Scottish Natural Heritage
Research Report No. 924

Site condition monitoring of maerl beds and seagrass beds in the Sound of Barra SAC 2015 – diving survey

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
nature.scot

RESEARCH REPORT

Research Report No. 924

Site condition monitoring of maerl beds and seagrass beds in the Sound of Barra SAC 2015 – diving survey

For further information on this report please contact:

Lisa Kamphausen
Scottish Natural Heritage
Great Glen House
Leachkin Road
INVERNESS
IV3 8NW
Telephone: 01463 725014
E-mail: lisa.kamphausen@nature.scot

This report should be quoted as:

Bunker, F.StP.D., Mercer, T.M., Howson, C.M., Moore, J.M., Diaz, P., Maggs, C.A. & Kamphausen, L. 2018. Site condition monitoring of maerl beds and seagrass beds in the Sound of Barra SAC 2015 – diving survey. *Scottish Natural Heritage Research Report No. 924*.

RESEARCH REPORT

Summary

Site condition monitoring of maerl beds and seagrass beds in the Sound of Barra SAC 2015 – diving survey

Research Report No. 882
Project No: 015666
Contractor: Aquatic Survey & Monitoring Ltd.
Year of publication: 2018

Keywords

marine survey; Sound of Barra SAC; maerl beds; seagrass beds; *Zostera marina*

Background

This report presents results of a survey which collected detailed biological information of seagrass beds and maerl beds in the Sound of Barra SAC. The survey built on previous broadscale mapping studies in the Sound of Barra SAC to continue inventory sampling, fill in gaps in coverage, and establish baseline monitoring with a focus on maerl beds and seagrass beds. Due to weather conditions it was not possible to study the extensive maerl beds on the eastern, more open side of the SAC by diving. The survey is part of an ongoing programme of remote video, grab sampling and diver surveys in the Sound of Barra SAC. Together the results from these surveys will contribute to informing the development of management measures for the site.

Main findings

- The shallow maerl beds on the west side of the Sound of Barra SAC contain a high proportion of live maerl and are species rich, including the endemic maerl bed algal species *Gelidiella calcicola* and *Cladophora rhodolithicola*.
- Three maerl species were found in the sites studied; *Phymatolithon calcareum*, *Phymatolithon lusitanicum* and *Lithothamnion corallioides*. The last two are new records for Scotland.
- The infauna of the maerl beds is rich and interesting with a diverse community composed mainly of polychaetes, crustaceans and bivalves. Occasional flame shell specimens were recorded.
- The infaunal assemblages found in the maerl in different areas within the SAC were distinctly different from one another, presumably reflecting the different hydrographic regimes.
- Maerl study site S18 to the east of the Eriskay causeway had a far greater silt content than the other maerl beds, and little live maerl. This is likely due to the lack of water movement caused by the road causeway.
- The seagrass beds to the west of the Eriskay causeway harbour a diverse associated community including the stalked jellyfish *Lucernariopsis campanulata* and the sea anemone *Anthopleura ballii*. To the east of the Eriskay causeway, seagrass is sparse and

covered in the epiphytic brown seaweed *Ectocarpus fasciculatus.* This difference is likely due to the lack of water movement on the east side of the causeway.

For further information on this project contact:
Lisa Kamphausen, Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW.
Tel: 01463 725014 or lisa.kamphausen@nature.scot
For further information on the SNH Research & Technical Support Programme contact:
Research Coordinator, Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW.
Tel: 01463 725000 or research@nature.scot

Table of Contents **Page**

Acknowledgements

The authors wish to thank local suppliers for assistance during the survey work.

Francis Bunker wishes to thank Dr. Pilar Diaz for identification work carried out on maerl samples and Professor Christine Maggs and for identifying the red encrusting seaweeds. Thank you to Javier Cremades for checking the identity of *Mesogloia vermiculata*.

1. INTRODUCTION

The Sound of Barra Special Area of Conservation (SAC) was designated for two Annex 1 European Habitats (European Commission, 1992):

- Sandbanks that are slightly covered by seawater all the time (including beds of maerl and *Zostera marina* and a range of coarse and fine sediment habitats)
- Reefs (including kelp forest, seaweed dominated habitats and a wide range of shores of different exposure).

Seabed habitat mapping surveys of the Sound of Barra SAC were undertaken in 2001 (Bates *et al*., 2004) and 2006 (Harries *et al*., 2007). These studies used acoustic survey and satellite image classification techniques validated by biological sampling to generate full coverage mapping. The predicted distribution of seabed biotopes is given in Figure 1.

The 2015 survey by Aquatic Survey and Monitoring Ltd. (ASML) repeated biological sampling at some former survey stations as well as studying some new locations in the SAC. The sampling was designed to assess a number of attributes of the seagrass beds and maerl beds, including the density of seagrass, the percentage cover of live maerl and the nature of the associated epibiota and infauna. Sample stations were planned to cover the range of maerl beds and seagrass beds present at different depths and levels of exposures, and to give a broad coverage across the site.

The survey employed the following range of sampling techniques:

- Drop-down video sampling
- Grab sampling
- Diver sampling
- Snorkelling / viewing bucket sampling

The planning, staffing, organisation and completion of the field survey and the analysis and reporting of the data was carried out by Aquatic Survey and Monitoring Ltd. in cooperation with Scottish Natural Heritage (SNH). SNH provided two members of diving survey staff for the duration of the survey. Dive survey boats were chartered from local companies.

1.1 Survey aims

The aims of the survey as specified by SNH were as follows:

- Continue baseline and inventory sampling to fill in gaps in coverage, with a focus on maerl beds and seagrass beds
- Establish baseline monitoring of the maerl bed and seagrass bed habitat features.

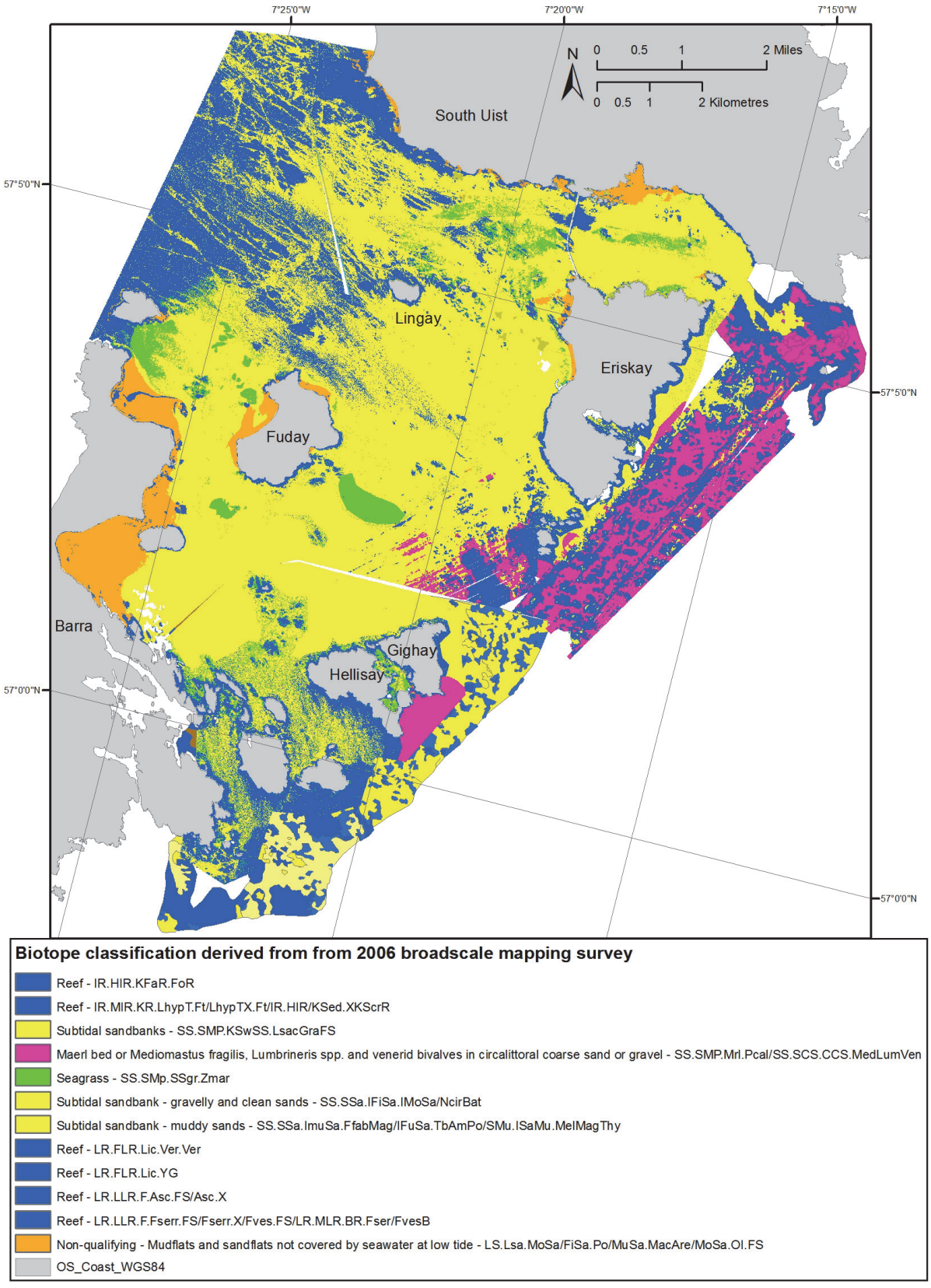


Figure 1. Predicted distribution of seabed habitats in the Sound of Barra in 2015 - see Bates et al. (2004) and Harries et al. (2007) (© Crown copyright and database right 2018. Ordnance Survey 100017908). Updated predictive mapping for the Sound of Barra and other protected areas was created in 2017, and is reported in Miller et al. 2017.

2. METHODS

The diving survey took place between Monday 7th September 2015 and Saturday 12th September 2015. The diving team consisted of personnel from ASML and SNH and worked from the charter vessel *Island Adventurer* of Uist Sea Tours. The boat operated from the boat jetty at Arcasaid Mor on the east side of Eriskay and from the ferry terminal on the west side of Eriskay.

2.1 Maerl monitoring transects

Five re-locatable maerl bed transects were established and studied (Stations S18, SA110, SOBX47, SOBX47B, SOBX17). Location information is given in Figure 2 and Table 1.

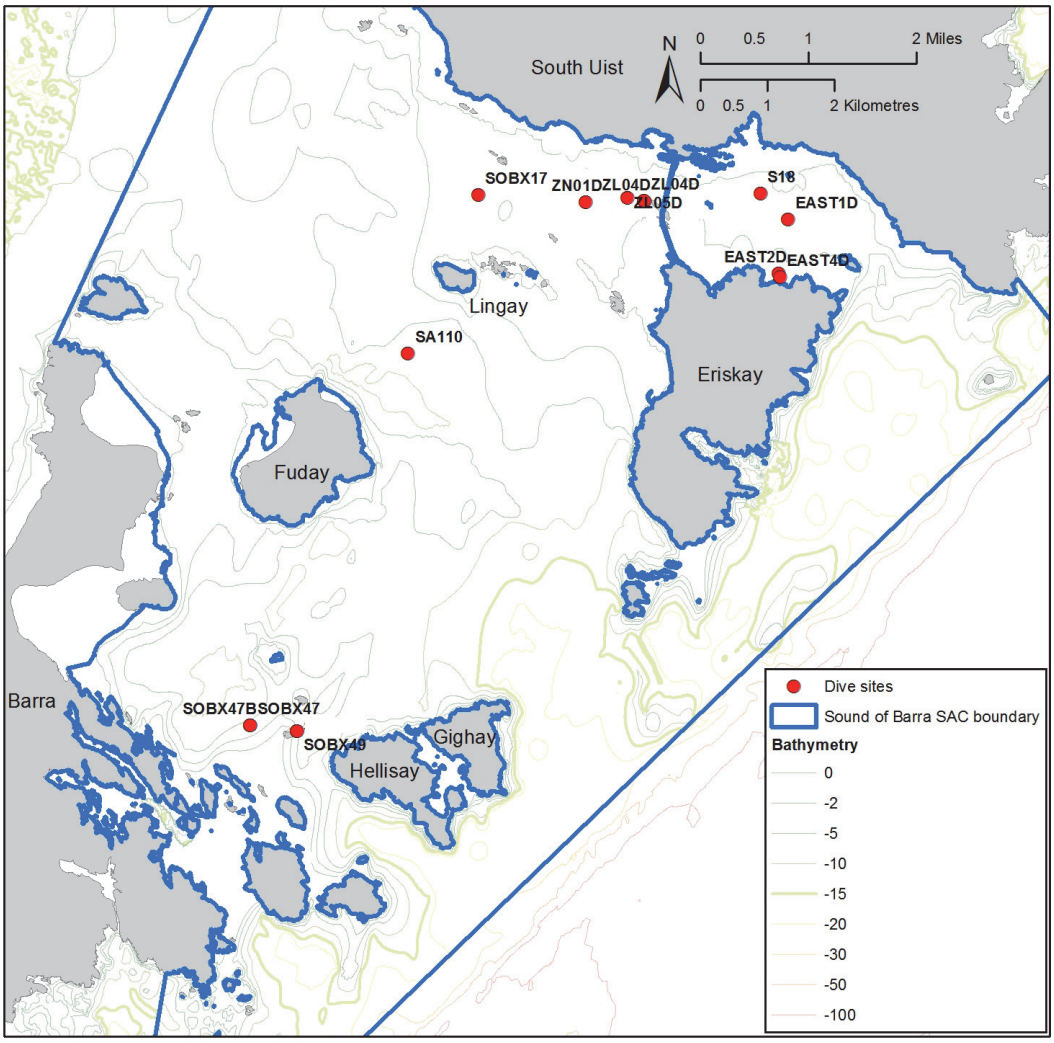


Figure 2. Dive survey sites 2015. (© Crown copyright and database right 2018. Ordnance Survey 100017908).

Table 1. Sites surveyed by diving in 2015 with location information (co-ordinates according to WGS 84 datum). FB = Francis Bunker, CH = Christine Howson, JM = Jon Moore, TM = Tom Mercer, BJ = Ben James, RM = Roddy McMinn

Site	Method	Latitude	Longitude	Surveyors	Date
S18	Maerl transect	57.10082	-7.2951	FB, CH, JM, TM	07/09/2015
SA110	Maerl transect	57.06861	-7.36984	FB, CH, JM, TM, BJ & RM	08/09/2015
SOBX47	Maerl transect	57.01545	-7.38483	FB, CH, JM, TM, BJ & RM	10/09/2015
SOBX47B	Maerl transect	57.01545	-7.38483	FB, CH, JM, TM, BJ & RM	11/09/2015
SOBX17	Maerl transect	57.09144	-7.36263	FB, CH, JM, TM, BJ & RM	12/09/2015
SOBX49	Maerl Phase 2	57.01627	-7.37341	JM, BJ	10/09/2015
ZN01D	*Zostera* phase 2	57.09398	-7.33649	CH, JM	09/09/2015
ZL05D	*Zostera* phase 2	57.09595	-7.32681	FB, BJ	09/09/2015
ZL04D	*Zostera* phase 2	57.09599	-7.32247	TM, RM	09/09/2015
ZL04D	Core samples	57.09613	-7.32257	TM, BJ	12/09/2015
EAST2D	*Zostera* phase 2	57.09107	-7.28597	CH, JM	09/09/2015
EAST1D	*Zostera* phase 2	57.09843	-7.28695	FB, BJ	09/09/2015
EAST4D	*Zostera* phase 2	57.09071	-7.28542	TM, RM	09/09/2015

At each of the re-locatable transect sites the ratio of live to dead maerl was determined from ~20 0.25m^2 quadrats, core samples were collected for infaunal analysis, an *in situ* assessment of epibiota communities was conducted and photographic and video records were captured.

Selection of study sites was based on several criteria:

1. The results of previous studies (Bates *et al.,* 2004, Harries *et al.,* 2007, James *et al.,* 1999a, 1999b, 2000).
2. The results of drop down video in July 2015 and September 2015.
3. Prevailing weather from the east which prevented diving in the east of the site.
4. A maximum depth of 20 m was determined to give divers sufficient bottom time to complete the studies within the time frame of the survey.

Previous studies had been conducted at all sites except sites SOBX49 and SOBX17. Details of the previous studies conducted at the different locations are given in Table 2. Note that the shot marker for sites SOBX47 and SOBX47B was in the same location but the transects were laid out along different compass bearings. The transect at SOBX47 traversed maerl that was predominantly dead and the transect at SOBX47B traversed maerl that was predominantly live.

Table 2. Sites studied in 2015 with information on previous studies at the sites (DDV = Drop Down Video).

Site Name 2015	**Study 2015**	**James *et al.*, 1999a**	**James *et al.*, 2000**	**Bates *et al.*, 2004**	**Harries *et al.*, 2007**	**ASML July 2015**	**ASML / SNH Sept 2015**
S18	Maerl transect	✓- Diving (Site 12 drift dive in vicinity of this site)				✓- DDV	
SA110	Maerl transect	✓-Dive in vicinity		✓- DDV	✓-Dives in vicinity		
ZN01D	*Zostera* phase 2				✓- Diving		
ZL05D	*Zostera* phase 2				✓- Diving		
ZL04D	*Zostera* phase 2				✓- Diving		
EAST2D	*Zostera* phase 2				✓- Diving		
EAST1D	*Zostera* phase 2				✓- Diving		
EAST4D	*Zostera* phase 2	✓- Diving (Site 16 nearby)					✓- Diving
SOBX49	Maerl Phase 2						✓- Diving
SOBX47	Maerl transect		✓- Grab (Nearby sites 7.1, 7.2 and 7.3)				✓- Diving
SOBX47B	Maerl transect			✓- Diving (Site DS3 near - labelled IMS.Lsac)			✓- Diving
ZL04D	cores samples				✓- Diving		
SOBX17	Maerl transect						✓- Diving

2.1.1 MNCR Phase 2 – style diver surveys

Study sites were located using handheld GPS units and once on site, a weighted and buoyed shot line was deployed to mark the site. A pair of divers descended to the seabed and screwed in an auger as a permanent site marker (Figure 3). A tape was then attached to the base of the shot line and run out to 25 m over suitable maerl habitat and weighted at the far end (Figure 4). A compass bearing was taken of the transect line for later relocation purposes.

The pair of divers swam either side of the tape from the 25 m mark to 0 m recording the macrobiota present and its abundance in a band 2 m either side of the tape using Marine Nature Conservation Review (MNCR) phase 2 methodology (Hiscock, 1996). A maximum time of 60 minutes was spent undertaking this survey. Samples of biota were collected for later laboratory identification (Figure 5). Still photographs were also taken to illustrate the habitat and biota present along the transect. Figures 3 - 8 illustrate the dive survey work.

Figure 3. Auger screwed into sediment as permanent marker.

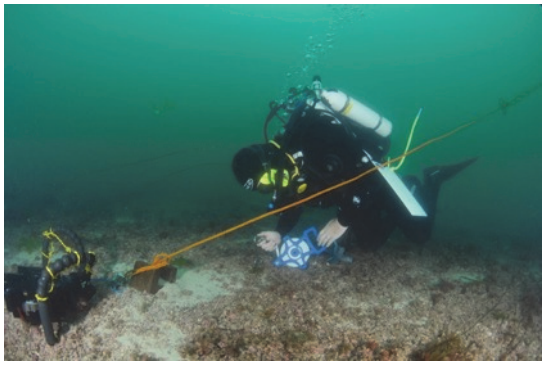


Figure 4. Diver prepares to attach and deploy transect tape with weighted reel.

Figure 5. Diver identifying, recording and collecting specimens during phase 2 survey of transect.

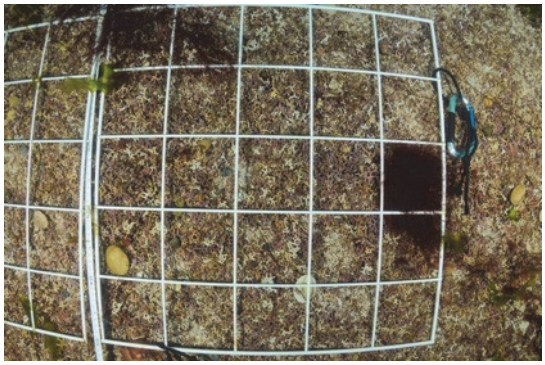


Figure 6. Quadrat in position for live and dead maerl percentage cover recording.

Figure 7. Divers on seabed by shot with survey equipment and preparing for core sampling.

Figure 8. Diver with core.

2.1.2 Quadrat studies, video recording and core sampling

Once the first pair of divers had returned to the boat, a second and third pair of divers descended to the transect. The second pair took underwater video of the transect together with estimates of percentage cover of live and dead maerl within at least 20 randomly placed 0.25 m² quadrats (normally 10 per diver). The quadrats were also photographed (Figure 6). The random positions of the quadrats were restricted to the 2 m band either side of the tape, and pre-determined on the surface prior to the dive as positions along and away from the tape.

The third pair carried out core sampling and sampling for small algae. The pair of divers was equipped with four diver corers for macrobenthic infaunal sampling, a pot for a particle size distribution analysis (PSA) sample and five fine meshed maerl algae bags. A small clip weight was used to help the divers drive the diver corers into the sediment to a depth of 20cm (minimum) before they were securely capped, extracted from the sediment and retained. The corers were constructed from 35cm lengths of 100mm diameter MDPE drainpipe. The PSA sample consisted of a sediment sample taken from the top 50 mm of the undisturbed seabed. The diver cores and PSA samples were all collected from random locations within 5 m of the shot weight.

2.1.3 Identification of cryptic seaweeds

Some of the small and finely branched seaweeds associated with maerl can only be identified reliably with the aid of a microscope. In order to cover this aspect of the maerl-bed biotope, samples of maerl and sediment were collected from five randomly selected decimetre squares in the vicinity of the transect. The surface 30 mm of maerl within these decimetre squares were sampled carefully by hand and placed in mesh bags with a 1mm mesh size and sealed with Velcro fastenings.

2.1.4 Identification of red encrusting seaweeds

Specimens of encrusting red seaweeds and other organisms which could not be identified in the field were also collected for later species determination. Identification was carried out by Christine Maggs (Bournemouth University).

Samples were collected from field sites and preserved in 4% formalin in seawater. The samples were identified using thin sections (using razor blades), microscopical examination and reference to the following identification keys: Irvine and Maggs (1983), Maggs *et al*. (1983) and Irvine (1983).

2.1.5 Identification of maerl species

Samples of live maerl were collected at each site for identification with molecular techniques, specifically examining the genetic bar code, COI-5P (the 5' end of the mitochondrial DNA encoded sub-unit COI or cytochrome oxidase subunit I). The analytical methodology broadly followed that outlined in Peña *et al.* (2015).

Eighteen specimens were air dried and preserved in sealed bags with silica gel and dispatched to Bournemouth University. Prior to processing, samples were photographed, the surface of the specimens was cleaned of epiphytes using a toothbrush, and surfaces selected under a stereomicroscope were broken and powdered using a hammer for DNA extraction.

Genomic DNA was extracted using a NucleoSpin® 96 Tissue kit (Macherey-Nagel, GmbH and Co. KG, Germany) following the manufacturer´s instructions. The mitochondrial COI-5P fragment was PCR-amplified using the primer pair GWSFn (forward; Le Gall and Saunders (2010) and GWSRn (reverse; Saunders unpublished; http://v2.boldsystems.org/views/primerlist.php). PCR reactions used the MyTaq™ DNA Polymerase (Bioline) and were performed in 25 µl containing 1 µl of DNA template, 5 µl of PCR buffer, 1 µl 10 µM of each primer, 16.875µl MilliQ ® and 0.125 µl 1U/µl of Taq DNAPolymerase. The thermal profile for PCR amplification for COI-5P included an initial denaturation at 95°C for 2 min followed by 35 cycles of 30 s denaturation at 94°C, 30 s annealing at 45°C and 90 s of extension at 72°C followed by an additional 5 min at 72°C.

PCR products were purified and sequenced by Beckman Coulter Genomics (Bishop's Stortford, England). Sequences were assembled, aligned and adjusted by eye using Geneious R6 (6.1.8) (http://www.geneious.com, Kearse *et al.* (2012)).

The COI-5P sequences of the holotype of the maerl-forming species *Phymatolithon calcareum* (KF808323) and *Phymatolithon lusitanicum* (KC861627) were obtained from GenBank (Pardo et al., 2014, Peña et al., 2015). In addition, BOLD and GenBank databases were searched for publicly available sequences of European maerl species.

Sequence comparisons were conducted on 28 sequences (10 downloaded from GenBank and 18 newly produced), using uncorrected-p distance. Distance analyses were performed using the neighbour joining method. Information on vouchers and GenBank accession numbers are given in Table 11.

2.1.6 Infaunal Studies

Once the core samples were returned to the shore, the sediments were sieved over a 1 mm mesh. This was carried out using sea water on the foreshore near the accommodation. Care was taken not to contaminate the samples with shore organisms during this operation. The sieved residue was placed in a container labelled inside and out with the site name, replicate number, date taken and sieve mesh size. The samples were then fixed in a 10% formaldehyde solution and labelled toxic and hazardous. Full PPE was used at all times and in strict adherence to the ASML formaldehyde handling protocol. The sediment sample collected for particle size distribution analysis was labelled and frozen for transport back to the laboratory.

The analysis of marine macrobenthic samples adhered to the mandatory sections of the NMBAQC Processing Requirement Protocol (Version 1.0) which conforms to EN ISO 16665:2005 and BS EN 14996:2006. All four replicate cores taken at each station were processed and analysed. The macrobenthic samples were processed by Tom Mercer.

Each of the fixed and preserved infaunal samples was carefully washed in freshwater to remove the formalin, transferred into labelled buckets and Rose Bengal added to stain the biological material in order to facilitate the sorting process. Samples were then placed in gridded white trays, systematically examined by eye and all fauna picked out, sorted into phyletic groups and placed in vials in 70% industrial methylated spirit.

The extracted biota was identified to the lowest possible taxonomic group using a combination of binocular stereo microscopes and high magnification binocular compound microscopes and counted. Where possible all organisms were identified to species level according to the nomenclature of the World Register of Marine Species (WoRMS) with species codes (where available) consistent with Howson & Picton (1997). Taxonomic literature used was consistent with the NMBQAC Taxonomic Literature database (version 107), including use of relevant journal papers, unpublished workshop keys (primarily from NMBAQC workshops), internet keys and internal documents compiled from these sources.

All whole organisms were identified and counted. Damaged or incomplete specimens were identified and counted only if the head was present, otherwise parts of organisms were recorded but not enumerated. Juveniles were recorded as such when identification to species level was not possible due to the under-development of key features, or if the specimen was less than 10% of the average adult body size.

2.1.7 Particle size distribution analysis

PSA analysis was carried out by Hebog Environmental Ltd. using a dry sieving technique and sieves conforming to the Wentworth scale. Approximately 80 g of sediment was oven dried at 100°C until constant weight was reached. The dried sediment was weighed and washed through a 63 µm sieve. The effluent, which contained the mud/silt fraction (< 63 µm) was not retained. The remaining sediment was again oven dried at 100°C until constant weight was reached. This weight was recorded and the percentage of the mud/silt fraction (< 63 µm) was calculated as the difference between these two weights. The fractions > 63 µm were transferred to the coarsest of a series of stacked sieves, placed on an automatic shaker for 15 minutes and the contents of each sieve weighed. Fractions are > 8 mm, 4 – 8 mm, 2 – 4 mm, 1 – 2000 µm, 500 – 1000 µm, 250 – 500 µm, 125 – 250 µm, 63 – 125 µm and < 63 µm. All fractions were weighed to an accuracy of ± 1 mg.

2.1.8 Loss on ignition analysis

This analysis was also performed by Hebog Environmental Ltd. It was carried out in order to determine the amount of organic matter found in the sediment and available to the macrobenthic infauna. Approximately 10 g of sediment were placed in a ceramic crucible and dried at 100°C in an oven. The sample was weighed to an accuracy of ± 1 mg and heated to 550°C for four hours. The crucible was placed over a desiccant to cool and then re-weighed. This methodology followed Holme and McIntyre (1984).

