SCOTTISH NATURAL HERITAGE

COMMISSIONED REPORT

Commissioned Report No. 212

Biotope mapping of the Sound of Harris, Scotland

(ROAME No. F01AC401/2)

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Summary

Biotope mapping of the Sound of Harris, Scotland

Commissioned Report No. 212 (ROAME No. F01AC401/2)
Contractor: University of Edinburgh, Heriot Watt University and Envision Mapping Ltd.
Year of publication: 2006

Background

The Sound of Harris is a topographically complex marine area situated between North Uist and Harris in the Outer Hebrides. Very little is known of the marine biota of the area but it is likely to be largely unmodified by anthropogenic influences. An increased knowledge of the marine biotope distribution in the Sound of Harris is desirable in order to assess the potential impacts of any proposed future developments in the area. Specifically, proposals to build access causeways linking Hebridean Islands are increasingly under consideration. Such developments have the potential to radically modify environmental conditions in neighbouring marine habitats.

This study utilised satellite imagery, underwater acoustic sensing techniques and biological ground surveys to develop a biotope distribution map of the area and relate this distribution to prevailing environmental conditions.

Main findings

- Extensive (~280ha) and well developed *Zostera* beds are present, generally occurring on sandy substrates in moderately exposed or sheltered environments.
- Maerl beds are present in both sheltered and exposed environments. The extent of the beds is relatively limited in comparison with the Sound of Barra.
- The marine benthic communities are strongly influenced both by exposure to wave action and by tidal currents.
- The western part of the Sound is highly exposed. Sediments are sandy and tend to be impoverished due to their high mobility. Stable infralittoral rocky substrates are dominated by kelp communities that are often modified by sand scour.
- The channels in the mid part of the Sound are strongly tide swept. Sediments are generally sandy but contain a more diverse fauna due to a combination of the tidal currents and reduced exposure. Stable rock substrates are dominated by kelp communities with a diverse associated fauna characteristic of accelerated tidal currents. These communities are also modified by sand scour in many locations.
- The eastern part of the Sound is considerably deeper than the rest of the area. Sediments are typically composed of heterogenous muddy sands and contain a diverse infauna. Rock substrates support a community characterised by *Swiftia* and axinellid sponges.

- The southern part of the Sound contains a system of sheltered basins separated by rocky reefs. Sediments grade from fine sands in the outer parts to soft mud in the inner reaches. Sediment communities are variable but tube dwelling amphipods are often an important component. Kelp communities are less diverse in terms of associated species and *Laminaria saccharina* has increased dominance.
- A combined spectral and acoustic classification for the Sound of Harris was produced which drew on further rules based on known tolerances of biotopes to exposure and water depth, overcoming the problems of a purely spectral based approach. Biotopes were also combined to appropriate hierarchical levels where they were poorly distributed in the Sound or where their reflectances were spectrally similar. As a result, a total of 19 intertidal and subtidal biotopes and biotope groupings were discriminated with an overall accuracy of 75%, with all classes individually discriminated to 50% accuracy or better.
- The project has shown that a combined acoustic and optical approach exploits synergies in the two techniques allowing discrimination of biotopes in shallow zones using optical data where light penetration is good, combined with the accurate mapping of biotopes using acoustic data in deeper waters where light penetration is low and where the optical datasets are of more limited utility.

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1 INTRODUCTION

This report details the results of the first extensive biological survey of the Sound of Harris, Outer Hebrides, with the overall aim of producing a comprehensive biotope map of the Sound. The survey is based on a range of integrated methods, incorporating satellite imaging and acoustic survey, combined with extensive ground truthing. The work was undertaken by the Universities of Edinburgh (EDU) and Heriot-Watt (HWU) with acoustic data supplied under subcontract by Envision Mapping Ltd. (EML).

The overall aims of the project were:

- in conjunction with extensive ground truthing, to produce comprehensive biotope maps of the Sound of Harris based on an integration of the methods involved;
- to develop methods for the integrated mapping and analysis of marine spatial data.

1.1 Sound of Harris – Site background

The Sound of Harris comprises a mixture of islands, extensive rocky reefs, sand banks and shallow channels in a broad stretch between the southern end of Harris and northern North Uist in the Outer Hebrides. The complex topography, diversity of habitat types and fast tidal streams have created an area of high biodiversity interest.

The target survey area extends from Relish Point on South Harris to Leac an Hoe, North Uist and Rubh' an Teampuill, South Harris to the Rubh' a' Chorrain of Berneray (Figure 1.3.1).

1.2 Geological background

The Outer Hebrides are composed almost entirely of Pre-Cambrian basement rocks known collectively as Lewisian, some of the oldest and most durable rocks found around the world (1.7–2.8 billion years). These rocks mostly comprise a series of monotonous grey gneisses, which are cut by a variety of Permo-Carboniferous and Tertiary basic igneous dykes and sills (Fettes *et al.*,1992). Granitic veining is also common. Along the south coast of the Sound gently northerly dipping gneisses form the common limb between an antiform and a synform which close in towards the island of Berneray. The structures have undergone folding, metamorphism and faulting. The landscape was modified by a period of intense glacial erosion during the Quaternary in which nearly the whole of the Outer Hebrides was heavily glaciated. This weathered the region to its distinctive subdued hummocky landscape. Dunes and extensive flats of blown sand (machair) characterise the land backing the sandy beaches and reach their greatest development on the islands in the Sound of Harris and North and South Uist. This complex formation process has led to a Sound with a highly complex morphology, being laced with islands and rocky outcrops separated by areas of sand and sand and mud in both intertidal and subtidal regions. The complexity of the morphology leads to a complex biology through providing a variety of different habitat niches.

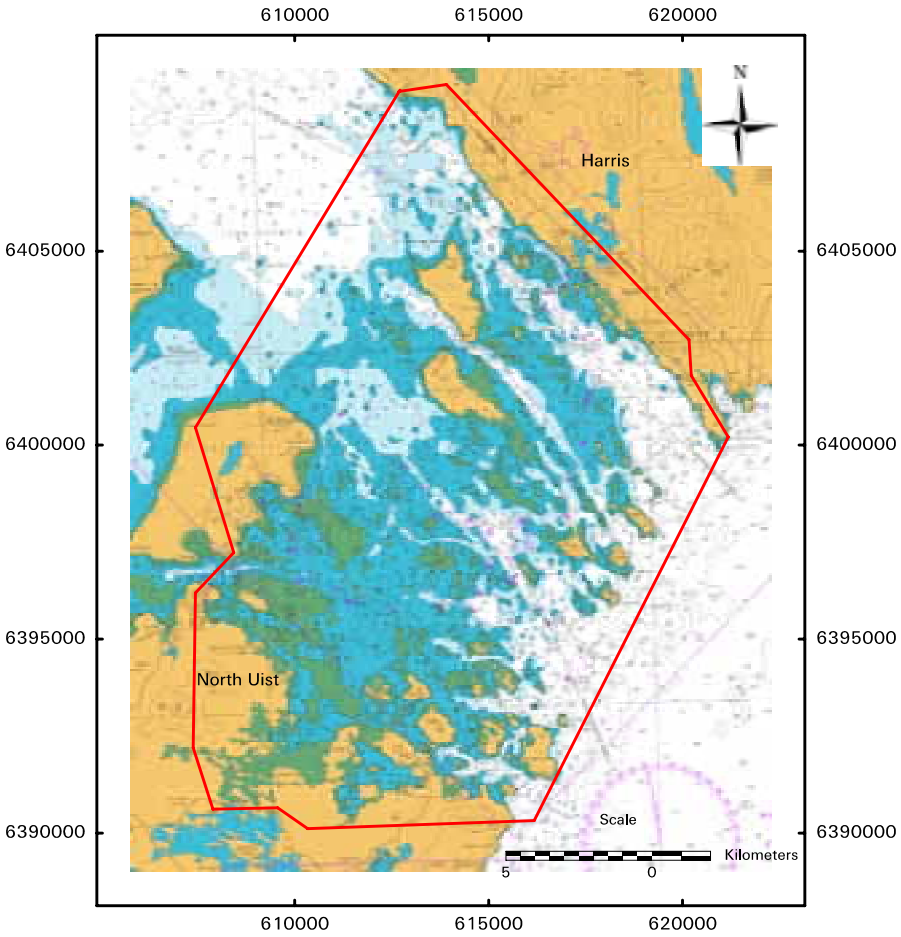
1.3 Pre-existing data

Pre-existing biological data on the Sound of Harris are very limited. An interrogation of the JNCC Marine Recorder database provides a few records of intertidal and subtidal surveys. All were conducted near Leverburgh on the northern boundary of the Sound and most were conducted in the small enclosed embayment of The Obbe. The Obbe is atypical of the northern part of the Sound in terms of exposure levels. Only two sites were surveyed outside of The Obbe, both were restricted to the intertidal of locally sheltered areas of shore. No biological data are available to give a broader picture of the biota within the Sound of Harris.

Comparable data are available from the 2001 survey of the Sound of Barra (Bates *et al.*, 2004a) and from surveys of the adjacent lagoonal system of Lochmaddy SAC (eg Moore *et al.*, 2006 (in press)). These are discussed in more detail in section 5 of this report.

The Sound of Harris is a topographically complex area encompassing a range of exposure levels and various tidal current regimes. Despite the lack of pre-existing biological data it was anticipated that this complexity would be reflected in the distribution of biotopes.

Figure 1.3.1 Extent of the Sound of Harris biotope survey area superimposed on the Hydrographic Office chart to provide geographic reference



2 METHODS

2.1 Scientific staff

A number of research scientists from EDU, HWU and EML, were involved with the field surveys and subsequent data analysis. These individuals are listed in Table 2.1.1

Table 2.1.1 Scientific staff involved in the 2005 Sound of Harris mapping survey

Scientist	Field Responsibility	Processing responsibility	Institution
Dr Tim J Malthus	EDU Team leader, ground truthing and project management	Optical image analysis, reporting, overall project management	EDU
Dr Evanthia Karpouzli	Ground truthing	Optical image analysis	EDU
Dr Dan Harries	HWU Team leader, biological surveying	Post survey biological data processing and reporting	HWU
Dr Colin Moore	Biological surveying, Skipper *RV Serpula*	Providing advice on data processing	HWU
Dr Alastair Lyndon	Biological surveying		HWU
Dr James D Mair	Biological surveying		
Dan Edwards	Biological surveying	Granulometric sample processing	HWU
Colin Trigg	Biological surveying		HWU
Andrew Mogg	Biological surveying		HWU
Paolo Pizzola	Biological surveying		HWU
Sue Hamilton		Infaunal sample processing	HWU
Dr Bob Foster-Smith	Acoustic survey	Acoustic data processing	EML
Ian Sotheran	Acoustic survey	Acoustic data processing	EML
Dan Foster-Smith		Acoustic data processing	EML

2.2 Ground survey observations

2.2.1 Survey station selection

The distribution of the ground survey stations was dictated by the requirement to relate biotopes to both the acoustic classification and the satellite image. It was also necessary to ensure that the distribution of the stations gave good geographical coverage of the Sound and were representative of the range of prevailing environmental conditions.

The stations were selected by subdividing the survey area into 20 sectors. The relative extent of each sector was dictated by anticipated habitat and environmental complexity based on an examination of the Admiralty chart and the satellite image. Within each sector a roughly equivalent number of potential stations was selected to give broad and representative coverage of features discernible on the satellite image and chart.

2.2.2 Field procedures

The survey was conducted by two independent teams.

One team (Team A) operated from the main survey vessel (*RV Serpula*) and concentrated on deeper areas of the Sound surveying groundtruth stations by dropdown video and sampling by Van Veen grab (0.1m^2) where appropriate.

The second team (Team B) operated from a Zodiac inflatable concentrating on shallow or inaccessible areas. Stations were surveyed by diver with a limited number of stations surveyed by snorkelling. At each station divers spent 10 minutes recording details of substrate, environmental conditions and biological communities. The divers also recorded video footage to give an overview of the nature of the site. Where appropriate the sites were sampled by 5 deployments of a 0.02m^2 mini Van Veen grab.

On 17 August weather conditions prevented the use of *RV Serpula* in exposed parts of the Sound and team A operated as a dive team from a second inflatable alongside team B.

During periods of low tide each team visited a number of intertidal groundtruth stations. At each site surveyors recorded details of substrate, environmental conditions and biological communities dividing the shore profile into biological zones as appropriate. Within selected biotopes a rapid survey of substrate and biota was made within a 5m x 5m area. In addition to field records, representative video footage and digital stills images were taken at each shore location. At selected sediment shores infaunal samples were collected, each sample consisting of 8 cores of 10cm internal diameter taken to a depth of 15cm. In addition, a dig-over was made of a 1m^2 area and the presence of any fauna noted.

Records were acquired from a total of 198 subtidal stations. Of these, 98 were surveyed by drop-down video, 91 by diver and 9 by snorkelling. A total of 51 shore locations were visited and records acquired from 320 shore zones. Sediment infauna samples were collected from 102 locations (94 subtidal and 8 intertidal). Subsequently 50 of these were selected for full identification and enumeration. Other samples were selected for rapid examination when it was necessary for establishing biotope identity.

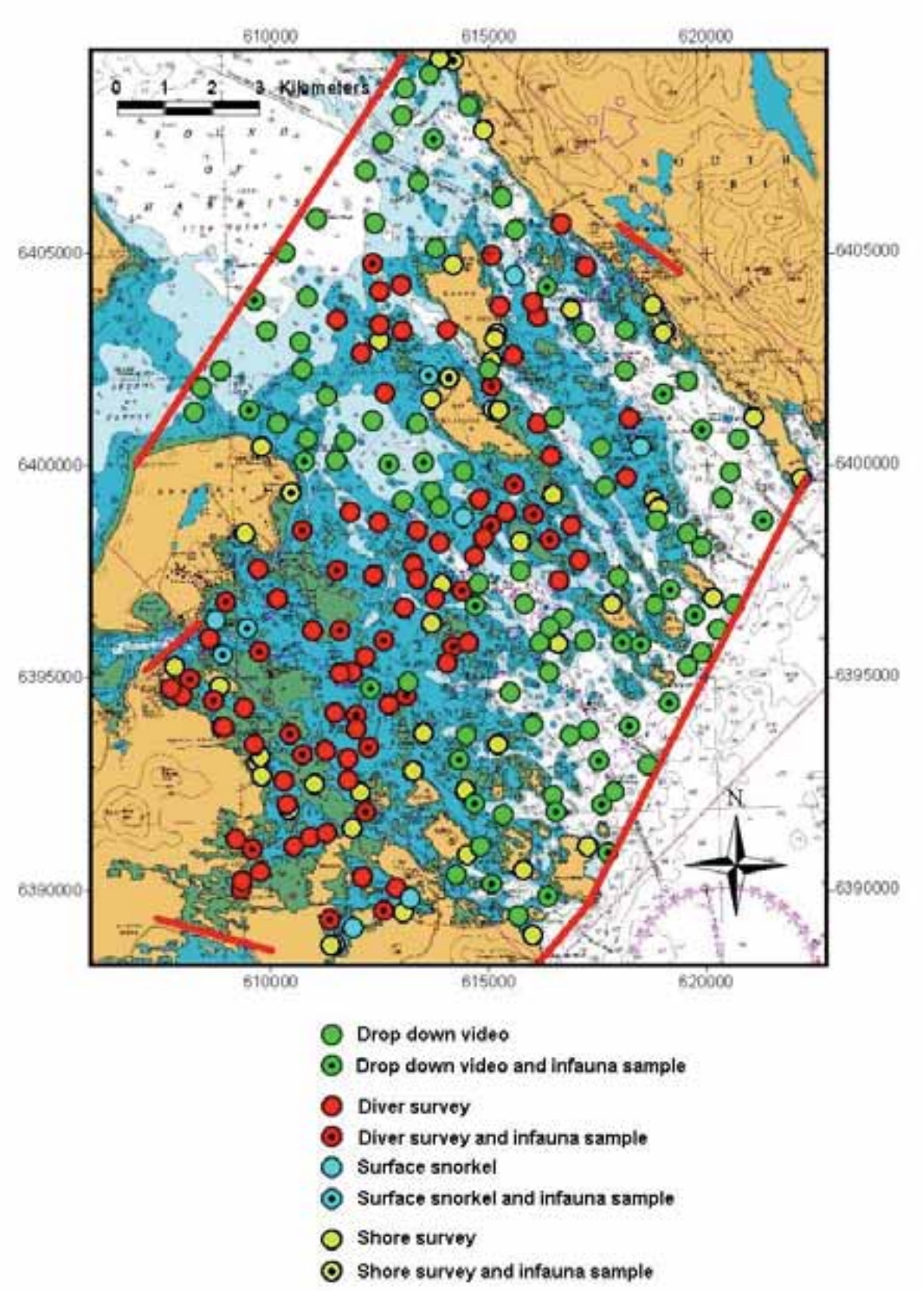
The locations and survey methods for the groundtruth stations are shown in Figure 2.2.1.

All subtidal and intertidal infaunal samples were sieved on a 1 mm mesh and preserved in 5% buffered saline formaldehyde. Sediment subsamples were retained for granulometric analysis.

Station positions were established using satellite differential GPS units. Positions were recorded in decimal degrees WGS 84 datum and subsequently converted to UTM (by the OS "Grid InQuest" conversion software) for plotting.

Corrections to chart datum were made based on tidal rise predictions for Leverburgh provided by the UK Hydrographic Office 'Total Tide' software.

Figure 2.2.1 Locations and survey methods for biological groundtruth stations



2.2.3 Coding system for survey stations

A coding system was established in order to avoid duplications in the labelling of data records and sample containers. Station codes were prefixed by SH05 denoting the Sound of Harris survey 2005. Intertidal sites are labelled with 'I' and subtidal sites with 'S'. The survey teams are identified with 'A' (Serpula team) or 'B' (inflatable team). Each team numbered their intertidal and subtidal sites consecutively. Hence, SH05 IA5 was the 5th intertidal location visited by team A. For convenience the SH05 prefix is omitted from the text of this report.

2.2.4 Post survey processing

All video records were reviewed and additional notes on substrate and biota were incorporated with field notes.

Sediment infauna were extracted from the samples, identified and enumerated at species level. A reference collection was retained for incorporation into the biological collections of the National Museums of Scotland.

Corresponding sediment samples were processed to establish particle size distribution. After drying, washing and disaggregation, sediments were processed by dry-sieving and recording the dry weight of particle size fractions at half phi intervals. Appropriate biologically relevant parameters were then calculated (ie median grain size, silt/clay content, gravel content).

2.2.5 Biotope allocation

The biotope classification scheme is that of Connor *et al*. (2004).

Rock substrates

A provisional categorisation was made based on the field records and the information provided by the video review. The consistency of this categorisation was subsequently confirmed by conducting exhaustive cross checks for each biotope using the video footage and images.

Sediment substrates

Biotopes were initially allocated for the sampled sites on the basis of the infaunal data, particle size analysis, field records and video review records. Detrended correspondence analysis was used to verify the biotope categorisation of samples. Biotopes were allocated to remaining sites based on rigorous cross checks of video footage and field records. Where remaining stations could not be confidently allocated to the biotopes identified for the sampled stations then a rapid examination was made of the sampled infauna (if available) to clarify the biotope identity.

Biotope distribution was examined by plotting them onto a background chart and satellite image using ArcView GIS software. The distribution was examined to confirm that the biotopes allocated to the stations were consistent with the prevailing environmental conditions at the stations.

2.3 Additional datasets

2.3.1 LiDAR bathymetric data

In addition to the original datasets obtained as part of this survey, the study also drew on bathymetric data for the Sound of Harris, acquired using LiDAR survey by the Maritime Coastguard Agency (Tenix LADS Corporation 2004). The data and area covered, surveyed in 2004, are shown in Figure 2.3.1. The data ranged from 50m above chart datum over land down to extinction depths (>30m below chart datum). The area was flown twice with a surface spot spacing of 3 x 3m on each flightline allowing a dense network of depths to be recorded. The total data set comprised some 32.4 million points (with a density generally better than 3m). The data was made available to the project through the UK Hydrographic Office. To reduce the size of the dataset, the raw LiDAR data were resampled and interpolated to a 3m grid resolution, compatible with that of the satellite imagery and acoustic data.

2.4 Satellite imaging

2.4.1 Satellite imagery

Orders were placed for QuickBird satellite sensor image acquisition over the Sound of Harris from June 2005. The characteristics and spectral response functions of the QuickBird sensor can be found in Bates *et al.* (2004b). Conditions on the acquisition in terms of timing were also placed by the need for acquisition during periods of low tide to ensure intertidal regions were exposed and to minimise the effects of water column attenuation. This requirement restricted the image acquisition 'windows' to two periods per month of approximately 7 days each.

A relatively cloud free image was acquired on 6 July 2005, the characteristics of which are given in Table 2.4.1. The image acquired was almost cloud free, with bands of cloud and associated shadow overlying some intertidal and subtidal areas (Figure 2.4.1). Visual inspection of the data revealed few radiometric problems or other flaws such as missing scan lines, etc. The tidal height at the time of acquisition was 1.1m above Chart Datum. This dataset was used in all subsequent satellite image processing and for mapping the biotopes in the Sound of Harris.

Table 2.4.1 Sound of Harris QuickBird image data acquisition characteristics

Acquisition Date:	**6.07.2005**
Acquisition Time:	11:03 GMT
Platform altitude:	450km
Orbit:	98°, sun-synchronous
Geometric Processing Level:	Standard
Interpolation Method:	Nearest neighbour
Bits per Pixel:	11 (2048 brightness levels)
Satellite Azimuth:	278.5°
Satellite Elevation:	73.7°
Sun Angle Azimuth:	168°
Sun Angle Elevation:	54.7°
Panchromatic resolution:	0.61m
Panchromatic bandwidth:	450–950nm
Multispectral data spatial resolution:	2.5m
Multispectral bands: Blue Green Red Near Infrared	 450–520nm 520–600nm 630–690nm 760–900nm

2.4.2 Field methods

All field-based measurements associated with the acquisition of data to support the processing of the satellite imagery were collected during a targeted field campaign in the Sound of Harris from the 9–14 August 2005.

2.4.2.1 Establishment of ground control points

The QuickBird imagery was supplied by DigitalGlobe Inc. in geocorrected form to a 1:50,000 scale accuracy. To check the accuracy of the imagery, 27 prominent and permanently located sites which were discernable on the imagery were measured for their precise location using a WAAS-enabled 12 channel Magellan Marine GPS unit. GPS station positions were recorded for at least 10 minutes, which, with EGNOS availability, gave a positional accuracy of approximately 2m, within one pixel of the true position of the multispectral imagery. Positions were recorded in UTM WGS84 coordinates.

The same GPS unit was used to accurately locate all other land and water-based measuring sites.

2.4.2.2 Measurements of land field target for atmospheric correction

Atmospheric correction of the imagery was undertaken using the empirical line method which provides an accurate method for atmospherically correcting high spatial resolution satellite imagery (Karpouzli and Malthus, 2002). Twelve large and relatively homogeneous land targets of varying brightness were measured for their spectral reflectance properties using a GER 1500 spectroradiometer hired for this research from the NERC Field Spectroscopy Facility (Table 2.4.2). The targets used ranged from dark tarmac, grass fields, and a sandy beach. The methods employed are outlined in detail in Bates *et al.* (2004a).

Figure 2.3.1 Extent of the LiDAR data set compared to the satellite imagery

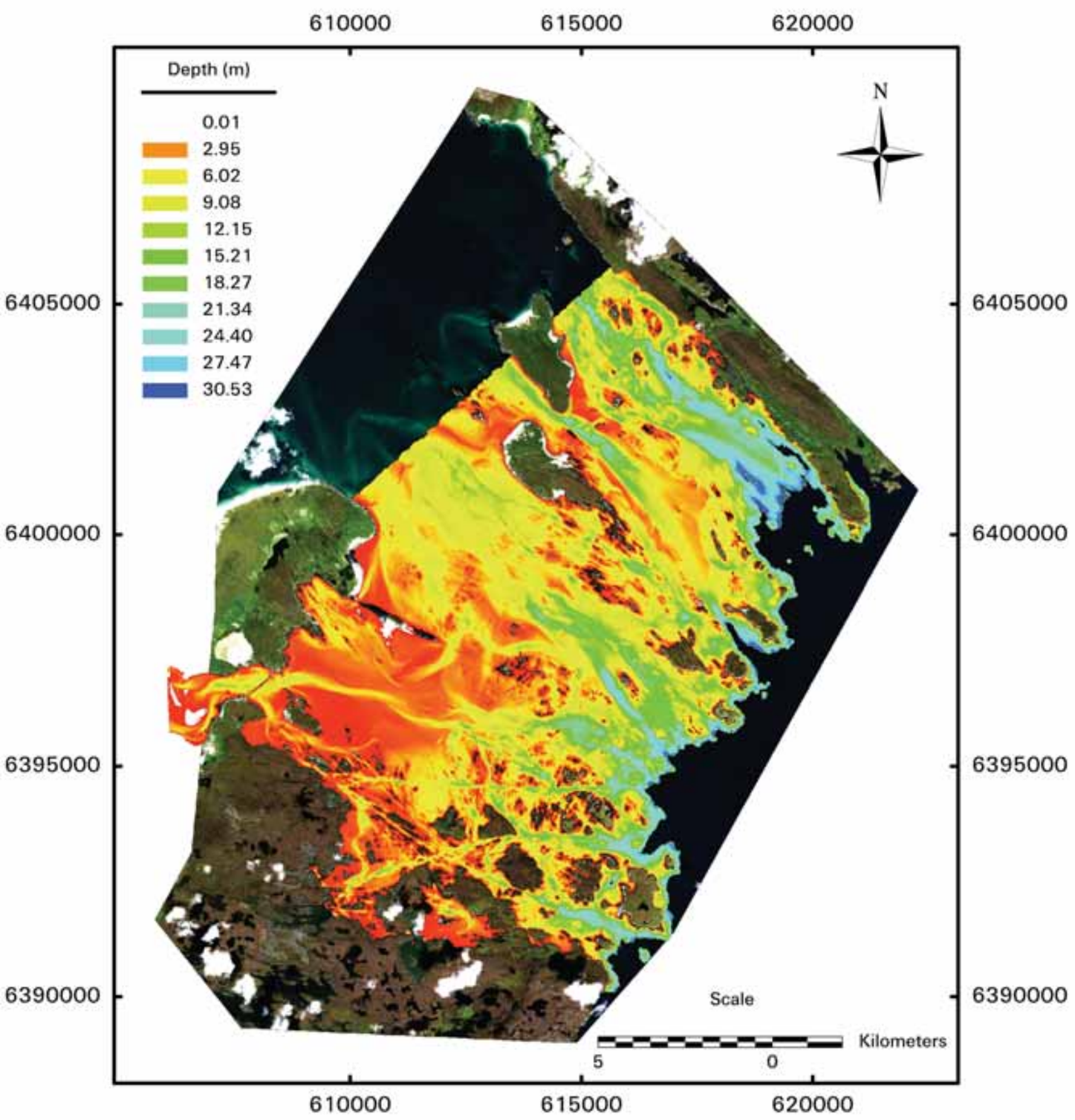


Figure 2.4.1 The raw QuickBird image acquired over the Sound of Harris

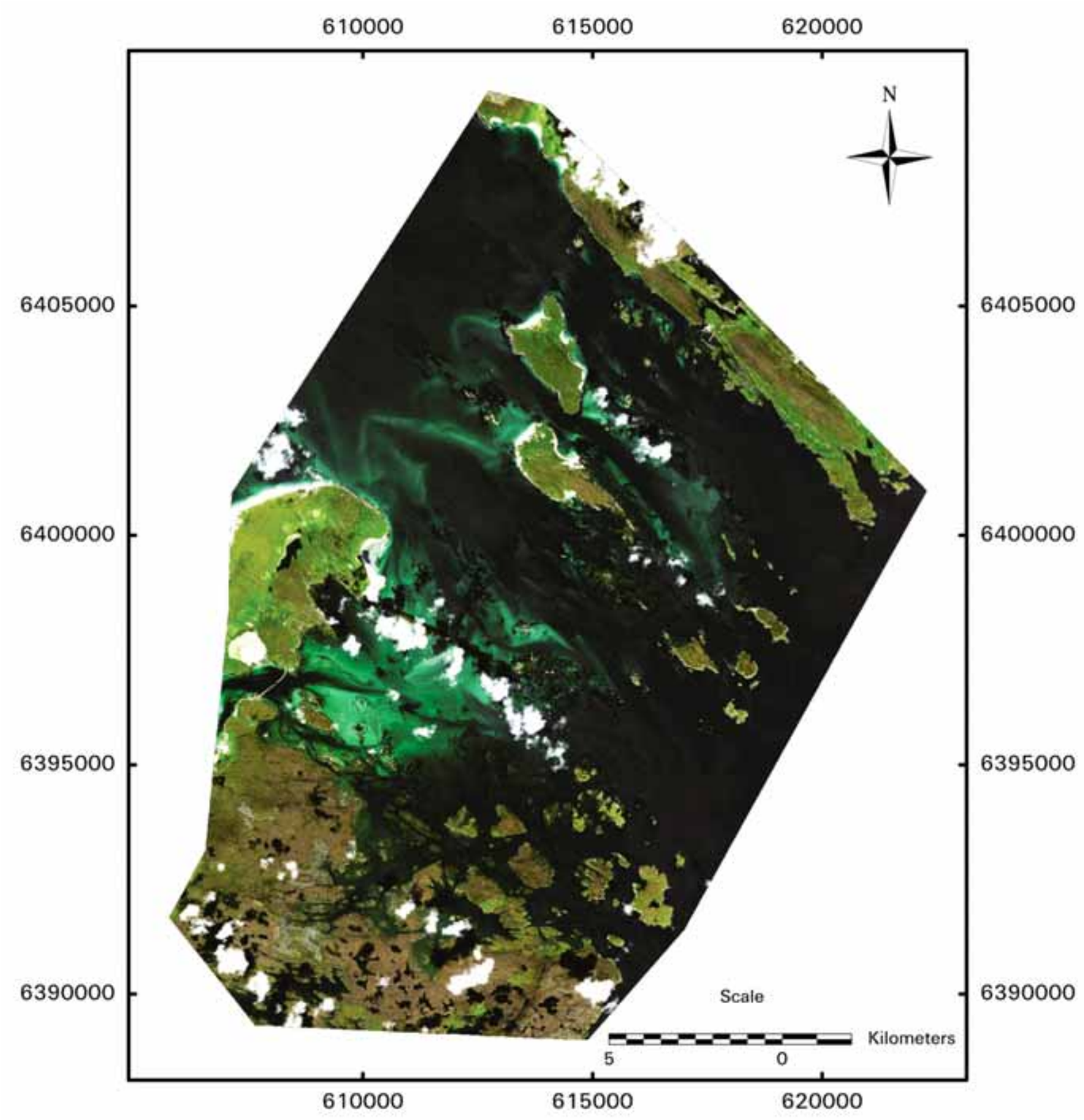


Table 2.4.2 Locations of the twelve land targets measured for atmospheric correction of the QuickBird imagery

Station	Northings	Eastings
SH05DA01	6397119	608430
SH05DA02S	6399729	608685
SH05DA02D	6399733	608682
SH05DA03	6397409	607830
SH05DA04	6397446	607808
SH05CA05	6399845	610014
SH05CA06	6399902	610174
SH05CA07	6399924	610172
SH05CA08	6399842	610004
SH05CA09	6399593	609897
SH05DA10	6399951	610046
SH05DA11	6390939	614626

2.4.2.3 Measurements of within-water spectral and broad band attenuation

In order to characterise the spectral nature of light attenuation in the region, 8 high spectral resolution attenuation measurements were made at 5 sites in the Sound of Harris (Table 2.4.3). The measurements were made using an Ocean Optics spectroradiometer and fibre optic probe fitted with a cosine-corrected sensor (Bates *et al.*, 2004a). Measurements were made at 0.5m intervals down to ~4m below the water surface. A reference photometer on the boat was used to check for any variations in overhead irradiance during the measurements.

Table 2.4.3 Location of spectral attenuation measurement sites in the Sound of Harris

Station	Northings	Eastings	Date
SH05DSp01	6404853	610316	11/08/2005
SH05DSp02	6401030	612137	11/08/2005
SH05DSp02 r	6400923	612299	11/08/2005
SH05DSp03	6404385	615567	11/08/2005
SH05DSp04	6394033	611615	12/08/2005
SH05DSp05	6396587	609914	12/08/2005

Measurements of gross spatial variations in downwelling Photosynthetically Active Radiation (PAR) and broad blue band attenuation were also made at 5 selected stations in the Sound using separate broad band underwater sensors (Table 2.4.4).

All attenuation measurements were made between 10:00 and 15:00 hours local time each day, to minimise solar angle effects.

Table 2.4.4 Location and calculated broad band attenuation coefficients for a number of sites in the Sound of Harris

Northings	Eastings	Attenuation coefficient (PAR, m^{-1})	Attenuation coefficient (Blue, m^{-1})	Date measured
6396938	615678	0.226	0.154	11/08/2005
6400705	612783	0.263		11/08/2005
6400787	612609		0.265	11/08/2005
6403865	609712	0.266		11/08/2005
6406609	611964	0.289		11/08/2005
6404402	615521	0.278		11/08/2005
6396760	609727	0.287		12/08/2005
6396711	609858		0.304	12/08/2005
6394024	611662	0.315		12/08/2005
6394055	611610		0.324	12/08/2005
6393994	611693	0.336		12/08/2005

2.4.3 Satellite image processing

2.4.3.1 Geocorrection

Qualitative comparison of our field-measured GPS data points with that of the original image supplied by DigitalGlobe indicated that the original data supplied were accurate to within 1 pixel of their 'true' location. This accuracy is sufficient to work with without further geocorrection, but it cannot be assumed that all "standard" QuickBird datasets will be this accurate. Nevertheless, the data were further geocorrected to the GPS data following the method outlined in Bates *et al.* (2004a).

2.4.3.2 Atmospheric correction

Using the homogeneous target data measured with the field spectroradiometer (Section 2.4.2.2), relationships were developed between the calculated ground-based QuickBird reflectance values and related values extracted from the corresponding pixel locations in the multispectral QuickBird image dataset. The relationships for all four bands were all highly linear (R^2 values >0.98, Table 2.4.5). These empirically derived relationships were used to atmospherically correct the QuickBird data to percent reflectance (Karpouzli and Malthus, 2002).

Table 2.4.5 Relationships between ground target reflectance (x) and image (y) pixel values used for atmospheric correction of the satellite data

QuickBird Band	Equation	R^2
Blue	y = 0.0871x – 13.115	0.986
Green	y = 0.0525x – 7.8048	0.984
Red	y = 0.0686x – 3.9404	0.982
Near infrared	y = 0.0648x – 1.6300	0.987

2.4.3.3 Masking

To remove land areas, the corrected QuickBird image datasets were masked to a manually adjusted Scottish coastline vector dataset previously supplied by SNH. Areas of cloud and cloud shadow were also removed from the imagery by manually digitising around the affected areas.

2.4.3.4 Water column correction

To account for the effects of water depth and scattering and absorption in the water column the image was further processed to better recognise bottom habitats. The method applied was that of Lyzenga (1978, 1981) whose method involves the initial linearisation of reflectances in all available bands for the attenuating effects of water depth, using:

$$X_i = \ln (L_i - Ls_i)$$

where L_i is the measured radiance in band i, and Ls_i is the measured radiance over deep water. This is followed by the calculation of relative bottom reflectance (Yi) determined by:

$Y_i = k_j X_i - K_i X_j / (k_i^2 + k_j^2)^{0.5}$, where k_i is the attenuation coefficient in band i.

2.4.3.5 Biotope classification

A preliminary maximum likelihood supervised classification was attempted on the whole image but was found to produce considerable spectral mixing between classes on account of similarities between subtidal and intertidal components. It was decided to split the image into two component sections;

a) a subtidal image consisting of all areas below chart datum adjusted for the time of acquisition of the image where all land and intertidal features were masked out, and

b) an intertidal image including shore elements up to the supra-littoral zone in which subtidal features were masked out. Separate classification procedures were run on each resulting image.

The ground truthing survey data obtained by HWU were used to provide the basis for training the classification process. All ground truthing station data were first assigned a biotope class and a separate ID code. Training areas were then delineated and assigned on each image component for each biotope except for those biotopes for which there were found to be ~3 or fewer stations identified. In all, some 188 training areas were defined (133 subtidal training areas and 55 intertidal training areas).

Once the classifications were performed, biotopes that were indistinguishable from other spectrally similar biotopes were combined in common biotope class definitions. The separate intertidal and subtidal classifications were then combined to form a separate biotope classification map.

To improve on the purely spectral-based classification a second combined spectral and expert systems-based approach to classification was attempted. This classification used the spectral information from the training areas defined above and combined it with defined rules based on expert knowledge of the zonation patterns of biotopes and the depth ranges within which they occur. The LiDAR dataset, which extended over both subtidal and exposed areas, was used to provide the height or bathymetric data with which to guide the zonation rules.

2.5 Acoustic survey

2.5.1 Survey methodology and calibration

The primary acoustic system used was a swath bathymetric system. An interferometric system was used as this not only gives bathymetry across a swath of up to 250m but also side scan quality images. The system has accurate motion sensing so that all images will be high quality and corrected for motion and tide. The system can be run at a tracking speed of up to 10km hr^{-1}. This system produces bathymetric data to IHO order 1 standards at a resolution similar to the existing LiDAR data set and is capable of giving side scan sonar images from backscatter information. A RoxAnn™ Acoustic Ground Discrimination System (AGDS) was run concurrently and the information was used to assist the interpretation of the swath/side scan sonar data.

