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Stock Assessment of Whelks in Quebec: Results from the Commercial Fishery (1987-2024) and Scientific Surveys (2005-2024)

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Canada

Foreword

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

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Waved whelk, *Buccinum undatum*, is a gastropod mollusc found along the Estuary and Gulf of St. Lawrence. In Quebec, it can reach a shell height of 120–130 mm, but individuals larger than 105 mm are increasingly rare. Its growth rate is fairly slow and its life span is at least 15 years.

There are 15 whelk fishing areas in Quebec. The whelk fishery is an inshore fishery that uses traps. It focuses essentially on *Buccinum undatum*, although some other species of *Buccinum* are present. The fishery is regulated by the number of licences, the number of traps and the minimum legal size which varies according to the fishing areas. Quotas on landings are in place in six areas. The stock status is determined primarily based on commercial fishery indicators.

In 2024, Quebec landings totalled 407 t, of which 73% were from the North Shore, 24% from the Magdalen Islands and 4% from the Gaspé Peninsula–Lower St. Lawrence. Landings had decreased in most fishing areas compared to 2019-2021. For areas managed by a total allowable catch (TAC), it has never or very rarely been reached in areas 1, 2, 12, 13 and 15.

The average catch per unit effort (CPUE) in 2022–2024 was below the historical average (2002–2021) in areas 1 (-24%), 2 (-40%), 3 (-54%), 4 (-16%), 5 (-29%), 6 (-34%), 7 (-54%) and 8 (-19%) on the North Shore; in areas 12 (-60%) and 13 (-50%) in the Gaspé–Lower St. Lawrence region; and in area 15 (-28%) in the Magdalen Islands. The status of these stocks is worrisome, with downward trends and local decreases in CPUE values observed in most areas. These stocks do not appear to be able to sustain the current fishing effort and consequently are vulnerable to overfishing and local depletion.

Following a recent assessment of size at sexual maturity in a number of fishing areas, the minimum legal size was increased in 2023 in areas 4, 5, 6, 7 (from 80 to 85 mm) and areas 8, 11, 12 and 14 (from 75 to 80 mm), and in 2024 in area 13 (from 75 to 80 mm). These changes could partly explain the decline in landings and CPUE values observed in recent years.

In the past few years, the proportion of sub-legal-size whelk landed has been below 5% in all fishing areas, except for areas 2 (2022–2023), 4 (2022–2023), 6 (2023), 7 (2024) and 8 (2022, 2023 and 2024).

The densities of legal-size whelk and juvenile recruits observed in the research survey (conducted every two years) in 2024 in areas 1 and 2 on the Upper North Shore were lower than those in the 2022 survey, and are among the lowest values in the time series (2005–2024).

INTRODUCTION

The commercial whelk fishery began in the Estuary and Gulf of St. Lawrence in the 1940s (D'Amours et al. 1983). Landings remained between 100 t and 350 t until 1985, buoyed by the arrival of new processors in the mid-1960s. This fishery expanded to the North Shore in the early 1990s and to the Magdalen Islands in 2003. It has been more intensive in the Gaspé Peninsula – Lower St. Lawrence since 2005. In the late 1990s, several stakeholders (industry, fishers and managers) expressed concern about the uncontrolled development of this fishery in Quebec, eventually leading to the introduction of various management measures in 1999.

There are 15 whelk fishing areas in Quebec. Areas 1 to 9 are along the North Shore, areas 11 to 14 in the Gaspé Peninsula–Lower St. Lawrence, and area 15 around the Magdalen Islands (Figure 1). Area 10 is under the joint responsibility of Gaspé Peninsula and Îles-de-la-Madeleine. The whelk fishery is an inshore fishery which is carried out with conical traps.

Fisheries and Oceans Canada (DFO) conducts a review and assessment of the whelk fishery in the inshore waters of Quebec every three years, with some exceptions. The most recent review was conducted on February 27, 2025 (DFO 2025). In support of this review, this document presents the data, techniques, analyses, and findings of this assessment following the 2022-24 fishing seasons. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada Science Advisory Schedule as they become available.

BIOLOGY

The Waved whelk, *Buccinum undatum*, is a gastropod mollusc found along the western Atlantic coast from New Jersey to the Arctic, including the Estuary and Gulf of St. Lawrence (Bousfield 1964). It is very common in cold waters, from the tidal level to depths of 30 m or more (Figure 1). Whelk is an opportunistic predatory carnivore and a scavenger (Himmelman and Hamel 1993). It feeds mostly on invertebrates, primarily Polychaetes, Molluscs and Echinoderms (Hamel 1989, Fahy 2001, Morel and Bossy 2004). They detect their prey through waterborne odours, making it vulnerable to baited fishing gear. Whelk's ability to detect prey is therefore highly influenced by current strength and direction. When food or predators are present, they can move at a rate of 2 to 15 cm/min over a distance of several tens of metres (Himmelman 1988, Sainte-Marie 1991, Lapointe and Sainte-Marie 1992, Giguère et al. 2007).

In the St. Lawrence, whelk growth is slow (Jalbert et al. 1989, Gendron 1992). It can reach a 120–130 mm shell height size, but individuals larger than 105 mm are increasingly rare. Its life span is at least 15 years (Jalbert 1986, Gunnarsson and Einarsson 1995, Kenchington and Glass 1998).

Whelk species are dioecious, having two separate sexes and the ova are fertilized internally. Along the North Shore and the Gaspé Peninsula, mating occurs in May and June (Boivin *et al.* 1985, Martel et al. 1986a, Himmelman and Hamel 1993). Eggs are laid two to three weeks after mating, mostly in June and July. Egg-laying is generally communal; with females congregating at a site to lay their eggs. Eggs are enclosed in chitin capsules clumped together in a mass several centimetres wide attached to the substrate. Several females can lay their eggs on the same mass, at a rate of about 140 capsules per female (Martel 1985). Each capsule contains an average of 2,700 eggs (Martel et al. 1986b). There is no planktonic larval stage. Young whelks grow directly in the capsules. In the Estuary and northern Gulf of St. Lawrence, juveniles are 2–3 mm long when they emerge from the capsules, from November to February, after five to eight months of development. On average, about 30 juveniles can emerge from each capsule (Martel et al. 1986b).

Adults have a rather sedentary life. They spend most of their time immobile and half buried in sediment (Hamel 1989). Evidence suggests that this behaviour, together with the absence of a larval phase, limits mixing with neighbouring populations and the possibility of rapidly recolonizing overexploited sites (Caddee et al. 1995, Nasution and Roberts 2004).

The commercial whelk fishery focuses essentially on the Waved whelk. A few other species of *Buccinum* inhabit the Estuary and Gulf of St. Lawrence. During the research surveys carried out in the Upper North Shore region and in the Magdalen Islands, the species *B. glaciale*, *B. terraenova (B. totteni)*, *B. scalariforme* and *B. undatum* (WoRMS 2021) were found along with some individuals that could not be identified to the species level.[1] However, the main species is *B. undatum*, which accounted for more than 90% of the whelks collected during the research surveys (Appendices 1 and 2).

MATERIAL AND METHODS

COMMERCIAL FISHERY

The commercial whelk fishery data come from three separate sources: purchase receipts, logbooks and commercial catch sampling. The information collected through purchase receipts and logbooks is provided in a ZIFF file (Zonal Interchange Format File). Purchase receipt is completed by the buyer and provide official landing figures. Landings used in this paper do not include estimates for unreported landings. Whelk logbooks, introduced in 2001, are filled by fishermen on a daily basis. They provide various information including the fisherman's identification, landing dates, trap haul dates, fishing location (first and last trap haul), fishing area, number of trap hauled, trap soak time and total weight landed.

The DFO commercial whelk sampling program aims to sample individuals at the dock or at the processing plant to describe the size structure (height) of landed individuals.

Commercial fishery indicators used to assess whelk by fishing area are:

- Landings in tonnes (t) of live weight;
- Fishing effort in number of trap hauled;
- Standardized catch per unit effort (CPUE) in kilograms of live weight per trap hauled (kg/trap);
- Average size (height in mm) of landed whelk;
- Percentage (%) of sub-legal size whelk in landings.

Data for the current year are generally considered preliminary, because a small percentage of logbook data may not have been entered yet at the time of analysis.

Data are validated annually to eliminate outliers. Annual landings are the aggregate of all commercial fishing activities. Fishing effort has been compiled from logbooks since 2002[2]. Because the number of trap used per fishing activity is not always known, a correction factor is

[1] Identifying species in the genus *Buccinum* is fairly complex (given the presence of several species, similar species in different regions, and possibly hybrids), an in-depth genetic study is needed to clarify the situation.

[2] The 2001 effort data are partial, making it difficult to estimate total effort, but these data were used to calculate CPUE.

required to provide an estimate of the total number of trap used per area and per year. A rule of three is used to calculate this factor using the sum of landings with their known effort and total landings by area, year and month.

CPUE is calculated for each observation (departure date, location and fisherman). CPUE were standardized to account for the effect of trap soak times on catches (Gavaris 1980). The following variables were standardized (PROC MIXED, SAS version 9.4, values previously converted to natural logarithm) by fishing area: soak times (from 24 to 120 hours), month and year. The effect of these variables is significant in all areas. When the number of observations was < 10 (area-year), these cases were not used to calculate standardized CPUE. The confidence interval for the average annual CPUE per area is 95%.

Appendix 3 provides the number of whelks measured by region, fishing area and year from DFO landed commercial catch sampling program. In the case of whelk, size is defined as shell height and is measured to the nearest mm (Appendix 4). Whelk size structures are aggregated by year to calculate an annual size structure by fishing area. The figures are aggregated to ensure each sample has the same weighting (does not depend on the number of individuals measured). Size structures are presented in a box plot on which the minimum legal size is shown.

Reference averages for landings, CPUE and size are calculated by fishing area, based on the entire period covered by the data, with the exception of the last three years. Consequently, for landings, the reference average is calculated for the years 1993 to 2021; for fishing effort and CPUE, from 2002 to 2021; and, for the size of landed whelk, from 1987 to 2021. In the Magdalen Islands, the reference average for fishing effort and CPUE excludes the years from 2014 to 2016 due to the unusually low temperatures recorded in 2014 on the fishing grounds, as well as the abundance of shell-boring polychaetes, factors that likely influenced CPUE values during this period. In addition, the average values obtained in the previous assessment (2019–2021) and in the current one (2022–2024) are illustrated in each of the graphs. Reference averages will only be mentioned in the text if the period differs from that specified above.

Lastly, in order to assess spatiotemporal variations in the commercial indicators, the data on landings, fishing effort and CPUE were aggregated by stock assessment period (i.e. every three years). These data were also spatially aggregated based on the fishing locations recorded in logbooks, using 4 km² (2 km x 2 km) grids. Average indicator values were calculated by grid and assessment period. These averages are presented in map form, allowing the spatial distribution of fishing intensity and changes in it over time, as well as the spatiotemporal dynamics of the fishery, to be visualized. The colour gradations used in the maps are based on an analysis of frequency histograms to assess the distribution of values, making it possible to select relevant thresholds that reflect gradients in the intensity of effort in a balanced way, while facilitating the visual interpretation of the areas fished.

Management measures for the commercial fishery

Various management measures have been put in place since 1999. Fishing effort has been controlled in all areas by a fishing season of about six months, limits on the number of licences and number and size of traps, and the introduction of a landings quota in areas 1, 2, 11, 12, 13 and 15.

The total number of licences issued is controlled, but inactive fishermen sometimes outnumber active fishermen, creating a high potential effort that could become problematic in some areas. Steps have been taken to reduce the number of licences (e.g. licence buy-backs). As a result, the total number of licences has decreased from 281 in 1999 to 249 in 2014, to 240 in 2017 and to 229 in 2021. However, there were only 43 active licences in 2024. The number of traps

allocated to inactive fishermen was also reduced in 1999 and 2006 in order to decrease potential effort.

Total allowable catches (TACs) are in effect in areas 1 and 2 along the North Shore, in areas 11, 12 and 13 of the Gaspé–Lower St. Lawrence and in area 15 of the Magdalen Islands (Appendix 5).

Following a recent assessment of size at sexual maturity in several fishing areas (Gianasi 2023), the minimum legal size (MLS) was increased in 2023 from 80 to 85 mm in areas 4, 5, 6 and 7 and from 75 to 80 mm in areas 8, 11, 12 and 14, and in 2024 from 75 to 80 mm in area 13 (Appendix 5).

RESEARCH

Upper North Shore survey

A research survey has been conducted every two years, with some exceptions, in the Forestville, Pointe-aux-Outardes and Baie-Comeau regions on the Upper North Shore in the fishing areas 1 and 2 (Appendix 6). This survey was put in place in 2005 following intensive fishing in the early 2000s. The three sites covered by the survey were determined based on the distribution of commercial fishing effort from 2001 to 2004 (Brulotte 2015). In recent years, fishing effort has decreased significantly at Pointe-aux-Outardes, whereas harvesting in the Forestville and Baie-Comeau sites has continued at the same level.

The survey is generally carried out in July and August with a Digby scallop dredge and its four baskets are lined with 19 mm Vexar™ netting. A fixed-station sampling design was used to cover the three sites, at depths ranging from 5 m to 40 m (Appendix 6). Since 2007, the sampling plan has consisted of 55 stations in Forestville, 26 in Pointe-aux-Outardes and 11 in Baie-Comeau.

All individuals of the genus *Buccinum* are collected, identified to species, counted, and measured (shell height to the nearest mm). A stratified subsample (at least 2 whelks per mm of height) was preserved by site (Forestville, Pointe-aux-Outardes and Baie-Comeau), species and year for analysis. Individuals were kept frozen until they were tested in the laboratory. All *Buccinum undatum* egg masses have been counted and weighed at each station.

Different variables are compiled on the individuals collected (sub-sample). A sequential number was assigned to each individual. The height (1 mm), width and minimum width (Appendix 4) as well as live weight (0.01 g) and sex of each individual were measured. The operculum was preserved for age determination.

Due to the mesh size used in the dredge baskets, whelks less than 20 mm were not included in density and yield calculations. Whelk are divided into three size classes: recruits (20–50 mm), pre-commercial-size (51–69 mm) and legal-size individuals (≥ 70 mm). The weight-height relationship, estimated from measurements was used to calculate the weight of each individual harvested (Appendix 7).

Densities (number/100 m^2) were calculated at each station for each size class by *Buccinum* species. Given that the commercial fishery includes all *Buccinum*, regardless of species, annual density and yield averages (± standard error) were calculated for each site for all whelk species. The calculation of whelk density at each station is based on the total number of individuals caught during a dredge haul. This calculation takes into account the distance covered—which ranged from 150 to 300 m depending on the station—as well as the effective width of the dredge. The beginning and ending positions of each tow are recorded to accurately determine the distance covered. The area covered by the dredge is then calculated by multiplying the total

width of the baskets (e.g. 4 baskets, each 0.76 m wide, for a total width of 3.04 m) by the distance covered. The densities obtained for each station (expressed as the number of individuals per 100 m²) are then used to calculate the annual mean density and its variations (standard error) at each of the sites studied—Forestville, Pointe-aux-Outardes and Baie-Comeau. Lastly, size structure histograms are presented by year and site.

Shell-boring polychaete infestations in the Magdalen Islands

Around 2015, a Magdalen Islands harvester observed that the shells of individuals caught in certain areas were abnormally fragile; these shells were more porous and broke easily. To assess the extent of this phenomenon and determine its cause, a research survey was carried out in 2016 in the southern part of the Magdalen Islands, at depths between 30 and 50 m. An analysis of the infected individuals collected during the survey identified the origin of the fragility: infestation by shell-boring polychaetes. Several species were identified, with *Polydora websteri* being the most abundant (Couillard et al. 2018.)

Since 2021, a sampling program has been carried out to monitor the evolution of polychaete infestations in the Magdalen Islands. Samples are collected under the dockside sampling program conducted by DFO Science. The protocol calls for the collection of ten samples spread over the entire whelk fishing season. The goal is ideally to cover all the fishing sites around the Magdalen Islands, but this has not yet been achieved. Each sample comprises around 150 individuals, which are frozen on site and then sent to the Maurice Lamontagne Institute (MLI) for processing in the laboratory.

In the laboratory, each shell is individually examined. A visual assessment is carried out to determine the surface area infested by polychaete tunnels and burrows, both on the dorsal (apical, D1 and basal, D2) and ventral (apical, V1 and basal, V2) sides of the shell. A severity score is assigned based on the estimated percentage of surface area affected on the shell: 0: no trace of worms; 1: less than 10% of surface area infested; 2: between 10% and 25% of surface area infested; 3: between 25% and 50% of surface area infested; and 4: more than 50% of surface area infested. The level of infestation is then determined on a shell-by-shell basis by adding up the scores for the four zones examined (D1, D2, V1 and V2) on each shell. The total score is used to classify the intensity of infestation as follows: low infestation: total score of 1; moderate infestation: total score between 2 and 3; and severe infestation: total score equal to or greater than 4.

The annual percentages of individuals with different levels of infestation are calculated by sex, size class and year. Finally, in order to assess spatiotemporal variations in infestations in the Magdalen Islands, samples are aggregated by harvesting location using 4 km² (2 km x 2 km) grids. The average infestation levels in the samples from each grid are then calculated and illustrated in map form, so that harvesting sites and infestation levels around the Magdalen Islands and changes in these over time can be visualized.

COMMERCIAL FISHERY RESULTS

From 1993 to 1998, annual landings ranged from 493 t to 1,032 t and were primarily from the North Shore (Figure 2 and Appendix 8). Landings subsequently peaked at 2,000 t in 2003 with the beginning of the fishery in the Magdalen Islands. Subsequently, landings decreased mainly along the North Shore, and then stabilized. Between 2009 and 2016, Quebec landings have fluctuated between 937 t and 1,484 t. Since 2016, they have been decreasing sharply (Figure 2).

In 2024, landings were 407 t, which 72% of it were from the North Shore, 17% from the Gaspé–Lower St. Lawrence and 24% from the Magdalen Islands. Landings decreased in many fishing areas relative to 2021. In the six areas managed with a total allowable catch (TAC) (i.e. areas 1, 2, 11, 12, 13 and 15), the TAC has never been reached—or has only been reached on rare occasions—in five of these.

Fishing effort measured in number of trap hauled for the whole fishing season has only been available since 2002. Changes in landings since 2002 are largely attributable to changes in fishing effort (Figure 3 and Appendix 9). Overall, effort reached a maximum value of 385,800 traps in 2003, but has been declining ever since. Effort subsequently declined to 206,200 traps in 2008. Average effort during the 2022–2024 period was 104,558 traps, which is below the historical average (-55%, 2002–2021).

Area 10 has not been fished since 1997, and there were a few days of fishing in Areas 9, 11 and 14 in recent years. It is therefore impossible to determine the status of the resource in these areas.

NORTH SHORE

Fishing Area 1

Fishing Area 1 extends from Pointe Rouge (Tadoussac) to Pointe du Bout at Pointe-aux-Outardes. For several years, commercial fishing has been concentrated mainly in the central-eastern portion of the area. In 2024, there were 8 active licences in this area of a total of 8 licences issued.

Landings exceeded 500 t between 2000 and 2002, and then gradually declined to 114 t in 2012 (Figure 4; Appendix 8). Between 2013 and 2016, they rose to a peak of 427 t, but have been declining since 2016. Average landings for 2022–2024 were 185 t, below the historical average (-30%). The precautionary TAC of 491 t, implemented in 2003, has never been fully fished.

Fishing effort decreased from close to 50,700 traps in 2002 to 13,600 traps in 2012 (Figure 4, Appendix 9). It then increased to 27,100 traps in 2017, but has declined since then. Average effort during 2022–2024 was 25,912 traps, slightly below the historical average (-6%).

CPUE values fell from 11 to 7 kg/trap between 2002 and 2004 (Figure 4; Appendix 10). Values then remained fairly stable until 2012, fluctuating between 7 and 9 kg/trap, and then increased to 15 kg/trap between 2013 and 2017. Since 2017, a strong downward trend in these values has been observed (Figure 4). The mean CPUE for 2022–2024 was 7 kg/trap, which is below the historical average (-24%).

Figures 5, 6 and 7 show the spatial distribution of average landings, average fishing effort and mean CPUE values in area 1 over the years. Between 2016 and 2018, effort increased along with landings and CPUE values. After 2019, the upwards trend in effort (intensity and spatial extent) continued, but the same trend was not observed in landings and CPUE.

Mean size of landed whelk has been relatively stable since 2014, varying around 80 mm (Figure 8; Appendix 11). Mean size of landed whelk during 2022–2024 was 82.9 mm, above the historical average (77.1 mm). The proportion of sub-legal-size whelk landed in the last three years was less than 5% (Figure 8; Appendix 12).

Fishing Area 2

Fishing Area 2 extends from the Pointe du Bout at Pointe-aux-Outardes to Pointe-des-Monts. In recent years, fishing has been concentrated in the Baie-Comeau area. Three or four licences have been active since 2007. In 2024, out of a total of 6 licences issued, three were active.

Landings surpassed 200 t in 2000, but then gradually declined to 21 t in 2008 (Figure 9; Appendix 8). Between 2009 and 2018, they increased, eventually stabilizing at around 50 t. In 2021, landings peaked a second time at 133 t, but have been declining ever since. Average landings for 2022–2024 were 45 t, below the historical average (-32%). A precautionary TAC of 109 t was implemented in 2003 and was exceeded by 4 t (3.8%) in 2021.

Fishing effort fluctuated between 8,100 traps in 2002 and 14,700 traps in 2005 (Figure 9; Appendix 9). Since 2018, effort has increased, reaching 12,200 traps in 2021. The average effort during 2022–2024 was 7,419 traps, slightly above the historical average (16.7%).

From 2002 to 2016, CPUE values ranged between 7 and 12 kg/trap (Figure 9; Appendix 10). Thereafter, values increased, reaching a maximum of 15 kg/trap in 2018. Since 2019, a strong downward trend has been observed. The mean CPUE for 2022–2024 was 6 kg/trap, which is below the historical average (-40%).

Figures 10, 11 and 12 show the spatial distribution of average landings, average effort and mean CPUE values in area 2 over the years. In general, fishing effort was high between 2002 and 2021, and dispersed throughout the western portion of the fishing area. However, between 2022 and 2024, effort intensified and became concentrated in a single region, in association with a reduction in CPUE.

Since 2012, the size of landed whelks has varied slightly from year to year (Figure 13, Appendix 11). Mean size of landed whelk during 2022–2024 was 80.9 mm, above the historical average (75.8 mm). The proportion of sub-legal-size whelk landed in the last three years was below 5%, except in 2022 when it reached 15% (Figure 13; Appendix 12).

Fishing Area 3

The boundaries of Fishing area 3 extend from Pointe-des-Monts in the west to Pointe Jambon in the east. The areas near Baie-Trinité and east of Rivière-Pentecôte have been the most visited since 2014. The number of active fishermen is usually low. In 2024, there were only one active licence of a total of seven licences issued.

Landings peaked at 52 t in 2001 (Figure 14 and Appendix 8). Since 2012, they have fallen to below 10 t. Average annual landings during 2022–2024 were 1.7 t, below the historical average (-88.9%).

Fishing effort was also low, with values declining since 2001 (Figure 14; Appendix 9). Average effort during 2022–2024 was 872 traps, which is below the historical average (-66.7%).

Mean CPUE values have also been falling since 2002 (Figure 14; Appendix 10). The mean value was 5.8 kg/trap in 2004, 1.9 kg/trap in 2020 and 2.7 kg/trap in 2021. The mean CPUE value for 2022–2024 was 1.8 kg/trap, below the historical average (-53.8%).

Figures 15, 16 and 17 show the spatial distribution of average landings, average effort and mean CPUE values in area 3 over the years. Between 2004 and 2006, the fishing effort was relatively well distributed throughout the area but, between 2007 and 2009, became concentrated in the western portion. Since 2013, the effort has shifted eastward, notably to the area around the Pentecost River.

Landed whelk sampling is sporadic (Figure 18). According to the most recent sampling in 2016 and 2018, the mean size was 97 mm and 93 mm (Appendix 11). The percentage of sub-legal size whelk in landings varied between 0 and 2.0% (Figure 18 and Appendix 12).

Fishing Area 4

Fishing Area 4 extends from Pointe Jambon to Cap du Cormoran (Rivière-au-Tonnerre). In recent years, the commercial fishery has covered the central portion of the area in the Moisie Bay sector and farther west. In 2024, there were only 1 active licences out of a total of 27 licences issued.

From 2001 to 2004, landings exceeded 142 t, and then began a downward trajectory (Figure 19; Appendix 8). Between 2008 and 2018, annual values remained between 40 and 82 t, but have fallen considerably since 2019. Average annual landings during 2022–2024 were 8.1 t, below the historical average (-89.1%).

Fishing effort peaked in 2003 and 2004, at over 50,000 traps (Figure 19; Appendix 9), but then declined substantially. The average fishing effort during 2022–2024 was 2,953 traps, below the historical average (-86.4%).

From 2002 to 2010, CPUE values remained fairly stable, but low, at around 3 kg/trap (Figure 19; Appendix 10). They then increased from 2011 to 2013, peaking at 4.6 kg/trap, but have been falling since then. The mean CPUE value for 2022–2024 was 2.7 kg/trap, below the historical average (-15.6%).

Figures 20, 21 and 22 show the spatial distribution of average landings, average effort and mean CPUE values in area 4 over the years. Between 2002 and 2006, the fishing effort was high and distributed fairly evenly over the entire area. However, since 2013, fishing activity has been concentrated around Sept-Îles, where CPUE values have been declining since 2016.

Size structures are spread out, with maximum sizes occasionally exceeding 120 mm (Figure 23; Appendix 11). The mean size of landed whelk in the last three years was 91.4 mm, down from the value of 99.8 mm in the previous assessment. The proportion of sub-legal-size whelk was relatively low until 2021 (Figure 23; Appendix 12), but increased in 2022 (9.4%) and 2024 (25.2%).

Fishing Area 5

Fishing area 5 extends from Cap du Cormoran (Rivière-au-Tonnerre) to Rivière Saint-Jean. The fishing effort in this area is spread out over almost the entire territory. In 2024, a total of 17 permits were issued, but only 2 permits were active.

Landings peaked at 493 t in 1999 (Figure 24; Appendix 8), and then fell from 385 t to 146 t between 2003 and 2008. Thereafter, values fluctuated between 250 t and 409 t. Landings have remained below a level of roughly 160 t since 2014. Average annual landings during the 2022–2024 period were 17.1 t, below the historical average (-92.8%).

Since 2002, trends in fishing effort have followed the same trends as those for landings (Figure 24; Appendix 9). Fishing effort peaked in 2003 and 2004 at just over 100,000 traps, and remained between 40,900 and 85,400 traps until 2013. Between 2014 and 2017, effort ranged between 46,400 and 29,400 traps. The average fishing effort during 2022–2024 was 6,536 traps, below the historical average (-88.3%).

From 2004 to 2008, CPUE values were low, at less than 4.0 kg/trap (Figure 24; Appendix 10). They subsequently rose to 6.7 kg/trap in 2011, but since then, have been declining. The mean

CPUE value for 2022–2024 was 3.0 kg/trap, which is slightly below the historical average (-28.6%).

Figures 25, 26 and 27 show the spatial distribution of average landings, average effort and mean CPUE values in area 5 over the years. Fishing effort was distributed fairly evenly across the fishing area between 2002 and 2021 but, since 2022, has been mainly concentrated in the western portion, around Magpie. Although this region continues to be fished, the effort has diminished considerably over the years.

Mean size of landed whelk has increased gradually since 2007 (Figure 28; Appendix 11). The average value in the last three years was 95.0 mm, above the historical average (84.7 mm). The proportion of sub-legal-size whelk landed in the last three years was less than 5% (Figure 28; Appendix 12).

Fishing Area 6

The boundaries of area 6 extend from Rivière Saint-Jean in the west to Baie de la Grande Hermine in the east. Commercial fishing takes place in almost the entire area except the far eastern portion. In 2024, there were 2 active licences out of a total of 15 licences issued.

Between 2001 and 2008, landings ranged from 152 t to 282 t (Figure 29; Appendix 8). Between 2009 and 2017, landings ranged from 270 t to 366 t. However, landings have been declining since then. Average annual landings during 2022–2024 were 99.5 t, below the historical average (-55.2%).

The greatest fishing effort occurred from 2003 to 2005, with over 89,100 traps in 2004 (Figure 29 and Appendix 9). Subsequently, effort remained stable at around 65,000 traps. Since 2018, there has been a sharp drop in the number of traps used. The average fishing effort during 2022–2024 was 29,599 traps, below the historical average (-51.1%).

CPUE values have fluctuated considerably over the years (Figure 29 and Appendix 10). They fell between 2003 and 2005 and rose between 2006 and 2009. Thereafter, the CPUE remained around 5 kg/trap between 2010 and 2016. However, CPUE values have been declining sharply since 2017. The mean CPUE value for 2022–2024 was 3.1 kg/trap, which is below the historical average (-34.0%).

Figures 30, 31 and 32 show the spatial distribution of average landings, average effort and mean CPUE values in area 6 over the years. Between 2004 and 2018, the fishing effort was high and mainly concentrated in the western portion of the area. Since 2018, the effort has fallen off substantially in the west and has remained relatively low in the area as a whole.

Mean size of landed whelk was around 88 mm between 2010 and 2017 (Figure 33 and Appendix 11). From 2018, it increased to 93 mm. The mean size during the last three years was 94.3 mm, above the historical average (85.2 mm). During the same period, the proportion of sub-legal-size landed whelk was less than 5%, except in 2023, when it rose to 11.8% (Figure 33; Appendix 12).

Fishing Area 7

Fishing area 7 extends from Baie de la Grande Hermine to Rivière de l’Étang. However, the commercial fishery is conducted only near Natashquan. In 2024, there was only 1 active licence out of a total of 6 licences issued.

Between 2005 and 2018, landings have ranged from 19 to 90 t (Figure 34 and Appendix 8). Since then, values have declined. No fishing took place between 2021 and 2023. Landings in 2024 totalled 1.7 t, which is below the historical average (-96.4%).

The fishing effort ranged from 4,100 to 11,000 traps between 2005 and 2018, but dropped to 2,200 and 200 traps in 2019 and 2020, respectively (Figure 34; Appendix 9). In 2024, an effort of 600 traps was recorded, which is below the historical average (-91.6%). In general, changes in fishing effort are largely modulated by changes in landings.

Annual CPUE values were quite variable until 2018 (Figure 34; Appendix 10). The mean CPUE value for 2024 was 3.2 kg/trap, below the historical average (6.9 kg/trap).

Figures 35, 36 and 37 show the spatial distribution of average landings, average effort and mean CPUE values in area 7 over the years. The spatial distribution of fishing effort shows that it has always been concentrated in the eastern portion of the fishing area, around Natashquan. Between 2013 and 2018, the effort in that region was particularly high. However, values have declined substantially since then.

Mean size of landed whelks was between 86 and 88 mm from 2008 to 2016 (Figure 38 and Appendix 11). From 2017, the mean size increased slightly to 90 mm in 2018 and to 95 mm in 2019. In the last three years, this value averaged 91.3 mm, which is above the historical average (85.2 mm). The proportion of sub-legal-size whelk landed in 2024 was 25.3% (Figure 38; Appendix 12).

Fishing Area 8

Fishing area 8 is the largest fishing area in Quebec, extending from Rivière de l'Étang to Blanc-Sablon. The commercial fishery is primarily concentrated in the Blanc-Sablon area. However, some fishing activities have occurred west of La Romaine since 2018 (Figure 28). In 2024, there were 7 active licences out of a total of 64 licences issued.

Landings are highly variable from year to year and highly dependent on fishing effort (Figure 39; Appendix 8). Landings ranged between 11 and 38 t between 2009 and 2019. However, they increased significantly to 56 t and 103 t in 2020 and 2021, respectively. Average landings during 2022–2024 were 44 t, above the historical average (-33.7%). The increase in landings in recent years is associated with fishing activities in the La Romaine area, which began in 2018 (Figure 40).

Between 2009 and 2020, fishing effort varied between 2,300 and 13,100 traps. However, it reached 16,000 traps in 2021 (Figure 39; Appendix 9). Average effort during 2022–2024 was 11,540 traps, slightly above the historical average (28.2%). This increase is also attributable to the increased effort in the La Romaine area (Figure 40).

CPUE was relatively stable until 2014. From 2015 onwards, CPUE decreased to around 3 kg/trap (Figure 39; Appendix 10); a decrease that is exclusively linked to the Blanc-Sablon fishery (Figure 40). After 2018, the fishery began in the La Romaine area, causing CPUE to rise. The mean CPUE in the Blanc-Sablon area in the last three years was 2.7 kg/trap, compared to 5.3 kg/trap in the La Romaine area (Figure 40). Both CPUE values are below their respective historical averages (Figure 40).

Figures 41, 42 and 43 illustrate the spatial distribution of average landings, average effort and mean CPUE values in the Blanc-Sablon area, while Figures 44, 45 and 46 show these same indicators for La Romaine. In the Blanc-Sablon region, fishing effort was more dispersed between 2002 and 2018 but, since 2018, has been concentrated around Blanc-Sablon. On the other hand, in the La Romaine region, the fishing effort has increased sharply since 2019, with a greater concentration of effort in the western part of the region.

Mean size of landed welks varied between 71 and 79 mm from 2007 to 2018 (Figure 47; Appendix 11). The mean size increased to 91 mm in 2019, but decreased to 83 mm in 2021. In

2022–2024, the mean size was 84.1 mm, exceeding the historical average (74.4 mm). From 2005 to 2014, the percentage of sub-legal size whelk in landings ranged from 19 to 40% (Figure 47; Appendix 12). Since 2015, the situation has improved and a percentage of less than 10% has been observed, except in 2018 and 2020 when the percentage reached 10.7% and 11.2% respectively. However, this percentage increased again in 2022 (16.1%), 2023 (28.2%) and 2024 (38%).

GASPÉ–LOWER ST. LAWRENCE

Fishing Area 12

Fishing area 12 extends from Rivière Tartigou to Pointe de Chasse (Rivière-à-Claude) on the North Shore of the Gaspé Peninsula. The commercial fishery covers most of the area, however, fishing is concentrated further west. In 2024, there were 6 active licences of a total of 29 licences issued.

From 2005 to 2011, landings remained stable between 84 t and 150 t (Figure 48; Appendix 8). However, they have since been declining, reaching 17 t in 2021. Average landings for 2022–2024 were 6.4 t, below the historical average (-88.1%). A 128 t TAC was introduced in 2010 and was slightly exceeded (129 t) that year. It was raised to 135 t in 2012 and was decreased to 46 t in 2015. Finally, the TAC was increased to 75 t in 2018.

Fishing effort reached the maximum value of 36,900 traps in 2006 and then decreased until 2014 to 18,800 traps (Figure 48; Appendix 9). Following a decrease of the TAC in 2015, the effort was 14,400 traps in 2015, 14,700 traps in 2016 and 11,900 traps in 2017. Despite the increase of the TAC in 2018, effort has continued to decline, reaching 6,500 traps in 2021. The average effort during 2022–2024 was 3,943 trap, below the historical average (-78.3%).

A CPUE of 2.5 kg/trap was observed in 2003 and 2014 (Figure 48; Appendix 10). From 2015 to 2017, the CPUE increased to 4.6 kg/trap; however, values have declined sharply since then (Figure 48). The mean CPUE value for 2022–2024 was 1.5 kg/trap, which is below the historical average (-59.5%).

Figures 49, 50 and 51 show the spatial distribution of average landings, average effort and mean CPUE values in area 12 over the years. Between 2004 and 2012, fishing effort was fairly high, but well distributed throughout the area. However, between 2016 and 2021, it was concentrated in the western part of the fishing area. Since 2022, the fishing effort has dropped off sharply across the entire fishing area.

Mean size of landed whelk is relatively high and parallels the increases in minimum legal size (Figure 52; Appendix 11). Mean size was 96.8 mm during 2022–2024, which is above the historical average (87.8 mm). Sub-legal-size whelk landed in the last three years made up less than 5% of landings (Figure 52; Appendix 12).

Fishing Area 13

The western boundary of fishing area 13 is the eastern point of Île d'Orléans, from this boundary to Pointe Rouge (Tadoussac), the area covers both shores of the Estuary of St. Lawrence. It then extends from the southern side of the Estuary to Rivière Tartigou. The commercial fishery exclusively covers the eastern portion of the area, starting at the Bic archipelago (near Rimouski). In 2024, there were 5 active licences of a total of 9 licences issued.

From 1993 to 2006, landings were less than 35 t (Figure 53; Appendix 8). Later, there was an increase in landings with the discovery of new sites by fishermen. In 2010, the area was subdivided into 13a (eastern portion) and 13b (west of the Bic archipelago). An initial TAC was

established for each of these subareas, 59 t in 13a and 50 t in 13b, to encourage fishermen to explore the western portion of the area. In 2010, after the TAC was reached in 13a, some fishermen made trips to subarea 13b, but landings were disappointing, and whelks were small. At the end of June 2010, an additional 41 t TAC was allocated for subarea 13a. In 2011, the two subareas were consolidated and a 73 t TAC was allocated to the eastern portion, with landings remaining unrestricted in the western portion of the area. In 2012, the TAC was increased to 82 t and the subareas were eliminated. The TAC was exceeded in 2016 (total landings of 89 t) and in 2018 (total landings of 83 t). However, landings have been declining since 2018. Average annual landings during 2022–2024 were 25.4 t, below the historical average (-43.0%).

Since 2002, fishing effort has increased significantly, from 5,300 to 15,500 traps in 2021 (Figure 53; Appendix 9). This increase in effort has not been followed by an increase in landings. However, fishing effort has fallen off sharply since 2021. The average fishing effort during 2022–2024 was 8,079 traps, slightly below the historical average (-17.9%).

From 2002 to 2005, CPUE values were low, around 3–4 kg/trap (Figure 53; Appendix 10). Subsequently, the CPUE gradually increased to 8.9 kg/trap in 2011, the highest value of the time series. Since 2012, the CPUE has decreased sharply. Values reached 4.5 and 2.9 kg/trap in 2020 and 2021. The mean CPUE during 2022–2024 was 2.8 kg/trap, below the historical average (-50%).

Figures 54, 55 and 56 show the spatial distribution of average landings, average effort and mean CPUE values in area 13 over the years. Both fishing effort and landings strongly increased across the fishing area between 2002 and 2019. However, since 2022, a decline in effort has been observed in the central part, around Rimouski, while it remains high in the eastern part. In addition, CPUE values in the eastern and western portions of area 13 diverged significantly in 2021; in the Rimouski/Bic region, CPUE values were relatively low, while those in the Saint-Flavie area were higher (Figure 56).

Mean size of landed whelk has increased substantially since 2000, paralleling increases in the minimum legal size (Figure 57; Appendix 11). Between 2022 and 2024, the mean size was 90.9 mm, above the historical average of 76.1 mm. The proportion of sub-legal-size whelk in landings is very low, and has been below 2% since 2010 (Figure 57; Appendix 12).

MAGDALEN ISLANDS

Fishing Area 15

Fishing area 15 covers the entire coastal area around the Magdalen Islands. Commercial fishing gained momentum in 2003. Every year, fishermen travel extensively in search of good fishing areas. In 2008, the area was slightly enlarged to the south, which explains why few trips were made outside area 15. In 2009, the area boundaries were brought back to their original location. In 2024, there were 7 active licences of a total of 11 licences issued. A management measure was added in 2011, allowing fishermen to use 150 traps each, provided they restrict their fishing season to between August and November, but few fishermen have used this clause to date.

In 2004, the area was divided into two subareas, with subarea 15a covering the portion that was already being exploited (southern portion), and a 400 t TAC was allocated to this subarea. The Area was subdivided to better distribute the fishing effort around the Islands. In 2006, because this measure had been successful and at the fishermen’s request, the two subareas were regrouped, and a 450 t TAC was allocated to area 15 as a whole. The TAC was reduced to 376 t in 2012, to 330 t in 2021 and to 264 t in 2023. The TAC is divided equally among the 11 licence holders, which may explain why the TAC has not been reached since 2006.

From 2003 to 2008, landings ranged from 352 t to 442 t, but have been declining since then (Figure 58; Appendix 8). In 2009, only two licences were active because of the low price offered by processing plants. From 2010 to 2013, landings increased from 150 t to 327 t. In 2014 and 2015, whelks were very scarce and only a few fishermen were active, generating landings of 15 and 11 t respectively. There was some recovery in the commercial fishery in 2016 with landings of 111 t. In 2021, landings were 167 t. Average landings during the 2022–2024 period were 98.8 t, below the historical average (-56.2%).

From 2003 to 2008, fishing effort changed little from 15,500 to 19,200 traps (Figure 58; Appendix 9). Since then, the effort has been more variable and is primarily related to the number of active fishermen. In 2021, fishing effort was 12,800 traps. The average fishing effort during 2022–2024 was 7,425 traps, below the historical average (-36.0%).

CPUE values were the highest in Quebec from 2003 to 2010. They generally ranged around 20 kg/trap (Figure 58; Appendix 10). From 2011 to 2013, there was a slight decrease in CPUE with values around 17 kg/trap. In 2014, the average CPUE was only 4.7 kg/trap, by far the lowest value in the series. In 2015, there were few active fishermen, hence the lack of a standardized CPUE value. In 2016, CPUE was higher than in 2014, but remained low for this area. In 2017, CPUE was 17.5 kg/trap, a value similar to those from 2011 to 2013. However, CPUE has been declining in recent years, reaching 11.6 kg/trap in 2021. The mean CPUE value during 2022–2024 was 11.8 kg/trap, below the historical average (-28.0%).

The 2013 CPUE did not foreshadow such a sharp decline in CPUE in 2014. Environmental conditions in the Magdalen Islands during the 2014 season, such as abnormally cold temperatures (~6 °C) on the fishing grounds (Galbraith et al. 2021) and the high presence of shell-boring polychaetes, could be responsible for the low yields. However, CPUE remained low in 2015. There was some increase in 2017, but not in the whole area.

Figures 59, 60 and 61 show the spatial distribution of average landings, average effort and mean CPUE values in area 15 over the years. Between 2003 and 2015, the fishing effort was fairly high, but was well distributed throughout the fishing area. However, since 2016, it has fallen sharply, and is concentrated in a few places, especially in the eastern part of the fishing area.

Few variations have been noted in size structures since 2008 (Figure 62; Appendix 11). Mean size of landed whelk during 2022–2024 was 86.3 mm, exceeding the historical average of 83.3 mm (1987–2021). Since 2008, the proportion of sub-legal-size whelk in landings has remained below 4%, except in 2023, when it rose to 9.8% (Figure 62; Appendix 12).

Since 2021, the monitoring of shell-boring polychaete infestations in whelk in the commercial fishery shows that the proportion of moderately infected individuals has increased over time, particularly in the small (60–74 mm) and medium (75–90 mm) size classes, reaching 80% in 2024 (Figure 63). However, severe infestations remain rare, and their numbers stable, across all size classes. The majority of cases observed in the largest individuals (91 mm and over) are in the moderate category, with very few individuals free of infestation. Uninfected individuals make up a very small proportion of all size classes. Sex differences are generally low, although some differences can be seen in certain years or size classes. In addition, the greatest interannual variations in infestations are found in the smallest individuals (Figure 63). These trends could indicate a gradual increase in infestations in the population over time. Spatiotemporal variations in infestations in the Magdalen Islands show that moderate infestations have remained stable over the years**,** with few notable changes in distribution (Figure 64). In order to more accurately assess the severity of infestations on the regional scale, additional samples should be collected in areas that have not been covered to date. The numbers of whelk assessed by sex, size class and year are shown in Table 1.

