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Benthic Habitat Mapping:
Douglas Bay Marine Nature Reserve

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

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November 2022

To cite this report: Garratt, M. J., Bloor, I. S. M., Emmerson, J. A. and Jenkins, S. R. (2022). Benthic Habitat Mapping: Douglas Bay Marine Nature Reserve. Sustainable Fisheries and Aquaculture Report (IoM), Bangor University. pp. 1 – 21.

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). Around the Isle of Man, 52% of the coastal territorial sea (0-3 nm) is designated within MPAs (designated 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).

Benthic habitat and biotype 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 (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 contribute data to 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 Douglas Bay MNR.

2. Methods

2.1 Location

Douglas Bay MNR is located on the East of the Island (Figure 1). Douglas Bay was originally designated as a Fisheries Closed Area (to mobile gears) in 2008, and was part of an initial network to help improve scallop recruitment processes around the island (Neill *et al.* 2008).

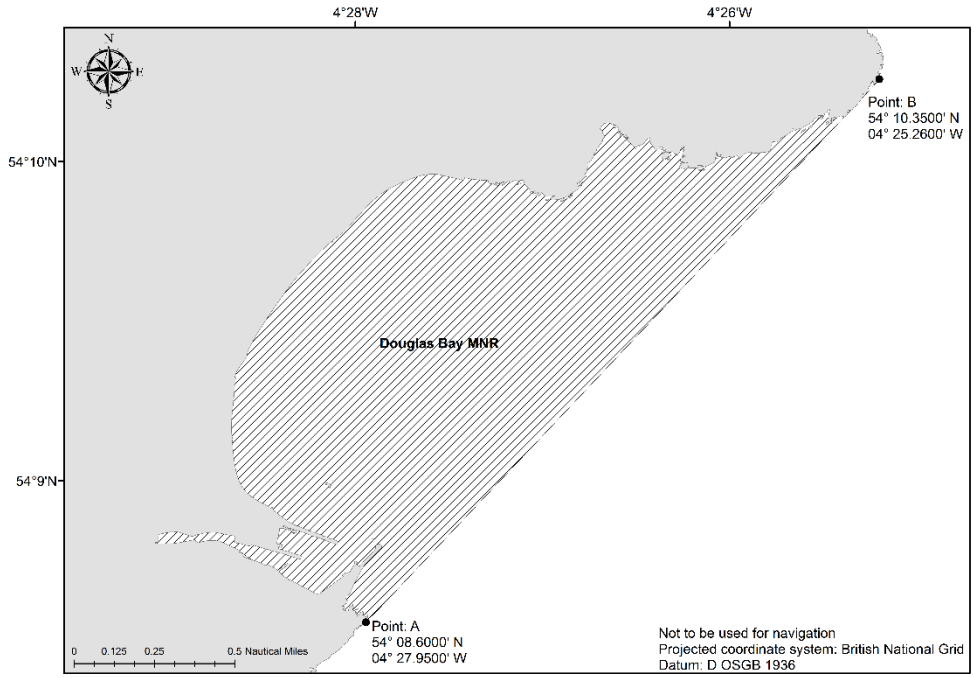

Figure 1: Map showing the location of Douglas Bay Marine Nature Reserve

2.2 Data collection

Benthic images were collected using a "video sledge" (Figure 2), consisting of a metal frame on skids towed along the seabed with cameras and lights attached. As surveying took place within a 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 Douglas Bay camera survey took place on June 16th 2016 from the Fisheries Protection Vessel (F.P.V.) Barrule. Seventeen (17) transects were completed within Douglas Bay MNR (Figure A 1; Table A 1), with the aim of collecting an even distribution of data throughout the area, although due to the inshore sandy habitats, and consequent gentle sloping profile, it was not possible to survey the close-inshore areas of Douglas bay due to vessel depth constraints. Each transect was 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) (Table 1).

Table 1: Scoring system used to determine the suitability of photographs for image analysis ~~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.

2.4 Habitat Classification

The EUNIS habitat classification system is an internationally-recognised habitat classification system (JNCC, 2015) and was used to identify benthic habitats in Douglas Bay MNR. This method provides a standard hierarchical classification approach, distinguishing habitats based on fundamental abiotic variables (substrate, depth, hydrodynamic exposure) and commonly occurring species (Table 2). This was achieved using bathymetric data (Digimap®) and a combination of photographic and video footage to classify the benthic substrate type, identify species and estimate the level of exposure to currents and waves. While the still images were better quality and more detailed, the videos provided continuous data and a more comprehensive look at the habitats including water movement, and so both were used in the assessment.

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

A dataset containing the GPS coordinates of the images inside the MNR and their corresponding habitat designations was then imported into ArcGIS, and Euclidean allocation used to create a habitat map.

During habitat classification, a record of all species identified was kept in order to create a species list for the MNR. Species were identified to the highest possible taxonomic resolution, although in some cases descriptive categories (e.g. filamentous red algae) had to be used.

3. Results

3.1 EUNIS Habitats

A total of 243 photographs were used to identify species and benthic habitats in Douglas Bay MNR. 117 living taxa were recorded (Table A 2), including 37 algae (32%), 19 cnidarians (16%), 15 molluscs (13%), 11 echinoderms (9%), 10 crustaceans (9%), 8 sponges (7%), 6 bryozoans (5%), 5 annelids (4%), 5 fish (4%) and 1 tunicate (1%). The majority of faunal taxa (80%) were identified to species or genus level, but only 46% of algae could be identified to the same level of accuracy, generally requiring more detailed identification techniques. Nine benthic habitats were identified from the photographs and video footage (Table 3), including algal-dominated sediment (34% of images), clean and muddy sands (28%), gravel habitats (26%) and rocky habitats (12%). The distribution of habitats in Douglas Bay MNR is presented in Figure 3, with detailed descriptions and characteristic photographs available in the Appendix.

