PRIFYSGOL
BANGOR
UNIVERSITY

Benthic Habitat Mapping:
Baie ny Carrickey Marine Nature Reserve

M.J. Garratt, May, L., I.S.M. Bloor, J.A. Emmerson & S.R. Jenkins

Bangor University Sustainable Fisheries and Aquaculture Group
School of Ocean Sciences

Report to Isle of Man Government, Department of Environment, Food and Agriculture

Contact: i.bloor@bangor.ac.uk

April 2020

To cite this report: Garratt, M. J., May, L., Bloor, I. S. M., Emmerson, J. A. and Jenkins, S. R. (2020). Benthic Habitat Mapping: Baie ny Carrickey Marine Nature Reserve. Sustainable Fisheries and Aquaculture Report (IoM), Bangor University. pp. 1 – 38.

1 | Introduction

Coastal benthic habitats provide important ecosystem services including food production, nutrient cycling, carbon sequestration and abiotic resources (Hall *et al*., 2002; Barbier *et al*., 2011). Marine Protected Areas (MPAs) offer a means of safeguarding benthic habitats and their associated functions, promoting increased biodiversity and biomass of commercially-targeted species (Halpern & Warner, 2002; Beukers-Stewart *et al*., 2005; Howarth *et al*., 2011). In the Isle of Man, 52% of the coastal territorial sea (0-3 nm) is designated within MPAs (defined as Marine Nature Reserves), with the aim of protecting priority habitats such as maerl beds, horse mussel reefs and seagrass, and supporting the fishing industry (DEFA, 2018; Howe, 2018). The most valuable fishery in Manx waters (*Pecten maximus*) is reliant on benthic habitat features such as stones, hydroids and bryozoans (Brand *et al*., 1980; Harvey *et al*., 1993; Duncan & Emmerson, 2018).

Benthic habitat mapping is therefore an important tool in marine management with regard to conservation, fisheries sustainability and marine-based resources (Harris & Baker, 2012). The general distribution of benthic habitats in the Manx territorial sea (0-12 nm) is well-established (White, 2011), however there is a need for finer scale surveys in areas of conservation interest in order to account for some habitats and species that have very restricted distributions and to feed into management and monitoring efforts. This report forms part of an ongoing camera survey project to assess benthic habitats within the Isle of Man's Marine Nature Reserves (MNRs), and presents the results for Baie ny Carrickey MNR.

2 | Methods

2.1 | Location

Baie ny Carrickey MNR is located on the South of the Island (Figure 1). Baie ny Carrickey was originally established as a fishery-restricted area in 2012 to reduce gear conlict between scallopers and pot fishers and to protect rocky reefs. The area was subsequently designated as a MNR on 1st September 2018.

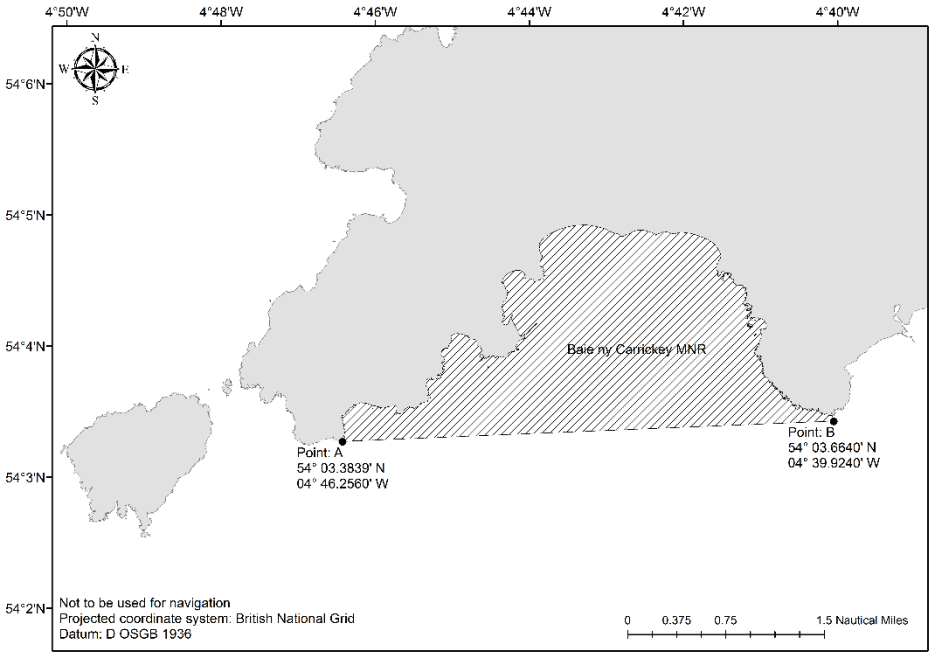


Figure 1: Map showing the location of Baie ny Carrickey Marine Nature Reserve

2.2 | Data Collection

Underwater video footage was collected using a drop-down camera system (Figure 1), consisting of a metal frame with a circular base which could be lowered to the seabed without causing any damage to the habitats in the MNR. A GoPro HERO3 camera was attached to the frame, along with underwater lights to illuminate the sea floor.

Figure 1: Photograph demonstrating the drop-down camera setup used to collect benthic video footage in Baie ny Carrickey MNR.

The drop-down camera was deployed at 83 stations within Baie ny Carrickey MNR (Appendix, Figure A), sampled between June and August 2015, with the aim of collecting an even distribution of data throughout the area. These locations were randomised within four depth zones (0-7 m, 7-14 m, 14-21 m and 21-28 m), with a minimum distance of 150 m between stations. At each station, four replicates were achieved by allowing the drop-down camera to rest on the seabed for approximately 5 seconds at four locations, determined by the drift of the boat. GPS position, time and water depth were also recorded. Substrate data for Baie ny Carrickey was acquired from MaxSea software aboard the fishing vessel *Nancy Ellen*, and ground-truthed using drop-down camera stations that fell within MaxSea seabed classes.

2.3 | Image Analysis

Still images were obtained from the video footage at each station using the screenshot function in VLC Media Player, to allow for quantitative community information to be extracted from the footage using ImageJ (Schneider *et al*., 2012). Prior to analysis, these images were assessed for visibility and quality using a standardised scoring technique (Table 1), adapted from Hannah & Blume (2012), and any images scoring 0 in either category were omitted.

Table 1: Scoring system used to determine the suitability of screenshotted images for community anlaysis (Hannah & Blume, 2012).

Score	Visibility	Quality
0	View totally obscured by suspended sediments or frame lens is blurred	Camera on side facing open water or majority of screen (>60%) obscured by marine flora (e.g.kelp fronds)
1	View partially obscured/limited viewing distance by suspended sediments	Camera at acceptable angle, although view of substrate is partially blocked
2	Clear view of substrate	Good view and image quality

Three types of information were extracted from the images:

- Categorisation of substrate type
- Percentage cover of sessile species
- Abundance counts of mobile species

The substrate in each image was visually assessed and described using the following categories, either individually or a combination of: sand; coarse sand; gravel; pebbles; cobbles; rock; boulders; shell hash; maerl; and dead maerl. All organisms present were then identified to the lowest possible taxonomic resolution and recorded in terms of percent cover (sessile species) or individual abundance (mobile species). Taxa that could not be identified with confidence were put into descriptive categories (e.g. filamentous red algae, mixed hyrdroid and bryozoan turf), and when two were distinguishable from one another these were described as 'A' and 'B' (e.g. porifera A, porifera B). Brittlestar species (*Ophiothrix fragilis* and *Ophiocomina nigra*) were observed in dense quantities and therefore recorded as percent cover rather than abundance count.

2.4 | Habitat Classification

Images were categorised into habitat types using a multivariate statistical approach and the EUNIS habitat classification system (JNCC, 2015). The statistical approach was used to identify distinct biological assemblages in Baie ny Carrickey from the community data extracted from the images, and the EUNIS approach was used to categorise habitats in a manner that is internationally recognised, incorporating both environmental and biological information.

Statistical approach: A hierarchical clustering procedure (group average) was applied to the Bray-Curtis dissimilarity matrix of square-root transformed percentage cover community data. A similarity profile analysis (SIMPROF) was used to identify clusters of images that were significantly different from each other at the 0.01 level, thus defining the different biological groups present in the data. The resulting assemblages were examined using SIMPER analysis and then assigned descriptive habitat names based on characterising species, sediment type and depth.

EUNIS approach: A hierarchical classification technique where images are described using standardised habitat categories, sequentially adding detail (Table 2). Habitats are identified by key environmental factors down to Level 3, with biological community information required from Level 4 for rocky habitats, and from Level 5 for sedimentary habitats. The images were categorised to Level 3 based on substrate type and additional environmental data from Digimap and UKSeaMap (depth, light attenuation, wave energy, current energy). The SIMPROF cluster groups were then incorporated in order to distinguish biological assemblages amongst the Level 3 habitats. Each drop-down camera station was assigned an official habitat code to the appropriate level of resolution (Level 4, 5 or 6).

Table 2: Example of the EUNIS hierarchical approach to habitat classification.

Level	Category	Example	Code
Level 1	Environment	Marine	–
Level 2	Broad habitat type	Sublittoral sediment	SS
Level 3	Habitat complex	Sublittoral mixed sediment	SS.SMx
Level 4	Habitat complex	Circalittoral mixed sediment	SS.SMx.CMx

Level 5	Habitat	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	SS.SMx.CMx.ClloMx
Level 6	Sub-habitat	*Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment	SS.SMx.CMx.ClloMx.Nem

2.5 | Mapping and Data Analysis

A dataset containing the GPS coordinates of drop-down camera stations and their corresponding habitat designations was imported into ArcGIS, and Euclidean allocation used to create distribution maps for the SIMPROF assemblages and EUNIS habitats. Analysis of similarities (ANOSIM) was used to test whether there were significant differences between habitat groups based on percentage cover (sessile species), abundance (mobile species) and full community composition (presence-absence). The habitats were scrutinised further using similarity percentage analysis (SIMPER) on percentage cover and presence-absence data, identifying the taxa that were characteristic of each SIMPROF and EUNIS habitat.

Habitat types were then compared with regard to key univariate community characteristics: mean species richness, abundance of mobile species and total algal cover (maerl excluded). One-way analysis was not appropriate given the range in sample sizes (1-31).

3 | Results

A total of 87 taxa were identified from the drop-down camera footage in Baie ny Carrickey MNR, (Appendix, Table B), including 29 algal taxa (33%), 12 sponges (14%), 11 cnidarians (13%), 11 molluscs (13%), 9 echinoderms (10%), 5 bryozoans (6%), 4 annelids (5%), 2 tunicates (2%), 2 fish (2%), 1 crustacean (1%) and 1 plant species (1%). The majority of taxa (77%) could be identified to species or genus level.

The most common taxa in Baie ny Carrickey MNR, each found in >30% of the images, were corallinaceae, filamentous red algae, foliose red algae, dark encrusting red algae, *Laminaria hyperborea*, mixed hydroid and bryozoan turf, *Clavelina lepadiformis*, *Nemertesia antennina* and *Alcyonium digitatum*. The most common mobile species by total abundance were *Gibbula* spp. (48), *Echinus esculentus* (22), *Actinothoe sphyrodeta* (18), *Littorina obtusata* (12), unidentified bivalve sp. (11), *Asterias rubens* (8) and *Henricia* spp. (8). Species richness in images ranged from 1 to 19 and was generally high throughout the bay, averaging at 11 taxa per image.

3.1 | SIMPROF Habitats

The statistical approach (SIMPROF) identified 14 distinct benthic assemblages in Baie ny Carrickey MNR based on percentage cover community data. ANOSIM confirmed that these cluster groups significantly differed with regard to percentage cover [sessile species] ($R = 0.71$, $p < 0.001$), abundance [mobile species) ($R = 0.26$, $p < 0.001$) and full community composition [presence-absence] ($R = 0.71$, $p < 0.001$). The SIMPROF habitats are described in Table 3 by characterising species (identified from SIMPER analysis), and the spatial distribution of habitats across the MNR is displayed in Figure 4A.

Mean species richness in SIMPROF habitats, not including those defined by a single station, ranged from 1 taxa per image in habitat A (infralittoral sand with bioturbation fauna) to 16 taxa per image in habitat M (Red and brown seaweeds with hydroids and sponges on lower infralittoral rocky mixed sediment) (Figure 2). Abundance of countable mobile species was generally low, peaking at 7 individuals per image in habitat C (turf/encrusting species on circalittoral mixed sediment) (Figure 2). Disregarding single site habitats, average seaweed cover in habitats ranged from 0% in habitat A (infralittoral sand with bioturbation fauna) to 76% in habitat N (Mixed kelp and red seaweeds on infralittoral rock).

Table 3: Benthic habitats in Baie ny Carrickey MNR using the statistical classification approach (SIMPROF), including the total number of images and the average similarity in percentage cover community data between images within each habitat group (full SIMPER results for percentage cover in Appendix, Table C). Characterising taxa were those contributing to 90% of the statistical similarity in species composition (presence-absence data) within habitats.

