Benthic Habitat Mapping:
Niarbyl Bay Marine Nature Reserve

M.J. Garratt, C. Allison, J. Patel, I.S.M. Bloor, J.A. Emmerson & S.R. Jenkins

Bangor University Sustainable Fisheries and Aquaculture Group
School of Ocean Sciences

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Contact: i.bloor@bangor.ac.uk

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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 coarse gravel, hydroids and bryozoans (Brand *et al*., 1980; Harvey *et al*., 1993; Duncan & Emmerson, 2018). Specific assessment of *P. maximus* was undertaken in this study due to the original closure of Niarbyl Bay in 2009 as a trial reseeding area for scallops.

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 at a coarse scale following the sampling of 154 stations covering the entire extent of the territorial waters, with a spacing of approximately 5km between individual stations (Hinz et al., 2010; 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 Niarbyl Bay MNR.

2. Methods

2.1 Location

Niarbyl Bay MNR is located on the West of the Island and covers an area of around 5.66 km^2 (**Error! Reference source not found.**). Niarbyl Bay was originally established as a Fisheries Closed Area for scallop reseeding trials in 2009.

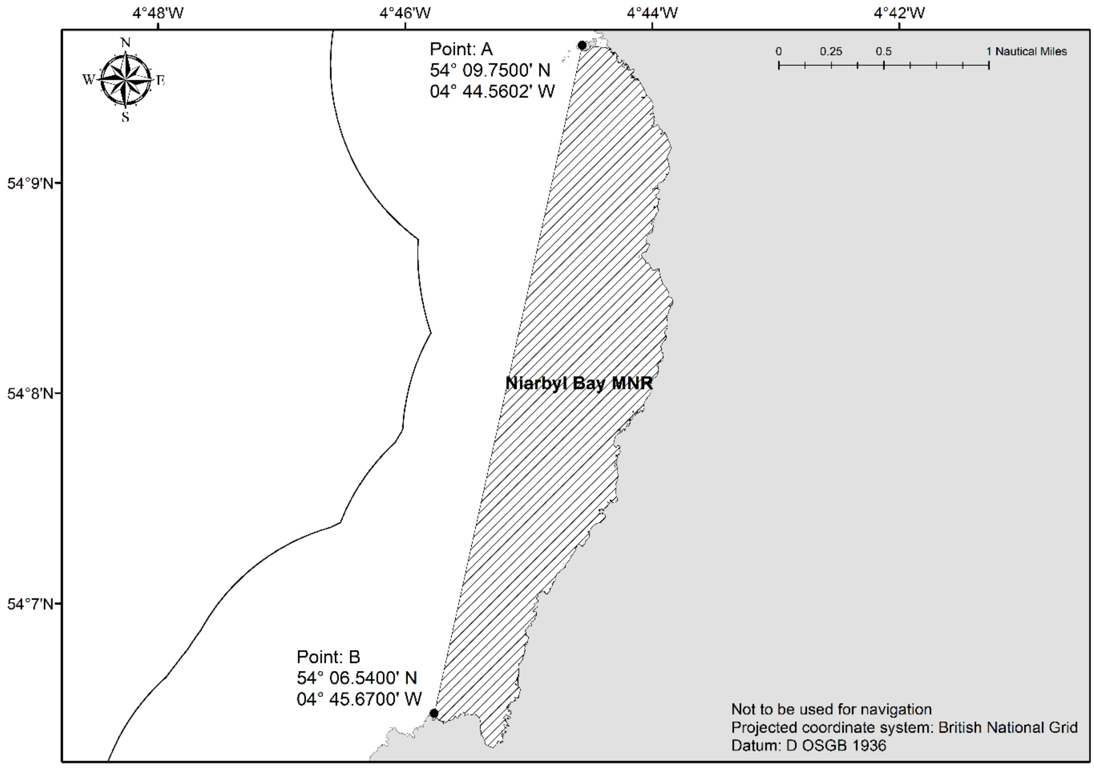

Figure 1: Map showing the location of the Niarbyl Bay Marine Nature Reserve.

2.2 Data collection

Benthic images were collected using a "video sledge" (**Error! Reference source not found.**), consisting of a metal frame on skids towed along the seabed with cameras and lights attached. As surveying took place within an MNR, the sledge was designed to minimise the amount of contact with the seabed. Two cameras in waterproof housings were used throughout the survey: a Canon EOS 400D set to take a flash photograph every 10 seconds (Field of View (FOV) 44x29 cm), and a GoPro HERO3 to capture continuous video footage (FOV ~62x35 cm). These cameras were attached to a raised frame in the centre of the sledge and oriented to face the seabed, along with 2 underwater lights (RSL Ultra 1, 800 + Lux, RovTech Solutions Ltd) to illuminate the sea floor.

Figure 2: Photograph of the equipment used to collect benthic image data, designed to "ski" along the seabed with minimal damage. Cameras and lights were attached to the central raised unit.

The Niarbyl Bay camera survey took place on June 20th 2016 from the Fisheries Protection Vessel (F.P.V.) Barrule. Twenty seven (27) transects were completed within Niarbyl Bay MNR with the aim of collecting an even distribution of data throughout the area, completed by towing the sledge along the seabed at slow speed (~1 knot) for approximately 10 minutes, providing a 10 minute video clip and 60 still photographs for each transect. To allow photographs to be geo-referenced, GPS data (including time and vessel speed) was recorded every 30 seconds throughout the survey onboard the vessel, in addition to the start and end times of each camera tow.

2.3 Image Analysis

From each transect every 6th still photograph was selected for analysis (one per minute of tow), due to time constraints and the general consistency in biotope type along transects, which was relatively homogeneous. Prior to analysis, the photographs were assessed for clarity and quality using a standardised scoring technique adapted from Hannah & Blume (2012) (**Error! Reference source not found.**).

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

Table 1: Score	Visibility	Quality
0	View **completely** obscured by close-up species or suspended sediment	Photograph **completely** blurred or major problems with lighting or camera angle
1	View **largely** (>50%) obscured by close-up species or suspended sediment	Photograph **largely** (>50%) blurred or some problems with lighting or camera angle
2	View **partly** (<50%) obscured by close-up species or suspended sediment	Photograph **partly** (<50%) blurred or minor problems with lighting or camera angle
3	Clear field of view/negligible obstruction	Clear photograph/negligible quality issues

Any selected images scoring 0 or 1 in either category were omitted and replaced by that directly succeeding or preceding (randomised), assuming the alternative photograph met the given criteria. In rare cases where there were no good quality alternatives available, images scoring 1 in either category were accepted.

