Distribution of marine organisms in the shallow coastal zone of Quebec surveyed by underwater imagery between 2017 and 2021

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2025

Canadian Technical Report of
Fisheries and Aquatic Sciences 3616

Fisheries and Oceans Canada | Pêches et Océans Canada

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Canadian Technical Report of Fisheries and Aquatic Sciences

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Cat. No. Fs97-6/3616E-PDF ISBN 978-0-660-75490-1 ISSN 1488-5379
https://doi.org/10.60825/qzcx-bz08

Correct citation for this publication:

Grégoire, B., Pitre, L.D., Provencher-Nolet, L., Paquette, L., and Desjardins, C. 2025. Distribution of marine organisms in the shallow coastal zone of Quebec surveyed by underwater imagery between 2017 and 2021. Can. Tech. Rep. Fish. Aquat. Sci. 3616: v + 74 p. https://doi.org/10.60825/qzcx-bz08

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ABSTRACT

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Between 2017 and 2021, eleven underwater imagery sampling campaigns were carried out over an extensive area of the shallow coastal zone of the Estuary and the Gulf of St. Lawrence. These campaigns provided ground-truthing data for the mapping of estuarine and marine macrophytes and were used to document the composition of coastal ecosystems. The imagery acquisition and video analysis methods used are described in this report. In addition, the occurrence data for 150 taxa and categories of marine organisms, as well as the relative dominance of macrophytes, are discussed. The occurrence data and distribution maps highlight general geographic and bathymetric distribution trends for several macroalgae, invertebrate and fish species, including some of commercial interest. *Saccharina latissima*, frequently observed throughout the study area, regularly dominated the algal beds. In contrast, *Chondrus crispus* was virtually absent from the St. Lawrence Estuary, but was found to be dominant in the Mingan region and south of Cap Gaspé, indicating a preference for warmer waters. The truncated distribution patterns of certain invertebrates, such as *Strongylocentrotus droebachiensis* and *Homarus americanus*, are presumably explained by the presence of limiting physicochemical conditions in certain sectors of the Estuary and the Gulf of St. Lawrence.

RÉSUMÉ

Grégoire, B., Pitre, L.D., Provencher-Nolet, L., Paquette, L., and Desjardins, C. 2025. Distribution of marine organisms in the shallow coastal zone of Quebec surveyed by underwater imagery between 2017 and 2021. Can. Tech. Rep. Fish. Aquat. Sci. 3616: v + 74 p. https://doi.org/10.60825/qzcx-bz08

Entre 2017 et 2021, onze campagnes d'échantillonnage d'imagerie sous-marine ont été menées sur une large étendue de la zone côtière peu profonde de l'estuaire et du golfe du Saint-Laurent. Ces échantillonnages dirigés ont servi de données de vérité terrain pour la cartographie des macrophytes estuariens et marins, et permis de documenter de manière détaillée la composition des écosystèmes côtiers. Les méthodes d'acquisition et d'analyse d'imagerie vidéo utilisées sont décrites dans cet ouvrage. De plus, les données d'occurrences de 150 taxons et catégories d'organismes marins observés, ainsi que la dominance relative des macrophytes sont discutées. Les données d'occurrences et les cartes de distribution mettent en lumière des tendances générales de distribution géographique et bathymétrique pour plusieurs espèces de macroalgues, d'invertébrés et de poissons, dont certaines d'intérêt commercial. *Saccharina latissima*, fréquemment observée sur l'ensemble de la région d'étude, dominait régulièrement les bancs d'algues. À l'inverse, *Chondrus crispus* s'est avérée quasi absente de l'estuaire du Saint-Laurent, mais était régulièrement dominante en Minganie et au sud de Cap Gaspé, indiquant une préférence pour des eaux plus chaudes. Les patrons de distribution tronqués de certains invertébrés tels *Strongylocentrotus droebachiensis* et *Homarus americanus* sont présumément expliqués par la présence de conditions physicochimiques limitantes dans certains secteurs de l'estuaire et du golfe du Saint-Laurent.

1. INTRODUCTION

The main mandate of the Integrated Marine Response Planning program[1] of Fisheries and Oceans Canada (DFO) is to provide support for oil spill preparedness and response by collecting data on sensitive species and environments. Quebec's estuarine and marine macrophyte communities, which are structural components of coastal ecosystems, are recognized as vulnerable (Joseph et al. 2013, Lemieux and Cusson 2014, DFO 2009, Desjardins et al. 2018). They have been mapped extensively through a collaborative project involving the Laboratoire de dynamique et de gestion intégrée des zones côtières [laboratory of coastal zone dynamics and integrated management] at the Université du Québec à Rimouski. The method developed was used to classify the coastal ecosystems of the Estuary and Gulf of St. Lawrence (EGSL) by analyzing high-resolution multispectral aerial photographs and oblique photographs of the coast (Provencher-Nolet et al. 2024).

Underwater imagery sampling, with a focus on macroalgae[†2] and eelgrass,[†] was carried out to generate validation data for the interpretation of physical and biological features visible in the aerial photographs and to document the composition of the shallow coastal ecosystems. These directed sampling campaigns, conducted by DFO along Quebec's maritime coast, also documented the presence of marine invertebrates and fish, including some taxa known to be vulnerable to oil spills, for example *Mya arenaria* and Amphipoda (Dauvin 1998, Desjardins et al. 2018, Gilfillan and Vandermeulen 1978). The resulting occurrence data (Grégoire 2022) were used to assess the geographic distribution of the macroalgae, marine plants and animals surveyed in a vast study area in the EGSL. The data on the distribution of organisms address the need to increase our knowledge about the distribution of macroalgae in Quebec (Merzouk 2016, Tamigneaux and Johnson 2016) and may be used as a baseline for marine planning and conservation. This document describes the sampling and imagery analysis methods used and the distribution of marine organisms in the shallow coastal zone surveyed between 2017 and 2021.

2. METHODOLOGY

2.1 STUDY AREA AND SAMPLE DISTRIBUTION

The study area encompasses large expanses of the Estuary and Gulf of St. Lawrence in the Quebec region, including both shores of the Upper and Lower Estuary, the Gaspé Peninsula, Chaleur Bay and the North Shore from Sept-Îles to Natashquan (Figure 1). The EGSL study area was divided into sectors using the approach described in Provencher-Nolet et al. (2024). Sampling was carried out in the lower midlittoral and infralittoral zones to a depth of approximately 10 m. Given the size of the study area and operational considerations, sampling was limited to 64 priority areas[†] (PAs). The sampling areas and stations were selected in order to generate ground-truthing data for

[1]The Planning for Integrated Environmental Response (PIER) initiative was continued as the Integrated Marine Response Planning (IMRP) program in 2022.

[2]A glossary of terms can be found in Table A1 (APPENDIX 1).

the mapping of estuarine and marine macrophytes in Quebec based on photointerpretation of orthophotographs (Provencher-Nolet et al. 2024). Eleven underwater imagery sampling campaigns were carried out between 2017 and 2021. A detailed list of sampling areas that includes the number of samples taken and the range of depths covered can be found in Table 1.

2.2 EQUIPMENT

The equipment used to carry out the fieldwork included small shallow-draft inflatable boats, a camera mounted on a telescopic pole, a live streaming system and a navigation, positioning and data capture system. The sampling equipment components used between 2017 and 2021 are shown in Table A2 (APPENDIX 2).

The pole-mounted camera system consisted of several pieces of equipment. A list of the equipment included in a standard kit used for underwater video production in 2021 can be found in Table A3 (APPENDIX 3). To standardize the equipment used to record videos, DFO assembled a number of similar kits for itself and for imaging providers. A GoPro camera (HERO9 Black in 2020 and 2021) and two dive lights (Bigblue VL8000P in 2020 and 2021) were attached to a stainless steel mount designed by AXSUB Inc. (Figure 2). The camera angle was set at 20° from the horizontal (towards the seabed) to capture images of both the seabed and the horizon. The steel mount was attached to an adapter into which a pole with a push-button mechanism was inserted. A removable 30 cm base was added under the mount to provide stability on the seabed and to raise the camera.

The live streaming system consisted of a 50 ft. (15.2 m) CamDo Underwater WiFi Extension Cable, which is compatible with the GoPro HERO5 Black camera and later models. This cable had a WiFi receiver at one end, making it possible to view live images on a mobile device, such as a rugged Blackwell BV9100 mobile phone (used in 2020 and 2021). With this system, the videographer could improve videos by repositioning the camera if something was blocking the lens or if there was something of interest to record.

Lastly, boats were positioned at the sampling stations and geographic coordinates were entered using Group Système Forêt's GSFNav app on a Unistrong E7759 Android tablet. The GSF Outils extension for ArcGIS made it easy to import and transfer georeferenced data to and from GSFNav.

2.3 VIDEO IMAGERY ACQUISITION

Underwater video imagery acquisition was scheduled from June 15 to September 30 to coincide with the peak growth period for vegetation,[†] in particular eelgrass and algae in the midlittoral zone, which are scoured by ice each year. September was avoided where possible because fall flooding, high winds and storms increase turbidity in coastal areas and make navigation more difficult.

Best efforts were made to position boats within 5 m of the planned coordinates. However, a radius of up to 10 m was considered acceptable. Each boat was stabilized by at least two anchors, one at the bow and the other on one side, towards the stern. At each station, a depth measurement was taken using an echo sounder.

In 2021, videos were recorded at resolutions of 2.7K and 4K (60 IPS, wide field of view) with HyperSmooth stabilization enabled (Table A2). The camera was remotely controlled using GoPro's Quik mobile phone app. The lights were set to maximum intensity regardless of the depth. The videos had to include two slow, smooth 360° rotations at two different heights. The first rotation was made with the base of the pole set on the seabed, to observe the substrate and the distinctive characteristics of the taxa present. The second rotation was made approximately 1 m above the canopy, to get an overall view of the habitat within a radius of approximately 2 m and to estimate percent vegetation cover. Figure 3 shows one example that meets this requirement (A) and another that does not (B). Each video was approximately three minutes long, with a 5-second pause after each 15-second, 90° rotation.

2.4 REDUCTION OF DEPTHS TO CHART DATUM

Depth data sampled at the surface while underwater imagery was being recorded was reduced to chart datum† by the Canadian Hydrographic Service (CHS) using the following formula:

$$X = D(Lat, Lng, t) - N(Lat, Lng, t)$$

where X is the depth of the sample at chart datum, $D(Lat, Lng, t)$ is the depth of the sample at water level at position *Lat, Lng* and measurement time *t*. $N(Lat, Lng, t)$ is the modelled water level at position *Lat, Lng* and measurement time *t*.

The purpose was to determine the water level at the place and time of measurement. To this end, the CHS used water level forecasts (provided every 15 minutes) at all available water level stations and cotidal zones in the study area.† The use of cotidal zones made it possible to extrapolate the water level predictions modelled at a given time at a water level station to an entire zone.

2.5 UNDERWATER VIDEO ANALYSIS

Metadata recorded in the field were entered into an underwater imagery database† (UIDB). Each year, one to three analysts analyzed the videos produced. Ecosystem components, hereafter referred to as objects of interest,† were identified using attribute values (e.g., sand, rocky, *Saccharina latissima* or membranous or bladelike red algae). Semi-quantitative classes were used specifically to describe the percent cover of vegetation (e.g., "semi-vegetated" means a cover of 25% to 75%) and of certain animals.

The video analysis data were compiled in the UIDB to make them easier to access for various purposes while respecting a format developed for the creation of surface maps for the Quebec estuarine and marine macrophyte mapping project (Provencher-Nolet et al. 2024). The main attributes used in the UIDB are shown and defined in Table A4. For example, occurrences† of vegetation observed in underwater videos were noted using identifiers (Table A5) that were named to the lowest taxonomic level possible (Vg_1; 2; 3; 4). Each identifier was associated with a unique combination of three attribute values (Vg_MORPH, Vg_TYPE and Vg_TAXO) corresponding to the values in the geospatial database† (GDB) used to map estuarine and marine macrophytes in maritime Quebec.

The videos were viewed using the VLC media player, at normal or slow speed, depending on the quality of the recording, and the analyst zoomed in and out as

required. All objects of interest were recorded in a notebook. The first camera rotation, close to the seabed, made it possible to identify substrates and organisms. The second camera rotation, above the canopy, provided a better view for interpreting the following:

- Visibility index (Table A6)
- Composition and order of dominant substrates (Table A7)
- Erect vegetation† cover (Table A8) and encrusting vegetation cover (Table A9)
- Composition and order of dominant vegetation (if any)
- Dominant animal (Table A10), where appropriate, its percent cover (Table A11), and the time in the video at which it was observed

Analysts recorded their observations in the UIDB using a data entry form with automated validation rules. Other information was also included in the UIDB, such as the following:

- Comments recorded in the field
- Comments recorded during metadata validation
- Comments recorded during video analysis
- Comments recorded for specific observations
- Notes related to observations of marginal vegetation†
- Notes related to observations of animals

This information was used in particular to point out details and specific observations useful for incorporating the data into surface maps, or to describe or comment on observations of organisms. An interactive visual dictionary containing examples (images) and descriptions of all the semantic categories was developed and updated as the images were being analyzed, to facilitate and standardize the identification process.[3]

Taxonomic names were checked against the World Register of Marine Species (WoRMS) to reflect the generally accepted nomenclature at the time of writing. Taxonomic ranks for identifying the various organisms observed were generally chosen taking into account the limitations associated with the use of imagery analysis alone (without specimens) for identification purposes and the latest taxonomic developments. For example, the algal species commonly known as *Phycodrys rubens* is identified as "*Phycodrys* sp." because it is indistinguishable from two other similar-looking species recently discovered through molecular research (Saunders and McDevit 2013).

In contrast, the name "*Saccharina longicruris*" was retained to differentiate this form, with its long, hollow stipe, from *Saccharina latissima*, even though recent molecular studies confirm that the two organisms are conspecific (Lane et al. 2006, McDevit and Saunders 2010). This additional information may help shed light on the distribution of these two forms. In addition, recent research has identified a third species of Laminariaceae in the Northwest Atlantic, *Hedophyllum nigripes*, which is morphologically similar to *Laminaria digitata* and sometimes, in the case of individuals with a single frond, to *S. latissima*

[3] English and French versions of the visual dictionary are available on the Government of Canada's Open Government website and on the SLGO website.

(Dankworth et al. 2020, Longtin and Saunders 2016). This species sometimes dominates certain sites, but it cannot be identified on the basis of underwater images alone. Consequently, *H. nigripes* could not be identified in this study. Because it may be present in the study area, caution should be exercised when interpreting the occurrence data for these large bladelike brown algae.

In addition, *Polyides rotunda* and *Furcellaria lumbricalis*, two small branched filamentous red algae, are particularly problematic in terms of imagery-based identification. These two species are from different families, but they are morphologically similar and are found in the same type of habitat, usually rocky seabed areas with sand cover. *Polyides rotunda* is considered native to the Northwest Atlantic and has a fragmented distribution in the EGSL according to Cardinal (1990a, 1990b). Cardinal did not report any occurrences of *F. lumbricalis* (syn. *Furcellaria fastigiata*) in Quebec waters; however, he did observe it nearby, in the waters south of Chaleur Bay at Pointe-Canot, New Brunswick (Cardinal 1966, 1967, 1968, 1990a, 1990b). *F. lumbricalis* is considered a naturalized species in the Northwest Atlantic, and its presence has also been confirmed in the southern Gulf of St. Lawrence (Bird et al. 1983, Mathieson and Dawes 2017, Mathieson et al. 2008). In this case, since it was not possible to confirm the identity of these species using specimens collected in situ, it was assumed that *P. rotunda* had a wide but fragmented distribution in the EGSL, whereas *F. lumbricalis* had a distribution largely confined to the warmer coastal waters of the Maritime Provinces, including the Magdalen Islands. Accordingly, it was decided that all occurrences of these two hard-to-distinguish species would be classified as *P. rotunda*.

It was often impossible to taxonomically identify the algae in the underwater images. Consequently, whether they were identifiable or not, the algae observed were categorized by shape and colour according to a classification system adapted from Leclerc (1987). These categories appear among the vegetation identifiers in Table A5. The colours refer to the three main classes of algae, Chlorophyta (green), Phaeophyta (brown) and Rhodophyta (red). The shape and colour categories for classifying encrusting† algae are shown in Table A12.

Best efforts were made to choose the appropriate taxonomic rank for each object of interest; however, classification errors were inevitable. The risk of misclassification varied depending on the object of interest. The main classification problems are described in the “Notes” column of tables A5 and A10. Other notes on identifying organisms also appear in that column.

Data quality was checked once the imagery analysis had been completed each year. For example, the occurrences were plotted on a map so that distributions could be checked visually. Observations of rare organisms or organisms with distributions that were fragmented or different from known distributions were reviewed. In addition, observations of organisms whose taxonomic identity was difficult to confirm through underwater imagery were reviewed where possible.

2.6 DISSEMINATION

In addition to being adapted and incorporated into the mapping of macrophytes in maritime Quebec (Provencher-Nolet et al. 2024), a complete version of the occurrence data was formatted according to the Darwin Core standard and made available on the

Ocean Biodiversity Information System (OBIS), the Government of Canada's Open Government portal and the St. Lawrence Global Observatory (SLGO) data catalogue.

3. RESULTS AND DISCUSSION

Although the main purpose of the underwater imagery sampling campaigns was to generate validation data for the interpretation of features visible in aerial photographs (Provencher-Nolet et al. 2024), the occurrence dataset produced can be used to learn more about the distribution of marine organisms (and the relative dominance of vegetation types) in the shallow coastal zone (<10 m) of the EGSL (Grégoire 2022). This dataset, the result of DFO field campaigns carried out between 2017 and 2021, contains 2,959 video samples and includes 21,490 occurrences. The observations are documented using 150 identifiers, 58% of which are at the species level. Of the 150 identifiers, 42% are for vegetation (algae and marine plants), and 58% are for animals.

The locations of the sampling stations are described in figures 4 to 8. A large area of the EGSL was sampled; however, the distribution of stations was neither systematic nor random. In some cases, large sections of the coastal zone were not sampled (e.g., the northern Gulf between Sept-Îles and Rivière-au-Tonnerre). Moreover, the density of sampling and the range of depths (median 1.26 m) varied from one location to another (Table 1 and Figure 9). Despite these biases, the occurrence data reveal general geographic and bathymetric distribution trends, especially for the most commonly observed organisms. A summary of the number of occurrences and the minimum and maximum depths at which organisms were observed is provided in Table 2.

Figures 10 to 19 show the distribution of occurrences of many macroalgae of commercial interest (Côté-Laurin et al. 2016). These maps also show the distribution of occurrences where these organisms were among the dominant macroalgae at the stations. A macroalga was considered dominant when it accounted for at least 25% of the vegetation cover at a station where the cover was classified as semi-vegetated or vegetated (25–100%).

Fucus individuals were rarely identified to the species level. These algae are common in the study area and have regularly been categorized as dominant in Chaleur Bay. Like *Ascophyllum nodosum*, these members of the family Fucaceae which are associated with the midlittoral zone may be under-represented in the underwater imagery data because this zone was difficult to access by boat (Himmelman and Lavergne 1985).

The unbranched filamentous brown alga *Chorda* sp. is sometimes difficult to distinguish from *Halosiphon tomentosus*. Both types of algae were observed regularly on the south shore of the Estuary and in the western part of the Mingan region. In Chaleur Bay, *Chorda* sp. was regularly observed to be dominant, whereas *H. tomentosus* was detected only once in the whole of the southern Gaspé Peninsula and Chaleur Bay. *Halosiphon tomentosus* is less tolerant of high temperatures than *Chorda filum* (Novaczek et al. 1986).

S. latissima and *Alaria esculenta* (order Laminariales) have regularly been categorized as dominant in monospecific beds or in assemblages with *L. digitata* and *Saccorhiza*

dermatodea (order Tilopteridales), in particular to the north and east of the Gaspé Peninsula, in the downstream and southern parts of the Lower Estuary, and in the Mingan region. *Saccharina latissima*, the most common of these bladelike brown algae (50% of samples), was observed regularly throughout the study area. It was also regularly observed in monospecific beds in its long-stipe form (*S. longicruris*). *A. esculenta* was not observed in Chaleur Bay, possibly because temperatures near the coast in summer exceeded the species' tolerance threshold [16 °C] (Chassé et al. 2014, Fredersdorf et al. 2009, Munda and Lüning 1977). *Laminaria digitata*, the least common member of the order Laminariales, was rarely observed in monospecific beds.

Agarum clathratum, which is more resistant to grazing by sea urchins, has generally been observed at greater depths than the other members of the order Laminariales (Blain and Gagnon 2014, Himmelman and Lavergne 1985, Himmelman and Nédélec 1990). *Agarum clathratum* was present in all sectors and was regularly observed to be dominant in the Mingan region and south of Cap Gaspé. However, it was not observed in the downstream part of Chaleur Bay or west of the eastern tip of Île aux Lièvres (Upper Estuary).

Membranous, tubular or bladelike green algae include a number of edible species that cannot be identified from underwater imagery. These algae are common throughout the study area. They were regularly dominant in the Upper Estuary, at the mouth of the Saguenay River and along the south shore of the Lower Estuary. Their percent cover appears to be lower in the downstream part of Chaleur Bay and in the eastern Mingan region.

Bangiaceae, membranous red algae, are also common but to a lesser extent than membranous, tubular or bladelike green algae. These algae were not observed in the downstream part of Chaleur Bay, nor were they found to be dominant in assemblages along the southern Gaspé Peninsula. Their coverage appears to be greater on the south shore of the Lower Estuary and in the Lower St. Lawrence region in particular.

The red alga *Palmaria palmata* is common in the study area and regularly dominant in the eastern part of Chaleur Bay, the southern Gaspé Peninsula, the Upper Estuary, the downstream part of the Lower Estuary (especially the south shore) and the eastern part of the Mingan region.

The distribution of *Chondrus crispus* shows that it prefers the warmer waters of the southern Gulf (Kübler and Davison 1993). This small red alga was regularly dominant south of Cap Gaspé. *Chondrus crispus* was not detected in the St. Lawrence Estuary, apart from a few isolated observations along the northern Gaspé Peninsula. However, it was observed repeatedly and was sometimes dominant in locations such as the eastern part of the Mingan region.

Mytilus sp. mussels, presumed to belong to the *Mytilus edulis* species complex because of the depths sampled, were regularly observed with high percent cover values (underestimated because vegetation cover was high) between the Baie de Gaspé and the eastern part of Chaleur Bay (Figure 20). On the Gaspé Peninsula, *Mytilus* sp. were generally very small and densely attached to rocky substrates. These bivalves were also regularly observed with high percent cover in the Estuary, especially on the south shore,

and in the Mingan region. In these sectors, the specimens observed were more frequently large and sometimes attached to apparently soft substrates.

The green sea urchin, *Strongylocentrotus droebachiensis*, was the third most commonly observed invertebrate. This herbivorous echinoderm plays an important role in determining the structure of algal communities through its grazing (Himmelman and Lavergne 1985). The green sea urchin was frequently observed in the Lower Estuary, northern Gaspé Peninsula and northern Gulf, and was regularly observed in the southern Gaspé Peninsula (Figure 21). However, few or no *S. droebachiensis* individuals were detected in the downstream part of Chaleur Bay and upstream of the eastern tip of Île aux Lièvres (Upper Estuary), presumably because its presence was limited by the physicochemical properties of the water (salinity, temperature) or the predominance of fine, soft substrates in those locations (Himmelman and Lavergne 1985, Scheibling and Hatcher 2007, Stephens 1972).

Similarly, the American lobster, *Homarus americanus*, exhibited a truncated distribution pattern, suggesting that there were limiting physicochemical conditions in some parts of the EGSL (Figure 22). The temperature and salinity in the coastal zone of the EGSL can vary significantly from one sector to another and from season to season (Chassé et al. 2014, Galbraith et al. 2023). These variations are caused in particular by currents and by the inflow of fresh water from the St. Lawrence River and its major tributaries. The presence of *H. americanus* on the North Shore and especially in the Gaspé Peninsula may be due to particularly favourable physicochemical conditions for the species. Commercial lobster abundance indicators in these two sectors have been rising sharply over the last ten years (DFO 2022a, 2022b).

A number of other invertebrates and fish were commonly observed in the underwater images. Some common invertebrates, such as the rock crab *Cancer irroratus* and the lugworm *Arenicola marina* are distributed relatively evenly throughout the study area (Figure 23 and Figure 24). For further examples, maps showing the distribution of occurrences of the sea cucumber *Cucumaria frondosa* and the polar sea star, *Leptasterias polaris*, are shown in Figure 25 and Figure 26.

The effectiveness of the underwater imagery sampling method in detecting the presence of marine organisms may vary depending on their size, their level of mobility and the types of habitat sampled. The detection of motile animals, for example, could be reduced because of their ability to flee and hide. Similarly, the structure and complexity of the habitat and the density of the canopy are factors that may affect the ability to detect the organisms present. All the occurrence data collected in this initiative, including data on organisms for which no occurrence map has been presented in this report, can be viewed using the OBIS Mapper (Grégoire 2022).