RESEARCH

UPPER NORTH SHORE SURVEY

Area 1: Forestville

Mean densities of recruits (20–50 mm) in the survey increased between 2005 and 2011, peaking at 6.6 whelk/100 m² (Figure 65; Table 2). Since 2015, they have plummeted, reaching 0.08 whelk/100 m² in 2024, the lowest value in the time series.

The trend in mean densities of pre-commercial-size whelk (51–69 mm) slightly lags behind that for recruits. Densities peaked in 2015 at 5.7 whelk/100 m², before beginning a steady decline. In 2024, the density was 0.18 whelk/100 m², the lowest recorded in the time series.

The trend in mean densities of legal-size whelk (70+ mm) also lags behind that for pre-commercial-size whelk (Figure 65; Table 2). Densities peaked in 2017 at 10.4 whelk/100 m², but have plummeted since then. By 2024, the mean density of legal-size whelk was 2.48 whelk/100 m², among the lowest values in the time series.

The spatial distribution of recruits and pre-commercial-size and legal-size whelk in Forestville is shown in Figures 66, 67 and 68.

Trends in size structures are similar to those in densities (Figure 69). Between 2005 and 2015, most whelk collected in the survey were below legal size, indicating the presence of a pulse of recruits and pre-commercial-size individuals. In 2017, a sharp increase in legal-size whelk was observed. However, since then, the abundance of sub-legal-size and legal-size whelk has plummeted. In 2024, the proportion of sub-legal-size whelk was just 9%, indicating low recruitment.

The average yield of egg masses in the Forestville survey was low in 2007 and 2009, but then rose sharply, peaking at 45 g/100 m² in 2019 (Table 3). However, a sharp decline has been observed since 2019. In 2024, the average yield of egg masses was just 0.6 g/100 m², below the historical average of 8.2 g/100 m².

Area 1: Pointe-aux-Outardes

The mean density of recruits (20–50 mm) in the survey increased between 2005 and 2011, peaking at 4.8 whelk/100 m² (Figure 70; Table 2). However, since 2011, these densities have declined substantially. By 2024, they reached 0.13 whelk/100 m², the lowest value in the time series.

The mean density of pre-commercial-size whelk (51–69 mm) also peaked in 2011 at 4.1 whelk/100 m², before beginning a decline that has continued until today. In 2024, the value reached 0.24 whelk/100 m², the lowest value in the time series.

The trend in the mean density of legal-size whelk (70+ mm) lags behind that for pre-commercial-size whelk (Figure 70; Table 2). Densities peaked in 2017 at 7.1 whelk/100 m², but have fallen substantially since then. By 2024, the mean density of legal-size whelk was 2.6 whelk/100 m², among the lowest values in the time series.

The spatial distribution of recruit, pre-commercial-size and commercial-size whelk in the Pointe-aux-Outardes sector is shown in Figures 71, 72 and 73.

The Pointe-aux-Outardes sector is characterized by greater interannual variations in size structures (Figure 73). Young whelk were abundant between 2009 and 2015, while legal-size whelk were numerous in 2007, and again between 2015 and 2019. However, since 2019, the

abundance of whelk in all size classes has fallen sharply. In 2024, the proportion of sub-legal-size whelk was only 12%, the lowest value in the time series (Figure 74).

The average yield of egg masses obtained in the Pointe-aux-Outardes survey gradually increased from 90 to 165 g/100 m² between 2007 and 2019 (Table 3). However, a sharp decline has been observed since 2019. By 2024, this value had fallen to 15.7 g/100 m², well below the historical average of 99.5 g/100 m².

Area 2: Baie-Comeau

The mean densities of recruits (20–50 mm) in the survey have been declining since 2005 (Figure 75). Between 2005 and 2024, values fell from 7.5 to 0.2 whelk/100 m², reaching the lowest level in the time series in 2024 (Table 2).

The mean densities of pre-commercial-size whelk (51–69 mm) have also been on a downward trajectory since 2005, falling from 26.9 whelk/100 m² in that year to 1.45 whelk/100 m² in 2024, the lowest value in the time series.

Mean densities of legal-size whelk (70+ mm) remained relatively low between 2005 and 2015, before increasing to a peak of 42.4 whelk/100 m² in 2017 (Figure 75). However, densities have plunged since then. By 2024, the mean density of legal-size whelk had reached 10.5 whelk/100 m², among the lowest values in the time series.

The spatial distribution of densities of recruits, and pre-commercial size and legal-size whelk in the Baie-Comeau area is shown in Figures 76, 77 and 78.

The trend in size structure is similar to that observed in densities (Figure 79). Between 2005 and 2013, most whelk collected in the survey were smaller than legal size, indicating the presence of a pulse of recruits and pre-commercial-size individuals. In 2017, a sharp increase in legal-size whelk was observed. However, since then, the abundance of sub-legal-size and legal-size whelk has declined substantially. In 2024, the proportion of sub-legal-size whelk was just 13%, indicating low recruitment.

The average yield of egg masses in the Baie-Comeau survey increased significantly between 2007 and 2011, from 37 to 554 g/100 m² (Table 3), followed by a sharp decline that has continued since then. By 2024, the value was down to a mere 15 g/100 m², well below the historical average of 180 g/100 m².

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TABLES

Table 1. Number of whelks from the commercial fishery with shell-boring polychaete infestations sampled in area 15 (Magdalen Islands), by year, sex (females, males), and shell height class (mm). The proportions (%) of whelk sampled in each category with different levels of infestation severity are shown in Figure 63.

Year	Height	Females	Males
2021	60-74 mm	26	30
2021	75-90 mm	539	483
2021	91+ mm	303	148
2022	60-74 mm	10	7
2022	75-90 mm	467	462
2022	91+ mm	332	174
2023	60-74 mm	59	65
2023	75-90 mm	560	514
2023	91+ mm	173	107
2024	60-74 mm	25	24
2024	75-90 mm	605	436
2024	91+ mm	229	135

Table 2. Average whelk density (number/100 m^2 ± standard error) by size class (mm), by year and by site in the Upper North Shore research surveys.

Year	Forestville			Pointe-aux-Outardes			Baie-Comeau		
	20-50 mm	**51-69 mm**	**70+ mm**	**20-50 mm**	**51-69 mm**	**70+ mm**	**20-50 mm**	**51-69 mm**	**70+ mm**
2005	1.79 ± 0.27	1.48 ± 0.17	3.33 ± 0.25	0.38 ± 0.16	0.96 ± 0.17	1.96 ± 0.64	7.57 ± 2.64	26.94 ± 8.40	8.22 ± 3.41
2007	1.70 ± 0.27	1.33 ± 0.12	2.48 ± 0.16	0.18 ± 0.05	1.14 ± 0.26	2.88 ± 0.57	3.51 ± 1.49	11.44 ± 2.37	6.74 ± 1.33
2009	3.23 ± 0.34	1.41 ± 0.10	1.88 ± 0.17	1.37 ± 0.41	1.27 ± 0.27	2.10 ± 0.37	7.17 ± 2.99	10.96 ± 2.45	6.25 ± 1.31
2011	6.58 ± 0.75	2.65 ± 0.23	2.95 ± 0.19	4.38 ± 1.28	4.12 ± 0.87	3.46 ± 0.64	5.63 ± 2.18	19.28 ± 4.75	16.85 ± 3.99
2013	4.78 ± 0.48	5.36 ± 0.63	5.80 ± 0.44	0.82 ± 0.28	1.94 ± 0.41	4.06 ± 0.98	1.02 ± 0.68	16.51 ± 7.64	18.67 ± 5.60
2015	5.74 ± 0.83	5.71 ± 0.56	4.71 ± 0.37	1.32 ± 0.47	2.10 ± 0.39	6.11 ± 0.56	2.35 ± 1.97	5.23 ± 1.07	9.12 ± 1.60
2017	0.85 ± 0.13	3.69 ± 0.31	10.42 ± 0.53	0.45 ± 0.19	1.27 ± 0.32	7.15 ± 1.31	0.43 ± 0.19	16.18 ± 6.05	42.48 ± 14.81
2019	0.84 ± 0.16	1.48 ± 0.22	4.69 ± 0.38	0.87 ± 0.42	0.83 ± 0.22	5.22 ± 0.80	1.05 ± 0.43	2.42 ± 0.48	9.66 ± 1.734
2022	0.64 ± 0.14	0.46 ± 0.06	3.97 ± 0.29	0.44 ± 0.14	0.38 ± 0.10	4.21 ± 1.16	1.44 ± 0.67	2.06 ± 0.73	7.978 ± 2.49
2024	0.08 ± 0.02	0.18 ± 0.03	2.48 ± 0.30	0.13 ± 0.04	0.23 ± 0.06	2.63 ± 0.52	0.21 ± 0.11	1.45 ± 0.38	10.53 ± 2.05

Table 3. Average yields per year (g/100 m^2 ± standard error) of egg masses in the Forestville (FOR), Pointe-aux-Outardes (PAO) and Baie-Comeau (BC) research surveys on the Upper North Shore. The historical average (2007-2022) is also shown for each site.

Year	Site	Yield
2005	FOR	-
2007	FOR	0.7 ± 0.3
2009	FOR	0.4 ± 0.2
2011	FOR	3.9 ± 1.7
2013	FOR	1.6 ± 0.9
2015	FOR	6.5 ± 2.5
2017	FOR	6.5 ± 3.6
2019	FOR	45 ± 7
2022	FOR	0.94 ± 0.59
2024	FOR	0.6 ± 0.6
Hist. Aver.	FOR	8.2
2005	PAO	-
2007	PAO	90 ± 27
2009	PAO	73 ± 32
2011	PAO	106 ± 54
2013	PAO	107 ± 37
2015	PAO	83 ± 20
2017	PAO	103 ± 43
2019	PAO	165 ± 48
2022	PAO	69 ± 24.3
2024	PAO	15.7 ± 6.3
Hist. Aver.	PAO	99.5
2005	BC	-
2007	BC	37 ± 18
2009	BC	43 ± 17
2011	BC	554 ± 283
2013	BC	269 ± 120
2015	BC	247 ± 100
2017	BC	157 ± 76
2019	BC	91 ± 38
2022	BC	42.05 ± 23.43
2024	BC	15 ± 10.7
Hist. Aver.	BC	180

FIGURES

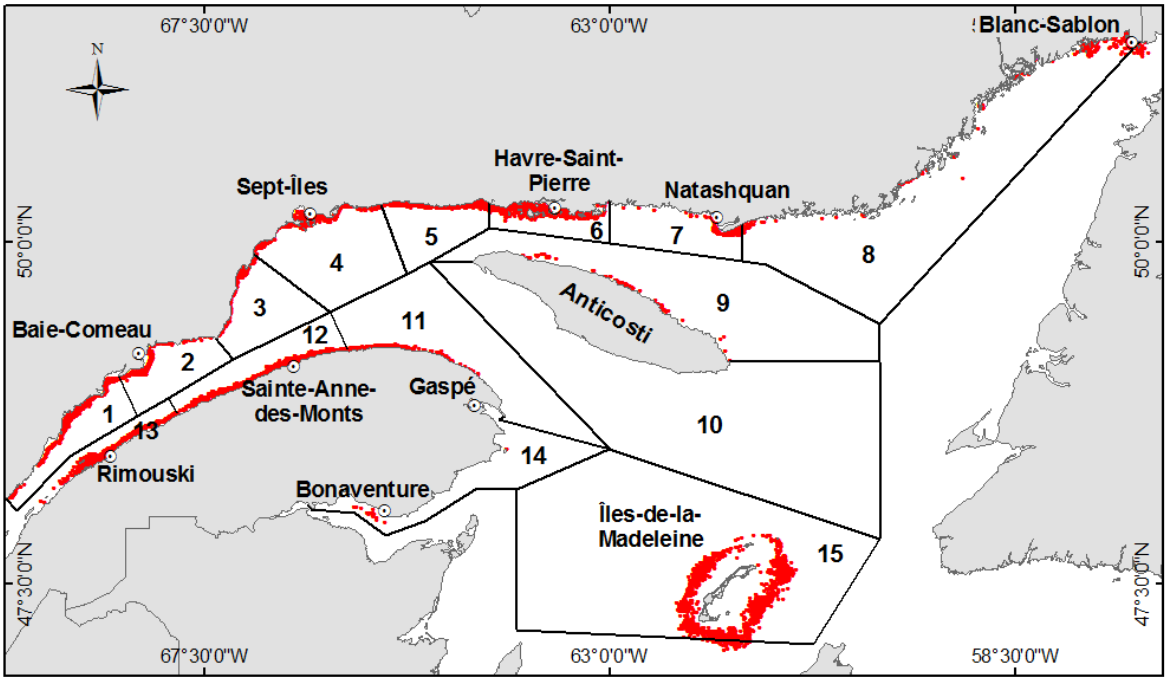


Figure 1. Fishing areas (areas 1 to 15) and known distribution (red circles) of whelks in Quebec (source: logbooks, commercial sampling program, research surveys and exploratory fishery).

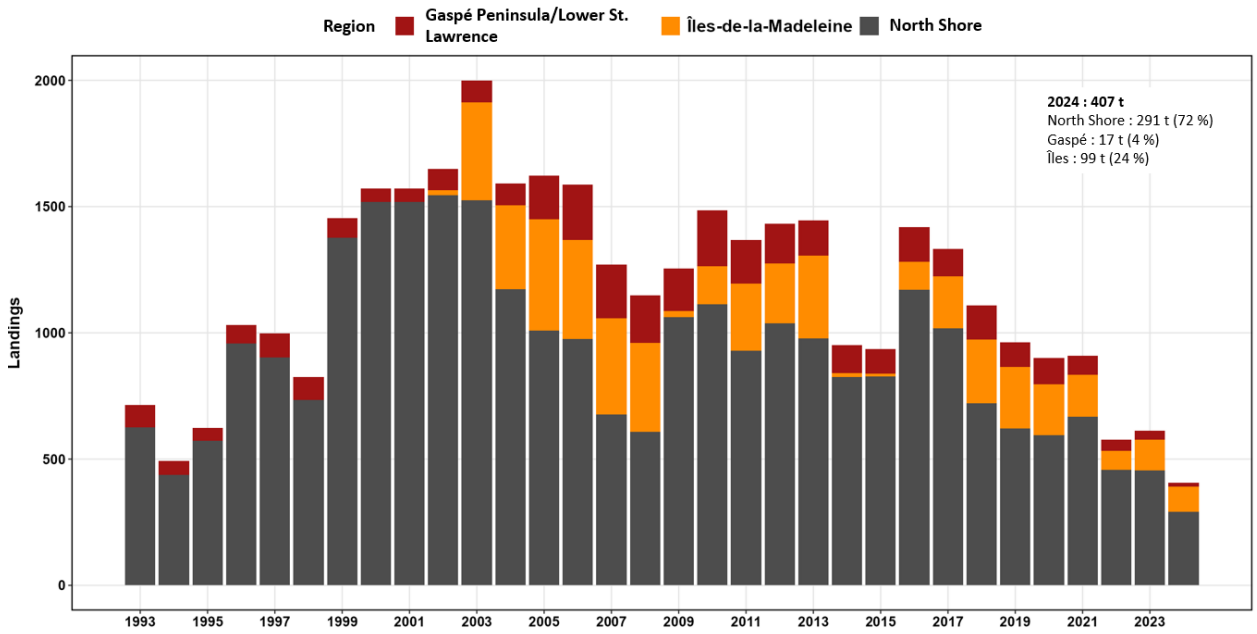


Figure 2. Annual landings (t) in the commercial whelk fishery by Quebec region.

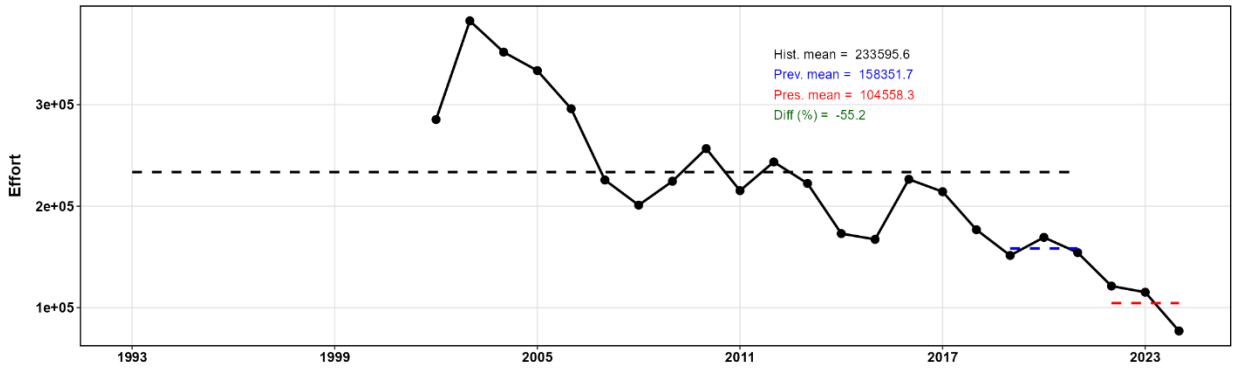


Figure 3. Annual effort (number of traps hauled) in the commercial whelk fishery in Quebec as a whole. The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type.

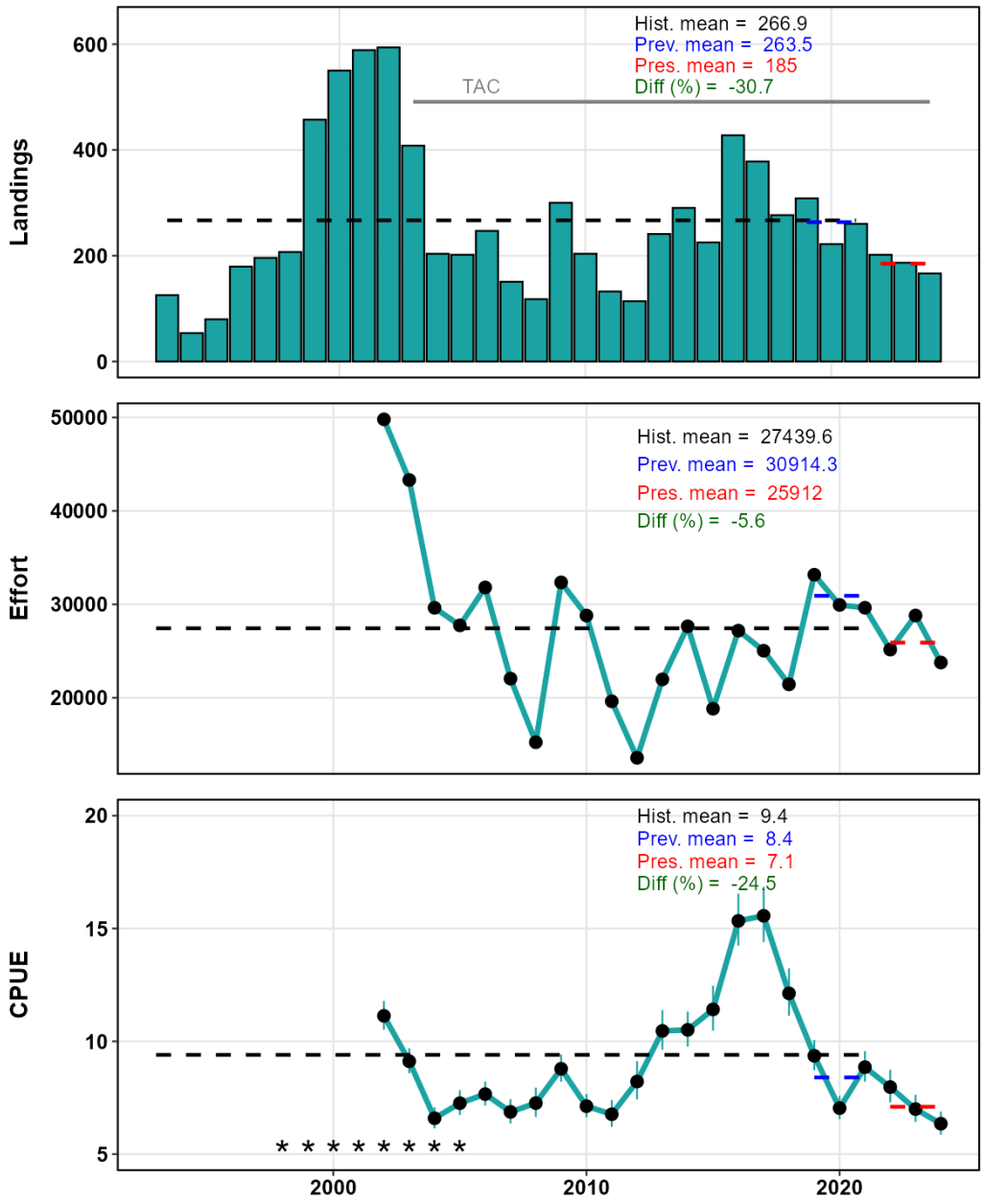


Figure 4. Status of the whelk stock in area 1, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

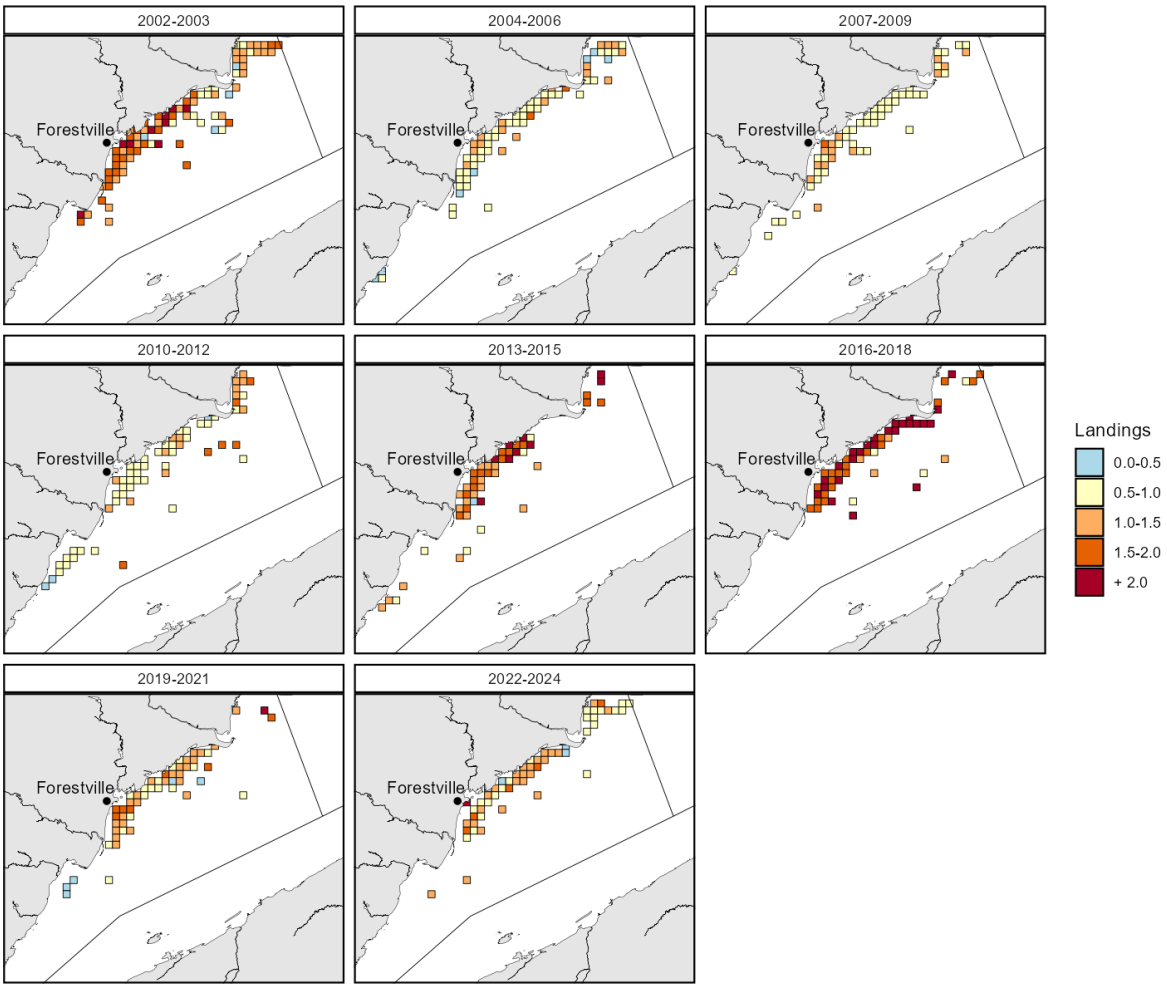


Figure 5. Spatiotemporal distribution of average landings (tons) in area 1.

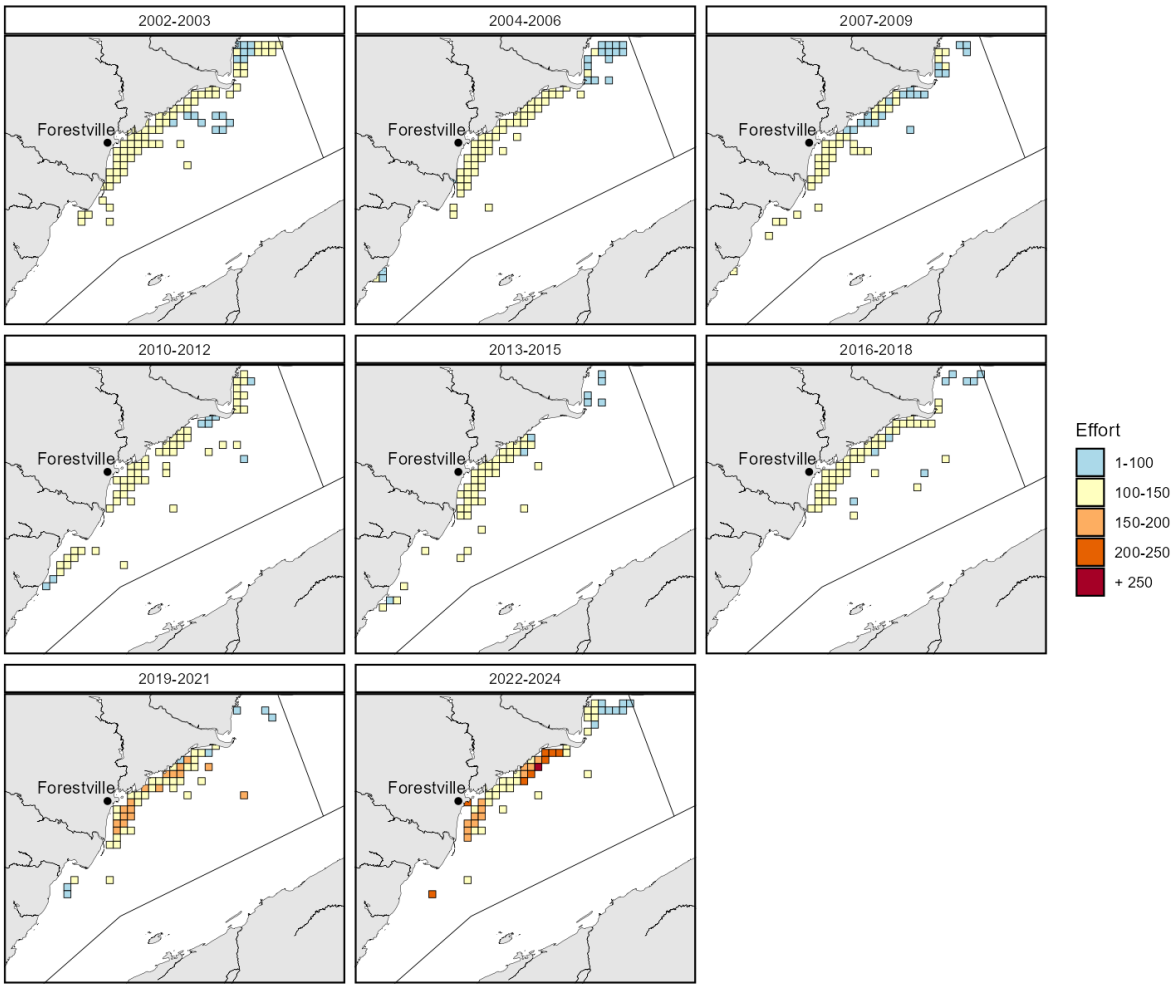


Figure 6. Spatiotemporal distribution of average effort (number of traps) in area 1.

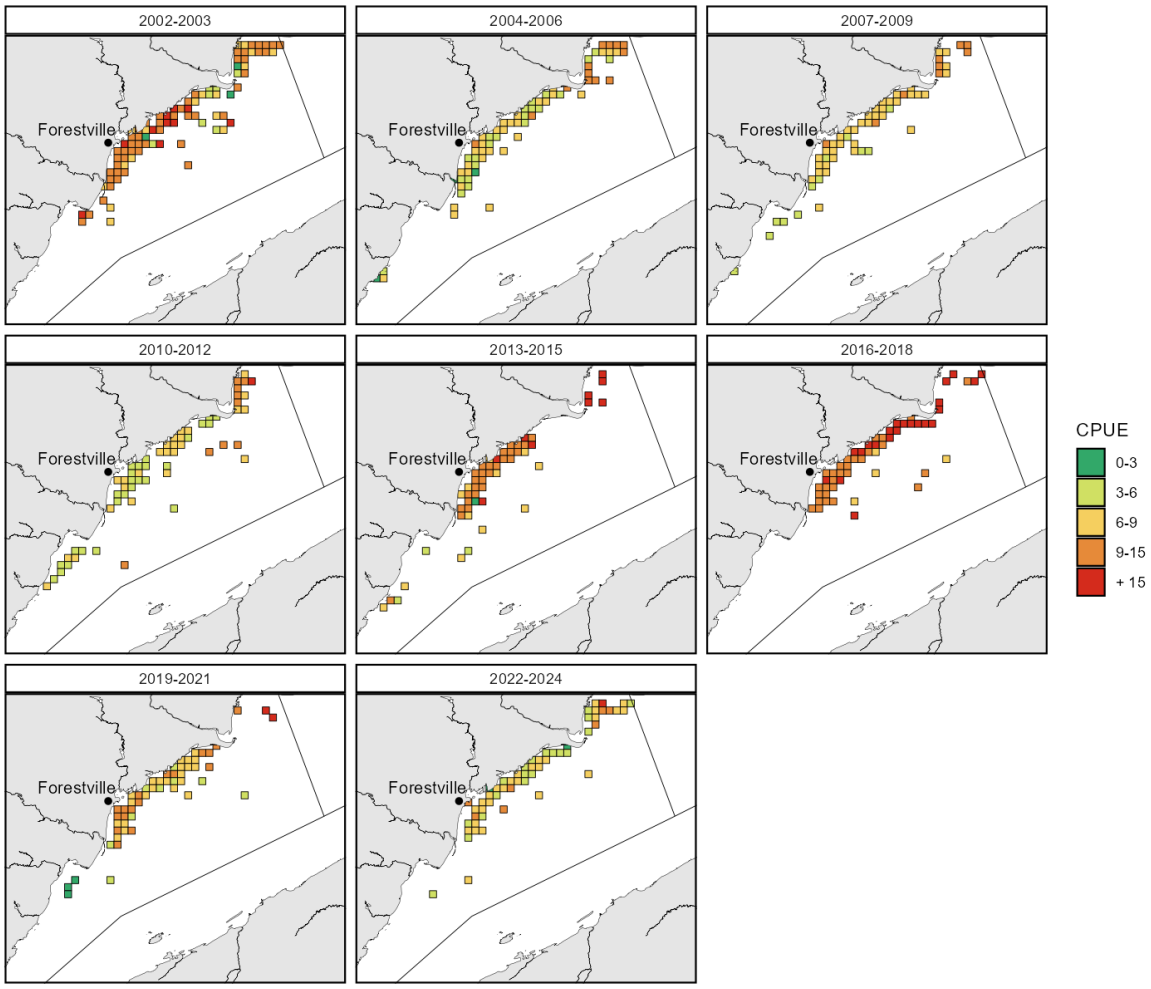


Figure 7. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 1.

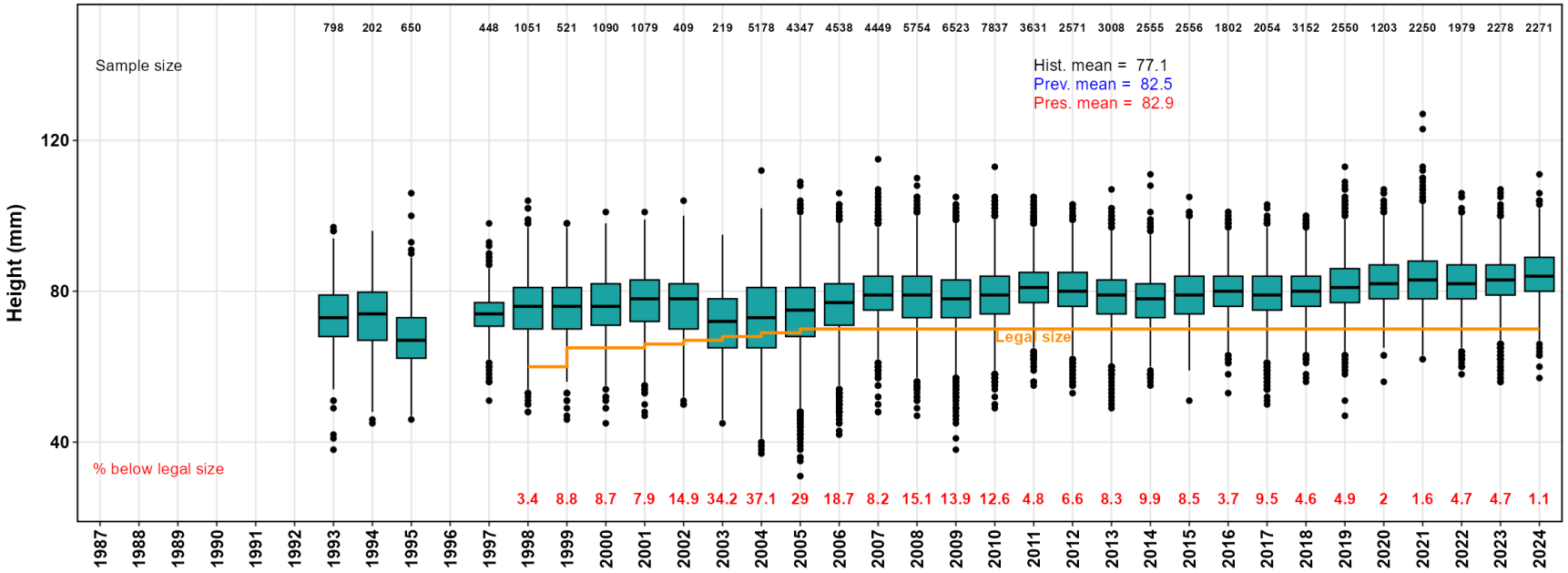


Figure 8. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 1. The historical mean for shell height (Hist. mean), the mean for the previous assessment period (Prev. mean) and the mean for the current assessment period (Pres. mean) are shown. The solid orange line shows variations in the minimum legal size (mm) over time.

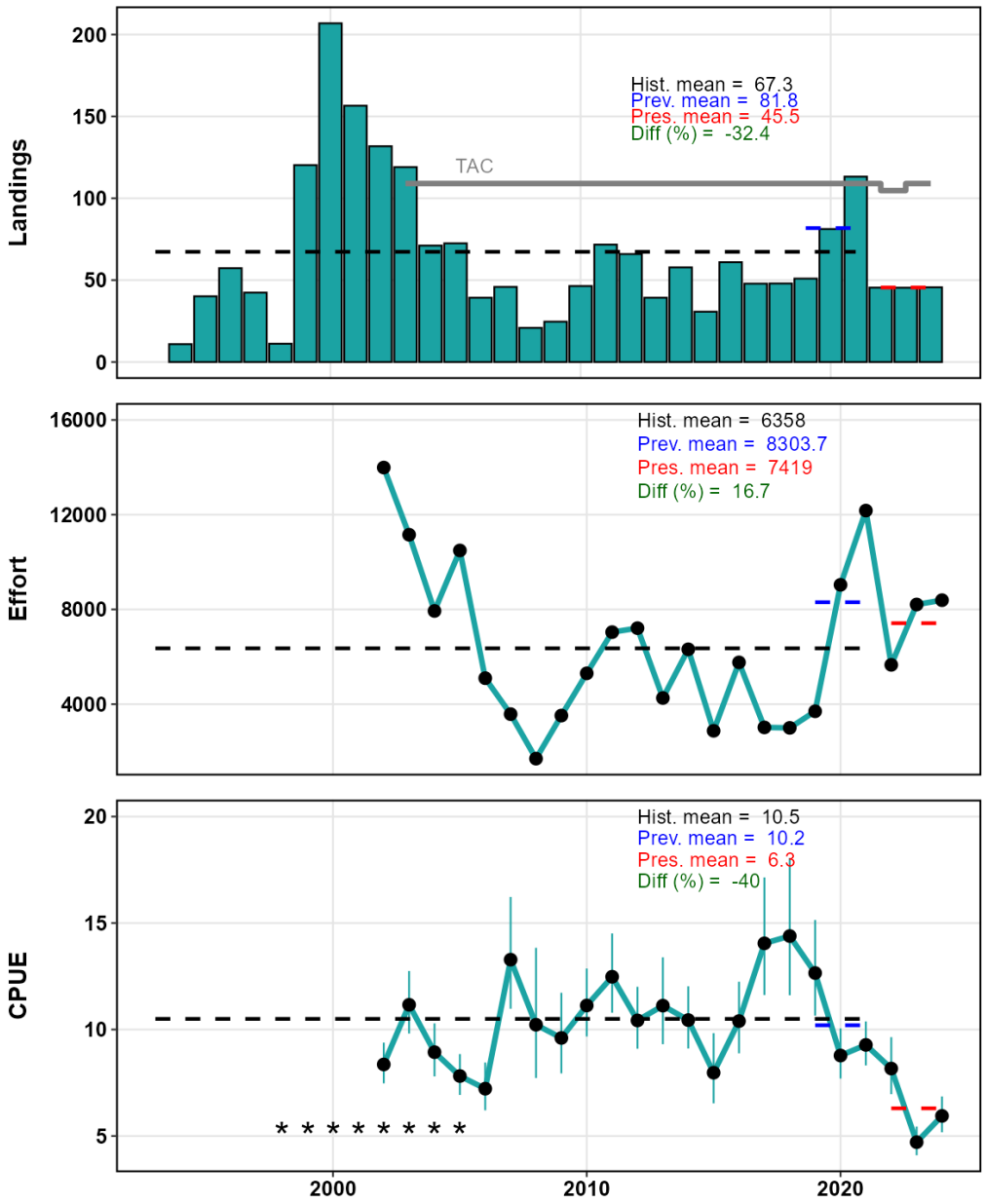


Figure 9. Status of the whelk stock in area 2, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

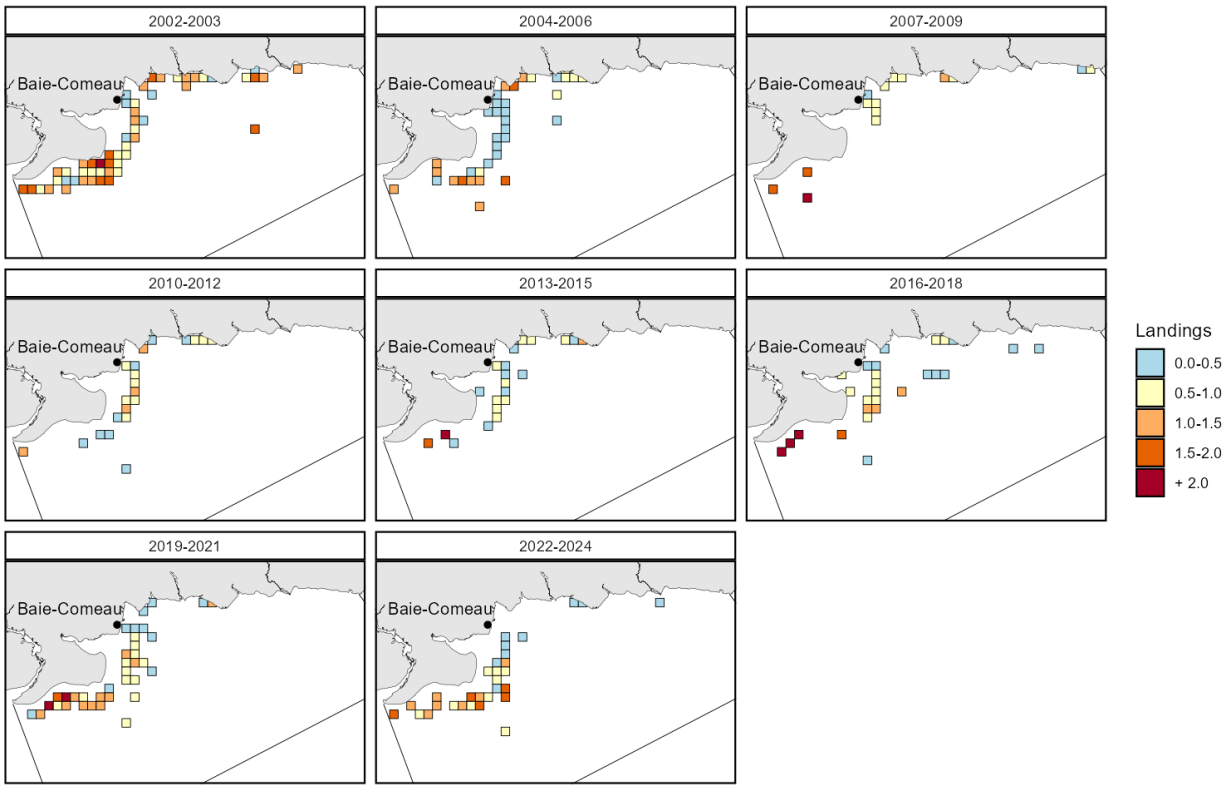


Figure 10. Spatiotemporal distribution of average landings (tons) in area 2.