SIMPROF habitat	Images	Avg sim	Characterising taxa
A Infralittoral sand with bioturbation fauna	2	71%	Bioturbation fauna
B Floral communities on shallow mixed sediments	2	27%	Corallinaceae, *Fucus serratus*, *Laminaria digitata*, *Zostera marina*
C Turf/encrusting species on circalittoral mixed sediment	3	40%	Corallinaceae, *Spirobranchus triqueter*, mixed hydroid and bryozoan turf, dark encrusting red algae, *Antedon bifida*, unidentified bivalves
D *Saccharina latissima* and other seaweeds on infralittoral mixed sediment	4	44%	Filamentous red algae, *Saccharina latissima*, corallinaceae, *Cystoseria* spp.
E Brown and red seaweeds on infralittoral coarse sediment	1	*NA*	*Dictyota dichotoma*, *Desmarestia aculeata*, *Halidrys siliquosa*, filamentous and foliose red algae
F *Sargassum muticum* and other seaweeds on shallow coarse sediment	1	*NA*	*Sargassum muticum*, foliose red algae, *Ulva* spp., *Sacsorhiza polyschides*
G Brittlestars and turf/encrusting species on circalittoral coarse sediment	2	47%	Corallinaceae, *Ophiocomina nigra*, *Ophiothrix fragilis*, mixed hydroid and bryozoan turf, dark encrusting red algae, foliose red algae
H Mixed hydroid and algal turf on circalittoral coarse sediment with boulders	8	58%	Corallinaceae, mixed hydroid and bryozoan turf, *Nemertesia antennina*, dark encrusting red algae, *Alcyonium digitatum*, filamentous and foliose red algae, *Clavelina lepadiformis*
I *Laminaria hyperborea* and sponges on circalittoral rock	1	*NA*	Corallinaceae, *Cliona celata, Laminaria hyperborea*, *Clavelina lepadiformis*, *Nemertesia antennina*, *Polymastia boletiformis*, *Alcyonium digitatum*, *Suberites ficus*, *Tethya aurantium*
J Red algae on lower infralittoral rock	3	42%	Corallinaceae, dark encrusting red algae, foliose and filamentous red algae, *Clavelina lepadiformis*
K Mixed seaweed, hydroid and bryozoan turf with sponges on circalittoral rock	9	65%	Corallinaceae, dark encrusting red algae, mixed hydroid and bryozoan turf, *Alcyonium digitatum*, filamentous red algae, *Nemertesia antennina*, *Clavelina lepadiformis*, *Cliona celata*, *Halecium halecinum*, *Tethya aurantium*

L Red and brown seaweeds with hydroids on lower infralittoral rock	9	71%	Corallinaceae, dark encrusting red algae, *Dictyota dichotoma*, filamentous and foliose red algae, mixed hydroid and bryozoan turf, *Nemertesia antennina*, *Clavelina lepadiformis*, *Tethya aurantium*, *Laminaria hyperborea*, *Cliona celata*
M Red and brown seaweeds with hydroids and sponges on lower infralittoral rocky mixed sediment	7	61%	Corallinaceae, dark encrusting red algae, *Dictyota dichotoma*, filamentous and foliose red algae, *Laminaria hyperborea*, mixed hydroid and bryozoan turf, *Clavelina lepadiformis*, *Echinus esculentus*, *Spirobranchus triqueter*, *Cliona celata*, *Pachymatisma johnstonia*, *Nemertesia antennina*
N Mixed kelp and red seaweeds on infralittoral rock	31	51%	Filamentous and foliose red algae, corallinaceae, *Laminaria hyperborea*, dark encrusting red algae, *Saccharina latissima, Delessia sanguinea*, *Gibbula* spp., *Saccorhiza polyschides*, *Phycodrys rubens*

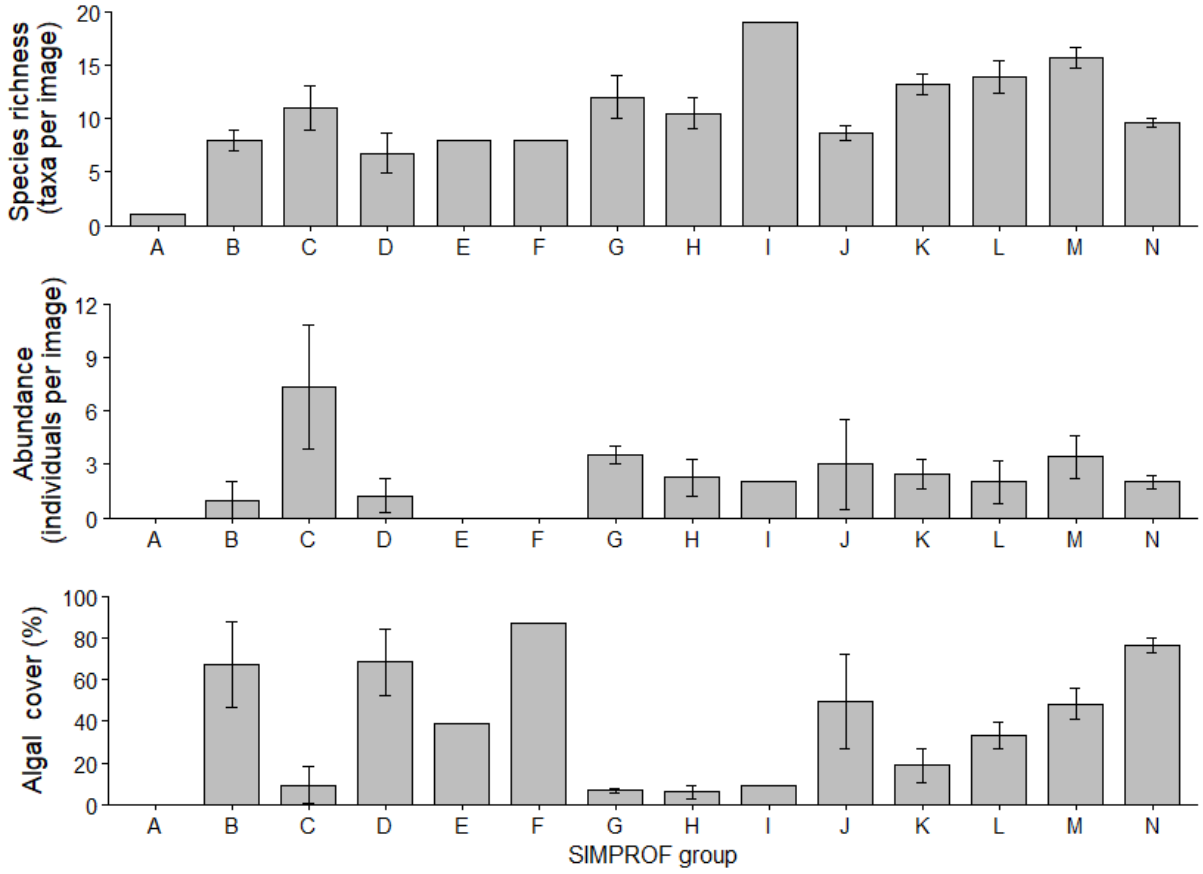


Figure 2: Mean (± S.E.) species richness, abundance of mobile species and total seaweed cover in images (n = 1-31) across the 14 habitats in Baie ny Carrickey MNR identified using SIMPROF analysis. Letters that are close-by indicate similar habitats.

3.2 | EUNIS Habitats

The EUNIS approach resulted in the identification of 18 official habitat types in Baie ny Carrickey MNR. ANOSIM confirmed that these habitats significantly differed with regard to percentage cover [sessile species] ($R = 0.72$, $p < 0.001$), abundance [mobile species] ($R = 0.12$, $p < 0.001$) and full community composition [presence-absence] ($R = 0.68$, $p < 0.001$). The habitats are listed in Table 4 in conjunction

with the results of SIMPER analysis, and their distribution across the MNR is displayed in Figure 4B. More detailed descriptions and habitat images are available in the appendix (page 21-38).

Mean species richness in EUNIS habitats, disregarding single station habitats, ranged from 1 taxa per image in SS.SSa.IFiSa (Infralittoral fine sand) to 14 taxa per image in IR.HIR.KFaR.FoR (Foliose red seaweeds on exposed lower infralittoral rock) (Figure 3). Abundance of countable mobile species was low across habitats, peaking at 7 individuals per image in SS.SMx.CMx (Circalittoral mixed sediment) (Figure 3), which was dominated by bivalves. Average seaweed cover in habitats, again disregarding single site habitats, ranged from 0% in SS.SSa.IFiSa (Infralittoral fine sand) to 82% in IR.HIR.KFaR.LhypR (*Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock) (Figure 3).

Table 4: Benthic habitats in Baie ny Carrickey MNR using the official European classification system (EUNIS) (JNCC, 2015), including the total number of images and the average similarity in percentage cover community data between images within each habitat group (full SIMPER results for percentage cover in Appendix, Table D). Characterising taxa were those contributing to 90% of the statistical similarity in species composition (presence-absence data) within habitats.

EUNIS habitat	Images	Avg sim	Characterising taxa
SS.SSa.IFiSa Infralittoral fine sand	2	71%	Bioturbation fauna
SS.SMx.CMx Circalittoral mixed sediment	3	29%	Corallinaceae, *Spirobranchus triqueter*, mixed hydroid and bryozoan turf, dark encrusting red algae, *Antedon bifida*, unidentified bivalves
SS.SMx.CMx.FluHyd *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	4	55%	Corallinaceae, dark encrusting red algae, mixed hydroid and bryozoan turf, *Nemertesia antennina*, *Alcyonium digitatum*, *Spirobranchus triqueter*, unidentified bivalve
SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	2	47%	Corallinaceae, *Ophiocomina nigra*, *Ophiothrix fragilis*, dark encrusting red algae, *Spirobranchus triqueter*, mixed hydroid and bryozoan turf, foliose red algae
SS.SMp.SSgr.Zmar *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand	1	*NA*	*Zostera marina*, red and brown algae
SS.SMp.KSwSS.LsacR *Laminaria saccharina* and red seaweeds on infralittoral sediments	2	48%	Filamentous red algae, *Laminaria saccharina*
IR.LIR.K.Sar *Sargassum muticum* on shallow slightly tide-swept infralittoral mixed substrata	1	*NA*	*Sargassum muticum*, foliose red algae, *Ulva* spp., *Sacsorhiza polyschides*
IR.MIR.KR.Ldig *Laminaria digitata* on moderately exposed sublittoral fringe rock	1	*NA*	*Fucus serratus*, *Laminaria digitata*, *Palmaria palmata*, *Mastocarpus stellatus*, corallinaceae
IR.MIR.KR.Lhyp *Laminaria hyperborea* and foliose red seaweeds on moderatelyexposed infralittoral rock	3	66%	Corallinaceae, filamentous and foliose red algae, dark encrusting red algae, *Laminaria hyperborea*, *Phycodrys rubens*
IR.MIR.KR.LhypTX *Laminaria hyperborea* on tide-swept, infralittoral mixed substrata	1	*NA*	Corallinaceae, *Laminaria hyperborea*, *Clavelina lepadiformis*, filamentous and foliose red algae, *Alcyonium digitatum*
IR.MIR.KT.XKT Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock	1	NA	*Dictyota dichotoma*, *Desmarestia aculeata*, *Halidrys siliquosa*, filamentous and foliose red algae, *Cliona celata*, *Clavelina lepadiformis*, *Tethya auratium*
IR.HIR.KSed.XKScrR Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	11	55%	Filamentous and foliose red algae, *Laminaria hyperborea*, corallinaceae, *Saccorhiza polyschides*, *Delessia sanguinea*, *Gibbula* spp., dark encrusting red algae, *Laminaria saccharina*
IR.HIR.KSed.LsacSac *Laminaria saccharina* and/or *Saccorhiza polyschides* on exposed infralittoral rock	9	47%	Corallinaceae, filamentous and foliose red algae, *Laminaria saccharina*, dark encrusting red algae, G*ibbula* spp., *Saccorhiza polyschides*, *Desmarestia aculeata*

IR.HIR.KFaR.FoR Foliose red seaweeds on exposed lower infralittoral rock	16	59%	Corallinaceae, filamentous and foliose red algae, dark encrusting red algae, mixed hydroid and bryozoan turf, *Clavelina lepadiformis*, *Dictyota dichotoma*, *Nemertesia antennina*, *Laminaria hyperborea*, *Cliona celata*, *Tethya auratium*
IR.HIR.KFaR.LhypR *Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock	11	60%	Filamentous and foliose red algae, *Laminaria hyperborea*, corallinaceae, dark encrusting red algae, *Delessia sanguinea*, *Phycodrys rubens*
CR.MCR.EcCr.FaAlCr Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	2	54%	Corallinaceae, dark encrusting red algae, mixed hydroid and bryozoan turf, *Alcyonium digitatum*, *Halecium halecinum*
CR.HCR.XFa.SpNemAdia Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata	6	43%	Corallinaceae, mixed hydroid and bryozoan turf, *Nemertesia antennina*, filamentous and foliose red algae, dark encrusting red algae, *Alcyonium digitatum*, *Tethya auratium*, orange porifera sp.
Cr.HCR.XFa.ByErSp Bryozoan turf and erect sponges on tide-swept circalittoral rock	7	61%	Corallinaceae, dark encrusting red algae, foliose and filamentous red algae, mixed hydroid and bryozoan turf, *Alcyonium digitatum*, *Nemertesia antennina*, *Clavelina lepadiformis*, *Hemimycale columella*, *Tethya auratium*, orange porifera sp.

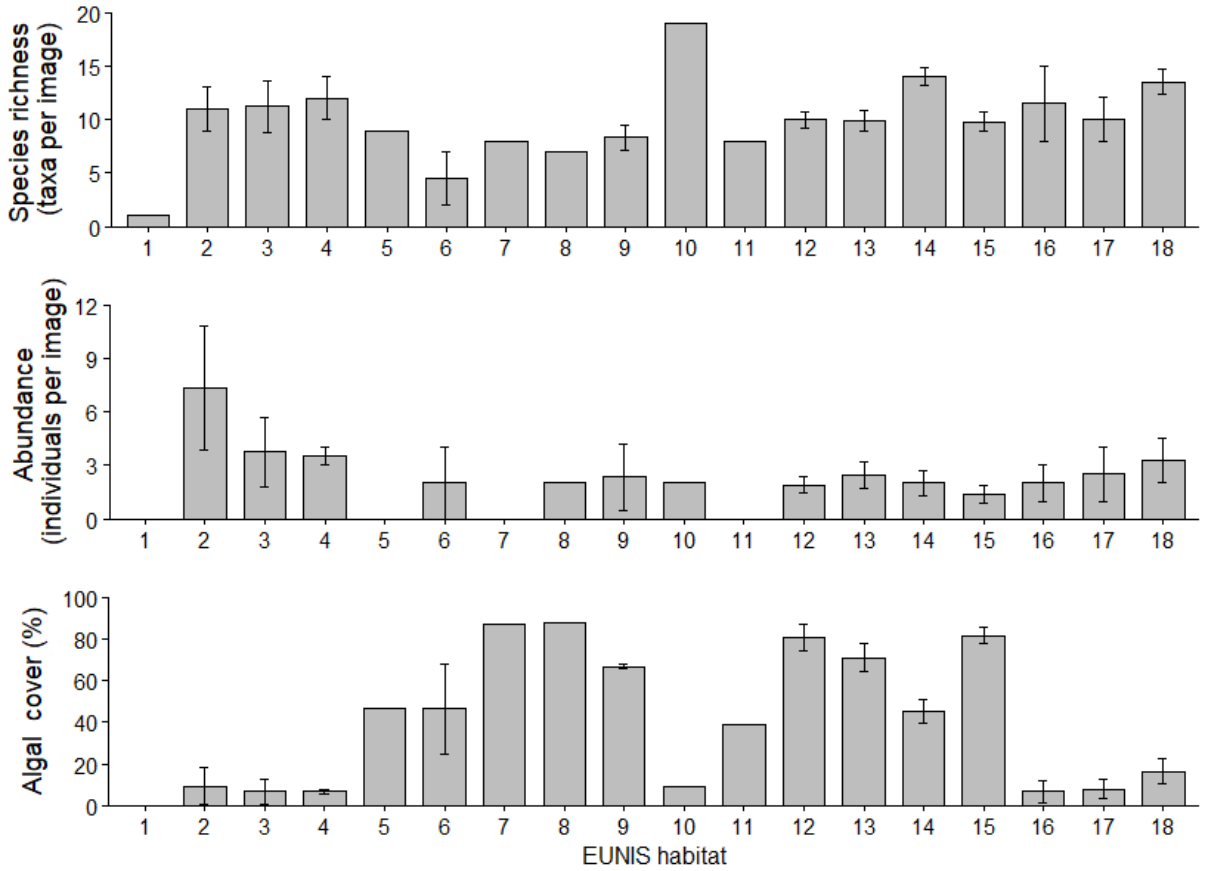


Figure 3: Mean (± S.E.) species richness, abundance of mobile species and total seaweed cover in images (n = 1-16) across the 18 habitats identified using the EUNIS habitat classification system (JNCC, 2015). 1 = SS.SSa.IFiSa; 2 = SS.SMx.CMx; 3 = SS.SMx.CMx.FluHyd; 4 = SS.SMx.CMx.OphMx; 5 = SS.SMp.SSgr.Zmar; 6 = SS.SMp.KSwSS.LsacR; 7 = IR.LIR.K.Sar; 8 = IR.MIR.KR.Ldig; 9 = IR.MIR.KR.Lhyp; 10 = IR.MIR.KR.LhypTX; 11 = IR.MIR.KT.XKT; 12 = IR.HIR.KSed.XKScrR; 13 = IR.HIR.KSed.LsacSac; 14 = IR.HIR.KFaR.FoR; 15 = IR.HIR.KFaR.LhypR; 16 = CR.MCR.EcCr.FaAlCr; 17 = CR.HCR.XFa.SpNemAdia; 18 = CR.HCR.XFa.ByErSp.