Specifically, extensive circalittoral maerl gravel (predominantly dead maerl) occurred towards the offshore limit of the MNR, with sandy habitats located along the infralittoral-circalittoral boundary. As depth decreased closer inshore, there was a shift to algal-dominated infralittoral habitats. Patches of diverse bedrock habitat occurred regularly in the survey area, with dense kelp forest present at the far south of the bay, towards Battery Pier.

Table 3: *Benthic habitat classifications in Douglas Bay MNR using the European classification system (EUNIS) (JNCC, 2015), including the total number of images in each habitat and the most common taxa encountered.*

EUNIS habitat classification	Images used	Characterising taxa
SS.SSa* Sublittoral sand	68	*Corymorpha nutans*, *Ophiura albida*, *Cumanotus beaumonti*, *Fjordia* spp., brown algae film, burrowing polychaetes,
SS.SCS.CCS.Nmix *Neopentadactyla mixta* in circalittoral shell gravel or corase sand	40	Corallinaceae crusts, hydroid turf, *Neopentadatyla mixta*, maerl
SS.SMp.Mrl.Pcal.Nmix *Phymatolithon calcareum* maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand	4	Maerl, *Ophiura albida*, corallinaceae crusts, *Neopentadactyla mixta*, fine red algae
SS.SCS.CCS Circalittoral coarse sediment	20	*Ophiura albida*, hydroid turf, corallinaceae crusts, *Cerianthus lloydii*, filamentous brown algae, *Neopentadactyla mixta*, *Pecten maximus*
SS.SMp.KSwSS.LsacR.Gv *Laminaria saccharina* and robust red algae on infralittoral gravel and pebbles	68	*Saccharina latissima*, *Chorda filum*, corallinaceae crusts, bushy red algae, *Gibbula cineraria*, *Plocamium cartilagineum*, *Laminaria hyperborea*
SS.SMp.KSwSS.LsacR.Mu	15	*Chorda filum*, *Saccharina latissima*, *Cerianthus lloydii*, *Desmarestia* spp., filamentous red algae

Laminaria saccharina with red and brown seaweeds on lower infralittoral muddy mixed sediment		
CR.MCR.EcCr.FaAlCr Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	5	Corallinaceae crusts, hydroid/bryozoan turf, encrusting brown algae, *Echinus esculentus*, *Ophiura albida*, Serpulidae spp., *Dysidea fragilis*, *Balanus balanus*
IR.MIR.KR.LhypT.Pk *Laminaria hyperborea* park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock	21	Hydroid/bryozoan turf, corallinaceae crusts, encrusting brown algae, bushy red algae, *Dictyota dichotoma*, *Laminaria hyperborea*, *Flustra foliacea*, *Echinus esculentus*, *Gibbula cineraria*, *Ophiura albida*, *Polymastia boletiformis*, *Plocamium cartilagineum*, *Dysidea fragilis*, *Kirchenpaueria pinnata*, *Stelligera* spp., *Clavelina lepadiformis*
IR.MIR.KR.LhypTX.Ft *Laminaria hyperborea* forest and foliose red seaweeds on tide-swept upper infralittoral mixed sediment	2	*Laminaria hyperborea*, corallinaceae crusts, bushy red algae, hydroid/bryozoan turf, *Echinus esculentus*, *Membranipora membranacea*, Serpulidae spp., *Gibbula cineraria*, *Delessaria sanguinea*

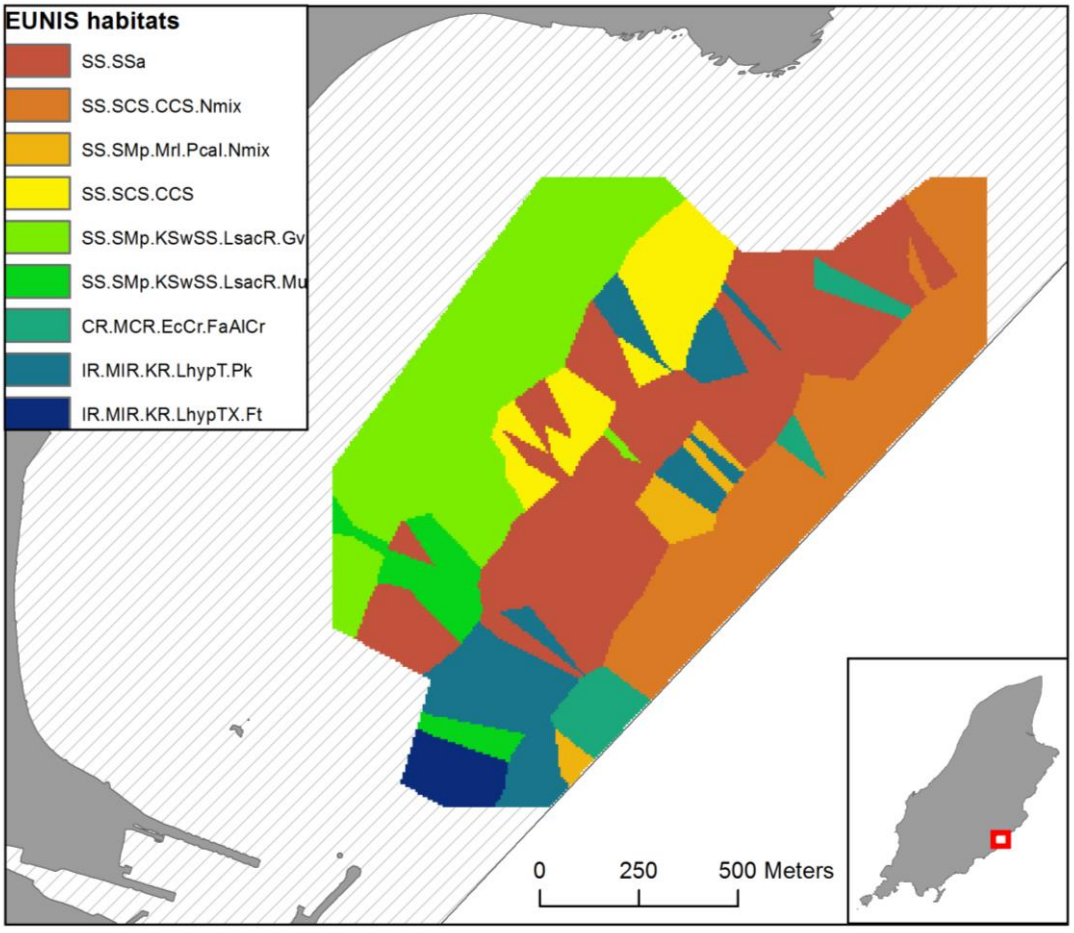

Figure 3: Habitat map for Douglas Bay MNR using the EUNIS classification approach. Refer to Table 3 and Appendix.