Images were then analysed using point sampling (Figure 3) using the software ImageJ (Schneider, Rasband and Eliceiri, 2012). To estimate percentage cover, a 5×8 grid was overlain over each image, then the substrate or organism beneath each point was counted and recorded, with each point representing 2.5% cover. Sediment cover was split into 5 main categories – sand/mud, gravel, pebble, boulder, and shell. Gravel, pebble, and boulder were distinguished by the size of stones that points fell on, though no strict parameters were set for distinguishing between gravel and pebble; distinctions between these groups were largely subjective.

The presence of any flora or fauna was recorded, with species identified to the lowest possible taxonomic level, or with a suitable physical description when necessary – e.g. for organisms too small to identify, or that could not be seen clearly in the image. Abundance data was recorded for epifaunal species whose frequencies could be feasibly counted, e.g. crustaceans or fish, otherwise only presence or absence was recorded.

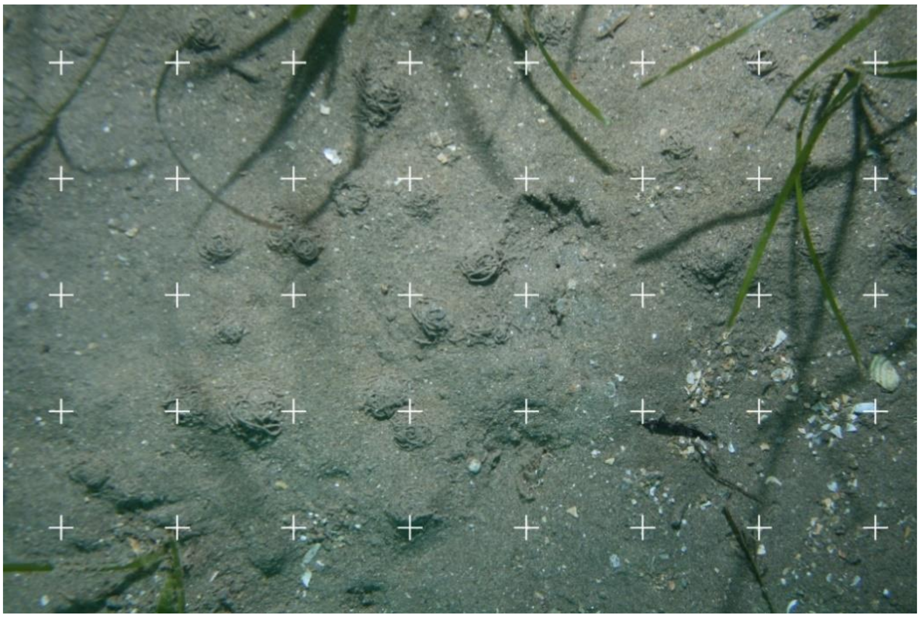

Figure 3. Image demonstrating the standardised point sampling grid used to extract percentage cover data, with each point representing 2.5% of the image.

2.4 Habitat Classification

Images were categorised into habitat types using the EUNIS habitat classification system (JNCC, 2015). The EUNIS system is a hierarchical classification procedure, which distinguishes habitats firstly into broad substrate categories before incrementally adding more detail regarding the biological community (Table 2). The expandable EUNIS habitat list on the JNCC website (https://mhc.jncc.gov.uk/) was used to qualitatively assign habitats based on a combination of video footage and still images. Each analysed image was assigned a EUNIS habitat code to the appropriate resolution (level 4, 5 or 6) based on the species present.

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	Biotope complex	Circalittoral mixed sediment	SS.SMx.CMx
Level 5 & 6	Biotope and sub-biotope	*Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment	SS.SMx.CMx.ClloMx.Nem

2.5 Mapping and Data Analysis

The aforementioned recordings of GPS co-ordinates taken approximately every 30 seconds were associated with their respective images. A benthic habitat map was constructed based on EUNIS habitat classification informed by sample images and tow video footage. Benthic habitat maps were constructed using the Euclidean Allocation function in ArcGIS Version 10.8.1. Euclidean allocation analysis used the positions and habitat designations to extrapolate habitat types of the surrounding, non-sampled area to construct habitat maps that encompassed the entire MNR.

Once EUNIS assignments were completed, ANOVAs were performed along with Tukey HSD post hoc tests ($\alpha = 0.05$) to determine which habitats significantly differed from one another in terms of species richness. Each habitat was also assigned a substrate category based on whether it was 'hard,' 'soft,' or 'mixed,' with any significant differences between habitats then compared with their respective substrate categories.

3. Results

3.1 Distribution of sampled images

The raw dataset was subset to every 6th image, then image quality and visibility was assessed as per the methodology. A total of 288 still images constituted the dataset for further analysis (Figure 4).

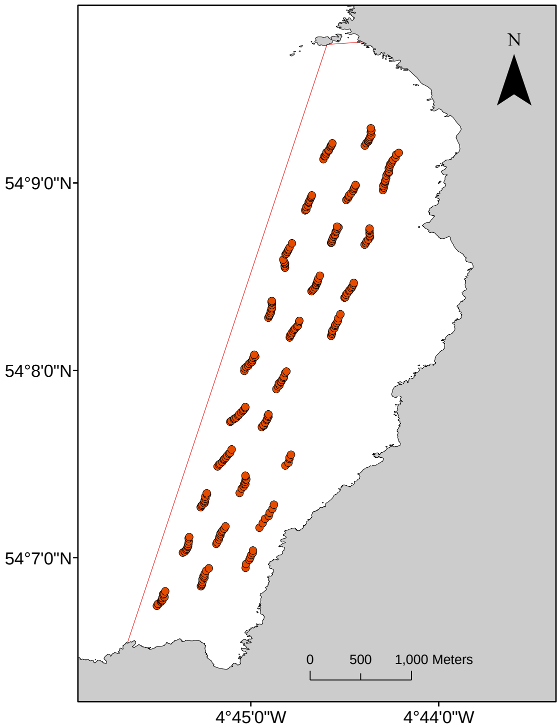

Figure 4. Distribution of sampled images from Niarbyl (n = 288). Red circles represent the location of each still image, red lines indicate the extent of the MNR.