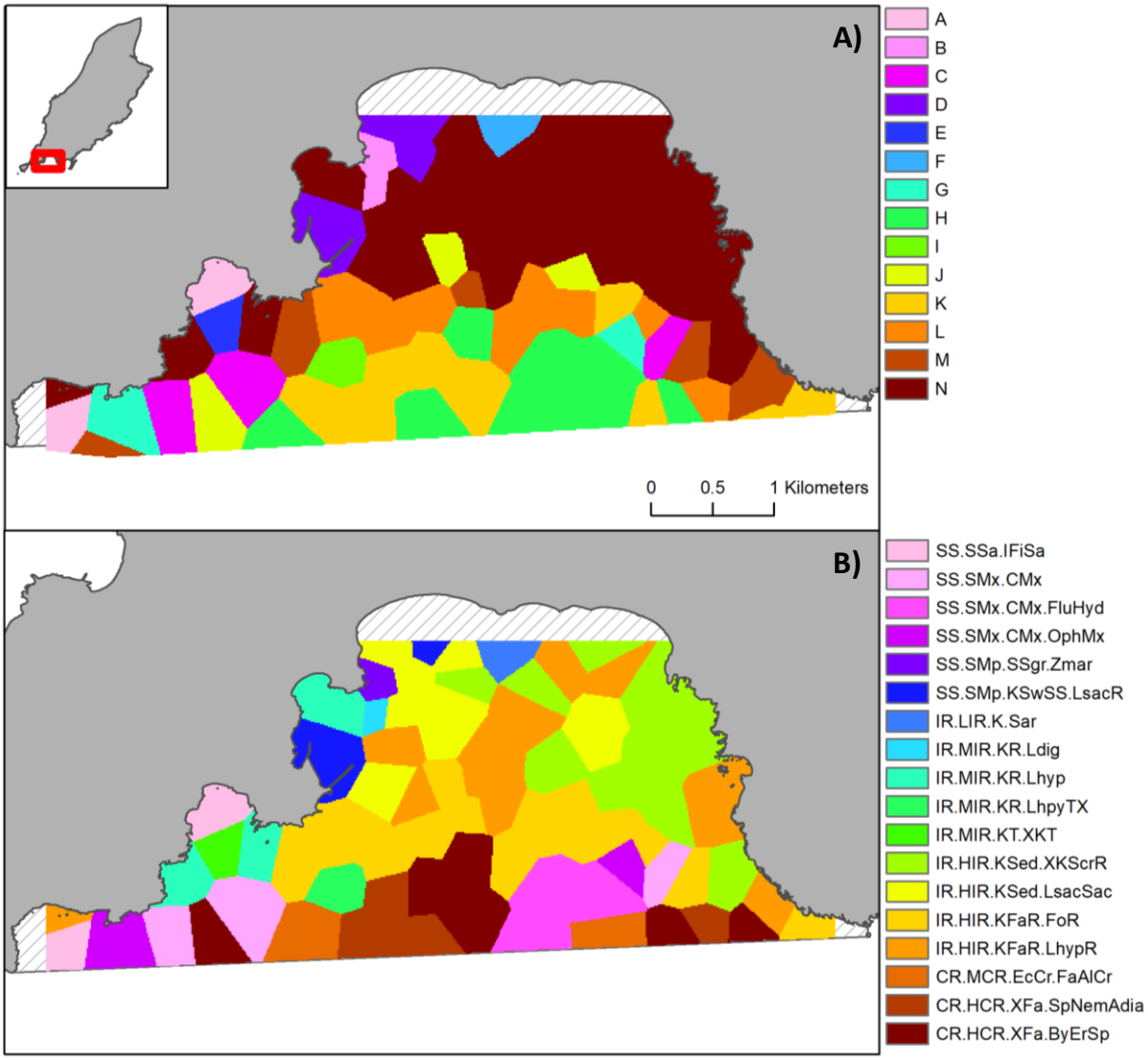


Figure 4: Habitat maps for Baie ny Carrickey MNR using two classification approaches: A) similarity profile analysis (SIMPROF); B) EUNIS habitat classification (JNCC, 2015). Refer to Tables 3 and 4 for habitat descriptions.

4 | Discussion

Baie ny Carrickey MNR contains a range of benthic habitats, from sparse sandy areas to diverse rocky reefs. Most habitats however are algal-dominated, with a variety of red and brown seaweeds identified. A conservation priority habitat was identified in shallow water off Gansey (SS.SMp.SSgr.Zmar), due to the presence of seagrass (42% cover) at one of the drop-down camera sites. Encrusting coralline algae was highly common throughout the bay (present at 89% of sites), however maerl nodules were rare, only found at 4 drop-down sites and in low densities (0.1 - 5.7 % cover). Dead maerl was found at 11 sites and in higher densities (0.5 - 43.4 % cover). Epifaunal species richness in Baie ny Carrickey was high, averaging above other MNRs (Port Erin, Ramsey, Niarbyl, Laxey), however it is important to note that a video sledge was deployed in other areas in contrast to the drop-down camera system used in this survey.

Few commercial species were present in the drop-down camera footage (4 *Pecten maximus* and 2 *Cancer pagurus* in total), however camera tows/transects are needed in order to estimate the abundance of commercial species on the seabed. Baie ny Carrickey MNR is an important region for static fisheries (*Homarus gammurus* and *Cancer pagurus*), and there is some evidence of habitat selection by juvelines in the area (May, 2015).

The data from our MNRs will feed into management efforts and provides useful baseline information with regard to species records and future monitoring. The overall aim is to work towards zoned management approaches based on this habitat information. In 2018, four additional MNRs were established (West Coast, Langness, Calf and Wart Bank, and Little Ness), increasing the total protected area of the inshore territorial sea (0-3 nm) to 52%. A high priority in the future will be to survey these areas, using the same methods.

5 | References

Barbier, E. B., Hacker, S. D., Kennedy, C., Koch, E. W., Stier, A. C., & Silliman, B. R. (2011). The value of estuarine and coastal ecosystem services. *Ecological monographs*, *81*(2), 169-193.

Beukers-Stewart, B. D., Vause, B. J., Mosley, M. W., Rossetti, H. L., & Brand, A. R. (2005). Benefits of closed area protection for a population of scallops. *Marine Ecology Progress Series*, *298*, 189-204.

Brand, A. R., Paul, J. D., & Hoogesteger, J. N. (1980). Spat settlement of the scallops Chlamys opercularis (L.) and Pecten maximus (L.) on artificial collectors. *Journal of the Marine Biological Association of the United Kingdom*, *60*(2), 379-390.

DEFA. (2018). Marine Nature Reserves [Online]. [Accessed 23/07/19]. Available from: https://www.gov.im/about-the-government/departments/environment-food-and-agriculture/ecosystem-policy-and-energy/wildlife-biodiversity-and-protected-sites/protected-sites/marine-nature-reserves/

Duncan P. F., & Emmerson J. A. (2018). Commercial Fisheries & Sea Angling. In: Manx Marine Environmental Assessment (2nd Ed.). Isle of Man Government. 71 pp.

Hall, S. J. (2002). The continental shelf benthic ecosystem: current status, agents for change and future prospects. *Environmental Conservation*, *29*(3), 350-374.

Halpern, B. S., & Warner, R. R. (2002). Marine reserves have rapid and lasting effects. *Ecology letters*, *5*(3), 361-366.

Hannah, R. W., & Blume, M. T. (2012). Tests of an experimental unbaited video lander as a marine fish survey tool for high-relief deepwater rocky reefs. *Journal of Experimental Marine Biology and Ecology*, *430*, 1-9.

Harris, P. T., & Baker, E. K. (2012). Why map benthic habitats?. In *Seafloor geomorphology as benthic habitat* (pp. 3-22). Elsevier.

Harvey, M., Bourget, E., & Miron, G. (1993). Settlement of Iceland scallop Chlamys islandica spat in response to hydroids and filamentous red algae: field observations and laboratory experiments. *Marine Ecology Progress Series*, *99*, 283-283.

Howarth, L. M., Wood, H. L., Turner, A. P., & Beukers-Stewart, B. D. (2011). Complex habitat boosts scallop recruitment in a fully protected marine reserve. *Marine Biology*, *158*(8), 1767-1780.

Howe, V. L. (2018). Subtidal Ecology. In: Manx Marine Environmental Assessment (2nd Ed). Isle of Man Government. pp 48.

JNCC. (2015). The Marine Habitat Classification for Britain and Ireland Version 15.03 [Online]. [Accessed 10/06/29]. Available from: jncc.defra.gov.uk/MarineHabitatClassification

May, L. (2015). Identifying habitat associations of European lobster, *Homarus Gammarus* (L.) and brown crab, *Cancer pagurus* (L.) in an Isle of Man marine protected area. MSc Thesis, Bangor University.

Ninio, R., Delean, S., Osborne, K., & Sweatman, H. (2003). Estimating cover of benthic organisms from underwater video images: variability associated with multiple observers. *Marine Ecology Progress Series*, *265*, 107-116.

Ryan, D. A. (2004). Point sampling strategies for estimating coverage from benthic video transects. *Environmetrics: The official journal of the International Environmetrics Society*, *15*(3), 193-207.

Schneider, C. A., Rasband, W. S., & Eliceiri, K. W. (2012). NIH Image to ImageJ: 25 years of image analysis. *Nature Methods*, *9*, 671-675.

Wakeford, M., Done, T. J., & Johnson, C. R. (2008). Decadal trends in a coral community and evidence of changed disturbance regime. *Coral Reefs*, *27*(1), 1-13.

White, S. (2011). Habitat distribution and susceptibility to fishing pressure. MSc Thesis, Bangor University.

6 | Appendix

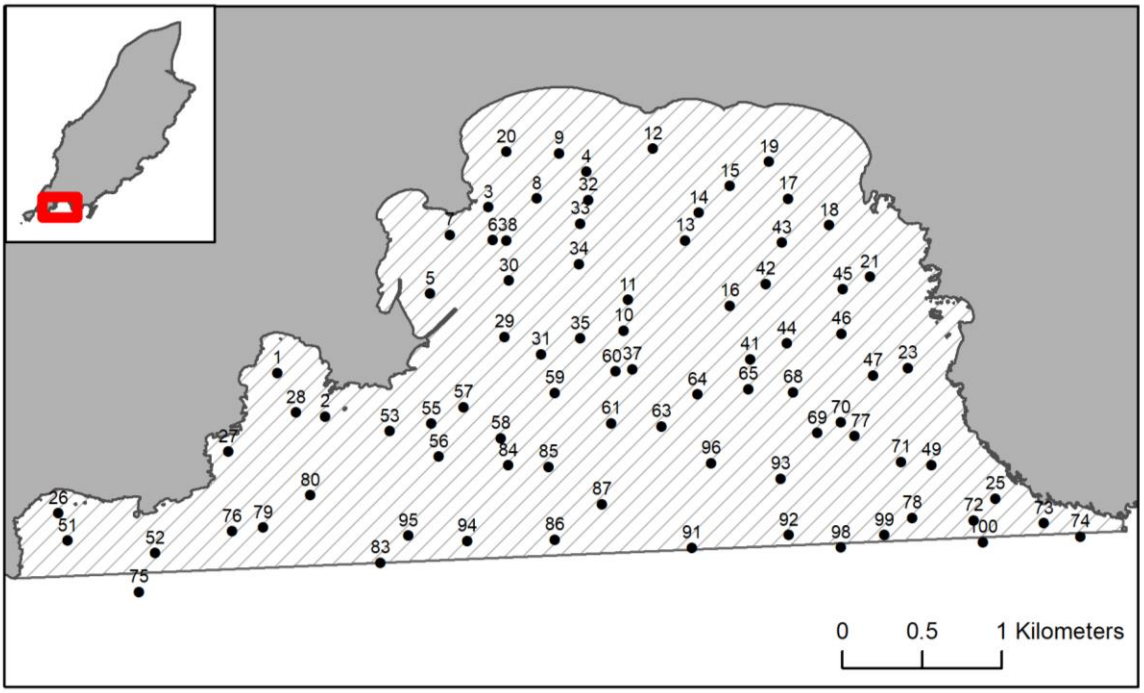


Figure A: Map of drop-down camera stations in Baie ny Carrickey MNR. Coordinates available in Table A.

Table A: Drop-down camera station coordinates (decimal degrees), depth (m) and substrate types (described from underwater images).

