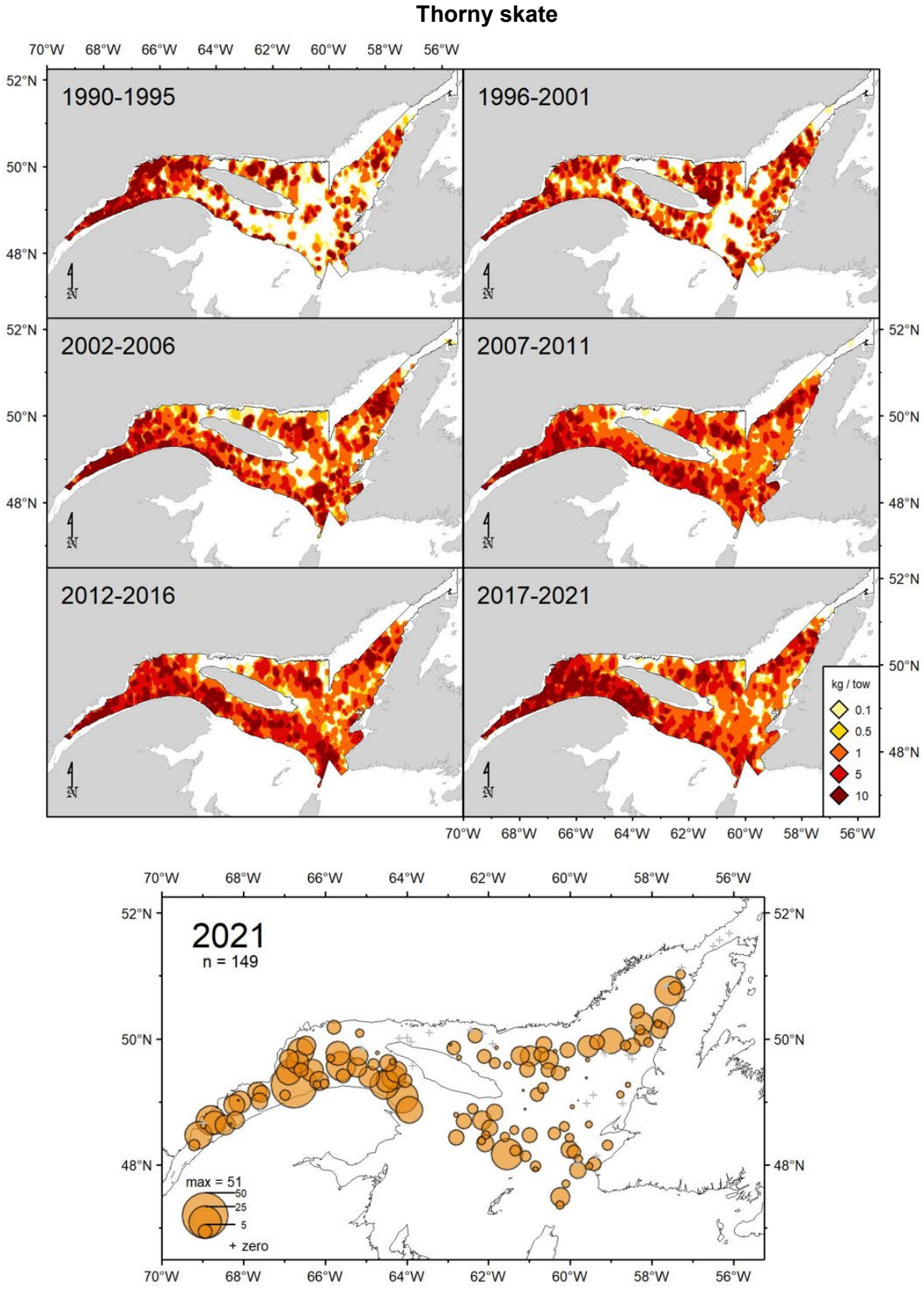

Figure 41. Thorny skate catch rates (kg/15 minute tow) distribution.

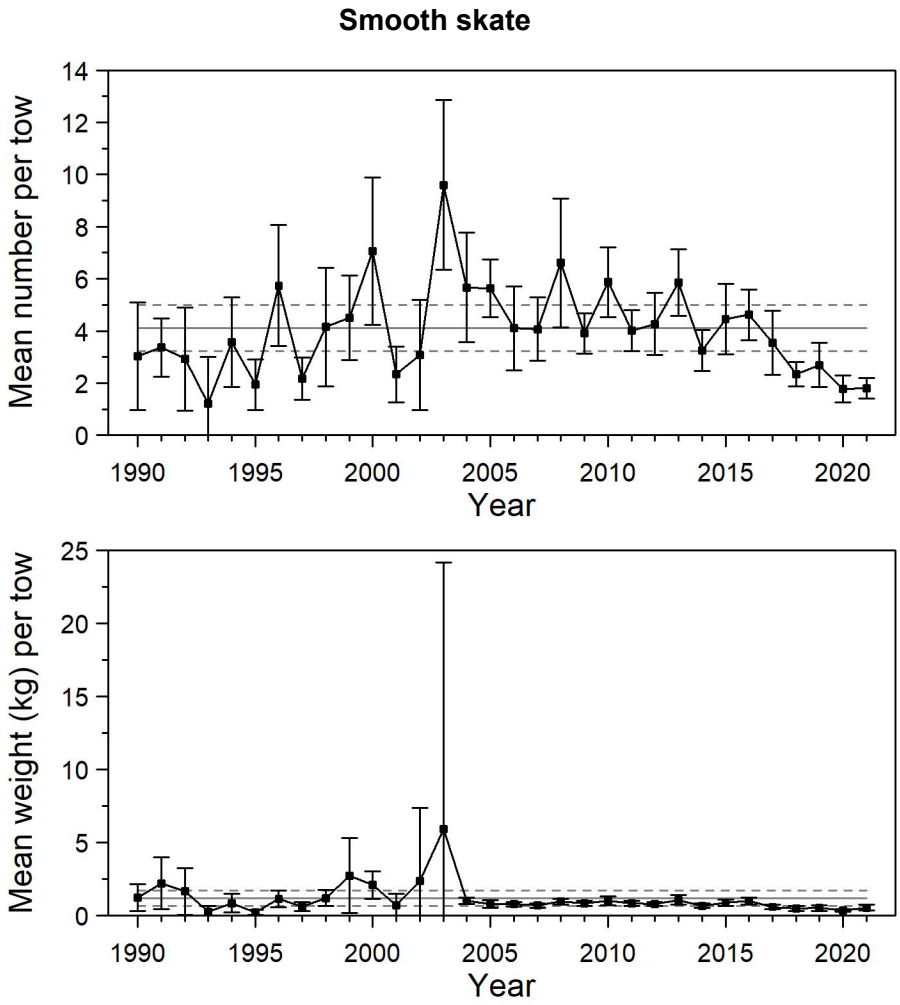

Figure 42. Mean numbers and mean weights per 15 minute tow observed during the survey for smooth skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

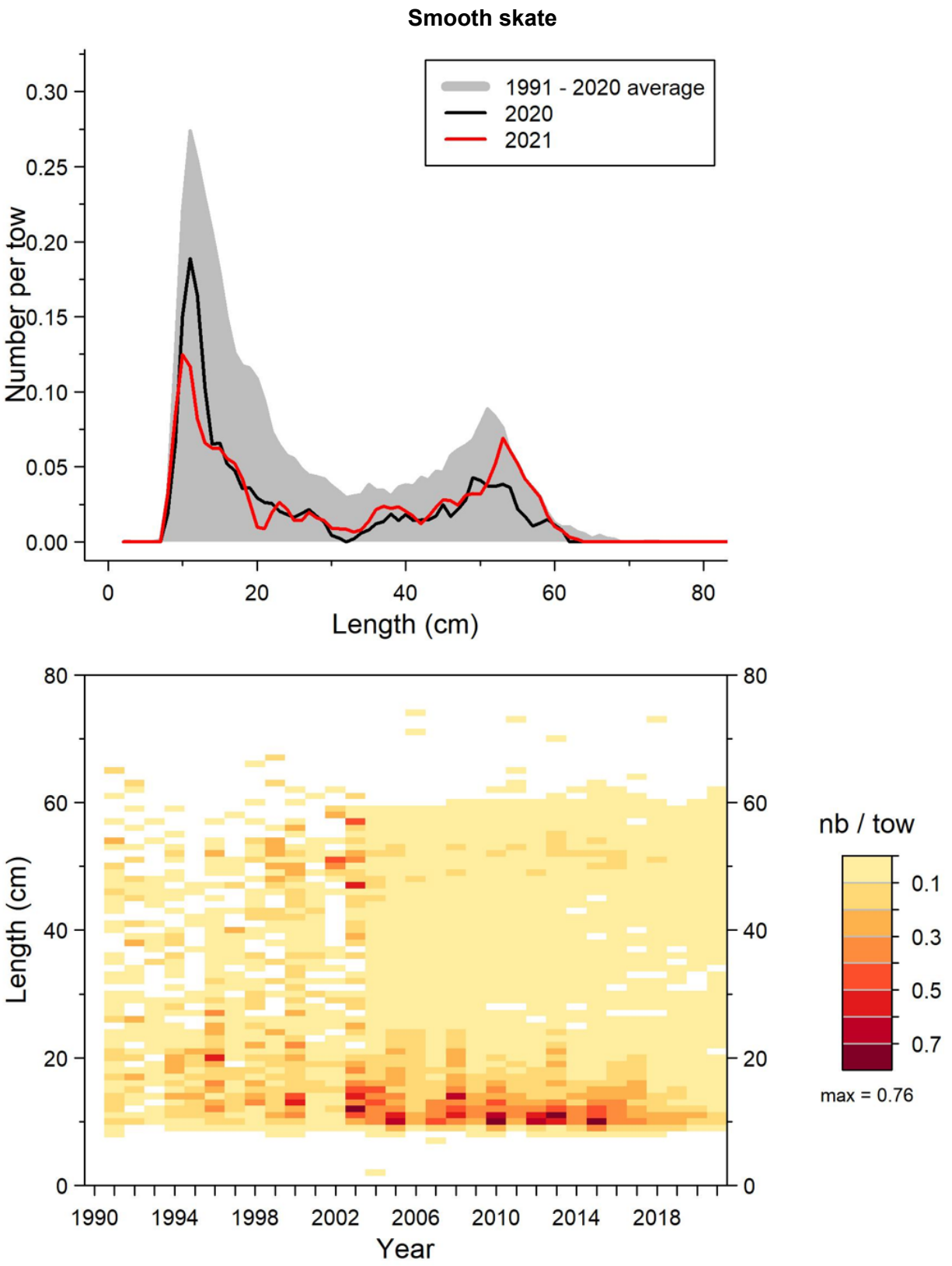

Figure 43. Length frequency distributions (mean number per 15 minute tow) observed during the survey for smooth skate in 4RST.

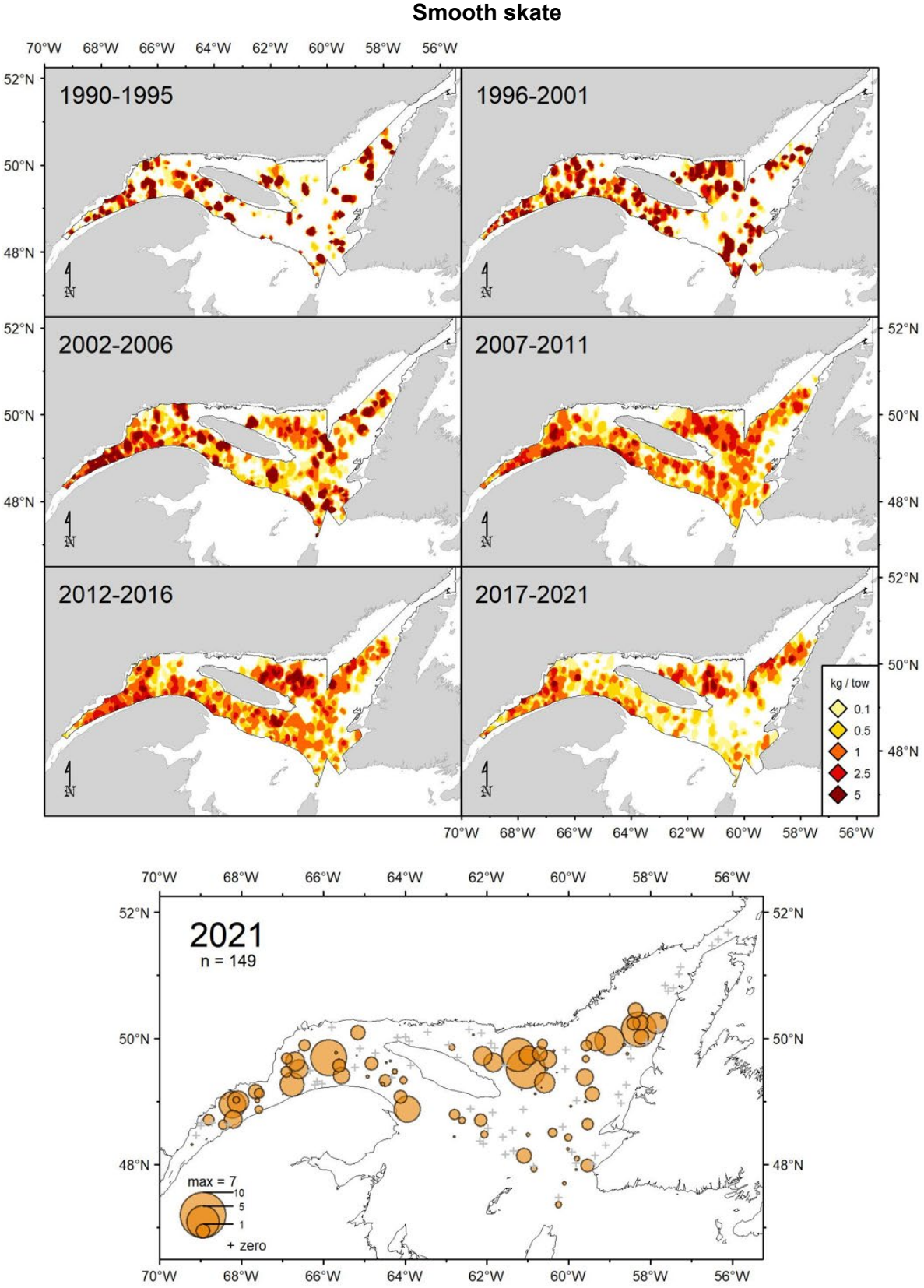

Figure 44. Smooth skate catch rates (kg/15 minute tow) distribution.

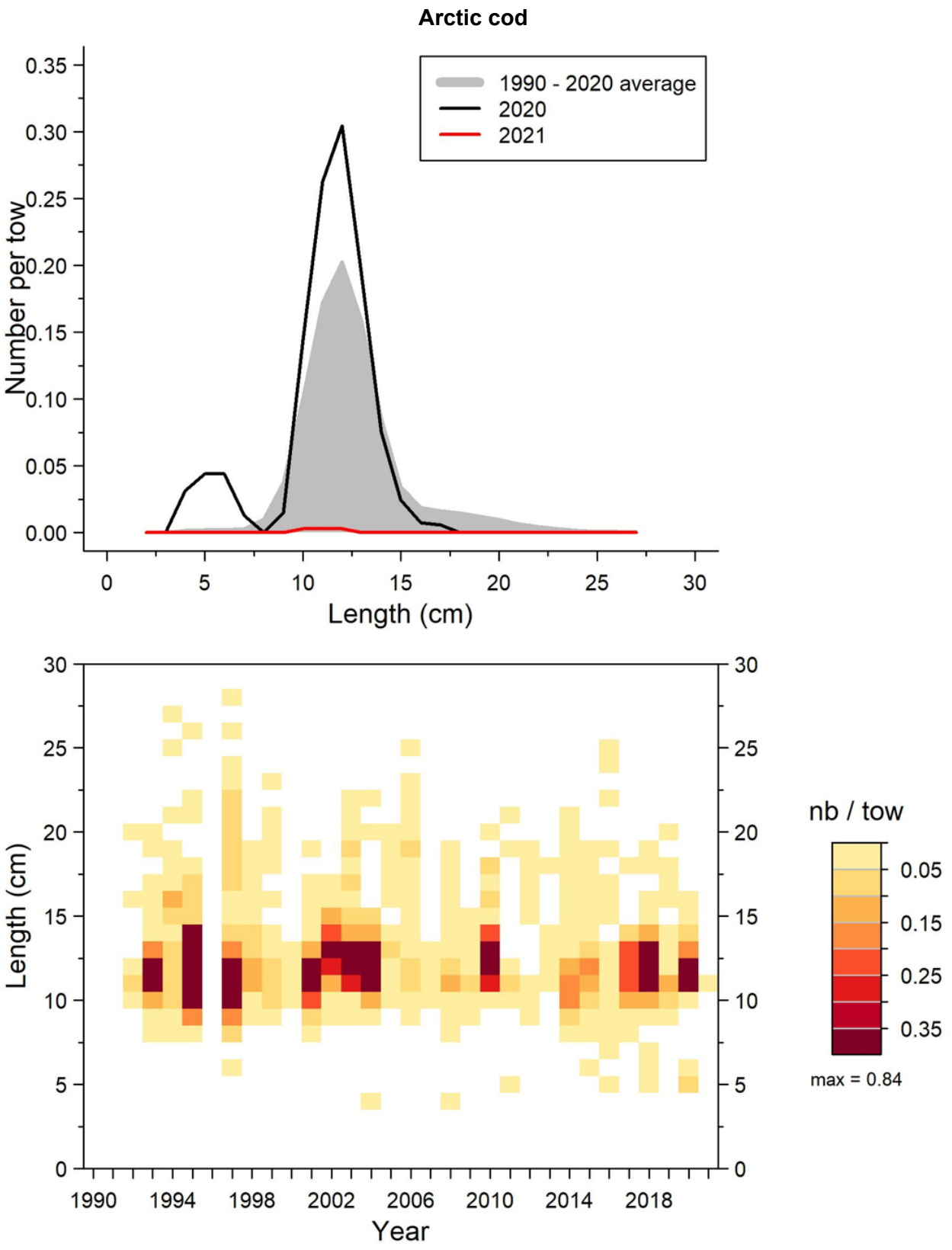

Figure 45. Length frequency distributions (mean number per 15 minute tow) observed during the survey for Arctic cod in 4RST.