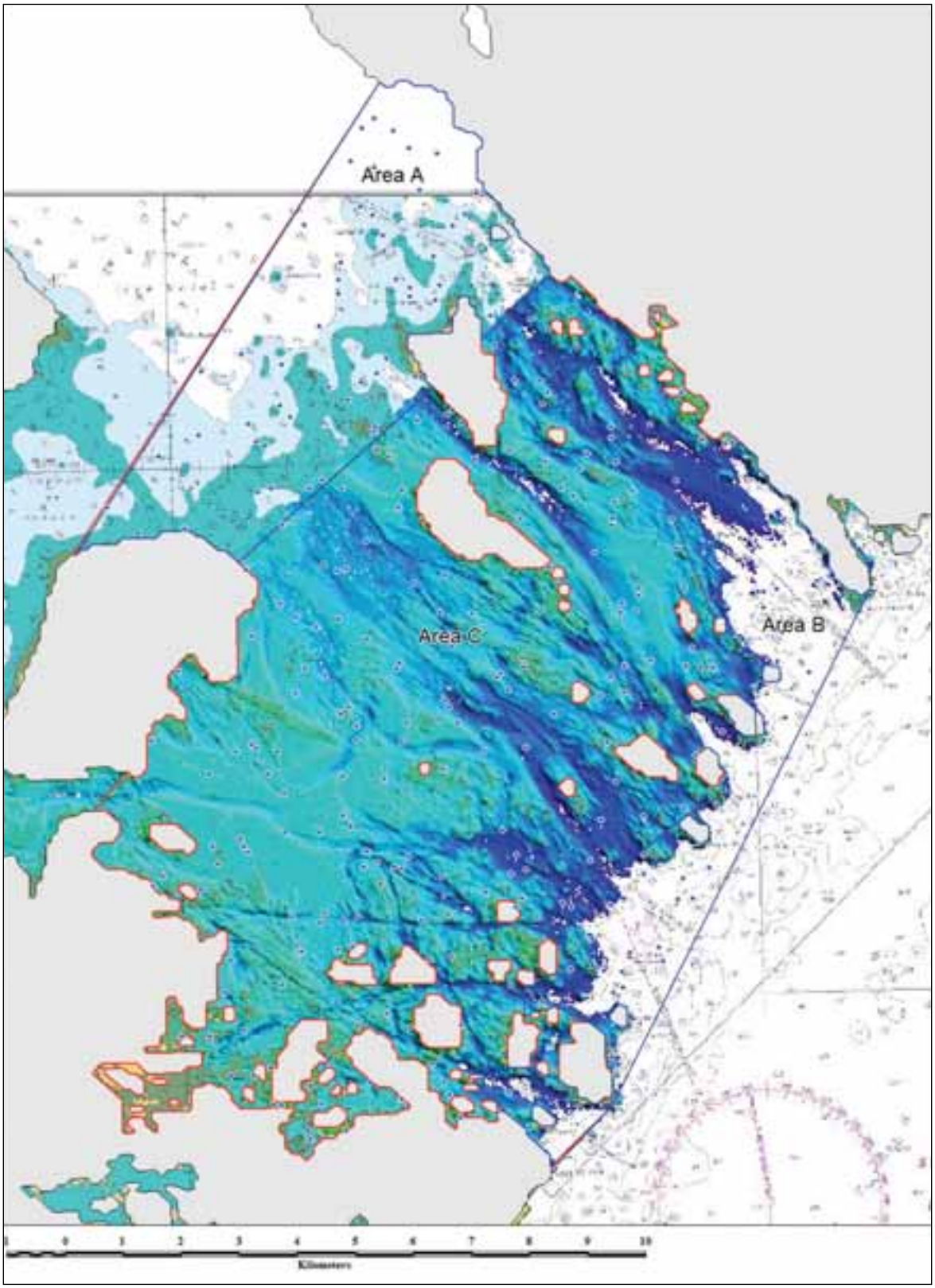
Deployment strategy: Three areas were identified from the available data and charts which require a different approach to the acoustic survey and assessment of risks involved (Figure 2.5.1).

Area A: This area is open to the oceanic swell and has a large area of shallow ground. It was not possible to survey this area acoustically owing to unfavourable weather conditions.

Area B: This area has a complex coastline but a relatively deep sea bed. This allowed the vessel tracking to be wider than planned for A to obtain a complete coverage. Track spacing varied from ~50m in the shallower areas up to ~200m in the deeper areas. It was estimated that this area would take 2–3 days to survey.

Area C: It was proposed to collect several scan lines through the deeper part of this area between Areas A and B in order to verify both the LiDAR data and to assist with combining the two data sets. Due to weather and time constraints is was only possible to collect overlapping data from the edges of area B and for a block within a shallow sheltered area.

Figure 2.5.1 Sound of Harris survey area, showing three defined areas referred to in the text in relation to the available LiDAR image



2.5.2 Technical specification

2.5.2.1 Swath bathymetry/side scan sonar

GeoAcoustics' GeoSwath meets IHO SP44 Special Order specifications. It is an interferometric system operating at 250kHz that uses the phase content of the signal to measure the angle of the wave front of the returning echo. The depth of the seabed reflecting surface is calculated from this angle and elapsed time. The system also measures signal amplitude and side scan images are derived from this information. The system offers a good resolution from which accurate and detailed bathymetric models can be produced.

2.5.2.2 RoxAnn AGDS System

Envision used a RoxAnn™ GroundMaster AGDS operating at 50kHz. Acoustic ground discrimination systems (AGDS) are based on single beam echo sounders and, apart from determining depth, are designed to detect different substrata by their acoustic reflectance properties: hard surfaces produce strong echoes whilst soft surfaces result in a weak signal. Additionally, rough surfaces will produce an echo that decays slowly (a property termed 'backscatter') whilst flat surfaces result in a rapid decay of the signal. These properties can be used to discriminate broad categories of sea floor habitats (Foster-Smith *et al.*, 2000, 2001; Foster-Smith and Sotheran, 2003). The acoustic data, together with GPS data, are logged onto a laptop and the systems are portable and self-contained.

Although the data can be displayed in real time, Envision analyse the data using image processing and GIS (Sotheran *et al.*, 1997) after carrying out detailed data quality assurance procedures.

2.5.2.3 Performance of the acoustic systems

The GeoSwath operated at 250kHz and at various power settings and swath widths between 100 and 250m depending on water depth and line spacing. The AGDS operated at 50kHz.

Basic processing (during which data is corrected for GPS offsets, tide and variations in speed of sound, gridded and mosaiced) cannot be undertaken with the GeoSwath system (on previously collected data) at the same time as data is being acquired. The raw data was backed up every evening and processed using a second land based PC; this enabled estimates of coverage and data quality to be made on a day to day basis and allowed for daily survey plans to be adapted.

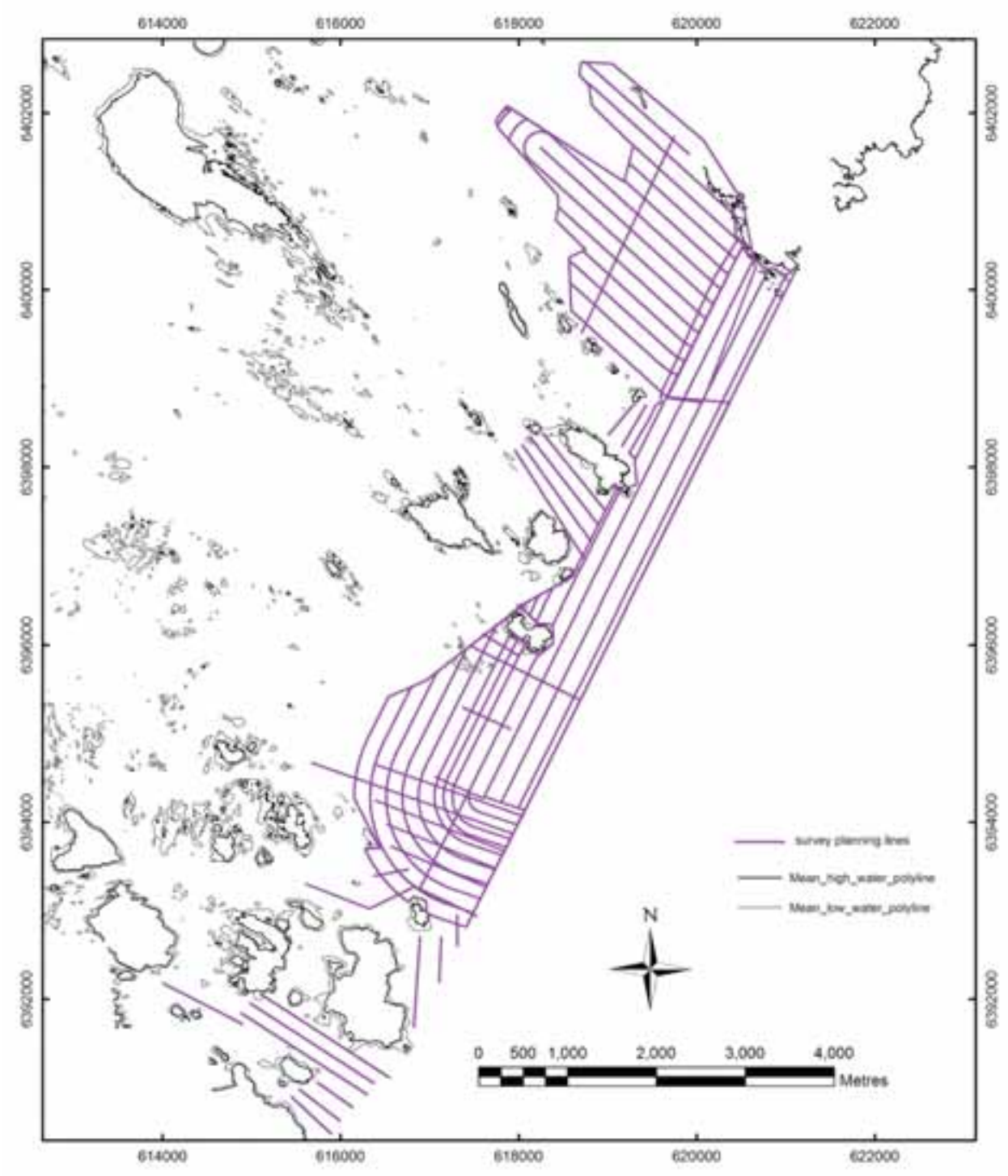
The AGDS data were processed on a day-to-day basis. The data showed some variation between days and it was judged that there was a requirement for standardisation between days. See Section 2.5.9.1 for details of standardisation.

2.5.2.4 Conducting the field survey

Survey lines were planned in a GIS system, MapInfo, and a GPS input allowed the vessel position to be displayed along the survey lines. The vessel skipper could then follow the course in real time and follow the survey lines as closely as possible. Deviations from the expected course were made due to navigational hazards such as shallow obstacles and fishing gear.

Figure 2.5.2 shows the survey planning workspace, with the planned survey lines.

Figure 2.5.2 Survey planning workspace with survey lines in Area B in south-eastern area of the Sound of Harris



2.5.3 GeoSwath calibration

The procedure for performing a calibration given below assumes that the vessel has moved into a position where the sea bed is relatively smooth, and where there is a slope (such as on a shallow bank).

The length of these survey lines depends on the seabed terrain. However, manufacturers recommendations state that they be less than 500m long. Using latency as an example, if the change in depth occurs very gradually then long lines will be required in order to accurately determine the calibration value. However, if the depth changes rapidly as for dredged channels then relatively short lines may be run. There are no hard and fast rules, but the time spent on ensuring that the relevant seabed terrain is found and length of lines longer rather than shorter will yield the best calibration parameters and ultimately the highest quality survey. Dependent upon local conditions all the calibration parameters may be determined from as little as four survey lines run as illustrated below in Figure 2.5.3.

General GeoSwath+ calibration (patch test) requirements are as follows:

Latency

A line run at normal survey speed (~2ms^{-1}) run over one of the following:

a) A steep slope, perpendicular to contours.

b) A dredged channel, perpendicular to channel.

The same line is to be run again in the same direction at a faster speed (~3ms^{-1}).

If the vessel is crabbing due to currents and the amount of crabbing is different for the two lines then the line direction should be adjusted to reduce the effect. If this is not possible then a new latency calibration site should be chosen.

Roll

Three lines are to be run in opposite directions with 100% overlap in data, ie if ping length is 50m the line spacing should be a maximum of 50m. The lines are to be run at normal survey speed (2ms^{-1}) over a flat seabed. Line direction should be chosen to minimise vessel crabbing.

Pitch and Yaw

For most shallow water surveys using standard GeoAcoustics 'V' plate assembly the pitch offset may be assumed to be zero. Three lines are to be run in opposite directions with 100% overlap in data, ie if ping length is 50m the line spacing should be a maximum of 50m.

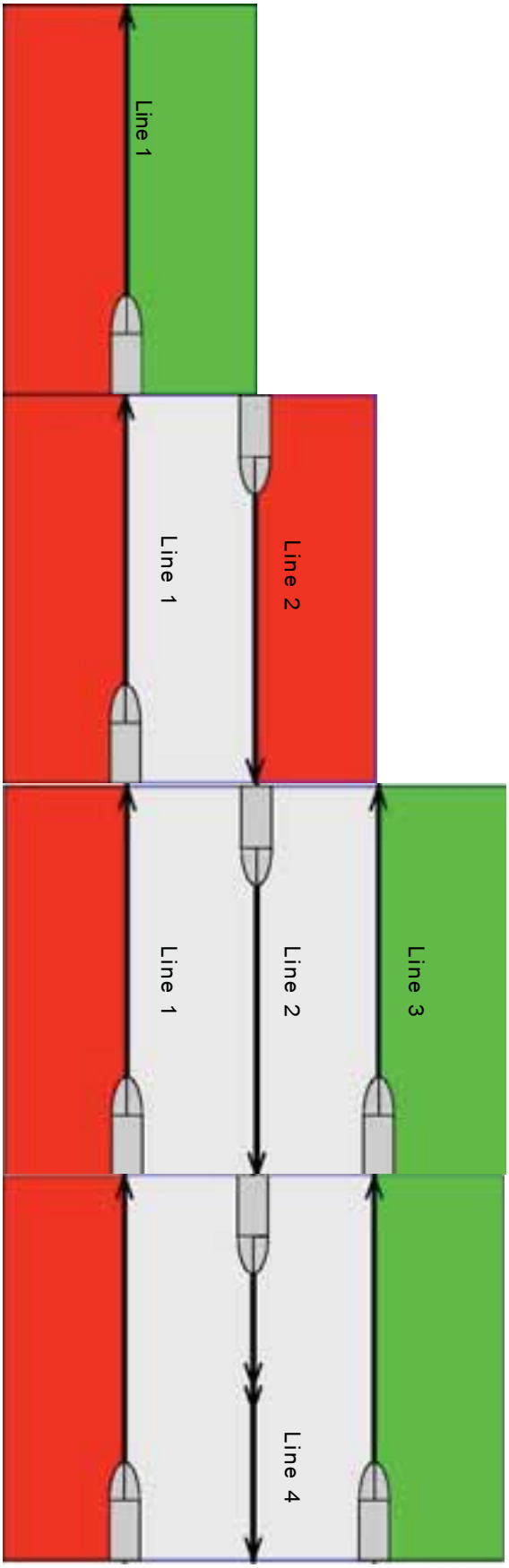
The lines are to be run at normal survey speed (~2ms^{-1}) over a one of the following:

a) A steep slope, perpendicular to contours.

b) A dredged channel, perpendicular to channel.

Line direction or location should be chosen to minimise vessel crabbing.

Figure 2.5.3 Illustration of calibration lines carried out by the vessel during calibration



Line 1:
In a straight line.
At a constant Speed.
Over a dredged channel (or flat area with a contour shift). Run three times in opposite directions for roll calibration.

Line 2:
Straight line, opposite direction and parallel to the 1st line. At the same constant speed as the 1st line. Over the same dredged channel with 100% overlap.

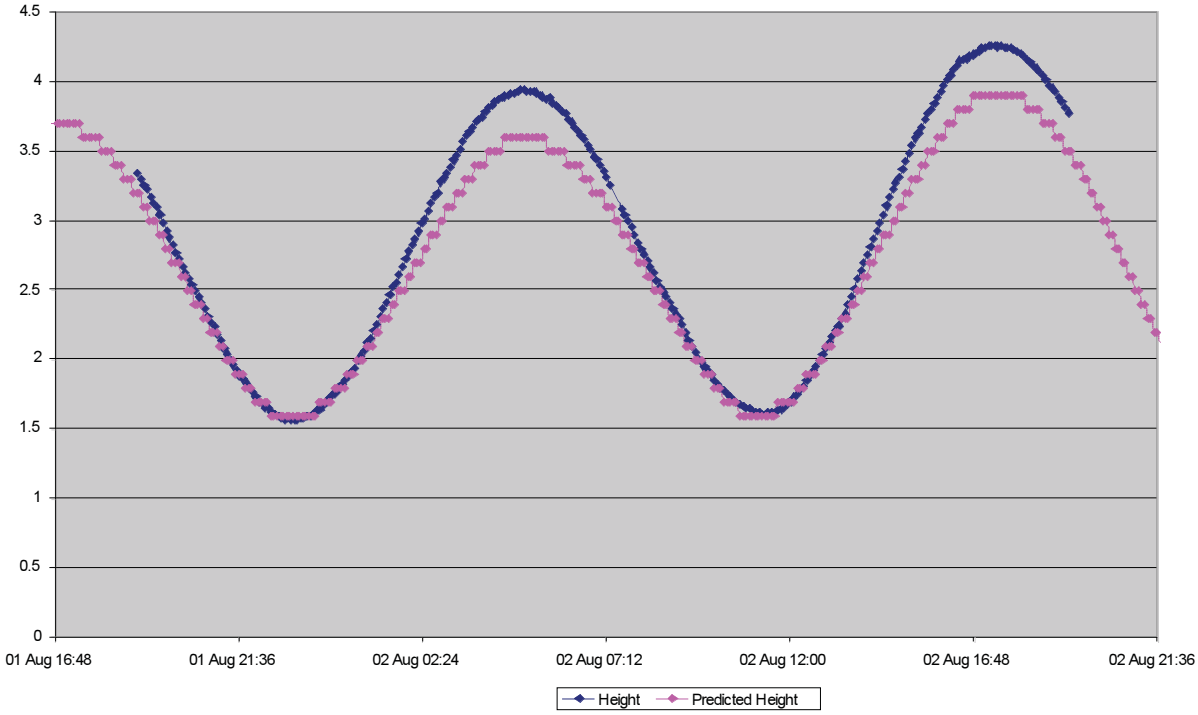
Line 3:
Straight line, opposite direction and parallel to the 2nd line. At the same constant speed as the 1st and 2nd lines. Over the same dredged channel with 100% overlap.

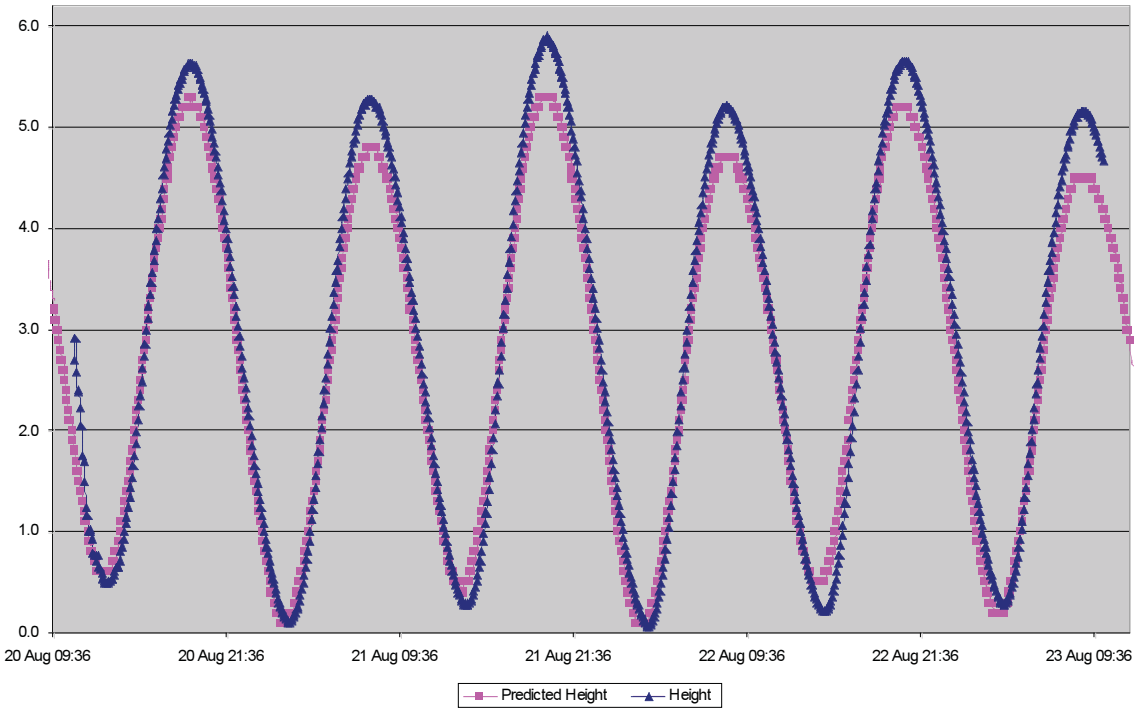
Line 4:
Directly over line 2 and in same direction. At a faster speed (at least 2 knots faster) 100 % overlap.

2.5.4 Tide data

A Valeport 740 instrument was deployed adjacent to the tidal height board located in Berneray Harbour. The gauge was calibrated using the tidal height board as reference. Predicted tides were also calculated for the two survey periods in order to compare the actual heights and the predictive data. Figure 2.5.4 shows the tidal graphs for the two survey periods. The tidal data is also available in a spreadsheet accompanying this report.

Figure 2.5.4 Plots of tidal data logged by tide gauge and predicted tides

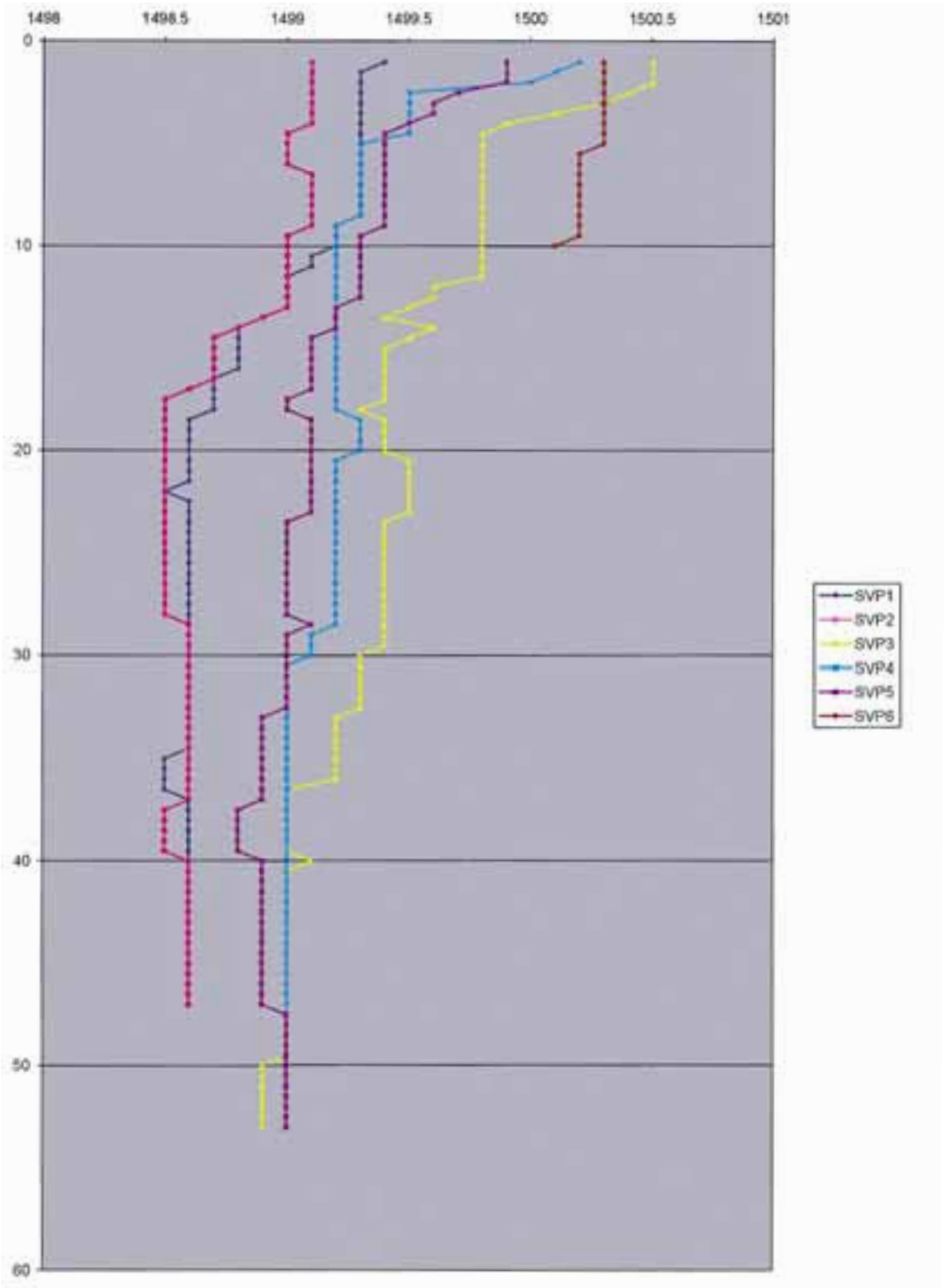




2.5.5 Sound velocity profiler data

An Odom hydrographic DigiBar Pro sound velocity profiler was used to measure water column sound velocities. Six sites were sampled through the survey region and the data is presented in Figure 2.5.5. These data were used when processing the swath bathymetric data to compensate for differences in sound velocity through the water column.

Figure 2.5.5 Sound velocity with depth for the six locations



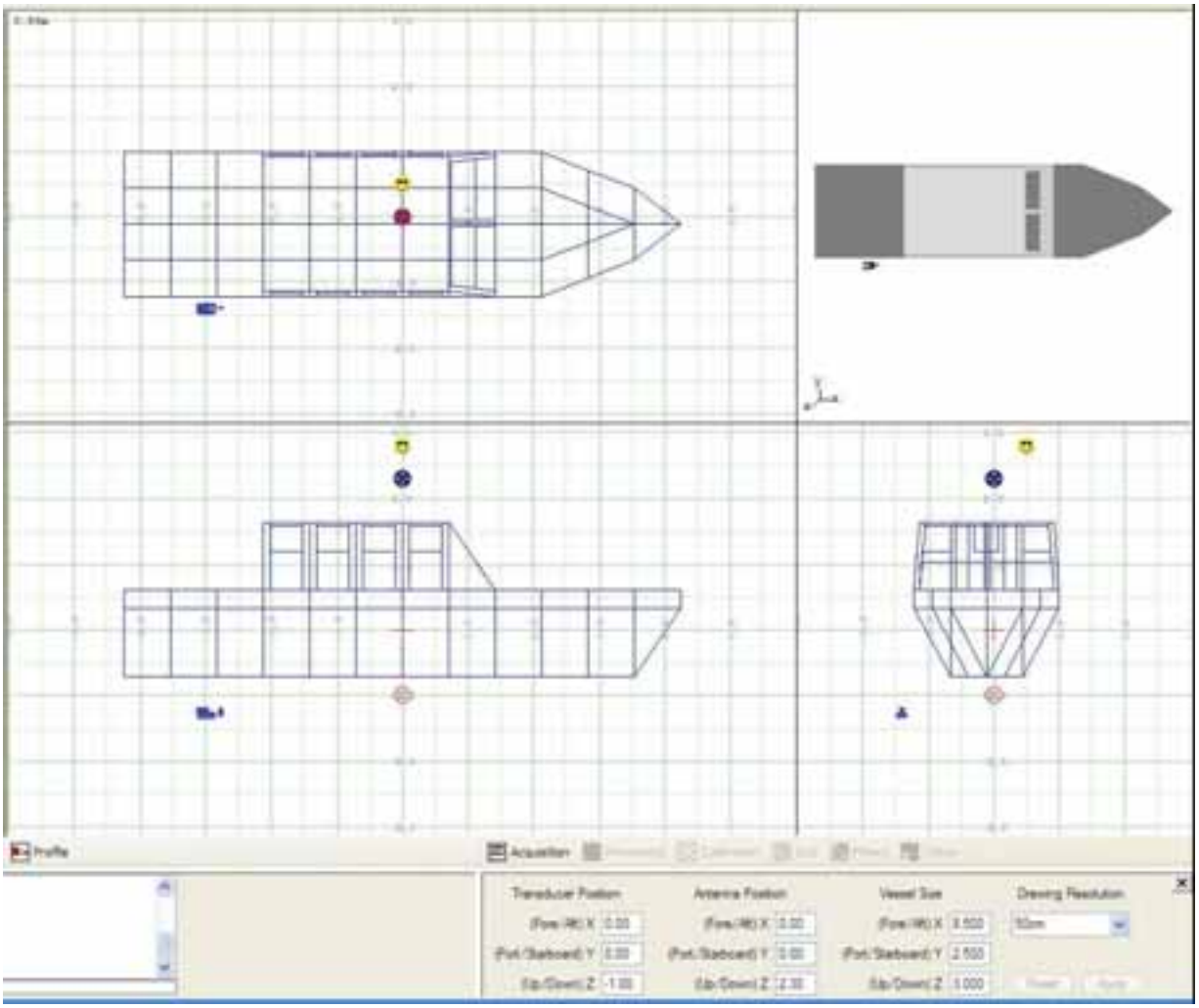
2.5.6 GPS calibration

A CSI Wireless Vector sensor was used for heading sensing and dGPS data. The GPS was calibrated/ verified by collecting 10 minutes duration of data points (between 300–500 points) at a fixed location. During the initial survey the GPS was calibrated whilst the vessel was alongside, and close to the loading steps in Berneray Harbour; during the second visit the GPS was calibrated with the vessel alongside the end of the pier at the entrance to the harbour. In both cases the vessel was held in position and the data logged. Both calibration data sets provide a consistent and accurate position with the variation being ±0.35m.

2.5.7 Vessel calibration

Physical measurements of the vessel and the location of the GPS antenna and acoustic transducers were recorded, these data were then used when processing the swath data to compensate for any offsets and geometrical errors. A copy of the vessel survey sheet is shown in Figure 2.5.6.

Figure 2.5.6 Vessel survey sheet, showing offsets recorded



2.5.8 Data processing

2.5.8.1 RoxAnn AGDS

The RoxAnn data were edited on a day-to-day basis. The data were cleaned (removal of depth spikes, records when the vessel was stationary and where there were zero values for depth). Tidal corrections were made to the depth records through the use of predicted tides of the nearest port (Leverburgh) (TotalTide™) and allowing for the depth of the transducer below water level (1m). The data were imported into MapInfo and displayed showing incremental values in E1 (roughness) and E2 (hardness) and records removed where there was any doubt about values (as compared to surrounding tracks). The data were acquired using lat/longs and WGS84.

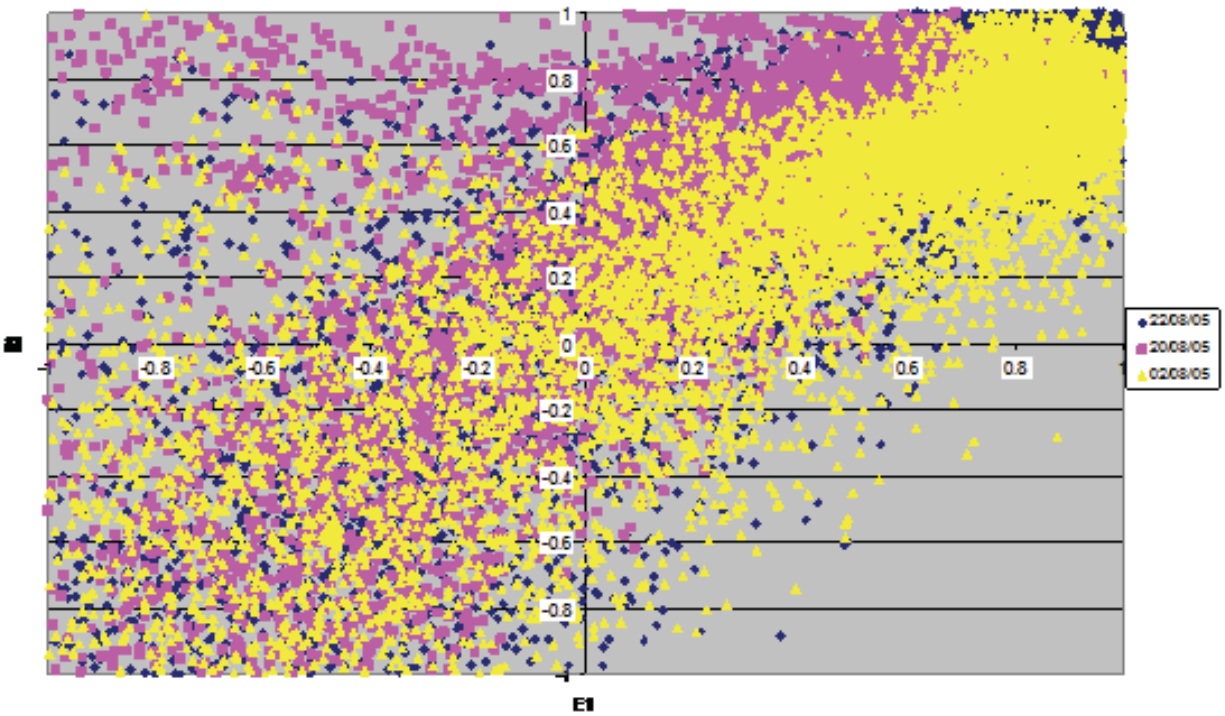
The daily data sets were compared using scatter grams. The data showed some variation between days and it was judged that there was a requirement for standardisation between days. The data were standardised by using residual values for E1 and E2 for each day and these were then standardised using the 99th percentile:

(Mean Daily Value) – (E1 or E2) = Residual Value

(Residual Value) ÷ (99th Percentile) values capped to –1.0 and 1.0

The resulting spread of data is shown in Figure 2.5.7.

Figure 2.5.7 Scatter plot of the standardised AGDS data showing data sets from each survey date



Copies of the daily data sets were amalgamated in MapInfo to create a single data set. The data was interpreted using image processing techniques, see section 2.5.9.

2.5.8.2 Interpolation

Interpolation transforms point data to a continuous surface by calculating new values for a grid of positions covering a rectangular area that encompasses the track point data. The reasons for interpolation are, firstly, to produce a coverage that is easier to view as a map than point data and, secondly, to enable raster-based image processing techniques to be applied to the data.

The edited track data were interpolated in Surfer™ using the following parameters:

- a grid spacing of 25m;
- inverse distance algorithm with a weighting toward the grid centroid of 2;
- a search and display radius of 1000m (to ensure there were no gaps in the coverage);
- a four-sector search with a maximum of 16 values per sector;
- a smoothing coefficient of 0.

The reports generated by Surfer™ during the interpolation are made available on the data CD accompanying this report.

2.5.8.3 Classification

The raster grid images were imported into Idrisi™ for classification. Supervised classification using the maximum likelihood classifier is regarded as a satisfactory means of interpreting multispectral data, and the different acoustic variables have been considered as analogous to electromagnetic data from satellite or airborne sensors.

The grid images used for classification were E1, E2 and Depth.

Ground truth data were categorised to biotope or, if this fine level of detail was not possible, to higher habitat complex level. Buffer zones of 50m were created around each video sample which were then used as 'training' sites to create the acoustic signatures from the three variables used (as above). The signatures were then applied using the maximum likelihood classifier. The process was repeated for the biological classes.

2.5.9 GeoSwath processing

The swath interferometric data were processed using proprietary software produced by the manufacturers of the system.

The procedure of processing involves replaying the raw data and applying any correction required from the calibration procedure; this removed effects of vessel movement, tide, speed of sound through the water column and the geometric offsets of equipment set up.

In addition to applying the corrections above this procedure allowed for the data to be filtered to remove noise and increase the accuracy of the processed data. These filters are:

Amplitude Filter

The amplitude filter sets amplitude (strength) below and above which all points are rejected.

Limits Filter

This filter uses only the data that have got past the previous filter, and here the limits are set for the minimum and maximum depth ranges, the minimum and maximum swath width and the minimum and maximum slant ranges.

Across track Filter

This is a learning filter which uses a percentage of the previous ping to guide the filtering of the new ping. Only data which remain after the previous filters are used. This filter detects variation across the swath by comparing the mean of previous pings to that of the current ping. Thresholds are set and if the value falls outside the threshold then the ping is removed.

Along track filter

This uses only the data that get through all the previous filters. A bin size is specified in metres and the mean value of depths within this are compared to previous ping values as the vessel travels forward. Thresholds are set and if the value falls outside the threshold then the ping is removed.

Each raw data track is replayed and the above offsets and filters are applied. The resulting data are then combined using a gridding technique.

2.5.9.1 Gridding

Gridding involves the creation of a data grid in which the user sets the geographic limits and the resolution (bin size). For this procedure the following parameters were used:

Min X: 96545.0 E	Max X: 104645.0 E
Min Y: 872540.0 N	Max Y: 884455.0 N
Cell: 5.0m	
Projection: OSGB1936	

The raw data were then examined by the software and where data occurred within a grid cell, an average reading was taken from all raw data tracks which fell within the cell; the grid cell was then assigned that value.

The gridded data were exported for display in 3-D within other software. The features are best seen using graduated colours for depth and sun illumination for both flat maps and 3-D renditions. Both modes of display are useful and have been provided in most cases.

3 RESULTS

3.1 Infaunal analysis

All station data and biotope identities of the groundtruth stations are presented in Appendix A Table 7.1.1–3. Images (where available) of the biotopes and a summary list of records are given in Appendix A Table 7.1.4–7.

Samples from 50 selected stations were fully processed and the data are given in Appendix A Table 7.1.8 in the form of a species by site matrix. Diversity indices were calculated and are given in Table 3.1.1 and corresponding granulometric data are given in Table 3.1.2.

Five samples were found to contain a very sparse fauna (3–16 individuals per 0.1m^2) with few species (3–10) present and were allocated to the biotope **SS.SSA.IFiSa.IMoSa**. The samples were from clean, well sorted, rippled, fine or medium sand. They originated from shallow water (<10m) in an exposed, wave surged area of the Sound. The community composition of the samples shows considerable variation but the consistently impoverished fauna and environmental conditions are a good match to the biotope.