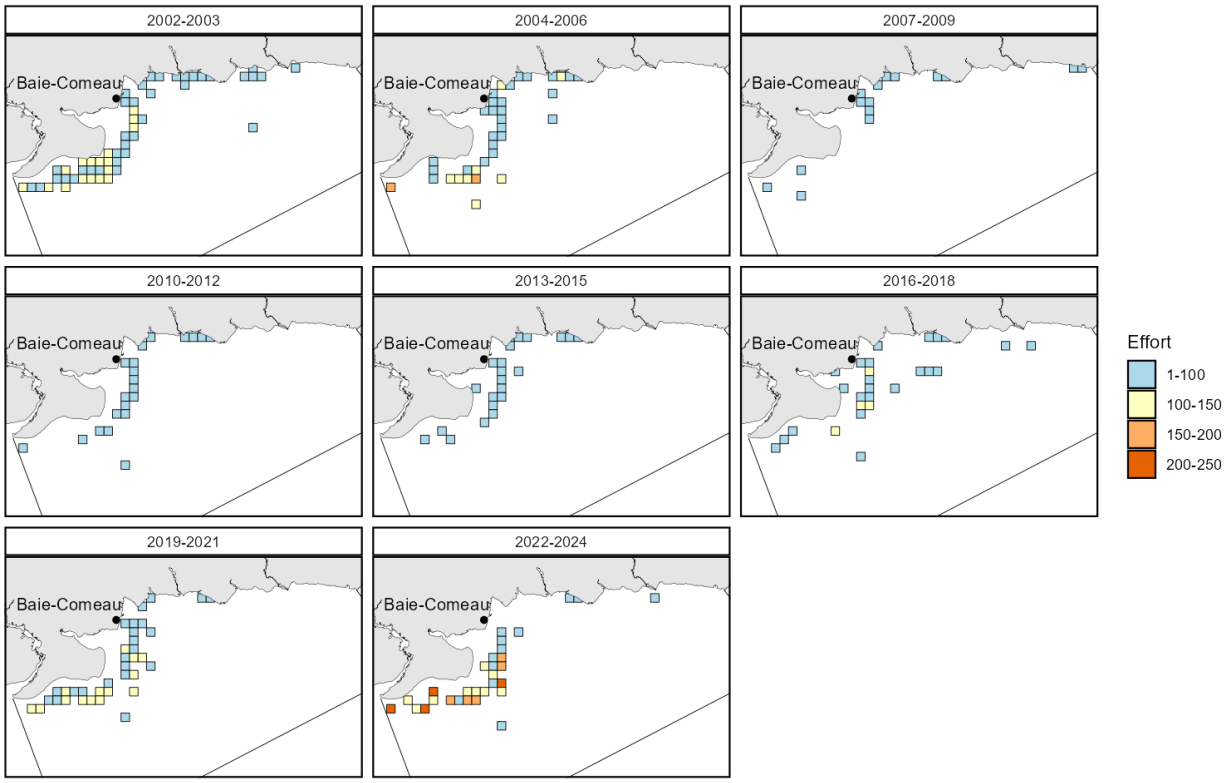


Figure 11. Spatiotemporal distribution of average effort (number of trap hauls) in area 2.

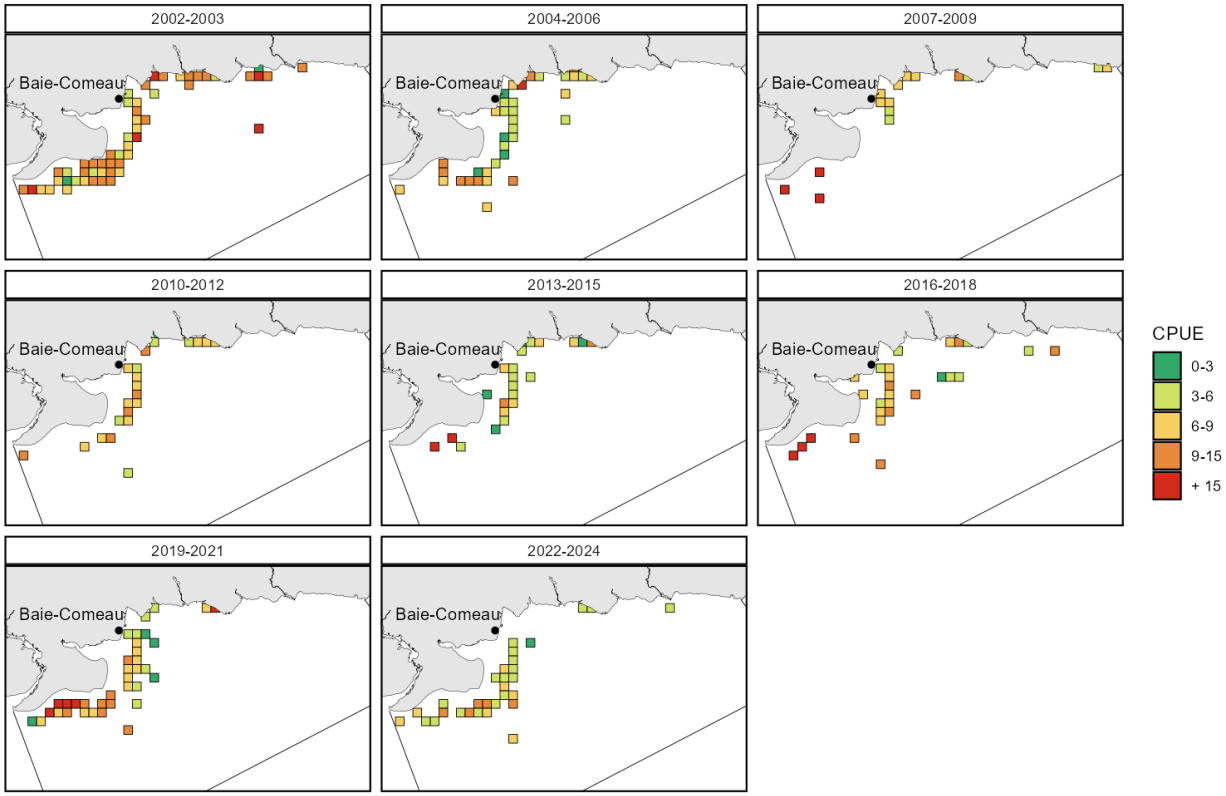


Figure 12. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 2.

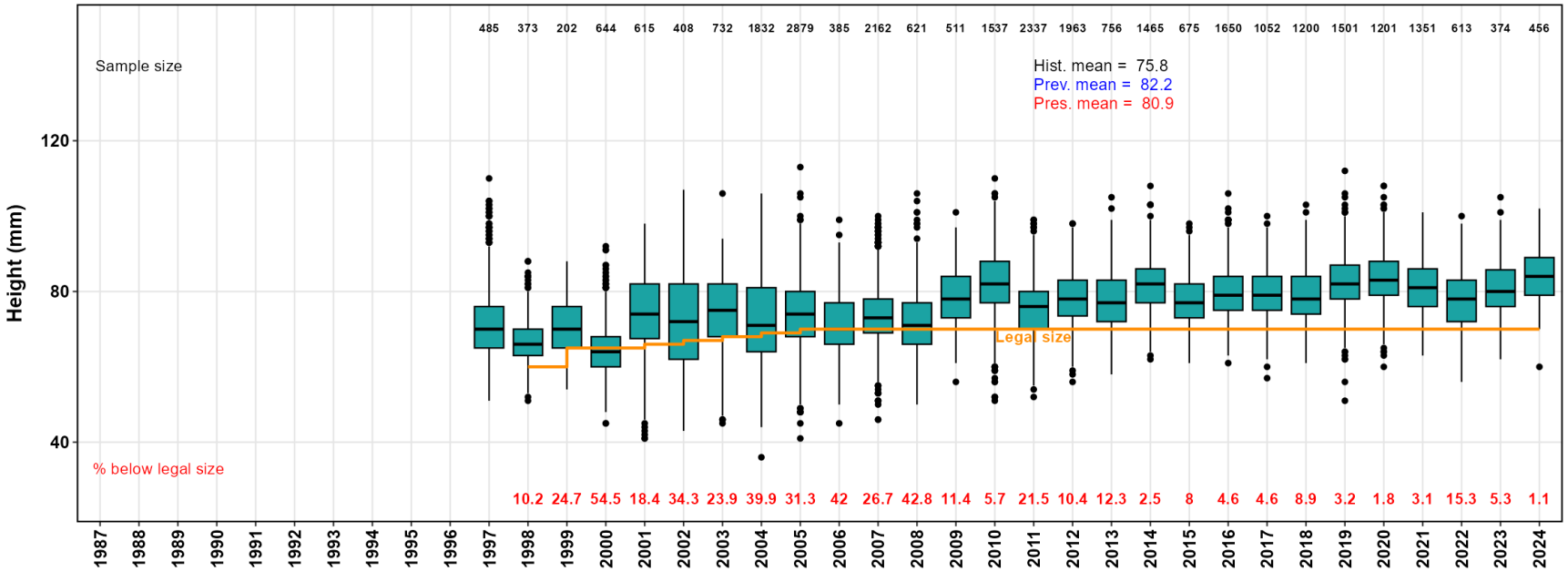


Figure 13. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 2. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

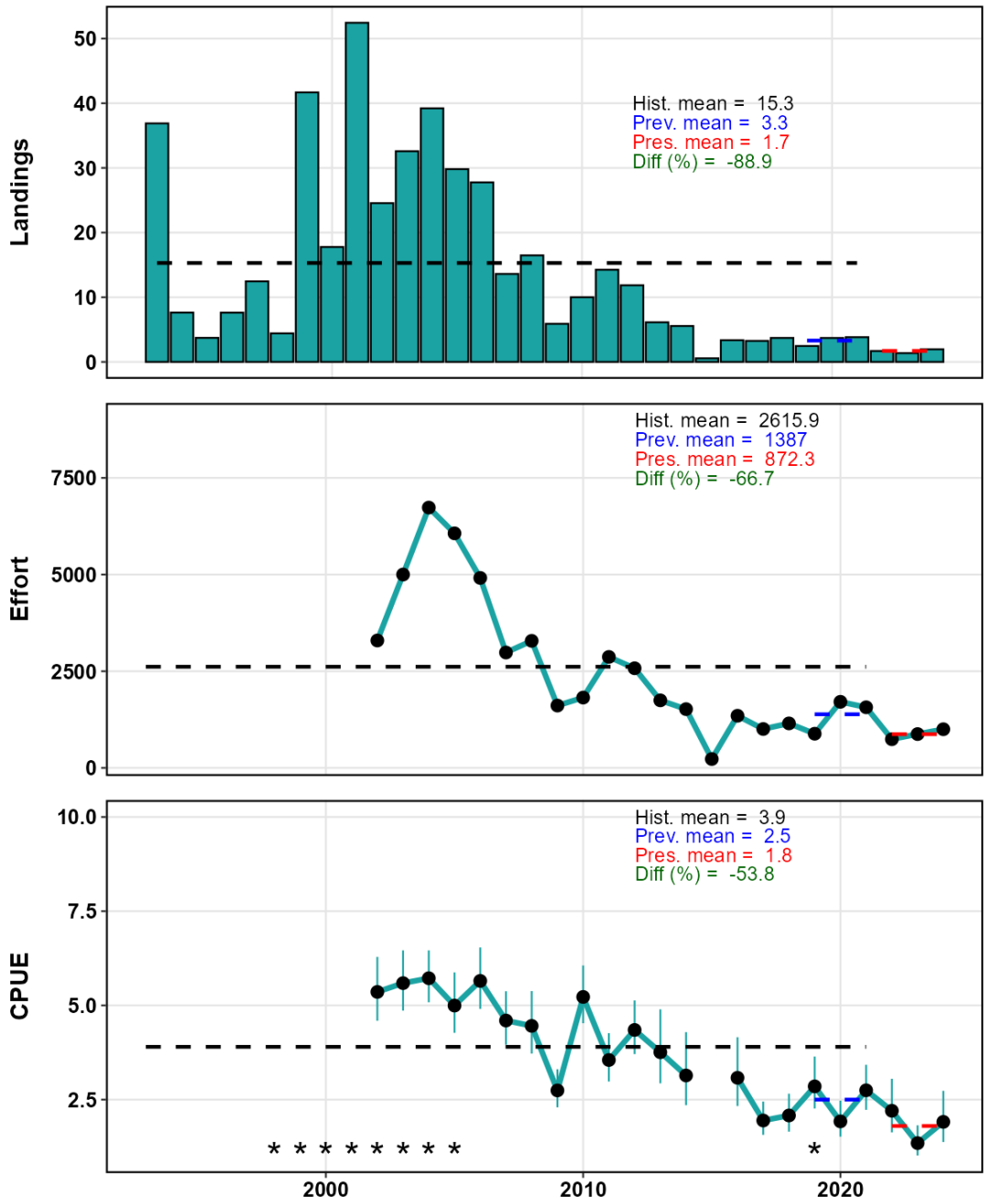


Figure 14. Status of the whelk stock in area 3, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

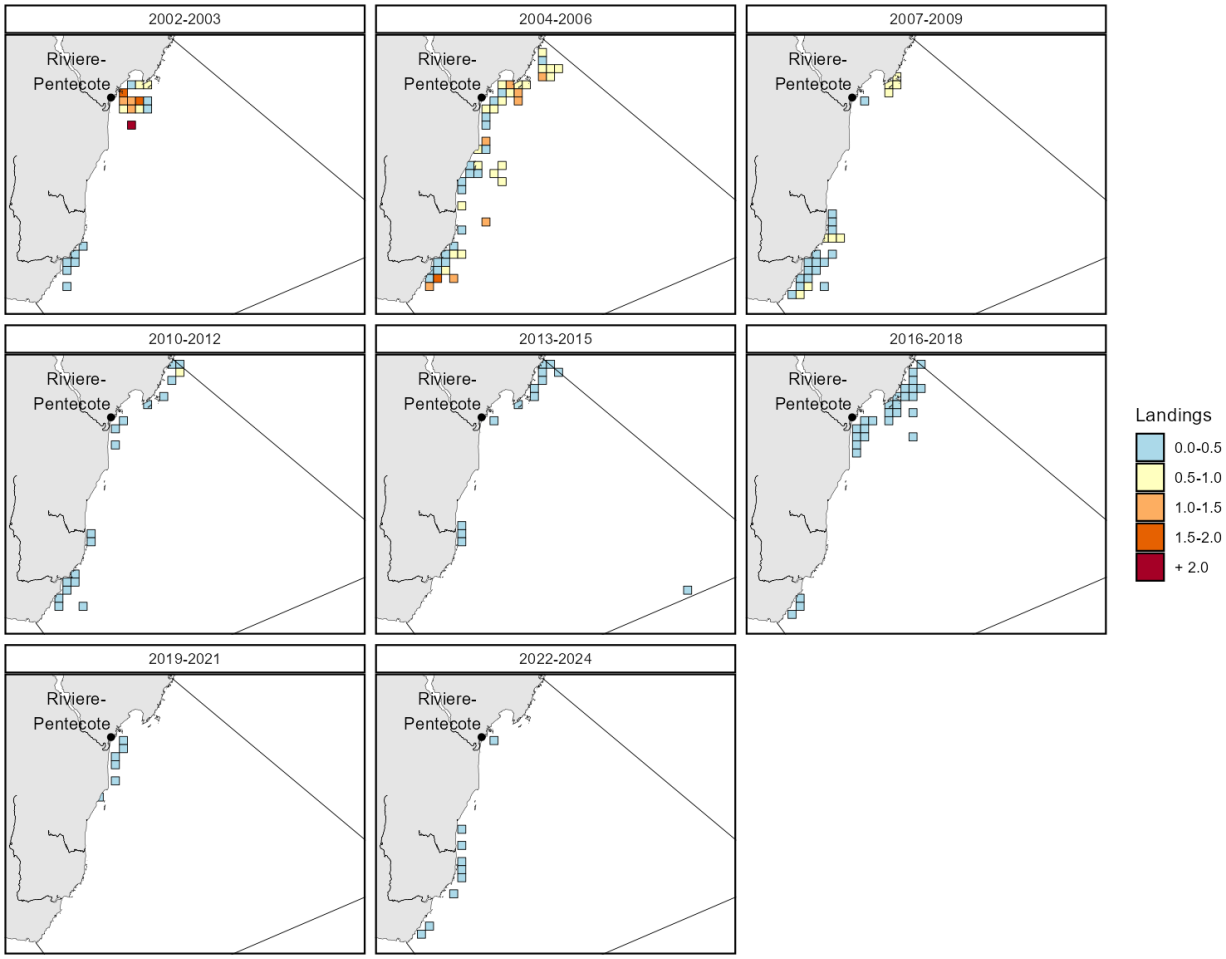


Figure 15. Spatiotemporal distribution of average landings (tons) in area 3.

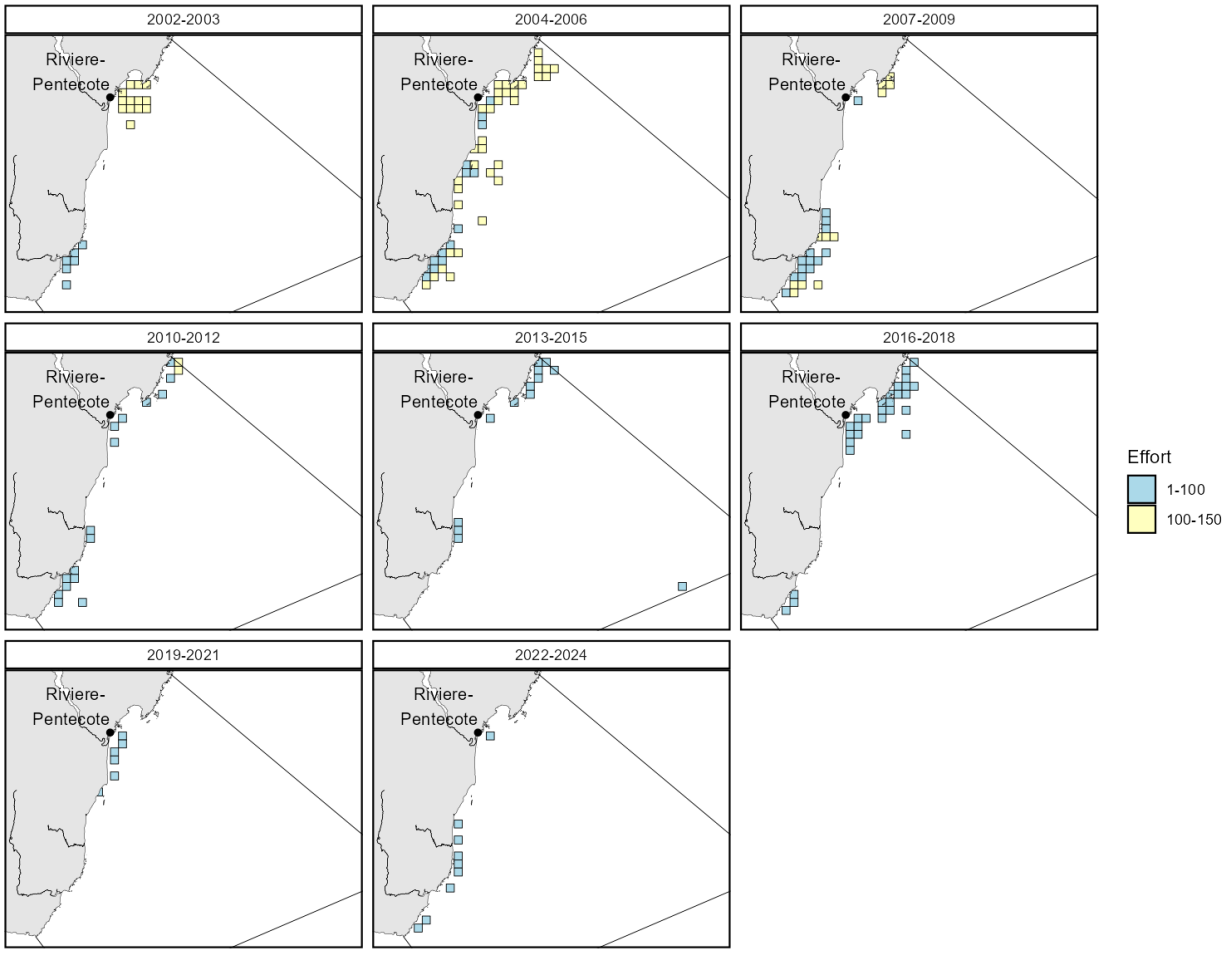


Figure 16. Spatiotemporal distribution of average effort (number of trap hauls) in area 3.

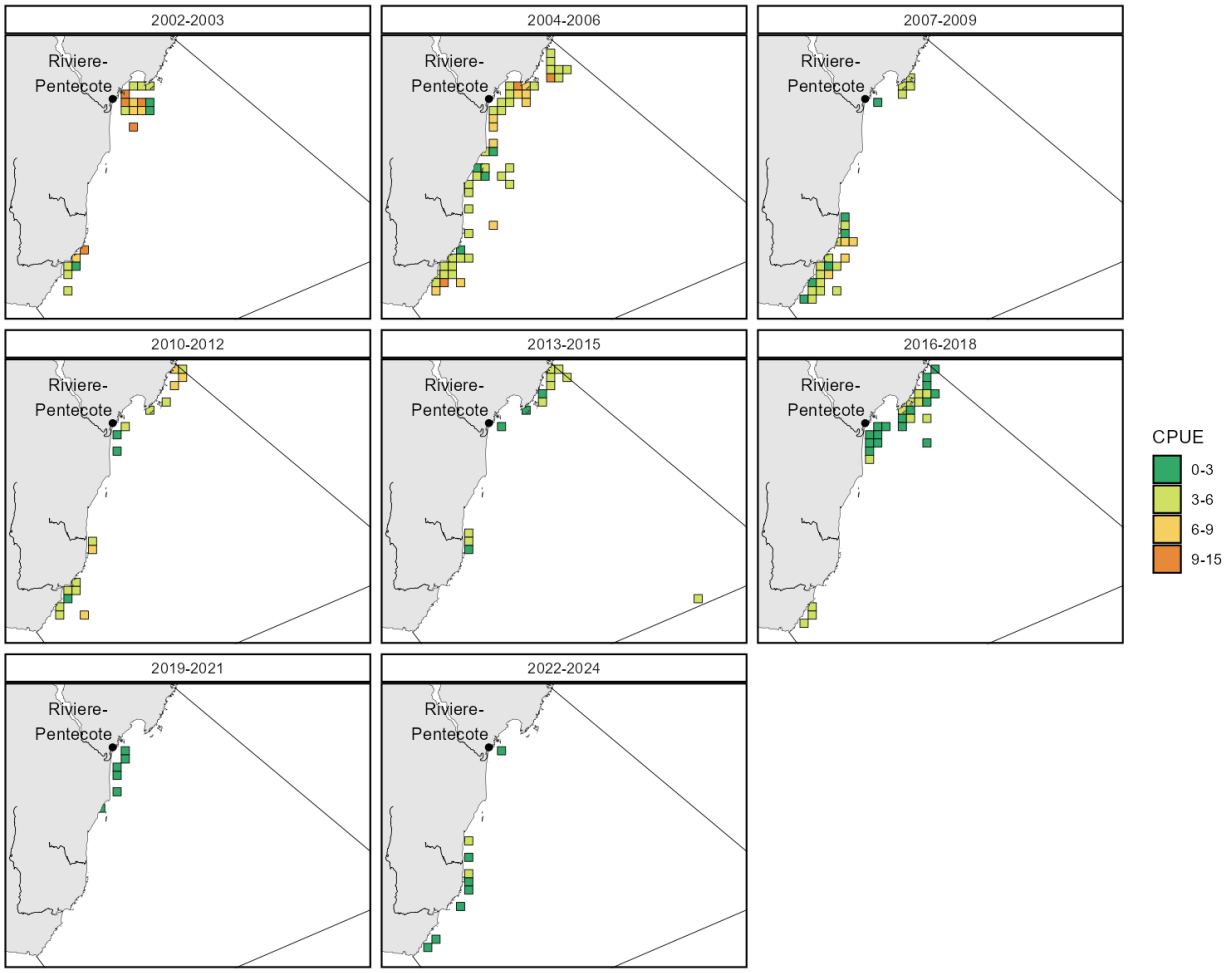


Figure 17. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 3.

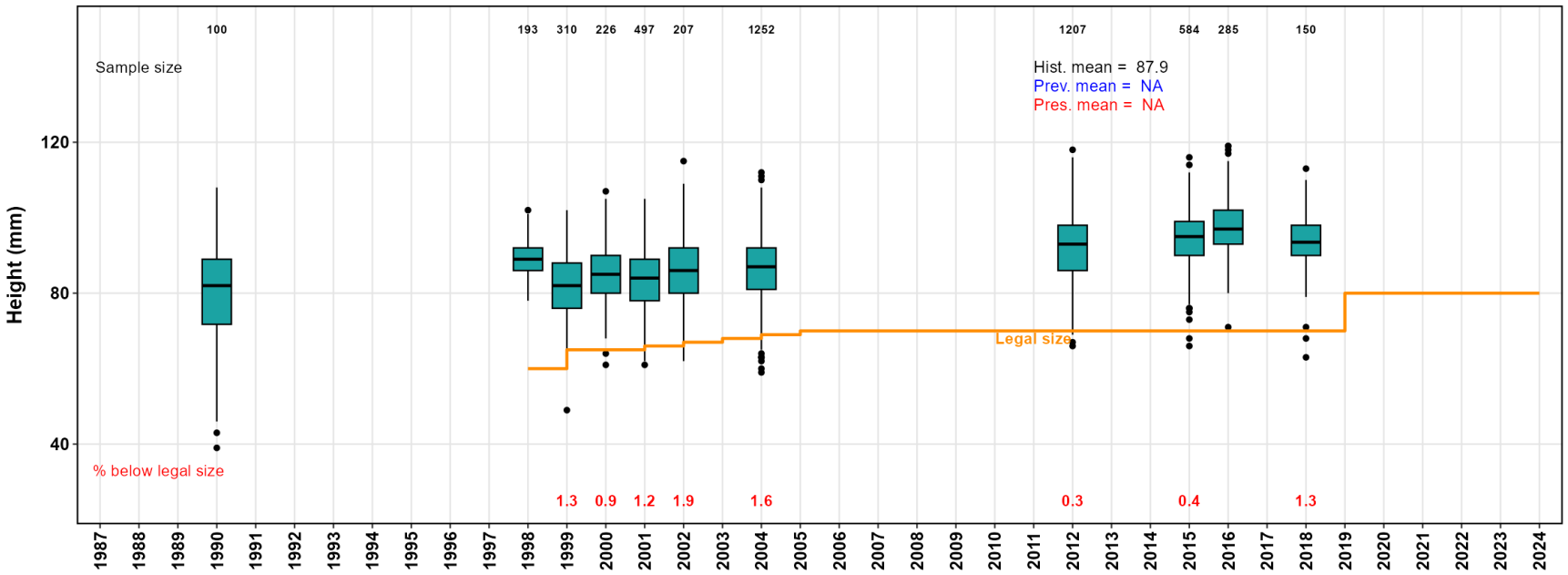


Figure 18. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 3. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

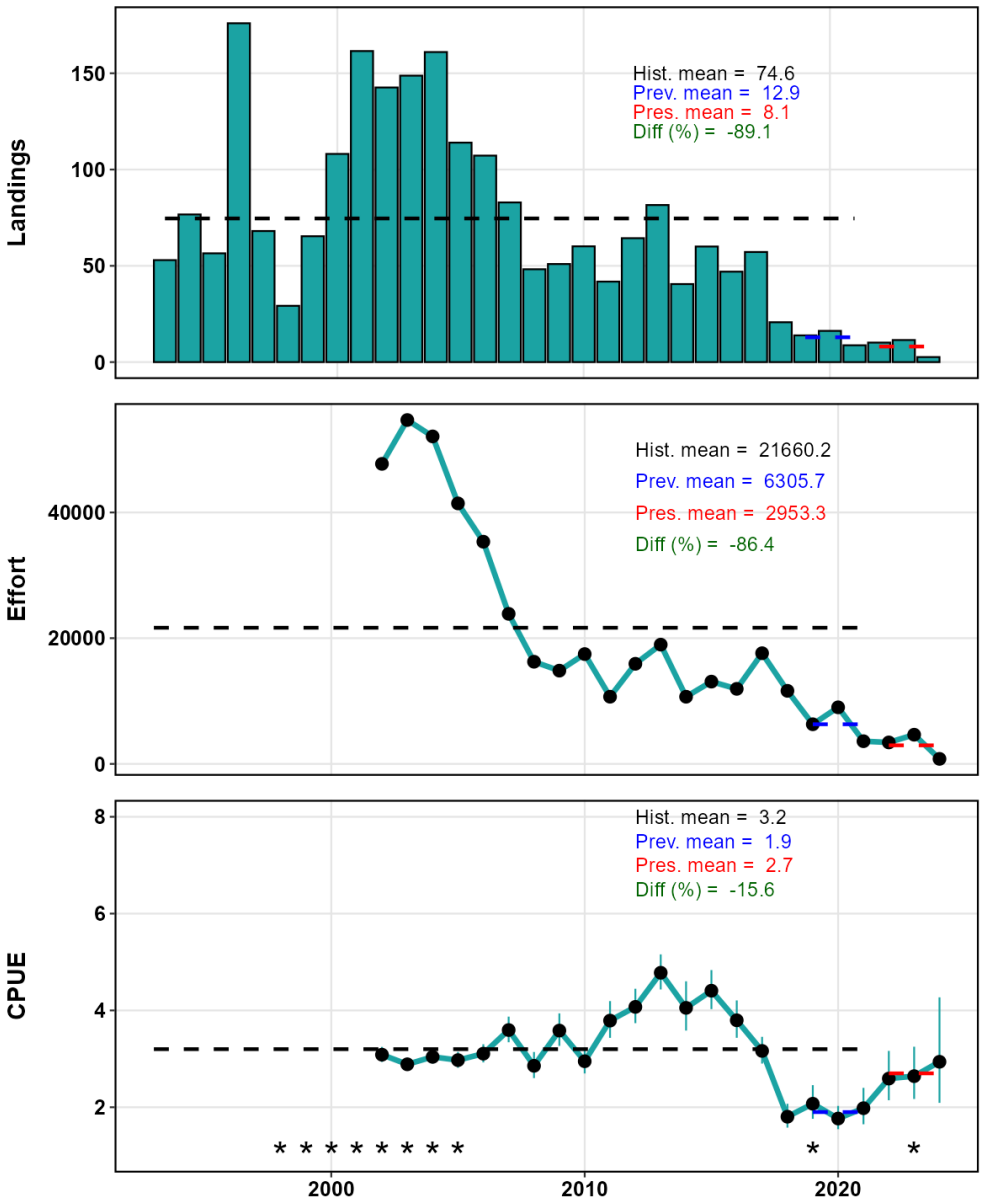


Figure 19. Status of the whelk stock in area 4, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

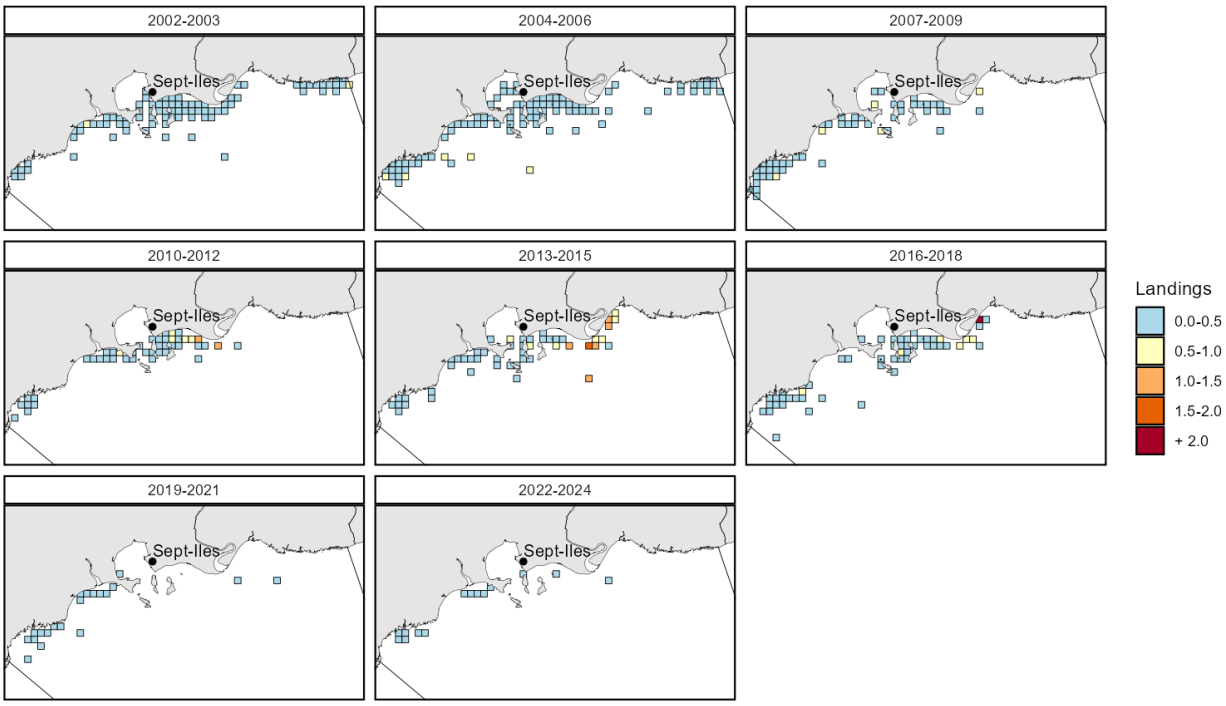


Figure 20. Spatiotemporal distribution of average landings (tons) in area 4.

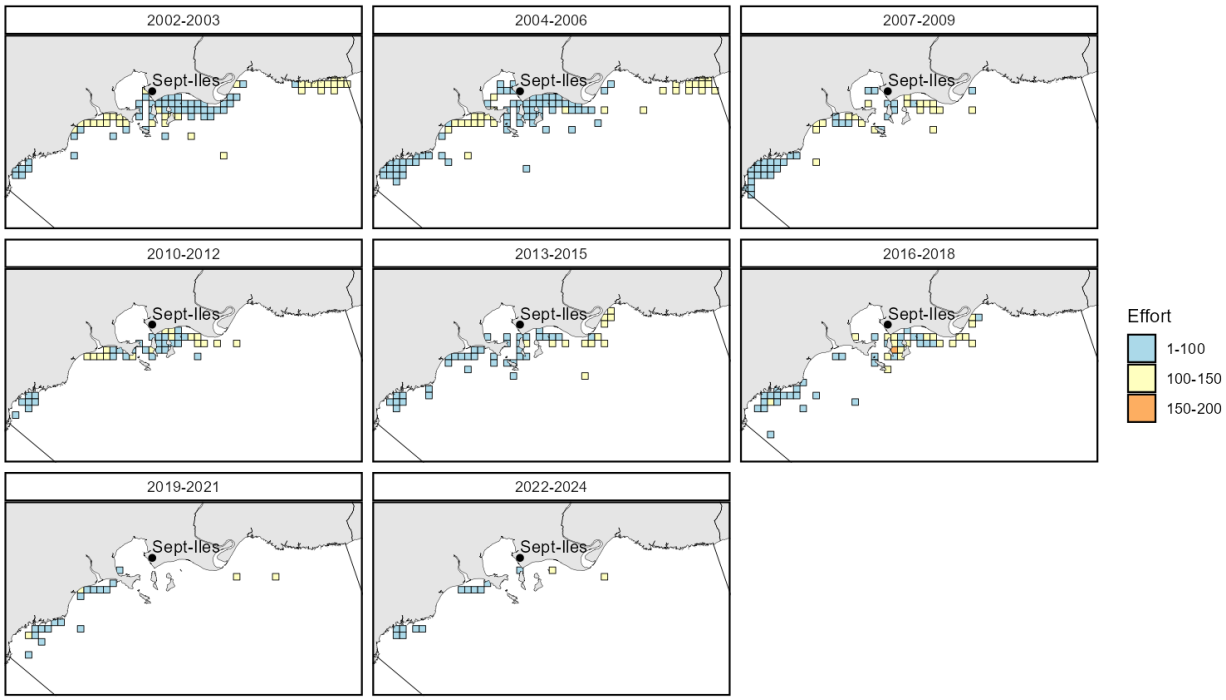


Figure 21. Spatiotemporal distribution of average effort (number of trap hauls) in area 4.

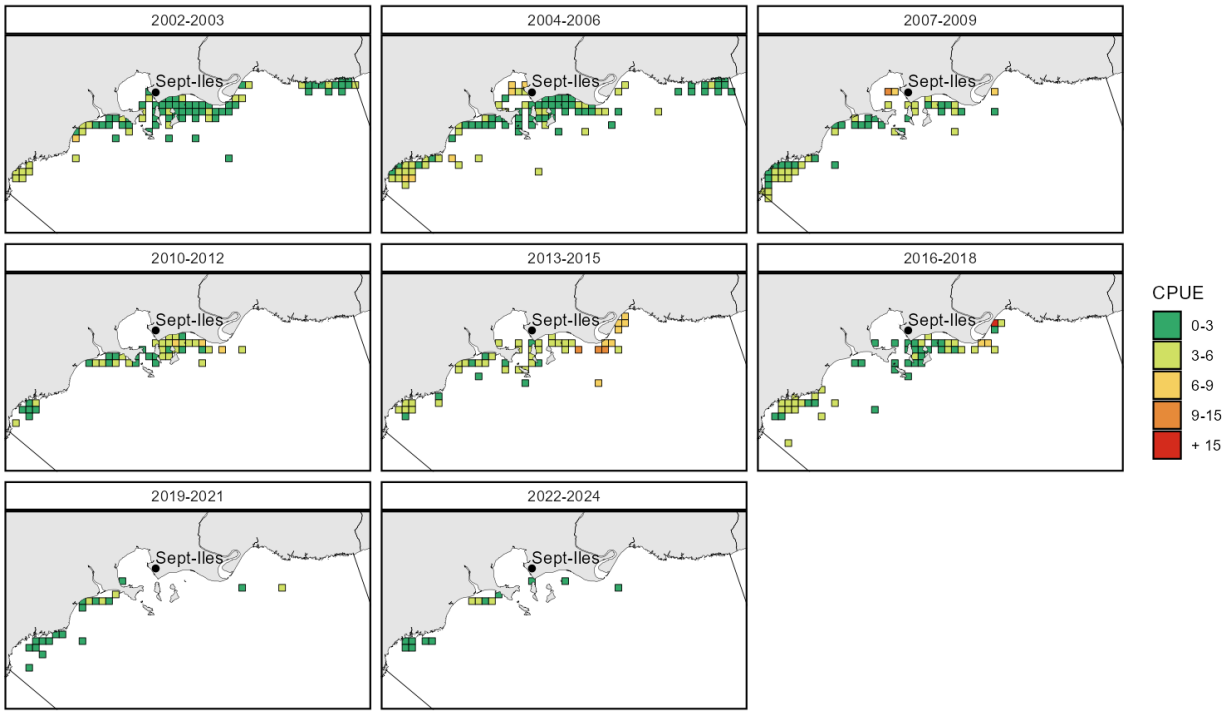


Figure 22. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 4.

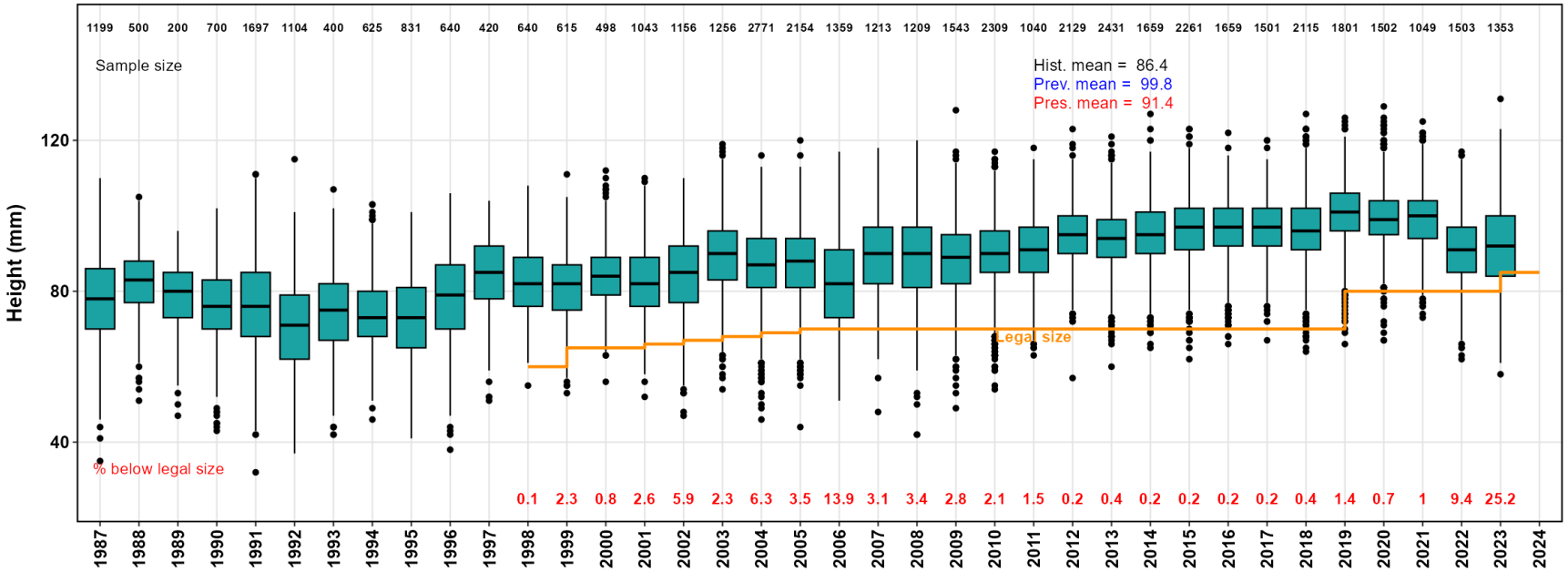


Figure 23. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 4. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

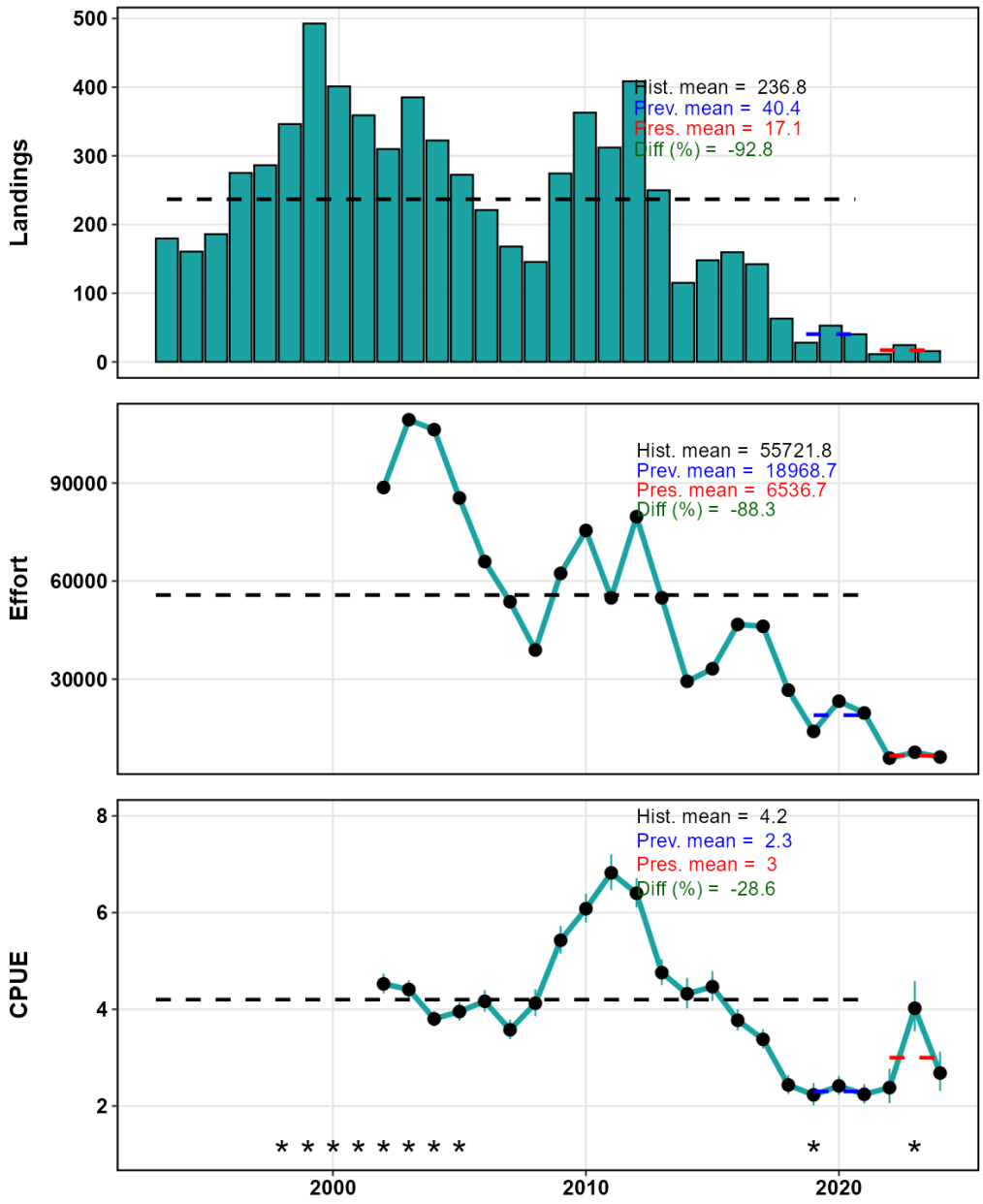


Figure 24. Status of the whelk stock in area 5, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

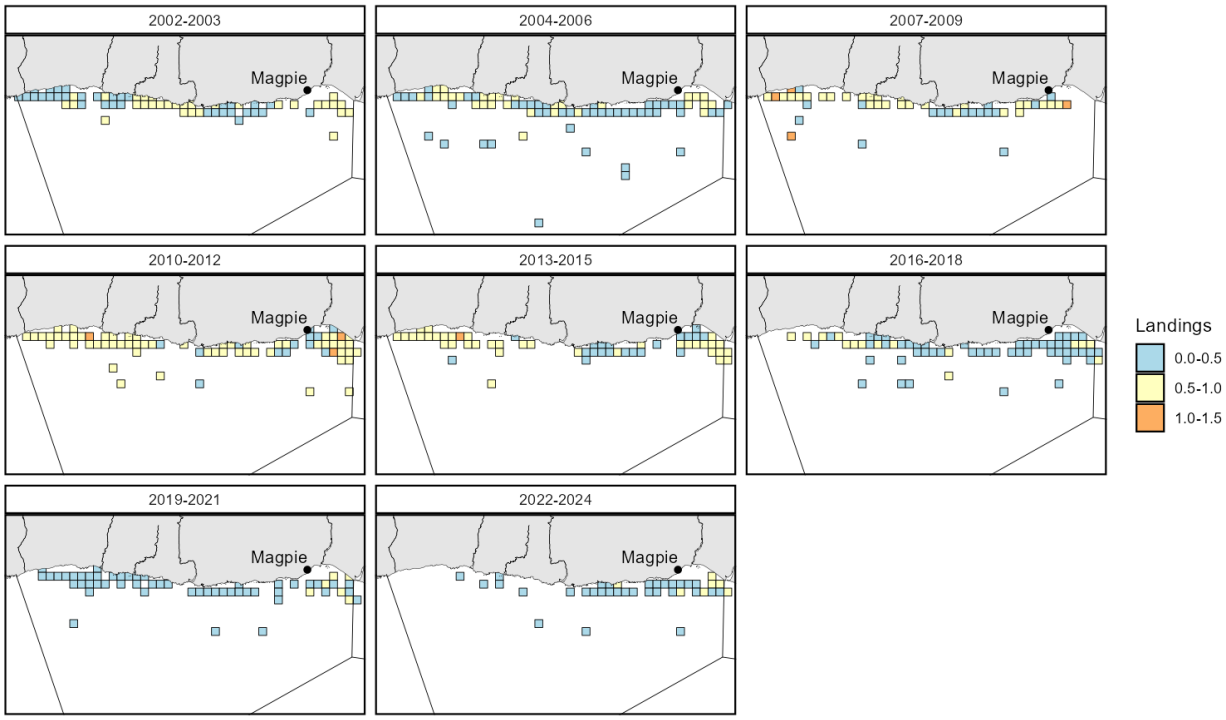


Figure 25. Spatiotemporal distribution of average landings (tons) in area 5.

