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Preliminary results from the groundfish and shrimp multidisciplinary survey in August 2013 in the Estuary and northern Gulf of St. Lawrence

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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

In 2013, the annual summer survey for the assessment of abundance and distribution of groundfish and shrimp in the Estuary and the northern Gulf of St. Lawrence was conducted from August 1st to September 1st aboard the *CCGS Teleost*. One of the primary objectives was to estimate abundance and biomass indices for the main groundfish species (Cod *Gadus morhua*, Greenland Halibut *Reinhardtius hippoglossoides*, Atlantic Halibut *Hippoglossus hippoglossus* and redfishes *Sebastes fasciatus* and *S. mentella*) and for the Northern Shrimp *Pandalus borealis*, and to identify the spatial distribution and biological characteristics of these species. The two other main objectives of the survey included monitoring the biodiversity of the Estuary and the northern Gulf, and describing the environmental conditions observed in August for the sampling area.

This report describes the preliminary results on the catch rates and distribution of twenty taxa, as well their size frequency distribution. These results were compared with results from the historical survey series began in 1990, taking into account the equivalency factors used to convert data from the tandem *CCGS Alfred Needler-URI* to the tandem *CCGS Teleost-Campelen*. In 2013, the abundance and/or biomass indices of many species were stable or decreased compared to 2012. In fact, Cod (biomass only), Longfin Hake (*Phycis chesteri*) and Snow crab (*Chionoecetes opilio*) showed indices values close to or lower than the lower reference limit of their respective averages calculated for the comparative period of 1990-2012. Although in 2013, the American Plaice *Hippoglossoides platessoides*, Black Dogfish *Centroscyllium fabricii* and Greenland Halibut indices decreased from 2012 to 2013, they were comparable or higher than the averages estimated for the 1990 – 2012 period. For about ten species, indices (abundance: Atlantic Halibut, Smooth Skate (*Malacoraja senta*); biomass: Witch Flounder (*Glyptocephalus cynoglossus*); abundance and biomass: Common Lumpfish (*Cyclopterus lumpus*), Hagfish (*Myxine glutinosa*), Silver Hake (*Merluccius bilinearis*), White Hake (*Urophycis tenuis*) and the two species of redfishes) increased in 2013 and showed values comparable to or higher than their respective averages for the period 1990-2012. However, increases for among of these three species indices (Acadian and Atlantic redfishes, Silver Hake) were such that the values observed in 2013 were among the highest for the period 1990-2012. The geographic distribution of catches recorded for the different species in 2013 showed the same pattern as in previous years. Finally, the size distributions ranges determined for each species remains relatively stable for the entire time of the historical series, except for the common lumpfish which showed a slight decrease (~ 5 cm) at the maximum size. In addition, for some species (Cod, Greenland Halibut, Hagfish, Acadian and Atlantic redfishes, Silver and White hakes), some size classes observed in 2013 were clearly dominant, and their abundance well above the calculated average distribution average for the comparative period.

RÉSUMÉ

En 2013, le relevé estival annuel pour l'évaluation de l'abondance et de la distribution des poissons de fond et de la crevette nordique dans l'estuaire et le nord du golfe du Saint-Laurent s'est déroulé du 1er août au 1er septembre, à bord du *NGCC Teleost*. Un des principaux objectifs était d'obtenir des estimations d'abondance et de biomasse des principales espèces de poissons de fond (morue *Gadus morhua*, flétan du Groenland *Reinhardtius hippoglossoides*, flétan atlantique *Hippoglossus hippoglossus* et sébaste – *Sebastes fasciatus* et *S. mentella* -) et de la crevette nordique *Pandalus borealis*, d'en préciser la répartition spatiale et d'en déterminer les caractéristiques biologiques. Les deux autres objectifs principaux du relevé étaient d'assurer un monitorage de la biodiversité de l'estuaire et du nord du golfe, et de décrire les conditions environnementales du milieu observées en août.

Le présent rapport décrit les résultats sommaires des taux de capture, des répartitions spatiales et des distributions de fréquences de taille d'une vingtaine de taxons. Ces résultats ont été mis en perspective avec l'ensemble des résultats de la série historique des relevés initiée en 1990 en tenant compte des facteurs d'équivalence utilisés pour convertir les données du tandem *NGCC Alfred Needler-URI* au tandem *NGCC Teleost-Campelen*. En 2013, les indices d'abondance et/ou de biomasse de plusieurs espèces sont demeurés stables ou en baisse par rapport aux valeurs de 2012. Ainsi, les indices calculés pour le crabe des neiges *Chionoecetes opilio*, la merluche à longues nageoires *Phycis chesteri* et la morue (indice de biomasse uniquement) présentent des valeurs avoisinant ou plus faibles que la limite de référence inférieure de leurs moyennes respectives calculées pour la période comparative de 1990-2012. Même si en 2013, les indices calculés pour l'aiguillat noir *Centroscyllium fabricii*, le flétan du Groenland et la plie canadienne *Hippoglossoides platessoides* ont diminué par rapport à 2012, leurs valeurs sont, selon l'espèce, comparables ou supérieures aux moyennes de la période 1990-2012. Une dizaine d'espèces a vu ses indices (abondance : flétan atlantique, raie lisse (*Malacoraja senta*); biomasse : plie grise (*Glyptocephalus cynoglossus*); abondance et biomasse : grosse poule de mer (*Cyclopterus lumpus*), merlu argenté (*Merluccius bilinearis*), merluche blanche (*Urophycis tenuis*), myxine (*Myxine glutinosa*) et les deux espèces de sébaste) augmenter en 2013 et présenter des valeurs comparables ou plus élevées que leur moyenne respective de la période 1990-2012. Les valeurs observées en 2013 pour le merlu argenté, le sébaste acadien et le sébaste atlantique figurent parmi les plus élevées de la période 1990-2012. Les distributions géographiques des captures des diverses espèces en 2013 étaient comparables aux années antérieures. Finalement, l'étendue des distributions de tailles déterminées pour chaque espèce demeure relativement stable pour l'ensemble de la série historique, à l'exception de la grosse poule de mer qui a présenté une légère diminution (~5 cm) au niveau de la taille maximale. Par ailleurs, pour certaines espèces (flétan du Groenland, merlu argenté, merluche blanche, morue, myxine, sébaste acadien et atlantique), certaines classes de taille observées en 2013 sont nettement dominantes, leur abondance dépassant largement la distribution moyenne calculée pour la période de comparaison.

INTRODUCTION

Since 1990, DFO conducts surveys in summer with a research vessel in the Estuary and Northern Gulf of St. Lawrence following a standardized protocol. The results of these surveys provide vital information on trends in distribution, abundance and biomass of species considered in the scientific assessments of groundfish stocks (Cod *Gadus morhua*, Atlantic Halibut *hippoglossus hippoglossus*, Greenland Halibut *Reinhardtius hippoglossoides*, redfish *Sebastes* spp) and Northern Shrimp *pandalus borealis* for which the Quebec region is responsible.

SURVEY DESCRIPTION

In 2013, the annual summer survey for the assessment of abundance and distribution of groundfish and Northern Shrimp in the Estuary and Northern Gulf of St. Lawrence was conducted from August 1st to September 1st onboard the *CCGS Teleost* (mission #IML-2013-030). The main objectives of the survey were to: 1) estimate abundance and biomass for about 20 species, examine their spatial distribution, and determine their biological characteristics; 2) collect data on other taxa in keeping with the ecosystemic approach and Northern shrimp's ecocertification; 3) measure environmental conditions in the Estuary and Gulf; and 4) sample phytoplankton and zooplankton and estimate their abundance. Along with these initial objectives, specific sampling was also conducted in order to achieve a marine bird census during the survey, activity initiated in 2011. This inventory is carried out by staff of Environment Canada onboard the *Teleost*.

As for previous summer surveys (1990-2012), the studied area covered in 2013 included Northwest Atlantic Fisheries Organization (NAFO) Divisions 4R and 4S, deep 4T strata as well as the Estuary (Figure 1). Since 2008, the coverage of Division 4T has been increased in the Lower Estuary by adding four shallow strata (851, 852, 854 and 855), two along each coast, in order to cover the depths between 37 and 183 m (20 and 100 fathoms) (Bourdages *et al.* 2008) (Figure 2). The portion of Division 4T covered by the survey in the Southern Gulf remained the same as in previous years, i.e. depth strata (401-408) deeper than 183 m (100 fathoms).

As with previous surveys, a stratified random sampling strategy was used in 2013 based on predetermined depth strata (Gagnon 1991). The number of fishing stations allocated was proportional to stratum surface, with a minimum of three stations for smaller strata. Appendix 1 shows the number of successful fishing stations by stratum for each year of the series.

The fishing gear used during 2013 was the same as usual for previous groundfish trawl surveys on the *CCGS Teleost*, a four-sided shrimp trawl, the *Campelen 1800*, 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 touched the sea floor as determined by the Scanmar™ hydroacoustic system. Tow durations had to be between 10 and 20 minutes (± 1/3 of the targeted time), in order to be valid. Towing speed is 3 knots (vessel speed set by the wheelhouse). Information on trawl geometry (horizontal opening of the doors and wings, vertical opening of the trawl, depth) was recorded for each tow using of Scanmar™ hydroacoustic sensors mounted on the trawl gear.

At the beginning, the total planned number of tows for the 2013 survey was set to 199 as 62 in 4R, 83 in 4S and 54 in 4T. Of total fishing sets referred, 165 were performed with

92% (152 sets) successful: 38 tows (out of 41) in 4R, 65 tows (out of 71) in 4S, and 49 tows (out of 53) in 4T (Figure 3). Because of various problems related to the ship, bad weather and time to find trawlable bottoms, the period time survey dedicated to sampling was appreciably reduced so that the number of fishing stations initially planned must be amputated by 18%. The regions most affected by this reduction are found in 4R and 4S, as: the entrance to Strait of Belle Isle (stratum 837) and the Strait itself (strata 838 and 840), the west coast of Newfoundland (strata 835 and 836), and the central portion of the Gulf (strata 803, 808, 811, 815 and 822) (Figure 2). With the exception of the two strata of the Strait of Belle Isle, all other strata included at least one fishing station.

A vertical profile of the water column was sampled with a SeaBird 911plus™ CTD equipped with a dissolved oxygen sensor (SBE 43), a photometer and a WetStar™ fluorimeter, with a rosette of Niskin bottles for 55% (91) fishing stations. From the twelve additional oceanographic stations planified to achieve the sampling of certain stations related to the Atlantic Zone Monitoring Program (AZMP), only 4 were completed because of time constraint. A SBE 19plus™ CTD equipped with a dissolved oxygen sensor (Aanderaa optode), a photometer, and a WetStar™ fluorimeter, was also fixed on the top of the trawl for collecting oceanographic data during each fishing tow. The sensors sampled the following variables: temperature, conductivity (salinity), pH, dissolved oxygen, PAR radiation, and fluorescence. For each profile, water was also sampled with the rosette at predetermined depths to measure salinity and dissolved oxygen concentration (Winkler titration), nutrients (nitrite, nitrate, phosphate, silicate) and chlorophyll contents. At the request of MLI scientists, an increased sampling of surface water (2.5 m), for the collection of phytoplankton and chlorophyll α, was carried out during the last week of August on the southern side of Anticosti Island to confirm the potential presence of coccoliths that would have been detected previously on satellite images for the Northern Gulf.

A third sampling component, aiming at studying the zooplankton distribution and biomass over the area covered, was conducted by collecting organisms using a zooplankton net (202 µm), towed vertically from bottom to surface, at 62 (35%) of the 178 stations visited. During the survey, hydroacoustic data were also collected with a SIMRAD™ EK60 echosounder equipped with 4 frequencies (38, 70, 120 and 200 kHz).

At each tow, the catch was sorted by taxon for which were collected the number of individuals and / or their total wet weight. For a lot of taxa identified at the species level (over 180), different biological parameters were measured, such as size, weight, sex if identifiable, gonad maturity and the weights of different organs (stomach, liver, gonads). Moreover anal fin rays and parasites were counted for redfish. Different structures (otoliths, stomachs, fins, purses and embryos) were also sampled for numerous specimens in order to determine: age (Atlantic Cod, Atlantic Halibut, Witch Flounder *Glyptocephalus cynoglossus*), diet (Atlantic Halibut), genetic identification of populations (Arctic Cod *Boreogadus saida*) and evolutive morphology (Chondrichtyens). In addition, whole species from different fish and invertebrate taxa were saved for in-depth taxonomic identification purposes, genetic identification of species (e.g. Cnidarians, redfish and Tunicates), feeding diet (e.g. Capelin *Mallotus villosus*, Herring *Clupea harengus harengus*, Sand Lance *Ammodytes* sp., Mackerel *Scomber scombrus*, Harbor Seal *Phoca vitulina concolor* via preys' fatty acid signatures and isotopes), populations studies (e.g. Herring spawners) and morphology (e.g. Heart Urchin *Brisaster fragilis*).

The analysis of 2013 abundance and biomass data were integrated into the combined annual summer survey series initiated in 1990. This combined series was developed following a comparative study between the two vessel-gear tandems (1990-2005: *CCGS*

Alfred Needler – URI 81'/114' trawl; 2004-2012: *CCGS Teleost – Campelen 1800* trawl) to establish specific correction factors for about twenty species caught (Bourdages *et al.* 2007). This resulted in adjustment of *Needler* catches into *Teleost* equivalent catches. Note that the distinction between the two redfish species, *Sebastes fasciatus and S. mentella*, is based on the analysis of the anal fin rays count and the depth of capture of individuals (H. Bourdages, pers. comm.).

Given that over the years, some strata were not sampled by a minimum of two successful tows (Appendix 1), a multiplicative model was used to estimate their catch rate indexes in number and weight. This model provides a predicted value with the data of the current year, if available, and the previous three years. Thus, indicators presented for the series are representative of a standard total area 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 1990-2012 period average (long-term average) and the two dotted lines associated to the mean ±0.5 standard deviation corresponding respectively to the upper and lower reference limits. Note that for Capelin and Herring, the calculated indices are instead probability values (%) of encountering species during the survey. Indeed, due to the pelagic character of these two species, the bottom trawl is not an ideal fishing gear for their capture and, therefore, to accurately estimate abundance.

Length frequency distributions are presented in two different forms. The first figure shows the distribution for the last two years of the series plus the average distribution for the 1990-2012 period (long-term average distribution). Frequency values are expressed as the average number of individuals caught per tow in increment of 1 cm, except for Northern Shrimp (0.05 cm) and Atlantic Halibut (3 cm). The second figure represents the length distributions in length mean per class length for each year of the historical surveys series (1990 to 2013).

The geographical distribution of catches by weight per tow (kg/15 minutes tow, except for sea pens n/15 minutes tow) was made for periods of four years. The interpolation of CPUE 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 rates distribution for the 2013 survey only is also presented in a bubbles type map.

The following section gives the preliminary results for the abundance and biomass indices, the catch rate distribution maps, and the size frequency distributions for about 20 taxa commercially fished. These results are preliminary and must be considered as such until validations and laboratory analyses have been completed.

Finally, Appendix 2 provides a list of all taxa, vertebrates and invertebrates, caught among the 152 successful tows achieved during the 2013 survey. The occurrence, or the number of tows where the species 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 parameter are also presented in Appendix 3. For 7 of the most common taxa, Appendix 4 presents per tow: geographic positions, depth, corresponding stratum and catches (number and weight).

RESULTS

ACADIAN REDFISH

Mean numbers and mean weights per tow of Acadian Redfish (*Sebastes fasciatus)* dropped between 1990 and 1994 (Figure 4). They remained at a low and stable level until 2004. The increase between 2005 and 2007 resulted primarily from the recruitment of the strong 2003 year-class, whose abundance decreased in 2008. Since then, the numbers and weights averages remained at low levels, falling below the average for the 1990-2012 period. In 2013, there was an increase of indices due to the arrival of a very strong cohort of small individuals*.

The size frequency distributions indicate low abundances of individuals of large sizes since 1994 (Figure 5). The strong 2003-cohort, observed between 2005 and 2008, disappeared in 2009 before reaching 20 cm. The recruitment around 10 cm observed in 2013 is greater than the average of the series and is likely associated with the 2011-year class. It should be noted that several individuals of size around 4 to 5 cm were observed in 2012 and 2013

In the early 1990s, significant concentrations were observed in the north and east of Anticosti Island, and in the southwest sector of the studied area. Thereafter, the distribution was concentrated in the southeast of Anticosti Island and the southern part of the Esquiman channel (Figure 6). In 2013, there was a wide distribution of the species, with high catch rates at west and south of Anticosti Island, as well as in the Esquiman channel.

AMERICAN PLAICE

Mean numbers and mean weights per tow for American Plaice (*Hippoglossoides platessoides*) fluctuated without notable trends between 1990 and 2003 (Figure 7). Between 2004 and 2009, these indices have stabilized near the average for the period 1990 to 2012. They increased in 2010 and are in 2013, higher or near the period averages with a mean number of 67 individuals per set and a mean weight of 5 kg.

Since the onset of the survey in 1990, the range of the length frequency distributions for American Plaice has remained relatively stable, with sizes ranging between 5 and 45 cm (Figure 8). Size structure in 2012 had an important 8 cm mode found at 11-12 cm in 2013. The abundance of this mode is higher than the average for the 1990-2012 period. In 2013, the abundance of plaice whose size is greater than 13 cm is similar to the long-term average for the 1990-2012 period.

The spatial distribution of American Plaice is generalized to the entire Estuary and Northern Gulf of St. Lawrence, but relatively absent from the deeper areas of the Laurentian Channel and south of the Esquiman Channel (Figure 46). In 2013, the species was listed at nearly 90% of the fishing stations. In fact, it is the species with the second highest occurrence value (Annex 1). Over the years, the important catch rates were observed in the Estuary, in the area of Bay of Sept-Iles, at the head of Laurentian,

* Determining redfish species is based on a count of soft rays of the anal fin on a maximum of 60 redfish per tow. This method may skew the results, especially when the arrival of a strong cohort. Genetic analyzes are therefore essential to confirm the identification and the proportion of each species (*S. fasciatus and S. mentella*).

Esquiman and Anticosti channels, and all along the west coast of Newfoundland, at depths of 250 m or less.

ATLANTIC HALIBUT

With low values throughout the 1990s, the average numbers and average weights per tow of Atlantic Halibut (*Hippoglossus hippoglossus*) have been steadily increasing until recent years (Figure 10). During last years, the observed yields remain high and well above the upper reference limit of the average of 1990-2012 period. In 2013, the abundance index increased again while the biomass index remained comparable to the value calculated for 2012.

In 2013, the sizes range for the caught halibut always remained very wide (22-132 cm), the median size being about 55 cm (Appendix 3). The abundance of small halibuts (less than 60 cm) was still very high, well above the average distribution of the 1990-2012 period (Figure 11). Although lower compared to 2012, the abundance of pre-recruits (60-85 cm) in 2013 was also above average distribution. Note that a larger number of halibut of commercial size (110-140 cm) was also captured during the survey in 2013.

The distribution pattern of Atlantic Halibut has changed little over the years, occupying the entire territory covered by the survey (Figure 12). However, since the mid-2000s, there was a marked increase in catch rates associated with higher yields per tow. As for the last years, the largest catch rates observed in 2013 were located along the 200 m isobath, on the slopes of Laurentian, Esquiman and Anticosti channels, and in the Sept-Îles sector and the Estuary.

BLACK DOGFISH

Mean numbers and mean weights per tow have varied over the years for Black Dogfish (*Centroscyllium fabricii*) (Figure 13). Large confidence intervals are generally associated with the highest values. This could be caused by the gregarious behaviour of this species and by its limited spatial distribution in the Gulf. In 2012, the abundance and biomass indices showed a strong increase and reached the highest values of the series, well above the upper reference limit. With a decrease in 2013, however the indices values remained high, remaining at the upper reference limits of the average for the 1990-2012 period.

In general, size structures observed over the years have two main modes. The first observed between 15 and 20 cm (Figure 14), represents young-of-the-year fish, which are released at 14 cm by ovoviviparous females (Scott and Scott 1988). The second mode includes adult dogfish whose lengths vary between 50 and 60 cm. Although lower compared to 2012, the abundance of most groups sizes calculated for 2013 remains above the average distribution for the 1991-2012period.

In general, the Black Dogfish distribution observed in the survey was concentrated on all of the Laurentian Channel and the Estuary (Figure 15). As for the last years, the largest catch rates in 2013 were recorded most upstream in the Laurentian Channel, off the coast of the Gaspé Peninsula.

CAPELIN

Capelin (*Mallotus villosus*) is a common catch in the survey. Over the years, the highest catch rates have mainly been recorded in the St. Lawrence Estuary, around Anticosti Island, and in the Strait of Belle Isle area (Figure 16).

Compared to 2012, the probabilities of finding Capelin during the 2013 survey were higher in the central sector of the west coast of Newfoundland (sub-divisions 4Rb and 4Rc) and in the area located near the Cabot Strait (Figure 17).

In Division 4R, the probabilities (kriging average) to find Capelin have fluctuated significantly since 1990 (Figure 18). However, they show a clear upward trend since 2006 and from 2010, values above the average for the 1990-2012 period. The value obtained in 2013 is the highest seen in the entire series.

In Division 4S, the probabilities to find capelin showed much less variability over the years (Figure 18). They were also higher than those in Division 4R. Between 2005 and 2010, the probabilities were stable and near the average for the 1990-2012 period which is near 80%. The calculated value for 2013 is identical to the 2011 and 2012 values, and is higher than the upper reference limit of the average for the 1990-2012 period.

COD

Mean numbers and mean weighs per tow for Cod (*Gadus morhua*) have been low but stable since 1992 (Figure 19).

In 2013, the size frequency distribution revealed the presence of two modes: 1) a first one to 18 cm (year-class 1) and a second to 26 cm (year-class 2) (Figure 20). The abundance of these two modes was significantly higher than the average of the 1990-2012 period for Cod of the same size. Compared to previous years, there was in 2013 a low abundance of fish whose size is greater than 40 cm. In addition, for the third consecutive year, the presence of cod of the year (4-8 cm) was observed during the survey.

From 1994 to 2005, concentrations of Cod in the north and west of Anticosti Island showed a gradual decrease to increase again from 2006 (Figure 21). Survey results from 2013 still indicate an expansion to the west and the north of Anticosti Island. As previously mentioned, because of various problems encountered in the first part of the survey, very few stations have been completed at the entrance and in the Strait of Belle Isle (Division 4R; strata 837, 838 and 840) in 2013. However, this region has already made in the past very high catch rates of Cod.

DEEPWATER REDFISH

Mean numbers and mean weights per tow of Deepwater Redfish (*Sebastes mentella)* decreased significantly between 1990 and 1994 (Figure 22). They remained at a low and stable level until 2012, falling below the average for the 1990-2012 period. In 2013, there was a rise in the indices due to the arrival of a very strong cohort of small individuals[*]. So, the mean number per tow is well above the average of the 1990-2012 period, while the mean weight per tow is located at the average level of the period.

The size frequency distributions indicate low abundances of individuals of large sizes since 1994 (Figure 23). The 2003 cohort, observed between 2005 and 2007, disappeared in 2008 before reaching 20 cm. The abundance of ~10 cm mode observed in 2013 was significantly higher than the average of the 1990-2012 period and was likely associated to

[*] Determining redfish species is based on a count of soft rays of the anal fin on a maximum of 60 redfish per tow. This method may skew the results, especially when the arrival of a strong cohort. Genetic analyzes are therefore essential to confirm the identification and the proportion of each species (*S. fasciatus and S. mentella*).

the 2011 cohort. The latter is the most abundant ever recorded since the survey began in 1990. Some individuals measuring from 4 to 5 cm have also been observed in 2013.

The pattern of distribution of Deepwater Redfish observed in the early 1990s indicates a wide distribution extending south and east of Anticosti Island. Thereafter, the distribution was more limited with significant concentrations southeast of Anticosti Island, especially in the deeper waters of the Laurentian Channel (Figure 24). In 2013, we again observed a broad distribution that extended westward into the Estuary, south to Cabot Strait and eastward in Esquiman Channel. Strong catch rates were recorded in the Esquiman Channel, southwest Newfoundland, southeast of Anticosti Island, and in the western sector of the Gulf (Sept-Îles and off Mont-Louis).

GREENLAND HALIBUT

Mean catch per tow, in numbers and weights, of Greenland Halibut (*Reinhardtius hippoglossoides*) declined in 2013 and are comparable to the average for the 1990-2012 period (Figure 25).

The size frequency distribution in 2013 showed that the year-class 1 (15-20 cm), cohort of 2012, was more abundant than the average for the 1990-2012 period (Figure 26). The year-class 2 fish (20-30 cm), cohort of 2011, were few while the mean abundance of fish over three year-old (more than 30 cm) were comparable to the 1990-2012 period.

The pattern of distribution of Greenland Halibut observed in 2013 was similar to that which prevails since 2000. The largest catch rates are found mainly in the Estuary and the western sector of Anticosti Island, and at the head of the Esquiman, Laurentian and Anticosti channels, at depths of over 200 m (Figure 27).

HAGFISH

Mean numbers and mean weights per tow of Hagfish (*Myxine glutinosa*) fluctuated throughout the series (Figure 28). In 2013, they were above their respective 1990-2012 period average with a mean number of 32 individuals per tow for an average weight of about 1.6 kg.

The sampling of length data for this species began in 2003 (Figure 29). The size frequency distribution is composed of a single wide mode ranging between 25 and 45 cm. In 2013, the abundance of different size groups was above the 2003-2012 period average distribution.

Throughout the series, catches of Hagfish were concentrated in the Estuary and in the deep waters of the Laurentian Channel (Figure 30). Catches per tow are generally small, not exceeding 5 kg.

HERRING

Although pelagic (ie low catchability in bottom trawl), Herring (*Clupea harengus harengus*) are regularly caught on the survey. They are associated with four spawning stocks and are found throughout the sampled area, particularly along the channels (Figure 31). Over the years, the highest catch rates (kg/tow) have been recorded in the St. Lawrence Estuary, along the Laurentian Channel, between Anticosti Island and the west coast of Newfoundland, and in the Strait of Belle Isle.

Compared to 2012, the probabilities of finding Herring during the 2013 survey were higher in the Estuary, to the north of Anticosti Island, and on the west coast of Newfoundland (Figure 32).

In Division 4R, the probabilities (kriging average) of finding Herring were relatively stable between 1993 and 1997 (Figure 33). Thereafter, they increased to a maximum of around 75% in 2000 and 2001, before falling and reaching 35% in 2004. They increased in 2005 and remained stable up to 2009. They fluctuate from and the probability measured in 2013 is slightly higher than the 2012 value, but not significantly different of the average for the 1990-2012 period. Identical results are observed in Division 4S (Figure 33).

LONGFIN HAKE

With the exception of the year 2000, the average numbers and average weight per tow of Longfin Hake (*Phycis chesteri*) have declined since the early 1990s (Figure 34). Since then, the general trend of these indices has been decreasing. In 2013, they reached the lowest values in the series, well below the lower reference limit of the average for the 1990-2012 period.

The size frequency distributions of Longfin Hake extend mainly between 12 and 40 cm and this, throughout years of the survey (Figure 35). In 2013, the abundance of different size classes of fish caught still falls far short of the average distribution for the 1990-2012 period. Note that compared to the previous year, catches of fish over 30 cm were significantly less in 2013.

Since the beginning of the survey in 1990, the Longfin Hake is distributed in the southern part of the area sampled , from Cabot Strait to the Estuary (Figure 36). The highest catch rates were found in the downstream half of the Laurentian Channel. Since 2010, catches were smaller.

LUMPFISH

Although regularly captured in the survey, the Lumpfish (*Cyclopterus lumpus*) is scarce. On average, the annual catch is composed of 30 individuals distributed in 20 fishing sets. In 2013, 36 individuals were captured in a total of 25 tows. Mean numbers and mean weights per tow are generally low and stable (Figure 37). In 2013, they were close to the 1990-2012 period average with 0.2 individuals per tow for 0.07 kg on average.

Length frequency distribution (Figure 38) shows a range of sizes between 4 and 48 cm.

During the survey, Lumpfish catches were mainly carried out in the northern part of the Gulf, along the North Shore, in the Strait of Belle Isle, at the head of Esquiman Channel and along the west coast of Newfoundland. Since 2006, an expansion of the lumpfish distribution area was observed in the western part of the study area (Figure 39). For the regions sampled by the survey in 2013, catches were sparse in the Esquiman channel and more important southeast of Anticosti Island and in the western half of the survey, in areas of Sept-Îles and in the Estuary.

NORTHERN SHRIMP

Preliminary data on Northern Shrimp (*Pandalus borealis*) are presented for the whole Northern Gulf rather than for each shrimp fishing area.

The mean numbers of individuals caught per tow and the mean catches in weight showed a decreasing trend since 2003 (Figure 40). The values observed in 2013 were lower than the average for the 1990-2012 period.

The size frequency distributions show that in 2013, the majority of shrimp size categories were below the average for the 1990-2012 period, with exception for the smaller individuals less than 12 mm (carapace length, CL) (Figure 41).

Overall, the spatial distribution of Northern Shrimp in 2013 was similar to that observed in recent years (Figure 42). The best catch rates were observed along the channels and west of Anticosti Island.

SEA PENS

The identification of different taxa of sea pen in the catches began in 2011. The data collected allowed following the pattern of distribution and catching rates of four species: *Anthoptilum grandiflorum*, *Halipteris finmarchica*, *Pennatula aculeata* and *Pennatula grandis*.

Over the past three years, catches of *A. grandiflorum* were mainly concentrated in the Laurentian Channel, including the area of Cabot Strait, at depths of over 200 m (Figure 43). In 2013, this sea pen species was listed in 47 tows, the highest catch rates (number per tow) were found in the downstream sector of the Laurentian Channel.

Between 2011 and 2013, the distribution of *H*. *finmarchica* in the study area was limited to the Laurentian Channel. The highest catch rates were located mainly in deep waters (> 200 m) between Anticosti Island and the extremity of the Gaspé Peninsula (Figure 44). Its occurrence during the survey was occasional, rarely listed more than 20 stations. Catch rates were low, usually below ten individuals per tow for a total weight of less than one kilogram. The largest recorded catch, more than 250 individuals totaling 6.6 kg, was caught in 2013 in the central sector of the Laurentian Channel.

Although the distribution of sea pen *P. aculeata* is generalized to the entire survey area in 2013, it was less abundant in the southern part, particularly in the downstream sector of Esquiman and Laurentian channels (Figure 45). On average, the frequency of occurrence for this sea pen species during a survey was approximately 50%. From 2011 to 2013, large catches were recorded in the Estuary and upstream part of the Laurentian Channel, northeast of Anticosti Island and the head of Esquiman channel, at depths over 200 m. In general, the number of individuals captured by set rarely exceeded twenty individuals with a weight of less than 200 grams. In 2013, the highest catch rates were found in the Estuary, totaling 100 to 400 individuals for a weight between 225 and 925 grams.

Comparable to that of *A. grandiflorum*, the distribution of the fourth sea pen species, *P. grandis* is limited to deep water (> 200 m) of the Laurentian Channel, from the Estuary to Cabot Strait (Figure 46). During surveys from 2011 to 2013, this species appeared in nearly 20% of the fishing stations (less than 40), with a catch rates generally less than one hundred individuals per set for a maximum total weight of less 5 kg. The 2013 survey presented the largest ever recorded capture, slightly more than 1,400 individuals totaling about 85 kg in the area of Cabot Strait. Another important capture was also reported at the extremity of the Gaspé Peninsula, 568 individuals weighing 40.5 kg.

SILVER HAKE

Until the mid-2000s, catches of Silver Hake (*Merluccius bilinearis*) were infrequent and of little importance during the survey (Figure 47). However, since 2007, the presence of this

species in the study area was more marked, having been listed in 2013 survey in more than half (82) fishing stations. Increasing since 2009, the abundance and biomass indices reached levels never seen before in 2013, with 4.4 individuals per tow for an average weight of 0.6 kg, well above the average of the 1990 – 2012 period (< 0.5 ind./set and < 0.1 kg/set).

During the surveys, the sizes of Silver Hake caught ranged between 10 and 45 cm, the abundance of different size classes being very low until the late 2000s (Figure 48). For the first time in 2013, two major modes characterized the size frequency distribution, the first between 13-20 cm and the second between 26-34 cm.

Except for the west coast of Newfoundland, the distribution of Silver Hake extends over the survey area, although infrequently captured (Figure 49). In recent years, the highest catch rates were observed at the entrance of the Cabot Strait, on the Newfoundland side, and along the northern edge of the Laurentian Channel.

SMOOTH SKATE

Although variable throughout the 1990s, the average numbers of Smooth Skate (*Malacoraja senta*) caught per tow were low, ranging on or near the average for the 1990-2012 period (Figure 50). Following a significant increase between 2002 and 2003 (two years where some species showed abnormal indices values), the abundance in number caught per tow declined somewhat to oscillate around the long-term period average up to 2013. Meanwhile, the average catch weight per tow remained low throughout the series but within the confidence interval of 95%, excluding the 2003 value.

The 2013 size frequency distribution revealed the presence of three modes (Figure 51). A first mode between 10 and 18 cm whose abundance in 2013 slightly exceeded that of 2012 and that the average distribution of this group sizes for the 1991-2012 period. A second mode, combining Smooth Skate measuring between 18 and 23 cm, stands out in the 2013 distribution with its abundance significantly higher than the average distribution for this group size for the 1991-2012 period. Finally, a third mode, gathering adult fish whose sizes vary between 50 and 58 cm, was detected. Again, the abundance of this last mode seen in 2013 exceeded the average distribution of those size classes.

Since the 2000s, the species is captured in most fishing sets, the greatest abundances are met in depths greater than 100 m (Figure 52). In 2013, the highest catch rates were observed mainly south and north of Anticosti Island, in the Anticosti and Laurentian channels, and in the western part of the survey, in the Estuary and Sept-Îles sector.

SNOW CRAB

Declining since 2009, the average number of Snow Crab (*Chionoecetes opilio*) per tow in 2013 was lower than that observed in 2012. It was well below the average for the 1990-2012 period (Figure 53). After a rising trend between 2006 and 2012, the average weight per tow declined significantly in 2013. The estimated weight for this last survey was below the long term period average. Also in 2013, both indices showed low variability compared to previous years.

Snow Crab was caught in each sampled survey sectors. However, since the early 2000s, its distribution pattern has changed little over the years (Figure 54). This species is scarce species beyond 200 meters.

In 2013, the distribution of catch rates showed a heterogeneous distribution, with a significant presence of the species in the western half area of the sampled area. The highest catch rates were observed mainly in the Sept-Îles sector and in the Estuary.

THORNY SKATE

The evolution of the abundance indices of Thorny Skate (*Amblyraja radiatia*) emerges in two periods. For 1990's, the general trend for the average numbers of fish caught is one of decline compared to the average for the 1990-2012 period (Figure 55). Meanwhile, the average catch weights are exception of 1991, below the long term average. Both indices showed a significant increase between 2002 and 2003 then exceeding the upper reference limit of the long-term period average. The two indices decreased somewhat thereafter but remained close (number per tow) or higher (weight per tow) to the average for the 1990-2012 period. Note that since 2011, the abundance indice is rising while the biomass index remains relatively stable, but close to the upper reference limit.

The 2013 size frequency distribution still indicates the presence of a dominant mode between 10 and 18 cm, whose abundance is greater than the 2012 mode and the average distribution for the 1991-2012 period (Figure 56). Beyond 20 cm, no important modes are detected from the 2013 distribution, that one being comparable to the 2012 distribution and to the average distribution of the long-term period.

The spatial distribution of Thorny Skate extends to the entire study area of the survey (Figure 57). In 2013, the species was found in 85% (129/152) of tows, the highest catch rates are listed at depths between 150 and 250 m. There is a recurring concentration at the head of the Laurentian Channel, in the St. Lawrence Estuary, while during the survey.

WHITE HAKE

The average numbers and average weights per tow of White Hake (*Urophycis tenuis*) for Divisions 4RST declined significantly between 1990 and 1994 (Figure 58). Subsequently, they have fluctuated until the mid-2000s showing no clear trend. Since 2004, the values are near or below the average of the 1990-2012 period. In 2013, there was an increase in the indices whose values are around the long-term period.

The length frequency distributions observed between 1990 and 2013 do not allow tracking cohorts (Figure 59). The range of sizes recorded, mainly between 20 and 60 cm, has remained the same throughout the series. In 2013, individuals in size classes between 30 and 36 cm contributed largely to the dominant mode of the 2013 length frequency distribution, surpassing the average distribution for the 1990-2012 period. Furthermore, the adult hakes of 45 cm and over were still few.

Generally, the highest White Hake catch rates were mainly found in the southern portion of the sampled area (Figure 60). In 2013, the high catch rates were found in the lower half part of the Laurentian channel and in the southern sector of the Esquiman channel.

WITCH FLOUNDER

The mean numbers and mean weights per tow of Witch Flounder (*Glyptocephalus cynoglossus*) decreased between 1990 and 1993, then remained relatively stable from 1994 to 1998 (Figure 61). This period of stability was followed by two waves of increase and decrease between 1998 and 2006. Subsequently, the average numbers per tow increased gradually and remained near or somewhat above the average for the 1990-2012

period. In contrast, the average catch in weight increased only in 2010 and remains at the upper reference limit so far.

The size frequency distributions of Witch Flounder caught during the series remained relatively constant, with a range of lengths varying between 5 and 45 cm (Figure 62). However, the modes that characterize the different years are rather different and are mainly explained by the growth of stronger cohorts. So, the main mode observed at 26 cm in 2011, is observed at 28 cm in 2012, then 30-31 cm in 2013. The follow-up of this important cohort is possible since 2008. A second mode, observed at 18 cm in 2011, reaches 22 cm in 2012 and 24-25 cm in 2013. The presence of these two strong cohorts explains that in recent years, the abundance of Witch Flounder between 22 and 35 cm is greater than the average of the long-term period.

Witch Flounder is found in the entire Northern Gulf of St. Lawrence sampling area (Figure 63). It is present in 80% of the fishing tows. The largest catches are usually made at the head and along the southern slope of the Laurentian Channel, and in the Estuary. For some years, significant catch rates are also observed along the west coast of Newfoundland and on Beaugé Bank. The spatial distribution of Witch flounder in 2013 is similar to previous years.

WOLFFISHES

Three wolffish species were captured during the summer survey series (1990-2013): Atlantic Wolffish (*Anarhichas lupus*), Spotted Solffish (*Anarhichas minor*), and Northern Wolffish (*Anarhichas denticulatus*). These three species are considered endangered. According to the Act Species at Risk Act (SARA), Spotted Wolffish and Northern Wolffish are endangered, while the Atlantic Wolffish is considered special concern species status.

Atlantic Wolffish is the most common of the three wolffish species during the surveys, which may be listed in more than forty stations in a single survey. Over the years, when captured, the average number of Atlantic Wolffish per tow varied between 8 and 50 on the *Needler* (1990-2003) and rarely more than 10 on the *Teleost* (2004-2012). The mean weight per tow was of the order of 1.25 to 10 kg on the *Needler* and 1.7 to 4.5 kg on the *Teleost*. In 2013, 160 Atlantic wolffishes were caught in 36 fishing sets. The average catch per set was 1.4 kg (maximum of 15.2 kg). The size range of fish caught during this survey varied between 6 and 80 cm (absence of figure due to low numbers). The spatial distribution of Atlantic Wolffish in that survey was mainly concentrated in its eastern portion (Figure 64). In 2013, the highest catch rates were recorded along the west coast of Newfoundland and in the northern part of the Esquiman channel.

Catches of Spotted Wolffish were less frequent during the surveys, to be limited to an average of 5-6 stations for the *Needler* and twice for the *Teleost*. For the entire series (1990-2013), the average number of Spotted Wolffish caught per tow was 1 to 2 Individuals with an average weight of 0.5 to 7.5 kg. The size range of Spotted Wolffish captured varied between 8.5 and 155 cm. As for Atlantic Wolffish, the Spotted Wolffish presence in the surveys is generally confined to eastern part (east of 62° longitude) (Figure 65). In 2013, six small Spotted Wolffish were caught in five fishing stations, the average catch rate per tow was 0.05 kg (maximum 0.22 kg).

Catches of Northern Wolffish remained rare in the series. On the *Needler*, its presence has been limited to one individual per tow on 3 surveys between 1995 and 2000 for NAFO Divisions 4RST. Only the 2012 *Teleost* survey identified a specimen measuring 48.5 cm and weighing 1.5 kg, at a depth of 355 m in the downstream sector of the Esquiman channel.

INVERTEBRATES - GENERALITY

Invertebrate catches during the survey were very diverse, the total number of taxa identified in a given year approaching double that recorded for fish. In 2013, 160 invertebrate taxa were identified in the 152 successful fishing sets. These taxa belong to nearly a dozen phyla for which is presented a brief summary.

According to data collected in 2013, the Arthropoda phylum was the largest group of invertebrates in the survey, the Northern Shrimp *Pandalus borealis* alone totaling more than 4000 kg (with the equivalent of nearly 640,000 individuals) collected at 137 stations (Appendix 2), which is normal with respect to the fishing gear used for the survey. Besides Northern Shrimp, 22 other shrimp species have been identified, five of which were found in 25% of stations, namely: the White Shrimp *Pasiphea multidentata* (103 stations, 72.4 kg), the Striped Pink shrimp *Pandalus montagui* (78 stations, 333 kg), the Norwegian Shrimp *Pontophilus norvegicus* (54 stations, 2.1 kg), the Polar Lebbeid Shrimp *Lebbeus polaris* (40 stations, 0.9 kg) and the Arctic Argid Shrimp *Argis dentate* (38 stations, 24.1 kg). In addition, 7 species (*Aristaeopsis edwardsiana*, *Atlantopandalus propinquus, Eualus gaimardii belcheri*, *Eualus gaimardii gaimardii*, *Hymenopenaeus debilis*, *Plesionika martia*, *Sergia robusta*), rarely captured in a survey, were present in the unique 2013 survey. Other Arthropod groups have also been identified: 1) Hermit Crab *Pagurus* sp; 2) Cirripeds (barnacles) (2 species); 3) Crabs (Arctic Lyre Crab *Hyas coarctatus*, Atlantic Lyre Crab *Hyas* araneus, Snow Crab *C. opilio* and Spiny crab *Lithodes maja*); 4) Euphausiids (*Meganyctiphanes norvegica*); 5) Squat Lobster (*Munidospsis curvirostrata*); 6) Gammariids (2 species); 7) Isopods (2 species); 8) Pycnogonids (Sea Spider *Nymphon* sp) (Appendix 2).