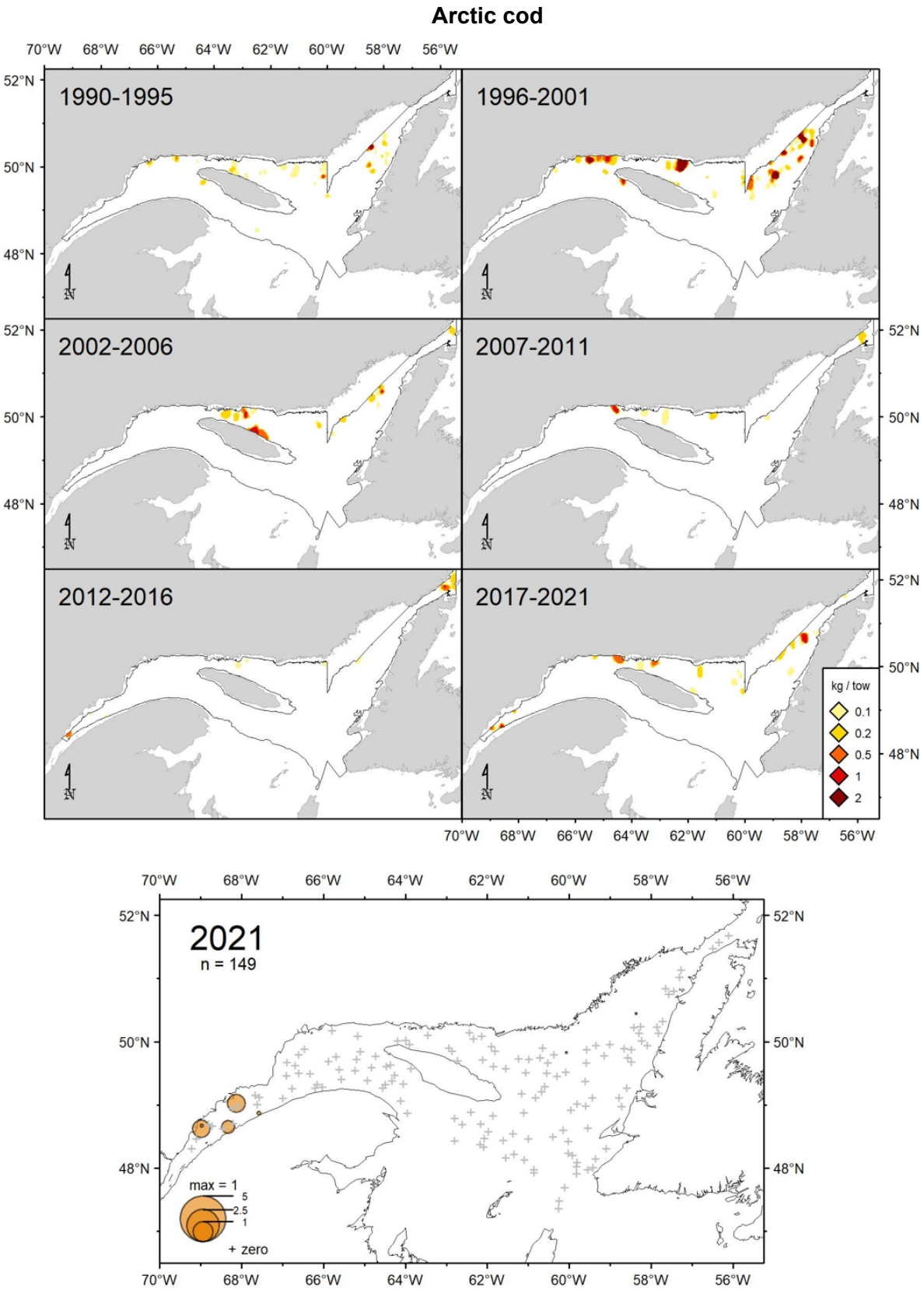

Figure 46. Arctic cod catch rates (kg/15 minute tow) distribution.

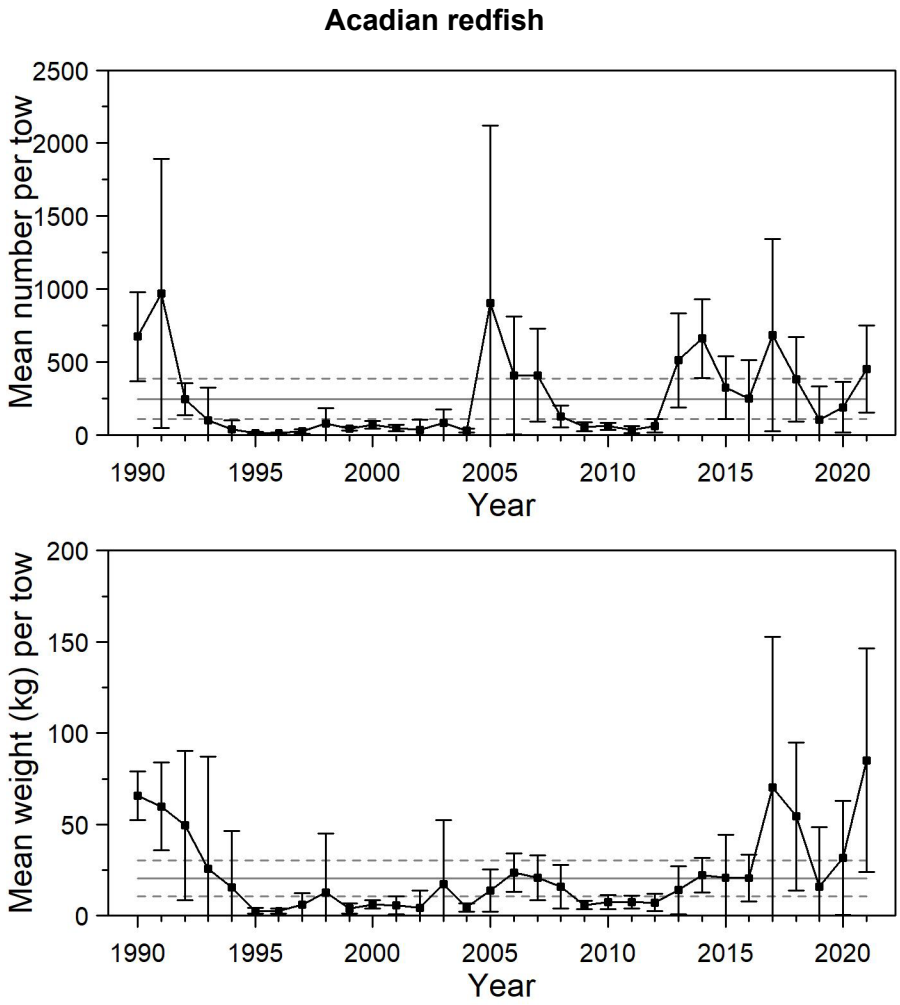

Figure 47. Mean numbers and mean weights per 15 minute tow observed during the survey for Acadian redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

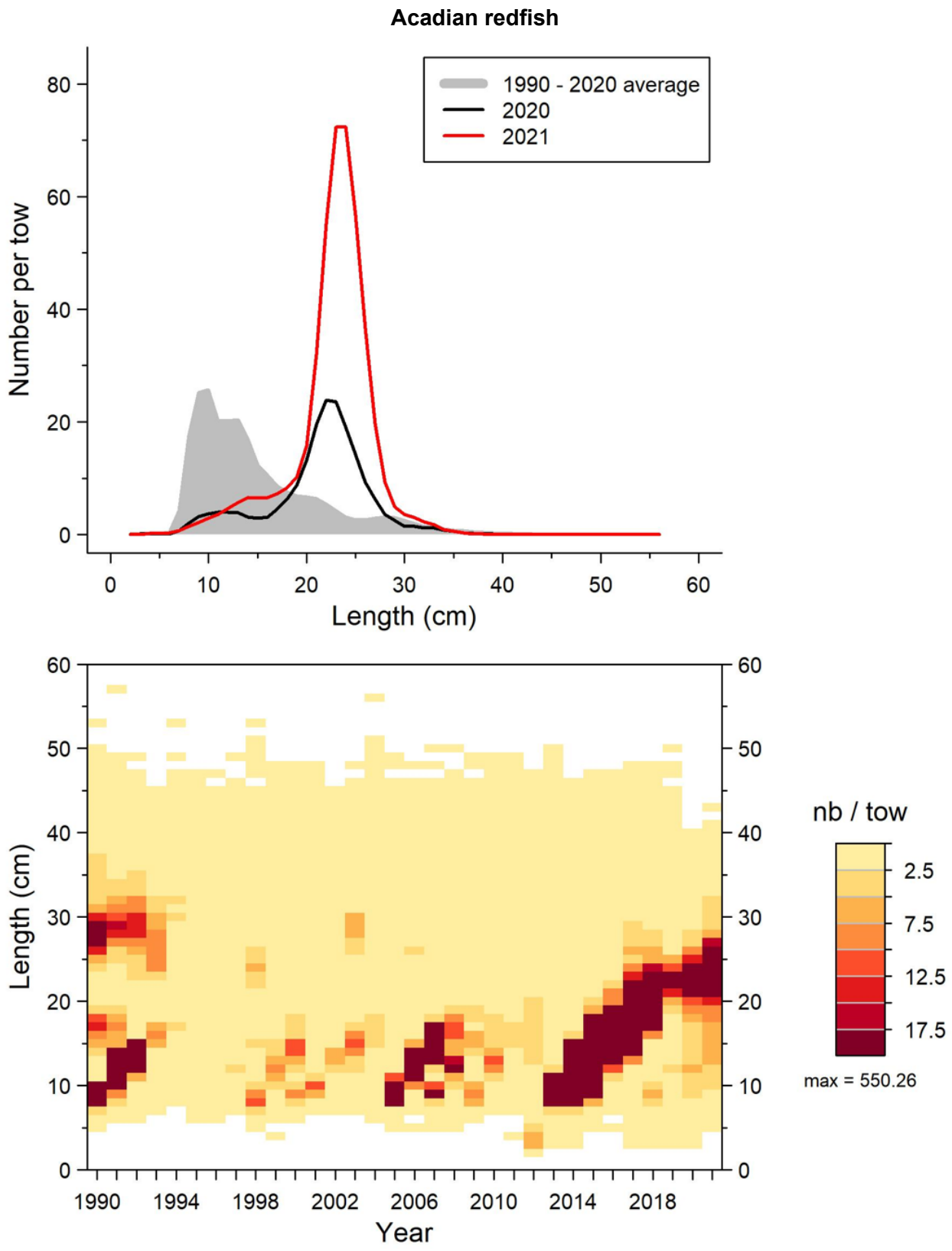

Figure 48. Length frequency distributions (mean number per 15 minute tow) observed during the survey for Acadian redfish in 4RST.

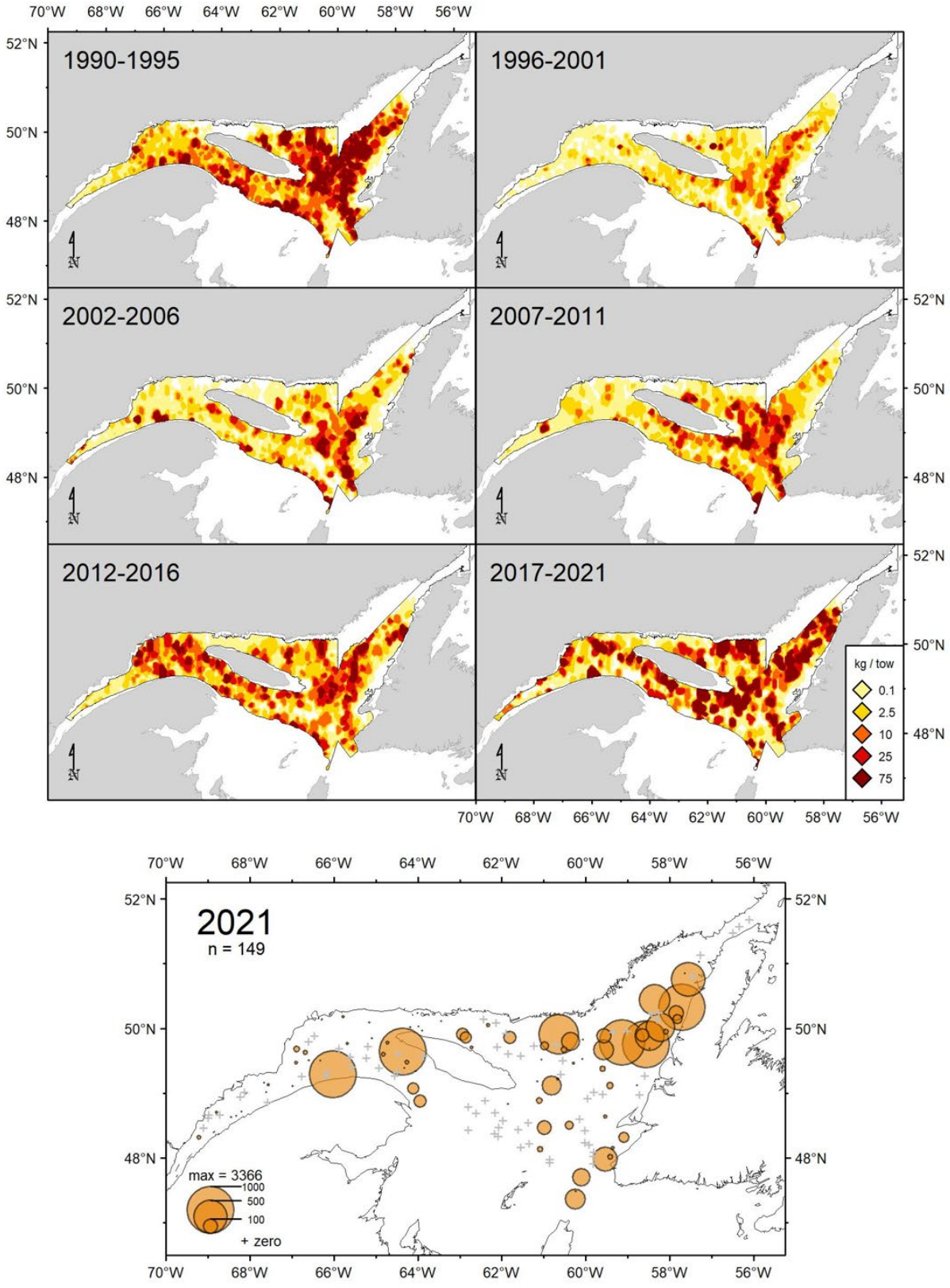

Figure 49. Acadian redfish catch rates (kg/15 minute tow) distribution.