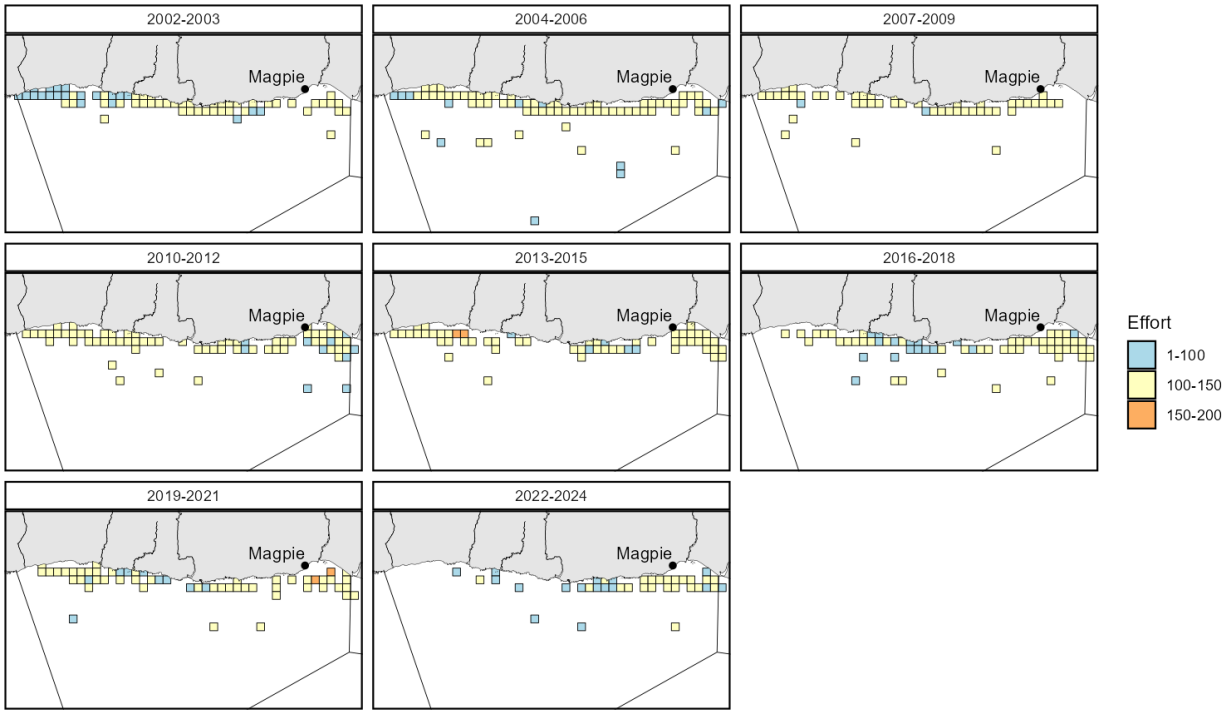


Figure 26. Spatiotemporal distribution of average effort (number of trap hauls) in area 5.

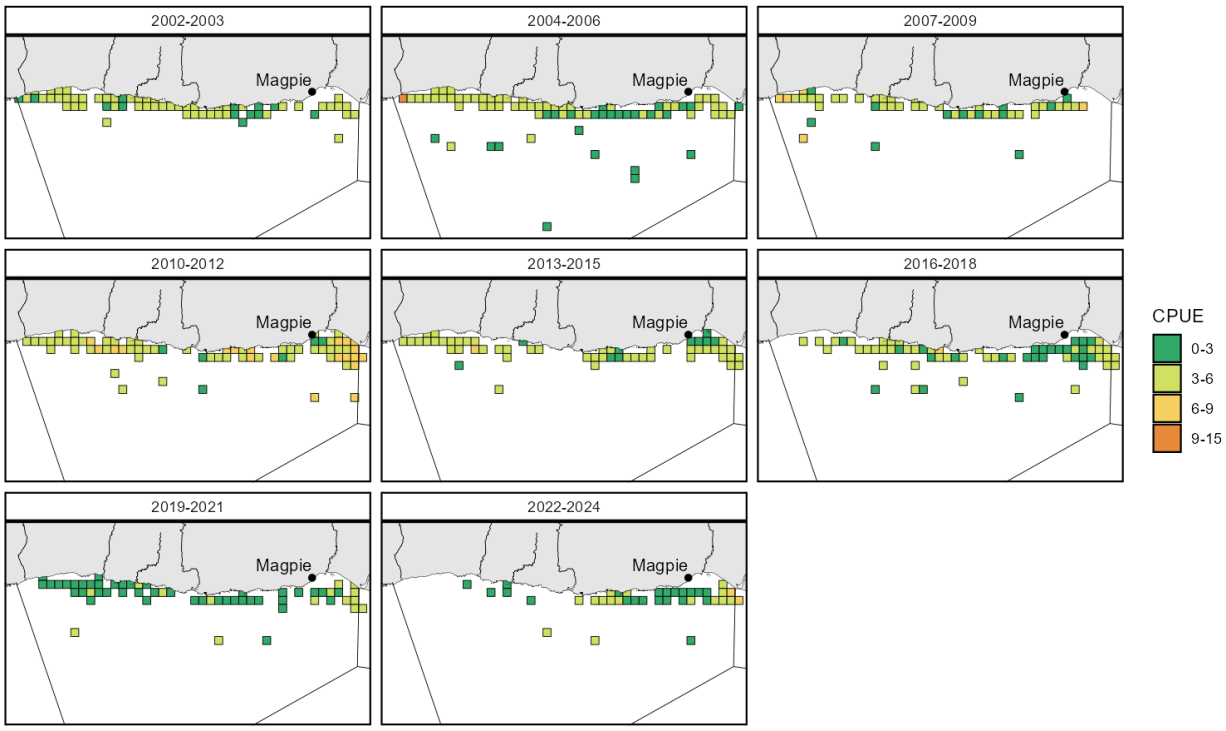


Figure 27. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 5.

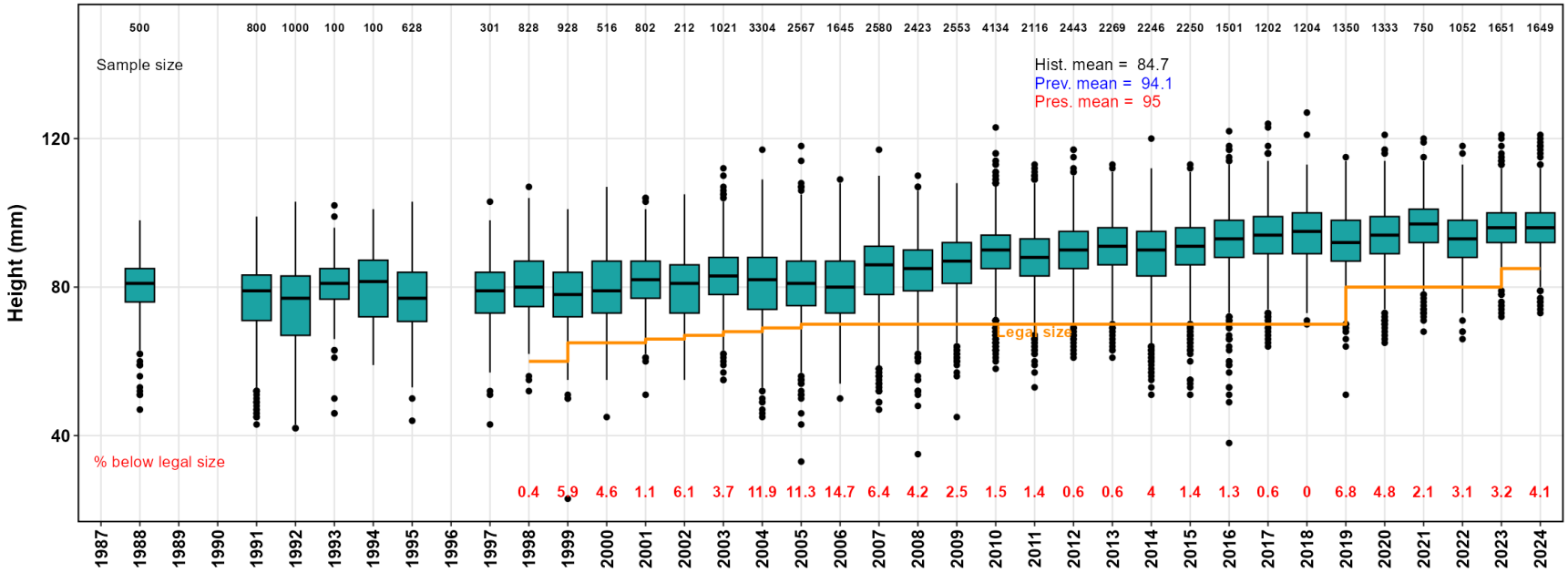


Figure 28. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 5. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

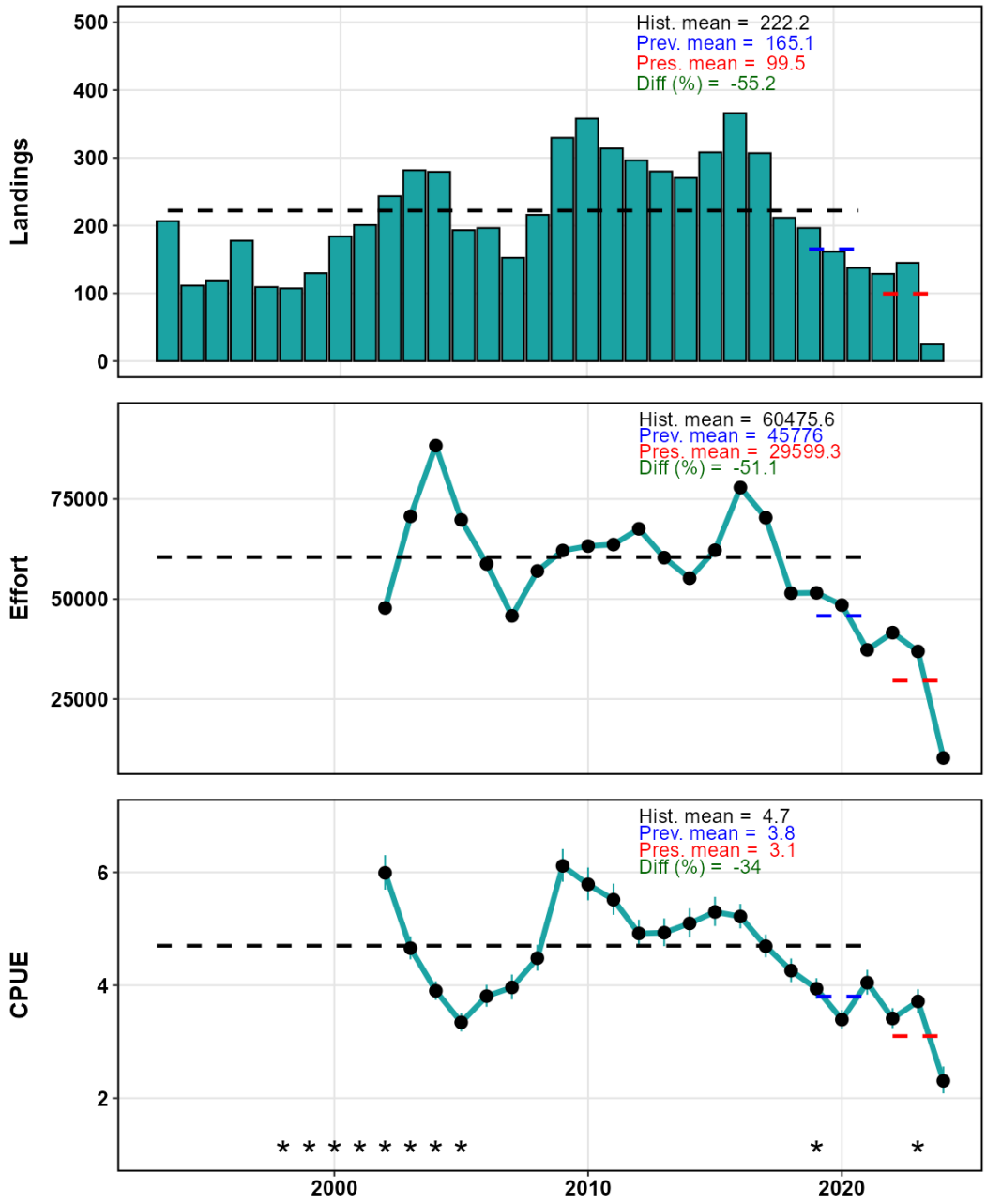


Figure 29. Status of the whelk stock in area 6, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

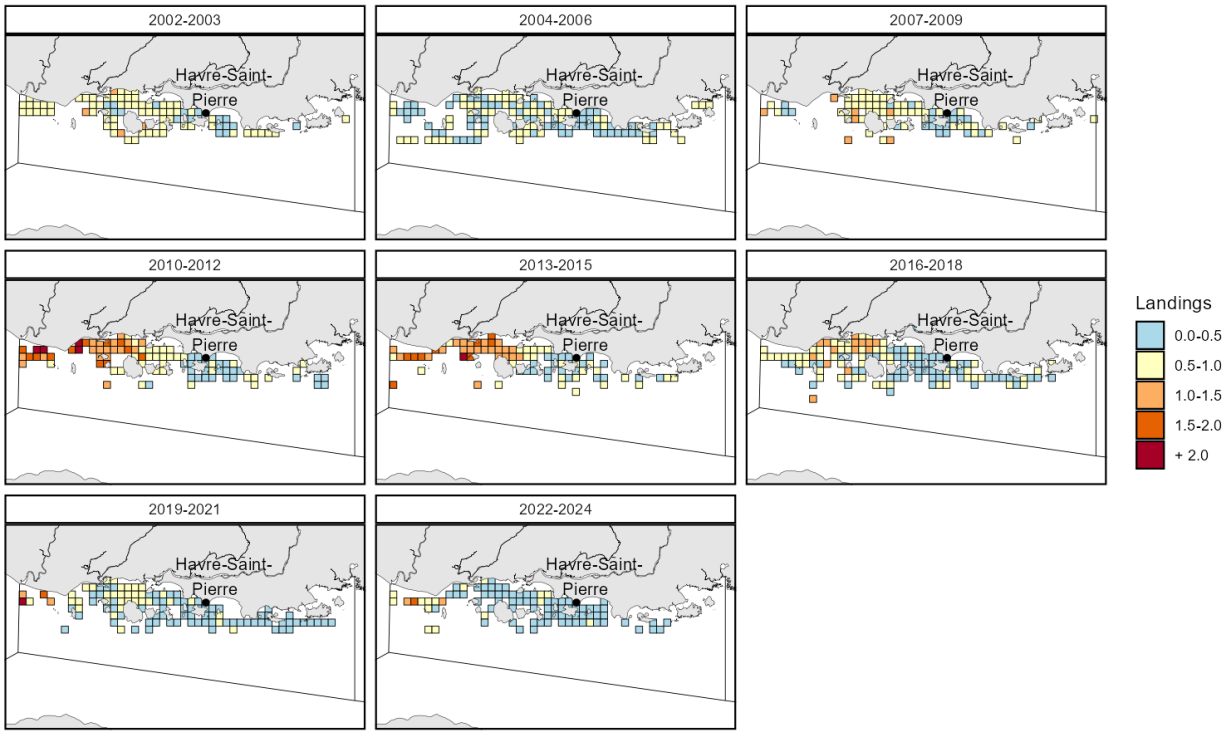


Figure 30. Spatiotemporal distribution of average landings (tons) in area 6.

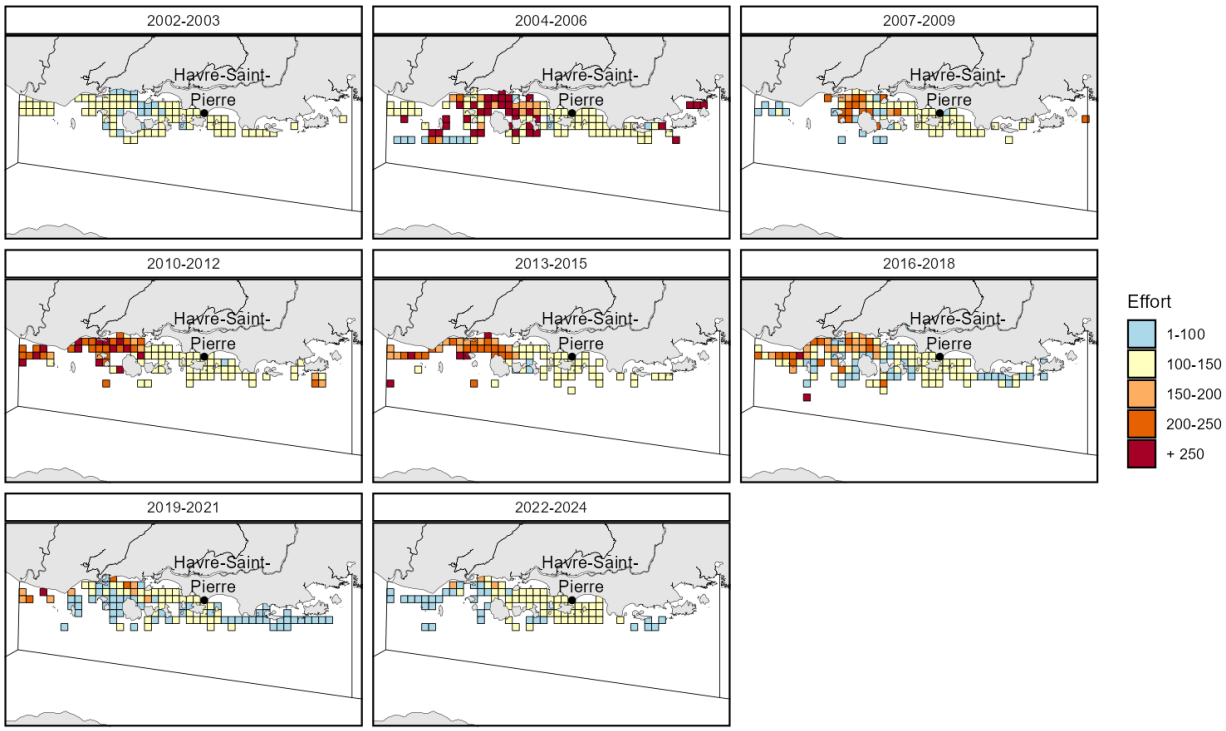


Figure 31. Spatiotemporal distribution of average effort (number of trap hauls) in area 6.

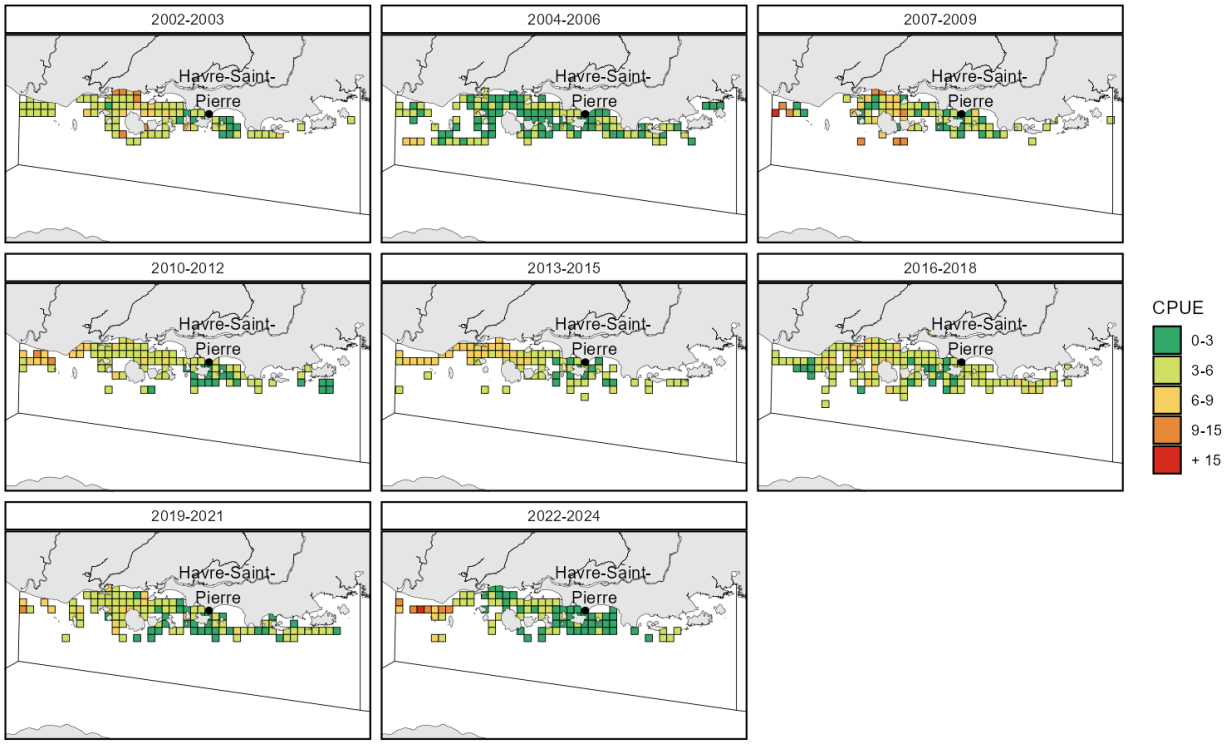


Figure 32. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 6.

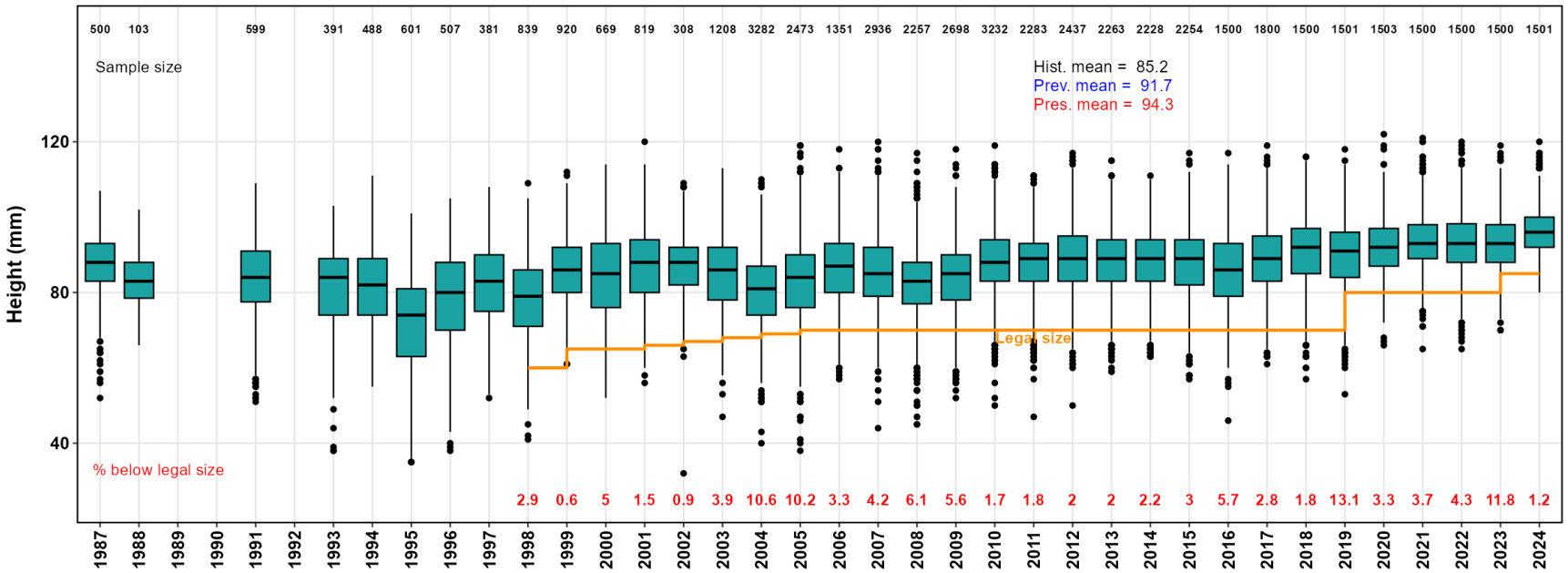


Figure 33. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 6. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

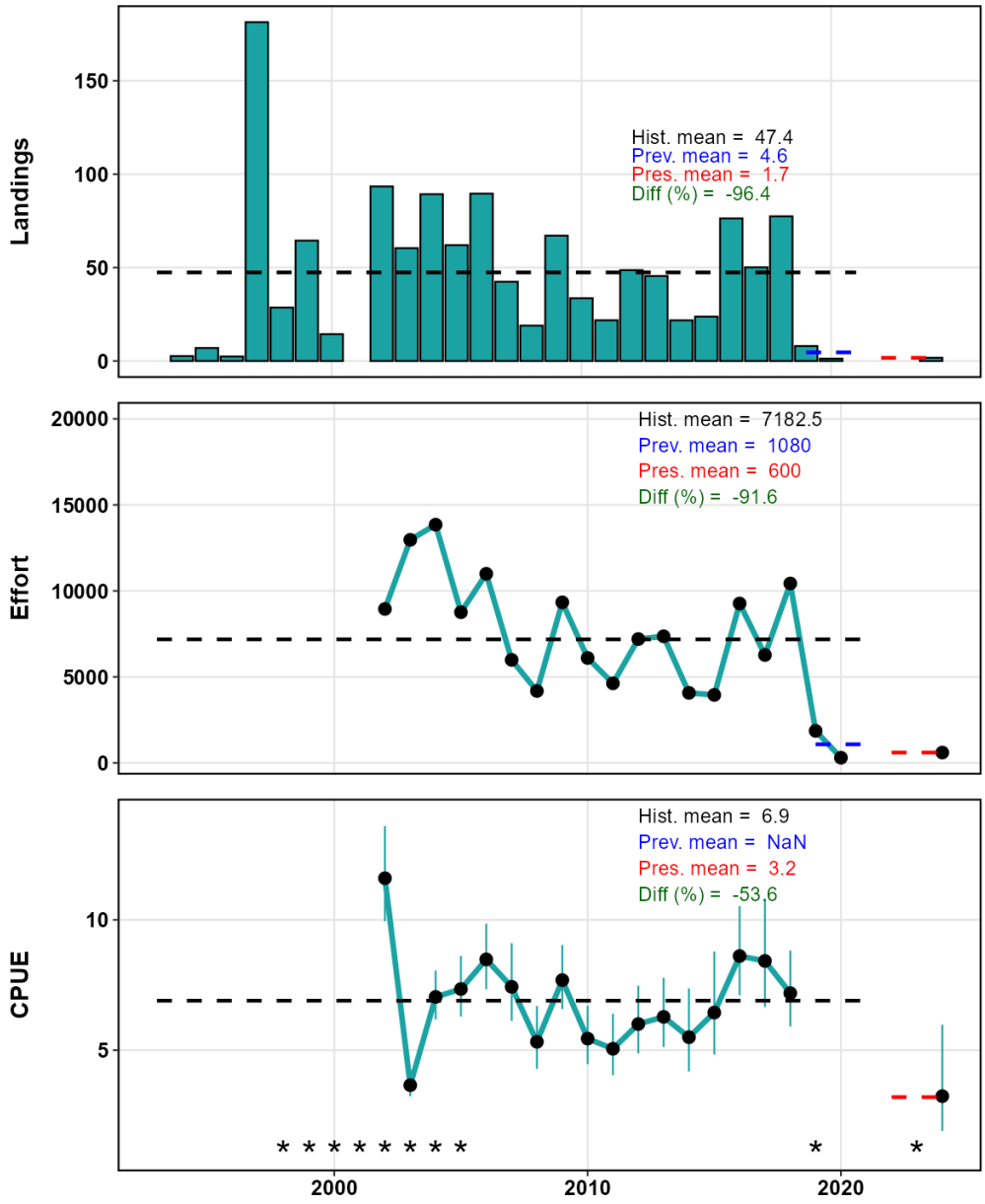


Figure 34. Status of the whelk stock in area 7, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

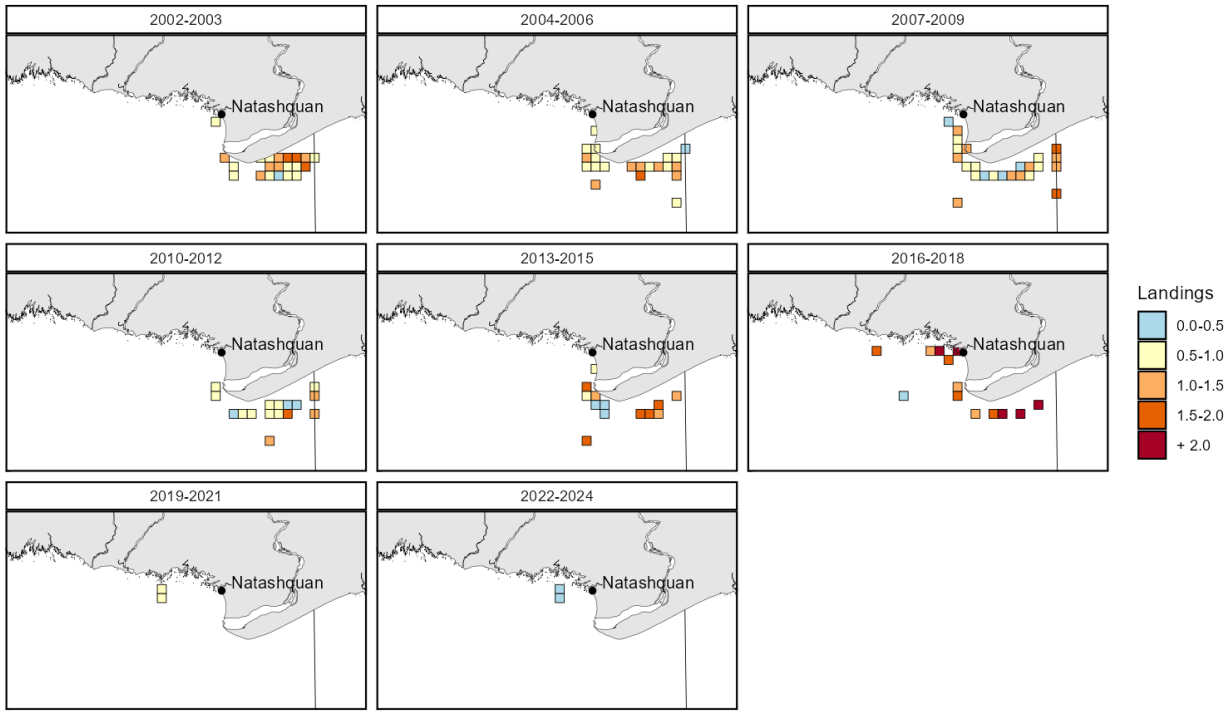


Figure 35. Spatiotemporal distribution of average landings (tons) in area 7.

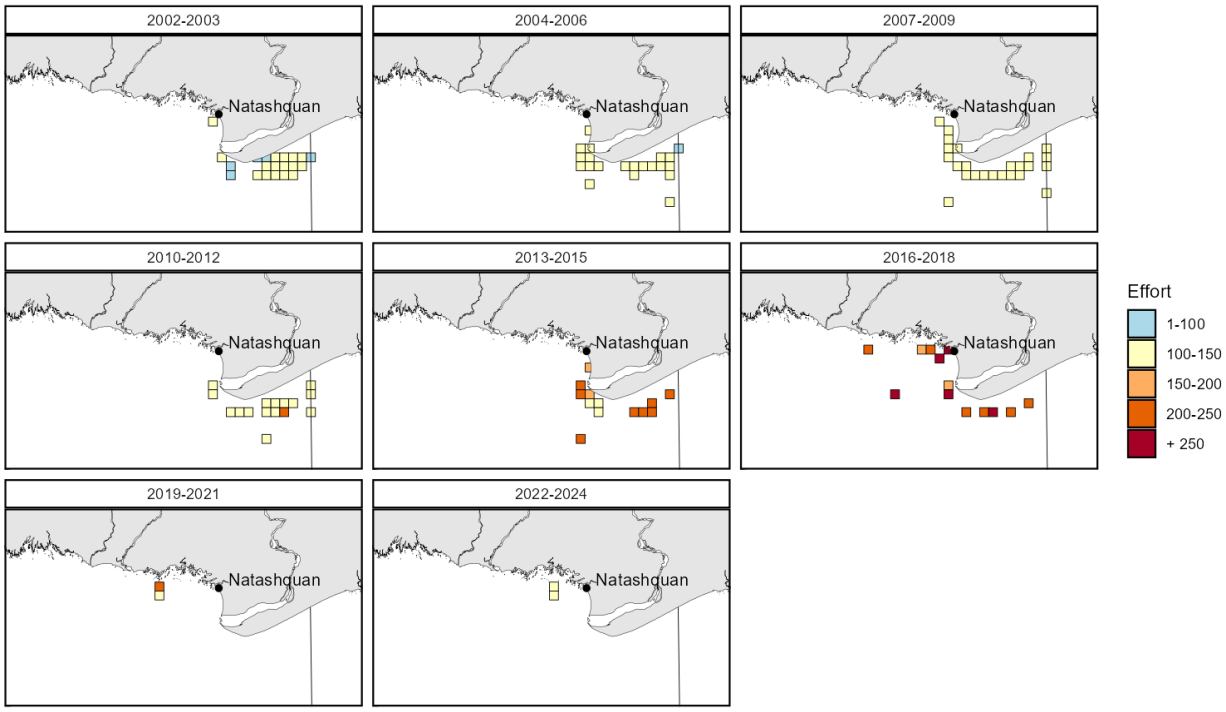


Figure 36. Spatiotemporal distribution of average effort (number of trap hauls) in area 7.

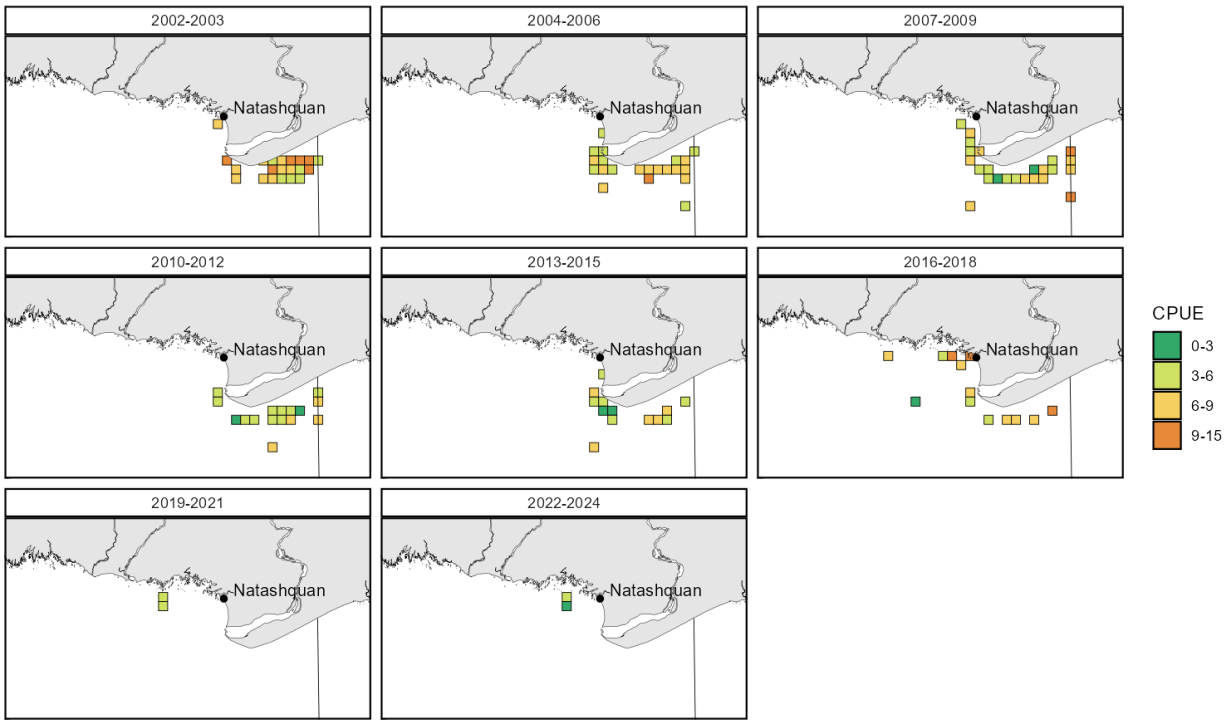


Figure 37. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 7.