The second most diversified phylum found in the survey was that of Echinoderms with 25 taxa (Appendix 2). The Starfish group alone counted a dozen species of which 3 have been identified in at least 20% of stations, namely: Mud Star *Ctenodiscus crispatus* (109 stations, 247 kg), *Henricia* sp (47 stations, 0.4 kg), *Hippasteria phrygiana* (32 stations, 15.5 kg). Two species rarely listed in a survey, *Pteraster obscurus* and *Tremaster mirabilis*, were captured in 2013 (Appendix 2). The other group of Echinoderms that stands out for its biomass captured in a survey, was that Sea Urchins with 3 species in 2013, namely: the Heart Urchin *Brisaster fragilis* (76 stations, 338 kg), *Strongylocentrotus* sp (47 stations, 36.5 kg) and the Sand Dollar *Echinarachnius parma* (4 stations, 0.5 kg). The third group of Echinoderms in importance was that of Brittle stars with 3 species: *Ophiura sarsii* (40 stations, 32 kg), the Daisy Brittle Star *Ophiopholis aculeata* (39 stations, 1.8 kg) and *Ophiacantha bidentata* (18 stations; < 0.1 kg). The Basket Stars group (*Gorgonocephalus* sp) has accumulated more than 60 kg in 13 stations. The Sea Cucumbers group was represented by 4 species: the Orange Footed Sea Cucumber *Cucumaria frondosa* (6 stations, 6.6 kg), *Molpadia oolitica* (rare, 1 station, <0.1 kg), the Scarlet Psolus *Psolus fabricii* (rare, 1 station, 0 1 kg) and *Psolus phantapus* (4 stations, <0.1 kg). Finally, four specimens of Sea Lilies (Crinoids), invertebrate rarely listed in the survey due to its fragility, were captured at one station 2013.

With 25 taxa identified during the 2013 survey, the Molluscs phylum also proved to be an important group of invertebrates in catches (Appendix 2). Thus, 10 taxa of the Gastropods class have been identified, among them Whelks (*Buccinum*, *Colus*), Moonsnails (*Lunatia*, Naticidae), Murexes (*Boreotrophon*), Clams (*Cuspidaria*), American Pelicanfoot (*Arrhoges occidentalis*) and Topsnails (*Margarites*). The Bivalves group was also found with nearly a dozen taxa, the most common being the Astartes (*Astarte*, 30 stations), the Iceland Scallop (*Chlamys islandica*, 12 stations) and Mussels (*Mytilus*, 11 stations). The Cephalopods class was represented by 4 taxa, namely: the octopus *Bathypolypus bairdii*

(49 stations), the Bobtail Squid *Rossia* sp (31 stations), the Northern Shortfin Squid *Illex illecebrosus* (12 stations) and the octopus *Stauroteuthis syrtensis* (2 stations). Note that the latter species was rarely captured during the survey series, especially as complete specimen. Three other groups of Molluscs were found in catches of some stations, namely: Cephalapsids (*Scaphander punctostriatus*), Nudibranchs (*Colga villosa, Dendronotus* sp and *Doridoxa ingolfiana*) and Polyplacophora (Chitons). The total number of individuals captured for each of them was at most 6.

The Cnidaria phylum is the last group of invertebrates that have been identified which large catches in 2013 (Appendix 2). Thus, 6 species of Sea Anemones (Actiniaria order) were identified during the survey, 3 species over 50 stations: *Bolocera tuediae* (63 stations, 76 kg), *Actinostolla callosa* (55 stations, 498 kg) and *Actinauge cristata* (51 stations, 58 kg). Note the presence of the sea anemone *Stephanauge nexilis* (16 stations) whose characteristic is to be fixed to the upper end rachis of the sea pen *Halipteris finmarchica*. However, as previously reported, 4 other Pennatulids (*A. grandiflorum*, *H. finmarchica*, *P. aculeate* and *P. grandis*) were recorded in the catches. Three other soft corals (Sea Broccoli *Drifa glomerata*, Sea Cauliflower *Duva florida* and Sea Strawberry *Gersemia rubiformis* – Sea Strawberry -) were also caught. *Flabellum alabastrum* is the only hard coral captured three times in 2013. Jellyfish (Scyphozoa class) that were listed for the survey belong to 5 species, the 3 most common being: Lion's Mane *Cyanea capillata* (81 stations, 120 kg), Crown Jellyfish *Periphylla periphylla* (50 stations, 97 kg) and *Ptychogena lactea* (40 stations, 1 7 kg). Finally, *Epizoanthus* sp (a Zoanthid) is the latest member of Cnidarians to have been clearly identified in the catches in 2013.

Six other taxa were identified during the survey in 2013 and are associated with: Ascidians (e.g. Cactus Sea *Boltenia echinata*, Sea Potato *Boltenia ovifera*, Sea Peach *Halocynthia pyriformis*), Brachiopods (e.g. *Hemithiris psittacea*, Northern Lamp Shell *Terebratulina septentrionalis*), Bryozoans (e.g. *Securiflustra securiflons*), Hydrozoa (e.g. Bottlebrush Hydroid *Thuiaria thuja*), Nemerteans and Sipunculida. Catches of these taxa were infrequent and in low abundance. Note that a particular sampling has been done to document cases of invasive species associated with the group of Ascidians (Tunicates) as the Golden Star Tunicate *Botryllus schlosseri* and *Didemnum vexillum*, two encrusting colonial species, and the Yellow Sea Squirt *Ciona intestinalis* and the Stalk Sea Squirt *Styela clava*, two solitary species.

SPECIAL FEATURES IN 2013

Just as in 2012, specific elements were observed during the 2013 survey. Thus, more than twenty taxa, rarely or never seen in the historical survey series, were captured (Appendix 2). For some of them, their presence in the Northern Gulf survey is even more special because they are known to be either residents of more southern waters (e.g. Haddock *Melanogrammus aeglefinus*, Pollock *Pollachius virens*, Butterfish *Peprilus triacanthus*; shrimps *Hymenopenaeus debilis* and *Plesionika martia* - Gulf of Mexico) or more oceanic waters (e.g. Threebeard Rockling *Gaidropsarus ensis*, Straightline Dragonfish *Borostomias antarcticus*) . Other interesting fact to note in 2013 for two species whose occurrence is usually occasional in a survey: 1) the almost generalized presence of Silver Hake *M. bilinearis*, a southern species, in the area survey including colder waters of the Estuary; and 2) Arctic Cod *Boreogadus saida* catches, an arctic species, that have spread into the Estuary, with more than a dozen individuals per station for some fishing stations.

As in 2012, catches of some commercial groundfish (Greenland Halibut, Cod, American Plaice, Acadian and Atlantic redfishes), revealed the presence of very small individuals

(5 cm or less) born in 2013 (Appendix 3; Figures 5, 8, 20, 23 and 26). In addition, the sizes group of 5-12 cm of the two species of redfish have the highest mean abundances per tow (> 100 ind.) never seen in the historical series, especially with regard to Deepwater Redfish (*S. mentella*).

Finally, the preliminary data analysis of water temperature measured during the survey in 2013, based on an up-to-date of a report describing the oceanographic conditions in 2012 (Galbraith et al. 2013), shows that, for the Gulf in general (Figure 66):

1. The summer water temperature at the surface, averaged for the Estuary and northern Gulf from July to September, was near normal (13.2 º C; anomaly of +0.3 ° C compared to the period 1985-2010) in 2013, in contrast to the 2012 record of 14.7 º C (+ 1.8 º C anomaly).
2. The cold intermediate layer (CIL) was colder in August 2013 than in August 2012, resembling conditions observed in 2011. Overall, it was the third warmest CIL since 1984. However, cold water persisted as almost every year in the Mecatina trough (off the Lower North Shore) where temperatures below 75 m depth were less than 0 º C, reaching - 1.3 º C on the bottom.
3. The waters at 200 m depth were cooler in 2013 than in 2012. At 300 m depth, the water temperature reached the highest value observed since 1980. In Esquiman and North Anticosti channels, and along the northern margin of the Laurentian Channel southeast of Anticosti Island, the water bottom temperature exceeded 6 º C.

A more detailed analysis of the measured environmental conditions in the Estuary and the Gulf during the 2013 survey will be available shortly (Peter Galbraith, pers. comm.).

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Finally, we would like to thank Denis Bernier and Claude Savenkoff for reviewing this document.

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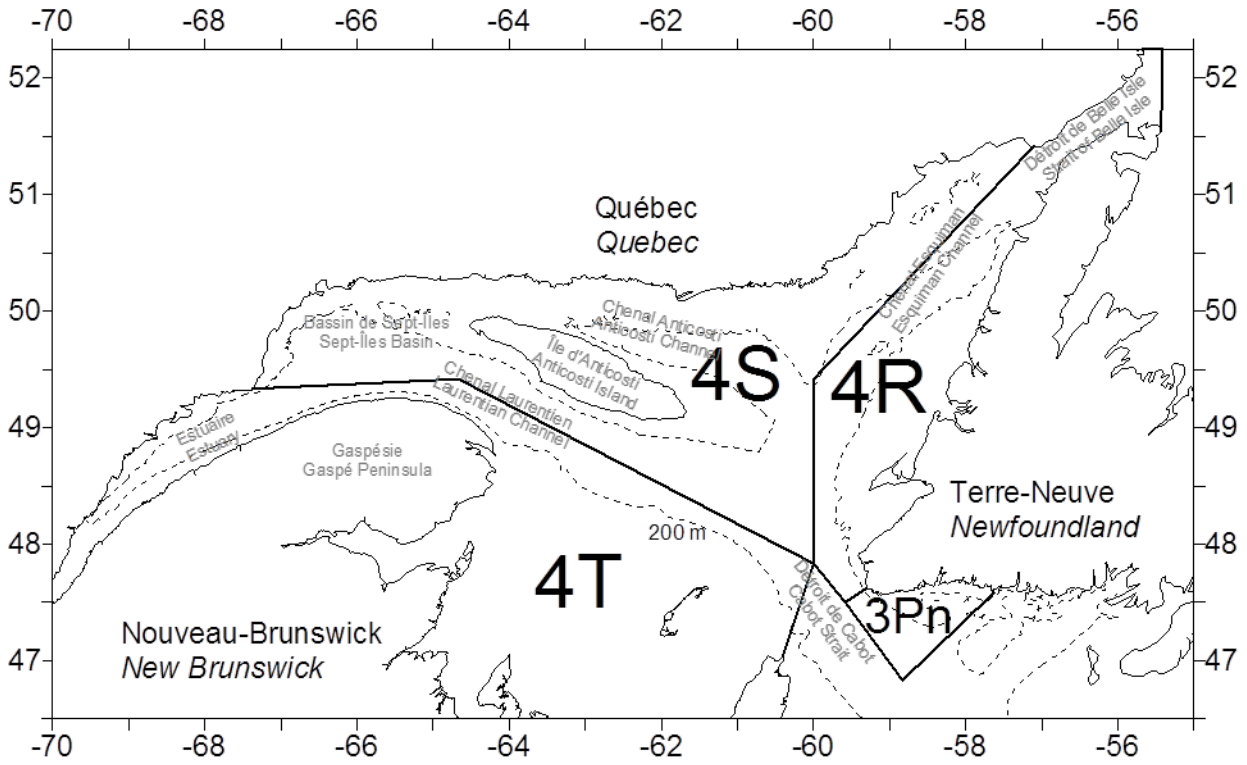

Figure 1. NAFO Divisions of the Estuary and Gulf of St. Lawrence and names of locations mentioned in the text.

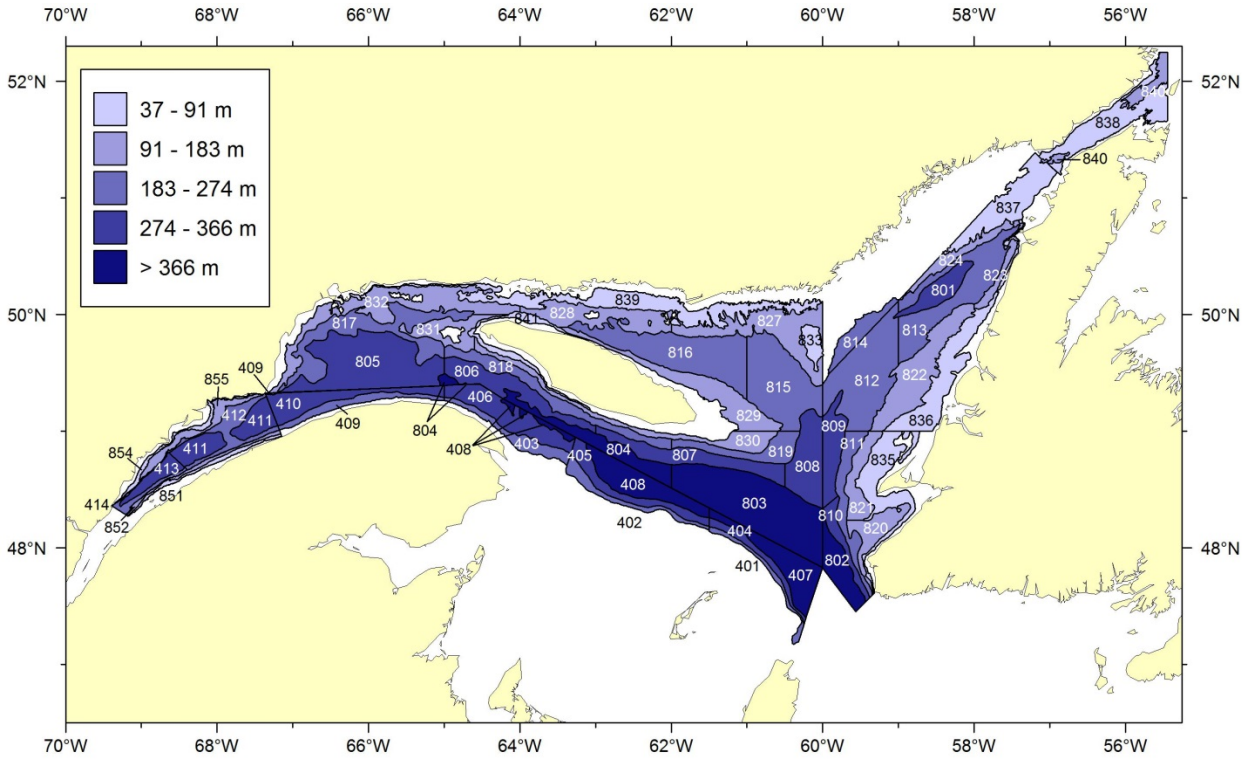

Figure 2. Stratification scheme used for the groundfish and shrimp research survey in the Estuary and northern Gulf of St. Lawrence.

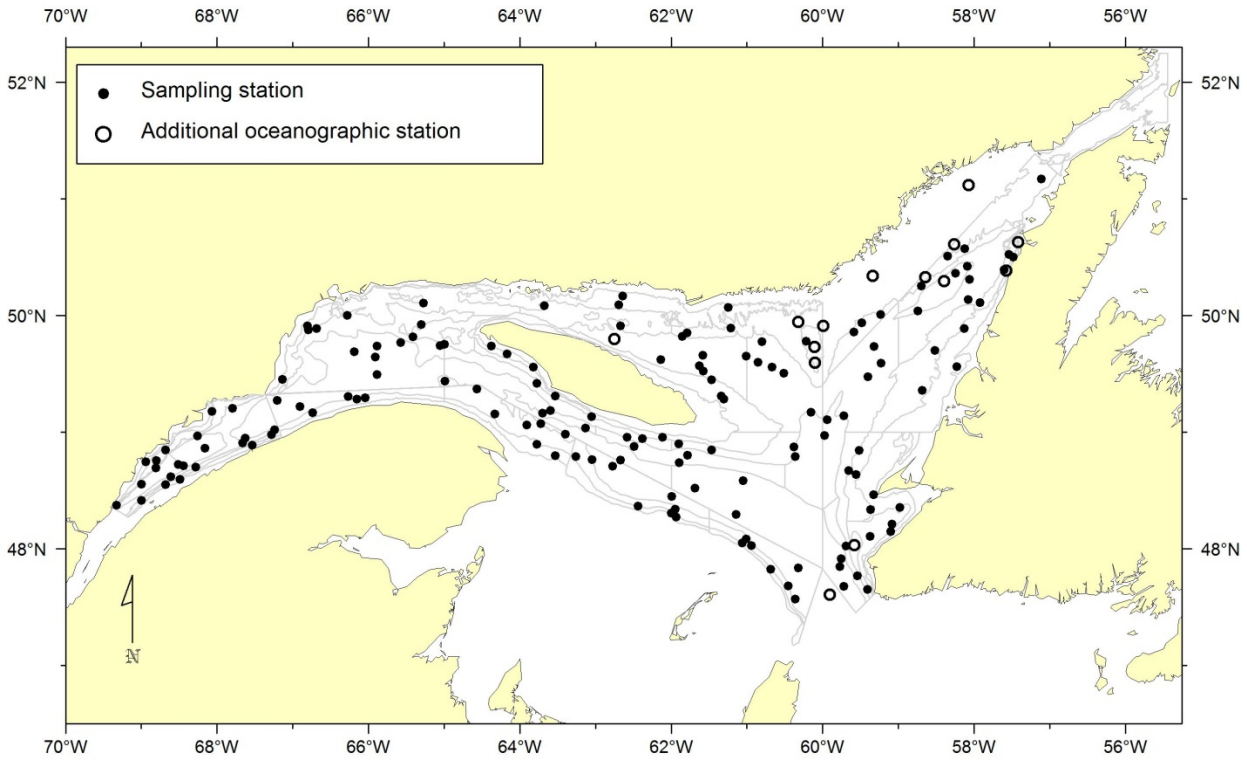

Figure 3. Locations of successful sampling stations (trawl and oceanography) and additional oceanographic stations for the 2013 survey.

Acadian Redfish

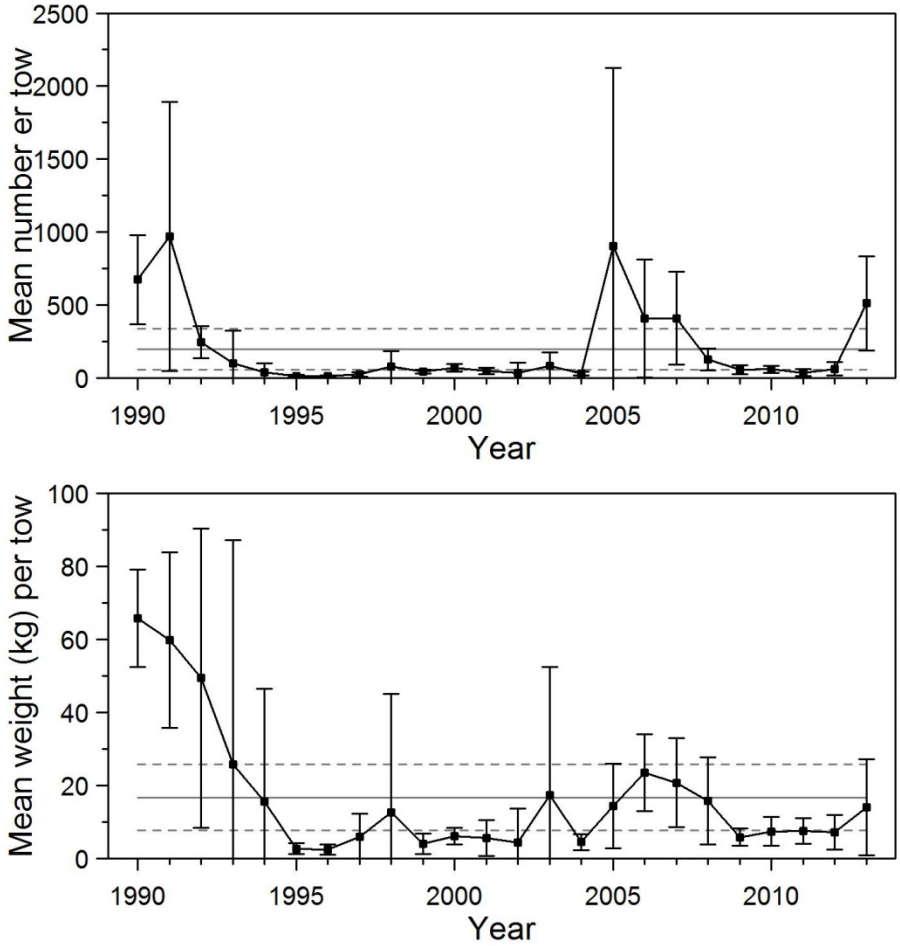

Figure 4. Mean numbers and mean weights per 15 minutes tow observed during the survey for Acadian Redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Acadian Redfish

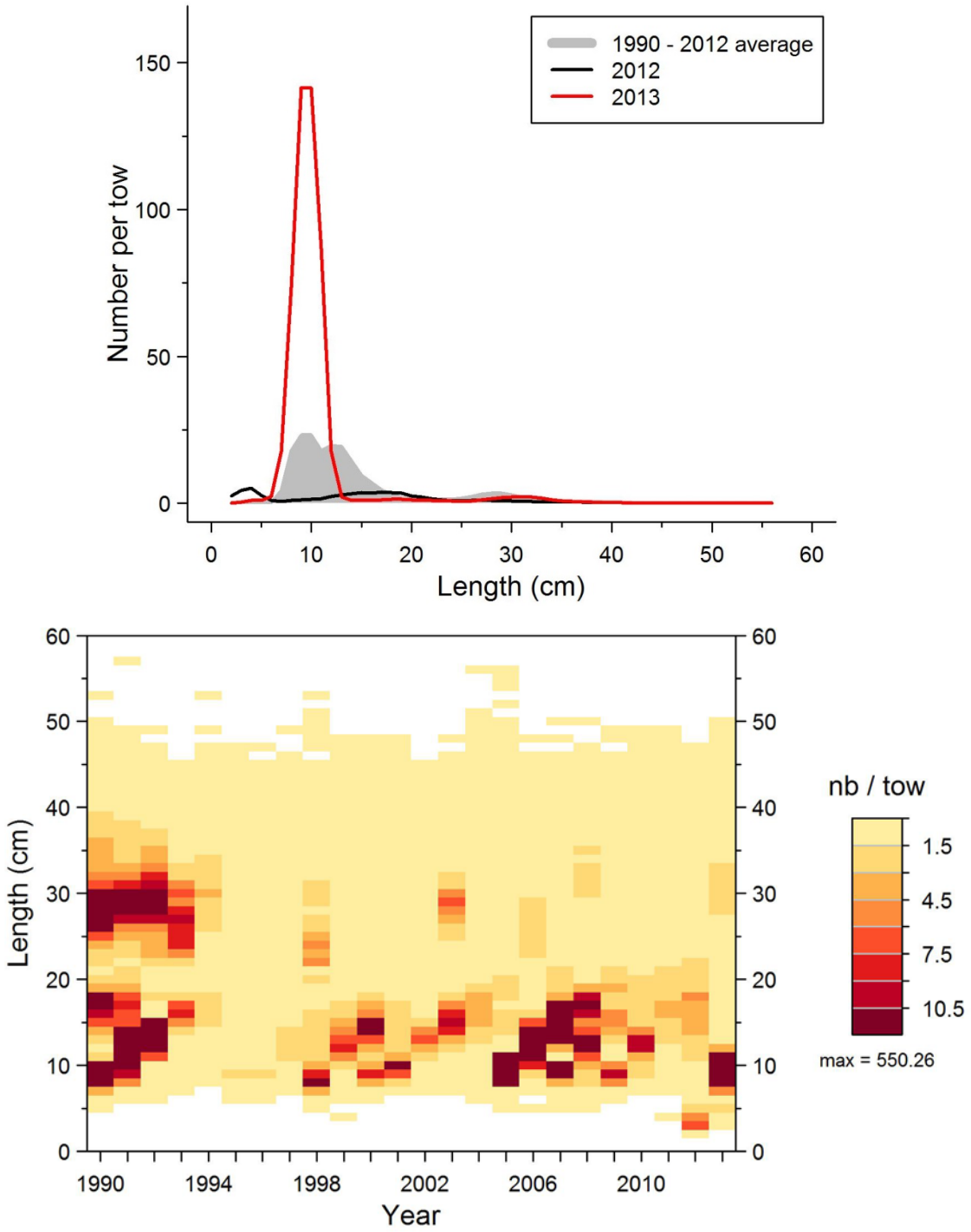

Figure 5. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Acadian Redfish in 4RST.

Acadian Redfish

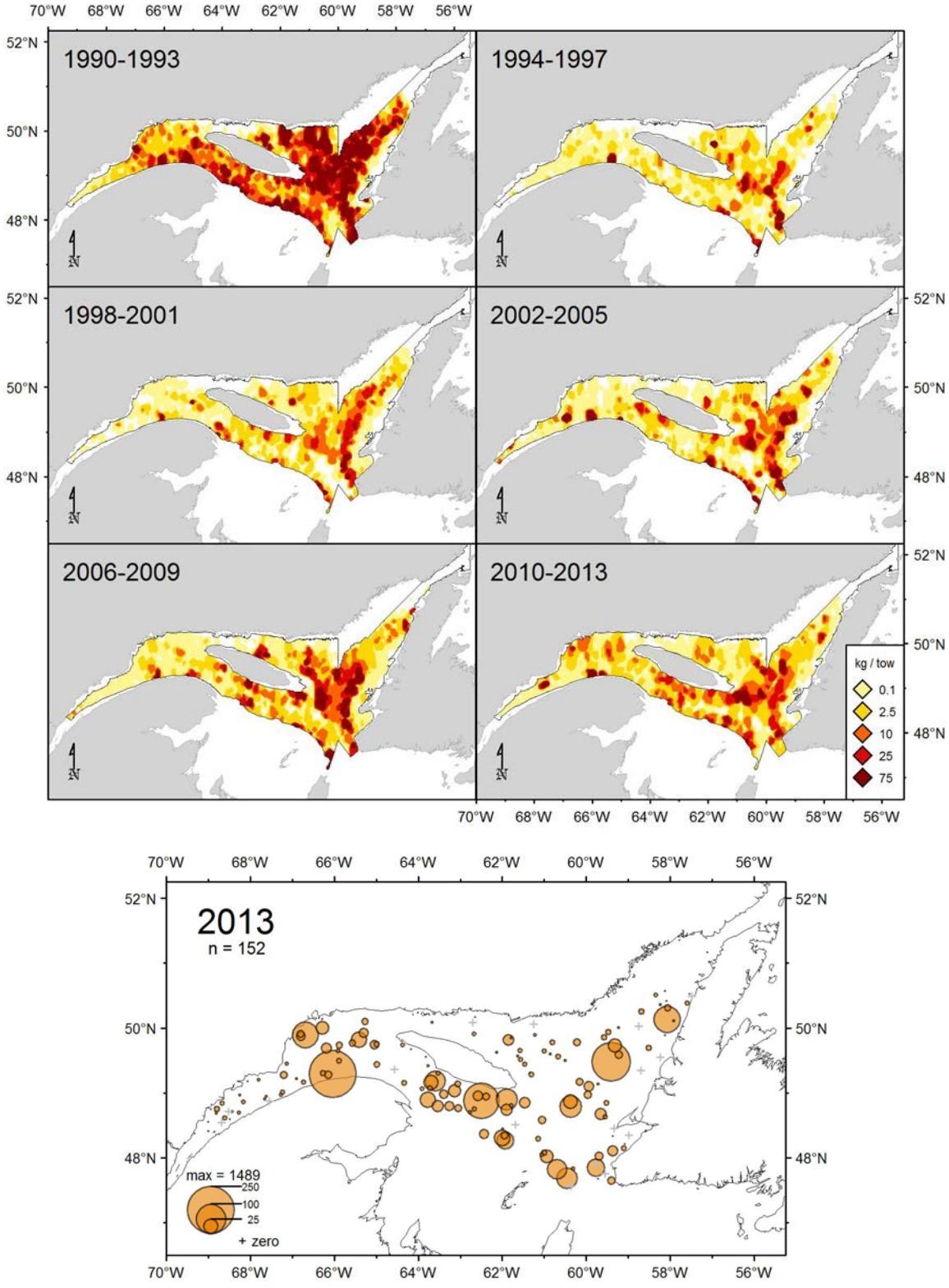

Figure 6. Acadian Redfish catch rates (kg/15 minutes tow) distribution.

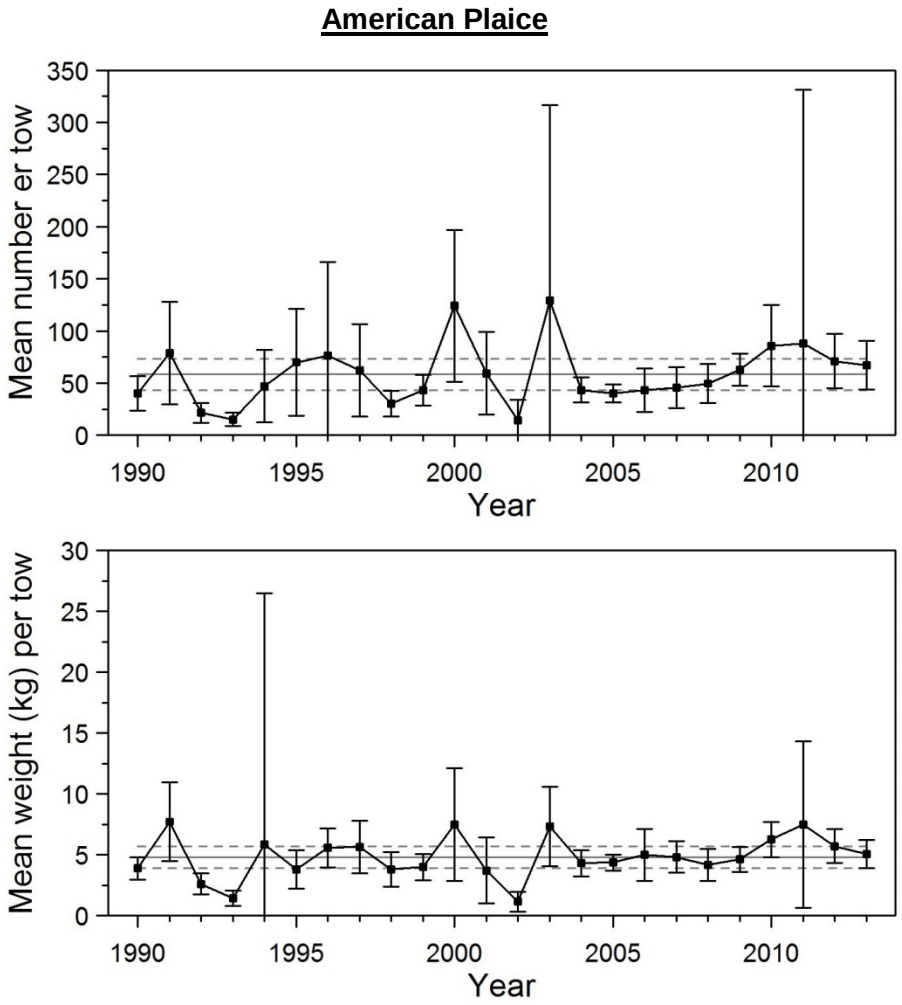

Figure 7. Mean numbers and mean weights per 15 minutes tow observed during the survey for American Plaice in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

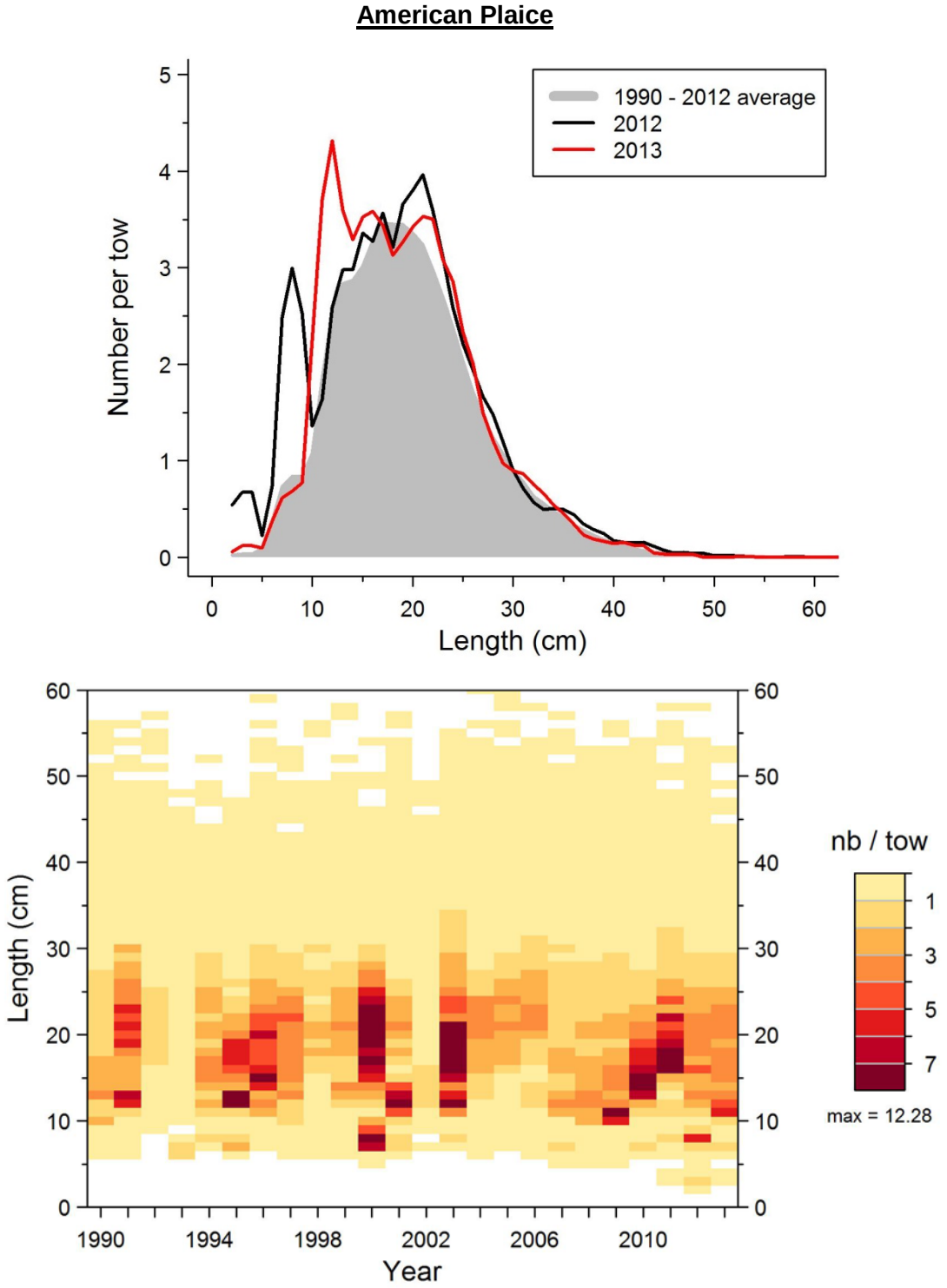

Figure 8. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for American Plaice in 4RST.

American Plaice

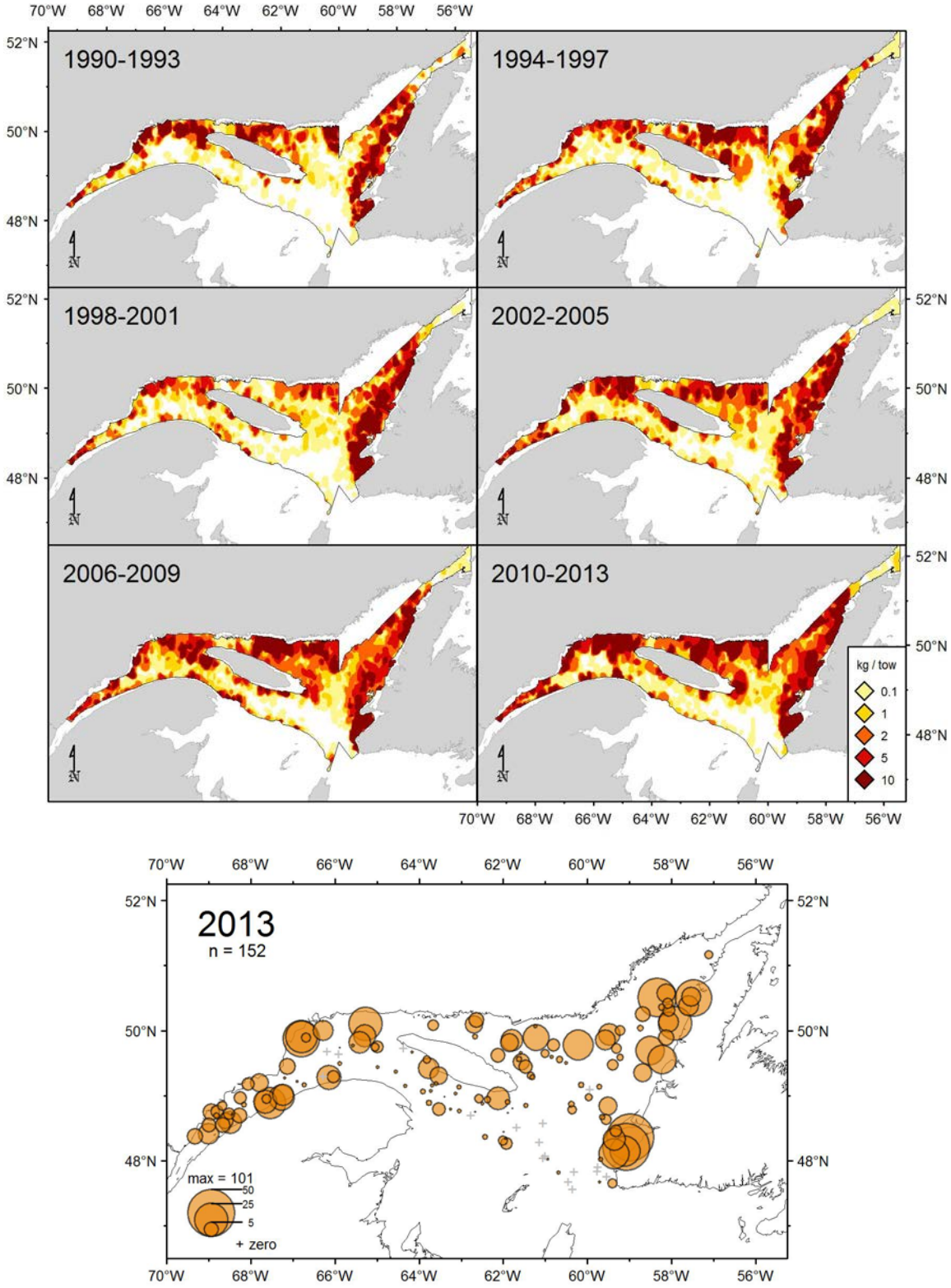

Figure 9. American Plaice catch rates (kg/15 minutes tow) distribution.

Atlantic Halibut

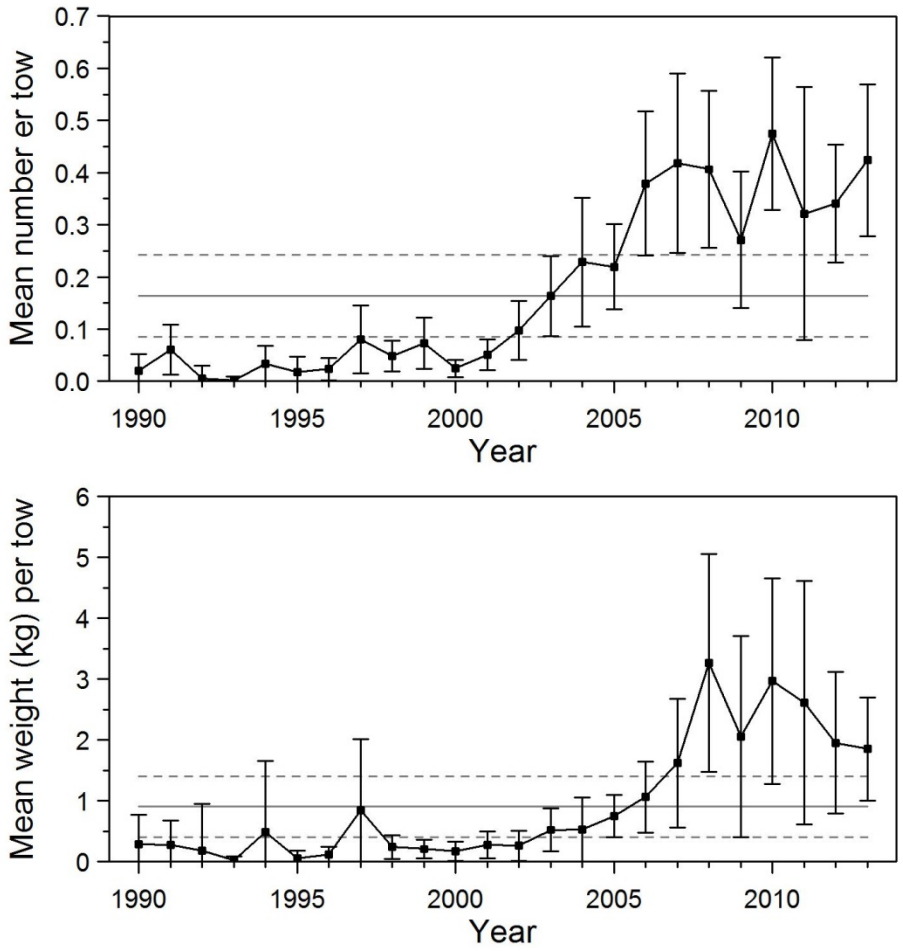

Figure 10. Mean numbers and mean weights per 15 minutes tow observed during the survey for Atlantic Halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

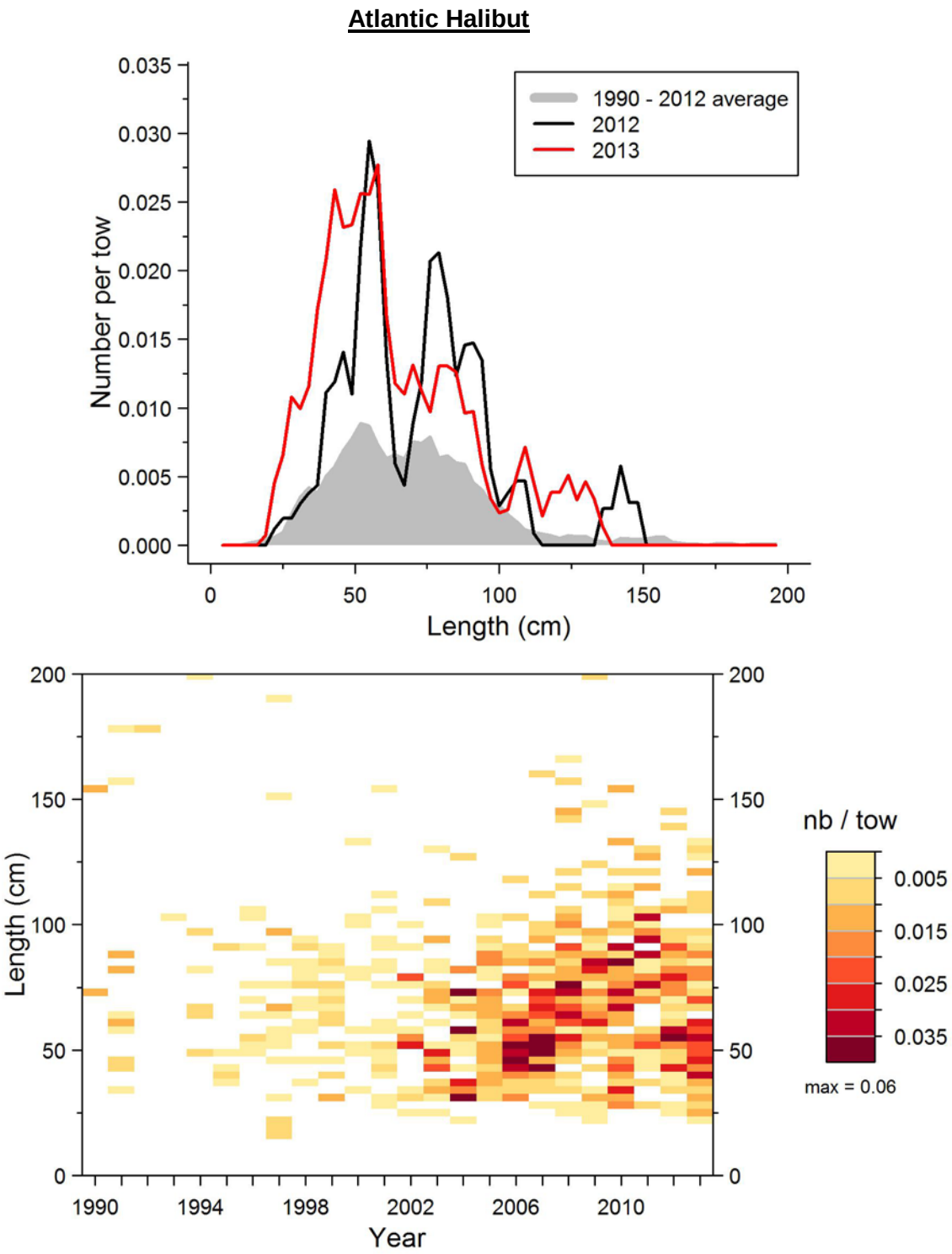

Figure 11. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Atlantic Halibut in 4RST.