One sample showed strong similarities to **SS.SSA.IFiSa.IMoSa** but a slightly more diverse fauna (13 spp. and 19 ind.) and differences in species composition led to the allocation of the biotope **SS.SSA.IFiSa.NcirBat**. Sediment type was virtually indistinguishable from **SS.SSA.IFiSa.IMoSa** but the site was located in a less exposed environment.

Six samples were found to contain a more diverse and abundant fauna (8–53 spp. and 14–304 individuals per 0.1m^2) characterised by bivalve molluscs and were allocated to the biotope **SS.SCS.ICS.MoeVen**. The sediment type was similar to that of **SS.SSA.IFiSa.IMoSa** although with a slightly increased gravel fraction in some cases. The samples originated from tide swept channels in less exposed locations than was the case for **SS.SSA.IFiSa.IMoSa**. The appearance of the sediment surface of these stations was variable. In some locations the sediment was virtually indistinguishable from **SS.SSA.IFiSa.IMoSa** and in others it was more heterogenous with less pronounced rippling and scattered ephemeral algae on the sediment surface. These differences are apparent in the infaunal data with more diverse and abundant fauna present at stations influenced by algal cover (21–53 spp. and 106–304 individuals per 0.1m^2). Despite the differences the similarities of the infauna and environmental conditions are appropriate to the allocation of the biotope **SS.SCS.ICS.MoeVen**.

Seven samples were characterised by a moderately diverse (14–72 spp. and 49–391 individuals per 0.1m^2) fauna including tube-dwelling amphipods and were allocated to the biotope **SS.SSA.IFiSa.TbAmPo**. The sediment type was finer than for the previous biotopes and contained small quantities of silt/clay. The locations were relatively sheltered and shallow. The sediment appearance was similar to the lower energy variants of **SS.SCS.ICS.MoeVen** but was discernibly more silty. Similarly to **SS.SCS.ICS.MoeVen** there was some variation in community composition that is related to the abundance of algae present on the sediment surface (two algal influenced stations with 58 and 75 spp. and 203 and 391 individuals per 0.1m^2, respectively).

Table 3.1.1 Diversity, species richness, abundance and biotope identity of infaunal samples

Sample	Shannon's Index	Number of Species	Abundance (No./0.1m^2)	Biotope
IB3	1.424	5	12	LS.LSA.FiSa.Po.Aten
IB23	0.693	2	2	LS.LSA.MuSa.MacAre (var. 2)
SA48	3.954	94	306	SS.SCS.CCS.MedLumVen
SA53	3.718	60	115	SS.SCS.CCS.MedLumVen
SA85	2.364	12	17	SS.SCS.ICS.MoeVen
SA95	1.866	8	14	SS.SCS.ICS.MoeVen
SB20	2.966	37	160	SS.SCS.ICS.MoeVen
SB24	2.244	12	21	SS.SCS.ICS.MoeVen
SB54	2.676	21	106	SS.SCS.ICS.MoeVen
SB74	3.325	53	304	SS.SCS.ICS.MoeVen
SB30	2.874	22	39	SS.SMP.SSgr.Zmar
SB41	2.418	29	109	SS.SMP.SSgr.Zmar
SB48	2.868	20	28	SS.SMP.SSgr.Zmar
SA67	3.665	63	178	SS.SMP.Mrl.Pcal
SA20	3.241	42	150	SS.SMU.CSaMu.AfilMysAnit
SA34	3.309	54	170	SS.SMU.CSaMu.AfilMysAnit
SA35	2.257	34	172	SS.SMU.CSaMu.AfilMysAnit
SA37	3.35	72	276	SS.SMU.CSaMu.AfilMysAnit
SA38	3.461	51	130	SS.SMU.CSaMu.AfilMysAnit
SA40	2.473	27	103	SS.SMU.CSaMu.AfilMysAnit
SA46	3.48	69	253	SS.SMU.CSaMu.AfilMysAnit
SA51	2.919	43	172	SS.SMU.CSaMu.AfilMysAnit
SA80	2.938	45	176	SS.SMU.CSaMu.AfilMysAnit
SA103	3.241	73	383	SS.SMU.CSaMu.AfilMysAnit
SA105	3.022	74	509	SS.SMU.CSaMu.AfilMysAnit
SB59	1.871	16	121	SS.SMU.IFiMu.Are
SB91	1.521	9	147	SS.SMU.IFiMu.Are
SB93	2.535	19	74	SS.SMU.IFiMu.Are
SA43	3.093	48	224	SS.SMU.ISaMu.AmpPlon
SB35	1.868	32	485	SS.SMU.ISaMu.AmpPlon
SB38	2.741	46	313	SS.SMU.ISaMu.AmpPlon
SB57	2.498	44	484	SS.SMU.ISaMu.AmpPlon
SB62	1.965	25	184	SS.SMU.ISaMu.AmpPlon
SB84	2.577	19	76	SS.SMX.IMx.SpavSpAn
SA22	1.099	3	3	SS.SSA.IFiSa.IMoSa
SA29	1.55	5	7	SS.SSA.IFiSa.IMoSa
SA61	2.079	10	16	SS.SSA.IFiSa.IMoSa
SB13	1.205	4	13	SS.SSA.IFiSa.IMoSa

Table 3.1.1 *(continued)*

Sample	Shannon's Index	Number of Species	Abundance (No./0.1m^2)	Biotope
SB19	1.516	5	11	SS.SSA.IFiSa.IMoSa
SB4	2.507	13	19	SS.SSA.IFiSa.NcirBat
SB28	2.538	27	113	SS.SSA.IFiSa.TbAmPo
SB31	3.094	34	87	SS.SSA.IFiSa.TbAmPo
SB33	2.477	29	91	SS.SSA.IFiSa.TbAmPo
SB50	2.493	25	69	SS.SSA.IFiSa.TbAmPo
SB73	3.318	58	203	SS.SSA.IFiSa.TbAmPo
SB75	3.271	72	391	SS.SSA.IFiSa.TbAmPo
SB88	2.14	14	49	SS.SSA.IFiSa.TbAmPo
SB79	1.386	4	4	SS.SSA.IMuSa.AreISa
SB81	2.425	13	21	SS.SSA.IMuSa.AreISa
SA83	3.343	35	72	SS.SSA.IMuSa.FfabMag

Table 3.1.2 Sediment data corresponding to infaunal samples

	Median grain size (μ)	% silt/clay	% gravel	Biotope
IB3	217.64	1.37	0.06	LS.LSA.FiSa.Po.Aten
IB23	80.77	29.17	0.00	LS.LSA.MuSa.MacAre (var. 2)
SA48	615.57	12.48	4.50	SS.SCS.CCS.MedLumVen
SA53	1414.21	6.12	12.52	SS.SCS.CCS.MedLumVen
SA85	217.64	1.77	0.11	SS.SCS.ICS.MoeVen
SA95	707.11	1.27	1.33	SS.SCS.ICS.MoeVen
SB20	378.93	1.66	2.37	SS.SCS.ICS.MoeVen
SB24	353.55	0.97	3.26	SS.SCS.ICS.MoeVen
SB54	812.25	1.87	2.41	SS.SCS.ICS.MoeVen
SB74	1231.14	2.35	6.66	SS.SCS.ICS.MoeVen
SB30	189.47	1.89	0.50	SS.SMP.SSgr.Zmar
SB41	164.94	3.59	2.82	SS.SMP.SSgr.Zmar
SB48	203.06	1.70	1.21	SS.SMP.SSgr.Zmar
SA67	267.94	2.91	5.25	SS.SMP.Mrl.Pcal
SA103	125.00	13.36	1.55	SS.SMU.CSaMu.AfilMysAnit
SA105	143.59	15.88	0.01	SS.SMU.CSaMu.AfilMysAnit
SA20	164.94	5.19	1.41	SS.SMU.CSaMu.AfilMysAnit
SA34	133.97	25.56	4.20	SS.SMU.CSaMu.AfilMysAnit
SA35	125.00	25.34	2.56	SS.SMU.CSaMu.AfilMysAnit
SA37	176.78	20.40	3.54	SS.SMU.CSaMu.AfilMysAnit
SA38	353.55	18.24	0.76	SS.SMU.CSaMu.AfilMysAnit
SA40	116.63	28.57	2.01	SS.SMU.CSaMu.AfilMysAnit

Table 3.1.2 *(continued)*

	Median grain size (μ)	% silt/clay	% gravel	Biotope
SA46	101.53	34.31	0.67	SS.SMU.CSaMu.AfilMysAnit
SA51	71.79	46.18	1.83	SS.SMU.CSaMu.AfilMysAnit
SA80	116.63	21.50	0.65	SS.SMU.CSaMu.AfilMysAnit
SB59	<63	79.76	0.00	SS.SMU.IFiMu.Are
SB91	<63	88.23	0.00	SS.SMU.IFiMu.Are
SB93	<63	85.31	0.00	SS.SMU.IFiMu.Are
SA43	<63	51.26	0.00	SS.SMU.ISaMu.AmpPlon
SB35	116.63	17.40	0.05	SS.SMU.ISaMu.AmpPlon
SB38	101.53	27.13	0.00	SS.SMU.ISaMu.AmpPlon
SB57	125.00	26.76	0.15	SS.SMU.ISaMu.AmpPlon
SB62	329.88	9.35	0.00	SS.SMU.ISaMu.AmpPlon
SB84	143.59	17.30	0.28	SS.SMX.IMx.SpavSpAn
SA22	153.89	1.21	0.00	SS.SSA.IFiSa.IMoSa
SA29	378.93	1.44	0.00	SS.SSA.IFiSa.IMoSa
SA61	378.93	1.21	0.00	SS.SSA.IFiSa.IMoSa
SB13	757.86	2.00	0.18	SS.SSA.IFiSa.IMoSa
SB19	378.93	1.55	0.00	SS.SSA.IFiSa.IMoSa
SB28	133.97	7.31	0.03	SS.SSA.IFiSa.TbAmPo
SB31	176.78	2.32	1.64	SS.SSA.IFiSa.TbAmPo
SB33	143.59	4.88	0.13	SS.SSA.IFiSa.TbAmPo
SB50	143.59	4.02	2.01	SS.SSA.IFiSa.TbAmPo
SB73	133.97	6.42	0.00	SS.SSA.IFiSa.TbAmPo
SB75	143.59	7.06	0.00	SS.SSA.IFiSa.TbAmPo
SB88	143.59	4.75	0.79	SS.SSA.IFiSa.TbAmPo
SB79	143.59	3.74	0.00	SS.SSA.IMuSa.ArelSa
SB81	153.89	7.68	0.00	SS.SSA.IMuSa.ArelSa
SA83	176.78	3.34	0.34	SS.SSA.IMuSa.FfabMag

Two samples were from a similar environment to **SS.SSA.IFiSa.TbAmPo** but had a relatively impoverished fauna (4–13 spp. and 4–21 individuals per 0.1m^2) and were allocated to the biotope **SS.SSA.IMuSa.ArelSa**. The sediment type was of slightly silty fine sand and the stations were located in sheltered shallow environments. The biotope appears to be an impoverished version of **SS.SSA.IFiSa.TbAmPo** and lacks tube-dwelling amphipods. There are numerous *Arenicola* casts and the biotope may be associated with mats of filamentous algae on the sediment surface.

Five samples contained a fauna very similar to **SS.SSA.IFiSa.TbAmPo** but from considerably muddier environments. These were allocated to the biotope **SS.SMU.ISaMu.AmpPlon** (25–48 spp. and 184–485 ind./0.1m^2). The sediment type ranged from fine slightly silty sand to sandy mud, in general with a higher proportion of the silt/clay fraction than **SS.SSA.IFiSa.TbAmPo**. The locations were typically more sheltered

than seen at the **SS.SSA.IFiSa.TbAmPo** stations. Again there is some variation in community composition related to the presence of ephemeral algae on the sediment surface (two algal influenced stations with 46 and 48 spp. and 313 and 224 individuals per 0.1m^2, respectively).

Three samples were characterised by burrowing leptosynaptid holothurians and were allocated to the biotope **SS.SMU.IFiMu.Are** (9–19 spp. and 74–147 individuals per 0.1m^2). The sediment type was mud and the stations were from shallow water in extremely sheltered conditions. The sediment surface was covered by a mat of filamentous green algae with anemones such as *Anemonia viridis*. *Arenicola* was not present in significant abundance but the presence of the holothurians and the environmental conditions of the sites lead to the allocation of this biotope.

Eleven stations contained a diverse fauna (27–74 spp. and 103–509 individuals per 0.1m^2) characterised by *Abra nitida* and *Amphiura* spp. These were allocated to the biotope **SS.SMU.CSaMu.AfilMysAnit**. The sediment type was predominantly muddy sand with a variable proportion of the silt/clay fraction and small quantities of gravel. The locations were restricted to deep water in the eastern part of the Sound with reduced levels of wave exposure and tidal currents. There is variation in community composition but the correspondence analysis shows these stations to constitute a discrete grouping.

Two stations contained a very diverse fauna and were allocated to the biotope **SS.SCS.CCS.MedLumVen** (60 and 94 spp. and 115–306 individuals per 0.1m^2). The sediment type was broadly similar to **SS.SMU.CSaMu.AfilMysAnit** but with a lower proportion of silt/clay and a higher proportion of gravel. The sites were located in slightly shallower waters than **SS.SMU.CSaMu.AfilMysAnit** in the eastern part of the Sound near where the shallow tide swept channels deepen and merge with the waters of The Minch.

One sample contained a community similar to **SS.SCS.ICS.MoeVen** but with differences in composition and environmental conditions leading to the allocation of the biotope **SS.SSA.IMuSa.FfabMag**. The sediment was finer than is typical for **SS.SCS.ICS.MoeVen** and the station was from deeper water in a lower energy environment.

One sample showed similarities in community composition to both **SS.SSA.IFiSa.TbAmPo** and **SS.SMU.IFiMu.Are** but distinctive differences in the epifaunal species composition led to allocation of the epifaunally defined biotope **SS.SMX.IMx.SpavSpAn**. The substrate was fine sand with a high proportion of silt/clay and was located in a very sheltered, slightly tide swept environment. The epifauna was characterised by *Sabella pavonina* and mats of filamentous algae. The infaunal species composition is influenced by the algal presence.

One sample containing a very diverse fauna, (63 spp. and 178 individuals per 0.1m^2), originated from a maerl bed and was accordingly allocated to the biotope **SS.SMP.Mrl.Pcal**. The sediment was graded as medium sand but contained a high proportion of coarse shelly fragments and maerl. The station was located in an exposed and tide swept environment. In the absence of the maerl and the associated algal communities it is likely that infaunal communities in this environment would approximate to **SS.SSA.IFiSa.IMoSa** or possibly **SS.SCS.ICS.MoeVen**.

Three samples originated from well developed beds of *Zostera marina* and were accordingly designated as the biotope **SS.SMP.SSgr.Zmar**. The infaunal communities showed similarities to **SS.SSA.IFiSa.TbAmPo** but are distinguished by differences in community composition related to the presence of the *Zostera*.

3.2 Satellite imagery and maps

3.2.1 Broad band attenuation measurements

Calculated PAR and blue light attenuation coefficients in the Sound of Harris were low and varied only over a small range from 0.226–0.336m^{-1} (Table 2.4.4). This indicates that the waters in the Sound are relatively clear and that attenuation is not significantly spatially variable. Blue light attenuation was generally lower than PAR attenuation as this light is the most penetrating visible wavelength. Patterns in variation in blue light attenuation were generally similar to those of PAR.

3.2.2 *In situ* spectral attenuation measurements

Representative examples of downwelling spectral measurements, made at two sites using the spectroradiometer fitted with the fibre optic probe, are presented in Figures 3.2.1 and 3.2.2. Both sets of spectra show little variation in the spectral quality of penetrating light, at least to the 4m depth limit to which the measurements were made. Calculated spectral attenuation is very similar across the Sound of Harris (Figure 3.2.3). Attenuation is lowest over the visible; increases at approximately 600, 650 and 700nm are due to increases in absorption of light by water itself. Higher attenuation of blue light, compared to other visible light wavelengths, could be the result of increased scattering and possible absorption by dissolved aquatic humus, the latter potentially arising from runoff from land. The spectra show no visible signs of absorption due to pigments in phytoplankton, suggesting that phytoplankton concentrations in the Sound, at least at the time of measurement, were low.

The results suggest that a single attenuation value could reasonably be assumed for depth correction of the remotely sensed data.

3.2.3 Initial processed QuickBird image

The fully corrected satellite image (including geocorrection, atmospheric correction, land masking, cloud and cloud shadow masking) is shown in Figure 3.2.4. The extent of the image has also been trimmed to the boundary extent of the study area as defined by SNH (Figure 1.3.1).

The image shows good penetration to bottom sediments particularly in the blue and green spectral bands. There is some noise introduced as a result of surface reflectance effects due to wave action. The presence of cloud and cloud shadow masking some areas means that there are areas where classification of habitat type using the image data was not possible.

Figure 3.2.1 Measured spectral variation in downwelling light at 0.5m intervals at Site 2

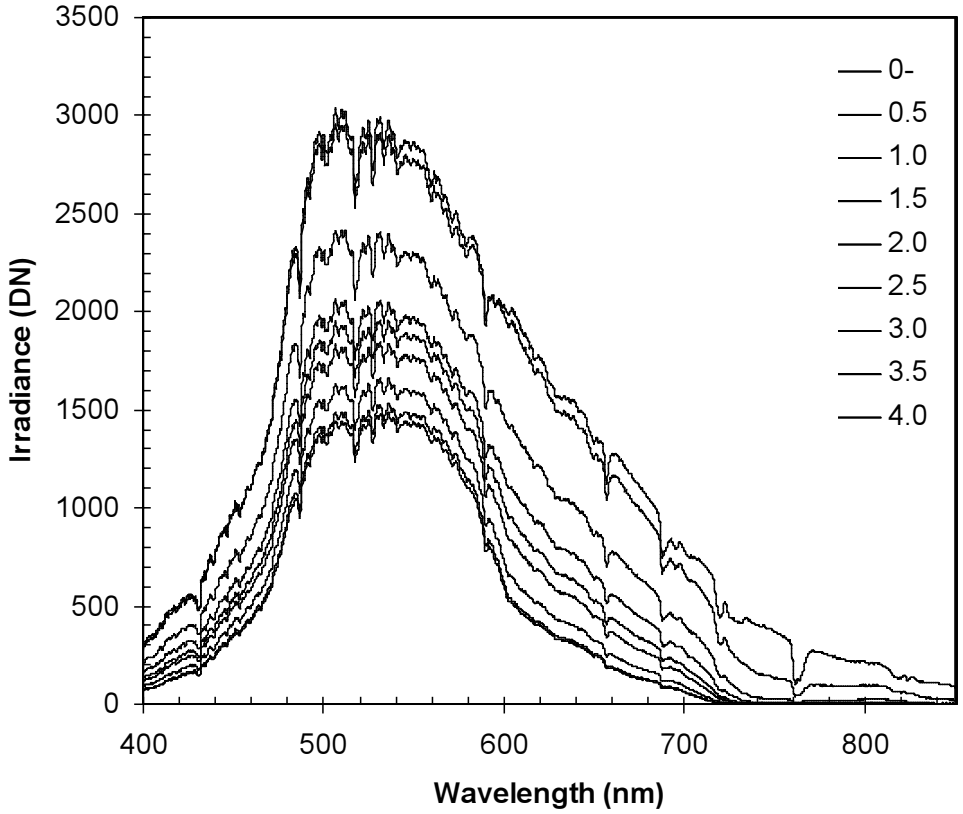


Figure 3.2.2 Measured spectral variation in downwelling light at 0.5m intervals at Site 3

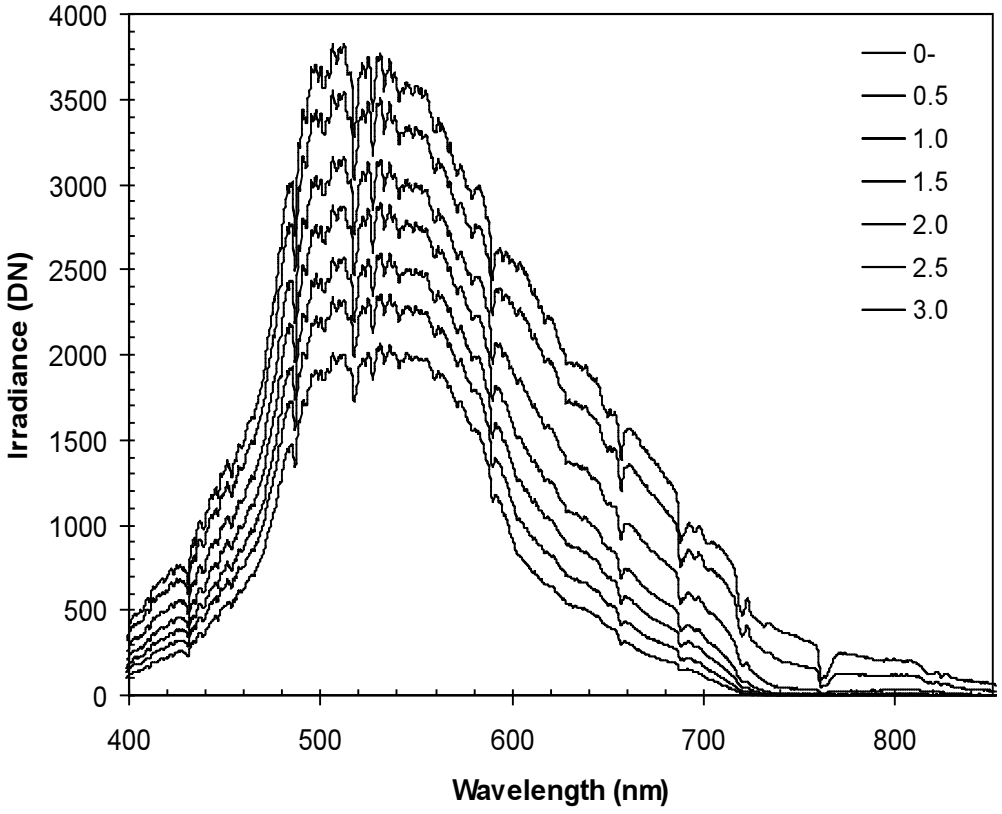
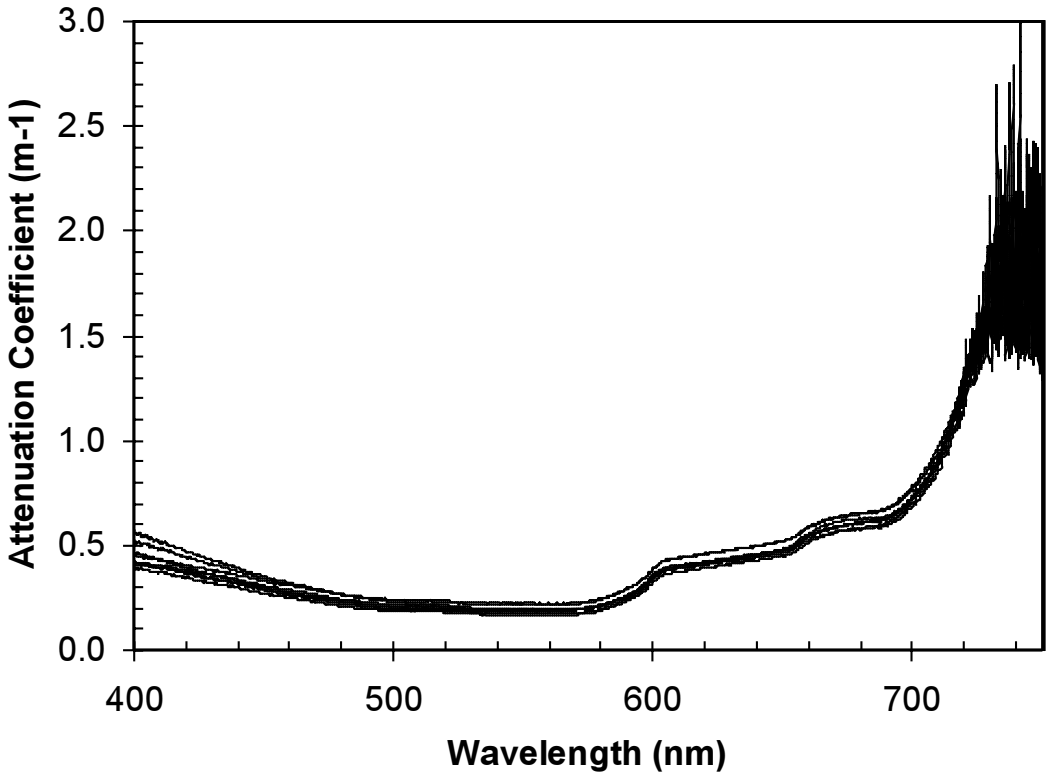


Figure 3.2.3 Calculated spectral attenuation coefficients for all measurements in the Sound of Harris



3.2.4 Water column correction

The water column corrected image is presented in Figure 3.2.5. The correction produced a 'flat' image to suggest that water depth has been well catered for, with bottom features evident across the whole study area. However, those features apparently present in the deeper waters on the eastern edge of the study area (~30m depths) should be treated with caution. Differences in apparent bottom reflectance show up well, particularly in regions of up to ~10m in depth; exposed intertidal and algal covered areas show up bright green in this colour combination, with darker submersed seagrass and rock surfaces showing up darker against the more brightly coloured sand and mud sediments. In deeper waters the apparent reflectance is darker; although these deeper waters may indicate that the depth correction technique may be approaching its depth limits, the extent of these dark reflectances would suggest that the bottom surface here is influenced by darker organic or inorganic surface features through this zone. This concurs with the findings of the biological survey.

3.2.5 Spectral biotope classification

A maximum likelihood classification was used to classify the principal subtidal biotopes found based on training classes provided. The classification produced was determined on the basis of just nine broad biotope classes but from this only five broadscale classes could be produced. This indicates a high degree of spectral confusion and overlap between many biotope classes when a classification based purely on spectral signatures is attempted. The resulting broadscale map is shown in Figure 3.2.6. The classification was only attempted for the part of the imagery where depth was less than 20m due to the limited penetration of light in depths greater than that.

On the basis of the broad classes found, overall accuracy was attributed at 48%. The broadscale class that classified with greatest accuracy was mobile sand with a user's accuracy of 76%.

3.3 Acoustic survey

3.3.1 AGDS

Cleaned and standardised the resulting track data are shown in Figure 3.3.1–3.3.3.

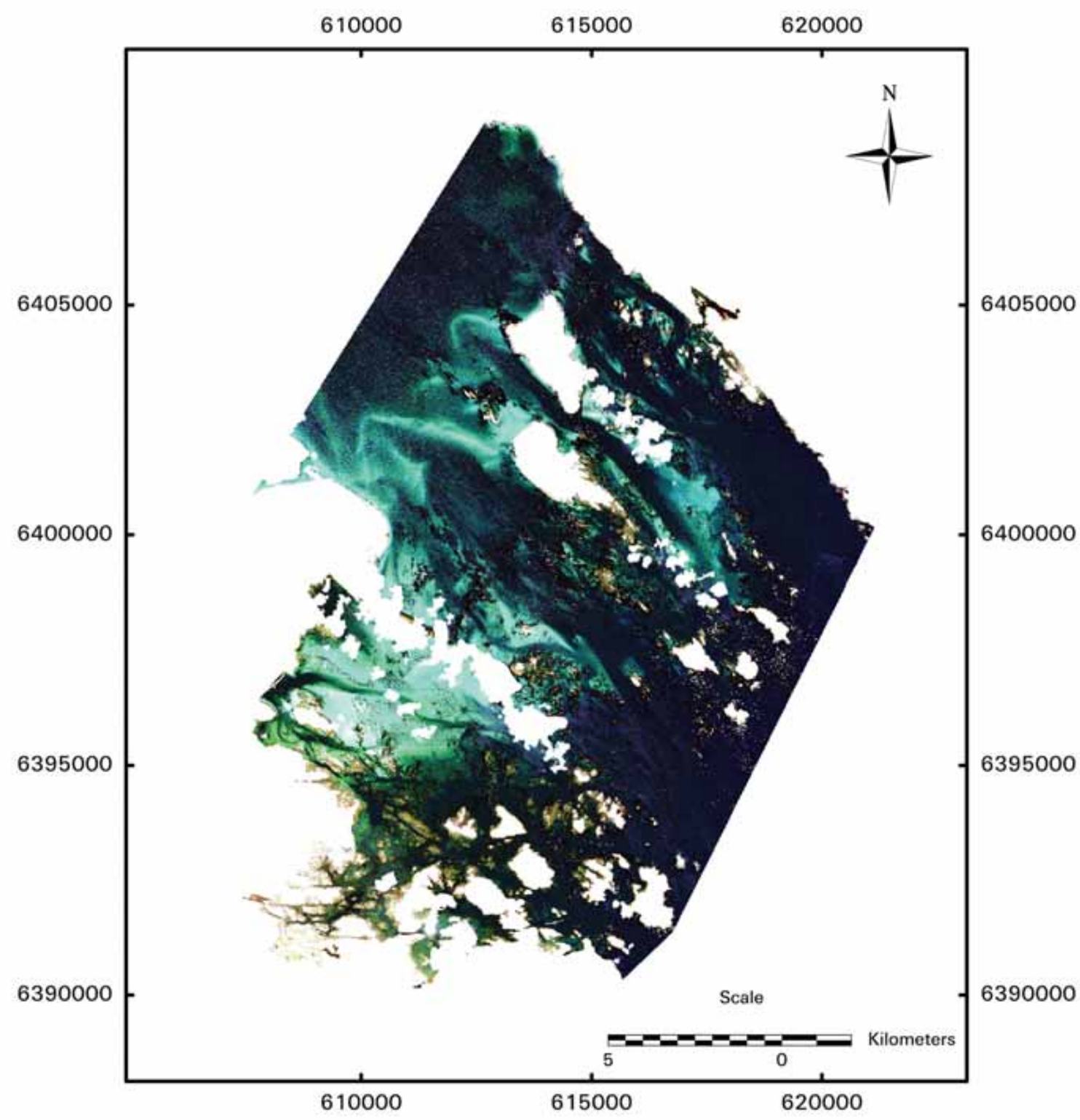
A total of 7 biotopes were identified from the ground truth survey which were located within the region surveyed using acoustic techniques. The predicted distribution of these biotopes, based on the acoustic data, is mapped for the surveyed area in Figure 3.3.4 (based on the MNCR colour scheme). In addition to the biotopes identified 7 biological mapping classes were identified and the predicted distribution of these is shown in Figure 3.3.5. Using the biological classes assists with the interpretation of the maps over the whole area of interest and to identify trends or patterns in the distribution of biological complexes.

The agreement between classification and the ground truth data can be visually assessed from the resultant maps shown above. A measure of the agreement can be calculated by overlaying the ground truth and classified images and matching predicted to actual on a pixel-by-pixel basis (the 'error matrix'). The percentage agreement for the biotope and biological class classifications were 98% and 83% respectively, with a Kappa agreement (probability of agreement above chance) of 0.95 and 0.78, respectively. This level of agreement is very high in terms of acoustic mapping surveys where perfect agreement is never expected due to a combination of positional error and variability in the acoustic reflectance data. Overall, the classification can be considered successful, particularly in demonstrating broad spatial patterns in habitat and biotope distribution.

3.3.2 Swath bathymetry

The bathymetry of the survey area derived from the swath bathymetric data is illustrated in Figure 3.3.6. The bathymetry of the area is relatively complex and ranges from 0–130m. The area is characterised by tidal channels and scattered raised features. The central area of the eastern edge of the Sound contains a steep slope leading to a deep trough with a raised area in the centre of this region. Figure 3.3.6 shows a sun-illuminated image of the bathymetry of the area whilst Figure 3.3.7 shows the bathymetric contours associated with the area surveyed.

Figure 3.2.4 The corrected and masked QuickBird satellite image, prior to water column correction



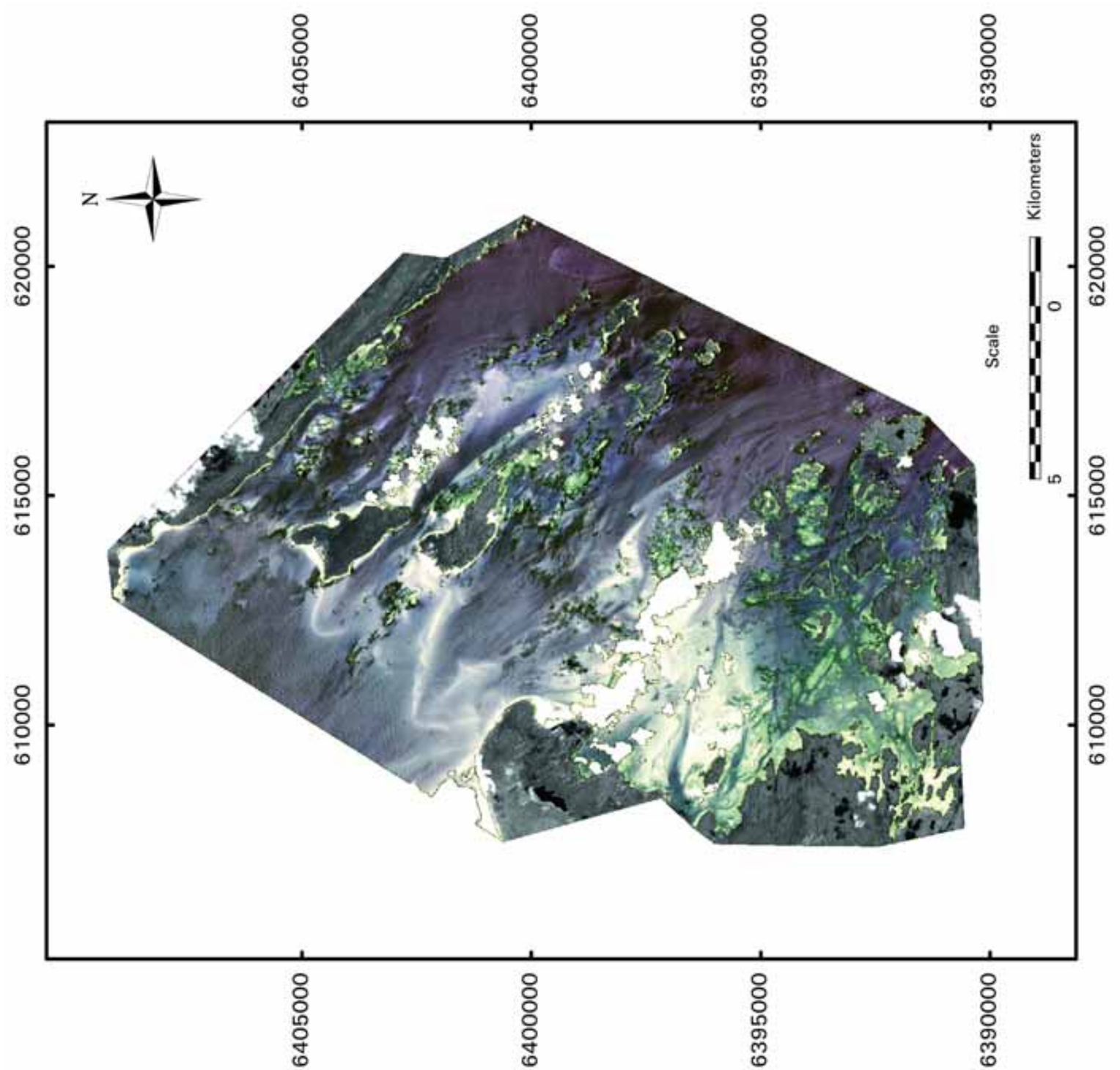
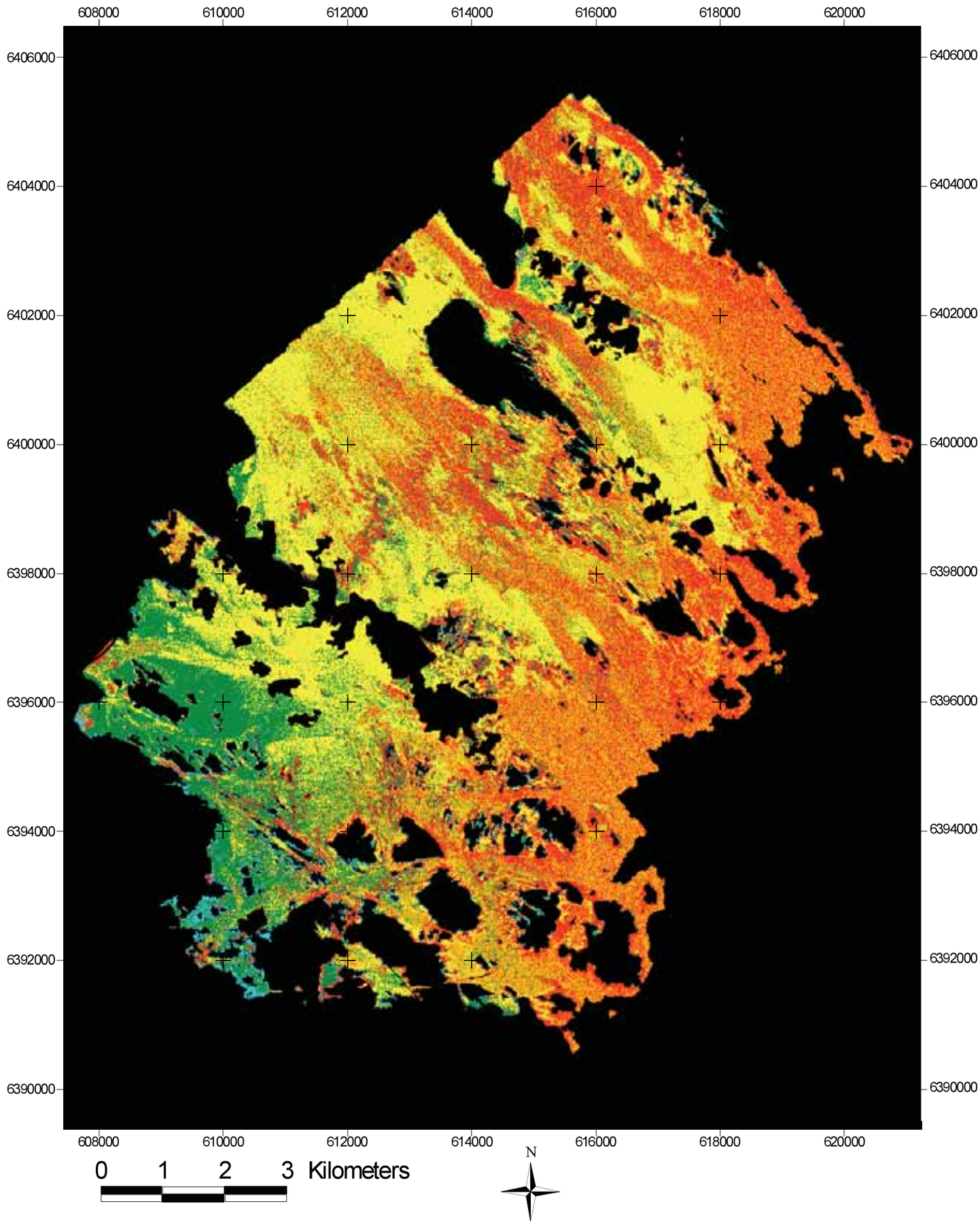