3.2 Benthic Image Analysis, Statistical Analysis & Habitat Maps

3.2.1 Image Overview

Niarbyl appeared to show quite a high degree of diversity in habitat types, with the substrates sand/mud, gravel, pebble, and shell appearing frequently, in a wide range of proportions. Sand/mud was the most frequent substrate, recorded in 213 of the 288 images, though its percentage cover varied widely, between 2.5% and 97.5%. Gravel was similarly common and variable, observed in 208 images with percentage cover varying between 2.5% and 100%.

In total, 56 taxa were identified from 11 different phyla (See Appendix I). In many of the sand/mud dominated images, the arms of the brittlestar *Amphiura filiformis* were also observed (Figure 5).

Figure 5. Image of sandy/muddy seabed with buried brittlestars (*Amphiura filiformis*).

3.2.2 Niarbyl EUNIS

The EUNIS classification system led to the identification of 8 distinct biotopes in Niarbyl Bay MNR (Table 3; Appendix II).

Table 3. Benthic habitat types determined by EUNIS classification in Niarbyl Bay MNR, substrate category (soft, mixed, or hard), and the number of images comprising these biotopes. The average similarity alongside the taxa contributing >25% of the within-group similarity from SIMPER analysis are also reported.

Habitat Number, JNCC Code and EUNIS Habitat Name	**In-text Habitat Name**	**Substrate category**	**Images**	**Average similarity (%)**	**Characterising taxa**
1 – SS.SMp.KSwSS.LsacR.CbPb Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles	Kelp on Cobbles and Pebbles	Hard	32	36.3	Fine Rhodophyta spp., Fine Phaeophyceae spp.
2 – SS.SSa.CMuSa Circalittoral muddy sand	Circalittoral Muddy Sand	Soft	73	55.2	Brown Algae Film, Brittlestar Arms
3 – SS.SMx.CMx.ClloMx.Nem *Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment	Cerianthus Mixed Sediment	Mixed	47	21.1	*Cerianthus lloydii*
4 – SS.SMp.KSwSS.LsacR.Mu *Saccharina latissima* with red and brown seaweeds on lower infralittoral muddy mixed sediment	Kelp on Mixed Sediment	Mixed	4	53.9	*Pomatoceros triqueter* tubes, Fine Rhodophyta spp.
5 – SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	Brittlestars on Mixed Substrate	Mixed	12	32.7	*Clavelina lepadiformis*
6 – SS.SCS.CCS Circalittoral Coarse Sediment	Circalittoral Coarse Sediment	Hard	77	34.0	Brown Algae Film

7 – SS.SMp.KSwSS.LsacR.Gv *Saccharina latissima* and robust red algae on infralittoral gravel and pebbles	Saccharina on Gravel and Pebbles	Hard	49	35.8	Fine Rhodophyta spp.
8 – SS.SMp.KSwSS.Tra Mats of *Trailliella* on infralittoral muddy gravel	Trailliella on Muddy Gravel	Hard	4	48.3	Fine Rhodophyta spp.

Mean species richness varied significantly between EUNIS biotopes ($F_{(7,290)}$=13.7, p < 0.001). The greatest species richness, upwards of 5 species per image, was observed from Kelp on Mixed Sediment and Brittlestars on Mixed Substrate (Figure 6). Every other habitat aside from Kelp on Cobbles and Pebbles contained markedly lower species richness, with averages between 2 and 3.

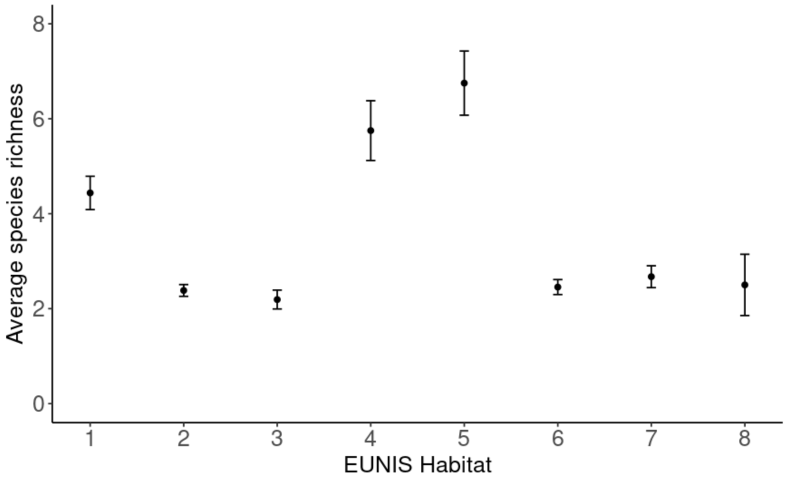

Figure 6. Mean (±SE) species richness per image (n = 4-77) for each Niarbyl EUNIS biotope.

Tukey HSD post hoc identified significant differences between means of different pairs of EUNIS habitats, as detailed in Table 4. Overall, Niarbyl only features 1 habitat with soft substrate, which had a significantly lower richness than 2 mixed and 1 hard substrate habitat. Most of the differences came from comparisons between either Kelp on Mixed Sediment or Brittlestars on Mixed Substrate and other habitats.

Table 4. Table showing Tukey HSD outputs at a 95% confidence level from ANOVA of species richness between Niarbyl EUNIS habitats. Within each pairwise comparison, the habitat with the lower mean species richness is listed on the left side, while the habitat with greater species richness is listed above. Substrate categories are also listed adjacent to each habitat label. Only results for which p ≤ 0.1 are included. Adjusted p reported to 3 decimal places.

			Habitat with greater Species Richness		
			Mixed		**Hard**
			Kelp on Mixed Sediment	Brittlestars on Mixed Substrate	Kelp on Cobbles and Pebbles
Habitat with lower Species Richness	**Soft**	Circalittoral Muddy Sand	0.019	<0.001	<0.001
	Mixed	Cerianthus Mixed Sediment	0.004	<0.001	<0.001

Hard	Kelp on Cobbles and Pebbles	<0.001	0.071	-
	Circalittoral Coarse Sediment	0.013	<0.001	<0.001
	Saccharina on Gravel and Pebbles	0.027	<0.001	<0.001
	Trailliella on Muddy Gravel	-	0.014	-

3.2.3 Niarbyl Benthic Habitat Maps

Benthic habitat maps based on EUNIS habitat types were constructed using Euclidean Allocation in ArcGIS 10.8.1 (Figure 7). Eight 8 EUNIS habitats were identified although infralittoral counterparts of circalittoral habitats that were associated with the coastline, e.g. Circalittoral Coarse Sediment at around 54°8’N, 4°44’W could no doubt be added if survey was extended.