Atlantic Halibut

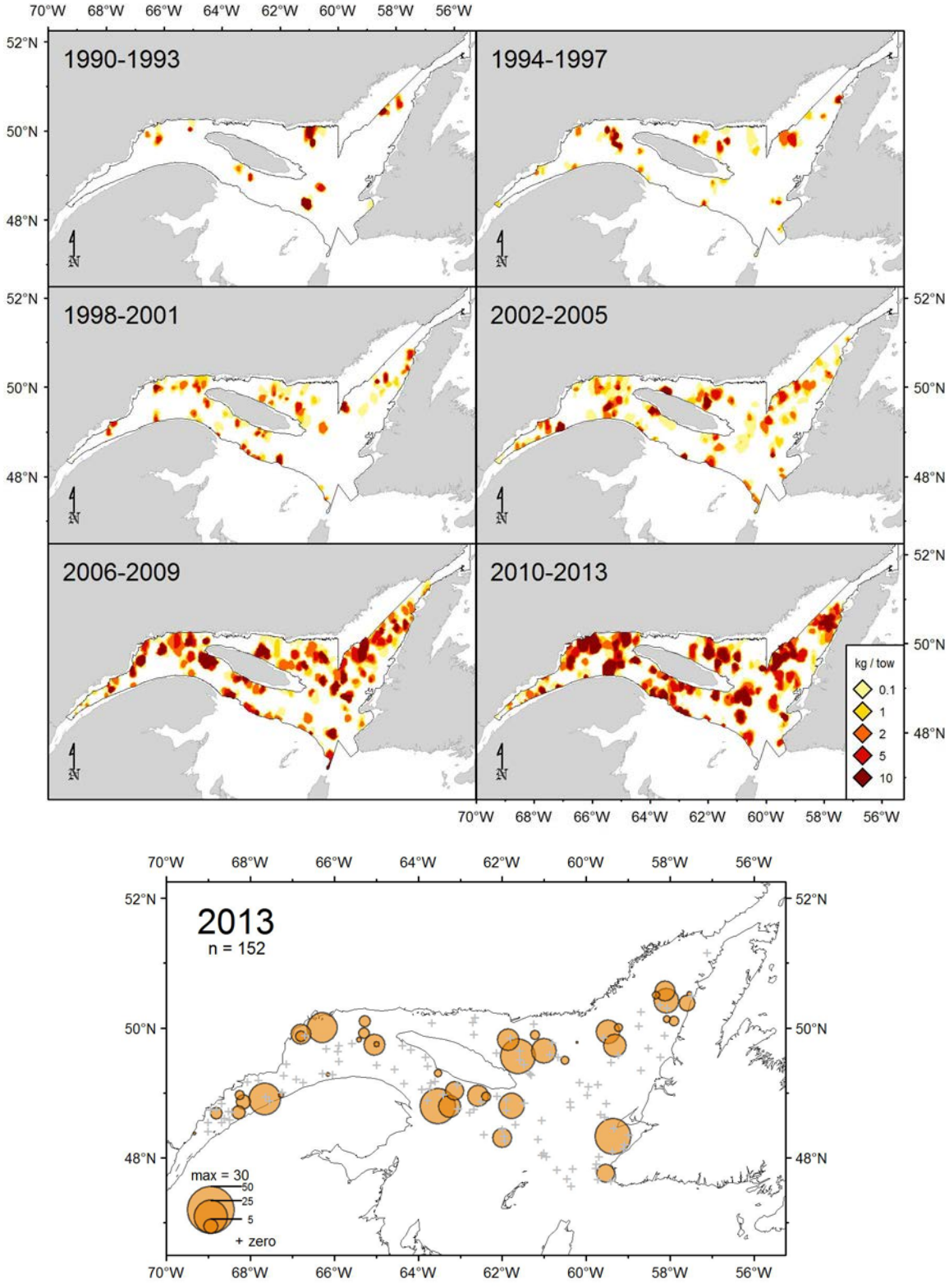

Figure 12. Atlantic Halibut catch rates (kg/15 minutes tow) distribution.

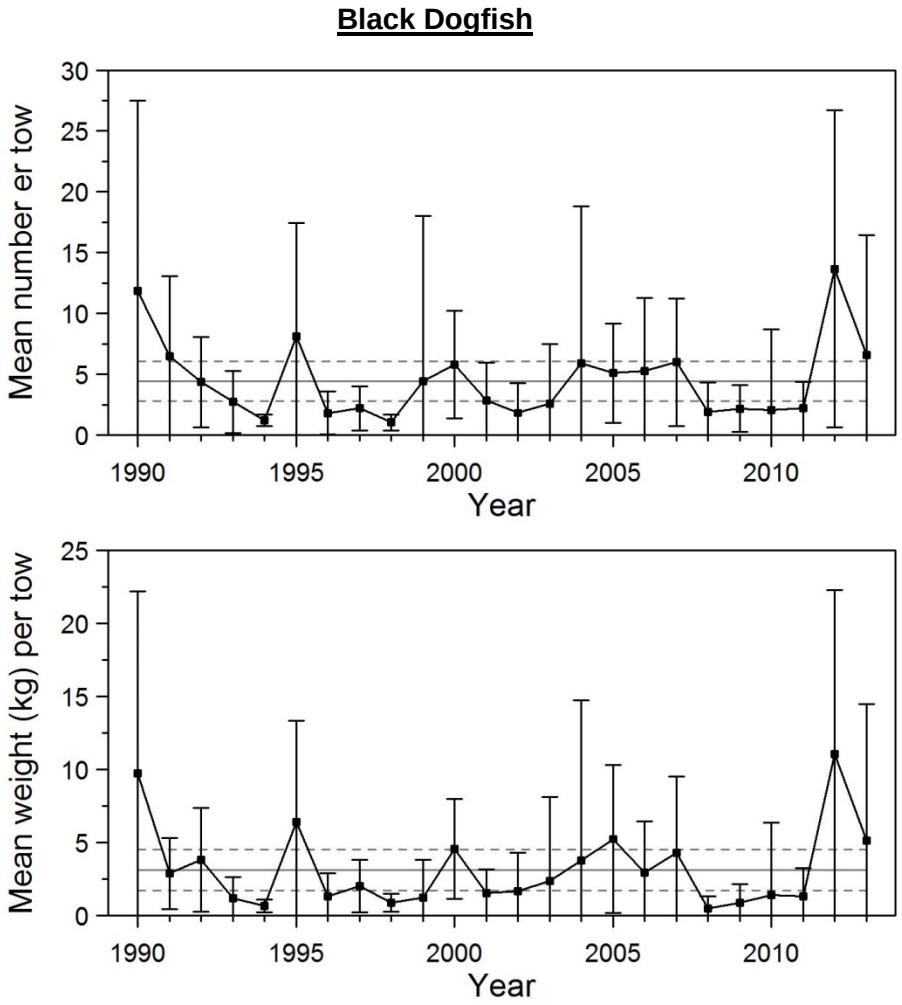

Figure 13. Mean numbers and mean weights per 15 minutes tow observed during the survey for Black Dogfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Black Dogfish

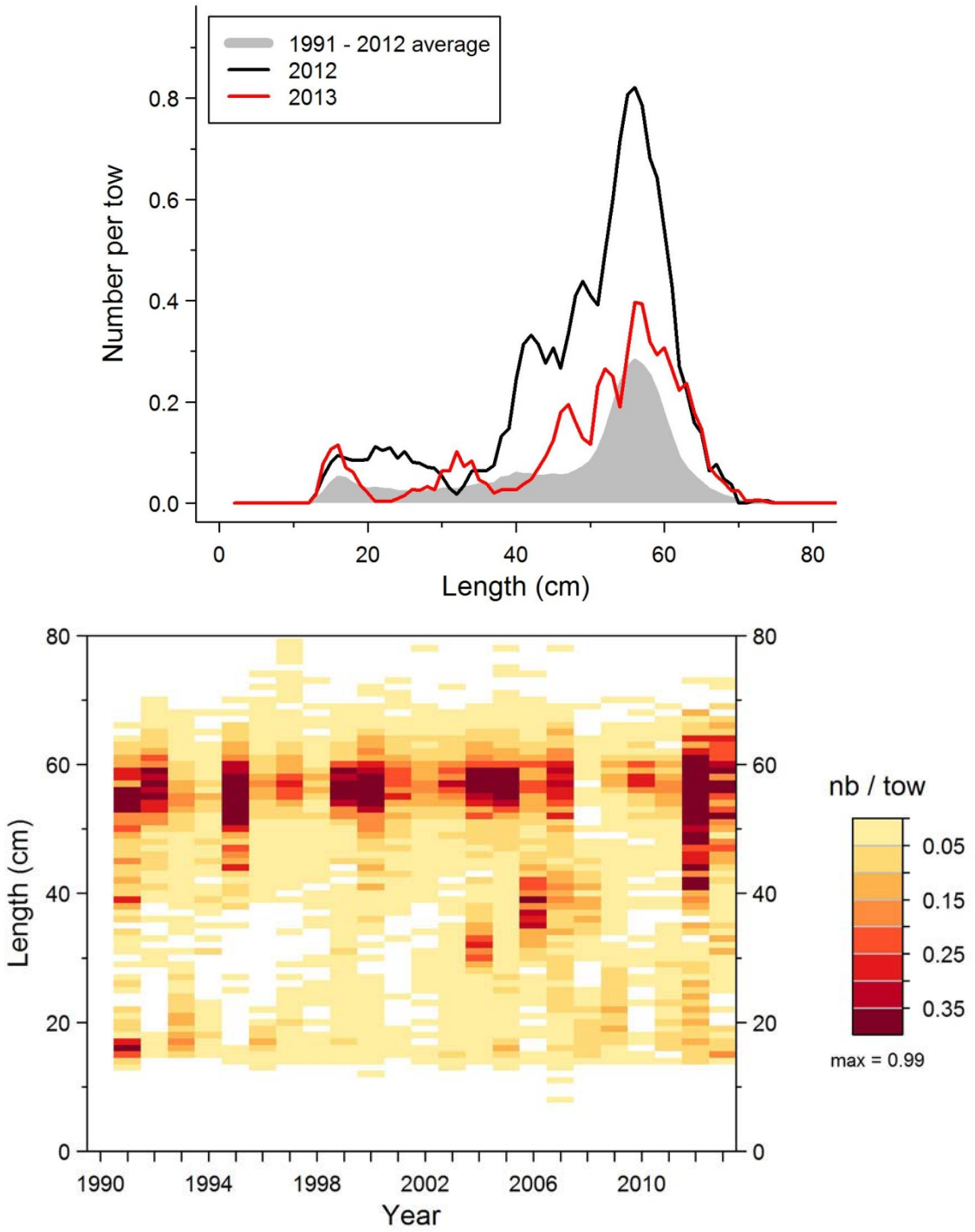

Figure 14. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Black Dogfish in 4RST.

Black Dogfish

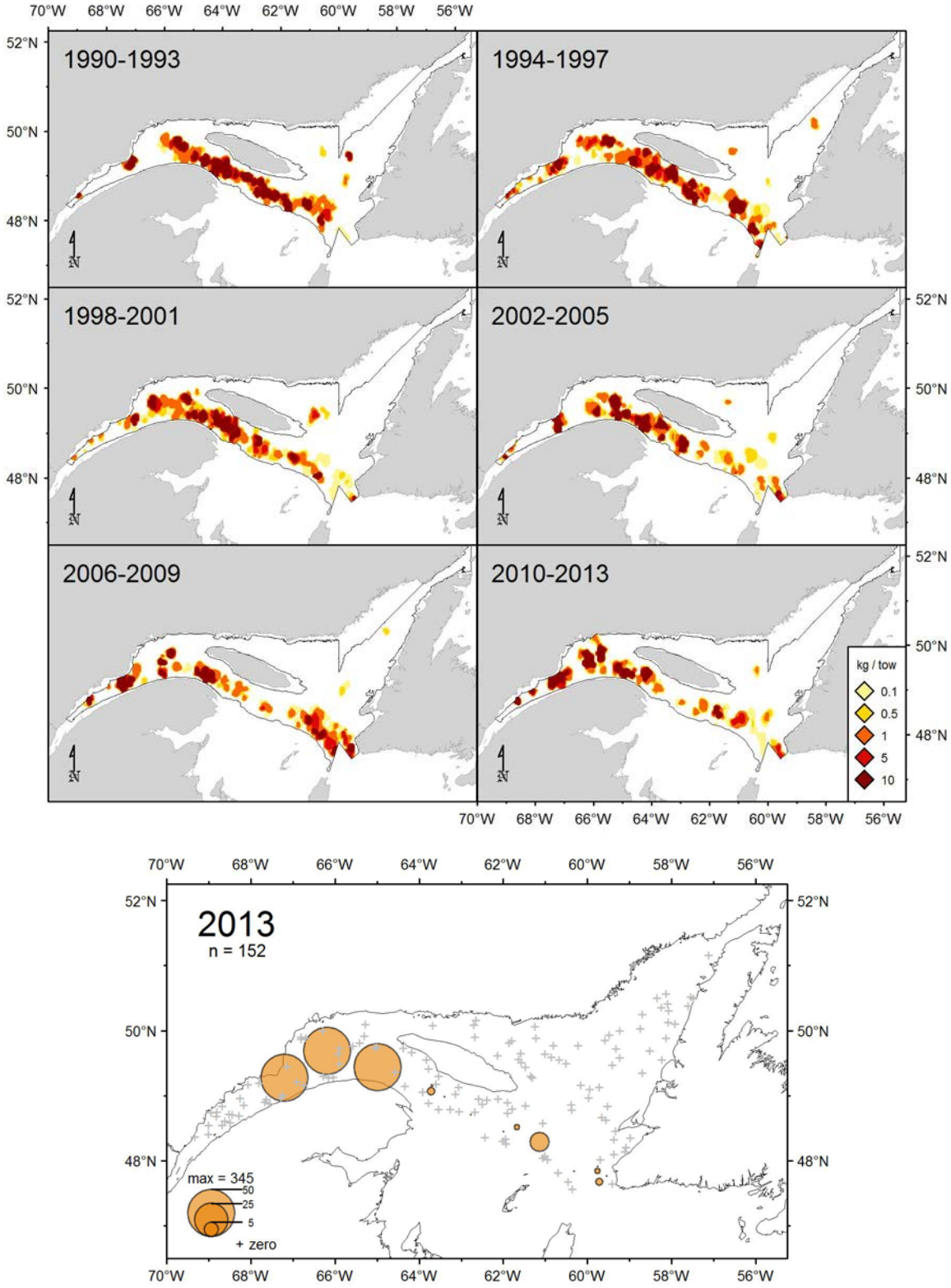

Figure 15. Black Dogfish catch rates (kg/15 minutes tow) distribution.

Capelin

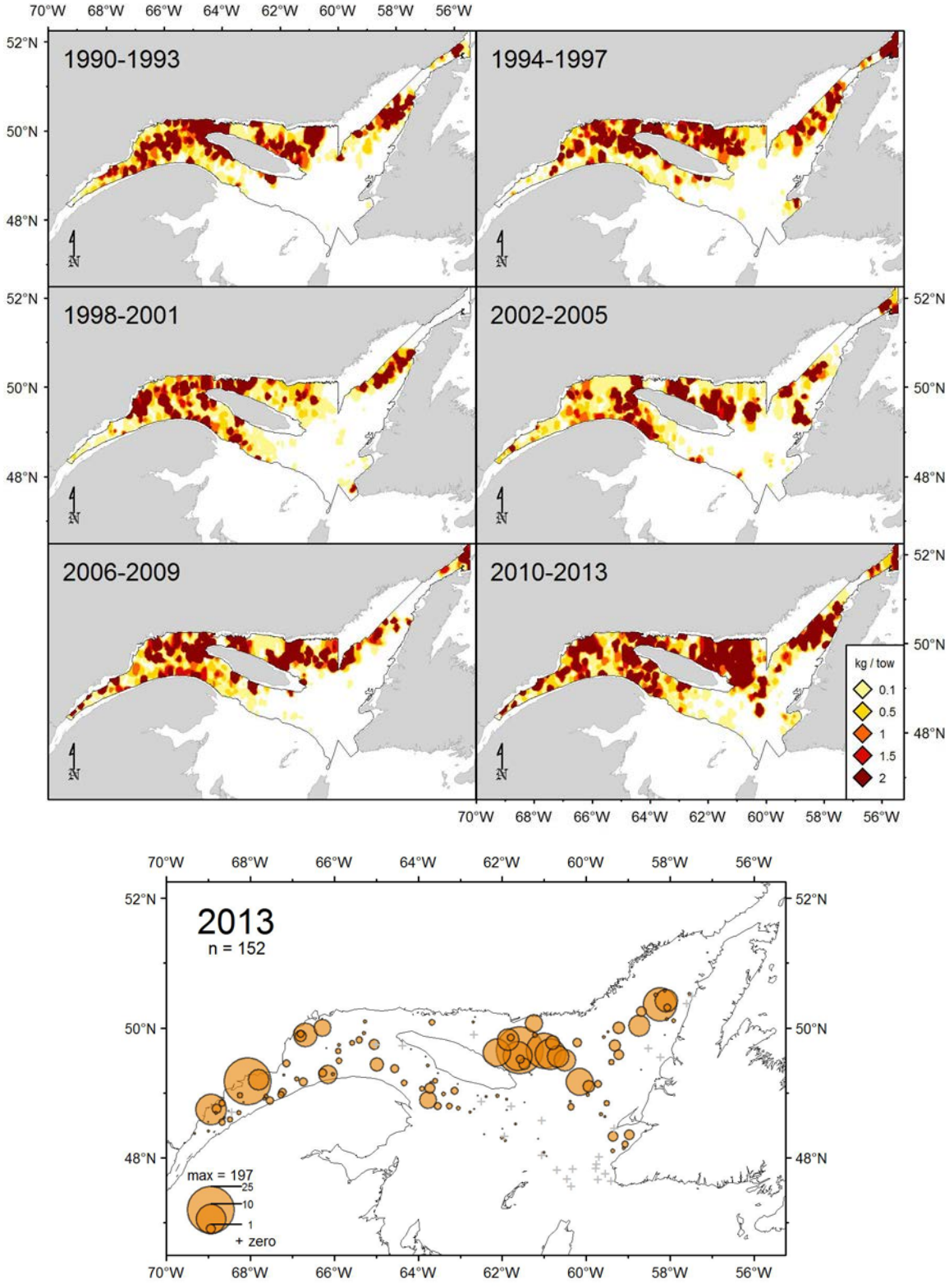

Figure 16. Capelin catch rates (kg/15 minutes tow) distribution.

Capelin

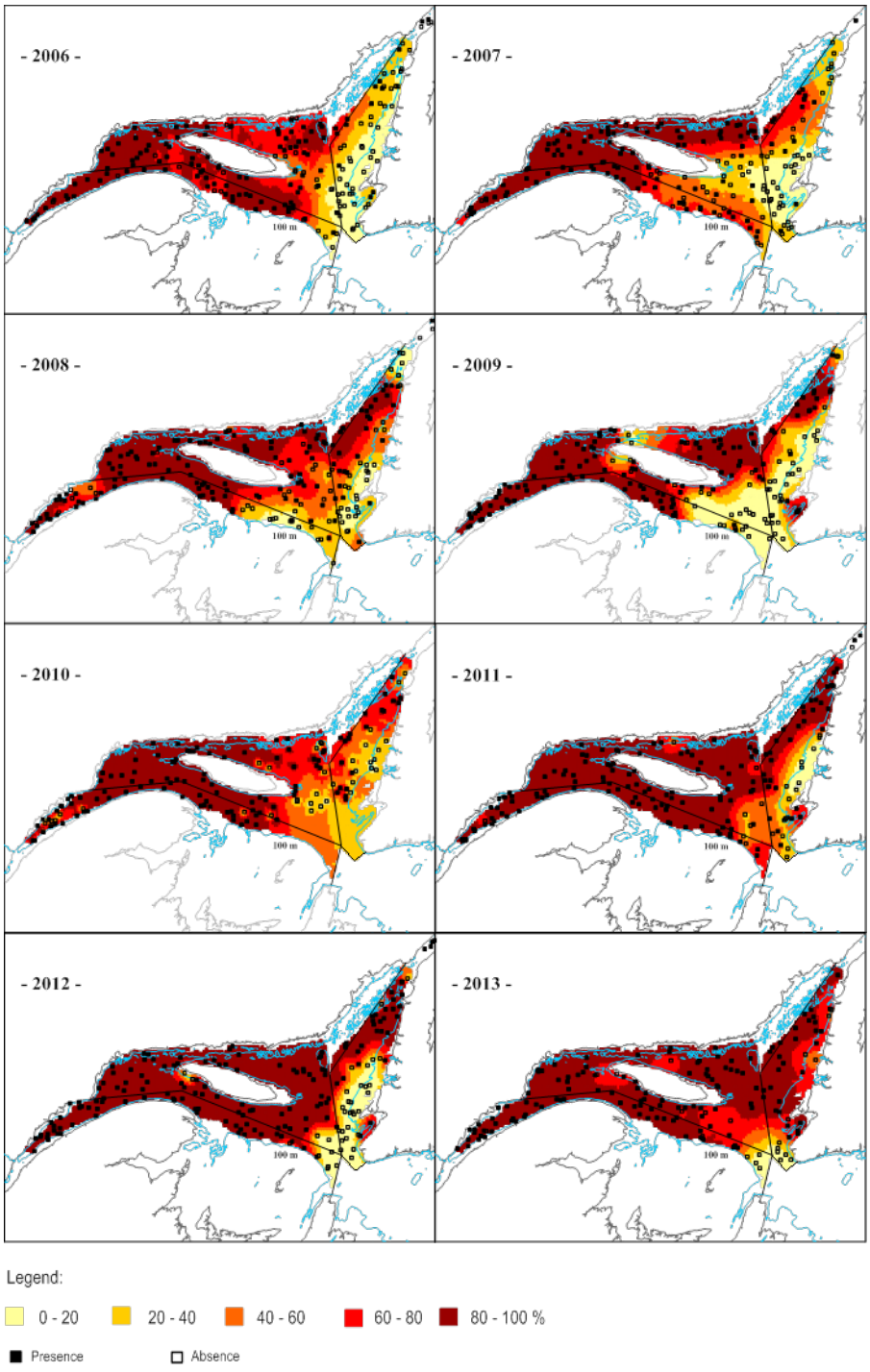

Figure 17. Probabilities areas (%) associated with the presence of Capelin.

Capelin

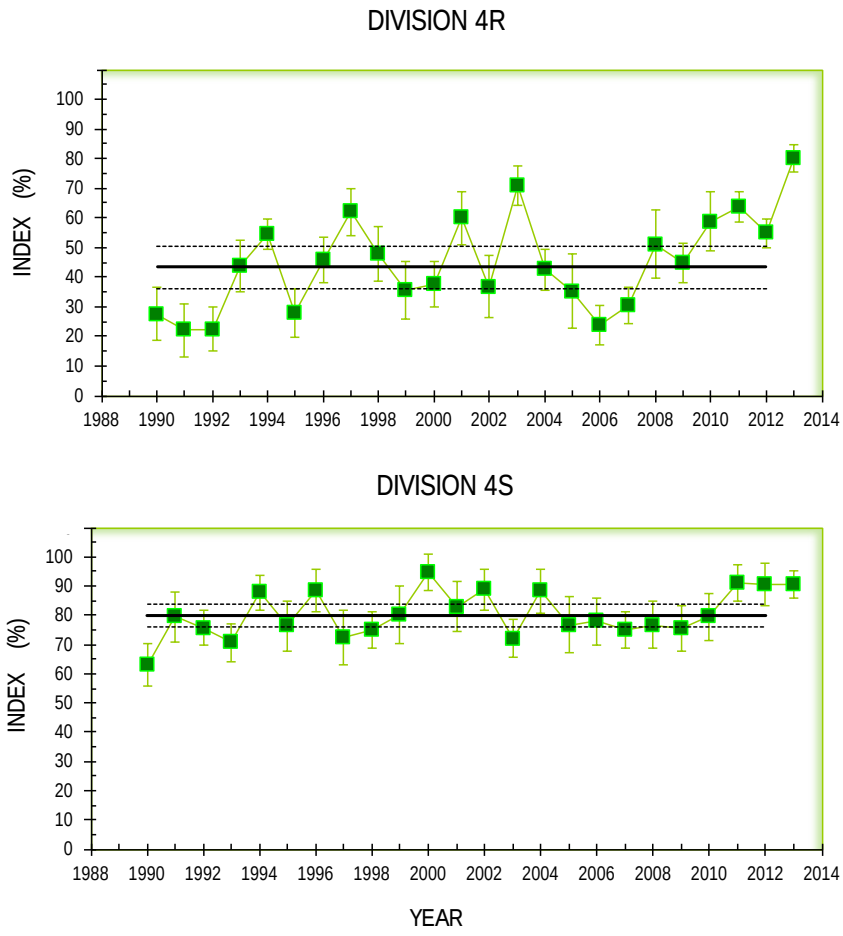

Figure 18. Mean probabilities of finding Capelin in NAFO Divisions 4R and 4S. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

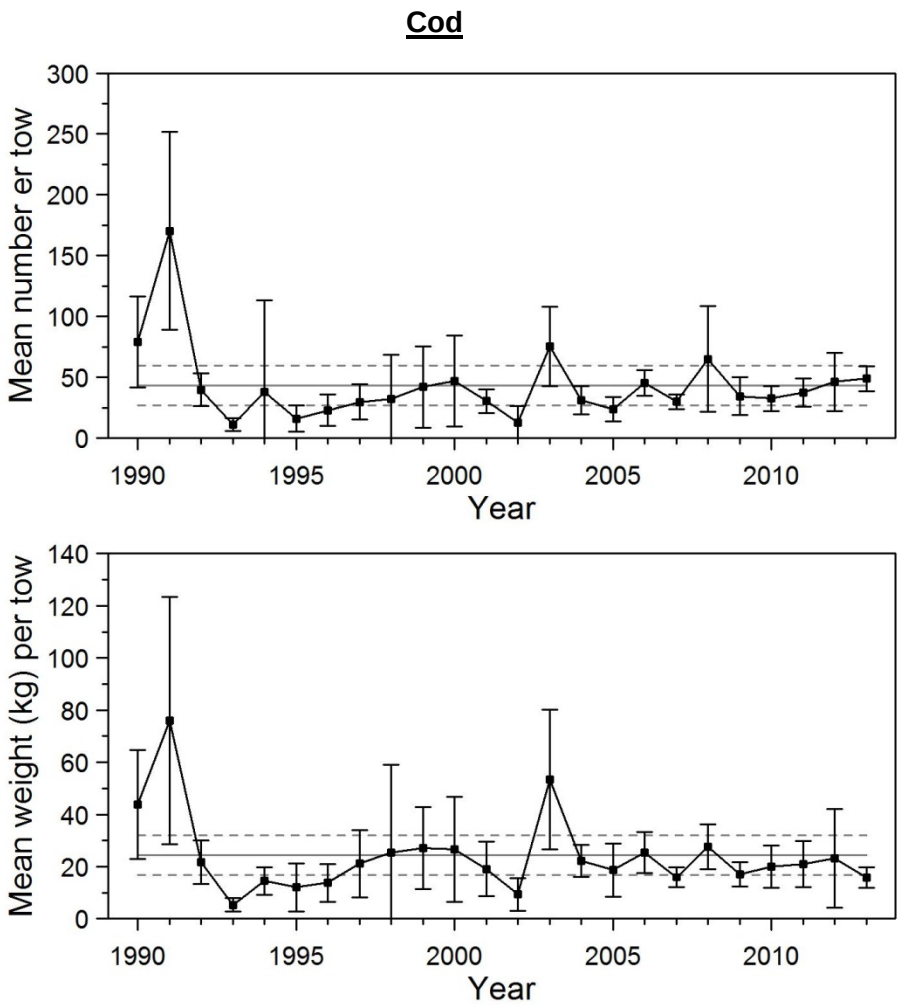

Figure 19. Mean numbers and mean weights per 15 minutes tow observed during the survey for Cod in 4RS. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

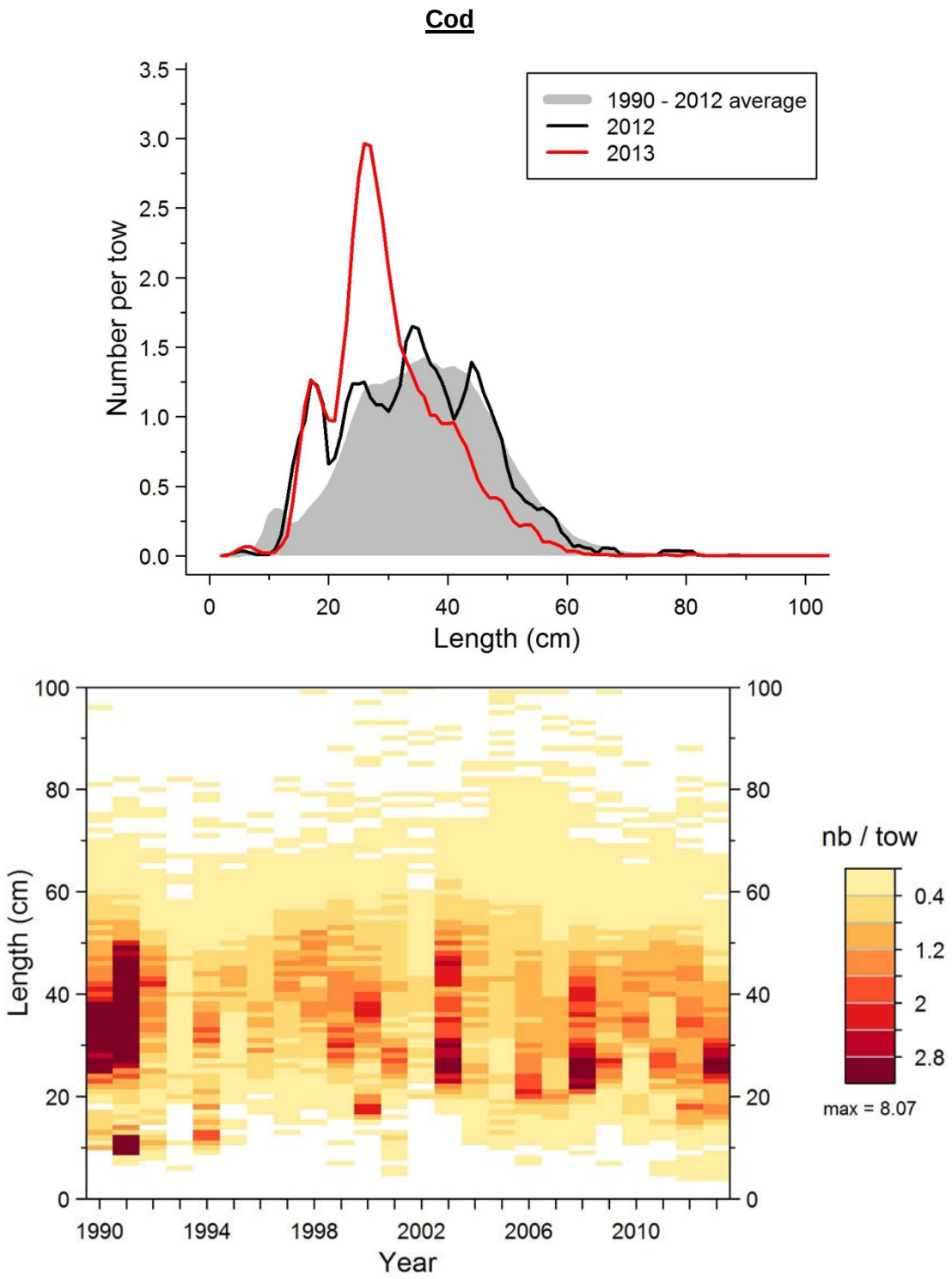

Figure 20. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Cod in 4RS.

Cod

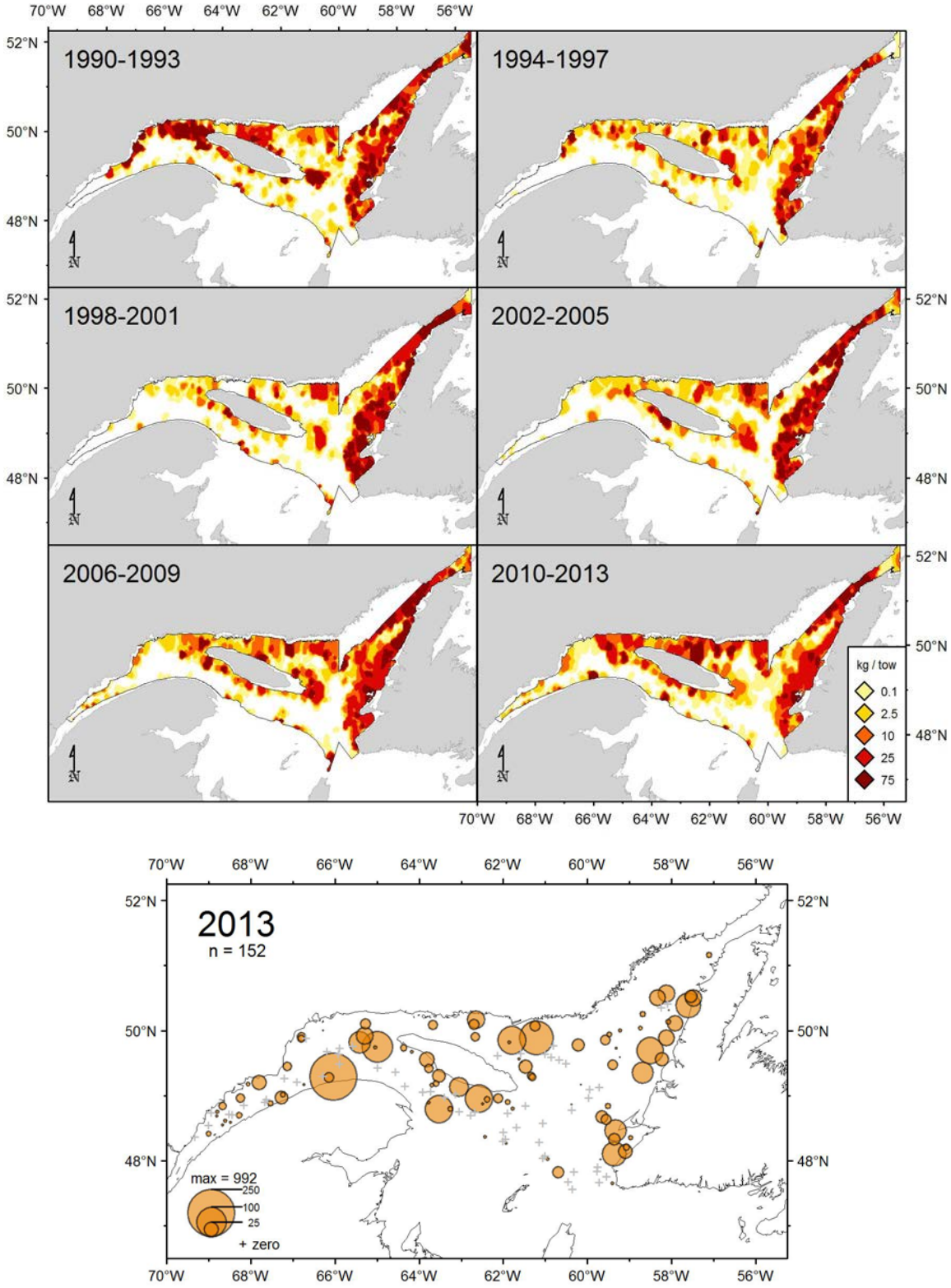

Figure 21. Cod catch rates (kg/15 minutes tow) distribution.

Deepwater Redfish

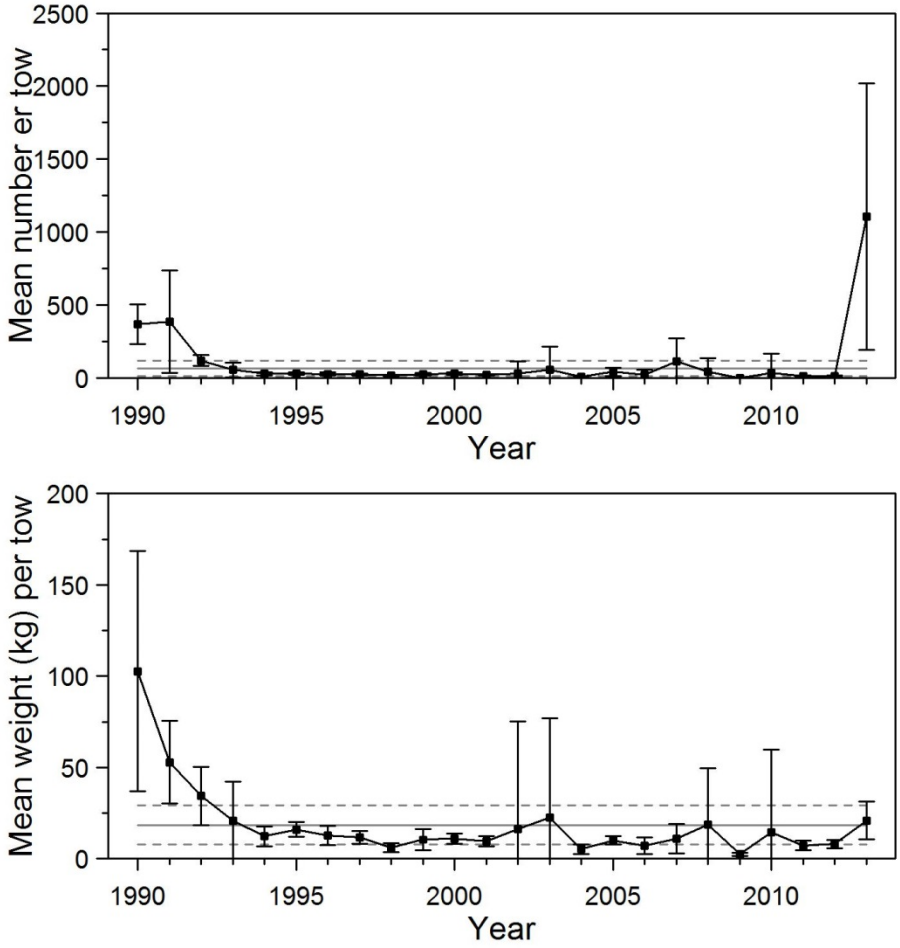

Figure 22. Mean numbers and mean weights per 15 minutes tow observed during the survey for Deepwater Redfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Deepwater Redfish

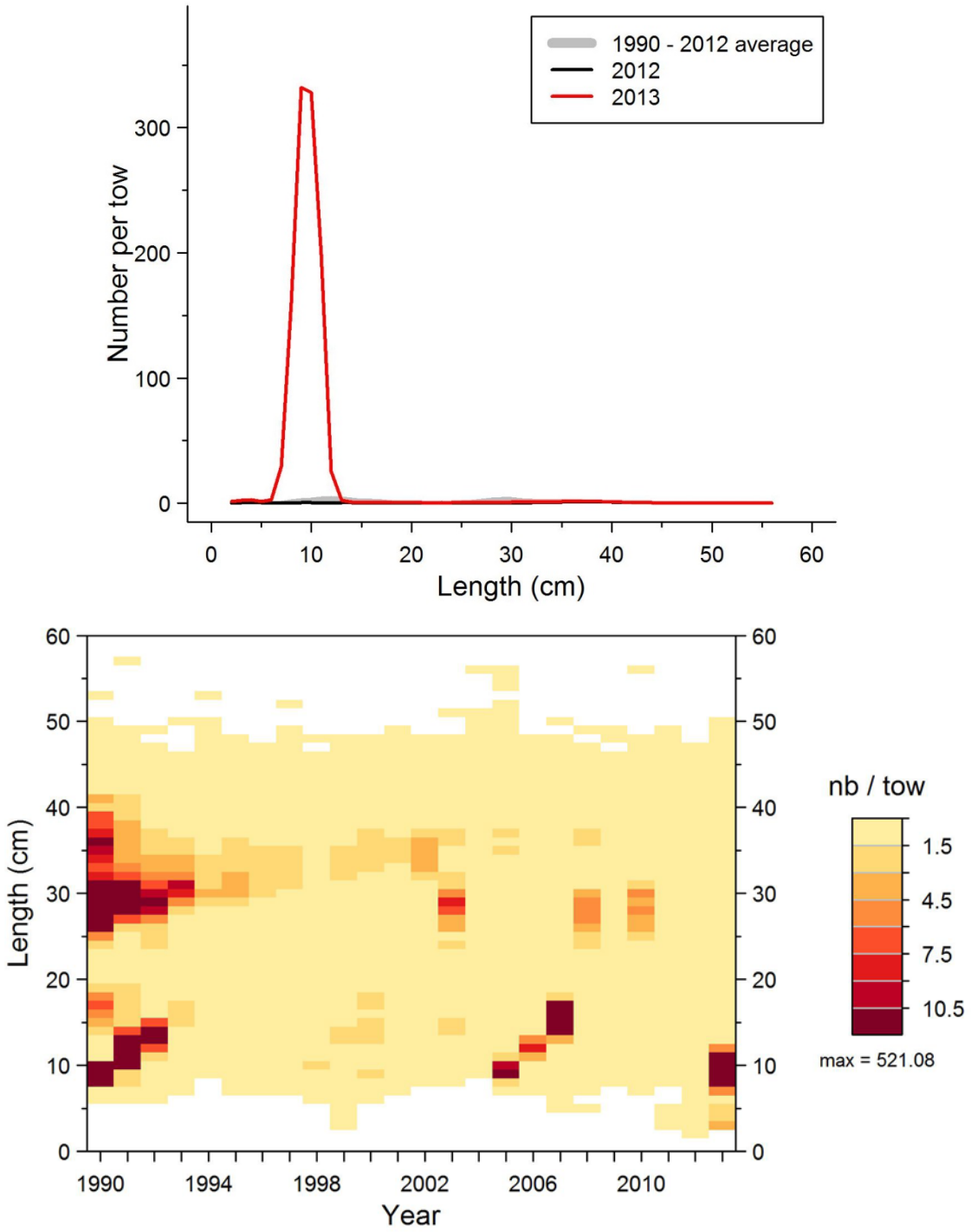

Figure 23. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Deepwater Redfish in 4RST.