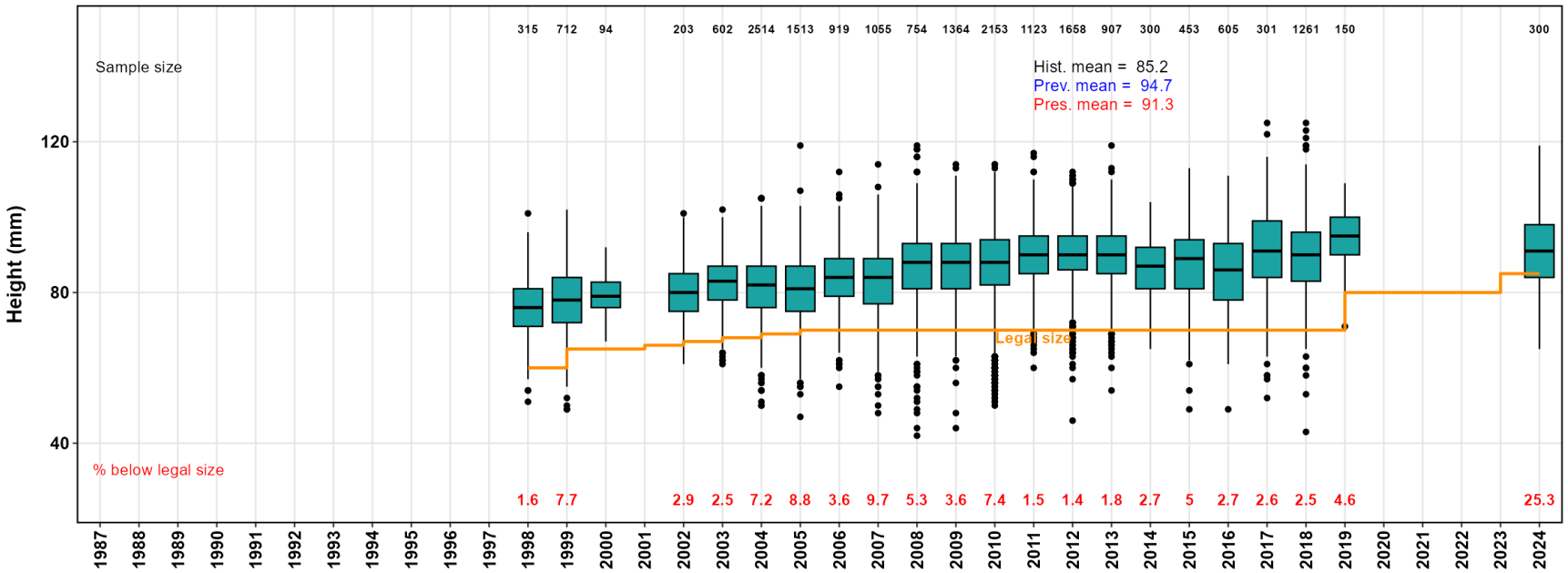


Figure 38. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 7. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

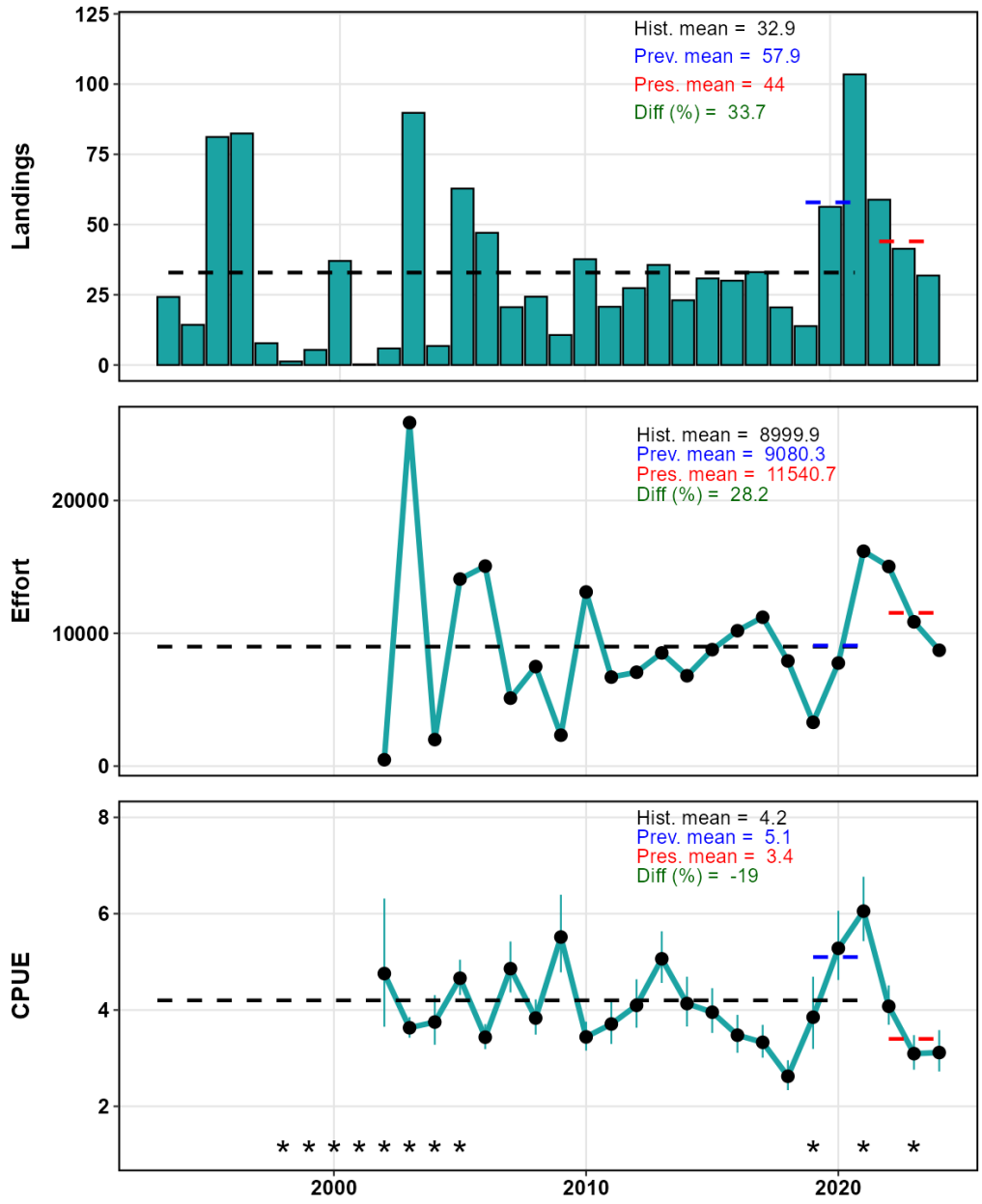


Figure 39. Status of the whelk stock in area 8, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines show the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

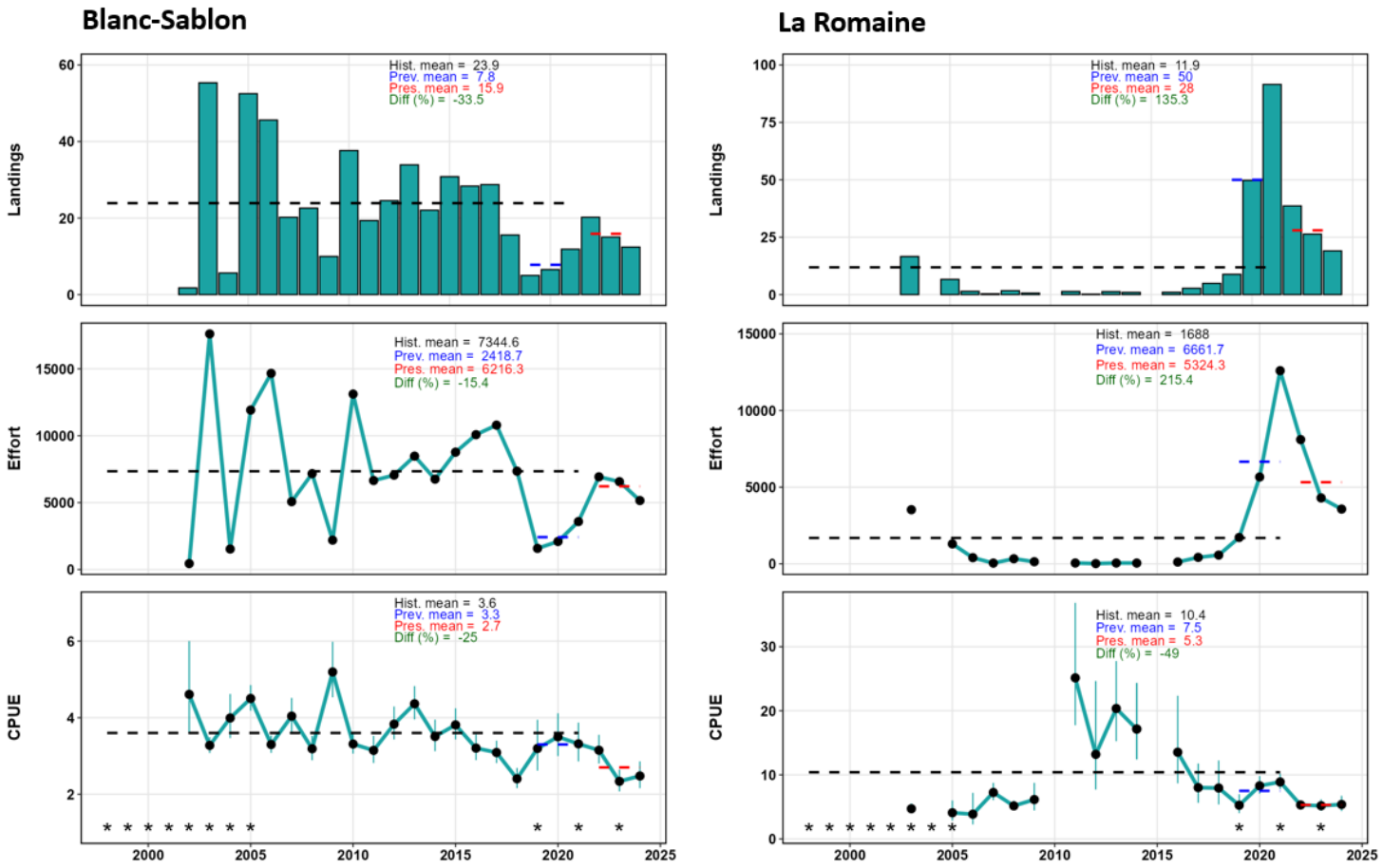


Figure 40. Status of the whelk stock at Blanc-Sablon (left side) and La Romaine (right side), including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

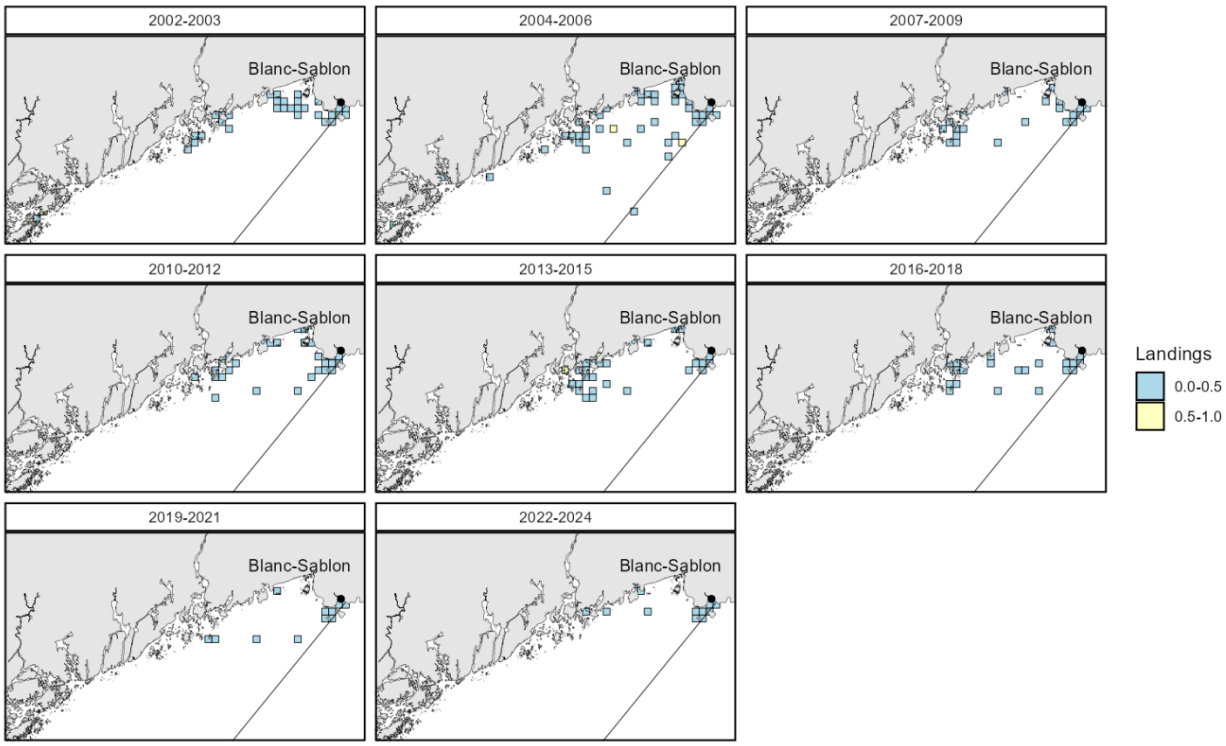


Figure 41. Spatiotemporal distribution of average landings (tons) at Blanc-Sablon in area 8.

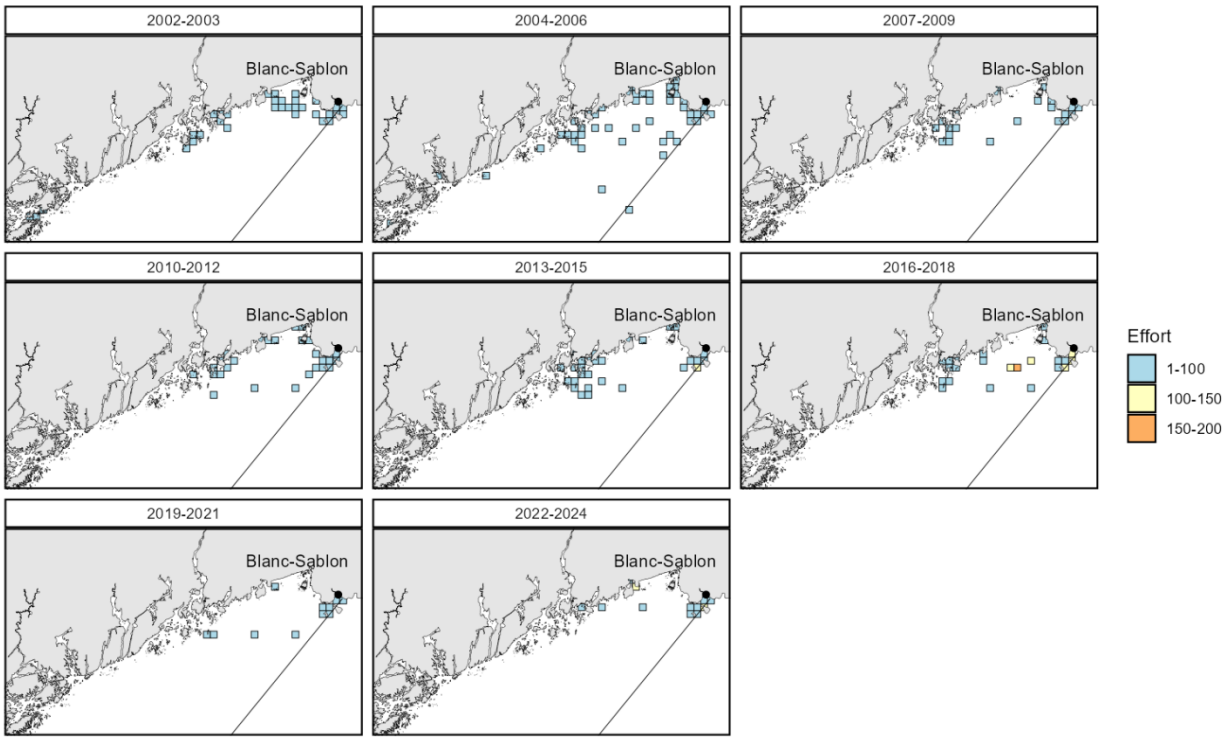


Figure 42. Spatiotemporal distribution of average effort (number of trap hauls) at Blanc-Sablon in area 8.

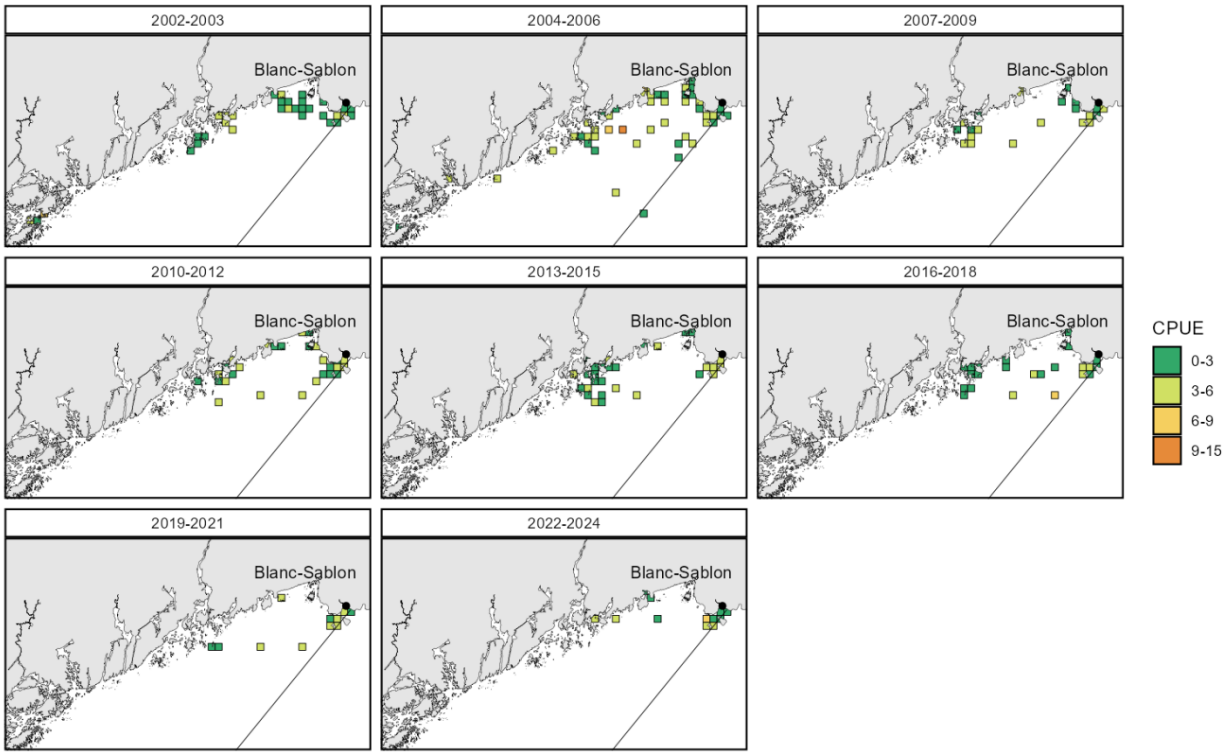


Figure 43. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) at Blanc-Sablon in area 8.

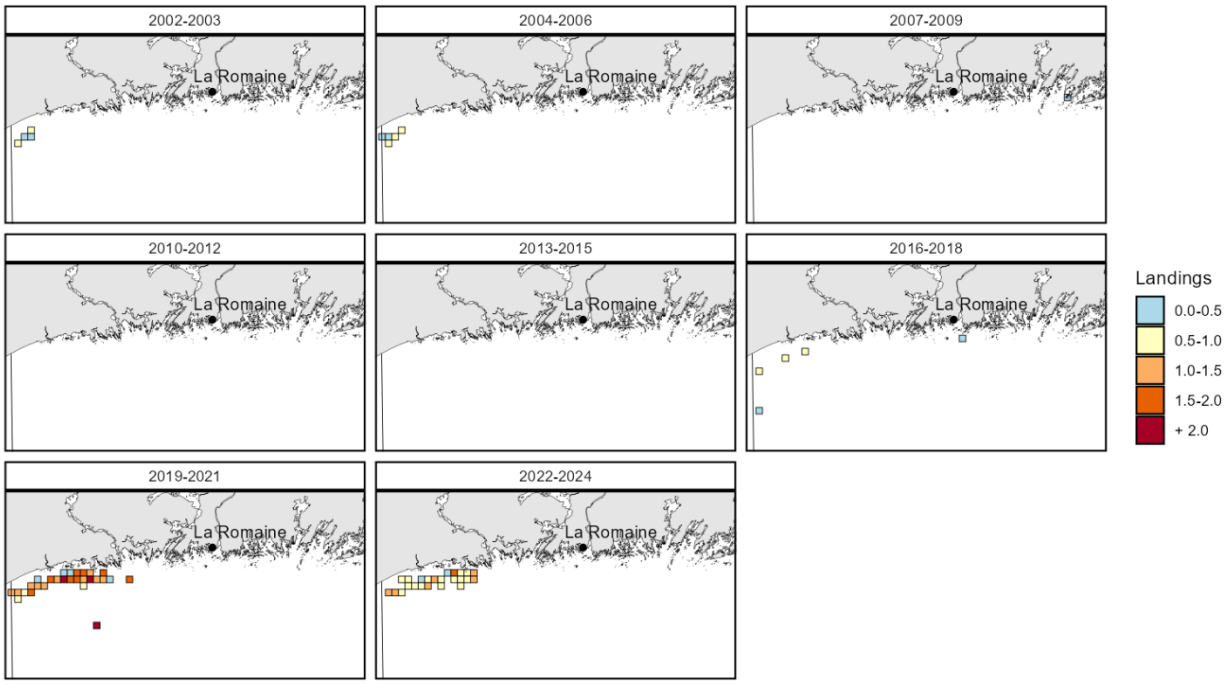


Figure 44. Spatiotemporal distribution of average landings (tons) at La Romaine in area 8.

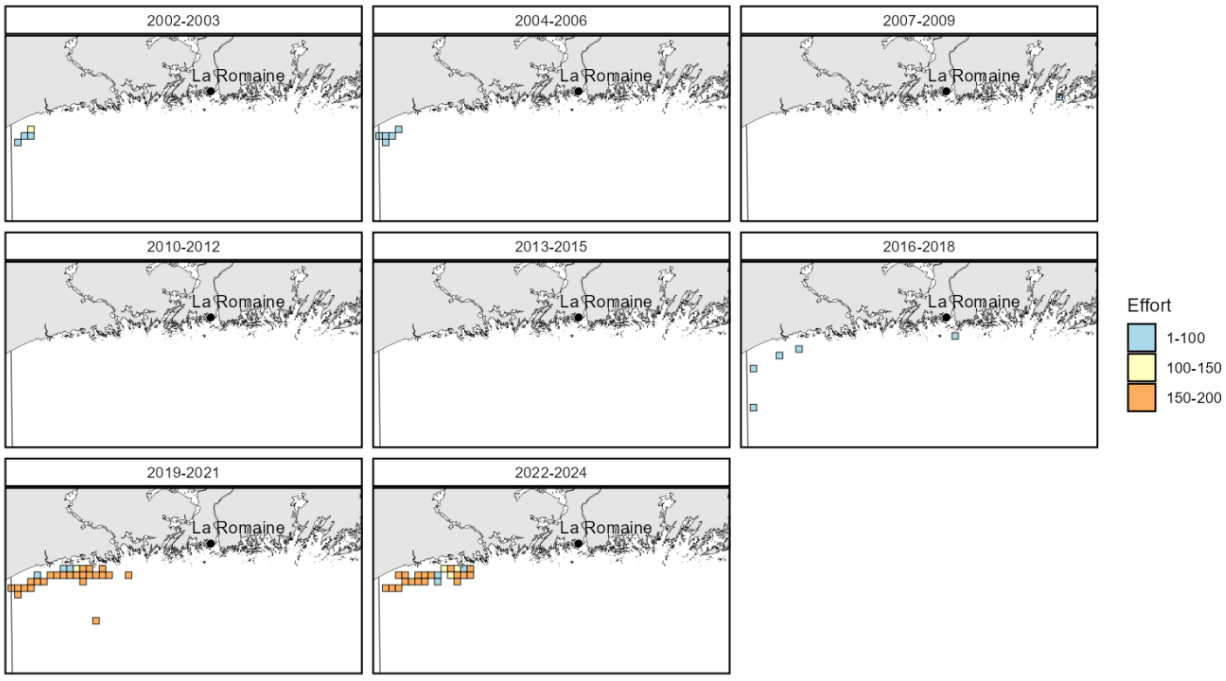


Figure 45. Spatiotemporal distribution of average effort (number of trap hauls) at La Romaine in area 8.

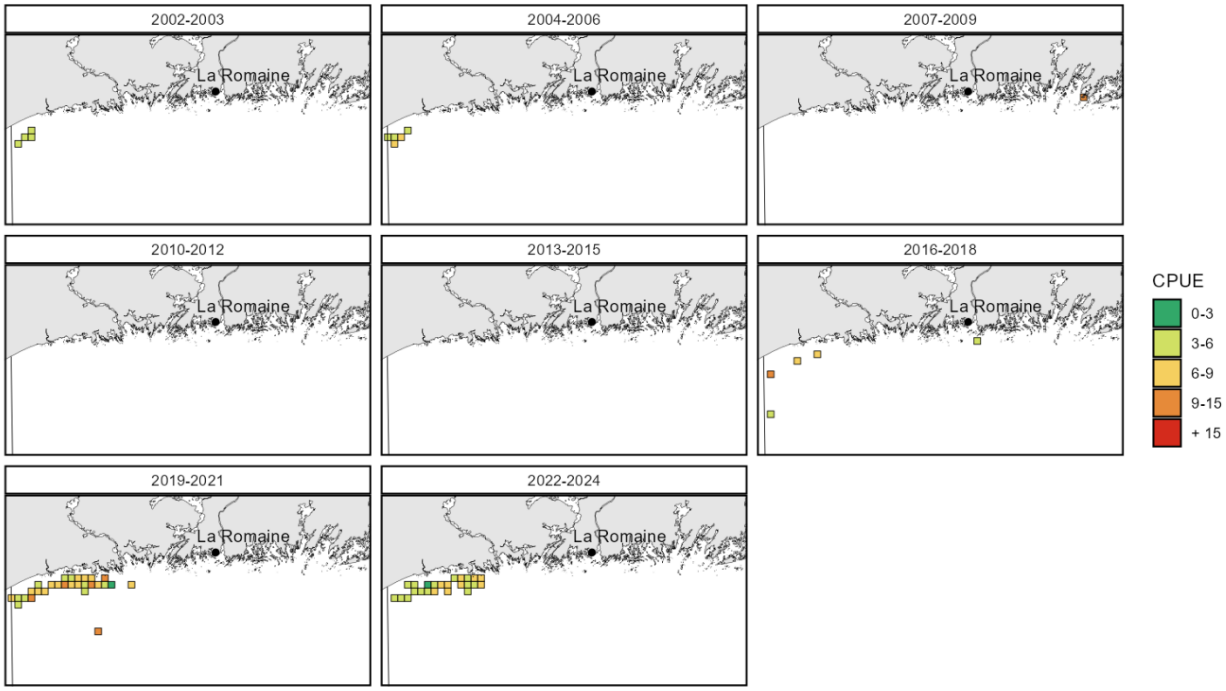


Figure 46. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) at La Romaine in area 8.

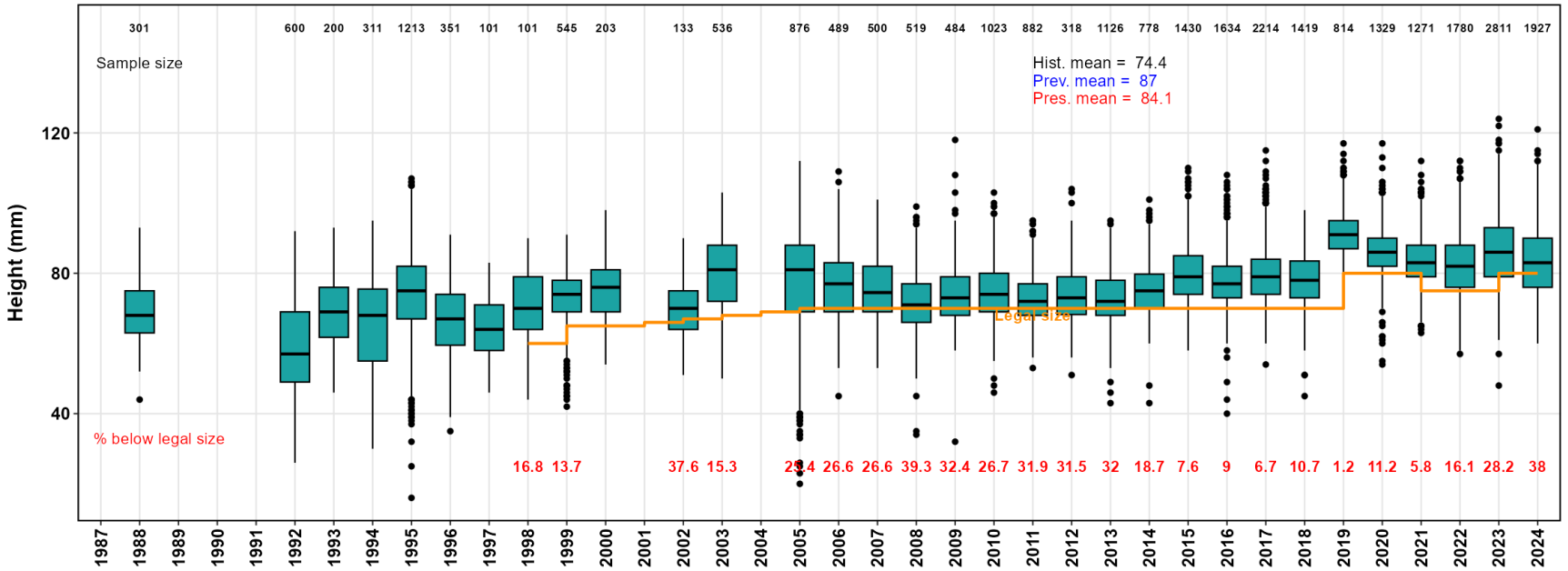


Figure 47. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in Blanc-Sablon in area 8. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

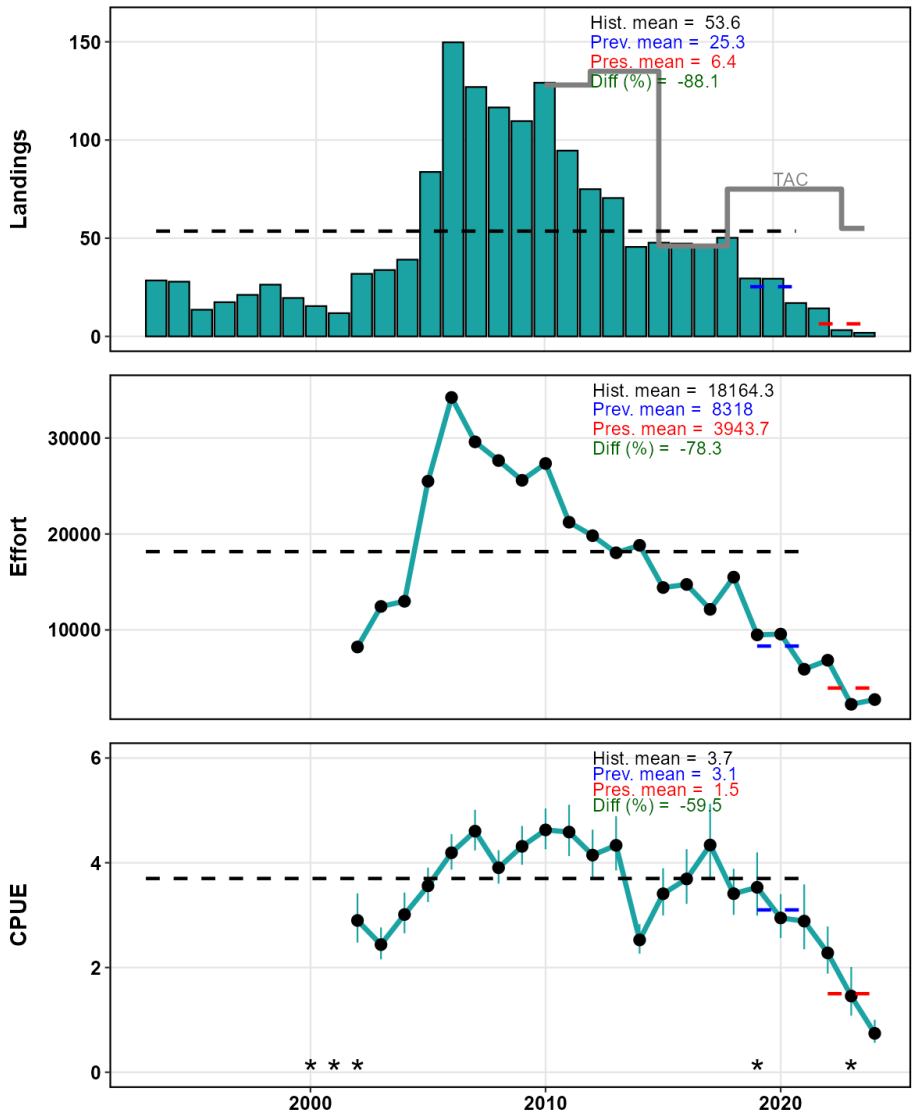


Figure 48. Status of the whelk stock in area 12, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

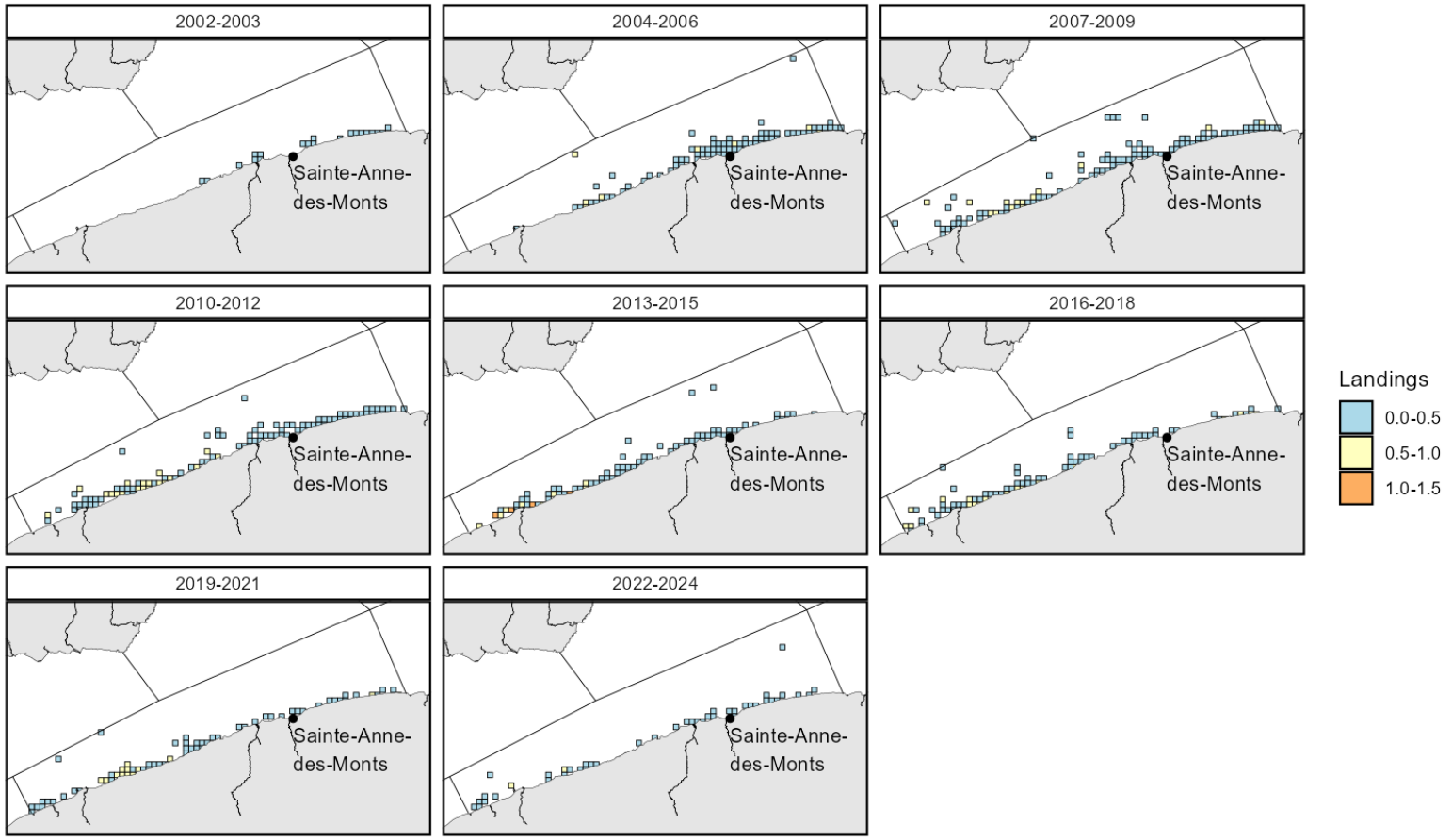


Figure 49. Spatiotemporal distribution of average landings (tons) in area 12.

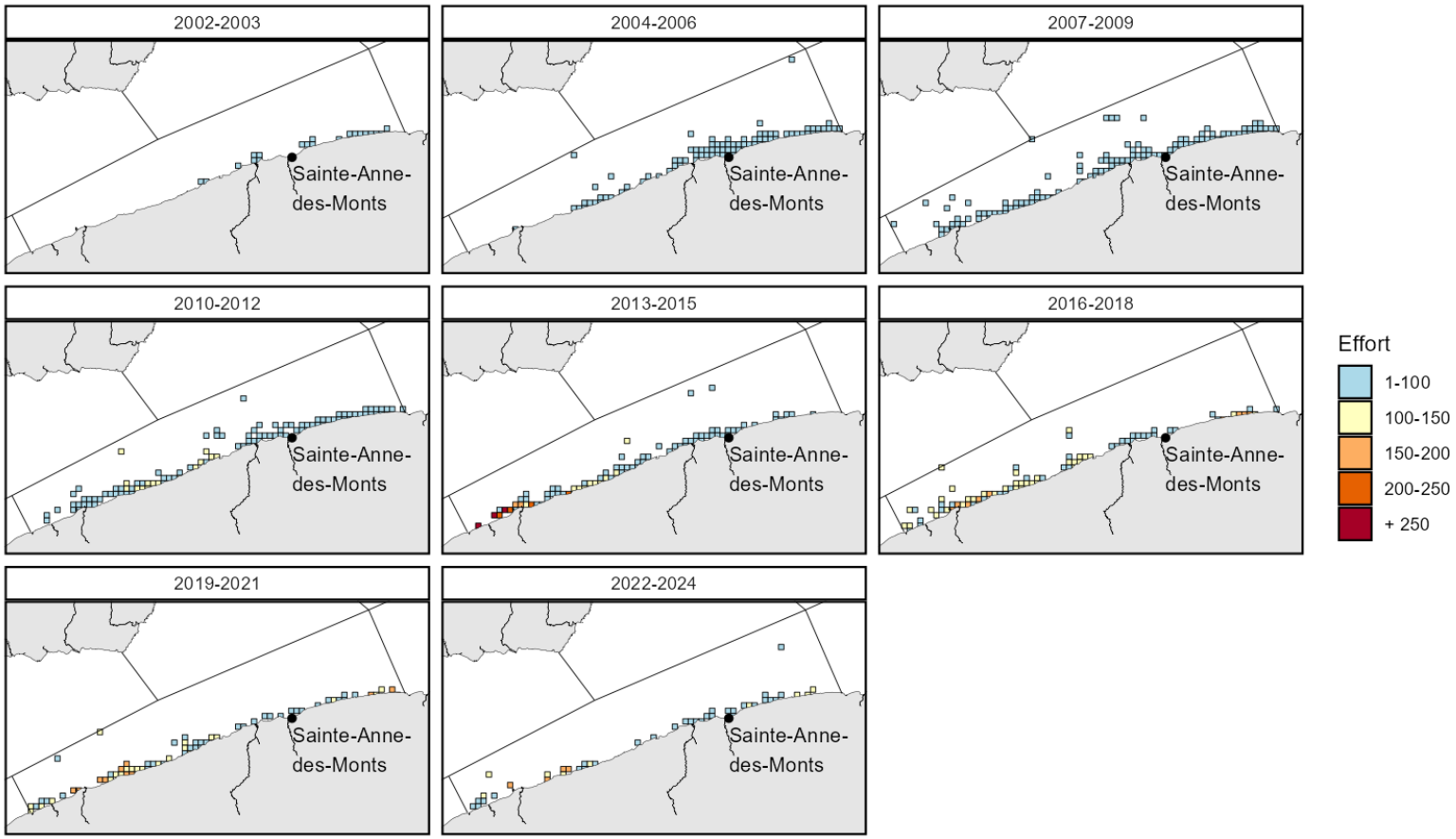


Figure 50. Spatiotemporal distribution of average effort (number of trap hauls) in area 12.

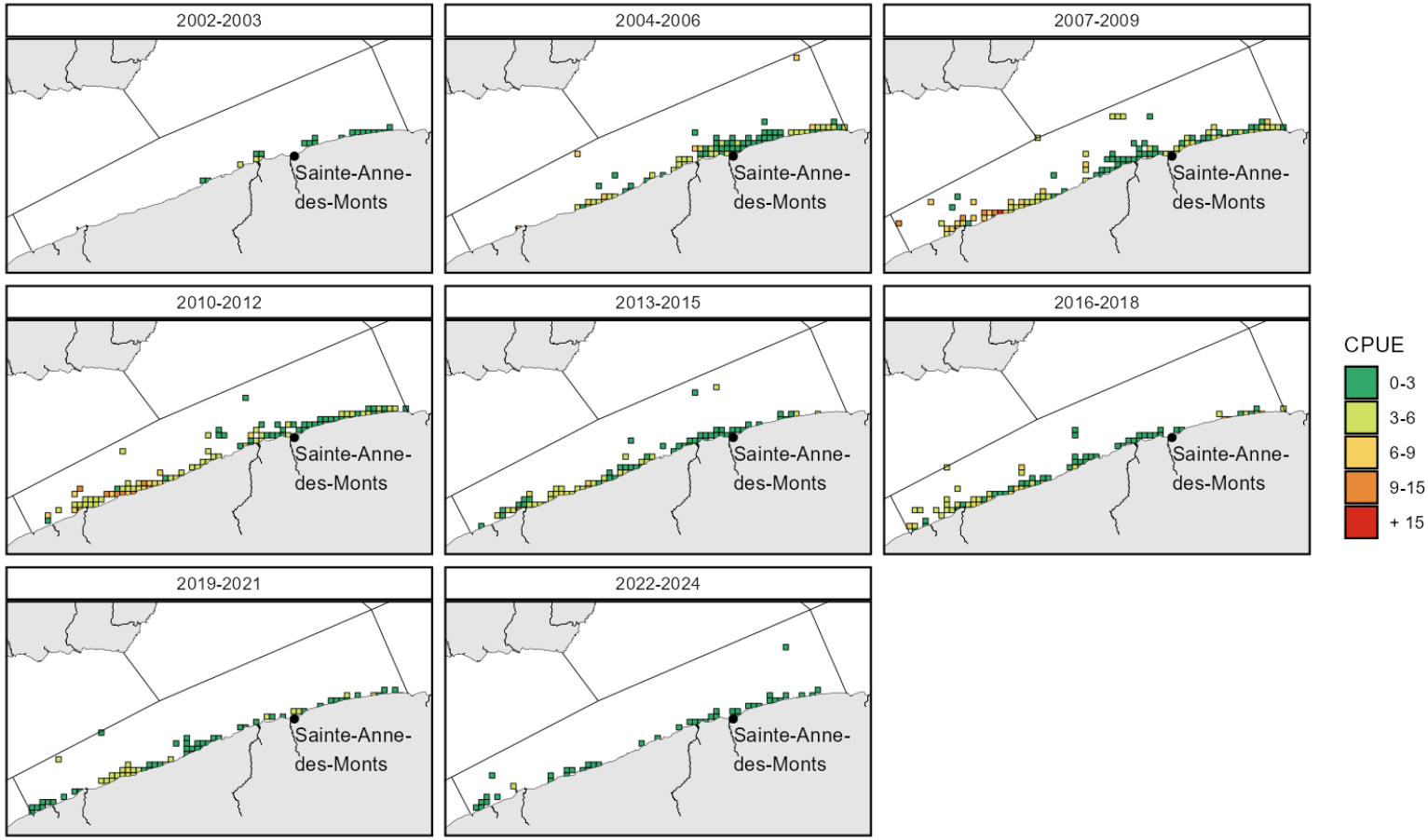


Figure 51. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 12.