4. CONCLUSION

Underwater videos of the shallow coastal zone of the Estuary and Gulf of St. Lawrence were compiled between 2017 and 2021 to support the mapping of macroalgal beds and eelgrass beds in maritime Quebec for purposes of oil spill preparedness and response (Provencher-Nolet et al. 2024). The marine organism occurrence data generated partly offsets the lack of knowledge about the distribution of marine organisms in shallow

coastal zones, including certain macroalgae of commercial interest, and makes it possible to assess the geographic distribution and the relative dominance of 150 taxa across a large part of the study area.

In particular, *S. latissima*, the most common of the bladelike brown algae, was observed regularly throughout the study area and was regularly dominant. *L. digitata*, the least common member of the order Laminariales, was rarely observed in monospecific beds. *A. esculenta* was not detected in Chaleur Bay, possibly because temperatures exceeded its tolerance threshold. In contrast, *C. crispus* regularly dominated algal beds in the Mingan region and particularly south of Cap Gaspé but was virtually absent from the Estuary, reflecting its preference for warmer waters. Some commonly observed marine invertebrates such as *C. irroratus* and *A. marina* were distributed relatively evenly throughout the study area. By contrast, the truncated distribution patterns of some common species such as *S. droebachiensis* and *H. americanus* presumably reflect the spatial boundaries of the physiochemical conditions favourable to these species.

The occurrence data generated under this initiative are publicly available on various platforms (Open Government, OBIS and SLGO). They may be particularly useful for marine planning and conservation and may serve as useful reference data in the context of climate change.

5. ACKNOWLEDGEMENTS

We would like to thank all those who contributed directly or indirectly to this major undertaking, whether by collaborating on the project, providing technical support or scientific advice, or lending valuable assistance in the field.

Thanks to Mélanie Poirier, Valérie Massé-Beaulne, Stéphanie Caron, Louis-Philippe Caron, Anaïs Tétreault, Aurélie Rivard, Yves Clermont, Jean-Daniel Tourangeau-Larivière, Sophie Proudfoot, Jean Thibault and François Roy for their work on this project. We would like to thank all the imagery providers who worked with DFO to carry out the imagery acquisition campaigns at sea: the Comité ZIP du Sud-de-l'Estuaire, Explos-Nature, Merinov, Enviro-Mer and PESCA Environment.

Thanks also to Mathieu Rondeau and his team at the Canadian Hydrographic Service for the reduction of depths to chart datum, to Claude Nozères for his assistance in identifying the invertebrates and fish observed during the underwater imagery analysis, and to Bernard Sainte-Marie for his valuable advice on presenting and interpreting the occurrence data.

Finally, we wish to thank Yanick Gendreau and Fanny Noisette for reviewing this report.

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7. TABLES

Table 1. Underwater imaging sampling campaigns ordered by sector and priority area (PA) number. The number of underwater image samples and the minimum and maximum depths are indicated for each priority area (total of 2,959 samples).

Sector	No.	Priority area (PA) name	Year	Start date	End date	Provider	No. of samples	Min. depth (m)	Max. depth (m)
Chaleur Bay	PA42	Grande-Rivière-Ouest	2019	08-28	09-24	Merinov	70	0.16	6.41
	PA 43	Chandler	2021	06-23	07-14	Enviro-Mer	37	-0.25	7.69
	PA45	Port-Daniel	2020	08-16	09-07	Enviro-Mer	61	-0.12	7.13
	PA46	Sigawake	2021	07-26	08-05	Enviro-Mer	65	-0.35	6.55
	PA47	Paspébiac	2021	06-21	08-02	Enviro-Mer	44	-0.13	6.48
	PA48	Bonaventure	2019	08-14	08-15	Department of Fisheries and Oceans	85	-0.69	6.40
	PA49	Rivière Caplan	2019	08-10	08-16	Department of Fisheries and Oceans	62	-0.54	6.70
	PA50	Cascapédia	2019	08-08	08-17	Department of Fisheries and Oceans	96	-0.48	4.99
	PA51	Carleton	2019	08-06	08-07	Department of Fisheries and Oceans	45	-0.33	6.70
	PA52	Miguasha	2019	08-07	08-07	Department of Fisheries and Oceans	39	-1.17	5.41
	PA53	Escouminac	2019	08-08	08-16	Department of Fisheries and Oceans	42	-1.61	3.23
	PA59	New Port	2020	08-21	08-23	Enviro-Mer	70	0.00	7.41
Lower Estuary (north shore)	PA01	Godbout	2018	08-14	08-14	Pesca Environment	25	-0.05	5.39
	PA02	Franquelin	2018	08-15	08-15	Pesca Environment	27	-1.20	4.05
	PA03	Baie-Comeau	2018	08-15	08-15	Pesca Environment	22	0.28	6.35
	PA06	Colombier	2018	08-17	08-18	Pesca Environment	20	-0.52	6.04
	PA07	Baie Laval	2018	08-17	08-18	Pesca Environment	20	-1.67	6.19
	PA08	Portneuf	2018	08-17	08-18	Pesca Environment	10	-1.31	2.11
	PA09	Longue-Rive	2018	08-18	08-18	Pesca Environment	15	-0.57	3.35
	PA10	Escoumins	2018	08-18	08-18	Pesca Environment	27	0.02	7.74

Sector	No.	Priority area (PA) name	Year	Start date	End date	Provider	No. of samples	Min. depth (m)	Max. depth (m)
	PA11	Escoumins-Ouest	2018	08-19	08-19	Pesca Environment	35	0.08	8.71
	PA12	Bergeronnes	2018	08-19	08-19	Pesca Environment	24	-0.22	10.88
	PA13	Tadoussac	2018	08-20	08-20	Pesca Environment	64	-1.18	4.49
Lower Estuary (south shore)	PA20	Isle-Verte	2018	09-20	09-20	Department of Fisheries and Oceans	33	-1.18	1.71
	PA20	Isle-Verte	2019	09-09	09-30	Comité ZIP du Sud-de-l'Estuaire (contracted by Merinov)	70	-2.38	2.51
	PA20e	Trois-Pistoles	2019	09-26	09-30	Comité ZIP du Sud-de-l'Estuaire (contracted by Merinov)	40	-1.84	2.10
	PA21	Bic	2017	08-29	08-29	Comité ZIP du Sud-de-l'Estuaire	13	-0.85	2.33
	PA21	Bic	2018	07-25	09-28	Department of Fisheries and Oceans	53	-0.80	2.93
	PA22	Rimouski	2017	07-31	08-30	Comité ZIP du Sud-de-l'Estuaire	54	-1.78	3.30
	PA22	Rimouski	2018	07-05	08-01	Department of Fisheries and Oceans	66	-1.87	3.96
	PA23	Mitis	2018	07-13	08-31	Department of Fisheries and Oceans	80	-1.29	3.13
	PA24	Matane	2018	08-14	08-17	Department of Fisheries and Oceans	36	-0.37	4.59
	PA25	Capucins	2018	08-21	08-25	Department of Fisheries and Oceans	33	0.23	4.44
	PA26	Cap-Chat	2018	08-08	08-12	Department of Fisheries and Oceans	35	0.32	4.29
Upper Estuary	PA14	Batture aux Alouettes	2019	09-06	09-09	Merinov	62	-1.48	3.81
	PA15	La Malbaie	2019	09-05	09-06	Merinov	45	-0.91	2.90
	PA16	Baie-Saint-Paul	2019	09-03	09-03	Merinov	2	-0.58	-0.08
	PA17	Île aux Lièvres	2019	09-10	09-12	Comité ZIP du Sud-de-l'Estuaire (contracted by Merinov)	36	-0.59	3.89
	PA18	Kamouraska	2019	09-16	09-19	Comité ZIP du Sud-de-l'Estuaire (contracted by Merinov)	74	-1.85	2.61
	PA19	Rivière Ouelle	2019	09-18	09-18	Comité ZIP du Sud-de-l'Estuaire (contracted by Merinov)	14	-2.00	-0.57
	PA64	Rivière-au-Renard	2021	08-11	08-18	Enviro-Mer	41	-0.01	7.54

Sector	No.	Priority area (PA) name	Year	Start date	End date	Provider	No. of samples	Min. depth (m)	Max. depth (m)
Northern Gaspé Peninsula	PA66	Petite- et Grande-Vallée	2021	06-29	07-04	Enviro-Mer	39	0.00	6.42
	PA67	Sainte-Madeleine-de-la-Riviere-Madeleine	2021	07-03	07-04	Enviro-Mer	40	-0.20	6.62
	PA68	Saint-Maxime-du-Mont-Louis	2021	07-05	08-10	Enviro-Mer	69	-0.38	6.33
	PA71	Sainte-Anne-des-Monts	2021	08-16	08-23	Enviro-Mer	49	-0.09	6.26
Northern Gulf	PA30	Baie-Trinite	2020	09-19	09-29	Explos-Nature	63	-1.05	8.24
	PA31	Rivière-Pentecôte	2020	10-02	10-05	Explos-Nature	37	-1.00	7.42
	PA31	Rivière-Pentecôte	2021	06-13	06-18	Explos-Nature	22	-0.87	7.29
	PA33	Sept-Îles	2021	06-19	08-23	Explos-Nature	21	-1.36	6.68
	PA34	Rivière-au-Tonnerre	2021	08-02	08-02	Department of Fisheries and Oceans	47	0.30	9.30
	PA35	Mingan	2021	07-29	07-30	Department of Fisheries and Oceans	50	-0.39	9.28
	PA36	Havre-Saint-Pierre	2021	07-27	08-08	Department of Fisheries and Oceans	118	-0.91	9.40
	PA37	Baie-Nickerson	2021	08-05	08-08	Department of Fisheries and Oceans	79	-0.51	8.55
	PA38	Baie-Johan-Beetz	2021	07-19	07-20	Department of Fisheries and Oceans	69	-0.47	9.06
	PA39	Aguanish	2021	07-18	07-24	Department of Fisheries and Oceans	63	-0.63	8.95
	PA40	Natashquan	2021	07-13	07-21	Department of Fisheries and Oceans	87	-0.68	9.01
Southern Gaspé Peninsula	PA60	Percé	2020	08-29	09-01	Enviro-Mer	69	0.03	7.28
	PA61	Bridgeville	2020	09-04	09-06	Enviro-Mer	40	0.32	7.24
	PA62	Gaspé	2020	07-28	08-12	Enviro-Mer	111	-0.41	7.31
	PA63	Pointe Forillon	2020	07-24	08-13	Enviro-Mer	94	-0.25	8.21

Table 2. Summary of occurrence data for all organisms observed in underwater images collected between 2017 and 2021 (min. depth = -2.4 m; max. depth = 10.9 m). All the identifiers for observed organisms are listed under "Classification/Identifier." The higher taxonomic ranks in bold are not identifiers. Rather, they are used to organize the organisms according to taxonomic classification, where applicable. The number of occurrences in each sector is shown, followed by the total number of occurrences and the minimum and maximum depths adjusted to chart datum. UE = Upper Estuary; LEss = Lower Estuary (south shore); LEns = Lower Estuary (north shore); NG = Northern Gulf; NGP = Northern Gaspé Peninsula; SGP = Southern Gaspé Peninsula; CB = Chaleur Bay.

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
ANIMALIA										
ANNELIDA, CLITELLATA										
Hirudinea										
Hirudinea	-	-	1	2	-	-	-	***3***	-0.7	6.9
ANNELIDA, POLYCHAETA										
Polychaeta	-	-	-	1	-	-	-	***1***	1.1	1.1
Arenicolidae										
Arenicola marina	33	80	96	149	32	24	87	***501***	-1.3	8.7
Echiuroidea, Bonelliidae										
Pseudobonellia iraidii	2	2	9	4	-	-	-	***17***	0.6	8.0
Sabellida, Sabellidae										
Myxicola sp.	-	-	-	2	-	-	-	***2***	0.5	6.9
Sabellida, Serpulidae										
Spirorbinae	-	-	-	12	-	14	6	***32***	-0.3	6.6
Terebellida, Terebellidae										
Terebellidae	1	3	-	3	-	-	1	***8***	-1.4	6.0
ARTHROPODA, MALACOSTRACA										
Amphipoda										
Amphipoda	31	95	82	36	3	17	4	***268***	-1.8	7.1
Amphipoda, Caprellidae										
Caprellidae	2	40	12	60	21	14	7	***156***	-0.5	8.2
Decapoda										
Caridea	-	-	-	1	-	-	-	***1***	3.5	3.5
Decapoda, Cancridae										
Cancer irroratus	2	82	39	93	129	53	126	***524***	-1.8	9.1
Decapoda, Crangonidae										
Crangon septemspinosa	4	9	-	12	1	16	14	***56***	-1.0	7.2

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Decapoda, Nephropidae										
Homarus americanus	-	12	-	12	85	96	91	***296***	-0.3	8.2
Decapoda, Oregoniidae										
Hyas sp.	-	-	-	4	-	1	-	***5***	2.2	8.2
Decapoda, Paguridae										
Pagurus sp.	-	4	6	32	10	7	51	***110***	-0.5	8.2
Isopoda, Idoteidae										
Idotea sp.	-	-	1	16	-	12	3	***32***	-1.4	2.8
Mysida, Mysidae										
Mysidae	26	224	66	191	52	88	150	***797***	-1.8	8.2
ARTHROPODA, THECOSTRACA										
Balanomorpha										
Balanoidea	-	99	37	22	58	57	113	***386***	-1.2	8.2
BRACHIOPODA, RHYNCHONELLATA										
Terebratulida, Cancellothyrididae										
Terebratulina septentrionalis	-	-	2	-	-	-	-	***2***	1.7	2.0
BRYOZOA										
Encrusting bryozoa	3	32	3	43	27	137	256	***501***	-1.1	8.2
CHORDATA										
Actinopterygii										
Actinopterygii	-	3	1	6	1	4	10	***25***	-1.2	7.4
CHORDATA, ACTINOPTERI										
Eupercaria *incertae sedis*, Labridae										
Tautogolabrus adspersus	-	-	-	-	-	7	69	***76***	-0.5	7.2
Eupercaria *incertae sedis*, Moronidae										
Morone saxatilis	-	-	-	-	-	-	1	***1***	3.2	3.2
Gadiformes, Gadidae										
Gadus sp.	-	-	-	-	1	1	-	***2***	4.5	6.7
Perciformes, Ammodytidae										
Ammodytes	-	5	2	11	7	7	7	***39***	-0.1	8.5
Perciformes, Cottidae										

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Cottidae	-	1	-	1	4	3	1	***10***	0.1	6.6
Perciformes, Cyclopteridae										
Cyclopterus lumpus	-	-	2	-	3	3	-	***8***	-0.5	6.4
Perciformes, Gasterosteidae										
Gasterosteidae	-	-	-	9	-	11	-	***20***	-1.4	4.9
Perciformes, Liparidae										
Liparis sp.	-	1	-	-	1	-	-	***2***	1.0	1.3
Perciformes, Pholidae										
Pholis gunnelus	-	-	-	-	1	-	-	***1***	0.4	0.4
Perciformes, Stichaeidae										
Stichaeus punctatus	-	-	-	2	4	7	5	***18***	0.9	8.0
Perciformes, Zoarcidae										
Zoarces americanus	-	-	-	-	1	-	-	***1***	0.1	0.1
Pleuronectiformes, Pleuronectidae										
Pleuronectidae	-	-	-	1	4	1	9	***15***	-0.5	6.4
Scombriformes, Scombridae										
Scomber scombrus	-	-	-	-	-	-	1	***1***	5.2	5.2
CHORDATA, ASCIDIACEA										
Ascidiacea	-	-	1	1	-	-	-	***2***	2.5	6.0
Stolidobranchia, Pyuridae										
Halocynthia pyriformis	-	-	2	2	-	1	-	***5***	0.9	8.2
CNIDARIA										
Cnidaria	-	-	-	1	-	-	-	***1***	0.2	0.2
CNIDARIA, ANTHOZOA										
Actiniaria										
Actiniaria	-	-	5	12	13	22	10	***62***	0.4	8.2
Actiniaria, Actiniidae										
Actiniidae	-	-	5	-	-	-	-	***5***	2.8	7.9
Aulactinia stella	-	3	-	-	-	-	-	***3***	-1.0	-0.2
Actiniaria, Actinostolidae										
Stomphia coccinea	-	-	-	-	1	-	-	***1***	4.9	4.9

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Actiniaria, Halcampidae										
Halcampa duodecimcirrata	-	-	-	7	-	-	-	***7***	4.7	6.6
Actiniaria, Metridiidae										
Metridium senile	-	1	13	1	2	2	-	***19***	3.4	8.7
Alcyonacea, Nephtheidae										
Gersemia rubiformis	-	-	21	5	-	2	-	***28***	1.7	9.4
CNIDARIA, HYDROZOA										
Hydrozoa	11	94	44	91	6	28	98	***372***	-1.8	8.3
Anthoathecata, Pandeidae										
Catablema vesicarium	-	-	-	2	-	-	-	***2***	1.7	2.7
Anthoathecata, Tubulariidae										
Tubulariidae	-	-	-	-	-	-	20	***20***	0.6	6.7
Leptothecata, Laodiceidae										
Ptychogena lactea	-	-	4	-	-	-	-	***4***	2.7	6.1
Leptothecata, Laodiceidae										
Staurostoma mertensii	-	-	-	10	-	-	1	***11***	0.6	7.9
Leptothecata, Sertulariidae										
Sertulariidae	1	2	3	3	4	3	-	***16***	0.2	7.4
CNIDARIA, SCYPHOZOA										
Semaeostomeae, Cyaneidae										
Cyanea sp.	-	-	-	1	-	-	43	***44***	-0.5	6.7
Semaeostomeae, Ulmaridae										
Aurelia sp.	-	-	-	1	-	-	-	***1***	1.1	1.1
Stauromedusae										
Stauromedusae	1	2	1	4	-	-	-	***8***	-0.3	5.6
CTENOPHORA										
Ctenophora	1	-	12	16	1	-	2	***32***	-0.9	8.2
ECHINODERMATA, ASTEROIDEA										
Asteroidea	-	9	11	41	22	4	9	***96***	0.2	8.6
Forcipulatida, Asteriidae										
Asterias rubens	-	24	33	116	53	6	38	***270***	-0.2	8.8

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Forcipulatida, Asteriidae										
Leptasterias polaris	6	29	89	14	8	1	-	***147***	0.1	10.9
Spinulosida, Echinasteridae										
Henricia sp.	-	1	-	3	5	14	8	***31***	2.1	7.2
Valvatida, Solasteridae										
Crossaster papposus	-	-	-	-	2	-	-	***2***	3.7	5.2
Valvatida, Solasteridae										
Solaster endeca	-	-	-	1	-	-	-	***1***	2.9	2.9
ECHINODERMATA, ECHINOIDEA										
Camarodonta, Strongylocentrotidae										
Strongylocentrotus droebachiensis	24	92	165	210	118	48	46	***703***	-1.0	10.9
Clypeasteroida, Echinarachniidae										
Echinarachnius parma	3	2	20	109	7	2	1	***144***	0.0	9.3
ECHINODERMATA, HOLOTHUROIDEA										
Dendrochirotida, Cucumariidae										
Cucumaria frondosa	-	5	42	30	9	-	-	***86***	0.4	8.7
Dendrochirotida, Psolidae										
Psolus fabricii	-	-	55	10	-	-	-	***65***	0.0	10.9
Dendrochirotida, Psolidae										
Psolus phantapus	-	-	2	-	-	-	-	***2***	3.6	7.7
ECHINODERMATA, OPHIUROIDEA										
Amphilepidida, Ophiopholidae										
Ophiopholis aculeata	-	-	3	53	4	9	-	***69***	0.5	8.3
MOLLUSCA, BIVALVIA										
Bivalvia	-	3	-	2	2	-	6	***13***	-0.5	6.9
Adapedonta, Pharidae										
Ensis leei	-	1	-	-	-	-	-	***1***	1.8	1.8
Myida, Myidae										
Mya sp.	-	-	2	-	-	-	-	***2***	2.1	7.1
Myida, Pholadidae										
Zirfaea crispata	-	-	6	2	-	-	-	***8***	1.7	7.1

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Mytilida, Mytilidae										
Mytilus sp.	17	71	24	76	76	153	122	***539***	-1.9	8.2
Pectinida, Pectinidae										
Placopecten magellanicus	-	-	-	-	-	1	-	***1***	6.6	6.6
Venerida, Mesodesmatidae										
Mesodesma arctatum	-	-	1	-	-	-	-	***1***	0.4	0.4
MOLLUSCA, GASTROPODA										
Gastropoda	18	128	18	294	100	152	357	***1067***	-2.4	8.3
Lottiidae										
Testudinalia testudinalis	5	29	29	55	107	48	39	***312***	-1.0	8.2
Littorinimorpha, Littorinidae										
Littorina sp.	2	56	4	81	40	22	212	***417***	-2.4	6.9
Littorinimorpha, Naticidae										
Euspira heros	-	-	-	1	3	-	1	***5***	2.0	8.3
Neogastropoda, Buccinidae										
Buccinidae	1	-	12	7	-	-	-	***20***	0.5	6.5
Neogastropoda, Muricidae										
Nucella lapillus	-	-	-	-	-	2	1	***3***	0.4	6.0
Nudibranchia, Dendronotidae										
Dendronotus sp.	-	-	2	-	-	-	-	***2***	1.5	2.4
MOLLUSCA, POLYPLACOPHORA										
Chitonida, Tonicellidae										
Tonicellidae	1	1	1	-	1	5	7	***16***	1.4	8.2
PORIFERA, DEMOSPONGIAE										
Demospongiae	-	1	-	1	-	-	3	***5***	1.6	4.6
Demospongiae morph. encrusting	-	11	11	18	8	15	36	***99***	0.3	8.2
Haplosclerida, Chalinidae										
Haliclona oculata	-	-	-	-	-	1	1	***2***	3.1	4.9
Suberitida, Halichondriidae										
Halichondria sitiens	-	-	-	-	2	-	-	***2***	3.9	5.3
ANIMALIA (other)										

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Endobenthos	3	1	1	53	1	7	27	***93***	-1.1	8.6
Small sediment tubes	-	-	-	2	-	3	-	***5***	2.5	7.1
CHROMISTA										
OCHROPHYTA, PHAEOPHYCEAE										
Desmarestiales, Desmarestiaceae										
Desmarestia sp.	5	128	13	95	30	58	35	***364***	-0.8	8.5
Ectocarpales										
Ectocarpales	1	33	5	2	1	10	64	***116***	-0.4	7.1
Ectocarpales, Chordariaceae										
Chordaria sp.	1	51	21	28	20	16	73	***210***	-1.0	7.4
Ectocarpales, Scytosiphonaceae										
Scytosiphonaceae (tubular)	1	15	-	6	6	-	2	***30***	-0.3	2.7
Fucales, Fucaceae										
Fucaceae	-	4	-	-	-	-	-	***4***	0.3	3.1
Ascophyllum nodosum	3	8	1	17	-	-	4	***33***	-1.2	2.7
Fucus distichus subsp. *edentatus*	13	17	6	3	7	-	6	***52***	-1.8	2.8
Fucus distichus subsp. *evanescens*	-	1	1	5	-	1	2	***10***	-0.6	4.4
Fucus sp.	44	57	33	99	26	27	231	***517***	-1.8	7.7
Fucus vesiculosus	-	4	1	-	-	4	2	***11***	-1.8	1.7
Laminariales										
Laminariales	5	-	1	2	-	-	-	***8***	-1.0	6.8
Laminariales, Agaraceae										
Agarum clathratum	3	35	37	181	46	69	64	***435***	-0.4	9.1
Laminariales, Alariaceae										
Alaria esculenta	58	147	82	131	86	55	1	***560***	-1.5	8.7
Laminariales, Chordaceae										
Chorda sp.	1	57	-	19	8	5	111	***201***	-1.8	6.1
Laminariales, Laminariaceae										
Laminariaceae	2	-	2	2	-	-	1	***7***	0.0	2.8
Laminaria digitata	-	31	-	59	7	17	34	***148***	-1.0	6.7
Saccharina latissima	107	170	58	142	124	176	296	***1073***	-1.8	9.3