4. Discussion

Douglas Bay MNR contains a diverse range of benthic habitats, from sand flats to rocky reefs and kelp forest. The area was predominately characterised by gravelly sediment interspersed with patches of bedrock. In the infralittoral zone, these sparse rock patches became characterised by *Laminaria hyperborea* and a rich understory of seaweeds, hydroids, bryozoans and sponges.

Various habitats of conservation interest were identified. At the far south of the survey area, near Battery Pier, a kelp forest habitat was observed. Extensive maerl gravel (dead maerl) was present along the MNR boundary, although small patches of live maerl beds were also observed in slightly shallower water adjacent to rocky habitat. Sandy areas in Douglas Bay (SS.SSa) were characterised by abundant *Corymorpha nutans* (a solitary hydroid) and the associated nudibranchs *Cumanotus beaumonti*, and *Fjordia lineata* a rare assemblage only recorded in a few locations worldwide.

The habitat and biodiversity data from our MNRs will feed into future management programmes and provide useful baseline information with regard to species records and future monitoring.

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6. Appendix

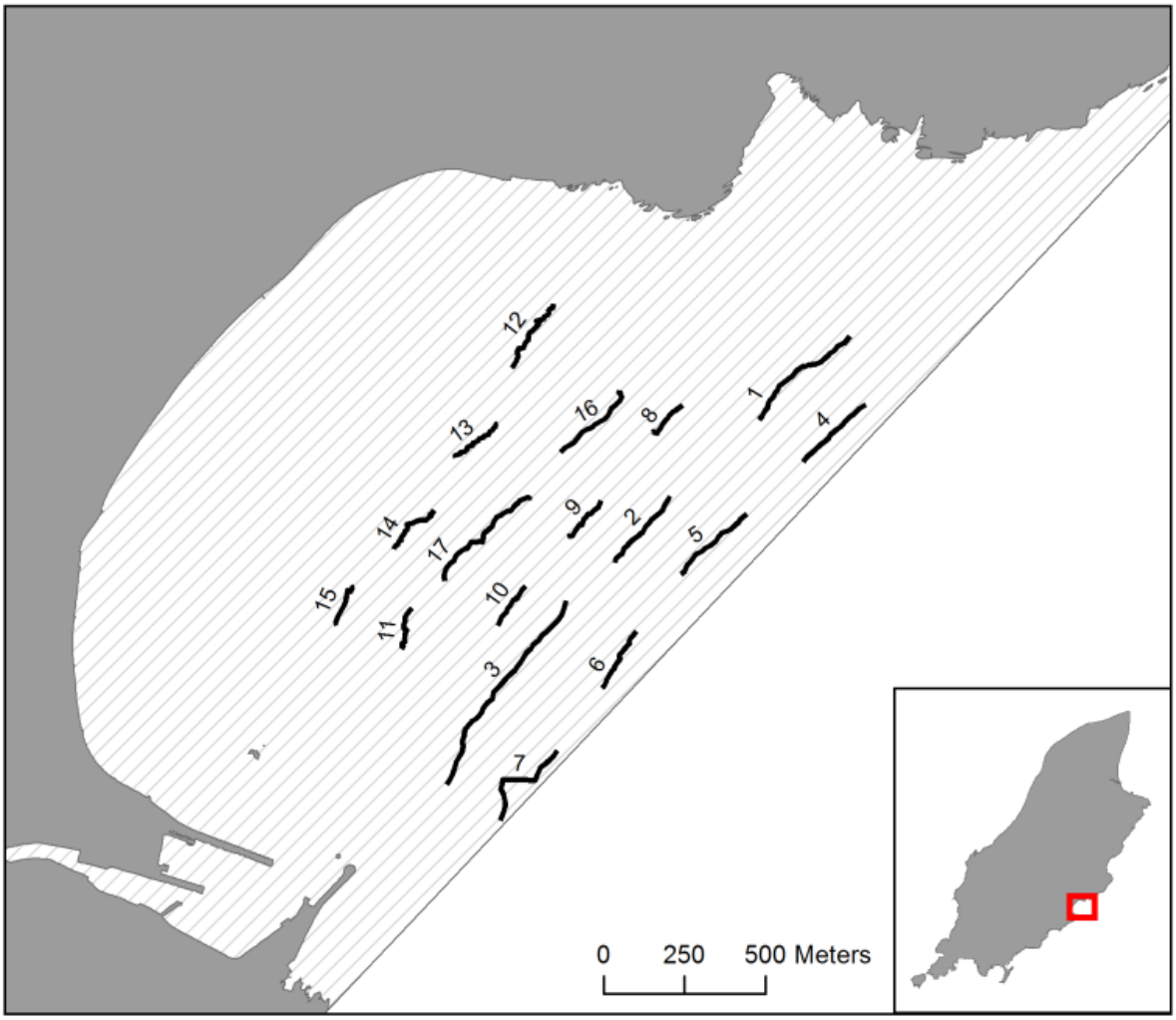

Figure A 1: Map of the camera tow transects used to collect videos and images of the seabed inside Douglas Bay MNR. Start and end coordinates for each tow are available in Table A 1.