Station	Latitutde	Longitude	Depth	Substrate
1	54.068183	-4.747117	2.2	Sand
2	54.065833	-4.742400	6.6	Rock
3	54.077950	-4.727550	1.4	Coarsesands_pebbles
4	54.080150	-4.718300	4.5	Coarsesands_pebbles
5	54.072967	-4.732783	2.1	Sand_pebbles
6	54.076117	-4.726983	1.5	Rock
7	54.076317	-4.731083	1.5	Rock
8	54.078550	-4.722950	6.9	Rock_boulders
9	54.081133	-4.720983	5.6	Sand
10	54.071317	-4.714150	3.1	Rock
11	54.073050	-4.713850	6.2	Rock
12	54.081583	-4.712000	0.6	Coarse_sand_pebbles
13	54.076500	-4.708567	6.2	Rock_pebbles
14	54.078083	-4.707350	6.0	Rock
15	54.079667	-4.704500	5.8	Pebbles_rock
16	54.072933	-4.704067	5.1	Rock
17	54.079067	-4.698850	3.8	Rock
18	54.077667	-4.694833	2.9	Rock_cobbles_pebbles
19	54.081100	-4.700866	1.5	Rock_pebbles_sand
20	54.081100	-4.726000	0.8	Pebbles_sand
21	54.074867	-4.690717	4.1	Rock
23	54.069833	-4.686817	3.0	Rock
25	54.062683	-4.677917	15.5	Rock
26	54.059817	-4.767517	10.3	Large boulders
27	54.063650	-4.751533	11.6	Bedrock_smallboulders
28	54.066000	-4.745167	13.3	Sand_some_rock_pebbles
29	54.070700	-4.725517	11.3	Gravel
30	54.073867	-4.725300	8.6	Rock
31	54.069800	-4.721917	8.5	Rock
32	54.078567	-4.717983	8.1	Mixed_gravel_pebbles
33	54.077217	-4.718700	8.8	Mixed_gravel_pebbles
34	54.074950	-4.718650	10.3	Pebbles_cobbles_smallboulders
35	54.070783	-4.718283	13.5	Pebbles_smallrocks_bedrock
37	54.069167	-4.713183	11.9	Rock_some_pebbles
38	54.076117	-4.725667	2.5	Pebbles_cobbles
41	54.069983	-4.701883	12.9	Rock_some_pebbles
42	54.074233	-4.700667	7.9	Pebbles_cobbles_smallboulders
43	54.076600	-4.699283	7.1	Rock_pebbles_smallboulders
44	54.070950	-4.698483	10.2	Rock_pebbles_smallboulders
45	54.074100	-4.693300	8.0	Pebbles_cobbles_smallboulders
46	54.071600	-4.693283	10.7	Pebbles_cobbles_smallboulders
47	54.069333	-4.690067	10.5	Pebbles_cobbles_smallboulders
49	54.064433	-4.684183	13.2	Rock_pebbles_smallboulders
51	54.058300	-4.766567	16.9	Sand
52	54.057800	-4.758117	21.2	Pebbles_cobbles

53	54.065167	-4.736167	16.9	Rock
55	54.065667	-4.732167	16.8	Rock
56	54.063833	-4.731333	20.3	Rock_maerl
57	54.066667	-4.729167	20.3	Rock_gravel
58	54.065000	-4.725500	19.8	Rock
59	54.067667	-4.720500	19.3	Rock
60	54.069000	-4.714750	13.6	Rock
61	54.066083	-4.714950	19.5	Rockyoutcrops_deadmaerl_coarsesands
63	54.066017	-4.710167	19.4	Rock_coarsesands
64	54.067883	-4.706833	17.9	Rock_coarsesands
65	54.068300	-4.701967	18.4	Rock
68	54.068217	-4.697717	16.2	Rock
69	54.065983	-4.695217	20.4	Rock_cobbles
70	54.066633	-4.693017	18.3	Rock
71	54.064533	-4.687083	17.0	Rock_cobbles
72	54.061417	-4.679933	20.8	Rock_coarsesands
73	54.061400	-4.673217	18.3	Rock
74	54.060733	-4.669700	18.2	Cobbles_rock
75	54.055583	-4.759517	28.9	Pebbles_largerocks
76	54.059200	-4.750867	24.1	Gravel_pebbles
77	54.065883	-4.691667	20.2	Gravel_ridges
78	54.061417	-4.685833	21.2	Rock_pebbles
79	54.059467	-4.747900	24.4	Rock_maerl
80	54.061383	-4.743517	22.0	Gravel_ridges
83	54.057750	-4.736533	26.4	Shellhash_cobbles
84	54.063500	-4.724667	23.9	Mixed_rock_pebbles_cobbles_smallboulders
85	54.063500	-4.720833	23.6	Rock_coarsesands
86	54.059417	-4.719950	26.9	Boulders_maerl_shellhash
87	54.061517	-4.715567	23.7	Rock
91	54.059267	-4.706800	26.2	Gravel_smallboulders_shellhash
92	54.060183	-4.697583	25.8	Gravel_smallboulders_shellhash
93	54.063333	-4.698550	24.2	Maerl_coarsesands_boulders
94	54.059167	-4.728333	26.1	Rock_smallboulders
95	54.059333	-4.734000	24.8	Rock_gravel
96	54.064067	-4.705267	23.0	Maerl_shellhash
98	54.059600	-4.692533	25.5	Rock_gravel
99	54.060400	-4.688450	23.3	Rock_maerl
100	54.060200	-4.678967	22.0	Rock

Table B: List of taxa identified from drop-down camera footage in Baie ny Carrickey MNR.

Phylum	Taxon
Sponges	*Cliona celata*
	Grantia compressa
	Hemimycale columella
	Pachymatisma johnstonia
	Phorbas fictitious
	Polymastia boletiformis
	Scyon ciliatum
	Suberites ficus
	Tethya aurantium
	Leucosolenia spp.
	Orange porifera sp.
	White porifera sp.
Cnidarians	*Actinothoe sphyrodeta*
	Alcyonium digitatum
	Anemonia viridis
	Cerianthus lloydii
	Halecium halecinum
	Nemertesia antennina
	Nemertesia ramosa
	Peachia cylindrica
	Urticina felina
	Obelia spp.
	Unidentified anemone
Bryozoans	*Alcyonidium diaphanum*
	Electra pilosa
	Flustra foliacea
	Membranipora membranacea
	Mixed hydroid and bryozoan turf
Crustaceans	*Cancer pagurus*
Annelids	*Spirobranchus triqueter*
	Spirorbis spirorbis
	Tube-dwelling polychaete A
	Tube-dwelling polychaete B
Molluscs	*Littorina obtusata*
	Pecten maximus
	Gibbula spp.
	Patella spp.
	Bivalve A
	Bivalve B (*Fabulina* spp.?)
	Bivalve C (*Glycemeris* spp.?)
	Bivalve D
	Bivalve E
	Burrowing bivalves
	Unidentified gastropod
Echinoderms	*Antedon bifida*
	Asterias rubens
	Echinus esculentus
	Luidia ciliaris
	Ophiocomina nigra
	Ophiothrix fragilis
	Porania pulvillus
	Henricia spp.
	Ophiura spp.
Tunicates	*Aplidium punctum*
	Clavelina lepadiformis
Fish	*Ctenolabrus rupestris*
	Scyliorhinus canicula
Plants	*Zostera marina*
Algae	*Chondrus crispus*
	Chorda filum
	Delessia sanguinea
	Desmarestia aculeata
	Dictyopteris polypodioides
	Dictyota dichotoma
	Dilsea carnosa
	Fucus serratus
	Halidrys siliquosa
	Laminaria digitata
	Laminaria hyperborea
	Mastocarpus stellatus
	Mesogloia vermiculata
	Palmaria palmata
	Petalonia fascia
	Phycodrys rubens
	Saccharina latissima
	Saccorhiza poluschides
	Sargassum muticum
	Taonia atomaria
	Cladophora spp.
	Cystoseira spp.
	Ulva spp.
	Corallinaceae
	Dark encrusting red algae
	Filamentous brown algae
	Filamentous red algae
	Foliose red algae
	Maerl

Table C: SIMPER analysis on percentage cover data for the 14 benthic assemblages identified using the SIMPROF procedure.

Taxa	Av.%cover	Av.Sim	Sim/SD	Contrib%	Cum.%
Group A: average similarity 71.11%					
Bioturbation fauna	0.15	71.11	NaN	100.00	100.00
Group B: average similarity 27.02%					
Laminaria digitata	12.80	12.54	NaN	46.39	46.39
Fucus serratus	24.50	11.26	NaN	41.65	88.04
Corallinaceae	6.05	3.23	NaN	11.96	100.00
Group C: average similarity 39.72%					
Corallinaceae	11.50	22.36	1.63	56.30	56.30
Spirobranchus triqueter	0.44	10.97	2.82	27.62	83.92
Mixed hyrdroid and bryozoan turf	2.88	6.39	2.12	16.08	100.00
Group D: average similarity 44.04%					
Saccharina latissima	25.01	26.38	3.68	59.90	59.90
Filamentous red algae	6.09	11.47	3.52	26.04	85.94
Cystoseira spp.	14.85	3.74	0.41	8.48	94.43
Group E: single sample					
Dictyota dichotoma	25.74	–	–	–	–
Desmarestia aculeata	4.33	–	–	–	–
Halidrys siliquosa	3.21	–	–	–	–
Filamentous red algae	2.40	–	–	–	–
Group F: single sample					
Sargassum muticum	50.19	–	–	–	–
Foliose red algae	15.57	–	–	–	–
Ulva spp.	12.41	–	–	–	–
Saccorhiza polyshides	4.94	–	–	–	–
Group G: average similarity 47.35%					
Corallinaceae	31.92	20.01	NaN	42.26	42.26
Dark encrusting red algae	3.23	8.15	NaN	17.22	59.48
Mixed hydroid and bryozoan turf	3.91	4.28	NaN	9.03	68.51
Ophiocomina nigra	7.32	4.22	NaN	8.90	77.41
Foliose red algae	2.71	3.93	NaN	8.30	85.72
Alcyonidium digitatum	0.92	3.55	NaN	7.50	93.22
Group H: average similarity 58.14%					
Mixed hydroid and bryozoan turf	12.62	22.73	3.55	39.10	39.10
Corallinaceae	7.44	18.13	2.86	31.19	70.28
Nemertesia antennina	2.38	6.95	3.08	11.95	82.23
Dark encrusting red algae	1.70	4.60	1.43	7.91	90.15
Group I: single sample					
Corallinaceae	16.27	–	–	–	–
Cliona celata	10.55	–	–	–	–
Laminaria hyperborea	3.80	–	–	–	–
Clavelina lepadiformis	3.52	–	–	–	–
Group J: average similarity 41.79%					
Filamentous red algae	30.25	11.85	0.58	28.35	28.35
Corallinaceae	13.35	10.73	1.71	25.67	54.02
Foliose red algae	13.82	9.96	0.89	23.83	77.85
Dark encrusting red algae	3.61	7.56	2.56	18.10	95.95

Taxa	Av.%cover	Av.Sim	Sim/SD	Contrib%	Cum.%
Group K: average similarity 64.73%					
Mixed hydroid and bryozoan turf	23.88	17.45	2.78	26.97	26.97
Corallinaceae	11.05	11.23	3.45	17.35	44.32
Foliose red algae	4.36	6.72	1.70	10.39	54.70
Dark encrusting red algae	3.64	6.11	2.48	9.45	64.15
Clavelina lepadiformis	2.14	5.97	6.80	9.22	73.37
Filamentous red algae	9.60	4.80	2.29	7.42	80.79
Alcyonidium digitatum	3.33	3.62	1.04	5.60	86.39
Nemertesia antennina	2.77	2.82	1.06	4.36	90.75
Group L: average similarity 70.91%					
Foliose red algae	11.69	10.94	4.75	15.43	15.43
Mixed hydroid and bryozoan turf	14.44	10.58	4.69	14.91	30.35
Filamentous red algae	11.93	9.96	2.39	14.05	44.39
Corallinaceae	7.29	8.72	9.13	12.30	56.69
Clavelina lepadiformis	8.17	7.73	3.43	10.91	67.60
Dictyota dichotoma	4.52	6.56	2.60	9.25	76.85
Dark encrusting red algae	3.95	6.43	3.72	9.06	85.91
Nemertesia antennina	3.17	4.49	2.45	6.33	92.25
Group M: average similarity 60.59%					
Corallinaceae	15.35	11.69	2.15	19.30	19.30
Filamentous red algae	17.14	10.28	4.82	16.97	36.27
Dictyota dichotoma	6.94	8.26	3.43	13.64	49.91
Foliose red algae	8.99	7.28	1.51	12.02	61.93
Laminaria hyperborea	11.82	6.55	1.19	10.81	72.74
Mixed hydroid and bryozoan turf	7.02	6.36	1.51	10.50	83.24
Dark encrusting red algae	3.00	6.11	2.88	10.09	93.33
Group N: average similarity 51.42%					
Laminaria hyperborea	25.08	14.55	1.29	28.30	28.30
Filamentous red algae	17.52	12.90	2.01	25.10	53.40
Foliose red algae	9.58	6.96	1.32	13.53	66.93
Corallinaceae	4.80	5.64	1.61	10.97	77.90
Saccorhiza polyschides	7.14	2.99	0.52	5.82	83.73
Dark encrusting red algae	1.71	2.23	0.86	4.34	88.07
Delessia sanguinea	2.04	1.92	0.61	3.73	91.79

Table D: SIMPER analysis on percentage cover data for the 18 habitats identified using the EUNIS procedure.

Taxa	Av.%cover	Av.Sim	Sim/SD	Contrib%	Cum.%
SS.SSa.IFiSa: average similarity 71.11%					
Bioturbation fauna	0.15	71.11	NaN	100.00	100.00
SS.SMx.CMx: average similarity 28.73%					
Corallinaceae	11.50	13.27	1.55	46.18	46.18
Mixed hydroid and bryozoan turf	2.88	6.60	0.95	22.99	69.18
Spirobranchus triqueter	4.37	5.07	2.14	17.65	86.82
Dark encrusting red algae	2.03	2.89	0.58	10.06	96.88
SS.SMx.CMx.FluHyd: average similarity 55.05%					
Corallinaceae	9.53	22.36	2.56	40.62	40.62
Mixed hydroid and bryozoan turf	10.55	18.85	3.08	34.24	74.86
Dark encrusting red algae	1.44	5.53	2.93	10.01	84.90
Nemertesia antennina	0.71	4.86	3.61	8.82	93.72
SS.SMx.CMx.OphMx: average similarity 47.35%					
Corallinaceae	31.92	20.01	NaN	42.26	42.26
Dark encrusting red algae	3.23	8.15	NaN	17.22	59.48
Mixed hydroid and bryozoan turf	3.91	4.28	NaN	9.03	68.51
Ophiocomina nigra	7.32	4.22	NaN	8.90	77.41
Foliose red algae	2.71	3.93	NaN	8.30	85.72
Alcyonium digitatum	0.92	3.55	NaN	7.50	93.22
SS.SMp.SSgr.Zmar: single sample					
Zostera marina	41.18	–	–	–	–
Filamentous red algae	16.36	–	–	–	–
Filamentous brown algae	14.77	–	–	–	–
SS.SMp.KSwSS.LsacR: average similarity 48.38%					
Saccharina latissima	19.08	35.51	NaN	73.40	73.40
Filamentous red algae	3.36	12.87	NaN	26.60	100.00
IR.LIR.K.Sar: single sample					
Sargassum muticum	50.19	–	–	–	–
Foliose red algae	15.57				
Ulva spp.	12.41	–	–	–	–
IR.MIR.KR.Ldig: single sample					
Fucus serratus	42.81	–	–	–	–
Laminaria digitata	17.91	–	–	–	–
Palmaria palmata	15.39	–	–	–	–
Mastocarpus stellatus	12.01	–	–	–	–
Corallinaceae	11.59	–	–	–	–
IR.MIR.KR.Lhyp: average similarity 66.29%					
Laminaria hyperborea	24.30	25.12	5.94	37.89	37.89
Filamentous red algae	9.43	15.46	2.32	23.32	61.21
Corallinaceae	9.44	8.76	3.97	13.21	74.42
Dark encrusting red algae	6.66	6.96	2.00	10.51	84.93
Foliose red algae	8.69	4.72	1.70	7.11	92.04
IR.MIR.KR.LhypTX: single sample					
Corallinaceae	16.27	–	–	–	–
Cliona celata	10.55	–	–	–	–
Laminaria hyperborea	3.80	–	–	–	–