The habitat with the least distribution was *Trailliella* on Muddy Gravel, which was a difficult habitat to assign due to the patchy nature of the data and the potential confusion with bushy Rhodophyta spp. resembling *Trailliella*. The presence of large boulders which would feature their own communities of small, robust algae, added to the difficulty of identifying EUNIS habitat types from image analysis alone – making the benthic tow videos vital. Using the tow video to assist with habitat identification also revealed that instances of *Laminaria digitata* and Rhodophyta spp. were inconsistent across the area, therefore designations between Circalittoral Coarse Sediment and Saccharina on Gravel and Pebbles should be treated tentatively. Furthermore, Circalittoral Muddy Sand may be composed of 2 different habitats based on community composition, as some of the allocated area only featured substrate with some shell fragments, while other areas contained burrowing brittlestars (likely *Amphiura filiformis*) at high concentrations.

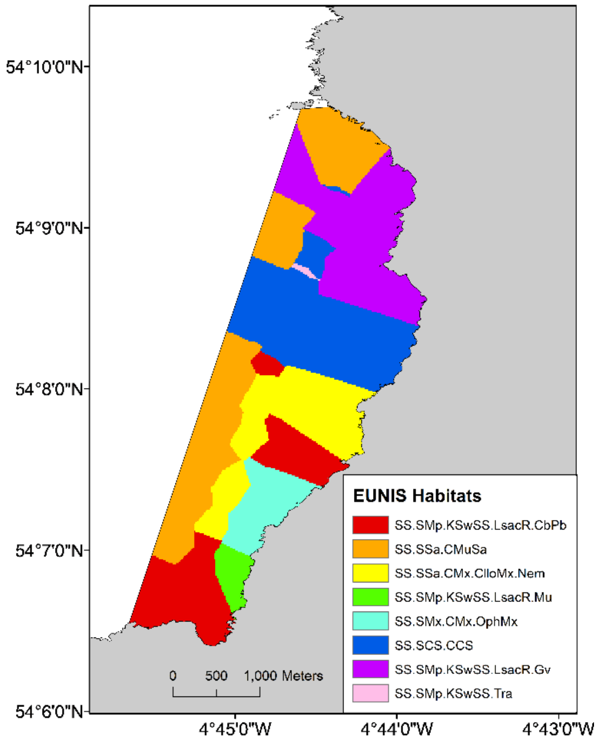

Figure 7. Benthic habitat maps of Niarbyl produced by Euclidean allocation of EUNIS habitat types.

No species of particular conservational or commercial importance were identified from benthic images of Niarbyl, though a wide variety of macroalgae were observed throughout many of the hard and mixed substrate habitats. Kelps (*Laminaria digitata* and *Saccharina latissima*) are of particular importance in these areas by acting as a canopy, allowing turf algae to grow as understorey.

3.3 Scallop Densities

Mean scallop density (*Pecten maximus*) in Niarbyl Bay MNR was 4 per 100m^2, ranging from 0 to 18 in individual video tows, there was considerable variation across habitat types with the greatest abundance in circalittoral gravelly areas.

Of the 139 scallops that were captured by the video footage, 125 could be measured to reasonable accuracy from the footage (± 4 mm). Sizes ranged from 25 to 186 mm (shell width); 54% of individuals measured above minimum landing size (MLS = 110 mm).

4. Discussion

Niarbyl Bay MNR contains a range of benthic habitats, from fine sand to rocky habitat, with the majority of the area characterised by mixed gravelly sediments. The most widespread taxa in the bay were encrusting species (calcareous tube worms, coralline crusts and turf algae). In comparison to other MNRs, epifaunal species richness in Niarbyl Bay was higher than Laxey Bay and comparable to Port Erin and Ramsey.

With regard to commercial species, scallops (*Pecten maximus*) were widespread in the MNR (present in 74% of video tows), but mostly in the southern half of the bay. For comparison, mean scallop density in Niarbyl Bay MNR was higher than Laxey Bay and equivalent to that of Ramsey MNR (however localised densities in Ramsey Bay reached double that of Niarbyl). Other commercial species were present in Niarbyl MNR (*Cancer pagurus* and *Aequipecten opercularis*) but in low abundances.

The data from our MNRs will feed into management efforts and provides useful baseline information with regard to species records and future monitoring.

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6. Appendix

Appendix I

List of taxa identified from benthic images taken from the Niarbyl MNR.

Phylum	Taxon
Porifera	Orange encrusting sponge sp.
	White encrusting sponge sp.
Bryozoa	*Vesicularia spinosa*
	Eucratea loricata
	Cellaria spp.
Cnidaria	*Cerianthus lloydii*
	Unidentified brown anemone sp.
	Nemertesia antennina
	Nemertesia ramosa
	Unidentified Hydroid spp.
Arthropoda	*Necora puber*
	Liocarcinus duperator
	Ebalia sp.
	Macropodia sp.
	Galathea intermedia
	Mysid shrimp sp.
	Pomatoceros triqueter (tubes)
	Family Spirorbidae (tubes)
	Balanus sp.
Annelida	*Oxydromus flexuosus*
	Tubulanus annulatus
	Eupolymnia nebulosa
	Lanice conchilega
	Family *Sabellidae*
	Arenicola marina (casts)
Mollusca	*Lutraria lutraria* (siphons)
	Unidentified bivalve sp.
	Flabellina lineata
	Turritella communis
	Buccinum undatum
	Family Littorinidae
Echinoderms	*Marthasterias glacialis*
	Asterias rubens
	Ophiura ophiura
	Ophiothrix fragilis
	Amphiura filiformis (arms)
	Antedon bifida
Chordata	*Blennius ocellaris*
	Parablennius gattorugine
	Gobius paganellus
	Diplecogaster bimaculata
	Ammodytes tobianus
	Orange fish sp.
Rhodophyta	*Phymatolithon calcareum*
	Encrusting maerl sp.
	Phycodrys rubens
	Fine Rhodophyta spp.
	Encrusting Rhodophyta spp.
Phaeophyta	*Dictyota dichotoma*
	Laminaria digitata

	Saccharina latissima
	Fine Phaeophyceae spp.
	Flat robust Phaeophyceae spp.
	Dark Brown encrusting algae sp.
	Brown encrusting algae sp.
Chlorophyta	*Ulva* spp.
	Filamentous Chlorophyta spp.