2.2 Sound of Eriskay monitoring

Sampling locations within the Sound of Eriskay were chosen to study the distribution and condition of the seagrass beds and maerl beds. A map showing the location of these sites is given in Figure 9 and coordinates for these stations together with the nature of the studies undertaken are given in Table 1. Apart from the maerl transect stations established at SOBX17 and S18, the other locations had been studied in former surveys (seeTable 2).

The 2006 survey (Harries *et al.,* 2007) had visited a station in this area, and it was intended to revisit it in 2015. However, since this station was adjacent to the causeway on its eastern side and live maerl was no longer present, the decision was made to discontinue monitoring this station.

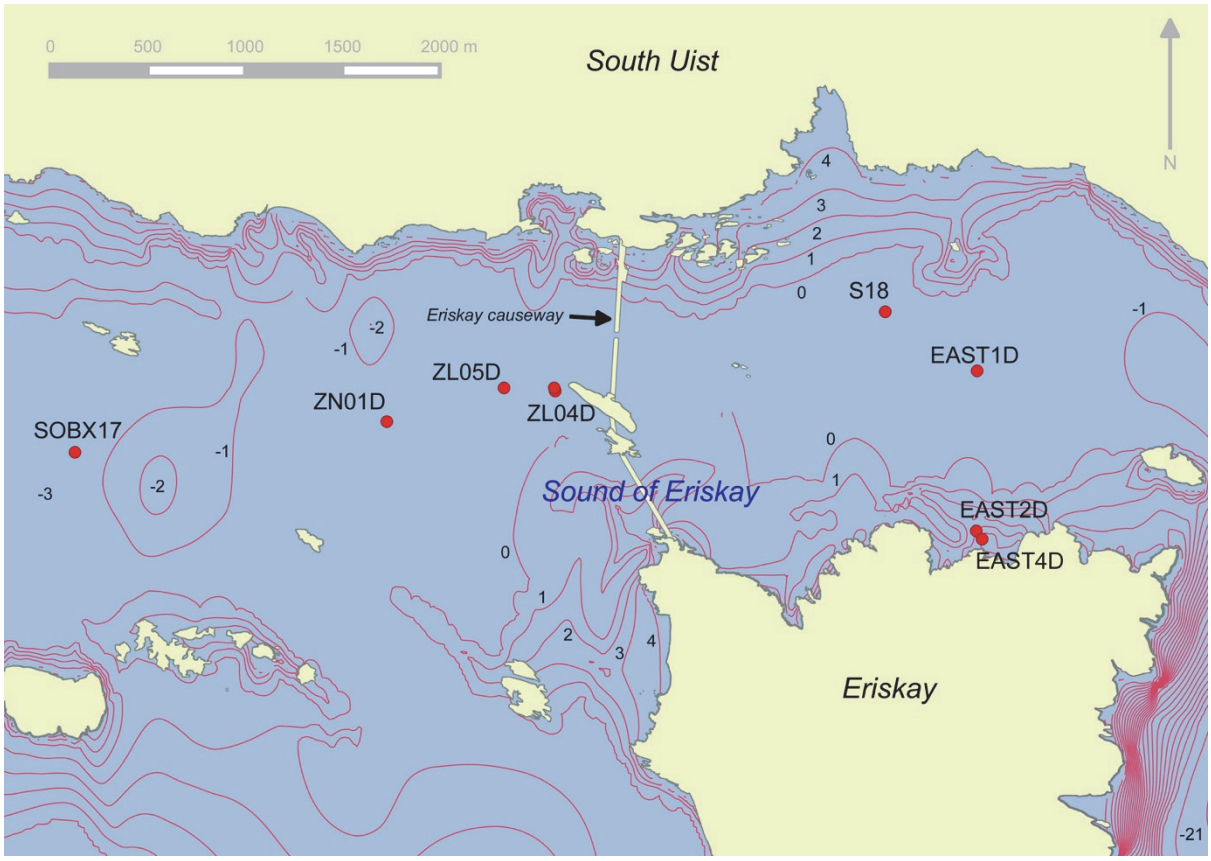


Figure 9. Map to show dive sites in the Sound of Eriskay studied in 2015. © British Crown and OceanWise, 2018. All rights reserved. License No. EK001 - 20140401. Not to be used for Navigation.

2.2.1 Zostera *dives*

MNCR Phase 2 - style dive surveys were carried out at six sites supporting *Zostera marina*; three either side of the causeway. Each of these sites had been studied previously (seeTable 2). The nature of the *Zostera* beds within the Sound was very patchy, particularly on the east side of the causeway, and on some occasions no *Zostera* was found at the coordinates of the planned stations. In these cases, if there was a patch within 15 m of the coordinates, then this was surveyed. In cases where there were no nearby patches of *Zostera* the site was not studied. Due to bad weather, including strong easterly winds for most of the survey, the water to the east side of the causeway was turbid and it was not easy to locate *Zostera* by looking over the side of the boat, even in shallow water. A snorkeller therefore checked the sea bed prior to divers being deployed.

At each study site two pairs of divers were deployed. The first pair carried out Phase 2 style recording and photography, and the second pair collected video footage. Core samples were collected at two *Zostera* study sites. The method for Phase 2 recording followed Hiscock (1996), and the method for coring was as described for the maerl bed in section 2.1.6.

2.2.2 Zostera *transects*

In 2006, Harries *et al.* (2007) studied three north-to-south running *Zostera* transects on the east side of the Eriskay causeway. The presence and abundance of *Zostera* was assessed using a viewing bucket lowered over the side of the boat.

During the 2015 survey portions of these three transects were repeated by making observations at a number of recorded waypoints along those transects, using a viewing bucket lowered over the side of the boat (see Figure 32 and Figure 33). The methodology involved recording the presence or absence of *Zostera* and a qualitative assessment of its patchiness.

Unfortunately the transect positions of the 2015 survey did not coincide exactly with the transects studied in 2006 due to errors in converting the UTM coordinates system used in Harries *et al.* (2007) to WGS 84 (the system used for the 2015 survey).

2.3 Nomenclature and quality control

All nomenclature in this report follows the web based WoRMS (World Register of Marine Species) by Boxshall *et al.* (2015).

The filamentous sporophyte phases of the red algae *Bonnemaisonia hamifera* and *Asparagopsis armata* were both common in the study sites. These have been referred to by their commonly used names *Trailliella* and *Falkenbergia* respectively in most of this report.

2.3.1 Quality assurance of Phase 2 data

Data quality assurance of the Phase 2 data was based on the following system:

- Specimens of key / difficult to identify species were collected for later identification and verification.
- A catalogue of specimens has been collated (see ANNEX 1: Specimen Catalogue).
- Identifications and abundances were entered into a bespoke Access database together with information on voucher specimens and / or confidence.

2.3.2 Quality assurance of the infaunal core data

The diver cores were sorted in the laboratory at Aquatic Environments. Ten percent of the trays of sediment were checked for extraction efficiency by an independent assessor and a voucher collection containing specimens of each identified taxon has been lodged with National Museums Scotland.

2.4 Data analysis

The diver species records and those derived from the study of the collected epibiota, video footage and still photographs, have been collated into a species list with SACFOR abundance estimates. Based on the physical and biological data collected, biotopes have been allocated using Connor *et al*. (2004).

Samples have been sent to National Museums Scotland for incorporation into their reference collections (in accordance with the guidance in Annex 4).

3. RESULTS

The sites studied during the September 2015 diving survey are described below with work undertaken summarised in Table 3. A map showing the study sites is presented in Figure 2 and location information is given in Table 1. Results of the *Zostera* viewing bucket transects are presented in section 3.3.

Table 3. A summary of work undertaken at the sites studied by diving.

Site	Habitat	Cores	Phase 2 Study	Quadrats
S18	Maerl	✓	✓	✓
SOBX17	Maerl	✓	✓	✓
SA110	Maerl	✓	✓	✓
SOBX47	Maerl	✓	✓	✓
SOBX47b	Maerl	✓	✓	✓
SOBX49	Maerl & *Zostera*		✓	
ZN01D	*Zostera*		✓	
ZL04D	*Zostera*	✓	✓	
ZL05D	*Zostera*		✓	
EAST1D	*Zostera*		✓	
EAST2D	*Zostera*		✓	
EAST4D	*Zostera*		✓	

3.1 Maerl monitoring transects

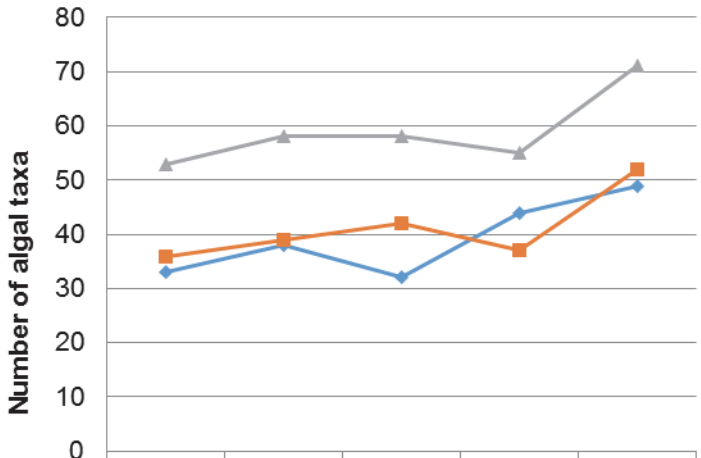
Each maerl monitoring transect is briefly described below, and full Phase 2 species and abundance data are presented in ANNEX 2: Species and Abundance Data for Maerl monitoring transects . Table 4 provides an overview of the number of species found at each location.

Table 4. Numbers of species recorded from the maerl monitoring transects.

	S18	SOBX17	SA110	SOBX47	SOBX47B
Transect algal taxa	36	39	42	37	52
Transect animal taxa	28	23	33	12	34
Total taxa	**64**	**62**	**75**	**49**	**86**

A list of the cryptic algae found in the samples of maerl gravel collected at each site and examined using a microscope is given in ANNEX 3: Seaweed species identified from maerl samples. The numbers of different algal taxa recorded from the samples at each site are given in Table 5, as well as a pooled count of taxa from both transect data and lab sample data.

Table 5. Seaweed species recorded from maerl samples examined in the laboratory versus transect records and pooled data.



	S18	SOBX17	SA110	SOBX47	SOBX47B
Lab sample algal taxa	33	38	32	44	49
Transect algal taxa	36	39	42	37	52
Pooled algal taxa (transect and lab)	53	58	58	55	71

The quadrat data for percentage of live and dead maerl collected *in situ* are given in ANNEX 4: Percentage live and dead maerl quadrat data.

3.1.1 S18 (East of Eriskay causeway, Figure 2 and Figure 9)

The sea bed was formed of fine sand, maerl and shell. Maerl formed an estimated 23% of the sediment with only 0.5% live, based on data from 22 quadrats along the transect. Much of the live maerl was partially bleached (Figure 10) and covered with fine sediment. The biota was characterised by a luxuriant growth of silted foliose algae. Dominant seaweeds included *Trailliella*, *Saccharina latissima*, *Dictyota dichotoma* and *Chorda filum*. The non-native *Dasysiphonia japonica* was also conspicuous. Large growths of *Griffithsia corallioides* were present and of interest was the presence of *Spyridia griffithsiana* and the endemic maerl bed species *Cladophora rhodolithicola* and *Gelidiella calcicola*.

Conspicuous animals included Sabellidae indet. worms, *Pecten maximus* spat, *Liocarcinus depurator* and frequent small *Gibbula cineraria*. A general view of the sea bed is shown in Figure 11.

Figure 10. Bleached maerl, typical of site S18.

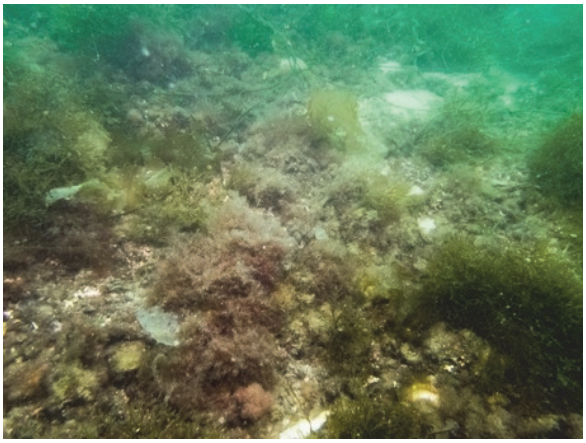


Figure 11. Trailliella, Dasysiphonia japonica and other foliose algae on sea bed.

3.1.2 SOBX17 (West of Eriskay causeway, Figure 2 and Figure 9)

The sea bed at SOBX17 was formed of a veneer of maerl over fine sand and shell (see Figure 12). The maerl formed an estimated 86% cover of the sea bed of which 83% was live (based on 20 quadrats along the transect). There were patches of foliose seaweed on the maerl, many of which were covered with fuzzy balls of *Falkenbergia,* which obscured their identity (see Figure 13). Other conspicuous seaweeds included the brown species *Saccharina latissima*, *Chorda filum* and *Sphacelaria* sp. Conspicuous red algae included the non-native *Dasysiphonia japonica* and growths of the gametophyte of *Asparagopsis armata*. Species endemic to maerl included *Cladophora rhodolithicola* and *Gelidiella calcicola*. Also of interest were the rarely recorded calcicole, *Ptilothamnion sphaericum* and the predominantly southern species *Spyridia griffithsiana*.

A variety of small animal species were present including numerous *Tectura virginea* and Rissoidae snails, and there were many *Dosinia exoleta* burrowing in the sediment.

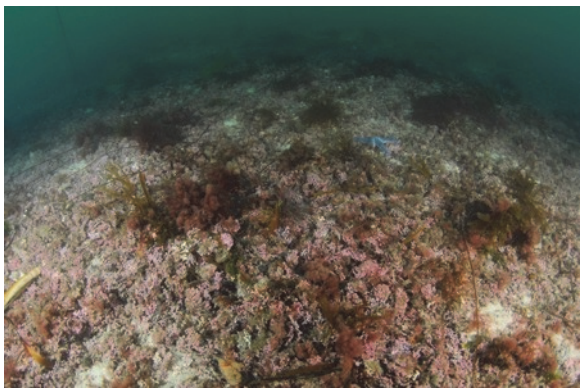


Figure 12. The maerl community at site SBX17.

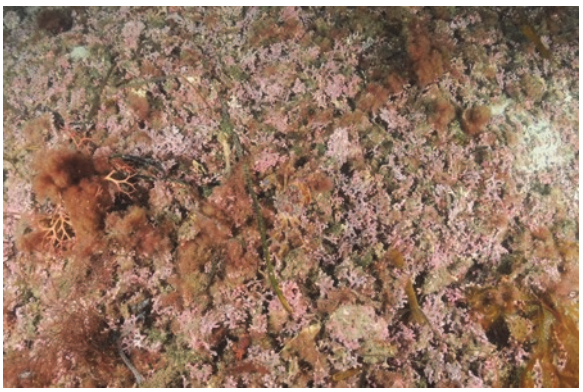


Figure 13. Close-up of maerl showing abundant Falkenbergia and Liocarcinus corrugatus at SBX17.

3.1.3 SA110 (Channel between Lingay and Fuday, Figure 2)

The sea bed at site SA110 was formed by maerl, with fine sand and shell (see Figure 14Figure 14). Maerl formed an estimated 95% cover of which 31% was live (based on 20 quadrats along the transect). There was a rich foliose algal community dominated by *Ceramium secundatum*, *Chorda filum*, *Saccharina latissima* and *Dictyota dichotoma* (see Figure 14). The endemic maerl bed species *Cladophora rhodolithicola* and *Gelidiella calcicola* were both found in collected samples. Of note was the presence of the non-native red alga *Grateloupia turuturu* with an abundance estimated as 'frequent'. A variety of small animal species were present with the crab *Liocarcinus corrugatus* recorded as 'frequent' (see Figure 15).

Figure 14. Maerl habitat at SA110 with conspicuous species foliose seaweeds; (r to l) Ceramium secundatum, Saccharina latissima and Grateloupia turuturu.

Figure 15. The camouflaged Liocarcinus corrugatus in the centre of the image, on maerl at SA110.

3.1.4 SOBX47 (East of Hellisay, Figure 2)

The sea bed at SOBX47 was composed of maerl with many dead shells, especially of the species *Dosinia exoleta* and *Tapes rhomboides.* Maerl covered most of the sea bed but only 3% was alive (Figure 16 - based on 20 quadrats along the transect). Foliose algae were common with large plants of *Cladostephus spongiosus*, *Ulva lactuca, Dictyota dichotoma*, and clumps of *Trailliella*. Two seaweeds endemic to maerl were recorded, *Cladophora rhodolithicola* and *Gelidiella calcicola*. Other species of note included the rarely recorded calcicole *Ptilothamnion sphaericum*, the morphologically similar *Spermothamnion strictum* and also the predominantly southern species, *Spyridia griffithsiana*. Also present was the non-native *Dasysiphonia japonica*.

Numerous *Gibbula magus (F)* and hermit crabs (*Pagurus bernhardus,* F) were present at this site (Figure 17).

Figure 16. Largely dead maerl habitat of SOBX47.

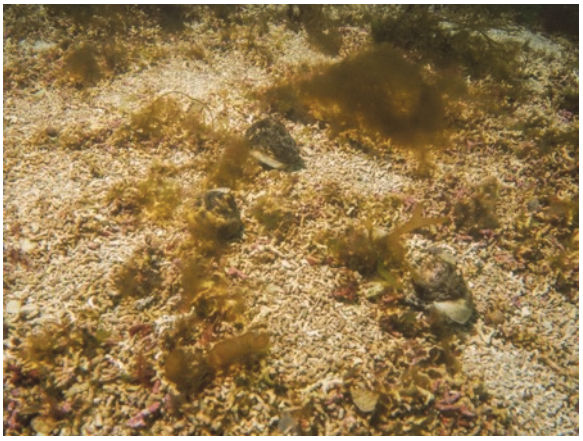


Figure 17. Group of Gibbula magus, a frequent species at SOBX47.

3.1.5 SOBX47B (East of Hellisay, Figure 2)

This site was a continuation of SOBX47, where percentage cover of live maerl increased to up to 80% (but averaging 46%, based on 20 quadrats) in a patchwork with dead maerl gravel (Figure 18). Many whole dead shells occurred amongst the maerl in the substratum including the species *Tapes rhomboides* and *Dosinia exoleta*. Foliose algae dominate the epibiota with *Dictyota dichotoma*, *Dasysiphonia japonica* and *Sphacelaria* sp. Samples of maerl taken back for laboratory examination were found to be the most species rich of all the sites with 49 species of epiphytic seaweed. Species included *Gelidiella calcicola,* which is endemic to maerl. Many of the whole shells were colonised with brown and red crustose seaweeds and fringed with *Sphacelaria* (Figure 19).

The most abundant epifauna were the small molluscs *Rissoa parva* (F) and *Tectura virginea* (F), while in the sediment (viewed as siphons on the surface) *Dosinia exoleta* (A) and to a lesser extent *Mya arenaria* (O) were numerous.

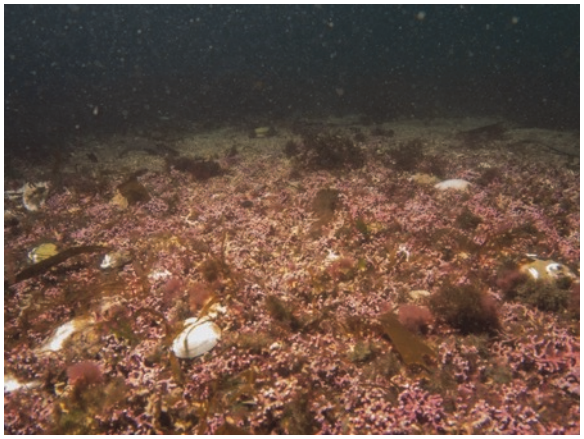


Figure 18. Dense patch of live maerl with shells and foliose seaweeds at SOBX47B.

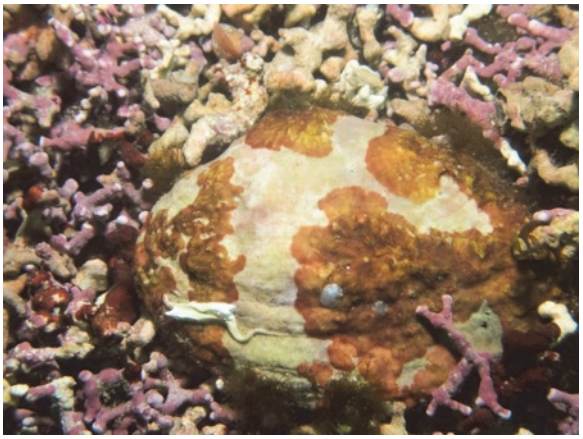


Figure 19. Peyssonnelia dubyi encrusting empty Tapes rhomboides shell fringed with the brown seaweed Sphacelaria sp. at SOBXS47B.

3.2 Phase 2 only studies

A map showing the location of study sites is presented in Figure 12 and location information is given in Table 1.

Phase 2 methodology (Hiscock, 1996) was used to study the sites described below. Species lists are given in ANNEX 5: Species and abundance data for phase 2 studies (on sites other than maerl monitoring transects). The number of species found at each location is given in Table 6.

Table 6. Numbers of species recorded from Phase 2 study sites.

	SOBX49_ Maerl	SOBX49_ Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Total seaweed taxa	21	11	11	23	24	24	12	8
Total animal taxa	15	8	18	13	15	12	21	16
Total taxa	**36**	**19**	**29**	**36**	**39**	**36**	**33**	**24**

3.2.1 SOBX49 (east of Hellisay)

This site was a mixed habitat of maerl and *Zostera marina* (Figure 20 and Figure 21).

The sea bed was formed from maerl gravel, fine sand and broken shell with cover of live maerl estimated to be approximately 20% (based on diver estimate while doing phase 2 recording). Communities were diverse with abundant *Trailliella*, frequent *Falkenbergia* and numerous other algae. Occasional large thalli of *Saccharina latissima* were present and the scallop *Pecten maximus* was occasional.

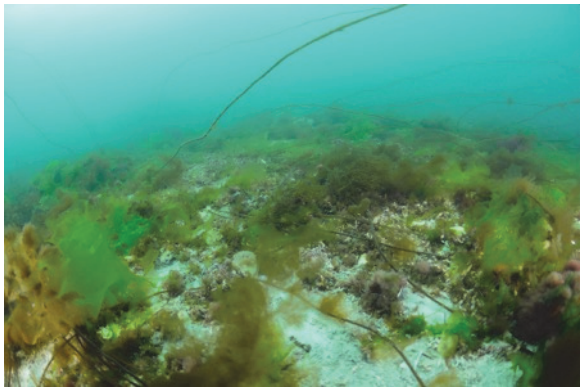


Figure 20. Patchy maerl on sandy sediment with foliose seaweeds at site SB0X49.

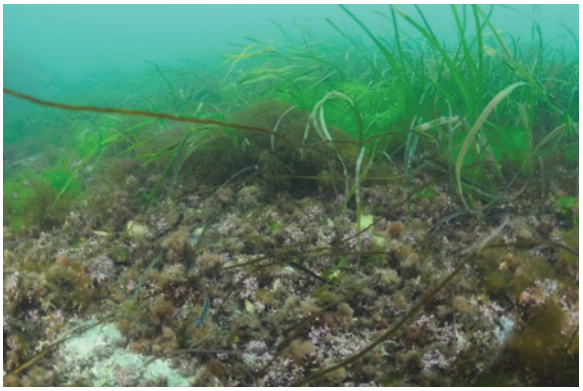


Figure 21. Interface between maerl and Zostera bed at site SB0X49.

3.2.2 ZN01D (west of Eriskay causeway)

This site comprised small patches of dense *Zostera marina* on fine sand (see Figure 22). Common algae at the edges and within the seagrass bed patches included *Chorda filum*, *Asparagopsis armata* (Figure 23) and *Chylocladia verticillata*. *Anemonia viridis* and Stauromedusae (stalked jellyfish) were common on *Zostera* leaves and *Carcinus maenas* (C) and *Pagurus bernhardus* (F) occurred on the sand.

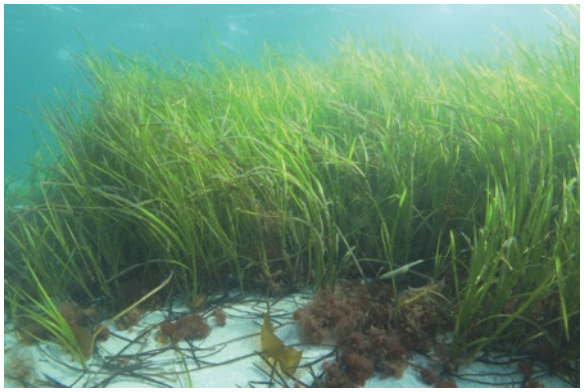


Figure 22. Dense patch of Zostera marina at ZZN01D.

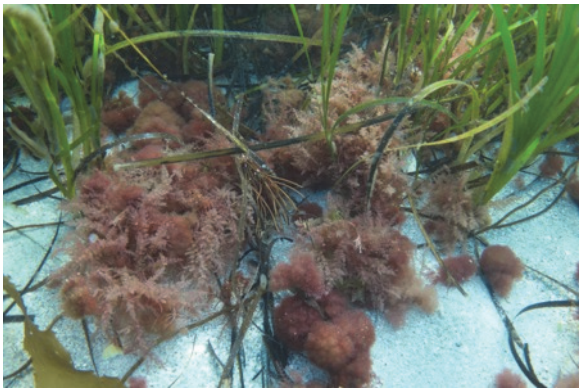


Figure 23. Asparagopsis armata and balls of Falkenbergia at edge of Zostera bed at site ZN01D.

3.2.3 ZL04D (West of Eriskay causeway)

The sea bed at ZL04D was composed of patches of dense *Zostera* with patches of bare sediment between. The sediment was 95% fine sand and 5% broken and whole shells. Seaweeds were common both at the edges and within the seagrass bed patches, and included *Chorda filum*, *Asparagopsis armata* and *Chylocladia verticillata*. Conspicuous animal species included *Diplosoma listerianum* (Figure 24), *Anemonia viridis* (Figure 25) and Stauromedusae (stalked jellyfish) on *Zostera* leaves. Life on the sand included *Carcinus maenas* and *Pagurus bernhardus*. Several *Anthopleura ballii* anemones were noted in the sand and the 15 spined stickle-back, *Spinachia spinachia* and the crab *Hyas araneus* were present amongst the *Zostera* leaves with two-spot gobies, *Gobiusculus flavescens* and small gadoids above the beds.

Figure 24. Diplosoma listerianum on Zostera marina leaves at site ZL04D.

Figure 25. Anemonia viridis on Zostera leaves at site ZL04D.

3.2.4 ZL05D (West of Eriskay causeway)

The site consisted of a dense area of *Zostera marina* on a clean sandy sea bed. Foliose algae were present within the bed but were most conspicuous around the edges including *Trailliella*, *Falkenbergia*, *Asparagopsis armata*, *Mesogloia vermiculata* and *Chondrus crispus*. A variety of species were conspicuous on the *Zostera* leaves, including Ectocarpaceae, *Anemonia viridis* the stalked jellyfish *Lucernariopsis campanulata* (Figure 28) and *Diplosoma listerianum*. More cryptic species included the hydroid *Laomedea flexuosa* and many small gastropods including *Tricolia pullus* and *Rissoa parva*. Of note was the red encrusting seaweed *Rhodophysema georgii* which is endemic to *Zostera*. The scarce

anemone *Anthopleura ballii* (Figure 27) was recorded in the sediment below the *Zostera* sward.

Figure 26. Lucernariopsis campanulata on Zostera marina at site ZL05D.

Figure 27. Anthopleura ballii at site ZL05D.