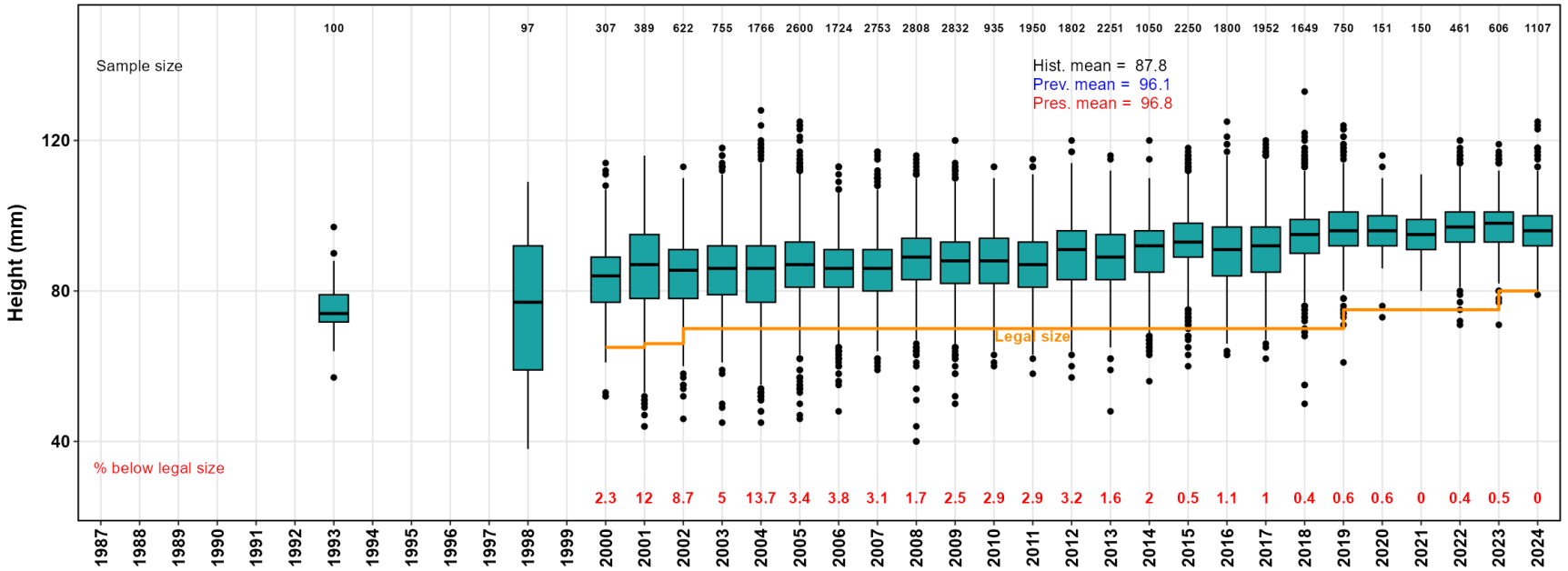


Figure 52. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 12. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows variations in the minimum legal size (mm) over time.

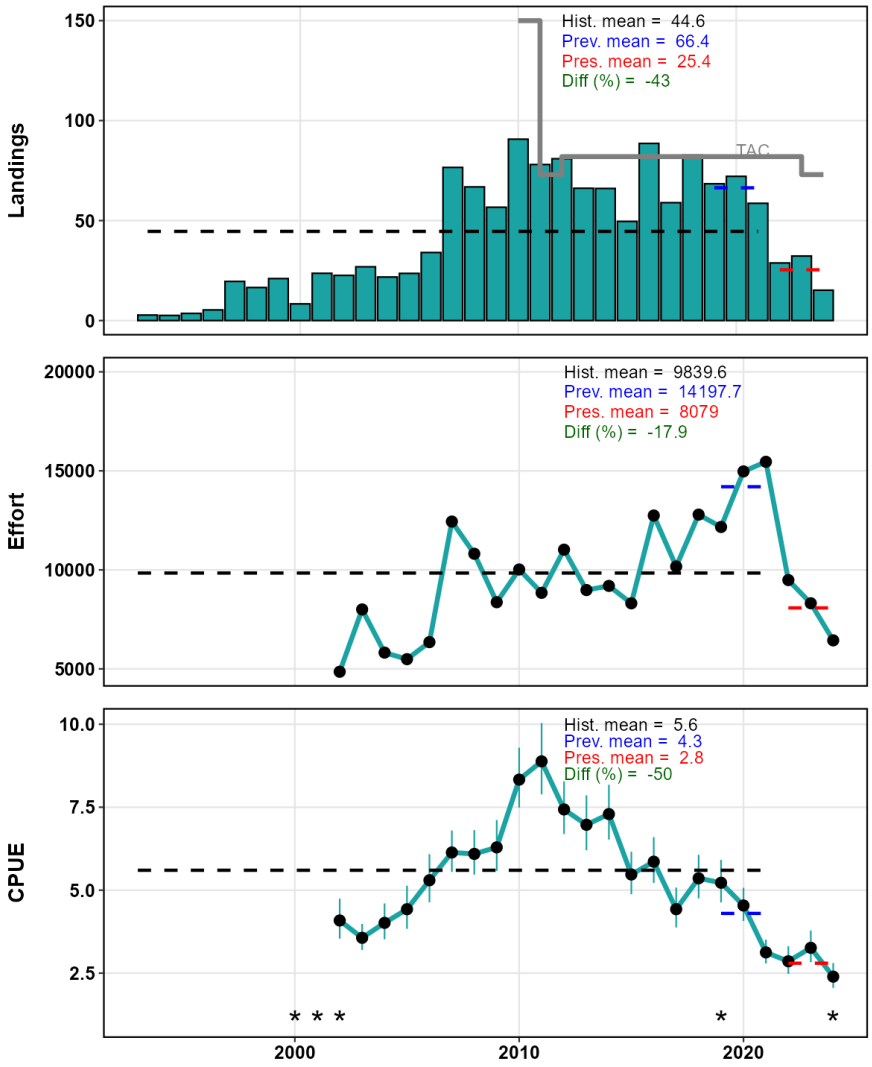


Figure 53. Status of the whelk stock in area 13, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

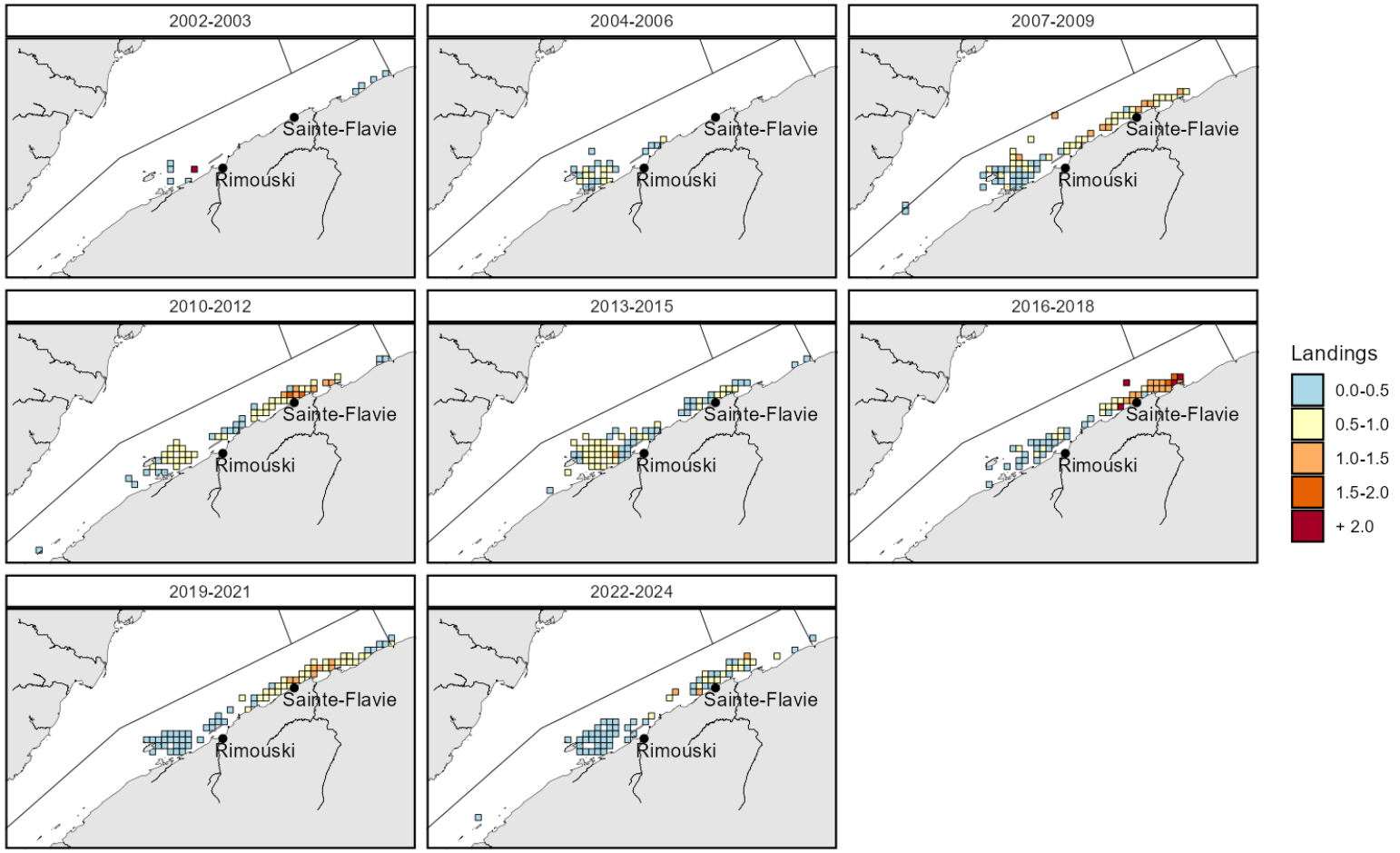


Figure 54. Spatiotemporal distribution of average landings (tons) in area 13.

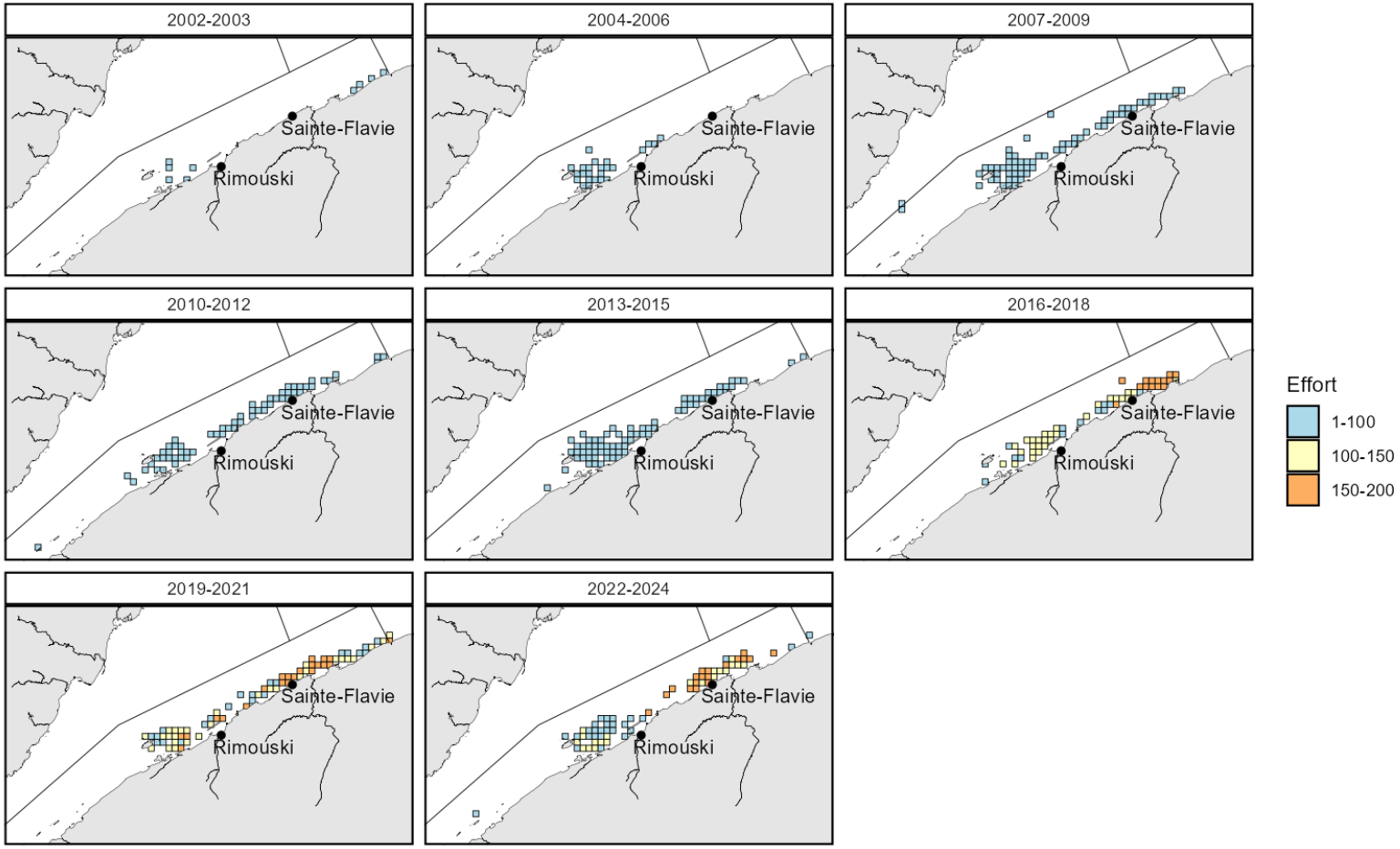


Figure 55. Spatiotemporal distribution of average effort (number of trap hauls) in area 13.

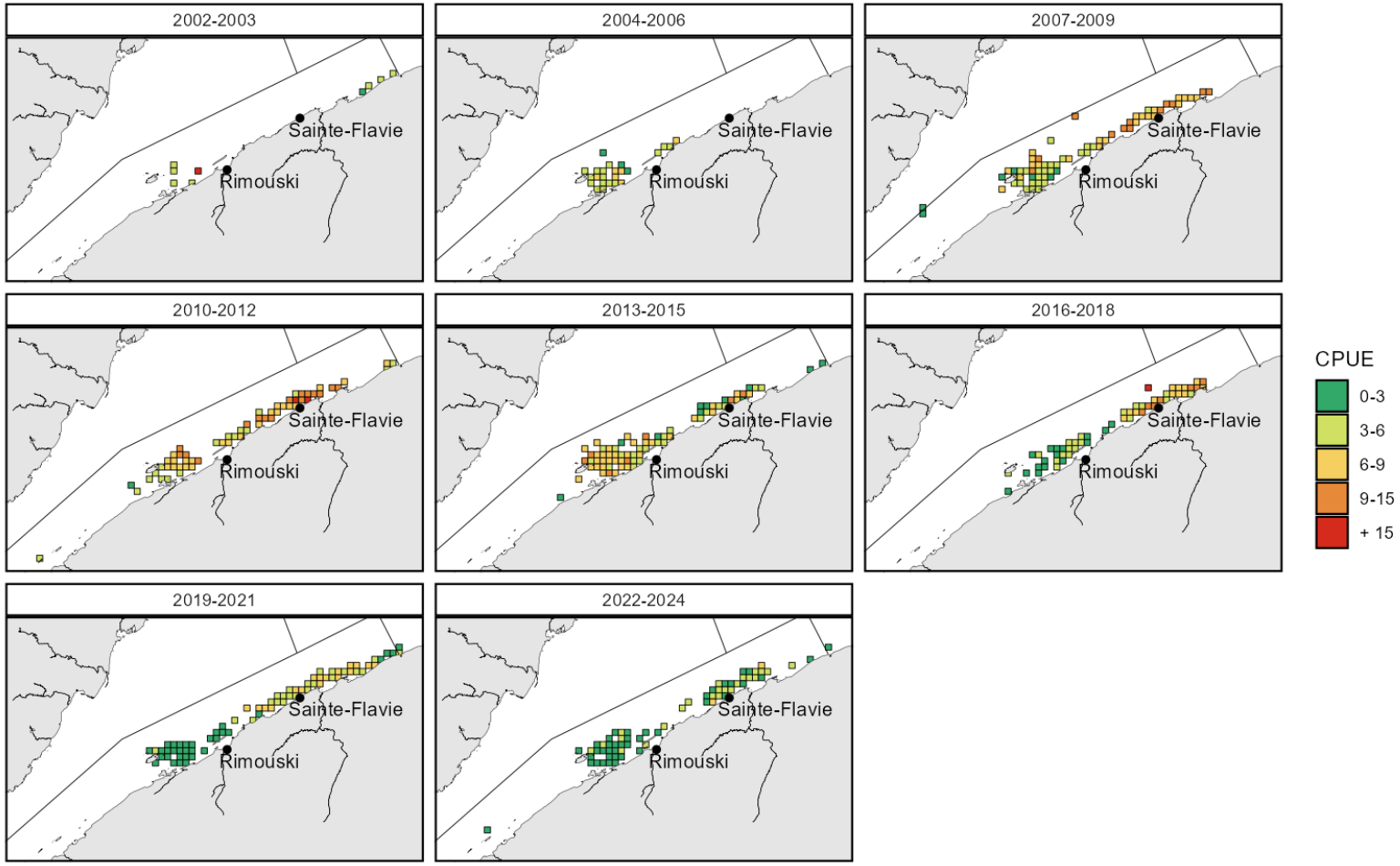


Figure 56. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 13.

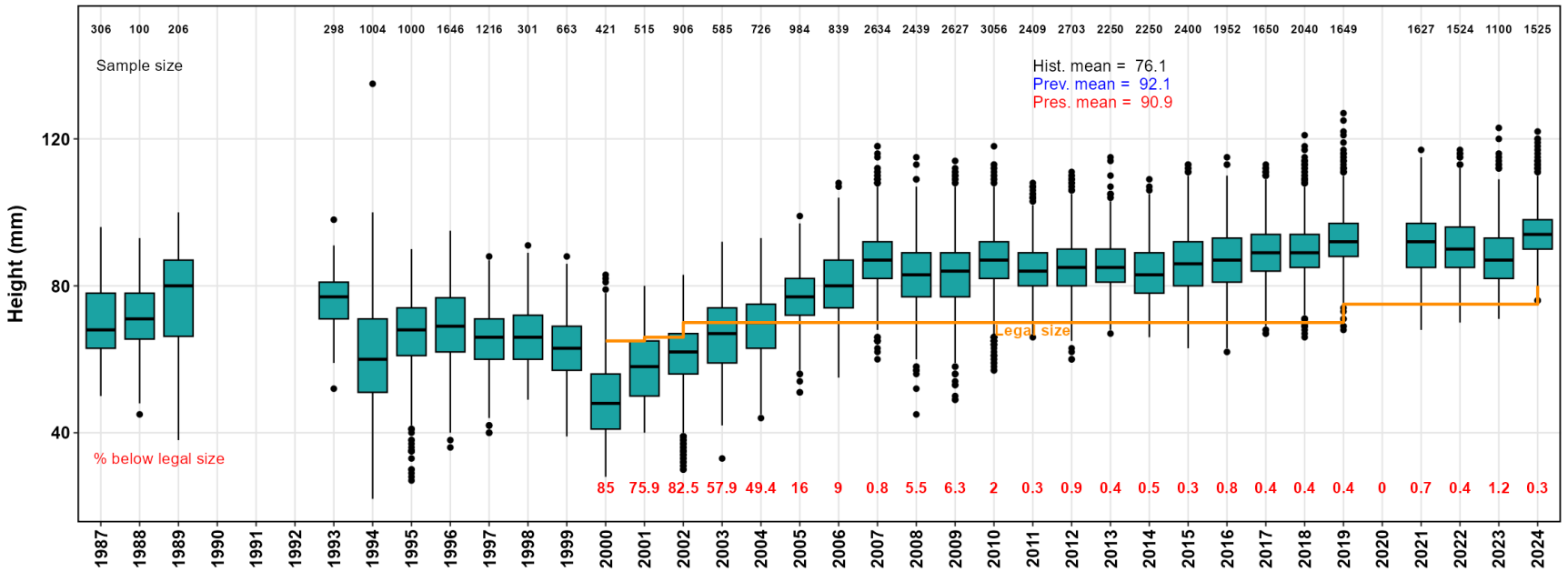


Figure 57. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 13. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows the variations in the minimum legal size (mm) over time.

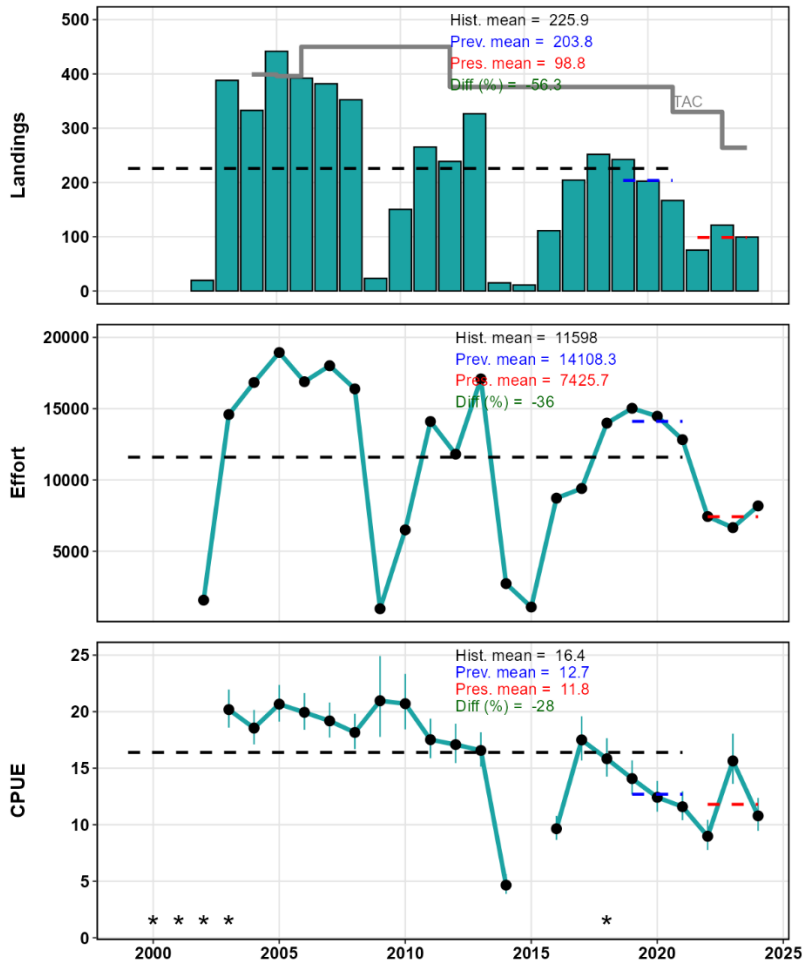


Figure 58. Status of the whelk stock in area 15, including annual landings (bars, tonnes), total allowable catch (TAC, solid line, tonnes) (top panel), effort (number of traps hauled) (middle panel) and mean standardized catch per unit effort (CPUE, kg/trap, ± confidence interval) from the commercial fishery (bottom panel). The different dashed lines indicate the historical mean (Hist. mean, in black), the mean for the previous assessment period (Prev. mean, in blue) and the mean for the current assessment period (Pres. mean, in red). The percentage difference (Diff) between the value for the current assessment period and the historical mean is shown in green type. Years in which there was a change in the minimum legal size are indicated by an asterisk (*).

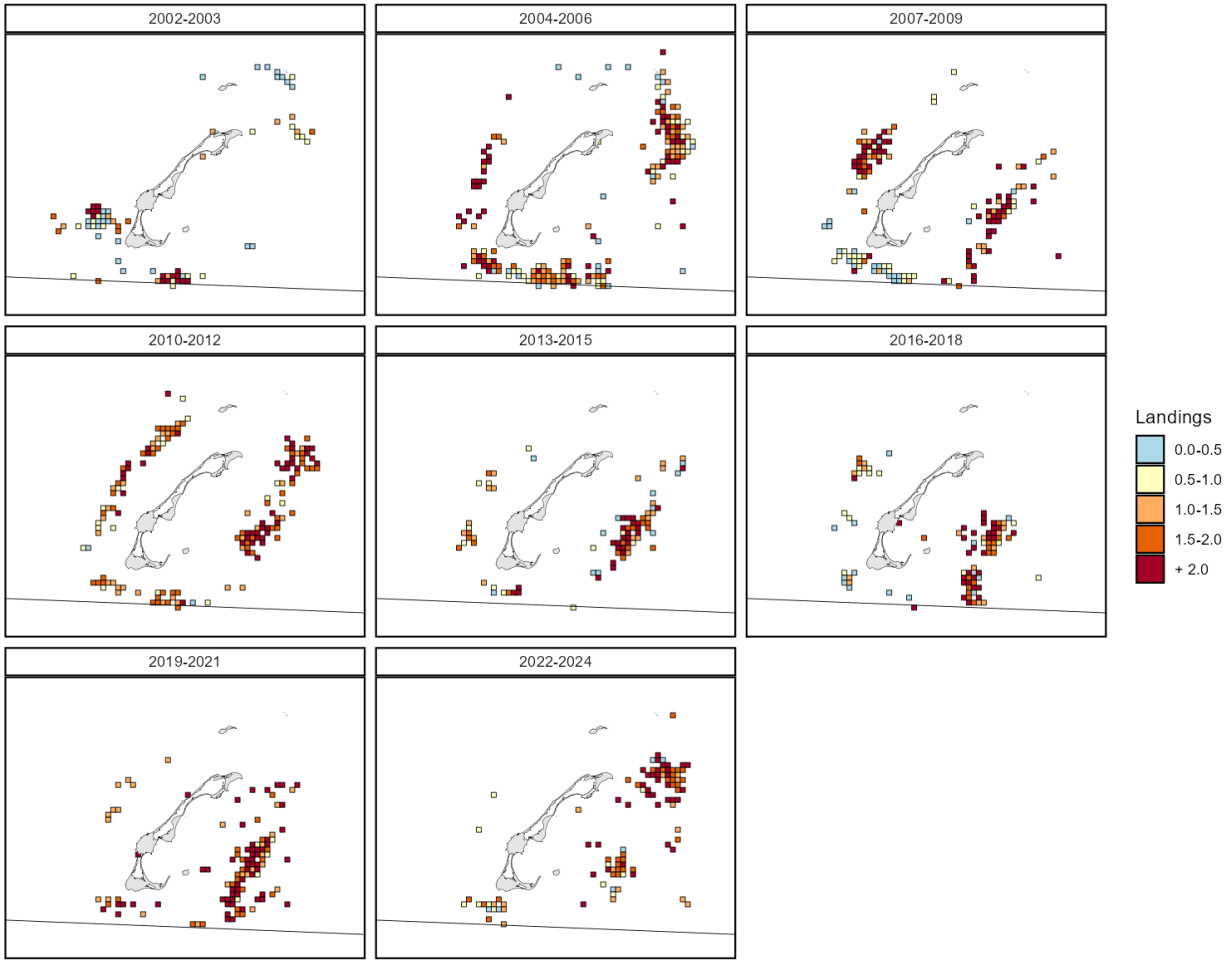


Figure 59. Spatiotemporal distribution of average landings (tons) in area 15 in the Magdalen Islands.

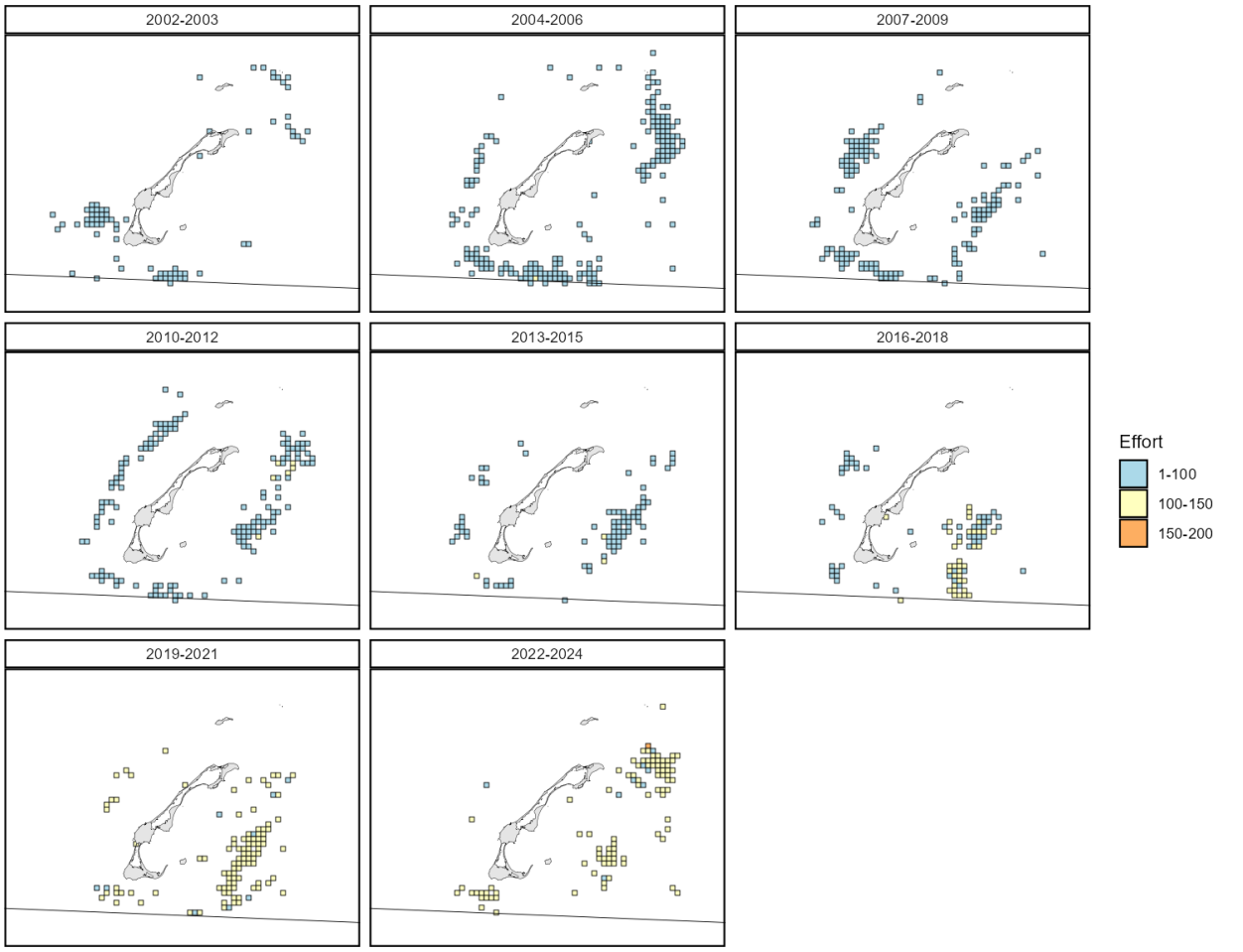


Figure 60. Spatiotemporal distribution of average effort (number of trap hauls) in area 15 in the Magdalen Islands.

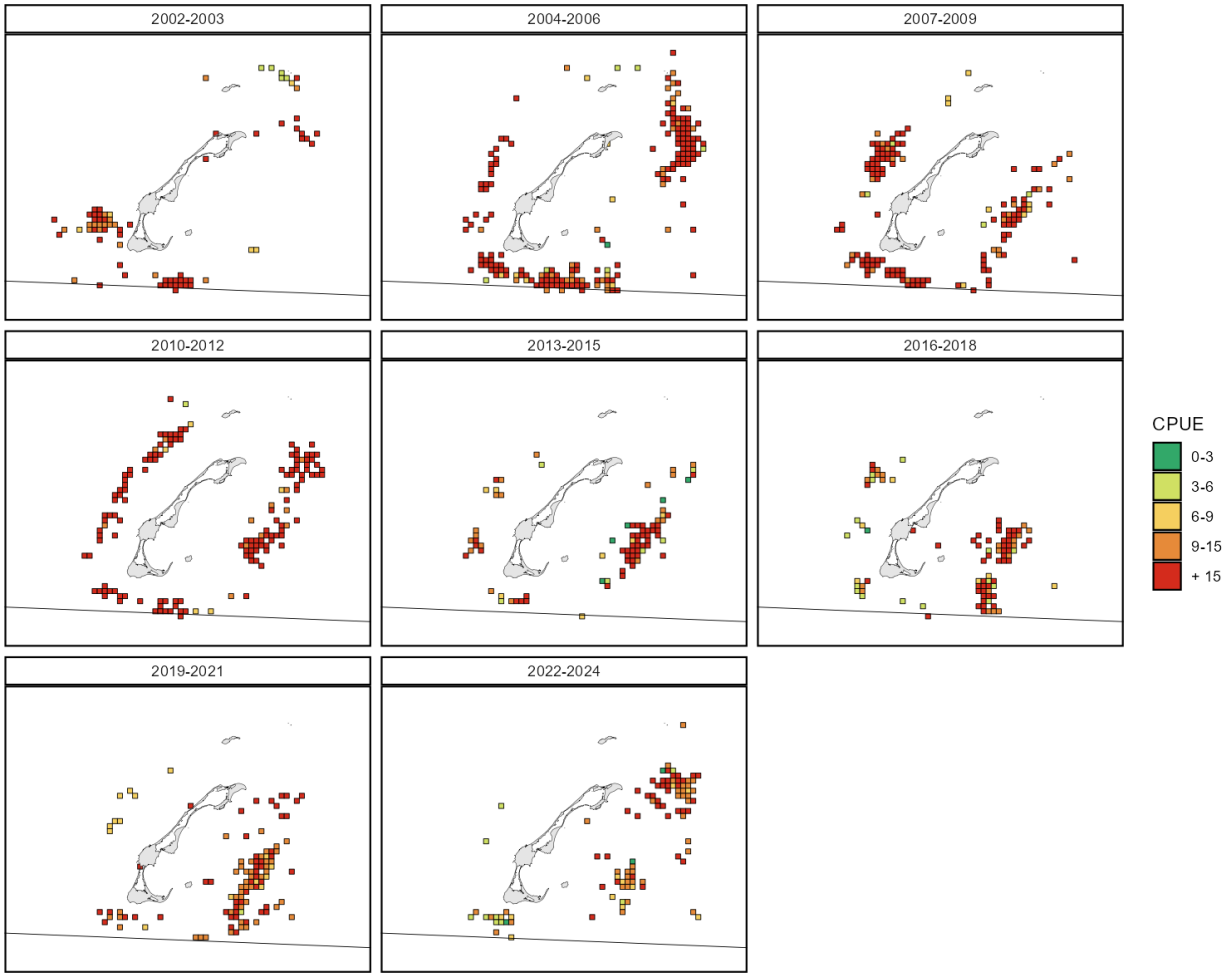


Figure 61. Spatiotemporal distribution of average non-standardized catch per unit effort (CPUE, kg/trap) in area 15 in the Magdalen Islands.

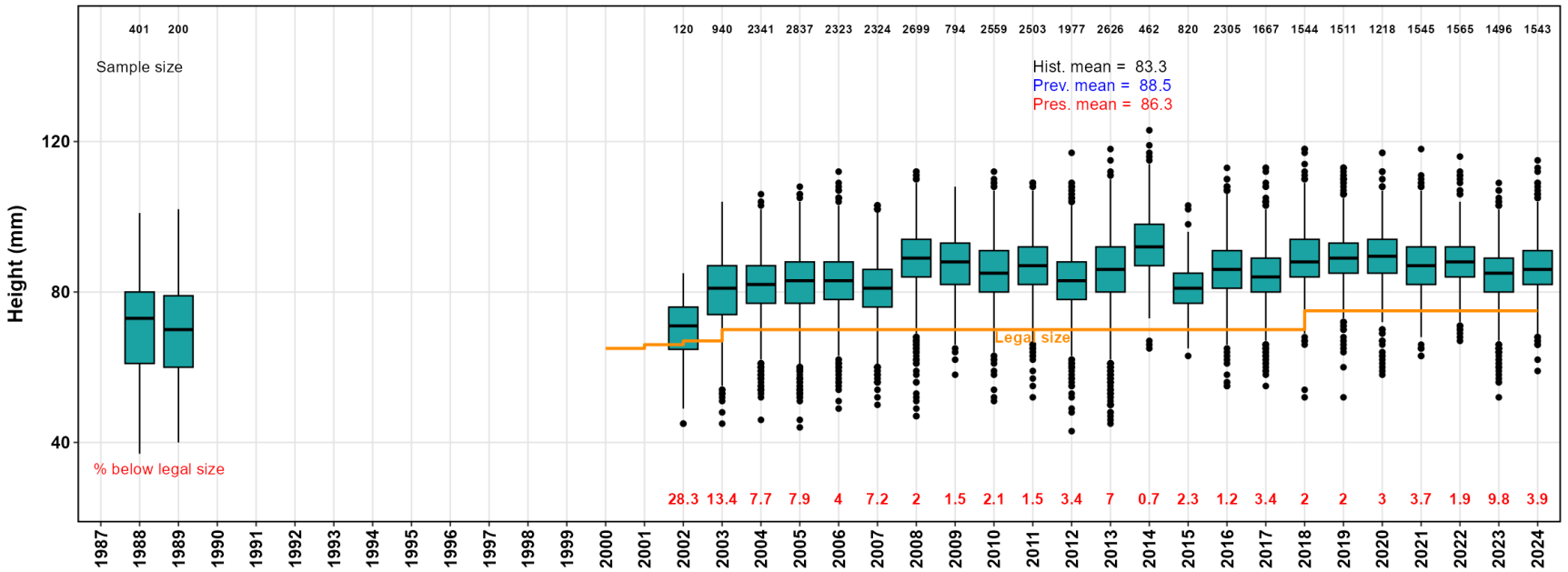


Figure 62. Temporal variation in shell heights (mm), the proportions of sub-legal-size whelk and the numbers of whelk measured in the commercial fishery in area 15. The historical mean (Hist. mean) is shown in black, the mean for the previous assessment period (Prev. mean) in blue, and the mean for the current assessment period (Pres. mean) in red. The solid orange line shows the variations in the minimum legal size (mm) over time.

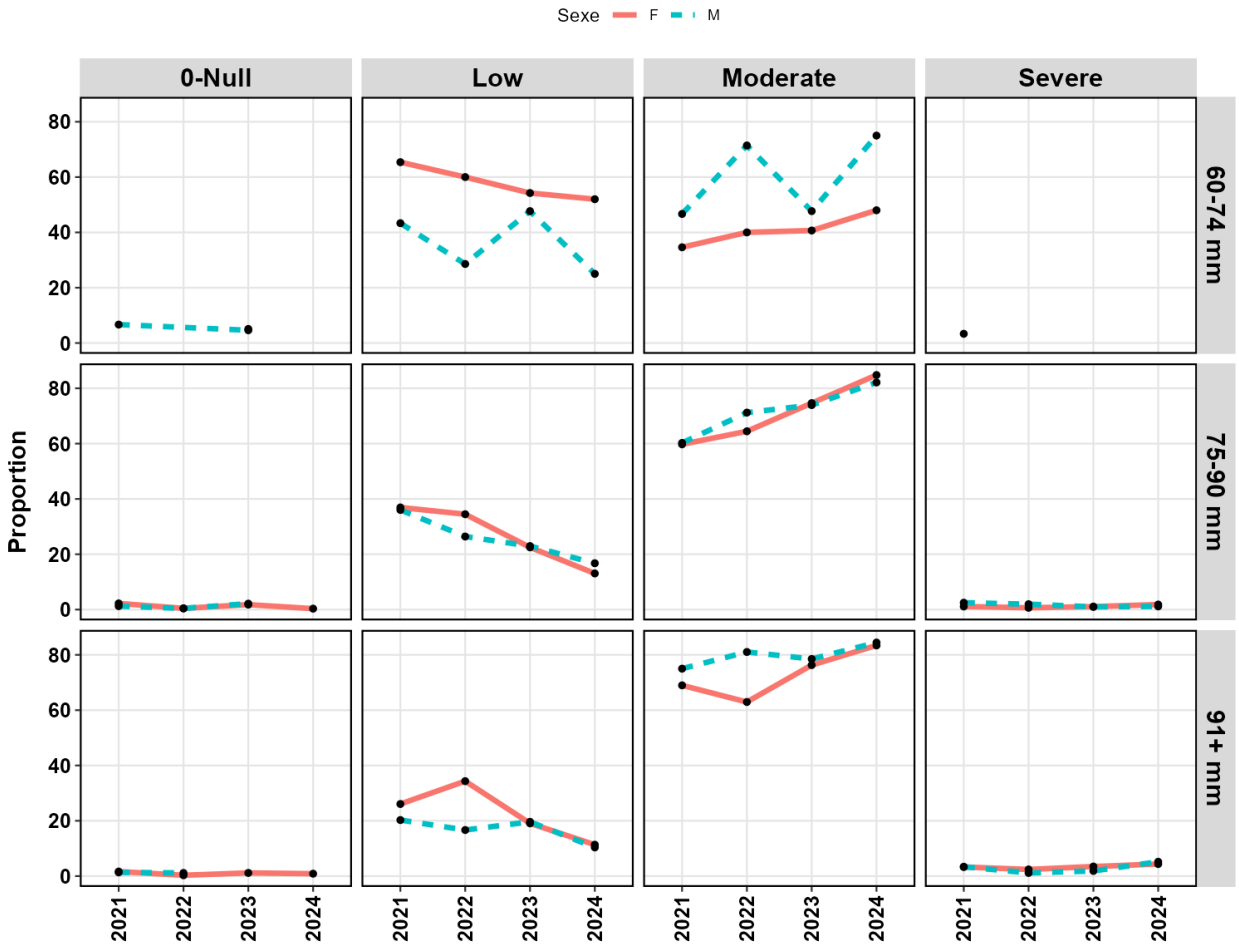


Figure 63. Proportions (%) of whelk sampled in the commercial fishery with shell-boring polychaete infestations in area 15, by year, sex (F: females; M: males), shell height class (mm) and infestation severity (null, low, moderate or severe). The numbers of male and female whelk sampled, by year and size class, are shown in Table 1.

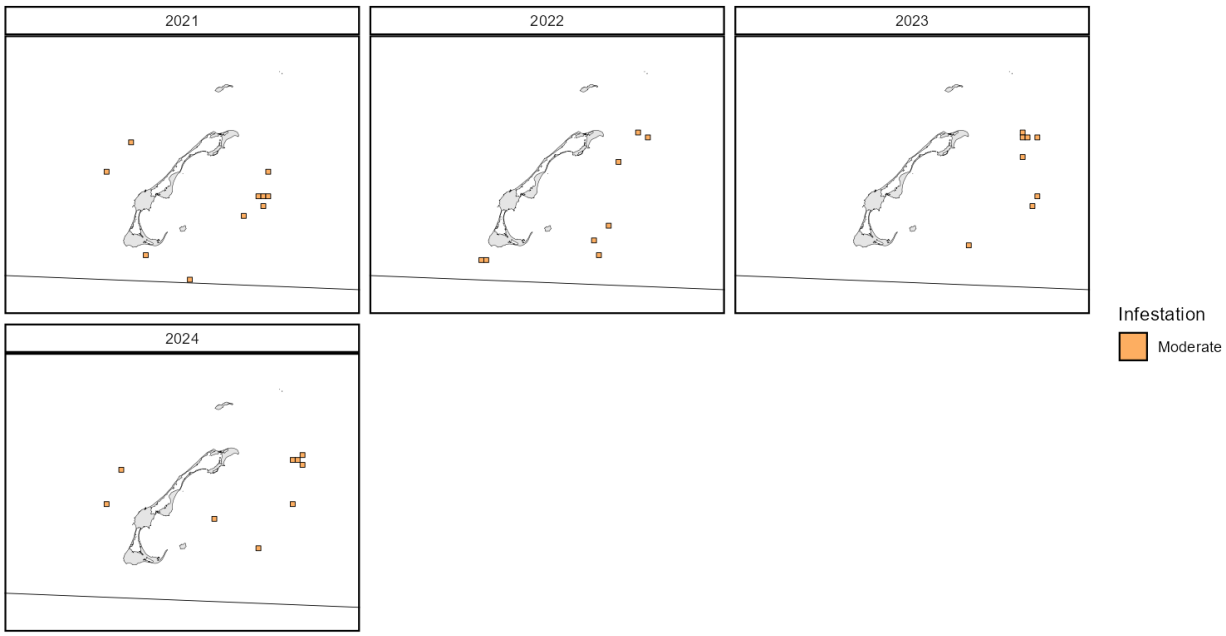


Figure 64. Average spatiotemporal variations in shell-boring polychaete infestations in whelk sampled in the commercial fishery (60 mm) in area 15 (Magdalen Islands).