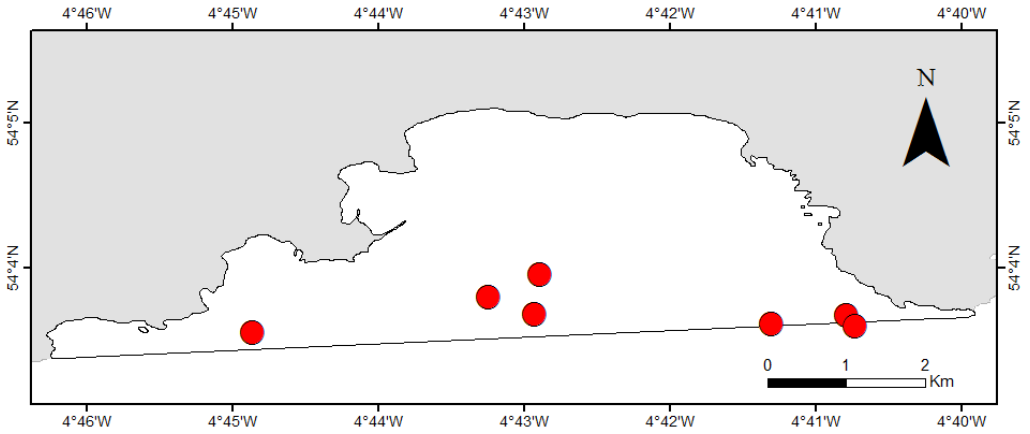
Taxa	Av.%cover	Av.Sim	Sim/SD	Contrib%	Cum.%
IR.MIR.KT.XKT: single sample					
Dictyota dichotoma	25.74	–	–	–	–
Desmarestia aculeata	4.33	–	–	–	–
Halidrys siliquosa	3.21	–	–	–	–
IR.HIR.KSed.XKScrR: average similarity 55.37%					
Laminaria hyperborea	25.67	18.39	3.55	33.21	33.21
Filamentous red algae	20.27	10.46	1.45	18.88	52.10
Saccorhiza polyschides	9.07	7.14	1.44	12.90	65.00
Foliose red algae	12.17	6.98	0.99	12.61	77.61
Corallinaceae	2.54	4.16	1.64	7.52	85.13
Saccharina latissima	5.63	2.76	0.59	4.99	90.13
IR.HIR.KSed.LsacSac: average similarity 47.05%					
Filamentous red algae	8.65	11.60	3.24	24.65	24.65
Saccharina latissima	16.78	8.14	0.95	17.30	41.95
Saccorhiza polyschides	13.50	7.41	0.79	15.74	57.69
Corallinaceae	4.98	6.22	1.69	13.22	70.91
Foliose red algae	4.28	6.10	1.56	12.97	83.88
Desmarestia aculeata	7.49	2.15	0.43	4.56	88.44
Dark encrusting red algae	0.84	1.68	0.96	3.57	92.00
IR.HIR.KFaR.FoR: average similarity 59.20%					
Filamentous red algae	21.34	12.27	1.90	20.73	20.73
Foliose red algae	10.99	9.36	1.82	15.81	36.53
Corallinceae	9.55	8.82	3.36	14.90	51.44
Mixed hydroid and bryozoan turf	10.96	7.69	1.86	13.00	64.43
Dark encrusting red algae	4.11	6.44	2.85	10.88	75.31
Dictyota dichotoma	4.69	4.17	1.20	7.04	82.35
Clavelina lepadiformis	5.57	3.87	1.17	6.54	88.89
Nemertesia antennina	2.08	1.94	0.81	3.27	92.16
IR.HIR.KFaR.LhypR: average similarity 60.09%					
Laminaria hyperborea	37.36	23.58	3.53	39.24	39.24
Filamentous red algae	21.91	15.82	2.57	26.32	65.57
Foliose red algae	11.57	8.12	1.61	13.51	79.08
Corallinaceae	5.28	5.25	1.46	8.73	87.81
Dark encrusting red algae	1.97	2.91	1.16	4.84	92.65
CR.MCR.EcCr.FaAlCr: average similarity 53.54%					
Mixed hydroid and bryozoan turf	19.25	18.98	2.56	40.62	40.62
Corallinaceae	14.03	16.86	3.08	34.24	74.86
Alcyonium digitatum	3.89	8.36	2.93	10.04	84.90
Dark encrusting red algae	4.30	6.46	3.61	8.82	93.72
CR.HCR.XFa.SpNemAdia: average similarity 42.58%					
Mixed hydroid and beyozoan turf	20.08	17.05	1.42	40.04	40.04
Corallinaceae	11.41	14.88	3.46	34.96	75.00
Nemertesia antennina	0.75	2.79	0.71	6.55	81.54
Dark encrusting red algae	1.88	2.13	0.73	5.00	86.54
Filamentous red algae	1.50	1.87	0.75	4.39	90.93

CR.HCR.XFa.ByErSp: average similarity 61.17%					
Mixed hydroid and bryozoan turf	18.08	14.70	4.74	24.03	24.03
Corallinaceae	10.96	10.42	3.34	17.03	41.06
Alcyonium digitatum	7.32	8.39	1.61	13.72	54.78
Dark encrusting red algae	2.91	6.39	2.44	10.44	65.22
Foliose red algae	5.15	6.31	2.41	10.32	75.54
Nemertesia antennina	5.04	5.19	1.31	8.48	84.02
Filamentous red algae	7.17	4.24	1.35	6.93	90.95

Habitat code: CR.HCR.XFa.ByErSp

Habitat description: Bryozoan turf and erect sponges on tide-swept circalittoral rock**.**

Biological zone:	Circalittoral – lower
	Circalittoral – upper
Depth ranges:	10 – 20m, 20 – 30m
Wave exposure:	Extremely exposed to moderately exposed
Current exposure:	Strong to moderately strong



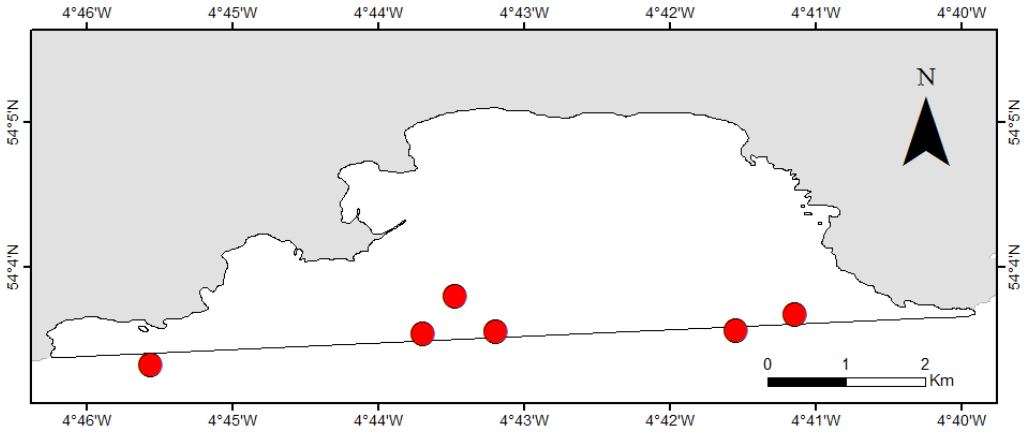
Description of community assemblages in Baie ny Carrickey:

Circalittoral bedrock habitat. Abundant species were *Echinus esculentus, Nemertsia antennina* and *Tethya aurantium*. *Alcyonium digitatum* and bryozoan turf were common.

Habitat code: CR.HCR.Xfa.SpNemAdia

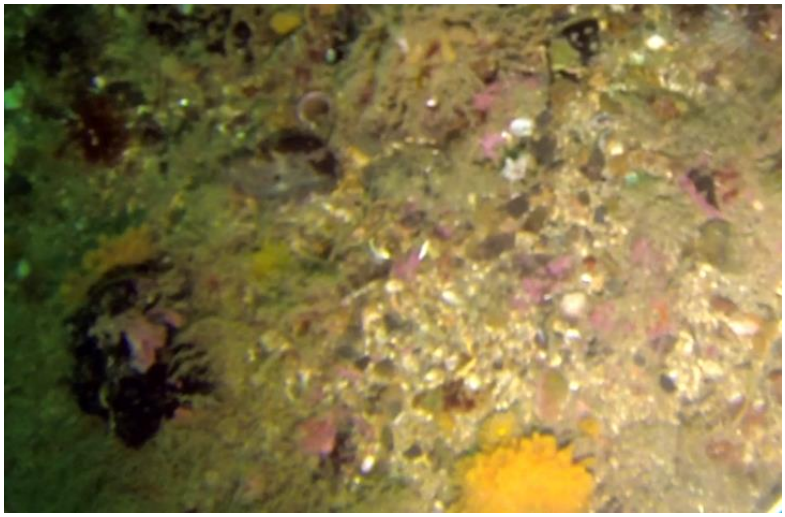
Habitat description: Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata.

Biological zone:	Circalittoral
Depth ranges:	10 – 20m, 20 – 30m
Wave exposure:	Moderately exposed
Current exposure:	Moderately strong



Description of community assemblages in Baie ny Carrickey:

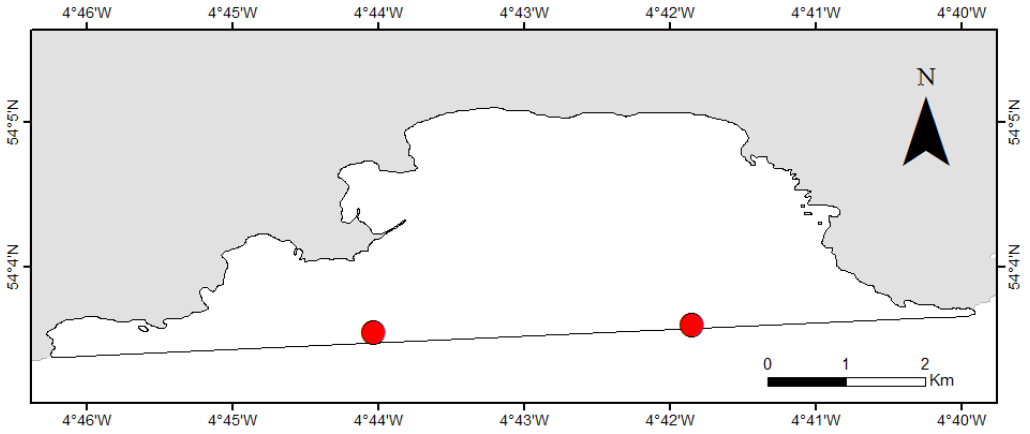
This community was observed on boulders, cobbles and pebbles in the circalittoral. *Nemertesia antennina*, *Clavelina lepadiformis* and mixed hydroid and bryozoan turf were found in patches. Sparse sponges also observed.



Habitat code: CR.MCR.EcCr.FaAlCr

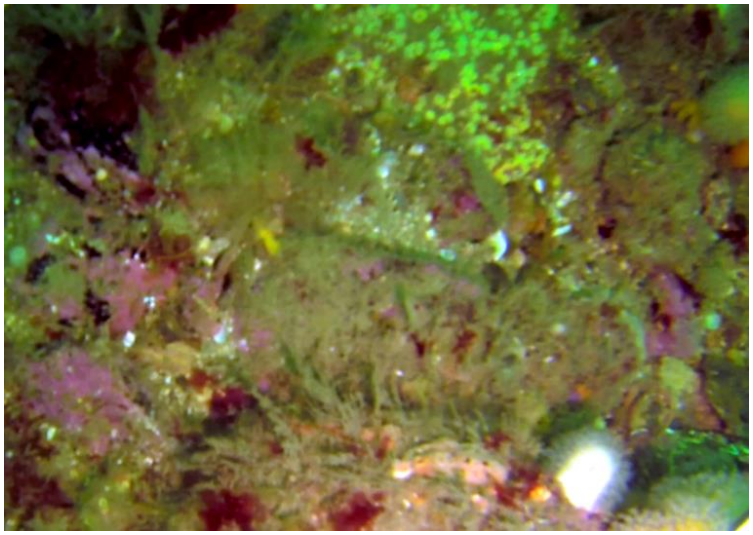
Habitat description: Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock.

Biological zone:	Circalittoral
Depth ranges:	10 – 20m, 20 – 30m, 30 – 50m
Wave exposure:	Exposed to moderately exposed
Current exposure:	Moderately strong to very weak



Description of community assemblages in Baie ny Carrickey:

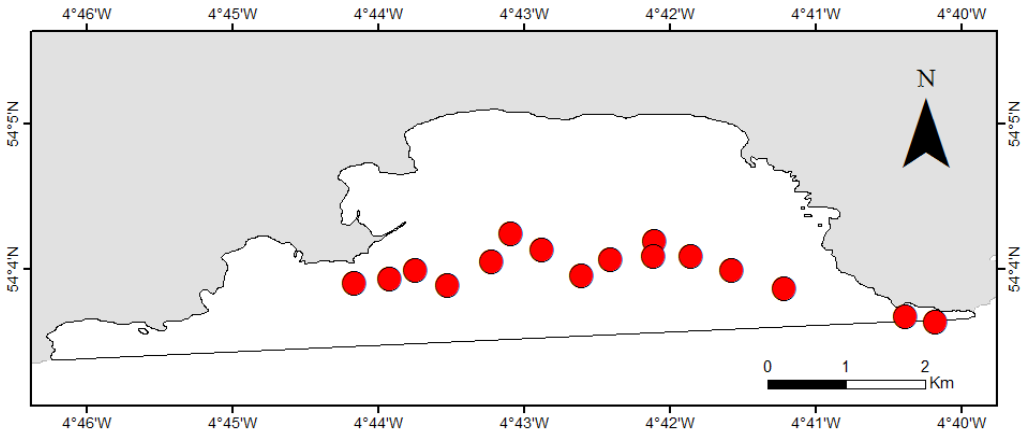
Habitat observed at two sites on cobbles and boulders. *Alcyonium digitatum*, Corallinaceae and sponges were abundant.



Habitat code: IR.HIR.KFar.FoR

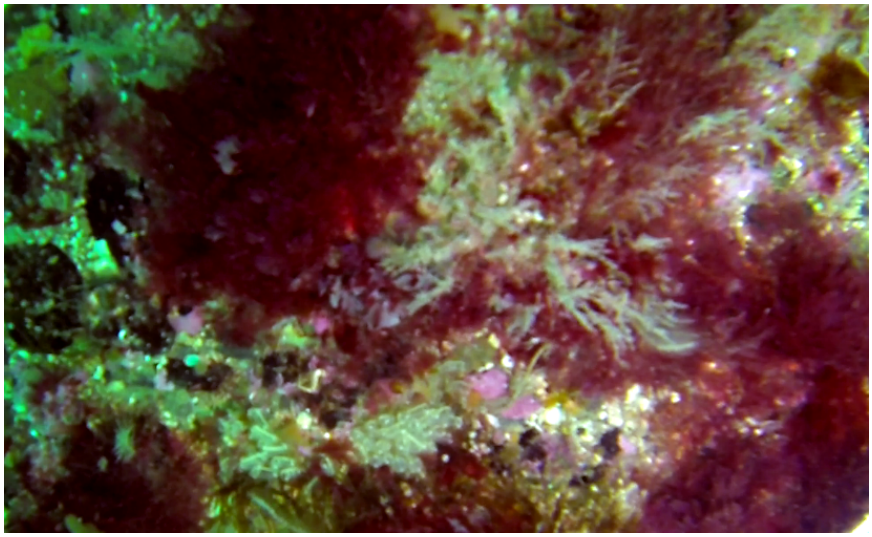
Habitat description: Foliose red seaweeds on exposed lower infralittoral rock.