Deepwater Redfish

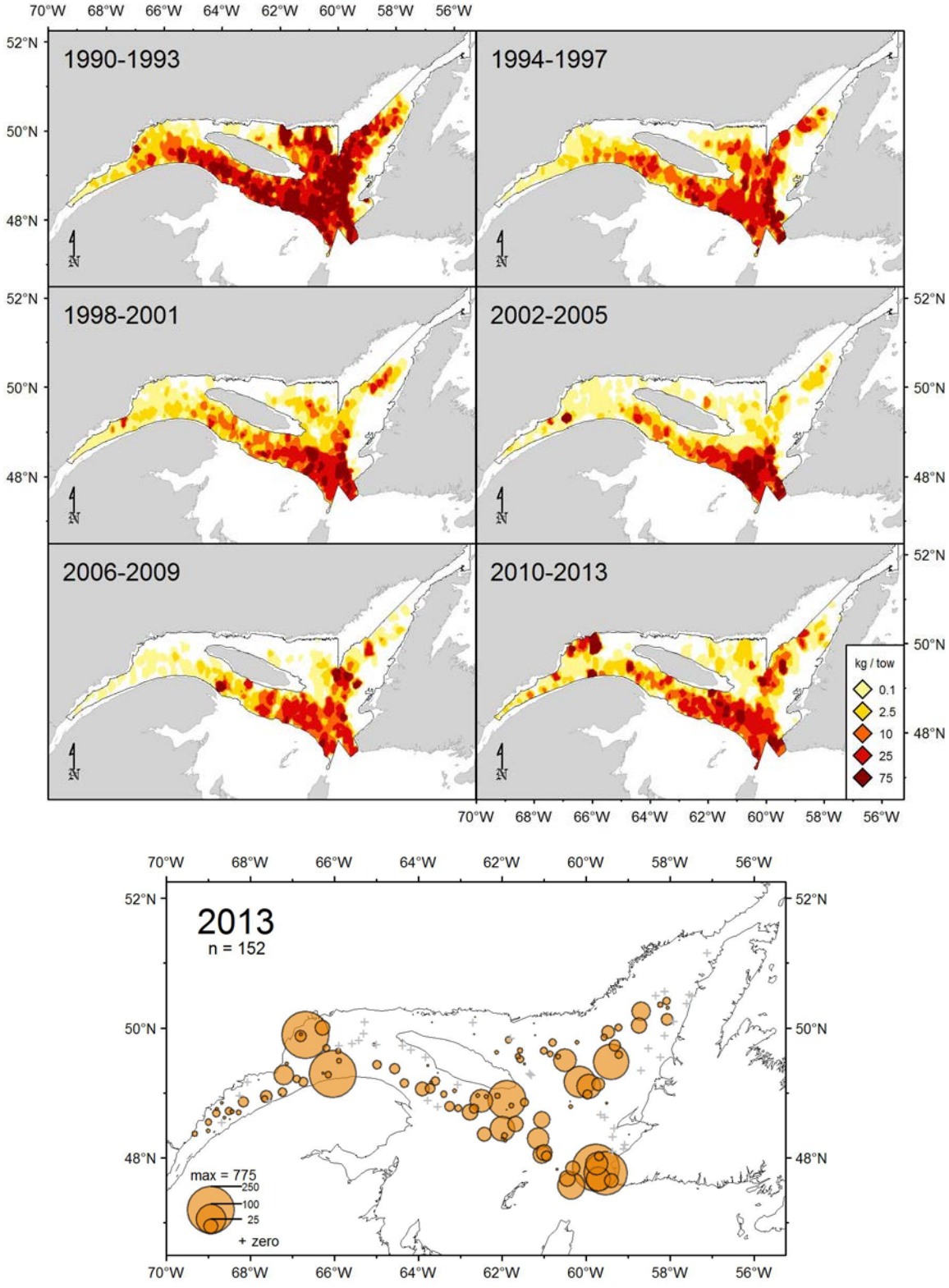

Figure 24. Deepwater Redfish catch rates (kg/15 minutes tow) distribution.

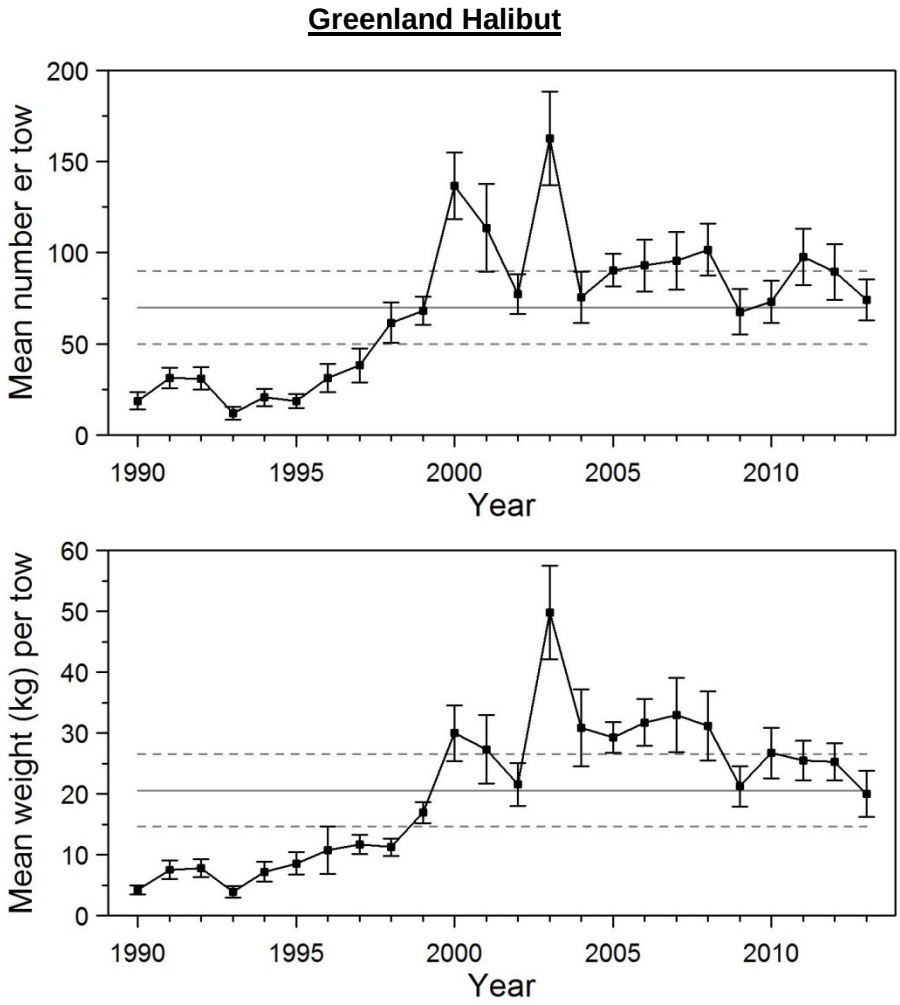

Figure 25. Mean numbers and mean weights per 15 minutes tow observed during the survey for Greenland Halibut in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Greenland Halibut

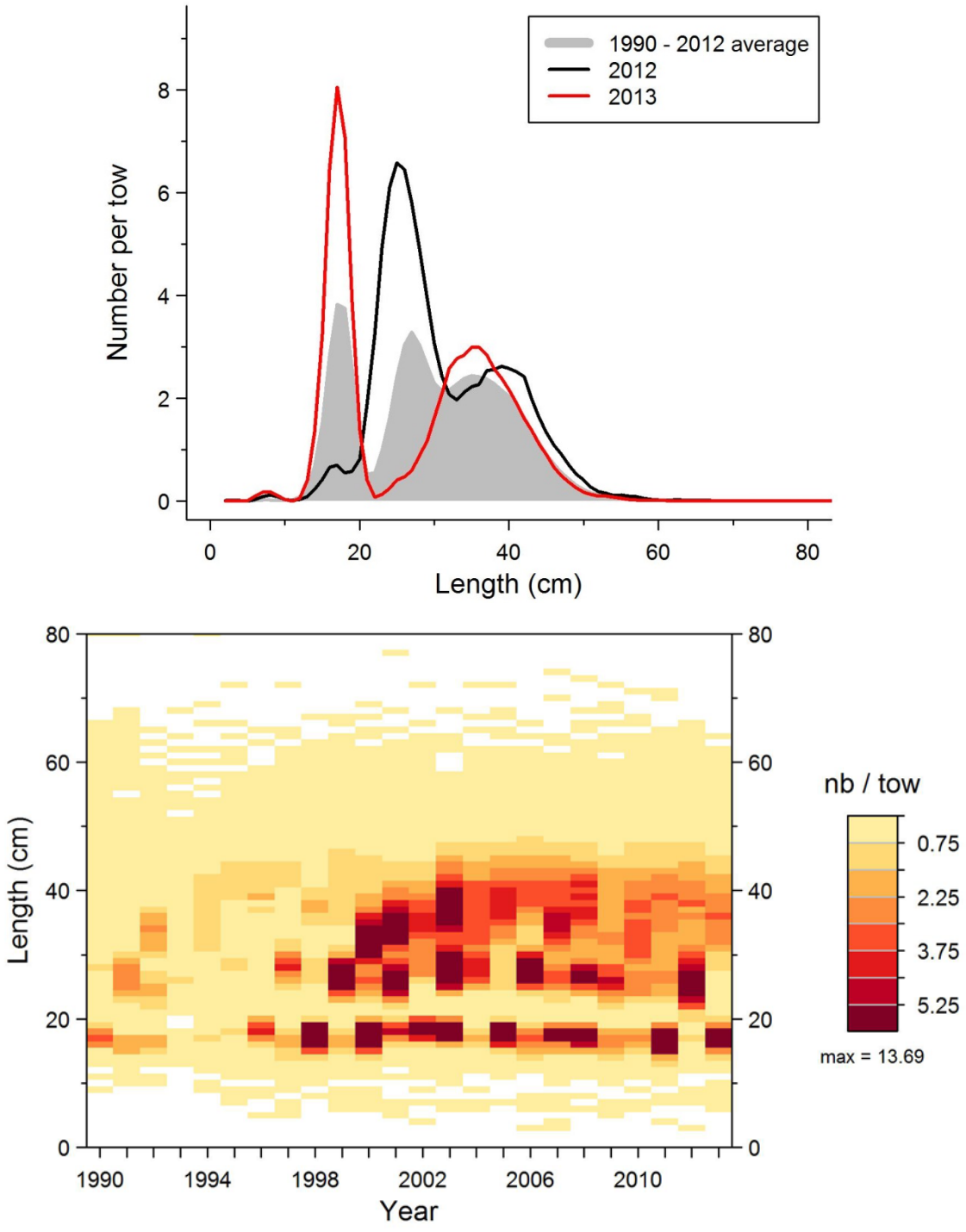

Figure 26. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Greenland Halibut in 4RST.

Greenland Halibut

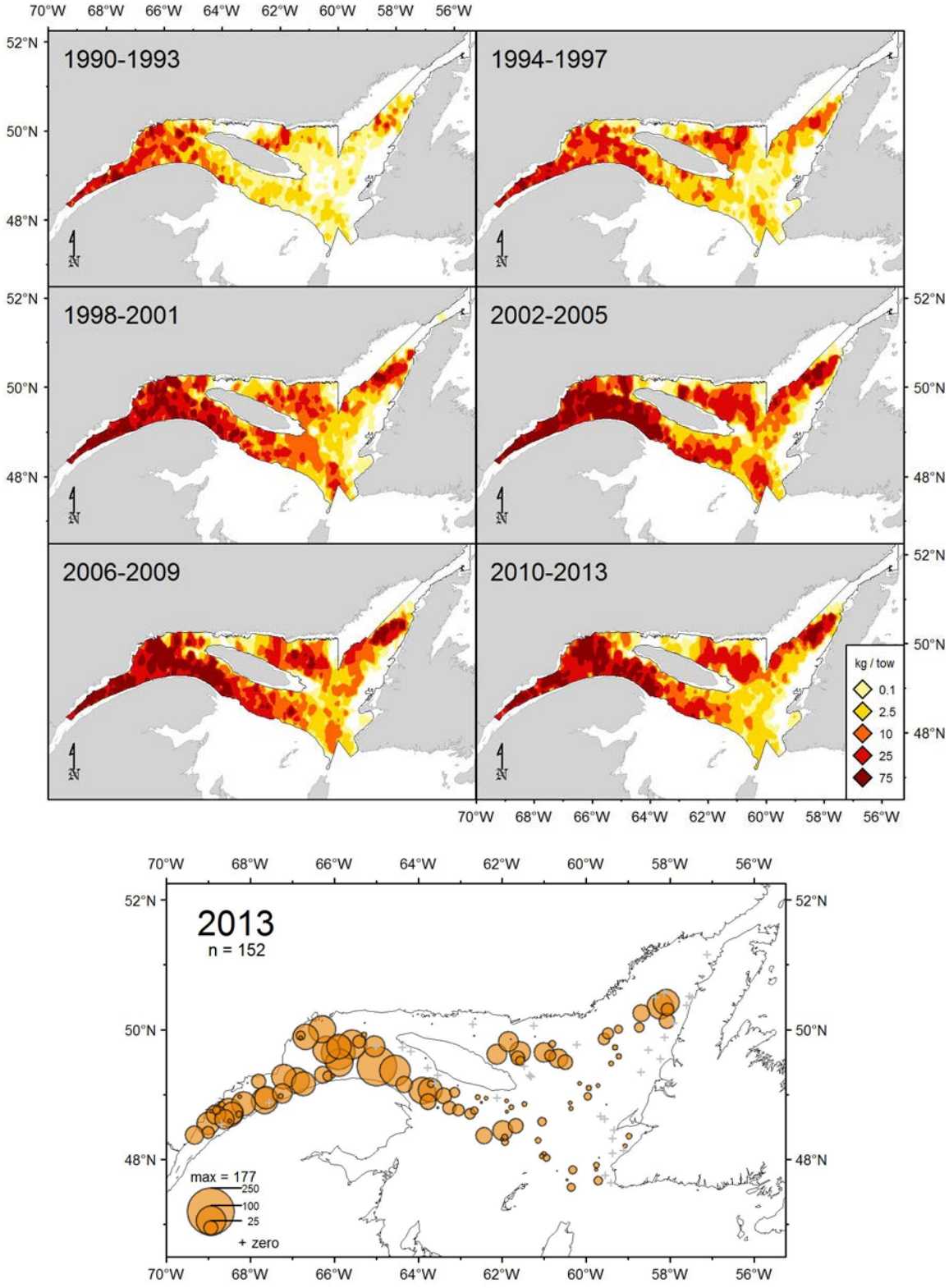

Figure 27. Greenland Halibut catch rates (kg/15 minutes tow) distribution.

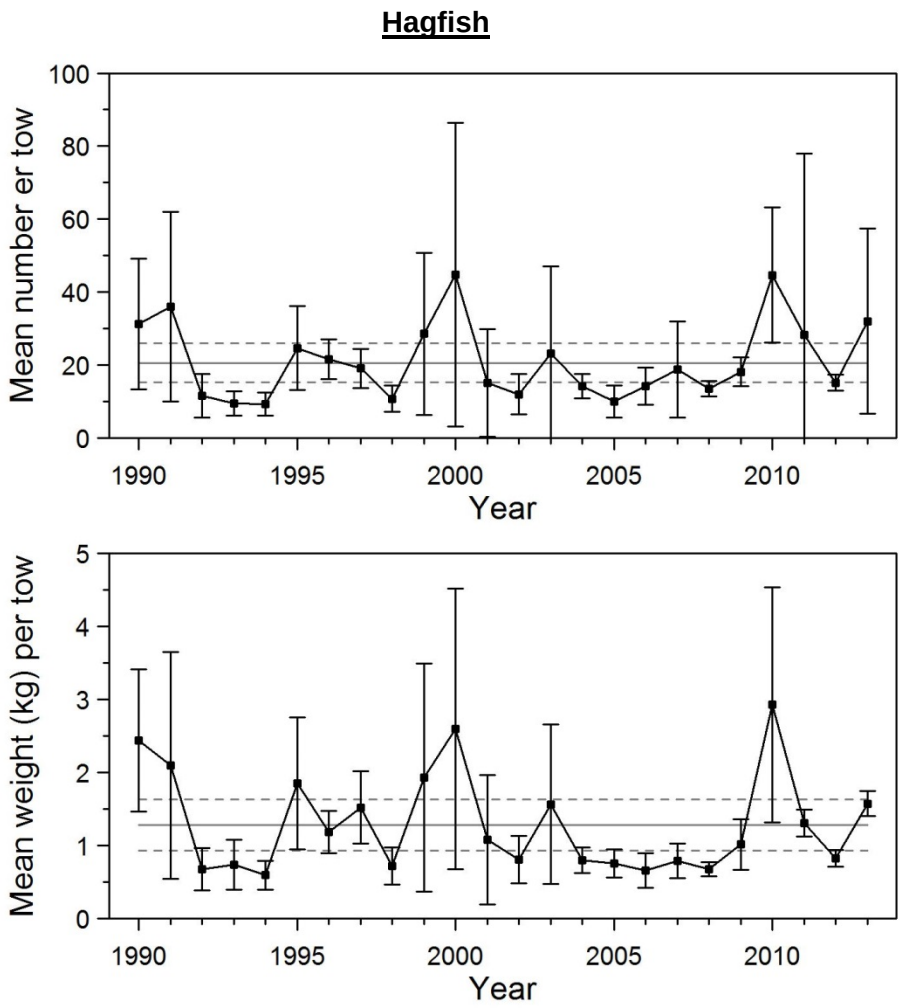

Figure 28. Mean numbers and mean weights per 15 minutes tow observed during the survey for Hagfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Hagfish

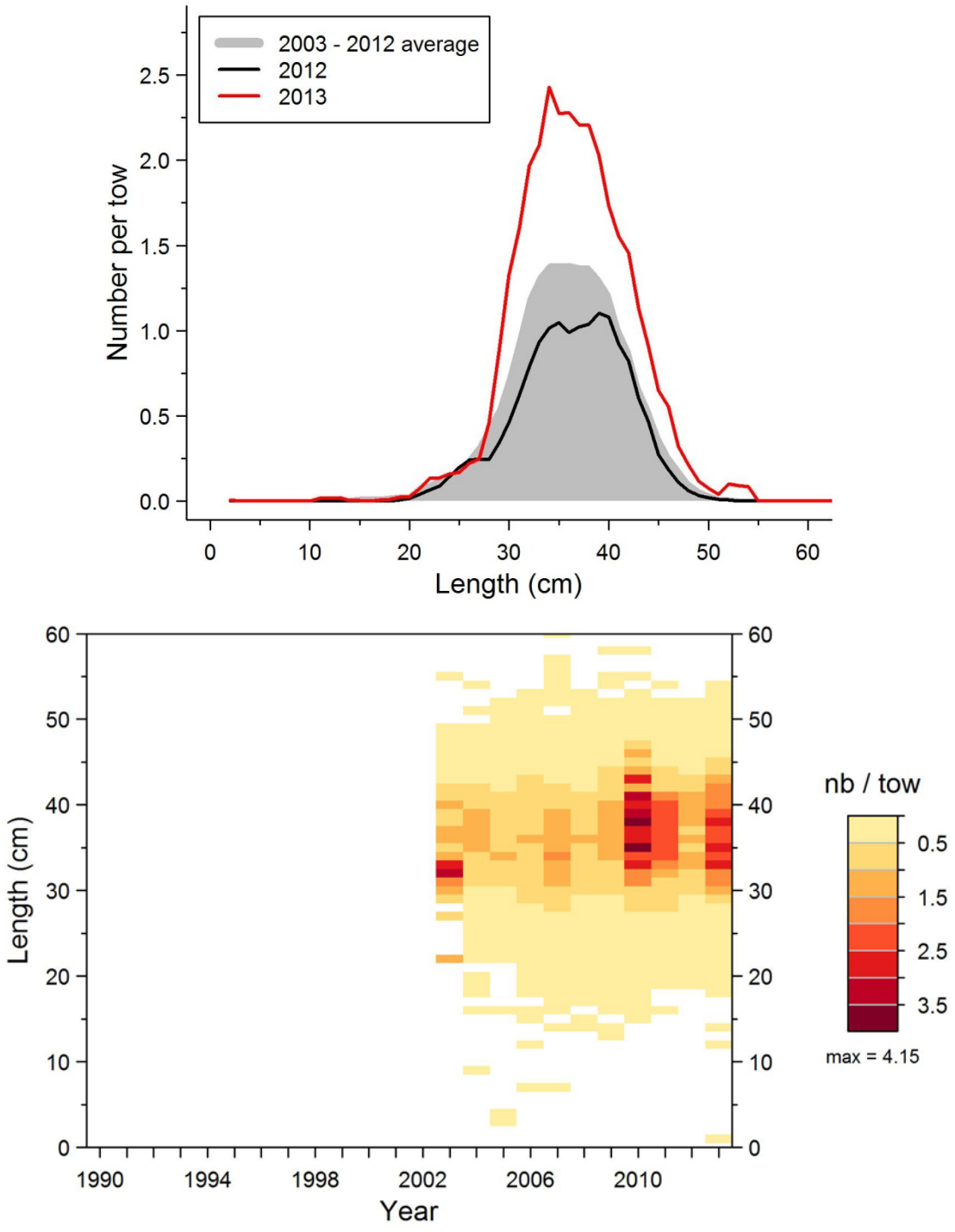

Figure 29. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Hagfish in 4RST.

Hagfish

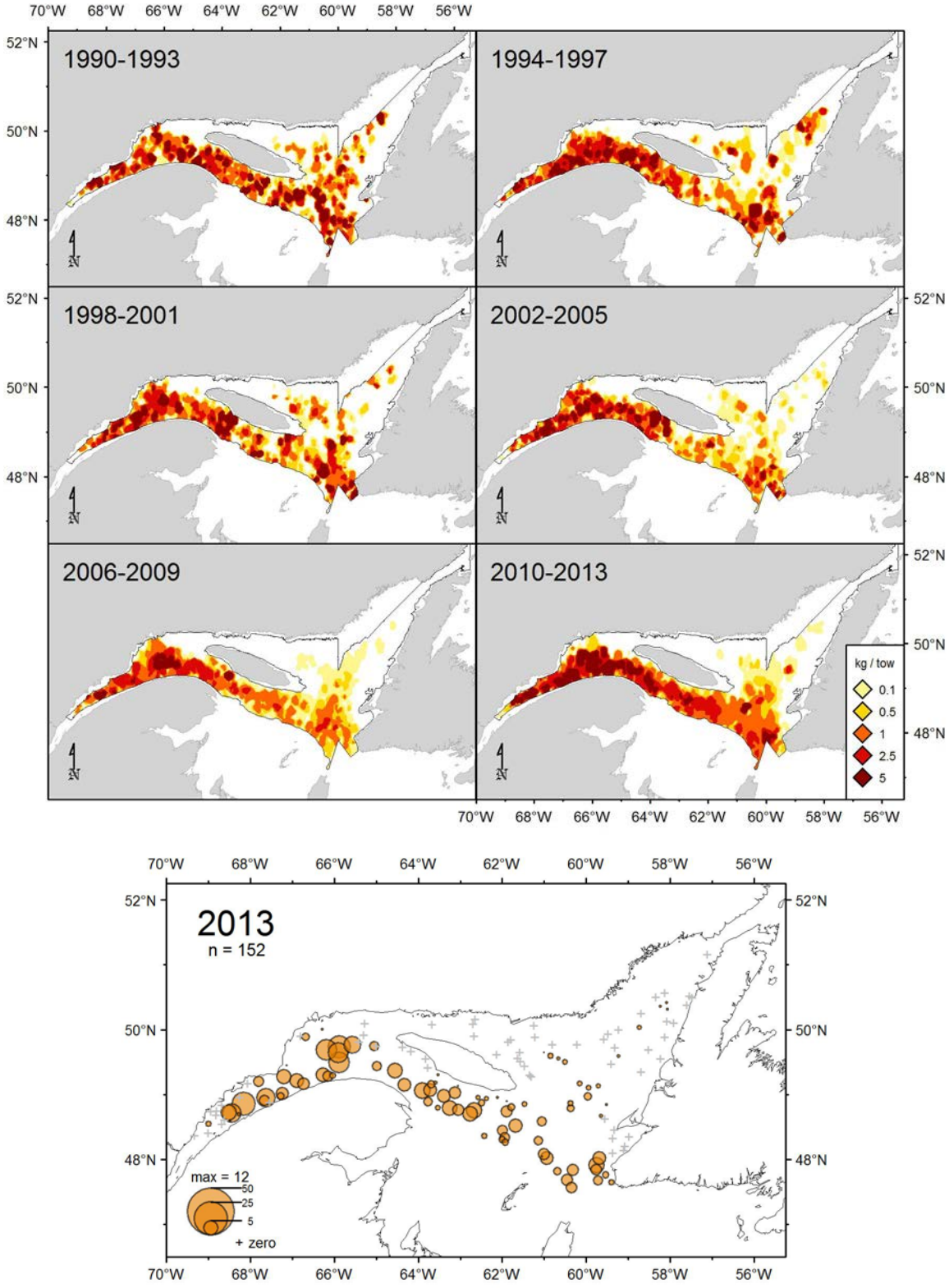

Figure 30. Hagfish catch rates (kg/15 minutes tow) distribution.

Herring

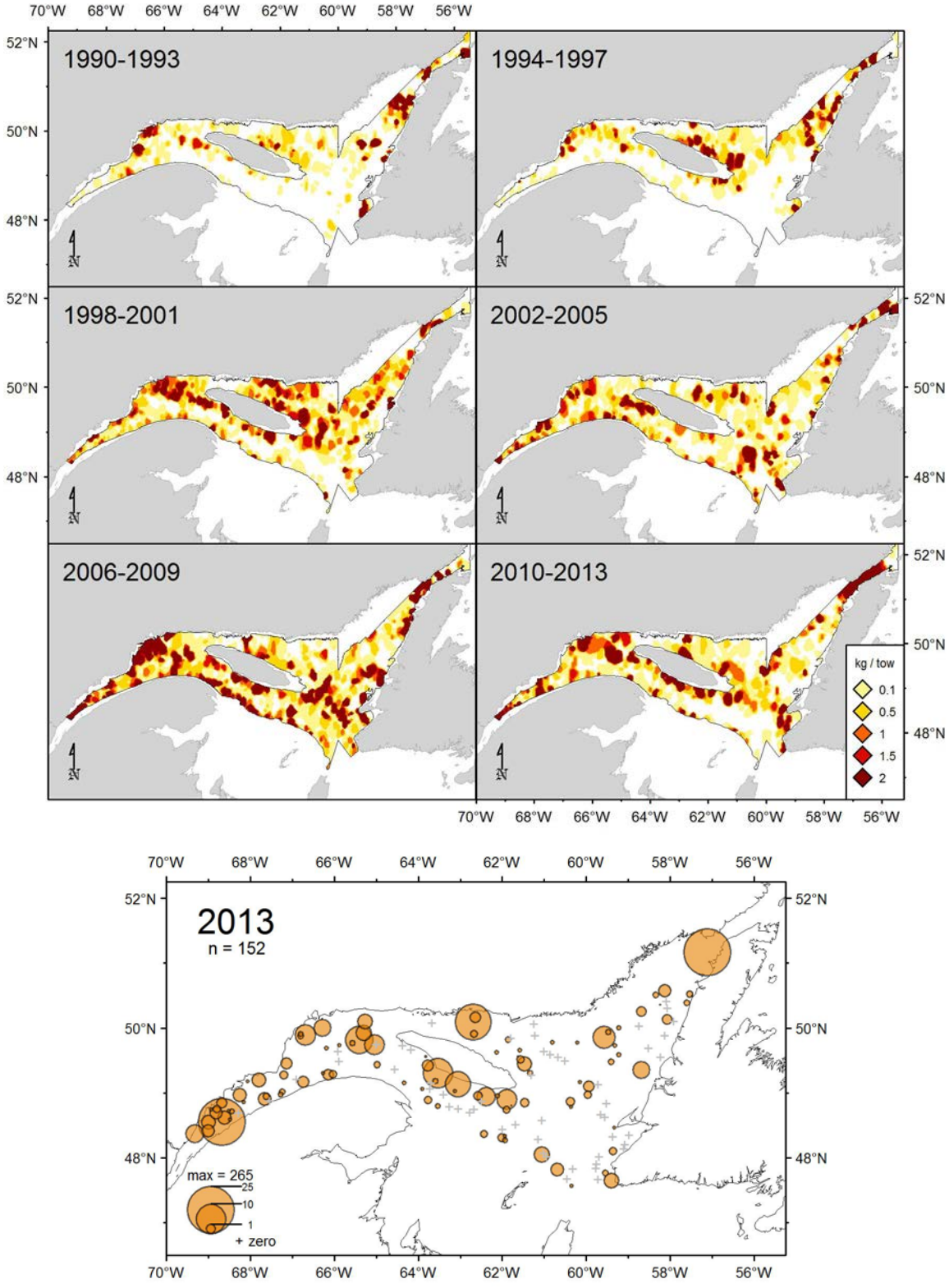

Figure 31. Herring catch rates (kg/15 minutes tow) distribution.

Herring

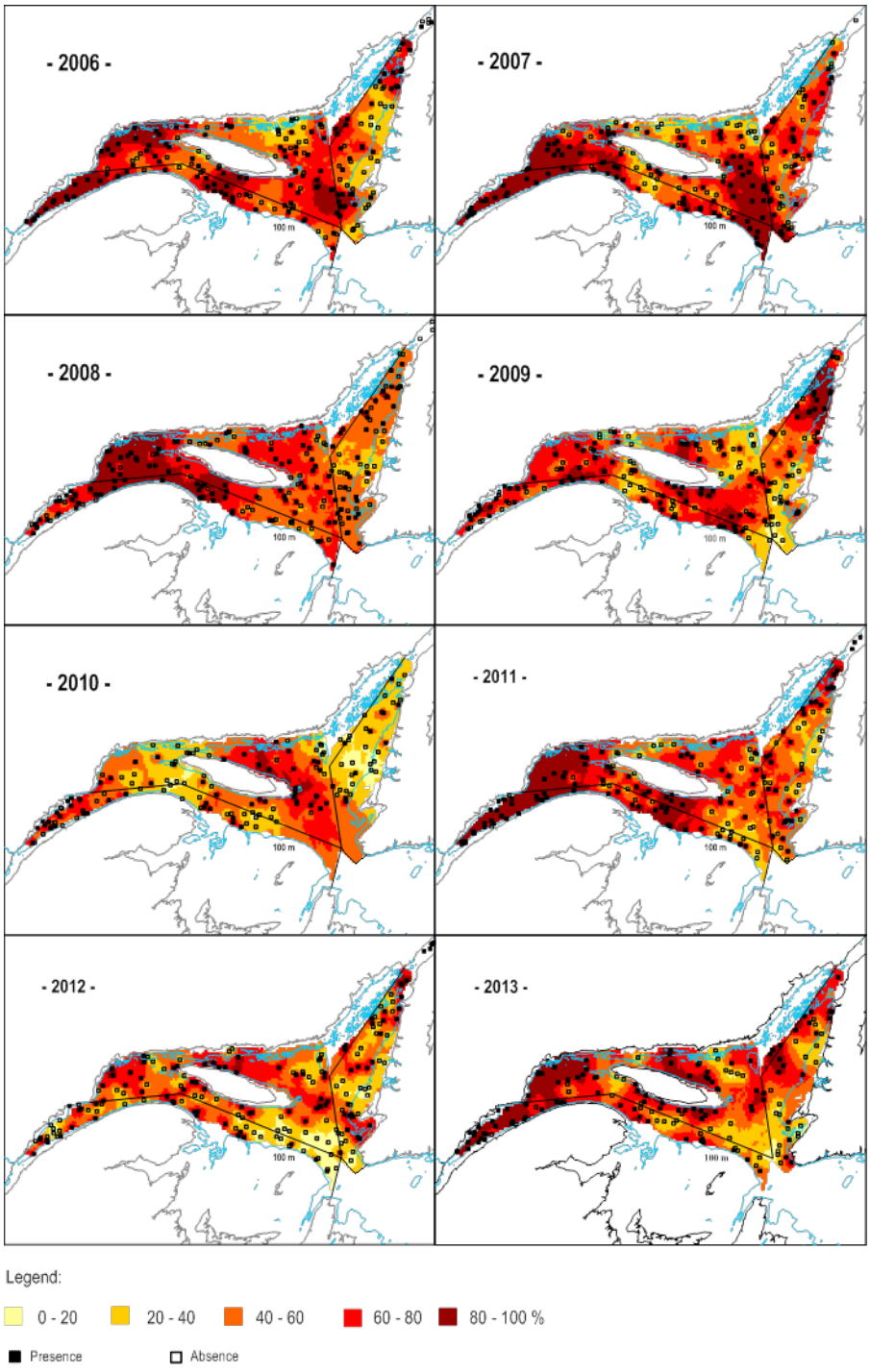

Figure 32. Probabilities areas (%) associated with the presence of Herring.

Herring

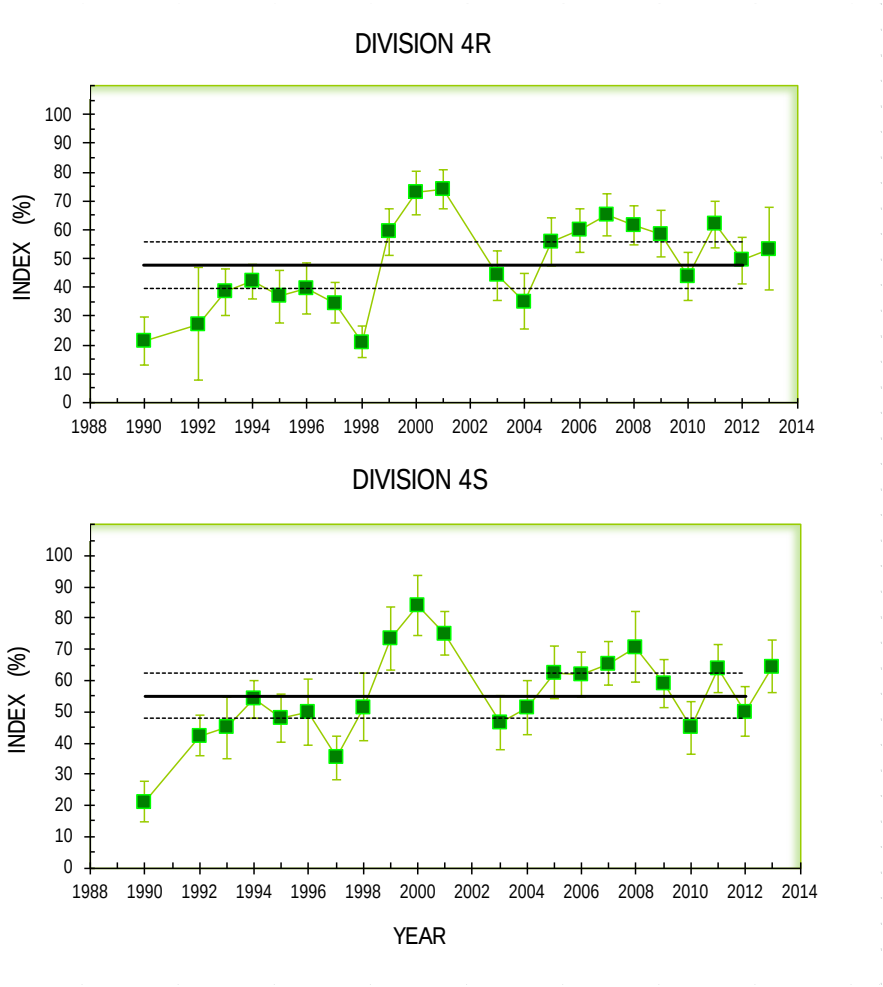

Figure 33. Mean probabilities of finding Herring in NAFO Divisions 4R and 4S. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

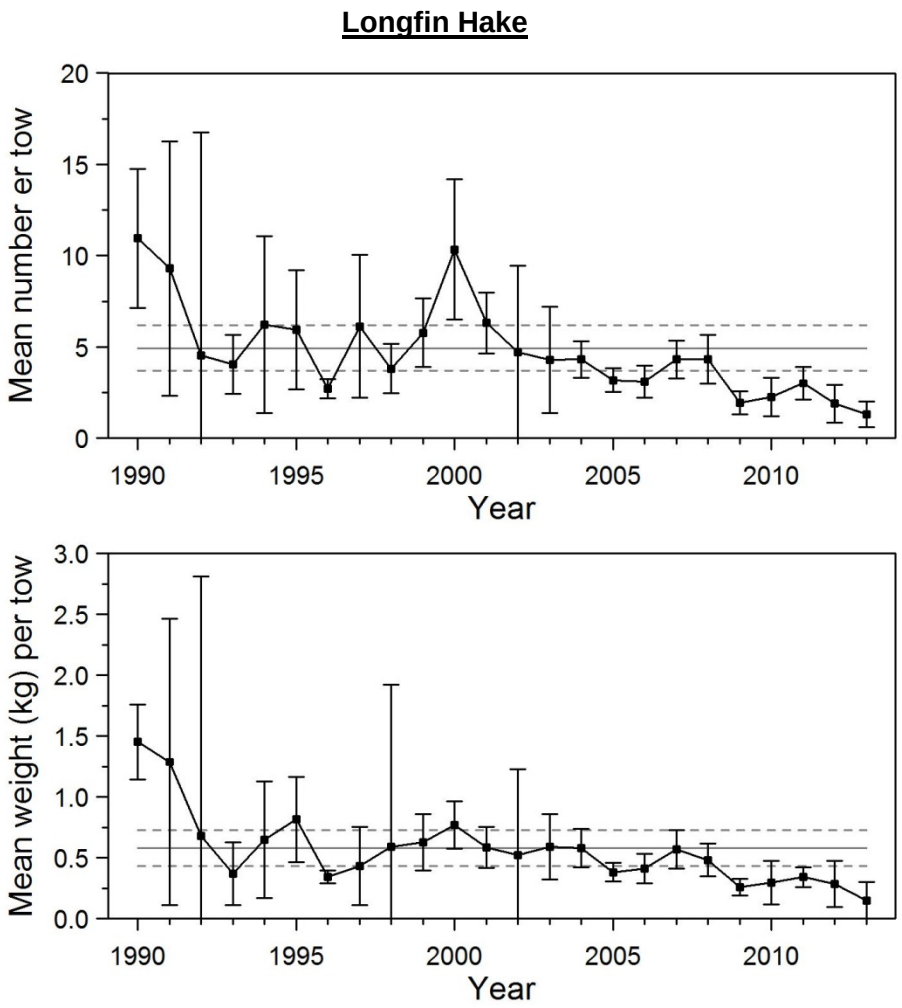

Figure 34. Mean numbers and mean weights per 15 minutes tow observed during the survey for Longfin Hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Longfin Hake

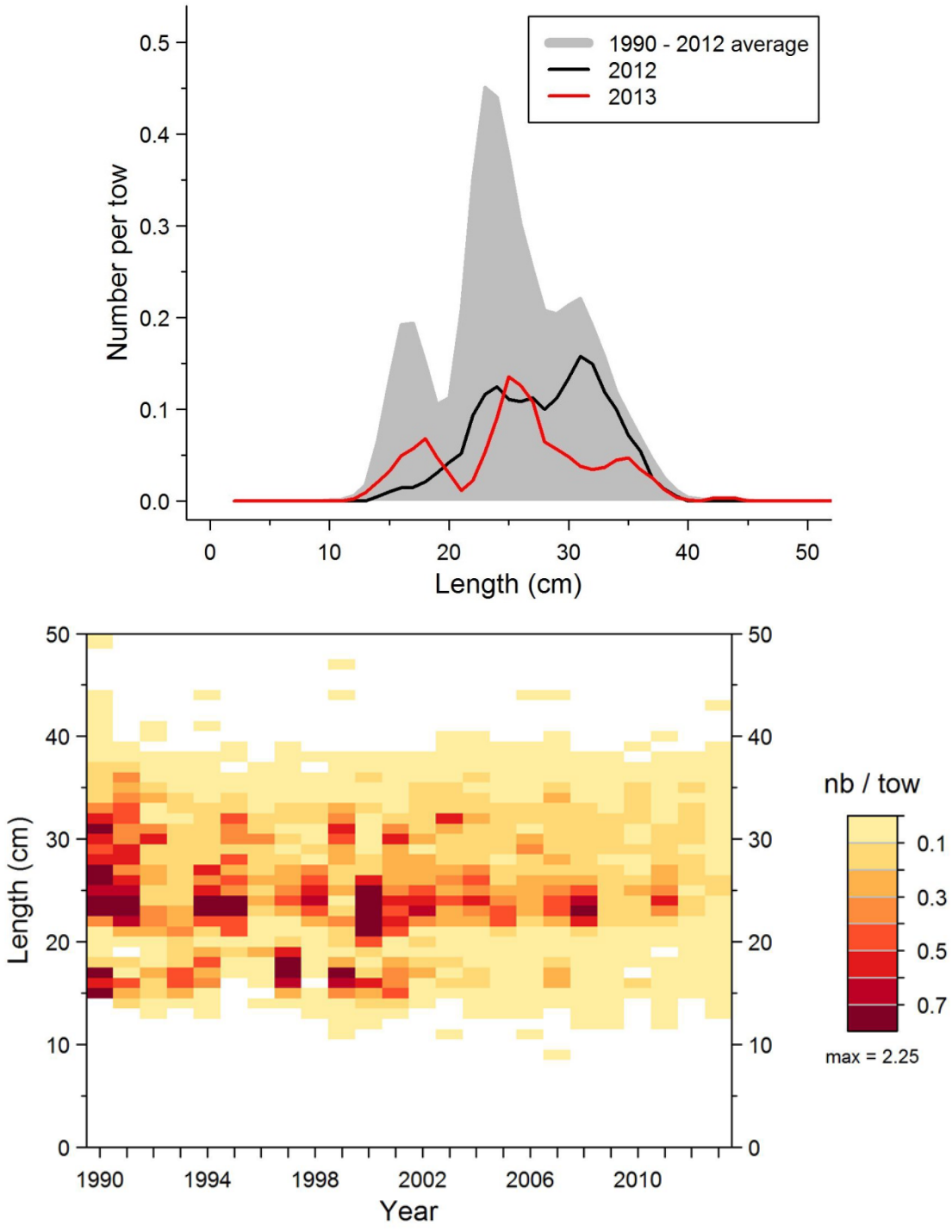

Figure 35. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Longfin Hake in 4RST.