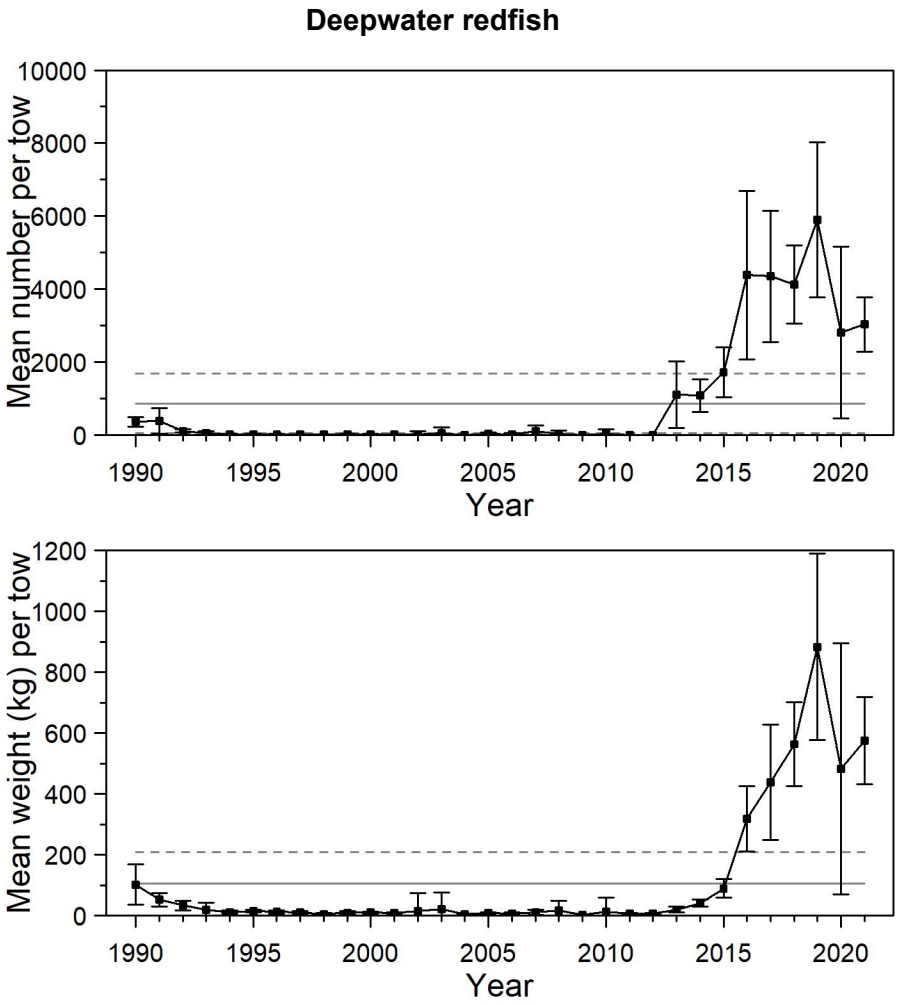

Figure 50. Mean numbers and mean weights per 15 minute tow observed during the survey for deepwater redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

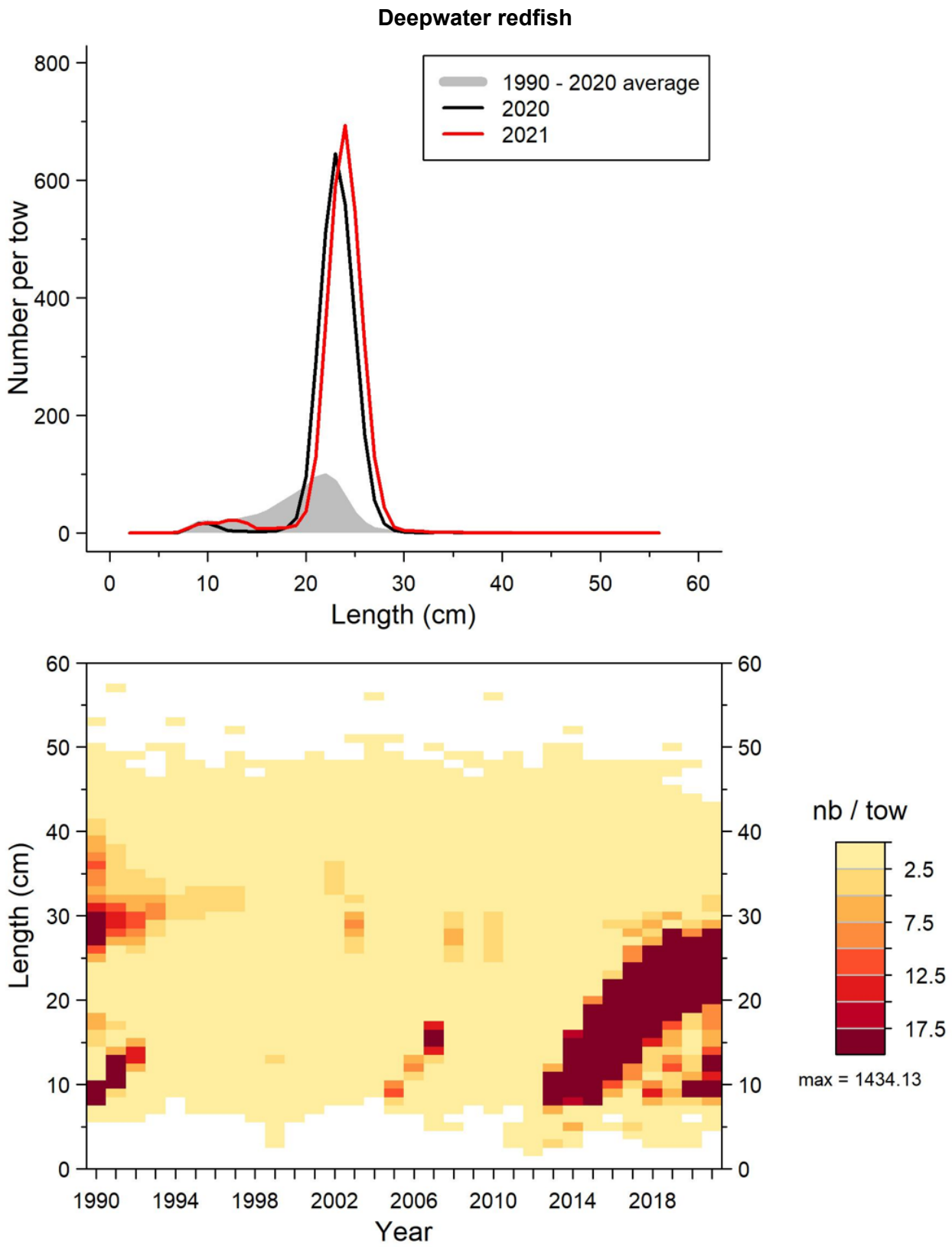

Figure 51. Length frequency distributions (mean number per 15 minute tow) observed during the survey for deepwater redfish in 4RST.

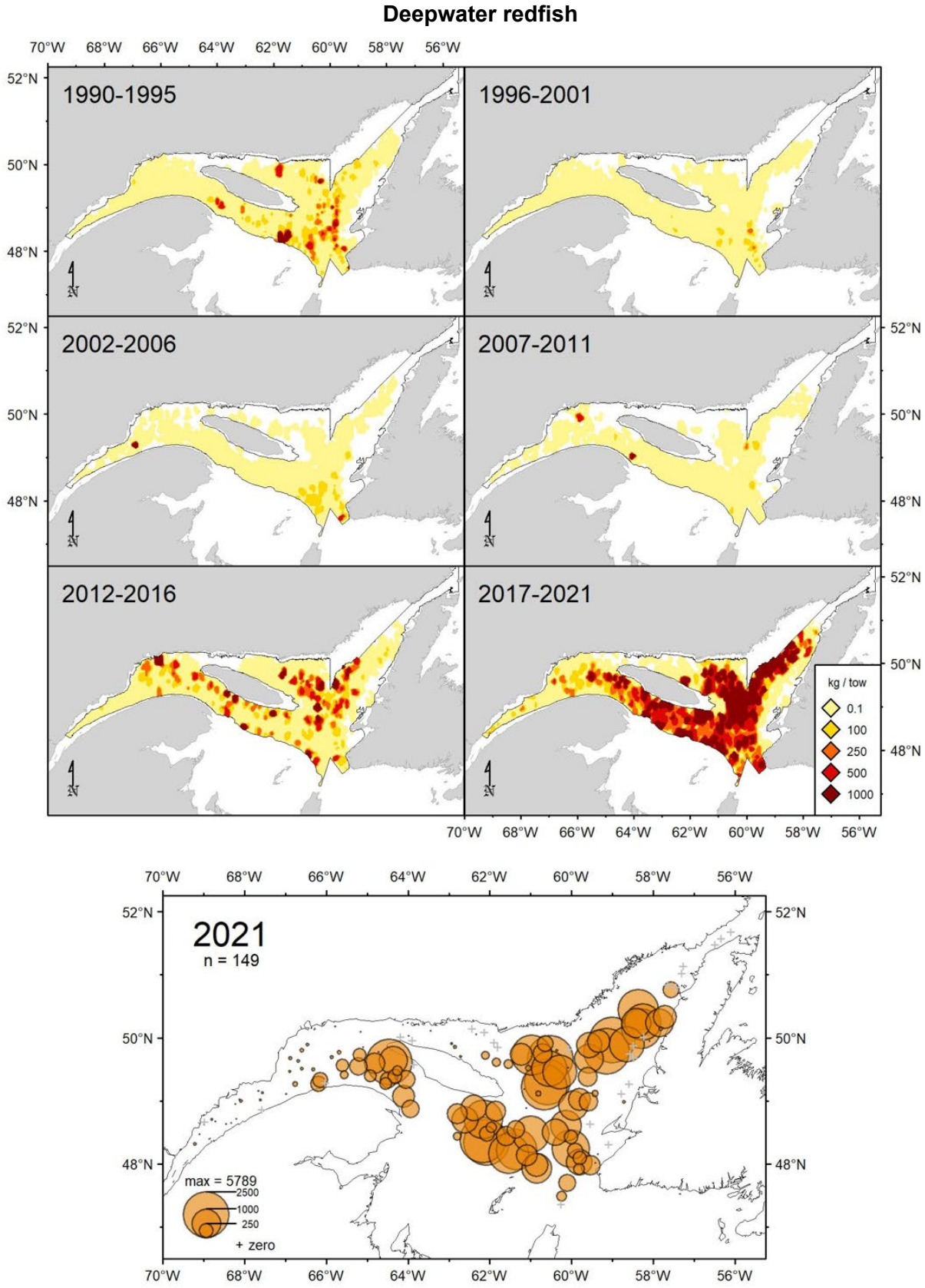

Figure 52. Deepwater redfish catch rates (kg/15 minute tow) distribution.

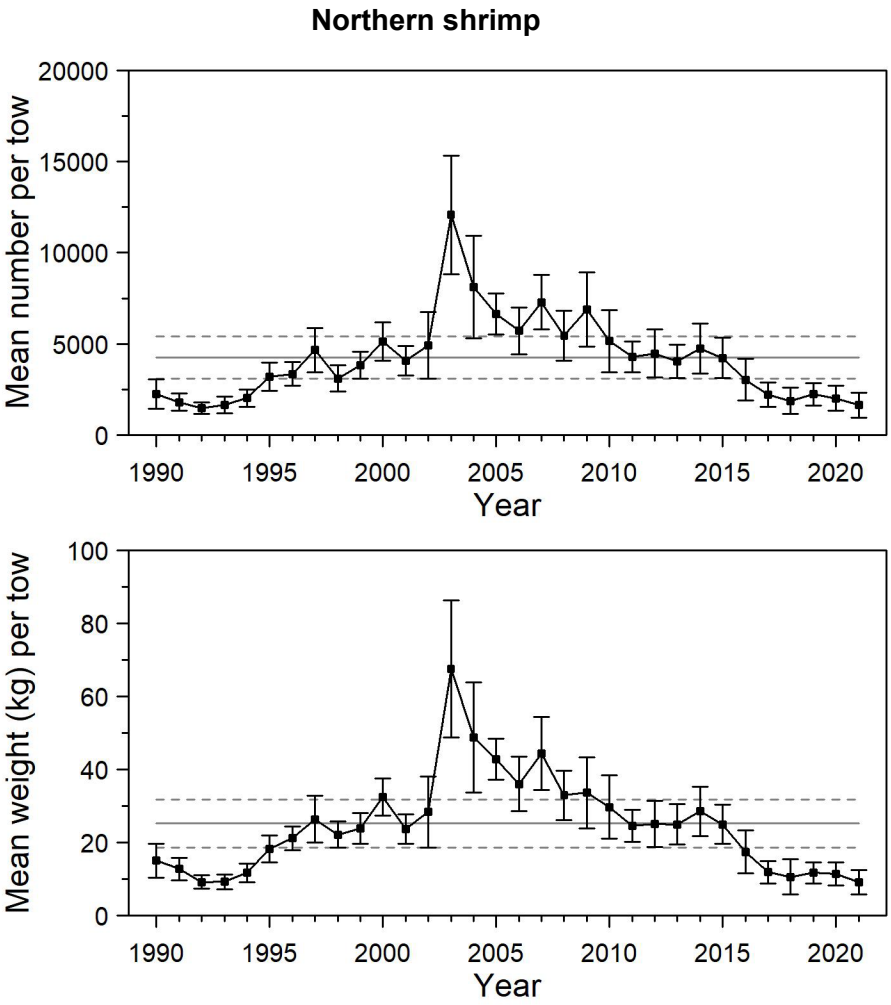

Figure 53. Mean numbers and mean weights per 15 minute tow observed during the survey for northern shrimp in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

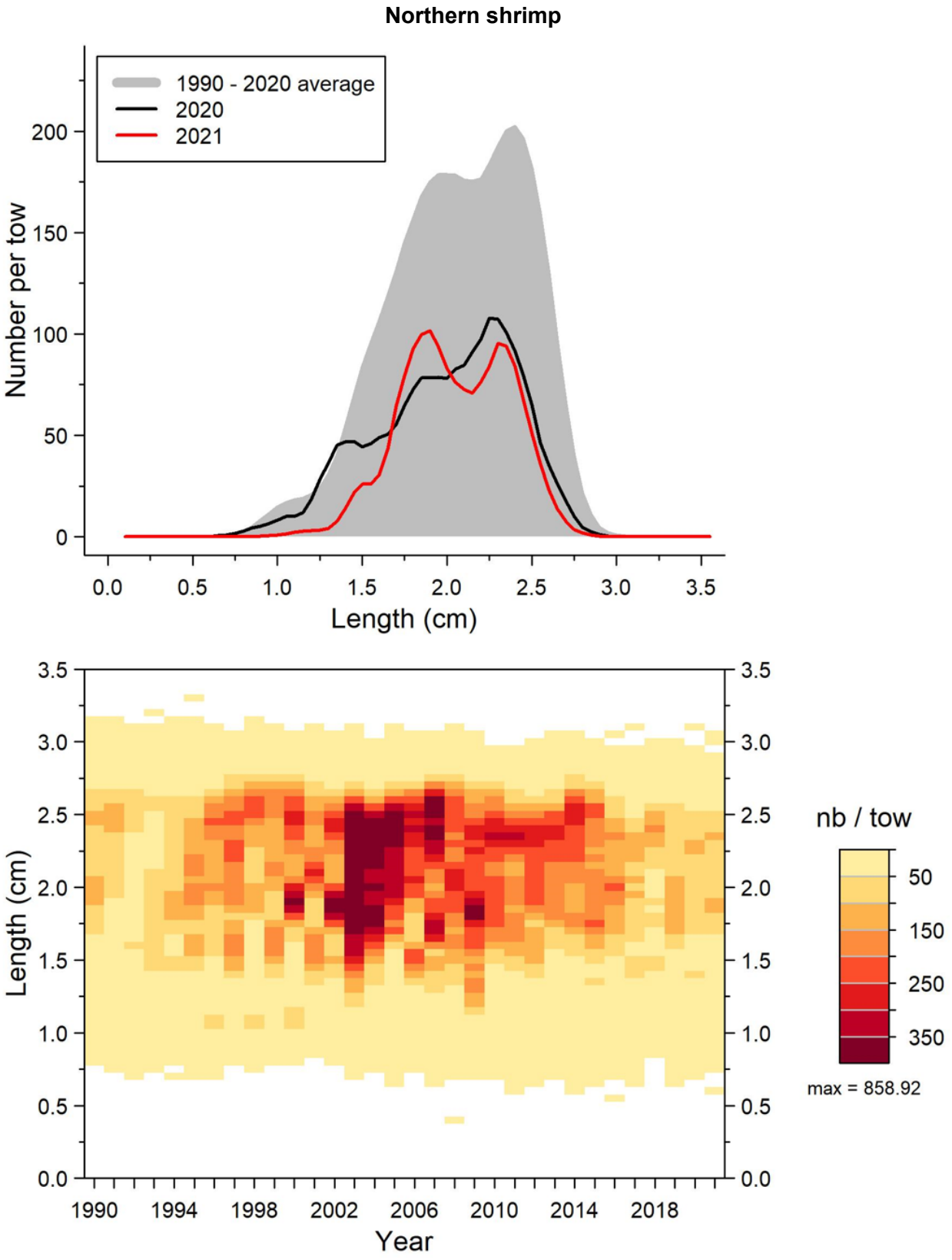

Figure 54. Carapace length frequency distributions (mean number per 15 minute tow) observed during the survey for northern shrimp in 4RST.