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Saccharina longicruris	47	167	38	63	6	18	73	***412***	-1.3	8.5
Ralfsiales (shape and colour)										
Brown encrusting algae	1	5	1	8	17	9	22	***63***	-1.8	8.2
Tilopteridales, Halosiphonaceae										
Halosiphon tomentosus	-	20	2	11	30	-	1	***64***	-0.3	7.4
Tilopteridales, Phyllariaceae										
Saccorhiza dermatodea	21	99	11	44	66	44	100	***385***	-1.4	7.4
OCHROPHYTA, PHAEOPHYCEAE (shape and colour)										
Striplike brown algae	-	-	-	2	-	-	-	***2***	3.6	6.8
Thick unbranched filamentous brown algae	8	8	-	5	1	1	1	***24***	-0.6	6.1
Membranous or bladelike brown algae	36	23	15	7	1	2	20	***104***	-1.4	6.9
Membranous or bladelike brown algae (small)	-	26	11	2	1	-	-	***40***	-0.8	3.7
PLANTAE										
CHLOROPHYTA, ULVOPHYCEAE										
Cladophorales, Cladophoraceae										
Chaetomorpha sp.	8	7	-	14	2	6	6	***43***	-0.3	3.5
CHLOROPHYTA (shape and colour)										
Delicate branched filamentous green algae	4	11	3	12	10	-	35	***75***	-1.1	5.0
Unidentified† green algae	2	4	-	4	-	-	5	***15***	-0.5	2.0
Membranous or bladelike green algae	140	109	45	87	56	88	123	***648***	-1.8	8.5
Non-filamentous green algae	5	127	52	25	33	25	31	***298***	-2.0	7.4
Tubular or baglike green algae	4	81	17	1	2	3	14	***122***	-2.0	5.0
RHODOPHYTA, BANGIOPHYCEAE										
Bangiales, Bangiaceae										
Bangiaceae (membranous or bladelike)	13	96	23	31	49	23	8	***243***	-1.2	8.5
RHODOPHYTA, FLORIDEOPHYCEAE										
Ahnfeltiales, Ahnfeltiaceae										
Ahnfeltia sp.	6	-	-	3	-	13	32	***54***	-1.1	5.0
Ceramiales										
Ceramiales (flattened or foliated filamentous)	16	28	1	-	-	2	1	***48***	-0.9	7.0
Ceramiales, Callithamniaceae										

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Ptiloteae	-	1	-	21	31	14	1	***68***	0.5	8.0
Ceramiales, Delesseriaceae										
Phycodrys sp.	17	28	-	21	19	24	7	***116***	-0.8	8.2
Corallinales, Corallinaceae										
Corallina officinalis	-	-	-	20	7	42	82	***151***	-0.5	6.4
Gigartinales, Gigartinaceae										
Chondrus crispus	-	6	-	14	2	86	261	***369***	-1.0	7.2
Gigartinales, Phyllophoraceae										
Phyllophoraceae	-	-	-	2	-	7	4	***13***	0.3	6.4
Gigartinales, Polyidaceae										
Polyides rotunda	1	-	-	-	-	15	13	***29***	0.1	6.4
Hildenbrandiales, Hildenbrandiaceae (shape and colour)										
Red non-calcareous encrusting algae	-	2	3	4	1	1	21	***32***	-0.4	6.5
Palmariales, Palmariaceae										
Devaleraea ramentacea (filamentous)	6	47	2	31	13	28	6	***133***	-1.3	5.2
Devaleraea ramentacea (tubular)	7	7	1	6	9	20	8	***58***	-1.0	6.9
Palmaria palmata	85	111	5	74	22	82	158	***537***	-1.4	6.9
RHODOPHYTA, FLORIDEOPHYCEAE (shape and colour)										
Red calcareous encrusting algae	42	265	180	278	195	185	318	***1,463***	-1.4	10.9
Red calcareous encrusting algae and red non-calcareous encrusting algae	-	-	-	-	-	-	2	***2***	0.6	3.4
Red non-calcareous encrusting algae and red calcareous encrusting algae	-	-	-	1	-	-	3	***4***	0.6	3.9
Rhodolith bed (red calcareous encrusting algae)	-	-	-	7	-	-	-	***7***	2.2	8.0
RHODOPHYTA (shape and colour)										
Flattened or foliated filamentous red algae	18	48	5	46	14	23	22	***176***	-1.3	9.1
Delicate branched filamentous red algae	36	65	5	147	56	105	70	***484***	-1.6	9.3
Membranous or bladelike red algae	18	43	9	8	4	2	6	***90***	-1.4	6.9
TRACHEOPHYTA, MAGNOLIOPSIDA										
Alismatales, Zosteraceae										
Zostera marina	-	49	2	133	2	66	227	***479***	-2.4	6.7
UNIDENTIFIED ALGAE (shape and colour)										
Brown encrusting algae and red calcareous encrusting algae	-	-	-	3	1	-	-	***4***	-0.4	1.3

Classification/Identifier	Sector								Depth (m)	
	UE	LEss	LEns	NG	NGP	SGP	CB	*Total*	Min.	Max.
Brown encrusting algae and non-calcareous red encrusting algae	-	-	-	-	-	-	1	***1***	-1.2	-1.2
Red calcareous encrusting algae and brown encrusting algae	-	-	-	2	1	17	16	***36***	-0.3	7.1
Red non-calcareous encrusting algae and brown encrusting algae	-	-	-	-	-	3	4	***7***	-0.3	6.9
Delicate filamentous algae	45	196	53	184	52	108	253	***891***	-2.0	8.7
Thick branched filamentous algae	32	45	18	107	56	25	135	***418***	-1.2	8.0
Unidentified filamentous algae	35	26	8	14	2	6	11	***102***	-1.0	9.0
Unidentified membranous or bladelike algae	3	6	1	1	-	1	7	***19***	-1.0	5.5
Unidentified tubular or baglike algae	-	-	-	-	-	-	1	***1***	0.9	0.9
Unidentified algae	24	20	16	16	7	2	15	***100***	-1.2	7.3
Colonial microalgae	28	181	54	90	7	38	94	***492***	-1.8	8.7

8. FIGURES

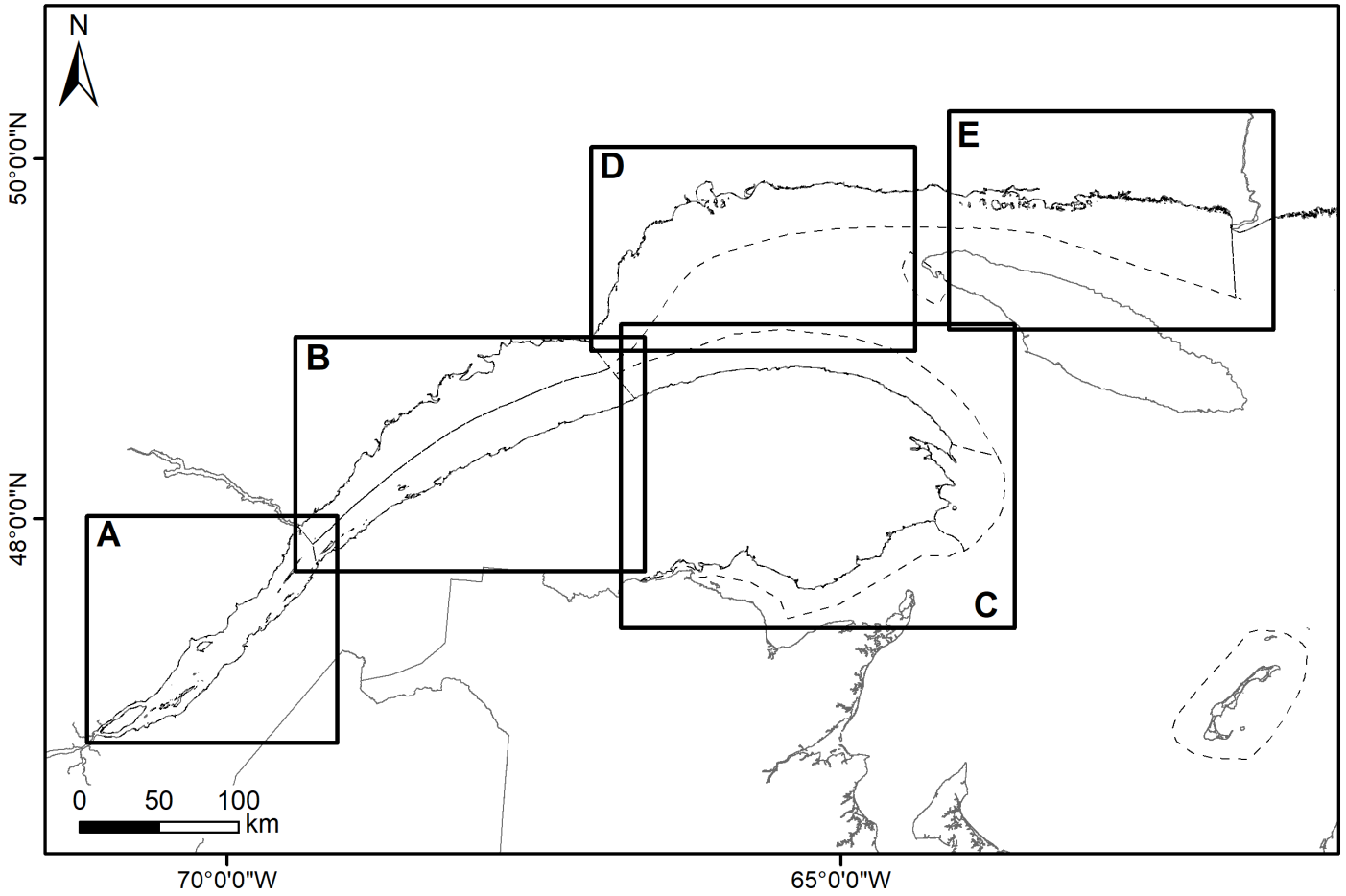

Figure 1. The study area. Each labelled box (A–E) corresponds to a detailed location map of the stations sampled (figures 4–8). The dotted lines represent the boundaries of the sectors established in the Integrated Marine Response Planning (IMRP) initiative (Table 1).

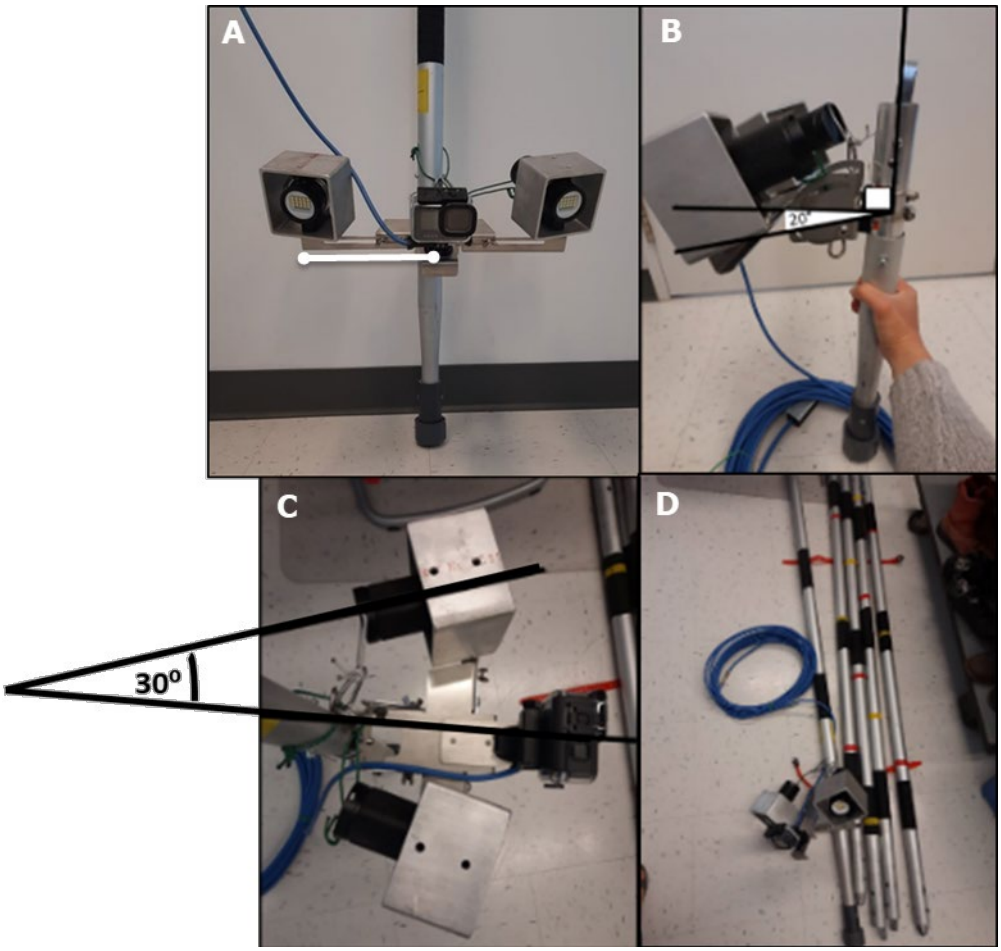

Figure 2. Pole-mounted camera system used in 2021, consisting of a mount with extendable wings for attaching two lights spaced 18 cm from the camera (A) at a downward angle of 20° (B) and an outward angle of 30° (C), and five push-button interlocking pole sections (D).

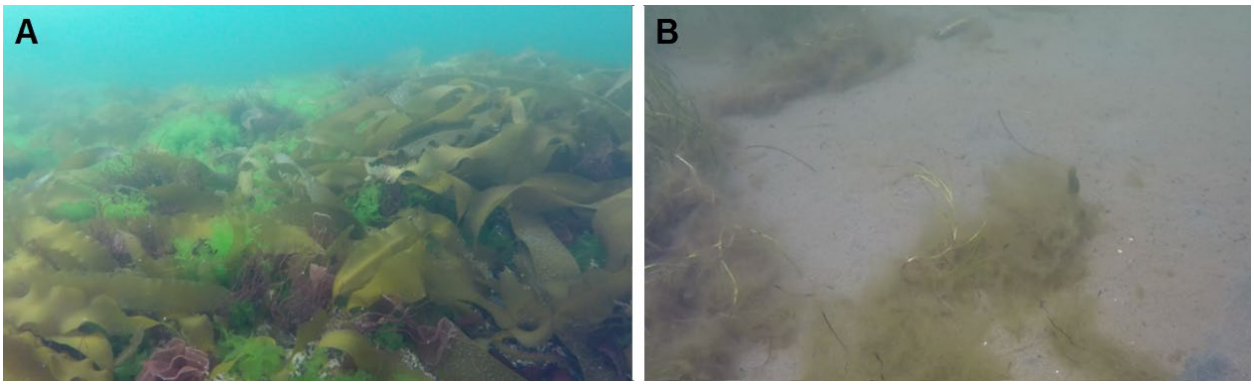

Figure 3. Examples of photos taken during the second rotation above the canopy (A) where the established criteria are met (more than two thirds of image dominated by seabed and the other third includes the horizon and the water column) and (B) where the criterion requiring that the horizon be included in the images is not met.

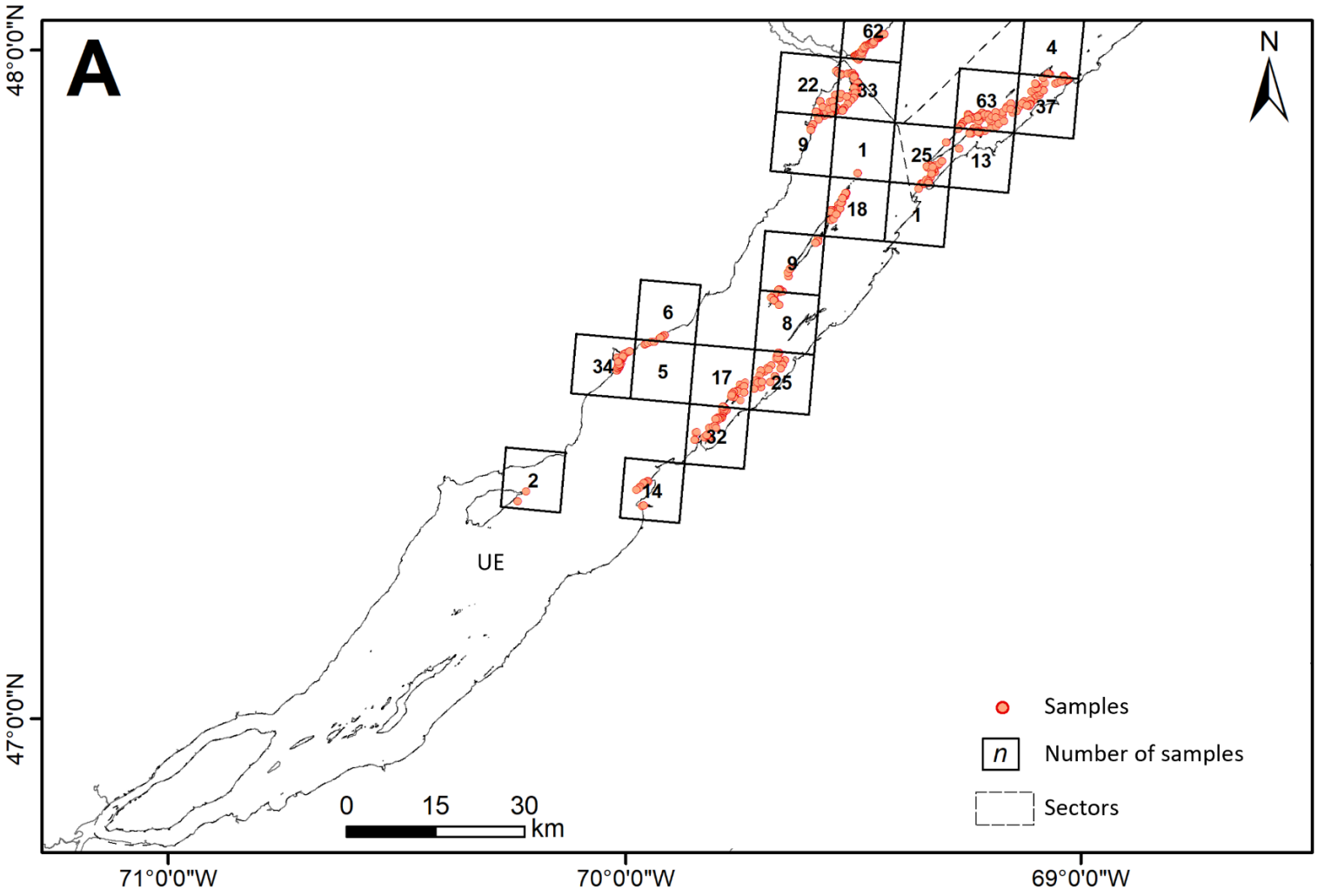

Figure 4. Location of stations sampled in the Upper Estuary (UE) of the St. Lawrence.

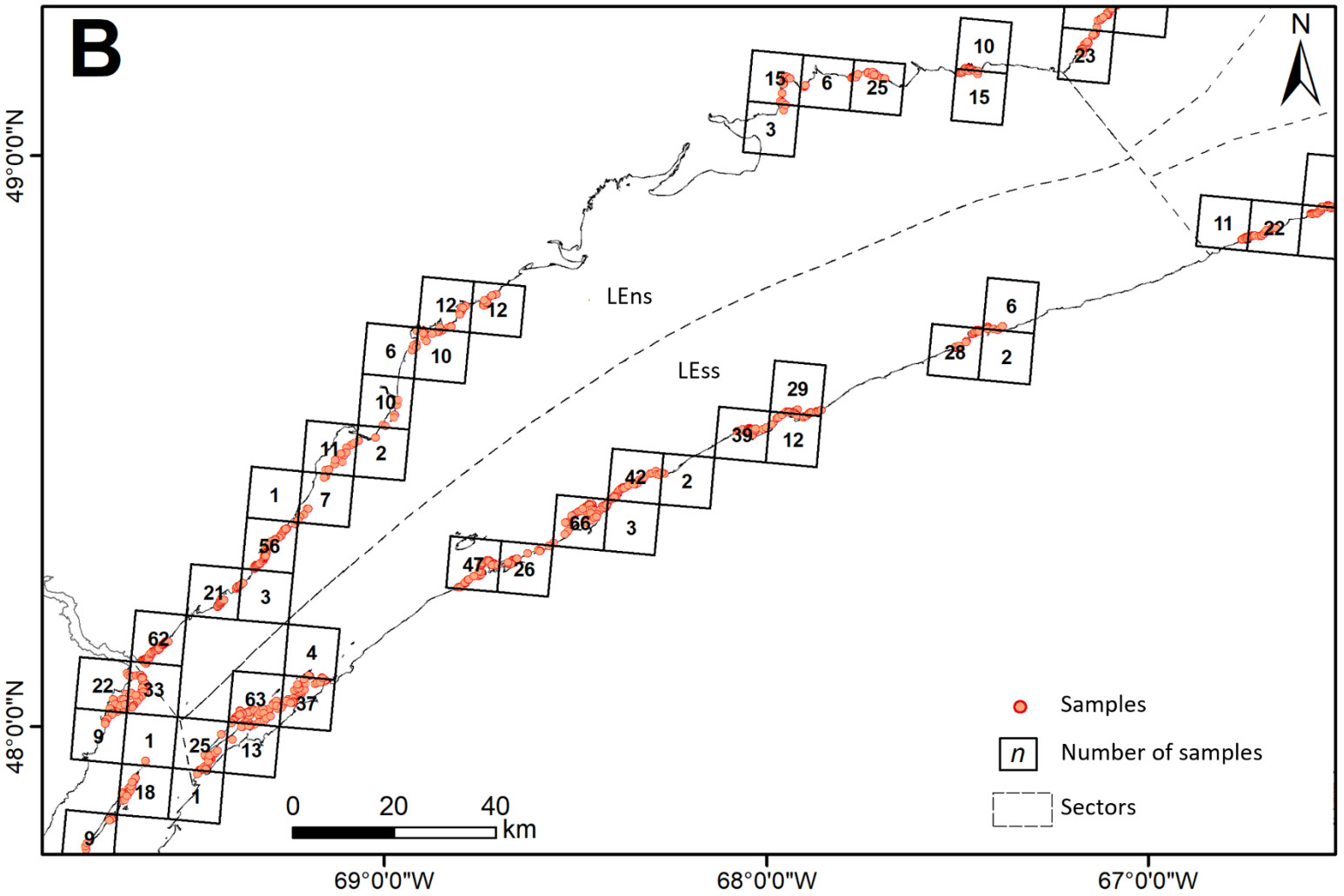

Figure 5. Location of stations sampled in the Lower Estuary (south shore; LEss), Lower Estuary (north shore; LEns) and the St. Lawrence River.

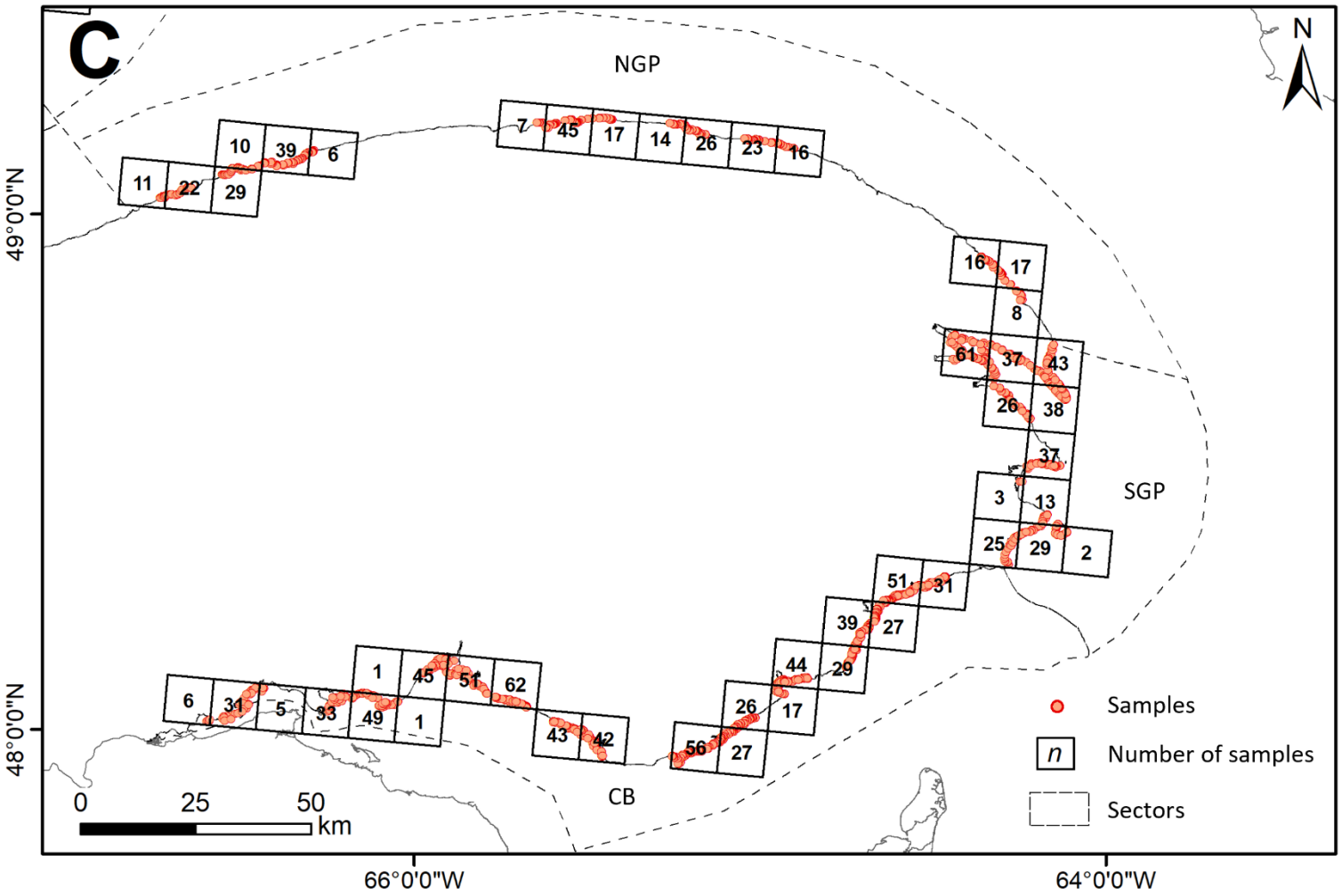

Figure 6. Location of stations sampled in the northern Gaspé Peninsula (NGP), southern Gaspé Peninsula (SGP) and Chaleur Bay (CB) sectors.