Table A 1: Start and end coordinates (decimal degrees) of camera tows (vessel position).

Tow	Start	End
1	54.16259°N, 4.44134°W	54.16019°N, 4.44551°W
2	54.15797°N, 4.44962°W	54.15607°N, 4.45211°W
3	54.15497°N, 4.45434°W	54.14975°N, 4.45972°W
4	54.16070°N, 4.44049°W	54.15905°N, 4.44335°W
5	54.15756°N, 4.44594°W	54.15581°N, 4.44897°W
6	54.15419°N, 4.45098°W	54.15258°N, 4.45251°W
7	54.15082°N, 4.45453°W	54.14880°N, 4.45711°W
8	54.16051°N, 4.44914°W	54.15975°N, 4.45056°W
9	54.15778°N, 4.45287°W	54.15675°N, 4.45441°W
10	54.15535°N, 4.45628°W	54.15422°N, 4.45755°W
11	54.15462°N, 4.46162°W	54.15348°N, 4.46208°W
12	54.16320°N, 4.45544°W	54.16139°N, 4.45730°W
13	54.15982°N, 4.45788°W	54.15884°N, 4.45980°W
14	54.15735°N, 4.46073°W	54.15624°N, 4.46259°W
15	54.15517°N, 4.46441°W	54.15411°N, 4.46533°W
16	54.16085°N, 4.45216°W	54.15910°N, 4.45487°W
17	54.15785°N, 4.45623°W	54.15541°N, 4.46014°W

Table A 2: List of taxa identified from benthic photographs taken inside Douglas Bay MNR.

Phylum	Taxon	Phylum	Taxon
Sponges	*Dysidea fragilis*	Annelids	*Lanice conchilega*
	Hemimycale columella		*Sabella pavonina*
	Phorbas fictitius		Serpulidae spp.
	Polymastia boletiformis		Spirorbidae spp.
	Tethya citrina		Terebellidae spp.
	Stelligera spp.	Molluscs	*Calliostoma zizyphinum*
	Unidentified orange sponge		*Cumanotus beaumonti*
	Yellow-orange sponge spp.		*Fjordia browni*
Cnidarians	*Alcyonium digitatum*		*Fjordia lineata*
	Anemonia viridis		*Gibbula cineraria*
	Capnea sanguinea		*Gibbula magus*
	Caryophyllia smithii		*Lepidochitona cinerea*
	Cerianthus lloydii		*Nucella lapillus*
	Corymorpha nutans		*Pecten maximus*
	Epizoanthus couchii		*Pleurobranchus membranaceus*
	Halecium halecinum		*Tectura virginea*
	Kirchenpaueria pinnata		*Testudinalia testudinalis*
	Nemertesia antennina		*Euspira* spp.
	Nemertesia ramosa		Small sea slug
	Obelia geniculata		Smooth black gastropod
	Peachia cylindrica	*Echinoderms*	*Asterias rubens*
	Plumularia setacea		*Crossaster papposus*
	Urticina felina		*Echinus esculentus*
	Brown speckled anemone		*Leptasterias muelleri*
	Feathery hydroid spp.		*Neopentadactyla mixta*
	Hydroid/bryozoan turf		*Ophiothrix fragilis*
	Small fine branching hydroid		*Ophiura albida*
Bryozoans	*Electra pilosa*		*Ophiura ophiura*
	Flustra foliacea		*Psammechinus miliaris*
	Membranipora membranacea		*Antedon* spp.
	Parasmittina trispinosa		*Henricia* spp.
	Alcyonidium spp.	Tunicates	*Clavelina lepadiformis*
	Bugulidae spp.	Fish	*Callionymus lyra*
Crustaceans	*Balanus balanus*		*Lepadogaster candolii*
	Cancer pagurus		*Phrynorhombus norvegicus*
	Galathea intermedia		*Taurulus bubalis*
	Ebalia spp.		*Pomatoschistus* spp.
	Inachus spp.	*Algae*	*Alaria esculenta*
	Macropodia spp.		*Callophyllis laciniata*
	Paguroidea spp.		*Chorda filum*
	Paguroidea spp. 2		*Chordaria flagelliformis*
	Brachyura spp.		*Cryptopleura ramosa*
	Brachyura spp. 2		*Delesseria sanguinea*

Phylum	Taxon	Phylum	Taxon
Algae cont.	*Dictyopteris polypodioides*		
	Dictyota dichotoma		
	Furcellaria lumbricalis		
	Halidrys siliquosa		
	Laminaria hyperborea		
	Phycodrys rubens		
	Plocamium cartilagineum		
	Saccharina latissima *Vertebrata byssoides*		
	Desmarestia spp.		
	Ulva spp.		
	Corallinaceae crusts		
	Branched Chlorophyta spp.		
	Branched Rhodophyta spp.		
	Brown algae film		
	Bushy Rhodophyta spp.		
	Dark brown encrusting algae		
	Dark red encrusting algae		
	Feathery Phaeophyceae spp.		
	Filamentous Chlorophyta spp.		
	Filamentous Phaeophyceae spp.		
	Filamentous Rhodophyta spp.		
	Fine Chlorophyta spp.		
	Fine Phaeophyceae spp.		
	Fine Rhodophyta spp.		
	Flat Phaeophyceae spp.		
	Maerl		
	Orange-brown encrusting algae		
	Robust flat Rhodophyta spp.		
	Robust long Phaeophyceae spp.		
	Thin Rhodophyta spp.		

Habitat code: SS.SSa

Habitat description: Sublittoral sand

Wave exposure: Moderately exposed to very sheltered
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Medium to fine sands and muddy sands
Zone: Infralittoral to circalittoral
Depth: 0-50 m

Clean sands and muddy sands with shell fragments. Faunal community dominated by the solitary hydroid *Corymorpha nutans* and nudibranchs which feed on it (*Cumanotus beaumonti*, *Fjordia lineata*, *Fjordia browni*). Also highly common were *Ophiura albida*, burrowing polychaetes and brown algae film. This habitat occurred at the infralittoral-circalittoral transition in Douglas Bay, between the algal-dominated habitats and the offshore gravelly habitats. It was identified in images at 11-18 m depth.