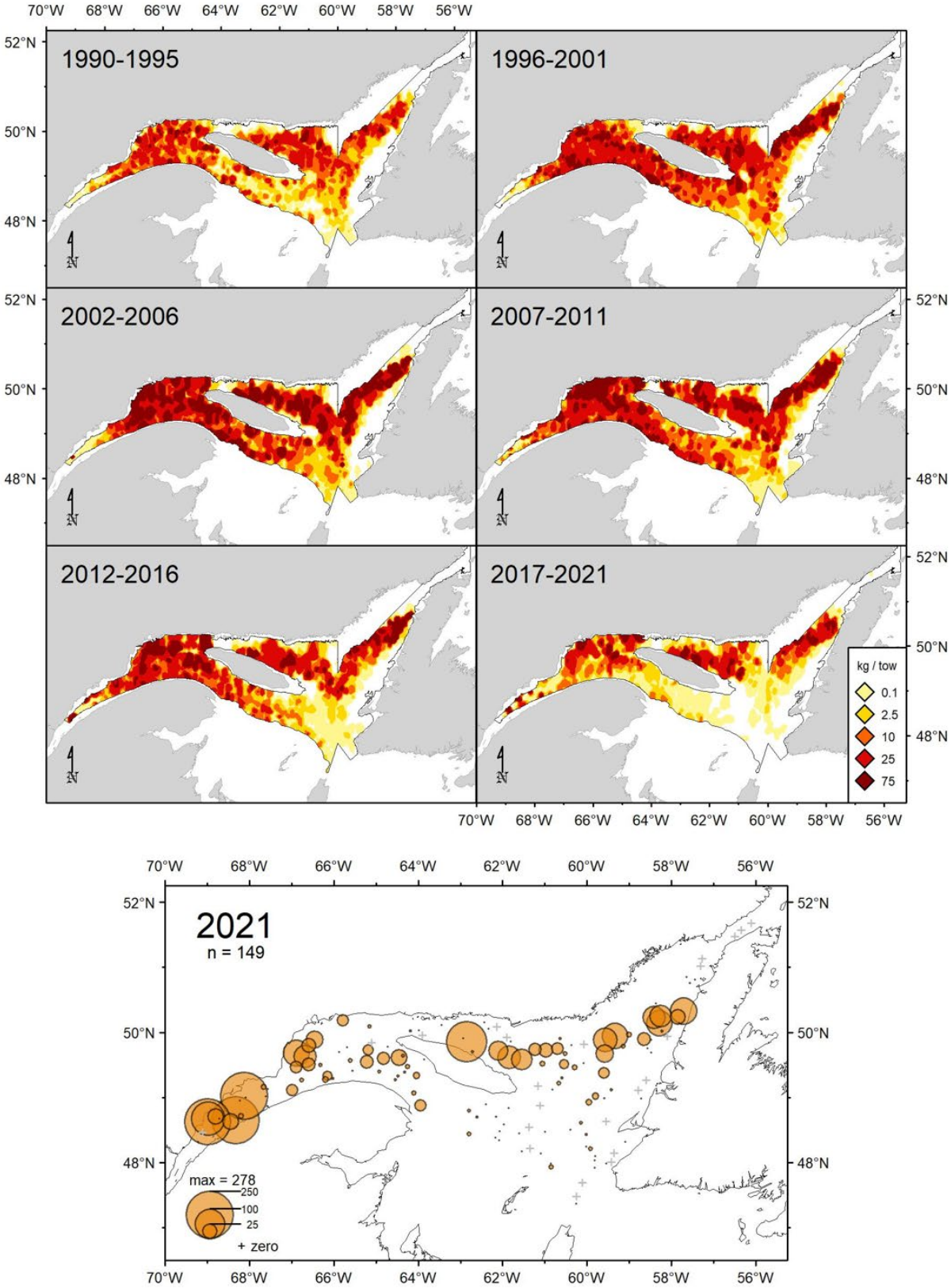

Figure 55. Northern shrimp catch rates (kg/15 minute tow) distribution.

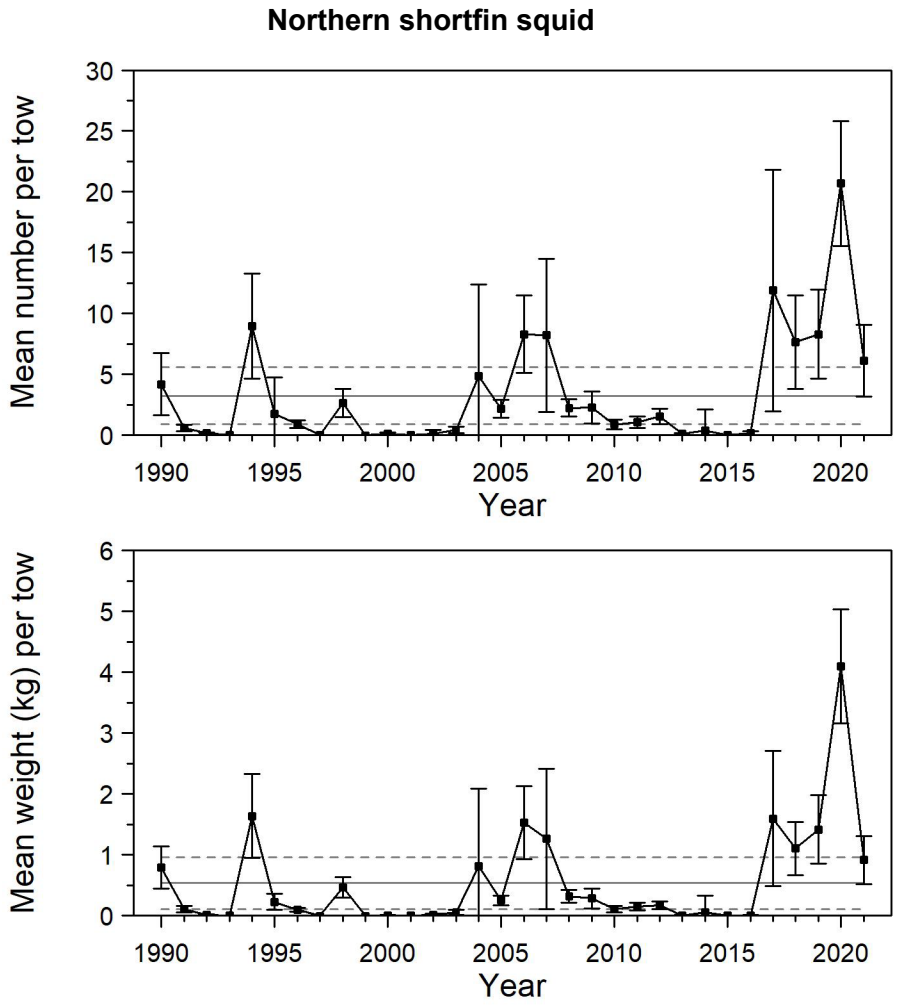

Figure 56. Mean numbers and mean weights per 15 minute tow observed during the survey for northern shortfin squid in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990–2020 period (solid line) and upper and lower reference (see text) limits (dashed lines).

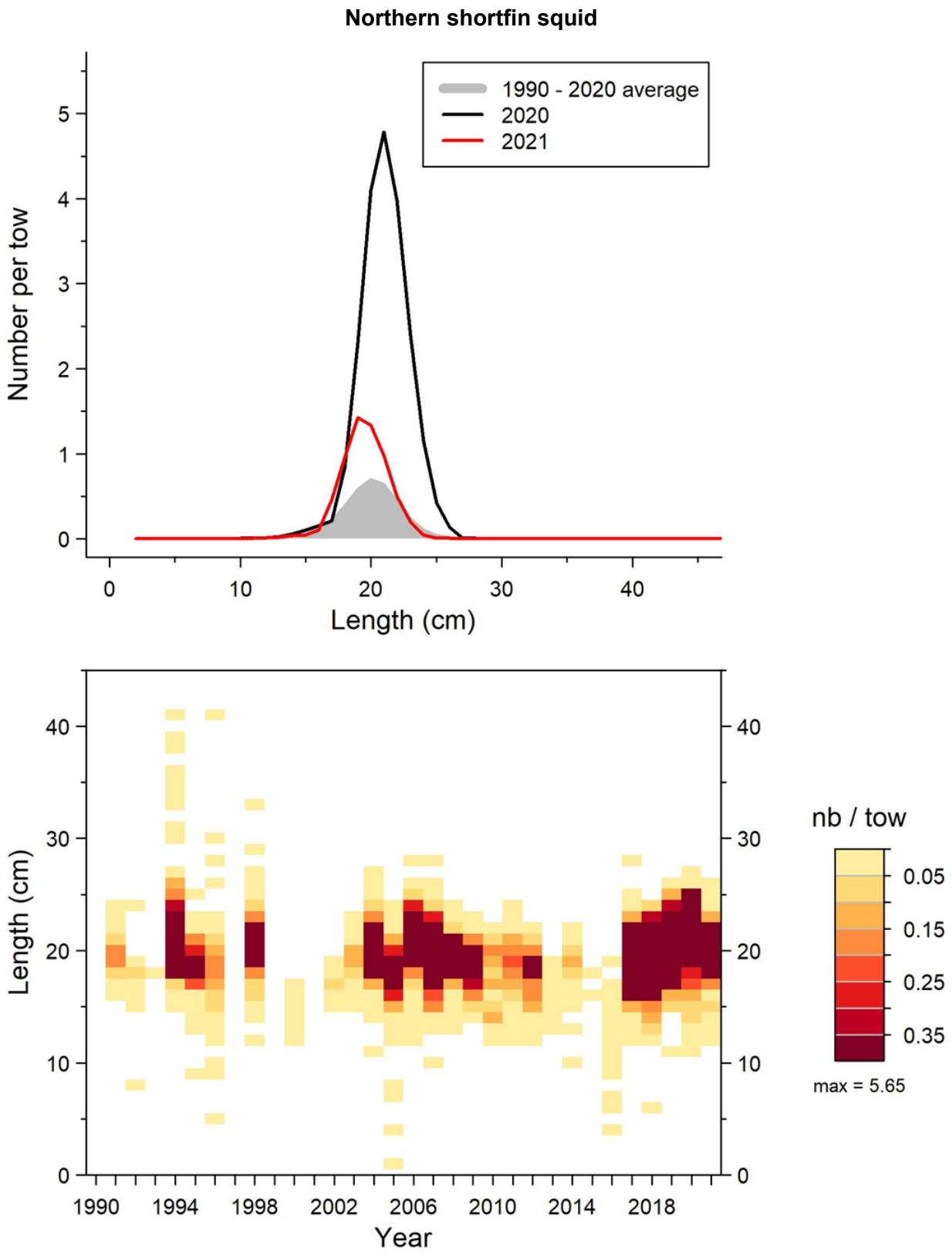

Figure 57. Mantle length frequency distributions (mean number per 15 minute tow) observed during the survey for northern shortfin squid in 4RST.

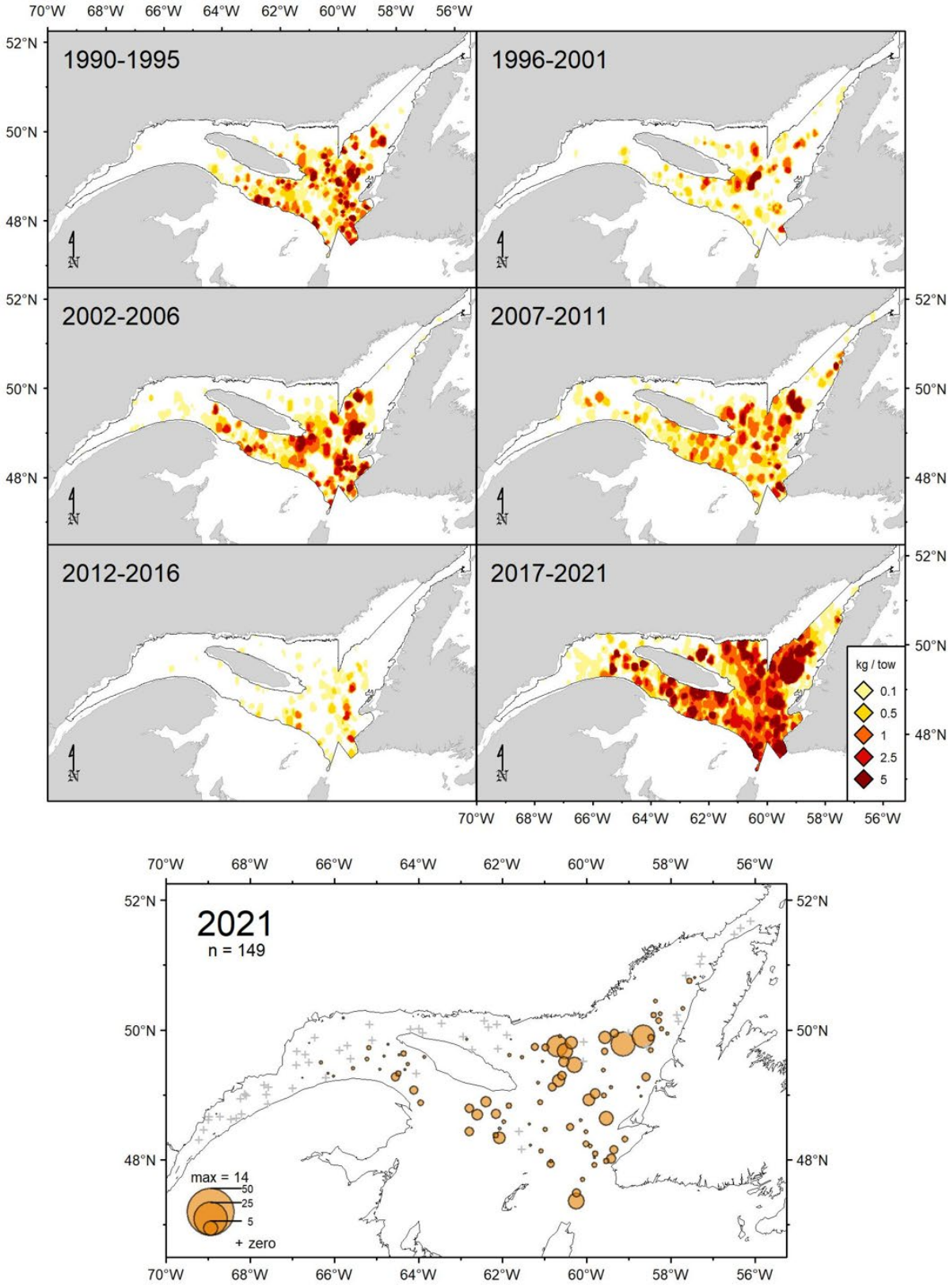

Figure 58. Northern shortfin squid catch rates (kg/15 minute tow) distribution.