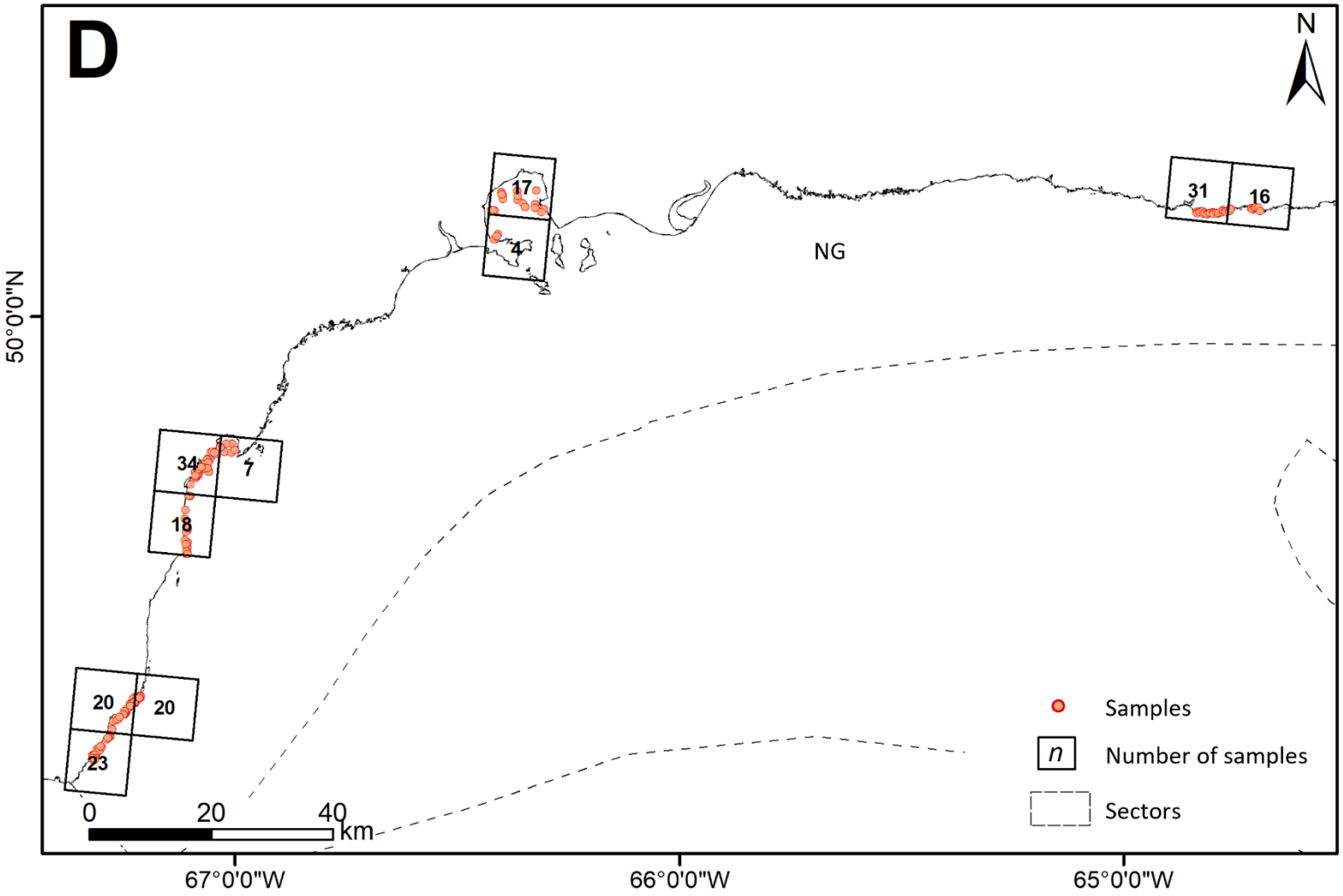

Figure 7. Location of stations sampled in the western portion of the Northern Gulf (NG) of St. Lawrence.

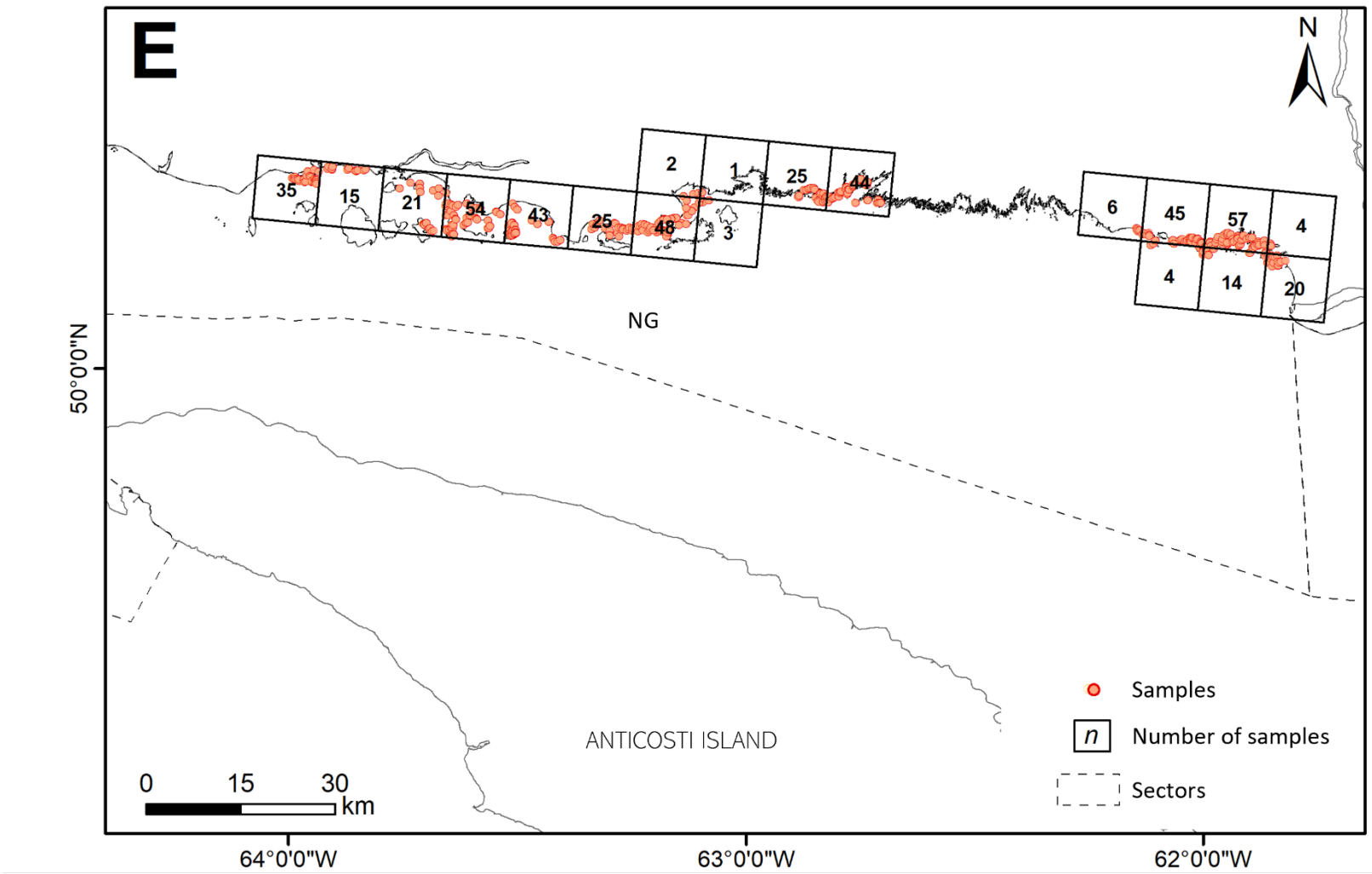

Figure 8. Location of stations sampled in the eastern portion of the northern Gulf (NG) of St. Lawrence.

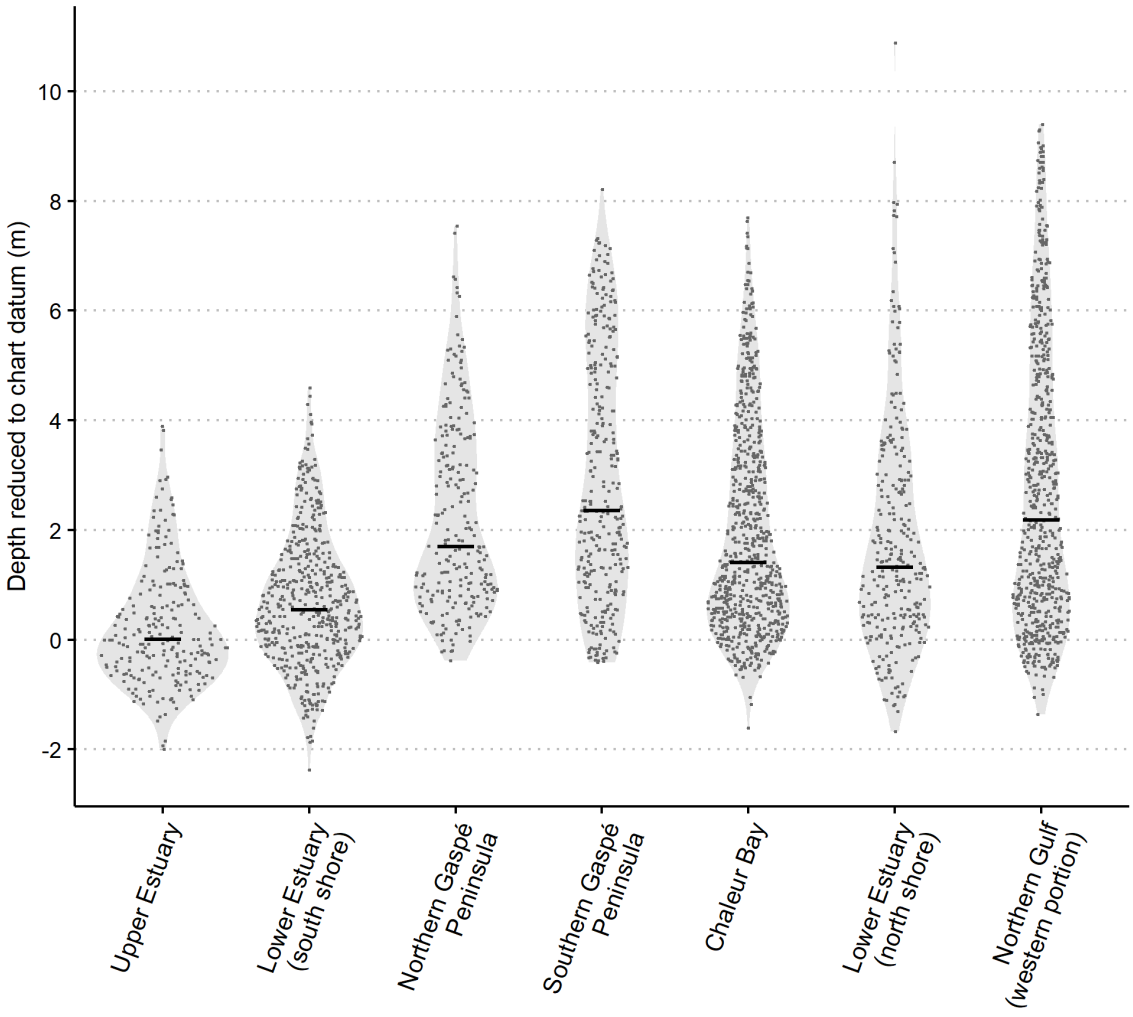

Figure 9. Distribution of sample station depths reduced to chart datum, by sector in the Estuary and Gulf of St. Lawrence. Each point corresponds to one sample. The crossbar in each violin plot represents the median depth.

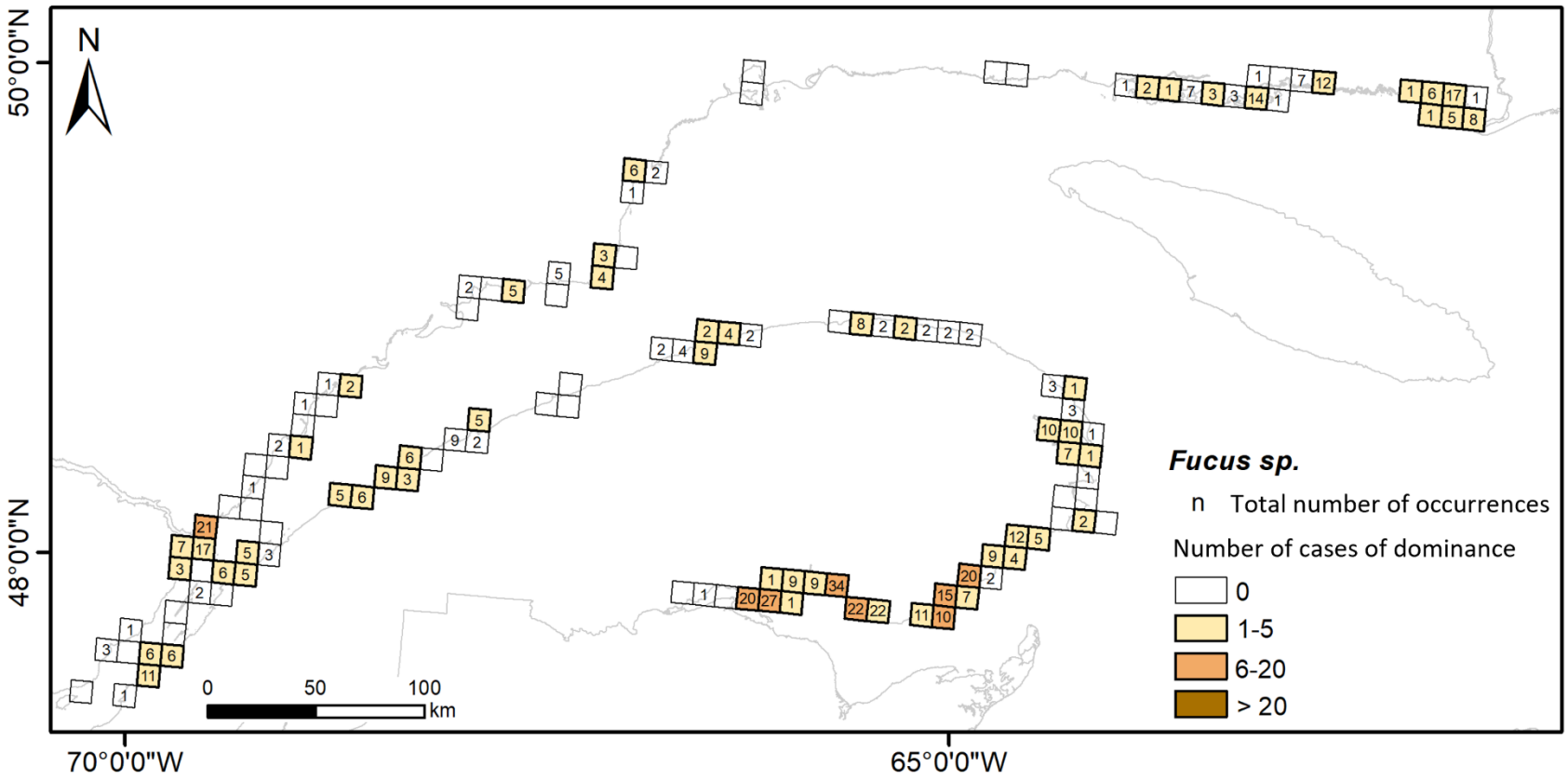

Figure 10. Distribution of occurrences and cases of dominance of *Fucus* sp. (including lower taxonomic ranks) in each 10 km by 10 km square. Each square shows the total number of samples in which *Fucus* sp. was identified. A square with no number indicates that the organism was not detected. *Fucus* sp. is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour classes are used to represent the number of samples in which the organism was considered dominant (min. depth = -1.8 m; max. depth = 7.7 m).

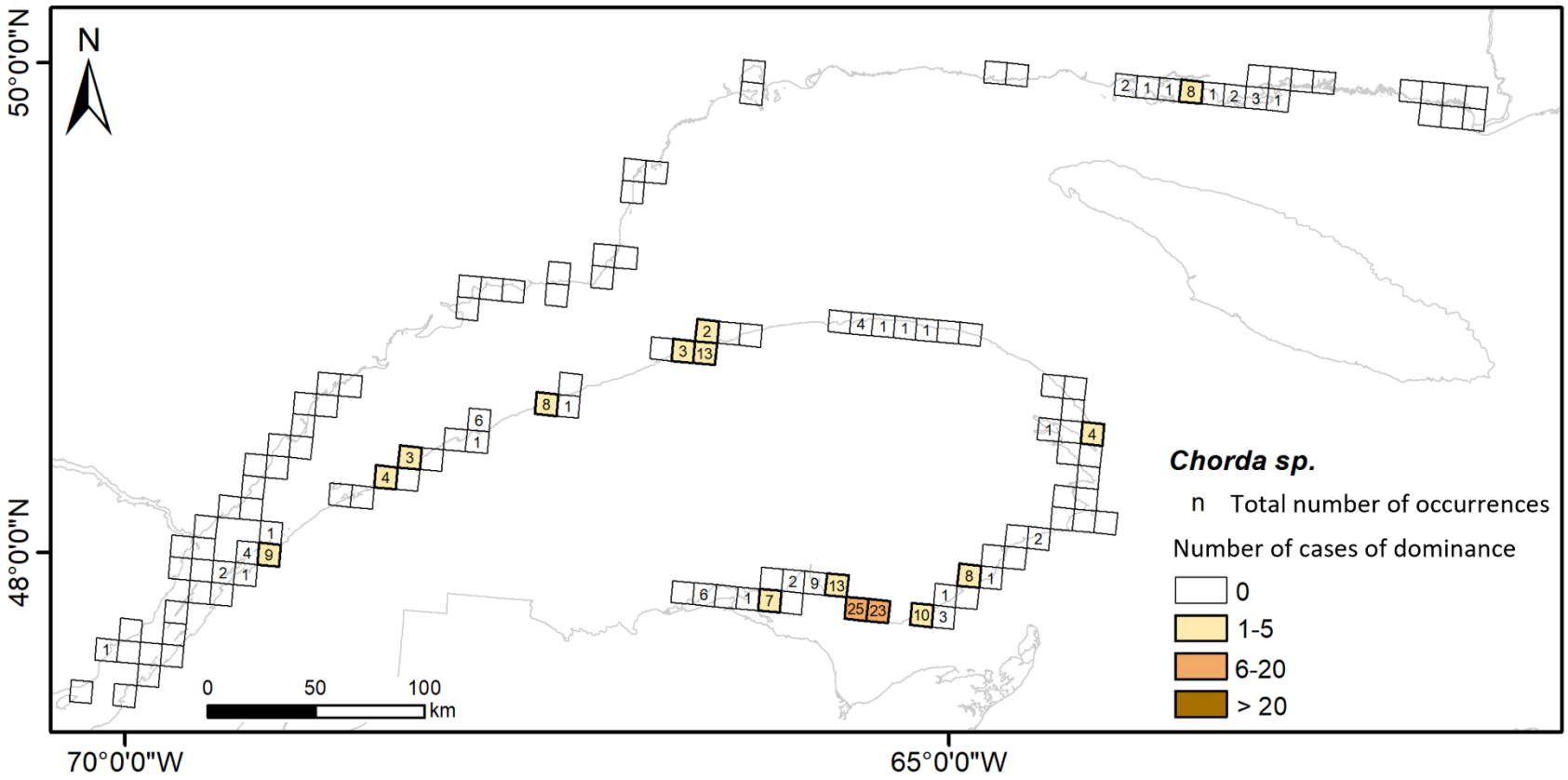

Figure 11. Distribution of occurrences and cases of dominance of *Chorda* sp. in each 10 km by 10 km square. Each square shows the total number of samples in which *Chorda* sp. was identified. A square with no number indicates that the organism was not detected. *Chorda* sp. is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -0.6 m; max. depth = 3.0 m).

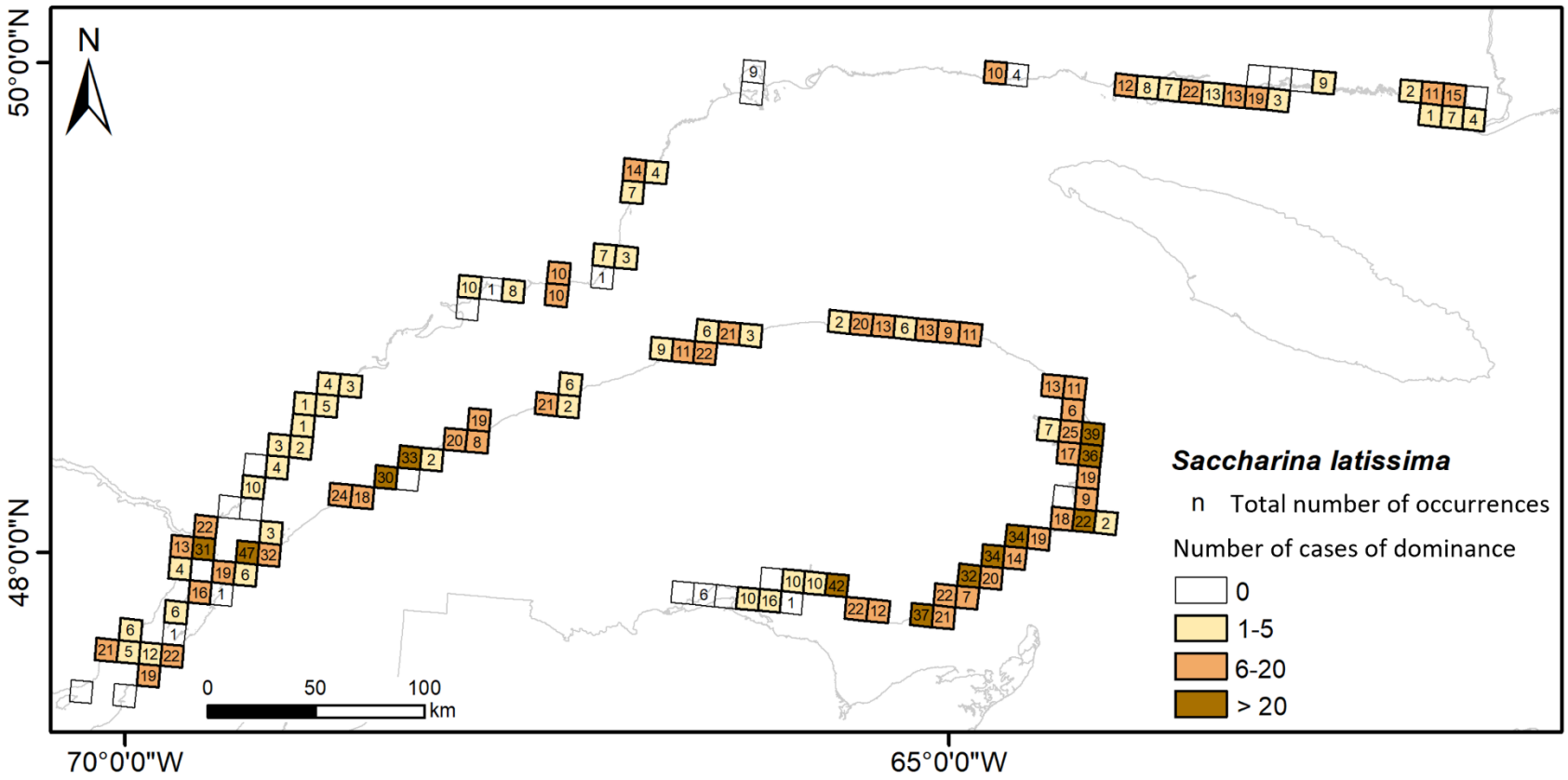

Figure 12. Distribution of occurrences and cases of dominance of *Saccharina latissima* (including *S. longicruris*) in each 10 km by 10 km square. Each square shows the total number of samples in which *S. latissima* was identified. A square with no number indicates that the organism was not detected. *S. latissima* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -1.5 m; max. depth = 8.5 m).