Biological zone:	Infralittoral - lower
Depth ranges:	5 – 10m, 10 – 20m, 20 – 30m
Wave exposure:	Very exposed to moderately exposed
Current exposure:	Moderately strong to weak



Description of community assemblages in Baie ny Carrickey:

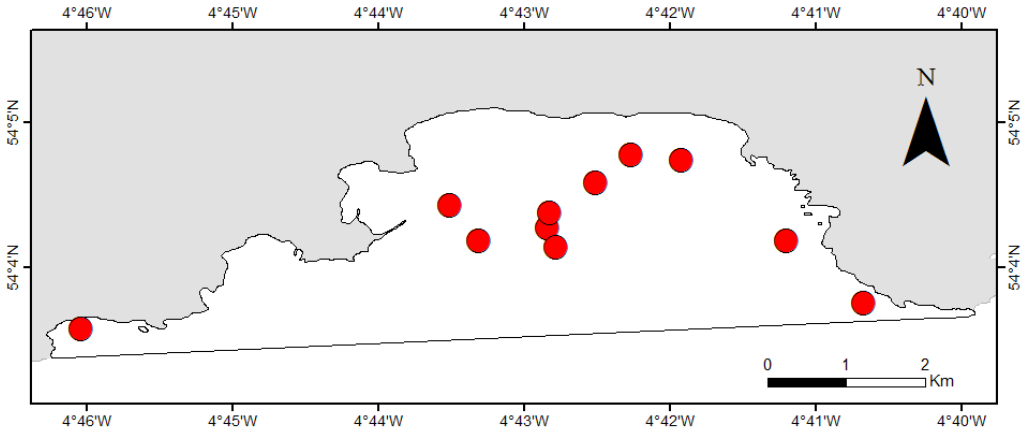
Frequently observed habitat in the infralittoral zone. Foliose and filamentous red algae, Corallinaceae, *Delesseria sanguinea* and the ascidian *Clavelina lepadiformis* were common.



Habitat code: IR.HIR.KFaR.LhypR

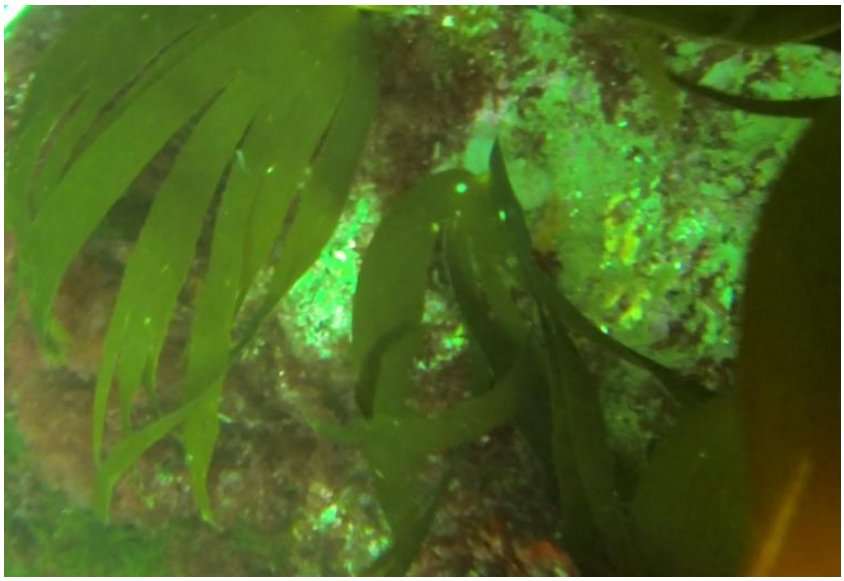
Habitat description: *Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m, 20 – 30m
Wave exposure:	Extremely exposed to exposed
Current exposure:	Strong to very weak



Description of community assemblages in Baie ny Carrickey:

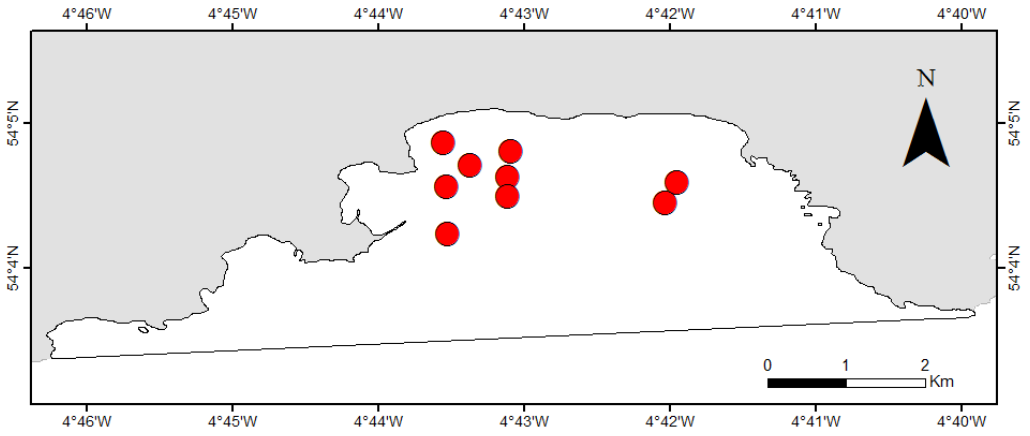
Found on infralittoral exposed rock. Communities were dominated by *Laminaria hyperborea*, with dense foliose algae, including *Delesseria sanguinea* and *Dictyota dichotoma* found beneath.



Habitat code: IR.HIR.K.Sed.LsacSac

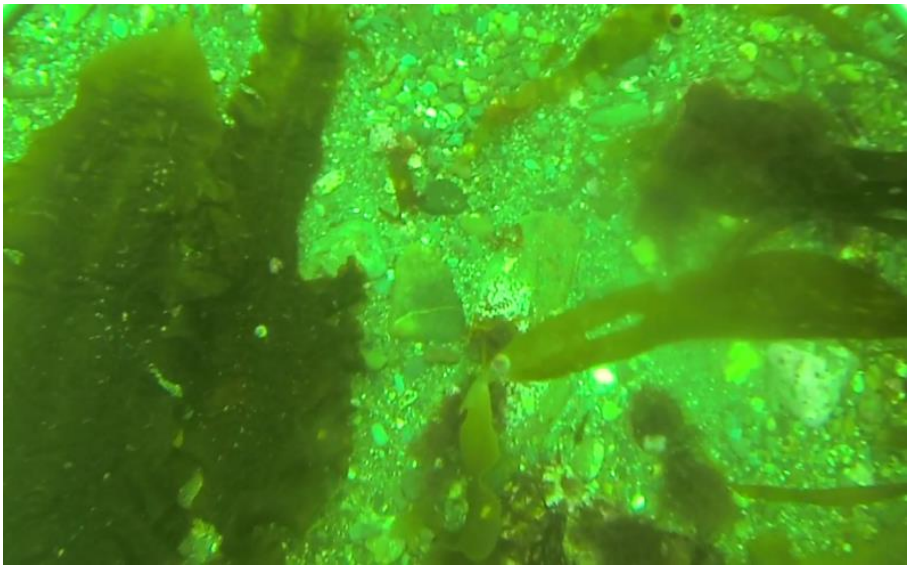
Habitat description: *Laminaria saccharina* and/or *Saccorhiza polyschides* on exposed infralittoral rock

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m, 20 – 30m
Wave exposure:	Very exposed to moderately exposed
Current exposure:	Moderately strong to weak



Description of community assemblages in Baie ny Carrickey:

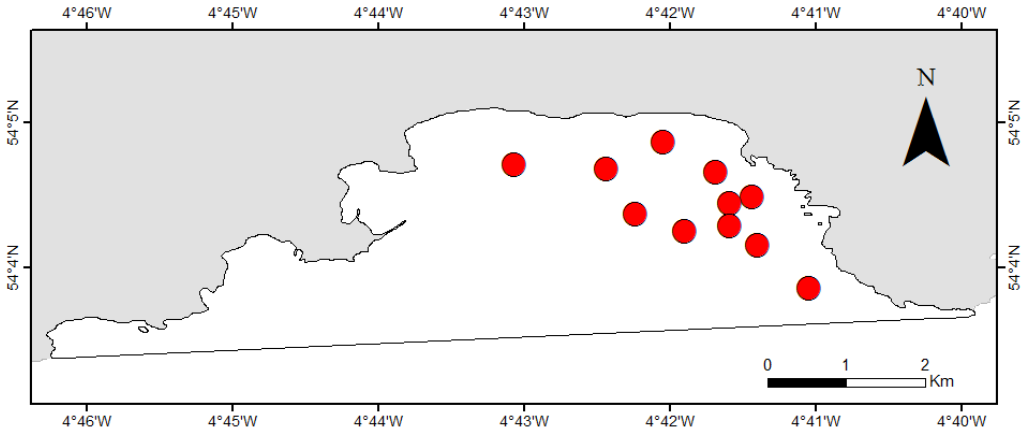
Substratum varied considerably from pebbles to bedrock. *Saccharina latissimia* and *Sacchoriza polyschides* were dominant. *Desmarestua aculeata* and *Gibbula* spp. were frequently observed.



Habitat code: IR.HIR.KSed.XKScrR

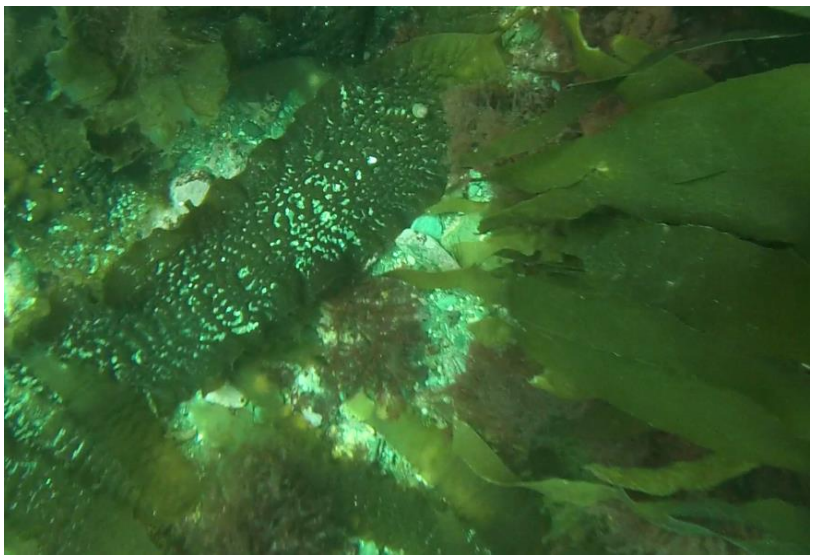
Habitat description: Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m
Wave exposure:	Exposed to moderately exposed
Current exposure:	Moderately strong to weak



Description of community assemblages in Baie ny Carrickey:

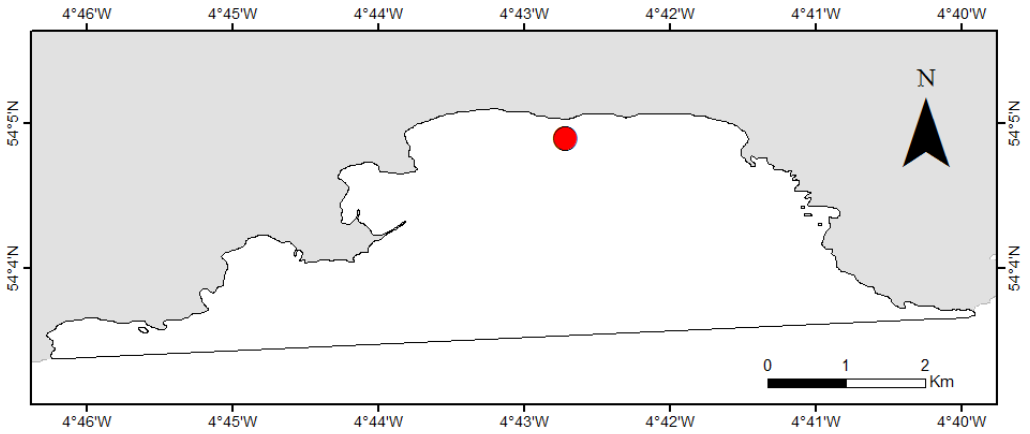
Habitats were characterised *by Laminaria hyperborea, Saccharina latissima* and *Sacchoriza polyschides*, on sand scoured cobbles boulders and bedrock. Foliose red algae were abundant.



Habitat code: IR.LIR.K.Sar

Habitat description: *Sargassum muticum* on shallow slightly tide-swept infralittoral mixed substrata.

Biological zone:	Infralittoral – upper Sublittoral fringe
Depth ranges:	0 – 5m
Wave exposure:	Sheltered to extremely sheltered
Current exposure:	Moderately strong



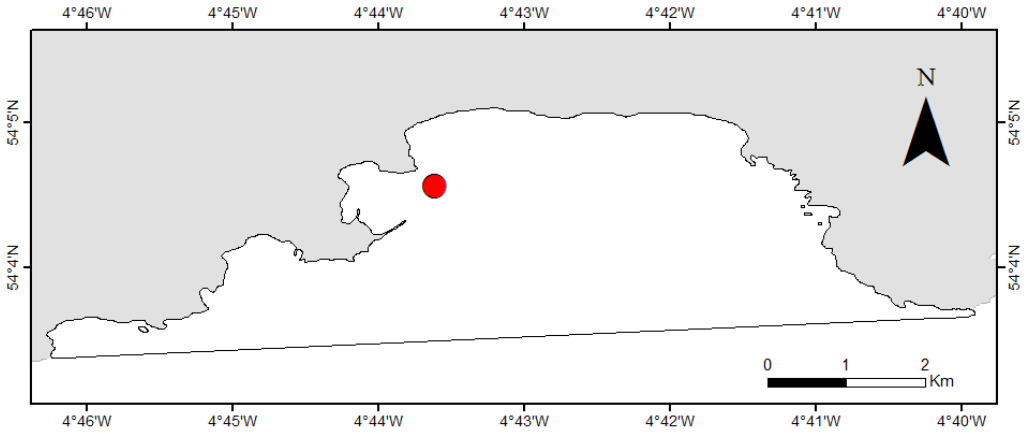
Description of community assemblages in Baie ny Carrickey:

Sargassum muticum dominated communities, located in the sheltered, shallow infralittoral zone. *Ulva* spp., *Cystoseir*a spp and filamentous red algae were also present.