Sea pen (*Anthoptilum grandiflorum*)

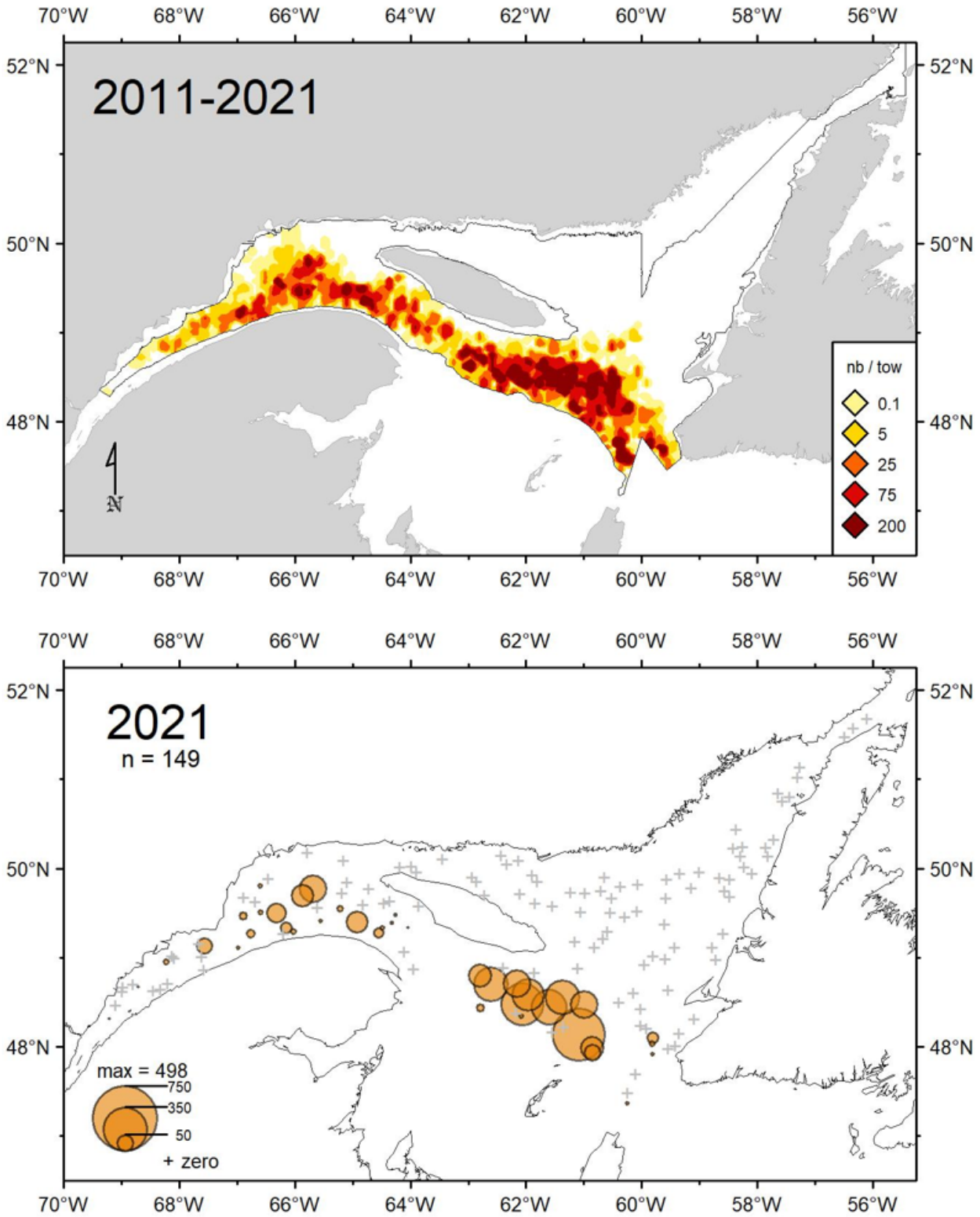

Figure 59. Sea pen (Anthoptilum grandiflorum) catch rates (nb/15 minute tow) distribution.

Sea pen (*Halipteris finmarchica*)

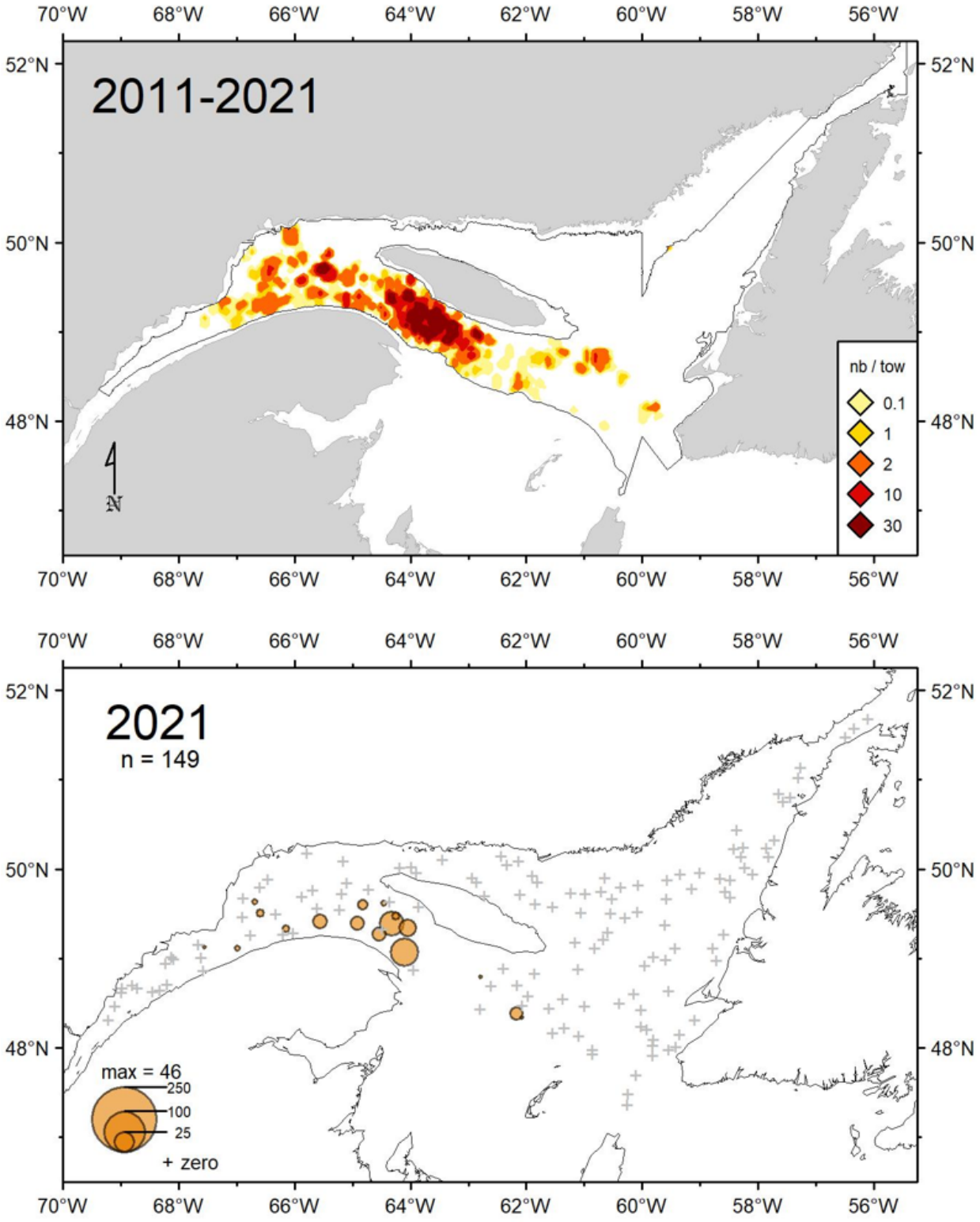

Figure 60. Sea pen (Halipteris finmarchica) catch rates (nb/15 minute tow) distribution.

Sea pen (*Pennatula aculeata*)

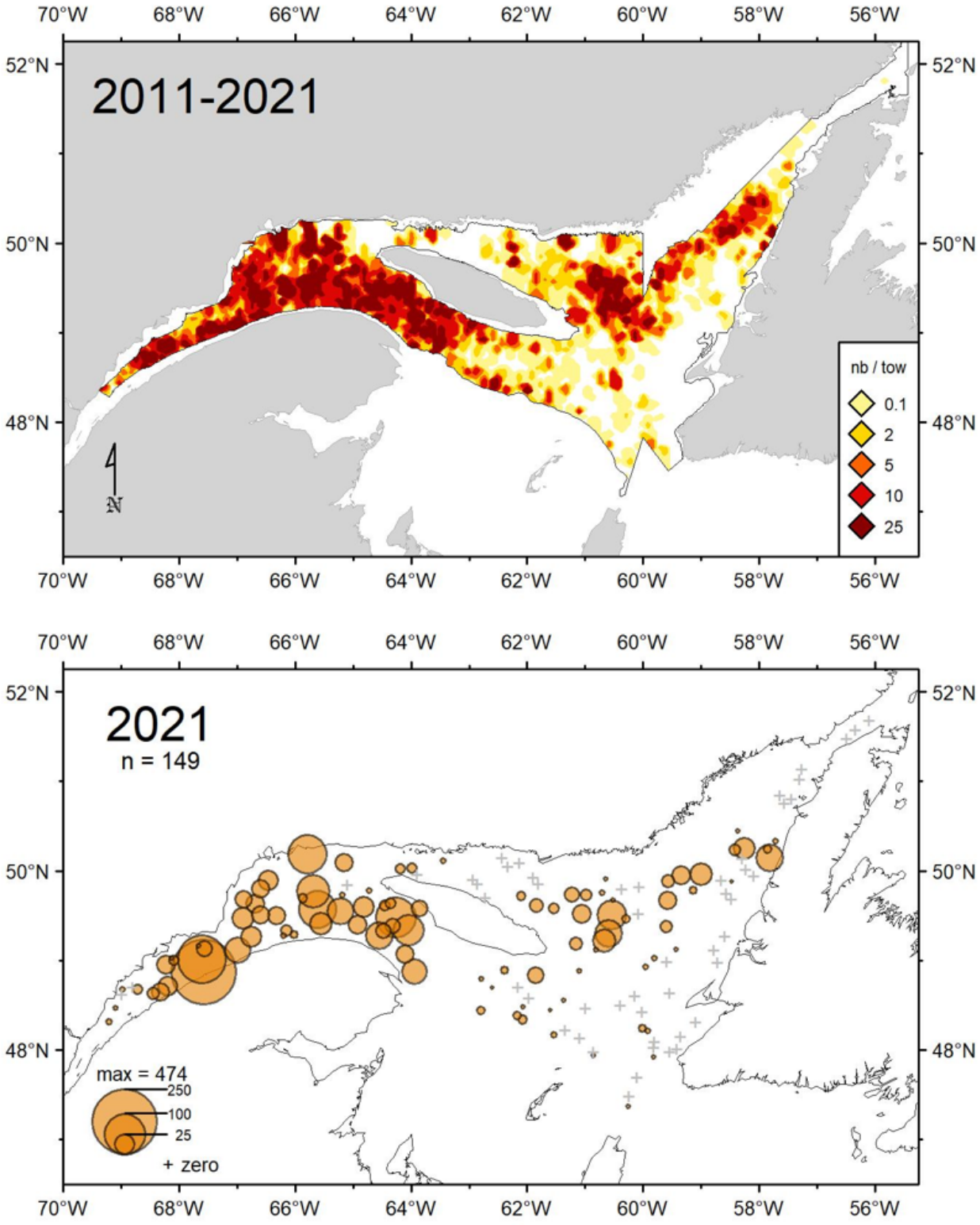

Figure 61. Sea pen (Pennatula aculeate) catch rates (nb/15 minute tow) distribution.

Sea pen (*Ptilella grandis*)

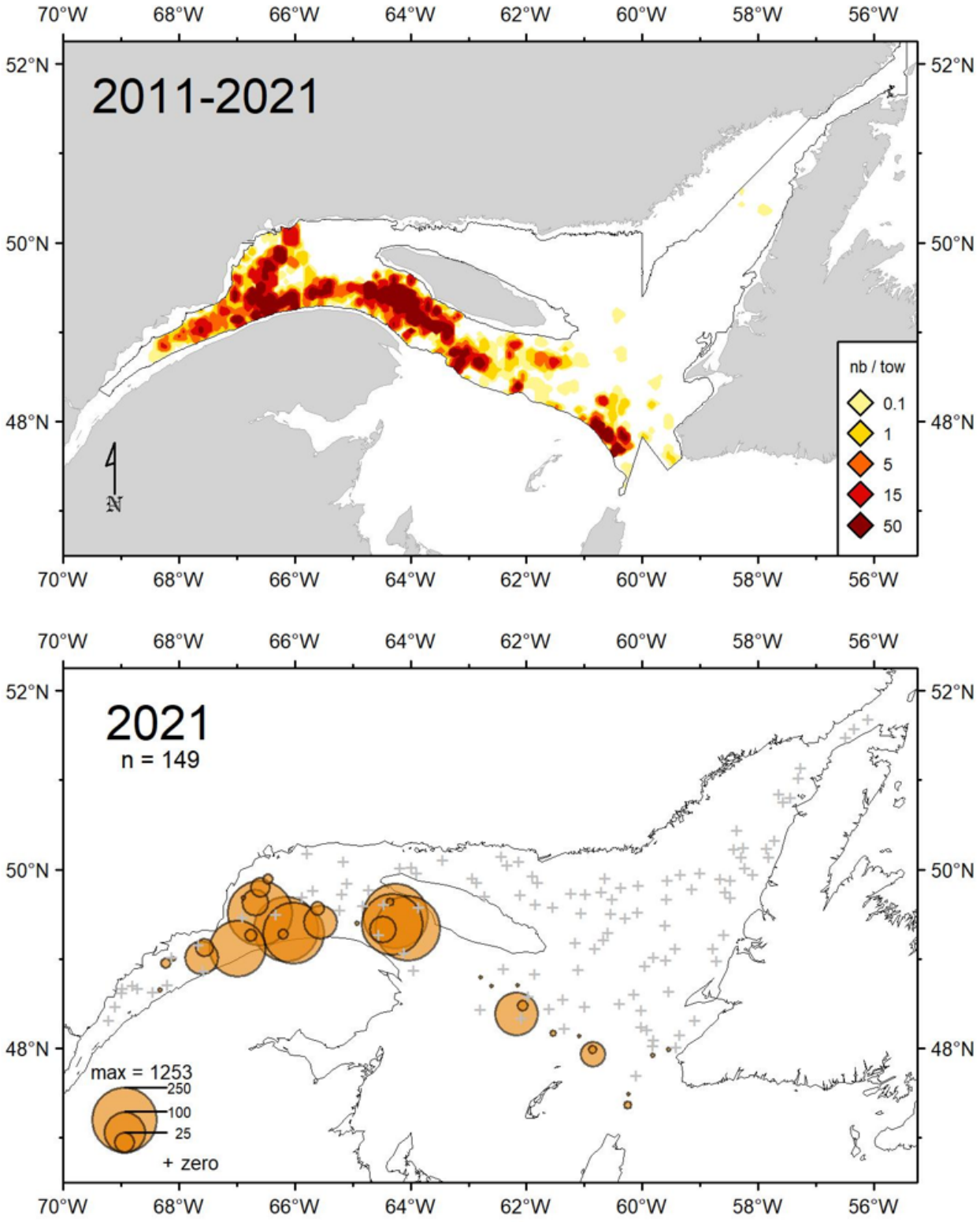

Figure 62. Sea pen (Ptilella grandis) catch rates (nb/15 minute tow) distribution.

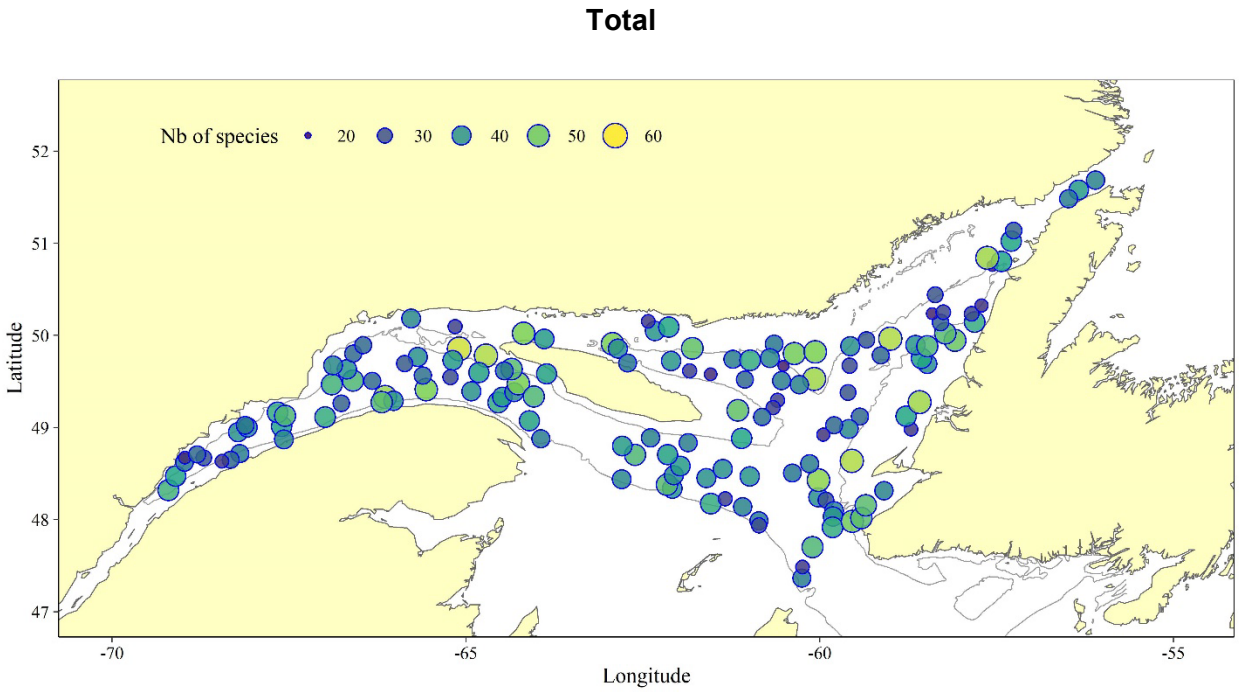

Figure 63. Species richness expressed as the number of species collected per station.