Appendix II

Biotopes identified in Niarbyl Bay MNR using EUNIS classification. Descriptions informed by JNCC website, accessible via the URL: https://mhc.jncc.gov.uk/

Biotope code: SS.SMp.KSwSS.LsacR.CbPb

Biotope description: Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles

Wave exposure: Moderately exposed to Very sheltered

Tidal streams: Moderately strong to Very weak

Substratum: Gravel and coarse sand with some pebbles

Zone: Infralittoral

Depth range: 0-20m

Description: Mostly coarse gravel and round pebbles, with some patches of sand/mud, as well as dead shells/shell fragments. Frequent patches of small Rhodophyta and Phaeophyceae algae. Occasional sea pens (*Nemertesia antennina*), sea squirts (*Clavelina lepadiformis*) and anemones (*Cerianthus lloydii*) observed throughout this habitat. This habitat was generally designated close to the coastline, though one region north of 54°8'N was designated over 1km offshore.

Biotope code: SS.SSa.CMuSa

Biotope description: Circalittoral Muddy Sand

Wave exposure: Exposed to Moderately exposed

Tidal streams: Moderately strong to Very weak

Substratum: Fine to very fine sand with a fine silt fraction

Zone: Circalittoral

Depth range: 10-50m

Description: Sand with some shell fragments and brown algae film. Many brittlestar arms protruding from the seabed, believed to be *Amphiura filiformis*. Other common species include *Ophiura ophiura*, *Cerianthus lloydii* and the polychaete *Oxydromus flexuosus*. This habitat was mainly designated at the western border of the MNR, further offshore, though one region at the northernmost extent of the MNR closer to the coast was also designated as circalittoral muddy sand.

Biotope code: SS.SMx.CMx.ClloMx.Nem

Biotope description: *Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment

Wave exposure: Moderately exposed to Very sheltered

Tidal streams: Moderately strong to Very weak

Substratum: Sandy muddy gravel with surficial cobbles, pebbles, and shells

Zone: Infralittoral – lower, Circalittoral

Depth range: 10-30m

Description: Many rounded pebbles with larger patches of sand than SS.SMp.KSwSS.LsacR.CbPb. Rare occasions of small Phaeophyceae/Rhodophyta spp., benthos occupied more by *Cerianthus lloydii*, brown algae film, and various hydroid species, including *Eucratea loricata* and *Hydrallmania falcata*. Some *Pomatoceros triqueter* tubes were also recorded, attached to dead shells.

Biotope code: SS.SMp.KSwSS,LsacR.Mu

Biotope description: *Saccharina latissima* with red and brown seaweeds on lower infralittoral muddy mixed sediment

Wave exposure: Moderately exposed to Very sheltered

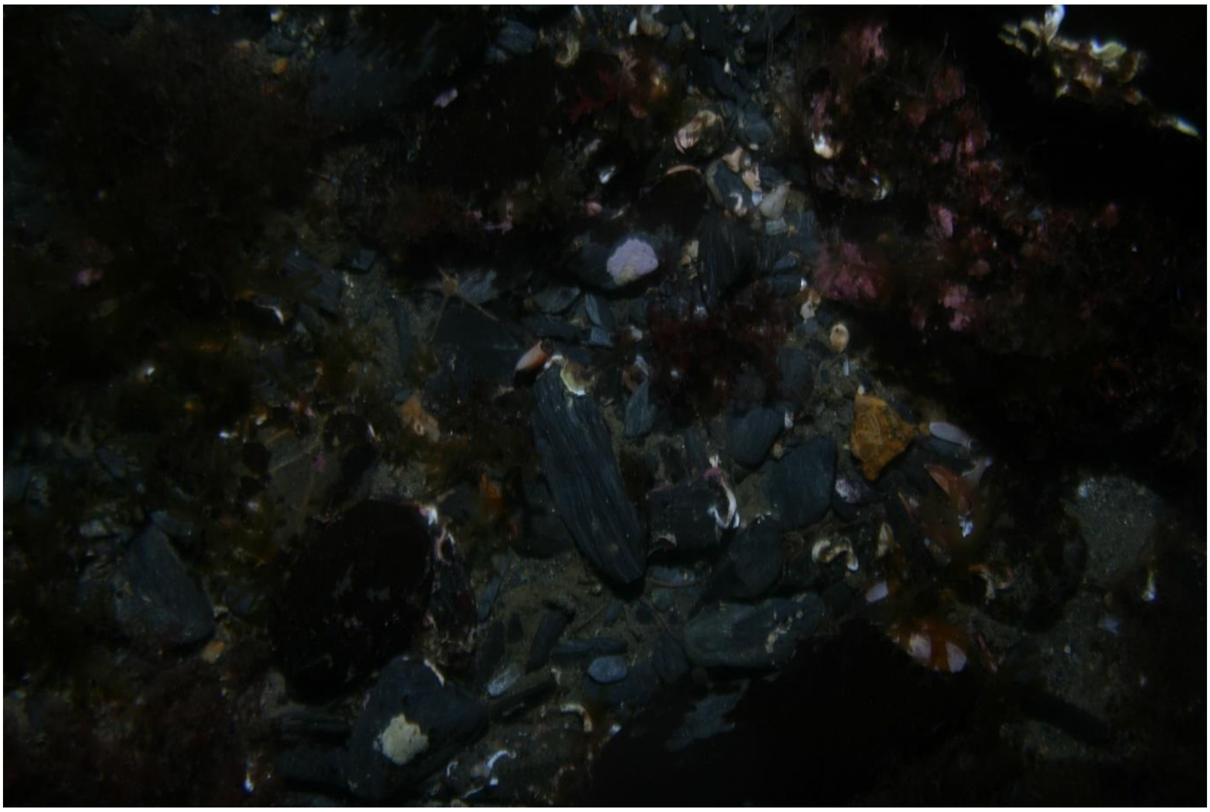
Tidal streams: Moderately strong to Very weak

Substratum: Sand with some gravel

Zone: Infralittoral

Depth range: 0-20m

Description: Similar to SS.SMp.KSwSS.LsacR.CbPb, but with higher densities of *Saccharina latissima*, Rhodophyta spp., and Phaeophyceae spp.. Other species frequently observed were *Clavelina lepadiformis*, tubes of *Pomatoceros triqueter* and encrusting maerl (*Lithothamnion* sp.). This habitat covered the 2nd smallest area of every habitat in Niarbyl, entirely below 54°7'N.