3.2.5 EAST1D (East of Eriskay causeway)

This site comprised patches of sparse *Zostera marina* on sand. The *Zostera* and foliose algae were smothered by Ectocarpaceae (see Figure 28 and Figure 29). Conspicuous foliose algal species included *Asparagopsis armata, Gracilariopsis longissima* and *Chorda filum*, *Ulva lactuca* and *Cladophora hutchinsiae*.

Animals associated with the sediment included *Lanice conchilega, Crangon vulgaris* and *Carcinus maenas*.

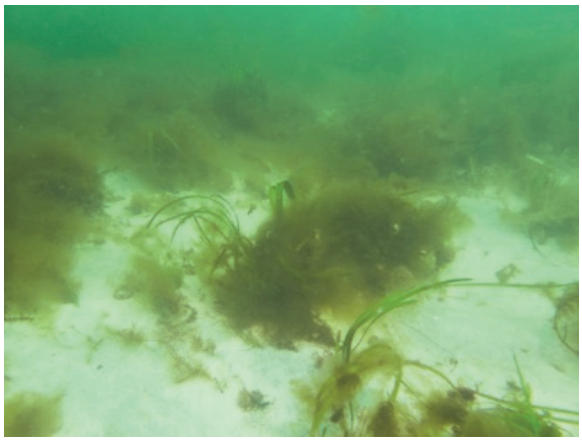


Figure 28. Patchy Zostera marina coated with Ectocarpaceae at site EAST1D.

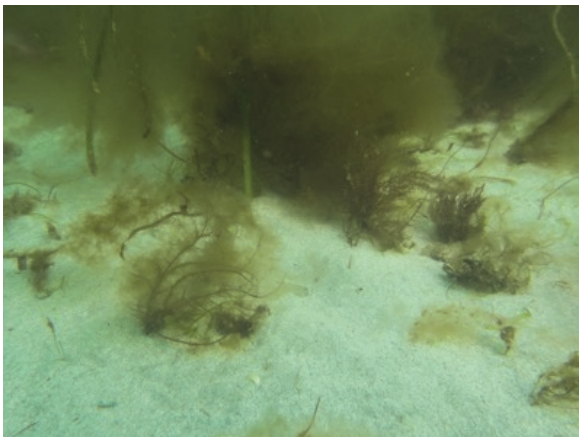


Figure 29. Foliose algae coated with Ectocarpaceae at site East 1D.

3.2.6 EAST2D (East of Eriskay causeway)

The sea bed was formed of patches of *Zostera marina* with sandy sediment between (composed of 95% fine sand and 5% whole shell). The *Zostera* at this site was smothered in super abundant Ectocarpaceae. Despite the Ectocarpaceae, there were several epiphytes on the *Zostera* leaves (see Figure 31). Numerous other algae were present, particularly *Dictyota dichotoma*, *Chylocladia verticillata* and *Ulva* (tubular). Numerous *Carcinus maenas*,

Macropodia tenuirostris and *Pagurus bernhardus* were present. *Echinocardium caudatum* and *Ensis* sp. were common in the sand. Also present was the sea anemone *Cereus pedunculatus* (Figure 30).

Figure 30. Cereus pedunculatus in sediment

Figure 31. Rissoa parvula and Laomedea flexuosa on Zostera leaf.

3.2.7 EAST4D (East of Eriskay causeway)

The sea bed comprised small beds of *Zostera marina* with bare sand between. The *Zostera* was smothered in super abundant Ectocarpaceae. Numerous other algae were present, particularly *Dictyota dichotoma*, *Chylocladia verticillata* and *Ulva* (tubular). Numerous *Carcinus maenas*, *Macropodia tenuirostris* and *Pagurus bernhardus* were present. Rissoid molluscs and juvenile top shells occurred on the *Zostera*, which had some disease on the leaves. *Arenicola* sp. were present in the sand.

3.3 *Zostera* transects

The positions of the *Zostera* transects are given in Figure 32 and Figure 33.

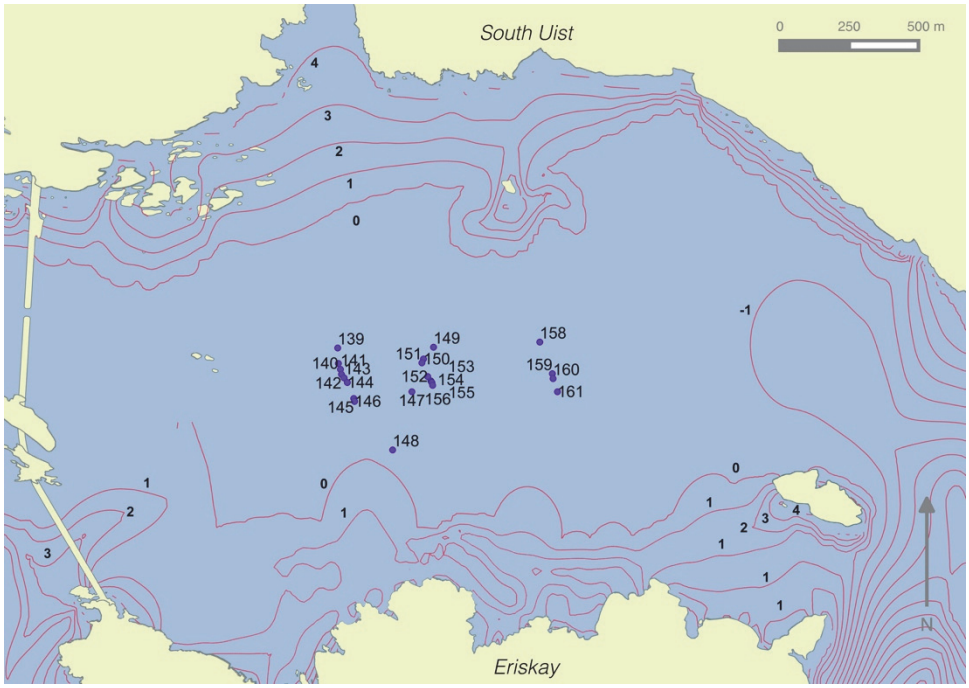


Figure 32. Map to show overview of waypoints surveyed during snorkelling Zostera transect studies east of the Eriskay causeway.© British Crown and OceanWise, 2018. All rights reserved. Licence No. EK001 - 20140401. Not to be used for Navigation.

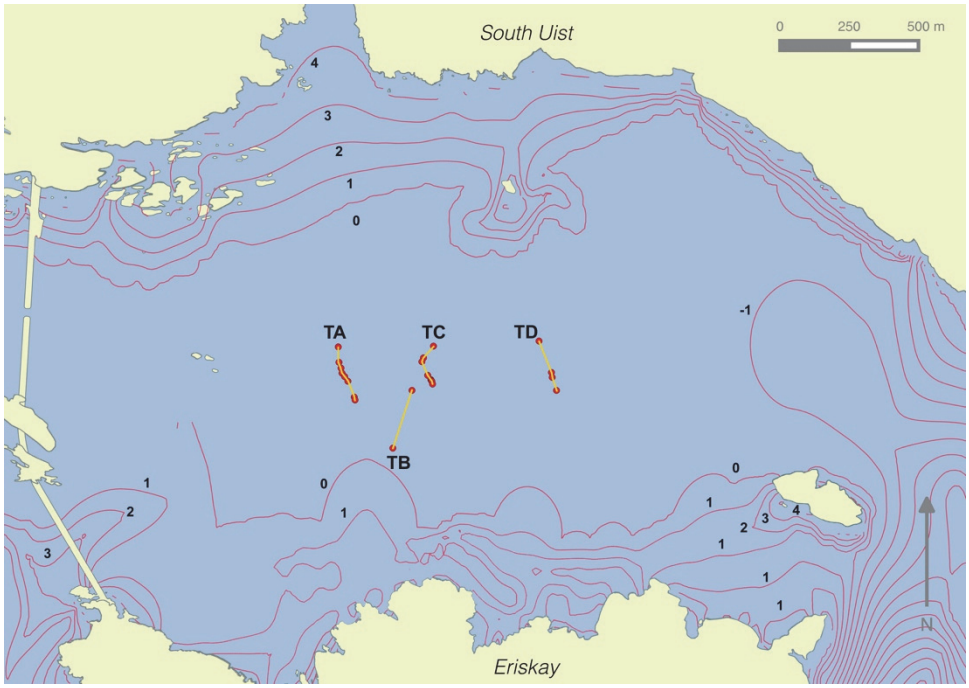


Figure 33. Detail of Zostera snorkelling transect paths and observation waypoints with transect names. © British Crown and OceanWise, 2018. All rights reserved. Licence No. EK001 - 20140401. Not to be used for Navigation.

3.3.1 Transect A

The observations at the eight study waypoints of Transect A (TA) are given in Table 7.

Table 7. Information recorded at waypoints along Zostera transect A.

Transect	Waypoint	Latitude	Longitude	Comments
TA	139	57.098452	7.299036	Start of TA transect. Sand with some drift algae and *Chorda filum*
TA	140	57.097957	7.298924	1-2 m patch of *Zostera* then back onto sand
TA	141	57.097773	7.298776	*Zostera* bed from here to wpt. 142
TA	142	57.097613	7.298693	Sand again
TA	143	57.097507	7.298519	2-3 m small patch of *Zostera* then back onto sand
TA	144	57.097367	7.298309	2-3 m small patch of *Zostera* then back onto sand
TA	145	57.09687	7.297856	2-3 m small patch of *Zostera* then back onto sand
TA	146	57.096777	7.297796	End of TA transect

3.3.2 Transect B

The observations at the two study waypoints of Transect B (TB) are given in Table 8.

Table 8. Information recorded at waypoints along Zostera transect B.

Transect	Waypoint	Latitude	Longitude	Comments
TB	147	57.097232	7.294458	Start of TB transect. Sand all the way along - no Zostera observed on this transect.
TB	148	57.095314	7.295328	End of TB transect

3.3.3 Transect C

The observations at the eight study waypoints of Transect C (TC) are given in Table 9.

Table 9. Information recorded at waypoints along Zostera transect C.

Transect	Waypoint	Latitude	Longitude	Comments
TC	149	57.098717	7.293389	Start of TC transect. Sand.
TC	150	57.098312	7.293927	Patchy *Zostera* bed
TC	151	57.098184	7.294002	Sand again
TC	152	57.097759	7.293596	1-2 m patch of *Zostera* then back onto sand
TC	153	57.097625	7.293387	Sand patch then *Zostera*
TC	154	57.097587	7.293339	*Zostera* bed
TC	155	57.097575	7.29332	*Zostera* bed
TC	156	57.097488	7.293265	End of TC transect

3.3.4 Transect D

The observations at the four study waypoints of Transect D (TD) are given in Table 10.

Table 10. Information recorded at waypoints along Zostera transect D.

Transect	Waypoint	Latitude	Longitude	Comments
TD	158	57.099146	7.287144	Start of TD transect. Sand.
TD	159	57.098162	7.28626	Still sand
TD	160	57.098005	7.286194	Possibly a 1 m diameter patch of seagrass here
TD	161	57.097594	7.285877	End of TD transect. Sand.

3.4 Dark red (non-calcareous) encrusting seaweeds

Analysis of samples of red encrusting seaweeds on maerl and shell collected at the transect sites returned three species:

Peyssonnelia dubyi - the most common species in the samples, found both encrusting maerl and shell, and occurring at all sites except S18. See Figure 34 to Figure 36.

Peyssonnelia immersa - found on a shell at site SOBX47B. See Figure 37 to Figure 40.

Atractophora hypnoides (the sporophyte '*Rhododiscus pulcherrimus*' phase) - found on maerl at site SOBX17. See Figure 41 and Figure 42.

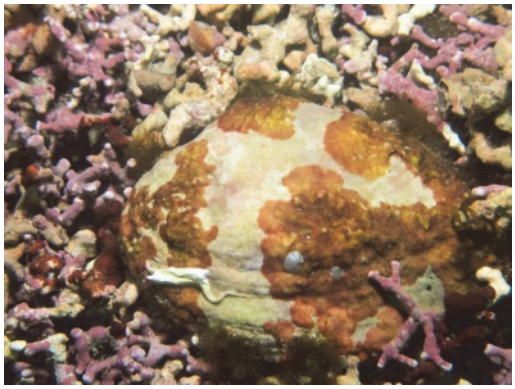


Figure 34. Peyssonnelia dubyi on shell at site SOBX47B (approximately 6 cm wide).

Figure 35. Peyssonnelia dubyi on maerl at site SOBX47B.

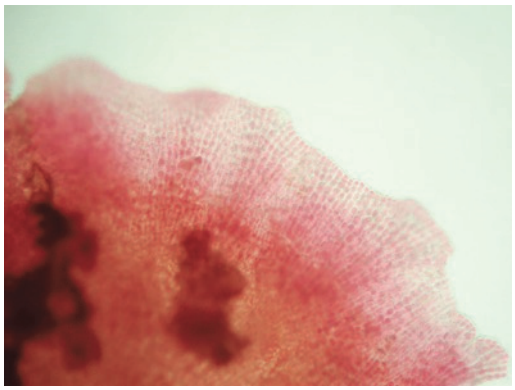


Figure 36. Peyssonnelia dubyi - margin of plant in surface view showing fan-shaped branching pattern (approximately 1 mm wide).

Figure 37. Peyssonnelia immersa on shell (approximately 4 cm long) at site SOBX47B.

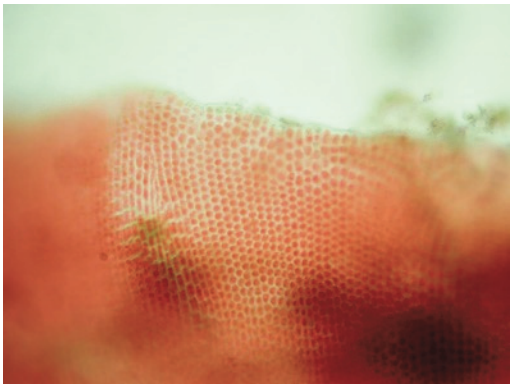


Figure 38. Peyssonnelia immersa showing margin of plant with straight chains of cells (width of margin shown in picture approximately 0.5 mm).

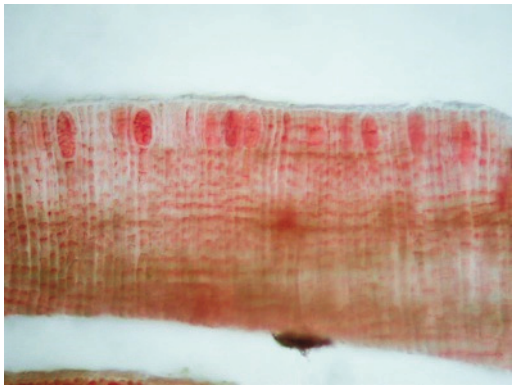


Figure 39. Peyssonnelia immersa – vertical section showing tetrasporangia (approximately 300 µm wide).

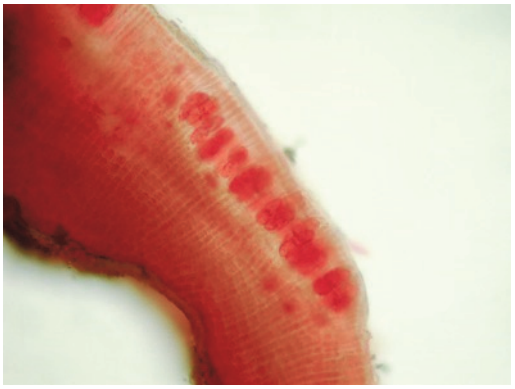


Figure 40. Peyssonnelia immersa vertical section (approximately 300 µm wide) showing cystocarps.

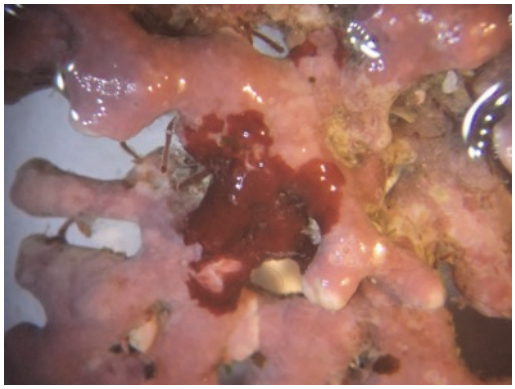


Figure 41. Atractophora hypnoides (the sporophyte 'Rhododiscus pulcherrimus' phase) on maerl (width of plant 4 mm) at site SOBX17.

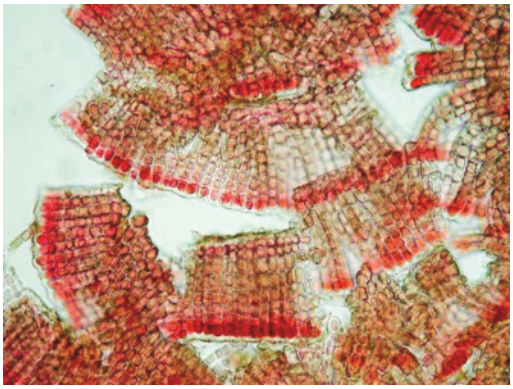


Figure 42. Atractophora hypnoides (the sporophyte 'Rhododiscus pulcherrimus' phase) - vertical section (approximately 100 µm) showing short chains of filaments highly coloured epithelial cells.

3.5 Maerl species

Twelve COI-5P sequences were identified as *Phymatolithon calcareum* (Pallas) W.H.Adey & D.L.McKibbin, 1970. Five COI-5P sequences were identified as *Phymatolithon lusitanicum* V.Peña, 2015. One COI-5P sequence was identified as *Lithothamnion corallioides* (P.L.Crouan & H.M.Crouan) P.L.Crouan & H.M.Crouan, 1867. Details of the species identified at each of the sites studied and their voucher codes and GenBank Accession Numbers are given in Tables 11 to 15. Photographs of the maerl samples from which the identities were obtained are given in Appendix 8.

The distance tree obtained from the neighbour-joining analysis of the COI-5P alignment is given in Figure 43.

Table 11. Sample information for species included in molecular analyses.

Species	Voucher	GenBank Accession Number (COI-5P)
Phymatolithon calcareum		KF808323
Phymatolithon calcareum	CPVP-43	KC861547
Phymatolithon calcareum	CPVP-607	KC861551
Phymatolithon calcareum	SA110.5	-
Phymatolithon calcareum	SOBX17.1	-
Phymatolithon calcareum	SOBX17.2	-
Phymatolithon calcareum	SOBX17.3	-
Phymatolithon calcareum	SOBX17.6	-
Phymatolithon calcareum	SOBX17.7	-
Phymatolithon calcareum	SOBX47.1	-
Phymatolithon calcareum	SOBX47.2	-
Phymatolithon calcareum	SOBX47.3	-
Phymatolithon calcareum	S18.1	-
Phymatolithon calcareum	S18.2	-
Phymatolithon calcareum	S18.3	-
Phymatolithon lusitanicum	CPVP-503	KC861633
Phymatolithon lusitanicum	CPVP-627	KC861617
Phymatolithon lusitanicum	CPVP-480	KC861629
Phymatolithon lusitanicum	CPVP-452	KC861618
Phymatolithon lusitanicum	CPVP-1261	KC861650
Phymatolithon lusitanicum	CPVP-77	KC861643
Phymatolithon lusitanicum	CPVP-676	KC861627
Phymatolithon lusitanicum	SA110.1	-
Phymatolithon lusitanicum	SA110.2	-
Phymatolithon lusitanicum	SA110.4	-
Phymatolithon lusitanicum	SOBX17.4	-
Phymatolithon lusitanicum	SOBX17.5	-
Lithothamnion corallioides	SA110.3	-
Lithothamnion corallioides	CPVP-1232	KC861500
Lithothamnion corallioides	CPVP-1231	KC861499
Lithothamnion corallioides	CPVP-794	KC861501
Lithothamnion corallioides	CPVP-799	KC861502

Table 12. Maerl species identified from each sample taken at site S18 (? means sample identification was not successful). Pictures of each sample are given in Annex 8.

	S18			
Sample Number	1	2	3	4
Phymatolithon calcareum	?	✓	?	?
Phymatolithon lusitanicum	?	-	?	?
Lithothamnion corallioides	?	-	?	?

Table 13. Maerl species identified from each sample taken at site SOBX17. Pictures of each sample are given in Annex 8

	SOBX17						
Sample Number	1	2	3	4	5	6	7
Phymatolithon calcareum	✓	✓	✓	✓	-	✓	✓
Phymatolithon lusitanicum	-	-	-	-	✓	-	-
Lithothamnion corallioides	-	-	-	-	-	-	-

Table 14. Maerl species identified from each sample taken at site SA110. Pictures of each sample are given in Annex 8

	SA110				
Sample Number	1	2	3	4	5
Phymatolithon calcareum	-	-	-	-	✓
Phymatolithon lusitanicum	✓	✓		✓	-
Lithothamnion corallioides	-	-	✓	-	-

Table 15. Maerl species identified from each sample taken at site SOBX47 (? means sample identification did not work). Pictures of each sample are given in Annex 8

	SOBX47			
Sample Number	1	2	3	4
Phymatolithon calcareum	✓	✓	✓	?
Phymatolithon lusitanicum	-	-	-	?
Lithothamnion corallioides	-	-	-	?

Figure 43. Neighbour-joining tree inferred from the COI-5PDNA barcode sequences.

3.6 Particle size distribution and sediment organic content of diver cores

The results of the particle size distribution analyses for the diver collected core sediments are presented in Annex 5.

The particle size distributions confirm the divers' Phase II findings and illustrate the pattern expected. The sites in the south of the Sound at SoBX47 and SOBX47b appear to be undisturbed, sheltered maerl beds and are dominated by coarse sands, granules and gravels (the maerl and maerl gravel itself). SA110, which lies in the middle of the Sound and is exposed to the north-west winds, is similar, being dominated by coarse sediments and gravels. SOBX17 located in the north-west of the Sound and exposed both to the west winds and considerable tidal streams, appears to be a thin maerl bed veneer lying on medium and fine sands, whereas S18 lying to the east of the 'causeway' road barrier is a dead/dying maerl bed with very little live maerl present and formed mainly of fine to very fine sand as well as a considerable mud and silt fraction. Finally the *Zostera marina* bed (ZL04) was found to be growing in an area of medium fine sand near the causeway.

The Loss on Ignition values (LoI) for the diver cored sediments (20 cm depth) are also presented in ANNEX 5: Species and abundance data for phase 2 studies (on sites other

than maerl monitoring transects) and they show a relatively consistent figure of between 5-7% organic matter in the surface sediments of the maerl beds. The *Zostera marina* bed shows a lower sediment organic content of circa 1%.

3.7 The macrobenthic infauna

Analysis of the >1mm macrobenthic infauna revealed a diverse community of invertebrates within the maerl and maerl gravel sediments. The table of taxa and their abundances for each core are also presented in ANNEX 5: Particle size analysis for diver collected cores. In total 150 taxa were identified in the 20 maerl cores collected. When these data were analysed with PRIMER 6 (a marine invertebrate community analytical computer package) several patterns were detected. These are described in more detail in the following sections.

3.7.1 Community characteristics revealed by univariate analysis

A univariate analysis of key community parameters was conducted on all individual cores from all sites (Diverse protocol within PRIMER 6). The results and mean values per site are shown in Table 16.

Table 16. Univariate characteristics for the diver core macrobenthic data.

Station Rep.	S	N	d	J'	H'(loge)	1-Lambda'	S Tot
SoBX47#1	26.00	108.00	5.34	0.81	2.63	0.89	
SoBX 47#2	30.00	95.00	6.37	0.89	3.02	0.95	
SoBX 47#3	35.00	108.00	7.26	0.88	3.11	0.94	
SoBX 47#4	42.00	112.00	8.69	0.91	3.42	0.96	
SoBX 47 Mean	33.25	105.75	6.91	0.87	3.05	0.94	66
SoBX 47b#1	41.00	105.00	8.60	0.89	3.30	0.95	
SoBX 47b#2	46.00	148.00	9.01	0.89	3.40	0.96	
SoBX 47b#3	41.00	182.00	7.69	0.85	3.15	0.94	
SoBX 47b#4	32.00	136.00	6.31	0.85	2.93	0.92	
SoBX 47b Mean	40.00	142.75	7.90	0.87	3.19	0.95	74
SoBX 17#1	20.00	186.00	3.64	0.75	2.24	0.85	
SoBX 17#2	23.00	123.00	4.57	0.77	2.41	0.87	
SoBX 17#3	22.00	146.00	4.21	0.78	2.40	0.88	
SoBX 17#4	26.00	148.00	5.00	0.75	2.45	0.85	
SoBX 17 Mean	22.75	150.75	4.36	0.76	2.37	0.86	43
SA110#1	36.00	116.00	7.36	0.84	3.00	0.92	
SA110#2	29.00	90.00	6.22	0.77	2.60	0.85	
SA110#3	28.00	66.00	6.44	0.87	2.89	0.92	
SA110#4	30.00	84.00	6.55	0.89	3.02	0.94	
SA110 Mean	30.75	89.00	6.64	0.84	2.88	0.91	60
S18#1	27.00	56.00	6.46	0.91	2.99	0.95	
S18#2	30.00	76.00	6.70	0.81	2.76	0.90	
S18#3	26.00	55.00	6.24	0.92	3.00	0.95	
S18#4	28.00	76.00	6.24	0.89	2.97	0.94	
S18 Mean	27.75	65.75	6.41	0.88	2.93	0.94	58
ZL04#1	18.00	77.00	3.91	0.78	2.26	0.86	
ZL04#2	19.00	81.00	4.10	0.78	2.29	0.85	
ZL04#3	20.00	79.00	4.35	0.87	2.59	0.91	
ZL04#4	17.00	41.00	4.31	0.92	2.62	0.94	
ZL04 Mean	18.50	69.50	4.17	0.84	2.44	0.89	36

S – total taxa: taxa with non zero counts.

N – total individuals: The mean number of individuals per core.
d – Margalef's richness for each sample. (S-1)/Log(N) - it is a measure of the number of taxa present, making some allowance for the number of individuals.
J' – Pielou's evenness - this is a measure of equitability, a measure of how evenly the individuals are distributed among the different taxa.
H'(loge) – Shannon-Wiener diversity index
1-Lambda'- Simpson's diversity index
S Tot – Total number of taxa recorded in all four cores per site

The greatest number of taxa in the maerl cores pooled per station (S Tot) were found in the SoBX47b cores, whilst the fewest were found in the SoBX17 cores. The greatest mean number of individuals were found in the SoBX17, closely followed by the SoBX47b cores, whilst the S18 cores were the most impoverished containing the smallest mean. Margalef's richness statistic indicates that SoBX47 and 47b cores possessed the richest invertebrate faunal communities. Pielou's evenness statistic shows that S18 is perhaps the least dominated community, having fewer individuals and many taxa and SoBX17 the most dominated, with the highest number of individuals and fewer taxa, with spionids, capitellids and amphipods dominating the community to produce this effect. This pattern is further supported by the Shannon-Wiener and the Simpson's diversity indices, which yield the highest diversity scores for SoBX47 and 47b and the lowest for SoBX17.

3.7.2 Multivariate analysis of the diver core data

Multivariate analysis of the data was used to further illustrate trends within the macrobenthic community. A Bray Curtis similarity analysis was performed on the taxa / site matrix producing a similarity matrix. This was run through a group average clustering routine in PRIMER 6 to produce a dendrogram illustrating the similarity trends within the data (Figure 44).

The group clustering shown in Figure 44 is clearly defined and illustrates the strong similarities that exist between the cores on an intra-site basis. A Multi-Dimensional Scaling analysis (MDS) performed within PRIMER 6 (Figure 45) illustrates the groupings as a 'two dimensional squash' with a two dimensional stress value of 0.1, which shows that the plot is an accurate illustration of both the inter- and intra-site differences.