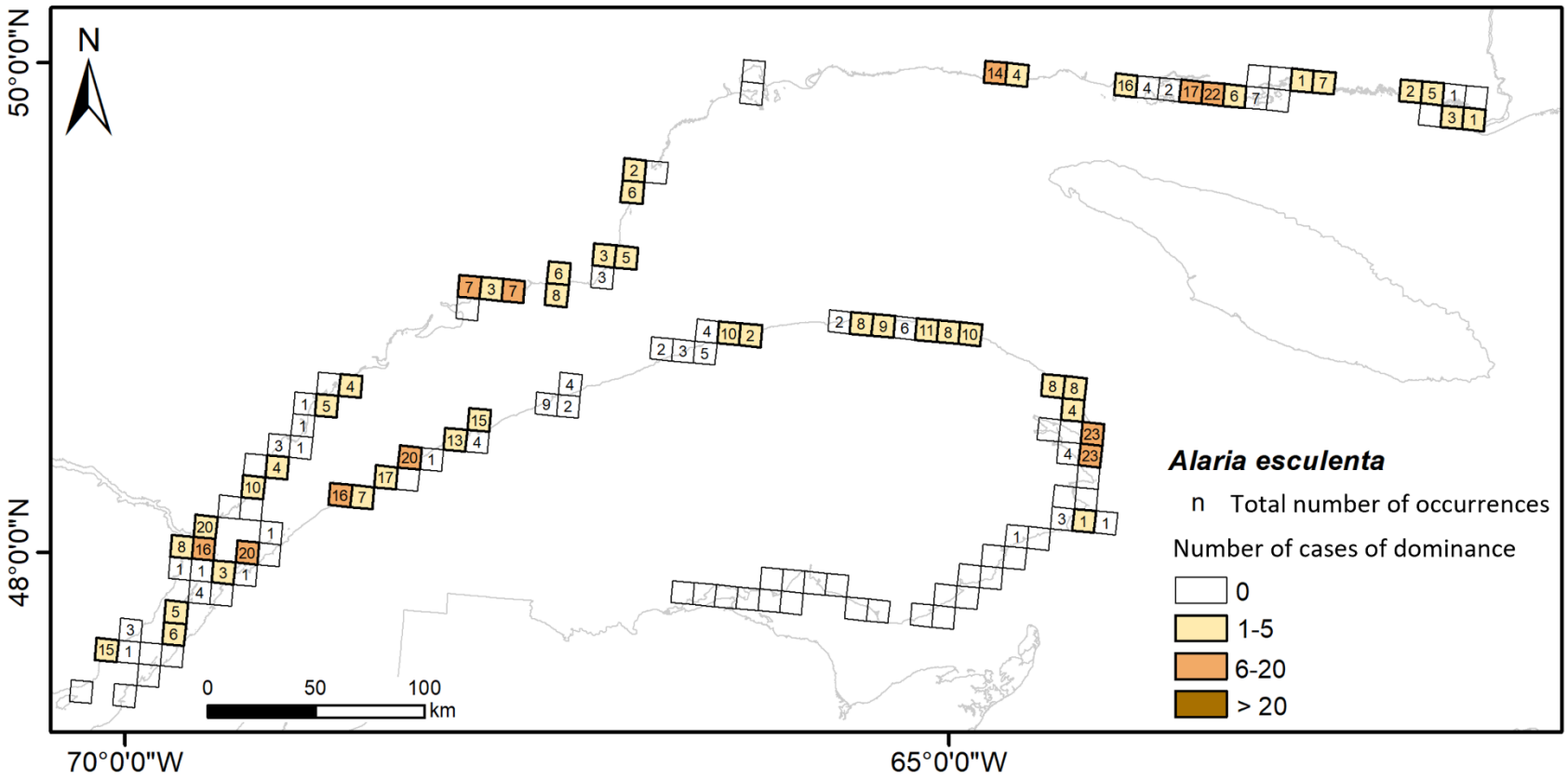

Figure 13. Distribution of occurrences and cases of dominance of *Alaria esculenta* in each 10 km by 10 km square. Each square shows the total number of samples in which *A. esculenta* was identified. A square with no number indicates that the organism was not detected. *A. esculenta* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -0.9 m; max. depth = 6.9 m).

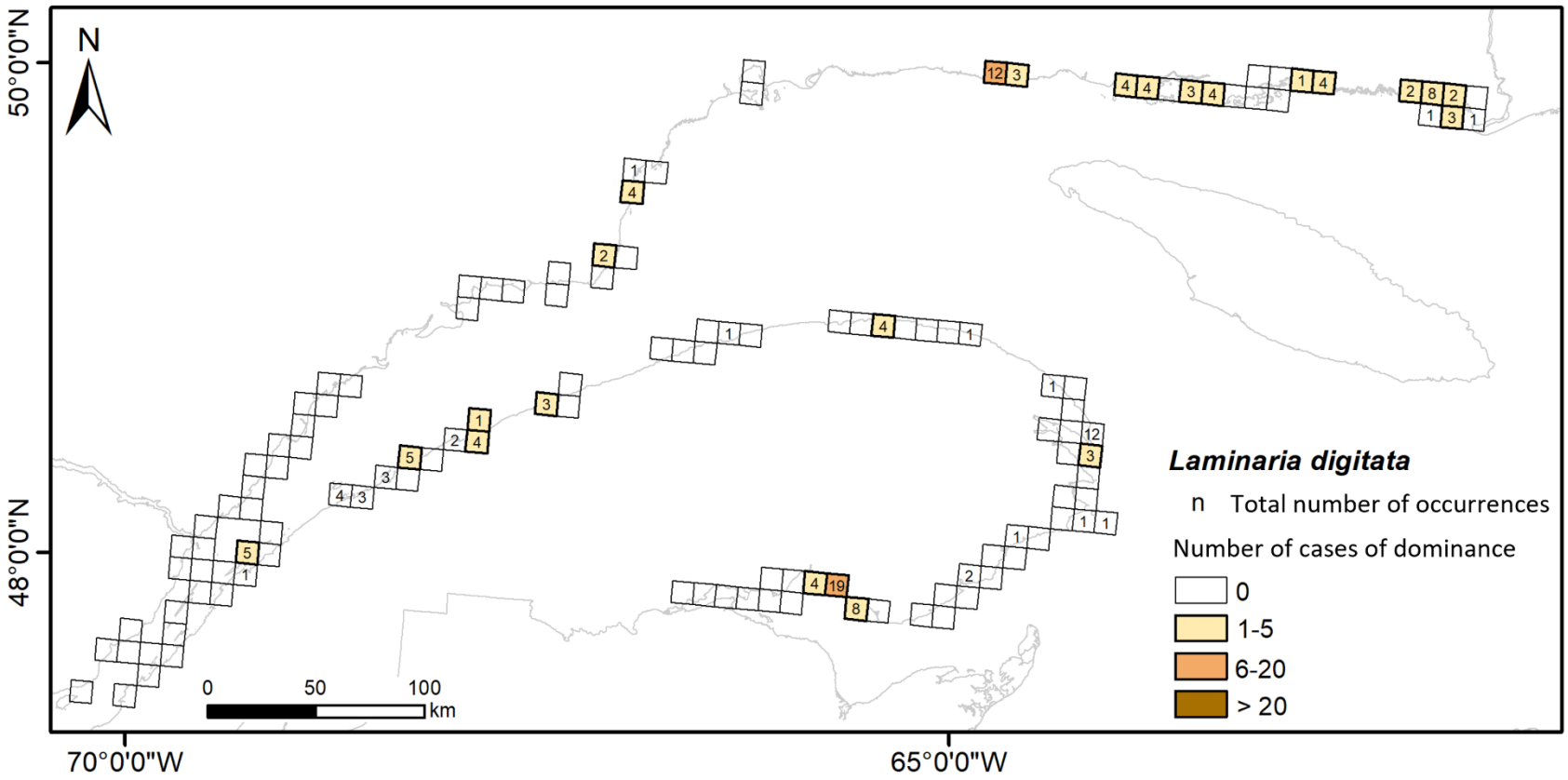

Figure 14. Distribution of occurrences and cases of dominance of *Laminaria digitata* in each 10 km by 10 km square. Each square shows the total number of samples in which *L. digitata* was identified. A square with no number indicates that the organism was not detected. *L. digitata* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -0.4 m; max. depth = 5.0 m).

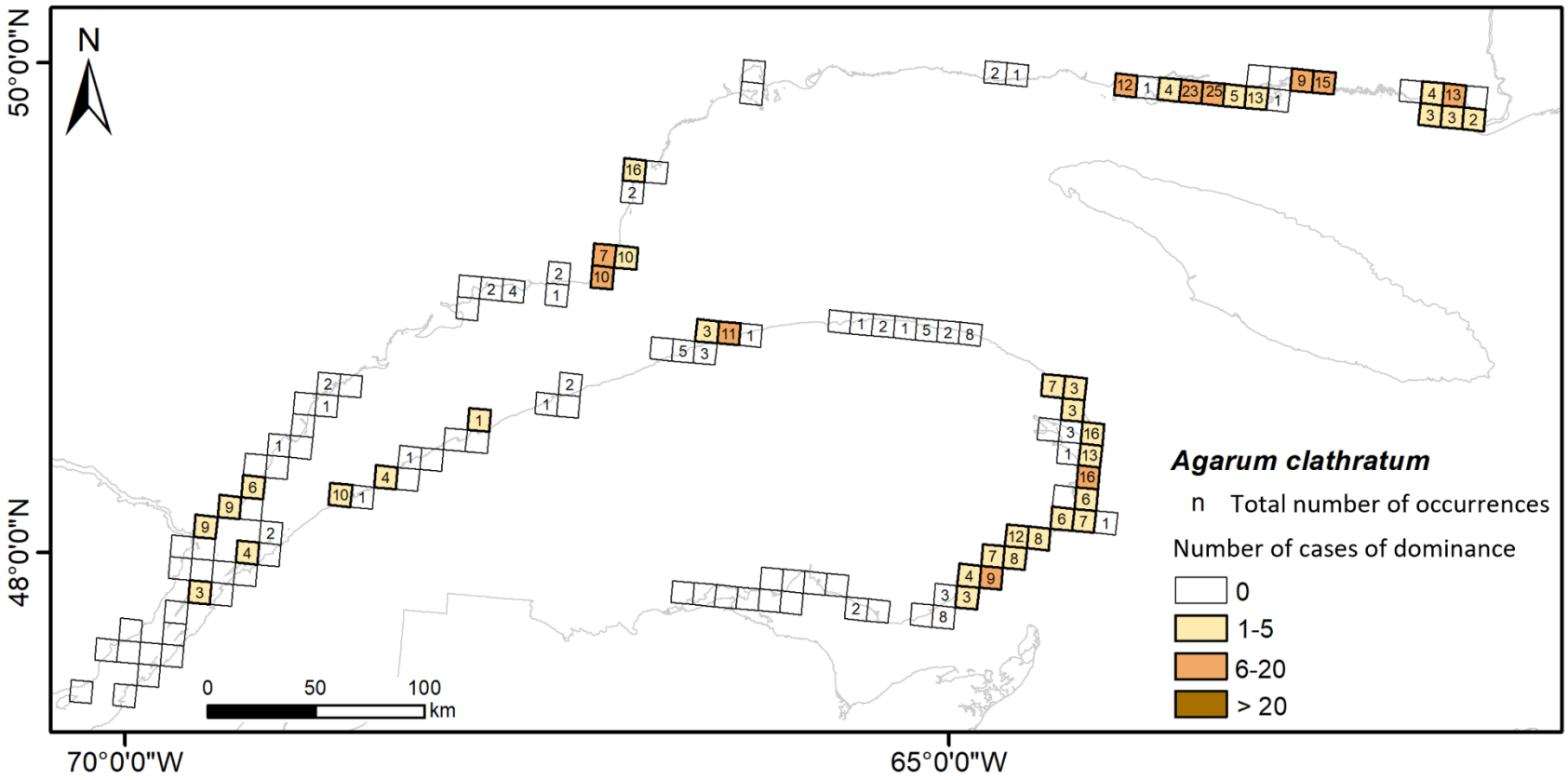

Figure 15. Distribution of occurrences and cases of dominance of *Agarum clathratum* in each 10 km by 10 km square. Each square shows the total number of samples in which *A. clathratum* was identified. A square with no number indicates that the organism was not detected. *A. clathratum* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = 0.1 m; max. depth = 9.1 m).

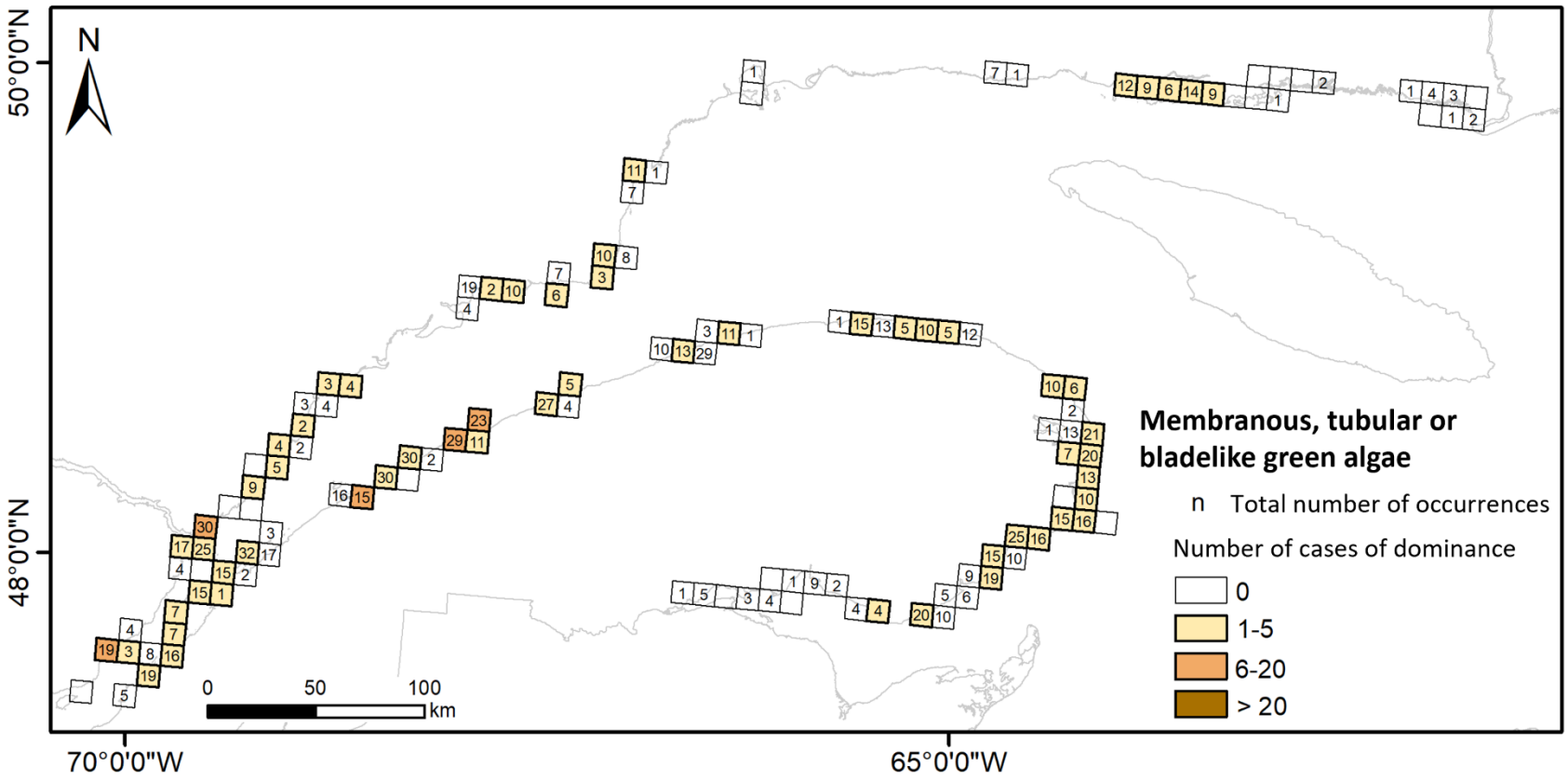

Figure 16. Distribution of occurrences and cases of dominance of membranous, tubular or bladelike green algae. Each square shows the total number of samples in which these algae were identified. A square with no number indicates that the organism was not detected. Membranous, tubular or bladelike green algae are considered dominant when they cover at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organisms were considered dominant (min. depth = -1.4 m; max. depth = 7.1 m).

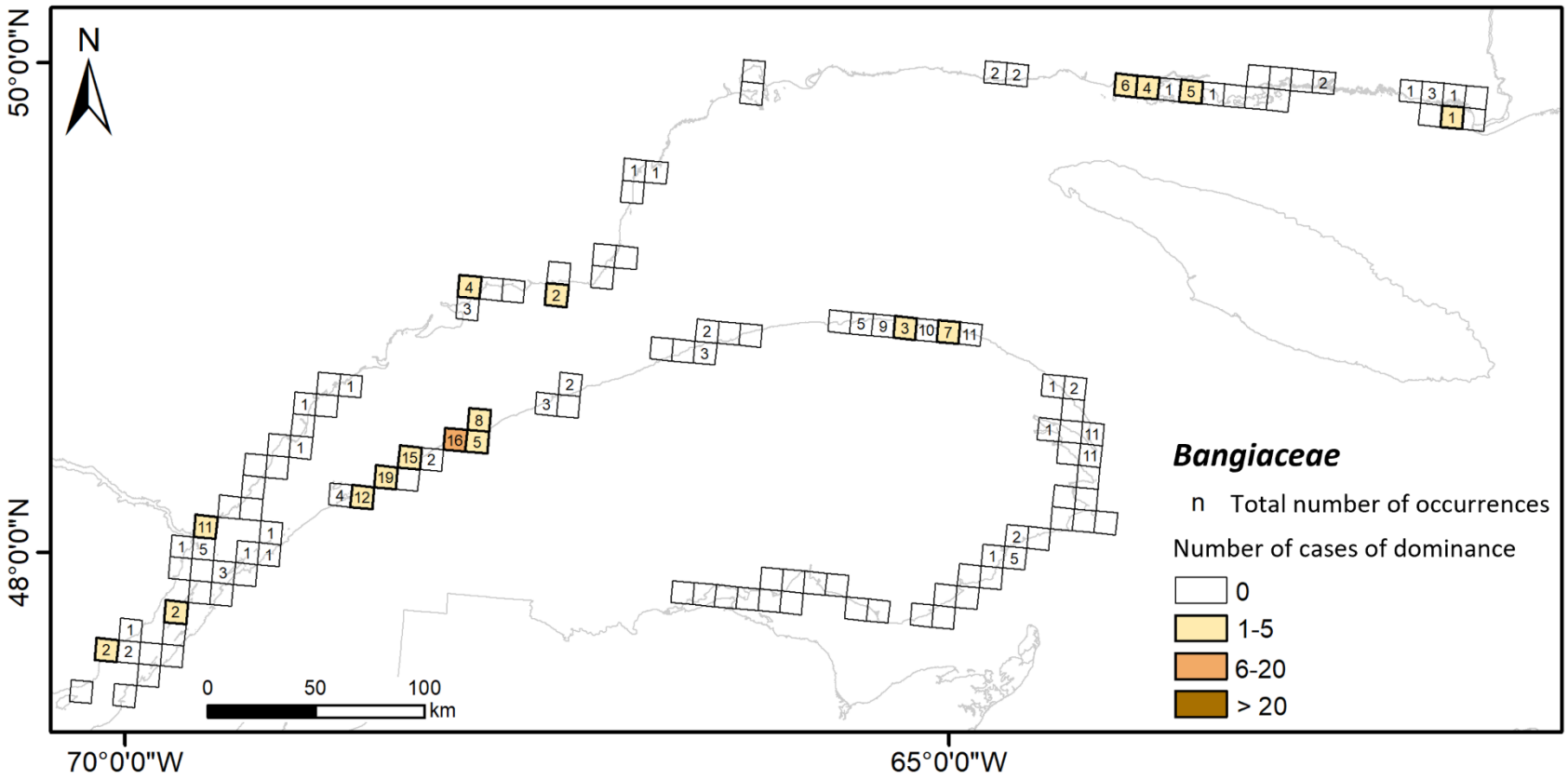

Figure 17. Distribution of occurrences and cases of dominance of *Bangiaceae* in each 10 km by 10 km square. Each square shows the total number of samples in which *Bangiaceae* was identified. A square with no number indicates that the organism was not detected. *Bangiaceae* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -1 m; max. depth = 3.3 m).

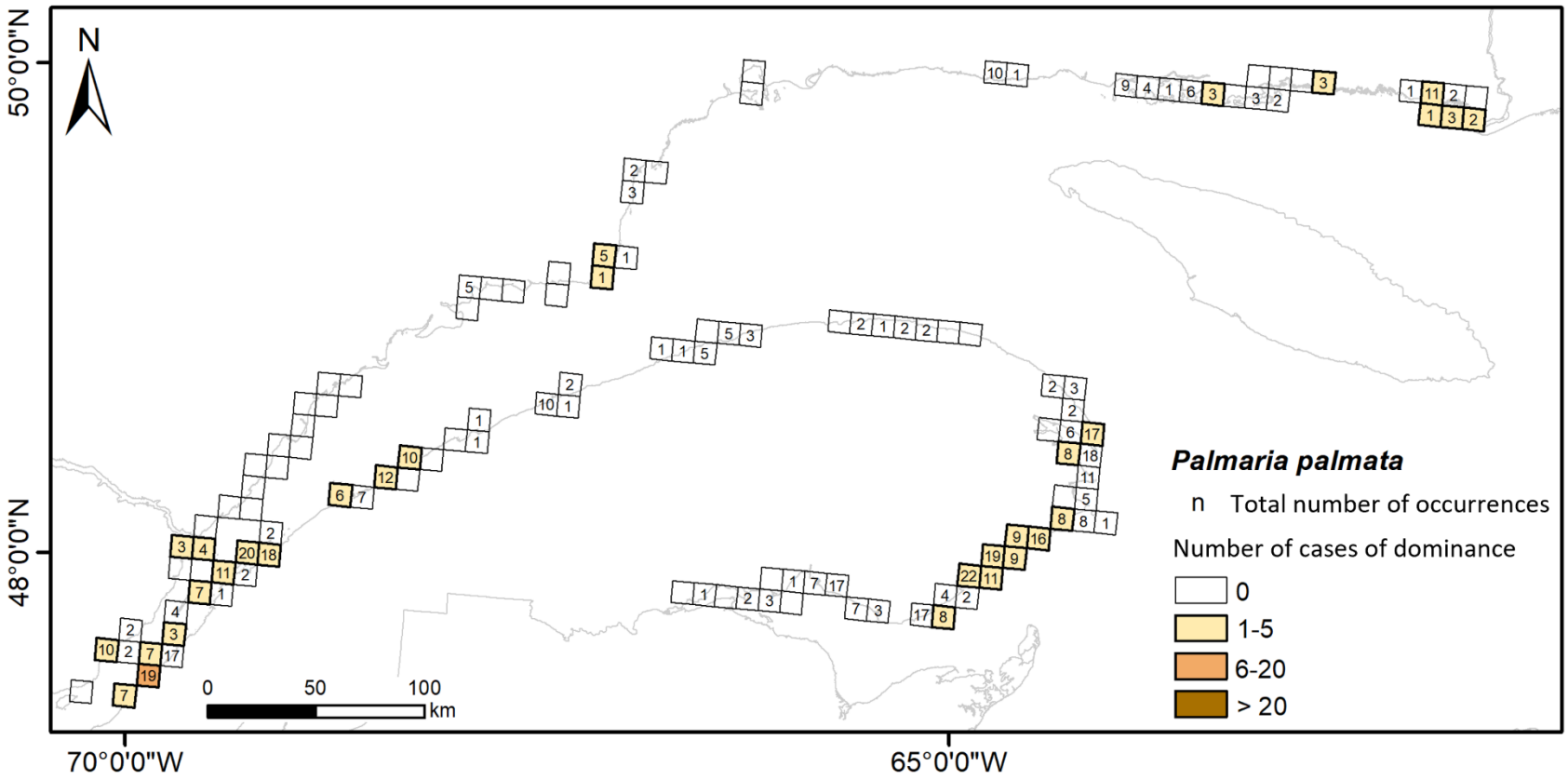

Figure 18. Distribution of occurrences and cases of dominance of *Palmaria palmata* in each 10 km by 10 km square. Each square shows the total number of samples in which *P. palmata* was identified. A square with no number indicates that the organism was not detected. *P. palmata* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -1.1 m; max. depth = 2.7 m).