Figure 3.2.5 Image of apparent bottom reflectance after correction for water depth

Figure 3.2.6 Initial spectral-based biotope classification



Scottish Natural Heritage Commissioned Report No. 212 (Report No. F01AC401/2)

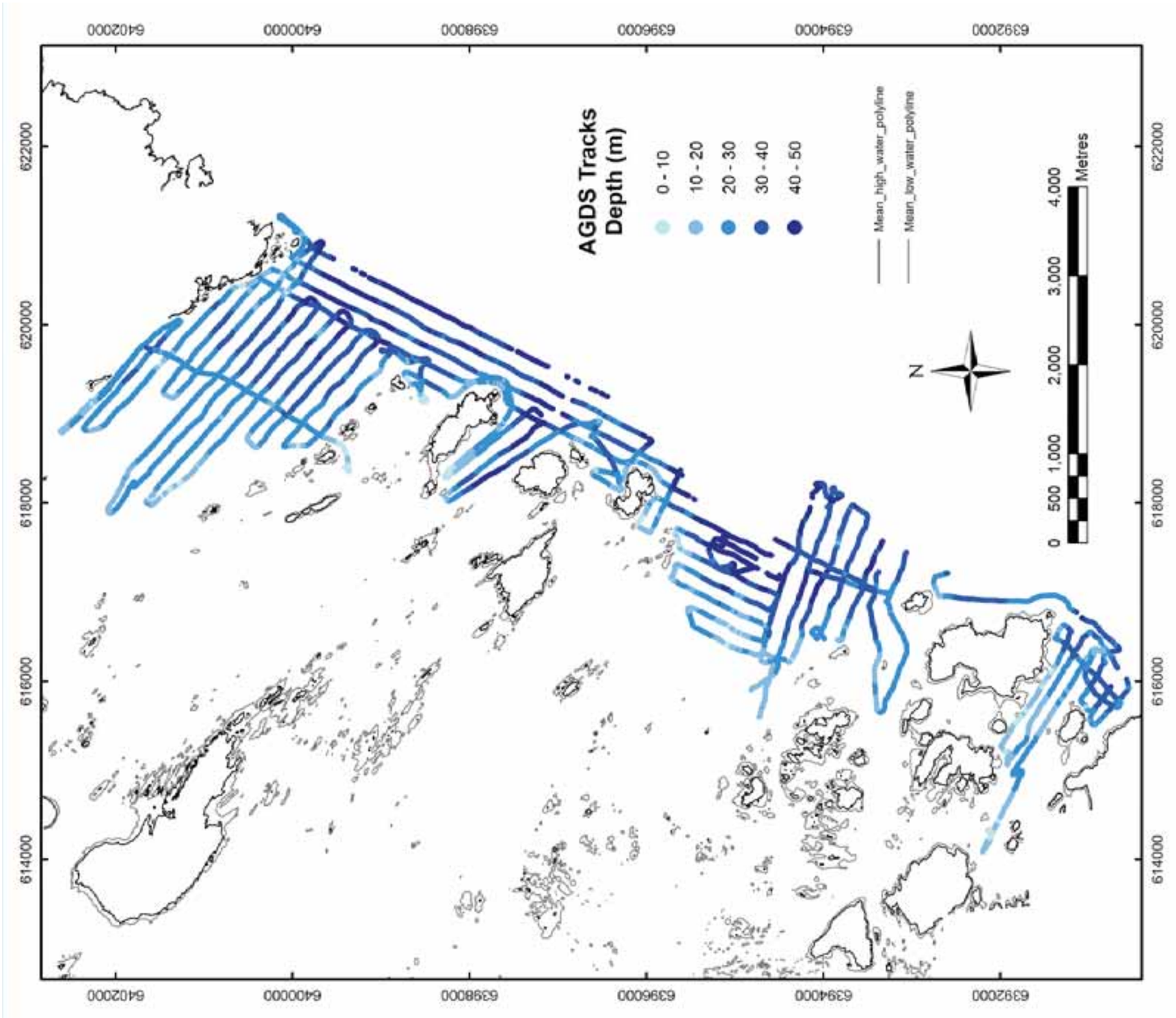


Figure 3.3.1 The AGDS tracks collected during the surveys, coloured on an incremental scale to indicate depth

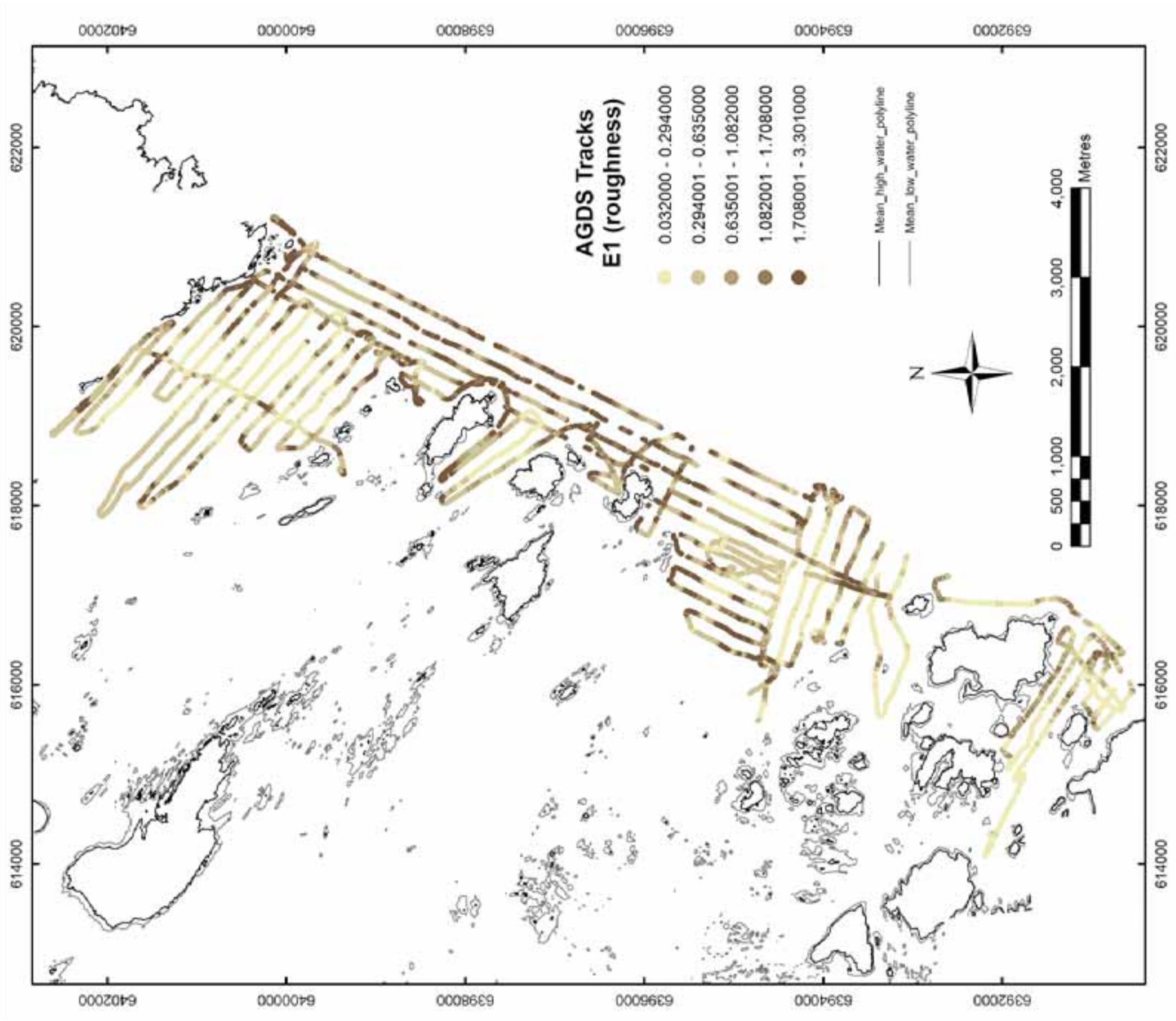


Figure 3.3.2 The AGDS tracks collected during the surveys, showing roughness values from signal E1

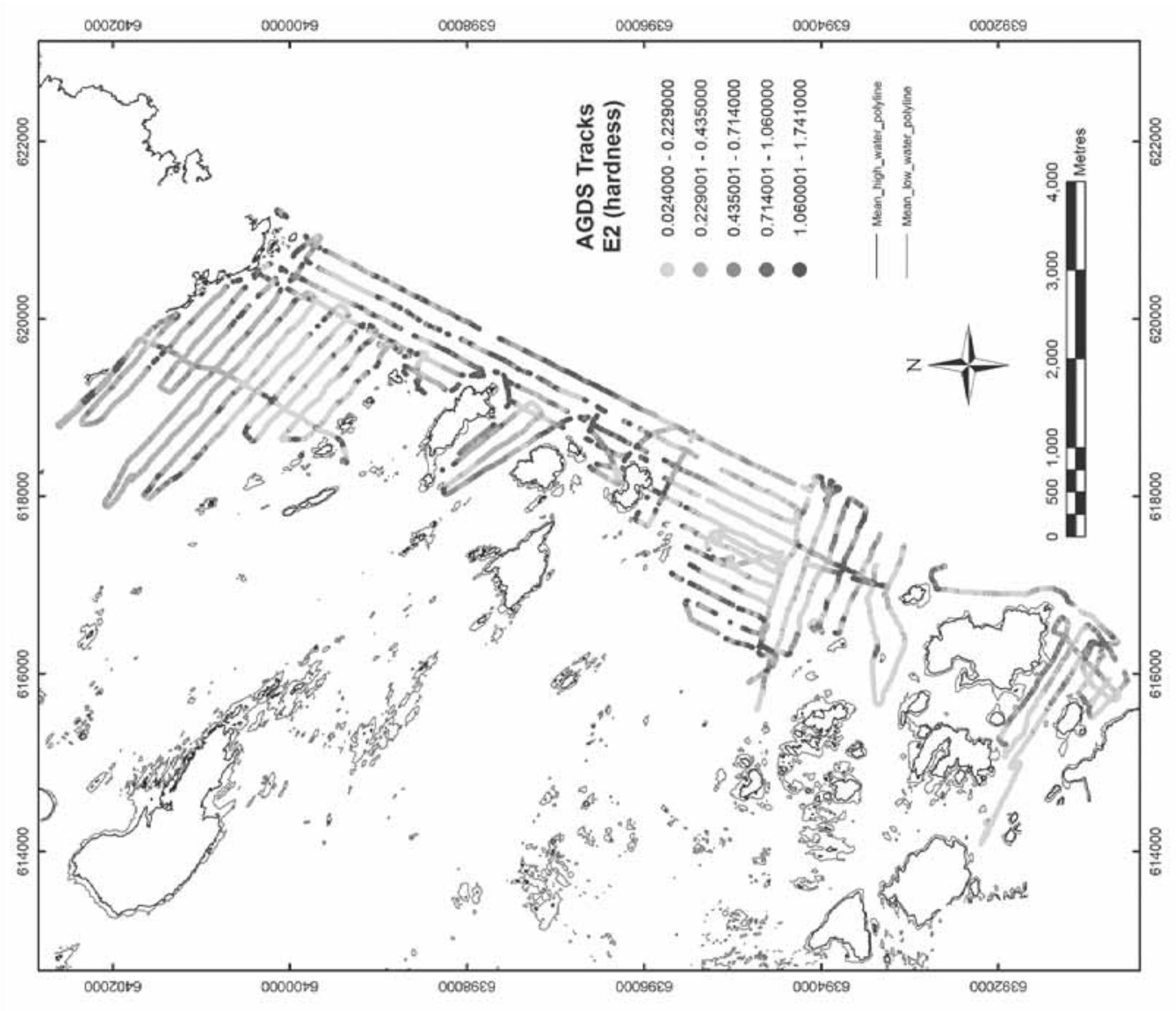


Figure 3.3.3 The AGDS tracks collected during the surveys, showing hardness values derived from signal E2

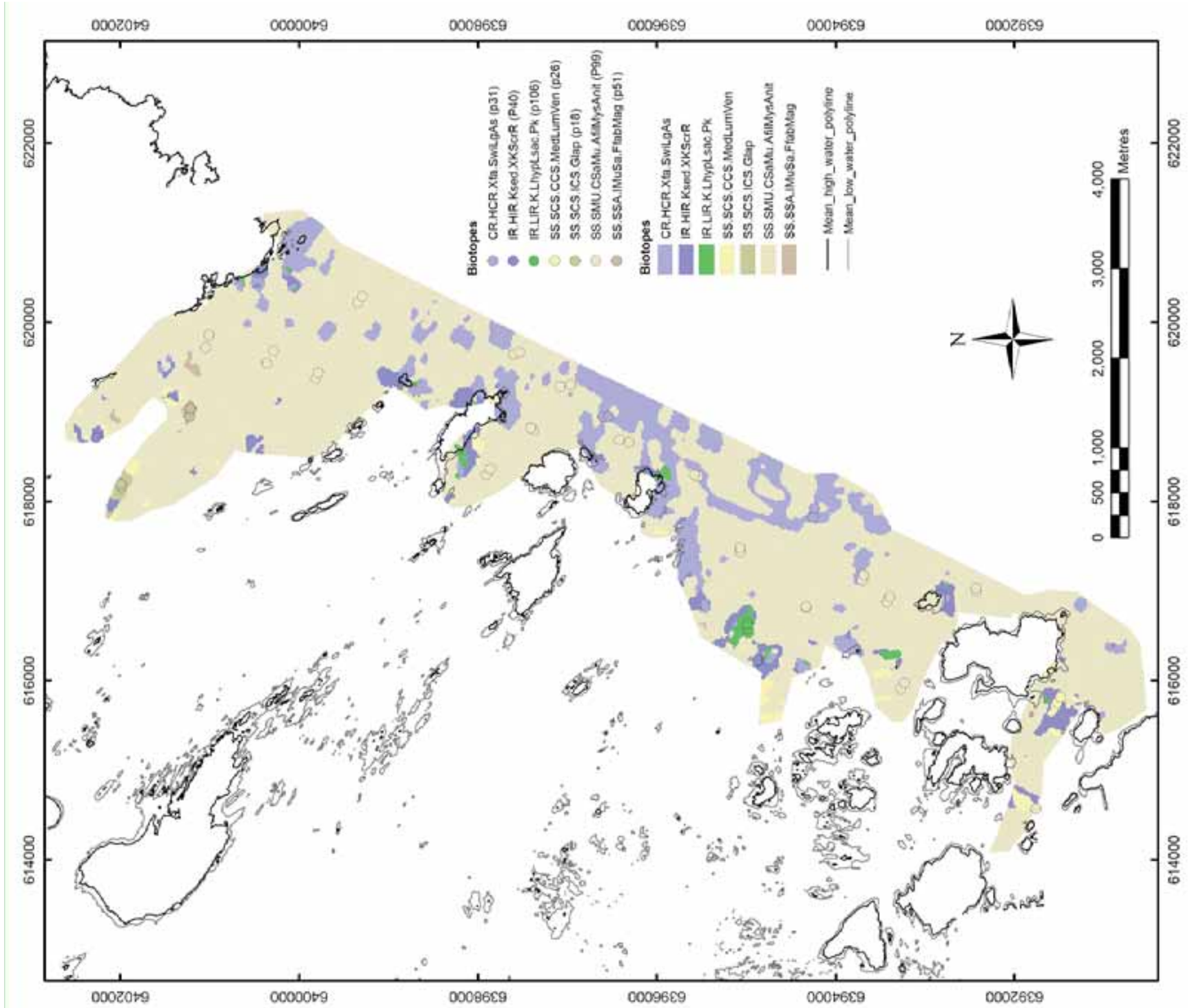


Figure 3.3.4 Predicted distribution of biotopes across south-eastern edge of the Sound of Harris

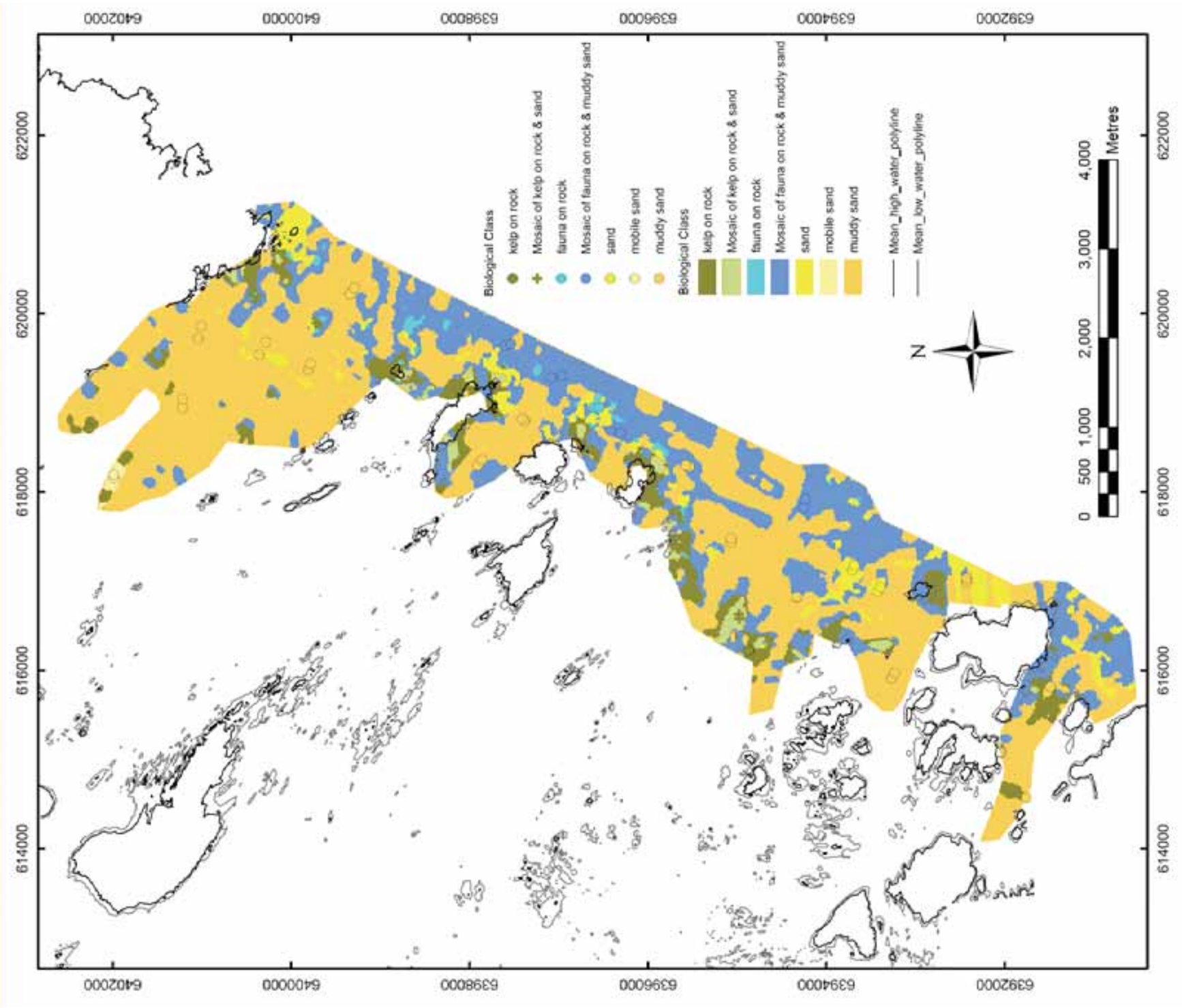


Figure 3.3.5 Predicted distribution of biological classes across south-eastern edge of the Sound of Harris

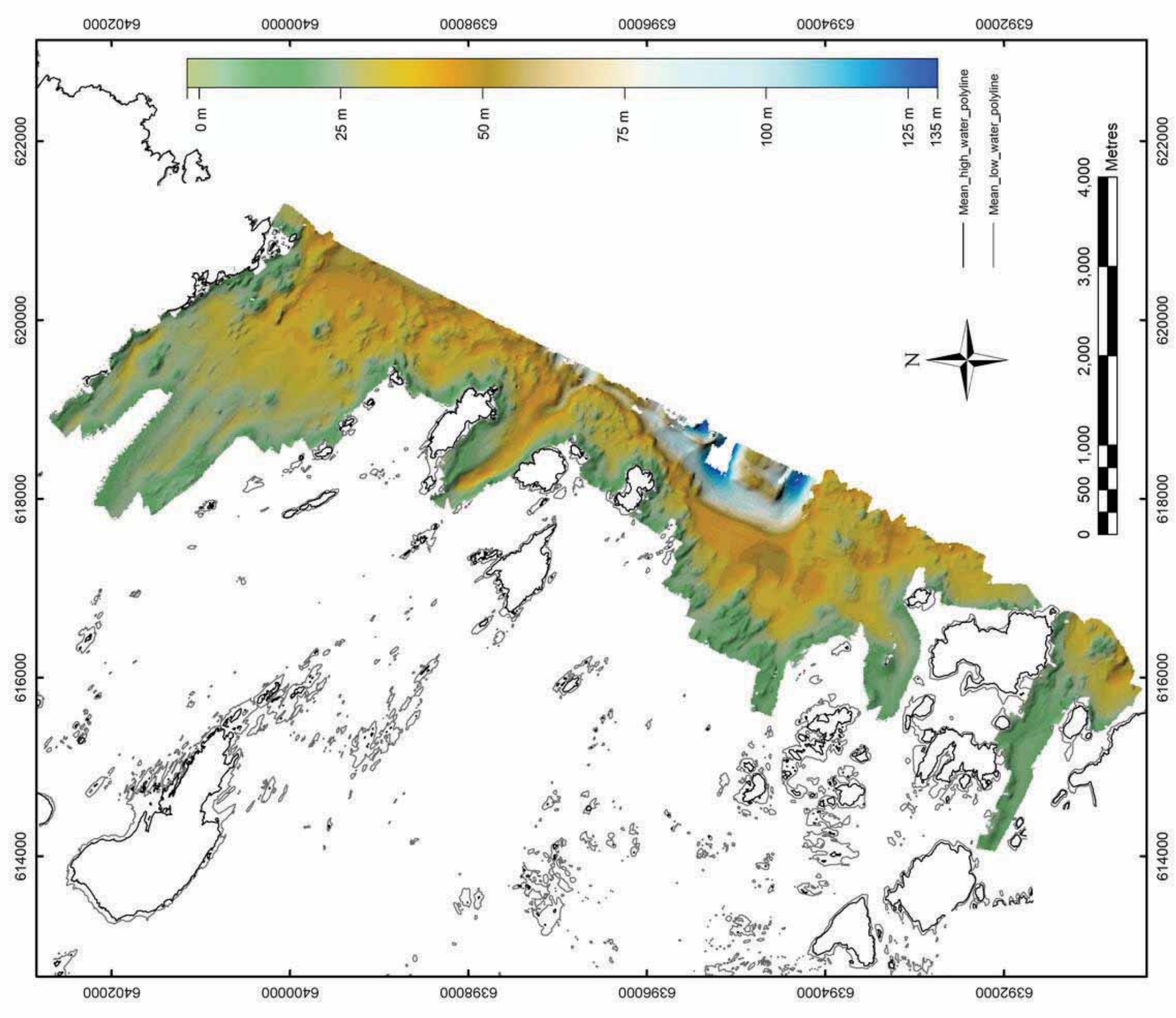


Figure 3.3.6 Sun-illuminated bathymetric image for the south-eastern edge of the Sound of Harris

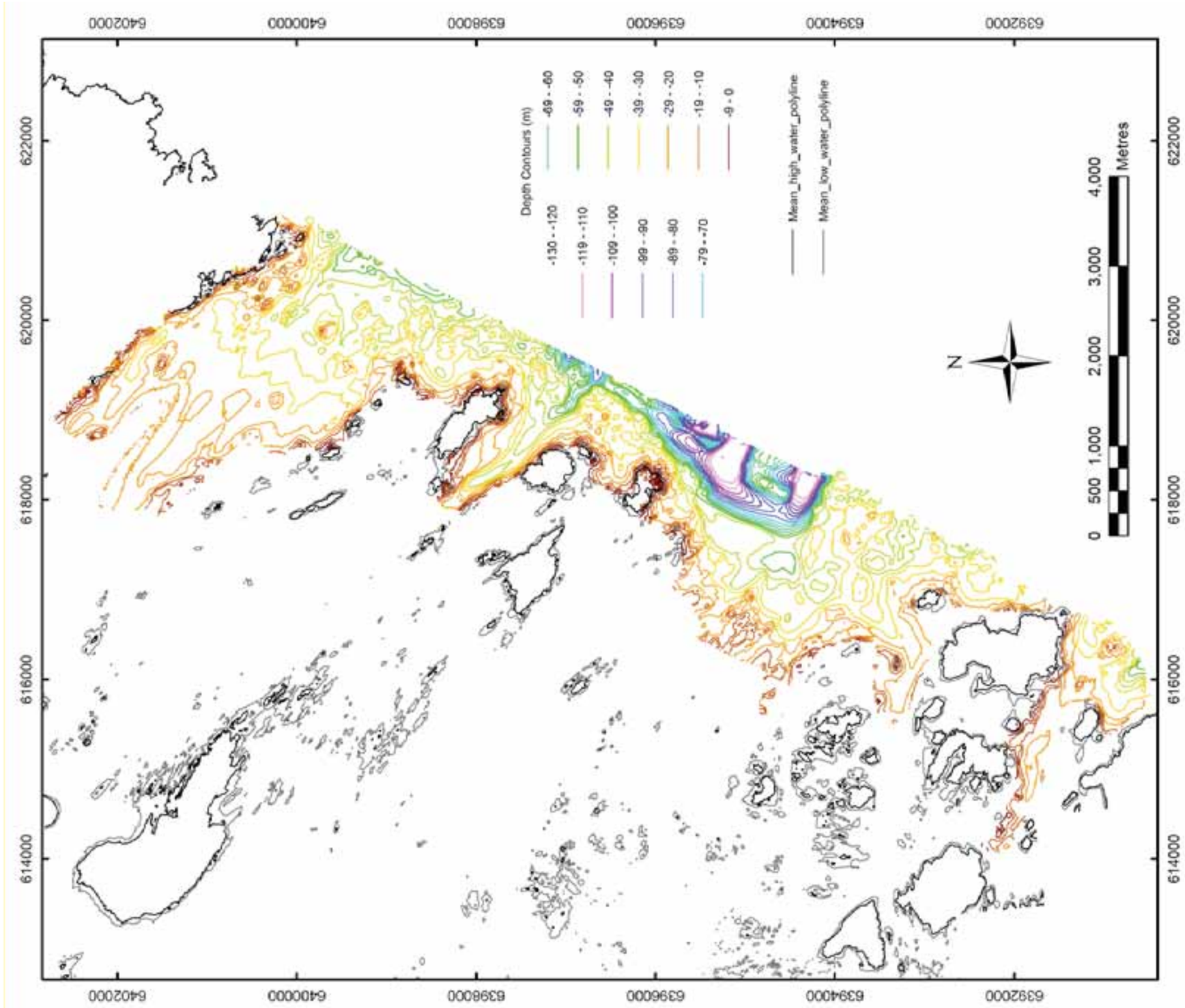


Figure 3.3.7 Contour plot for the south-eastern edge of the Sound of Harris

3.3.3 Backscatter

From the mosaiced image of the backscatter data (Figure 3.2.8), it was possible to identify 5 seabed types (Figure 3.2.9):

Bedrock areas: The areas have a high intensity of return and the physical continuous nature of the rock can be visually identified.

Boulder areas: These areas also have a high intensity of return, but not as high as bedrock areas; the physical nature of the substrate is more broken than for bedrock areas.

Mosaic of rock and sediment: These areas have a mixed intensity of return and are patchy in appearance with small <10m rocky outcrops interspersed with sedimentary features.

Rippled sand areas: The backscatter return shows regular variation in return which indicated a rippled sediment.

Featureless sediment: These areas have a low intensity of return and have no marked features showing; it is assumed these are sedimentary areas.

Figure 3.6 shows the mosiaced backscatter images for the area surveyed through which seabed features can be visually identified. Figure 3.7 shows the interpreted map from the backscatter data showing the distribution of the five seabed types identified.

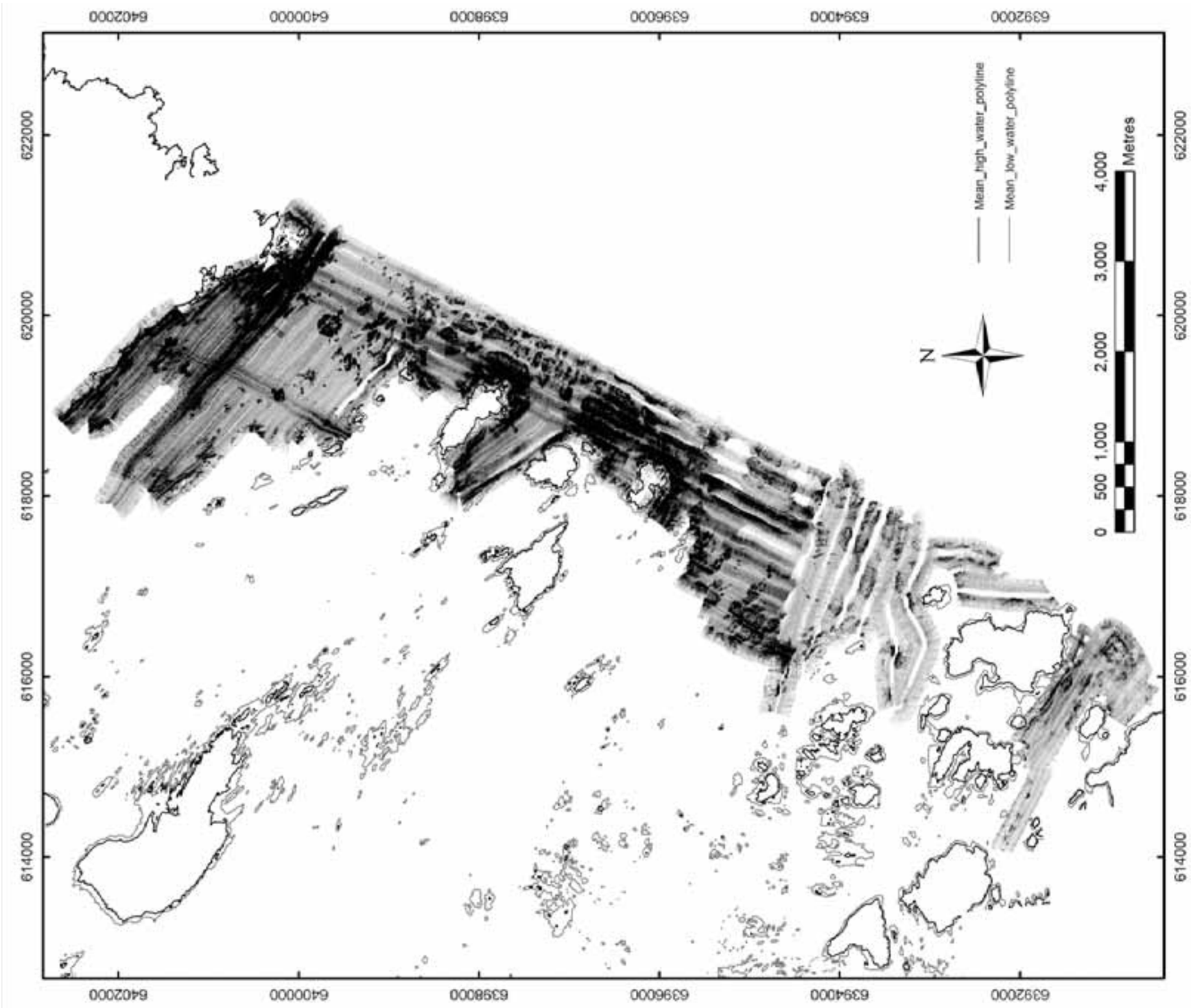


Figure 3.3.8 *Mosaiced backscatter data for the south-eastern edge of the Sound of Harris*

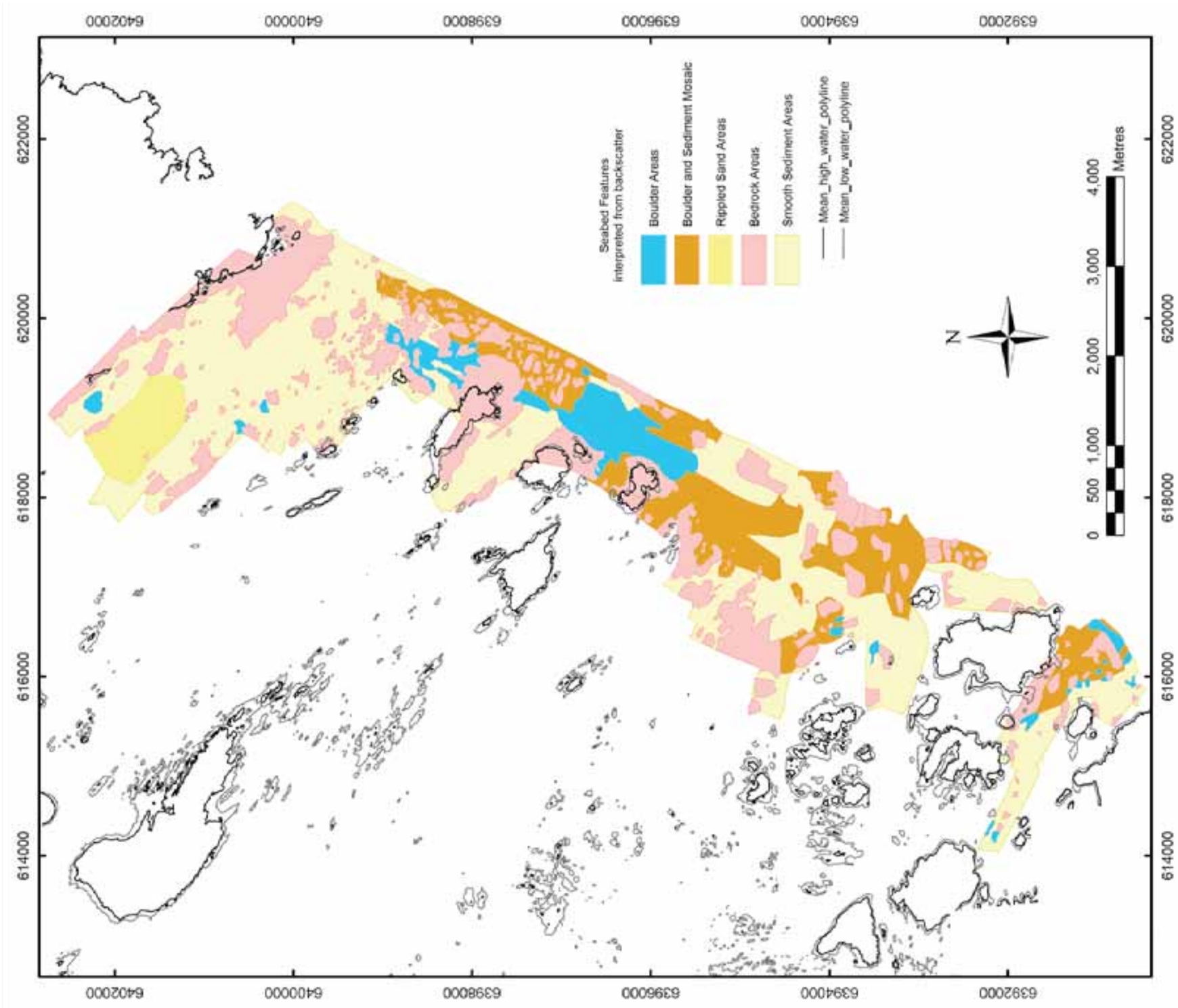


Figure 3.3.9 Seabed features interpreted from backscatter data for the south-eastern edge of the Sound of Harris

4 DATA INTEGRATION

4.1 Geography and abiotic factors

The Sound of Harris lies with the northern shore of North Uist on its southern boundary and the southern shore of Harris in the north. It is a topographically complex area with numerous islands, emergent intertidal areas and shallow rocky reefs. This complexity is continued subtidally where the seabed is a mosaic of outcrops of bedrock and boulders projecting from the sediment.

Bathymetrically, the Sound is fairly shallow with much of the seabed charted as less than 5m below chart datum. However, there is much variation with deeper enclosed basins and tide swept channels between the islands. Where the western part of the Sound opens into the Atlantic the seabed is gently sloping and remains relatively shallow (<20m BCD). Shallow arcing sandbanks separate this area from the tideswept channels that pass through the mid part of the Sound in a south-east direction. At the eastern end the Sound emerges into the waters of The Minch. Here, the seabed slopes more abruptly dropping to over 50m BCD within a relatively short distance. The southern part of the Sound has many extensive intertidal reefs and the shore of North Uist is deeply indented. These combined features give rise to a complex system of sheltered semi-enclosed basins in the south.