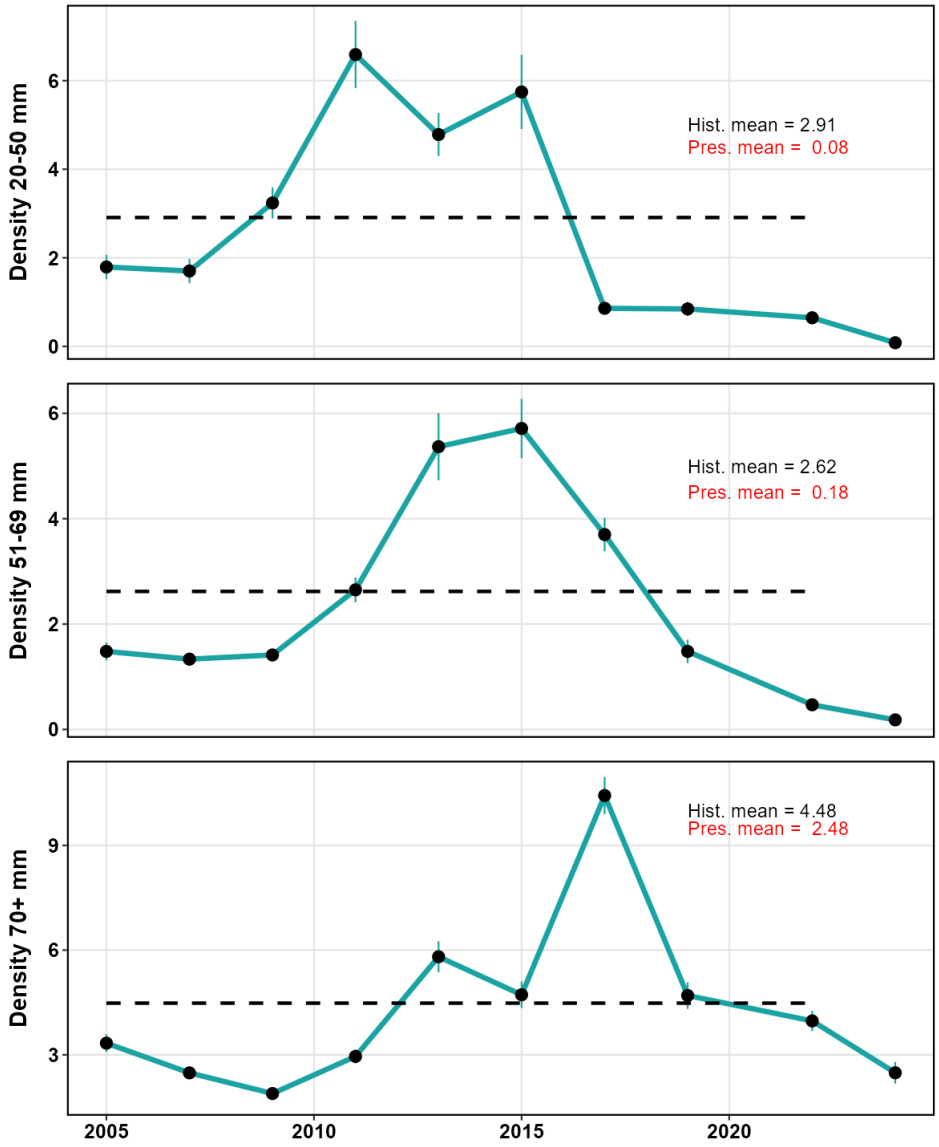


Figure 65. Temporal variation in the density (number/100 m^2 ± standard error) of juvenile (20–50 mm), pre-commercial-size (51–69 mm) and commercial-size (70+ mm) whelk in the Forestville research surveys. Values for the historical mean (Hist. mean; 2005–2022) are shown in black (dashed lines and type) and the mean densities in the 2024 survey are shown in red type.

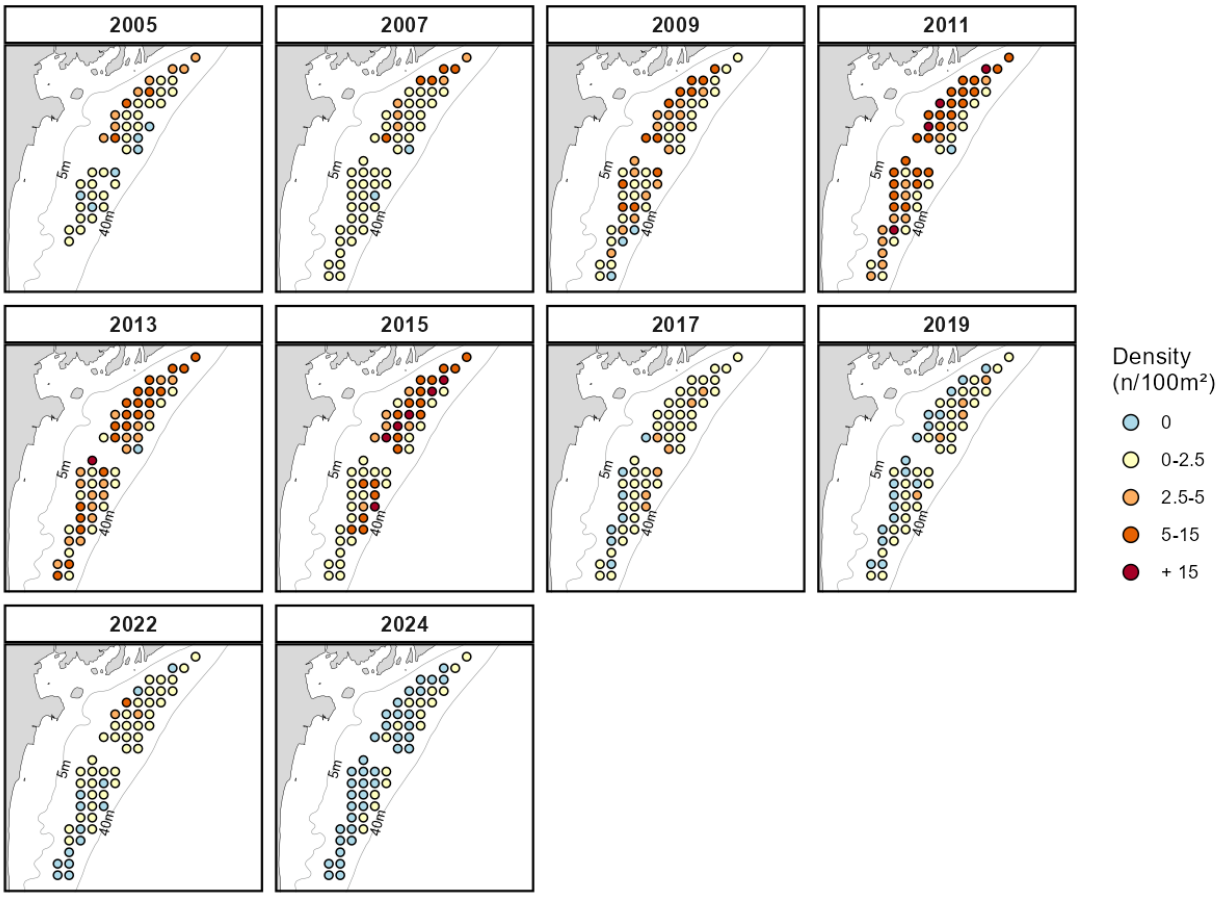


Figure 66. Spatiotemporal distribution of densities (number/100 m^2) of juvenile recruits (20–50 mm) of whelk per station in the Forestville research surveys. The 5 m and 40 m isobaths are illustrated.

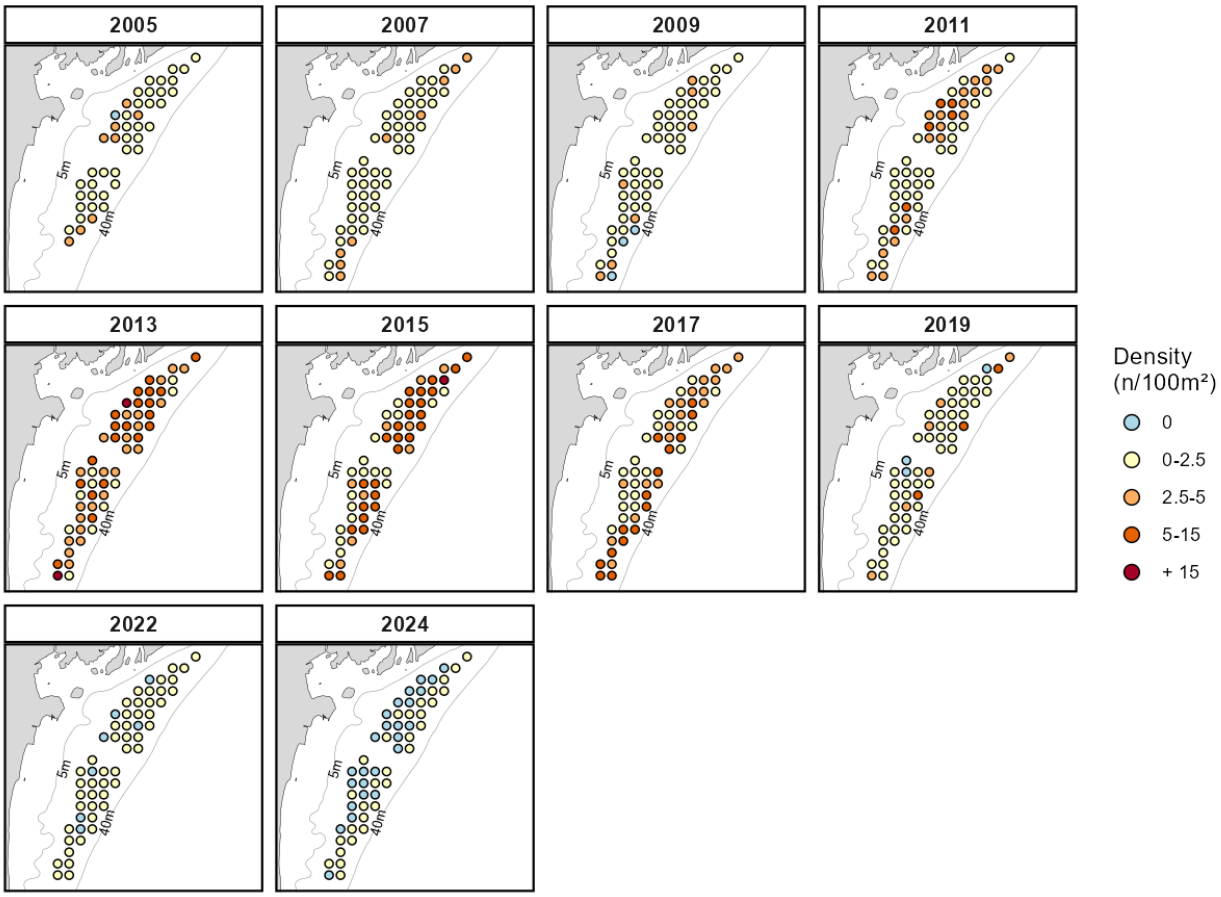


Figure 67. Spatiotemporal distribution of densities (number/100 m^2) of pre-commercial-size (51–69 mm) whelk per station in the Forestville research surveys. The 5 m and 40 m isobaths are illustrated.

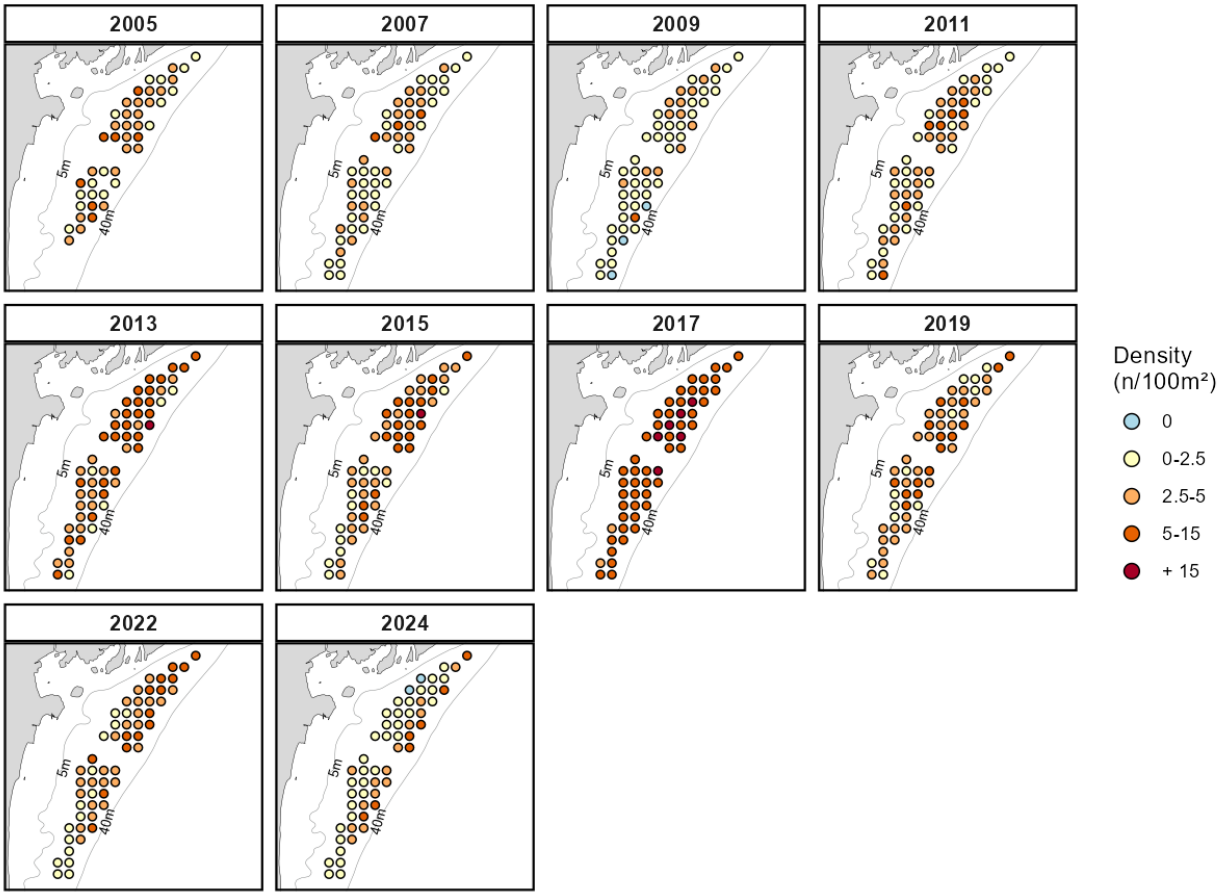


Figure 68. Spatiotemporal distribution of densities (number/100 m^2) of commercial-size (70+ mm) whelk per station in the Forestville research surveys. The 5 m and 40 m isobaths are illustrated.

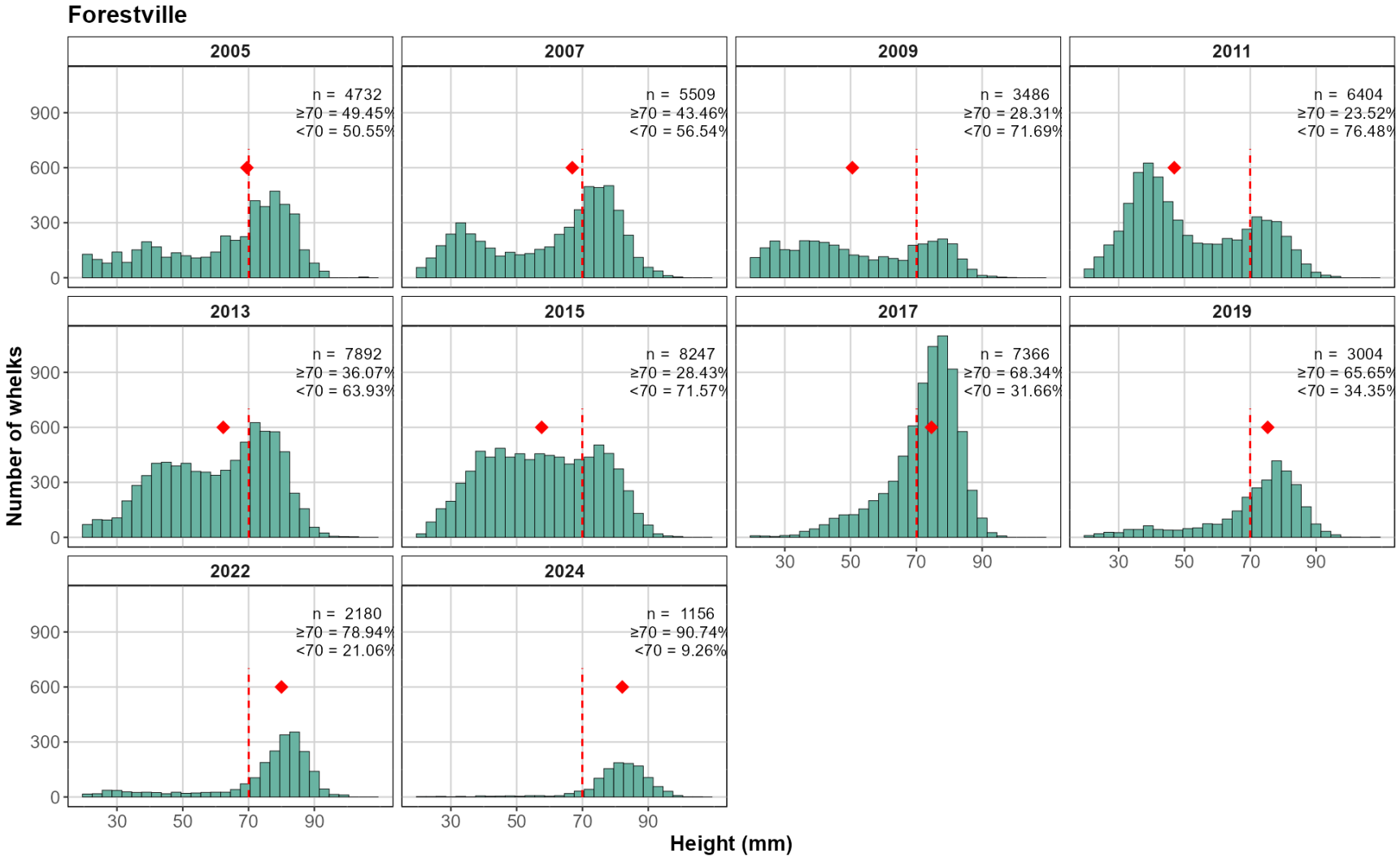


Figure 69. Temporal variation in the whelk size structure obtained in the Forestville research surveys. The vertical line represents the minimum legal size of 70 mm and the red diamond represents the median size.

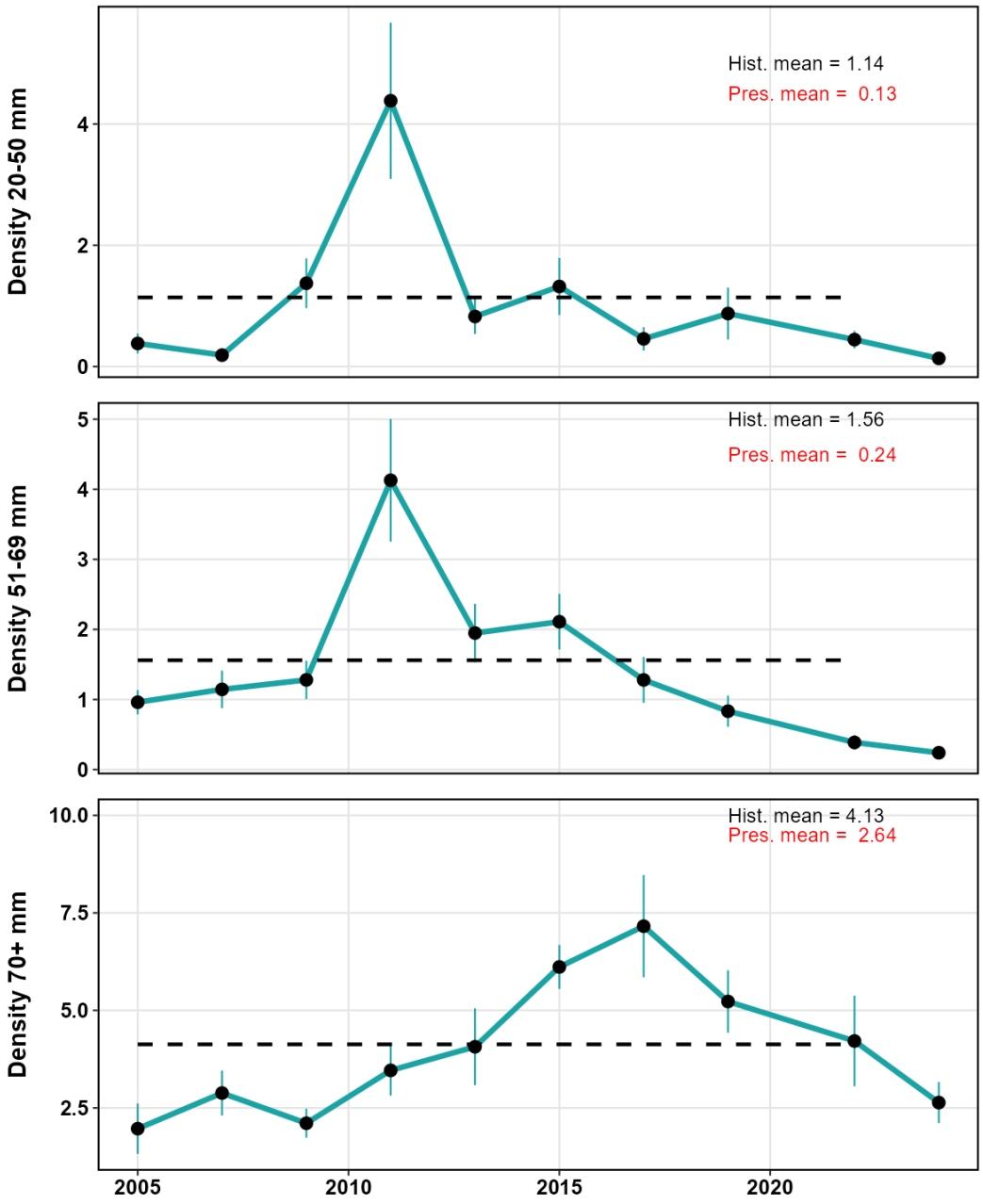


Figure 70. Temporal variation in the density (number/100 m^2 ± standard error) of juvenile (20–50 mm), pre-commercial-size (51–69 mm) and commercial-size (70+ mm) whelk in the Pointe-aux-Outardes research surveys. Values for the historical mean (Hist. mean; 2005–2022) are shown in black (dashed lines and type) and the average densities in the 2024 survey are shown in red type.

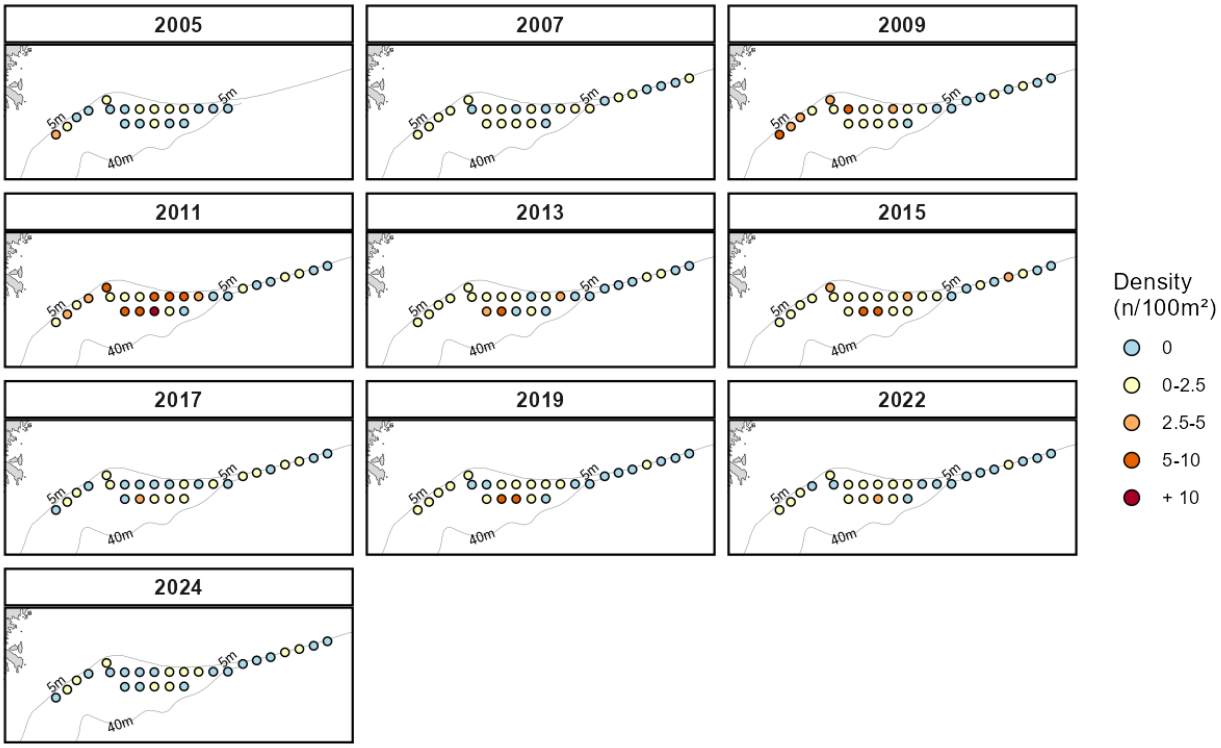


Figure 71. Spatiotemporal distribution of densities (number/100 m^2) of juvenile recruits (20–50 mm) of whelk per station in the Pointe-aux-Outardes research surveys. The 5 m and 40 m isobaths are illustrated.

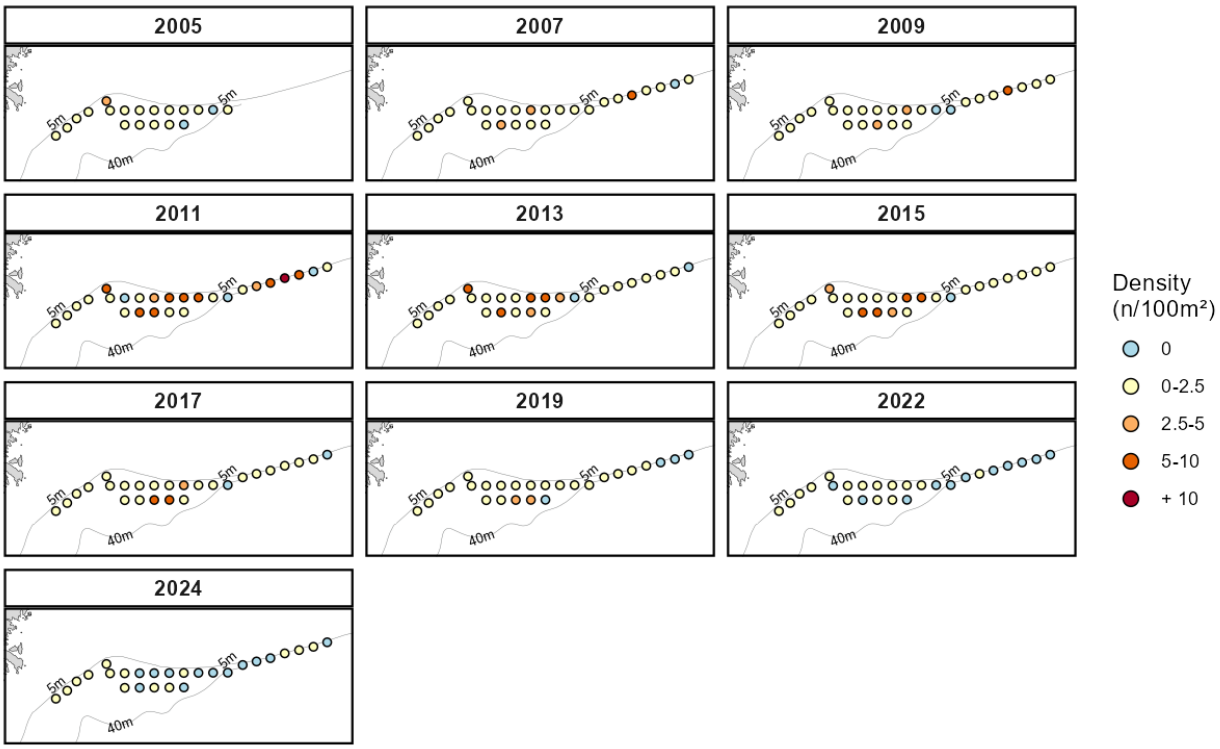


Figure 72. Spatiotemporal distribution of densities (number/100 m^2) of pre-commercial-size (51–69 mm) whelk per station in the Pointe-aux-Outardes research surveys. The 5 m and 40 m isobaths are illustrated.

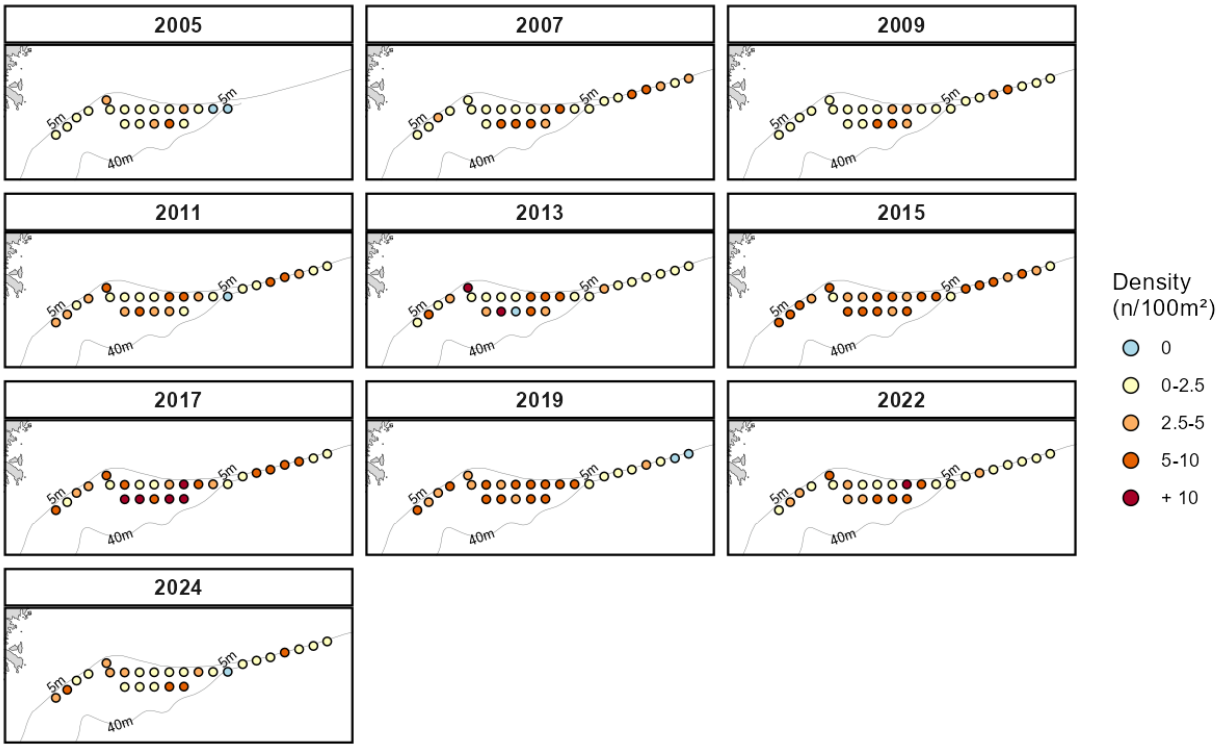


Figure 73. Spatiotemporal distribution of densities (number/100 m^2) of commercial-size (70+ mm) whelk per station in the Pointe-aux-Outardes research surveys. The 5 m and 40 m isobaths are illustrated.

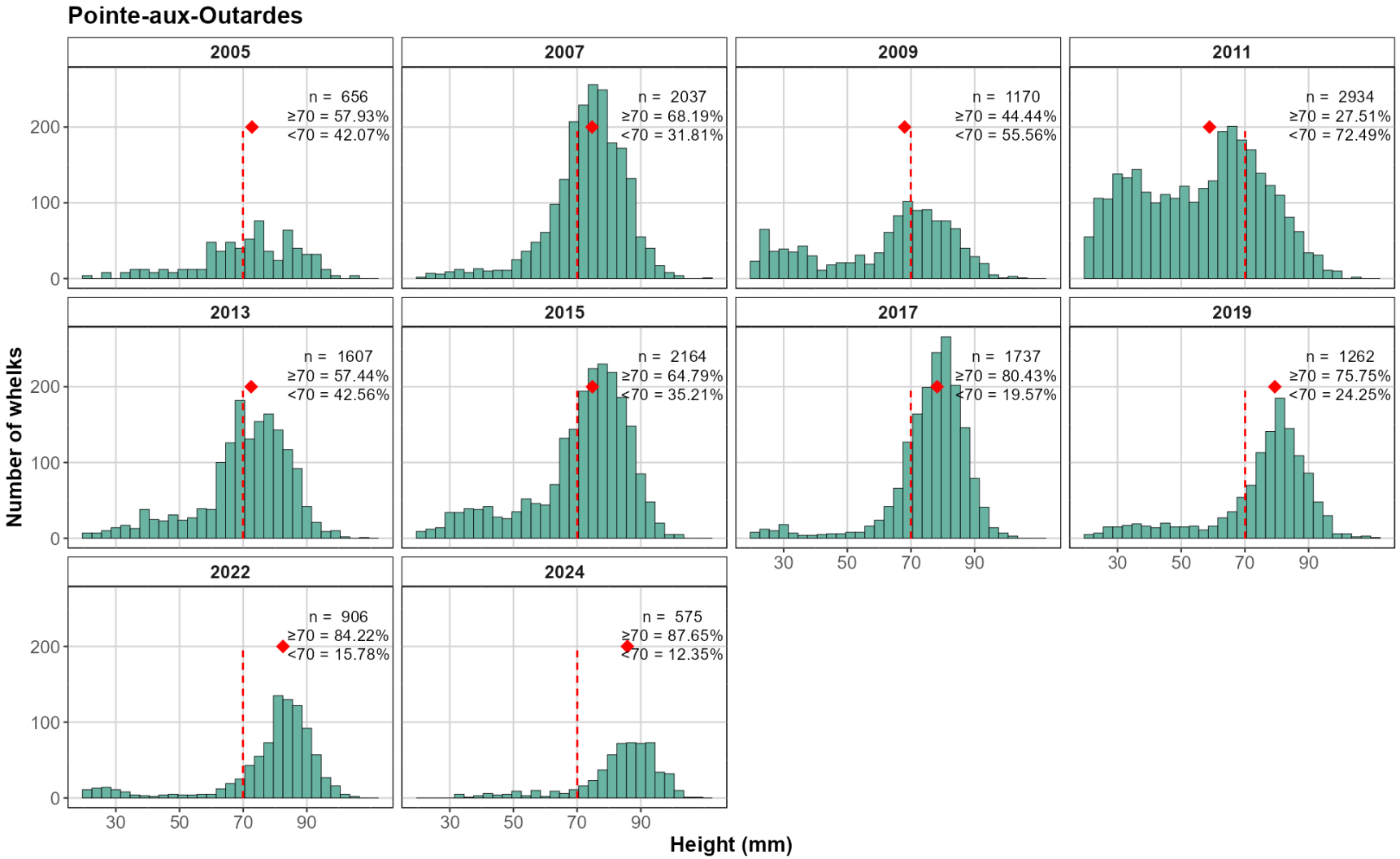


Figure 74. Temporal variation in the whelk size structure obtained in the Pointe-aux-Outardes research surveys. The vertical line represents the minimum legal size of 70 mm and the red diamond represents the median size.

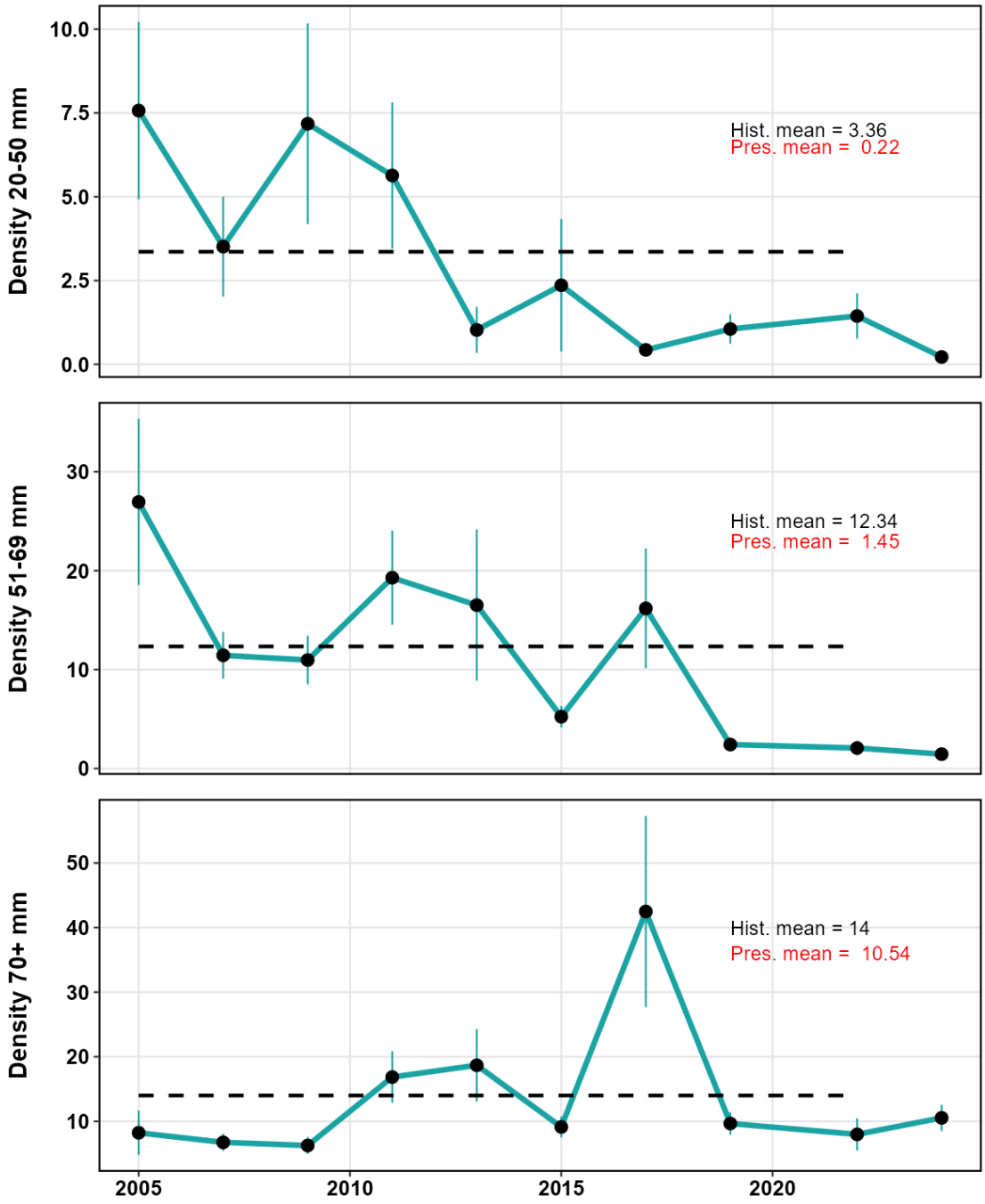


Figure 75. Temporal variation in the densities (number/100 m^2 ± standard error) of juvenile (20–50 mm), pre-commercial-size (51–69 mm) and commercial-size (70+ mm) whelk in the Baie-Comeau research surveys. Historical mean density (Hist. mean; 2005–2022) values are shown in black (dashed lines and type) and the mean densities in the 2024 survey are shown in red type.

Figure 76. Spatiotemporal distribution of densities (number/100 m^2) of juvenile recruits (20–50 mm) of whelk per station in the Baie-Comeau research surveys. The 5 m and 40 m isobaths are illustrated.

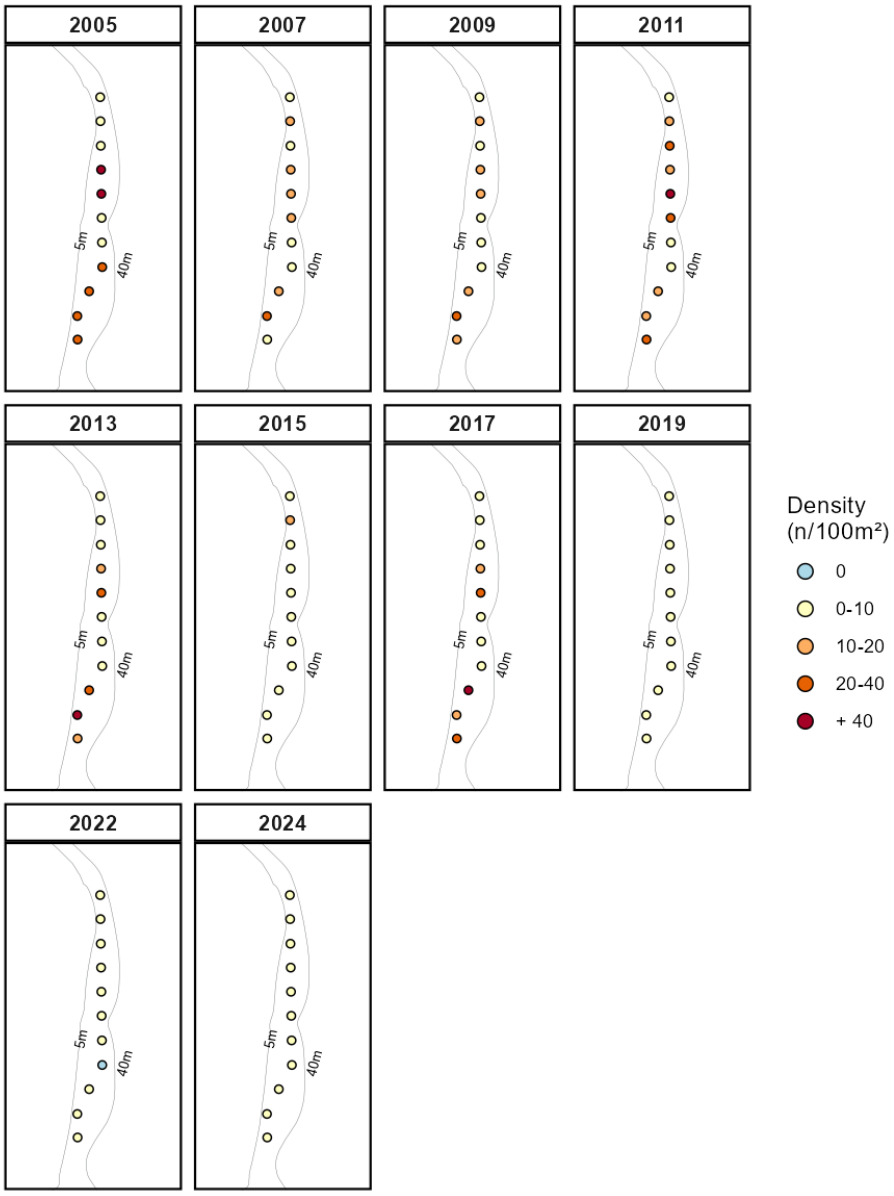


Figure 77. Spatiotemporal distribution of densities (number/100 m^2) of pre-commercial-size (51–69 mm) whelk per station in the Baie-Comeau research surveys. The 5 m and 40 m isobaths are illustrated.