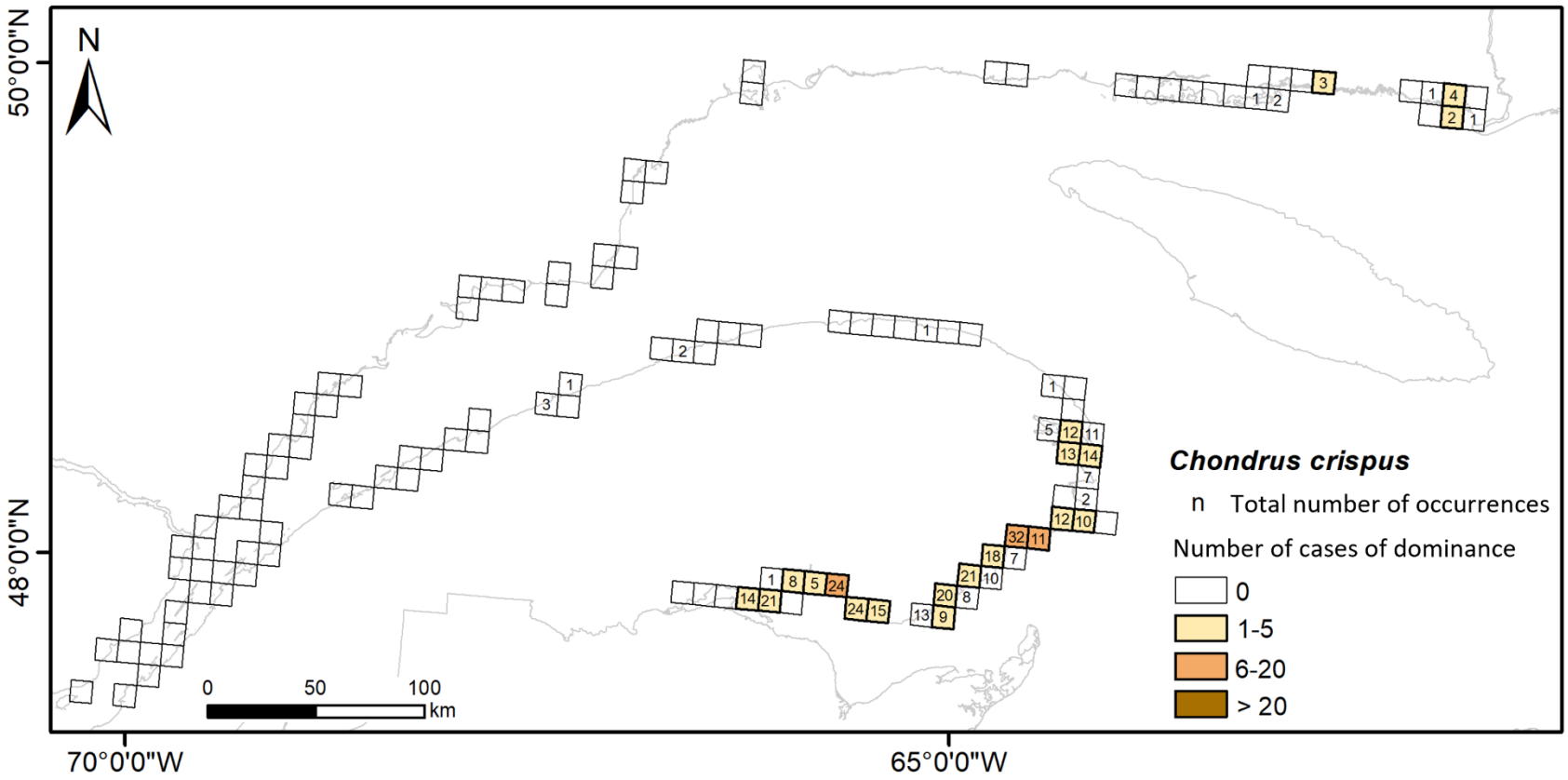

Figure 19. Distribution of occurrences and cases of dominance of *Chondrus crispus* in each 10 km by 10 km square. Each square shows the total number of samples in which *C. crispus* was identified. A square with no number indicates that the organism was not detected. *C. crispus* is considered dominant when it accounts for at least 25% of the total vegetation cover, and the vegetation cover is semi-vegetated or vegetated (25–100%). Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -0.5 m; max. depth = 5.4 m).

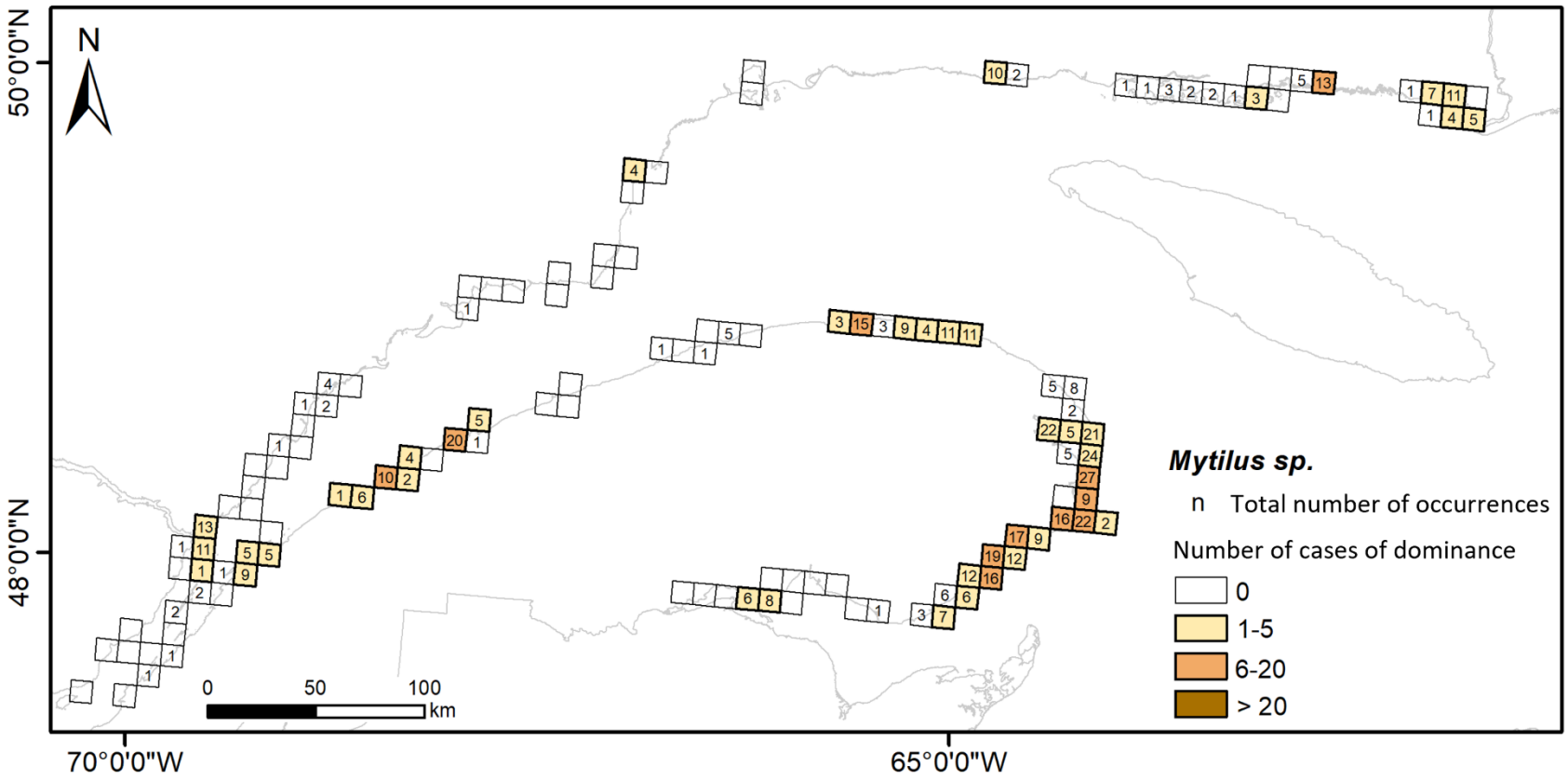

Figure 20. Distribution of occurrences and cases of dominance of *Mytilus* sp. in each 10 km by 10 km square. Each square shows the total number of samples in which *Mytilus* sp. was identified. A square with no number indicates that the organism was not detected. *Mytilus* sp. is considered dominant when it accounts for at least 25% of the observed seabed area. Colour categories are used to represent the number of samples in which the organism was considered dominant (min. depth = -1.9 m; max. depth = 7.4 m).

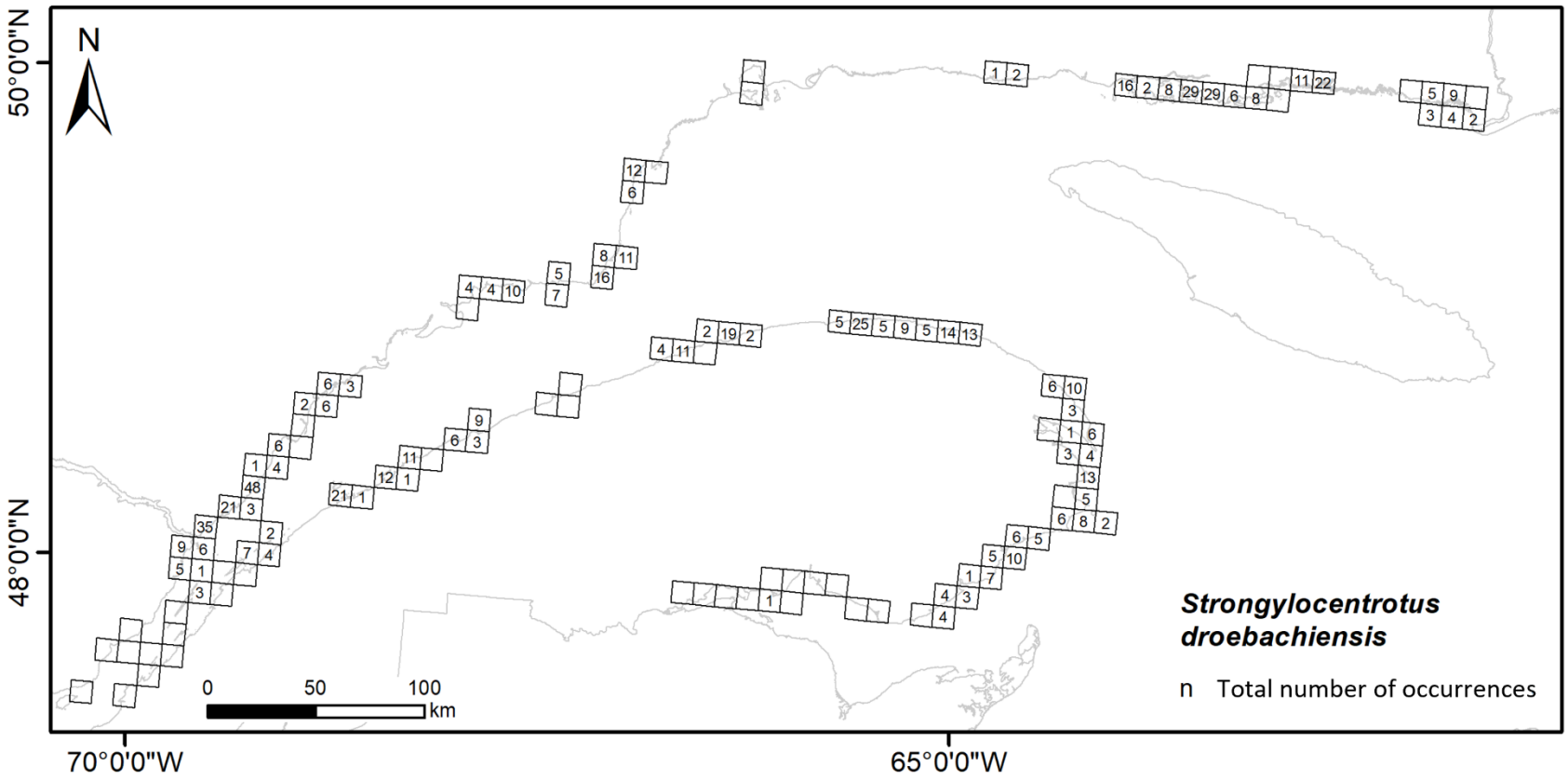

Figure 21. Distribution of *Strongylocentrotus droebachiensis* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *S. d*roebachiensis was identified. A square with no number indicates that the organism was not detected.

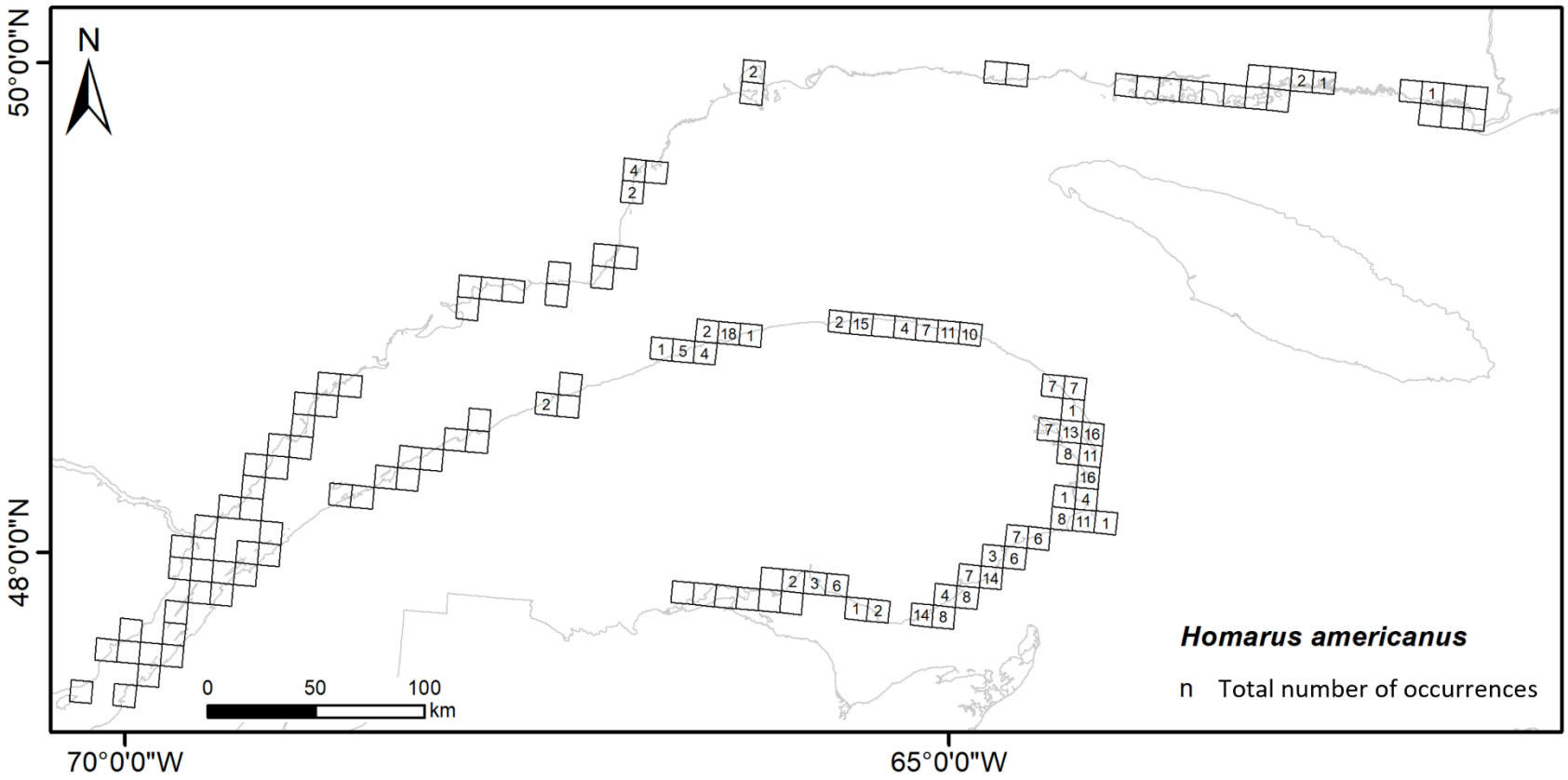

Figure 22. Distribution of *Homarus americanus* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *H. americanus* was identified. A square with no number indicates that the organism was not detected.

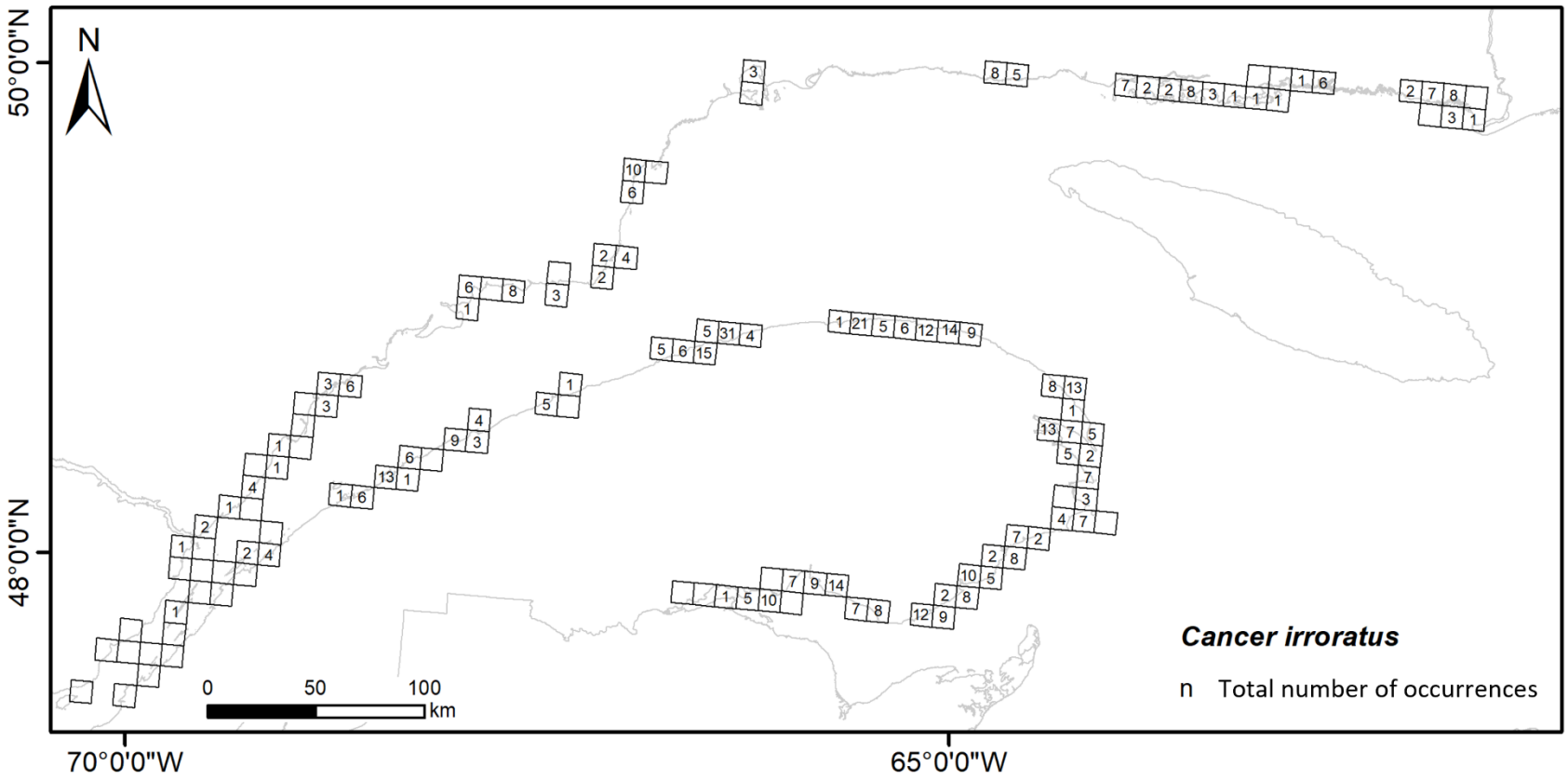

Figure 23. Distribution of *Cancer irroratus* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *C. irroratus* was identified. A square with no number indicates that the organism was not detected.

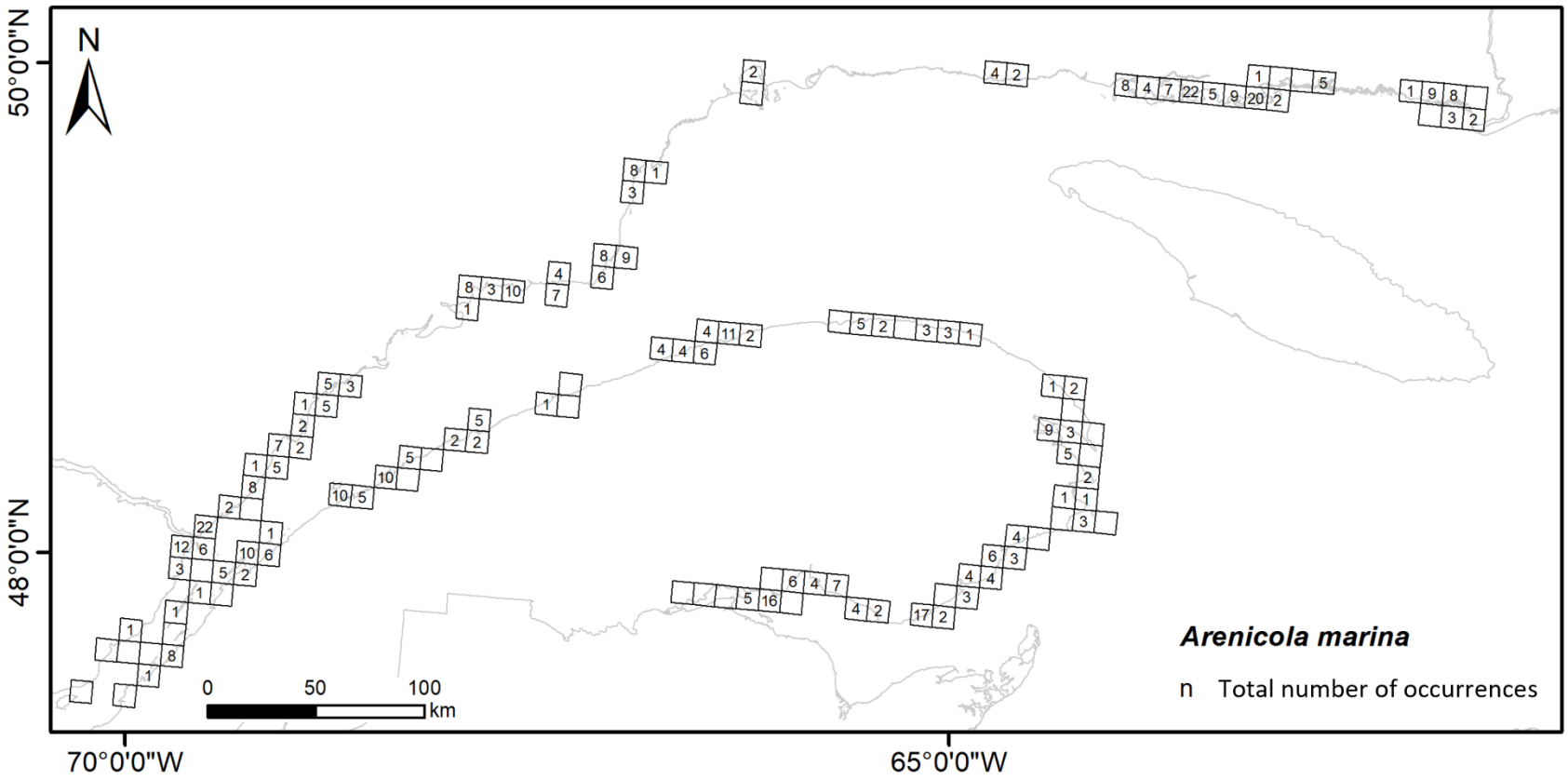

Figure 24. Distribution of *Arenicola marina* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *A. marina* was identified. A square with no number indicates that the organism was not detected.

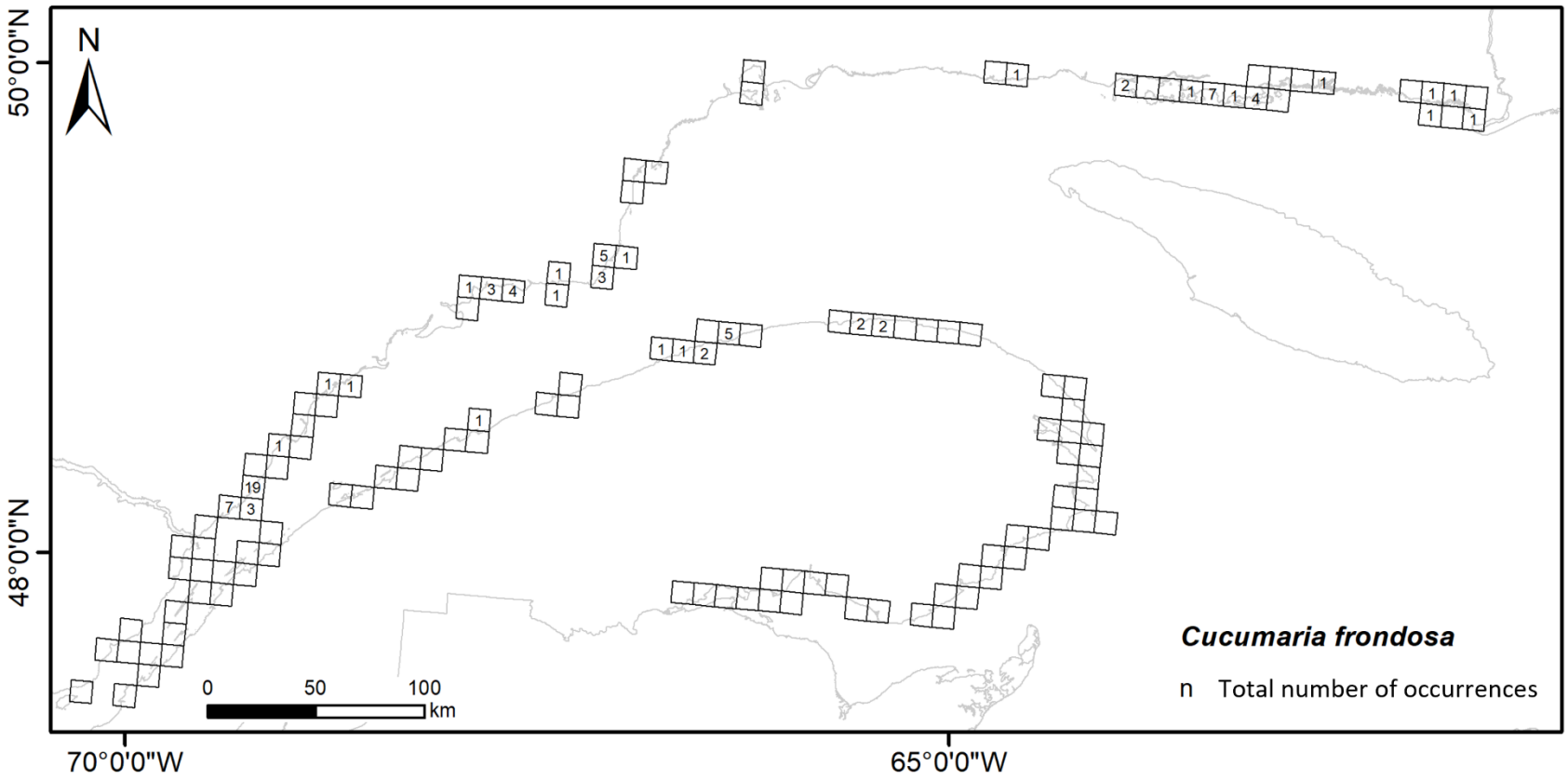

Figure 25. Distribution of *Cucumaria frondosa* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *C. frondosa* was identified. A square with no number indicates that the organism was not detected.