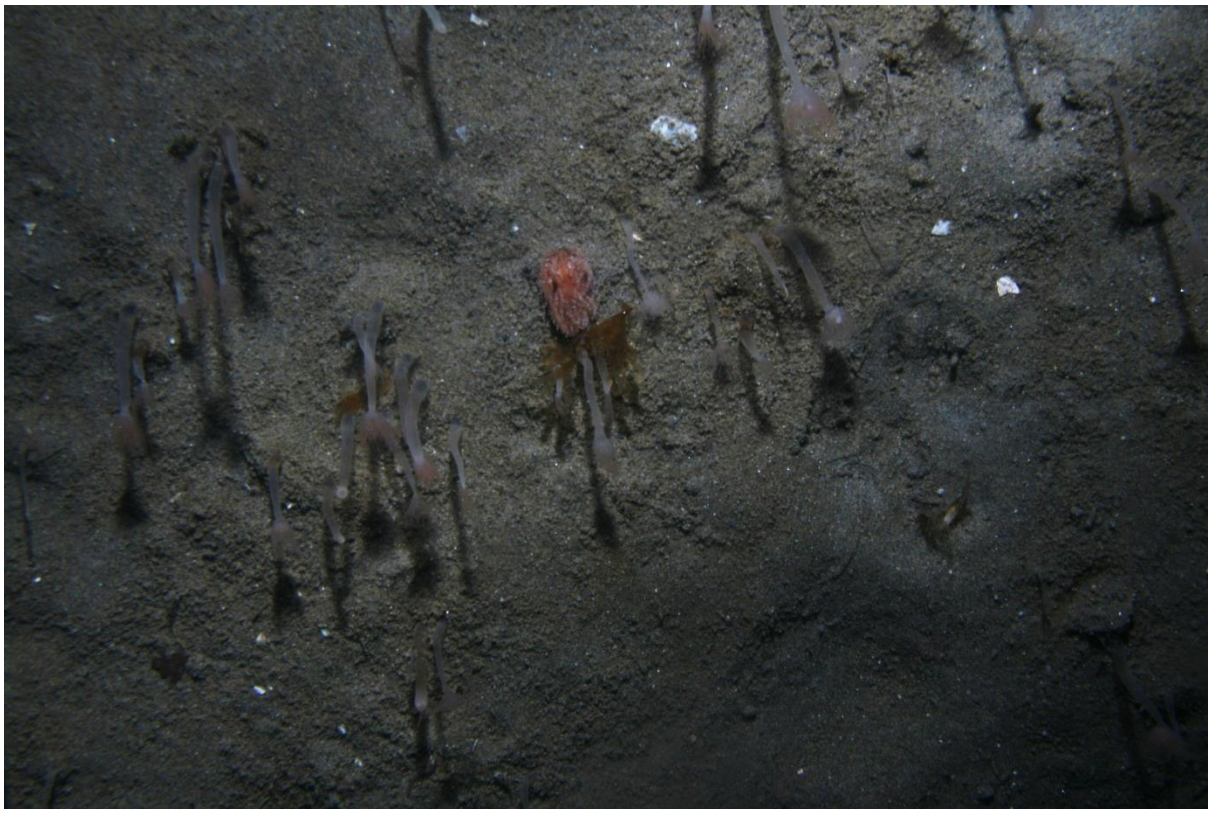

Figure A 2: EUNIS Habitat Code SS.SSa

Habitat code: SS.SCS.CCS.Nmix

Habitat description: *Neopentadactyla mixta* in circalittoral shell gravel or coarse sand

Wave exposure: Exposed to moderately exposed
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Clean shell and stone gravel; very coarse sand with a finer sand fraction
Zone: Lower infralittoral to circalittoral
Depth: 10-50 m

Mixed beds of shell, gravel, dead maerl and coarse sand. Sparse biological community dominated by corallinaceae crusts and occasional live maerl, hydroid turf on dead shells and *Neopentadactyla mixta*. This habitat occurred offshore in the deepest part of Douglas Bay MNR, between 18 and 20 m depth.

Figure A 3: EUNIS Habitat Code SS.SCS.CCS.Nmix

Habitat code: SS.SMp.Mrl.Pcal.Nmix

Habitat description: *Phymatolithon calcareum* maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand

Wave exposure: Exposed to sheltered
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Maerl gravel; coarse sand
Zone: Lower infralittoral to upper circalittoral
Depth: 5-30 m

Maerl on shelly gravel and coarse sand. Relatively sparse faunal community dominated by echinoderms (*Ophiura albida, Neopentadactyla mixta, Leptasterias muelleri*, *Echinus esculentus*). Occasional Rhodophyta spp. and *Pecten maximus*. This habitat occurred amongst or adjacent to bedrock (IR.MIR.KR.LhypT.Pk; CR.MCR.EcCr.FaAlCr), and was identified at 15-16 m depth.