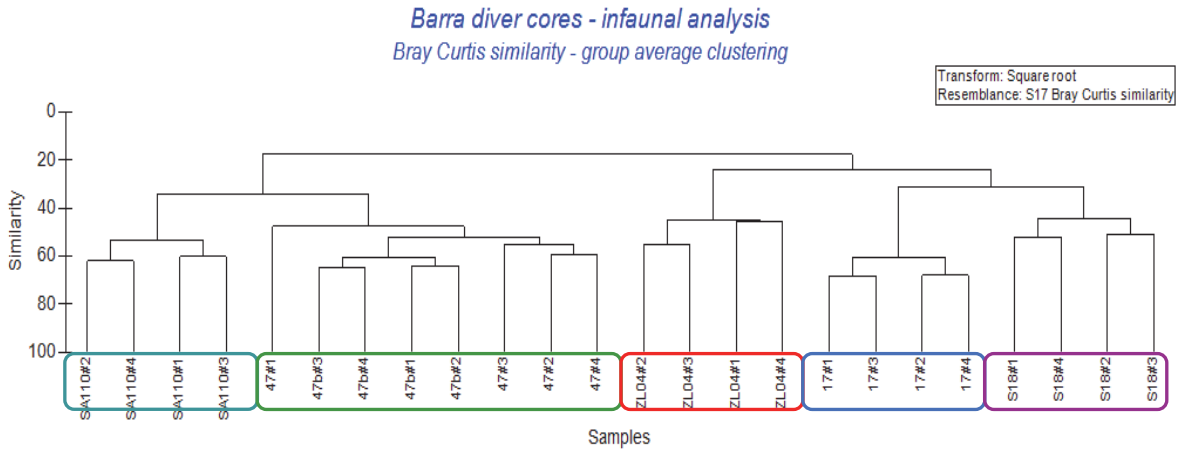


Figure 44. A dendrogram plot of the group average clustering of the Bray Curtis Similarity percentages of the diver core samples.

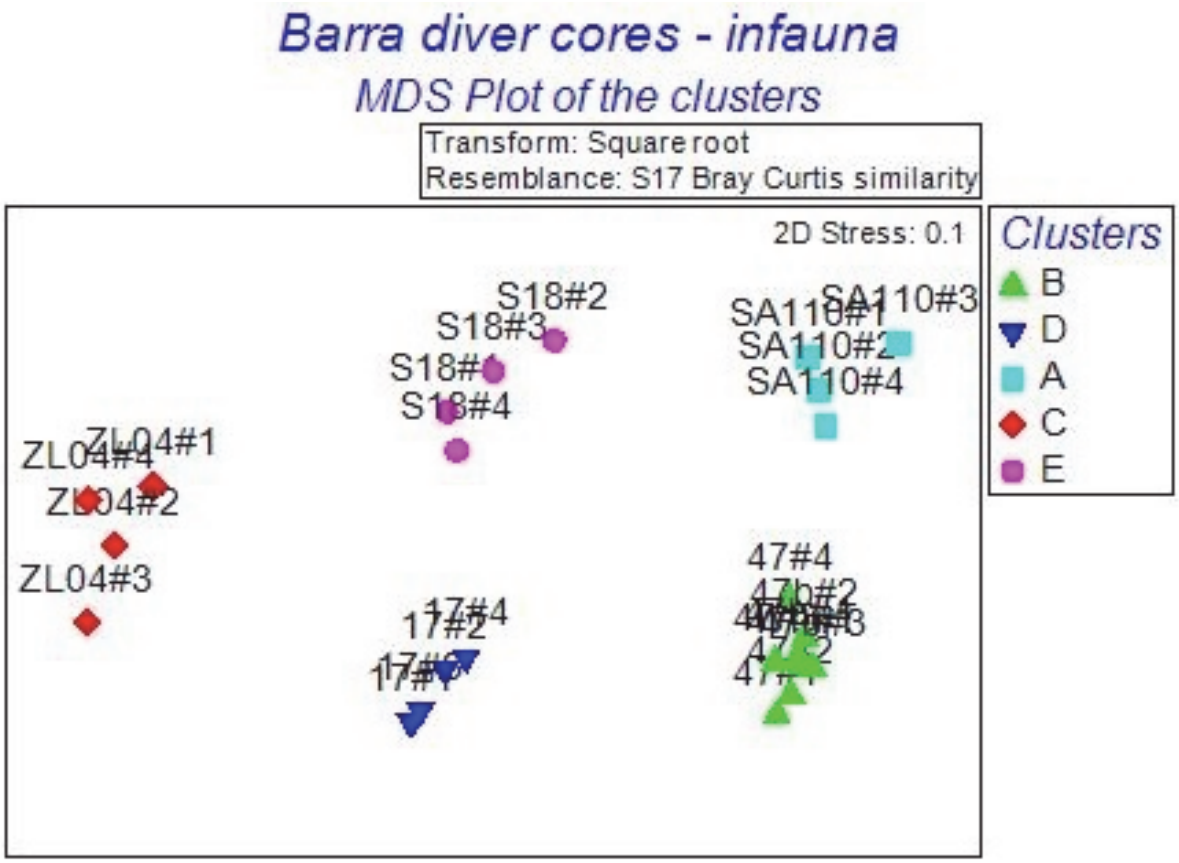


Figure 45. An MDS plot of the infaunal core data Bray Curtis similarity clusters.

Figures 44 and 45 show that the infaunal communities at all sites were quite different from each other, with each having its own characteristic infaunal/sessile epifaunal community.

A SIMPER test was conducted on the Bray Curtis similarities within PRIMER 6 to reveal the key taxa responsible for the clustering patterns. These taxa are shown in the following tables (17 - 21). Only taxa with a percentage contribution of over 5%, or those making up the top cumulative 50%, are included.

Table 17. SIMPER taxa for group A clustered cores.

Group A – SA110				
Average similarity: 56.21				
Species	**Av.Abund**	**Av.Sim**	**Contrib%**	**Cum.%**
Goodallia triangularis	4.47	7.91	14.07	14.07
Amphipholis squamata	2.27	4.37	7.78	21.84
Syllis cornuta	2.28	4.1	7.29	29.14
Enchytraeidae spp.	2.09	3.98	7.09	36.22
Nematoda	2.65	3.91	6.95	43.18
Socarnes erythrophthalmus	1.87	3.87	6.88	50.06
Glycera lapidum	1.83	3.42	6.08	56.13
Timoclea ovata	1.7	3.2	5.69	61.82

Av.Abund – Mean abundance of the taxon
Av.Sim – Mean percentage similarity
Contrib% - Percentage of the total similarity
Cum.% - Cumulative percentage similarity

Table 17 shows that the abundance of the bivalves *Goodallia triangularis* and presence of the bivalve *Timoclea ovata* at SA110 contribute to its cohesion as a cluster. *Goodallia triangularis* does not feature in such large numbers at the other sites.

Table 18. SIMPER taxa for group B clustered cores.

Group B – SoBX 47 and 47b				
Average similarity: 53.77				
Species	**Av.Abund**	**Av.Sim**	**Contrib%**	**Cum.%**
Mediomastus fragilis	3.82	5.7	10.6	10.6
Aonides oxycephala	3.21	4.71	8.77	19.37
Syllis cornuta	3.17	3.86	7.17	26.54
Amphipholis squamata	2.55	3.84	7.14	33.68
Glycera lapidum	2.11	3.19	5.93	39.61
Pista cristata	1.82	2.51	4.67	44.28
Nematoda	1.84	2.45	4.55	48.83
Sphaerosyllis bulbosa	1.97	2.26	4.21	53.04

Av.Abund – Mean abundance of the taxon
Av.Sim – Mean percentage similarity
Contrib% - Percentage of the total similarity
Cum.% - Cumulative percentage similarity

Within group B (Table 18), the presence of small, medium and large polychaetes such as *Mediomastus fragilis, Aonides oxycephala* and *Pista cristata* help to create the identity for this cluster. *Pista cristata* in particular does not feature to the same extent in the other areas.

Table 19. SIMPER taxa for group C clustered cores.

Group C – ZL04				
Average similarity: 46.96				
Species	**Av.Abund**	**Av.Sim**	**Contrib%**	**Cum.%**
Crassicorophium crassicorne	3.38	7.97	16.96	16.96
Pygospio elegans	2.89	6.14	13.07	30.04
Capitella agg.	1.9	5.18	11.04	41.08
Scoloplos (Scoloplos) armiger	1.46	3.89	8.29	49.36
Pariambus typicus	1.56	3.77	8.03	57.39
Urothoe elegans	1.95	3.75	7.98	65.37
Anthopleura ballii	1.21	2.31	4.92	70.28

Av.Abund – Mean abundance of the taxon
Av.Sim – Mean percentage similarity
Contrib% - Percentage of the total similarity
Cum.% - Cumulative percentage similarity

In the sandier sediments of the northern channel running between South Uist and Eriskay, the *Zostera marina* infaunal community is dominated by the mobile amphipods *Crassicorophium crassicorne* and *Urothoe elegans* along with the epifaunal caprellid *Pariambus typicus* and the anemone *Anthopleura ballii* directly associated with the *Zostera* plants (Table 19).

Table 20. SIMPER taxa for group D clustered cores.

Group D – SoBX17				
Average similarity: 63.39				
Species	**Av.Abund**	**Av.Sim**	**Contrib%**	**Cum.%**
Mediomastus fragilis	6.35	12.21	19.26	19.26
Capitella agg.	5.22	9.86	15.55	34.81
Aonides oxycephala	3.79	6.75	10.66	45.46
Urothoe marina	3.08	6.17	9.74	55.2
Urothoe elegans	3.08	4.99	7.88	63.08
Crassicorophium crassicorne	2.69	3.87	6.1	69.18
Euclymene oerstedi	2.11	3.55	5.6	74.78

Av.Abund – Mean abundance of the taxon
Av.Sim – Mean percentage similarity
Contrib% - Percentage of the total similarity
Cum.% - Cumulative percentage similarity

At the sandy maerl site SoBX17 at the north-western end of the northern channel the robust mobile amphipods *Crassicorophium crassicorne, Urothoe marina* and *Urothoe elegans* dominate the community together with opportunistic infaunal capitellids.

Table 21. SIMPER taxa for group E clustered cores.

Group E – S18				
Average similarity: 46.71				
Species	**Av.Abund**	**Av.Sim**	**Contrib%**	**Cum.%**
Phtisica marina	2.51	5.2	11.13	11.13
Mediomastus fragilis	2.03	4.59	9.83	20.95
Nematoda	2.42	4.24	9.07	30.03
Urothoe elegans	1.68	3.5	7.5	37.53
Crassicorophium crassicorne	1.67	3.11	6.66	44.19
Notomastus agg.	1.66	3.01	6.44	50.63
Amphipholis squamata	1.49	2.9	6.21	56.84
Iphinoe trispinosa	1.21	2.76	5.91	62.75

Av.Abund – Mean abundance of the taxon
Av.Sim – Mean percentage similarity
Contrib% - Percentage of the total similarity
Cum.% - Cumulative percentage similarity

At site S18, east of the road barrier between South Uist and Eriskay where the water movement is reduced and the sediment finer, the infaunal community is characterised by high numbers of amphipods, caprellids and cumaceans.

4. DISCUSSION

4.1 Methodology

The maerl beds in the Sound of Barra survey were studied using Marine Nature Conservation Review (MNCR) phase 2 methodology (Hiscock, 1996), similar to other recent MPA-related surveys (e.g. Arisaig, Moore *et al., 2015,* Wester Ross, Moore *et al.,* 2011, Shetland, Hirst *et al.,* 2013, Mercer *et al.*, 2017 in prep.). Rather than employ quadrats to obtain quantitative community information, in phase 2 methodology divers record semi-quantitative estimates of the abundance of species within a set recording area and over a set time. The data collected do not lend themselves to statistical analysis, but where good field taxonomists are employed, the timed searches over a small area can produce extensive species lists. Together with the photographic and video evidence obtained, the data produced by this method are suitable for detecting gross change to the communities in the future. Microscopic examination of maerl specimens collected in the field added to the species list and enabled detection of some of the small cryptic species associated with maerl.

The small-scale variation of the sea bed is well illustrated by comparing the adjacent sites SOBX47 and SOBX47B (see sections 3.1.4 and 3.1.5). These sites were very different in terms of the amount of live maerl present and species recorded, and yet they were adjacent. It will be important to ensure that further surveys are carried out in the same habitat to enable comparison of results.

Problems of species delimitation in algae using morphology or sexual compatibility, are discussed in Leliaert *et al.* (2014). These problems are exacerbated with maerl where morphology within a species can vary widely with environmental conditions (Irvine and Chamberline, 1994). Identification using the traditional techniques of sectioning is difficult with maerl and obtaining reproductive material (which helps confirm identification) means collecting specimens in the winter, which is not always practical. The use of molecular techniques, such as those employed here, are a great step forward in enabling maerl to be identified reliably.

4.2 Comparison with previous studies

Previous work conducted at the locations studied during the 2015 survey is summarised in Table 2. Most of the sites studied in 2015 had been visited previously during broadscale mapping surveys employing drop video and grab sampling. The 2015 survey added detailed biological information to the more general nature descriptions of sea bed habitats and communities of those sites. The differences in methodology and resolution of data obtained meant no direct comparison of results was possible, but a baseline was set for future reference.

Study sites in 2015 were chosen on the basis of data collected in the previous studies. Maerl and seagrass beds recorded previously were relocated at all stations chosen in 2015. The seagrass populations at sites to the east of the Eriskay causeway appeared to have declined though, presumably due to reduced water flow as a consequence of the building of the causeway.

A direct comparison of amounts of live and dead maerl between the 2015 and previous studies has only been possible at site SA110. A density of 31% live maerl was determined at station SA110 in 2015 (see Figure 2 and ANNEX 4: Percentage live and dead maerl quadrat data). In previous studies in this vicinity, estimates for percentage live maerl ranged from 20 to 40 % (James *et al.* 1999a) to between 10 and >40% (Harries *et al.* 2007). The percentage cover of live maerl measured at SA110 in 2015 is therefore in line with previous observations in the vicinity.

Cover of live maerl on the sea bed is often patchy, and can vary significantly across short distances dependent on fine-scale seabed topography and hydrography (e.g. see Arisaig (Moore *et al., 2015*), Shetland (Hirst *et al., 2013*), Ullapool approaches (Moore *et al.,* 2011) Arran (Mercer *et al.,* 2016), Milford Haven, Wales (Bunker and Camplin, 2007) and the Helford River, Cornwall (Bunker, 2013). This was seen at sites SOBX47 and SOBX47B where percentage cover of live maerl was estimated to be 3% at SOBX47 compared to 46% at the adjacent site SOBX47B. Surveys must have wide enough coverage to integrate the small scale variability.

4.3 Biodiversity of the Sound of Barra maerl habitats

Maerl beds contain a variety of different micro-habitats which are suitable for a range of species. The substrata include the maerl itself (with both live and dead rhodoliths), and shells, gravel and small stones which are usually present. More often than not there is also sand, underlying the maerl, which provides a habitat for species which are tolerant of sand scour (e.g. *Spyridia griffithiana*).

Some disturbance is common in many maerl beds (e.g. by crabs and rays, and movement of rhodoliths by currents) and if not extreme (such as disturbance by dredging and siltation) can provide more variation and diversity within the habitat, as can be seen in mild disturbance to coral reefs and rain forests (Connell, 1978).

The importance of maerl beds in terms of their biodiversity is well documented. Peña *et al*. (2014) estimated that 30% of the species in the north east Atlantic flora occur on maerl compared with 10% for kelp forests. In the north east Atlantic, the maerl beds of Britain, Ireland and the Iberian Peninsula have the highest diversity of seaweeds with between 150 and 257 associated species, but there is a paucity of data on maerl beds from Northern Britain, including Scotland (Peña *et al.,* 2014).

The results of the 2015 studies in the Sound of Barra show a diverse flora associated with the maerl beds (see Table 22). The numbers of seaweeds recorded would most likely be even higher if studies were undertaken in spring or early summer where diversity is known to peak on maerl beds e.g. Maggs (1983), Bárbara *et al.* (2004) and Peña and Bárbara (2010b).

Table 22. Numbers of seaweed species recorded from Sound of Barra maerl in September 2015 compared with those known from Britain and Ireland after Brodie et al. (2015)

	Rhodophyta (red)	**Chlorophyta (green)**	**Heterokonta (brown)**
Total British seaweed species	348	186	110
SOB maerl	62	8	18
% of British flora	18%	4%	16%

The suite of seaweeds associated with the Sound of Barra maerl is typical of the NE Atlantic maerl flora, but with a northern flavour as exemplified by the presence of the brown seaweed *Halosiphon tomentosus*. Two species considered to be endemic to maerl beds were recorded during this survey: the red alga *Gelidiella calcicola* (Maggs and Guiry, 1987) and the green alga *Cladophora rhodolithicola* (Leliaert *et al.*, 2009).

All the maerl sites studied differed only slightly from each other with the exception of S18 which differed greatly from the rest. The maerl at S18 has been choked with fine sediment, which may be a result of a lack of water flow caused by the building of the Eriskay causeway. There was very little live maerl present in 2015 and it will be interesting to see whether or not maerl dies off completely at this site in future years.

4.3.1 Non-native species

Non-native species are found on most maerl beds (Peña *et al.*, 2014), and increasingly so as more non-native species become established in NE Atlantic waters. *Bonnemaisonia hamifera, Asparagopsis armata, Dasysiphonia japonica* and *Grateloupia turuturu* are all known non-natives from NE Atlantic maerl beds (Peña *et al.*, 2014) and they were all recorded on the Sound of Barra maerl beds. All these species, except for *Grateloupia turuturu* were also recorded from a recent study in Arran (Mercer *et al.*, 2018).

The most common form of *Bonnemaisonia hamifera* around the Sound of Barra is the sporophyte phase known as *Trailliella*. It is thought that this species requires short day lengths and water temperatures of above 11º C for the production of tetrasporangia and in turn the production of gametophytes (Breeman *et al.*, 1988). Records of both gametophyte and sporophyte plants of *Bonnemaisonia hamifera* were made during this survey, which is of interest, as it implies that conditions for production of tetrasporangia have been met in the Sound of Barra. In much of northern Britain seawater temperatures are too cold for this in most years, and the species only occurs in the *Trailliella* phase, spreading by vegetative propagation only.

Records of both gametophyte and sporophyte plants were also made of *Asparagopsis armata* during the 2015 Sound of Barra survey. The sporophyte *Asparagopsis armata* was found to be particularly common at site SA110 where it covered some other species of seaweed making them hard to identify. The impact of this is not known. The production of tetrasporangia by *Asparagopsis armata* in the *Falkenbergia* phase was found to require temperatures between 15º and 21º C and a day-length of less than 9 hours (Guiry and Dawes, 1992). It is considered that this is unlikely to be attained very often in the Sound of Barra at present, but may change as climate change progresses.

It is noteworthy that the gametophyte phases of *Bonnemaisonia hamifera* and *Asparagopsis armata* occurred in the Sound of Barra in 2015, as these life history stages are normally restricted to the south.

4.3.2 Maerl Species

This study provides the first confirmed records of *Phymatolithon lusitanicum* and *Lithothamnion corallioides* for Scotland. *P. lusitanicum* is a newly described species for the NE Atlantic and prior to the current study was known mainly from Portugal and north-west Spain but had also been found to occur in Galway in Ireland (Pardo *et al.*, 2014). *L. corallioides* is known as a species of southern Europe occurring from the Mediterranean north to the west coast of Ireland and Milford Haven. To date, Scottish records of this species were considered unreliable (Hall-Spencer, 1995, Irvine and Chamberline, 1994).

Maerl-forming coralline algae species are notoriously difficult to identify and this includes the separation of *Phymatolithon calcareum*, *Lithothamnion corallioides* and *Lithothamnion glaciale*, the main maerl species known from Britain and Ireland (Hall-Spencer et al., 2008, Irvine and Chamberline, 1994). There is much overlap in the growth forms of these species, which vary according to environmental conditions (Bosence, 1976, Irvine and Chamberline, 1994). Confirmation of species identity using morphological characteristics requires examination of the cell structures, a time consuming process requiring dissolving of the calcium carbonate skeleton using acid, in order to be able to section the material. Identification based on morphology is easiest when the maerl is reproducing but obtaining reproductive specimens is not always possible. The risk of misidentification has been exacerbated by the discovery of another maerl species from Ireland, *Phymatolithon lusitanicum* (Peña *et al.,* 2015). The difficulty in visually separating the Sound of Barra maerl

into species in the field is well illustrated by the photographs of the different maerl species shown in Appendix 8.

Recent advances in molecular taxonomy mean that species of the Corallinales can be separated based on the characteristics of the plastidial gene *psb*A and COI-5P mitochondrial bar code. These two molecular markers have been employed successfully in several recent studies to elucidate phylogenetic relationships within the Corallinales (Bittner *et al*., 2010, 2011, Walker *et al*., 2009). Although examination of *psb*A has not been undertaken in the current study, the COI-5P bar code is considered robust enough to determine firm identifications of maerl.

The presence of the southern maerl species *P. lusitanicum* and *L. corallioides* in the Sound of Barra SAC is an example of warmer water influence on the marine biota of a northern area. Understanding the distribution of species at this time of global climate change is particularly important. Recognising the nature of the species present in the Sound of Barra SAC is also important for our understanding of the ecology and diversity of the area.

4.3.3 Dark red (non calcareous) encrusting seaweeds

Non-calcareous encrusting red seaweeds are a feature of maerl beds and have been the subject of some comparatively recent studies (Irvine and Maggs, 1983, Maggs and Guiry, 1989, Peña and Bárbara, 2010a, 2013). These seaweeds are difficult to identify. Three species were found in the Sound of Barra samples (see Section 3.4): *Peyssonnelia dubyi*, *Peyssonnelia immersa* and *Atractophora hypnoides* (tetrasporophyte phase). The species endemic to maerl, *Cruoria cruoriaeformis,* was not found during the survey. The most common non-calcareous encrusting red seaweed found in the Sound of Barra in 2015 was *Peyssonnelia dubyi*.

4.4 *Zostera marina*

The main concentration of *Zostera* studied during this survey was in the Sound of Eriskay where interesting comparisons could be made between sites east and west of the causeway. To the west of the causeway, the seagrass habitat was diverse and harboured a rich community of associated seaweeds and fauna. To the east of the causeway, low densities of seagrass plants, relatively low diversity of associated communities, and an abundance of the fine epiphytic brown seaweed *Ectocarpus fasciculari*s on the seagrass leaves may have been caused by a lack of water movement. It is noted, however, that James *et al.* (1999a) recorded Ectocarpaceae to be abundant in the seagrass habitat at a site near EAST2D and EAST4D before the causeway was built. How much the community has changed to the east of the causeway after its construction is therefore uncertain.

Of special interest in the *Zostera* habitats was the presence of numerous stalked jelly fish, *Lucernariopsis campanulata* (Figure 26)*,* which is a UK BAP priority species, and the sea anemone *Anthopleura ballii* (Figure 27) which has a predominantly southern distribution. James *et al.* (1999a) also noted numerous stalked jellyfish to be present on the seagrass, but they recorded the species to be *Haliclystus auricula*. The southern nature of some species associated with the seagrass bed was noted by James *et al.* (1999a) with the species such as *Jania rubens* and *Asparagopsis armata*. Both of these species were also recorded in 2015.

The *Zostera* transects on the east side of the causeway illustrated the sparse and patchy nature of the seagrass beds on this side of the causeway in 2015.

The results of the diver surveys of six seagrass beds in the Sound of Barra showed the beds to be locally dense. The complement of epifauna and epiflora was relatively reduced, when

compared to two seagrass beds on the Wester Ross coast, where diver MNCR phase 2 style surveys were also carried out in 2011. Between 49 and 56 epibenthic taxa were recorded there (Moore *et al.,* 2011), while in the Sound of Barra results were between 20 and 39 taxa with six beds studied.

4.5 Macrobenthic infauna - comparison to other UK maerl and seagrass beds

Considering only the maerl cores, 150 taxa were recorded in the 20 cores collected at the five maerl sites. This compares favourably with e.g. 130 taxa recorded in the 25 cores taken at five Arran dive sites studied by the same methodology in 2014, and similarly well with other maerl beds around the UK: the Milford Haven maerl bed in south-west Wales, for a similar sampling effort over five sampling occasions, returned between 86 and 142 taxa in 25 cores, with a mean of 107 taxa per sampling occasion. A similar sampling effort in Loch Maddy in 1998 (Howson, 1999) returned an almost identical 152 taxa with an especially rich amphipod fauna.

The Linnhe Mhurich rapids' maerl bed also possessed a rich amphipod fauna when it was sampled, with much less intensity, in 1999 (Bunker, 1999), but had abundances of individuals at a mean of 1407 per core, compared to Loch Maddy's 389, Arran's 84 and Barra's 111. However Milford Haven's maerl bed mean individual abundance per core was lower still at 51 individuals. This possibly highlights the differences between maerl beds exposed to almost perpetual tidal currents, as are found in the Loch Maddy (Loch Blashval) rapids and Linnhe Mhurich's rapids, and the more benign, semi-diurnal tidal conditions of the South Arran coast, Milford Haven Waterway and the more sheltered beds in the Sound of Barra studied here.

Moore *et al.* (2011) sampled four maerl beds in the vicinity of Ullapool and compared the results with 12 other similar Scottish maerl bed studies. Their infaunal sampling effort was identical to this study, with four cores taken per site. The site-wise infaunal taxon richness described by Moore, with a range of between 56 and 122 species, leaves Barra's maerl beds slightly on the low side with a range between 43 and 74 taxa. Mean infaunal abundance values of between 72 and 453 reported by Moore *et al.* are also higher than Barra's 65 to 151.

The number of epifaunal and epifloral taxa recorded on the Barra maerl beds is similar to other beds on the west of Scotland. On Barra's beds between 49 and 87 taxa were recorded, compared to 33 to 109 taxa recorded on beds from Arran (x5) (Mercer *et al.*, 2018 in prep.) Arisaig (x5) (Moore *et al.*, 2004), Loch Maddy (x4) (Moore *et al.*, 2006) and Loch Laxford (x3) (Moore *et al.*, 2010).

Of special interest in the macrobenthic cores was a record of a small *Limaria hians* (flame shells) specimen at SoBX47b, though no beds of adult *Limaria hians* were recorded in the vicinity of any maerl beds.

Cores taken from within the *Zostera* bed at ZL04 returned between 17 and 20 taxa and a total of 36 for the four cores. The anemone *Anthopleura ballii* was characteristic of the bed's infauna.

5. REFERENCES

Bárbara, I., Cremades, J. & Veiga, A.J. 2004. Floristic study of a maërl and gravel bed in the 'Ría de Arousa' (Galicia, Spain). *Botanica Complutensis*, 28, 27-37.

Bates, C.R., Moore, C.G., Malthus, T., Harries, D.B., Austin, W., Mair, J.M. & Karpouzli, E. 2004. Broad scale mapping of sublittoral habitats in The Sound of Barra, Scotland. *Scottish Natural Heritage Commissioned Report No. 005.*

Bittner, L., Halary, S., Payri, C., Cruaud, C., de Reviers, B., Lopez, P. & Bapteste, E. 2010. Some considerations for analyzing biodiversity using integrative metagenomics and gene networks. *Biology Direct,* 5, 47.

Bittner, L., Payri, C.E., Maneveldt, G.W., Couloux, A., Cruaud, C., de Reviers, B. & Le Gall, L. 2011. Evolutionary history of the Corallinales (Corallinophycidae, Rhodophyta) inferred from nuclear, plastidial and mitochondrial genomes. *Molecular Phylogenetics and Evolution,* 61(3), 697-713.

Bosence, D.W. 1976. Ecological studies on two unattached coralline algae from western Ireland. *Palaeontology,* 19(2), 365–395.

Boxshall, G.A., Mees, J., Costello, M.J., Hernandez, F., Bailly, N., Boury-Esnault, N., Gofas, S., Horton, T., Klautau, M., Kroh, *et al.* 2015. World Register of Marine Species (WoRMS). WoRMS Editorial Board.