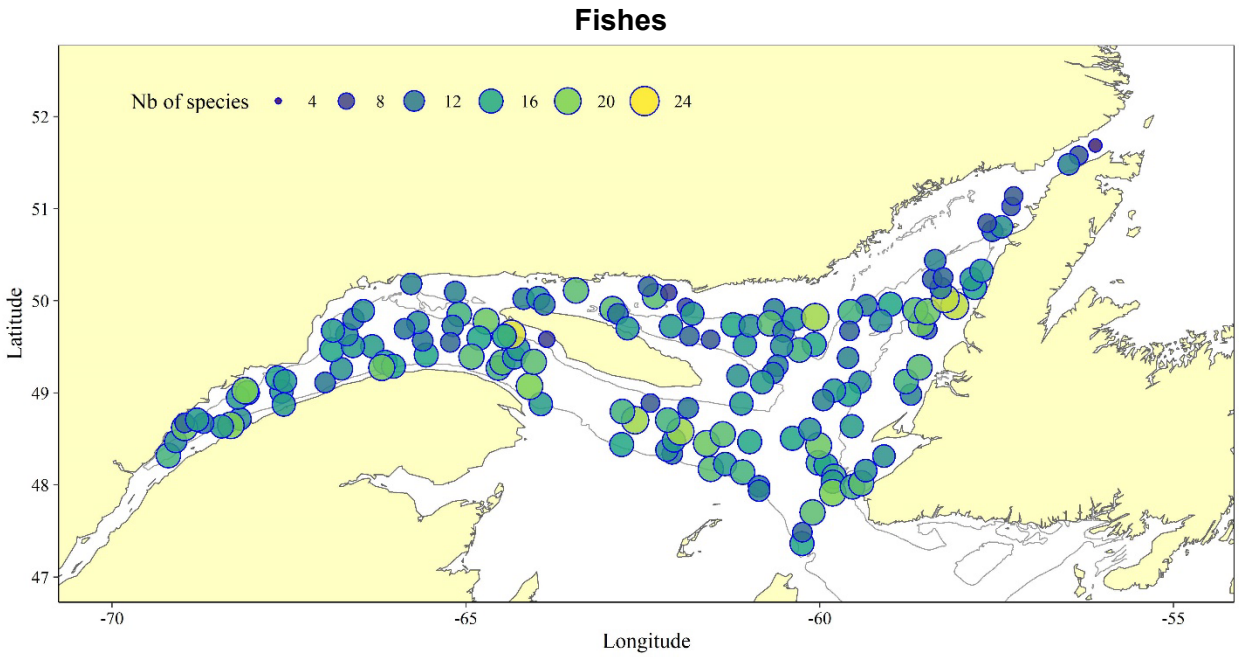

Figure 64. Species richness expressed as the number of species collected per station for the fish grouping.

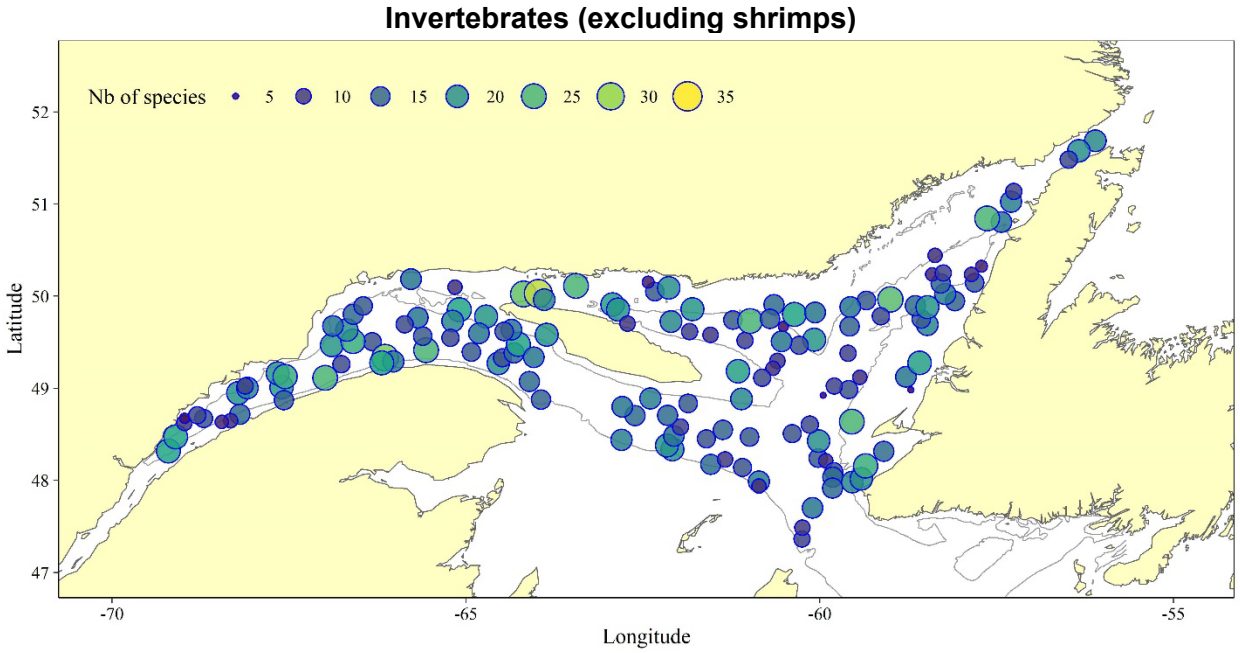

Figure 65. Species richness expressed as the number of species collected by station for the invertebrates grouping excluding the shrimps.

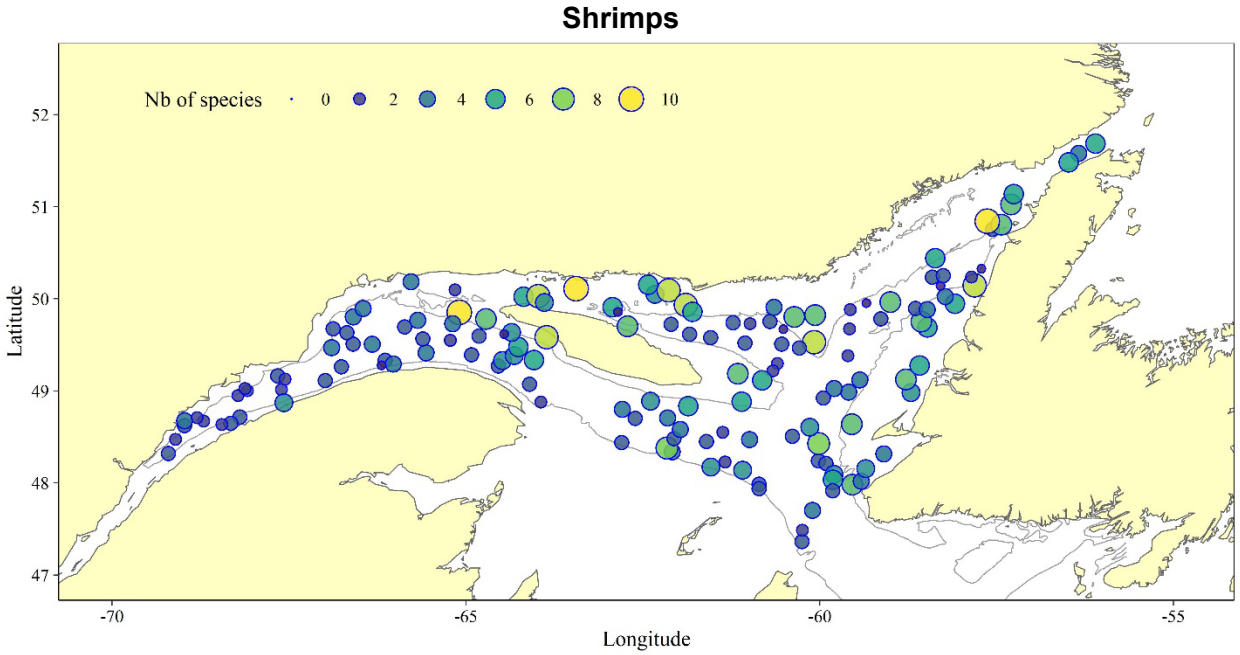

Figure 66. Species richness expressed as the number of species collected by station for the shrimps grouping.

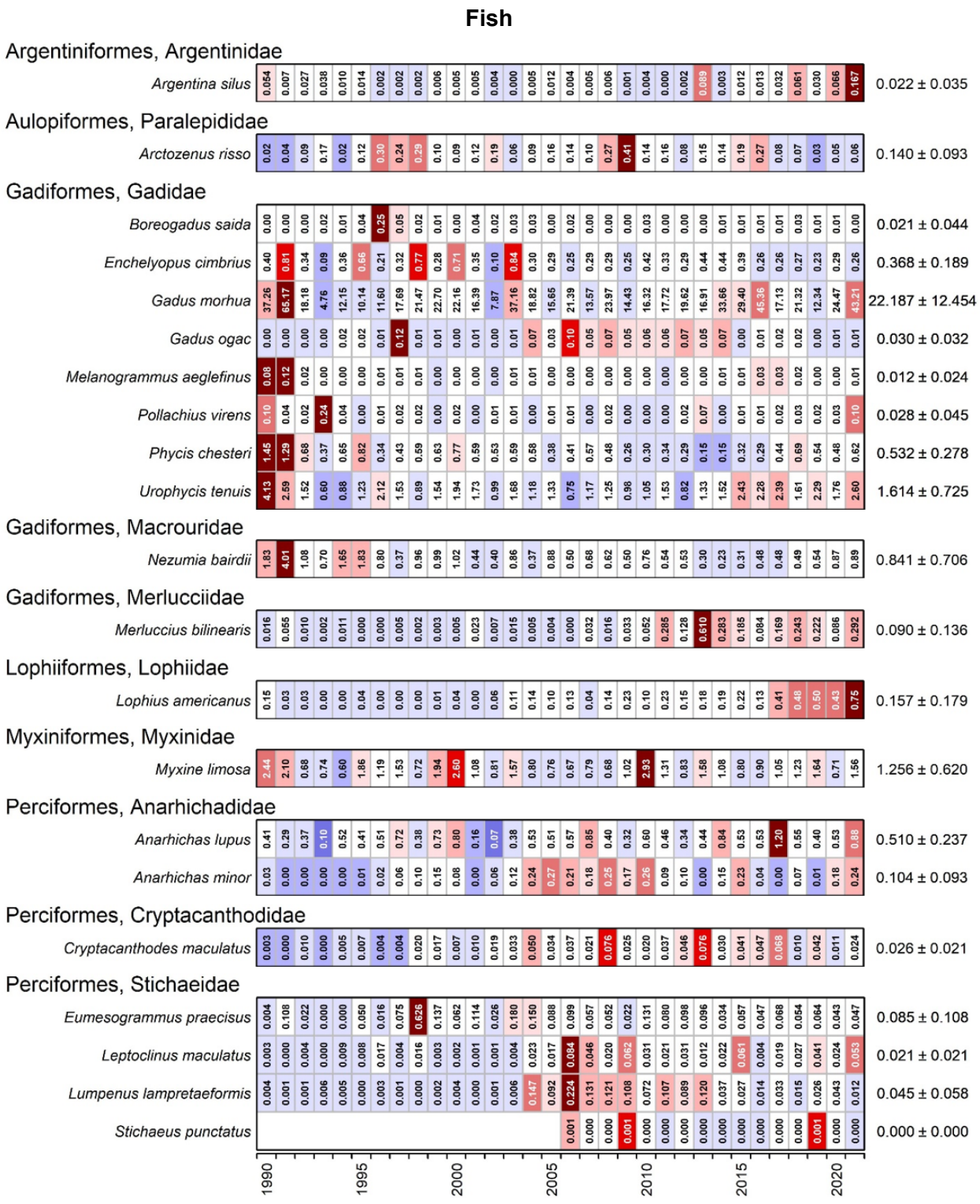

Figure 67. Average weight of fish taxa per 15-minute tow observed during the survey. The colour code represents the anomaly value, which corresponds to the difference between the CPUE in a given year and the average CPUE of the time series for each taxon divided by the standard deviation of this average.

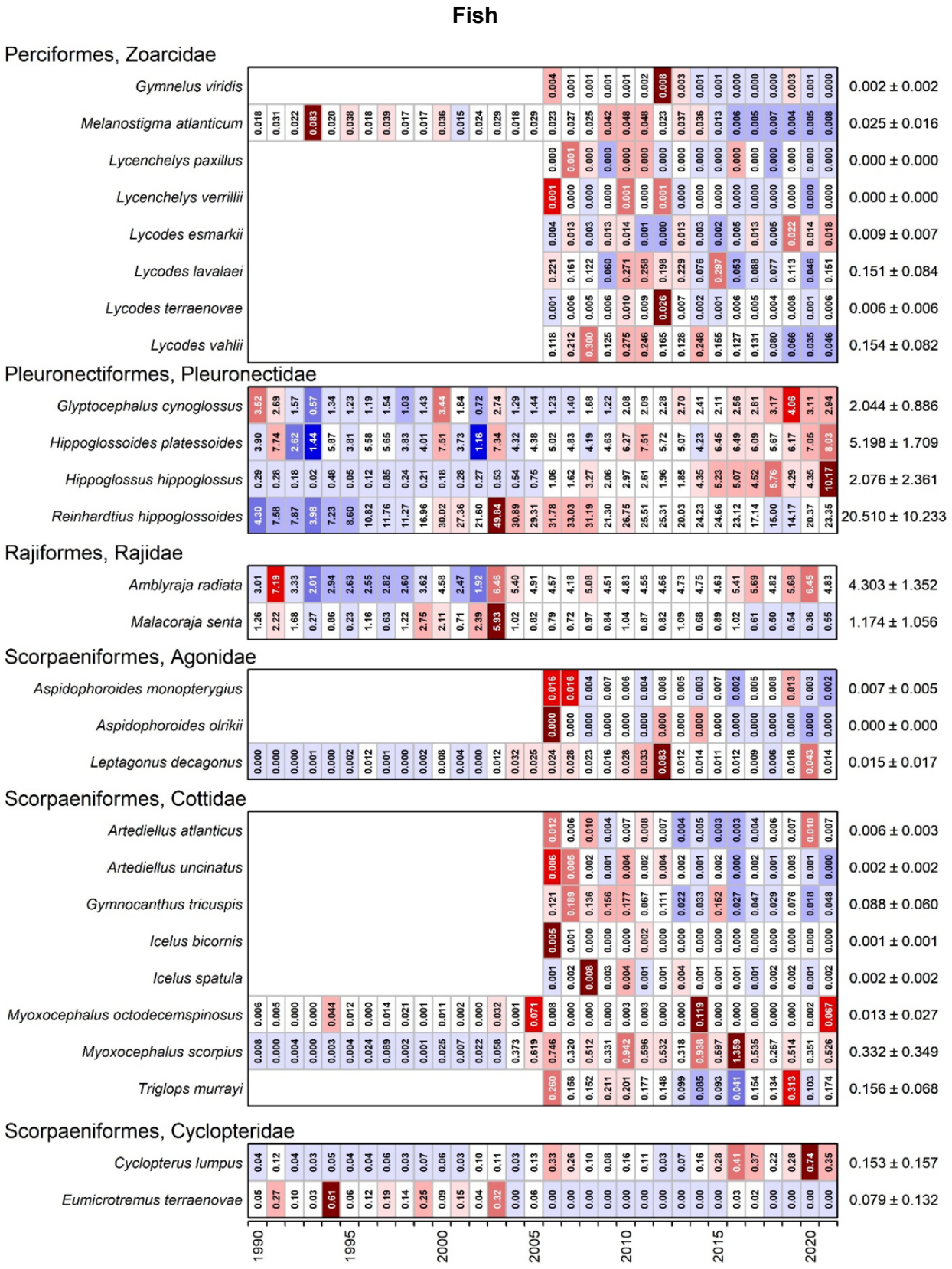

Figure 67. Continued.