Biotope code: SS.SMx.CMx.OphMx

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

Wave exposure: Moderately exposed to Sheltered

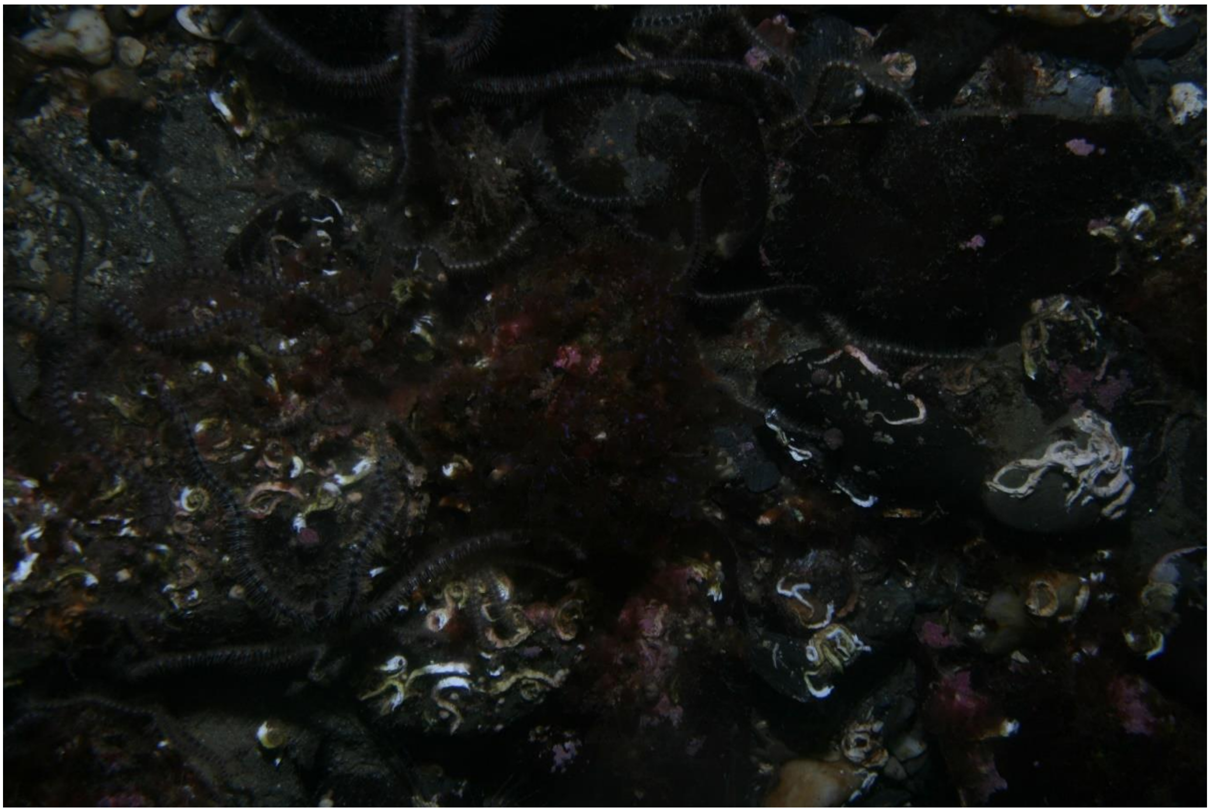
Tidal streams: Strong to Weak

Substratum: Mixed sediment, often with cobbles and pebbles

Zone: Circalittoral

Depth range: 5-50m

Description: Circalittoral sediment dominated by brittlestars – primarily *Ophiothrix fragilis*, though *Ophiura ophiura* was also frequently observed. Other frequently observed species include *Clavelina lepadiformis*, tubes of *Pomatoceros triqueter*, and the feather star *Antedon bifida*. Observed algae included various small Rhodophyta and Phaeophyceae spp. (both in fairly high densities), as well as encrusting maerl (*Lithothamnion* sp.). Despite being circalittoral, this habitat was designated close to the southern coastline, just north of 54°7'N.



Biotope code: SS.SCS.CCS

Biotope description: Circalittoral Coarse Sediment

Wave exposure: Exposed to Moderately exposed

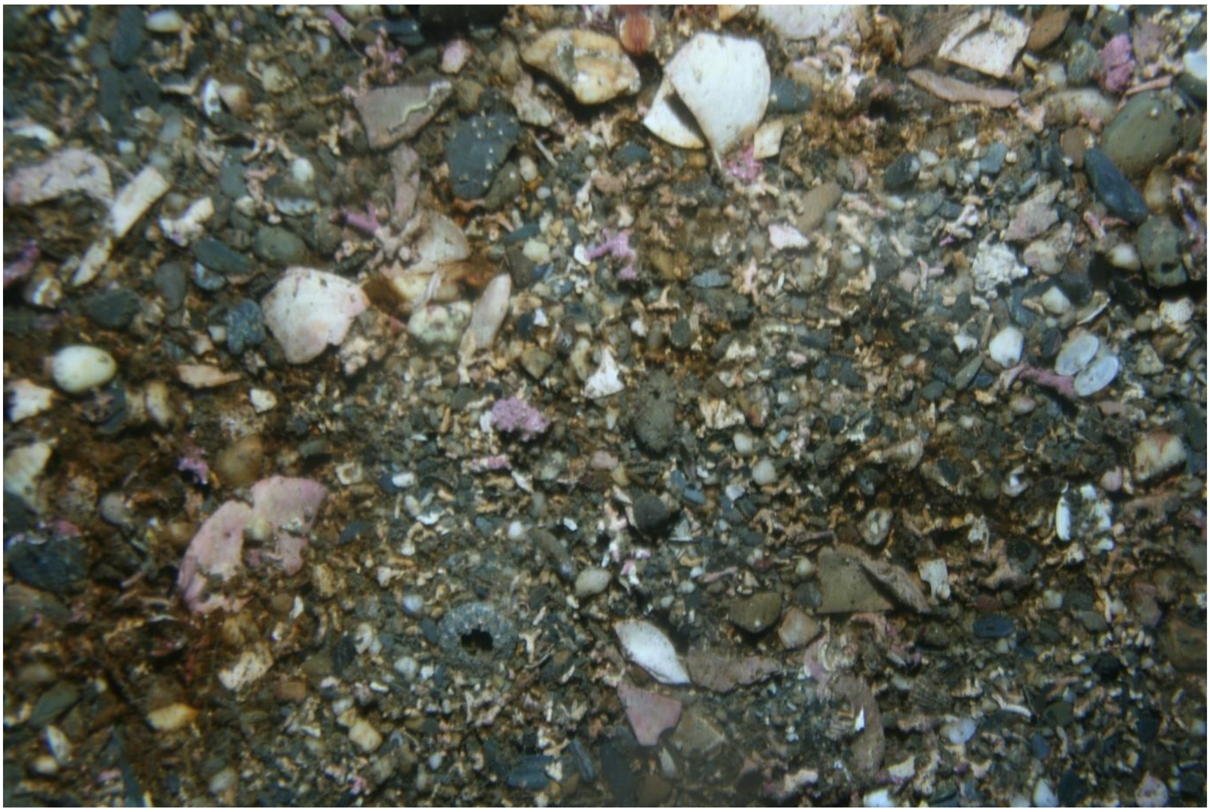
Tidal streams: Moderately strong to Very weak