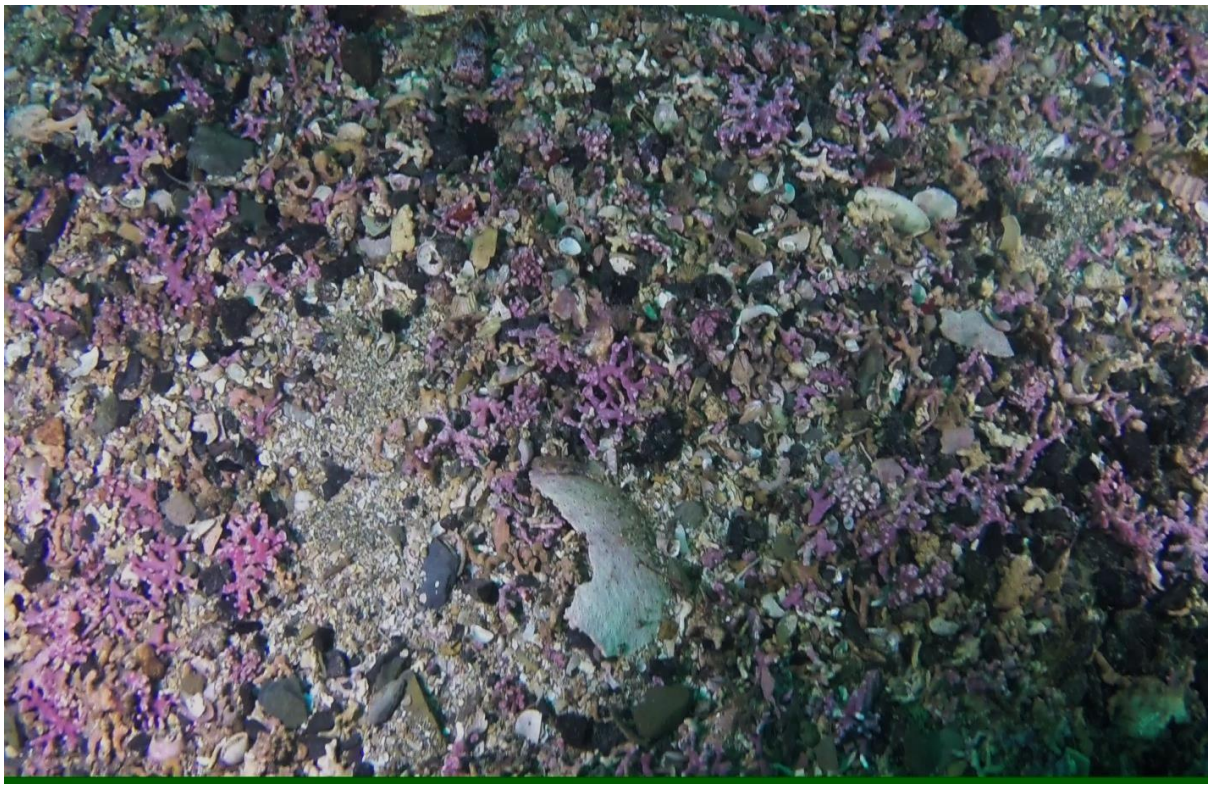

Figure A 4: EUNIS Habitat Code SS.SMx.Mrl.Pcal.Nmix

Habitat code: SS.SCS.CCS

Habitat description: Circalittoral coarse sediment

Wave exposure: Exposed to moderately exposed
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Coarse sand and gravel with a minor finer sand fraction
Zone: Lower infralittoral to circalittoral
Depth: 10-50 m

Coarse gravel and pebbles overlying sand, with some shell fragments. Sparse biological community consisting predominately of echinoderms (*Ophiura albida*, *Neopentadactyla mixta*), corallinaceae crusts and filamentous brown algae. Occasional *Cerianthus lloydii*, *Gibbula* spp. and *Corymorpha nutans*. This habitat was found at the upper limit of the circalittoral zone in Douglas Bay, in depths between 12 and 16 m.

Figure A 5: EUNIS Habitat Code SS.SCS.CCS

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

Habitat description: *Laminaria saccharina* and robust red algae on infralittoral gravel and pebbles

Wave exposure: Moderately exposed to very sheltered
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Gravel and coarse sand with some pebbles
Zone: Infralittoral
Depth: 0-20 m

Coarse gravel and pebbles overlying sand, with occasional boulders. Biological community dominated by kelp (*Saccharina latissima* and occasional *Laminaria hyperborea*), red algae (corallinaceae crusts, *Plocamium cartilagineum, Cryptopleura ramosa, Delesseria sanguinea*) and brown algae (*Chorda filum*, *Dictyota dichotoma*). Faunal community characterised by frequent *Gibbula* spp., and occasional limpets and *Ophiura albida*. This habitat occurred inshore between 9 and 13 m depth.

Figure A 6: EUNIS Habitat Code SS.SMp.KSwSS.LsacR.Gv

Habitat code: SS.SMp.KSwSS.LsacR.Mu

Habitat description: *Laminaria saccharina* with red and brown seaweeds on lower infralittoral muddy mixed sediment

Wave exposure: Moderately exposed to extremely sheltered
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Muddy gravelly mixed sediment
Zone: Infralittoral to lower infralittoral
Depth: 5-20 m

Muddy mixed sediment characterised by fine brown and red algae, occasional *Saccharina latissima*, *Cerianthus lloydii* and corallinaceae crusts. This habitat occurred adjacent to SS.SMp.KSwSS.LsacR.Gv in relatively shallow water (10-12 m depth).

Figure A 7: EUNIS Habitat Code SS.SMp.KSwSS.LsacR.Mu

Habitat code: CR.MCR.EcCr.FaAlCr

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

Wave exposure: Exposed to moderately exposed
Tidal streams: Moderately strong (1-3 kn) to very weak (negligible)
Substratum: Bedrock, boulders, cobbles
Zone: Circalittoral
Depth: 10-50 m

Circalittoral rocky habitat with sandy gravel patches. Relatively barren in appearance, dominated by encrusting and turf species: corallinaceae and phaeophyceae crusts; hydroid/bryozoan turf; calcareous tube worms; *Balanus balanus*, *Parasmittina trispinosa*). Other characteristic taxa included echinoderms (*Echinus esculentus*, *Ophiura albida*), patches of brown algae (*Dictyota dichotoma, Dictyopteris polypodiodes*), cushion sponges (*Dysidea fragilis*, *Hemimycale columella*), gastropods (*Gibbula cineraria*, *Calliostoma zizyphinum*), *Clavelina lepadiformis* and *Alcyonium digitatum*. This habitat occurred in deeper water close to the edge of the MNR (17-20 m depth).