The most exposed part of the area is in the west where the Sound is open to the full force of the Atlantic. Further into the Sound there is a general increase in shelter although the picture is complicated by the numerous islands and reefs which can create abrupt changes in exposure levels. The eastern opening of the Sound is generally less exposed than in the west but the distribution of shore biotopes shows that waves moving in from The Minch are still sufficient to have a significant effect on the biota. The most sheltered parts of the area lie in the system of semi-enclosed basins in the south. The inner reaches of this system are extremely sheltered, particularly within Loch Mhic Phail and the lagoonal basin of Loch Aulasary.

The distribution of the biota in the Sound is profoundly influenced by tidal currents as well as by depth and wave exposure. Although parts of the open western area of the Sound are significantly tide swept the most pronounced tidal streams are in the main channels in the mid part of the Sound. There are 3 main channels, Stanton Channel in the north, Caolas Skaari between Ensay and Killegray islands and the Cope Passage in the south. In some areas such as Caolas Skaari east of Killegray the seabed has sand waves and megaripples of considerable magnitude created by the tidal flow. Apart from these main areas of tide flow there are numerous areas where topography creates accelerated tidal currents. This is also true of the system of semi-enclosed basins in the south where significant currents can develop in the sheltered connecting channels of the basins.

The rocky substrates of the Sound consist mainly of elevated areas of large stable boulders and areas of outcropping bedrock, often with overlying boulders. The sedimentary substrates reflect the range of exposure levels found at the site. Most of the wave surged western area has sediments of clean, well-sorted, rippled, mobile sand. The tide swept central channels also often have rippled sand but more stable than in the west and more heterogenous with coarser sediments in areas of particularly severe currents and finer sediments in areas of localised shelter. The deeper, less exposed areas in the east of the Sound are generally characterised by fine sands and muddy sands. Again, these can be heterogeneous, often with a high component of shell gravel or pebbles. The southern part of the Sound is characterised by finer sediments ranging from fine slightly silty sands in the outer parts through muddy sand, sandy mud and soft mud found in the extremely sheltered inner basins.

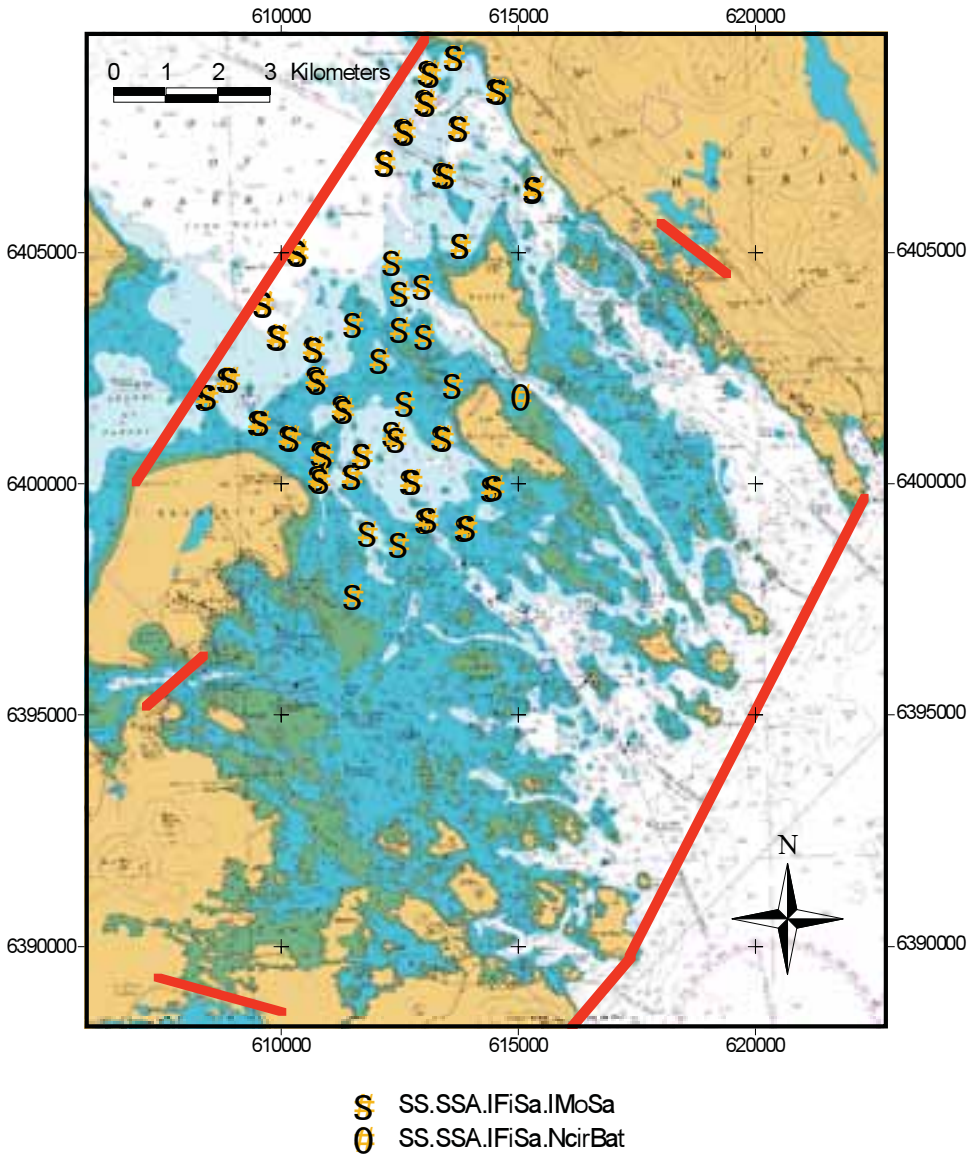
4.2 Distribution patterns of biotopes

4.2.1 Sublittoral sediments

The distribution of biotopes largely follows the distribution of sediment composition as determined by exposure to wave action and the influence of tidal currents.

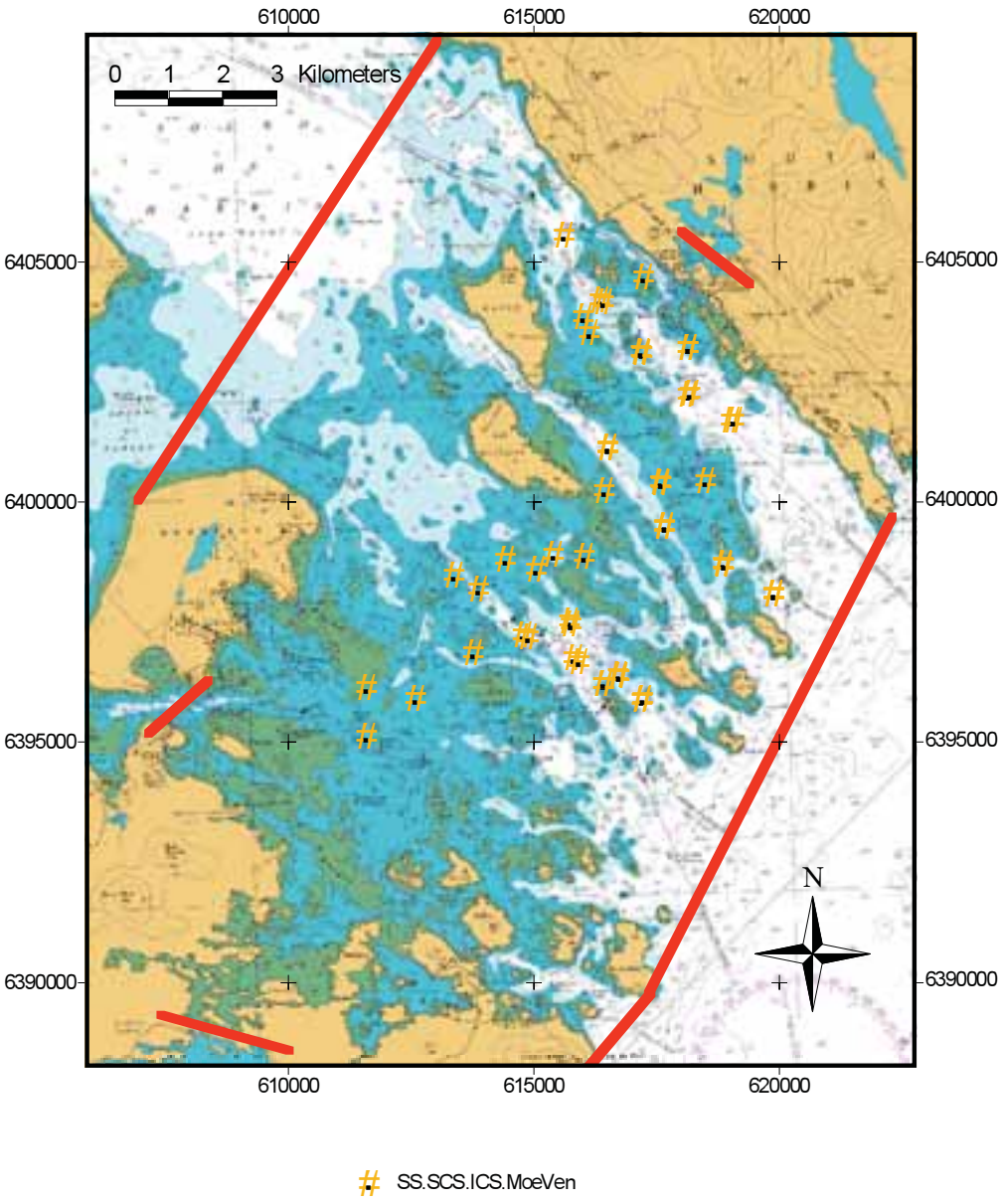
The clean, well-sorted, rippled sand in the western area has an almost total absence of visible epifauna and infaunal samples show a variable species composition with all species in low abundance and low diversity overall (Figure 4.2.1). This impoverished biota is due to the high mobility of the sediment under the influence of wave action. The biotope **SS.SSA.IFiSa.IMoSa** has been assigned to this area. It should be noted that this biotope may include impoverished versions of biotopes that would occur if the sand was more stable.

Figure 4.2.1 Distribution of mobile sand sites



The tide swept sands of the channels in the mid part of the Sound are slightly more stable than the mobile sands of the west and have a considerably more diverse fauna characterised by bivalve molluscs (Figure 4.2.2). On the basis of examination of the infaunal samples, most of this area has been assigned the biotope **SS.SCS.ICS.MoeVen**. There is considerable variation in the physical appearance of this biotope. In parts of the Stanton Channel and Caolas Skaari there are areas of rippled sand and sand waves that are virtually indistinguishable from the mobile sands of the western part of the area but the composition of the infauna is clearly different and approximates to **SS.SCS.ICS.MoeVen**. In other parts of the Sound where the current is less intense the sands are more heterogeneous with shell debris, pebbles and scattered ephemeral algae on the surface. Despite the difference in appearance the infaunal samples show that the communities of these environments are similar to those in the higher current areas.

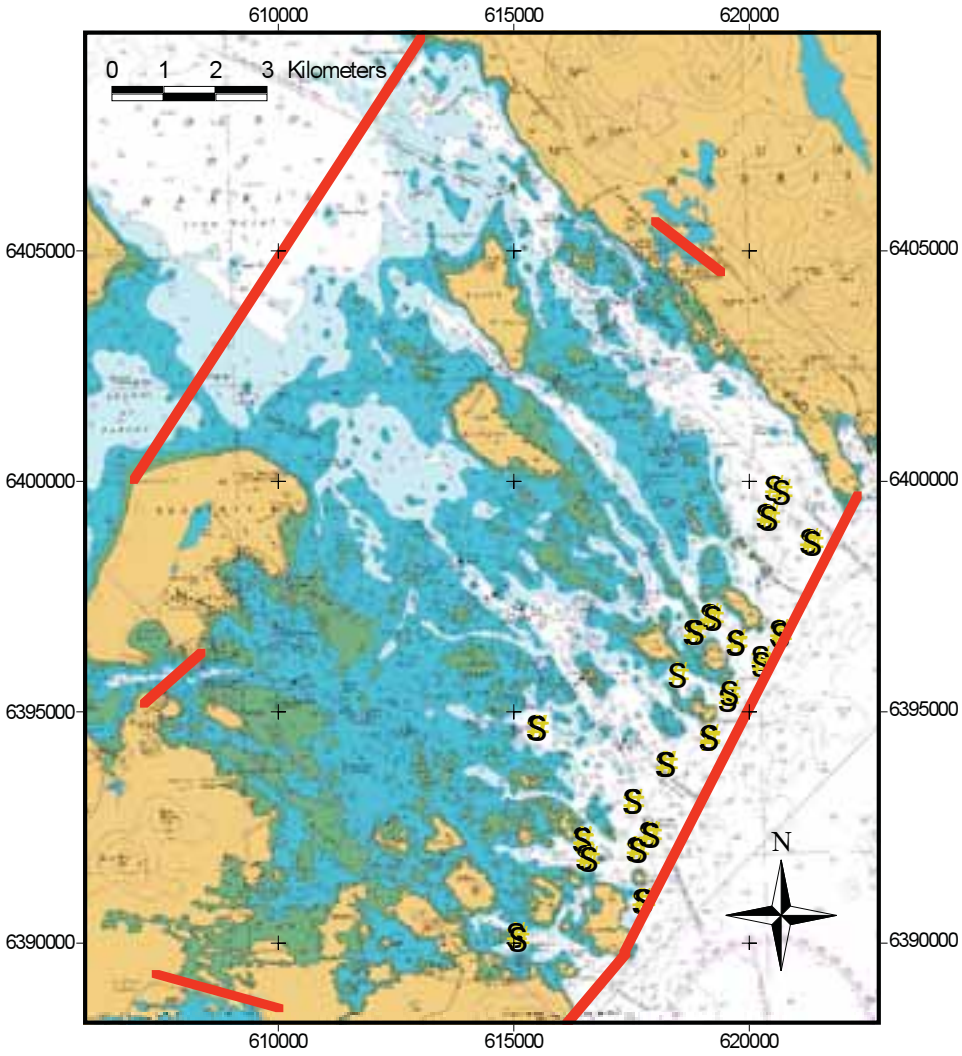
Figure 4.2.2 Distribution of tide swept sand sites



Some of these lower energy **SS.SCS.ICS.MoeVen** sites contained a significant number of *Ensis* sp. These sites could also be allocated to the epifaunally defined **SS.SSA.IMuSa.EcorEns** biotope but wherever possible we have defined sedimentary biotopes on the basis of the sampled infauna.

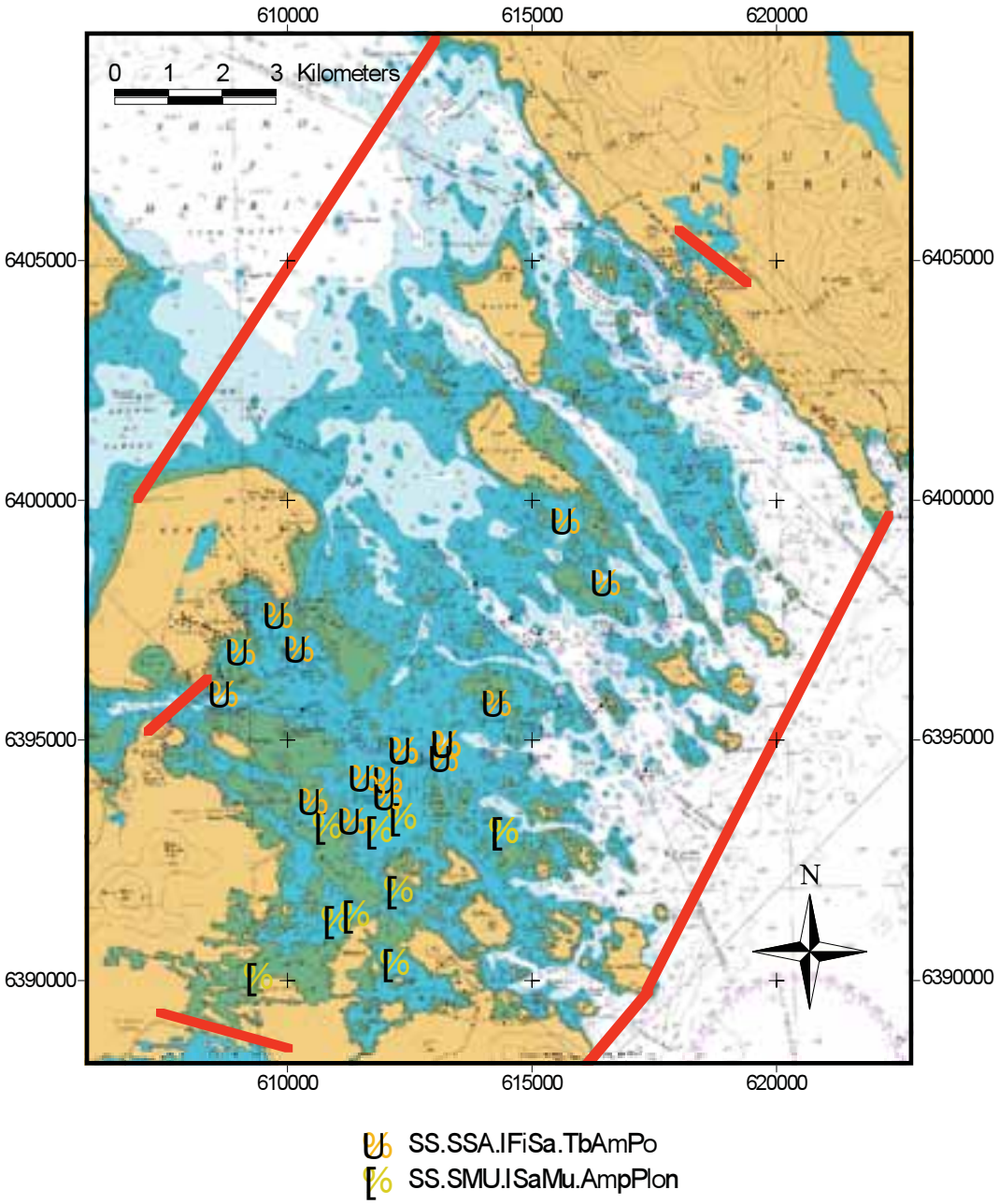
In the eastern part of the Sound the deeper water and less exposed conditions have resulted in a seabed predominantly composed of muddy sand (Figure 4.2.3). However, these sediments are variable in composition ranging from fine sands with a limited proportion of silt/clay to muddy sands with ~50% silt/clay. There was also variation in the amount of surface shell debris and pebbles leading to differences in the associated epifauna. The sediments were found to contain a diverse fauna characterised by species such as *Abra nitida*, *Amphiura* spp. and *Turritella communis*. This community was allocated to the biotope **SS.SMU.CSaMu.AfilMysAnit**.

Figure 4.2.3 Distribution of circalittoral muddy sand sites



Shallow silty sediments occur sporadically in areas of localised shelter in the main channel and more extensively in the system of sheltered basins in the southern part of the Sound (Figure 4.2.4). Most of these sediments are characterised by tube dwelling amphipods and are assigned to two main biotopes. **SS.SSA.IFiSa.TbAmPo** occurs in less sheltered areas and contains a relatively small proportion of silt/clay. The appearance of this biotope is not dissimilar to the lower energy **SS.SCS.ICS.MoeVen** sites with scattered ephemeral algae on the surface but the sediment is distinctly siltier and there are clear differences in the composition of the infauna. With increasing levels of shelter the **SS.SSA.IFiSa.TbAmPo** grades into the muddier **SS.SMU.ISaMu.AmpPlon** biotope with up to 50% silt/clay.

Figure 4.2.4 Distribution of infralittoral muddy sand sites

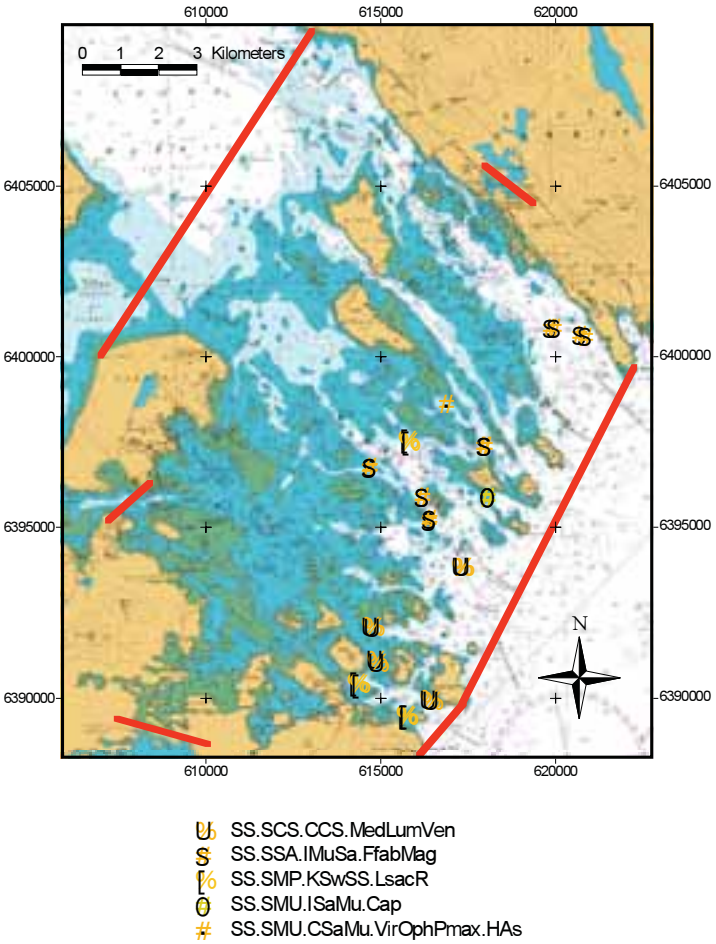


These five biotopes cover the general distribution of subtidal sediment communities over most of the Sound. However there is a range of other communities which in some cases may represent transitional stages or variants and in other cases are due to modification by epifauna, algae or macrophytes.

SS.SSA.IFiSa.NcirBat (shown in Figure 4.2.1), was recorded at a single station and appears to be a shallow water variant of **SS.SSA.IFiSa.IMoSa**. The habitat appears indistinguishable but occurred in more sheltered conditions and contained a more diverse infauna.

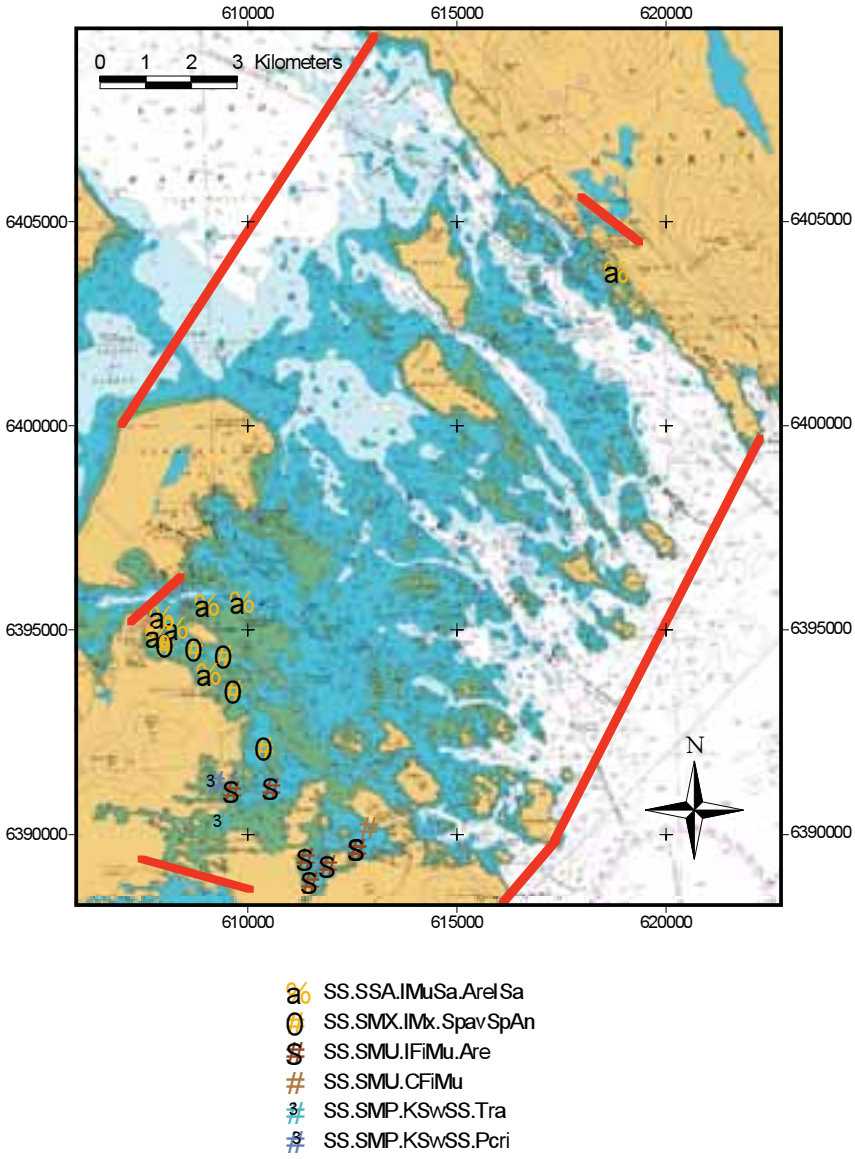
A series of communities occur at the transition zone between the tide swept sands of **SS.SCS.ICS.MoeVen** and the deeper muddy sands of **SS.SMU.CSaMu.AfilMysAnit** (Figure 4.2.5). These include sites classed as **SS.SSA.IMuSa.FfabMag**, which are similar to **SS.SCS.ICS.MoeVen** but occur in areas of deeper water or localised shelter and have a different species composition. **SS.SCS.CCS.MedLumVen** sites are a gravely tide swept variant of **SS.SMU.CSaMu.AfilMysAnit** with a very diverse fauna. The single **SS.SMU.CSaMu.VirOphPmax.HAs** site is moderately deep and slightly tide swept with fine sand, surface gravel and shell fragments. **SS.SMU.ISaMu.Cap** was also a single site and seems to represent a localised area of shelter with organic enrichment presumably due to drift algae. **SS.SMP.KSwSS.LsacR** also occurs at some shallow sites with pebbles suitable for the attachment of a patchy algal canopy.

Figure 4.2.5 Distribution of transitional sediment sites in the east of the Sound



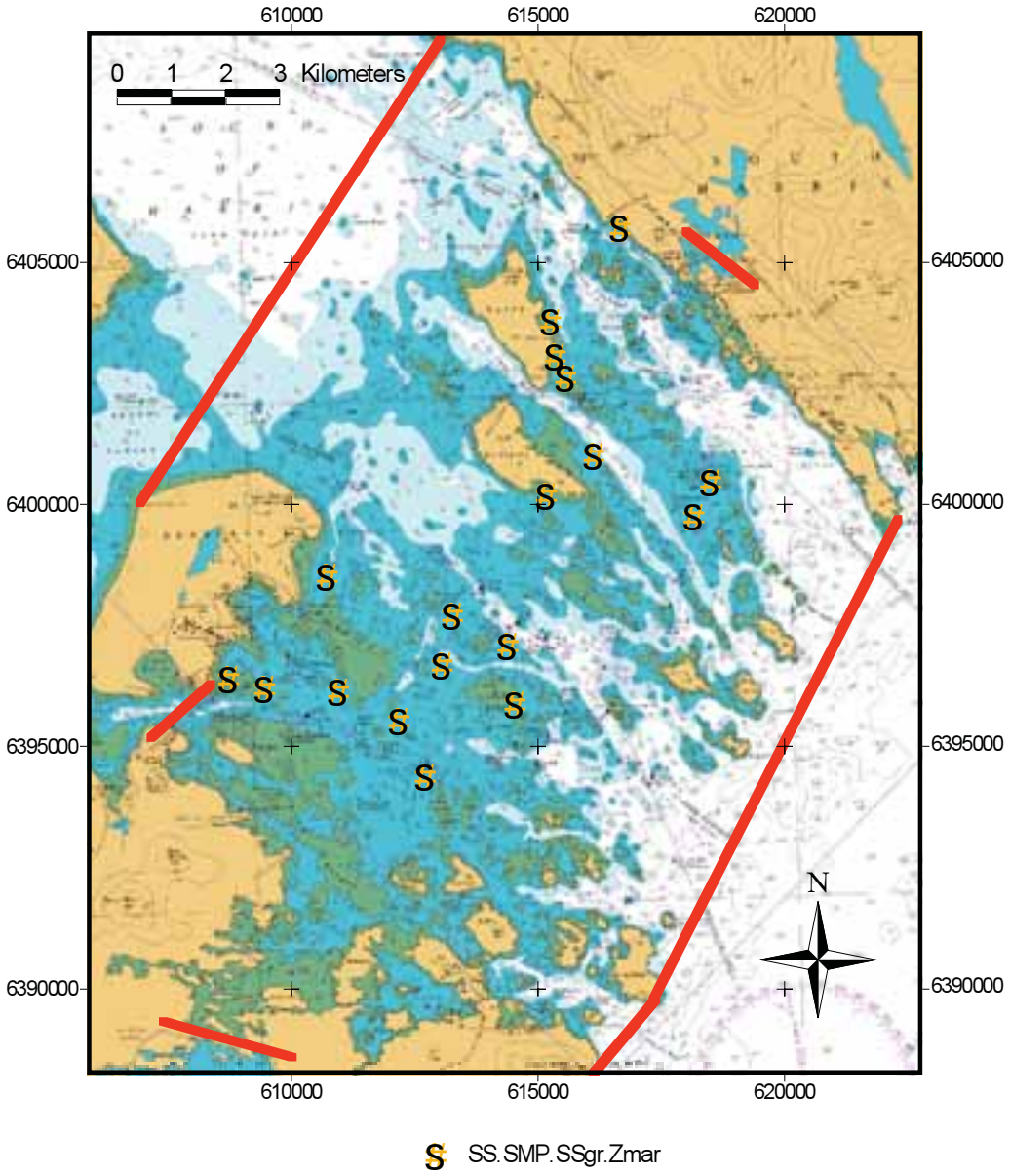
Another range of communities exists in the sheltered and sometimes tide swept southern part of the Sound (Figure 4.2.6). Fine sands and muddy sands dominated by *Arenicola* are common in the area. These are designated **SS.SSA.IMuSa.ArelSa** which is an epifaunally defined biotope broadly similar to **SS.SSA.IFiSa.TbAmPo** but with differences in species composition and generally low species abundance. In conditions of extreme shelter the sediment is composed of soft mud often covered by a mat of filamentous algae with burrowing holothurians and anemones (**SS.SMU.IFiMu.Are**). Both **SS.SSA.IMuSa.ArelSa** and **SS.SMU.IFiMu.Are** may be associated with mats of green filamentous algae but algal mats of differing composition are present at other sites. These include algal communities dominated by *Trailliella* (**SS.SMP.KSwSS.Tra**) and by *Phyllophora crispa* (**SS.SMP.KSwSS.Pcri**). Several sites were characterised by *Sabella pavonina* and algal mats (**SS.SMX.IMx.SpavSpAn**). This biotope designation might be considered an epibiotic overlay on **SS.SSA.IMuSa.ArelSa** but with a more diverse and abundant infauna.

Figure 4.2.6 Distribution of sheltered sediment sites



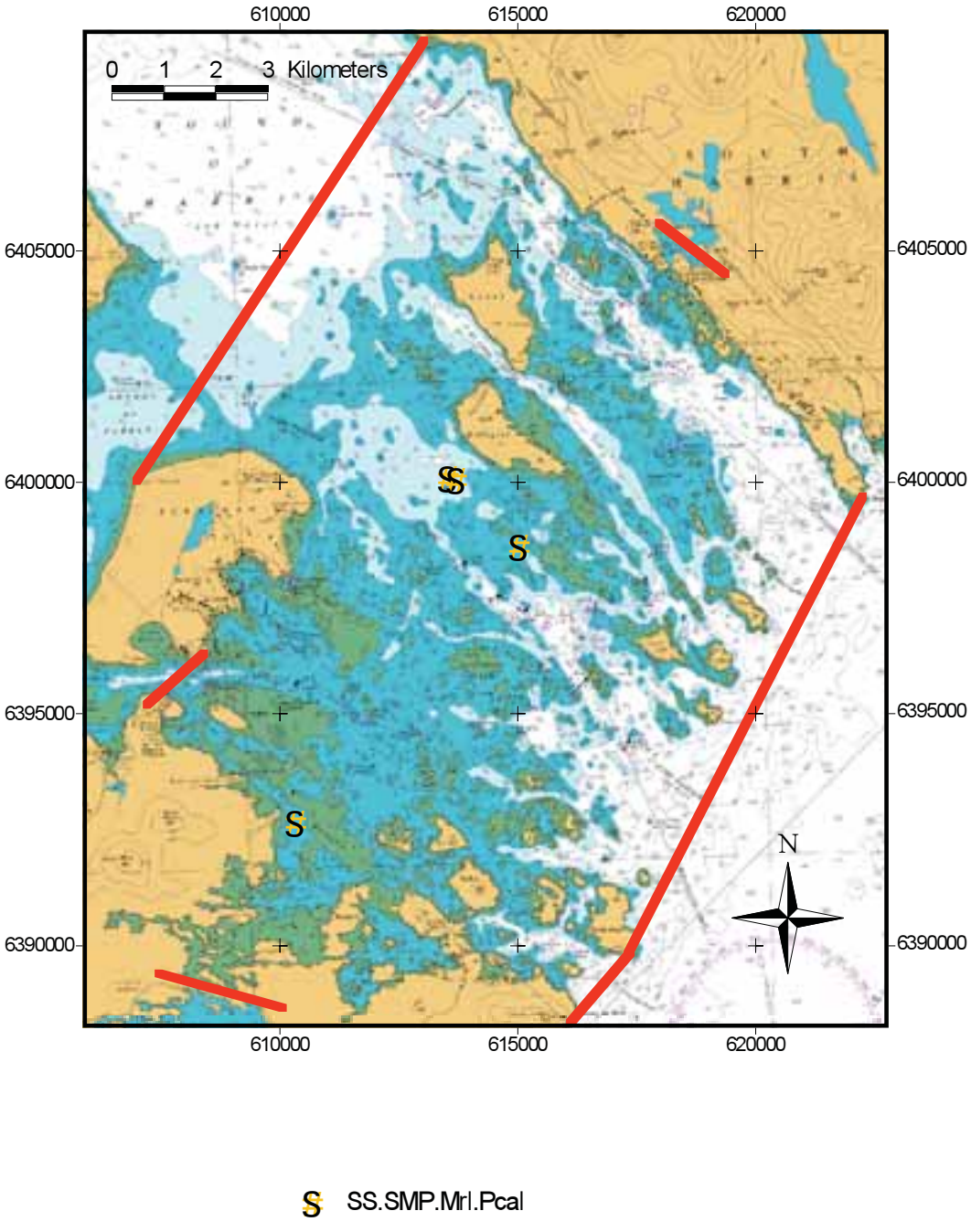
The presence of plants appears to be a major modifying factor influencing the composition of sediment infauna in the Sound. This is perhaps most obvious from the extensive and well developed beds of *Zostera marina* (**SS.SMP.SSgr.Zmar**) that occur in shallow sandy areas with some degree of shelter from wave action (Figure 4.2.7). The beds typically consist of a series of bands of dense *Zostera* several metres wide with areas of bare sand separating the *Zostera* bands. The composition of the infauna from these areas of bare sand is modified by the presence of the *Zostera* and the sediment itself is slightly more silty than in corresponding areas devoid of *Zostera*. This is presumably due to shelter provided by the dense stands of *Zostera* which may have a sward height of well over a metre. The fauna tends to be more diverse than would be expected in the absence of *Zostera* and often includes epiphytic species.

Figure 4.2.7 Distribution of *Zostera* sites



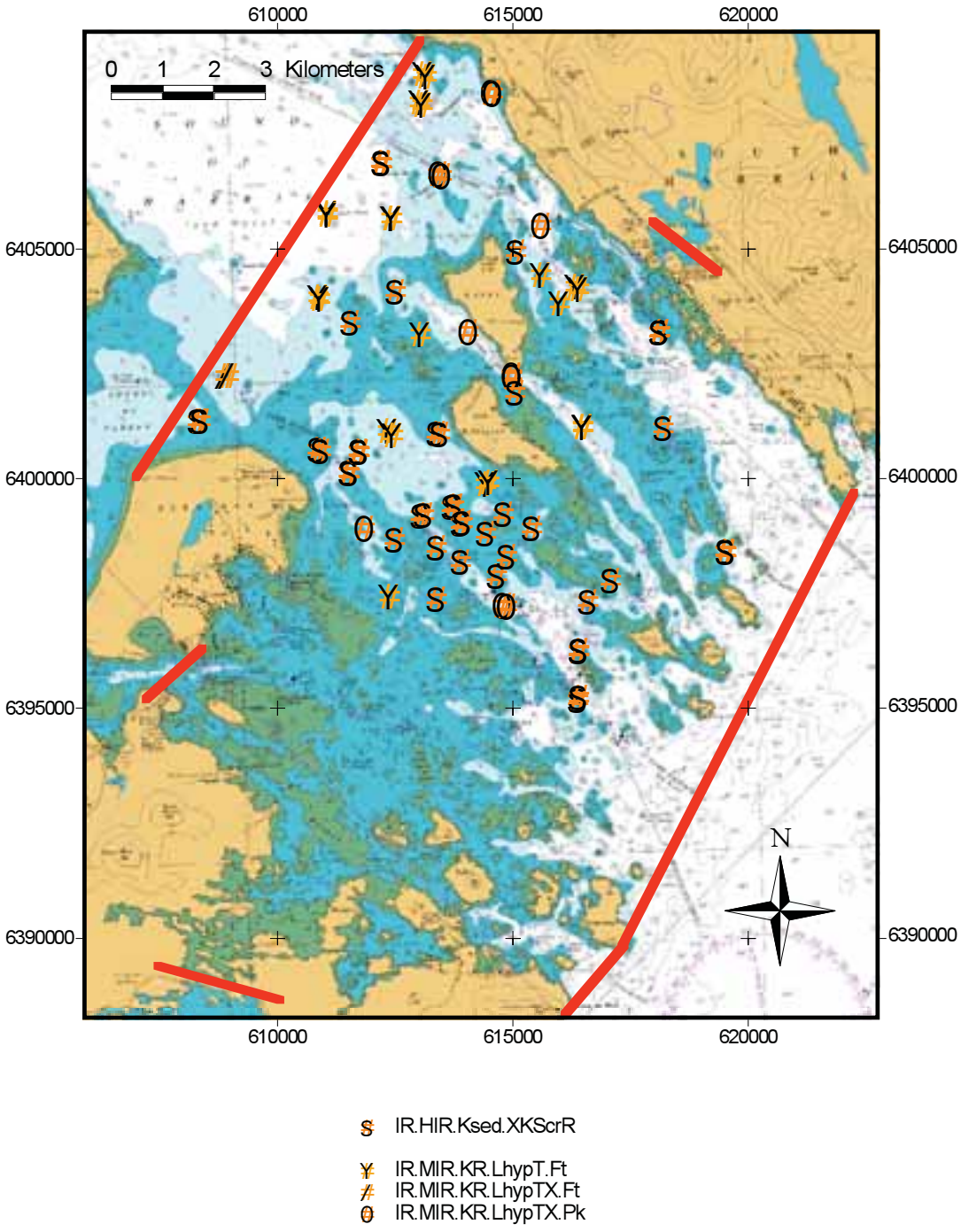
Maerl beds (**SS.SMP.Mrl.Pcal**) are present at locations in the tide swept channels in the middle of the Sound (Figure 4.2.8). Maerl and coarse shell sand is formed into mega ripples by the current and there is a diverse and abundant algal flora with a correspondingly diverse community of sediment infauna and epiphytic animals. Maerl is also present in a very different environment in tide swept channels in the sheltered south of the Sound. Here, the maerl lies on mixed muddy sediment and is associated with a dense cover of *Phyllophora crispa*.