Longfin Hake

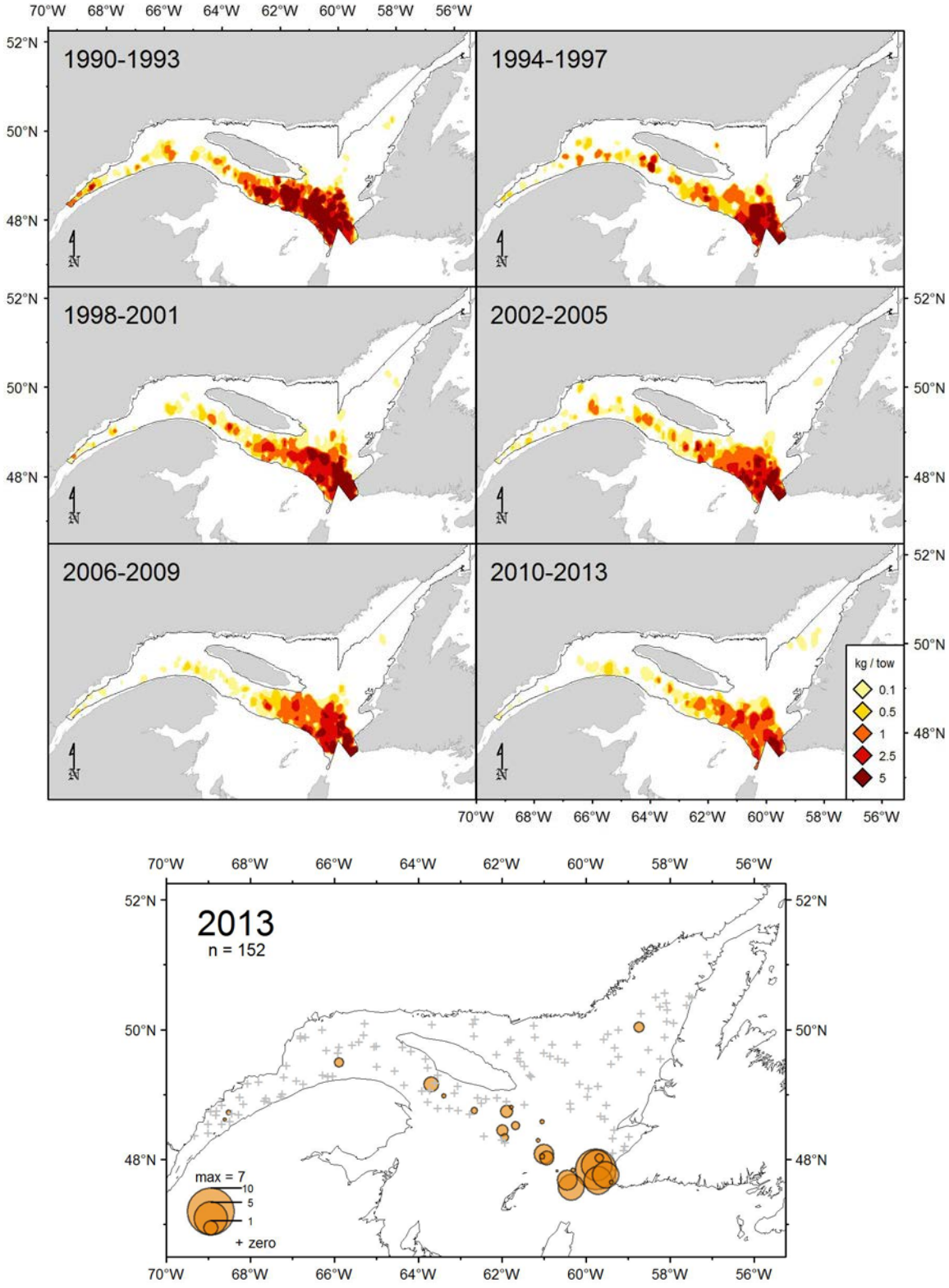

Figure 36. Longfin Hake catch rates (kg/15 minutes tow) distribution.

Lumpfish

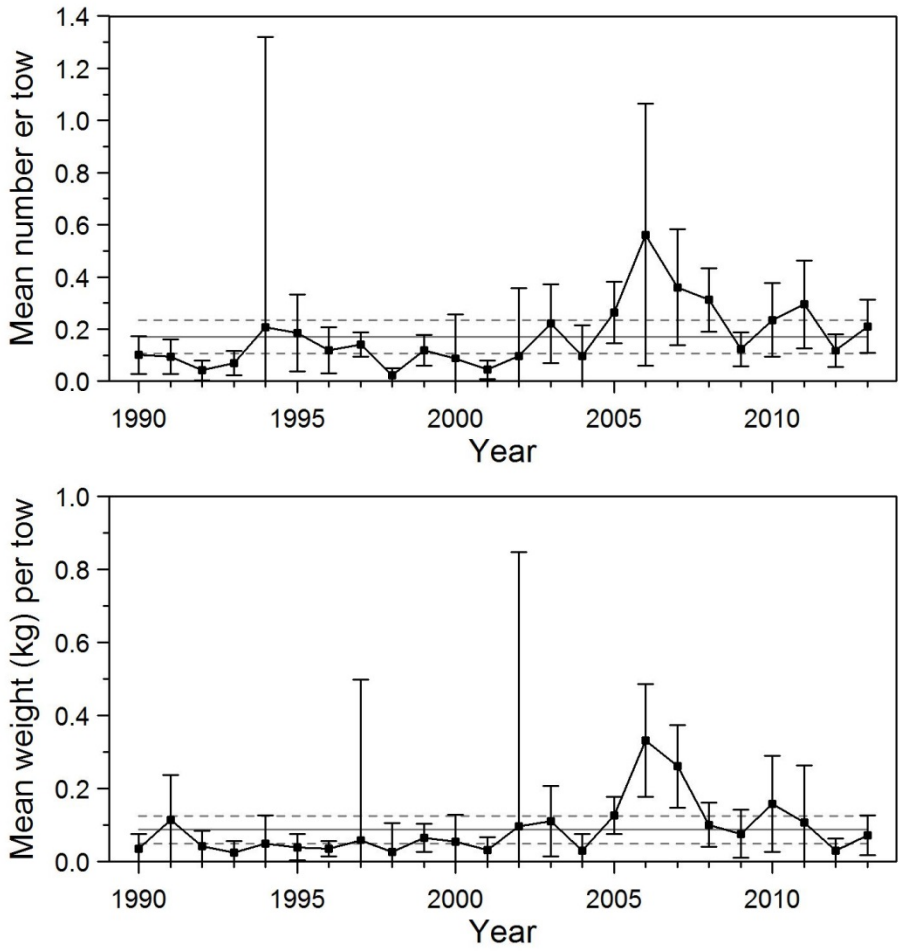

Figure 37. Mean numbers and mean weights per 15 minutes tow observed during the survey for Lumpfish in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Lumpfish

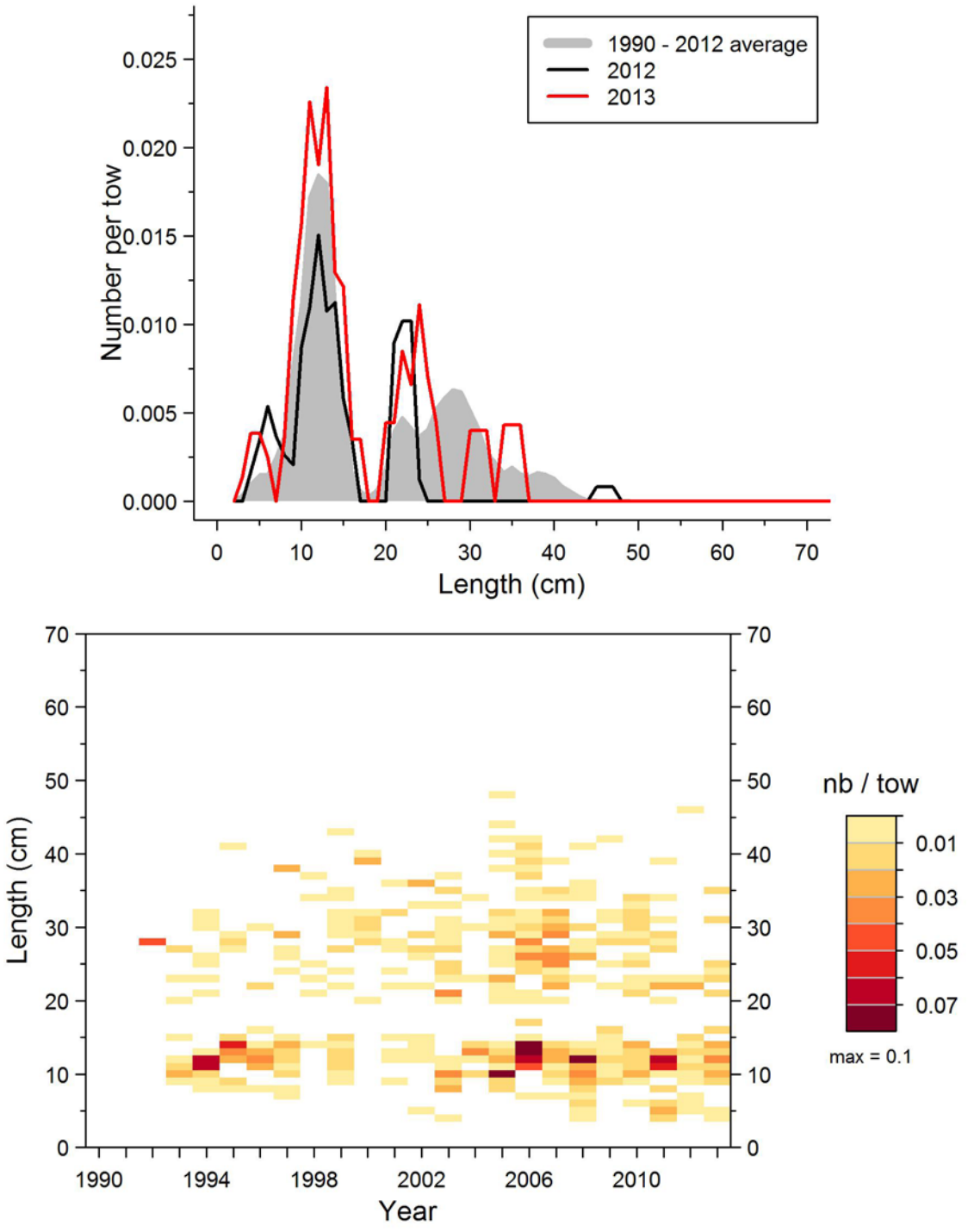

Figure 38. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Lumpfish in 4RST.

Lumpfish

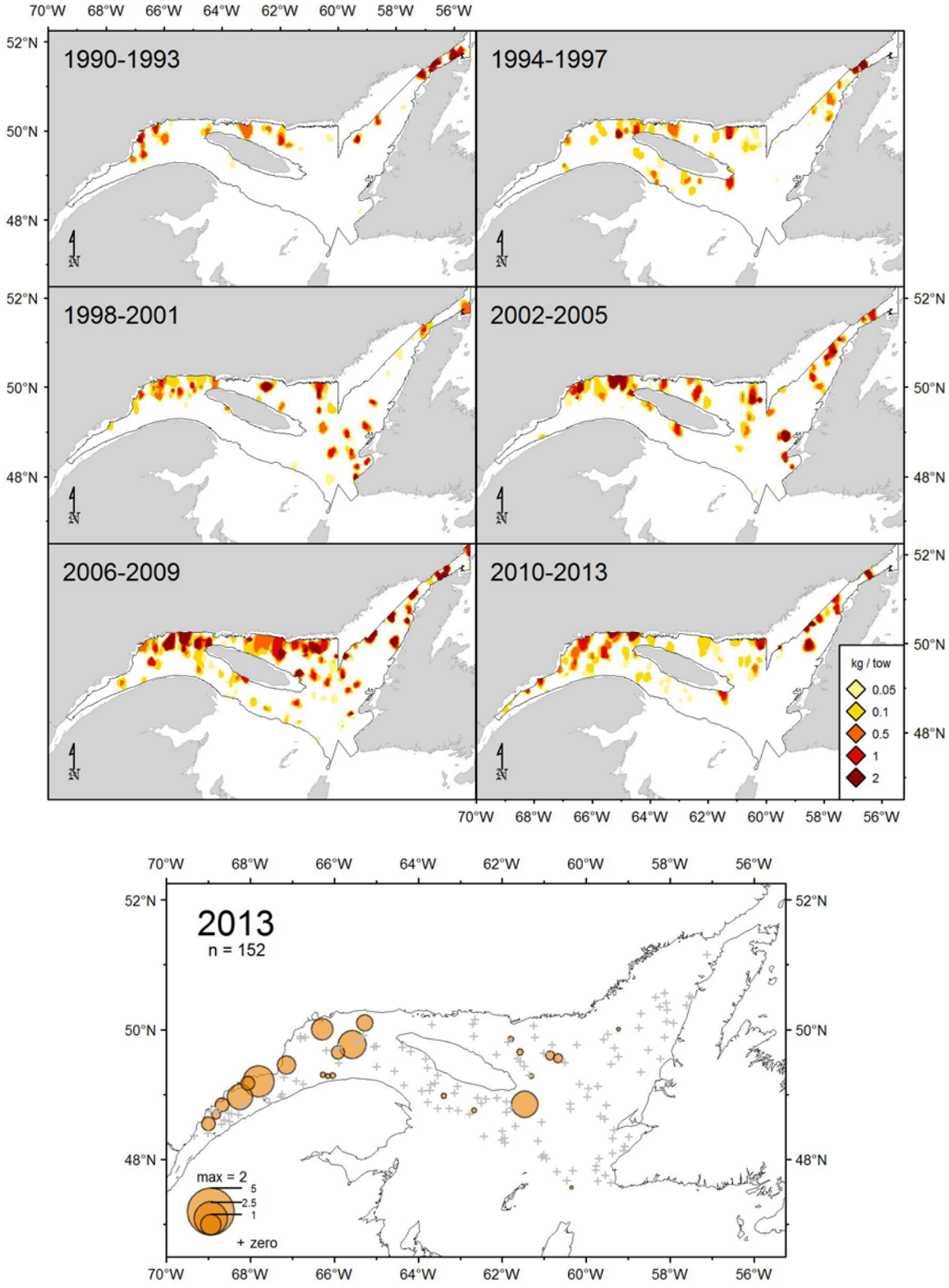

Figure 39. Lumpfish catch rates (kg/15 minutes tow) distribution.

Northern Shrimp

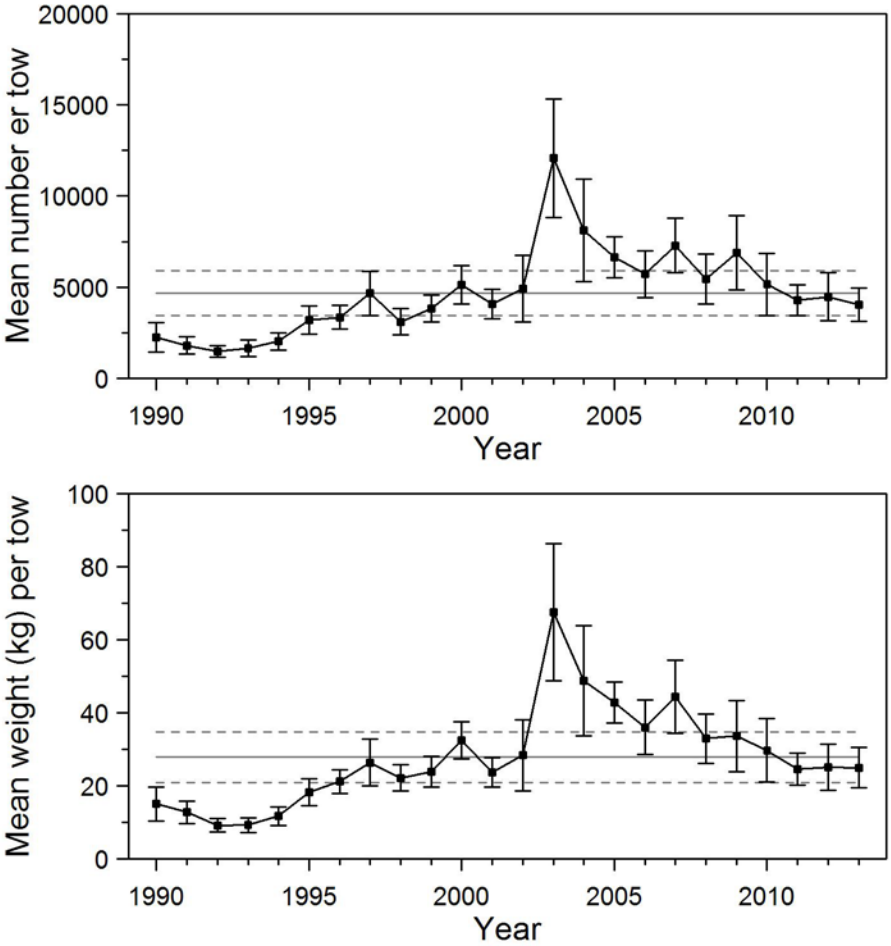

Figure 40. Mean numbers and mean weights per 15 minutes tow observed during the survey for Northern Shrimp in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Northern Shrimp

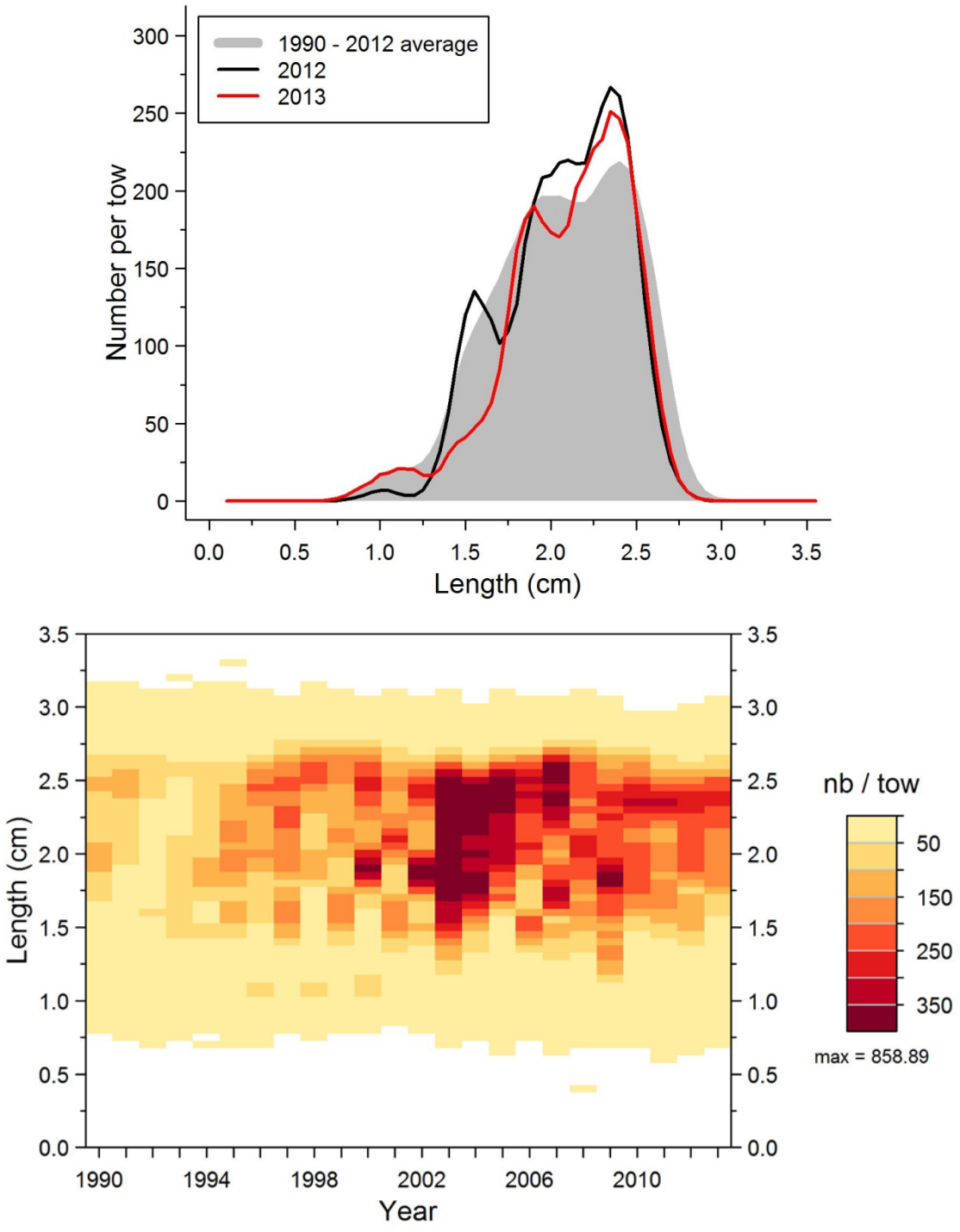

Figure 41. Carapace length frequency distributions (mean number per 15 minutes tow) observed during the survey for Northern Shrimp in 4RST.

Northern Shrimp

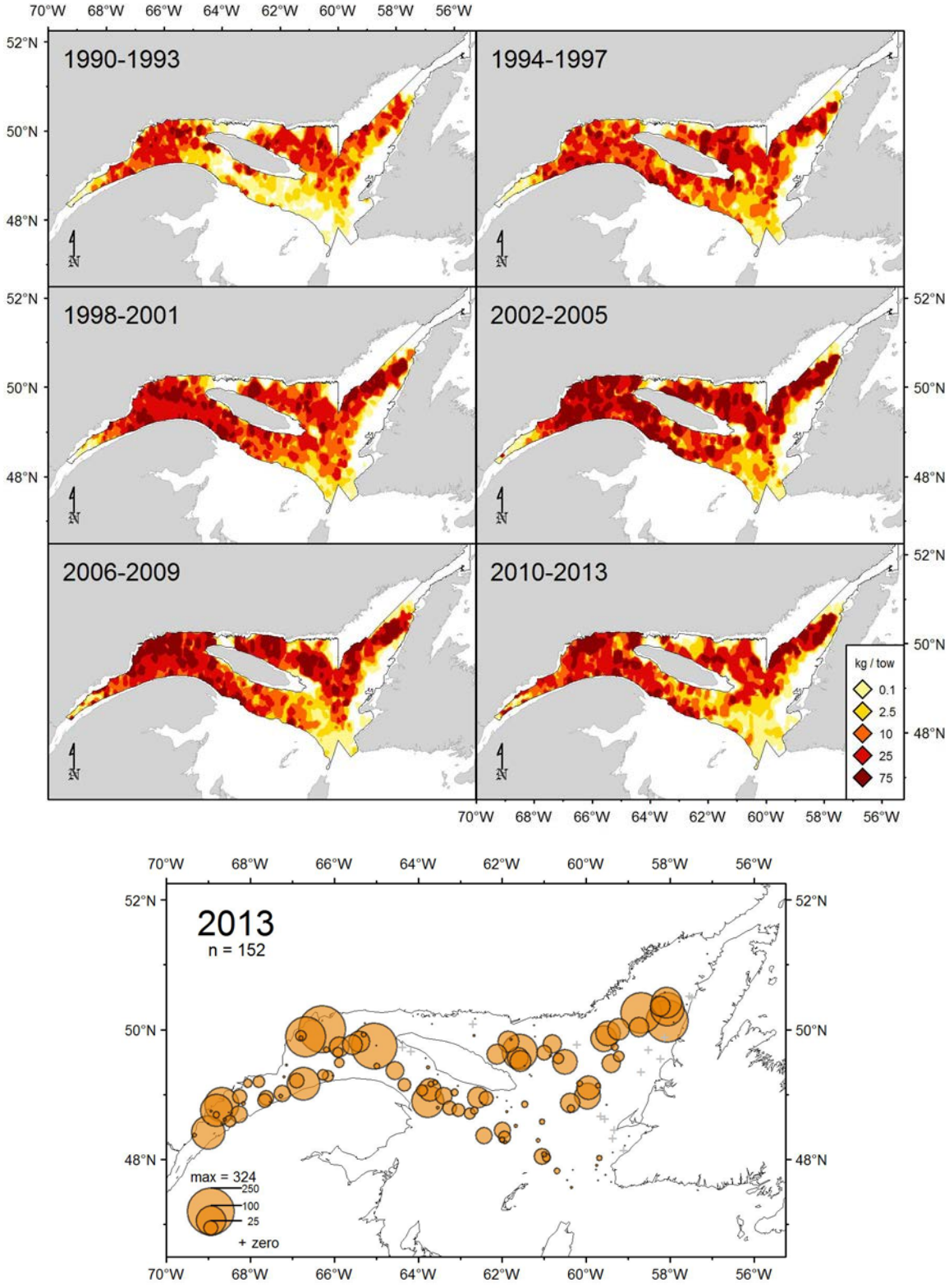

Figure 42. Northern Shrimp catch rates (kg/15 minutes tow) distribution.

Sea pen (*Anthoptilum grandiflorum*)

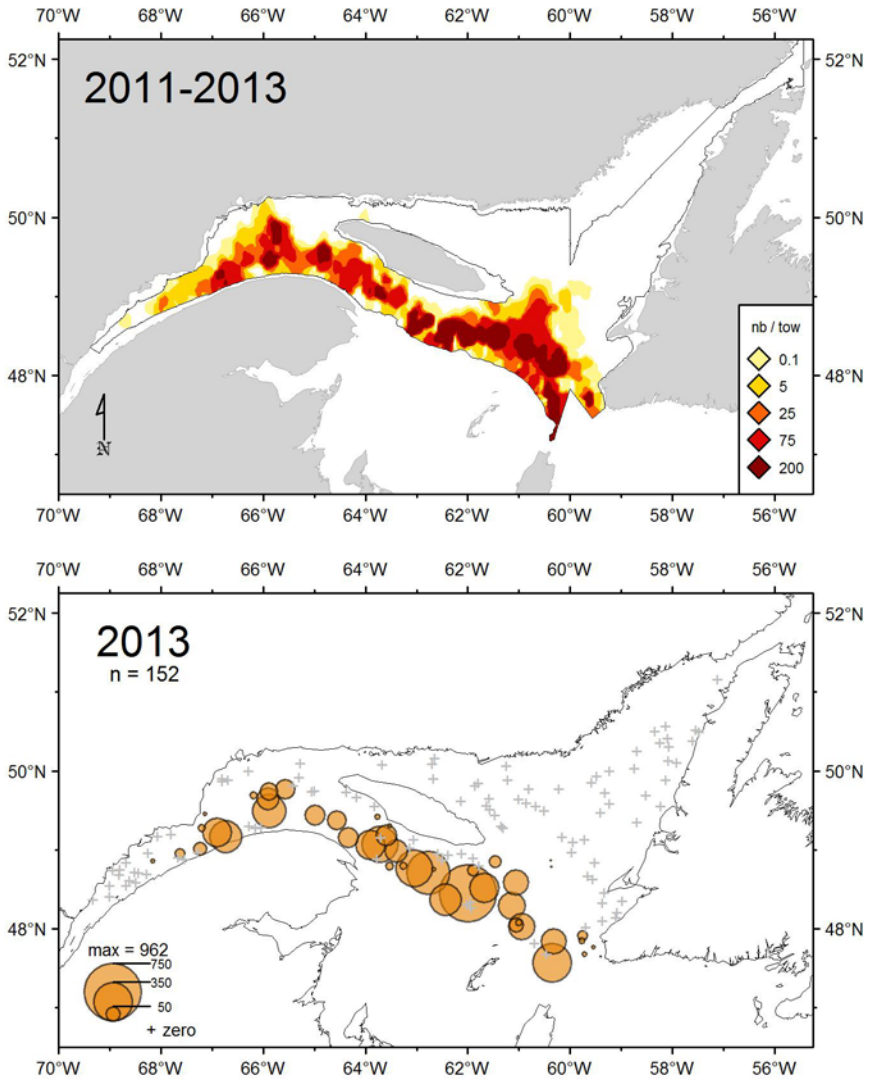

Figure 43. Sea pen Anthoptilum grandiflorum catch rates (nb/15 minutes tow) distribution.

Sea pen (*Halipteris finmarchica*)

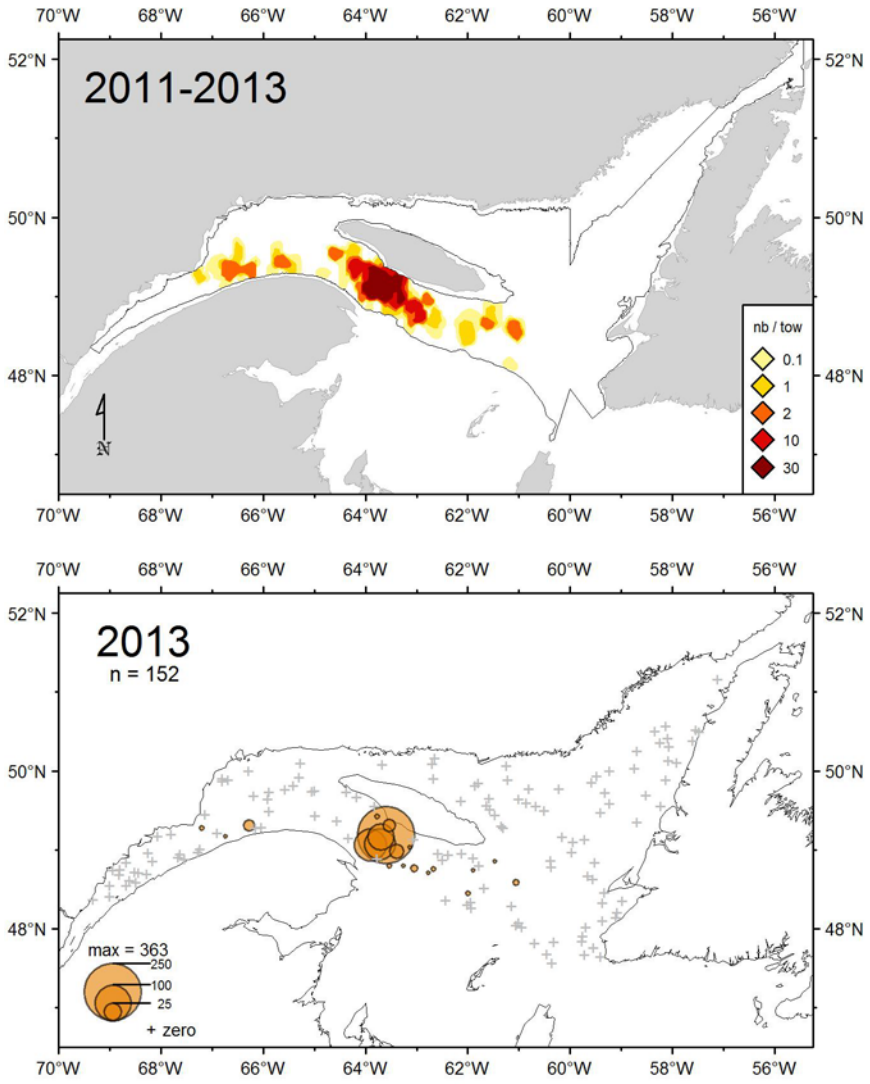

Figure 44. Sea pen Halipteris finmarchica catch rates (nb/15 minutes tow) distribution.

Sea pen (*Pennatula aculeata*)

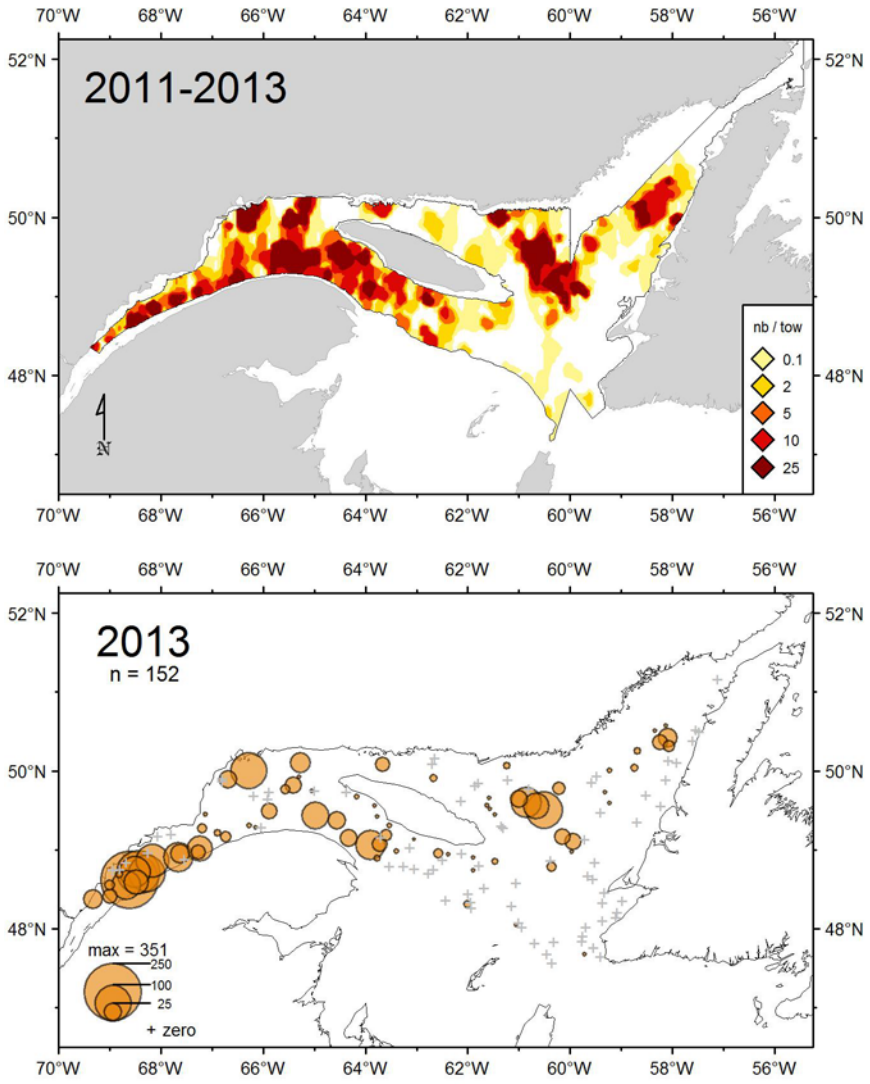

Figure 45. Sea pen Pennatula aculeata catch rates (nb/15 minutes tow) distribution.

Sea pen (*Pennatula grandis*)

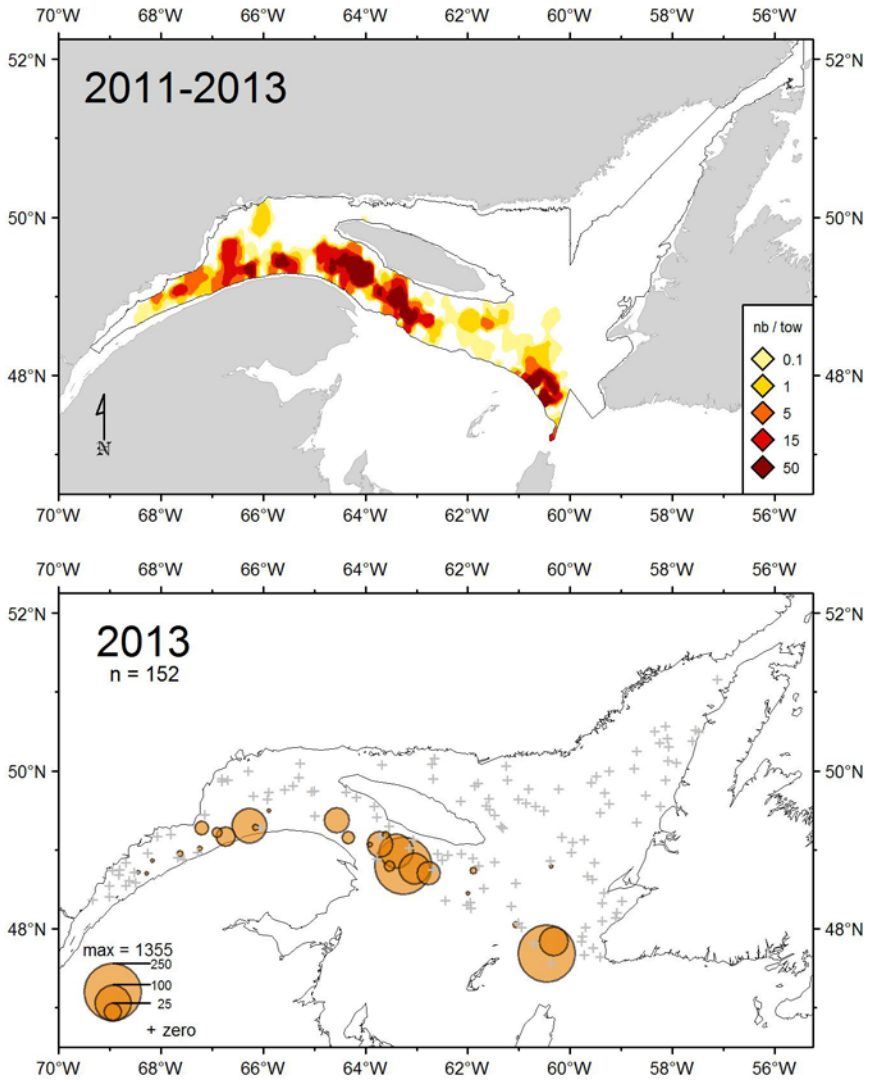

Figure 46. Sea pen Pennatula grandis catch rates (nb/15 minutes tow) distribution.

Silver Hake

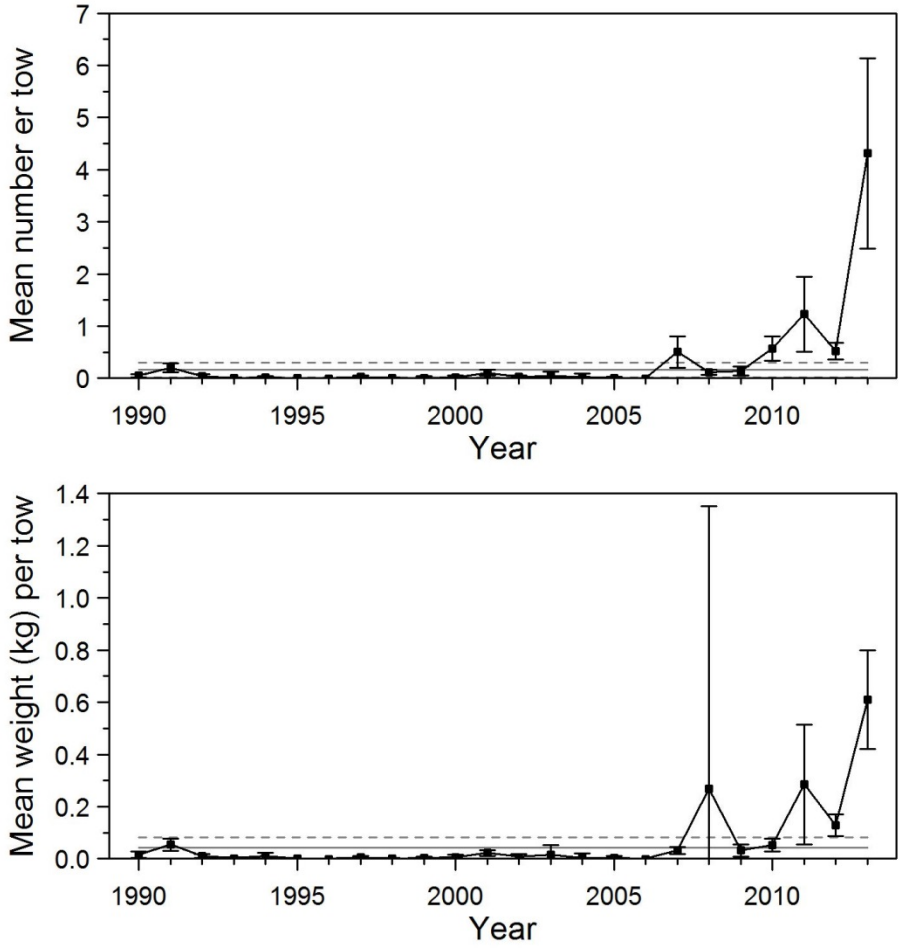

Figure 47. Mean numbers and mean weights per 15 minutes tow observed during the survey for Silver Hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Silver Hake

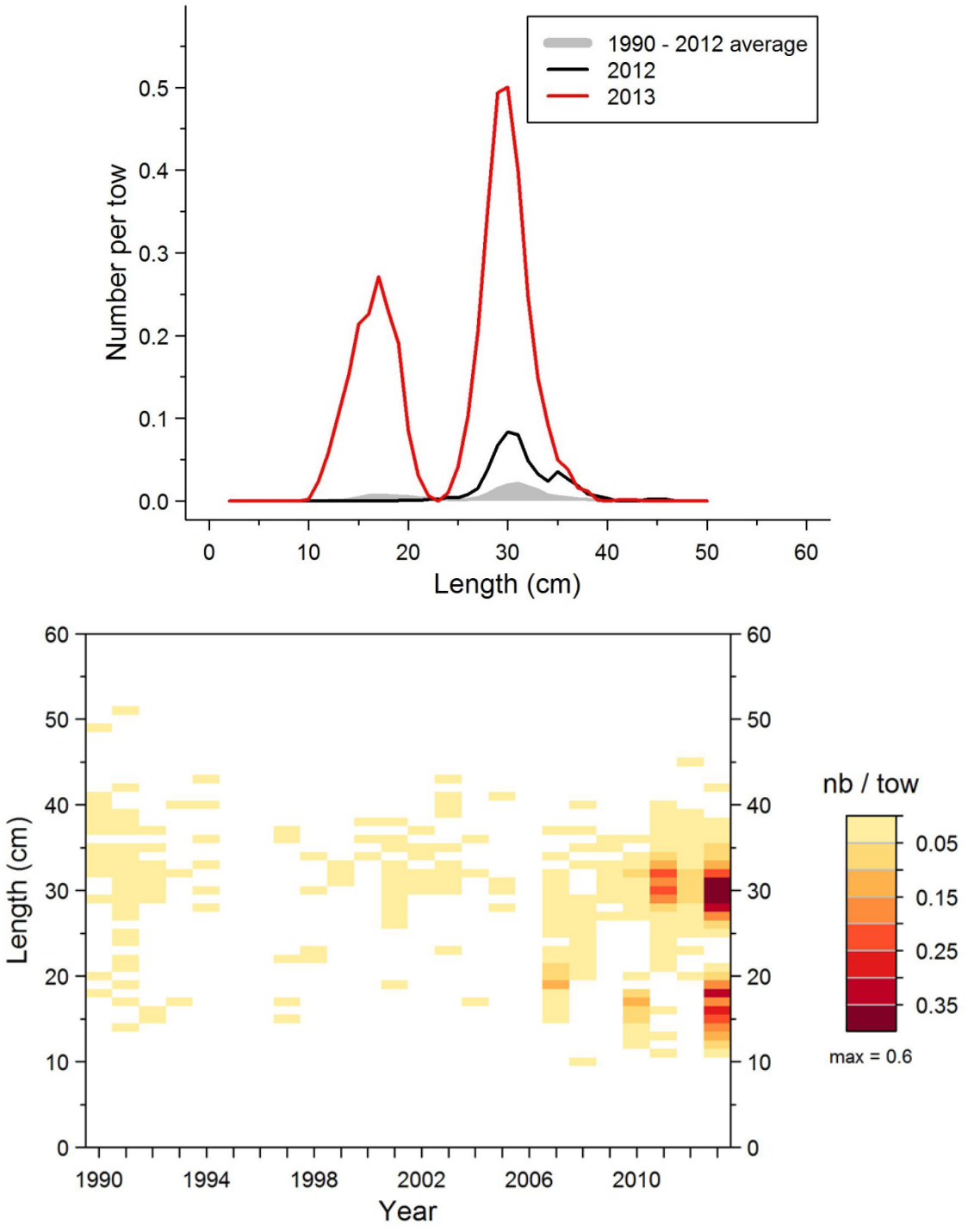

Figure 48. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Silver Hake in 4RST.