Breeman, A.M., Meulenhoff, E.J.S. & Guiry, M.D. 1988. Life history regulation and phenology of the red alga *Bonnemaisonia hamifera*. *Helgoländer Meeresuntersuchungen,* 42(3), 535-551.

Brodie, J., Wilbraham, J., Pottas, J. & Guiry, M.D. 2015. A revised check-list of the seaweeds of Britain. *Journal of the Marine Biological Association of the United Kingdom,* FirstView 1-25.

Bunker, F.StP.D. 2013. Fal and Helford SAC kelp forest condition assessment and maerl studies in August 2012. A report for Natural England from MarineSeen, Aquatic Survey and Monitoring Ltd. and JNCC.

Bunker, F.StP.D. & Camplin, M.D. 2007. A study of the Milford Haven maerl bed in 2005 using drop down video and diving. CCW Contract Science Report 769. Countryside Council for Wales, Bangor.

Bunker, F.StP.D. 1999. Monitoring within Linne Mhuirich and Rapids in January 1999. A report to Scottish Natural Heritage from MarineSeen, Estuary Cottage, Bentlass, Hundleton, Pembrokeshire, SA71 5RN, Wales UK.

Connell, J.H. 1978. Diversity in Tropical Rain Forests and Coral Reefs. *Science,* 199(4335), 1302-1310.

Connor, D.W., Allen, J.H., Golding, N.,Howell, K.L., Lieberknecht, L.M., Northern, K.O., & Reker, J.B. (2004) The Marine Habitat Classification for Britain and Ireland Version 04.05. In: JNCC (2015) The Marine Habitat Classification for Britain and Ireland Version 15.03. http://jncc.defra.gov.uk/MarineHabitatClassification

European Commision 1992. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Communities,* 35(No L 206/7).

Guiry, M.D. & Dawes, C.J. 1992. Daylength, temperature and nutrient control of tetrasporogenesis in *Asparagopsis armata* (Rhodophyta). *Journal of Experimental Marine Biology and Ecology*, 158(2), 197-217.

Hall-Spencer, J.M. 1995. *Lithothamnion corallioides* (P. & H. Crouan) P. & H. Crouan may not extend into Scottish waters. *Coralline News*, 20, 1-3.

Hall-Spencer, J.M., Kelly, J. & Maggs, C.A. 2008. Assessment of maerl beds in the OSPAR area and the development of a monitoring program. OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic. Meeting of the Working Group on Marine Protected Areas Species and Habitats (MASH). Baiona (Spain): 21-24 October 2008.

Harries, D.B., Malthus, T.J., Karpouzli, E., Moore, C.G., Lyndon, A.R., Mair, J.M., Service, M. & Mitchell, A. 2007. Biotope mapping of the Sound of Barra, Scotland. *Scottish Natural Heritage Commissioned Report No. 212.*
https://www.nature.scot/snh-commissioned-report-212-biotope-mapping-sound-harris-scotland

Hirst, N.E., Kamphausen, L.M., Cook, R.L., Porter, J.S. & Sanderson, W.G. 2013. The distribution and status of proposed protected features within the Fetlar and Haroldswick MPA proposal. *Scottish Natural Heritage Commissioned Report No. 599*.

Hiscock, K. ed. 1996. Marine Nature Conservation Review: rationale and methods (Summary Report). Coast and seas of the United Kingdom, MNCR series. Peterborough, Joint Nature Conservation Committee.

Holme & McIntyre. 1984. Sediment Analysis. Methods for the Study of Marine Benthos. IBP Handbook 16. Blackwell Scientific Publications. pp. 41-65.

Howson, C.M. 1999. Trials of monitoring techniques in Loch Maddy cSAC, North Uist. Discussion document. Report to Scottish Natural Heritage.

Howson, C.M. & Picton, B.E. (ed.), 1997. *The species directory of the marine fauna and flora of the British Isles and surrounding seas.* Ulster Museum and The Marine Conservation Society, Belfast and Ross-on-Wye. Belfast: Ulster Museum. Ulster Museum Publication No. 276.

Irvine, L.M. 1983. Seaweeds of the British Isles. A collaborative project of the British Phycological Society and the Natural History Museum. Volume 1 Rhodophyta. Part 2A Cryptonemiales (senu stricto), Palmariales, Rhodymeniales. London: HMSO.

Irvine, L.M. & Chamberline, Y.M. 1994. Seaweeds of the British Isles. A collaborative project of the British Phycological Society and The Natural History Museum. Volume 1 Rhodophyta. Part 2B Corallinales, Hildenbrandiales. London: HMSO.

Irvine, L.M. & Maggs, C.A. 1983. Peyssonneliaceae. In L. M. Irvine ed. Seaweeds of the British Isles. A collaborative project of the British Phycological Society and the Natural History Museum. Volume 1 Rhodophyta. Part 2A Cryptonemiales (sensu stricto), Palmariales, Rhodymeniales. London: HMSO. pp. 52-61.

James, B., Baker, T., Dykes, R. & Moore, J. 2000. Barra Ferry Terminal Marine Environmental Impact Assessment. A report for BABTIE Group PLC. Aberdeen, Cordah Environmental Management Consultants.

James, B., Baker, T., Moore, J., Dykes, R. & Smith, J. 1999a. Eriskay Causeway: Survey of Marine and Intertidal Habitats, May 1999. A report for BABTIE Group PLC. Aberdeen, Cordah Envirtonmental Management Consultants.

James, B., Baker, T., Moore, J. and Smith, J. 1999b. Sound of Barra Ferry Facilities: Survey of Marine and Intertidal Habitats. A report for BABTIE Group PLC. Aberdeen, Cordah Environmental Management Consultants.

Kearse, M., Moir, R., Wilson, A., Stones-Havas, S., Cheung, M., Sturrock, S., Buxton, S., Cooper, A., Markowitz, S., Duran, C., Thierer, T., Ashton, B., Mentjies, P. & Drummond, A. 2012. Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics*, 28(12), 1647-1649.

Le Gall, L. & Saunders, G.W. 2010. DNA barcoding is a powerful tool to uncover algal diversity: a case study of the Phyllophoraceae (Gigartinales, Rhodophyta) in the Canadian Flora. *Journal of Phycology*, 46(2), 374-389.

Leliaert, F., Boedeker, C., Pea, V. Bunker, F., Verbruggen, H., & De Clerck, O. 2009. *Cladophora rhodolithicola* sp. nov. (Cladophorales, Chlorophyta), a diminutive species from European maerl beds. *European Journal of Phycology*, 44(2), 155-169.

Leliaert, F., Verbruggen, H., Vanormelingen, P., Steen, F., López-Bautista, J.M., Zuccarello, G.C. & De Clerck, O. 2014. DNA-based species delimitation in algae. *European Journal of Phycology,* 49(2), 179-196.

Maggs, C.A. 1983. A phenological study of the epiflora of two maerl beds in Galway Bay. Galway, University College, Galway, Ireland.

Maggs, C.A. & Guiry, M.D. 1987. *Gelidiella calcicola* sp. nov. (Rhodophyta) from the British Isles and Northern France. *British Phycological Journal*, 22(4), 417-434.

Maggs, C.A. & Guiry, M.D. 1989. A re-evaluation of the crustose red algal genus *Cruoria* and the family Cruoriaceae. *British Phycological Journal,* 24(3), 253-269.

Maggs, C.A., Guiry, M.D. & Irvine, L.M. 1983. The life history in culture of an isolate of *Rhododiscus pulcherrimus* (Naecariaceae; Rhodophyta) from Ireland. *British Phycological Journal*, 18, 206.

Miller, F., McCallum, S., White, A., Azzarello, J. & Caryl, F. 2017. Predictive mapping of seabed features within selected Special Areas of Conservation and Nature Conservation MPAs in Scottish territorial waters using available datasets. *Scottish Natural Heritage Commissioned Report No. 980.*
https://www.nature.scot/snh-commissioned-report-980-predictive-mapping-seabed-features-within-selected-special-areas

Mercer, T., Kamphausen, L., Moore, J., Bunker, F., Archer Thompson, J. & Howson, C. 2018. South Arran MPA diver survey of maerl beds, kelp and seaweed communities on sublittoral sediment, and seagrass beds 2014. Scottish *Natural Heritage Research Report No. 882*.

Moore, C.G., Harries, D.B., Porter, J.S. & Lyndon, A.R. 2010. The establishment of site condition monitoring of marine features of Loch Laxford Special Area of Conservation. *Scottish Natural Heritage Commissioned Report No. 378*. https://www.nature.scot/snh-commissioned-report-378-establishment-site-condition-monitoring-marine-features-loch-laxford

Moore, C.G., Harries, D.B., Trigg, C., Porter, J.S. & Lyndon, A.R. 2011. The distribution of Priority Marine Features and MPA search features within the Ullapool Approaches: a broadscale validation survey. *Scottish Natural Heritage Commissioned Report No. 422*. https://www.nature.scot/snh-commissioned-report-422-distribution-priority-marine-features-and-mpa-search-features-within

Moore, C.G., Lyndon, A.R. & Mair, J.M. 2004. The establishment of site condition monitoring of marine sedimentary habitats in the Sound of Arisaig cSAC. *Scottish Natural Heritage Commissioned Report No. 071.*

Moore, C.G., Saunders G.W., Mair, J.M. & Lyndon, A.R. 2006. The inauguration of site condition monitoring of marine features of Loch Maddy Special Area of Conservation. *Scottish Natural Heritage Research Commissioned Report No. 152*.

Moore, C.G., Harries, D.B., Cook, R.L., Saunders, G.R., Atkinson, R.J.A. & Sanderson, W.G. 2015. 2014 site condition monitoring survey of marine sedimentary habitats in the Sound of Arisaig SAC. *Scottish Natural Heritage Commissioned Report No. 807*. https://www.nature.scot/snh-commissioned-report-807-2014-site-condition-monitoring-survey-marine-sedimentary-habitats-sound

Pardo, C., Lopez, L., Peña, V., Hernandez-Kant˙n, J., Le Gall, L., Bárbara, I. & Barreiro, R. 2014. A Multilocus Species Delimitation Reveals a Striking Number of Species of Coralline Algae Forming Maerl in the OSPAR Maritime Area. *PLoS One,* 9(8) e104073.

Peña, V. & Bárbara, I. 2010a. New records of crustose seaweeds associated with subtidal maërl beds and gravel bottoms in Galicia (NW Spain). *Botanica Marina,* 53, 41-61.

Peña, V. & Bárbara, I. 2010b. Seasonal patterns in the maërl community of shallow European Atlantic beds and their use as a baseline for monitoring studies. *European Journal of Phycology*, 45(3), 327-342.

Peña, V. & Bárbara, I. 2013. Non-coralline crustose algae associated with maerl beds in Portugal: a reappraisal of their diversity in the Atlantic Iberian beds. *Botanica Marina*. 56, 481-493.

Peña, V., Bárbara, I., Grall, J., Maggs, C.A. & Hall-Spencer, J.M. 2014. The diversity of seaweeds on maerl in the NE Atlantic. *Marine Biodiversity*, 44(4), 533-551.

Peña, V., Pardo, C., López, L., Carro, B., Hernandez-Kantun, J., Adey, W.H., Bárbara, I., Barreiro, R. & Gall, L.L. 2015. *Phymatolithon lusitanicum* sp. nov. (Hapalidiales, Rhodophyta): the third most abundant maerl-forming species in the Atlantic Iberian Peninsula. *Cryptogamie, Algologie,* 36(4), 1-31.

Walker, R.H., Brodie, J., Russell, S., Irvine, L.M. & Orfanidis, S. 2009. Biodiversity of coralline algae in the northeastern Atlantic including *Corallina Caespitosa* sp. nov. (Corallinoideae, Rhodophyta). *Journal of Phycology*, 45(1), 287-297.

ANNEX 1: SPECIMEN CATALOGUE

Specimens have been lodged with the Royal Botanic Garden, Edinburgh.

AphiaID	ScientificName	Authority	Qualifier	Date	Site	Collected	Identified	Herbarium Sheet
144582	*Griffithsia corallinoides*	(Linnaeus) Trevisan, 1845		10/09/2015	X47	CMH	CMH	A
144538	*Ceramium cimbricum*	H.E.Petersen, 1924		10/09/2015	X47	CMH	CMH	A
144634	*Polysiphonia fibrillosa*	(Dillwyn) Sprengel, 1827		10/09/2015	X47	CMH	CMH	A
145617	*Rhodophyllis divaricata*	(Stackhouse) Papenfuss, 1950		10/09/2015	X47	CMH	CMH	A
145621	*Halarachnion ligulatum*	(Woodward) Kützing, 1843		10/09/2015	X47	CMH	CMH	B
145297	*Cutleria multifida*	(Turner) Greville, 1830		10/09/2015	X47	CMH	CMH	C
295880	*Grateloupia turuturu*	Yamada, 1941		08/09/2015	SA110	CMH	FDB	D
145700	*Gracilaria gracilis*	(Stackhouse) M.Steentoft, L.M.Irvine & W.F.Farnham, 1995		08/09/2015	SA110	CMH	CMH	E
145808	*Chylocladia verticillata*	(Lightfoot) Bliding, 1928		08/09/2015	SA110	CMH	CMH	F
852	Rhodophyta	Wettstein, 1901	uncertain - Heterosiphonia-like	08/09/2015	SA110	CMH	CMH	F
145621	*Halarachnion ligulatum*	(Woodward) Kützing, 1843		08/09/2015	SA110	CMH	CMH	G
146401	*Scinaia interrupta*	(A.P.de Candolle) M.J.Wynne, 1989		08/09/2015	SA110	CMH	CMH	G
144683	*Pterothamnion plumula*	(J.Ellis) Nägeli, 1855		08/09/2015	SA110	CMH	CMH	G
145613	*Calliblepharis ciliata*	(Hudson) Kützing, 1843		08/09/2015	SA110	CMH	CMH	G
145313	*Asperococcus fistulosus*	(Hudson) W.J.Hooker, 1833		08/09/2015	SA110	CMH	CMH	H
144296	*Ulva*	Linnaeus, 1753	species uncertain	08/09/2015	SA110	CMH	CMH	H
143996	*Cladophora*	Kützing, 1843	species uncertain	08/09/2015	SA110	CMH	CMH	H
144438	*Asparagopsis armata*	Harvey, 1855		08/09/2015	SA110	CMH	CMH	H
145620	*Furcellaria lumbricalis*	(Hudson)		08/09/2015	SA110	CMH	CMH	H

AphiaID	ScientificName	Authority	Qualifier	Date	Site	Collected	Identified	Herbarium Sheet
		J.V.Lamouroux, 1813						
144223	*Plocamium*	J.V.Lamouroux, 1813	species uncertain	08/09/2015	SA110	CMH	CMH	I
144799	*Chondria dasyphylla*	(Woodward) C.Agardh, 1817		07/09/2015	S18	FDB	FDB	J
144672	*Polysiphonia stricta*	(Dillwyn) Greville, 1824		07/09/2015	S18	FDB	FDB	J
145668	*Polyides rotunda*	(Hudson) Gaillon, 1828		07/09/2015	S18	FDB	FDB	J
376729	*Spyridia griffithsiana*	(J.E.Smith) G.C.Zuccarello, Prud'homme van Reine & H.Stegenga, 2004		07/09/2015	S18	FDB	FDB	J
836896	*Dasysiphonia japonica*	(Yendo) H.-S.Kim, 2012		07/09/2015	S18	FDB	FDB	J
145615	*Cystoclonium purpureum*	(Hudson) Batters, 1902		07/09/2015	S18	FDB	FDB	J
156078	*Ulva clathrata*	(Roth) C.Agardh, 1811		07/09/2015	S18	FDB	FDB	J
145226	*Dudresnaya verticillata*	(Withering) Le Jolis, 1863		07/09/2015	S18	FDB	FDB	J
144562	*Ceramium secundatum*	Lyngbye, 1819		07/09/2015	S18	FDB	FDB	K
144582	*Griffithsia corallinoides*	(Linnaeus) Trevisan, 1845		07/09/2015	S18	FDB	FDB	K
145782	*Plocamium cartilagineum*	(Linnaeus) P.S.Dixon, 1967		07/09/2015	S18	FDB	FDB	K
144595	*Halurus flosculosus*	(J.Ellis) Maggs & Hommersand, 1993		07/09/2015	S18	FDB	FDB	K
144296	*Ulva*	Linnaeus, 1753	species uncertain	07/09/2015	S18	CMH	CMH	L
145847	*Cordylecladia erecta*	(Greville) J.Agardh, 1852		07/09/2015	S18	CMH	CMH	L
145367	*Dictyota dichotoma*	(Hudson) J.V.Lamouroux, 1809		07/09/2015	S18	CMH	CMH	L
145306	*Arthrocladia villosa*	(Hudson) Duby, 1830	probably Sporochnus FDB	07/09/2015	S18	CMH	CMH	M
145915	*Sporochnus pedunculatus*	(Hudson) C.Agardh, 1820		07/09/2015	S18	CMH	CMH	N
144595	*Halurus flosculosus*	(J.Ellis) Maggs & Hommersand, 1993		07/09/2015	S18	CMH	CMH	O
145226	*Dudresnaya verticillata*	(Withering) Le Jolis,		07/09/2015	S18	CMH	CMH	O

AphiaID	ScientificName	Authority	Qualifier	Date	Site	Collected	Identified	Herbarium Sheet
		1863						
156078	*Ulva clathrata*	(Roth) C.Agardh, 1811	uncertain	07/09/2015	S18	CMH	CMH	P
145615	*Cystoclonium purpureum*	(Hudson) Batters, 1902		07/09/2015	S18	CMH	CMH	Q
376729	*Spyridia griffithsiana*	(Wulfen) Harvey, 1833	check	07/09/2015	S18	CMH	CMH	R
145703	*Gracilaria longissima*	(S.G.Gmelin) Steentoft, L.M.Irvine & Farnham, 1995		08/09/2015	SA110	FDB	FDB	S
144562	*Ceramium secundatum*	Lyngbye, 1819		08/09/2015	SA110	FDB	FDB	S
295880	*Grateloupia turuturu*	Yamada, 1941		08/09/2015	SA110	FDB	FDB	T
145306	*Arthrocladia villosa*	(Hudson) Duby, 1830		08/09/2015	SA110	FDB	FDB	U
143717	Ectocarpaceae	C. Agardh, 1828	on Chorda	08/09/2015	SA110	FDB	FDB	U
144438	*Asparagopsis armata*	Harvey, 1855		09/09/2015	ZN01D	CMH	CMH	V
145808	*Chylocladia verticillata*	(Lightfoot) Bliding, 1928		09/09/2015	ZN01D	CMH	CMH	W
144634	*Polysiphonia fibrillosa*	(Dillwyn) Sprengel, 1827		09/09/2015	ZN01D	CMH	CMH	W
178915	*Ceramium virgatum*	Roth, 1797		09/09/2015	ZN01D	CMH	CMH	W
144924	*Mesogloia vermiculata*	(Smith) S.F.Gray, 1821		09/09/2015	ZN01D	CMH	CMH	X
852	Rhodophyta	Wettstein, 1901	Dark red encrusting on maerl	08/09/2015	SA110	FDB	FDB	In formalin
145700	*Gracilaria gracilis*	(Stackhouse) M.Steentoft, L.M.Irvine & W.F.Farnham, 1995	?	07/09/2015	S18	FDB	FDB	In formalin
	Cladophora Ectocarpaceae			09/09/2015	EAST1D	FDB	FDB	In formalin
135318	*Lucernariopsis campanulata*	(Lamouroux, 1815)		08/09/2015	SA110	JJM	JJM	In formalin
124465	*Leptosynapta inhaerens*	(O.F. Müller, 1776)		08/09/2015	SA110	JJM	JJM	In formalin
117382	*Laomedea flexuosa*	Alder, 1857		10/09/2015	SOBX17	JJM	JJM	In formalin
129229	*Chaetopterus*	Cuvier, 1830		08/09/2015	SA110	JJM	JJM	In formalin

ANNEX 2: SPECIES AND ABUNDANCE DATA FOR MAERL MONITORING TRANSECTS

Species lists and abundances for maerl transects. Nomenclature after Boxshall *et al*. (2015) and abundances after Hiscock (1996).

Taxon	Qualifier	Aphia Id	S18	SA110	SOBX17	SOBX47	SOBX47B
Leucosolenia	-	131715					R
Leucosolenia botryoides	-	132216	R				
Lucernariopsis campanulata	-	135318		R			
Hydractinia echinata	-	117644	O				
Aglaophenia kirchenpaueri	-	117277		R			
Plumularia setacea	-	117824					
Sertularia argentea	-	117912		R	R		
Clytia hemisphaerica	-	117368					R
Laomedea angulata	-	117379					
Laomedea flexuosa	-	117382					
Obelia geniculata	-	117388		R	R		R
Cerianthus lloydii	-	283798		R		R	
Anemonia viridis	-	100808			F	R	R
Anthopleura ballii	-	100812					
Sagartia elegans	-	100991					
Cereus pedunculatus	-	100987	R	O			
Polycelis nigra	-	416417					
Chaetopterus	-	129229	O	O	O		R
Arenicola	-	129206	O		F		
Lanice conchilega	-	131495	O	O	O		
Pista cristata	-	131516					P
Sabellidae	-	985		R			
Branchiomma bombyx	-	130878	F				
Myxicola infundibulum	-	130932	R				
Sabella pavonina	-	130967	R				
Spirobranchus	-	129582			F		O
Spirobranchus triqueter	-	555935		F			
Spirorbis	-	129642	O				
Ericthonius punctatus	-	102408					
Jassa falcata	-	102431		O			
Caprella acanthifera	-	101822		O			
Caprella linearis	-	101839	O				
Phtisica marina	-	101864		O			
Idotea	-	118454		R			
Idotea balthica	-	119039					
Idotea linearis	-	119046		P			
Anapagurus hyndmanni	-	107217		O	R	O	R
Pagurus bernhardus	-	107232	O	O	R	F	R
Pagurus prideaux	-	107239	O				
Hyas araneus	-	107322	R				
Macropodia tenuirostris	-	107346	O		O	R	R
Cancer pagurus	-	107276		O	O	O	
Liocarcinus corrugatus	-	107386		F	C		R
Liocarcinus depurator	-	107387	F	R	O		
Liocarcinus marmoreus	-	107390		R			
Necora puber	-	107398			F		
Carcinus maenas	-	107381	O				R
Tectura virginea	-	153552			O		F
Margarites helicinus	-	141821					
Gibbula magus	-	141790	R			F	R

Taxon	Qualifier	Aphia Id	S18	SA110	SOBX17	SOBX47	SOBX47B
Gibbula cineraria	-	141782	F	O			O
Tricolia pullus	-	141700					
Lacuna pallidula	-	140168					
Lacuna vincta	-	140170	O				
Rissoidae	-	123		F			F
Rissoa parva	-	141365	F	F			F
Nassarius reticulatus	-	140513					
Elysia viridis	-	139686		R			
Hermaea bifida	-	140092	R		P		
Eubranchus	-	137954				R	
Eubranchus	Tiny white on Laomedea on Zostera	137954					
Aequipecten opercularis	-	140687					R
Pecten maximus	-	140712					
Pecten maximus	juvenile	140712					R
Pecten maximus	Spat	140712	F				
Ensis	-	138333					
Dosinia exoleta	-	141911		P			A
Polititapes rhomboides	-	745846					P
Chamelea gallina	-	141907					
Clausinella fasciata	-	141909		P			P
Mya truncata	-	140431	O				
Mya arenaria	-	140430					O
Thracia phaseolina	-	152378					P
Sepiola atlantica	-	141454					
Patinella verrucaria	-	146845		R			
Celleporella hyalina	-	111397					R
Membranipora membranacea	-	111411					R
Electra pilosa	-	111355					R
Scrupocellaria	-	110866		R			
Cradoscrupocellaria reptans	-	738997					R
Asterias rubens	-	123776	R		R	C	O
Asterias rubens	juvenile	123776			F		
Ophiura albida	-	124913					
Echinocardium cordatum	-	124392					
Leptosynapta inhaerens	probably (anchors studied under x40)	124465		P			
Diplosoma listerianum	-	103579					R
Corella parallelogramma	-	103743				R	R
Ascidiella aspersa	-	103718					O
Ascidiella scabra	-	103719					O
Botrylloides leachii	-	250081					
Pollachius pollachius	-	126440					
Gasterosteus aculeatus aculeatus	-	236462					
Spinachia spinachia	-	126508					
Myoxocephalus scorpius	-	127203			O		
Taurulus bubalis	-	127204	R	R			
Pholis gunnellus	-	126996			R		
Callionymus reticulatus	-	126795	F	F	F	O	R
Gobiidae	-	125537					

Taxon	Qualifier	Aphia Id	S18	SA110	SOBX17	SOBX47	SOBX47B
Gobiusculus flavescens	-	126898					
Pomatoschistus	-	125999					
Pomatoschistus	?microps	125999					
Pomatoschistus microps	-	126927					
Pomatoschistus pictus	-	126930	F	F	F	F	F
Hippoglossus hippoglossus	check	127138			R		
Rhodophyta	non calcareous red crusts	852	O		O		
Porphyra	-	143808		R			
Scinaia interrupta	-	146401	R	O	R		
Asparagopsis armata	-	144438			R		
Asparagopsis armata	Falkenbergia	144438		O	F	R	O
Asparagopsis armata	Gametophytes	144438					
Bonnemaisonia asparagoides	-	144440	R				
Bonnemaisonia hamifera	Trailliella	144442	A		O	C	R
Gelidiella calcicola	-	145568		P	R		
Palmaria palmata	-	145771					R
Rhodophysema georgei	-	371031					
Dudresnaya verticillata	-	145226	R		R		
Grateloupia turuturu	-	295880		F			
Peyssonnelia	-	144051			R		O
Corallinaceae	encrusting	143691		R			R
Corallinaceae	encrusting on Zostera - specimen	143691					
Corallina officinalis	-	145108			R		R
Jania rubens	-	145130		R		R	R
Maerl indet	-	999000908	F	C	S	F	
Maerl indet	specimens taken	999000908					S
Gracilaria gracilis	-	145700	R		O	R	
Gracilariopsis longissima	-	146960		O			
Ahnfeltia plicata	-	144422					R
Phyllophora crispa	-	145660	R				R
Chondrus crispus	-	145625			R		R
Polyides rotunda	-	145668	R		R		R
Plocamium	-	144223		O			
Plocamium cartilagineum	-	145782	R		R		R
Plocamium cartilagineum	maerl form	145782				R	
Plocamium lyngbyanum	-	502848	R				
Furcellaria lumbricalis	-	145620		R	O		
Halarachnion ligulatum	-	145621		F	R	R	
Calliblepharis ciliata	-	145613		R			R
Cystoclonium purpureum	-	145615	O	O			
Rhodophyllis divaricata	-	145617		R		R	R
Cruoria cruoriiformis	check specimen	145611			F		R
Cordylecladia erecta	-	145847	R				
Chylocladia verticillata	-	145808		R			O
Lomentaria clavellosa	-	145825	R	R	R	R	R
Aglaothamnion tenuissimum	-	144501					R