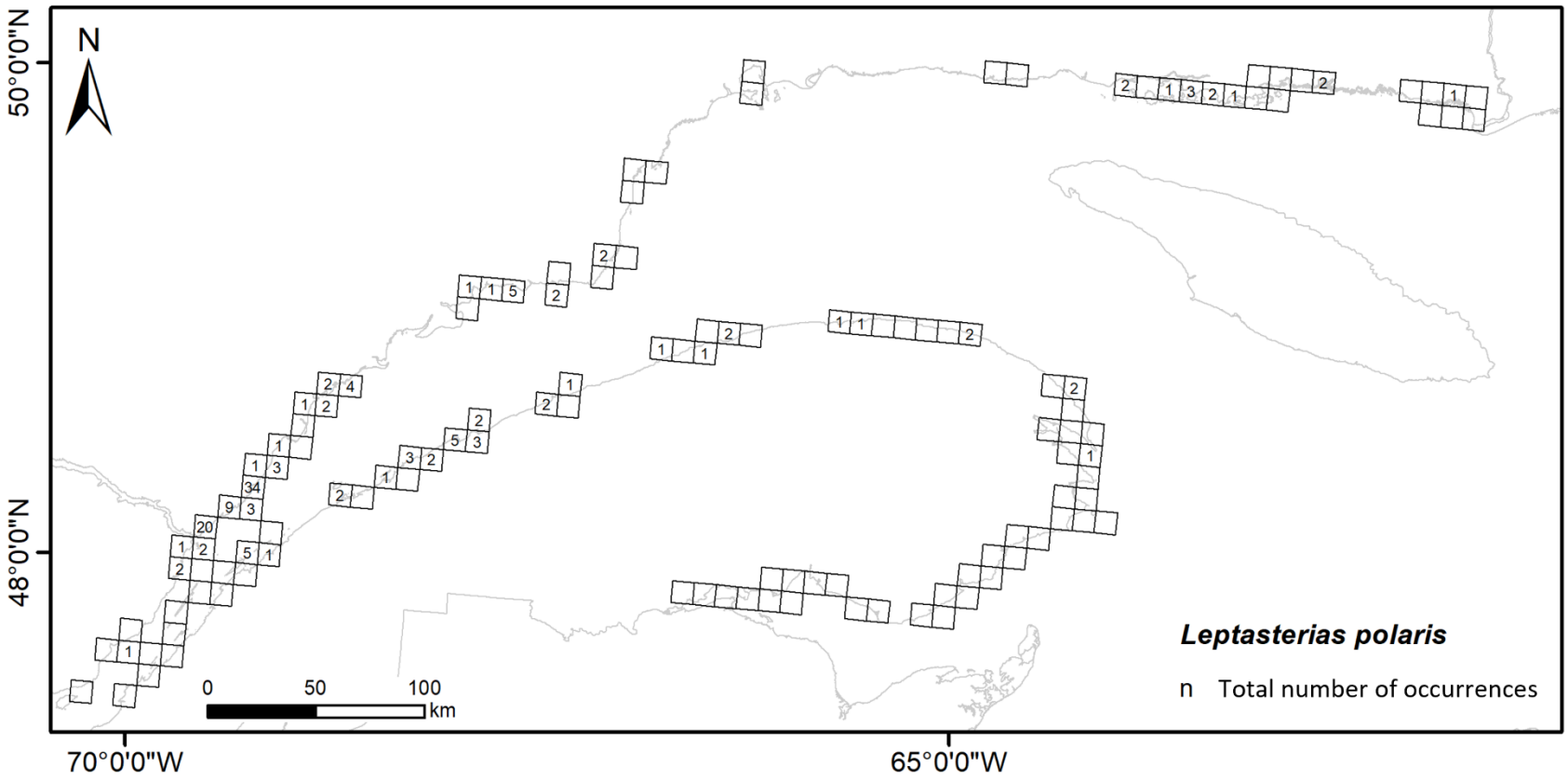

Figure 26. Distribution of *Leptasterias polaris* occurrences in each 10 km by 10 km square. Each square shows the total number of samples in which *L. polaris* was identified. A square with no number indicates that the organism was not detected.

APPENDIX 1. GLOSSARY

Table A1. Glossary of terms. The first instance of each term in the text is indicated by a cross (†).

Term	Definition
Chart datum	The reference low water surface elevation used on a chart. In tidal waters, the Canadian Hydrographic Service (CHS) uses the levels "Lower Low Water," "Large Tide" or "Lowest Normal Tide" as its reference plane for the chart datum.
Cotidal zone	Cotidal zones can be used to interpolate water level forecasts modelled at individual stations to an entire zone and to reduce depth data to chart datum.
Eelgrass bed	An aggregation of eelgrass (also called a meadow).
Encrusting	Adjective used to describe the shape and structure of algae (Leclerc 1987) that form a flat hard crust on the substrate or on the surface of an object.
Erect vegetation	Erect is an adjective that is used to describe vegetation with an upright growth habit. Erect vegetation occupies three-dimensional space. The descriptor "erect" is used in contrast to "encrusting."
Geospatial database (GDB)	ESRI geodatabase used to store and manage data characterizing georeferenced polygons.
Macroalgae	Multicellular macroscopic algae.
Marginal vegetation	Observed vegetation whose presence does not contribute significantly to the calculation of vegetation cover (Vg_COV). This may include vegetation that accounts for less than 25% of the total erect vegetation cover or the total subcanopy vegetation cover.
Occurrence	An observation of an organism at a specific location and date.
Priority area	Given the vastness of the study area and the logistical constraints associated with the use of small vessels in shallow coastal environments, the field campaigns were carried out in priority areas. These areas were selected on the basis of logistical criteria and the coastal environments concerned.
Object of interest	Ecosystem component detected by an observer during imagery analysis and identified using an attribute value (Schoening et al. 2016).
Underwater imagery database (UIDB)	A tool for managing data resulting from underwater imagery sampling and analysis, consisting of a relational database developed in Microsoft Access.
Unidentified	Term used when a component cannot be identified. For example, insufficient information may prevent a type of vegetation (macroalgae, vascular plant or unidentified vegetation) from being accurately

Table A1 (cont'd).

Term	Definition
	identified, or may prevent an observed organism from being assigned to a taxonomic level or class (field) based on shape and colour.
Vegetation	(1) All the vegetation growing in a given location. Term generally associated with plants, but used more broadly in this report to include both plants and algae. (2) The term is used to designate plants and algae, that is, primary producers in the marine environment which carry out photosynthesis.

APPENDIX 2. CHANGES IN EQUIPMENT BETWEEN 2017 AND 2021

Significant changes in equipment have occurred over the years. These include upgrades to the action cameras used (GoPro HERO4; 5; 9), the use of a fifth pole section which increased the overall length from 7.2 m to 9 m, and the use of higher-intensity lights (1,200 to 8,000 lumens). These upgrades made it possible to use waterproof underwater cameras with improved image definition and stabilization. While the HERO5 model enabled live viewing during video recording, this feature is not available on the GoPro HERO9, hence slight adjustments have to be made to the recording and data capture protocol. However, the GoPro HERO9 features HyperSmooth 3.0 stabilization, which significantly reduces the blurring of images caused by camera movements.

In terms of the pole model used, tests were carried out in 2018 with a Shurhold telescopic pole which extends to 9 m. However, the water currents caused the pole to bend, and extending it beyond 7.5 m in length was found to be dangerous when working from a small vessel. In addition, extending the telescopic pole was rendered more difficult by the salt, because it interfered with interlocking of the different pole sections. The aluminum push-button handles used from 2019 onwards are stronger, easier to handle and sections can be conveniently added as required.

In 2018 and 2019, the lights were positioned at an inward angle of 30°. This proved to be counterproductive when suspended particles were present, as the direct illumination of these particles reduced visibility and image quality. To overcome this problem, in 2020 the lights were positioned at a 30° angle outwards from the camera's transverse axis. In 2021, they were moved back slightly in relation to the camera to eliminate an area of shadow at the front of the camera where the beams did not intersect. The light intensity was also increased from 2 × 1,200 lumens (UK Aqualite Pro 100° Dive L) to 2 × 8,000 lumens, which further enhanced the brightness and colours captured on video. These equipment changes facilitated taxonomic identification during video analysis.

Table A2. Overview of equipment and technologies used for underwater video sampling between 2017 and 2021.

Component	2017[1]	2018	2019	2020[2]	2021
Vessel	Bombard 14 ft (4.3 m) 30 HP	Nautic & Art 1NA16 16 ft (4.9 m) 15 HP inflatable[3] 9 ft (2.7 m) 6 HP (dinghy)[3] 6 m 115 HP and 3 m 9.9 HP inflatables	Nautic & Art 1NA16 16 ft (4.9 m) 15 HP[3] Zodiac SRMN500 16 ft (4.9 m) 50 HP[3] 9 ft (2.7 m) inflatable 6 HP (dinghy)[3] Zodiac Airsolid 22 ft (6.7 m) 115 HP Cherokee 455 5.55 m 50 HP	22 ft (6.7 m) 90 HP and 115 HP inflatables Bombard Commando C5	Nautic & Art 1NA16 16 ft (4.9 m) 40 HP[3] Zodiac SRMN500 16 ft (4.9 m) 50 HP[3]
Pole type and total length	Shurhold 855 telescopic pole (2.75 m)	Aluminum push-button handles (4 sections totalling 7 m) 10 m telescopic pole	Aluminum push-button handles (4 sections totalling 7 m)	Aluminum push-button handles (5 sections totalling 9 m)	Aluminum push-button handles (5 sections totalling 9 m)
Camera	FishSens HD SondeCAM GoPro HERO4	GoPro HERO4	GoPro HERO4 GoPro HERO5 Black	GoPro HERO5 Black	GoPro HERO9 Black
Resolution and images per second (IPS)	-	1080p; 40 or 60 IPS	1080p; 40 or 60 IPS	2.7K; 60 IPS	2.7K; 60 IPS 4K; 60 IPS
Camera tilt angle	-	-	-	20º	20º
Light	Lumix 700 lumens Sola Dive 2,000 lumens	UK Aqualite Pro 100° Dive Light 1,200 lumens	UK Aqualite Pro 100° Dive Light 1,200 lumens	BigBlue VL8000P (120°) 8,000 lumens	BigBlue VL8000P (120°) 8,000 lumens
Light angle	-	-	30° inwards	30° outwards	30° outwards
Positioning system	GS Nav on Android ToughPad 8 tablet	GSFNav on Android E7759 Unistrong tablet	GSFNav on Android E7759 Unistrong tablet	GPS device built into vessel	GSFNav on Android E7759 Unistrong tablet
Viewing system	SondeCAM HD system CamDo [4]	In-house system CamDo [4]	Garmin GPS (Dinghy Team) CamDo [4]	CamDo [4]	CamDo

[1]Pilot year for testing underwater video sampling. The tests were carried out by the Comité ZIP du Sud-de-l'Estuaire.

[2]DFO fieldwork cancelled as a result of the COVID-19 pandemic. Fieldwork was carried out by suppliers only (external contracts).

[3]Canadian Coast Guard vessel used by DFO team.

[4]Used by supplier(s) only.

APPENDIX 3. SAMPLING EQUIPMENT

Table A3. Components of a set of underwater video sampling equipment used in 2021.

Set	Component
Marine	Aluminum push-button handles (1.8 m sections: 1 base and 4 extensions)
	Plastic tape for pole attachment
	Echo sounder
	Garmin GPSMAP 64 multisatellite device
	Large Rubbermaid container
	AXSUB stainless steel camera and light mount
	Aluminum pole base
	50 ft (15.2 m) CamDo Wi-Fi cable for GoPro HERO5+ camera
	Whiteboard and felt-tip markers
	Nanuk 920 waterproof case (marine kit)
	GoPro HERO9 Black camera
	Spare GoPro HERO9 Black camera
	Protective housing and waterproof case for HERO9 Black
	GoPro HERO9 Black batteries (with cases)
	USB cable for GoPro
	Spare o-ring for lights
	Silicone grease for o-ring
	BigBlue VL8000P light
	18650 × 4 lithium batteries for lights (3-hour runtime)
	Blackwell BV9100 field cellular device for viewing
	SanDisk Extreme microSDXC 64GB
	SanDisk Extreme microSDXC 128GB
	Portable lithium-ion battery (charging station at sea) and cable
	Desiccant box
Terrestrial	Small transparent box
	Supercharger GoPro HERO9 Black dual (USB/wall)
	18650 × 4 battery charger (wall socket only)
	USB/wall charger for Blackwell cell phones
	LaCie Rugged USB-C 5T external hard drives with cables
	USB 1.0A charger and cable
	USB microSD reader
	Spare parts for pole
	Rugged tablet with GSFNav (for positioning and data capture)
	Field computer

APPENDIX 4. UIDB DATA STRUCTURE

Table A4. Main attributes of the underwater imagery database (UIDB).

Name	Alias	Definition	Notes
ANALYST	Analyst	Name(s) of analyst(s) involved in video sample analysis	This field, which must be completed when analyzing a video, enables tracking of completed analyses and revisions. The analysis date is automatically recorded when the analyst name is entered.
VISIB	Visibility index	Visibility assessment	Visibility is mainly influenced by suspended particles (turbidity) and phytoplankton (represented by a greenish tint).
SUBSTRATE_ 1;2;3	Substrates	First, second and third substrate types, in descending order of dominance	In order for a substrate type to be entered in these fields, it must represent at least 25% of the total surface observed. The corresponding dominance level (1, 2, 3) is automatically assigned to the substrate during data entry.
Vg_COV	Erect vegetation cover	Class of erect vegetation cover	-
Vg_Eelgrass	Presence of eelgrass	Presence or absence of eelgrass	The observation of a single living specimen is sufficient to indicate that eelgrass is present (yes; no; nd).
Cru_COV	Encrusting algae cover	Estimated encrusting algae cover on substrate	Only encrusting algae visible during video analysis are considered when assessing total encrusting algae cover. With this approach, the encrusting algae cover is likely to be underestimated when the erect algae cover is classified as vegetated or semi-vegetated.
Cru_MORPH	Shape and colour of dominant encrusting algae	Dominant shape(s) and colour(s) of encrusting algae	For shape and colour to be included in these fields, the algae concerned must account for at least 25% of the total encrusting algae cover (Cru_COV). If there are two dominant morphotypes, the most dominant appears first. If an alga represents less than 25% of the total encrusting algae cover, it is entered in the Vg_NOTES field.
Vg_1;2;3;4	Dominant erect vegetation	First, second, third and fourth vegetation taxon listed in descending order of abundance	In order for erect vegetation to be entered in these fields, it must account for at least 25% of the erect vegetation cover (Vg_COV). The corresponding dominance level (1, 2, 3, 4) is automatically assigned to the taxon during data entry. Each taxon is linked to a Vg_TYPE,

Table A4 (cont'd).

Name	Alias	Definition	Notes
		(excluding encrusting algae and microalgae)	Vg_TAXO and Vg_MORPH. If the vegetation represents less than 25% of the total vegetation cover, it is entered in the Vg_NOTES field.
Vg_NOTES	Marginal vegetation	Marginal taxa observed	All observed taxa that do not appear in Vg (1, 2, 3, 4) are listed here. The notes field associated with each occurrence may contain additional information associated with the observation.
COMM 3_ ANALYSIS	Comments recorded during video analysis	-	-
sp_ANIML	Animals	Invertebrate and fish taxa observed	All observed taxa are listed here. A dominant taxon is identified for each video sample. An estimate of the percent cover of certain taxa (e.g. *Mytilus* sp.) is entered (An_COV). The time stamp in the video corresponding to the observation is recorded for some taxa of interest (e.g. encrusting bryozoan) to facilitate viewing at a later time. A notes field is also associated with each observation.

Table A5. Identifiers for vegetation observed during underwater video analysis. All identifiers used to complete the data tables on dominant erect vegetation (Vg_1; 2; 3; 4) and marginal vegetation (Vg_NOTES) are listed under "Classification/Identifier" in the UIDB. The Vg_MORPH, Vg_TYPE and Vg_TAXO attribute values correspond to those used in the geospatial database (GDB). The higher taxonomic ranks in bold are not identifiers. Rather, they are used to organize the organisms according to taxonomic classification, where applicable. The identifiers used for observations of the shape and colour of encrusting algae differ from those used here and are presented in Table A12. Notes on identification are included where relevant.

Classification/Identifier	Vg_MORPH	Vg_TYPE	Vg_TAXO	Notes
OCHROPHYTA, PHAEOPHYCEAE (BROWN ALGAE)				
Desmarestiales, Desmarestiaceae				
Desmarestia sp.	Thick branched filamentous brown algae	Desmarestiaceae	*Desmarestia* sp.	*Desmarestia aculeata* or *D. viridis*. May be confused with other filamentous brown algae.
Ectocarpales				
Ectocarpales	Thick branched filamentous brown algae	Ectocarpales	-	Higher taxonomic rank assigned to very bushy, delicate branched filamentous brown algae. Uncertain taxonomic assignment.
Ectocarpales, Chordariaceae				
Chordaria sp.	Thick branched filamentous brown algae	Chordariaceae	*Chordaria* sp.	Likely *Chordaria flagelliformis*, but recent genetic studies confirm the presence of a morphologically similar species in the North Atlantic. May be confused with other filamentous brown algae.
Ectocarpales, Scytosiphonaceae				
Scytosiphonaceae (tubular)	Tubular or baglike brown algae	Scytosiphonaceae	-	Higher taxonomic rank assigned to tubular brown algae. Recent genetic studies confirm the presence of a number of morphologically similar species in the Northwest Atlantic.
Fucales, Fucaceae				
Fucaceae	Striplike brown algae	Fucaceae	-	Higher taxonomic rank assigned to striplike brown algae when a lower taxonomic level cannot be assigned. Specimen cannot be assigned to *Fucus* or *Ascophyllum*.
Ascophyllum nodosum	Striplike brown algae	Fucaceae	*Ascophyllum nodosum*	-
Fucus sp.	Striplike brown algae	Fucaceae	*Fucus* sp.	Species level assignment not possible. At the very least, observation of receptacles and/or vesicles is required for identification to species level.
Fucus distichus subsp. *edentatus*	Striplike brown algae	Fucaceae	*Fucus distichus* subsp. *edentatus*	Assignment of subspecies based on receptacle shape.
Fucus distichus subsp. *evanescens*	Striplike brown algae	Fucaceae	*Fucus distichus* subsp. *evanescens*	Assignment of subspecies based on receptacle shape.
Fucus vesiculosus	Striplike brown algae	Fucaceae	*Fucus vesiculosus*	-
Laminariales				

Table A5 (cont'd).

Classification/Identifier	Vg_MORPH	Vg_TYPE	Vg_TAXO	Notes
Laminariales	Membranous or bladelike brown algae	Laminariales	-	Higher taxonomic rank assigned to membranous or bladelike brown algae when there is uncertainty between *Agarum*, *Alaria*, *Saccharina* and *Laminaria* (may include *Hedophyllum nigripes*). Not *Saccorhiza dermatodea*.
Laminariales, Agaraceae				
Agarum clathratum	Membranous or bladelike brown algae	Agaraceae	*Agarum clathratum*	-
Laminariales, Alariaceae				
Alaria esculenta	Membranous or bladelike brown algae	Alariaceae	*A laria esculenta*	-
Laminariales, Chordaceae				
Chorda sp.	Thick unbranched filamentous brown algae	Chordaceae	*Chorda* sp.	Usually assigned to *Chorda filum*, but recent genetic studies confirm the presence of a morphologically similar species in the Northwest Atlantic: *Chorda borealis*. May be confused with *Halosiphon tomentosus*.
Laminariales, Laminariaceae				
Laminariaceae	Membranous or bladelike brown algae	Laminariaceae	-	Higher taxonomic rank assigned to membranous or bladelike brown algae when there is uncertainty between *Saccharina* and *Laminaria* (may include *Hedophyllum nigripes*).
Laminaria digitata	Membranous or bladelike brown algae	Laminariaceae	*Laminaria digitata*	May be mistaken for *Hedophyllum nigripes* (cannot be ruled out on the sole basis of underwater images).
Saccharina latissima	Membranous or bladelike brown algae	Laminariaceae	*Saccharina latissima*	Considered conspecific with *Saccharina longicruris*. Labelled as *S. latissima* when the specimen lacks the classic long, swollen stipe found in *S. longicruris* or when in doubt. May be mistaken for *Hedophyllum nigripes*.
Saccharina longicruris	Membranous or bladelike brown algae	Laminariaceae	*Saccharina longicruris*	Considered conspecific with *Saccharina latissima*. Labelled as *S. longicruris* when a long, swollen and often floating stipe is visible. Specimens identified as *S. latissima* when in doubt.
Tilopteridales, Halosiphonaceae				
Halosiphon tomentosus	Thick unbranched filamentous brown algae	Halosiphonaceae	*Halosiphon tomentosus*	May be confused with *Chorda sp.*
Tilopteridales, Phyllariaceae				
Saccorhiza dermatodea	Membranous or bladelike brown algae	Phyllariaceae	*Saccorhiza dermatodea*	-
Shape and colour				
Bladelike brown algae	Bladelike brown algae	Unidentified algae	-	Identifier for bladelike brown algae when a lower taxonomic level cannot be assigned. The specimen cannot be assigned to *Fucus* or *Ascophyllum*. The label "Fucaceae" should be used whenever possible.
Thick unbranched filamentous brown algae	Thick unbranched filamentous brown algae	Unidentified algae	-	Identifier for thick unbranched filamentous brown algae when a lower taxonomic level cannot be assigned.

Table A5 (cont'd).

Classification/Identifier	Vg_MORPH	Vg_TYPE	Vg_TAXO	Notes
Membranous or bladelike brown algae	Membranous or bladelike brown algae	Unidentified algae	-	Identifier for membranous or bladelike brown algae when a lower taxonomic level cannot be assigned.
Membranous or bladelike brown algae (small)	Membranous or bladelike brown algae (small)	Unidentified algae	-	Identifier for membranous or bladelike brown algae (small) when a lower taxonomic level cannot be assigned. May include juvenile specimens of larger membranous brown algae.
CHLOROPHYTA (GREEN ALGAE), ULVOPHYCEAE				
Cladophorales, Cladophoraceae				
Chaetomorpha sp.	Thick unbranched filamentous green algae	Cladophoraceae	*Chaetomorpha* sp.	Usually *Chaetomorpha melagonium* (uniserial unbranched filaments, cells sometimes visible), but may include other species in the genus.
CHLOROPHYTA (GREEN ALGAE)				
Shape and colour				
Delicate branched filamentous green algae	Delicate branched filamentous green algae	Unidentified algae	-	Identifier for delicate branched filamentous green algae when a lower taxonomic level cannot be assigned.
Unidentified green algae	Unidentified green algae	Unidentified algae	-	Identifier for unidentified green algae when a lower taxonomic level cannot be assigned.
Membranous or bladelike green algae	Membranous or bladelike green algae	Unidentified algae	-	Identifier for membranous or bladelike green algae when a lower taxonomic level cannot be assigned. Used specifically when the observer cannot differentiate between membranous and tubular forms.
Non-filamentous green algae	Non-filamentous green algae	Unidentified algae	-	Identifier for non-filamentous green algae when a lower taxonomic level cannot be assigned.
Tubular or baglike green algae	Tubular or baglike green algae	Unidentified algae	-	Identifier for tubular or baglike green algae when a lower taxonomic level cannot be assigned.
RHODOPHYTA (RED ALGAE), BANGIOPHYCEAE				
Bangiales, Bangiaceae				
Bangiaceae (membranous or bladelike)	Membranous or bladelike red algae	Bangiaceae	-	Higher taxonomic rank assigned to membranous or thin-bladed, often translucent algae. It is impossible to assign a lower taxonomic rank on the sole basis of underwater images.
RHODOPHYTA (RED ALGAE), FLORIDEOPHYCEAE				
Ahnfeltiales, Ahnfeltiaceae				
Ahnfeltia sp.	Thick branched filamentous red algae	Ahnfeltiaceae	*Ahnfeltia* sp.	Usually attributed to *Ahnfeltia plicata*, but recent genetic studies confirm the presence of a morphologically similar species in the Northwest Atlantic: *A. borealis*, mainly (sub)arctic.
Ceramiales				

Table A5 (cont'd).