Silver Hake

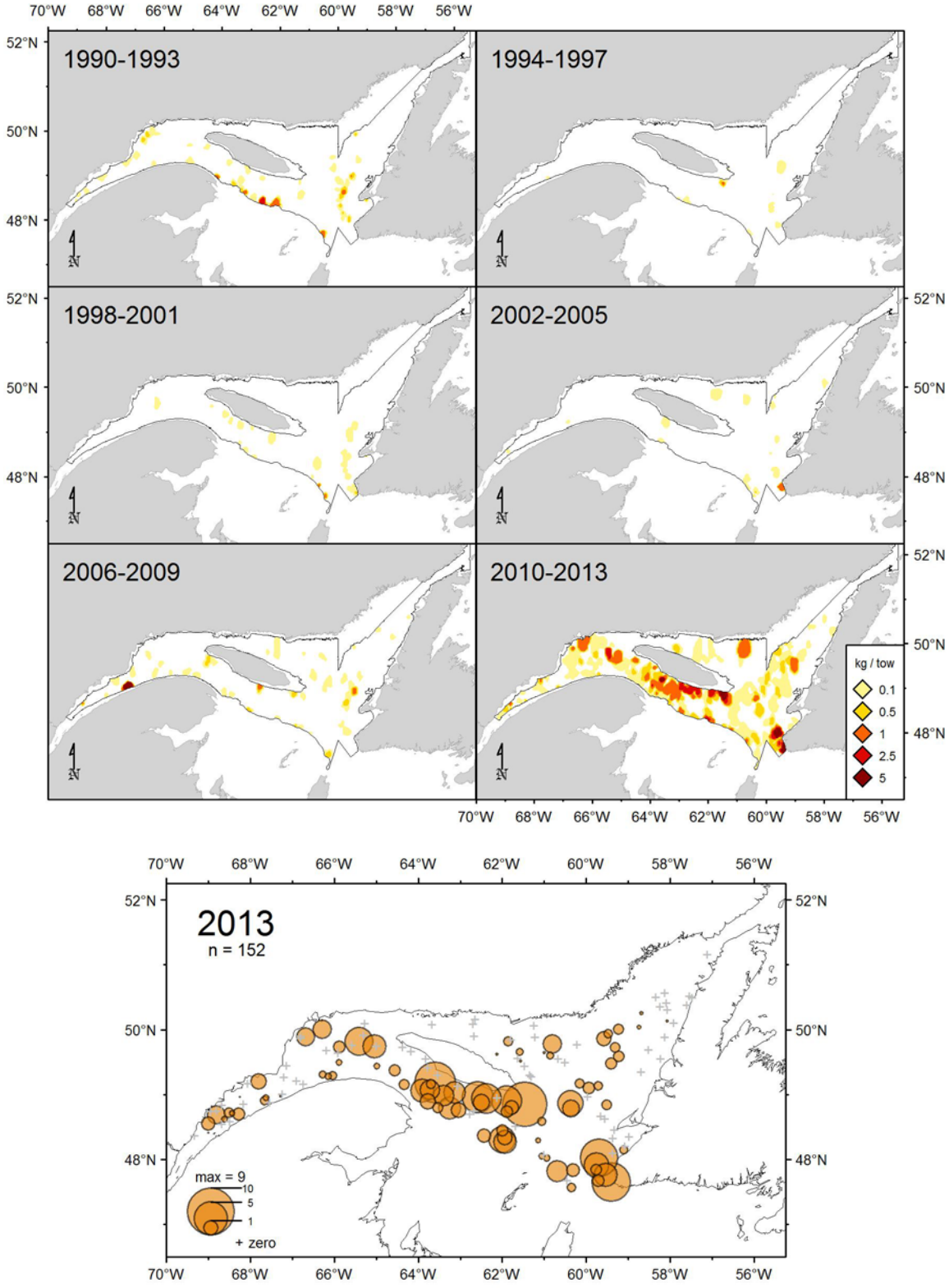

Figure 49. Silver Hake catch rates (kg/15 minutes tow) distribution.

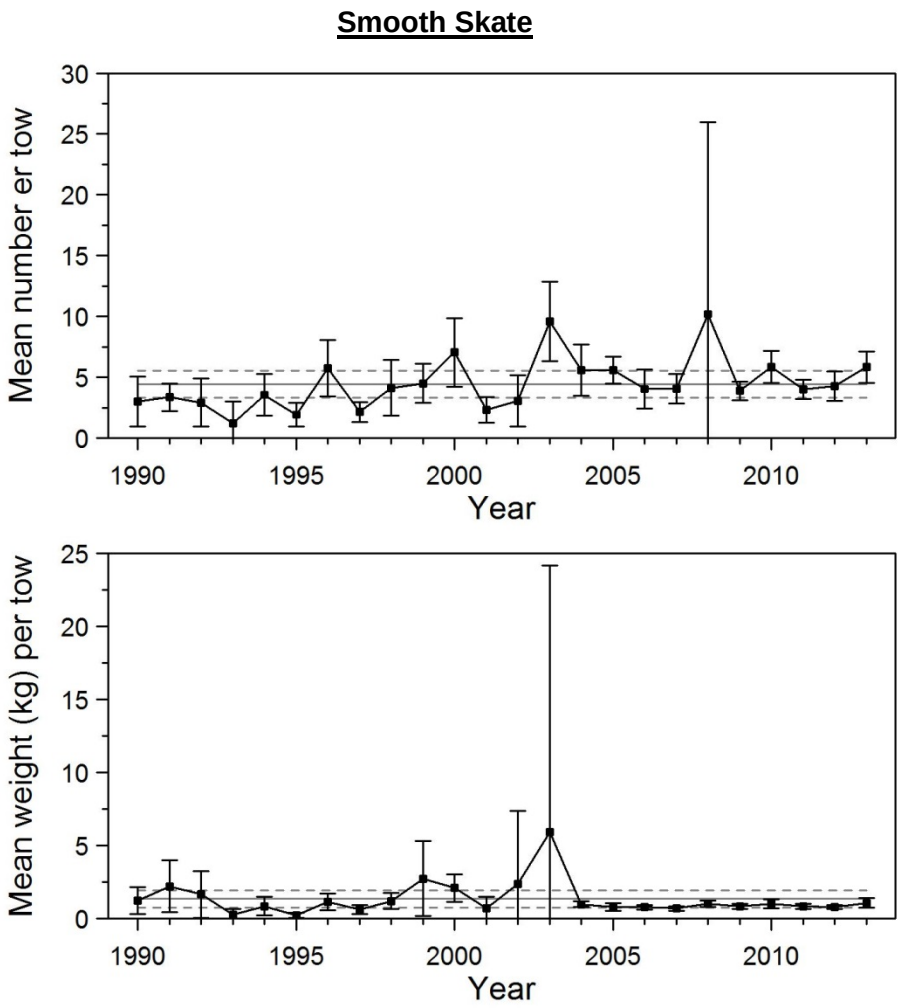

Figure 50. Mean numbers and mean weights per 15 minutes tow observed during the survey for Smooth Skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

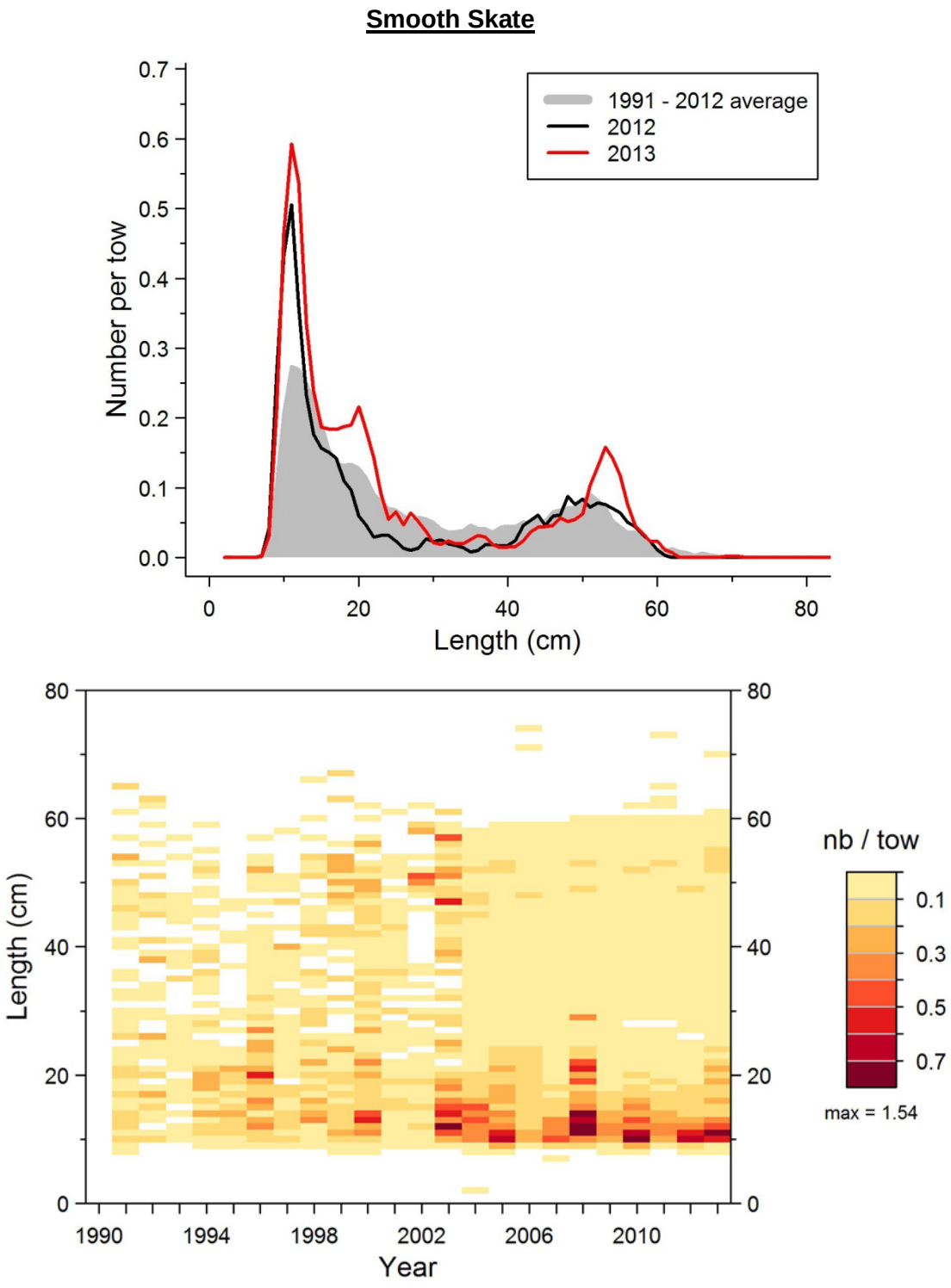

Figure 51. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Smooth Skate in 4RST.

Smooth Skate

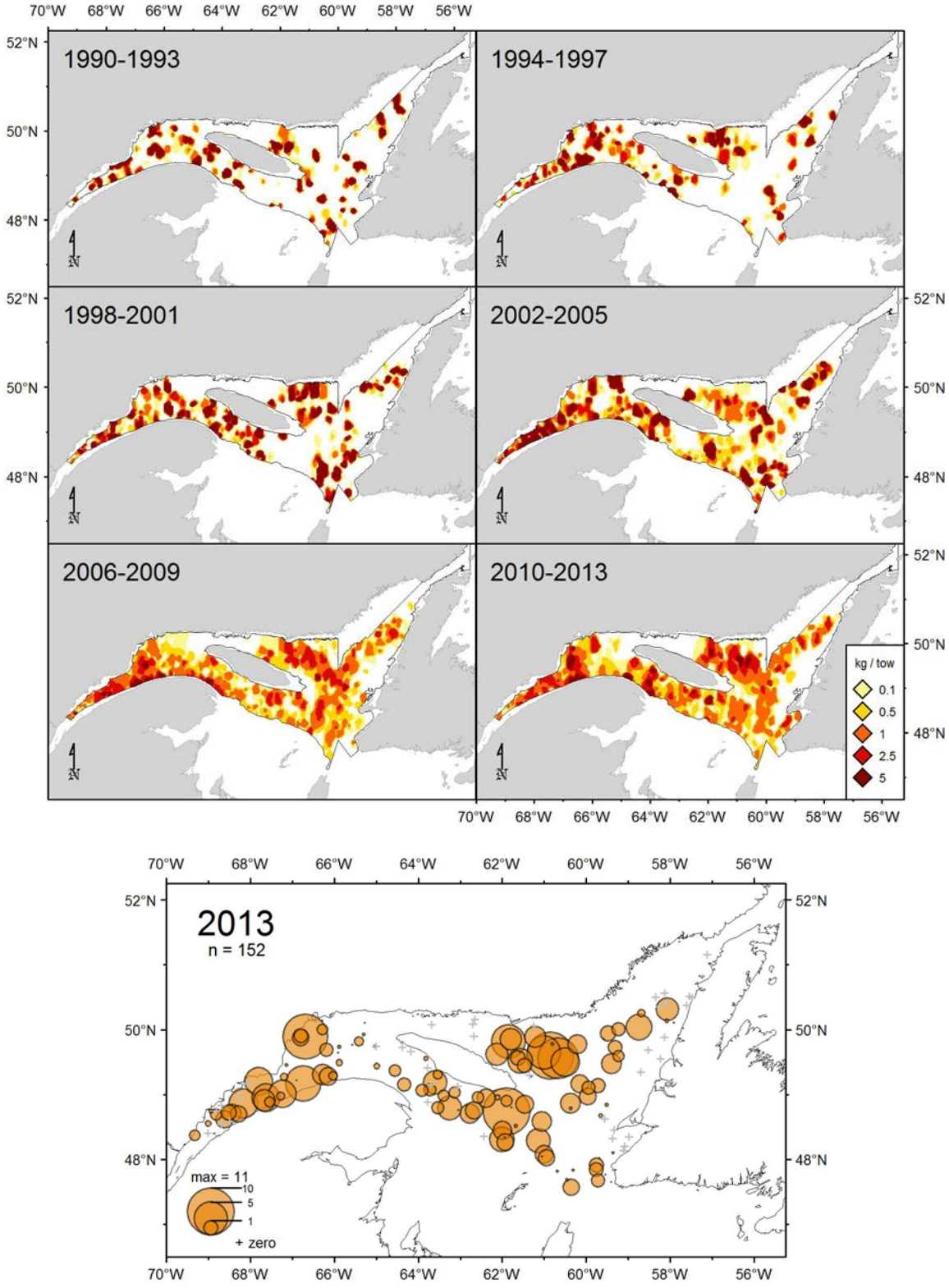

Figure 52. Smooth Skate catch rates (kg/15 minutes tow) distribution.

Snow Crab

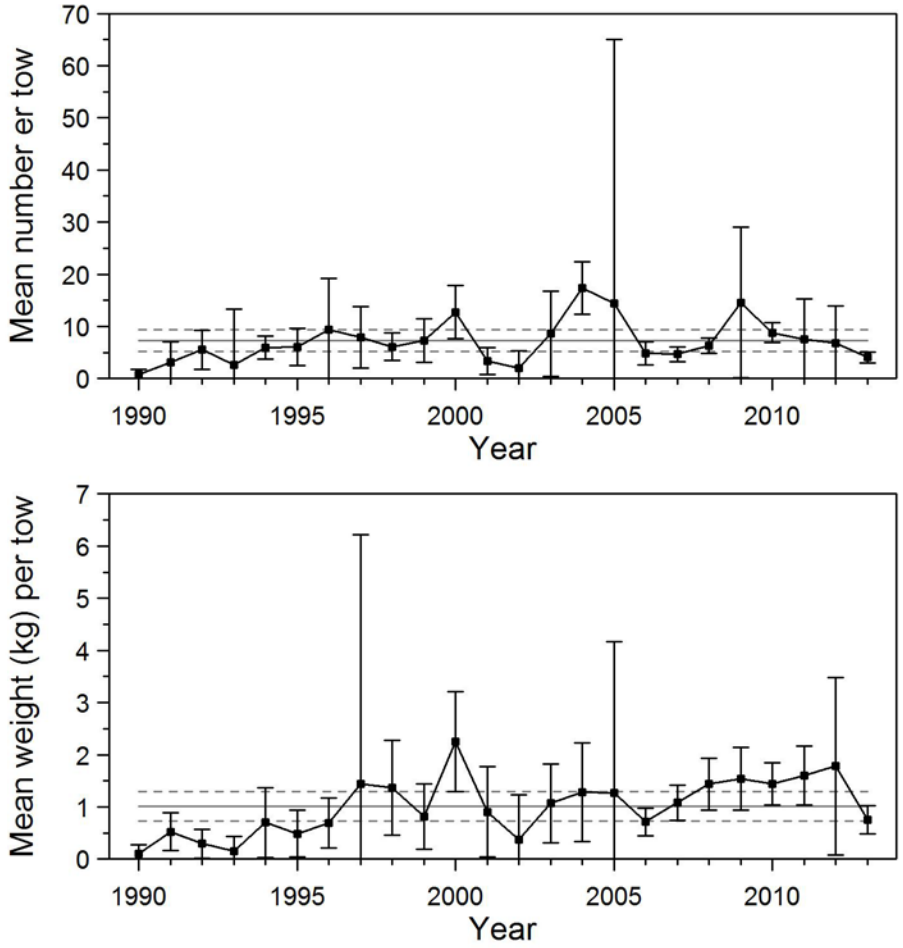

Figure 53. Mean numbers and mean weights per 15 minutes tow observed during the survey for Snow Crab in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Snow Crab

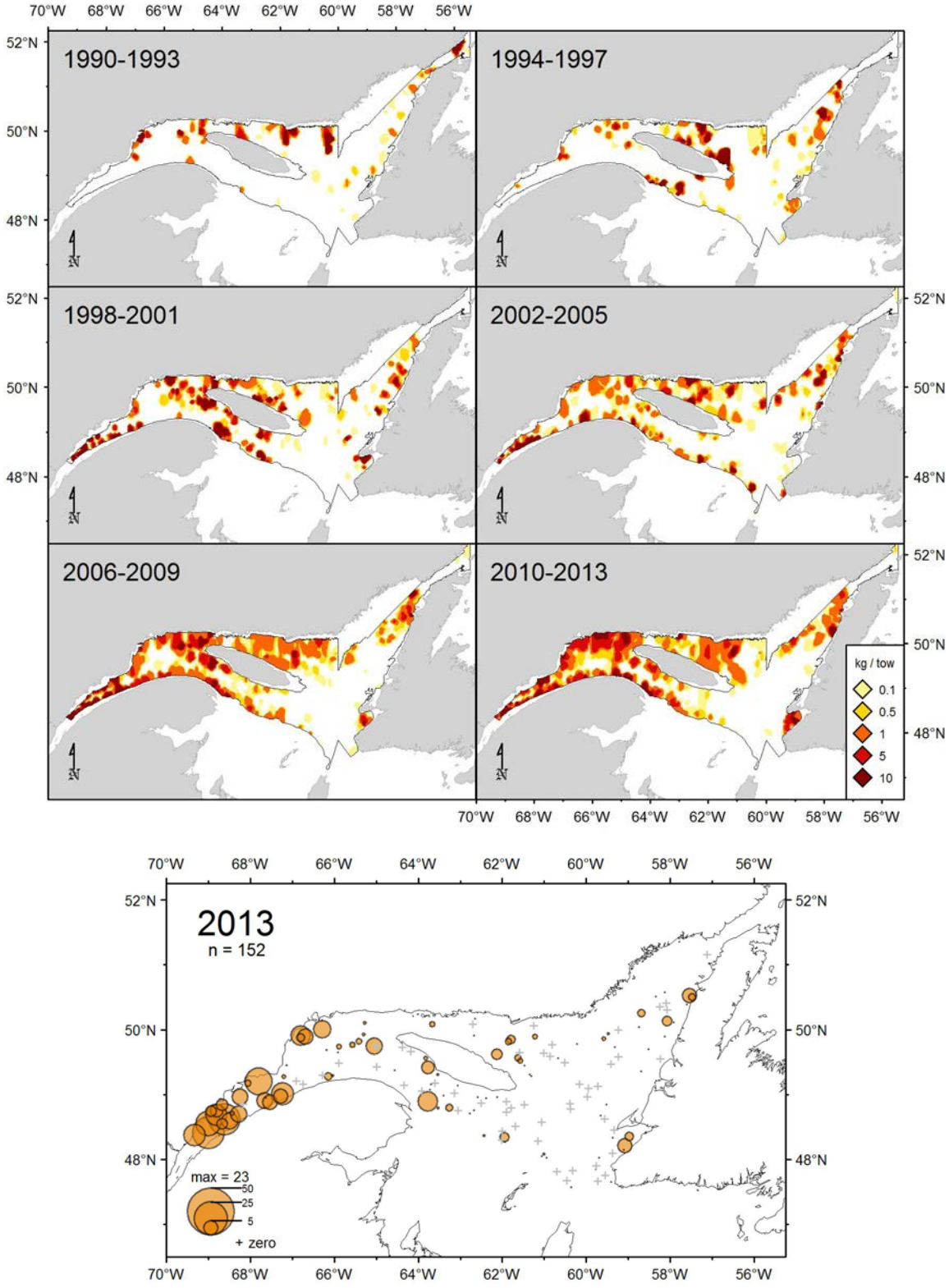

Figure 54. Snow Crab catch rates (kg/15 minutes tow) distribution.

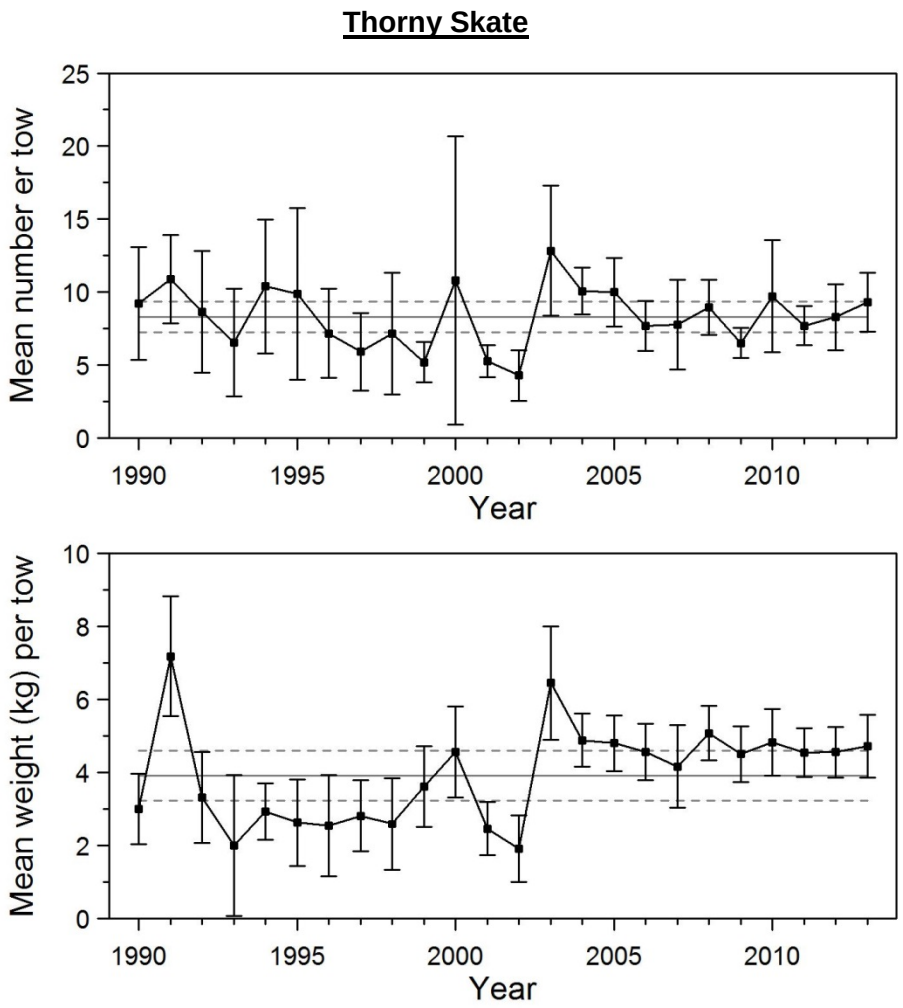

Figure 55. Mean numbers and mean weights per 15 minutes tow observed during the survey for Thorny Skate in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Thorny Tkate

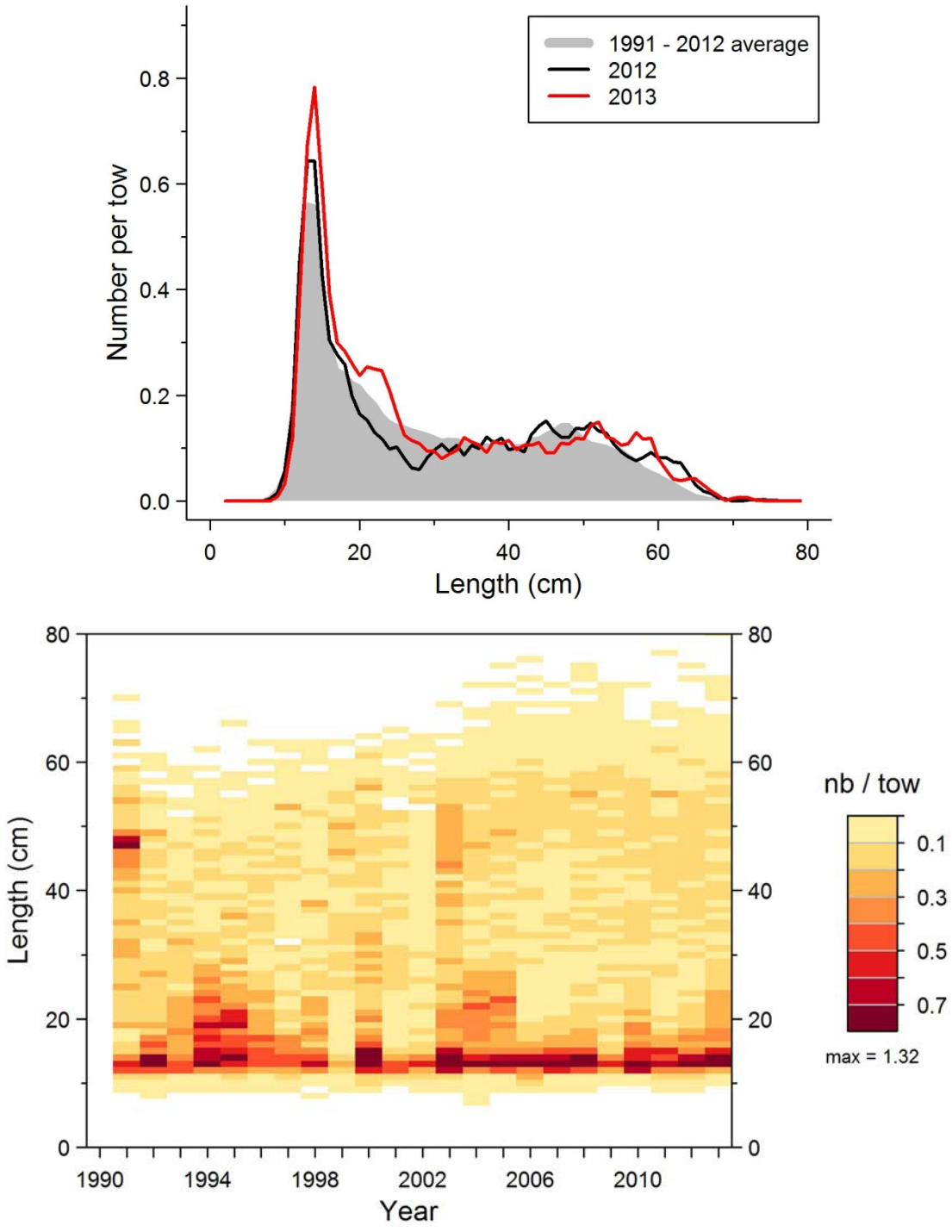

Figure 56. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Thorny Skate in 4RST.

Thorny Skate

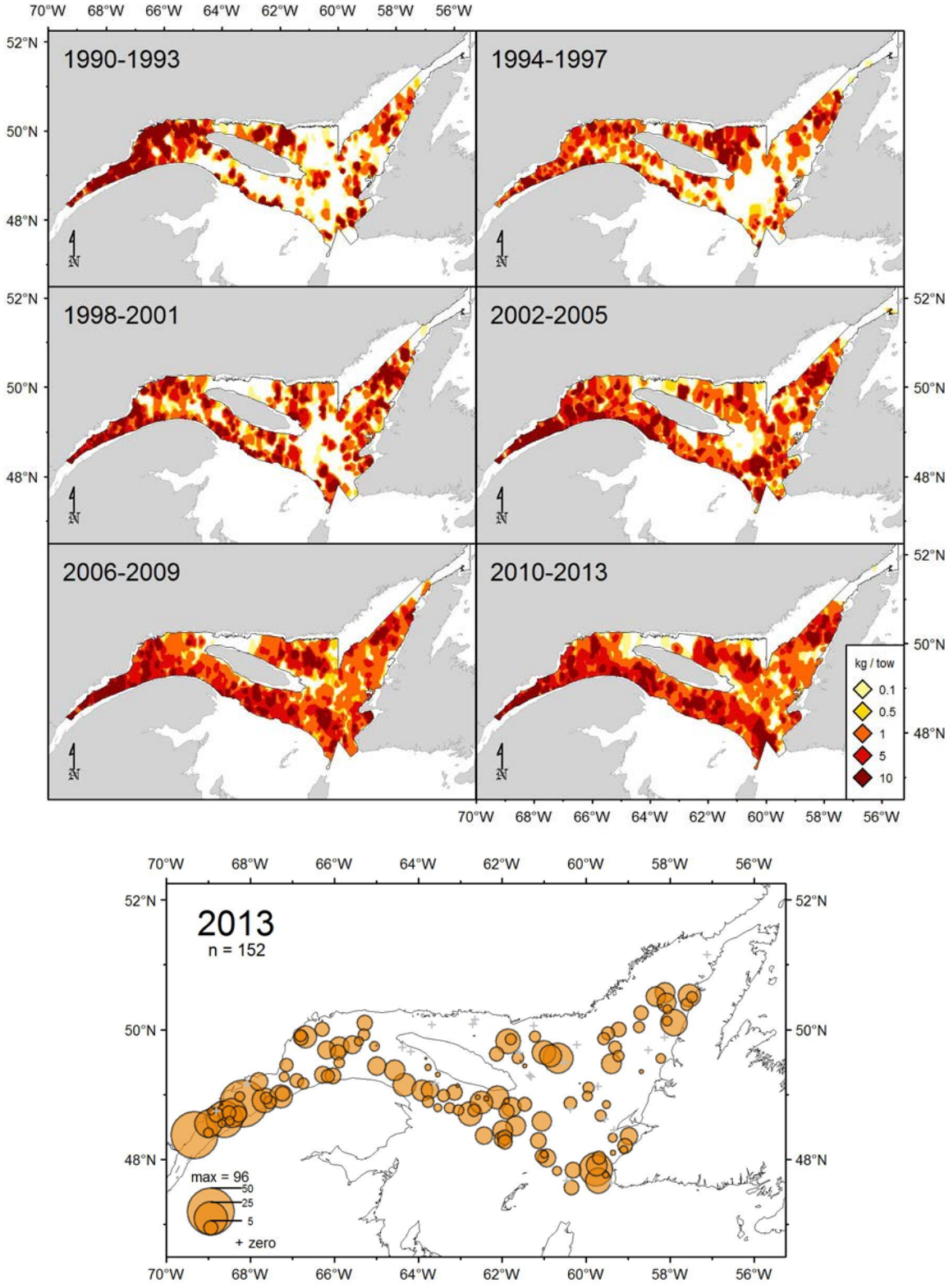

Figure 57. Thorny Skate catch rates (kg/15 minutes tow) distribution.

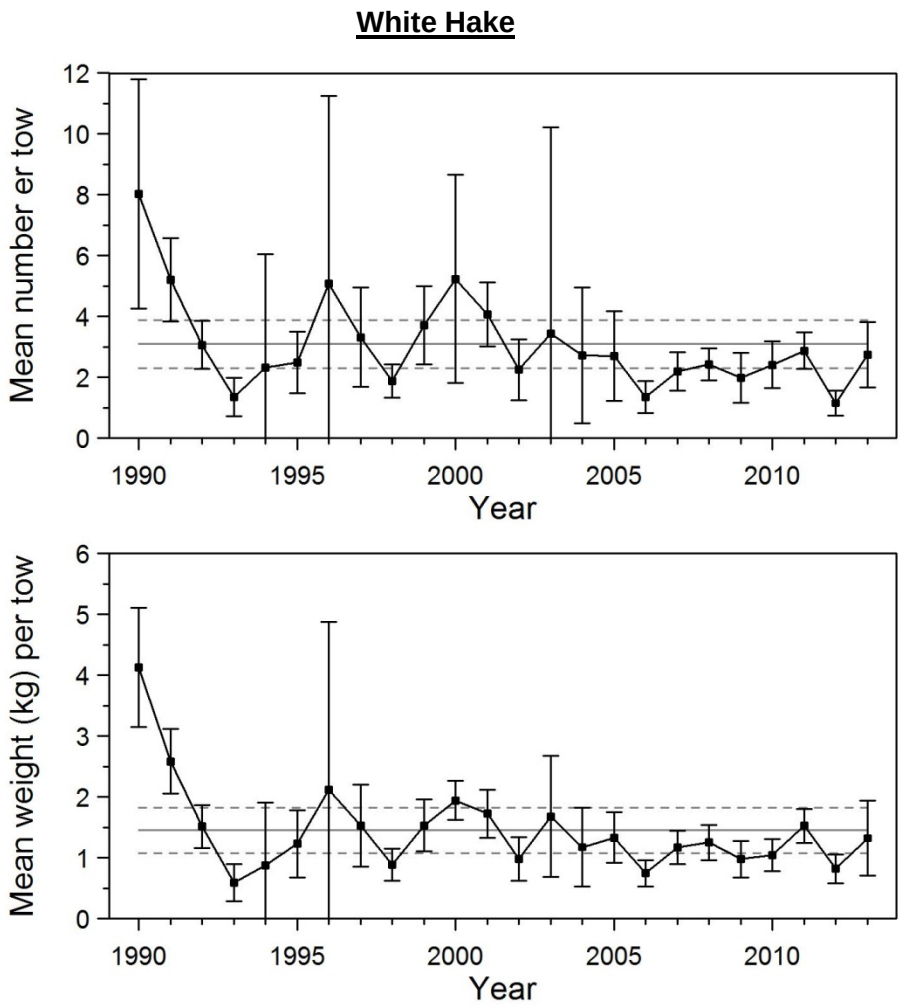

Figure 58. Mean numbers and mean weights per 15 minutes tow observed during the survey for White Hake in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

White Hake

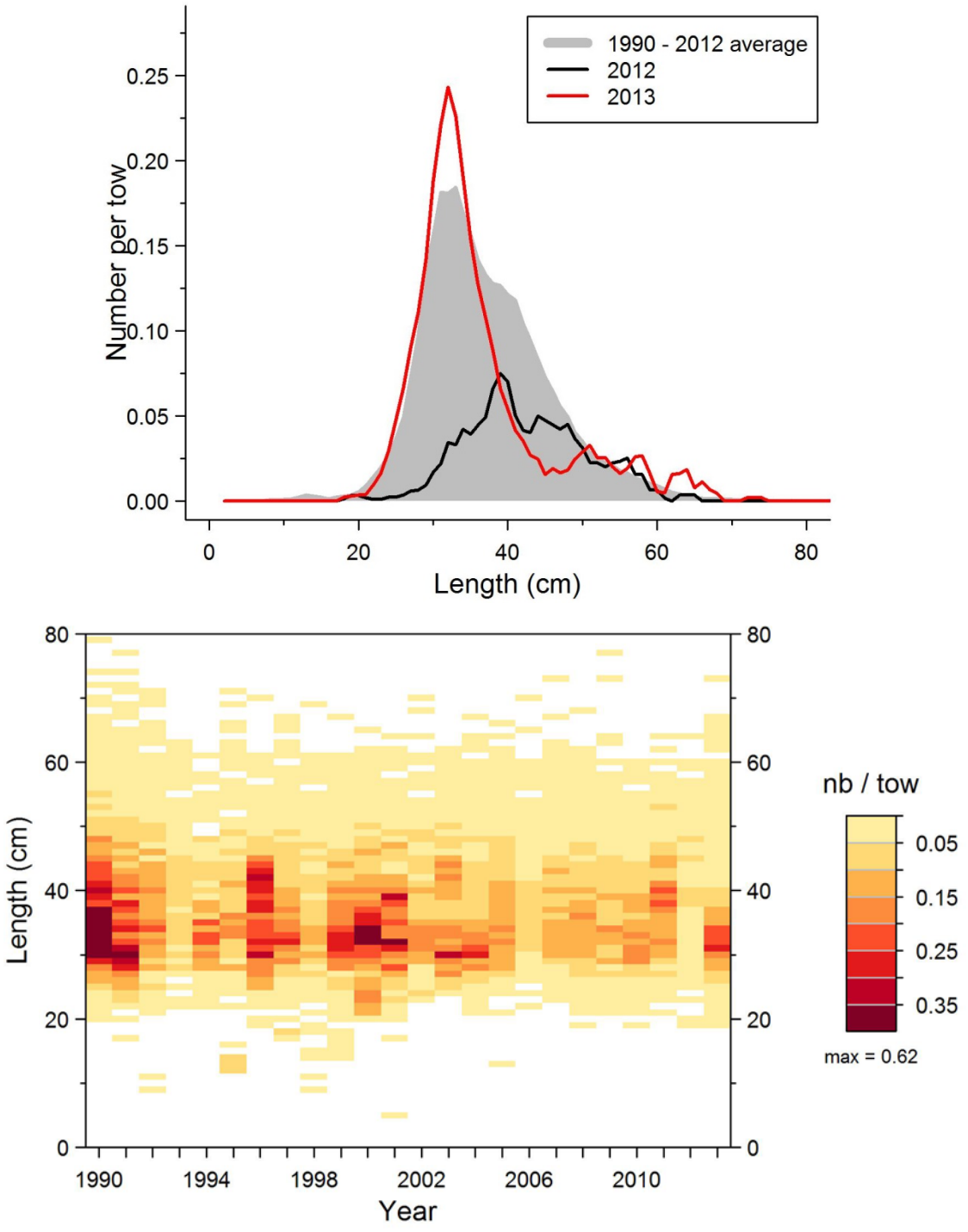

Figure 59. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for White Hake in 4RST.

White Hake

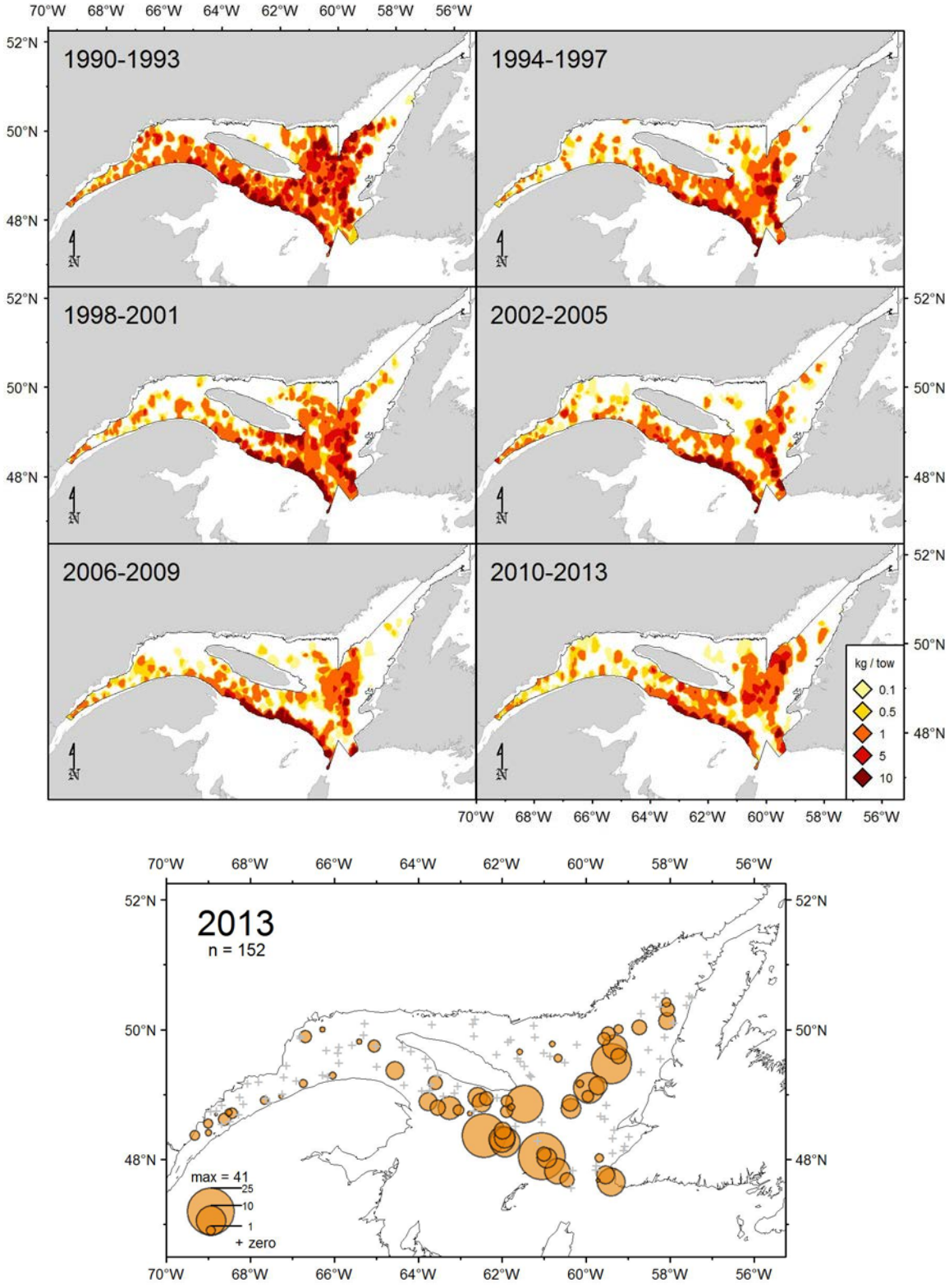

Figure 60. White Hake catch rates (kg/15 minutes tow) distribution.