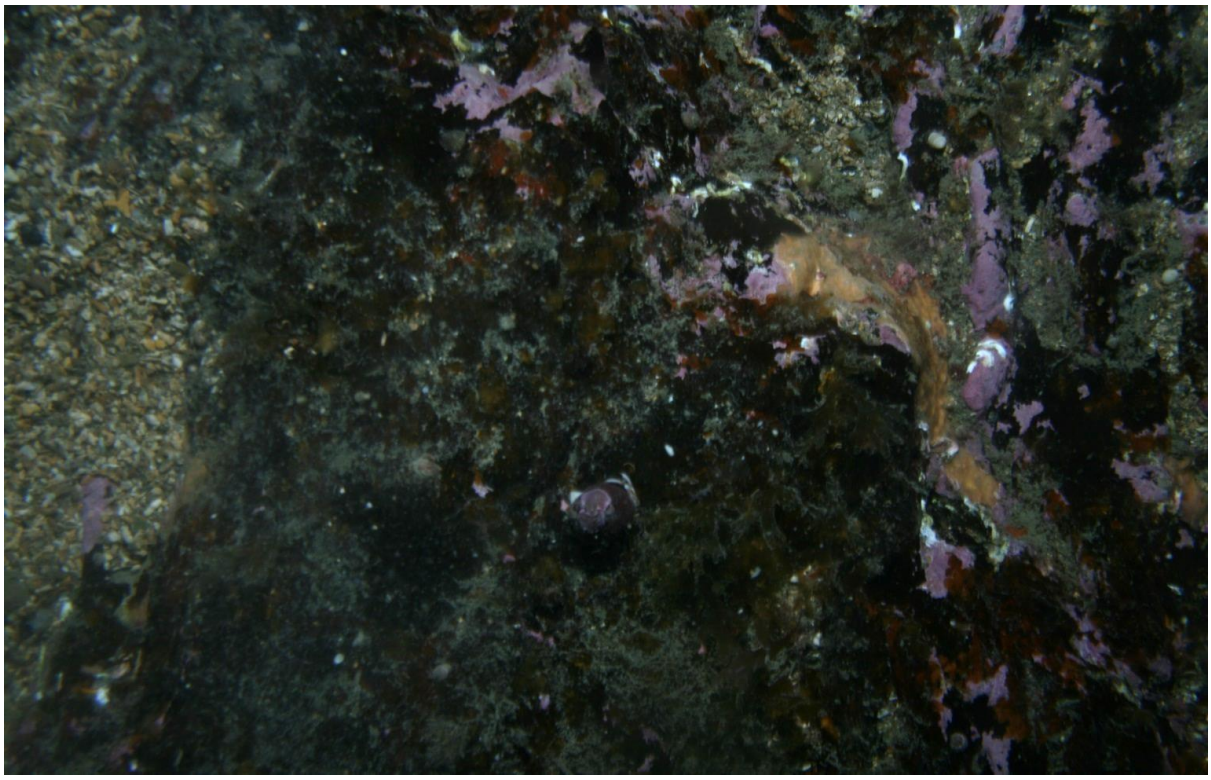

Figure A 8: EUNIS Habitat Code CR.MCR.EcCrFaAlCr

Habitat code: IR.MIR.KR.LhypT.Pk

Habitat description: *Laminaria hyperborea* park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock

Wave exposure: Extremely exposed to moderately exposed
Tidal streams: Strong (3-6 kn) to moderately strong (1-3 kn)
Substratum: Bedrock and boulders
Zone: Lower infralittoral
Depth: 5-20 m

Lower infralittoral rocky habitat with sparse but recurrent *Laminaria hyperborea* and a mixed understory of algae (e.g. *Plocamium cartilagineum*, *Dictyota dichotoma*, *Delesseria sanguinea*, *Dictyopteris polypodioides*), hydroids (e.g. *Kirchenpaueria pinnata*) and bryozoans (e.g. *Flustra foliacea*). Usually encountered with intermittent patches of mixed sediment and maerl between bedrock, and housing a diverse community comprising infralittoral and circalittoral species. Characteristic taxa included sponges (*Polymastia boletiformis*, *Stelligera* spp., *Dysidea fragilis*, *Hemimycale columella*, *Tecthya citrina*), gastropods (*Gibbula cineraria*, *Callistoma zizyphinum*) and *Clavelina lepadiformis*. This habitat was found at 13-17 m depth, occurring patchily along the infralittoral-circalittoral boundary and below the kelp forest (IR.MIR.KR.LhypTX.Ft).