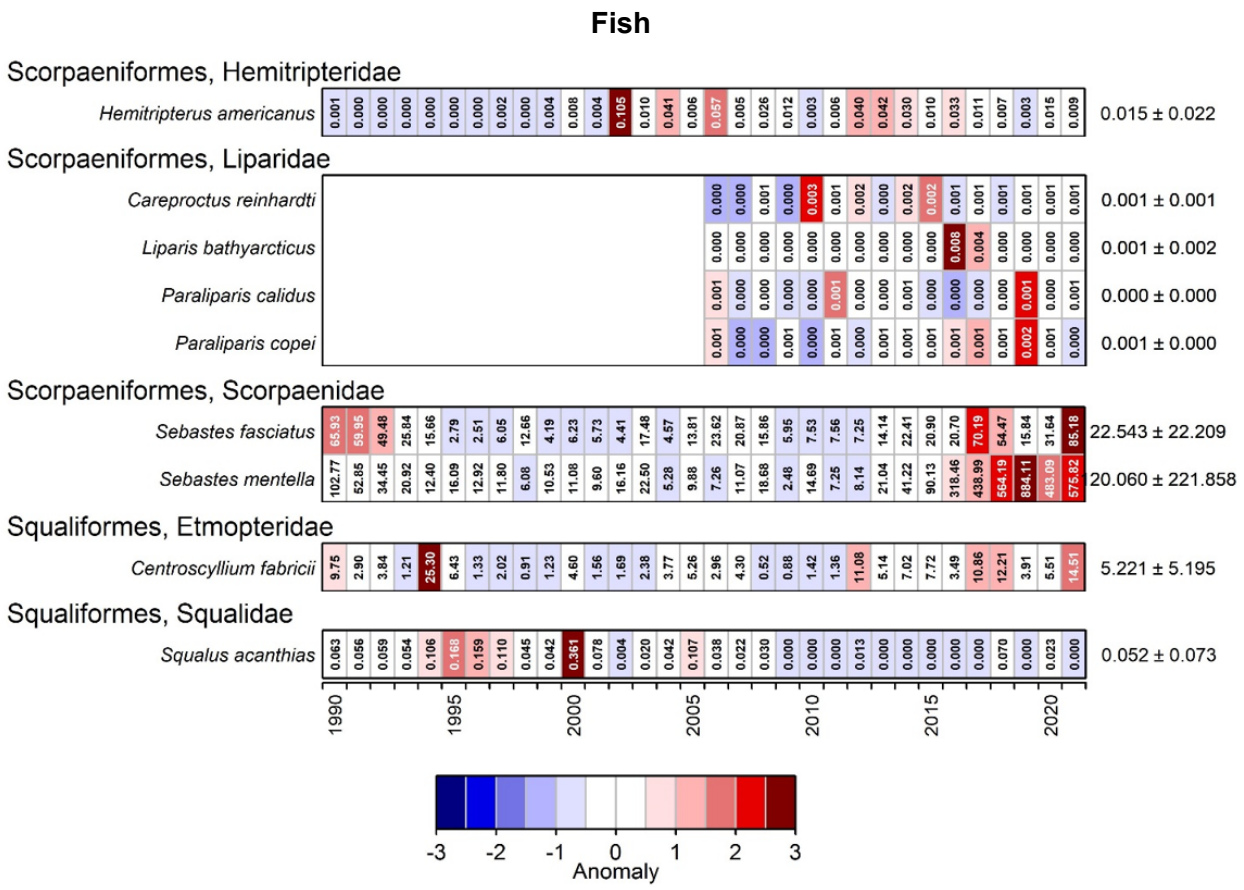

Figure 67. Continued.

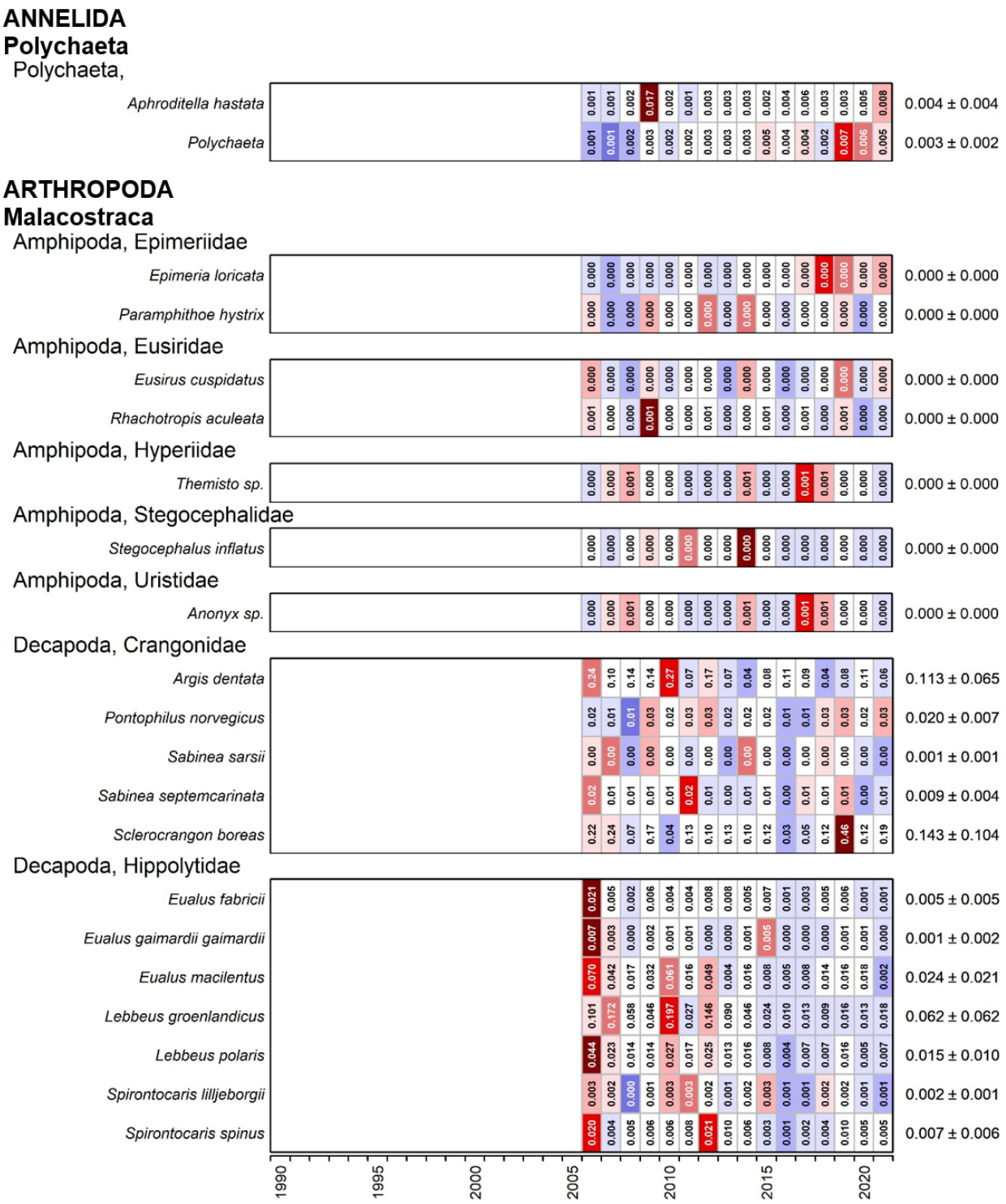

Figure 68. Average weight of invertebrate taxa per 15-minute tow observed during the survey. The colour code represents the anomaly value, which corresponds to the difference between the CPUE in a given year and the average CPUE of the time series for each taxon divided by the standard deviation of this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

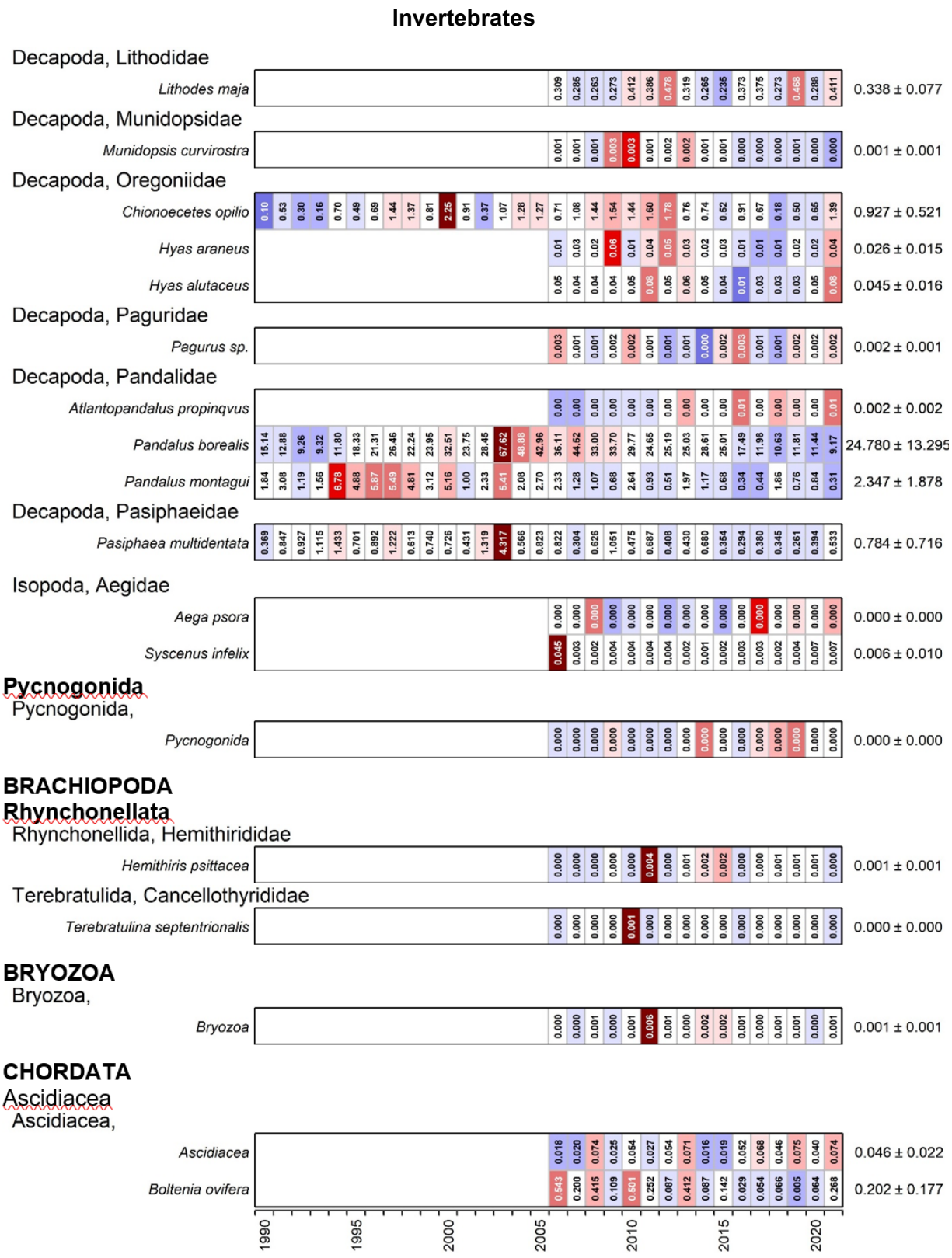

Figure 68. Continued.

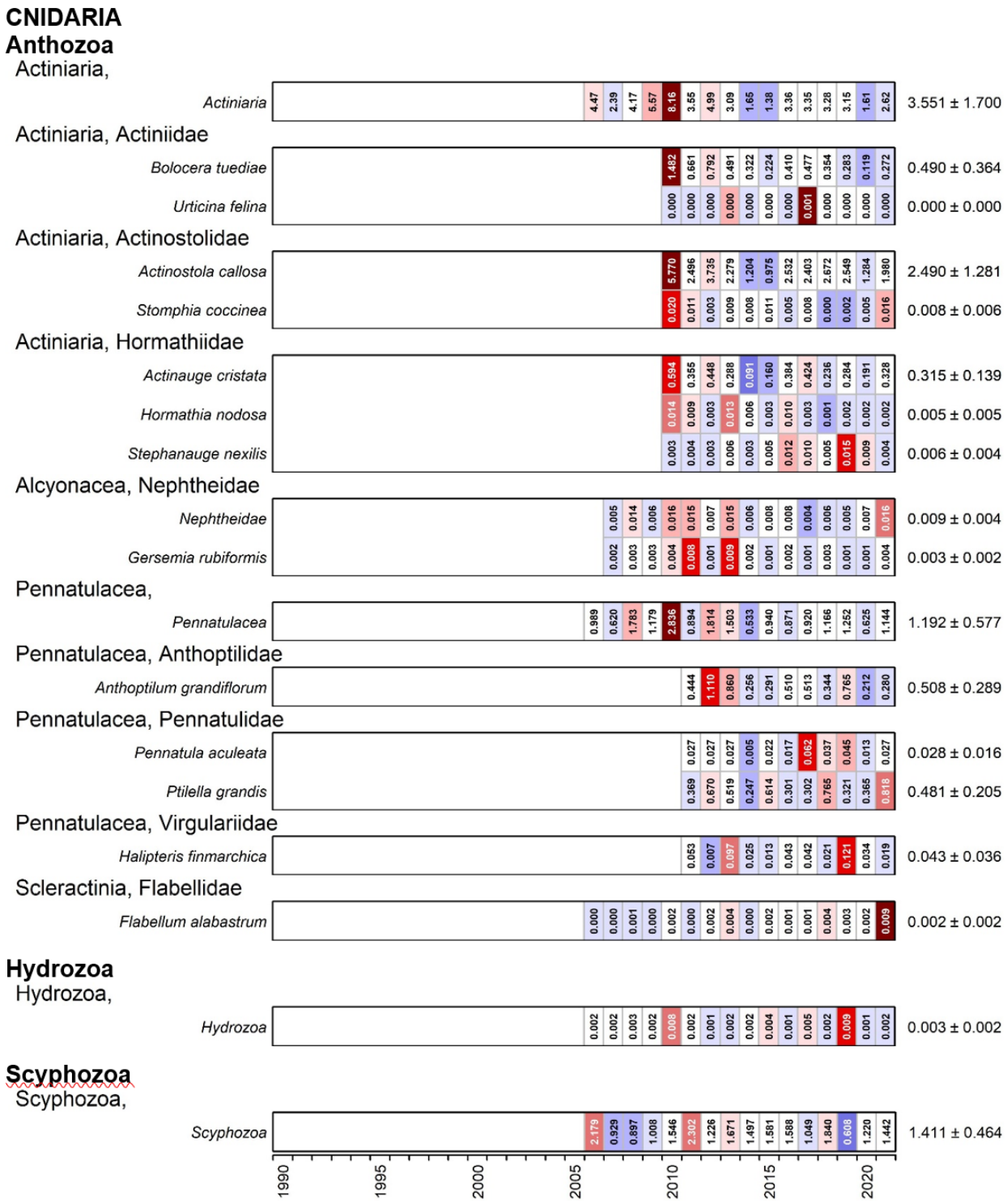

Figure 68. Continued.

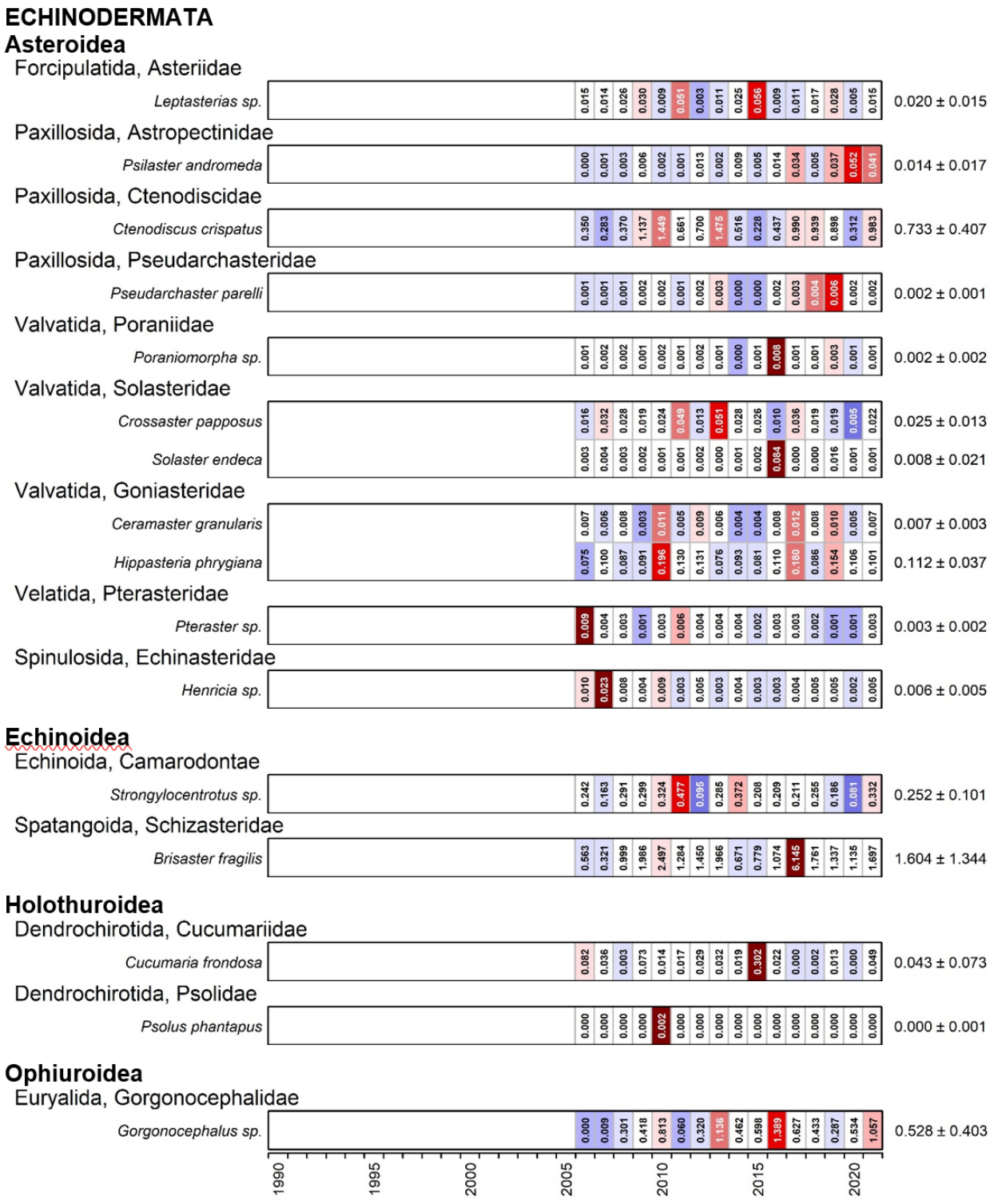

Figure 68. Continued.