Witch Flounder

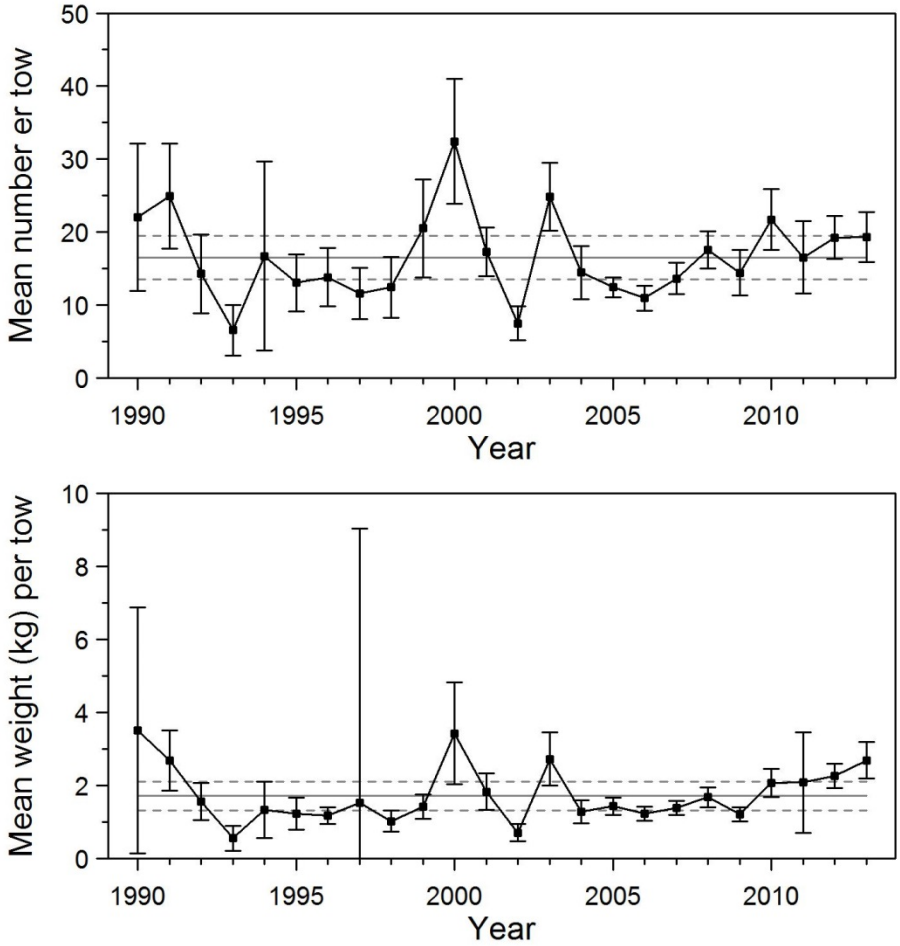

Figure 61. Mean numbers and mean weights per 15 minutes tow observed during the survey for Witch Flounder in 4RST. Error bars indicate the 95% confidence interval and the horizontal lines indicate the mean of the 1990-2012 period (solid line) and upper and lower reference (see text) limits (dashed lines).

Witch Flounder

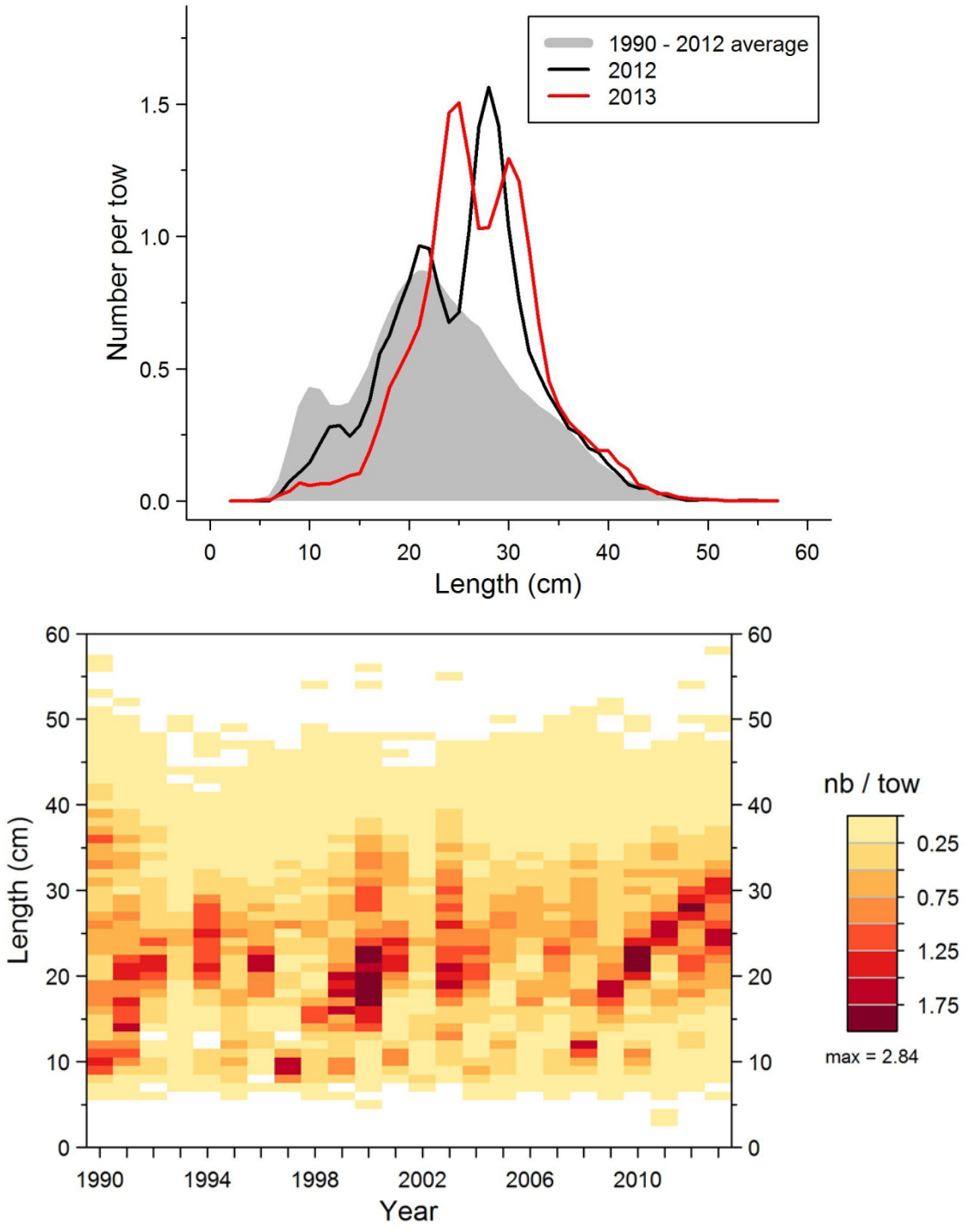

Figure 62. Length frequency distributions (mean number per 15 minutes tow) observed during the survey for Witch Flounder in 4RST.

Witch Flounder

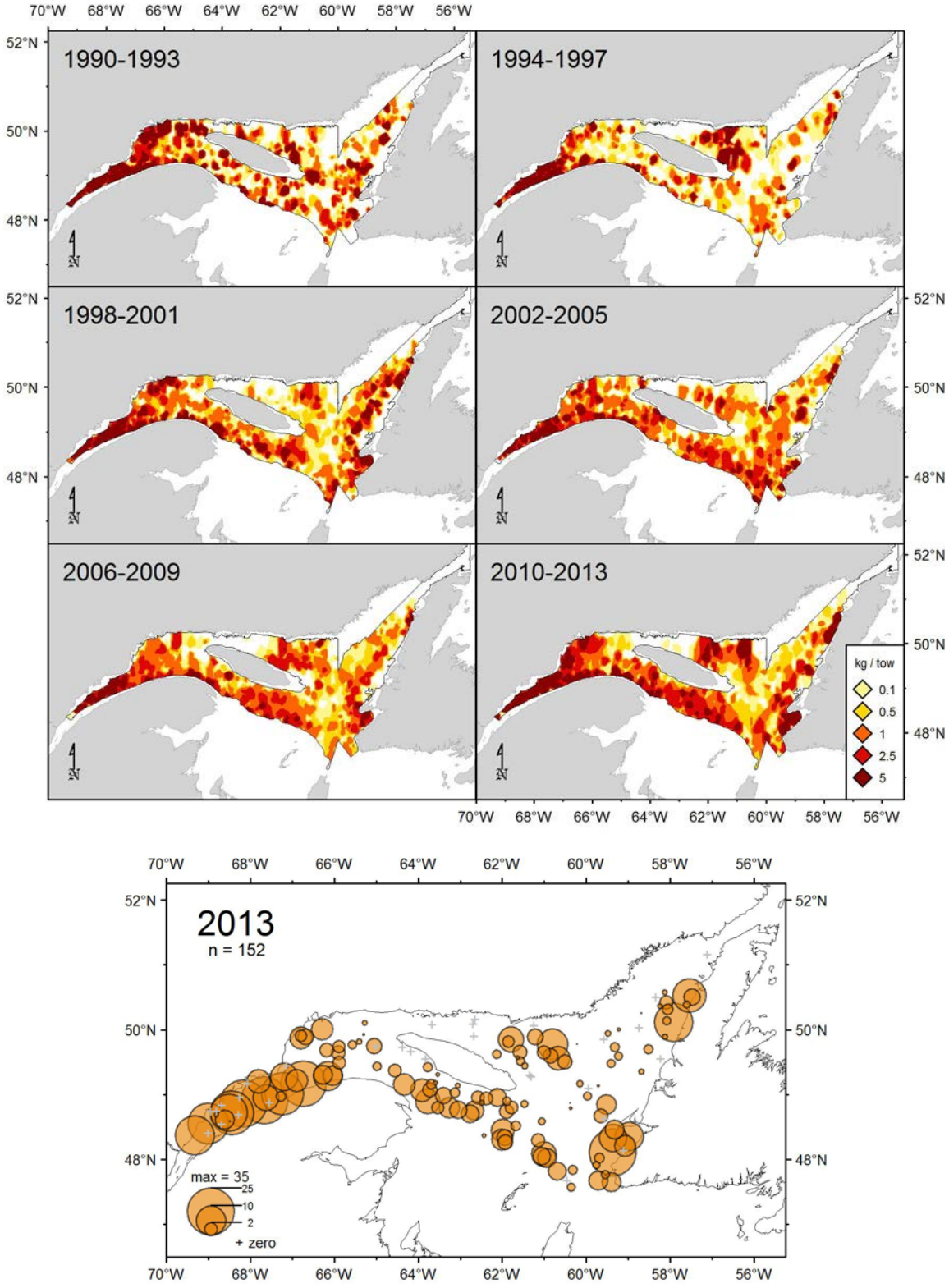

Figure 63. Witch Flounder catch rates (kg/15 minutes tow) distribution.

Wolffish, Atlantic Wolffish

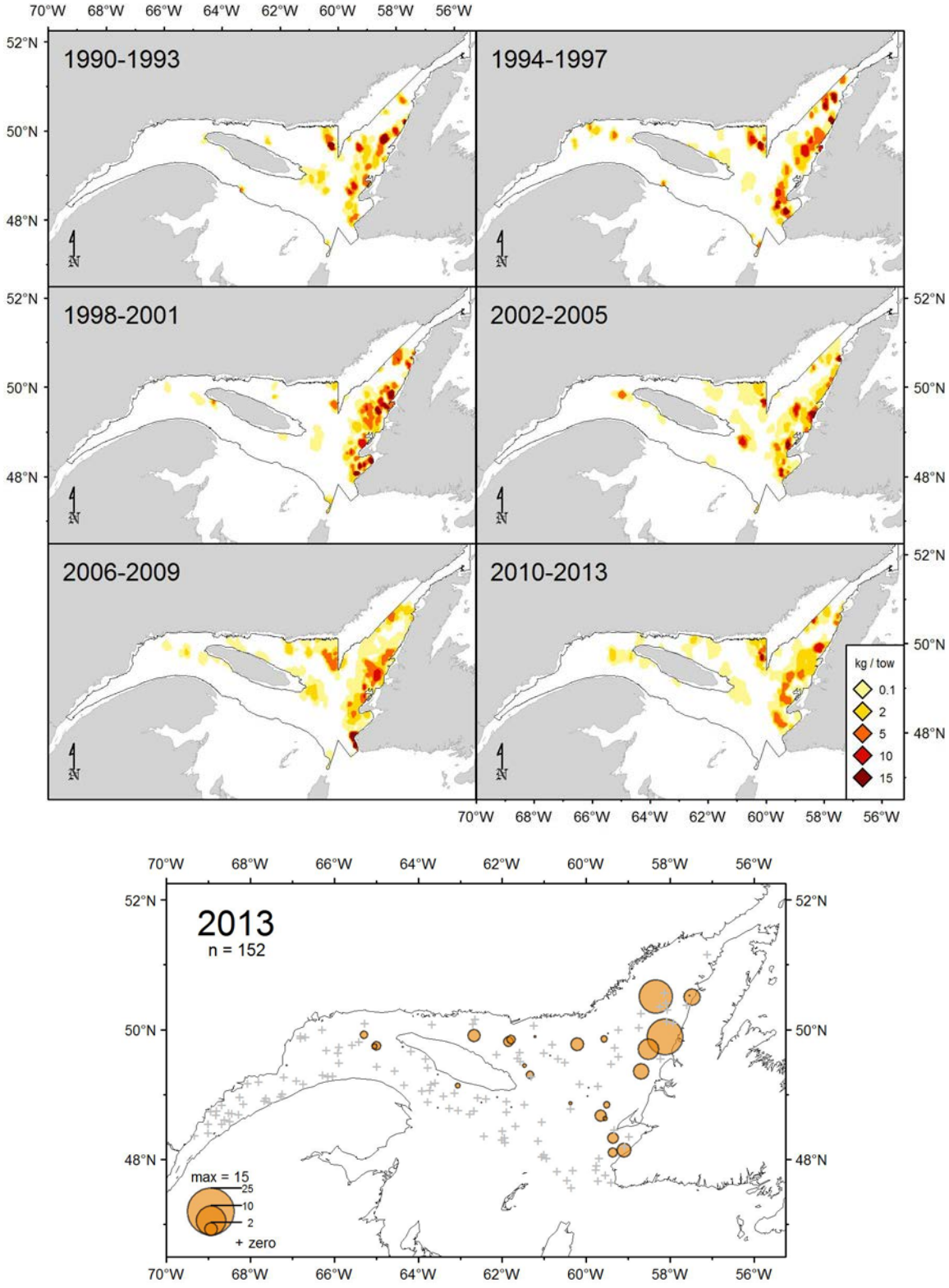

Figure 64. Atlantic Wolffish catch rates (kg/15 minutes tow) distribution.

Wolffish, Spotted Wolffish

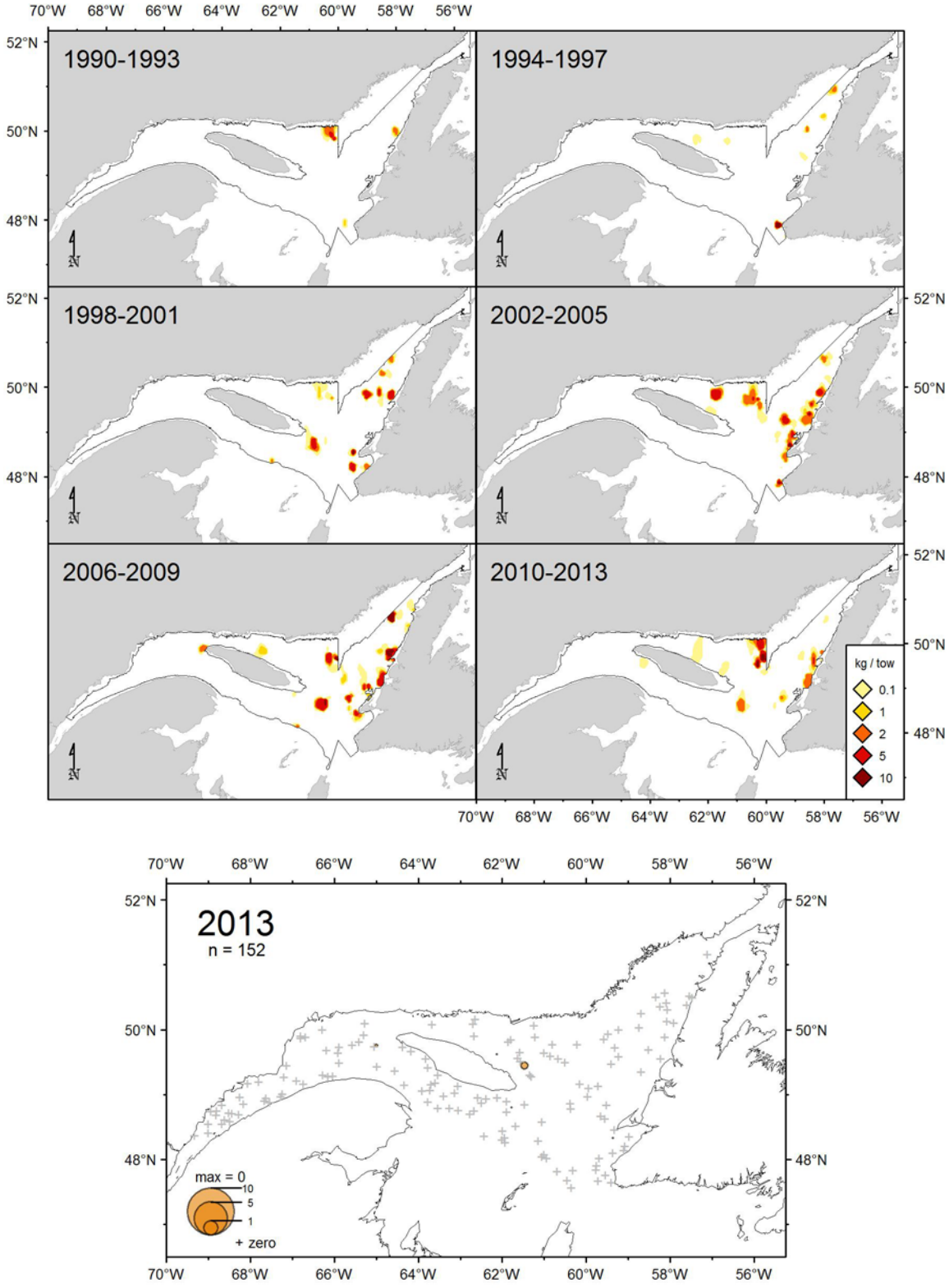

Figure 65. Spotted Wolffish catch rates (kg/15 minutes tow) distribution.

Water temperatures in the Gulf

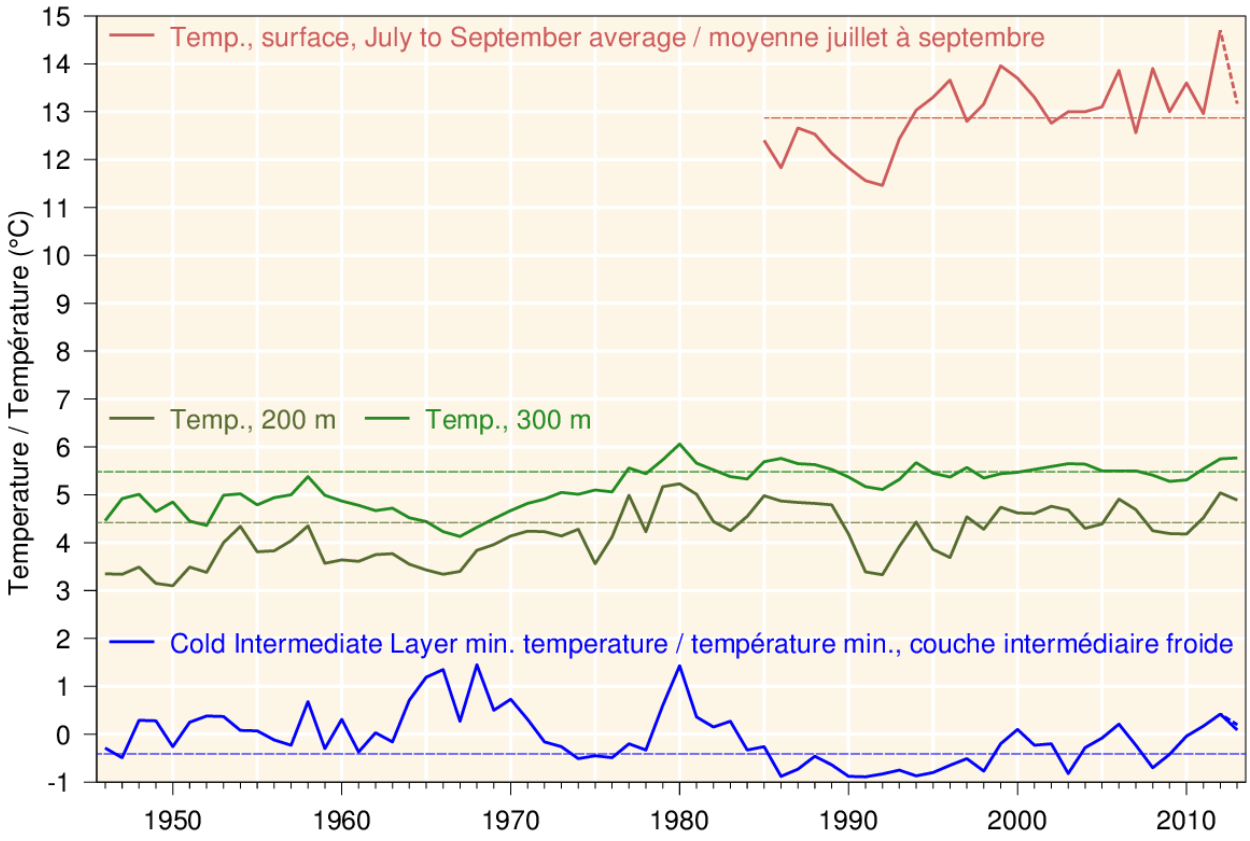

Figure 66 . July–September sea-surface temperature (SST) averaged over the Estuary and the northern Gulf (1985–2013) (red line). Layer-averaged temperature for the Gulf of St. Lawrence, at 200 and 300 m (green lines). Cold intermediate layer (CIL) minimum temperature index in the Gulf of St. Lawrence, adjusted to July 15th with 2013 value estimated from August survey data (blue line). Note that SST for September was missing and estimated from August-September air temperature anomalies. The dashed lines correspond to the average reference period, or 1985-2010 for the SST (red) and 1981-2010 for the other temperature layers (CIL -blue-; 200 and 300 m –green-).

APPENDICES

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

Stratum	NAFO	Area (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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
851	4T	456																			3	3	3	3	3	3
852	4T	427																			3	3	3	3	2	3
854	4T	83																			3	3	3	2	2	2
855	4T	465																			3	4	3	2	3	3

Appendix 2. Occurrences and total catches, in weight and number, by taxon during the 2013 survey (152 successful tows).

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
			Vertebrates			
90	*Amblyraja radiata*	Raie épineuse	Thorny Skate	129	888.9	2113
696	*Ammodytes* sp.	Lançons	Sand Lances	65	0.7	316
700	*Anarhichas lupus*	Loup atlantique	Atlantic Wolffish	36	50.8	160
701	*Anarhichas minor*	Loup tacheté	Spotted Wolffish	5	0.3	6
718	*Anisarchus medius*	Lompénie naine	Stout Eelblenny	2	0.2	38
320	*Arctozenus risso*	Lussion blanc	White Barracudina	96	20.5	1415
193	*Argentina silus*	Grande argentine	Atlantic Argentine	6	8.9	284
221	*Argyropelecus aculeatus***	Hache d'argent à grandes épines	Longspine Silver Hatchefish	1	< 0.1	1
811	*Artediellus atlanticus*	Hameçon atlantique	Atlantic Hookear Sculpin	36	0.7	142
812	*Artediellus uncinatus*	Hameçon neigeux	Arctic Hookear Sculpin	10	1.5	282
838	*Aspidophoroides monopterygius*	Poisson-alligator atlantique	Alligatorfish	39	0.7	180
102	*Bathyraja spinicauda*	Raie à queue épineuse	Spinytail Skate	4	23.0	4
451	*Boreogadus saida*	Saïda franc	Arctic Cod	22	1.6	123
234	*Borostomias antarcticus***	Dragon-saumon à grands yeux	Straightline Dragonfish	1	< 0.1	1
865	*Careproctus reinhardti*	Petite limace de mer	Sea Tadpole	11	0.3	19
27	*Centroscyllium fabricii*	Aiguillat noir	Black Dogfish	15	599.0	749
150	*Clupea harengus*	Hareng atlantique	Atlantic Herring	99	474.0	3170
829	*Cottunculus microps***	Cotte polaire	Polar Sculpin	3	0.2	3
721	*Cryptacanthodes maculatus*	Terrassier tacheté	Wrymouth	12	9.5	13
849	*Cyclopterus lumpus*	Grosse poule de mer	Lumpfish	25	13.8	36
208	*Cyclothone microdon*	Cyclothone à petites dents	Small-Toothed Bristlemouth	4	< 0.1	6
461	*Enchelyopus cimbrius*	Motelle à quatre barbillons	Fourbeard Rockling	100	104.7	2933
711	*Eumesogrammus praecisus*	Quatre-lignes atlantique	Fourline Snakeblenny	20	8.4	265
844	*Eumicrotremus spinosus*	Petite poule de mer atlantique	Atlantic Spiny Lumpsucker	14	1.3	66
438	*Gadus morhua*	Morue franche	Atlantic Cod	95	2594.1	6957
439	*Gadus ogac*	Ogac, morue ogac	Greenland Cod	7	6.1	32
437	*Gadus* sp.	Morue ou ogac	Atlantic or Greenland cod	1	0.1	1
455	*Gaidropsarus argentatus*	Mustèle argentée	Silver Rockling	5	< 0.1	8
454	*Gaidropsarus ensis***	Mustèle arctique à trois barbillons	Threebeard Rockling	2	< 0.1	2
426	*Gasterosteus aculeatus*	Épinoche à trois épines	Threespine Stickleback	9	< 0.1	10
890	*Glyptocephalus cynoglossus*	Plie grise	Witch Flounder	122	521.1	3543
205	Gonostomatidae	Cyclothones	Bristlemouths	2	< 0.1	9

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
823	*Gymnocanthus tricuspis*	Tricorne arctique	Arctic Staghorn Sculpin	23	6.2	107
809	*Hemitripterus americanus*	Hémitriptère atlantique	Sea Sculpin	7	7.6	8
889	*Hippoglossoides platessoides*	Plie canadienne	American Plaice	135	896.6	12895
893	*Hippoglossus hippoglossus*	Flétan atlantique	Atlantic Halibut	42	342.9	84
830	*Icelus* sp.	Icèles	Spatulate and Twohorn Sculpi	2	< 0.1	2
832	*Icelus spatula*	Icèle spatulée	Spatulate Sculpin	6	0.2	28
836	*Leptagonus decagonus*	Agone atlantique	Atlantic Poacher	28	7.9	404
717	*Leptoclinus maculatus*	Lompénie tachetée	Daubed Shanny	48	4.2	967
891	*Limanda ferruginea*	Limande à queue jaune	Yellowtail Flounder	5	7.0	44
859	*Liparis fabricii*	Limace gélatineuse	Gelatinous Seasnail	1	< 0.1	1
862	*Liparis gibbus*	Limace marbrée	Variegated Snailfish	11	1.2	48
966	*Lophius americanus*	Baudroie d'Amérique	Monkfish, Goosefish	8	34.9	9
716	*Lumpenus lampretaeformis*	Lompénie-serpent	Snakeblenny	34	26.4	930
750	*Lycenchelys paxillus*	Lycode commune	Common Wolf Eel	3	0.1	4
747	*Lycenchelys* sp.	Lycodes	Wolf Eels	1	0.2	3
752	*Lycenchelys verrillii*	Lycode à tête longue	Wolf Eelpout	6	< 0.1	7
727	*Lycodes esmarkii*	Lycode d'Esmark	Esmark's Eelpout	4	1.4	7
728	*Lycodes lavalaei*	Lycode du Labrador	Newfoundland Eelpout	24	21.0	164
726	*Lycodes* sp.	Lycodes	Eelpouts	1	< 0.1	1
734	*Lycodes terraenovae*	Lycode atlantique	Atlantic Eelpout	5	1.1	9
730	*Lycodes vahlii*	Lycode à carreaux	Vahl's Eelpout	39	65.0	1238
91	*Malacoraja senta*	Raie lisse	Smooth Skate	113	157.5	814
187	*Mallotus villosus*	Capelan	Capelin	129	409.2	50434
441	*Melanogrammus aeglefinus*	Aiglefin	Haddock	4	0.3	4
745	*Melanostigma atlanticum*	Molasse atlantique	Atlantic Soft Pout	64	6.4	2243
449	*Merluccius bilinearis*	Merlu argenté	Silver Hake	82	108.8	728
272	Myctophidae	Poissons-lanterne	Lanternfishes	12	0.4	104
271	Myctophiformes	Poissons des profondeurs	Deepwater Fishes	1	< 0.1	1
819	*Myoxocephalus scorpius*	Chaboisseau à épines courtes	Shorthorn Sculpin	25	30.1	68
12	*Myxine glutinosa*	Myxine du nord	Northern Hagfish	90	236.4	5159
478	*Nezumia bairdii*	Grenadier du grand Banc	Common Grenadier	78	38.8	1079
874	*Paraliparis calidus*	Limace ardente	Lowfin Snailfish	3	0.1	8
856	*Paraliparis copei*	Limace à museau noir	Blacksnout Snailfish	5	0.1	11
783	*Peprilus triacanthus***	Stromatée à fossette	Butterfish	1	< 0.1	1

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
15	*Petromyzon marinus***	Lamproie marine	Sea Lamprey	1	0.1	1
444	*Phycis chesteri*	Merluche à longues nageoires	Longfin Hake	27	32.5	298
443	*Pollachius virens*	Goberge	Pollock	3	18.0	11
222	*Polyipnus clarus*	Hache	Slope Hachetfish	4	< 0.1	4
94	*Rajella fyllae***	Raie ronde	Round Skate	2	< 0.1	2
892	*Reinhardtius hippoglossoides*	Flétan du Groenland, turbot	Greeenland Halibut, Turbot	118	3136.4	13204
572	*Scomber scombrus*	Maquereau bleu	Atlantic Mackerel	2	< 0.1	2
398	*Scomberesox saurus***	Balaou	Atlantic Saury	1	0.1	2
796	*Sebastes fasciatus*	Sébaste acadien	Acadian Redfish	136	2887.5	67196
794	*Sebastes mentella*	Sébaste atlantique	Deepwater Redfish	114	3599.3	148573
710	*Stichaeus punctatus***	Stichée arctique	Arctic Shanny	1	< 0.1	2
814	*Triglops murrayi*	Faux-trigle armé	Moustache Sculpin	35	6.2	470
447	*Urophycis tenuis*	Merluche blanche	White Hake	62	259.3	665
1		Vertébrés	Vertebrates	3	< 0.1	2
	Total	**Vertebrés**	**Vertebrates**		17 682	330 933
			Invertebrates			
2182	*Actinauge cristata*	Anémone de mer	Anemone	51	57.8	4753
2165	Actiniaria	Actinies et Anémones	Sea Anemones	3	0.7	34
2162	*Actinostola callosa*	Anémones de mer	Anemone	55	498.1	6380
6771	*Aega psora*	Isopode	Isopod	7	< 0.1	7
6930	*Amphipoda*	Amphipodes	Amphipods	5	< 0.1	8
4219	*Anomia* sp. **	Pétoncle	Jingle shells	1	< 0.1	1
7389	*Anonyx* sp.	Gammarides	Gammarids	7	< 0.1	11
2218	*Anthoptilum grandiflorum*	Plume de mer	Sea pen	47	943.0	5524
5002	*Aphroditella hastata*	Polychète errante	Sea Mouse	11	0.6	15
6594	*Arcoscalpellum michelottianum*	Balane	Barnacle	4	0.1	4
8138	*Argis dentata*	Crevette verte	Arctic Argid	38	24.1	4703
8024	*Aristaeopsis edwardsiana***	Gambon écarlate	Scarlet Shrimp	1	< 0.1	2
3418	*Arrhoges occidentalis*	Pied-de-pélican	American Pelicanfoot	16	1.0	121
8680	Ascidiacea	Ascidies, tuniqués sessiles	Ascidians, Sessile Tunicates	57	8.4	1220
4227	*Astarte* sp.	Astartes	Astartes	30	0.2	105
8495	Asteriidae	Étoiles de mer	Sea Stars	2	< 0.1	3

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
8390	Asteroidea	Étoiles de mer	Sea Stars	3	0.2	4
8113	*Atlantopandalus propinqvus*	Crevette	Shrimp	9	1.1	235
2097	*Atolla wyvillei*	Méduse	Jellyfish	6	0.4	6
3583	*Aulacofusus brevicauda*	Buccin	Whelk	1	< 0.1	1
2085	*Aurelia aurita*	Méduse de lune	Moon Jelly	2	0.2	2
6595	Balanidae	Balanes	Barnacles	1	1.9	
4904	*Bathypolypus bairdii*	Poulpe	North Atlantic Octopus	49	2.1	73
3995	Bivalvia	Bivalves	Bivalves	12	0.2	23
2158	*Bolocera tuediae*	Anémone de mer	Anemone	63	76.0	1255
8793	*Boltenia echinata*	Cactus de mer	Cactus Sea Squirt	1	< 0.1	2
8792	*Boltenia ovifera*	Patate de mer	Sea Potato	7	27.8	205
3487	*Boreotrophon clathratus*	Murex	Clathrate Trophon	8	< 0.1	13
3488	*Boreotrophon* sp.	Murex	Murex	2	< 0.1	2
8378	*Brisaster fragilis*	Oursin coeur	Heart Urchin	76	338.3	35586
2670	Bryozoa	Bryozoaires	Bryozoans	2	0.1	
3515	Buccinidae	Buccinidés	Whelks	3	0.1	3
3523	*Buccinum scalariforme*	Buccin	Ladder Whelk	1	< 0.1	3
3516	*Buccinum* sp.	Buccins	Whelk	29	2.7	158
3517	*Buccinum undatum*	Buccin commun	Waved Whelk	9	0.2	17
4545	Cephalopoda	Céphalopodes	Cephalopods	2	< 0.1	17
8429	*Ceramaster granularis*	Étoile de mer	Sea Star	12	0.8	36
8213	*Chionoecetes opilio*	Crabe des neiges	Snow Crab	99	239.7	1393
6593	*Chirona hameri***	Balane turbané	Turban Barnacle	2	0.1	2
4167	*Chlamys islandica*	Pétoncle d'Islande	Iceland Scallop	12	3.5	118
4351	*Ciliatocardium ciliatum ciliatum*	Coque d'Islande	Iceland Cockle	7	2.1	79
1340	Cnidaria	Cnidaires	Cnidarians	1	< 0.1	3
3908	*Colga villosa*	Nudibranche	Nudibranch	2	< 0.1	4
3577	*Colus pubescens*	Buccin	Hairy Whelk	4	0.1	6
3575	*Colus* sp.	Buccins	Whelks	9	0.2	15
3576	*Colus stimpsoni*	Buccin	Whelk	9	0.6	17
8261	Crinoidea	Crinoides	Crinoids	1	< 0.1	4
8447	*Crossaster papposus*	Soleil de mer épineux	Spiny Sun Star	19	2.9	33
3422	*Cryptonatica affinis*	Lunaties	Arctic moonsnail	6	< 0.1	11
8407	*Ctenodiscus crispatus*	Étoile de mer	Mud Star	109	247.2	70162

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
2250	Ctenophora	Cténophores	Comb-Jellies	1	< 0.1	14
8312	*Cucumaria frondosa*	Concombre de mer	Orange Footed Sea Cucumber	6	6.6	26
4525	*Cuspidaria* sp.	Myes	Dipperclams	28	0.2	179
2080	*Cyanea capillata*	Crinière de lion	Lion's Mane	81	119.7	245
3893	*Dendronotus* sp.	Nudibranche	Nudibranch	2	< 0.1	2
3965	*Doridoxa ingolfiana*	Nudibranche	Nudibranch	3	< 0.1	6
2191	*Drifa glomerata*	Corail mou	Soft coral	10	0.1	
2183	*Duva florida*	Corail mou	Sea Cauliflower	13	0.6	29
8373	*Echinarachnius parma*	Dollar de sable	Common Sand Dollar	4	0.5	35
7383	*Epimeria loricata***	Gammaridé	Gammarid	5	< 0.1	5
2157	*Epizoanthus* sp.	Anémone de mer	Sea Anemone	25	0.1	146
8075	*Eualus fabricii*	Bouc Arctique	Arctic Eualid	12	0.3	612
8081	*Eualus gaimardii belcheri***	Bouc	Circumpolar Eualid	1	< 0.1	5
8080	*Eualus gaimardii gaimardii*	Bouc	Circumpolar Eualid	1	< 0.1	1
8077	*Eualus macilentus*	Bouc du Groenland	Greenland Shrimp	19	17.2	16303
7991	Euphausiacea	Krill, Euphausides	Krill, Euphausids	1	< 0.1	125
2224	*Flabellum alabastrum*	Madrépore	Cup coral	3	0.4	34
3175	Gastropoda	Gastéropodes	Gastropods	3	< 0.1	4
2184	*Gersemia rubiformis*	Corail mou	Sea Strawberry	18	0.6	116
8540	*Gorgonocephalus* sp.	Gorgonocéphales	Basket Stars	13	63.6	267
2217	*Halipteris finmarchica*	Plume de mer	Sea pen	20	11.8	509
8797	*Halocynthia pyriformis***	Pêche de mer	Sea Peach	1	< 0.1	1
3090	*Hemithiris psittacea*	Brachiopode	Lamp Shell	1	< 0.1	1
8483	*Henricia* sp.	Étoiles de mer	Sea Stars	47	0.4	129
4437	*Hiatella arctica*	Saxicave arctique	Arctic Saxicave	1	< 0.1	1
8431	*Hippasteria phrygiana*	Étoile de mer	Sea Star	32	15.5	44
8290	Holothuroidea**	Concombres de mer	Sea Cucumbers	3	< 0.1	3
2167	*Hormathia nodosa*	Anémone noduleuse	Rugose Anemone	9	1.4	35
8217	*Hyas araneus*	Crabe lyre	Atlantic Lyre Crab	11	1.5	32
8218	*Hyas coarctatus*	Crabe lyre	Arctic Lyre Crab	33	2.5	167
1341	Hydrozoa	Hydrozoaires	Hydrozoans	20	0.1	
8028	*Hymenopenaeus debilis***	Crevette	Shrimp	2	< 0.1	4
4753	*Illex illecebrosus*	Encornet rouge nordique	Northern Shortfin Squid	12	1.3	19
8092	*Lebbeus groenlandicus*	Bouc	Spiny Lebbeid	3	2.8	497

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
8095	*Lebbeus microceros***	Bouc	Shrimp	1	< 0.1	
8093	*Lebbeus polaris*	Bouc	Polar Lebbeid	40	0.9	570
8510	*Leptasterias* sp.	Étoiles de mer	Sea Stars	13	0.8	20
2207	*Liponema multicorne*	Anémone	Sea anemone	8	1.8	28
8196	*Lithodes maja*	Crabe épineux du Nord	Norway King Crab	54	52.2	140
3437	*Lunatia pallida*	Lunatie	Pale Moonsnail	4	< 0.1	4
4395	*Macoma calcarea*	Bivalve	Chalky Macoma	3	< 0.1	4
3216	*Margarites groenlandicus*	Troque	Greenland marguerite	1	< 0.1	2
3212	*Margarites* sp.	Patelle	Topsnail	9	< 0.1	28
7994	*Meganyctiphanes norvegica*	Euphauside	Horned Krill	10	0.1	470
4025	*Megayoldia thraciaeformis*	Bivalve	Broad Yoldia	19	1.3	257
8322	*Molpadia oolitica***	Holothurie	Sea Cucumber	1	< 0.1	1
8164	*Munidopsis curvirostra*	Munidopsis curvirostra	Squat Lobster	17	0.3	137
4121	*Mytilus* sp.	Moules	Mussels	11	0.7	106
3420	Naticidae	Lunaties	Moonsnails	2	< 0.1	2
3000	Nemertea	Némerte	Ribbon Worm	1	< 0.1	1
7483	*Neohela monstrosa*	Gammaride	Gammarid	3	< 0.1	5
2219	Nephtheidae	Coraux mous	Soft corals	9	0.1	24
3565	*Neptunea* sp.	Buccins	Whelks	8	0.5	12
4019	*Nuculana* sp.	Bivalves	Nutclams	1	< 0.1	1
3850	Nudibranchia	Nudibranches	Nudibranchs	3	< 0.1	13
5961	*Nymphon* sp.	Araignées de mer	Sea Spiders	22	< 0.1	56
8575	*Ophiacantha bidentata*	Ophiure épineuse	Brittle Star	18	< 0.1	71
8583	*Ophiopholis aculeata*	Ophiure paquerette	Daisy Brittle Star	39	1.8	1408
8553	*Ophiura sarsii*	Ophiure	Brittle Star	40	31.8	20688
8530	Ophiuroidea	Ophiures	Brittle Stars	9	< 0.1	37
8178	*Pagurus* sp.	Bernards hermites droitiers	Hermits Crabs	14	0.1	31
8111	*Pandalus borealis*	Crevette nordique	Northern Shrimp	137	4034.2	639983
8112	*Pandalus montagui*	Crevette ésope	Striped Pink Shrimp	78	333.0	102861
4438	*Panomya norvegica*	Saxicave	Arctic Roughmya	2	< 0.1	2
8057	*Pasiphaea multidentata*	Sivade rose, Crevette blanche	Pink Glass Shrimp	103	72.4	26244
8056	*Pasiphaea tarda***	Sivade	Crimson Pasiphaeid	1	< 0.1	2
2203	*Pennatula aculeata*	Plume de mer	Sea Pen	76	5.8	2000
2210	*Pennatula grandis*	Plume de mer	Sea Pen	27	151.1	2551

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
2096	*Periphylla periphylla*	Méduse à coronne	Crown jellyfish	50	96.6	105
8114	*Plesionika martia***	Crevette	Golden shrimp	1	< 0.1	2
2255	*Pleurobrachia pileus*	Groseille de mer ronde	Sea Gooseberry	30	0.2	133
3578	*Plicifusus kroeyeri***	Colus	Arctic Whelk	1	< 0.1	2
4950	Polychaeta	Polychètes	Polychaetes	77	0.4	275
3125	Polyplacophora	Chitons	Chitons	1	< 0.1	1
8135	*Pontophilus norvegicus*	Crevette	Norwegian Shrimp	54	2.1	1162
8435	*Poraniomorpha* sp.	Étoile de mer	Sea star	5	0.2	6
1101	Porifera	Éponges	Sponges	95	54.7	
8433	*Pseudarchaster parelii*	Étoile de mer	Sea Star	14	0.4	30
8520	*Psilaster andromeda*	Étoile de mer	Sea Star	15	0.2	26
8295	*Psolus fabricii***	Psolus écarlate	Scarlet Psolus	1	0.1	1
8294	*Psolus phantapus*	Holothurie	Sea Cucumber	4	< 0.1	6
8410	*Pteraster militaris*	Étoile de mer	Sea Star	15	0.1	31
8412	*Pteraster obscurus***	Étoile de mer	Sea Star	1	< 0.1	1
8411	*Pteraster pulvillus*	Étoile de mer	Sea Star	16	< 0.1	28
1353	*Ptychogena lactea*	Méduse	Jellyfish	40	1.7	372
5951	Pycnogonida	Araignées de mer	Sea Spiders	4	< 0.1	15
7211	*Rhachotropis aculeata*	Gammaride	Gammarid	7	< 0.1	30
4557	*Rossia* sp.	Sépioles	Bobtails	31	0.6	49
8129	*Sabinea sarsii*	Crevette	Sars Shrimp	6	< 0.1	13
8128	*Sabinea septemcarinata*	Crevette	Sevenline Shrimp	24	0.5	244
3715	*Scaphander punctostriatus*	Céphalaspide	Giant Canoe Bubble	21	0.1	89
8119	*Sclerocrangon boreas*	Crevette de roche	Scultured Shrimp	11	3.3	338
2040	Scyphozoa	Scyphozoaires	Scyphozoans	4	1.2	20
2679	*Securiflustra securifrons*	Bryozoaires marins	Marine bryozoans	4	< 0.1	
8033	*Sergestes arcticus*	Crevette	Shrimp	7	0.1	45
8035	*Sergia robusta***	Sergistidé écarlate	Scarlet Sergestid	1	< 0.1	2
4191	*Similipecten greenlandicus*	Pétoncle	Greenland Glass-Scallop	2	< 0.1	3
5900	Sipuncula	Sipunculides	Sipunculids	11	< 0.1	18
8087	*Spirontocaris lilljeborgii*	Bouc épineux	Friendly Blade Shrimp	24	0.2	146
8084	*Spirontocaris* sp.	Boucs	Blade Shrimps	1	< 0.1	
8085	*Spirontocaris spinus*	Bouc perroquet	Parrot Shrimp	12	0.1	63
4853	*Stauroteuthis syrtensis***	Pieuvre	Octopus	2	2.1	2

Appendix 2. (Continued)

STRAP* code	Scientific name	French name	English name	Occurrence	Weight (kg)	Number
7750	*Stegocephalus inflatus*	Gammaride	Gammarid	17	< 0.1	39
2159	*Stephanauge nexilis*	Anémone de mer	Sea anemone	16	0.7	61
2173	*Stomphia coccinea*	Anémone marbrée	Anemone	27	0.7	87
8363	*Strongylocentrotus* sp.	Oursins	Sea Urchins	47	36.5	1877
6791	*Syscenus infelix*	Isopode	Isopod	40	0.3	141
3101	*Terebratulina septentrionalis*	Térébratule du Nord	Northern Lamp Shell	13	< 0.1	32
6972	*Themisto libellula*	Hypéride	Hyperiid	7	< 0.1	16
1357	*Thuiaria thuja*	Hydrozoaire	Bottlebrush Hydroid	6	< 0.1	14
8446	*Tremaster mirabilis***	Étoile de mer	Sea star	1	0.1	2
1100		Invertébrés	Invertebrates	14	0.1	56
	Total	**Invertebrés**	**Invertebrates**		7 622	955 317
			Other			
9995		Déchets	Trash	152	97.3	
9970		Capsule de raie	Skate Egg	51	3.7	230
9203	*Agarum cribrosum*	Laminaire criblée	Sea Colander	1	0.8	
9206	*Chondrus crispus*	Mousse d'Irlande	Brown Seaweed	2	17.0	
9220	*Laminaria* sp.	Laminaires	Kelps	2	3.5	

** : STRAP code based in part on works of Akenhead LeGrow (1981) for vertebrates and Lilly (1982) for invertebrates, as well as works on predation by marine organisms by the region of Quebec.*

*** : Taxa rarely caught during the historical surveys series (1990-2013).*

Appendix 3. Number of measured and weighed specimens and descriptive statistics for the length in 2013.