Figure 4.2.8 Distribution of maerl sites



Some of the sites allocated to other biotopes also show indications that diversity is increased by the proximity of ephemeral algae on the sediment surface. This can be seen in certain sites that correspond to the biotopes **SS.SCS.ICS.MoeVen**, **SS.SSA.IFiSa.TbAmPo** and **SS.SMU.ISaMu.AmpPlon**. These sites have a greater diversity of species from infaunal samples and were associated with records of significant quantities of algae attached to pebbles and shell fragments.

Figure 4.2.9 Distribution of exposed kelp sites



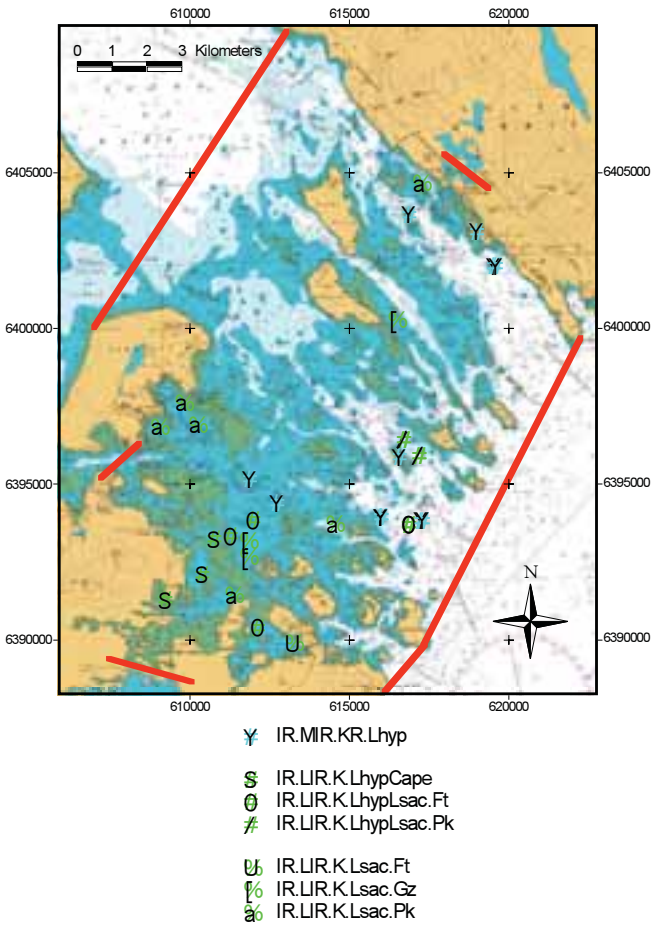
4.2.2 Sublittoral rock

The majority of sublittoral rock within the Sound lies in the infralittoral and is sediment influenced in many locations.

The exposed and tide swept areas that cover much of the Sound tend to be dominated by *Laminaria hyperborea* while sheltered locations in the south of the Sound have a high proportion of *Laminaria saccharina* and *Halidrys siliquosa*.

Most of the *L. hyperborea* sites are influenced to a greater or lesser extent by accelerated tidal currents and sand scour. Depending on the substrate and the species composition of the kelp they are allocated to **IR.MIR.KR.LhypT**, **IR.MIR.KR.LhypTX** or **IR.HIR.Ksed.XKScrR** (Figure 4.2.9). These are essentially the same community including intermediate stages between the three biotopes. *L. hyperborea* stipes are typically heavily fouled, particularly by *Alcyonidium* but also with *Halichondria*, ascidians and foliose red algae (eg *Cryptopleura* and *Delesseria*). Kelp fronds are typically fouled by *Obelia geniculata* and *Membranopora*. The rock surface community varies in composition depending on the magnitude of scour influences but is often sparse. In some of the exposed western rock there is a relatively rich encrusting fauna on the rock surfaces that shows similarities with **IR.HIR.KFaR.LhypFa** although scour influences are still apparent.

Figure 4.2.10 Distribution of sheltered kelp sites



Scour effects are most pronounced where rock outcrops are small and low-lying relative to the surrounding sand. **IR.HIR.Ksed.XKScrR** sites are characterised by the presence of a range of kelp species such as *Saccorhiza*, *L. saccharina* and *Alaria* that occur amongst the dominant *L. hyperborea*. In these environments *Furcellaria/Polyides* can be a prominent feature particularly at the rock/sediment boundary. Rock surfaces tend to be relatively bare of fauna and are often coated with a layer of sand.

Mixed kelp canopies in the exposed western area and in the tideswept channels of the mid Sound tend to have a clean washed appearance. However, the mixed kelps seen in the eastern part of the Sound tend to be more silty and generally appear to exist in a lower energy environment.

It is likely that in these cases the scour effects that have led to a mixed kelp canopy are seasonal events while in more exposed parts of the site the scour effects are a more regularly occurring influence.

Where rock outcrops are larger and elevated well above the surrounding sand the scour effect is diminished and the community is wholly dominated by *L. hyperborea* (**IR.MIR.KR.LhypT**). However, apart from the lack of other kelp species and in some cases, a richer community on the rock surface, this community remains very similar to the scoured variant **IR.HIR.Ksed.XKScrR**.

At locations which lack significant scour or current influence *L. hyperborea* areas are allocated to the biotope **IR.MIR.KR.Lhyp** (Figure 4.2.10). This biotope lacks significant proportions of other kelp species because it is less scoured. It is distinguished from **IR.MIR.KR.LhypT** by a generally siltier, lower energy environment and less fouling organisms present on the stipes.

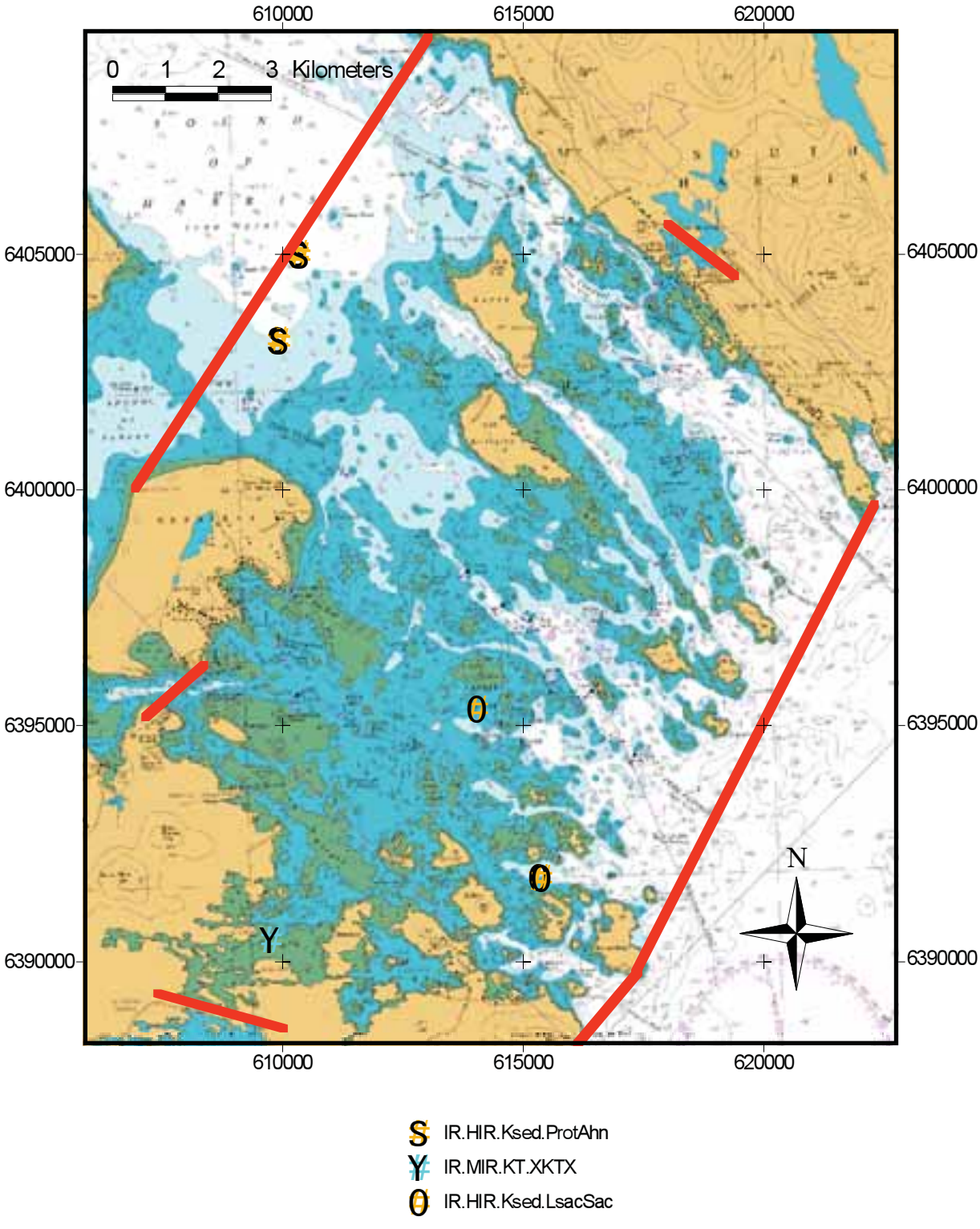
L. saccharina becomes a significant component of the kelp community in some areas of localised shelter in the east of the Sound as well as in the sheltered areas characteristic of the south of the Sound. These southern areas are dominated by silty kelp forests of variable composition including **IR.LIR.K.LhypCape**, **IR.LIR.K.LhypLsac** and **IR.LIR.K.Lsac** (Figure 4.2.10).

These communities are dominated by *L. hyperborea* and/or *L. saccharina*. *Halidrys* is also often a significant component of these communities and *Saccorhiza* may also occur. The presence of *Saccorhiza* may indicate that even in these sheltered sites the kelp community can be subject to occasional disturbance events from severe winter storms leading to the development of a mixed kelp community.

Stipe epibionts and rock surface communities tend to be sparse in comparison to the higher energy *L. hyperborea* sites. There are exceptions in sheltered tide swept channels where kelp stipes were heavily fouled with organisms such as *Halichondria*. At certain locations the high abundance of *Echinus* and bare rock surfaces indicate the allocation of a grazed variant of the biotope (eg **IR.LIR.K.Lsac.Gz**).

Other infralittoral rock biotopes are present at a limited number of locations (Figure 4.2.11). **IR.HIR.KSed.ProtAhn** is a sand scoured biotope and was allocated to certain areas of rounded cobbles and small boulders in the western part of the Sound. These substrates support a sparse community of ephemeral algae and kelp sporelings. They are likely to be periodically buried by shifting sand and are a transient habitat. **IR.HIR.Ksed.LsacSac** was recorded at some sites in the eastern part of the Sound. This can be viewed as a variant of **IR.HIR.Ksed.XKScrR** and may be due to unstable substrata or a particularly severe recent winter storm which removed the *L. hyperborea* allowing *Saccorhiza* and *L. saccharina* to dominate the community. **IR.MIR.KT.XKTX** was recorded at a single location in a slightly tide swept and extremely sheltered rocky channel. It supported a patchy forest of *L. hyperborea* with a high proportion of encrusting sponges and patches of *Lithothamnion glaciale* in the form of nodular pebbles.

Figure 4.2.11 Distribution of other infralittoral rock sites



Circalittoral rock communities are limited to the deep eastern entrance to the Sound and to a few isolated areas of the sheltered southern basins where increased turbidity limits the depth extent of infralittoral communities (Figure 4.2.12).

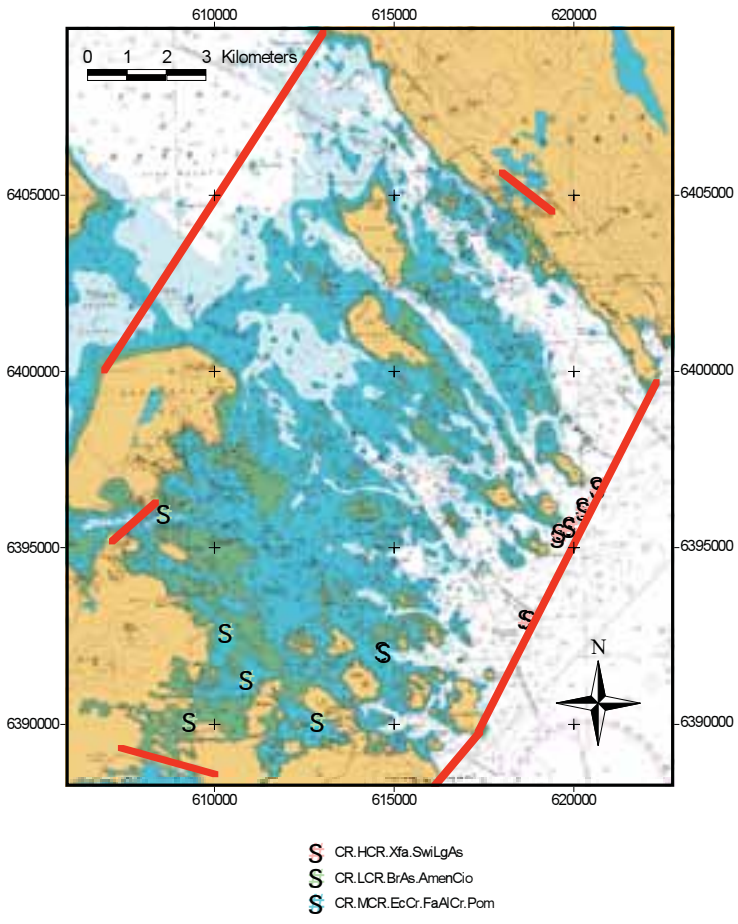
In the eastern part of the Sound the rock surfaces are silty and have a diverse fauna of *Swiftia*, axinellid sponges, hydroids and large ascidians including *Diazona*. These sites have been allocated the biotope **CR.HCR.Xfa.SwiLgAs**.

The fauna of deep rock in the sheltered southern basins is generally more impoverished and variable in composition. These have been allocated to the biotope **CR.LCR.BrAs.AmenCio**. The species of characterising ascidians varied between sites with either *Ascidia mentula*, *Ascidiella aspersa* or *Ciona* predominating.

Ciona is particularly abundant at certain tide swept sheltered sites where a strikingly orange coloured variant of the species forms a dense carpet over rock surfaces.

CR.MCR.EcCr.FaAlCr.Pom was recorded from a single location of boulder outcrops with sparse fauna and bare looking rock surfaces. This is likely to be due to grazing by *Echinus* but periodic seasonal scouring events may also have an influence.

Figure 4.2.12 Distribution of circalittoral rock sites

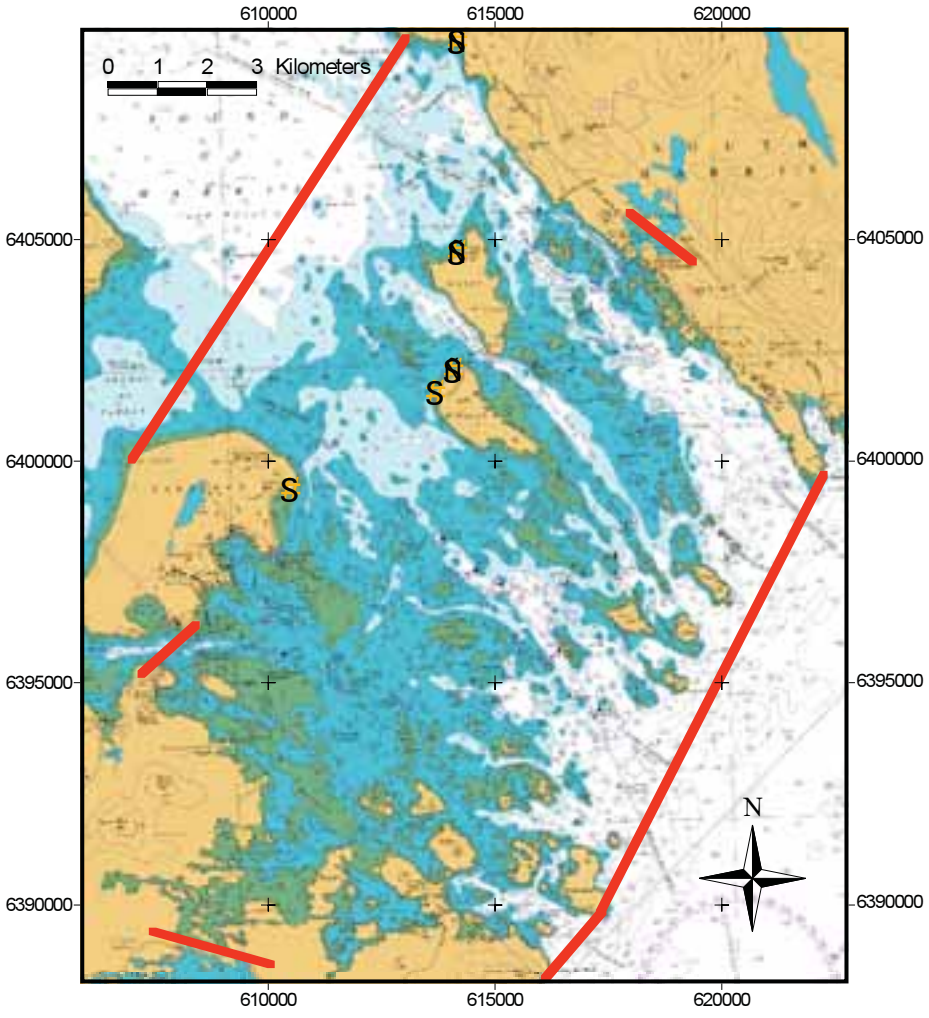


4.2.3 Littoral sediments

Most of the intertidal area of the Sound is composed of rock with sediments limited to a number of sandy beaches and a few pockets of muddy sand in sheltered basins.

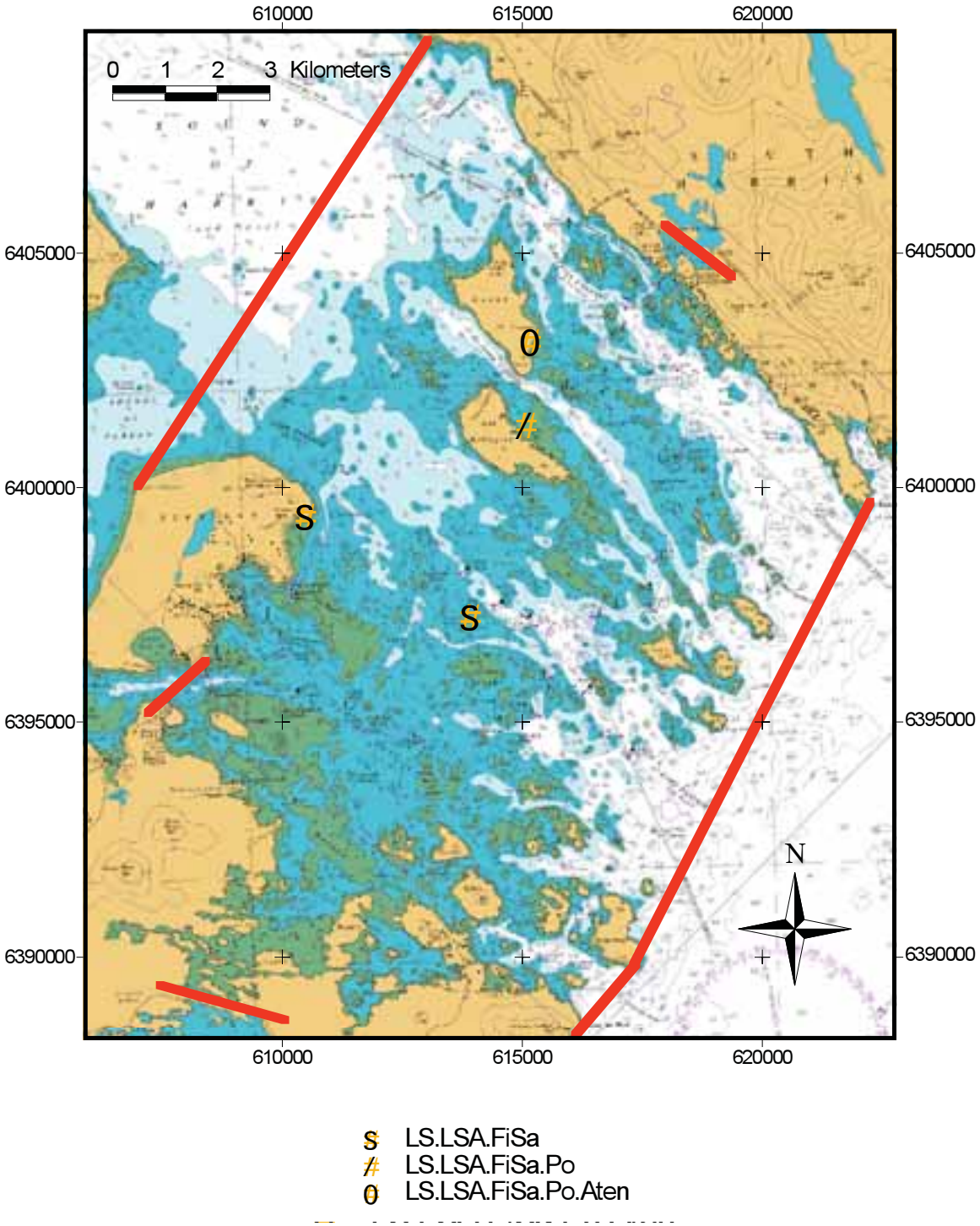
The more exposed sand beaches such as those on the north-western ends of the islands of Killegray and Ensay have a relatively steep shore of clean sand rising from the waters edge to a berm beyond which is an extensive area of level dry sand with scattered and desiccated algal drift debris. This upper part of the beach has little apparent fauna apart from numerous holes built by talitrid amphipods and is allocated to the biotope **LS.LSA.St.Tal**. The steep wave exposed lower shore contains a very sparse fauna and is allocated to the biotope complex **LS.LSA.MoSa.BarSa** (Figure 4.2.13).

Figure 4.2.13 Distribution of exposed sand sites



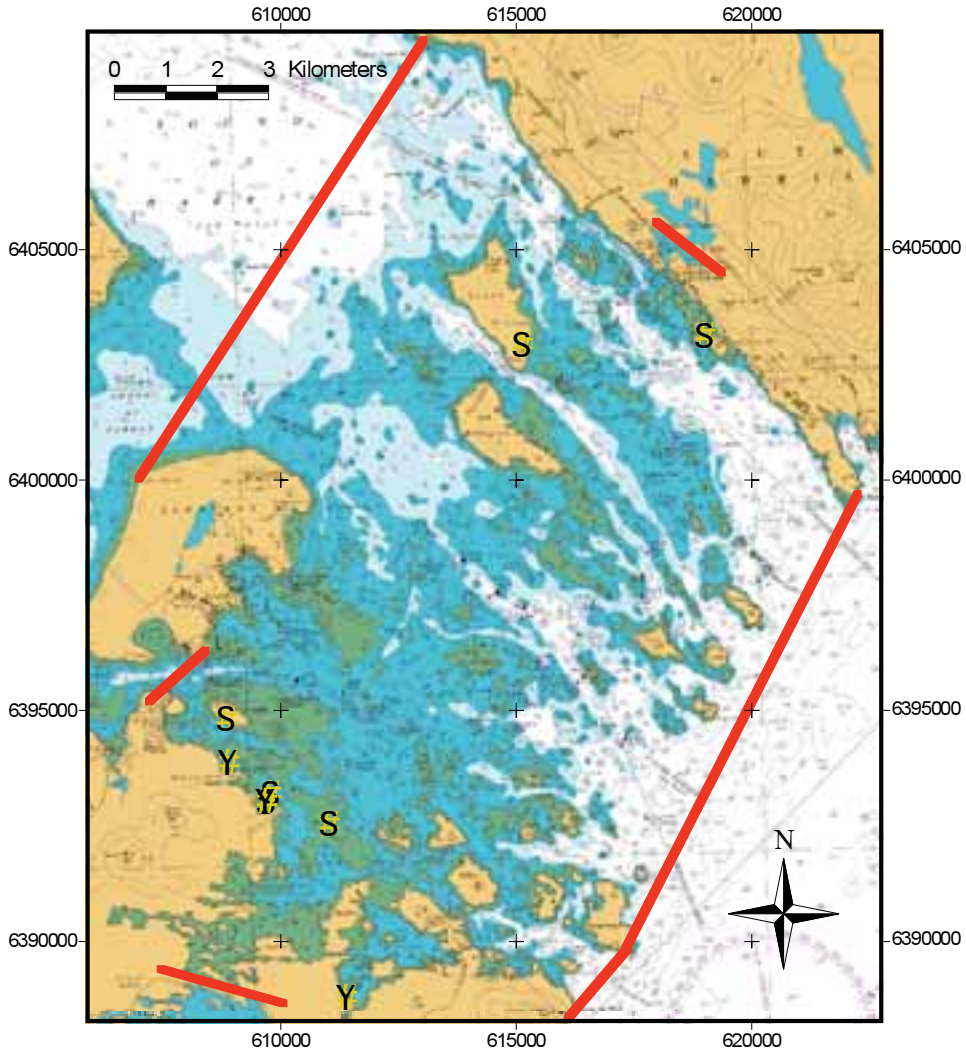
Sand beaches with less direct exposure to wave action have a more level gradient and finer sediment. These contain a more diverse fauna characterised by species such as *Angulus tenuis*, *Nephtys cirrosa* and burrowing amphipods. These sites are allocated to the biotope **LS.LSA.FiSa.Po** and may include sub biotopes such as **LS.LSA.FiSa.Po.Aten** at different locations (Figure 4.2.14).

Figure 4.2.14 Distribution of sheltered sand sites



Sheltered pockets of intertidal muddy sand are found at a few locations east of Leverburgh but the majority of these sites are found in the sheltered areas in the south of the Sound. The sediment surface is typically covered by pronounced hummocks from *Arenicola* casts and has shallow pools of standing water. These sediments have sparse, low diversity infauna and have been allocated tentatively to the biotope **LS.LSA.MuSa.MacAre** although there is no evidence for the presence of *Macoma* or other bivalves. Two varieties of this biotope are distinguished. **LS.LSA.MuSa.MacAre** Var 1 is composed of slightly silty fine sand while **LS.LSA.MuSa.MacAre** Var 2 is composed of softer muddy sand and is generally found at a lower tidal height. The sediment of **LS.LSA.MuSa.MacAre** Var 2 was often covered by a mat of filamentous green algae with occasional large macrofaunal burrows amongst the *Arenicola* casts (Figure 4.2.15).

Figure 4.2.15 Distribution of sheltered muddy sand sites



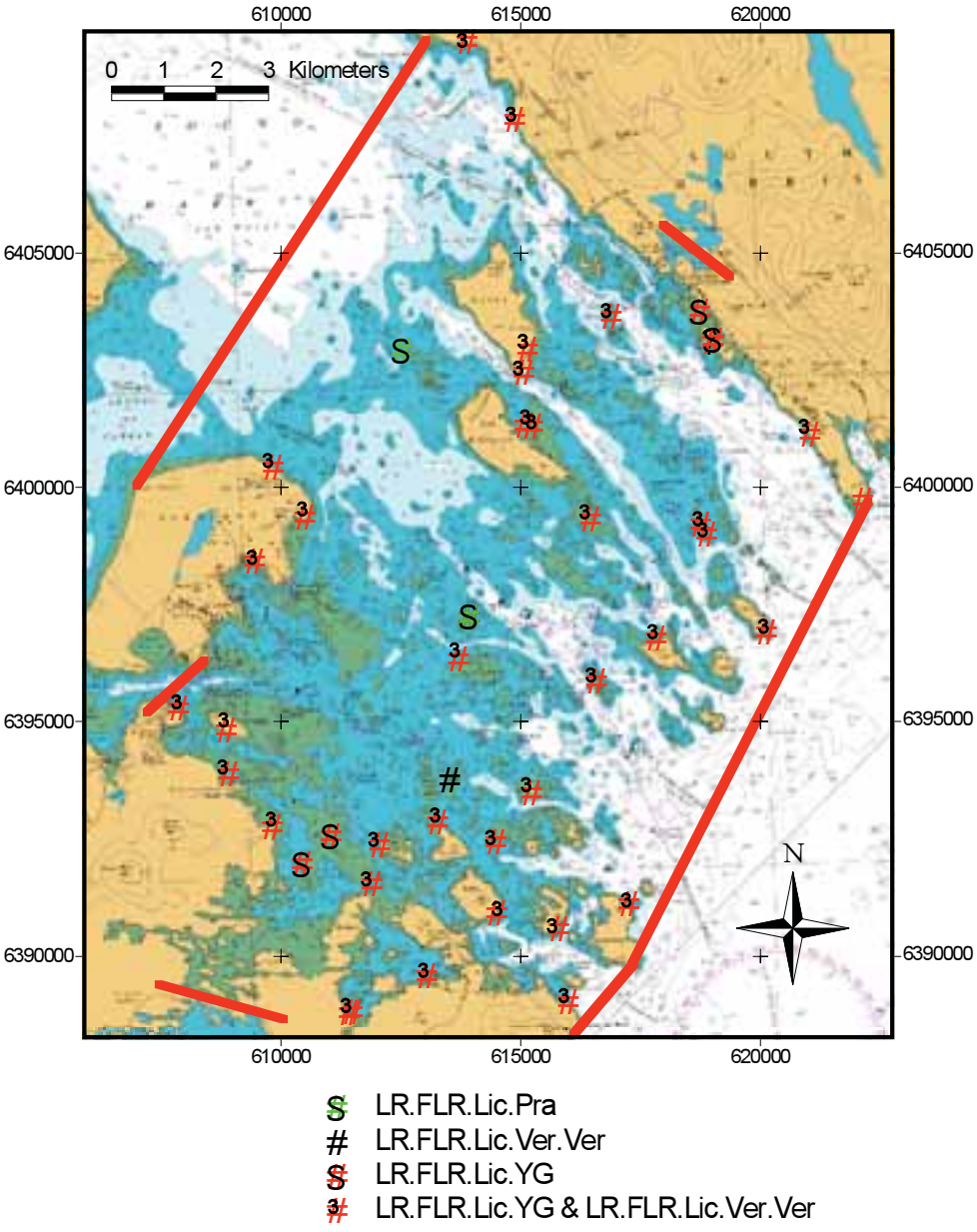
Y LS.LSA.MuSa.MacAre (Var 2)
S LS.LSA.MuSa.MacAre (Var 1)

4.2.4 Littoral rock

The rock shores of the Sound range from steep bedrock slopes to extensive undulating intertidal reefs of stable boulders and bedrock outcrops.

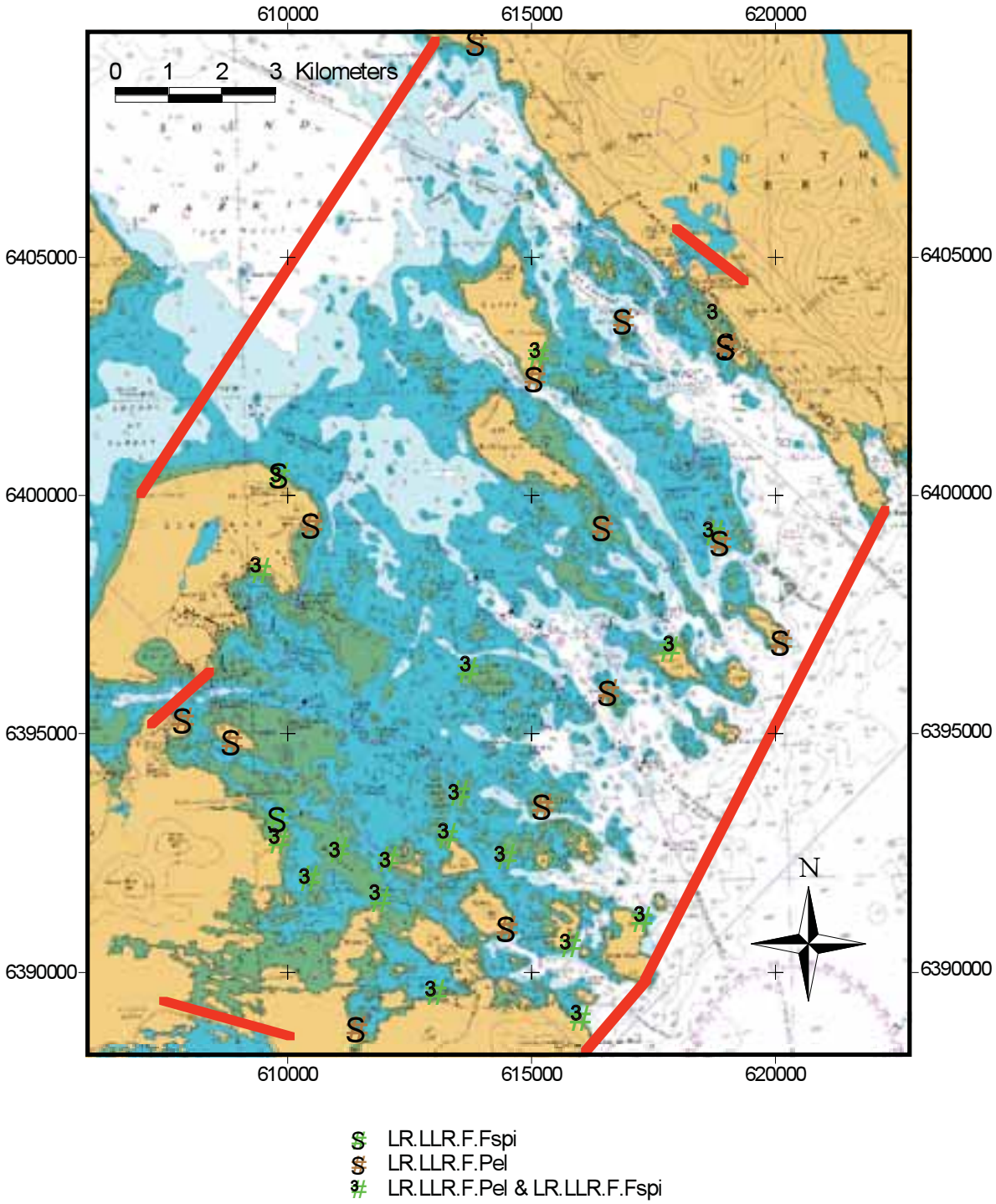
The supralittoral lichen biotopes **LR.FLR.Lic.YG** and **LR.FLR.Lic.Ver.Ver** are ubiquitous in the Sound and are found wherever there is suitable rocky substrate in the upper shore. Some small islands are used as roost sites by large numbers of seabirds and the upper shore is dominated by the guano enriched *Prasiola*-dominated biotope **LR.FLR.Lic.Pra** (Figure 4.2.16).

Figure 4.2.16 Distribution of lichen dominated sites



The upper shore fucoids *Pelvetia* and *Fucus spiralis* also occur across the site although more frequently found on sheltered and moderately exposed shores than on highly exposed rock. These biotopes (**LR.LLR.F.Pel** and **LR.LLR.F.Fspi**) typically occur as narrow bands between the supralittoral lichens and the fucoid or barnacle dominated biotopes that account for most of the intertidal area (Figure 4.2.17).