Taxon	Qualifier	Aphia Id	S18	SA110	SOBX17	SOBX47	SOBX47B
Aglaothamnion pseudobyssoides	-	144498					
Ceramium cimbricum	-	144538				O	R
Ceramium echionotum	-	144547				R	
Ceramium virgatum	-	178915					
Ceramium pallidum	-	144555					
Ceramium secundatum	-	144562	R	C	O		O
Griffithsia corallinoides	-	144582	R	R		R	R
Halurus flosculosus	-	144595	R	O	R		R
Pterothamnion plumula	-	144683	R	O		R	R
Spermothamnion repens	-	144702				R	
Spermothamnion strictum	-	144704				R	
Spyridia griffithsiana	-	376729	O				R
Cryptopleura ramosa	-	144743		O			R
Delesseria sanguinea	-	144744		R			R
Hypoglossum hypoglossoides	-	144756		R			R
Nitophyllum punctatum	-	144770		F	O	R	R
Heterosiphonia plumosa	-	144732			O		
Dasysiphonia japonica	-	232226	C		O	R	F
Brongniartella byssoides	-	144792	O				
Chondria dasyphylla	-	144799	R		R	R	R
Polysiphonia elongata	-	144628	R	R		R	R
Polysiphonia fibrillosa	-	144634				O	R
Polysiphonia fucoides	-	144639				R	R
Polysiphonia stricta	-	144672					
Pterosiphonia parasitica	-	144851				R	
Rhodomela confervoides	-	144854		R	R	O	
Phaeophyceae	-	830			O		
Phaeophyceae	straggly branched specimen	830					R
Ectocarpaceae	-	143717	O	O	O	C	
Ectocarpaceae	on Zostera	143717					
Ectocarpaceae	see specimen	143717					F
Eudesme virescens	-	144918				R	
Mesogloia vermiculata	-	144924					R
Cutleria multifida	-	145297				R	
Cutleria multifida	Aglaozonia	145297	R		F		
Sphacelaria	-	144272	O				
Sphacelaria	see specimen	144272			O		F
Chaetopteris plumosa	check	497297				R	
Cladostephus spongiosus	-	145888			O		O
Cladostephus spongiosus	Large subtidal variety	145888				F	
Dictyota dichotoma	-	145367	A	C	F	F	F
Sporochnus pedunculatus	-	145915	O	F	O		
Desmarestia aculeata	-	145307		O		R	
Desmarestia ligulata	-	145309		R			
Desmarestia viridis	-	145310				R	O
Arthrocladia villosa	-	145306	O	O			
Asperococcus fistulosus	-	145313		R		O	
Asperococcus bullosus	-	145311	O				R

Taxon	Qualifier	Aphia Id	S18	SA110	SOBX17	SOBX47	SOBX47B
Colpomenia peregrina	-	145856	R				R
Chorda filum	-	145722	C	F	O	F	F
Halosiphon tomentosus	-	145723		R			
Laminaria	sporelings	144199		R			R
Laminaria hyperborea	-	145725		R	R		R
Saccharina latissima	-	234483	C	F	F		F
Halidrys siliquosa	-	145540					
Chlorophyta	green wool see specimen	801					R
Ulva clathrata	-	156078	O				
Ulva compressa	?	234462					
Ulva intestinalis	-	234471					
Ulva	flat	144296	R	O	F	O	R
Ulva	tubular	144296	R				
Ulva lactuca	-	145984	R	O	R	F	R
Cladophora	-	143996		R		F	
Cladophora	big see specimen	143996					R
Cladophora	small see specimen	143996					R
Cladophora albida	-	145033	R				
Cladophora hutchinsiae	specimen	145049					
Cladophora rupestris	-	145064					
Cladophora rhodolithicola	-	580339				R	
Zostera (*Zostera*) *marina*	-	145795			R		

ANNEX 3: SEAWEED SPECIES IDENTIFIED FROM MAERL SAMPLES FOR MAERL MONITORING TRANSECTS

The data in the following table is presence / absence information where presence = 1 and absence = blank

		Site	S18	S18	S18	S18	S18
		Identifier	FB	FB	CMH	CMH	CMH
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
143661	Acrochaetiaceae						
144438	*Asparagopsis armata*	*Falkenbergia*					1
145311	*Asperococcus bullosus*						
148899	Bacillariophyceae	Tubes					
144440	*Bonnemaisonia asparagoides*					1	
144442	*Bonnemaisonia hamifera*	*Trailiella*	1	1	1	1	1
144792	*Brongniartella byssoides*				1		1
144526	*Callithamnion corymbosum*						
144538	*Ceramium cimbricum*						
144547	*Ceramium echinotum*						
144562	*Ceramium secundatum*		1				
145027	*Chaetomorpha linum*		1	1			
145029	*Chaetomorpha melagonium*						
144799	*Chondria dasyphylla*						
145808	*Chylocladia verticillata*						
145049	*Cladophora hutchensiae*						
580339	*Cladophora rhodolithicola*		1	1	1	1	1
143996	*Cladophora* sp.			1			1
145888	*Cladostephus spongiosus*		1				
145108	*Corallina officinalis*						
143691	Corallinaceae	Crusts	1	1	1	1	1
144743	*Cryptopleura ramosa*						
145297	*Cutleria multifida*	Gametophyte					
145297	*Cutleria multifida*	*Aglaozonia* sporophyte					
145307	*Desmarestia aculeata*						
145367	*Dictyota dichotoma*		1	1	1		
145404	*Ectocarpus fasciculatus*						
145568	*Gelidiella calcicola*		1	1	1	1	1

		Site	S18	S18	S18	S18	S18
		Identifier	FB	FB	CMH	CMH	CMH
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
145700	*Gracilaria gracilis*		1	1	1	1	
144582	*Griffithsia corallinoides*						
145621	*Halarachnion ligulatum*						
144595	*Halurus flosculosus*		1	1			
836896	*Dasysiphonia japonica*		1	1	1	1	1
144732	*Heterosiphonia plumosa*				1		
144756	*Hypoglossum hypoglossoides*			1			
145130	*Jania rubens*						
145821	*Lomentaria articulata*						
145825	*Lomentaria clavellosa*						
	Maerl	Maerl (live)	1	1	1		1
	Maerl	Maerl (dead)	1	1	1	1	1
144770	*Nitophyllum punctatum*						
144051	*Peyssonnelia*						
830	Phaeophyceae	Brown crusts	1	1		1	1
830	Phaeophyceae	Filamentous					
145660	*Phyllophora crispa*			1			
162854	*Polysiphonia brodiei*						
145782	*Plocamium cartilagineum*		1	1	1	1	1
502848	*Plocamium lyngbyanum*						
144639	*Polysiphonia fucoides*		1				
144634	*Polysiphonia fibrillosa*						
144628	*Polysiphonia elongata*						
144651	*Polysiphonia nigra*						
145668	*Polyides rotundus*						
144672	*Polysiphonia stricta*			1			
144851	*Pterosiphonia parasitica*						
144683	*Pterothamnion plumula*						1
144690	*Ptilothamnion sphaericum*		1	1	1		
144854	*Rhodomela confervoides*						
145617	*Rhodophyllis divaricata*						
852	Rhodophyta	Dark crusts	1	1	1	1	1

		Site	S18	S18	S18	S18	S18
		Identifier	FB	FB	CMH	CMH	CMH
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
144702	*Spermothamnion repens*				1	1	1
144704	*Spermothamnion strictum*						
145892	*Sphacelaria cirrosa*		1				
497297	*Chaetopteris plumosa*						
376729	*Spyridia griffithsiana*		1	1			
144296	*Ulva*	flat	1	1		1	
144296	*Ulva*	tubular	1				
156078	*Ulva clathrata*				1	1	1

		Site	SOBX17	SOBX17	SOBX17	SOBX17	SOBX17
		Identifier	FB	FB	FB	FB	FB
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
143661	Acrochaetiaceae		1				
144438	*Asparagopsis armata*	*Falkenbergia*	1	1	1	1	1
145311	*Asperococcus bullosus*						
148899	Bacillariophyceae	Tubes					
144440	*Bonnemaisonia asparagoides*						
144442	*Bonnemaisonia hamifera*	*Trailiella*					
144792	*Brongniartella byssoides*						
144526	*Callithamnion corymbosum*						
144538	*Ceramium cimbricum*						
144547	*Ceramium echinotum*						1
144562	*Ceramium secundatum*				1		1
145027	*Chaetomorpha linum*						1
145029	*Chaetomorpha melagonium*						
144799	*Chondria dasyphylla*		1	1		1	
145808	*Chylocladia verticillata*			1		1	
145049	*Cladophora hutchensiae*			1	1	1	
580339	*Cladophora rhodolithicola*		1	1	1	1	1
143996	*Cladophora* sp.		1	1			
145888	*Cladostephus spongiosus*						
145108	*Corallina officinalis*		1		1	1	
143691	Corallinaceae	Crusts	1	1	1		
144743	*Cryptopleura ramosa*			1		1	1
145297	*Cutleria multifida*	Gametophyte					
145297	*Cutleria multifida*	*Aglaozonia* sporophyte				1	
145307	*Desmarestia aculeata*						
145367	*Dictyota dichotoma*						
145404	*Ectocarpus fasciculatus*						
145568	*Gelidiella calcicola*		1	1	1	1	1
145700	*Gracilaria gracilis*		1		1	1	1
144582	*Griffithsia corallinoides*						
145621	*Halarachnion ligulatum*						
144595	*Halurus flosculosus*						
836896	*Dasysiphonia japonica*		1	1	1	1	
144732	*Heterosiphonia plumosa*						

		Site	SOBX17	SOBX17	SOBX17	SOBX17	SOBX17
		Identifier	FB	FB	FB	FB	FB
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
144756	*Hypoglossum hypoglossoides*		1				
145130	*Jania rubens*		1	1			
145821	*Lomentaria articulata*						
145825	*Lomentaria clavellosa*		1	1	1		1
	Maerl	Maerl (live)	1	1	1	1	1
	Maerl	Maerl (dead)	1	1	1	1	1
144770	*Nitophyllum punctatum*						
144051	*Peyssonnelia*		1	1	1	1	1
830	Phaeophyceae	Brown crusts					
830	Phaeophyceae	Filamentous					
145660	*Phyllophora crispa*						
162854	*Polysiphonia brodiei*						
145782	*Plocamium cartilagineum*		1	1			1
502848	*Plocamium lyngbyanum*					1	1
144639	*Polysiphonia fucoides*						1
144634	*Polysiphonia fibrillosa*						
144628	*Polysiphonia elongata*		1	1			
144651	*Polysiphonia nigra*		1	1		1	
145668	*Polyides rotundus*			1			
144672	*Polysiphonia stricta*		1	1	1	1	
144851	*Pterosiphonia parasitica*		1				
144683	*Pterothamnion plumula*			1			
144690	*Ptilothamnion sphaericum*		1	1			
144854	*Rhodomela confervoides*			1			
145617	*Rhodophyllis divaricata*						
852	Rhodophyta	Dark crusts					1
144702	*Spermothamnion repens*						
144704	*Spermothamnion strictum*						
145892	*Sphacelaria cirrosa*		1	1		1	1
497297	*Chaetopteris plumosa*						
376729	*Spyridia griffithsiana*			1			
144296	*Ulva*	flat			1	1	1
144296	*Ulva*	tubular					
156078	*Ulva clathrata*						

		Site	SA110	SA110	SA110	SA110	SA110
		Identifier	CMH	CMH	CMH	FB	FB
		Sample No.	**1**	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
143661	Acrochaetiaceae					1	
144438	*Asparagopsis armata*	*Falkenbergia*			1	1	1
145311	*Asperococcus bullosus*						
148899	Bacillariophyceae	Tubes					
144440	*Bonnemaisonia asparagoides*			1			
144442	*Bonnemaisonia hamifera*	*Trailiella*	1	1	1		
144792	*Brongniartella byssoides*		1		1		
144526	*Callithamnion corymbosum*						
144538	*Ceramium cimbricum*						
144547	*Ceramium echinotum*						
144562	*Ceramium secundatum*					1	1
145027	*Chaetomorpha linum*						
145029	*Chaetomorpha melagonium*						
144799	*Chondria dasyphylla*						
145808	*Chylocladia verticillata*						
145049	*Cladophora hutchensiae*						
580339	*Cladophora rhodolithicola*		1	1	1		1
143996	*Cladophora* sp				1		
145888	*Cladostephus spongiosus*						
145108	*Corallina officinalis*						
143691	Corallinaceae	Crusts	1	1	1	1	
144743	*Cryptopleura ramosa*						
145297	*Cutleria multifida*	Gametophyte					
145297	*Cutleria multifida*	Aglaozonia sporophyte					
145307	*Desmarestia aculeata*						
145367	*Dictyota dichotoma*		1			1	1
145404	*Ectocarpus fasciculatus*						
145568	*Gelidiella calcicola*		1	1	1	1	1
145700	*Gracilaria gracilis*		1	1			
144582	*Griffithsia corallinoides*						
145621	*Halarachnion ligulatum*						
144595	*Halurus flosculosus*					1	1
836896	*Dasysiphonia japonica*		1	1	1		
144732	*Heterosiphonia plumosa*		1				

		Site	SA110	SA110	SA110	SA110	SA110
		Identifier	CMH	CMH	CMH	FB	FB
		Sample No.	**1**	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
144756	*Hypoglossum hypoglossoides*					1	
145130	*Jania rubens*					1	
145821	*Lomentaria articulata*						
145825	*Lomentaria clavellosa*					1	1
	Maerl	Maerl (live)	1		1	1	1
	Maerl	Maerl (dead)	1	1	1		
144770	*Nitophyllum punctatum*					1	
144051	*Peyssonnelia*						
830	*Phaeophyceae*	Brown crusts		1	1		
830	*Phaeophyceae*	Filamentous					
145660	*Phyllophora crispa*						
162854	*Polysiphonia brodiei*						
145782	*Plocamium cartilagineum*		1	1	1		
502848	*Plocamium lyngbyanum*						
144639	*Polysiphonia fucoides*						
144634	*Polysiphonia fibrillosa*						
144628	*Polysiphonia elongata*					1	1
144651	*Polysiphonia nigra*						
145668	*Polyides rotundus*						
144672	*Polysiphonia stricta*						
144851	*Pterosiphonia parasitica*					1	
144683	*Pterothamnion plumula*				1	1	1
144690	*Ptilothamnion sphaericum*		1			1	1
144854	*Rhodomela confervoides*						
145617	*Rhodophyllis divaricata*						
852	Rhodophyta	Dark crusts	1	1	1	1	
144702	*Spermothamnion repens*		1	1	1		
144704	*Spermothamnion strictum*			1	1		
145892	*Sphacelaria cirrosa*						
497297	*Chaetopteris plumosa*						
376729	*Spyridia griffithsiana*						
144296	*Ulva*	flat		1		1	1
144296	*Ulva*	tubular					
156078	*Ulva clathrata*		1	1	1		

		Site	SOBX47	SOBX47	SOBX47	SOBX47	SOBX47
		Identifier	FB	CMH	CMH	CMH	CMH
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
143661	Acrochaetiaceae						
144438	*Asparagopsis armata*	*Falkenbergia*	1		1	1	1
145311	*Asperococcus bullosus*						1
148899	Bacillariophyceae	Tubes	1				
144440	*Bonnemaisonia asparagoides*			1	1	1	
144442	*Bonnemaisonia hamifera*	Trailiella	1	1	1	1	1
144792	*Brongniartella byssoides*						
144526	*Callithamnion corymbosum*			1			1
144538	*Ceramium cimbricum*				1	1	
144547	*Ceramium echinotum*		1		1	1	1
144562	*Ceramium secundatum*						
145027	*Chaetomorpha linum*				1	1	1
145029	*Chaetomorpha melagonium*						
144799	*Chondria dasyphylla*				1	1	
145808	*Chylocladia verticillata*			1	1	1	
145049	*Cladophora hutchensiae*						
580339	*Cladophora rhodolithicola*			1	1		1
143996	*Cladophora* sp		1	1	1	1	1
145888	*Cladostephus spongiosus*				1		
145108	*Corallina officinalis*				1		
143691	Corallinaceae	Crusts	1	1	1	1	1
144743	*Cryptopleura ramosa*						
145297	*Cutleria multifida*	Gametophyte					
145297	*Cutleria multifida*	*Aglaozonia* sporophyte					
145307	*Desmarestia aculeata*						
145367	*Dictyota dichotoma*		1	1		1	1
145404	*Ectocarpus fasciculatus*		1				
145568	*Gelidiella calcicola*			1	1	1	1
145700	*Gracilaria gracilis*					1	
144582	*Griffithsia corallinoides*		1				
145621	*Halarachnion ligulatum*			1	1		
144595	*Halurus flosculosus*				1	1	
836896	*Dasysiphonia japonica*		1	1	1	1	1
144732	*Heterosiphonia plumosa*						

		Site	SOBX47	SOBX47	SOBX47	SOBX47	SOBX47
		Identifier	FB	CMH	CMH	CMH	CMH
		Sample No.	1	2	3	4	5
Aphia ID accepted	Taxon	Qualifier					
144756	*Hypoglossum hypoglossoides*			1	1	1	1
145130	*Jania rubens*			1			
145821	*Lomentaria articulata*						
145825	*Lomentaria clavellosa*		1	1	1	1	1
	Maerl	Maerl (live)	1	1	1	1	
	Maerl	Maerl (dead)		1	1	1	
144770	*Nitophyllum punctatum*						
144051	*Peyssonnelia*						
830	Phaeophyceae	Brown crusts					
830	Phaeophyceae	Filamentous					
145660	*Phyllophora crispa*						
162854	*Polysiphonia brodiei*						
145782	*Plocamium cartilagineum*		1	1	1	1	1
502848	*Plocamium lyngbyanum*				1		
144639	*Polysiphonia fucoides*						
144634	*Polysiphonia fibrillosa*			1	1		1
144628	*Polysiphonia elongata*			1	1	1	1
144651	*Polysiphonia nigra*						
145668	*Polyides rotundus*						
144672	*Polysiphonia stricta*						
144851	*Pterosiphonia parasitica*						
144683	*Pterothamnion plumula*			1		1	1
144690	*Ptilothamnion sphaericum*		1	1	1	1	1
144854	*Rhodomela confervoides*						
145617	*Rhodophyllis divaricata*			1			
852	Rhodophyta	Dark crusts	1	1	1	1	1
144702	*Spermothamnion repens*		1	1	1		1
144704	*Spermothamnion strictum*				1	1	
145892	*Sphacelaria cirrosa*		1	1	1	1	1
497297	*Chaetopteris plumosa*				1		1
376729	*Spyridia griffithsiana*		1		1		1
144296	*Ulva*	flat	1	1	1		
144296	*Ulva*	tubular					
156078	*Ulva clathrata*						

		Site	SOBX47B	SOBX47B	SOBX47B	SOBX47B	SOBX47B
		Identifier	FB	FB	FB	FB	FB
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
143661	Acrochaetiaceae						
144438	*Asparagopsis armata*	*Falkenbergia*	1	1		1	1
145311	*Asperococcus bullosus*				1		
148899	Bacillariophyceae	Tubes					
144440	*Bonnemaisonia asparagoides*						
144442	*Bonnemaisonia hamifera*	*Trailiella*	1				1
144792	*Brongniartella byssoides*						
144526	*Callithamnion corymbosum*						
144538	*Ceramium cimbricum*		1	1			
144547	*Ceramium echinotum*		1	1	1		1
144562	*Ceramium secundatum*		1	1		1	1
145027	*Chaetomorpha linum*					1	1
145029	*Chaetomorpha melagonium*						
144799	*Chondria dasyphylla*				1		
145808	*Chylocladia verticillata*		1				
145049	*Cladophora hutchensiae*						
580339	*Cladophora rhodolithicola*						
143996	*Cladophora* sp		1	1	1	1	
145888	*Cladostephus spongiosus*			1		1	
145108	*Corallina officinalis*		1	1			
143691	Corallinaceae	Crusts	1	1	1	1	1
144743	*Cryptopleura ramosa*			1	1		
145297	*Cutleria multifida*	Gametophyte	1				
145297	*Cutleria multifida*	*Aglaozonia* sporophyte			1	1	
145307	*Desmarestia aculeata*		1				
145367	*Dictyota dichotoma*		1	1	1	1	
145404	*Ectocarpus fasciculatus*			1			
145568	*Gelidiella calcicola*		1		1	1	1
145700	*Gracilaria gracilis*				1		
144582	*Griffithsia corallinoides*						
145621	*Halarachnion ligulatum*			1	1	1	1
144595	*Halurus flosculosus*		1	1			
836896	*Dasysiphonia japonica*		1	1	1	1	1
144732	*Heterosiphonia plumosa*						

		Site	SOBX47B	SOBX47B	SOBX47B	SOBX47B	SOBX47B
		Identifier	FB	FB	FB	FB	FB
		Sample No.	1	2	3	4	5
Aphia ID accepted	**Taxon**	**Qualifier**					
144756	*Hypoglossum hypoglossoides*		1	1	1	1	
145130	*Jania rubens*		1	1	1	1	1
145821	*Lomentaria articulata*			1			
145825	*Lomentaria clavellosa*		1	1	1	1	1
	Maerl	Maerl (live)	1	1	1	1	1
	Maerl	Maerl (dead)		1	1	1	1
144770	*Nitophyllum punctatum*						
144051	*Peyssonnelia*		1	1	1	1	1
830	Phaeophyceae	Brown crusts			1		
830	Phaeophyceae	Filamentous			1		
145660	*Phyllophora crispa*						
162854	*Polysiphonia brodiei*			1			
145782	*Plocamium cartilagineum*		1	1	1	1	1
502848	*Plocamium lyngbyanum*						
144639	*Polysiphonia fucoides*			1	1		1
144634	*Polysiphonia fibrillosa*				1		
144628	*Polysiphonia elongata*		1	1		1	1
144651	*Polysiphonia nigra*		1			1	1
145668	*Polyides rotundus*						
144672	*Polysiphonia stricta*		1	1	1	1	
144851	*Pterosiphonia parasitica*		1		1		
144683	*Pterothamnion plumula*						
144690	*Ptilothamnion sphaericum*		1		1	1	
144854	*Rhodomela confervoides*		1				
145617	*Rhodophyllis divaricata*		1				1
852	Rhodophyta	Dark crusts	1				1
144702	*Spermothamnion repens*						
144704	*Spermothamnion strictum*						
145892	*Sphacelaria cirrosa*		1	1	1	1	1
497297	*Chaetopteris plumosa*						
376729	*Spyridia griffithsiana*		1	1	1	1	1
144296	*Ulva*	flat	1	1	1	1	
144296	*Ulva*	tubular			1		
156078	*Ulva clathrata*						

ANNEX 4: PERCENTAGE LIVE AND DEAD MAERL QUADRAT DATA FROM MAERL MONITORING TRANSECTS

The table below gives the *in-situ* estimations of live and dead maerl from quadrats at the different study sites.

Site & Date	S18	07/09/2015		SA110	08/09/2015		SOBX47	10/09/2015		SOBX47B	11/09/2015		SOBX17	12/09/2015	
Quadrat	% live maerl	% total maerl / maerl gravel	Recorder	% live maerl	% total maerl / maerl gravel	Recorder	% live maerl	% total maerl / maerl gravel	Recorder	% live maerl	% total maerl / maerl gravel	Recorder	% live maerl	% total maerl / maerl gravel	Recorder
1	0.25	5	JJM	45	98	RM	3	100	BJ	26	100	RM	46	50	RM
2	0.25	15	JJM	42	100	RM	1	100	BJ	68	100	RM	86	94	RM
3	1	30	JJM	28	90	RM	3	100	BJ	22	100	RM	90	93	RM
4	0.25	4	JJM	36	93	RM	3	100	BJ	16	100	RM	86	88	RM
5	1	70	JJM	38	100	RM	2	100	BJ	47	100	RM	94	96	RM
6	0.25	30	JJM	26	84	RM	4	100	BJ	92	100	RM	76	78	RM
7	1	15	JJM	22	98	RM	0.5	100	BJ	1	100	RM	98	100	RM
8	1	25	JJM	22	88	RM	2	100	BJ	58	100	RM	96	98	RM
9	0.25	25	JJM	30	100	RM	2	100	BJ	42	100	RM	42	44	RM
10	0.25	25	JJM	28	96	RM	1	100	BJ	60	100	RM	90	92	RM
11	0.25	15	JJM	33	98	BJ	3	100	RM	12	100	BJ	76	80	BJ
12	0.25	20	JJM	36	99	BJ	4	100	RM	59	100	BJ	94	96	BJ
13	0.25	5	JJM	35	94	BJ	3	100	RM	38	100	BJ	90	93	BJ
14	0.25	10	JJM	24	84	BJ	4	100	RM	80	100	BJ	90	92	BJ
15	0.25	20	JJM	29	98	BJ	5	100	RM	56	100	BJ	90	91	BJ
16	1	30	JJM	26	96	BJ	3	100	RM	54	100	BJ	91	94	BJ
17	0.25	30	JJM	33	98	BJ	2	100	RM	26	100	BJ	82	85	BJ
18	0.25	25	JJM	28	98	BJ	8	100	RM	59	100	BJ	76	80	BJ
19	0.25	30	JJM	22	97	BJ	2	100	RM	27	100	BJ	79	83	BJ
20	0.25	10	JJM	28	90	BJ	8	100	RM	75	100	BJ	88	89	BJ
21	1	30	JJM												
22	0.25	30	JJM												
Mean	**0.45**	**22.68**		**30.55**	**94.95**		**3.175**	**100**		**45.9**	**100**		**83**	**85.8**	

ANNEX 5: SPECIES AND ABUNDANCE DATA FOR PHASE 2 STUDIES (ON SITES OTHER THAN MAERL MONITORING TRANSECTS)

The following species lists follow nomenclature by Boxshall et al. (2015) and abundances follow Hiscock (1996)

Taxon	Qualifier	Aphiaid	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Leucosolenia	-	131715								
Leucosolenia botryoides	-	132216								
Lucernariopsis campanulata	-	135318		O		O	F		R	
Hydractinia echinata	-	117644								
Aglaophenia kirchenpaueri	-	117277								
Plumularia setacea	-	117824	R		R		O		R	R
Sertularia argentea	-	117912								
Clytia hemisphaerica	-	117368								
Laomedea angulata	-	117379					O		O	
Laomedea flexuosa	-	117382	O	O		F				
Obelia geniculata	-	117388								
Cerianthus lloydii	-	283798							O	
Anemonia viridis	-	100808	R	F	F	F	F		F	
Anthopleura ballii	-	100812			O	R				
Sagartia elegans	-	100991			O				R	
Cereus pedunculatus	-	100987			O			R	R	O
Polycelis nigra	-	416417						R		
Chaetopterus	-	129229	O							
Arenicola	-	129206			O		O			
Lanice conchilega	-	131495						F		O
Pista cristata	-	131516								
Sabellidae	-	985								
Branchiomma bombyx	-	130878								
Myxicola infundibulum	-	130932								
Sabella pavonina	-	130967							R	
Spirobranchus	-	129582	R							

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Spirobranchus triqueter	-	555935						O		
Spirorbis	-	129642								
Ericthonius punctatus	-	102408	P			O				F
Jassa falcata	-	102431								C
Caprella acanthifera	-	101822								
Caprella linearis	-	101839								
Phtisica marina	-	101864								
Idotea	-	118454						R	R	
Idotea balthica	-	119039			R					P
Idotea linearis	-	119046								
Anapagurus hyndmanni	-	107217								
Pagurus bernhardus	-	107232			A		F	O	C	C
Pagurus prideaux	-	107239								
Hyas araneus	-	107322								R
Macropodia tenuirostris	-	107346	O						C	
Cancer pagurus	-	107276								
Liocarcinus corrugatus	-	107386								R
Liocarcinus depurator	-	107387								
Liocarcinus marmoreus	-	107390								
Necora puber	-	107398			F					
Carcinus maenas	-	107381			C		C	O	C	A
Tectura virginea	-	153552								
Margarites helicinus	-	141821		P						
Gibbula magus	-	141790	R							
Gibbula cineraria	-	141782	F	A						R
Tricolia pullus	-	141700				F				
Lacuna pallidula	-	140168			R		R			R
Lacuna vincta	-	140170			R					O
Rissoidae	-	123								
Rissoa parva	-	141365			C	F	F	R		F

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Nassarius reticulatus	-	140513	O						R	
Elysia viridis	-	139686						R		
Hermaea bifida	-	140092								
Eubranchus	-	137954								
Eubranchus	Tiny white on *Laomedea* on *Zostera*	137954							R	
Aequipecten opercularis	-	140687								
Pecten maximus	-	140712	O							
Pecten maximus	juvenile	140712								
Pecten maximus	Spat	140712								
Ensis	-	138333							F	
Dosinia exoleta	-	141911								
Polititapes rhomboides	-	745846								
Chamelea gallina	-	141907							P	
Clausinella fasciata	-	141909								
Mya truncata	-	140431								
Mya arenaria	-	140430								
Thracia phaseolina	-	152378								
Sepiola atlantica	-	141454				R				
Patinella verrucaria	-	146845								
Celleporella hyalina	-	111397					R			
Membranipora membranacea	-	111411	O							
Electra pilosa	-	111355				R			R	
Scrupocellaria	-	110866								
Cradoscrupocellaria reptans	-	738997								
Asterias rubens	-	123776	O							
Asterias rubens	juvenile	123776								
Ophiura albida	-	124913						R		
Echinocardium cordatum	-	124392							C	