STRAP* code	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1**	Median	P99**	Max
	Vertebrates							
90	*Amblyraja radiata*	1707	1282	9.8	11.2	21.6	64.8	79.5
696	*Ammodytes* sp.	265	236	6.2	6.5	9.7	14.7	16.4
700	*Anarhichas lupus*	160	156	6.5	6.7	19.2	75.5	77.1
701	*Anarhichas minor*	6	6	9.7	9.7	13.0	28.2	28.2
718	*Anisarchus medius*	38	18	11.6	11.6	13.2	15.1	15.1
320	*Arctozenus risso*	1183	927	13.1	17.2	22.5	27.6	29.6
193	*Argentina silus*	6	6	10.2	10.2	12.9	25.3	25.3
221	*Argyropelecus aculeatus*	1	1	8.2	8.2	8.2	8.2	8.2
811	*Artediellus atlanticus*	142	142	3.5	3.7	6.9	12.8	13.0
812	*Artediellus uncinatus*	104	74	4.4	5.1	6.8	8.2	8.6
838	*Aspidophoroides monopterygius*	179	169	5.4	7.2	12.8	16.1	16.6
102	*Bathyraja spinicauda*	4	4	31.0	31.0	84.4	142.0	142.0
451	*Boreogadus saida*	123	101	9.5	10.4	12.1	15.2	17.5
234	*Borostomias antarcticus*	1	1	19.5	19.5	19.5	19.5	19.5
865	*Careproctus reinhardti*	19	19	4.7	4.7	9.6	13.6	13.6
27	*Centroscyllium fabricii*	402	169	13.8	14.5	55.0	67.3	73.0
150	*Clupea harengus*	1138	853	8.9	12.8	26.9	36.1	38.0
829	*Cottunculus microps*	3	3	7.6	7.6	11.0	17.6	17.6
721	*Cryptacanthodes maculatus*	13	13	22.6	22.6	64.1	85.6	85.6
849	*Cyclopterus lumpus*	35	34	3.9	3.9	20.1	35.0	35.0
208	*Cyclothone microdon*	3	3	6.0	6.0	6.1	6.7	6.7
461	*Enchelyopus cimbrius*	1353	869	5.0	10.7	19.2	27.4	29.6
711	*Eumesogrammus praecisus*	216	147	8.8	10.1	15.7	22.9	23.1
844	*Eumicrotremus spinosus*	66	60	2.5	2.5	5.8	12.2	12.2
438	*Gadus morhua*	4029	1954	4.1	11.6	28.1	58.0	80.5
439	*Gadus ogac*	17	32	16.6	16.6	24.9	47.1	47.1
437	*Gadus* sp.	1	1	18.7	18.7	18.7	18.7	18.7
455	*Gaidropsarus argentatus*	8	8	4.2	4.2	5.4	6.4	6.4
454	*Gaidropsarus ensis*	2	2	7.7	7.7	11.2	14.7	14.7
426	*Gasterosteus aculeatus*	10	10	3.7	3.7	6.1	6.9	6.9
890	*Glyptocephalus cynoglossus*	2964	2100	5.5	9.7	27.3	43.2	57.6
205	Gonostomatidae	1	1	6.5	6.5	6.5	6.5	6.5
823	*Gymnocanthus tricuspis*	98	97	8.8	8.8	16.5	23.5	23.5
809	*Hemitripterus americanus*	8	8	26.6	26.6	34.9	43.1	43.1
889	*Hippoglossoides platessoides*	5702	2503	2.9	7.1	19.5	40.3	52.9
893	*Hippoglossus hippoglossus*	84	84	21.9	21.9	55.7	132.0	132.0
830	*Icelus* sp.	2	2	2.6	2.6	4.3	6.0	6.0
832	*Icelus spatula*	28	28	4.4	4.4	7.5	16.0	16.0
836	*Leptagonus decagonus*	244	162	4.1	6.5	18.4	21.6	21.9
717	*Leptoclinus maculatus*	493	340	8.4	8.7	10.6	19.1	24.4
891	*Limanda ferruginea*	44	44	13.9	13.9	26.5	31.1	31.1
862	*Liparis gibbus*	48	40	2.9	2.9	10.8	23.2	23.2
966	*Lophius americanus*	9	9	23.7	23.7	55.0	86.2	86.2
716	*Lumpenus lampretaeformis*	431	292	16.6	18.4	31.6	41.6	45.5
750	*Lycenchelys paxillus*	4	3	17.9	17.9	21.2	23.0	23.0
747	*Lycenchelys* sp.	3	3	22.9	22.9	26.3	29.7	29.7
752	*Lycenchelys verrillii*	7	7	9.6	9.6	12.0	14.9	14.9
727	*Lycodes esmarkii*	7	7	14.5	14.5	33.6	48.3	48.3
728	*Lycodes lavalaei*	164	147	6.2	6.8	18.8	52.6	59.3
726	*Lycodes* sp.	1	1	13.2	13.2	13.2	13.2	13.2
734	*Lycodes terraenovae*	9	9	14.2	14.2	23.4	40.1	40.1
730	*Lycodes vahlii*	464	308	7.8	8.8	21.9	37.7	41.8
91	*Malacoraja senta*	764	723	8.3	9.1	16.4	59.1	70.0
187	*Mallotus villosus*	2441	1693	5.9	9.5	13.9	16.3	18.8
441	*Melanogrammus aeglefinus*	4	4	18.2	18.2	19.8	22.1	22.1

Appendix 3. (Continued)

STRAP* code	Scientific name	Sampled number		Length (cm)				
		Length	Weight	Min	P1**	Median	P99**	Max
745	*Melanostigma atlanticum*	964	577	5.8	7.3	10.5	13.2	14.8
449	*Merluccius bilinearis*	725	715	10.5	12.3	28.5	36.6	41.5
272	Myctophidae	35	35	5.0	5.0	6.6	14.0	14.0
271	Myctophiformes	1	1	9.0	9.0	9.0	9.0	9.0
819	*Myoxocephalus scorpius*	68	68	4.2	4.2	30.7	41.5	41.5
12	*Myxine glutinosa*	1841	1108	0.8	21.8	36.5	49.4	53.6
478	*Nezumia bairdii*	1010	814	6.7	8.6	22.8	31.6	33.9
874	*Paraliparis calidus*	8	7	9.4	9.4	10.6	12.2	12.2
856	*Paraliparis copei*	11	11	4.1	4.1	10.4	12.7	12.7
783	*Peprilus triacanthus*	1	1	13.6	13.6	13.6	13.6	13.6
15	*Petromyzon marinus*	1	1	30.5	30.5	30.5	30.5	30.5
444	*Phycis chesteri*	298	241	13.1	13.5	25.1	38.4	43.0
443	*Pollachius virens*	11	11	39.1	39.1	50.5	60.1	60.1
222	*Polyipnus clarus*	4	4	4.9	4.9	6.4	6.5	6.5
94	*Rajella fyllae*	2	2	12.5	12.5	12.5	12.5	12.5
892	*Reinhardtius hippoglossoides*	6326	2960	5.6	13.4	32.4	51.8	63.5
572	*Scomber scombrus*	2	2	13.0	13.0	13.5	13.9	13.9
398	*Scomberesox saurus*	2	2	24.1	24.1	25.1	26.0	26.0
796	*Sebastes fasciatus*	6992	5047	2.8	3.9	12.8	42.8	49.8
794	*Sebastes mentella*	5953	4440	2.8	3.7	10.8	43.5	49.8
710	*Stichaeus punctatus*	2	2	10.0	10.0	10.6	11.1	11.1
814	*Triglops murrayi*	386	296	7.0	7.6	12.0	17.8	18.9
447	*Urophycis tenuis*	620	472	18.7	22.2	32.3	63.2	73.1
	Invertebrates							
8138	*Argis dentata*	559	0	0.6	0.7	1.6	2.2	2.3
8024	*Aristaeopsis edwardsiana*	1	0	2.8	2.8	2.8	2.8	2.8
8113	*Atlantopandalus propinqvus*	128	0	0.9	0.9	1.7	2.3	2.4
8213	*Chionoecetes opilio*	1218	729	0.5	1.0	6.5	12.7	14.0
8075	*Eualus fabricii*	159	0	0.5	0.5	0.8	1.1	1.2
8081	*Eualus gaimardii belcheri*	2	0	1.0	1.0	1.1	1.1	1.1
8080	*Eualus gaimardii gaimardii*	1	0	0.9	0.9	0.9	0.9	0.9
8077	*Eualus macilentus*	331	0	0.5	0.7	1.0	1.3	1.3
8217	*Hyas araneus*	32	18	1.0	1.0	1.8	9.0	9.0
8218	*Hyas coarctatus*	167	84	0.5	0.6	1.7	7.2	7.4
8028	*Hymenopenaeus debilis*	4	0	1.6	1.6	1.8	2.0	2.0
4753	*Illex illecebrosus*	17	17	13.1	13.1	14.9	18.9	18.9
8092	*Lebbeus groenlandicus*	19	0	0.9	0.9	1.7	2.3	2.3
8093	*Lebbeus polaris*	307	0	0.5	0.7	1.1	1.4	1.4
8196	*Lithodes maja*	137	121	1.0	1.6	8.3	11.4	11.6
8111	*Pandalus borealis*	21986	997	0.7	0.9	2.3	2.8	3.1
8112	*Pandalus montagui*	2239	0	0.5	0.8	1.5	2.1	2.3
8057	*Pasiphaea multidentata*	2716	0	0.7	1.3	2.4	3.0	3.3
8056	*Pasiphaea tarda*	2	0	3.5	3.5	3.5	3.6	3.6
8114	*Plesionika martia*	2	0	2.4	2.4	2.4	2.4	2.4
8135	*Pontophilus norvegicus*	413	0	0.5	0.7	1.3	1.6	1.7
8129	*Sabinea sarsii*	13	0	0.5	0.5	1.1	1.7	1.7
8128	*Sabinea septemcarinata*	173	0	0.5	0.6	1.2	1.6	1.6
8119	*Sclerocrangon boreas*	176	0	1.0	1.1	1.8	3.5	3.7
8033	*Sergestes arcticus*	22	0	1.3	1.3	1.6	2.0	2.0
8035	*Sergia robusta*	2	0	1.0	1.0	1.1	1.2	1.2
8087	*Spirontocaris lilljeborgii*	50	0	0.6	0.6	1.1	1.5	1.5
8085	*Spirontocaris spinus*	36	0	0.5	0.5	1.0	1.3	1.3

** STRAP code based in part on works of Akenhead LeGrow (1981) for vertebrates and Lilly (1982) for invertebrates, as well as works on predation by marine organisms by the region of Quebec.*

*** P1 : 1st percentile P99 : 99th percentile*

Appendix 4. Set positions and depth of successful fishing sets, and standardized catches (0.75 nm) in number and weight for cod, Greenland halibut, redfish, northern shrimp, Atlantic halibut, herring and capelin during the 2013 survey.

Set	Stratum	Latitude Deg-Min	Longitude Deg-Min	Depth (m)	Cod		Greenland Halibut		Redfish		Northern Shrimp		Atlantic Halibut		Herring		Capelin	
					n	kg	n	kg	n	kg	n	kg	n	kg	n	kg	n	kg
1	403	48º54'	63º46'	270	1.5	1.1	145.5	30.3	229	27.8	16834	117.0	0.0	0.0	4.5	0.7	501.6	3.4
2	806	49º02'	63º08'	353	0.0	0.0	23.0	12.0	230	20.0	688	6.1	1.0	8.0	1.0	0.2	81.7	0.6
3	818	48º57'	62º23'	242	10.6	4.5	6.7	2.2	335	7.8	3080	23.4	1.0	1.9	26.9	4.0	4.0	0.1
4	807	48º44'	61º54'	357	0.0	0.0	5.0	1.3	84	15.3	105	0.8	0.0	0.0	6.0	0.6	1.0	0.0
5	819	48º51'	61º28'	264	0.0	0.0	8.0	3.0	305	21.3	703	5.1	0.0	0.0	5.0	0.9	1.0	0.0
6	819	48º52'	60º23'	267	0.9	0.3	25.3	1.9	194	23.1	7168	45.5	0.0	0.0	5.4	0.9	4.5	0.1
7	809	48º58'	59º58'	312	0.0	0.0	23.1	6.9	56	17.4	10899	76.5	0.0	0.0	3.8	0.7	12.5	0.2
8	809	49º06'	59º56'	283	0.0	0.0	18.8	3.6	6127	79.2	9508	64.6	0.0	0.0	8.8	1.3	131.7	1.7
9	808	49º10'	60º09'	276	1.0	0.2	20.2	1.9	10457	119.3	642	4.4	0.0	0.0	1.0	0.1	524.8	8.2
12	833	49º47'	60º13'	81	41.3	18.1	0.0	0.0	566	8.1	0	0.0	0.9	0.1	0.9	0.2	73.1	0.9
15	814	49º51'	59º35'	221	21.6	10.9	75.0	16.0	764	8.8	17408	76.3	0.0	0.0	34.7	5.8	9.8	0.1
16	814	49º56'	59º29'	222	2.8	2.9	79.7	15.4	2620	23.8	14959	69.9	2.8	13.0	2.8	0.4	4.3	0.0
18	814	50º00'	59º14'	234	1.0	1.6	43.3	8.1	670	6.9	8685	55.7	1.0	1.7	2.9	0.3	123.6	1.6
19	813	50º15'	58º42'	229	4.8	3.4	98.1	33.9	4939	43.6	34790	186.4	0.0	0.0	6.7	1.1	89.3	1.1
22	824	50º30'	58º21'	145	67.2	29.3	0.0	0.0	170	2.2	11	0.0	1.3	1.4	3.9	0.4	22.3	0.2
23	824	50º34'	58º07'	159	115.4	33.7	0.0	0.0	28	0.3	2	0.0	6.7	9.2	8.7	1.7	9.4	0.1
26	837	51º10'	57º07'	63	34.5	3.8	0.0	0.0	5	0.0	0	0.0	0.0	0.0	915.0	264.8	3.0	0.0
28	823	50º31'	57º32'	141	96.7	17.3	0.0	0.0	1	0.0	0	0.0	1.1	0.7	2.2	0.5	6.5	0.1
29	836	50º30'	57º29'	85	116.3	31.7	0.0	0.0	0	0.0	0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
31	823	50º23'	57º36'	146	194.9	72.1	0.0	0.0	153	2.7	2	0.0	1.9	5.9	1.9	0.4	0.0	0.0
32	822	49º21'	58º41'	110	110.5	51.5	0.0	0.0	0	0.0	0	0.0	0.0	0.0	15.8	3.4	1.3	0.0
33	836	49º34'	58º14'	62	56.0	20.6	0.0	0.0	0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	822	49º42'	58º31'	116	177.5	79.1	0.0	0.0	153	3.5	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	836	49º53'	58º08'	79	121.2	29.6	0.0	0.0	41	0.3	0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
36	823	50º07'	57º55'	159	145.9	28.3	0.0	0.0	30	0.6	73	0.1	1.4	2.2	0.0	0.0	15.0	0.2
37	813	50º08'	58º05'	228	2.9	3.3	99.0	27.3	9676	96.9	42656	201.2	1.0	1.1	10.6	1.1	7.7	0.1
38	813	50º19'	58º04'	256	1.0	0.1	44.2	18.8	364	6.8	21841	127.9	0.0	0.0	0.0	0.0	49.8	0.6
39	801	50º25'	58º05'	296	0.0	0.0	221.7	77.9	330	7.0	18252	106.2	1.0	14.0	0.0	0.0	589.0	6.1
40	801	50º22'	58º15'	315	0.0	0.0	160.1	78.3	279	4.4	7826	46.5	0.0	0.0	1.0	0.0	508.7	12.5
42	801	50º02'	58º45'	285	3.4	2.1	28.0	10.8	545	27.1	5940	44.2	0.0	0.0	0.0	0.0	355.6	5.3
43	812	49º44'	59º19'	245	0.9	0.5	9.4	3.5	3113	35.8	829	6.1	1.9	11.9	0.9	0.2	113.6	1.5
44	812	49º35'	59º14'	225	0.9	0.1	15.9	4.0	1004	14.0	2076	13.1	0.0	0.0	1.9	0.2	84.7	1.1
45	812	49º28'	59º24'	242	12.3	10.7	7.2	2.8	20288	309.8	6814	40.7	0.0	0.0	3.1	0.4	29.0	0.4
46	809	49º08'	59º43'	285	0.0	0.0	4.0	1.8	1269	19.5	333	3.0	0.0	0.0	0.0	0.0	52.9	0.6
48	821	48º50'	59º31'	179	24.0	3.6	1.0	0.0	161	3.8	200	0.2	0.0	0.0	0.0	0.0	32.3	0.4
49	811	48º40'	59º39'	191	49.6	17.8	0.0	0.0	167	14.5	0	0.0	0.0	0.0	0.0	0.0	12.7	0.1
50	821	48º38'	59º33'	97	29.0	12.1	0.0	0.0	122	2.5	0	0.0	0.0	0.0	0.0	0.0	3.0	0.0

Appendix 4. (Continued)

Set	Stratum	Latitude Deg-Min	Longitude Deg-Min	Depth (m)	Cod		Greenland Halibut		Redfish		Northern Shrimp		Atlantic Halibut		Herring		Capelin	
					n	kg	n	kg	n	kg	n	kg	n	kg	n	kg	n	kg
52	835	48º28'	59º19'	77	117.2	54.1	0.0	0.0	0	0.0	0	0.0	0.0	0.0	0.9	0.1	0.0	0.0
53	821	48º20'	59º22'	117	41.3	16.9	0.0	0.0	3	0.1	0	0.0	1.1	29.8	0.0	0.0	155.1	1.2
54	820	48º21'	58º59'	108	6.6	2.3	7.5	4.1	1	0.0	51	0.0	0.0	0.0	0.0	0.0	238.0	1.1
55	820	48º13'	59º05'	123	18.8	5.1	3.8	2.3	2	0.0	27	0.0	0.0	0.0	0.0	0.0	93.2	0.5
56	835	48º09'	59º06'	84	138.8	21.9	0.0	0.0	143	2.8	0	0.0	0.0	0.0	0.0	0.0	19.3	0.1
57	820	48º06'	59º22'	142	119.7	69.1	0.0	0.0	211	12.4	12	0.0	0.0	0.0	1.4	0.7	29.4	0.2
59	810	48º01'	59º41'	336	0.9	0.3	2.8	0.1	62	18.7	579	4.0	0.0	0.0	0.0	0.0	0.0	0.0
60	802	47º55'	59º45'	444	0.0	0.0	5.8	4.4	95	57.4	74	0.6	0.0	0.0	0.0	0.0	0.0	0.0
61	802	47º51'	59º46'	481	0.0	0.0	0.9	1.3	1113	811.8	26	0.2	0.0	0.0	0.0	0.0	0.0	0.0
62	810	47º46'	59º32'	317	0.0	0.0	0.0	0.0	361	210.8	26	0.2	1.0	7.5	4.8	0.4	0.0	0.0
63	811	47º39'	59º24'	252	0.9	1.0	0.0	0.0	310	28.8	2	0.0	0.0	0.0	8.4	2.5	0.0	0.0
64	802	47º41'	59º43'	525	0.0	0.0	15.0	8.9	106	68.8	9	0.1	0.0	0.0	0.0	0.0	0.0	0.0
67	407	47º34'	60º21'	430	0.0	0.0	10.6	7.9	107	83.9	98	0.9	0.0	0.0	1.0	0.2	0.0	0.0
68	404	47º41'	60º27'	325	0.0	0.0	1.0	0.6	184	80.1	30	0.3	0.0	0.0	0.0	0.0	0.0	0.0
69	407	47º50'	60º19'	479	0.0	0.0	13.1	7.8	44	26.7	10	0.1	0.0	0.0	0.0	0.0	0.0	0.0
70	401	47º49'	60º41'	227	17.3	15.5	1.0	0.0	381	44.4	761	4.8	0.0	0.0	11.5	1.9	0.0	0.0
71	404	48º02'	60º56'	336	1.0	1.2	6.7	6.0	133	32.0	1050	8.1	0.0	0.0	0.0	0.0	1.0	0.0
72	401	48º03'	61º04'	263	0.0	0.0	5.6	3.0	211	37.5	4384	29.8	0.0	0.0	7.5	2.9	0.9	0.0
73	404	48º05'	61º00'	362	0.0	0.0	2.9	3.4	64	33.9	493	4.0	0.0	0.0	0.0	0.0	3.1	0.0
74	803	48º18'	61º08'	407	0.0	0.0	9.4	4.5	70	57.4	256	2.1	0.0	0.0	0.0	0.0	1.9	0.0
75	803	48º35'	61º03'	392	0.0	0.0	14.4	9.0	55	37.9	376	3.5	0.0	0.0	0.0	0.0	0.0	0.0
76	803	48º31'	61º41'	423	0.0	0.0	52.5	25.2	46	27.9	173	1.6	0.0	0.0	0.0	0.0	2.8	0.0
77	402	48º16'	61º56'	246	0.9	0.5	19.7	6.3	651	34.6	233	1.3	0.0	0.0	1.9	0.3	4.7	0.1
78	402	48º18'	62º00'	230	0.0	0.0	4.8	1.0	340	29.9	600	3.9	3.8	8.5	5.8	0.8	8.7	0.1
79	405	48º20'	61º57'	318	0.0	0.0	5.8	5.5	77	10.8	2654	17.7	0.0	0.0	1.0	0.1	0.0	0.0
80	408	48º27'	61º59'	413	0.0	0.0	92.3	46.8	88	71.7	3854	32.2	0.0	0.0	0.0	0.0	1.0	0.0
81	402	48º22'	62º26'	268	0.9	1.1	144.4	31.6	226	32.8	4157	31.2	0.0	0.0	4.7	0.6	2.8	0.0
82	804	48º45'	62º40'	372	0.0	0.0	15.4	6.9	74	12.3	789	7.2	0.0	0.0	0.0	0.0	1.9	0.0
84	406	49º04'	63º54'	358	0.0	0.0	190.1	80.7	1351	25.0	1647	15.1	0.0	0.0	1.0	0.1	27.0	0.3
85	408	49º04'	63º43'	376	0.0	0.0	168.7	68.5	663	14.6	7215	59.5	0.0	0.0	0.0	0.0	126.0	1.3
86	806	49º11'	63º36'	300	5.8	4.5	0.0	0.0	348	56.3	337	3.0	0.0	0.0	1.4	0.4	30.8	0.3
87	830	49º18'	63º32'	167	178.6	19.9	0.0	0.0	204	2.8	8	0.0	3.8	1.5	62.5	9.9	4.4	0.0
88	818	49º25'	63º46'	198	76.0	8.7	0.0	0.0	40	1.0	253	1.5	0.0	0.0	21.2	1.5	9.0	0.1
89	841	49º33'	63º49'	52	651.9	26.2	0.9	0.0	12	0.2	6	0.0	0.0	0.0	2.8	0.0	0.9	0.0
90	841	49º40'	64º10'	65	28.8	1.2	0.0	0.0	11	0.1	0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
91	841	49º44'	64º23'	49	78.8	5.5	0.0	0.0	438	2.2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	831	49º45'	64º60'	146	388.3	109.1	0.0	0.0	382	3.6	2	0.0	3.5	0.8	0.0	0.0	0.0	0.0
93	817	49º44'	65º03'	267	2.8	1.7	142.8	53.0	1236	10.4	34643	236.6	2.8	10.1	65.6	4.7	104.1	1.2

Appendix 4. (Continued)

Set	Stratum	Latitude Deg-Min	Longitude Deg-Min	Depth (m)	Cod		Greenland Halibut		Redfish		Northern Shrimp		Atlantic Halibut		Herring		Capelin	
					n	kg	n	kg	n	kg	n	kg	n	kg	n	kg	n	kg
94	831	49º55'	65º18'	180	114.7	33.2	13.5	4.1	1511	9.5	829	3.1	3.8	2.6	23.3	2.8	15.4	0.2
95	817	49º49'	65º25'	241	108.9	55.0	51.9	19.8	2741	26.9	11248	52.7	1.0	0.6	55.1	8.6	44.0	0.5
96	805	49º46'	65º34'	340	0.0	0.0	337.9	95.8	598	5.0	5789	45.9	0.0	0.0	3.8	0.4	28.1	0.3
97	805	49º44'	65º53'	342	0.0	0.0	329.0	70.3	667	5.5	5790	46.6	0.0	0.0	1.9	0.1	9.4	0.1
98	805	49º41'	66º11'	345	0.0	0.0	294.1	84.1	1539	18.1	503	4.3	0.0	0.0	1.0	0.2	1.0	0.0
99	805	49º39'	65º55'	342	0.0	0.0	419.8	129.9	570	5.6	1292	12.1	0.0	0.0	0.0	0.0	30.0	0.4
100	805	49º30'	65º53'	343	0.0	0.0	299.9	86.7	599	6.6	1252	11.1	0.0	0.0	0.0	0.0	34.8	0.5
102	804	49º26'	64º59'	384	0.0	0.0	480.3	176.8	1001	13.1	408	4.2	0.0	0.0	2.6	0.5	149.1	2.1
103	406	49º22'	64º34'	379	0.0	0.0	236.2	108.3	1209	12.3	4287	38.7	0.0	0.0	0.0	0.0	56.0	0.8
104	406	49º09'	64º20'	341	0.0	0.0	193.3	30.8	1545	12.2	2153	19.6	0.0	0.0	1.0	0.2	33.7	0.4
106	409	49º18'	66º02'	193	1131.6	992.5	7.0	2.5	4701	1955.4	33	0.2	0.0	0.0	4.0	0.7	12.0	0.1
107	409	49º17'	66º09'	225	15.0	11.4	141.8	12.3	126	11.9	2120	15.3	1.0	0.4	9.0	1.4	354.4	4.1
108	410	49º18'	66º16'	283	0.0	0.0	347.1	34.6	209	4.3	1718	13.5	0.0	0.0	1.0	0.1	75.2	0.8
109	409	49º10'	66º44'	246	1.0	0.6	362.5	67.6	1252	11.9	15362	122.5	0.0	0.0	11.0	1.6	70.4	0.8
110	410	49º13'	66º54'	319	0.0	0.0	406.5	74.7	905	7.6	2779	26.4	0.0	0.0	0.0	0.0	18.4	0.2
111	412	49º01'	67º14'	236	5.0	3.0	276.2	44.3	1839	11.0	3446	30.9	0.0	0.0	3.0	0.4	55.4	0.7
112	852	48º59'	67º17'	148	74.0	19.2	65.0	3.0	87	1.8	311	2.2	1.0	0.8	2.0	0.3	45.4	0.6
113	851	48º53'	67º32'	75	5.0	4.1	0.0	0.0	0	0.0	71	0.0	0.0	0.0	0.0	0.0	53.7	0.7
114	411	48º57'	67º37'	282	0.0	0.0	348.0	59.1	2374	17.7	2925	26.5	0.0	0.0	4.0	0.6	15.0	0.2
115	412	48º54'	67º40'	247	0.0	0.0	432.3	78.8	1082	6.4	3265	22.0	2.0	23.3	13.0	1.9	9.0	0.1
116	411	48º52'	68º09'	335	0.0	0.0	452.3	67.2	1800	14.7	195	1.8	1.0	5.0	1.0	0.2	2.0	0.0
117	852	48º42'	68º17'	155	12.0	4.6	60.9	4.9	728	4.4	5691	34.2	3.0	4.1	0.0	0.0	21.0	0.2
118	411	48º43'	68º26'	345	0.0	0.0	394.8	58.2	467	3.3	6	0.0	0.0	0.0	2.0	0.3	0.0	0.0
119	413	48º43'	68º31'	340	0.0	0.0	391.9	92.4	942	6.5	17	0.1	0.0	0.0	1.0	0.1	1.0	0.0
120	851	48º36'	68º29'	64	2.0	0.6	8.0	1.9	33	0.2	2059	15.6	0.0	0.0	1.0	0.1	28.0	0.4
121	414	48º37'	68º36'	268	2.6	1.5	227.9	44.2	393	3.4	430	1.5	0.0	0.0	13.2	2.1	4.4	0.1
122	851	48º33'	68º41'	49	1.9	0.7	0.0	0.0	0	0.0	138	0.9	0.0	0.0	1416.5	147.2	41.5	0.5
123	852	48º25'	68º60'	128	10.0	2.9	69.0	17.1	568	2.2	15002	127.0	0.0	0.0	17.0	1.8	7.0	0.1
124	414	48º22'	69º20'	265	0.0	0.0	419.0	40.8	503	3.8	274	1.7	2.0	0.2	31.0	3.9	5.0	0.1
125	413	48º33'	68º60'	328	0.0	0.0	336.4	59.7	566	5.1	19	0.1	0.0	0.0	15.0	2.3	1.0	0.0
126	414	48º41'	68º48'	208	2.6	0.9	368.2	44.5	1017	7.8	519	5.2	1.8	3.1	10.6	1.7	7.9	0.1
127	854	48º45'	68º56'	61	0.0	0.0	12.0	1.3	20	0.1	661	0.7	0.0	0.0	1.0	0.2	694.6	10.7
128	855	48º45'	68º48'	126	41.0	1.4	115.8	7.9	951	5.1	18661	120.1	0.0	0.0	7.0	0.7	74.6	1.0
129	855	48º51'	68º41'	132	223.6	6.6	109.1	4.5	489	3.4	19186	132.6	0.0	0.0	15.0	1.3	48.5	0.5
130	855	48º58'	68º15'	160	115.9	8.8	40.8	1.9	66	0.6	3169	24.3	1.5	2.0	15.9	2.1	26.5	0.4
131	854	49º11'	68º04'	74	22.1	2.1	1.0	0.0	6	0.0	5479	9.4	0.0	0.0	1.0	0.1	31038	196.6
132	412	49º12'	67º48'	213	53.0	23.7	178.6	24.1	154	1.1	4469	16.8	0.0	0.0	18.0	2.3	811.8	4.9
133	410	49º16'	67º12'	328	0.0	0.0	527.4	70.1	7621	51.7	81	0.6	0.0	0.0	5.0	0.8	5.0	0.1

Appendix 4. (Continued)

Set	Stratum	Latitude Deg-Min	Longitude Deg-Min	Depth (m)	Cod		Greenland Halibut		Redfish		Northern Shrimp		Atlantic Halibut		Herring		Capelin	
					n	kg	n	kg	n	kg	n	kg	n	kg	n	kg	n	kg
134	832	49º27'	67º08'	153	65.0	8.8	2.6	0.0	258	2.8	281	0.6	0.0	0.0	12.8	1.4	78.1	0.6
135	832	49º53'	66º48'	165	33.2	6.4	22.2	1.7	3219	24.0	570	2.6	0.9	2.8	3.4	0.4	163.0	1.6
136	832	49º55'	66º48'	159	31.0	8.8	104.7	9.9	897	7.8	3634	14.0	3.0	9.4	2.0	0.3	63.6	0.6
137	817	49º53'	66º41'	230	0.0	0.0	263.4	75.3	48237	366.6	28654	182.4	0.0	0.0	54.4	4.9	462.9	6.5
138	817	50º00'	66º17'	228	1.7	0.4	432.5	82.5	4977	44.1	54279	324.0	2.6	20.7	46.9	3.5	174.6	3.4
139	832	50º06'	65º16'	131	25.0	12.6	12.0	0.0	880	5.6	103	0.3	2.0	2.9	23.0	2.5	16.0	0.2
141	828	50º05'	63º41'	114	22.0	10.3	2.0	0.0	86	0.5	54	0.1	0.0	0.0	0.0	0.0	43.6	0.5
143	839	50º10'	62º39'	65	251.2	35.9	1.5	0.0	33	0.3	11	0.0	0.0	0.0	9.0	1.3	1.5	0.0
144	839	50º05'	62º41'	59	102.2	12.8	0.0	0.0	0	0.0	0	0.0	0.0	0.0	92.8	14.6	20.7	0.1
146	828	49º55'	62º40'	147	34.5	8.7	12.0	0.3	112	2.1	115	0.4	0.0	0.0	4.5	0.6	0.0	0.0
149	827	49º51'	61º47'	149	230.0	88.3	9.2	0.0	100	0.9	576	0.7	0.0	0.0	0.0	0.0	77.7	0.6
150	816	49º49'	61º51'	198	3.0	1.2	235.3	45.8	1198	18.8	8752	51.5	4.0	10.8	7.0	0.5	451.7	5.4
151	816	49º37'	62º08'	236	0.0	0.0	137.8	47.2	142	2.3	7300	48.0	0.0	0.0	4.0	0.2	590.5	8.7
152	816	49º34'	61º38'	249	0.9	0.7	62.3	23.0	449	4.6	8175	52.7	1.7	27.5	1.7	0.0	1051.2	9.7
153	829	49º27'	61º28'	164	91.4	20.5	0.0	0.0	227	3.0	263	0.3	0.0	0.0	21.1	2.5	158.9	1.4
154	816	49º31'	61º34'	231	1.0	0.3	91.7	9.5	803	8.5	12402	51.9	0.0	0.0	9.0	0.7	85.3	0.8
155	816	49º40'	61º35'	281	0.0	0.0	98.0	51.1	425	6.6	22410	143.1	0.0	0.0	1.0	0.2	3324.9	34.0
156	839	50º04'	61º15'	56	95.7	12.4	0.0	0.0	25	0.2	38	0.3	0.0	0.0	0.0	0.0	352.3	3.6
157	827	49º54'	61º13'	135	195.4	131.8	0.9	0.0	238	1.2	95	0.1	1.7	1.9	0.0	0.0	37.0	0.3
158	815	49º47'	60º48'	232	0.0	0.0	44.0	6.2	1218	9.5	5916	40.1	0.0	0.0	1.0	0.2	223.0	2.2
159	816	49º39'	61º00'	279	0.0	0.0	83.0	43.5	738	9.0	2944	25.6	1.0	14.4	0.0	0.0	1410.3	14.2
160	815	49º36'	60º51'	287	0.0	0.0	28.0	14.9	263	5.3	112	0.7	0.0	0.0	0.0	0.0	1039.3	10.7
161	815	49º33'	60º40'	289	0.0	0.0	89.5	43.3	476	6.2	2035	13.9	0.0	0.0	0.0	0.0	494.1	5.4
162	815	49º30'	60º31'	294	0.0	0.0	43.5	25.9	5525	61.2	9861	70.5	1.5	1.5	0.0	0.0	446.3	5.4
163	808	48º47'	60º22'	289	0.0	0.0	4.0	2.3	228	55.7	862	6.7	0.0	0.0	1.0	0.2	39.1	0.5
164	829	49º17'	61º18'	120	30.0	6.4	0.0	0.0	15	2.9	20	0.0	0.0	0.0	0.0	0.0	1.5	0.0
165	829	49º19'	61º20'	124	28.0	6.8	0.0	0.0	15	0.1	21	0.0	0.0	0.0	2.0	0.4	1.0	0.0
166	807	48º48'	61º47'	320	0.9	1.4	5.6	2.9	145	4.9	4	0.0	0.9	14.8	0.9	0.0	0.0	0.0
167	819	48º54'	61º54'	226	7.0	3.3	5.0	1.9	25028	219.5	6	0.0	0.0	0.0	33.0	4.7	5.0	0.1
168	830	48º57'	62º07'	161	57.2	9.9	0.0	0.0	589	5.0	13	0.0	0.0	0.0	2.8	0.2	15.0	0.1
169	807	48º53'	62º29'	313	3.0	0.7	1.0	0.5	587	201.8	33	0.3	0.0	0.0	0.0	0.0	0.0	0.0
170	818	48º57'	62º35'	259	157.5	87.1	5.3	3.2	334	13.3	6917	51.9	1.8	10.3	4.4	0.9	0.9	0.0
171	830	49º08'	63º03'	173	277.8	42.5	1.8	0.0	450	4.7	125	0.2	0.0	0.0	46.5	7.4	0.9	0.0
172	806	49º10'	63º42'	340	1.5	1.9	13.3	6.2	214	25.7	492	4.1	0.0	0.0	0.0	0.0	4.5	0.1
173	804	48º59'	63º24'	380	0.0	0.0	92.5	30.6	265	14.3	3887	33.7	0.0	0.0	0.0	0.0	16.0	0.2
174	403	48º48'	63º32'	206	106.8	86.7	4.7	0.6	176	14.5	159	1.1	2.8	28.9	1.9	0.3	79.5	0.6
176	405	48º47'	63º16'	296	3.0	3.2	52.9	20.7	455	20.6	2720	22.9	1.0	11.4	0.0	0.0	48.7	0.4
177	405	48º46'	63º03'	368	0.0	0.0	27.9	16.4	176	11.9	1939	18.7	0.0	0.0	0.0	0.0	18.0	0.2
178	408	48º42'	62º46'	390	0.0	0.0	32.0	13.9	53	32.0	1639	14.4	0.0	0.0	0.0	0.0	5.2	0.1

Appendix 4. (Continued)

Set	Stratum	Latitude Deg-Min	Longitude Deg-Min	Depth (m)	Cod		Greenland Halibut		Redfish		Northern Shrimp		Atlantic Halibut		Herring		Capelin	
					n	kg	n	kg	n	kg	n	kg	n	kg	n	kg	n	kg
178	408	48º42'	62º46'	390	0.0	0.0	32.0	13.9	53	32.0	1639	14.4	0.0	0.0	0.0	0.0	5.2	0.1