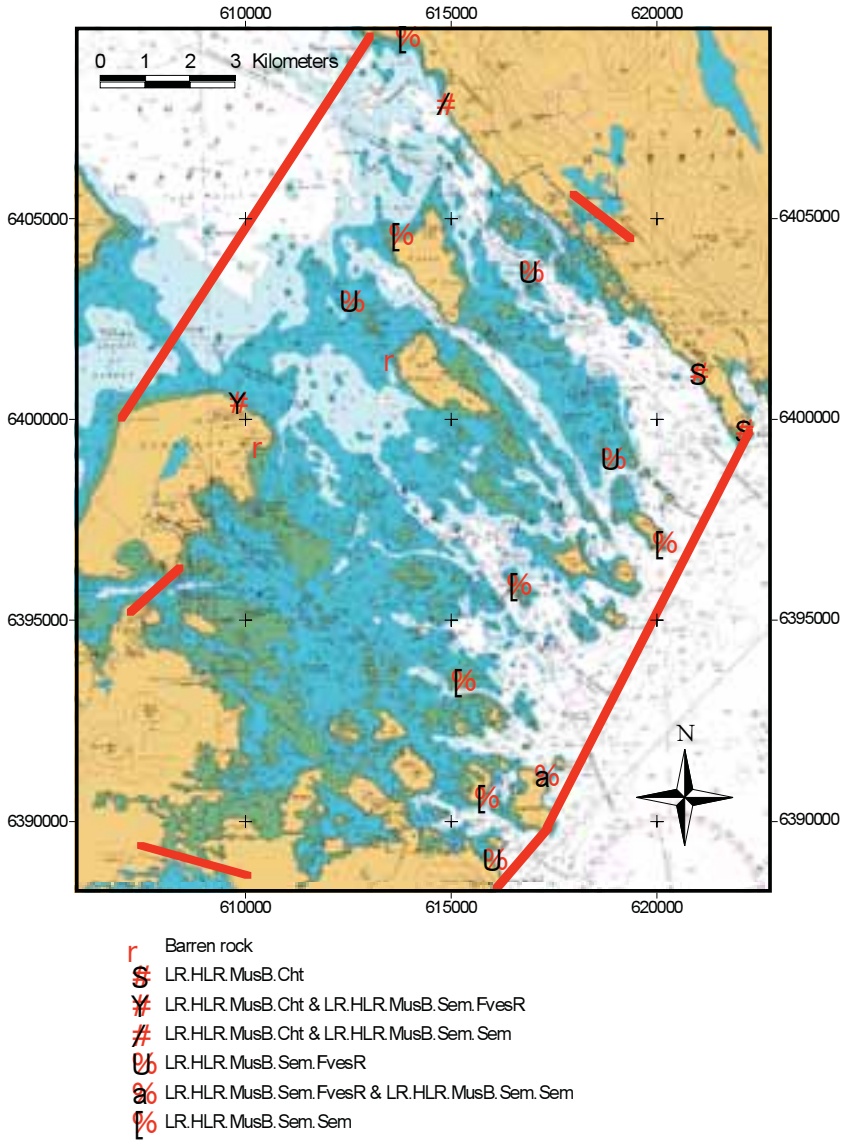
Figure 4.2.17 Distribution of upper shore fucoid sites



The effects of differing exposure levels are more apparent in the mid and lower shore where barnacle dominated biotopes (**LR.HLR.MusB.Sem.Sem** and **LR.HLR.MusB.Sem.FvesR**) occur in more exposed situations, barnacle fucoid mosaics (**LR.MLR.BF.FvesB**) predominate where there is less exposure and fucoid dominated biotopes (**LR.LLR.F.Fves** and **LR.LLR.F.Asc**) occur in sheltered conditions.

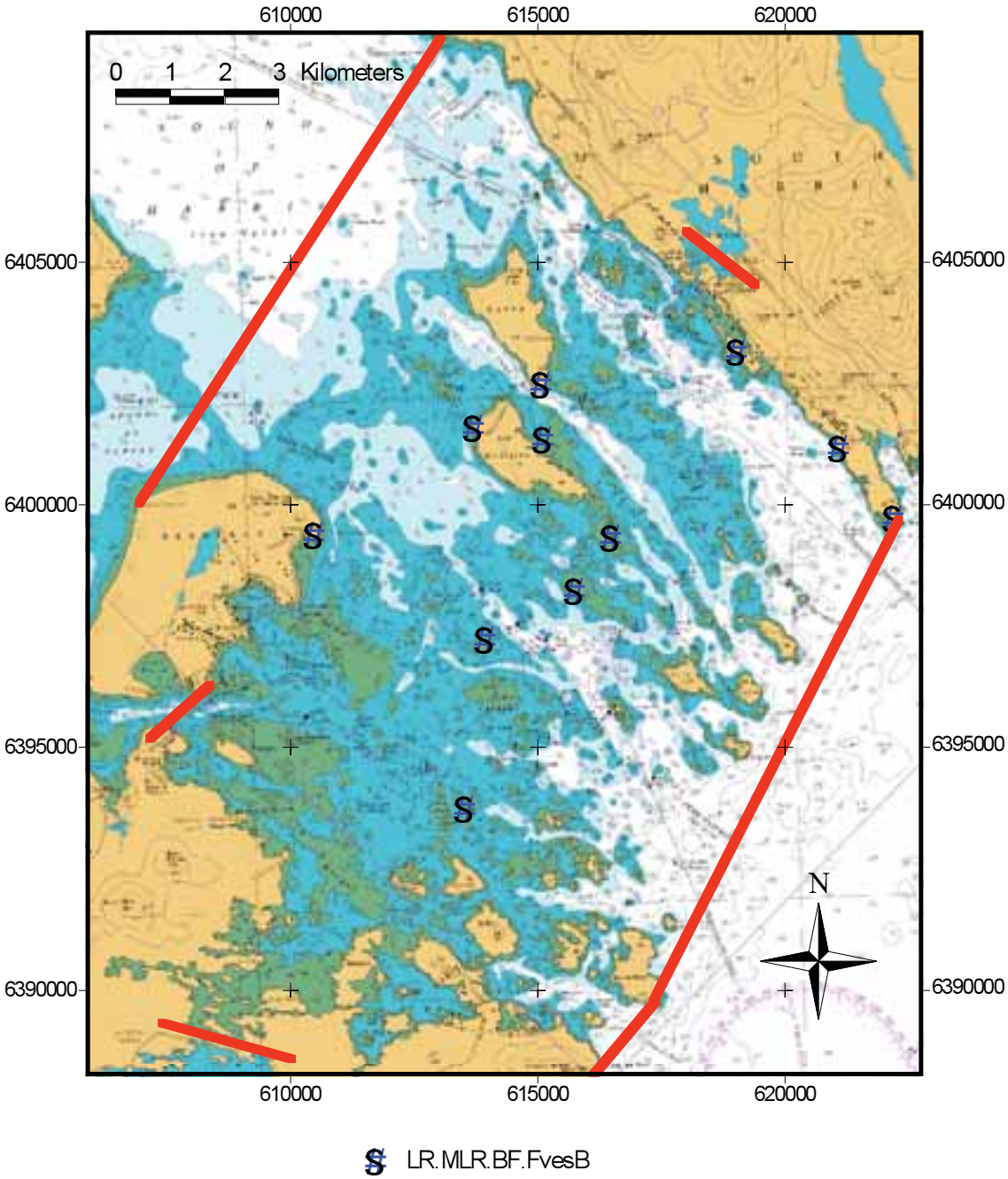
Rocky shores in the exposed western and eastern entrances of the Sound tend to be dominated by *Semibalanus* and *Patella* with *Fucus vesiculosus* absent or present only as scattered isolated tufts (**LR.HLR.MusB.Sem.Sem** and **LR.HLR.MusB.Sem.FvesR**). At the more exposed locations the barnacle *Cthamalus* forms a narrow band (**LR.HLR.MusB.Cht**) above the much more extensive *Semibalanus* zone. At some locations where areas of exposed intertidal sand occurs near a rocky shore the rock is scoured bare by the abrasive sand and very little biota survive (barren rock) (Figure 4.2.18).

Figure 4.2.18 Distribution of exposed rocky shore sites



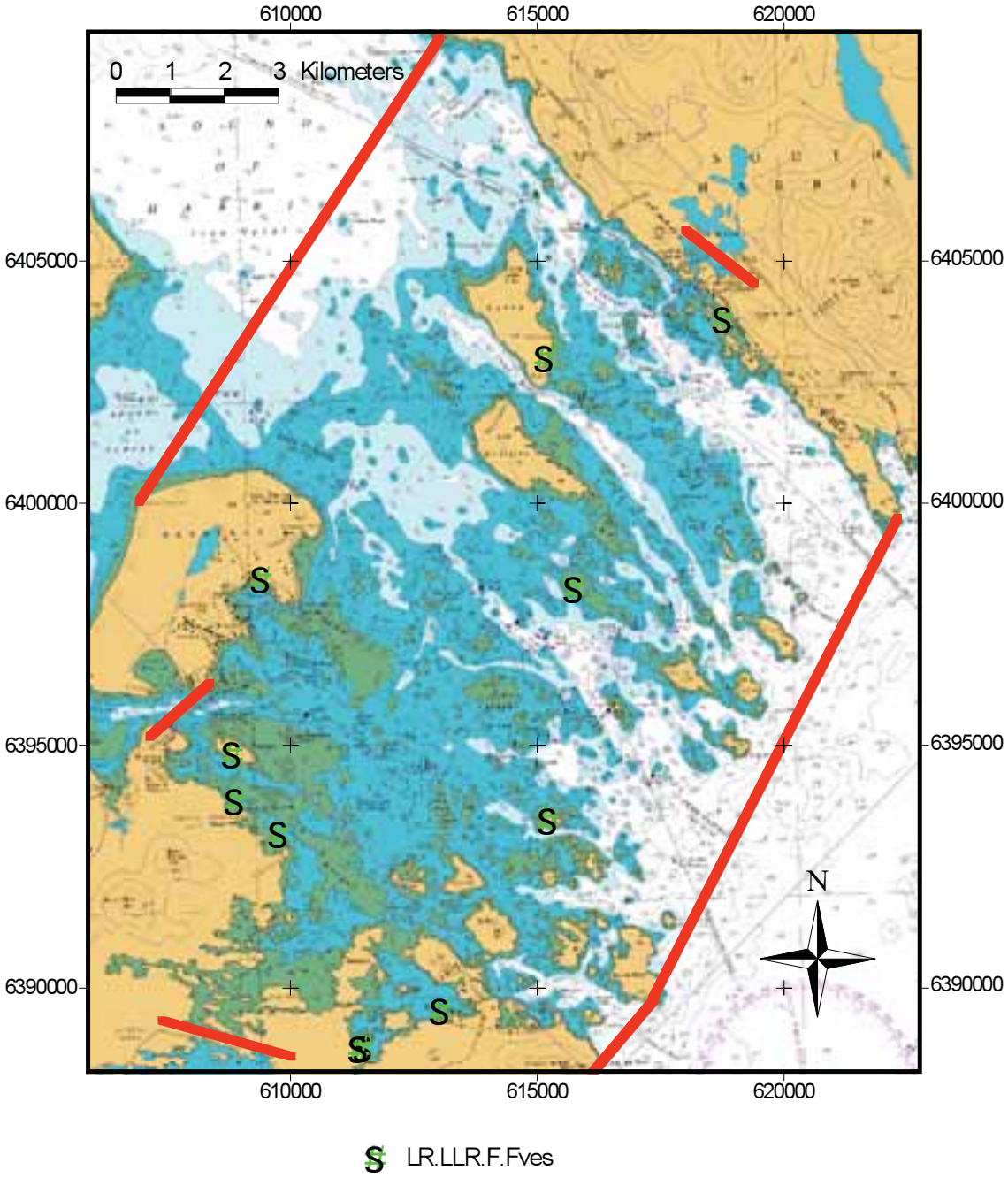
In the conditions of reduced exposure in the central part of the Sound *F. vesiculosus* is better developed and forms a mosaic of patches with areas of dense *Semibalanus* (**LR.MLR.BF.FvesB**). This mosaic often takes the form of *Semibalanus* on elevated rock projections or large boulders while lower lying areas are dominated by *F. vesiculosus* (Figure 4.2.19).

Figure 4.2.19 Distribution of barnacle/fucoid mosaic sites



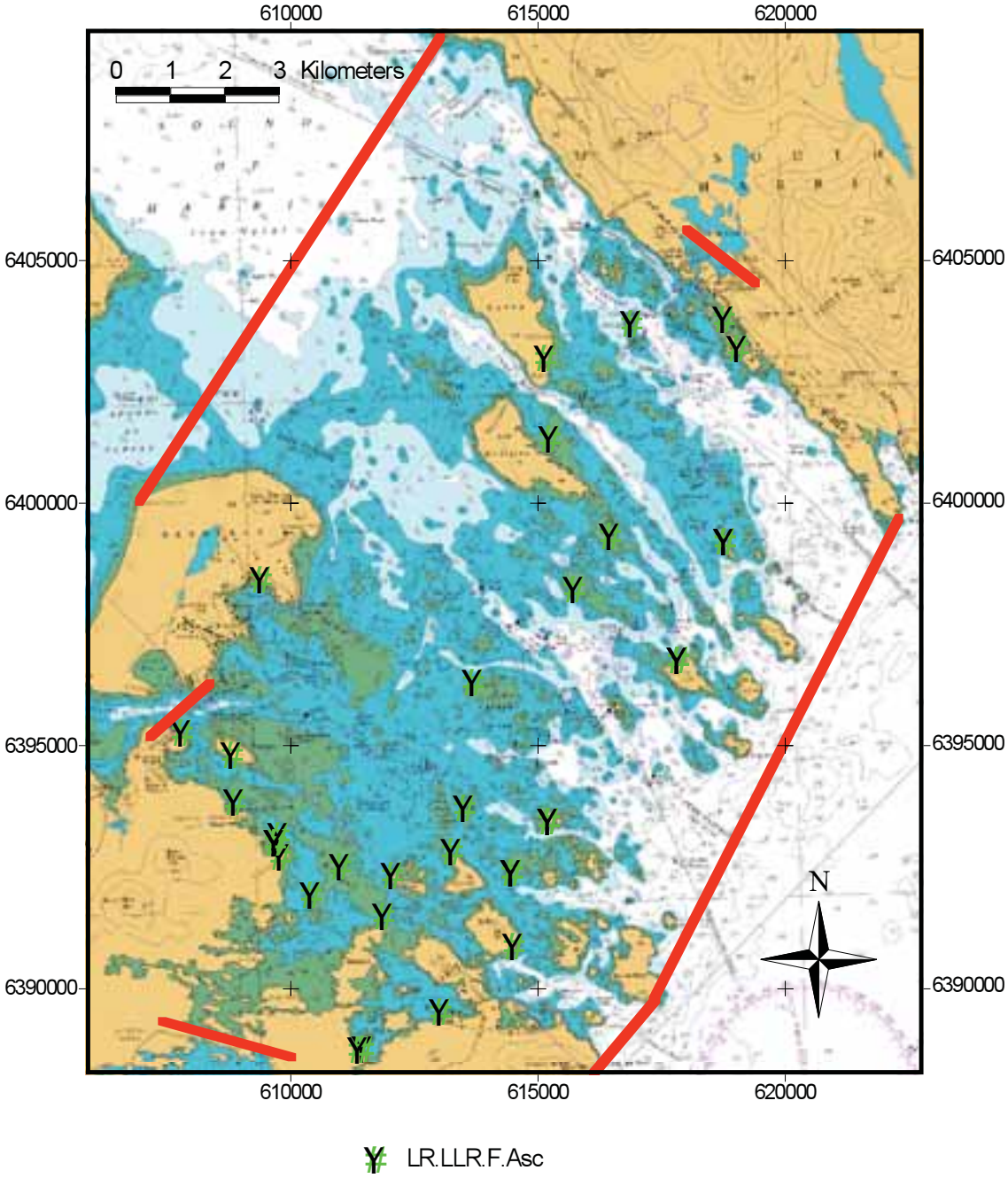
Dense beds of *F. vesiculosus* (**LR.LLR.F.Fves**) do occur in sheltered conditions at certain locations within the central area of the Sound but occur with greater frequency on the sheltered shores in the south of the Sound. However, these beds are not of any great extent and tend to occur as a relatively narrow band above a much more extensive area of *Ascophyllum* or as isolated patches within a wider bed of *Ascophyllum* (Figure 4.20).

Figure 4.2.20 Distribution of *F. vesiculosus* sites



Ascophyllum beds (**LR.LLR.F.Asc**) account for the greatest area of intertidal biotopes within the Sound. In the sheltered southern part of the Sound there are many broad boulder shores and reefs with a dense cover of *Ascophyllum*. Even in the more exposed conditions of the central part of the Sound there are dense beds of *Ascophyllum* where extensive undulating areas of intertidal boulders create the necessary sheltered conditions (Figure 4.2.21).

Figure 4.2.21 Distribution of *Ascophyllum* dominated sites



The lower shore at certain highly exposed sites is characterised by a zone of scour tolerant algae such as *Corallina* or *Mastocarpus* (**LR.HLR.FR.Coff.Puly** and **LR.HLR.FR.Mas**) or by ephemeral algae such as *Enteromorpha* (**LR.FLR.Eph.EntPor**) (Figure 4.2.22). But more commonly the lower shore is dominated by a narrow band of *Fucus serratus* (**LR.MLR.BF.Fser**). This biotope is more frequently encountered in moderately exposed or sheltered locations while in more exposed conditions it may be mixed with or replaced by *Himanthalia* (**LR.HLR.FR.Him**) (Figure 4.2.23).

Figure 4.2.22 Distribution of scoured lower shore sites

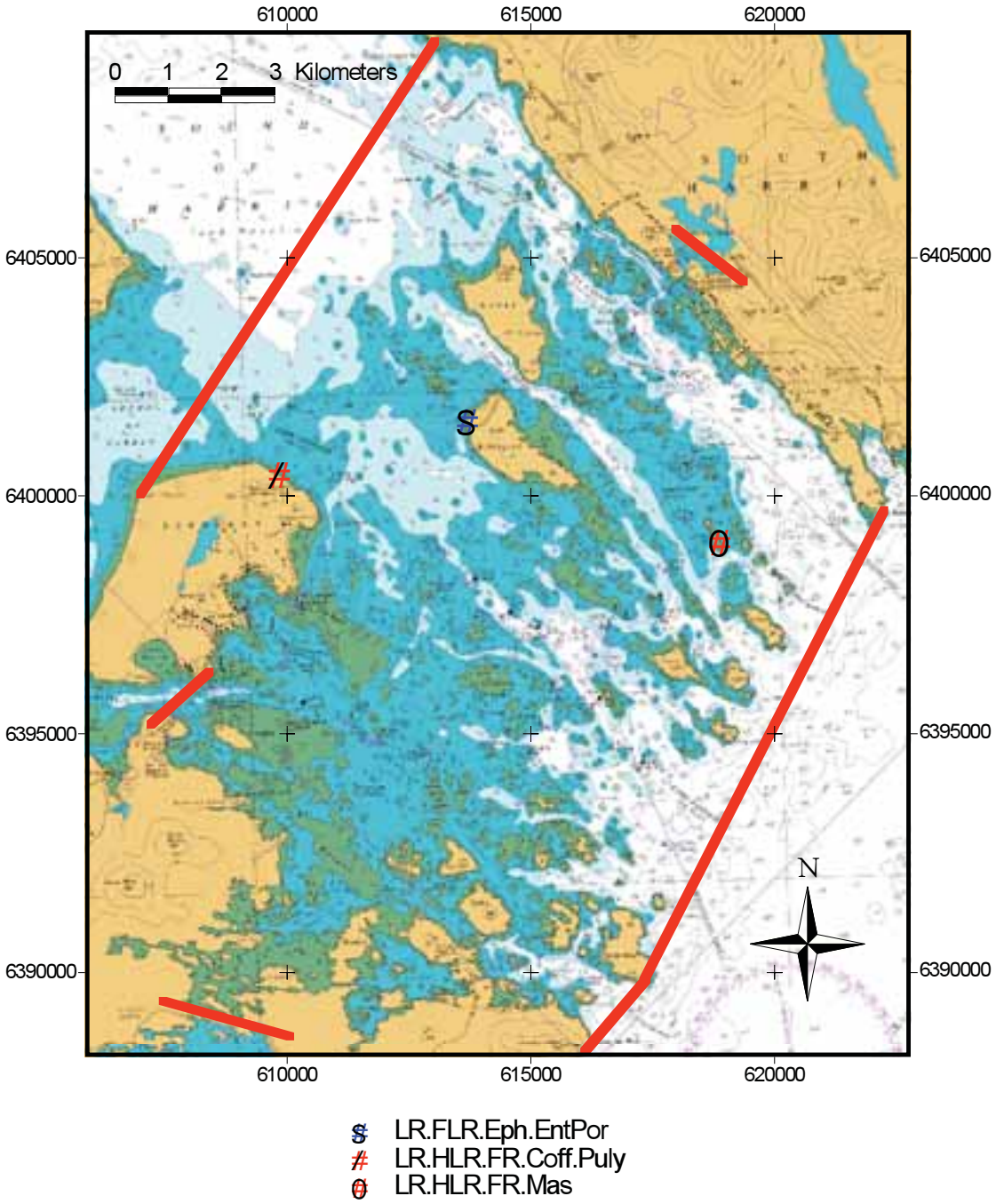
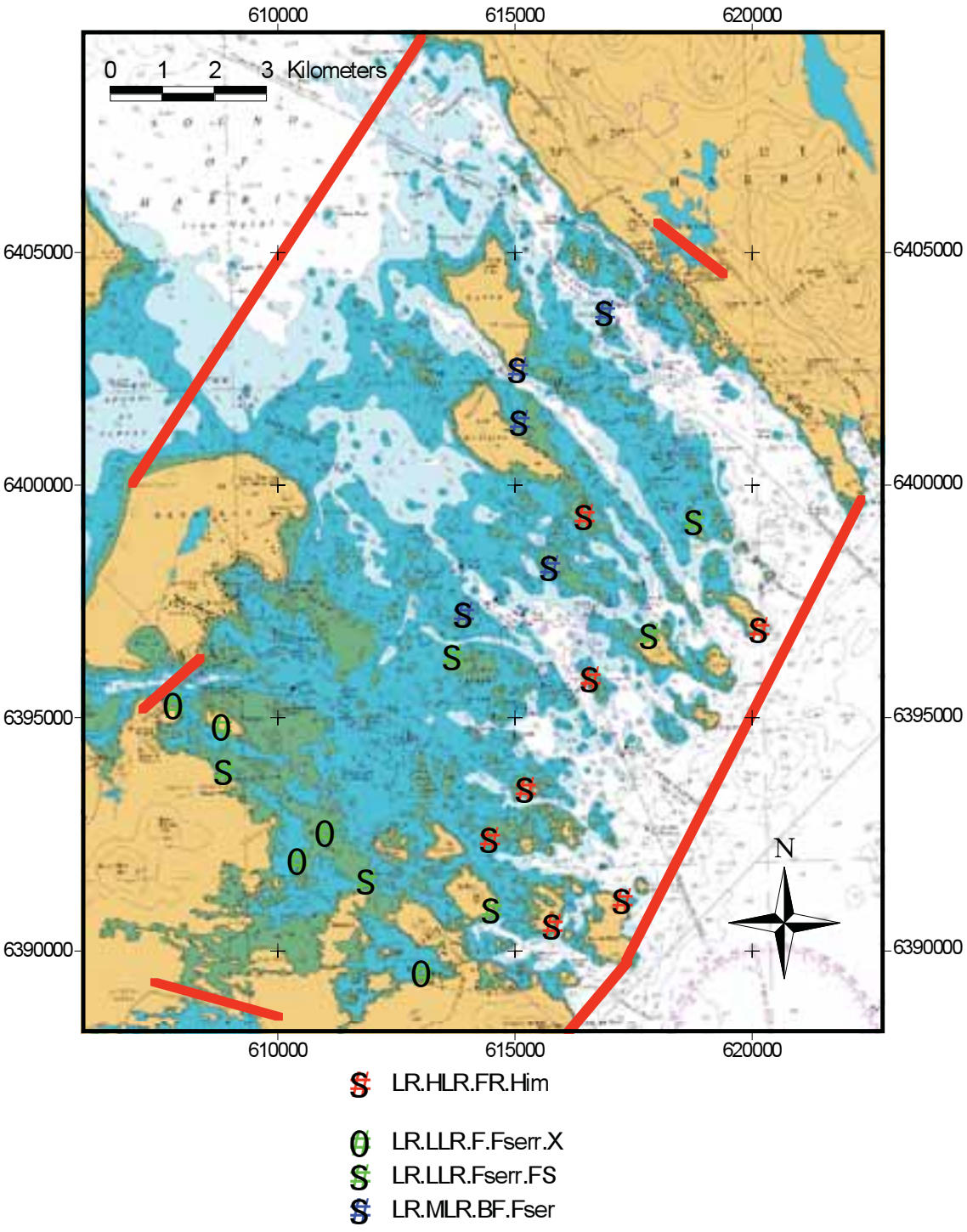
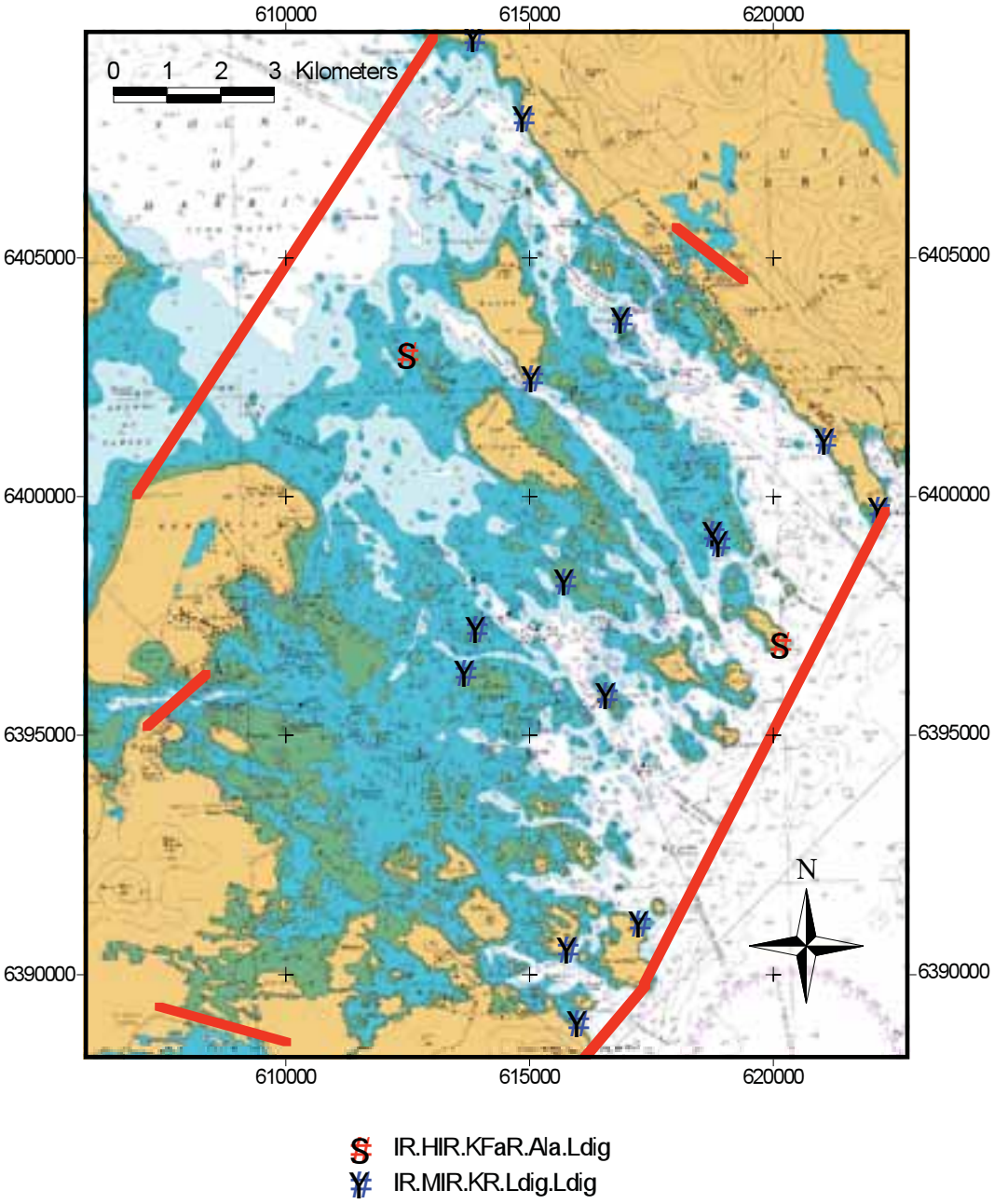


Figure 4.2.23 Distribution of lower shore fucoid sites



At many locations (apart from the sheltered southern area) there is a sublittoral fringe kelp zone below the *F. serratus* zone (Figure 4.2.24). This zone is normally dominated by *Laminaria digitata* (**IR.MIR.KR.Ldig.Ldig**), but in more exposed locations *Alaria* is also present amongst the *L. digitata* (**IR.HIR.KFaR.Ala.Ldig**). The sublittoral fringe kelp zone appeared narrow at most locations with its lower boundary merging into the sublittoral *L. hyperborea* biotopes typical of the Sound. The *L. digitata* zone was not recorded in the sheltered southern area where the *F. serratus* zone tended either to be directly at the rock/sediment boundary or lie above sublittoral kelps such as *L. saccharina*.

Figure 4.2.24 Distribution of sublittoral fringe kelp sites



4.3 Integrated biotope classification and accuracy assessment

To improve on the purely spectral-based biotope classification for subtidal regions presented in Section 3.2.5, a second combined spectral and expert systems-based approach to classification was attempted (as briefly outlined in section 2.4.3.5). This classification used the spectral information from a refined training area dataset and combined it with defined rules based on expert knowledge of the occurrence of different biotopes in areas differing in *exposure* and *bathymetry*, as outlined in detail for each biotope in Section 4.2. Exposure is a key variable within the definition of the biotope classification system (Connor *et al.*, 2004) and zonation according to depth is readily observed in the field.

At this stage similar biotopes in both intertidal and subtidal areas were also combined but done so following as close as possible their hierarchical grouping as defined by Connor *et al.* (2004). The reasons for doing so were due to the;

- lack of spectral discrimination to separate biologically similar species. For example, for fucoid species where the presence of similar photosynthetic pigments gives similar spectral reflectance properties. In addition to this, those biotopes which were only distinguishable following the laboratory-based infaunal analysis were also combined, ie for biotopes where visual differences could not be observed using drop-down video or diver's video and where infaunal differences would not likely influence their spectral reflectance properties,
- low occurrence of some biotopes. Where biotopes were only found at a few sites in the ground survey they were combined with other similar biotopes, or left out of the classification.

The resulting detailed grouped biotope listings used for the classification is presented in Tables 4.3.1 and 4.3.2.

To set the rules for exposure, regimes of high, middle and low exposure were defined on the satellite image dataset on the basis of exposure to the prevailing wind and currents. This information was distilled from the spatial knowledge of the area of the biological survey teams. Depth ranges for each biotope were defined using the information recorded during the ground truthing survey. These formed the depth rules for each biotope. The calibrated LiDAR dataset provided to the project was then used to test the rule in the integrated classification. Two regions in the study area lay outwith the area covered by the LiDAR survey; these corresponded to an area in the west where no LiDAR coverage was attempted, approximately defined by region Area A in Figure 2.5.1, and to the deeper waters in the east of the study area where LiDAR was unable to penetrate, approximating Area B in Figure 2.5.1. For area A the spectral classification was guided only by the exposure rules. For Area B, a region where the satellite imagery is limited for biotope discrimination on the basis of limits to light penetration, the classification was heavily weighted to the acoustic data, by integrating the accurate classification results obtained from the sonar survey (Section 3.3).

The rule based approach was not attempted for improved classification of the intertidal biotopes on the imagery where a similar approach based on apparent exposure, substrate type and altitude could hypothetically have been applied. This was due to;

a) the convoluted nature of the shoreline, making it much more difficult to define exposure zones, and

b) the heterogeneity and narrowness of the intertidal zones found, which were often beyond the spatial resolution of the imagery.

Table 4.3.1 Detailed listing of the grouped subtidal biotopes used for the integrated classification

Biotope ID	Biotope Name	Broad Class Description
3	SS.SMP.SSgr.Zmar	Seagrass Beds
6	IR.HIR.Ksed.XKScrR IR.MIR.KR.LhypT.Ft IR.MIR.KR.LhypT.Pk IR.MIR.KR.Lhyp.GzFt IR.HIR.KFaR.Ala.Ldig IR.MIR.KR.Ldig.Ldig	Kelp on Infralittoral exposed rock
7	IR.LIR.K.LhypLsac.Pk IR.LIR.K.Lsac.Pk IR.LIR.K.LhypLsac.Ft IR.LIR.K.Lsac.Gz IR.HIR.Ksed.LsacSac IR.MIR.KT.XKTX	Kelp on Infralittoral sheltered rock
10	SS.SMU.CsaMu.Afil.MysAnit SS.SSA.ImuSa.Ffab.Mag	Circalittoral muddy sand
16	SS.SMU.IFiMu.Are SS.SMP.KSwSS.LsacR.Mu SS.SMP.KSwSS.Tra SS.SMP.KSwSS.Pcri	Infralittoral mud with algal cover
17	SS.SSA.IfiSa.ImoSa SS.SSA.IFiSa.NcirBat	Mobile sand
19	SS.SCS.ICS.Moeven	Tide swept sand
20	SS.SSA.IfiSa.TbAmPo	Infralittoral muddy sand
21	CR.HCR.Xfa.SwiLgAs	Fauna on circalittoral exposed rock
23	SS.SMX.Imx SS.SMX.IMx.SpavSpAn	Infralittoral mixed sediment
25	SS.SMU.ISaMu.AmpPlon	Infralittoral muddy sand with algal cover
26	SS.SSA.IMuSa.ArelSa	Sheltered infralittoral muddy san
27	SS.SMU.IFiMu.Are	Infralittoral mud with algal cover
41	SS.SCS.CCS.MedLumVen	Circalittoral gravels and sand, muddy sand
43	SS.SMP.Mrl.Pcal	Infralittoral coarse/medium sand with surface gravel of maerl

Table 4.3.2 Detailed listing of the grouped intertidal biotopes used for the integrated classification

Biotope ID	Biotope Name	Broad Class Description
11	LS.LSA.MuSa.MacAre	Muddy sand with *Arenicola*
50	LR.LLR.F.Fves LR.LLR.Fserr.FS LR.MLR.BF.Fser LR.HLR.FR.Him	Dense fucoids
52	LR.LLR.F.Asc.X LR.LLR.F.Asc.FS	Dense *Ascophyllum*
55	LR.FLR.Lic.YG	White lichens
60	LR.FLR.Lic.Ver.Ver	Black lichens
61	LS.LSA.St.Tal LS.LSA.MoSa LS.LSA.FiSa.Po LS.LSA.FiSa.Po.Aten	Mobile fine beach sand
65	Barren rock	Barren rock
66	LR.HLR.MusB.Sem.FvesR/LR.HLR.MusB.Sem.Sem	Barnacles and limpets on exposed rocky shores

The resulting, integrated, biotope classification is presented in Figure 4.3.1. An accuracy assessment for this classification was conducted using the 266 ground truthing sites as the reference source. The resulting confusion matrix is presented in Table 4.3.2. The overall classification accuracy is calculated as 66%.

Classes which were very well discriminated included: class 25 (**SS.SMU.ISaMu.AmpPlon**) which was well defined by bathymetry; class 41 (**SS.SCS.CCS.MedLumVen**) which had a distinct acoustic signature and; 43 (**SS.SMP.Mrl.Pcal**) though, as there were few sites, confidence in the distribution of this class is low.

Class 10 (**SS.SMU.CsaMu.Afil.MysAnit** and **SS.SSA.ImuSa.Ffab.Mag**) was well classified at 86% accuracy on account of its distinct acoustic signature and widespread nature. The combined mobile sand class 17 (**SS.SSA.IfiSa.ImoSa/SS.SSA.IFiSa.NcirBat**) was also accurately classified at 83% on account of its bright spectral signature which can be easily distinguished even in deep water. Class 21 (fauna on circalittoral rock, **CR.HCR.Xfa.SwiLgAs**) was accurately discriminated at 80% accuracy as its acoustic signature is distinguishable from the muddy sand (class 10) background.

Moderately accurately classified sites included *Zostera* (class 3, **SS.SMP.SSgr.Zmar**) – dense beds were very well distinguished. The poorly classified areas were mainly sparse *Zostera* beds where density was less than 30%. Class 27 (Infralittoral mud with algal cover, **SS.SMU.IFiMu.Are**) was also moderately classified but only consisted of very few sites and thus the confidence in the classification is low.

Class 7 (Kelp on Infralittoral sheltered rock) classified poorly at 29% being mainly confused with another kelp dominated class 6 (Kelp on Infralittoral exposed rock) largely as a result of their similarities in spectral reflectance signatures. Class 26 (sheltered infralittoral muddy sand), although few in number, also classified poorly (33%) showing confusion with class 23 (infralittoral mixed sediment). Class 20 (infralittoral muddy sand) classified poorly mainly as a result of confusion with other sand and sandy mud classes.

Table 4.3.3 Confusion matrix resulting from the accuracy assessment performed on the detailed biotope classification presented in Figure 4.3.1. Biotope class numbers correspond to those ID numbers presented in Table 4.3.1.

	Reference class															
Image Class	**3**	**6**	**7**	**10**	**16**	**17**	**19**	**20**	**21**	**23**	**25**	**26**	**27**	**41**	**43**	**User's Accuracy (%)**
3	7	4	1	0	0	1	0	1	0	0	0	0	0	0	0	**50**
6	1	37	7	7	0	6	9	0	0	1	0	0	0	0	1	**54**
7	0	7	4	0	1	0	0	0	0	0	1	0	0	1	0	**29**
10	0	0	0	30	1	0	1	0	0	0	0	0	0	3	0	**86**
16	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	**60**
17	0	8	0	0	0	40	0	0	0	0	0	0	0	0	0	**83**
19	6	2	0	0	0	9	24	4	0	0	0	0	0	0	0	**53**
20	1	1	2	0	0	0	0	10	0	0	4	4	0	0	0	**45**
21	0	0	0	1	0	0	0	0	4	0	0	0	0	0	1	**80**
23	0	1	0	0	1	1	0	0	0	5	0	0	0	0	0	**63**
25	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	**100**
26	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	**33**
27	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	**50**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**100**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**100**

A second broader classification was undertaken to both improve the accuracy of the classification further on the basis of the further logical amalgamation of biotope classes (Figure 4.3.2). The biotope classes combined were:

- Kelp classes 6 (kelp on infralittoral exposed rock) and 7 (kelp on infralittoral sheltered rock), combined into a general kelp class.
- Mobile sand classes 19 (fine mobile sand), 20 (infralittoral muddy sand) and 26 (sheltered infralittoral muddy sand), combined in to a general class 19 (muddy sand class).
- Class 16 (infralittoral mud with algal cover), with few sites, was incorporated into class 10 (circalittoral muddy sand).

The confusion matrix for the broader subtidal classification is given in Table 4.3.4. Overall accuracy achieved was improved to 75% with no individual class accuracies below 50%. The classification of kelp classes improved dramatically when combined (to 62% from 29% and 54% for the two separate classes, respectively). The muddy sand class improved to 63% accuracy from 45% (class 20) and 53% (class 19) previously. Class 10 (circalittoral muddy sand) increased from 86–90%.