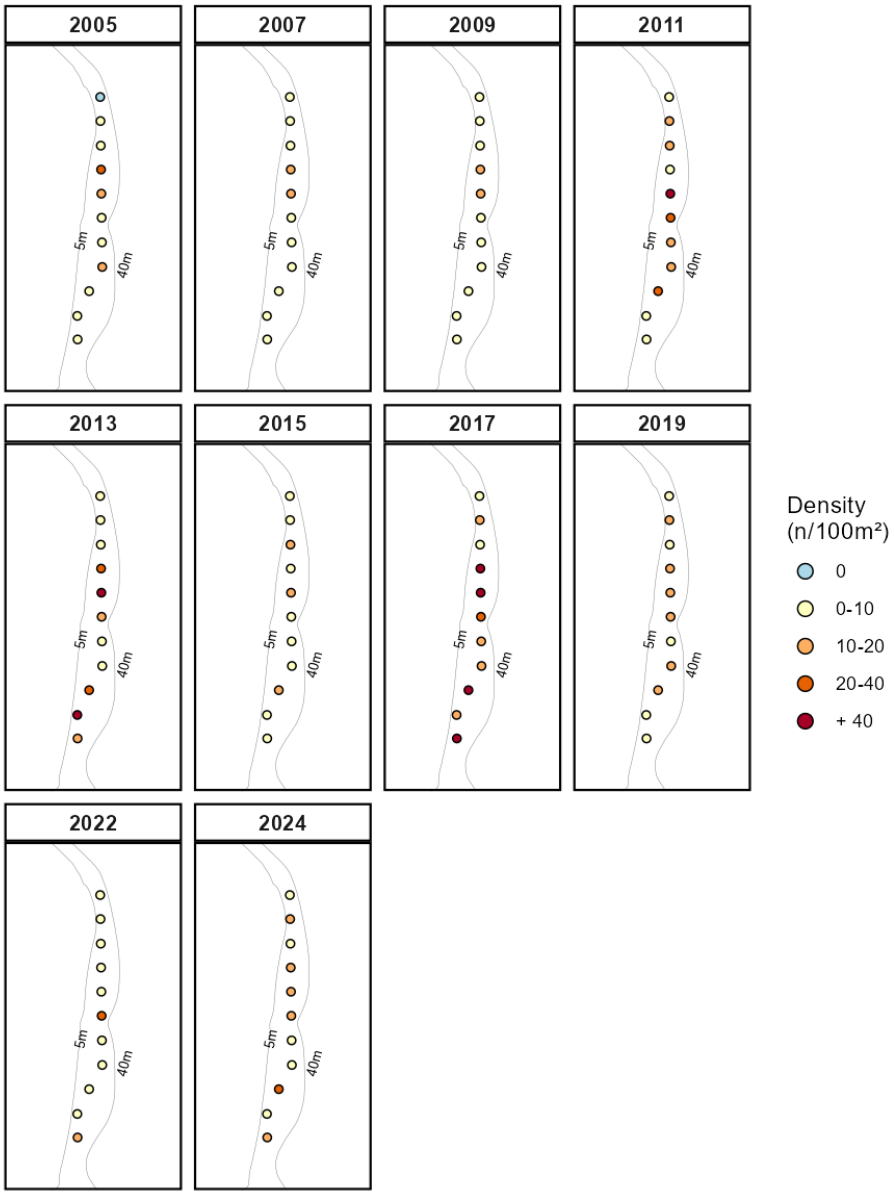


Figure 78. Spatiotemporal distribution of densities (number/100 m^2) of commercial-size (70+ mm) whelk per station in the Baie-Comeau research surveys. The 5 m and 40 m isobaths are illustrated.

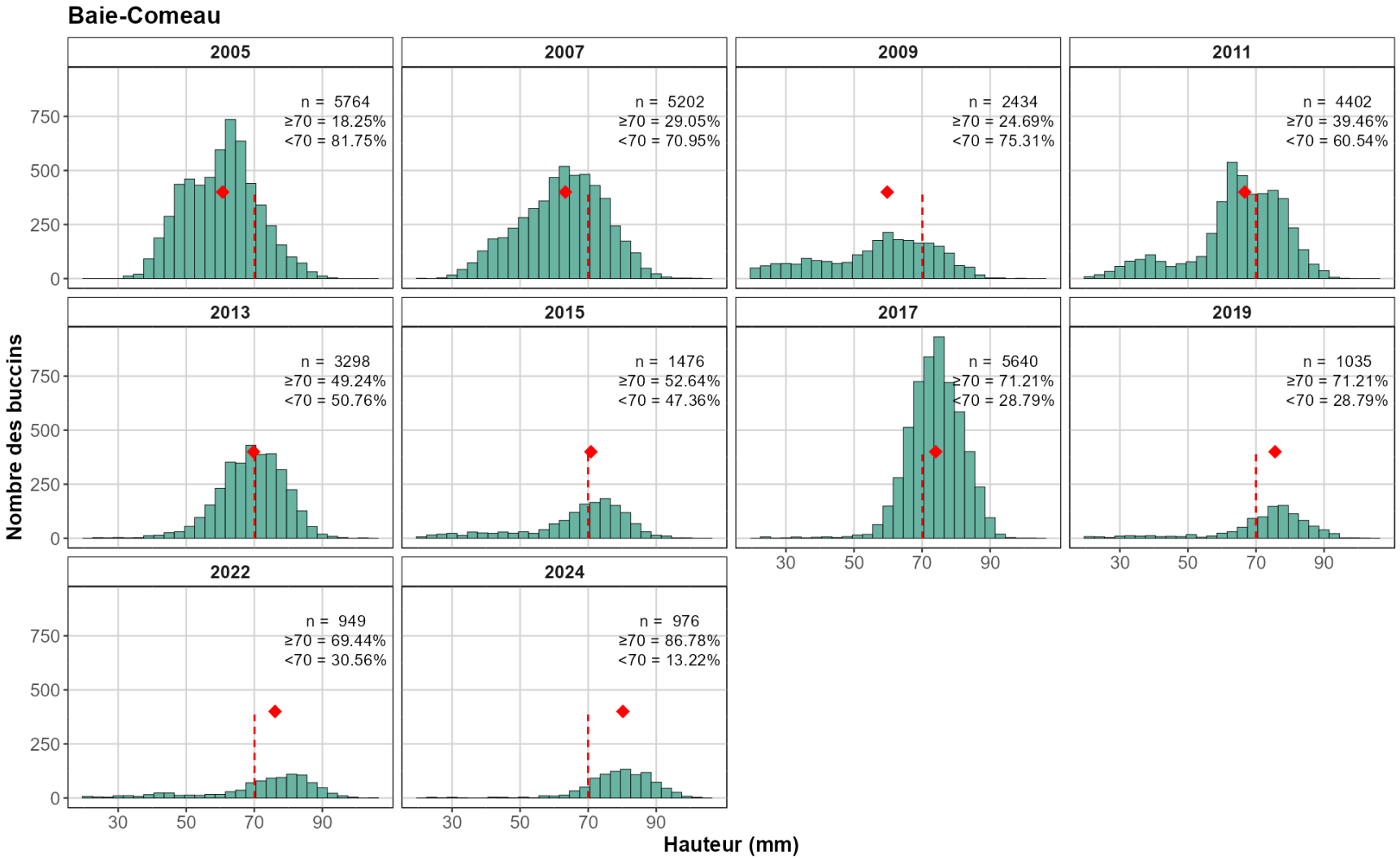


Figure 79. Temporal variation in the whelk size structure obtained in the Baie-Comeau research surveys. The vertical line represents the minimum legal size of 70 mm and the red diamond represents the median size.

APPENDICES

Appendix 1. Average density (number/100 m^2) and number of individuals harvested (in parentheses) for the various Buccinum *species of ≥ 20 mm and proportion of* B. undatum *(density) of all* Buccinum *by site and by year in the Upper North Shore and Magdalen Islands research surveys.*

Site and Year	Density and number					Proportion (%)
	B. undatum	***B. terraenovae***	***B. glaciale***	***B. scalariforme***	***Buccinum* sp.**	
Forestville						
2009	6.421 (3 494)	0.073 (40)	0.022 (11)	0.002 (1)	0.002 (1)	98.5%
2011	11.832 (6 241)	0.281 (132)	0.059 (30)	0	0.002 (1)	97.2%
2013	15.404 (7 783)	0.162 (81)	0.052 (26)	0.002 (1)	0.002 (1)	98.6%
2015	16.083 (8 200)	0. 037 (19)	0.054 (27)	0.002 (1)	0	99.4%
2017	14.916 (7 332)	0.004 (2)	0.054 (28)	0.004 (2)	0.004 (2)	99.6%
2019	7.000 (2 990)	0.0024 (1)	0.0273 (11)	0	0.0081 (4)	99.5%
2022	5.084 (2 180)	0	0	0	0	100%
2024	2.748 (1 156)	0	0	0	0	100%
Pointe-aux-Outardes						
2009	4.561 (1 109)	0.181 (42)	0	0.004 (1)	0	96.1 %
2011	11.911 (2 912)	0.029 (7)	0	0.015 (3)	0	99.6 %
2013	6.827 (1 605)	0.004 (1)	0	0.004 (1)	0	99.9 %
2015	9.520 (2 159)	0.021 (5)	0	0	0	99.8 %
2017	8.866 (1 733)	0.009 (2)	0	0	0.015 (3)	99.7 %
2019	6.930 (1 262)	0.0042 (1)	0	0	0	99.9 %
2022	5.045 (906)	0	0	0	0	100 %
2024	3.009 (575)	0	0	0	0	100 %
Baie-Comeau						
2009	24.201 (2 437)	0.040 (5)	0	0.010 (1)	0	99.8%
2011	41.683 (4 396)	0.046 (5)	0	0	0.010 (1)	99.9%
2013	36.217 (3 297)	0	0	0	0.011 (1)	100%
2015	16.715 (1 475)	0.012 (1)	0	0	-	99.9%
2017	59.143 (5 640)	0	0	0	-	100%
2019	13.126 (1 034)	0	0	0	0.0121 (1)	99.9%
2022	11.489 (949)	0	0	0	0	100%
2024	12.211 (976)	0	0	0	0	100%
Magdalen Islands						
2016	0.982 (823)	0.065 (63)	0	0.026 (28)	0.007 (7)	90.9 %

Appendix 2. Photographs of the various Buccinum species observed since 2009 in the Upper North Shore and Magdalen Islands research surveys (photographers: M. Boudreau DFO 2010 and S. Brulotte DFO 2015).

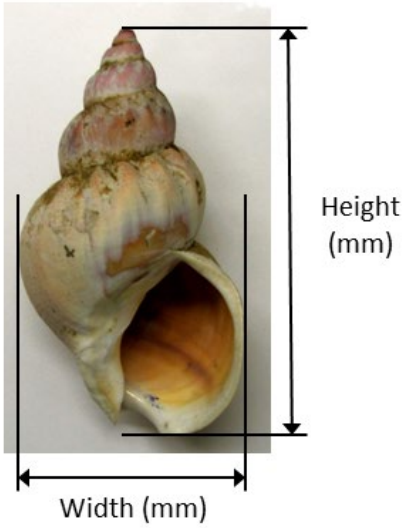
Buccin commun – *Buccinum undatum*

Buccinum terraenovae *Buccinum scalariforme* *Buccinum glaciale* *Buccinum cyaneum*

Appendix 3. Number of whelks collected by region, fishing area and year as part of DFO's landed commercial catch sampling program.

Year	North Shore								Gaspé – Lower St. Laurence		Magdalen Islands
	1	2	3	4	5	6	7	8	12	13	15
1987	-	-	-	1 199	-	500	-	-	-	306	-
1988	-	-	-	500	500	103	-	301	-	100	401
1989	-	-	-	200	-	-	-	-	-	206	200
1990	-	-	100	700	-	-	-	-	-	-	-
1991	-	-	-	1 697	800	599	-	-	-	-	-
1992	-	-	-	1 104	1 000	-	-	600	100	-	-
1993	798	-	-	400	100	391	-	200	-	298	-
1994	202	-	-	625	100	488	-	311	-	1 004	-
1995	650	-	-	831	628	601	-	1 213	-	1 000	-
1996	-	-	-	640	-	507	-	351	-	1 646	-
1997	448	485	-	420	301	381	-	101	-	1 216	-
1998	1 051	373	193	640	828	839	315	101	97	301	-
1999	314	409	310	615	928	920	712	545	-	663	-
2000	1 090	644	226	397	516	669	195	203	307	421	-
2001	1 079	615	497	1 043	802	819	-	-	389	515	-
2002	409	4 444	207	1 156	2 284	3 185	203	133	622	906	120
2003	219	4 380	-	1 256	1 021	1 208	602	536	755	940	940
2004	5 178	1 832	1 252	2 771	3 304	3 282	2 514	-	1 766	725	2 341
2005	4 347	2 879	-	2 154	2 567	2 473	1 513	876	2 600	984	2 837
2006	4 538	385	-	1 359	1 645	1 351	919	489	1 724	839	2 323
2007	4 449	2 162	-	1 213	2 580	2 936	1 055	500	2 753	2 634	2 324
2008	5 754	621	-	1 209	2 423	2 257	754	519	2 808	2 439	2 699
2009	6 690	344	-	1 543	2 553	2 698	1 364	484	2 832	2 627	794
2010	7 837	1 537	-	2 309	4 134	3 232	2 153	1 023	935	3 056	2 559
2011	3 631	2 337	-	1 040	2 116	2 283	1 123	882	1 950	2 409	2 503
2012	2 571	1 963	1 207	2 130	2 443	2 437	1 658	318	1 802	2 703	1 977
2013	3 008	756	-	2 431	2 269	2 263	907	1 126	2 251	2 250	2 626
2014	2 555	1 465	-	1 659	2 246	2 228	300	778	1 050	2 250	462
2015	2 556	675	584	2 261	2 250	2 254	453	1 430	2 250	2 400	820
2016	1 802	1 650	285	1 659	1 501	1 500	605	1 634	1 800	1 952	2 305
2017	2 054	1 052	-	1 501	1 202	1 800	301	2 214	1 952	1 650	1 667
2018	3 152	1 200	150	2 115	1 204	1 500	1 261	1 419	1 649	2 040	1 544
2019	2 550	1 501	-	1 801	1 350	1 501	150	814	750	1 649	1 511
2020	1 203	1 201	-	1 502	1 333	1 503	-	1 329	151	-	1 218
2021	2 626	1 351	-	1 049	750	1 500	-	1 271	150	1 627	1 545
2022	1 979	613	-	1 503	1 052	1 500	-	1 780	461	1 524	1 565
2023	2 278	374	-	1 353	1 651	1 500	-	2 811	606	1 100	1 496
2024	2 271	456	-	-	1 649	1 501	300	1 927	1 107	1 525	1 543

Appendix 4. Identification of the various whelk measurements. (Photos: N. Paille DFO).



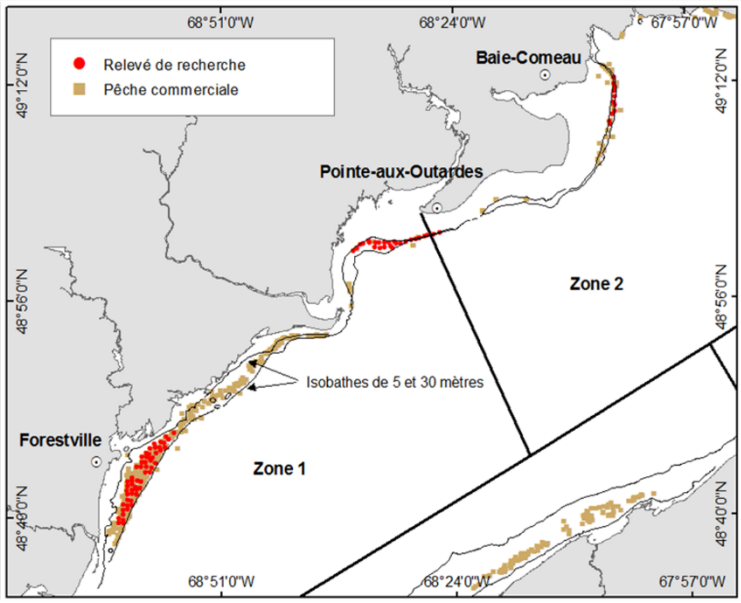
Minimum width (mm)

Appendix 5. Changes in minimum legal size (MLS) and total allowable catch (TAC) over the years in each whelk fishing area.

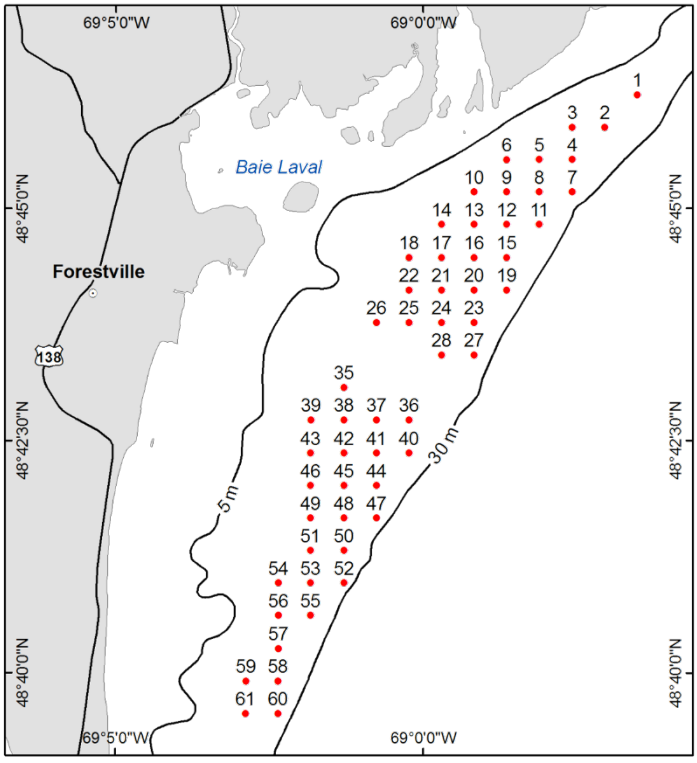
Year	Area 1		Area 2		Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 11		Area 12		Area 12		Area 15	
	TML (mm)	TAC (t)	TML (mm)	TAC (t)	TML (mm)	TML (mm)	TML (mm)	TML (mm)	TML (mm)	TML (mm)	TML (mm)	TAC (t)	TML (mm)	TAC (t)	TML (mm)	TAC (t)	TML (mm)	TAC (t)
1998	60	-	60	-	60	60	60	60	60	60	-	-	-	-	-	-	-	-
1999	65	-	65	-	65	65	65	65	65	65	-	-	-	-	-	-	-	-
2000	65	-	65	-	65	65	65	65	65	65	65	-	65	-	65	-	65	-
2001	66	-	66	-	66	66	66	66	66	66	66	-	66	-	66	-	66	-
2002	67	-	67	-	67	67	67	67	67	67	70	-	70	-	70	-	67	-
2003	68	491	68	109	68	68	68	68	68	68	70	-	70	-	70	-	70	-
2004	69	491	69	109	69	69	69	69	69	69	70	-	70	-	70	-	70	399
2005	70	491	70	109	70	70	70	70	70	70	70	-	70	-	70	-	70	396
2006-2009	70	491	70	109	70	70	70	70	70	70	70	-	70	-	70	-	70	450
2010-2011	70	491	70	109	70	70	70	70	70	70	70	32	70	128	70	150	70	450
2012	70	491	70	109	70	70	70	70	70	70	70	32	70	135	70	82	70	376
2013-2014	70	491	70	109	70	70	70	70	70	70	70	32	70	135	70	82	70	376
2015-2017	70	491	70	109	70	70	70	70	70	70	70	11	70	46	70	82	70	376
2018	70	491	70	109	70	70	70	70	70	70	70	32	70	75	70	82	75	376
2019-2020	70	491	70	109	80	80	80	80	80	80	75	32	75	75	75	82	75	376
2021	70	491	70	109	80	80	80	80	80	75	75	32	75	75	75	82	75	330
2022	70	491	70	104,7	80	80	80	80	80	75	75	32	75	75	75	82	75	330
2023	70	491	70	109	80	85	85	85	85	80	80	11	80	55	75	73	75	264
2024	70	491	70	109	80	85	85	85	85	80	80	11	80	55	80	73	75	264

Appendix 6. Location A) of the whelk research survey sampling sites and commercial whelk fishery, and sampling stations at B) Forestville, C) Pointe-aux-Outardes and D) Baie-Comeau. The 5 m and 30 m deep isobaths are shown.

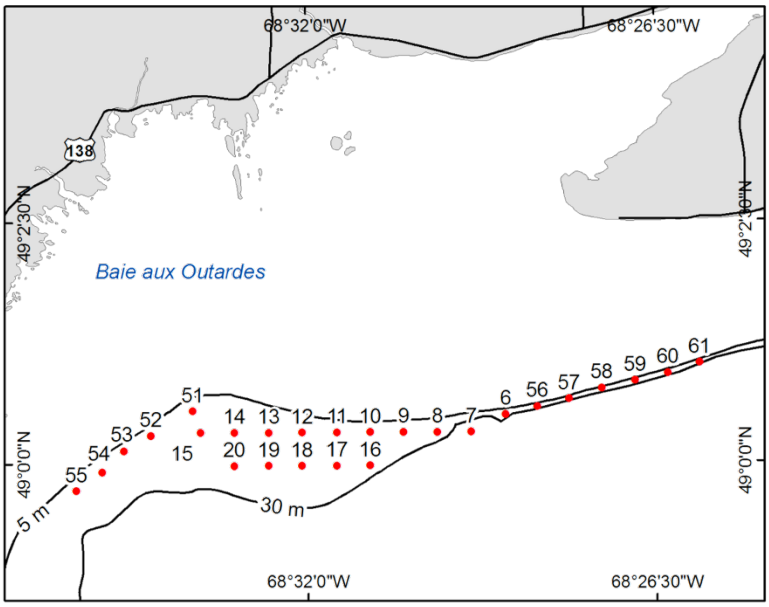
A)



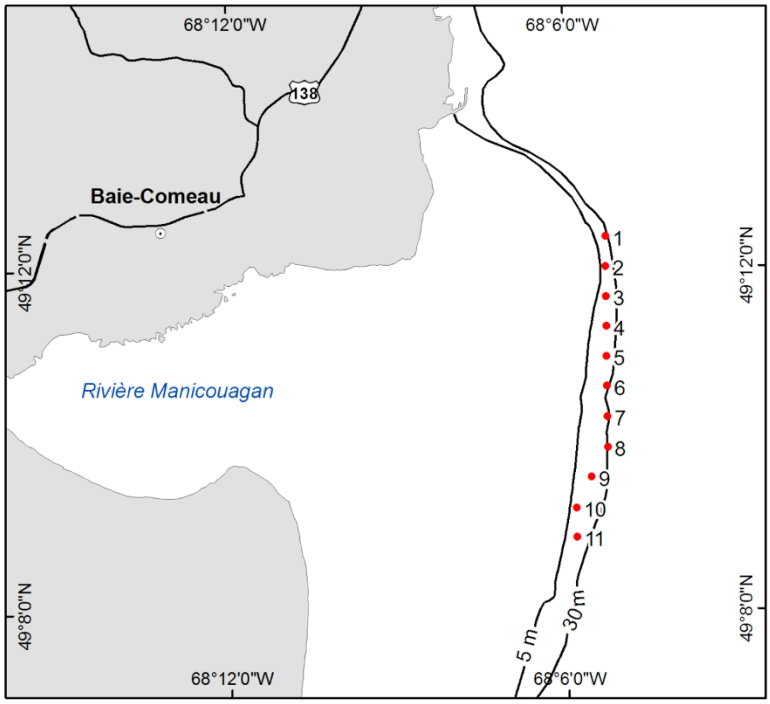
B)



C)


68°32'0"W
68°26'30"W
138
49°2'30"N
Baie aux Outardes
51
52
53
54
55
14
13
12
11
10
9
8
7
6
56
57
58
59
60
61
15
20
19
18
17
16
49°0'0"N
5 m
30 m
68°32'0"W
68°26'30"W

D)


68°12'0"W
68°6'0"W
138
Baie-Comeau
49°12'0"N
Rivière Manicouagan
1
2
3
4
5
6
7
8
9
10
11
49°8'0"N
5 m
30 m
68°12'0"W
68°6'0"W

Appendix 7. Parameters of linear relationships between total live weight in g (y) and height in mm (x) of Buccinum undatum *from research surveys conducted in Forestville, Pointe-aux-Outardes and Baie-Comeau since 2005.*

Site	Year	Equation	R^2	*n*
Forestville	2005	ln(y) = 2.897 ln(x) – 8.566	0.974	303
	2007	ln(y) = 2.875 ln(x) – 8.566	0.992	176
	2009	ln(y) = 2.904 ln(x) – 8.594	0.991	324
	2011	ln(y) = 2.930 ln(x) – 8.708	0.993	269
	2013	ln(y) = 2.914 ln(x) – 8.663	0.992	238
	2015	ln(y) = 2.888 ln(x) – 8.578	0.994	238
	2017	ln(y) = 2.875 ln(x) – 8.489	0.992	371
	2019	ln(y) = 2.967 ln(x) – 8.897	0.995	245
	2022	ln(y) = 2.964 ln(x) – 8.859	0.992	414
	2024	ln(y) = 2.909 ln(x) – 8.577	0.983	128
Pointe-aux-Outardes	2005	ln(y) = 2.861 ln(x) – 8.447	0.963	133
	2007	ln(y) = 2.805 ln(x) – 8.244	0.987	155
	2009	ln(y) = 2.927 ln(x) – 8.696	0.992	261
	2011	ln(y) = 2.881 ln(x) – 8.556	0.995	196
	2013	ln(y) = 2.894 ln(x) – 8.609	0.995	191
	2015	ln(y) = 2.921 ln(x) – 8.734	0.995	275
	2017	ln(y) = 2.871 ln(x) – 8.489	0.992	276
	2019	ln(y) = 2.949 ln(x) – 8.879	0.994	251
	2022	ln(y) = 2.929 ln(x) – 8.810	0.994	363
	2024	ln(y) = 2.913 ln(x) – 8.680	0.985	124
Baie-Comeau	2005	ln(y) = 2.823 ln(x) – 8.297	0.972	209
	2007	ln(y) = 2.797 ln(x) – 8.244	0.984	137
	2009	ln(y) = 2.975 ln(x) – 8.909	0.995	250
	2011	ln(y) = 2.924 ln(x) – 8.750	0.993	171
	2013	ln(y) = 2.820 ln(x) – 8.258	0.988	123
	2015	ln(y) = 2.898 ln(x) – 8.661	0.996	256
	2017	ln(y) = 2.906 ln(x) – 8.669	0.995	108
	2019	ln(y) = 2.951 ln(x) – 8.841	0.996	198
	2022	ln(y) = 2.901 ln(x) – 8.677	0.988	331
	2024	ln(y) = 2.805 ln(x) – 8.200	0.981	108

Appendix 8. Commercial whelk fishery landings (t) by fishing area and for Quebec as a whole

Year	North Shore									Gaspé – Lower St. Laurence					Magdalen Islands	Quebec
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1993	125	0	37	53	180	206	0	24	0	0	58	28	3	0.1	0	715
1994	54	11	8	77	161	111	3	14	0	0	24	28	3	0	0	493
1995	80	40	4	56	186	119	7	81	0	0	34	14	4	0	0	624
1996	179	57	8	176	275	178	2	82	0	0	51	17	5	< 1	0	1 032
1997	196	42	12	68	286	109	181	8	0	0	54	21	20	0	0	999
1998	207	11	4	29	346	107	29	1	0	0	47	26	17	< 1	0	825
1999	457	120	42	65	493	130	64	5	0	0	36	20	21	0	0	1 453
2000	550	207	18	108	401	184	14	37	0	0	28	15	8	0	0	1 571
2001	589	157	52	162	359	201	0	0	0	0	18	12	24	0	0	1 573
2002	594	132	25	143	310	243	93	6	0	0	29	32	23	1	20	1 649
2003	408	119	33	149	385	282	60	90	0	0	25	34	27	< 1	388	2 000
2004	204	71	39	161	322	279	89	7	0	0	24	39	22	dc	369	1 628
2005	202	72	30	114	272	193	62	63	22	0	44	84	24	0	442	1 623
2006	247	39	28	107	221	196	90	47	1	0	35	150	34	0	392	1 587
2007	151	46	14	83	168	152	42	21	0	0	7	127	77	0	382	1 269
2008	118	21	16	48	146	216	19	24	0	0	4	117	67	0	352	1 147
2009	300	25	6	51	274	330	67	11	0	0	2	110	57	0	23	1 255
2010	204	46	10	60	363	358	34	38	0	0	2	129	91	0	150	1 484
2011	132	71	14	42	312	314	22	21	0	0	1	95	78	0	265	1 368
2012	114	66	12	64	409	296	49	27	0	0	< 1	75	81	0	239	1 432
2013	241	39	6	82	250	280	45	36	< 1	0	2	70	66	dc	327	1 445
2014	290	58	6	41	115	270	22	23	< 1	0	< 1	46	dc	dc	15	952
2015	225	31	1	60	148	308	24	31	1	0	< 1	48	50	0	11	937
2016	428	61	3	47	160	366	76	30	0	0	0	47	89	0	111	1 418
2017	378	48	3	57	142	307	50	30	3	0	1	46	59	0	204	1 329
2018	277	48	4	21	63	212	77	21	0	0	1	50	83	0	252	1 108
2019	308	51	2	14	28	196	8	14	0	0	0	30	68	0	242	962
2020	222	81	4	16	53	161	1	56	0	0	< 1	29	72	0	202	899
2021	260	113	4	9	40	138	0	103	0	0	0	17	59	0	167	909
2022	202	45	2	10	11	129	0	59	0	0	0	14	29	0	75	576
2023	187	45	1	11	24	145	0	41	0	0	< 1	3	32	0	121	613
2024	167	45	2	3	16	25	2	32	0	0	0	2	15	0	99	407

Appendix 9. Commercial whelk fishing effort (number of traps) by region, fishing area and for Quebec as a whole.

Year	North Shore								Gaspé – Lower St. Laurence		Magdalen Islands	Quebec
	1	2	3	4	5	6	7	8	12	13	15	
2002	50 700	14 700	3 300	47 200	88 500	47 900	9 000	1 500	11 700	5 300	1 700	293 700
2003	43 300	11 100	5 500	54 700	109 700	71 100	13 000	26 200	12 500	8 000	15 500	385 800
2004	29 700	8 100	6 800	53 300	106 200	89 100	13 900	2 000	13 100	5 800	18 500	356 300
2005	27 700	10 500	6 100	41 400	85 400	75 800	8 800	14 300	26 600	5 500	19 200	340 900
2006	31 900	-	4 900	35 400	65 800	64 600	11 000	15 000	36 900	6 400	17 200	305 200
2007	22 300	-	3 000	24 600	53 800	47 200	6 100	5 300	32 400	12 400	17 800	231 700
2008	15 300	-	3 300	16 400	40 900	56 900	4 200	7 500	30 300	10 900	16 400	206 200
2009	33 100	-	1 600	14 900	62 200	64 300	9 300	2 300	27 200	8 500	1 000	229 100
2010	28 800	-	1 800	20 700	75 800	64 300	6 100	13 100	27 900	10 100	6 500	261 900
2011	19 500	-	2 900	10 600	54 700	63 400	4 500	6 700	21 500	8 800	13 600	214 700
2012	13 600	-	2 600	15 700	79 900	67 500	7 600	7 900	19 900	11 000	11 900	244 900
2013	21 700	-	1 700	19 000	62 500	61 000	7 300	8 700	18 000	9 000	17 200	230 600
2014	27 600	-	1 500	10 500	29 400	55 300	4 100	6 900	18 800	9 200	2 700	173 200
2015	19 000	-	200	13 100	33 100	62 200	3 800	8 800	14 400	8 300	1 100	167 200
2016	27 100	-	1 300	12 100	47 000	78 000	9 300	10 400	14 700	12 700	8 700	227 000
2017	25 000	-	1 000	17 400	46 400	70 500	6 300	10 200	11 900	10 100	9 300	212 400
2018	21 300	3 000	1 200	11 568	26 285	51 300	10 400	8 000	15 600	12 800	14 000	176 400
2019	33 000	3 700	900	6 123	14 144	51 500	2 200	3 300	9 500	12 200	15 000	151 500
2020	30 100	9 000	1 700	8 949	23 398	48 500	200	7 900	9 600	15 000	14 500	169 500
2021	29 900	12 200	1 600	3 549	20 601	37 400	-	16 000	6 500	15 500	12 800	156 200
2022	25 155	5 659	745	3 462	5 796	41 550	-	15 023	2 223	8 377	7 341	121 344
2023	29 101	8 208	874	4 759	7 615	38 379	-	11 018	2 652	6 439	6 658	117 312
2024	24 499	8 672	1 000	800	6 160	10 406	600	8 882	2 223	8 377	8 182	78 292

Appendix 10. Annual average of standardized catch per unit effort (kg/trap) by region and fishing area, according to commercial whelk logbook.

Year	North Shore								Gaspé – Lower St. Laurence		Magdalen Islands
	1	2	3	4	5	6	7	8	12	13	15
2002	11.4	8.4	5.3	3.1	4.4	6.0	10.7	4.8	2.9	4.3	-
2003	9.3	11.1	5.8	2.8	4.6	4.8	4.9	3.5	1.8	3.3	22.8
2004	7.1	9.1	5.7	3.1	4.1	3.9	6.5	4.1	3.3	3.8	19.0
2005	7.8	7.8	5.2	3.0	3.9	3.3	7.0	4.6	3.7	4.2	22.9
2006	7.9	7.3	5.6	3.1	4.1	3.7	7.6	3.4	4.1	5.0	21.9
2007	6.9	13.2	4.6	3.6	3.5	3.9	7.1	4.8	4.6	6.1	21.3
2008	8.2	10.3	4.4	2.7	4.0	4.4	5.0	3.8	3.9	6.0	21.3
2009	9.0	9.7	2.7	3.6	5.3	6.1	7.3	5.5	4.3	6.5	24.2
2010	7.2	11.4	5.2	3.0	5.9	5.7	5.2	3.4	4.6	9.0	23.3
2011	7.1	12.8	3.5	3.8	6.7	5.5	4.9	3.7	4.6	8.8	20.3
2012	8.6	10.6	4.3	4.1	6.3	4.9	5.8	4.1	4.1	7.4	20.0
2013	11.2	11.4	3.7	4.8	4.7	4.9	6.0	5.0	4.3	7.4	18.9
2014	10.4	10.6	3.1	4.0	4.3	5.1	5.3	4.1	2.5	7.4	6.2
2015	12.0	8.1	-	4.5	4.4	5.3	6.1	3.9	3.4	5.8	12.2
2016	15.5	10.7	3.1	3.9	3.7	5.2	8.0	3.4	3.7	6.6	21.6
2017	15.3	14.1	1.9	3.2	3.3	4.7	8.1	3.3	4.3	5.4	18.5
2018	13.0	14.5	2.1	1.9	2.5	4.2	6.9	2.6	3.4	6.2	16.0
2019	9.8	12.8	2.8	2.1	2.0	3.9	-	3.8	3.5	5.4	14.0
2020	7.6	8.9	1.9	2.0	2.2	3.4	-	5.1	2.9	4.9	13.4
2021	9.0	9.6	2.7	2.2	2.1	4.0	-	6.0	2.9	3.7	12.2
2022	7.7	7.6	2.2	2.7	2.0	3.2	-	4.0	2.1	3.0	18.3
2023	7.6	4.6	1.6	2.7	3.6	4.0	-	3.2	1.4	3.6	12.3
2024	6.5	4.7	2.0	3.3	2.9	2.8	2.9	3.1	0.7	2.4	22.8

Appendix 11. Annual mean size (mm) of whelk landed by region and fishing area during the commercial whelk fishery.

Year	North Shore								Gaspé – Lower St. Laurence		Magdalen Islands
	1	2	3	4	5	6	7	8	12	13	15
1987	-	-	-	77.7	-	87.0	-	-	-	70.1	-
1988	-	-	-	82.4	80.3	83.4	-	69.1	-	71.0	71.0
1989	-	-	-	78.6	-	-	-	-	-	75.9	69.9
1990	-	-	78.5	76.4	-	-	-	-	-	-	-
1991	-	-	-	76.1	76.6	83.2	-	-	-	-	-
1992	-	-	-	70.2	74.5	-	-	58.7	-	-	-
1993	73.2	-	-	74.3	79.9	80.7	-	68.8	74.9	76.0	-
1994	72.7	-	-	74.6	80.2	81.8	-	65.7	-	61.1	-
1995	68.0	-	-	72.9	76.7	71.4	-	74.1	-	66.9	-
1996	-	-	-	78.1	-	77.9	-	66.4	-	69.2	-
1997	73.0	72.8	-	83.9	80.7	82.0	-	64.7	-	65.4	-
1998	75.5	66.7	89.3	82.5	78.1	78.6	76.2	70.4	75.8	66.4	-
1999	75.4	70.3	82.1	81.3	79.8	86.3	78.0	73.0	-	62.7	-
2000	75.8	64.5	84.8	84.3	81.7	84.0	79.1	75.4	83.6	49.5	-
2001	77.2	73.8	83.1	82.7	79.9	86.7	-	69.9	85.1	57.7	-
2002	7.60	72.4	85.9	83.9	82.9	86.5	79.6	79.8	84.1	60.8	69.9
2003	71.2	74.3	-	89.0	81.1	84.8	82.7	77.8	85.8	66.9	80.0
2004	72.4	72.5	89.3	86.7	80.4	80.6	81.6	76.5	83.8	69.4	81.7
2005	74.3	73.6	-	87.4	79.8	82.8	81.0	75.8	87.2	76.7	82.2
2006	76.6	71.4	-	82.4	84.6	86.5	83.7	71.3	85.6	80.4	82.9
2007	79.1	74.0	-	89.5	84.6	85.3	82.7	73.8	85.4	87.1	80.8
2008	78.4	71.7	-	88.8	86.3	82.6	86.8	74.7	88.0	83.0	88.4
2009	77.6	78.6	-	88.6	89.3	84.1	86.8	72.9	87.2	83.0	87.5
2010	78.5	82.4	-	90.0	87.9	88.1	86.7	74.2	87.5	86.9	85.4
2011	80.9	75.4	-	90.6	89.6	88.1	90.1	73.0	86.8	84.5	86.9
2012	80.2	78.1	91.8	95.0	90.6	88.8	90.0	75.2	89.2	85.1	83.4
2013	78.7	77.6	-	94.2	88.4	88.2	89.6	79.6	88.8	85.4	85.1
2014	77.7	81.9	-	95.2	90.6	88.1	86.3	77.8	90.3	83.7	92.8
2015	79.2	77.7	94.5	96.2	92.2	87.6	87.7	79.8	93.3	86.2	81.1
2016	80.3	79.6	97.1	96.3	93.6	85.7	85.6	78.4	90.7	87.0	86.1
2017	78.8	79.6	-	97.0	94.4	88.5	91.1	91.1	91.1	88.8	84.3
2018	79.8	78.8	93.6	96.3	92.3	90.6	89.5	86.4	95.0	89.4	88.8
2019	81.3	82.2	-	100.8	93.6	90.1	94.7	83.5	96.8	92.9	89.0
2020	82.7	83.1	-	99.4	96.3	92.0	-	82.4	96.4	-	89.5
2021	83.4	81.2	-	99.0	92.8	93.1	-	86.4	95.2	90.7	87.0
2022	82.1	77.9	-	90.7	96.3	93.1	-	83.5	96.8	87.9	88.0
2023	82.5	80.6	-	92.0	95.7	93.4	-	58.7	97.3	94.1	84.3
2024	84.2	84.2	-	-	76.6	96.4	91.3	68.8	96.2	76.0	86.5

Appendix 12. Annual percentage (%) of sub-legal size whelk in commercial whelk fishery landings by region and fishing area during the whelk fishery. See Appendix 5 for legal sizes in the various fishing areas.

Year	North Shore								Gaspé – Lower St. Laurence		Magdalen Islands
	1	2	3	4	5	6	7	8	12	13	15
1998	3.4	10.2	-	0.1	0.4	2.9	1.6	16.8	-	-	-
1999	8.8	24.7	1.3	2.3	5.9	0.6	7.7	13.7	-	-	-
2000	8.7	54.5	0.9	0.8	4.6	5	-	-	0.9	2.3	-
2001	7.9	18.4	1.2	2.6	1.1	1.5	-	-	1.5	12	-
2002	14.9	34.3	1.9	5.9	6.1	0.9	2.9	37.6	3.2	8.7	28.3
2003	34.2	23.9	-	2.3	3.7	3.9	2.5	15.3	2	5	13.4
2004	37.1	39.9	1.6	6.3	11.9	10.6	7.2	-	12.4	13.7	7.7
2005	29.0	31.3	-	3.5	11.3	10.2	8.8	25.4	3.4	16.0	7.9
2006	18.7	42.0	-	13.9	14.7	3.3	3.6	26.6	3.8	9.0	4.0
2007	8.2	26.7	-	3.1	6.4	4.2	9.7	26.6	3.1	0.8	7.2
2008	15.1	42.8	-	3.4	4.2	6.1	5.3	39.3	1.7	5.5	2.0
2009	13.9	11.4	-	2.8	2.5	5.6	3.6	32.4	2.5	6.3	1.5
2010	12.6	5.7	-	2.1	1.5	1.7	7.4	26.7	2.9	2.0	2.1
2011	4.8	21.5	-	1.5	1.4	1.8	1.5	31.9	2.9	0.3	1.5
2012	6.6	10.4	0.3	0.2	0.6	2.0	1.4	31.5	3.2	0.9	3.4
2013	8.3	12.3	-	0.4	0.6	2.0	1.8	32.0	1.6	0.4	7.0
2014	9.9	2.5	-	0.2	4	2.2	2.7	18.7	2.0	0.5	0.7
2015	8.5	8.0	0.4	0.2	1.4	3.0	5.0	7.6	0.5	0.3	2.3
2016	3.7	4.6	0	0.2	1.3	5.7	2.7	9.0	1.1	0.8	1.2
2017	9.5	4.6	-	0.2	0.6	2.8	2.6	6.7	1.0	0.4	3.4
2018	4.6	8.9	1.3	0.4	-	1.8	2.5	10.7	0.4	0.4	2.0
2019	4.9	3.2	-	1.4	6.8	13.1	4.6	1.2	0.6	0.4	2.0
2020	2.0	1.8	-	0.7	4.8	3.3	-	11.2	0.6	-	3.0
2021	1.6	3.1	-	1.0	2.1	3.7	-	5.8	0	0.7	3.7
2022	4.7	15.3	-	9.4	3.1	4.3	-	16.1	0.4	0.4	1.9
2023	4.7	5.3	-	25.2	3.2	11.8	-	28.2	0.5	1.2	9.8
2024	1.1	1.1	-	-	4.1	1.2	25.3	38.0	0.0	0.3	3.9