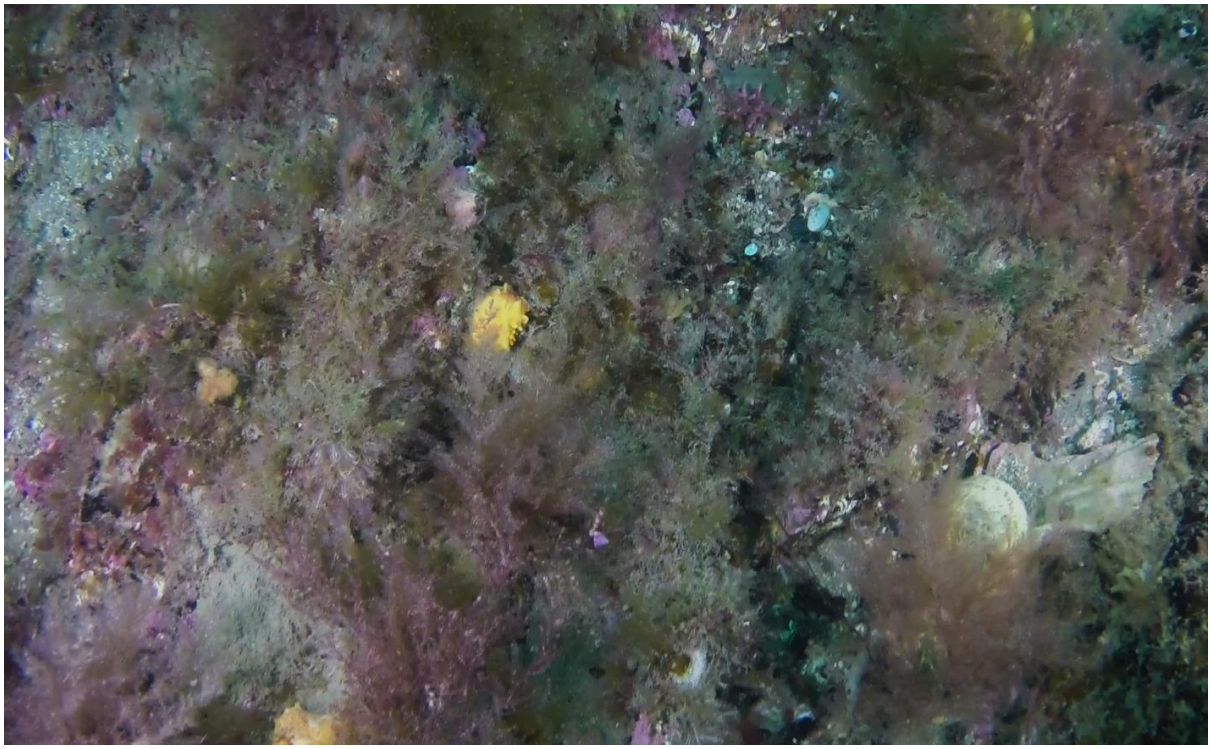

Figure A 9: EUNIS Habitat Code IR.MIR.KR.LhypT.Pk

Habitat code: IR.MIR.KR.LhypTX.Ft

Habitat description: *Laminaria hyperborea* forest and foliose red seaweeds on tide-swept upper infralittoral mixed substrata

Wave exposure: Moderately exposed to sheltered
Tidal streams: Strong (3-6 kn) to very weak (negligible)
Substratum: Bedrock, boulders, cobbles, pebbles and gravel
Zone: Infralittoral
Depth: 0-20 m

Laminaria hyperborea forest on infralittoral bedrock, boulders, and coarse sediment. Characterised by an understory and stipe flora of foliose algae (*Plocamium cartilagineum*, *Delesseria sanguinea*, *Phycodrys rubens*, *Dictyota dichotoma*, *Desmarestia* spp.). Bedrock and boulders encrusted with coralline algae and calcareous tube worms. Frequent *Echinus esculentus*, *Gibbula cineraria* and *Clavenlina lepadiformis*, with fish occasionally seen swimming through the kelp. This habitat occurred at 13-14 m depth towards the south of the bay, above the kelp park (IR.MIR.KR.LhypT.Pk).

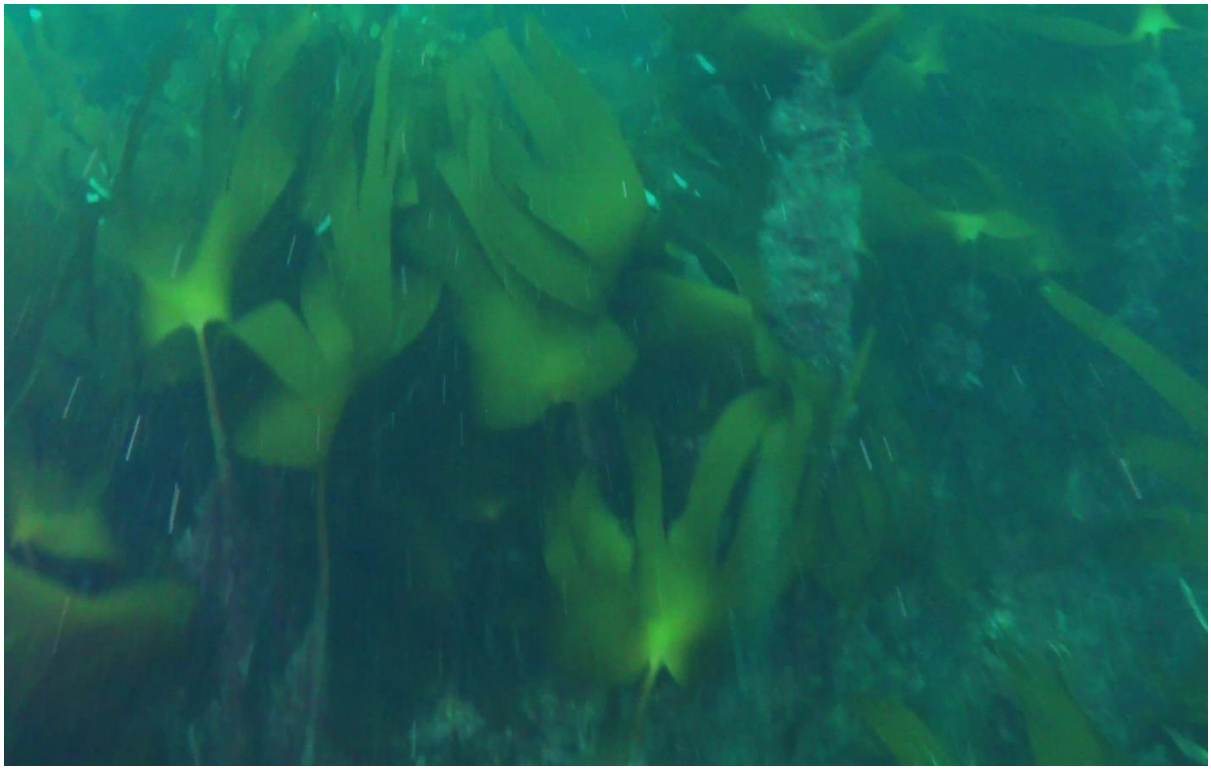

Figure A 10: EUNIS Habitat Code IR.MIR.KR.LhypTX.Ft