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Leptosynapta inhaerens	probably (anchors studied under x40)	124465								
Diplosoma listerianum	-	103579	R	C	A	F	O		A	R
Corella parallelogramma	-	103743								
Ascidiella aspersa	-	103718								
Ascidiella scabra	-	103719		R						
Botrylloides leachii	-	250081					R			
Pollachius pollachius	-	126440			O					R
Gasterosteus aculeatus aculeatus	-	236462					O			
Spinachia spinachia	-	126508		R	R				R	
Myoxocephalus scorpius	-	127203			P					
Taurulus bubalis	-	127204								
Pholis gunnellus	-	126996								
Callionymus reticulatus	-	126795			O	R	F			
Gobiidae	-	125537						R		
Gobiusculus flavescens	-	126898		O	F	O	F		F	F
Pomatoschistus	-	125999	F			O		O		
Pomatoschistus	?microps	125999							F	
Pomatoschistus microps	-	126927			C					
Pomatoschistus pictus	-	126930								
Hippoglossus hippoglossus	check	127138								
Rhodophyta	non calcareous red crusts	852	O							
Porphyra	-	143808								

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Scinaia interrupta	-	146401	R							
Asparagopsis armata	-	144438					F			
Asparagopsis armata	Falkenbergia	144438	F	O		O	O	F		
Asparagopsis armata	Gametophytes	144438				O				
Bonnemaisonia asparagoides	-	144440								
Bonnemaisonia hamifera	Trailliella	144442	A		O	F	F		F	R
Gelidiella calcicola	-	145568								
Palmaria palmata	-	145771								
Rhodophysema georgei	-	371031			O	O				F
Dudresnaya verticillata	-	145226								
Grateloupia turuturu	-	295880								
Peyssonnelia	-	144051						R		
Corallinaceae	encrusting	143691					F	O		
Corallinaceae	encrusting on Zostera - specimen	143691				O				
Corallina officinalis	-	145108								
Jania rubens	-	145130	R		R	O				
Maerl indet	-	999000908	A	F						
Maerl indet	specimens taken	999000908								
Gracilaria gracilis	-	145700						R		
Gracilariopsis longissima	-	146960					O	F		
Ahnfeltia plicata	-	144422								
Phyllophora crispa	-	145660	R							
Chondrus crispus	-	145625				O	O			
Polyides rotunda	-	145668								
Plocamium	-	144223								
Plocamium cartilagineum	-	145782								

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Plocamium cartilagineum	maerl form	145782								
Plocamium lyngbyanum	-	502848								
Furcellaria lumbricalis	-	145620				O	O			
Halarachnion ligulatum	-	145621								
Calliblepharis ciliata	-	145613								
Cystoclonium purpureum	-	145615					R			
Rhodophyllis divaricata	-	145617	O							
Cruoria cruoriiformis	check specimen	145611								
Cordylecladia erecta	-	145847						O		
Chylocladia verticillata	-	145808		R	A		F	O	F	O
Lomentaria clavellosa	-	145825				R	R			
Aglaothamnion tenuissimum	-	144501								
Aglaothamnion pseudobyssoides	-	144498				R				
Ceramium cimbricum	-	144538								
Ceramium echionotum	-	144547								
Ceramium virgatum	-	178915					O			
Ceramium pallidum	-	144555			R					R
Ceramium secundatum	-	144562				O		O	F	
Griffithsia corallinoides	-	144582					R			
Halurus flosculosus	-	144595						R		
Pterothamnion plumula	-	144683								
Spermothamnion repens	-	144702								

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Spermothamnion strictum	-	144704								
Spyridia griffithsiana	-	376729								
Cryptopleura ramosa	-	144743								
Delesseria sanguinea	-	144744							R	
Hypoglossum hypoglossoides	-	144756							R	
Nitophyllum punctatum	-	144770				O				
Heterosiphonia plumosa	-	144732								
Dasysiphonia japonica	-	232226	C	O				O		
Brongniartella byssoides	-	144792								
Chondria dasyphylla	-	144799					O			
Polysiphonia elongata	-	144628					O			
Polysiphonia fibrillosa	-	144634					R			
Polysiphonia fucoides	-	144639						R	O	
Polysiphonia stricta	-	144672						R		
Pterosiphonia parasitica	-	144851								
Rhodomela confervoides	-	144854						R	R	
Phaeophyceae	-	830								
Phaeophyceae	straggly branched specimen	830								
Ectocarpaceae	-	143717	F	F				S	S	S
Ectocarpaceae	on Zostera	143717				F				
Ectocarpaceae	see specimen	143717								
Eudesme virescens	-	144918								
Mesogloia vermiculata	-	144924				O	R	R		
Cutleria multifida	-	145297								
Cutleria multifida	Aglaozonia	145297	O					R		

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Sphacelaria	-	144272	O					R		
Sphacelaria	see specimen	144272								
Chaetopteris plumosa	check	497297								
Cladostephus spongiosus	-	145888	R			O		R		
Cladostephus spongiosus	Large subtidal variety	145888								
Dictyota dichotoma	-	145367	F	O				O	F	
Sporochnus pedunculatus	-	145915								
Desmarestia aculeata	-	145307	O			O				
Desmarestia ligulata	-	145309								
Desmarestia viridis	-	145310								
Arthrocladia villosa	-	145306								
Asperococcus fistulosus	-	145313	R		R		R			
Asperococcus bullosus	-	145311								
Colpomenia peregrina	-	145856	O		R	R				
Chorda filum	-	145722	O	O	F	O	F	F	C	F
Halosiphon tomentosus	-	145723								
Laminaria	sporelings	144199								
Laminaria hyperborea	-	145725	O							
Saccharina latissima	-	234483	F	O		R		O		
Halidrys siliquosa	-	145540					R			
Chlorophyta	green wool see specimen	801								
Ulva clathrata	-	156078								
Ulva compressa	?	234462					R			
Ulva intestinalis	-	234471							O	
Ulva	flat	144296	O	O	R	O		F		
Ulva	tubular	144296	O	R	R		O		C	
Ulva lactuca	-	145984					O			

Taxon	Qualifier	Aphiald	SOBX49 Maerl	SOBX49 Zostera	ZL04D	ZL05D	ZN01D	EAST1D	EAST2D	EAST4D
Cladophora	-	143996				R				
Cladophora	big see specimen	143996								
Cladophora	small see specimen	143996								
Cladophora albida	-	145033								
Cladophora hutchinsiae	specimen	145049						R		
Cladophora rupestris	-	145064	R		R	R	R			R
Cladophora rhodolithicola	-	580339								
Zostera (*Zostera*) *marina*	-	145795		S	S		S	S	A	S

ANNEX 5: PARTICLE SIZE ANALYSIS FOR DIVER COLLECTED CORES

Barra maerl core PSD	Size	Phi	SA110	SOBx 47	SOBx 47b	SOBx 17	S18	ZLO4D
Medium pebble (gravel)	>8mm	<-3	1.56	1.08	6.73	10.55	0	0
Small pebble (gravel)	5.6-8mm	-2.5 to -3	9.43	0.29	5.58	8.01	0.29	0.05
	4-5.6mm	-2 to -2.5	12.42	2.52	12.27	3.25	1.99	0
Granule	2.8-4mm	-1.5 to -2	21.24	8.71	12.17	2.06	2.38	0.30
	2-2.8 mm	-1 to -1.5	19.51	16.46	12.40	0.83	2.26	0.18
Sand - very coarse	1.4-2mm	-0.5 to -1	17.36	31.05	19.98	0.62	1.26	0.25
	1-1.4mm	0 to -0.5	5.83	19.64	12.32	0.37	0.53	0.25
Sand - coarse	710-1000µm	0.5 to 0	2.41	10.01	8.11	0.47	0.75	0.71
	500-710µm	1 to 0.5	2.44	3.27	4.17	2.56	1.24	4.58
Sand - medium	350-500µm	1.5 to 1	2.08	1.21	1.65	8.95	2.99	15.17
	250-350µm	2 to 1.5	1.17	0.63	0.61	18.64	9.45	34.72
Sand - fine	177-250µm	2.5 to 2	0.35	0.22	0.19	19.50	17.96	32.44
	125-177µm	3 to 2.5	0.10	0.09	0.09	13.10	23.20	8.97
Sand - very fine	90-125µm	3.5 to 3	0.04	0.07	0.08	4.44	12.76	0.99
	63-90µm	4 to 3.5	0.02	0.06	0.07	1.07	4.31	0.26
Silt & Clay	<63µm	>4	4.05	4.70	3.59	5.57	18.64	1.13
Percentage LoI			5.54	6.92	5.08	6.94	5.15	1.18

ANNEX 6: SPECIES AND ABUNDANCE DATA FOR DIVER COLLECTED CORES

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Porifera	Grant, 1836								
Sycon	Risso, 1827								
Cnidaria	Verrill, 1865								
Anthopleura ballii	(Gosse, 1854)								
Edwardsiidae indet.	Andres, 1881					1		1	2
Nemertea									
Nemertea spp.					2		2	1	
Nematoda									
Nematoda		4	1	1	3	3	4	8	6
Sipuncula									
Nephasoma minutum	(Keferstein, 1862)					3	1	2	6
Annelida									
Pisione remota	(Southern, 1914)								
Polynoidae juv.	Kinberg, 1856		2				2	2	1
Harmothoe imbricata	(Linnaeus, 1767)			1				2	
Harmothoe impar	(Johnston, 1839)			1	3	2		1	1
Pholoe baltica	Örsted, 1843	1							
Pholoe inornata	Johnston, 1839		1				1	2	
Sthenelais boa	(Johnston, 1833)								
Phyllodocidae juv.	Örsted, 1843						1		
Pseudomystides limbata	(Saint-Joseph, 1888)								
Phyllodoce mucosa	Örsted, 1843								
Paranaitis kosteriensis	(Malmgren, 1867)								
Glycera juv.	Lamarck, 1818		1		1				
Glycera lapidum	Quatrefages, 1866	4	5	4	2	4	4	9	5
Glycera tridactyla	Schmarda, 1861								
Ephesiella abyssorum	(Hansen, 1878)						2		
Hesionidae indet	Grube, 1850							1	
Oxydromus flexuosus	(Delle Chiaje, 1827)							1	
Psamathe fusca	Johnston, 1836	1	1	2		1	1	1	
Nereimyra punctata	(Müller, 1788)			1		1		1	2

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Eurysyllis tuberculata	Ehlers, 1864					1	1		
Syllis Sp. B	Savigny in Lamarck, 1818					1			
Syllis cornuta	Rathke, 1843		7	8	11	13	18	19	19
Syllis hyalina	Grube, 1863								
Syllis vittata	Grube, 1840								
Trypanosyllis coeliaca	Claparède, 1868		8	1	3	1	2	4	2
Sphaerosyllis bulbosa	Southern, 1914	12	3		3	2	8	3	8
Sphaerosyllis hystrix	Claparède, 1863								1
Sphaerosyllis taylori	Perkins, 1981				1				1
Parexogone hebes	(Webster & Benedict, 1884)					1			
Platynereis dumerilii	(Audouin & Milne Edwards, 1834)	1	1		2	1	1	6	2
Eunicidae	Berthold, 1827				1				
Lysidice unicornis	(Grube, 1840)					1		1	
Hilbigneris gracilis	(Ehlers, 1868)						1		
Protodorvillea kefersteini	(McIntosh, 1869)	6		3	2	5	4	9	1
Scoloplos armiger	(Müller, 1776)								
Aonides oxycephala	(Sars, 1862)	8	4	11	9	13	9	19	13
Aonides paucibranchiata	Southern, 1914	1	1	4		2	2	4	3
Dipolydora caulleryi	(Mesnil, 1897)								
Polydora ciliata	(Johnston, 1838)						1		
Aurospio banyulensis	(Laubier, 1966)				1		2		
Pseudopolydora pulchra	(Carazzi, 1893)	1							
Pygospio elegans	Claparède, 1863								
Spio juv.	Fabricius, 1785								
Paraspio decorata	(Bobretzky, 1870)								
Microspio mecznikowianus	(Claparède, 1869)			1					
Spiophanes bombyx	(Claparède, 1870)			3					
Marenzellaria wireni									

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Cirratulidae juv.	Carus, 1863								
Caulleriella alata	(Southern, 1914)								
Flabelligera affinis	M. Sars, 1829								
Macrochaeta clavicornis	(M. Sars, 1835)		1						
Capitella agg.	Blainville, 1828								
Mediomastus fragilis	Rasmussen, 1973	13	13	15	9	9	12	24	26
Notomastus agg.	Sars, 1850		1	2	2	3	3	7	2
Arenicola marina	(Linnaeus, 1758)								
Microclymene tricirrata	Arwidsson, 1906								1
Euclymene lombricoides	(Quatrefages, 1866)								
Euclymene oerstedi	(Claparède, 1863)			1	1				
Praxillella affinis	(M. Sars in G.O. Sars, 1872)								
Ophelia limacina	(Rathke, 1843)								
Polyophthalmus pictus	(Dujardin, 1839)		5		1	1	1		
Scalibregma celticum	Mackie, 1991			1					
Scalibregma inflatum	Rathke, 1843								
Polygordius sp.	Schneider, 1868	5	7		4			10	4
Owenia fusiformis	Delle Chiaje, 1844								
Trichobranchus glacialis	Malmgren, 1866								
Amphitritides gracilis	(Grube, 1860)								
Pista cristata	(Müller, 1776)	2	7	6	2	2	5	1	4
Polycirrus medusa	Grube, 1850					1			
Polycirrus norvegicus	Wollebaek, 1912			1		2	3	4	4
Dialychone dunerificta		1		1	1		1		
Hydroides norvegica	Gunnerus, 1768	1							
Spirobranchus triqueter	(Linnaeus, 1758)							1	
Tubificoides amplivasatus	(Erséus, 1975)								
Tubificoides benedii	(Udekem, 1855)	28	1	3	1				

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Tubificoides pseudogaster	(Dahl, 1960)					3	1	1	
Enchytraeidae spp.	Vejdovský, 1879	3			3	1	4	7	3
Crustacea	Brünnich, 1772								
Zoea larva			1						
Megalopa larva									
Copepoda	Milne-Edwards, 1840		1	1					
Nebalia bipes	(Fabricius, 1780)								
Apherusa bispinosa	(Bate, 1857)	1			1		3		
Perioculodes longimanus	(Bate & Westwood, 1868)								
Parapleustes bicuspis	(Krøyer, 1838)			2					
Apolochus neapolitanus	(Della Valle, 1893)								
Leucothoe lilljeborgi	Boeck, 1861	2	1	3	1	1	3		
Urothoe elegans	(Bate, 1857)								
Urothoe marina	(Bate, 1857)								
Harpinia laevis	Sars, 1891								
Harpinia pectinata	Sars, 1891								
Metaphoxus fultoni	(Scott, 1890)						1		1
Lysianassa caesarea	Ruffo, 1987		4	1	5	1	2	3	
Orchomenella nana	(Krøyer, 1846)								
Socarnes erythrophthalmus	Robertson, 1892			1	1	1		2	
Iphimedia minuta	G.O. Sars, 1882				2				
Dexamine spinosa	(Montagu, 1813)		2		2				
Ampelisca typica	(Bate, 1856)								
Melitidae indet	Bousfield, 1973								
Abludomelita obtusata	(Montagu, 1813)								
Animoceradocus semiserratus	(Bate, 1862)			1			2		
Cheirocratus sp.	Norman, 1867				1				
Cheirocratus intermedius	G.O. Sars, 1895								
Othomaera othonis	(Milne Edwards, 1830)							12	

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Gammaropsis nitida	(Stimpson, 1853)	1				1	1		
Ericthonius punctatus	(Bate, 1857)								
Aora typica	Krøyer, 1845								
Leptocheirus hirsutimanus	(Bate, 1862)	1		1	1	6	11		3
Leptocheirus pilosus	(Zaddach, 1844)		1	1	1				
Microdeutopus anomalus	(Rathke, 1843)								
Microdeutopus versiculatus	(Bate, 1856)				3				
Crassicorophium crassicorne	(Bruzelius, 1859)						1		
Caprella acanthifera	Leach, 1814					2			
Pariambus typicus	(Krøyer, 1884)		1						
Phtisica marina	Slabber, 1769								
Janira maculosa	Leach, 1814				1	1	4	1	
Bodotria arenosa	Goodsir, 1843								
Iphinoe trispinosa	(Goodsir, 1843)								
Vaunthompsonia cristata	Bate, 1858								
Aspseudes talpa								1	
Paguroidea	Latreille, 1802								
Munida	Leach, 1820								
Pisidia	Leach, 1820							1	
Liocarcinus juv.	Stimpson, 1871								
Liocarcinus corrugatus	(Pennant, 1777)						1		
Liocarcinus pusillus	(Leach, 1816)				1	1	1		
Mollusca									
Leptochiton cancellatus	(Sowerby, 1840)		3	1	1				
Lepidochitona cinerea	(Linnaeus, 1767)		2	3	8	3	7	2	5
Testudinalia testudinalis	(O. F. Müller, 1776)					1			
Jujubinus montagui	(Wood, 1828)		1						
Tricolia pullus	(Linnaeus, 1758)							1	

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Lacuna pallidula	(da Costa, 1778)								
Lacuna vincta	(Montagu, 1803)								
Rissoa parva	(da Costa, 1778)				1				
Alvania beanii	(Hanley in Thorpe, 1844)								
Onoba aculeus	(Gould, 1841)			1					
Crisilla semistriata	(Montagu, 1808)								
Hyala vitrea	(Montagu, 1803)				1				
Nucula nucleus	(Linnaeus, 1758)								
Crenella decussata	(Montagu, 1808)		2		2		1		1
Modiolus modiolus	(Linnaeus, 1758)								
Modiolula phaseolina	(Philippi, 1844)								
Glycymeris glycymeris	(Linnaeus, 1758)					1			
Limaria hians	(Gmelin, 1791)								1
Limatula surugensis	Stuardo, 1968								
Pectinidae juv.									
Anomiidae juv.	Rafinesque, 1815								
Lucinoma borealis	(Linnaeus, 1767)						1		
Kurtiella bidentata	(Montagu, 1803)								
Goodallia triangularis	(Montagu, 1803)	1		3	5				1
Parvicardium scabrum	(Philippi, 1844)						1	1	1
Spisula elliptica	(Brown, 1827)								
Ensis ensis	(Linnaeus, 1758)	1							
Moerella pygmaea	(Lovén, 1846)								
Gari tellinella	(Lamarck, 1818)			3		1	1	1	1
Abra alba	(W. Wood, 1802)								
Abra prismatica	(Montagu, 1808)								
Veneridae	Rafinesque, 1815								
Gouldia minima	(Montagu, 1803)								
Dosinia juv.	Scopoli, 1777	5			3	1	3		
Dosinia lupinus	(Linnaeus, 1758)								
Dosinia exoleta	(Linnaeus, 1758)	1	1	3	2			1	
Tapes juv.	Megerle von Mühlfeld, 1811				1				
Polititapes rhomboides	(Pennant, 1777)		1			2			

ScientificName_ accepted	Authority_ accepted	SoBX 47#1	SoBX 47#2	SoBX 47#3	SoBX 47#4	SoBX 47b#1	SoBX 47b#2	SoBX 47b#3	SoBX 47b#4
Chamelea gallina	(Linnaeus, 1758)								
Clausinella fasciata	(da Costa, 1778)						1		
Timoclea ovata	(Pennant, 1777)								
Thracia villosiuscula	(MacGillivray, 1827)				1				
Phoronida	Hatschek, 1888								
Phoronis sp.	Wright, 1856						3		1
Echinodermata	Bruguière, 1791 [ex Klein, 1734]								
Ophiothrix fragilis	(Abildgaard, in O.F. Müller, 1789)				1				
Amphipholis squamata	(Delle Chiaje, 1828)	6	8	13	5	4	8	5	5
Echinoidea juv.	Leske, 1778				1				
Echinocyamus pusillus	(O.F. Müller, 1776)								
Leptosynapta bergensis	(Östergren, 1905)	2							
Leptosynapta inhaerens	(O.F. Müller, 1776)								
Tunicata	Lamarck, 1816								
Corella parallelogramma	(Müller, 1776)					1			
Ascidiella scabra	(Müller, 1776)		1				1	1	
Molgula sp.	Forbes, 1848								
	Number of Taxa	27	34	36	48	42	49	42	33
	Number of individuals	113	100	109	120	106	154	184	137
	% total maerl	99	98	99	98	96	98	98	97
	Mean	98.5	97.25						
	% live maerl	5	4	4	4	4	8	5	4
	Mean	4.25	5.25						

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Porifera	Grant, 1836								
Sycon	Risso, 1827	P		P					p
Cnidaria	Verrill, 1865								
Anthopleura ballii	(Gosse, 1854)								
Edwardsiidae indet.	Andres, 1881					2		1	
Nemertea									
Nemertea spp.		2					2		3
Nematoda									
Nematoda			1		1	14	5	1	13
Sipuncula									
Nephasoma minutum	(Keferstein, 1862)								
Annelida									
Pisione remota	(Southern, 1914)						1		
Polynoidae juv.	Kinberg, 1856	1	1				1	1	
Harmothoe imbricata	(Linnaeus, 1767)								
Harmothoe impar	(Johnston, 1839)		1		1	2			
Pholoe baltica	Örsted, 1843								1
Pholoe inornata	Johnston, 1839								
Sthenelais boa	(Johnston, 1833)								
Phyllodocidae juv.	Örsted, 1843								
Pseudomystides limbata	(Saint-Joseph, 1888)					1			
Phyllodoce mucosa	Örsted, 1843				1				
Paranaitis kosteriensis	(Malmgren, 1867)								
Glycera juv.	Lamarck, 1818								
Glycera lapidum	Quatrefages, 1866	1		3	3	6	3	2	3
Glycera tridactyla	Schmarda, 1861								
Ephesiella abyssorum	(Hansen, 1878)								
Hesionidae indet	Grube, 1850								
Oxydromus flexuosus	(Delle Chiaje, 1827)					1			
Psamathe fusca	Johnston, 1836					1			
Nereimyra punctata	(Müller, 1788)								
Eurysyllis tuberculata	Ehlers, 1864								
Syllis Sp. B	Savigny in Lamarck,								

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
	1818								
Syllis cornuta	Rathke, 1843					8	2	5	7
Syllis hyalina	Grube, 1863						1	1	
Syllis vittata	Grube, 1840					3			
Trypanosyllis coeliaca	Claparède, 1868								
Sphaerosyllis bulbosa	Southern, 1914						1		1
Sphaerosyllis hystrix	Claparède, 1863								
Sphaerosyllis taylori	Perkins, 1981								
Parexogone hebes	(Webster & Benedict, 1884)					1			
Platynereis dumerilii	(Audouin & Milne Edwards, 1834)								
Eunicidae	Berthold, 1827								
Lysidice unicornis	(Grube, 1840)								
Hilbigneris gracilis	(Ehlers, 1868)								
Protodorvillea kefersteini	(McIntosh, 1869)	1		2		1	1		1
Scoloplos (Scoloplos) armiger	(Müller, 1776)								
Aonides oxycephala	(Sars, 1862)	11	17	24	8				
Aonides paucibranchiata	Southern, 1914				1			2	
Dipolydora caulleryi	(Mesnil, 1897)		1						
Polydora ciliata	(Johnston, 1838)								
Aurospio banyulensis	(Laubier, 1966)				1	1	1		2
Pseudopolydora pulchra	(Carazzi, 1893)								
Pygospio elegans	Claparède, 1863								
Spio juv.	Fabricius, 1785			1					
Paraspio decorata	(Bobretzky, 1870)				1				
Microspio mecznikowianus	(Claparède, 1869)								
Spiophanes bombyx	(Claparède, 1870)		2		3		1		1
Marenzellaria wireni			1		2				
Cirratulidae juv.	Carus, 1863								
Caulleriella alata	(Southern, 1914)								

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Flabelligera affinis	M. Sars, 1829							1	
Macrochaeta clavicornis	(M. Sars, 1835)								
Capitella agg.	Blainville, 1828	40	22	29	20				
Mediomastus fragilis	Rasmussen, 1973	51	31	31	51				1
Notomastus agg.	Sars, 1850					1		2	
Arenicola marina	(Linnaeus, 1758)								
Microclymene tricirrata	Arwidsson, 1906		1		5	1	2		1
Euclymene lombricoides	(Quatrefages, 1866)			1					
Euclymene oerstedi	(Claparède, 1863)	2	3	8	6				
Praxillella affinis	(M. Sars in G.O. Sars, 1872)								
Ophelia limacina	(Rathke, 1843)						1		
Polyophthalmus pictus	(Dujardin, 1839)				1				
Scalibregma celticum	Mackie, 1991								
Scalibregma inflatum	Rathke, 1843								
Polygordius sp.	Schneider, 1868						3	1	
Owenia fusiformis	Delle Chiaje, 1844	1							
Trichobranchus glacialis	Malmgren, 1866								
Amphitritides gracilis	(Grube, 1860)								
Pista cristata	(Müller, 1776)								
Polycirrus medusa	Grube, 1850								
Polycirrus norvegicus	Wollebaek, 1912				2				
Dialychone dunerificta									
Hydroides norvegica	Gunnerus, 1768					1		1	
Spirobranchus triqueter	(Linnaeus, 1758)								
Tubificoides amplivasatus	(Erséus, 1975)								
Tubificoides benedii	(Udekem, 1855)	9	5	6					
Tubificoides pseudogaster	(Dahl, 1960)								
Enchytraeidae spp.	Vejdovský, 1879	11		6	1	3	7	5	3
Crustacea	Brünnich, 1772								
Zoea larva				1		1			

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Megalopa larva							1		
Copepoda	Milne-Edwards, 1840								
Nebalia bipes	(Fabricius, 1780)	2	1						
Apherusa bispinosa	(Bate, 1857)						2		
Perioculodes longimanus	(Bate & Westwood, 1868)								
Parapleustes bicuspis	(Krøyer, 1838)								
Apolochus neapolitanus	(Della Valle, 1893)								
Leucothoe lilljeborgi	Boeck, 1861								
Urothoe elegans	(Bate, 1857)	21	9	9	3				
Urothoe marina	(Bate, 1857)	8	10	9	11				
Harpinia laevis	Sars, 1891		1	3	1	1			
Harpinia pectinata	Sars, 1891								
Metaphoxus fultoni	(Scott, 1890)								
Lysianassa caesarea	Ruffo, 1987								
Orchomenella nana	(Krøyer, 1846)	1	1		2				
Socarnes erythrophthalmus	Robertson, 1892					4	3	3	4
Iphimedia minuta	G.O. Sars, 1882			1					
Dexamine spinosa	(Montagu, 1813)		1	1		1	2		
Ampelisca typica	(Bate, 1856)	1		1					
Melitidae indet	Bousfield, 1973								1
Abludomelita obtusata	(Montagu, 1813)	3							
Animoceradocus semiserratus	(Bate, 1862)					3		2	4
Cheirocratus sp.	Norman, 1867								
Cheirocratus intermedius	G.O. Sars, 1895								
Othomaera othonis	(Milne Edwards, 1830)								
Gammaropsis nitida	(Stimpson, 1853)								1
Ericthonius punctatus	(Bate, 1857)			1					
Aora typica	Krøyer, 1845								
Leptocheirus hirsutimanus	(Bate, 1862)					1	1	1	