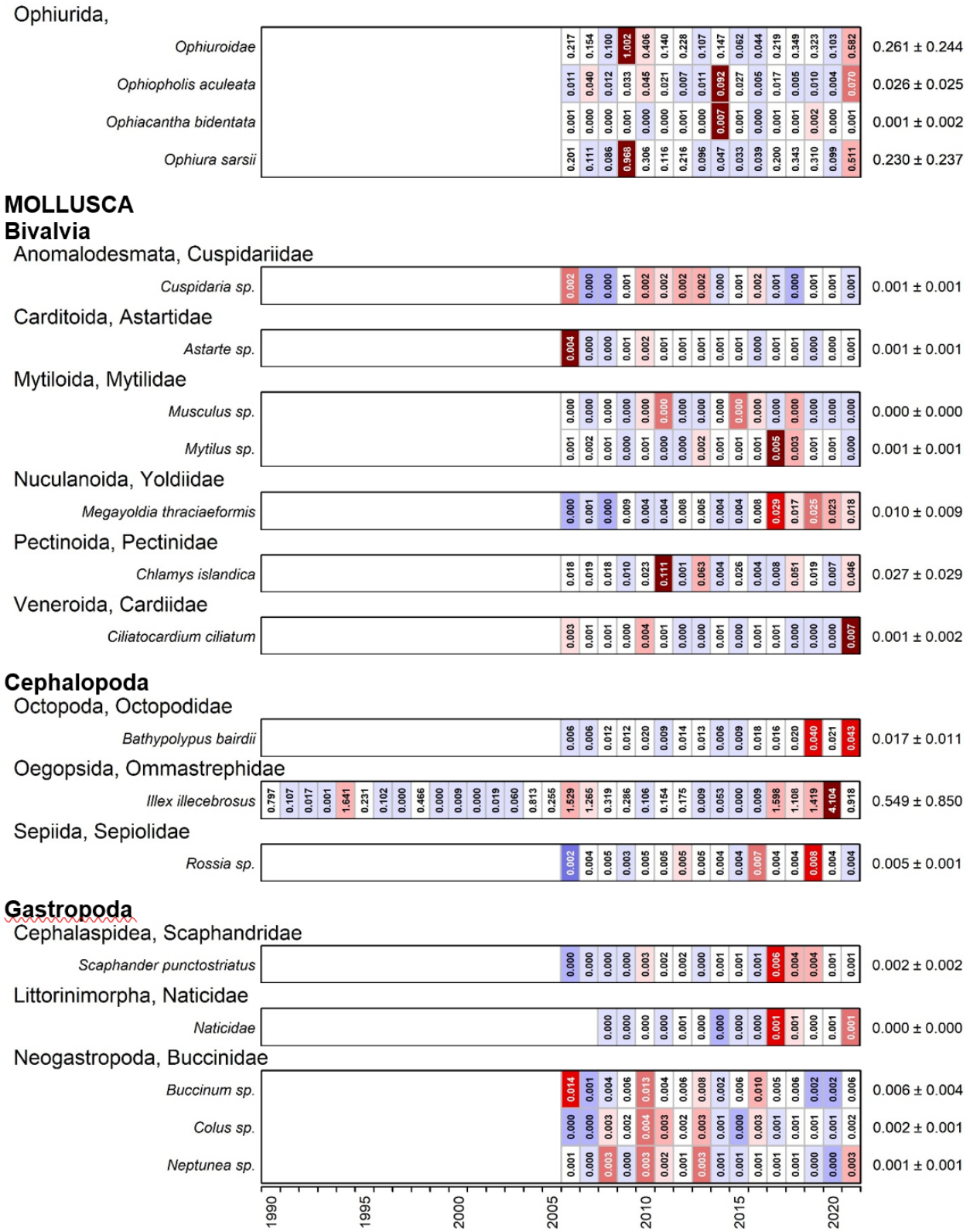

Figure 68. Continued.

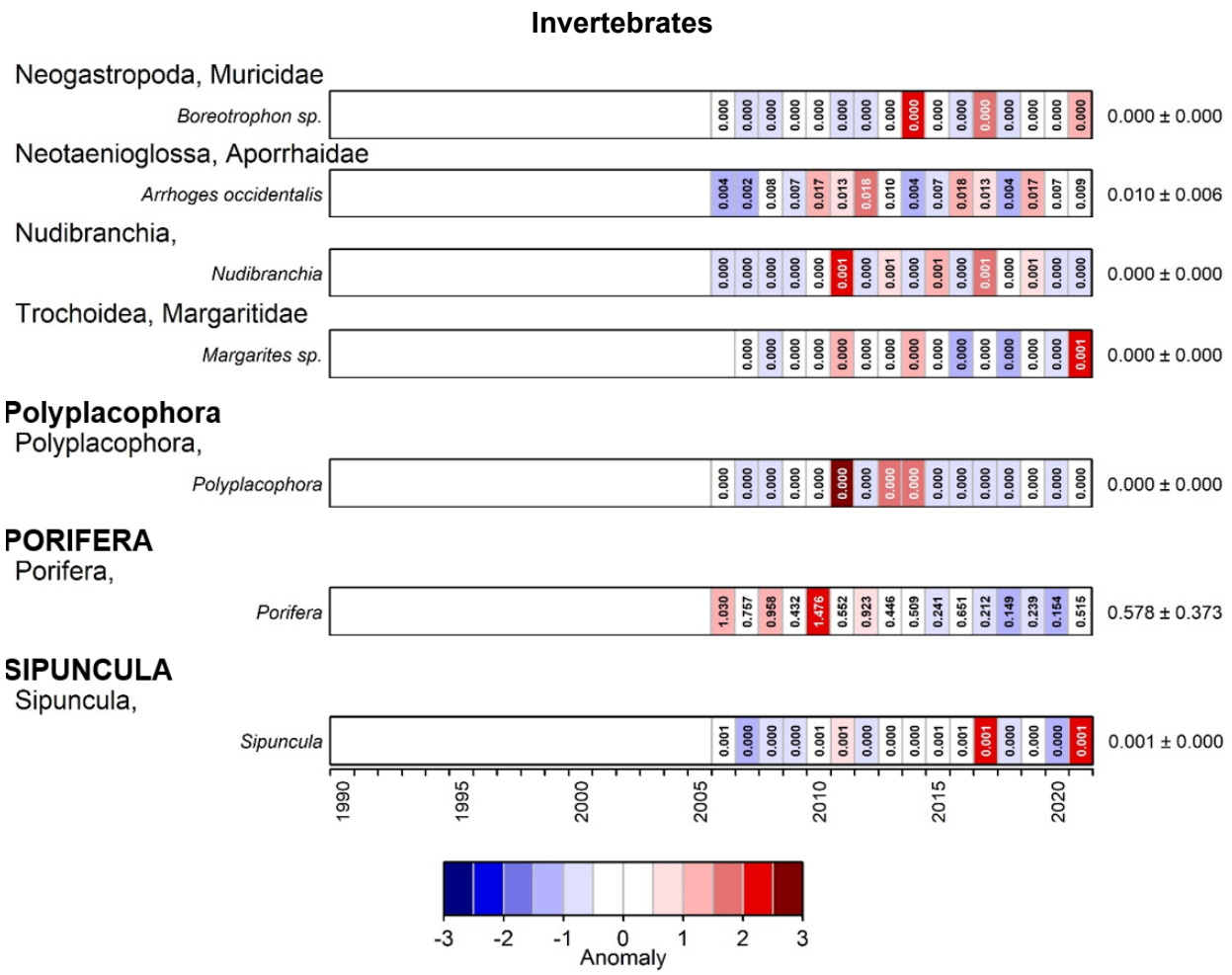

Figure 68. Continued.

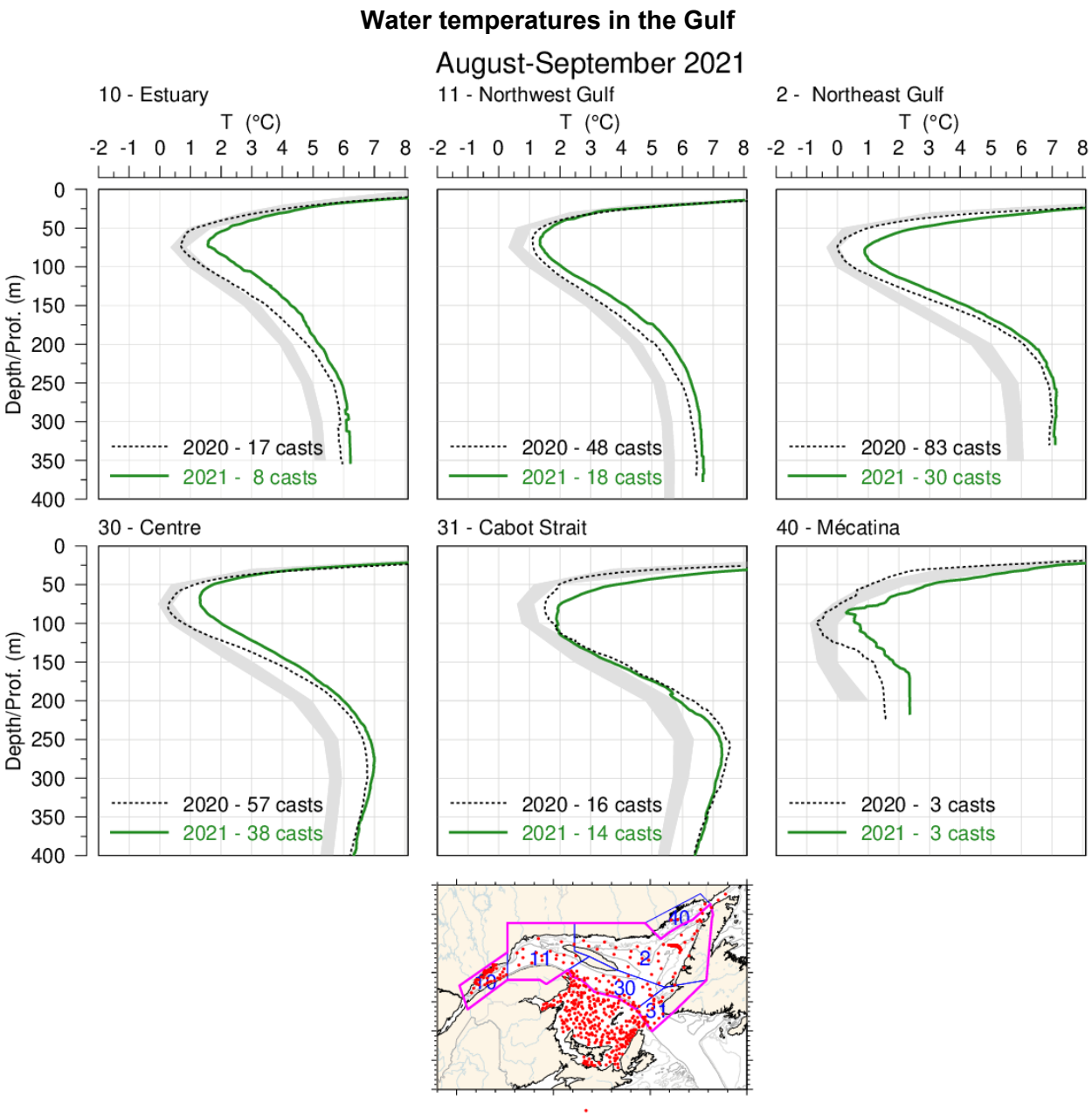

Figure 69. Mean temperature profiles observed in each region of the Gulf during the August 2021 survey. The shaded area represents the 1981–2010 climatological monthly mean ± 0.5 SD for August. Mean profiles for August and September 2020 are also shown for comparison. The violet outline on the map shows the area over which sea surface temperature is averaged in figure 70.

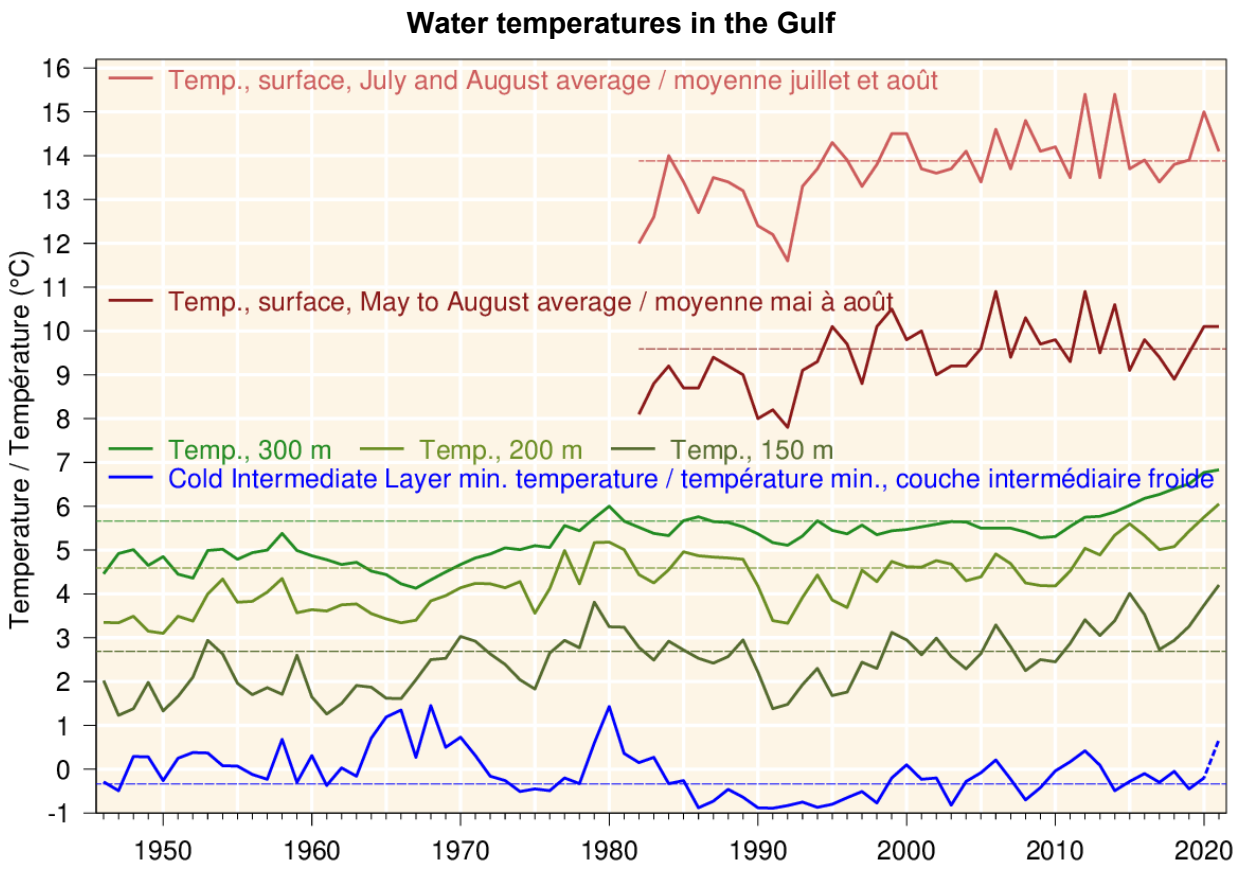

Figure 70. Water temperatures in the Gulf. Sea-surface temperature averaged over the Estuary and the northern Gulf (see violet outline on map of figure 69) for July–August and May–August (1982–2021) (red lines). Layer-averaged temperature for the Gulf of St. Lawrence at 150 m, 200 m and 300 m (green lines). Cold intermediate layer minimum temperature index in the Gulf of St. Lawrence adjusted to July 15, with the 2021 value estimated only from the August survey data (blue line).

APPENDIX

Equations of standard estimators of the mean, variance and confidence intervals for a random stratified sampling 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, i.e., 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*

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