Habitat code: IR.MIR.KR.Ldig

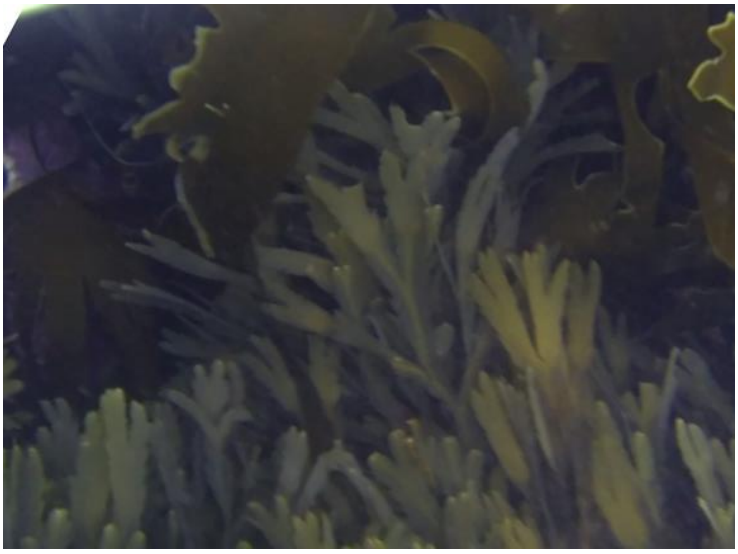
Habitat description: *Laminaria digitata* on moderately exposed sublittoral fringe bedrock.

Biological zone:	Sublittoral fringe
Depth ranges:	0 - 5m, lower shore
Wave exposure:	Exposed to sheltered
Current exposure:	Moderately strong to very weak



Description of community assemblages in Baie ny Carrickey:

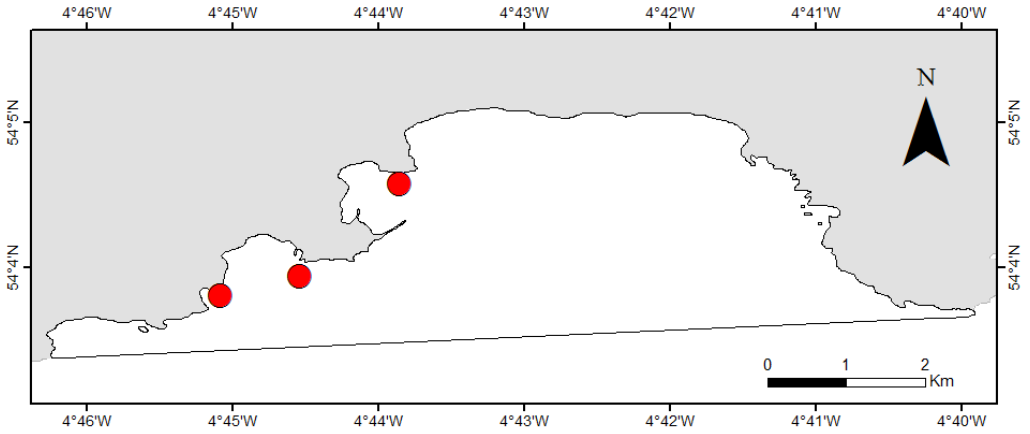
Community dominated by *Fucus serratus*, *Laminaria digitata* and *Palmaria palmata* on Corallinaceae encrusted bedrock. Found close to the sublittoral fringe.



Habitat code: IR.MIR.KR.Lhyp

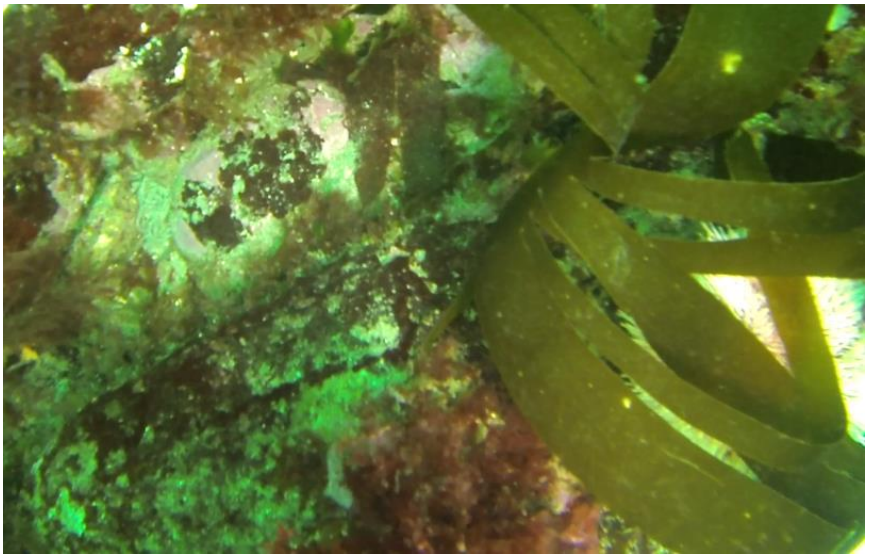
Habitat description*: Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m
Wave exposure:	Moderately exposed
Current exposure:	Strong to weak



Description of community assemblages in Baie ny Carrickey:

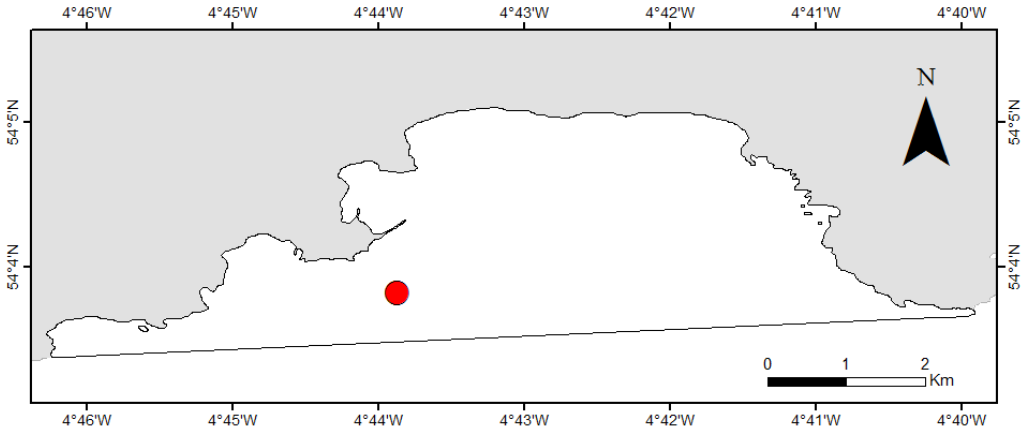
Occurring on moderately exposed infralittoral rock and boulders, this habitat was characterised by the kelp *Laminaria hyperborea*, with dense foliose seaweed found under the canopy. The sea urchin *Echinus esculentus* and snail *Gibbula* spp. were present



Habitat code: IR.MIR.KR.LhypTX

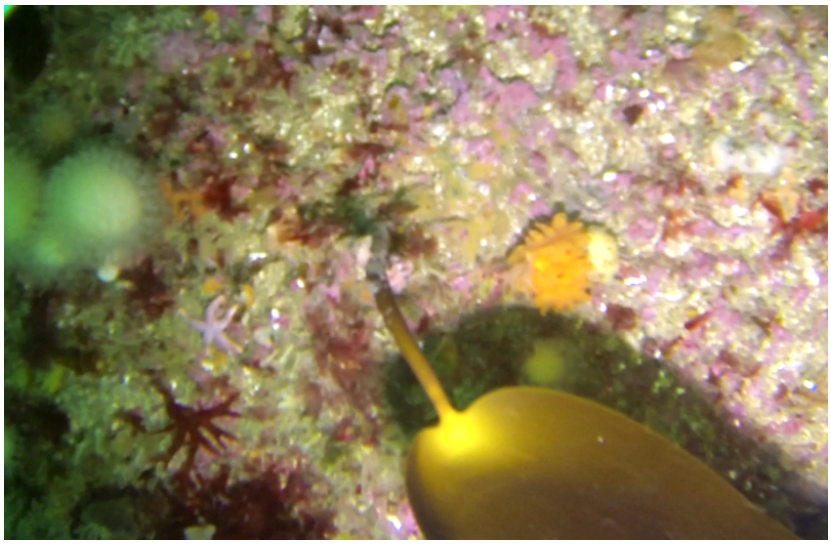
Habitat description*: Laminaria hyperborea* on tide-swept infralittoral mixed substrata.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m, 20 – 30m
Wave exposure:	Exposed to sheltered
Current exposure:	Strong to weak



Description of community assemblages in Baie ny Carrickey:

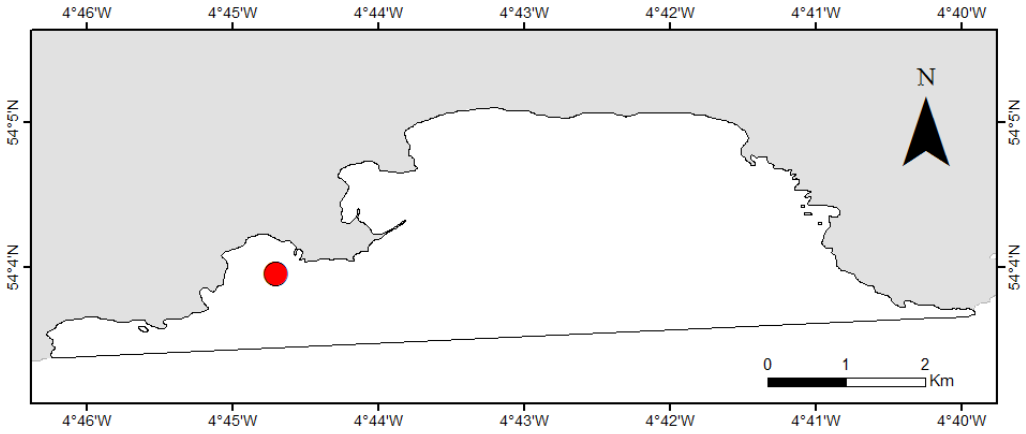
Habitat observed at a single location. *Laminaria hyperborea* was observed on bedrock encrusted in Corallinaceae. *Alcyonium digitatum*, foliose red algae, *Henricia* spp. and *Clavelina lepadiformis* were present



Habitat code: IR.MIR.KT.XKT

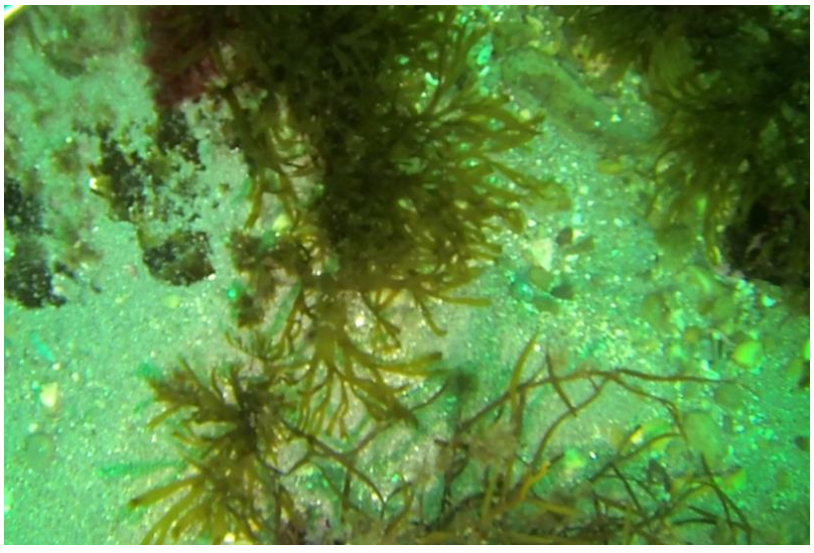
Habitat description: Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m
Wave exposure:	Sheltered to extremely sheltered
Current exposure:	Very strong to moderately strong



Description of community assemblages in Baie ny Carrickey:

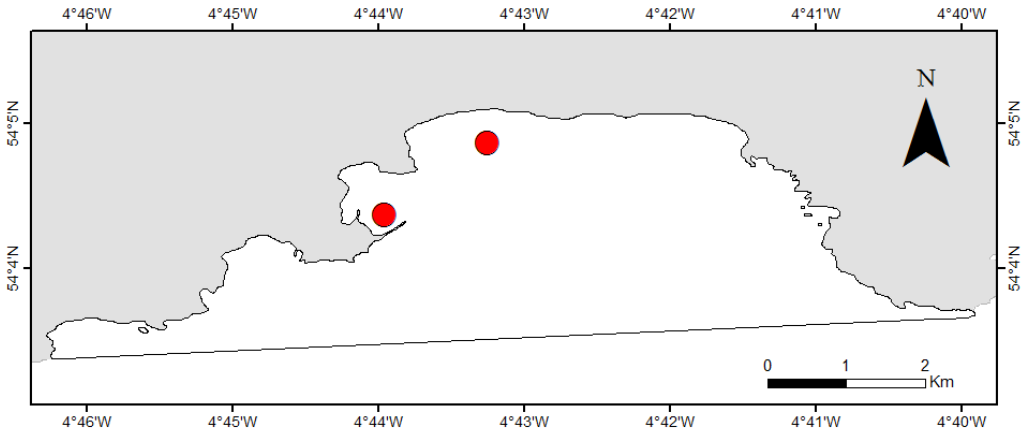
The mixed substratum was comprised of rock, pebbles and sand. *Laminaria hyperborea* and *Saccharina latissima* were observed on rocky outcrops, with *Dictyota dichotoma* and *Halidrys siliquosa* occurring in greater abundances.