Classification/Identifier	Vg_MORPH	Vg_TYPE	Vg_TAXO	Notes
Ceramiales (flattened or foliated filamentous)	Flattened or foliated filamentous red algae	Ceramiales	-	Higher taxonomic rank assigned to flattened or foliated filamentous red algae when the observer cannot discern whether the specimen is one of the following: *Membranoptera*, *Odonthalia*, Ptilotea, *Antithamnion*, etc.
Ceramiales, Callithamniaceae				
Ptiloteae	Flattened or foliated filamentous red algae	Ptiloteae	-	Usually attributed to *Ptilota serrata*, which cannot be distinguished from *Ptilota gunneri* and *Plumaria plumosa* on the sole basis of underwater images.
Ceramiales, Delesseriaceae				
Phycodrys sp.	Flattened or foliated filamentous red algae	Delesseriaceae	*Phycodrys* sp.	Usually attributed to *Phycodrys rubens*, but recent genetic studies confirm that this species is a complex with *Phycodrys fimbriata* (the most common).
Corallinales, Corallinaceae				
Corallina officinalis	Flattened or foliated filamentous red algae	Corallinales	*Corallina officinalis*	Regarded as the only articulated coralline algae species in the Northwest Atlantic.
Gigartinales, Gigartinaceae				
Chondrus crispus	Flattened or foliated filamentous red algae	Gigartinaceae	*Chondrus crispus*	Highly variable morphology, size and colour (yellowish/greenish to brownish-red). May be confused with other species such as *Mastocarpus stellatus* and *Fredericqia deveauniensis*.
Gigartinales, Phyllophoraceae				
Phyllophoraceae	Flattened or foliated filamentous red algae	Phyllophoraceae	-	Higher taxonomic rank assigned to small flattened or foliated filamentous red algae with tubular stipes. Often colonized by Spirorbinae.
Gigartinales, Polyidaceae				
Polyides rotunda	Thick branched filamentous red algae	Polyidaceae	*Polyides rotunda*	Cannot be distinguished from *Furcellaria lumbricalis* on the sole basis of underwater images. *F. lumbricalis* has not yet been identified in Quebec's coastal waters (except in the Magdalen Islands).
Palmariales, Palmariaceae				
Devaleraea ramentacea (filamentous)	Tubular or baglike red algae	Palmariaceae	*Devaleraea ramentacea*	Highly variable morphology. This observation pertains to filamentous shapes. May be confused with other species such as *Cystoclonium purpureum*.
Palmariales, Palmariaceae				
Devaleraea ramentacea (tubular)	Tubular or baglike red algae	Palmariaceae	*Devaleraea ramentacea*	Highly variable morphology. This observation pertains to tubular shapes. Could be mistaken for other species such as *Dumontia cortata*.
Palmariales, Palmariaceae				
Palmaria palmata	Membranous or bladelike red algae	Palmariaceae	*Palmaria palmata*	-
RHODOPHYTA (RED ALGAE)				
Shape and colour				

Table A5 (cont'd).

Classification/Identifier	Vg_MORPH	Vg_TYPE	Vg_TAXO	Notes
Flattened or foliated filamentous red algae	Flattened or foliated filamentous red algae	Unidentified algae	-	Identifier for flattened or foliated filamentous red algae when a lower taxonomic level cannot be assigned.
Delicate branched filamentous red algae	Delicate branched filamentous red algae	Unidentified algae	-	Identifier for delicate branched filamentous red algae when a lower taxonomic level cannot be assigned.
Membranous or bladelike red algae	Membranous or bladelike red algae	Unidentified algae	-	Identifier for membranous or bladelike red algae when a lower taxonomic level cannot be assigned.
TRACHEOPHYTA (VASCULAR PLANTS), MAGNOLIOPSIDA				
Alismatales, Zosteraceae				
Zostera marina	-	Eelgrass	*Zostera marina*	-
UNIDENTIFIED ALGAE				
Unidentified algae	-	Unidentified algae	-	Used to label unidentifiable macroalgae.
Delicate filamentous algae	Delicate filamentous algae	Unidentified algae	-	Identifier for delicate filamentous algae when a lower taxonomic level cannot be assigned.
Thick branched filamentous algae	Thick branched filamentous algae	Unidentified algae	-	Identifier for thick branched filamentous algae when a lower taxonomic level cannot be assigned.
Unidentified filamentous algae	Unidentified filamentous algae	Unidentified algae	-	Identifier for unidentified filamentous algae when a lower taxonomic level cannot be assigned.
Unidentified membranous or bladelike algae	Unidentified membranous or bladelike algae	Unidentified algae	-	Identifier for unidentified membranous or bladelike algae when a lower taxonomic level cannot be assigned.
Unidentified tubular or baglike algae	Unidentified tubular or baglike algae	Unidentified algae	-	Identifier for unidentified tubular or baglike algae when a lower taxonomic level cannot be assigned.
OTHER				
Encrusting algae	-	-	-	Entered only under "vegetation assemblage" (Vg_ECO 1;2)
Colonial microalgae	-	-	-	Entered only under "marginal vegetation" (Vg_NOTES).

Table A6. Visibility index (VISIB). Visibility is mainly influenced by suspended particles (turbidity) and by phytoplankton.

Description	Code	Definition
Excellent visibility	1	No particles or phytoplankton. Image is clear over long distances. Characterization is easier.
Good visibility	2	Few particles or phytoplankton. Image is clear over long distances. Still possible to characterize macroalgae, but accuracy is limited at greater distances.
Fair visibility	3	Presence of particles or phytoplankton which reduces visibility. Image is clear over short distances. Macroalgae are difficult to distinguish over long distances.
Low visibility	4	Presence of many particles or phytoplankton which significantly reduces visibility. Image is clear only within close range of the camera. Possible glare from particles. Characterization is only possible at short distances from the camera.
No visibility	5	No characterization possible. Significant glare from particles.

Table A7. Substrate types (SUBSTRAT_1; 2; 3) and definitions as applied to underwater video analysis. Up to three substrate types can be entered in the table in descending order of dominance. For a substrate type to be recorded, it must represent at least 25% of the total seabed surface observed. Substrate types must be entered separately, even if they are homogeneously mixed on the bottom (exception: fine sediments). For example, an environment consisting of sand (45%), scattered cobble (30%) and scattered boulders (25%) should be identified as follows: sand (dominance 1), cobble (dominance 2), boulders (dominance 3). In the case of fine sediments (e.g. mud, sandy mud, sand), a second and third substrate can only be entered if the observed seabed surface is divided into two or three separate sections of substrate (e.g. a muddy area next to a sandy area). Under certain conditions, substrate type may be defined by including multiple size classes (mixed coarse sediment, undetermined coarse sediment).

Description	Code	Definition
Silt-clay	siag	Very fine sediment with a hard and grey appearance; rare. Glaciomarine clay associated with a Quaternary deposit.
Mud	va	Fine sediment consisting mostly of clay and silt particles (~ 75% to 100%). May contain a small proportion (~ 0% to 25%) of sand particles and organic matter.
Sandy mud	sva	Fine sediment consisting of a mixture of clay/silt particles (~ 25% to 75%) and sand (~ 25% to 75%), with no predominance. Similar to mud but with a higher composition of sand particles. Use this descriptor when unable to differentiate between proportions of clay/silt and sand particles (i.e. when in doubt).
Sand	s	Sediment consisting mostly of sand particles (~ 75% to 100%). May contain some (~ 0% to 25%) clay and silt particles.
Gravel	g	Coarse sediment with an approximate diameter of 2 to 64 mm. Determine the size relative to organisms (e.g. sea urchins are generally ≤ 80 mm).
Cobble	ga	Coarse sediment with an approximate diameter of 64 mm to 256 mm. Determine the size relative to organisms (e.g. sea urchins are generally ≤ 80 mm).
Boulders	bl	Coarse sediment with a diameter of 256 mm or more. For rip-rap or fill, see "anthropogenic."

Table A7 (cont'd).

Description	Code	Definition
Rocky	R	The observable surface is hard and does not seem to consist of separate boulders (bedrock).
Mixed coarse sediment	mig	Presence of at least two size classes of coarse sediment (sand, gravel, cobble, boulders) and impossible to determine which is dominant. When there is significant vegetation cover which limits observation of the substrates, see "undetermined coarse sediment."
Undetermined coarse sediment	sgnd	The view of the substrate is partially obstructed by algae, but clues, such as relief features (boulders), indicate that it cannot be bedrock. The presence of algae indicates that it cannot be soft fine sediment. By deduction, it can be assumed that the substrate is composed of coarse sediment (gravel, cobble or boulders). When unable to eliminate the possibility of bedrock, use "nd."
Undetermined	nd	Impossible to determine substrate type. If lack of visibility is due to dense algae cover, check whether "undetermined coarse sediment" applies.
Anthropogenic	ant	Presence of an artificial feature (e.g. rip-rap or fill); rare. For rip-rap, do not indicate "boulders," but rather "anthropogenic" and specify that it is rip-rap in the COMM_VID column. Likewise for fill.

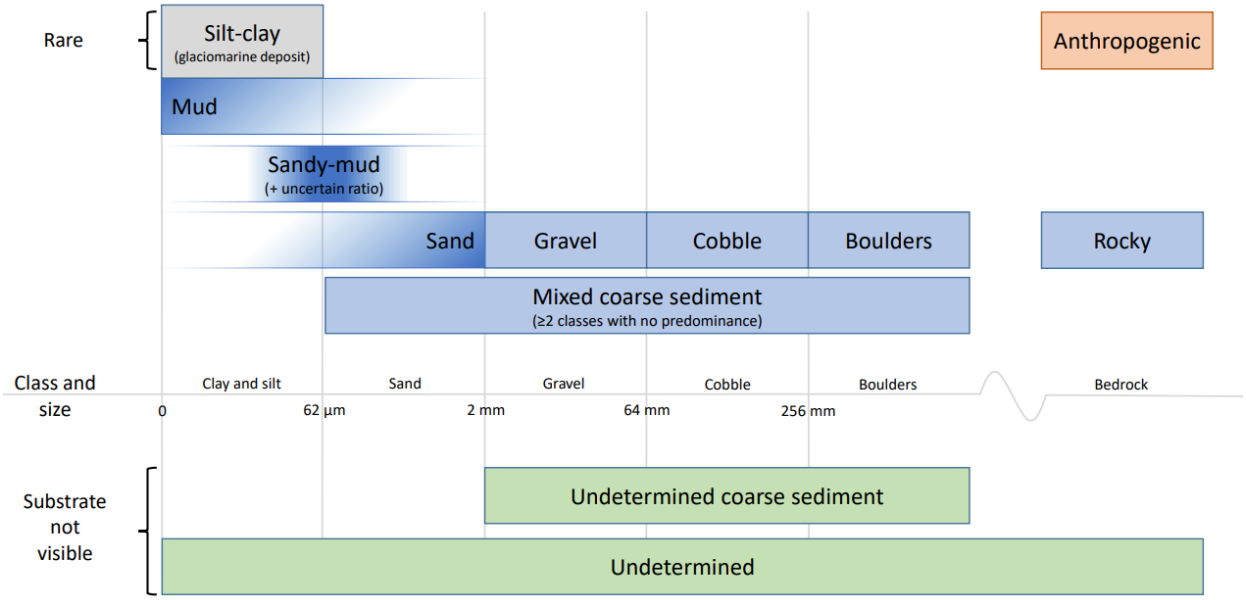

Figure A1. An excerpt from the “Substrate” sub-menu in the visual dictionary for analyzing underwater videos. Substrate types are organized by class and size.

Table A8. Erect vegetation cover (Vg_COV). As in the case of canopy vegetation, this cover is estimated vertically to the extent possible. Only erect macroalgae and vascular plants are taken into account when measuring this cover.

Description	Code	Definition
Non-vegetated	nv	0% to 1% of surface
Sparsely vegetated	pv	1% to 25% of surface
Semi-vegetated	sv	25% to 75% of surface
Vegetated	vg	75% to 100% of surface
Undetermined	nd	Percent vegetation cover cannot be determined. Often used in cases of zero visibility.

Table A9. Encrusting algae cover (Cru_COV). Only encrusting algae visible during video analysis are taken into account when assessing the total cover of encrusting algae. In situations where erect vegetation obstructs the view of a portion of the substrate, and therefore encrusting algae, the visible cover of encrusting algae must be determined (independently of the encrusting algae that may be present under the erect vegetation) and reported for the entire surface of the station. With this approach, the encrusting algae cover is likely to be underestimated where vegetated and semi-vegetated cover consisting of erect algae is present. This underestimation is intentional, to avoid over-representation of encrusting algae in the vegetation assemblages (Vg_ECO).

Description	Code	Definition
Non-vegetated	nv	0% to 1% of surface
Sparsely vegetated	pv	1% to 25% of surface
Semi-vegetated	sv	25% to 75% of surface
Vegetated	vg	75% to 100% of surface
Undetermined	nd	Impossible to determine the presence of encrusting algae, mainly due to total erect algae cover on the substrate which may be colonized by encrusting algae (when the hard substrate is not visible) or due to poor visibility.

Table A10. Identifiers for animals observed during underwater video analysis. All identifiers used in the UIDB are listed under “Classification/Identifier.” The higher taxonomic ranks in bold are not identifiers. Rather, they are used to organize the identifiers according to taxonomic classification, where applicable. Notes on identification are included where relevant.

Classification/Identifier	Notes
ANNELIDA, CLITELLATA	
Hirudinea	
Hirudinea	Uncertain identification.
ANNELIDA, POLYCHAETA	
Polychaeta	No attempt made to identify to a lower level.
Arenicolidae	
Arenicola marina	Identification based on burrows and excrement, not on the organism itself.
Echiuroidea, Bonelliidae	
Pseudobonellia iraidii	-
Sabellida, Sabellidae	
Myxicola sp.	-
Sabellida, Serpulidae	
Spirorbinae	-
Terebellida, Terebellidae	
Terebellidae	Observation of feeding tentacles.
ARTHROPODA, MALACOSTRACA	
Amphipoda	
Amphipoda	Crustacean with a gammarid-like appearance. May include Gammaridae and Hyperidae. Excludes Caprellidae.
Amphipoda, Caprellidae	
Caprellidae	
Caprellidae	May be mistaken for other similar-looking organisms classified in the family Dulchiidae.
Decapoda	
Caridea	Unidentified shrimp.
Decapoda, Cancridae	
Cancer irroratus	-
Decapoda, Crangonidae	
Crangon septemspinosa	-
Decapoda, Nephropidae	
Homarus americanus	-
Decapoda, Oregoniidae	
Hyas sp.	-
Decapoda, Paguridae	
Pagurus sp.	-
Isopoda, Idoteidae	
Idotea sp.	Likely *Idotea baltica*.
Mysida, Mysidae	

Classification/Identifier	Notes
Mysidae	-
ARTHROPODA, THECOSTRACA	
Balanomorpha	
Balanoidea	-
Terebratulida, Cancellothyrididae	
Terebratulina septentrionalis	-
BRYOZOA	
Bryozoa encroutant	Encrusting bryozoa, not erect. In most cases, likely *Membranipora* sp.
CHORDATA	
Actinopterygii	
Actinopterygii	Lower-level identification not possible for the fish specimen.
CHORDATA, ACTINOPTERI	
Eupercaria incertae sedis, Labridae	
Tautogolabrus adspersus	-
Eupercaria incertae sedis, Moronidae	
Morone saxatilis	-
Gadiformes, Gadidae	
Gadus sp.	Small individuals presumed to be *Gadus morhua*, which may include *Gadus ogac*.
Perciformes, Ammodytidae	
Ammodytes	At least two genetically distinct species.
Perciformes, Cottidae	
Cottidae	Likely belonging to the genus *Myoxcephalus* based on the depth of observation, but uncertain.
Perciformes, Cyclopteridae	
Cyclopterus lumpus	-
Perciformes, Gasterosteidae	
Gasterosteidae	-
Perciformes, Liparidae	
Liparis sp.	Presumed to be *Liparis atlanticus*, but could not be confirmed.
Perciformes, Pholidae	
Pholis gunnelus	-
Perciformes, Stichaeidae	
Stichaeus punctatus	-
Perciformes, Zoarcidae	
Zoarces americanus	-
Pleuronectiformes, Pleuronectidae	
Pleuronectidae	No attempt made to identify to a lower level.
Scombriformes, Scombridae	
Scomber scombrus	-

Classification/Identifier	Notes
CHORDATA, ASCIDIACEA	
Ascidiacea	-
Stolidobranchia, Pyuridae	
Halocynthia pyriformis	-
CNIDARIA	
Cnidaria	Uncertain identification. Presumed to be a hydrozoan jellyfish.
CNIDARIA, ANTHOZOA	
Actiniaria	
Actiniaria	Usually small individuals.
Actiniaria, Actiniidae	
Actiniidae	Previously identified as *Urticina felina*, now either *Cribrinopsis similis* or *Urticina crassicornis*.
Aulactinia stella	-
Actiniaria, Actinostolidae	
Stomphia coccinea	-
Actiniaria, Halcampidae	
Halcampa duodecimcirrata	Small sea anemones observed buried in the sand.
Actiniaria, Metridiidae	
Metridium senile	-
Alcyonacea, Nephtheidae	
Gersemia rubiformis	-
CNIDARIA, HYDROZOA	
Hydrozoa	Various shapes, erect. Generally found on algae and rocks.
Anthoathecata, Pandeidae	
Catablema vesicarium	-
Anthoathecata, Tubulariidae	
Tubulariidae	-
Leptothecata, Laodiceidae	
Ptychogena lactea	-
Staurostoma mertensii	-
Leptothecata, Sertulariidae	
Sertulariidae	-
CNIDARIA, SCYPHOZOA	
Semaeostomeae, Cyaneidae	
Cyanea sp.	Typically attributed to *Cyanea capillata*, but requires genetic confirmation.
Semaeostomeae, Ulmaridae	
Aurelia sp.	Typically attributed to *Aurelia aurita*, but requires genetic confirmation.
CNIDARIA, STAUROZOA	
Stauromedusae	

Classification/Identifier	Notes
Stauromedusae	-
CTENOPHORA	
Ctenophora	-
ECHINODERMATA, ASTEROIDEA	
Asteroidea	Uncertain observation. Usually small individuals.
Forcipulatida, Asteriidae	
Asterias rubens	May be mistaken for *Asterias forbesi* further south.
Leptasterias polaris	-
Spinulosida, Echinasteridae	
Henricia sp.	May be mistaken for *Asterias rubens*.
Valvatida, Solasteridae	
Crossaster papposus	-
Solaster endeca	-
ECHINODERMATA, ECHINOIDEA	
Camarodonta, Strongylocentrotidae	
Strongylocentrotus droebachiensis	May be confused with another species (*Strongylocentrotus pallidus*) at depths greater than 7 m or if water temperature is very cold (e.g. Lower North Shore).
Clypeasteroida, Echinarachniidae	
Echinarachnius parma	-
ECHINODERMATA, HOLOTHUROIDEA	
Dendrochirotida, Cucumariidae	
Cucumaria frondosa	-
Dendrochirotida, Psolidae	
Psolus fabricii	-
Psolus phantapus	-
ECHINODERMATA, OPHIUROIDEA	
Amphilepidida, Ophiopholidae	
Ophiopholis aculeata	Usually an arm is observed in rocky habitat. Presumed to be the only Ophiuroidea species found in rocky habitat.
MOLLUSCA, BIVALVIA	
Bivalvia	Observation of siphons. These organisms are typically buried and could not be identified.
Adapedonta, Pharidae	
Ensis leei	-
Myida, Myidae	
Mya sp.	Observation of siphons.
Myida, Pholadidae	
Zirfaea crispata	Observation of siphons.
Mytilida, Mytilidae	
Mytilus sp.	Species complex (*Mytilus edulis*).

Classification/Identifier	Notes
Pectinida, Pectinidae	
Placopecten magellanicus	-
Venerida, Mesodesmatidae	
Mesodesma arctatum	Observation of siphons. May be mistaken for *M. deauratum*.
MOLLUSCA, GASTROPODA	
Gastropoda	Usually small individuals.
Lottiidae	
Lottiidae	
Testudinalia testudinalis	
Littorinimorpha, Littorinidae	
Littorina sp.	-
Littorinimorpha, Naticidae	
Euspira heros	-
Neogastropoda, Buccinidae	
Buccinidae	Likely *Buccinum* sp., but could be *Colus* sp. or other larger Buccinidae.
Neogastropoda, Muricidae	
Nucella lapillus	-
Nudibranchia, Dendronotidae	
Dendronotus sp.	-
MOLLUSCA, POLYPLACOPHORA	
Chitonida, Tonicellidae	
Tonicellidae	Either *Boreochiton ruber* or *Tonicella marmorea.*
PORIFERA, DEMOSPONGIAE	
Demospongiae	Sponge whose shape cannot be identified or requires further observation.
Demospongiae, encrusting morphotype	Encrusting sponge.
Haplosclerida, Chalinidae	
Haliclona oculata	-
Suberitida, Halichondriidae	
Halichondria sitiens	-
OTHER	
Endobenthos	Identifier used to label unidentified endobenthic organisms. Does not include observation of bivalve siphons.
Small sediment tubes	Identifier used to label tubes formed by unidentified organisms.

Table A11. Estimated animal cover (An_COV). Only organisms visible during video analysis are taken into account when assessing the total cover of a target taxon. In situations where erect vegetation obstructs the view of a portion of the substrate, and therefore of the animal taxon, the visible taxon cover (independently of the taxa that may be present under the erect vegetation) must be determined and reported for the entire surface of the station. With this approach, taxon cover is likely to be underestimated where vegetated and semi-vegetated cover consisting of erect algae is present. Cover is only determined for bivalves and the “endobenthos” identifier.

Description	Code	Definition
Not covered	nc	Presence of at least one specimen with coverage (seabed surface) of less than 1%.
Sparsely covered	pc	1% to 25% of surface
Semi-covered	sc	25% to 75% of surface
Covered	c	75% to 100% of surface
Undetermined	nd	Taxon cover cannot be determined, usually due to significant erect algae cover or poor visibility.

Table A12. Shape and colour of dominant encrusting algae (Cru_MORPH). For encrusting algae to be included in this field, it had to account for more than 25% of the total encrusting algae cover. In cases where two dominant species are present, the most dominant is shown first. If other species of encrusting algae are present but represent less than 25% of the total encrusting algae cover at the station, they are included in the marginal vegetation field (Vg_NOTES).

Identifier	Code	Notes
Unidentified encrusting algae	en	Unidentifiable encrusting algae.
Brown encrusting algae	enb	Yellowish-brown, olive or blackish-brown crust. Shaped like rounded lobes or discs that eventually join to form a relatively continuous crust.
Red calcareous encrusting algae	enrc	Calcareous pink or reddish crust (white when dead). Smooth or covered with protuberances.
Rhodolith bed (red calcareous encrusting algae)	enrcm	Bed of detached nodules composed of red calcareous encrusting algae.
Red non-calcareous encrusting algae	enrnc	Non-calcareous red crust. Red on shaded rock faces, yellower on sunny spots. Stain-like appearance on rock.
Mixed encrusting algae	enmi	Encrusting algae with a combination of shapes/colours are present, but there is no pattern of dominance.
Brown encrusting algae and red calcareous encrusting algae	brc	Presence of at least two types of encrusting algae. Brown encrusting algae are dominant over red calcareous encrusting algae.
Brown encrusting algae and red non-calcareous encrusting algae	brnc	Presence of at least two types of encrusting algae. Brown encrusting algae are dominant over red non-calcareous encrusting algae.
Red calcareous encrusting algae and red non-calcareous encrusting algae	rcrnc	Presence of at least two types of encrusting algae. Red calcareous encrusting algae are dominant over red non-calcareous encrusting algae.
Red calcareous encrusting algae and brown encrusting algae	rcb	Presence of at least two types of encrusting algae. Red calcareous encrusting algae are dominant over brown encrusting algae.
Red non-calcareous encrusting algae and brown encrusting algae	rncb	Presence of at least two types of encrusting algae. Red non-calcareous encrusting algae are dominant over brown encrusting algae.
Red non-calcareous encrusting algae and red calcareous encrusting algae	rncrc	Presence of at least two types of encrusting algae. Red non-calcareous encrusting algae are dominant over red calcareous encrusting algae.