Substratum: Coarse sand and gravel with a minor finer sand fraction

Zone: Infralittoral – lower, Circalittoral

Depth range: 10-50m

Description: Tide-swept circalittoral coarse sand, gravel, and shingle generally in depths of over 15-20m. Smaller, more rounded pebbles than SS.SMp.KSwSS.LsacR.CbPb, along with shell fragments of varying sizes. Generally sparse arrangement of flora and fauna. Uncommon instances of maerl, small Rhodophyta spp., Phaeophyceae spp., and brown algae film throughout the habitat. Observed species included *Cerianthus lloydii* and bivalve *Lutraria lutraria* (identified from protruding siphons).



Biotope code: SS.SMp.KSwSS.LsacR.Gv

Biotope description: *Saccharina latissima* and robust red algae on infralittoral gravel and pebbles

Wave exposure: Moderately exposed to Extremely sheltered

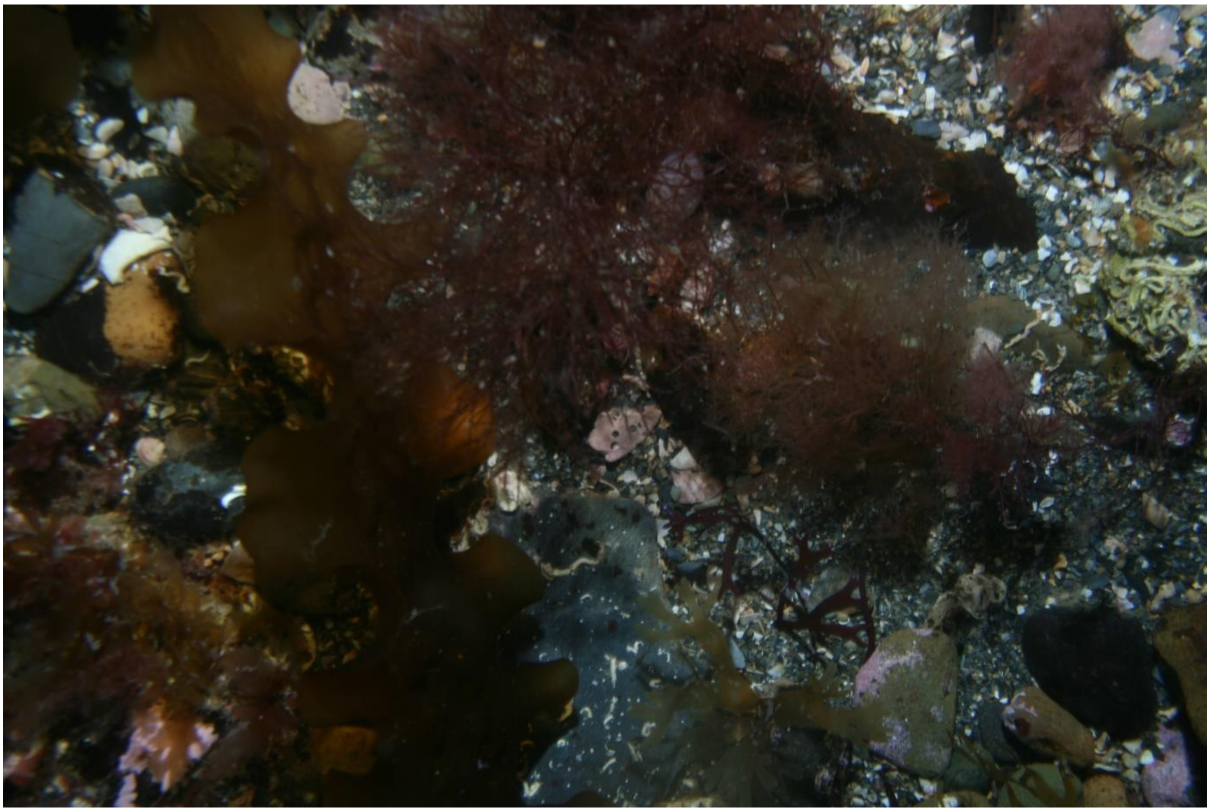
Tidal streams: Moderately strong to Very weak

Substratum: Muddy gravelly mixed sediment

Zone: Infralittoral

Depth range: 5-20m

Description: Similar to SS.SMp.KSwSS.LsacR.Mu, but greater densities of Rhodophyta spp. and Phaeophyceae spp., with gravel appearing finer where visible. Rich red algae undergrowth supported by canopy *Saccharina latissima*, though *Saccharina latissima* was not observed across the entire extent of the habitat, leaving patches of bare gravel in places.