Habitat code: SS.SMp.KSwSS.LsacR

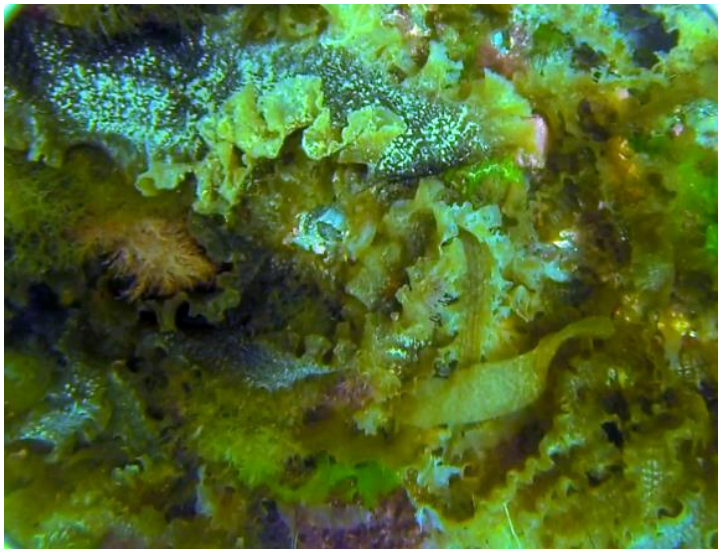
Habitat description*: Laminaria saccharina* and red seaweeds on infralittoral sediments**.**

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m
Wave exposure:	Exposed to very sheltered
Current exposure:	Moderately strong to very weak



Description of community assemblages in Baie ny Carrickey:

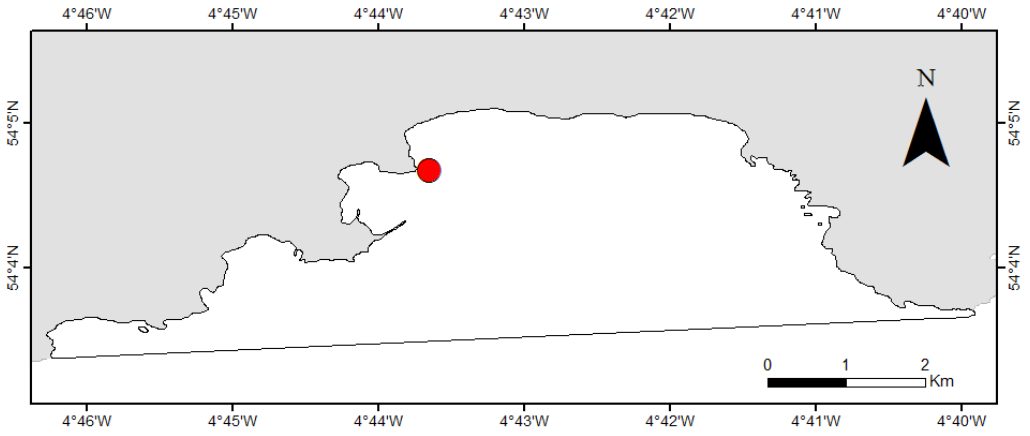
Found in shallow infralittoral sites, communities were characterised by *Saccharina latissima* (formerly *Laminaria saccharina*). Ulva spp., Gibbula spp. and filamentous red algae were also observed. Substratum was mixed, comprising of sand and pebbles



Habitat code: SS.SMp.SSgr.Zmar

Habitat description: *Zostera marina/angustifolia* beds on lower shore or infralittoral clean or muddy sand.

Biological zone:	Infralittoral
Depth ranges:	0 - 5m, 5 – 10m, lower shore
Wave exposure:	Moderately exposed to extremely sheltered
Current exposure:	Moderately strong to very weak



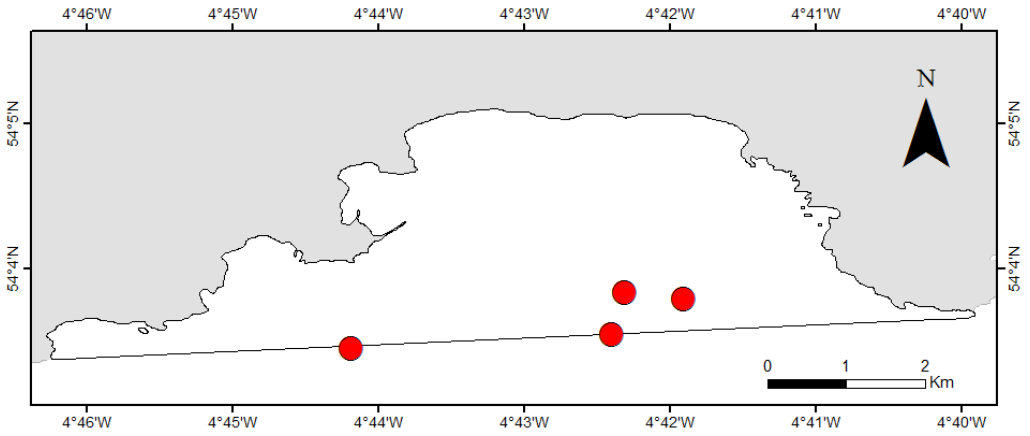
Description of community assemblages in Baie ny Carrickey:

The community was dominated by *Zostera marina* and found on mixed pebbles and sand. Foliose red algae and *Ectocarpus* agg. were also found in low abundances. *Fucus serratus* was also observed in one replicate, marking the edge of the littoral zone.

Habitat code: SS.SMx.CMx.FluHyd

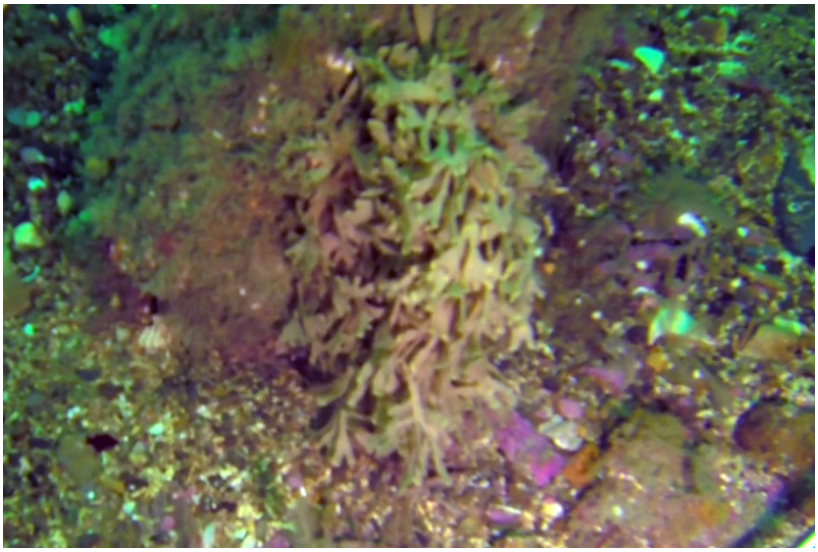
Habitat description*: Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment.

Biological zone:	Circalittoral
Depth ranges:	5 – 10m, 10 – 20m, 20 – 30m, 30 – 50m
Wave exposure:	Exposed to moderately exposed
Current exposure:	Strong to moderately strong



Description of community assemblages in Baie ny Carrickey:

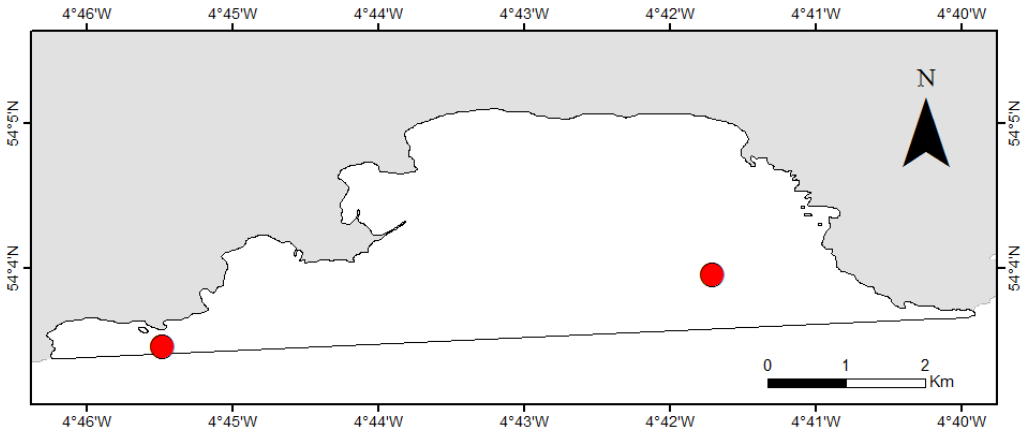
The bryozoan *Flustra foliacea* characterised circalittoral sites on mixed sediment composed of boulders, cobbles and pebbles. *Alcyonium digitatum* and calcareous tube-building polychaetes were observed infrequently



Habitat code: SS.SMx.CMx.OphMx

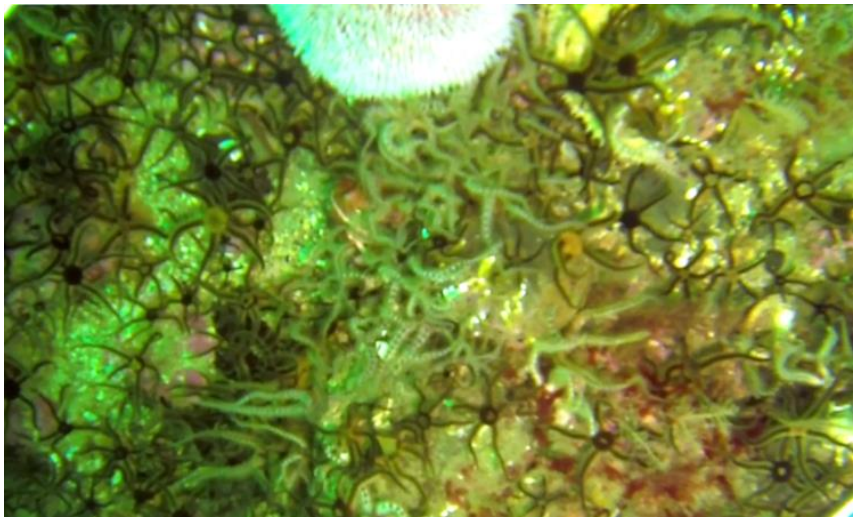
Habitat description: *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment.

Biological zone:	Circalittoral
Depth ranges:	5 - 10m, 10 – 20m, 20 – 30m, 30 – 50m
Wave exposure:	Moderately exposed to sheltered
Current exposure:	Strong to weak



Description of community assemblages in Baie ny Carrickey:

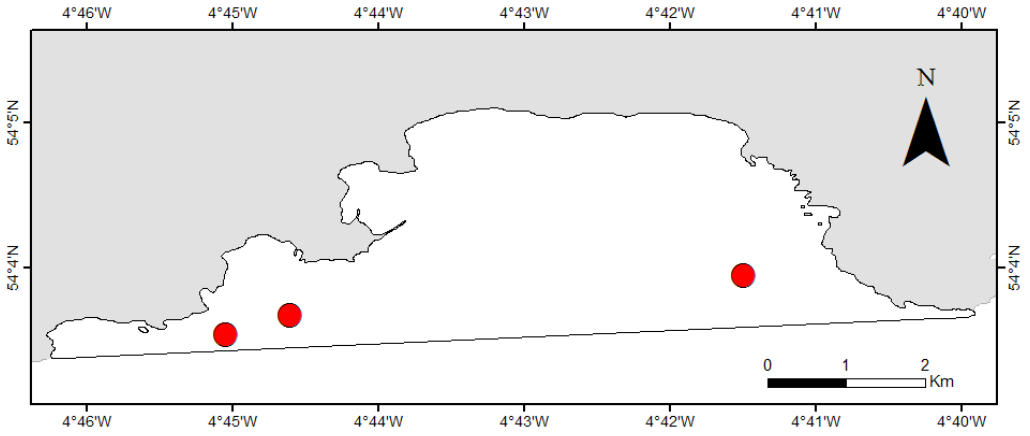
Observed at two locations, this habitat was dominated by *Ophiothrix fragilis* and O*phiocomina nigra* on pebble and cobble sediments. The sea urchin *Echinus esculentus*, the common starfish *Asterias rubens* were additionally present



Habitat code: SS.SMx.CMx

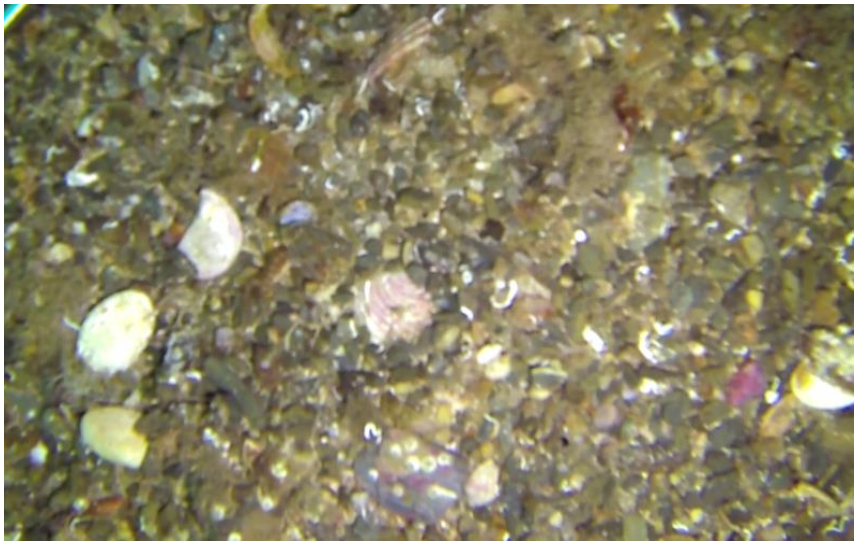
Habitat description: Circalittoral mixed sediment.

Biological zone: Circalittoral
Depth ranges: 5 – 10m, 10 – 20m, 20 – 30m, 30 – 50m
Wave exposure: Moderately exposed to very sheltered
Current exposure: Moderately strong to very weak



Description of community assemblages in Baie ny Carrickey:

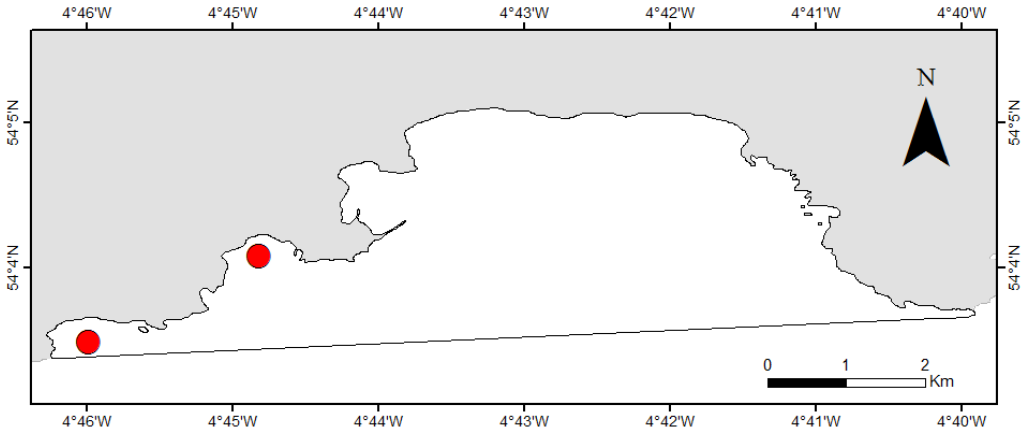
Mixed sediments containing shells and stones were found at these sites in the circalittoral zone. Habitats could not be assigned Level 5 due to the absence of any characterising benthic fauna or flora. Bryozoan turf, Corallinaceae and tube-building polychaetes were observed in low densities.



Habitat code: SS.Ssa.IFiSa

Habitat description: Infralittoral fine sand.

Biological zone:	Infralittoral
Depth ranges:	0 – 5m, 5 – 10m, 10 – 20m
Wave exposure:	Exposed to sheltered
Current exposure:	Strong to very weak



Description of community assemblages in Baie ny Carrickey:

Habitats could not be classified to Level 5 due to absence of taxa. There was some evidence of bioturbation fauna.