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Leptocheirus pilosus	(Zaddach, 1844)					1	1		2
Microdeutopus anomalus	(Rathke, 1843)								
Microdeutopus versiculatus	(Bate, 1856)	3	1		4			1	
Crassicorophium crassicorne	(Bruzelius, 1859)	16	1	6	11				
Caprella acanthifera	Leach, 1814			1					
Pariambus typicus	(Krøyer, 1884)				1				
Phtisica marina	Slabber, 1769		4	1					
Janira maculosa	Leach, 1814							1	
Bodotria arenosa	Goodsir, 1843								
Iphinoe trispinosa	(Goodsir, 1843)								
Vaunthompsonia cristata	Bate, 1858								
Aspseudes talpa									
Paguroidea	Latreille, 1802			1					
Munida	Leach, 1820		1			1			
Pisidia	Leach, 1820								
Liocarcinus juv.	Stimpson, 1871				1				
Liocarcinus corrugatus	(Pennant, 1777)								
Liocarcinus pusillus	(Leach, 1816)					3	1	1	
Mollusca									
Leptochiton cancellatus	(Sowerby, 1840)			1					1
Lepidochitona cinerea	(Linnaeus, 1767)	1	2	1	3	1	1		7
Testudinalia testudinalis	(O. F. Müller, 1776)								
Jujubinus montagui	(Wood, 1828)							1	
Tricolia pullus	(Linnaeus, 1758)					2		1	
Lacuna pallidula	(da Costa, 1778)								
Lacuna vincta	(Montagu, 1803)								
Rissoa parva	(da Costa, 1778)								
Alvania beanii	(Hanley in Thorpe, 1844)							1	
Onoba aculeus	(Gould, 1841)								
Crisilla semistriata	(Montagu, 1808)								
Hyala vitrea	(Montagu, 1803)								

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Nucula nucleus	(Linnaeus, 1758)								
Crenella decussata	(Montagu, 1808)					5	1	1	1
Modiolus modiolus	(Linnaeus, 1758)								
Modiolula phaseolina	(Philippi, 1844)					1	2	2	1
Glycymeris glycymeris	(Linnaeus, 1758)								
Limaria hians	(Gmelin, 1791)								
Limatula surugensis	Stuardo, 1968								1
Pectinidae juv.					1				
Anomiidae juv.	Rafinesque, 1815								
Lucinoma borealis	(Linnaeus, 1767)								
Kurtiella bidentata	(Montagu, 1803)								
Goodallia triangularis	(Montagu, 1803)					26	34	17	8
Parvicardium scabrum	(Philippi, 1844)			1					
Spisula elliptica	(Brown, 1827)								2
Ensis ensis	(Linnaeus, 1758)								
Moerella pygmaea	(Lovén, 1846)					2		1	
Gari tellinella	(Lamarck, 1818)					3	2	3	1
Abra alba	(W. Wood, 1802)								
Abra prismatica	(Montagu, 1808)								
Veneridae	Rafinesque, 1815						1	1	
Gouldia minima	(Montagu, 1803)					1			
Dosinia juv.	Scopoli, 1777						3	1	
Dosinia lupinus	(Linnaeus, 1758)								
Dosinia exoleta	(Linnaeus, 1758)								
Tapes juv.	Megerle von Mühlfeld, 1811						1		
Polititapes rhomboides	(Pennant, 1777)					1			1
Chamelea gallina	(Linnaeus, 1758)								1
Clausinella fasciata	(da Costa, 1778)						1		1
Timoclea ovata	(Pennant, 1777)		1			5	2	3	2
Thracia villosiuscula	(MacGillivray, 1827)								
Phoronida	Hatschek, 1888								
Phoronis sp.	Wright, 1856								2

ScientificName_ accepted	Authority_ accepted	SoBX 17#1	SoBX 17#2	SoBX 17#3	SoBX 17#4	SA 110#1	SA 110#2	SA 110#3	SA 110#4
Echinodermata	Bruguière, 1791 [ex Klein, 1734]								
Ophiothrix fragilis	(Abildgaard, in O.F. Müller, 1789)								
Amphipholis squamata	(Delle Chiaje, 1828)	1	6		4	6	5	3	7
Echinoidea juv.	Leske, 1778								
Echinocyamus pusillus	(O.F. Müller, 1776)						1		
Leptosynapta bergensis	(Östergren, 1905)								
Leptosynapta inhaerens	(O.F. Müller, 1776)					1		2	
Tunicata	Lamarck, 1816								
Corella parallelogramma	(Müller, 1776)								
Ascidiella scabra	(Müller, 1776)								
Molgula sp.	Forbes, 1848					1			
	Number of Taxa	21	25	25	28	38	34	31	31
	Number of individuals	187	125	149	150	118	97	69	85
	% total maerl	99	99	99	99	99	99	98	99
	Mean	99	98.75						
	% live maerl	85	40	50	35	5	3	6	15
	Mean	52.5	7.25						

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Porifera	Grant, 1836								
Sycon	Risso, 1827								
Cnidaria	Verrill, 1865								
Anthopleura ballii	(Gosse, 1854)					2		4	2
Edwardsiidae indet.	Andres, 1881								
Nemertea									
Nemertea spp.			1		1		2		
Nematoda									
Nematoda		1	16	6	5				
Sipuncula									
Nephasoma minutum	(Keferstein, 1862)								
Annelida									
Pisione remota	(Southern, 1914)								
Polynoidae juv.	Kinberg, 1856							1	
Harmothoe imbricata	(Linnaeus, 1767)								
Harmothoe impar	(Johnston, 1839)	1		1	1				
Pholoe baltica	Örsted, 1843		1						
Pholoe inornata	Johnston, 1839		1						
Sthenelais boa	(Johnston, 1833)			1					
Phyllodocidae juv.	Örsted, 1843								
Pseudomystides limbata	(Saint-Joseph, 1888)								
Phyllodoce mucosa	Örsted, 1843								
Paranaitis kosteriensis	(Malmgren, 1867)			1					
Glycera juv.	Lamarck, 1818								
Glycera lapidum	Quatrefages, 1866	1	1						
Glycera tridactyla	Schmarda, 1861	1							
Ephesiella abyssorum	(Hansen, 1878)		1	2					
Hesionidae indet	Grube, 1850								
Oxydromus flexuosus	(Delle Chiaje, 1827)				1				
Psamathe fusca	Johnston, 1836	2	3	1					
Nereimyra punctata	(Müller, 1788)								
Eurysyllis tuberculata	Ehlers, 1864								
Syllis Sp. B	Savigny in Lamarck, 1818								

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Syllis cornuta	Rathke, 1843								
Syllis hyalina	Grube, 1863								
Syllis vittata	Grube, 1840								
Trypanosyllis coeliaca	Claparède, 1868								
Sphaerosyllis bulbosa	Southern, 1914								
Sphaerosyllis hystrix	Claparède, 1863								
Sphaerosyllis taylori	Perkins, 1981								
Parexogone hebes	(Webster & Benedict, 1884)				1	1	3	2	
Platynereis dumerilii	(Audouin & Milne Edwards, 1834)								
Eunicidae	Berthold, 1827								
Lysidice unicornis	(Grube, 1840)								
Hilbigneris gracilis	(Ehlers, 1868)								
Protodorvillea kefersteini	(McIntosh, 1869)				1	1			
Scoloplos (Scoloplos) armiger	(Müller, 1776)					4	2	1	2
Aonides oxycephala	(Sars, 1862)		1		1				
Aonides paucibranchiata	Southern, 1914								
Dipolydora caulleryi	(Mesnil, 1897)								
Polydora ciliata	(Johnston, 1838)								
Aurospio banyulensis	(Laubier, 1966)	1							
Pseudopolydora pulchra	(Carazzi, 1893)		1	1					
Pygospio elegans	Claparède, 1863					1	19	14	6
Spio juv.	Fabricius, 1785								
Paraspio decorata	(Bobretzky, 1870)								1
Microspio mecznikowianus	(Claparède, 1869)								
Spiophanes bombyx	(Claparède, 1870)								
Marenzellaria wireni									
Cirratulidae juv.	Carus, 1863								2
Caulleriella alata	(Southern, 1914)								1

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Flabelligera affinis	M. Sars, 1829								
Macrochaeta clavicornis	(M. Sars, 1835)								
Capitella agg.	Blainville, 1828					2	6	3	4
Mediomastus fragilis	Rasmussen, 1973	3	3	7	4	1			
Notomastus agg.	Sars, 1850	4	1	1	7				
Arenicola marina	(Linnaeus, 1758)					1			
Microclymene tricirrata	Arwidsson, 1906	1		3	3	1		1	
Euclymene lombricoides	(Quatrefages, 1866)				1				
Euclymene oerstedi	(Claparède, 1863)	8		1	5		1	3	
Praxillella affinis	(M. Sars in G.O. Sars, 1872)	1							
Ophelia limacina	(Rathke, 1843)								
Polyophthalmus pictus	(Dujardin, 1839)		1						
Scalibregma celticum	Mackie, 1991								
Scalibregma inflatum	Rathke, 1843				1				
Polygordius sp.	Schneider, 1868								
Owenia fusiformis	Delle Chiaje, 1844								
Trichobranchus glacialis	Malmgren, 1866		1	2	2				
Amphitritides gracilis	(Grube, 1860)	1							
Pista cristata	(Müller, 1776)								
Polycirrus medusa	Grube, 1850			1					
Polycirrus norvegicus	Wollebaek, 1912								
Dialychone dunerificta									
Hydroides norvegica	Gunnerus, 1768								
Spirobranchus triqueter	(Linnaeus, 1758)								
Tubificoides amplivasatus	(Erséus, 1975)	6							
Tubificoides benedii	(Udekem, 1855)		17		2				
Tubificoides pseudogaster	(Dahl, 1960)		2	2					
Enchytraeidae spp.	Vejdovský, 1879			1		8	1	4	

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Crustacea	Brünnich, 1772								
Zoea larva									
Megalopa larva									
Copepoda	Milne-Edwards, 1840								
Nebalia bipes	(Fabricius, 1780)				1				
Apherusa bispinosa	(Bate, 1857)								
Perioculodes longimanus	(Bate & Westwood, 1868)						2	1	
Parapleustes bicuspis	(Krøyer, 1838)								
Apolochus neapolitanus	(Della Valle, 1893)							1	
Leucothoe lilljeborgi	Boeck, 1861								
Urothoe elegans	(Bate, 1857)	3	3	1	5	11	5		5
Urothoe marina	(Bate, 1857)					5	1		
Harpinia laevis	Sars, 1891	1		1	4	1	1		
Harpinia pectinata	Sars, 1891		1						
Metaphoxus fultoni	(Scott, 1890)		1		1				
Lysianassa caesarea	Ruffo, 1987	1			1				
Orchomenella nana	(Krøyer, 1846)						1		
Socarnes erythrophthalmus	Robertson, 1892		1		1				
Iphimedia minuta	G.O. Sars, 1882								
Dexamine spinosa	(Montagu, 1813)	1	1	2			3	2	
Ampelisca typica	(Bate, 1856)					1	1		1
Melitidae indet	Bousfield, 1973								
Abludomelita obtusata	(Montagu, 1813)								1
Animoceradocus semiserratus	(Bate, 1862)								
Cheirocratus sp.	Norman, 1867			1	2				
Cheirocratus intermedius	G.O. Sars, 1895	1		3					
Othomaera othonis	(Milne Edwards, 1830)								
Gammaropsis nitida	(Stimpson, 1853)							15	3
Ericthonius punctatus	(Bate, 1857)					21		1	3
Aora typica	Krøyer, 1845						3	3	

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Leptocheirus hirsutimanus	(Bate, 1862)								
Leptocheirus pilosus	(Zaddach, 1844)	1	2						
Microdeutopus anomalus	(Rathke, 1843)								1
Microdeutopus versiculatus	(Bate, 1856)	4			3			2	
Crassicorophium crassicorne	(Bruzelius, 1859)	5	1	1	6	14	24	10	3
Caprella acanthifera	Leach, 1814								
Pariambus typicus	(Krøyer, 1884)				1	1	4	1	5
Phtisica marina	Slabber, 1769	3	6	5	13		1		1
Janira maculosa	Leach, 1814								
Bodotria arenosa	Goodsir, 1843							3	
Iphinoe trispinosa	(Goodsir, 1843)	1	1	2	2	1			
Vaunthompsonia cristata	Bate, 1858		1						
Aspseudes talpa									
Paguroidea	Latreille, 1802								
Munida	Leach, 1820								
Pisidia	Leach, 1820								
Liocarcinus juv.	Stimpson, 1871								
Liocarcinus corrugatus	(Pennant, 1777)								
Liocarcinus pusillus	(Leach, 1816)								
Mollusca									
Leptochiton cancellatus	(Sowerby, 1840)								
Lepidochitona cinerea	(Linnaeus, 1767)								
Testudinalia testudinalis	(O. F. Müller, 1776)								
Jujubinus montagui	(Wood, 1828)								
Tricolia pullus	(Linnaeus, 1758)								
Lacuna pallidula	(da Costa, 1778)							3	1
Lacuna vincta	(Montagu, 1803)						1	5	
Rissoa parva	(da Costa, 1778)								

ScientificName_ accepted	Authority_ accepted	S18 #1	S18 #2	S18 #3	S18 #4	ZL 04#1	ZL 04#2	ZL 04#3	ZL 04#4
Alvania beanii	(Hanley in Thorpe, 1844)								
Onoba aculeus	(Gould, 1841)								
Crisilla semistriata	(Montagu, 1808)			1					
Hyala vitrea	(Montagu, 1803)								
Nucula nucleus	(Linnaeus, 1758)		1						
Crenella decussata	(Montagu, 1808)								
Modiolus modiolus	(Linnaeus, 1758)				1				
Modiolula phaseolina	(Philippi, 1844)								
Glycymeris glycymeris	(Linnaeus, 1758)								
Limaria hians	(Gmelin, 1791)								
Limatula surugensis	Stuardo, 1968								
Pectinidae juv.									
Anomiidae juv.	Rafinesque, 1815							1	
Lucinoma borealis	(Linnaeus, 1767)								
Kurtiella bidentata	(Montagu, 1803)		1	2					
Goodallia triangularis	(Montagu, 1803)								
Parvicardium scabrum	(Philippi, 1844)								
Spisula elliptica	(Brown, 1827)								
Ensis ensis	(Linnaeus, 1758)								
Moerella pygmaea	(Lovén, 1846)								
Gari tellinella	(Lamarck, 1818)								
Abra alba	(W. Wood, 1802)	1	1						
Abra prismatica	(Montagu, 1808)			1					
Veneridae	Rafinesque, 1815								
Gouldia minima	(Montagu, 1803)								
Dosinia juv.	Scopoli, 1777								1
Dosinia lupinus	(Linnaeus, 1758)	1							
Dosinia exoleta	(Linnaeus, 1758)	1							
Tapes juv.	Megerle von Mühlfeld, 1811								
Polititapes rhomboides	(Pennant, 1777)		1						
Chamelea gallina	(Linnaeus, 1758)								
Clausinella fasciata	(da Costa, 1778)								
Timoclea ovata	(Pennant, 1777)								

ScientificName_ accepted	**Authority_ accepted**	**S18 #1**	**S18 #2**	**S18 #3**	**S18 #4**	**ZL 04#1**	**ZL 04#2**	**ZL 04#3**	**ZL 04#4**
Thracia villosiuscula	(MacGillivray, 1827)								
Phoronida	Hatschek, 1888								
Phoronis sp.	Wright, 1856								
Echinodermata	Bruguière, 1791 [ex Klein, 1734]								
Ophiothrix fragilis	(Abildgaard, in O.F. Müller, 1789)								
Amphipholis squamata	(Delle Chiaje, 1828)	1	3	5	1				1
Echinoidea juv.	Leske, 1778								
Echinocyamus pusillus	(O.F. Müller, 1776)								
Leptosynapta bergensis	(Östergren, 1905)								
Leptosynapta inhaerens	(O.F. Müller, 1776)								
Tunicata	Lamarck, 1816								
Corella parallelogramma	(Müller, 1776)								
Ascidiella scabra	(Müller, 1776)								
Molgula sp.	Forbes, 1848								
	Number of Taxa	27	30	27	29	18	19	22	19
	Number of individuals	56	76	56	78	77	81	81	44
	% total maerl	92	97	95	90	0	0	0	0
	Mean	93.5	0						
	% live maerl	5	4	4	5	0	0	0	0
		4.5	0						

ANNEX 7: LIST OF ALL SEAWEED SPECIES FOUND ON MAERL DURING THE 2015 SURVEY

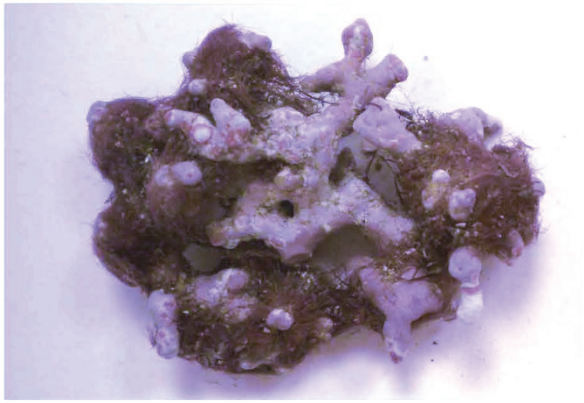
Aphia ID	Scientific Name	Qualifier	Authority
	Rhodophyta (red algae)		
143661	Acrochaetiaceae		Fritsch ex W.R. Taylor, 1957
144501	*Aglaothamnion tenuissimum*		(Bonnemaison) Feldmann-Mazoyer, 1941
144422	*Ahnfeltia plicata*		(Hudson) E.M.Fries, 1836
144438	*Asparagopsis armata*		Harvey, 1855
145313	*Asperococcus fistulosus*		(Hudson) W.J.Hooker, 1833
144440	*Bonnemaisonia asparagoides*		(Woodward) C.Agardh, 1822
144442	*Bonnemaisonia hamifera*		Hariot, 1891
144792	*Brongniartella byssoides*		(Goodenough & Woodward) F.Schmitz, 1893
145613	*Calliblepharis ciliata*		(Hudson) Kützing, 1843
144526	*Callithamnion corymbosum*		(Smith) Lyngbye, 1819
144538	*Ceramium cimbricum*		H.E.Petersen, 1924
144547	*Ceramium echionotum*		J.Agardh, 1844
144562	*Ceramium secundatum*		Lyngbye, 1819
144799	*Chondria dasyphylla*		(Woodward) C.Agardh, 1817
145625	*Chondrus crispus*		Stackhouse, 1797
145808	*Chylocladia verticillata*		(Lightfoot) Bliding, 1928
145108	*Corallina officinalis*		Linnaeus, 1758
143691	Corallinaceae	crusts	Lamouroux, 1812
143691	Corallinaceae	Maerl (live)	Lamouroux, 1812
144743	*Cryptopleura ramosa*		(Hudson) L.Newton, 1931
145615	*Cystoclonium purpureum*		(Hudson) Batters, 1902
836896	*Dasysiphonia japonica*		(Yendo) H.-S.Kim, 2012
144744	*Delesseria sanguinea*		(Hudson) J.V.Lamouroux, 1813
145226	*Dudresnaya verticillata*		(Withering) Le Jolis, 1863
145620	*Furcellaria lumbricalis*		(Hudson) J.V.Lamouroux, 1813
145568	*Gelidiella calcicola*		Maggs & Guiry, 1988
145700	*Gracilaria gracilis*		(Stackhouse) M.Steentoft, L.M.Irvine & W.F.Farnham, 1995
146960	*Gracilariopsis longissima*		(S.G.Gmelin) M.Steentoft, L.M.Irvine & W.F.Farnham, 1995
295880	*Grateloupia turuturu*		Yamada, 1941
144582	*Griffithsia corallinoides*		(Linnaeus) Trevisan, 1845
145621	*Halarachnion ligulatum*		(Woodward) Kützing, 1843
144595	*Halurus flosculosus*		(J.Ellis) Maggs & Hommersand, 1993
144732	*Heterosiphonia plumosa*		(J.Ellis) Batters, 1902
144756	*Hypoglossum hypoglossoides*		(Stackhouse) F.S.Collins & Hervey, 1917
145130	*Jania rubens*		(Linnaeus) J.V.Lamouroux, 1816
145821	*Lomentaria articulata*		(Hudson) Lyngbye, 1819
145825	*Lomentaria clavellosa*		(Lightfoot ex Turner) Gaillon, 1828
144770	*Nitophyllum punctatum*		(Stackhouse) Greville, 1830
145771	*Palmaria palmata*		(Linnaeus) Weber & Mohr, 1805
145278	*Peyssonnelia dubyi*		P.L.Crouan & H.M.Crouan, 1844
145280	*Peyssonnelia immersa*		Maggs & L.M.Irvine, 1983
830	Phaeophyceae	Filamentous	Kjellman, 1891
145660	*Phyllophora crispa*		(Hudson) P.S.Dixon, 1964
145782	*Plocamium cartilagineum*		(Linnaeus) P.S.Dixon, 1967
502848	*Plocamium lyngbyanum*		Kützing, 1843
145668	*Polyides rotunda*		(Hudson) Gaillon, 1828
162854	*Polysiphonia brodiei*		(Dillwyn) Sprengel, 1827

Aphia ID	Scientific Name	Qualifier	Authority
144628	*Polysiphonia elongata*		(Hudson) Sprengel, 1827
144634	*Polysiphonia fibrillosa*		(Dillwyn) Sprengel, 1827
144639	*Polysiphonia fucoides*		(Hudson) Greville, 1824
144651	*Polysiphonia nigra*		(Hudson) Batters, 1902
144672	*Polysiphonia stricta*		(Dillwyn) Greville, 1824
143808	*Porphyra*		C.Agardh, 1824
144851	*Pterosiphonia parasitica*		(Hudson) Falkenberg, 1901
144683	*Pterothamnion plumula*		(J.Ellis) Nägeli, 1855
144690	*Ptilothamnion sphaericum*		(P.L.Crouan & H.M.Crouan ex J.Agardh) Maggs & Hommersand, 1993
144854	*Rhodomela confervoides*		(Hudson) P.C.Silva, 1952
145617	*Rhodophyllis divaricata*		(Stackhouse) Papenfuss, 1950
144702	*Spermothamnion repens*		(Dillwyn) Rosenvinge, 1924
144704	*Spermothamnion strictum*		(C.Agardh) Ardissone, 1883
145892	*Sphacelaria cirrosa*		(Roth) C.Agardh, 1824
376729	*Spyridia griffithsiana*		(J.E.Smith) G.C.Zuccarello, Prud'homme van Reine & H.Stegenga, 2004
			Total Rhodophyta = 62 species
	Chlorophyta (green algae)		
145027	*Chaetomorpha linum*		(O.F.Müller) Kützing, 1845
145029	*Chaetomorpha melagonium*		(F.Weber & Mohr) Kützing, 1845
145049	*Cladophora hutchinsiae*		(Dillwyn) Kützing, 1845
580339	*Cladophora rhodolithicola*		Leliaert, 2009
145064	*Cladophora rupestris*		(Linnaeus) Kützing, 1843
144296	*Ulva*	flat	Linnaeus, 1753
144296	*Ulva*	tubular	Linnaeus, 1753
156078	*Ulva clathrata*		(Roth) C.Agardh, 1811
			Total Chlorophyta = 8 species
	Heterkonta (brown seaweeds)		
145306	*Arthrocladia villosa*		(Hudson) Duby, 1830
145311	*Asperococcus bullosus*		J.V.Lamouroux, 1813
148899	*Bacillariophyceae*		Haeckel, 1878
497297	*Chaetopteris plumosa*		(Lyngbye) Kützing, 1843
145888	*Cladostephus spongiosus*		(Hudson) C.Agardh, 1817
145856	*Colpomenia peregrina*		Sauvageau, 1927
145297	*Cutleria multifida*		(Turner) Greville, 1830
145307	*Desmarestia aculeata*		(Linnaeus) J.V.Lamouroux, 1813
145309	*Desmarestia ligulata*		(Stackhouse) J.V.Lamouroux, 1813
145310	*Desmarestia viridis*		(O.F.Müller) J.V.Lamouroux, 1813
145367	*Dictyota dichotoma*		(Hudson) J.V.Lamouroux, 1809
145404	*Ectocarpus fasciculatus*		Harvey, 1841
144918	*Eudesme virescens*		(Carmichael ex Berkeley) J.Agardh, 1882
145723	*Halosiphon tomentosus*		(Lyngbye) Jaasund, 1957
145725	*Laminaria hyperborea*		(Gunnerus) Foslie, 1884
144924	*Mesogloia vermiculata*		(Smith) S.F.Gray, 1821
830	Phaeophyceae	Brown crusts	Kjellman, 1891
234483	Saccharina latissima		(Linnaeus) C.E.Lane, C.Mayes, Druehl & G.W.Saunders, 2006
			Total Heterokonta = 11 species

ANNEX 8: PHOTOGRAPHIC RECORDS OF MAERL SAMPLES IDENTIFIED BY SEQUENCING

S18

Phymatolithon calcareum



Sample1

Phymatolithon calcareum

Sample2

Phymatolithon calcareum

Sample3

SOBX17

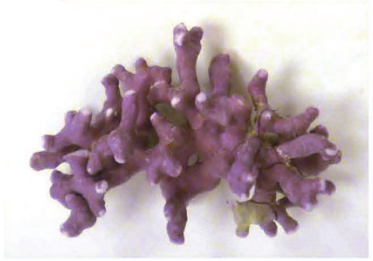
Phymatolithon calcareum

Sample1

Phymatolithon calcareum

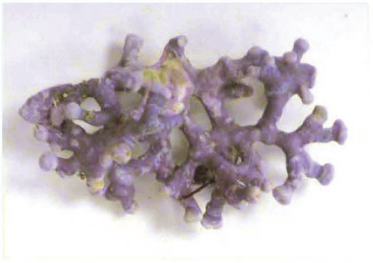
Sample2

Phymatolithon calcareum



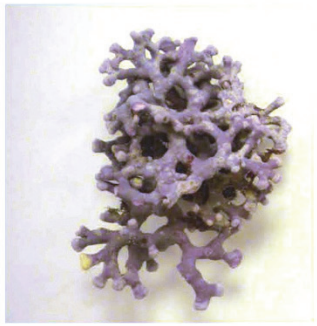
Sample3

Phymatolithon lusitanicum



Sample4

Phymatolithon lusitanicum

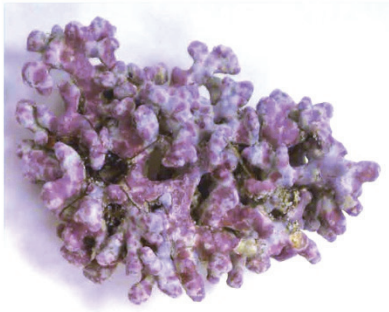


Sample5

Phymatolithon calcareum

Sample6

Phymatolithon calcareum



Sample7

SA110

Phymatolithon lusitanicum

Sample1

Phymatolithon lusitanicum

Sample2

Litothamnion corallioides

Sample3

Phymatolithon lusitanicum

Sample4

Phymatolithon calcareum

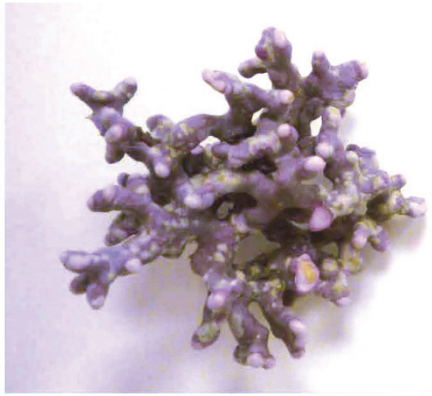
Sample5

SOBX47

Phymatolithon calcareum

Sample1

Phymatolithon calcareum



Sample2

Phymatolithon calcareum

Sample3

Sample4

www.nature.scot

ISBN: 978-1-78391-397-8

Great Glen House, Leachkin Road, Inverness, IV3 8NW
T: 01463 725000

You can download a copy of this publication from the SNH website.

recycle

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
nature.scot