Biotope code: SS.SMp.KSwSS.Tra

Biotope description: Mats of *Trailliella* on infralittoral muddy gravel

Wave exposure: Sheltered to Extremely sheltered

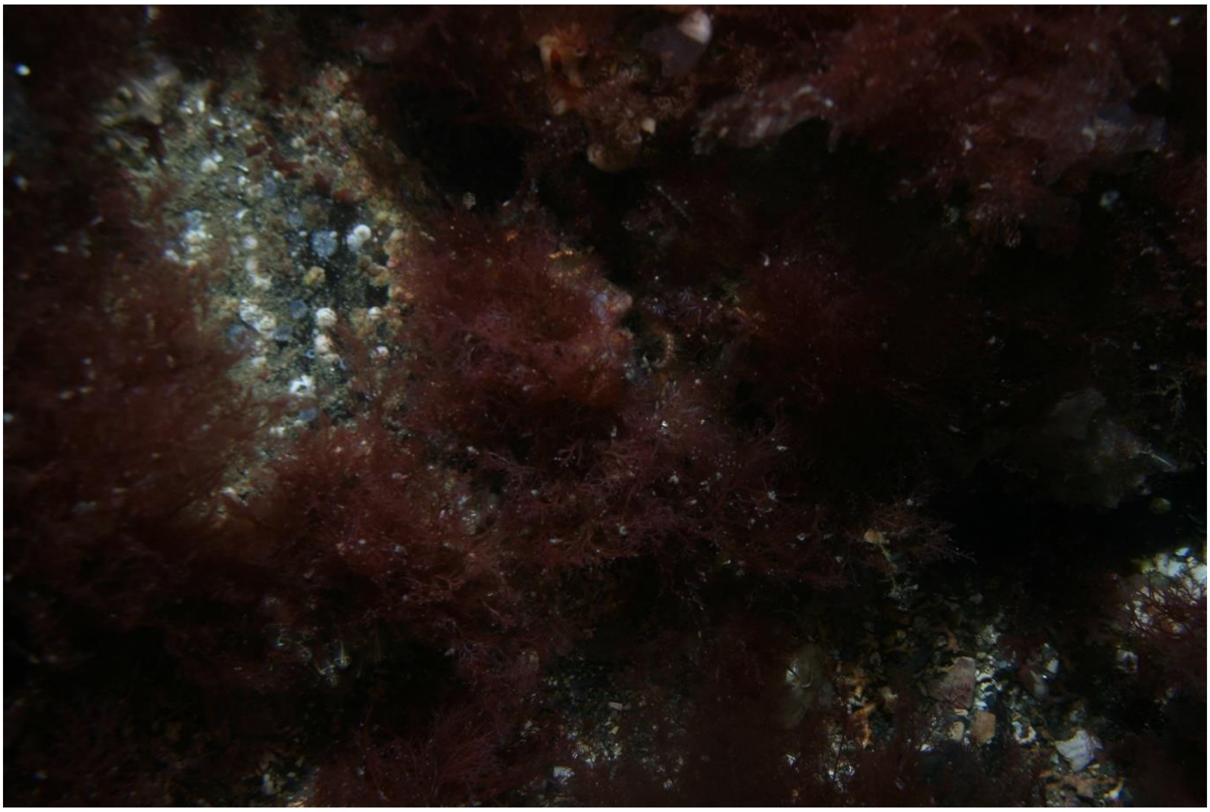
Tidal streams: Weak to Very weak

Substratum: Muddy gravel or muddy sand

Zone: Infralittoral

Depth range: 0-20m

Description: Dense loose-lying beds of the '*Trailliella*' phase of *Bonnemaisonia hamifera* in sheltered, shallow conditions. Occasional patches of gravel throughout the otherwise continuous mat of red algae. No other visible flora or fauna. This habitat had the smallest area of those identified within Niarbyl Bay.



Appendix III

List of taxa viewed in BRUV footage, along with maxN or presence, with presence used for species whose maxN could not be feasibly counted, e.g. for macroalgal species.

Location	BRUV Number	Taxon	maxN or presence
Laxey	1	*Ophiura ophiura*	2
		Adamsia palliata	1
		Buccinum undatum	4
		Pomatoceros triqueter tubes	present
		Balanomorpha spp.	present
		Pagurus spp.	14
		Scyliorhinus canicula	2
	2	*Adamsia palliata*	2
		Buccinum undatum	1
		Pagurus bernhardus	15
		Pagurus prideaux	2
		Liocarcinus duperator	1
		Ammodytes tobianus	1
		Callionymus lyra	1
		Eutrigla gurnardus	1
		Scyliorhinus canicula	3
	3	*Pagurus bernhardus*	7
		Liocarcinus duperator	3
		Cancer pagurus	1
		Corystes cassivelaunus	1
		Scyliorhinus canicula	4
	4	Gastropod sp.	1
		Pagurus bernhardus	10
		Liocarcinus duperator	2
		Eutrigla gernardus	2
		Limanda limanda	1
		Scyliorhinus canicula	2
	5	*Buccinum undatum*	1
		Pagurus bernhardus	10

		Pagurus prideaux	1
		Limanda limanda	1
		Scyliorhinus canicula	3
	6	*Asterias rubens*	1
		Buccinum undatum	14
		Pagurus bernhardus	13
		Scyliorhinus canicula	2
Niarbyl	1	*Homarus gammarus*	1
		Laminaria digitata	present
	2	*Marthasterias glacialis*	1
		Necora puber	1
		Gobiusculus flavescens	1
		Pollachius pollachius	3
		Symphodus melops	1
		Unidentified small fish sp.	1
		Laminaria digitata	present
		Saccharina latissima	present
		Dictyota dichotoma	present
		Fine brown macroalgae sp.	present
		Flat brown macroalgae sp.	present
		Fine Rhodophyta sp.	present
	3	*Ophiura ophiura*	8
		Astropecten irregularis	1
		Liocarcinus duperator	3
		Merlangius merlangus	1
	4	*Cerianthus lloydii*	1
		Ophiura ophiura	3
		Brittlestar arms	present
		Astropecten irregularis	1
		Pagurus bernhardus	1
		Liocarcinus duperator	4
		Cancer pagurus	1
		Small fish sp.	1
		Scyliorhinus canicula	1

5	*Marthasterias glacialis*	2
	Liocarcinus duperator	3
	Cancer pagurus	1
	Pomatoschistus minutus (?)	5
	Juvenile schooling fish, resembling *Pollachius pollachius*	11
6	*Pollachius pollachius*	1
	Symphodus melops	2
	Laminaria digitata	present
	Fine brown macroalgae sp.	present
	Fine Rhodophyta sp.	present
7	*Marthasterias glacialis*	1
	Pagurus bernhardus	6
	Liocarcinus duperator	2
	Callionymus lyra	1
	Juvenile schooling fish, resembling *Pollachius pollachius*	2
8	*Liocarcinus duperator*	2
	Cancer pagurus	1
	Penaeid shrimp sp.	1
	Scyliorhinus canicula	1