Figure 4.3.1 Integrated detailed biotope classification for the Sound of Harris

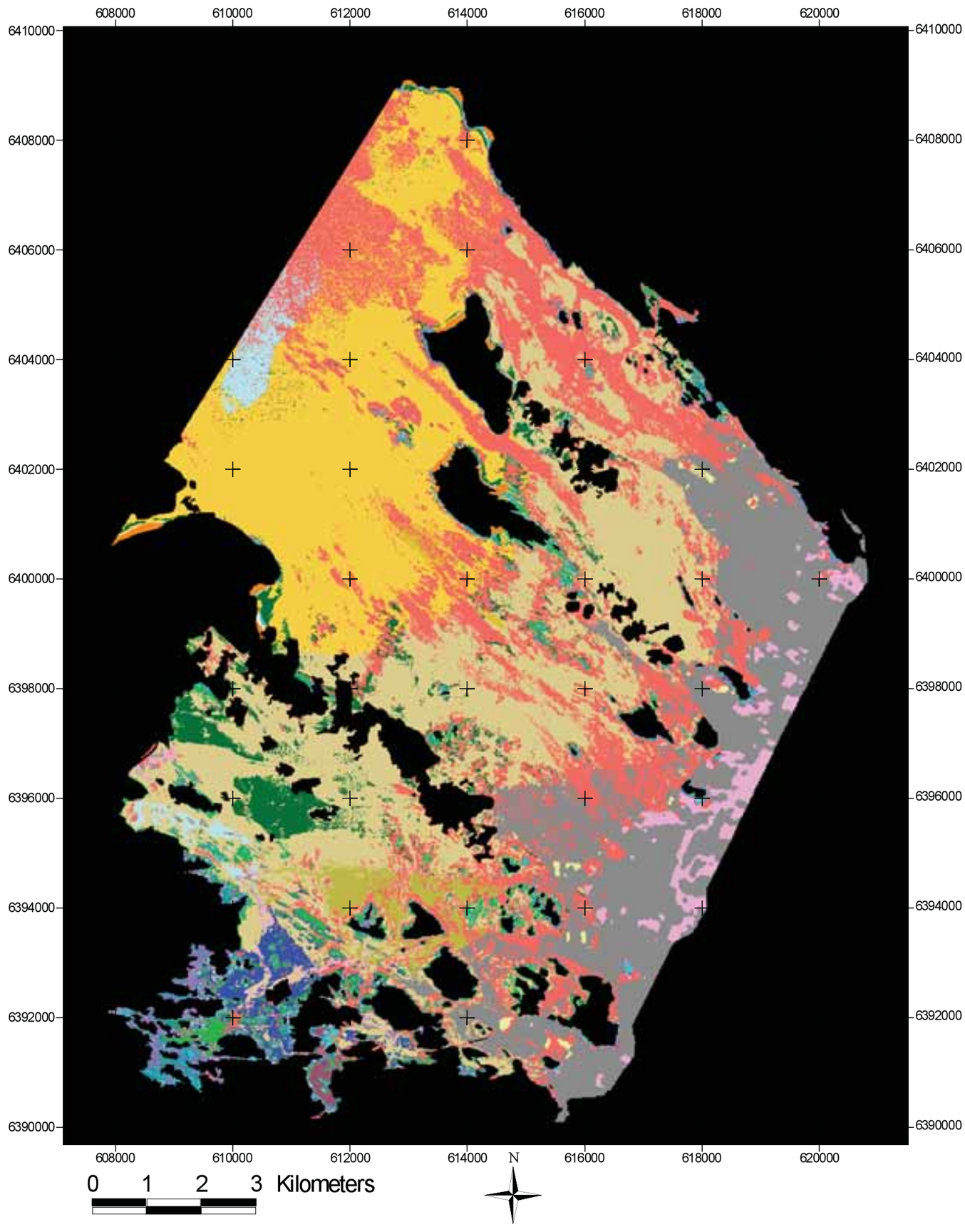


Figure 4.3.2 Integrated broader biotope classification for the Sound of Harris

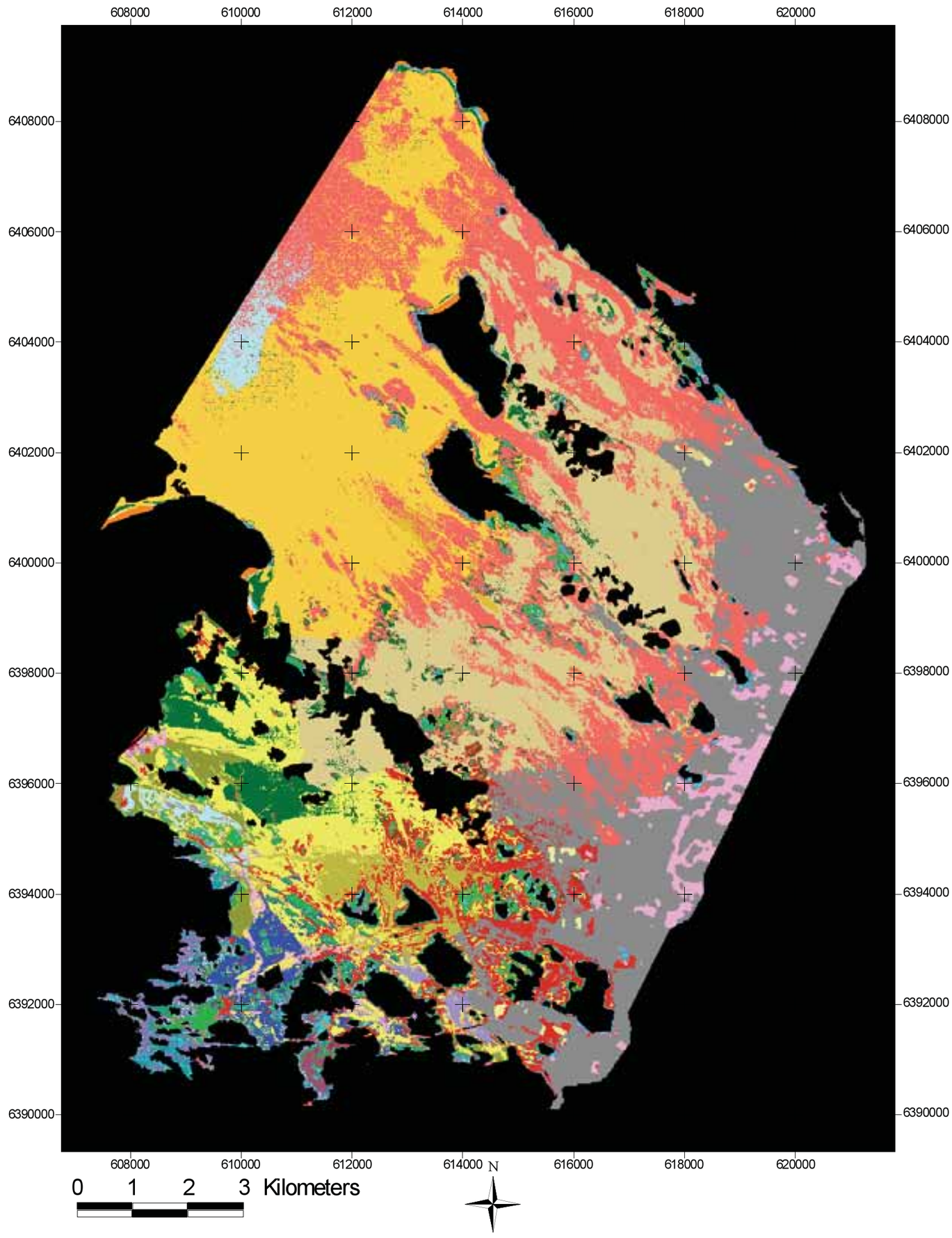


Table 4.3.4 Confusion matrix resulting from the accuracy assessment performed on the biotope classification presented in Figure 4.3.2. Biotope class numbers correspond to those ID numbers presented in the legend to same figure

	Reference class											
Image Class	**3**	**6**	**10**	**17**	**19**	**21**	**23**	**25**	**27**	**41**	**43**	**User's Accuracy (%)**
3	7	5	0	1	1	0	0	0	0	0	0	**50**
6	1	43	7	7	9	0	1	0	0	0	1	**62**
10	0	0	35	0	1	0	0	0	0	3	0	**90**
17	0	8	0	40	0	0	0	0	0	0	0	**83**
19	7	5	0	9	42	0	0	4	0	0	0	**63**
21	0	0	1	0	0	4	0	0	0	0	1	**67**
23	0	1	1	1	0	0	5	0	0	0	0	**63**
25	0	0	0	0	0	0	0	3	0	0	0	**100**
27	0	1	0	0	0	0	0	0	1	0	0	**50**
41	0	0	0	0	0	0	0	0	0	2	0	**100**
43	0	0	0	0	0	0	0	0	0	0	2	**100**

Accuracy assessment on the intertidal classification shown in Figures 4.3.1 and 4.3.2 were assessed separately, with the resulting confusion matrix presented in Table 4.3.5. Class 66 (barnacles and limpets on exposed rocky shores) were not assessed as both sites were used in training. Overall classification accuracy for the intertidal areas was 63%.

Table 4.3.5 Confusion matrix resulting from the accuracy assessment performed on the intertidal biotope classification presented in Figures 4.3.1 and 4.3.2. Biotope class numbers correspond to those ID numbers presented in the legends to the same figures

	Reference class							
Image Class	**11**	**50**	**52**	**55**	**60**	**61**	**65**	**User's Accuracy (%)**
11	2	0	0	1	0	0	0	**67**
50	0	2	3	0	0	0	0	**40**
52	2	4	20	1	0	0	0	**74**
55	0	0	0	6	2	0	2	**60**
60	4	0	0	0	4	0	0	**50**
61	0	0	0	0	0	9	0	**100**
65	0	0	0	1	0	0	1	**50**

Class 61 (mobile beach sand) was very accurately classified as it was spectrally very distinct from other intertidal areas. Class 52 (*Ascophyllum*-dominated sites) classified well as a result of its extensive coverage in the Sound that was distinguishable given the satellite spatial resolution. Biotope classes dominated by dense fucoids (class 50) were confused with the *Ascophyllum* class on account of their frequent coexistence spatially and similarity in spectral reflectance properties. Class 60 (black lichens) were partly confused with littoral muddy sand biotopes again on account of their similar reflectance properties (class 11).

5 DISCUSSION

5.1 The biota of the Sound of Harris

The biological communities of the Sound of Harris are of interest for a variety of reasons including the presence of diverse communities associated with beds of *Zostera* and maerl. The area also includes a wide range of wave exposure conditions ranging from extreme exposure to extreme shelter and a wide range of tidal current regimes from extremely tide swept channels to undisturbed tidal basins.

The *Zostera* beds are particularly extensive and well developed, covering an area of approximately 280ha. The beds typically take the form of a series of bands of dense *Zostera* alternating with bands of open sand with each band being several metres wide. The sward height of the *Zostera* is typically 1–1.5m and the plants are densely spaced to give continuous coverage within the band. Scattered individuals of *L. saccharina*, *Halidrys* or *Chorda* may occur amongst the *Zostera*. The *Zostera* fronds are typically covered in large numbers of *Lacuna vincta* and at some locations the fronds are encrusted by didemnid ascidians and *Obelia geniculata*. The cnidarians *Anemonia* and *Haliclystis* are also frequently found in association with the *Zostera*.

At least two distinct forms of maerl beds are present, both composed of *Phymatolithon calcareum*. In exposed and tide swept areas of the Sound there are extensive beds of maerl that support a diverse range of algae and fauna. These beds are formed into sandwaves with several metres between the crests of the waves and amplitudes of up to 0.5m. The maerl tends to be concentrated on the crests of the waves and supports a significant canopy of *Desmarestia*, *Dictyota*, *L. saccharina* and other algae. In sheltered tide swept channels in the south of the Sound there are maerl beds lying on muddy mixed substrata. The maerl is associated with a dense cover of algae dominated by *Phyllophora crispa* and a diverse faunal community including *Sabella pavonina*, sponges and anemones. At another site in similar conditions a significant amount of *Lithothamnion glaciale* was found forming nodular growths on pebbles but cover was not sufficient to justify the allocation of a biotope defined by maerl.

The exposure to wave action and tidal currents has significant consequences for the biota of both rock and sedimentary habitats. In the case of the sediments this led to a general impoverishment of the fauna in some areas. This is particularly true of the west of the site where the mobile littoral and infralittoral sands contain a very sparse and low diversity fauna. Intertidal muddy sands in the south of the Sound were also found to be somewhat impoverished. This may be due to the high exposure levels of the general area and the limited extent and discontinuous distribution of this habitat. If periodic storm events modify the composition of these sheltered communities then recolonisation will be limited because potential sources of recruitment are not available nearby. Where levels of wave exposure are reduced the subtidal sediments tend to become increasingly muddy and often more heterogeneous, particularly where moderate tidal currents are present. The most diverse infaunal communities tend to occur in heterogeneous sediments subject to moderate tidal flow. Algae on the sediment surface is another important factor influencing diversity and is often associated with enhanced infaunal diversity.

The intertidal rocky shores of the Sound reflect the wide range of exposure levels ranging through barren sand-scoured rock, highly exposed barnacle dominated shores, variable mosaics of barnacles and fucoids to the *Ascophyllum* dominated shores that account for the bulk of the intertidal rock of the Sound. The infralittoral rock of the Sound is dominated by *Laminaria hyperborea* over the bulk of the area.

However, these kelp beds show great variation from the silty canopies of cape form *L. hyperborea* found in the sheltered basins in the south to the spectacularly diverse and variable kelp forests in tide swept channels. Circalittoral rock is limited in extent in the Sound and few biotopes were identified. The bulk of it occurs in the deep eastern entrance of the Sound. This silty environment is dominated by a diverse epifaunal community including hydroids, *Diazona*, *Caryophyllia*, *Swiftia* and axinellid sponges. The relevant biotope, **CR.HCR.Xfa.SwiLgAs**, is a characteristic biotope of circalittoral rock off the eastern coast of the Hebrides. The sheltered southern basins contain the remainder of the circalittoral rock. These include tide swept channels where the rock is dominated by a dense carpet of *Ciona*.

5.2 Comparison with neighbouring areas

In 2001 a broadscale mapping survey was conducted in the Sound of Barra some 80km further south in the Outer Hebrides island chain (Bates *et al.*, 2004a). The Sound of Barra and the Sound of Harris are broadly similar but with clear differences in the patterns of exposure levels and scour influence. To generalise, it seems that the western part of the Sound of Harris is more exposed than the equivalent area in the Sound of Barra while the eastern part of the Sound of Harris is less exposed than the equivalent area in the Sound of Barra. Additionally, the Sound of Harris appears to be influenced to a greater degree by tidal currents, contains a greater range of exposure conditions and has a greater extent of sheltered environments than the Sound of Barra. Biotopes recorded in the Sound of Barra were designated from the 1997 version of the biotope classification system (Connor *et al.*, 1997). Where these biotopes are referred to they are identified with '(97)' to distinguish them from the 2004 biotope classification system used elsewhere in this report.

The western parts of both sites have similar substrates of outcropping rock supporting scour influenced kelp communities alternating with areas of rippled mobile sand. In the Sound of Barra the sand supported a relatively diverse community designated as **IGS.Sell** (97). In the Sound of Harris, the corresponding areas of sand are more impoverished and were designated as **SS.SSA.IFiSa.IMoSa**. The **IGS.Sell** (97) biotope is partially synonomised with the **SS.SCS.ICS.MoeVen** biotope of the 2004 version of the biotope classification system. The greater infaunal diversity of the western part of the Sound of Barra is probably due to a greater degree of sediment stability linked to a coarser sediment composition and reduced levels of exposure relative to the corresponding area of the Sound of Harris.

The eastern parts of the Sound of Barra are characterised by coarse sediments (**CGS.Ven.Neo** (97) and **IGS.Phy.HEc** (97)) and areas of scoured rock (**MCR.Flu.HbyS** (97)). Comparable habitats were not recorded in the Sound of Harris and the corresponding areas were instead dominated by fine and muddy sands (**SS.SMU.CSaMu.AfilMysAnit**) and areas of silty rock (**CR.HCR.Xfa.SwiLgAs**). These differences indicate that the environment in the east of the Sound of Barra is more energetic than the corresponding area of the Sound of Harris due to reduced depth and greater exposure to wave action. The difference is most marked in the northern region of the Sound of Barra. In the southern region of the Sound of Barra there are a greater proportion of finer sediments designated as **CMS.AfilEcor** (97). This 1997 biotope is allied to the 2004 biotope **SS.SMU.CSaMu.AfilMysAnit** so the eastern part of the southern region of the Sound of Barra can be considered to be more comparable to the eastern part of the Sound of Harris.

The greater importance of tidal currents in the Sound of Harris is evident in the greater frequency of records of tide swept kelp communities (**IR.MIR.KR.LhypT**). However, strong current influences were noted in the Sound of Barra and many of the kelp communities were scour influenced. Comparable tide swept communities exist at both sites but in the Sound of Harris such communities account for a greater proportion of the area.

The Sound of Harris clearly includes a greater proportion of sheltered regions than found in the Sound of Barra survey area. The areas of shelter in the Sound of Barra are, as is the case in the Sound of Harris, concentrated in the southern part of the Sound. This is evident in the high proportion of seabed designated as **CMS.AfilEcor** (97) which in the more sheltered areas has a surface cover of algae (**IMX.LsacX** (97)). Corresponding areas of the Sound of Harris are shallower and characterised by infralittoral biotopes (eg **SS.SSA.IFiSa.TbAmPo** and **SS.SMU.ISaMu.AmpPlon**) which are also often influenced by algal cover of the sediment.

Very sheltered habitats were extremely restricted in the Sound of Barra but show similarities to the much more extensive corresponding areas in the Sound of Harris. In the Sound of Barra these areas supported *L. saccharina* canopies (**SIR.Lsac.Ft** (97)) on hard substrates, shallow sediments were covered by an algal mat (**IMX.Tra** (97)) and deeper sediments were muddy and dominated by *Arenicola* (**IMU.AreSyn** (97)). Corresponding biotopes are recorded in the sheltered southern basins of the Sound of Harris.

Beds of *Zostera* and maerl are notable in both the Sound of Harris and the Sound of Barra. The *Zostera* beds in the Sound of Harris are considerably more extensive and well developed than those in the Sound of Barra. Coverage of dense *Zostera* (excluding the bands of bare sand) is estimated at 280ha in the Sound of Harris and estimated at 75ha in the Sound of Barra. The development of the beds as alternating bands of dense *Zostera* and open sand is similar at both sites as is the composition of the associated biota. Determining the extent of maerl beds is necessarily less precise than is the case with *Zostera* but it appears that the Sound of Barra supports more extensive maerl than the Sound of Harris. In the Sound of Harris maerl beds were encountered at two moderately exposed locations and one sheltered location within the Sound. In the Sound of Barra extensive areas of the north-eastern region are characterised by abundant to superabundant maerl, the same is true to a lesser extent in the south-eastern region and several small maerl beds are present in the tidal channel lying between Eriskay and South Uist.

In the northern part of North Uist, adjacent to the Sound of Harris, there is a complex of sheltered lagoonal basins that comprise the Lochmaddy SAC and Loch an Duin SSSI. This area has been the subject of several studies over the years the most recent of which was a site condition monitoring survey conducted in 2004 (Moore *et al.*, 2006 (in press)). The environmental conditions found in the Lochmaddy system (extreme shelter, reduced salinity etc.) are rather different from those prevailing in the Sound of Harris so the usefulness of a direct comparison of the biota is limited.

Loch Yeor lies in the northern part of the Lochmaddy system and is within 200m of the most southern part of Loch Mhic Phail in the Sound of Harris. The majority of Loch Yeor is less than 1.5m deep with a substrate of soft mud and a limited tidal range. The red/orange form of *Ciona* is present but at much shallower locations than was the case in the Sound of Harris and not in sufficient abundance to define the biotope. *Tralliella* mats are a characteristic feature of Loch Yeor. This is reflected in some sheltered locations in the southern part of Loch Mhic Phail. At station SB61 there are extensive areas of *Tralliella* (**SS.SMP.KSwSS.Tra**)

while at SB59 there is also a significant amount of *Tralliella* but not sufficient to justify allocation of the *Tralliella* biotope. The chief difference between Loch Yeor and the Sound of Harris is in the presence in Loch Yeor of beds of *Zostera* and *Ruppia* which are a characteristic feature of the sheltered lagoons of the Lochmaddy system. The *Zostera* beds in the Sound of Harris are all situated in more exposed locations and are absent from the sheltered southern basins of the Sound.

Pre-existing survey data from within the Sound of Harris are rather limited in coverage (Marine Recorder data supplied by SNH). Several sites have been investigated at The Obbe, which is a sheltered and enclosed tidal basin near Leverburgh. The biota described are in broad agreement with the findings of this survey. Within The Obbe there is mud and muddy sand with *Arenicola* and mixed substrates with silty kelp dominated by *L.saccharina*. Anemones, *Sabella* and *Phyllophora crispa* were also noted. The tide swept channel that connects The Obbe to the main part of the Sound is reported to contain a number of sheltered, tide swept biotopes dominated by kelp or fucoids while shores are fucoid dominated, notably by *Ascophyllum*. These habitats are similar to those encountered by this survey in the more extensive but otherwise similar sheltered basins in the South of the Sound. The Obbe is the only feature of its sort on the northern shore of the Sound and is not representative of the general area.

Littoral surveys are reported from two nearby locations in the north of the Sound but the level of survey resolution is limited (shore zones not separated) and a comparison is not informative. One of these surveys was conducted in a gully on a small island off Leverburgh and another conducted on the Harris shore south-east of Leverburgh. Both shores were fucoid dominated and similar to other areas of localised shelter in this part of the Sound.

In terms of conservation importance the extensive and well developed *Zostera* beds are the most notable feature of the Sound. The highly diverse maerl sites are also of potential importance but appear to be less extensive than in the neighbouring area of the Sound of Barra. The other biotopes are collectively of interest by illustrating the range of hydrodynamic environments within the Sound but they are not of obvious conservation importance when viewed individually. This relationship of the biotope distribution within the Sound to patterns in the hydrodynamic environment is significant. Any developments (such as causeways, barriers or dredged channels) that alter the hydrodynamic regime have the potential to cause persistent changes in the distribution and extent of biotopes. Both *Zostera* and maerl beds are included in the biotopes that could be susceptible to change due to the effects of such developments. Other factors with the potential to alter *Zostera* beds might include increased boat traffic because the shallow depths of the *Zostera* beds brings them within range of turbulence or direct damage from boat propellers. Benthic fishing operations have potential to damage both maerl and *Zostera*. However, it is unlikely that fishing operations would be conducted in the shallow areas where *Zostera* beds occur. No benthic fishing was observed over the course of the survey and it is likely that the mosaic of boulder patches and bedrock outcrops on the seabed would prevent the effective use of benthic trawls and dredges.

5.3 Satellite survey

Spectral and broad band attenuation showed little variation in light penetration around the Sound of Harris. The shapes of the spectral attenuation curves obtained indicated that much of the attenuation of light is attributable to absorption by water itself with some scattering by particulate matter, and suggested that concentrations of phytoplankton and dissolved aquatic humus were low in this region at the time of measurement.

QuickBird satellite sensor imagery of extremely high quality was obtained for this project under the fairly strict conditions of low tidal state and cloud free conditions. This highlights the potential for fairly routine acquisition of such data over targeted areas of Scotland's coastline. The geocorrection undertaken by the data providers was found to be accurate to within one pixel of locations measured in the field using GPS which indicates that generally such data may not need further more accurate geocorrection.

Empirical line atmospheric correction was employed in this and was shown to give an acceptable result for correcting the dataset. Although this correction could be eliminated from the processing chain, it is recommended to retain it, particularly to allow a standardised comparison of different satellite datasets acquired over the same region of interest.

5.4 Acoustic Biological Maps

5.4.1 AGDS Biological Maps

The predictive maps of the biotopes within the area surveyed suggest a typical distribution of biotopes within the area. In the shallower areas with hard substrate, kelp park and forest biotopes occur and, as the substrate deepens and is influenced by sediment, biotope mosaic complexes are found. Deeper areas of hard substrate have a faunal turf associated with them and the majority of these areas are influenced by a muddy sand habitat. The tidal channels appear to contain sand based biotopes dominated by muddy sands throughout.

The biological maps produced from the AGDS data have a very high index of agreement with the independently collected ground truth data and this gives confidence in the data collected and the classification procedures used. To more confidently assess the accuracy of the map independently collected ground truth data not used within the classification could be used.

5.4.2 Swath bathymetry

The bathymetry of the area surveyed does suggest certain sediment or substrate types such as sand waves or rocky reefs. The kelp biotopes distribution predicted from the AGDS classification coincides with rocky areas identified from the swath bathymetry; likewise the areas with obvious sand waves (within the northern passage) coincide with sandy biotopes. The biological class 'mosaic of fauna on rock and muddy sand' occupies sedimentary areas interspersed with rocky outcrops. The occasional faunal turf on rock areas coincide well with the rocky areas suggested by the swath bathymetry.

5.4.3 Backscatter

The interpretation of backscatter data is subjective in that selection of identifiable features and their extent is based on visual interpretation. In addition to the subjective nature of the interpretation, the backscatter data shows no biological information for the seabed other than a possible habitat for biotopes to be matched to. For a biological map to be produced other factors must be introduced to the backscatter data to enable predictive modelling to be carried out.

When comparing the interpretations of the backscatter maps to the AGDS biological maps, there is a general concurrence but with some differences. As mentioned above, it is not possible to produce fully

interpretative biological/biotope maps from backscatter data whereas AGDS data can be interpreted in this manner. When comparing areas of classification, the backscatter data enable precise placement of the harder substrate boundaries as there is no interpolation between tracks, as is necessary with AGDS. Therefore the backscatter maps give a more accurate estimation of the coverage of harder substrate. Conversely, the backscatter data has poor discrimination of sediment features, especially if they are flat and show as featureless returns; the AGDS data can discriminate between sediment types as the returned echo is softened when the substrate contains a high silt fraction.

5.5 Integrated biotope classification

Purely spectral based classifications of the principal intertidal and subtidal areas showed moderatelly low accuracy and reliability. Furthermore they only allowed for the discrimination of a limited number (five) of broadscale classes.

This was significantly improved using a combined spectral and expert systems-based approach to classification which drew on differences in spectral reflectance, but combined it with rules based on known tolerances to exposure water depth and acoustic signature. Similar biotopes were also combined following as close as possible their hierarchical grouping on the logical basis that they were poorly distributed in the Sound or that their reflectances were spectrally similar. When this approach was adopted the overall classification achieved for the subtidal biotopes was increased by 27% from 48–75%. Furthermore, a much larger number of classes were discriminated reliably, ranging from individual biotopes to small hierarchical groupings of similar biotopes. In total, 11 different subtidal biotope classes were discriminated – a significant improvement to the original five broadscale classes originally distinguished. In the final integrated classification (Figure 4.3.2) a total of 19 intertidal and subtidal biotopes and biotope groupings were discriminated with an overall accuracy of 75% which is regarded as very high for this type of mapping work. All classes were classified to 50% accuracy or better. As a result of the rule based approach spatial reliability maps for the classifications could not be produced but detailed confusion matrices were instead reported.

The spatial resolution of the imagery limited the application of a rule based approach to improve the classification of the intertidal biotopes, on account of the narrowness of the intertidal zones found, combined with a convoluted shoreline morphology. However, it is argued that a similar approach based on rules of apparent exposure, substrate type and altitude (height of the shore) could be used given availability of data with sufficient spatial resolution.

Overall accuracy of the classification of intertidal biotope areas was 63%, lower compared to the classification of the subtidal regions. Spatial resolution was a factor restricting accuracy as some narrow intertidal regions were difficult to both train (ie to define training polygons) and classify, as were the similarities of certain classes (eg between fucoid classes).

Whether subtidal or intertidal, the classification produced is a hard classification which attempts to classify to a single, presumed dominating biotope class. As such, for training purposes a single biotope ID was attributed to each field site and similarly for the accuracy assessment only the dominant class was used with which to assess the classification. However, this process ignores the coexistence of biotope classes at the spatial scale that cannot be resolved by the resolution of the satellite imagery (<2.4m) or in the case where classes are vertically overlapping. Examples include the mosaic of kelp on rock and muddy sand

(two different biotopes attributed to this, one sand and one rocky), the coexistence of *Fucus* and *Ascophyllum*, and barnacle species and fucoids frequently encountered on the interidal shore. Additionally, on many occasions the biotope is not always attributed to the dominant substrate or dominant epifauna but to key biota found within it but which may have little influence on the spectral signature of the site. This limits classifications based on spectral signatures alone, and highlights the limitations of using biotopes as the mapping unit of broadscale mapping projects.

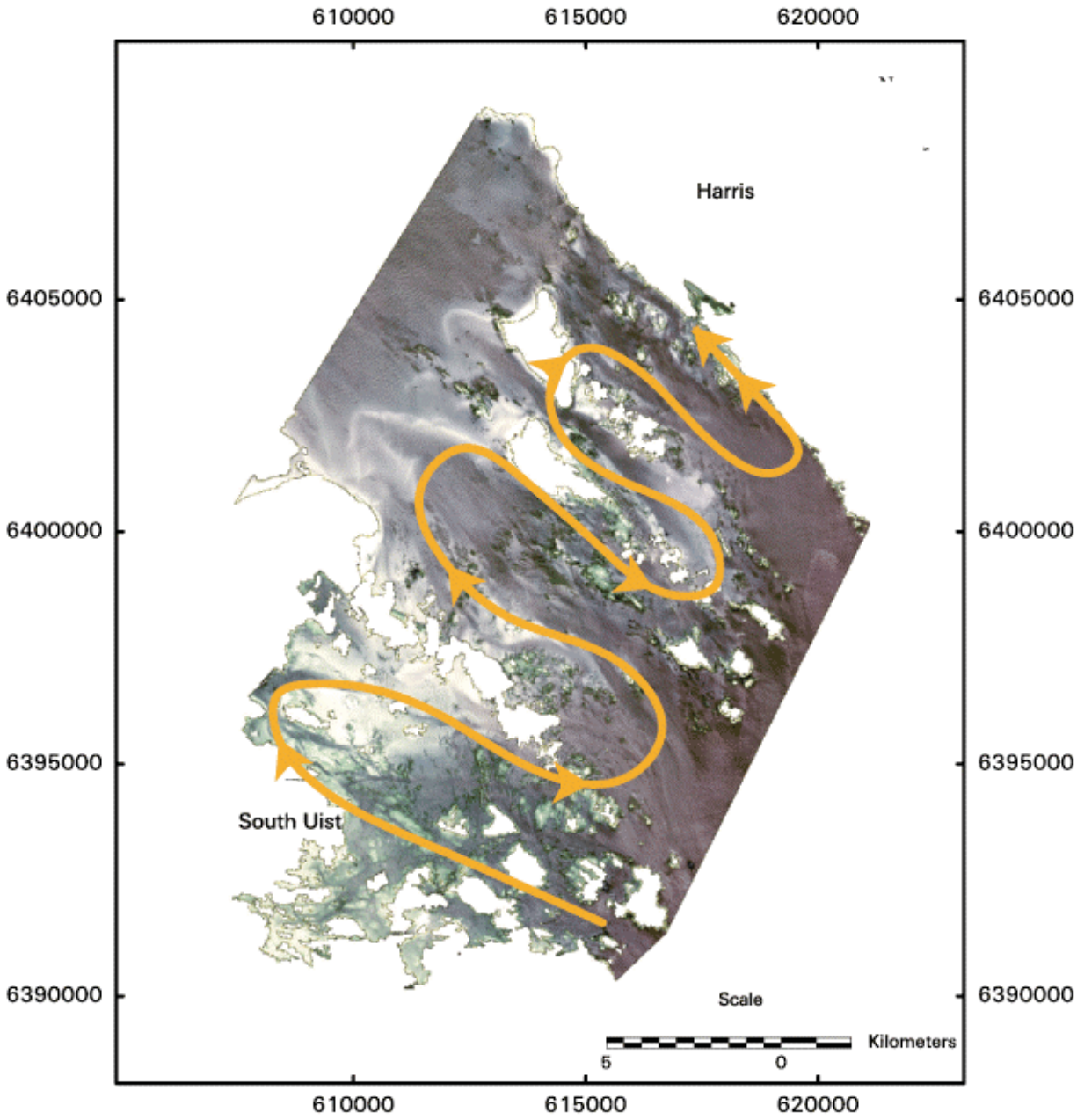
Penetration of light is severely limited by the water column and therefore the usefulness of optical datasets is limited to shallow areas. Measurements of the optical properties of the water column of the study area revealed the high transparency of the water column in that region which allowed moderate discrimination of the seabed habitats up to approximately 17m. The deeper regions of the study area were accurately classified using the acoustic dataset, and the integration of the two methods proved highly successful.

5.6 3-D Fly throughs

A range of 3D fly throughs have been produced as outputs for this project. These were produced using a three-dimensional visualization tool that allows the display of a digital elevation model overlaid with layers of raster imagery. The HO LiDAR dataset was used to provide the elevation layer. The raster images which were laid over the elevation layer were the atmospherically corrected Quick Bird image displayed as a true colour composition, and the detailed integrated biotope classification. One fly through was produced using each layer in turn.

The software provides a Flight Path Editor tool in order to establish the flight path parameters of the virtual aircraft, and the following parameters must be defined: X (northing), Y (easting), ASL (elevation above sea level), AGL (elevation above ground level), Look Azimuth (positive looking right), Look Pitch (null at the horizontal and negative looking down), FOV (field of view), Roll (positive clockwise) and Speed. The ASL was defined as 1500m and the FOV as 55 degrees to ensure coverage of the whole study area. The Look Pitch has been defined to range between –50 and –70 degrees with the aim of highlighting the relief. Finally, a flight path was defined to cover the most interesting areas of the Sound of Harris (Figure 5.6.1). To facilitate the location of the viewed target in the study area a geographically linked view has been created showing the flight path, aircraft and target position, and the field of view.

Figure 5.6.1 Flight path taken during fly throughs that were produced as part of the project



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Appendix A Details of the ground survey

Table 7.1.1 Details of ground truth survey stations surveyed by diving or snorkelling

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB1	IR.HIR.Ksed.XKScrR SS.SCS.ICS.MoeVen	Mosaic of boulders (50% cover) and small (~5X5m) patches of rippled sand (50% cover) with occasional pebbles	*L. hyperborea* forest and patches of scour tolerant kelp. Kelp stipes with dense epibiota	8.0	09/08/05	613495	6398866
SB2	IR.HIR.Ksed.XKScrR SS.SCS.ICS.MoeVen	Mixed ground with mosaic of boulders, cobbles, pebbles and medium to coarse sand. Strong current	Scour tolerant kelps on boulders and larger cobbles; ephemeral algae (inc. *Ulva* and *Polyides*) on sand areas	4.9	09/08/05	613038	6399139
SB3	SS.SMP.SSgr.Zmar	Medium sand with some shell fragments (5–10% shell)	Alternating bands of dense *Zostera* and open sand	0.0	10/08/05	615016	6402782
SB4	SS.SSA.IFiSa.NcirBat IR.HIR.Ksed.XKScrR	Fine to medium sand with ripples and sand waves over most (~90%) of area – occasional small patches (~4mX4m) with medium to large boulders (~10% of area)	No visible surface fauna, scour tolerant kelp on boulders. Sample with polychaetes and amphipods	0.7	10/08/05	614567	6402154
SB5	SS.SMP.SSgr.Zmar	Fine unrippled sand	Alternating bands of dense *Zostera* and open sand with Amphipod tubes and patchy cover 5–10% of mixed ephemeral algae	1.8	10/08/05	615548	6401354
SB6	IR.LIR.K.Lsac.Gz SS.SCS.ICS.MoeVen	Mosaic of boulders and occasional patches of coarse sand	*L. saccharina* on boulders with *Echinus* common, *Saccorhiza* present	3.5	10/08/05	615822	6400701
SB7	IR.HIR.Ksed.XKScrR	Mosaic of boulders and sparse patches of coarse sand	Slightly silty kelp forest with *L. hyperborea*, *Saccorhiza*, *L. saccharina* and *Echinus*	4.9	10/08/05	617446	6401474
SB8	SS.SMP.SSgr.Zmar	Medium sand with shell fragments	Alternating bands of dense *Zostera* and sand with *Ensis*	2.6	10/08/05	617384	6400253
SB9	SS.SCS.ICS.MoeVen SS.SMP.SSgr.Zmar	Medium rippled sand bank with some shell fragments	Patchy *Zostera* and sand with *Arenicola*	1.2	10/08/05	617689	6400869
SB10	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible surface fauna	1.5	11/08/05	612339	6402010
SB11	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible surface fauna	6.0	11/08/05	611859	6402830
SB12	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Bedrock ledges with sand on rock surfaces, sand patches and gullies with sand and boulders	*L.hyperborea* with heavily fouled stipes, *Desmarestia*, *Alaria* and *Furcellaria*	5.1	11/08/05	611356	6403516
SB13	SS.SSA.IFiSa.IMoSa	Medium to coarse mega rippled sand (amplitude 15–20cm)	No visible surface fauna (except sandeels)	3.6	11/08/05	612101	6404705
SB14	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Wave surged bedrock ridges, ~1m high with sand in gullies	*L.hyperborea* with heavily fouled stipes and *Obelia geniculata* on fronds, *Desmarestia* and *Alaria*. High cover of encrusting sponges and didemnid ascidians on rock	4.2	11/08/05	612239	6404124

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB15	SS.SSA.IFiSa.IMoSa	Clean medium to coarse mega rippled sand (amplitude ~30cm)	No visible surface fauna	7.0	11/08/05	612679	6404245
SB16	SS.SSA.IFiSa.IMoSa	Clean sand	No visible surface fauna other than single individuals of *Lunatia* and *Buccinum*	3.8	11/08/05	612250	6403422
SB17	IR.MIR.KR.LhypT.Ft SS.SSA.IFiSa.IMoSa	Mosaic bedrock outcrops and coarse sand (undulating topography)	Dense *L. hyperborea* forest; Odonthalia on rock, dense epibiota (50–80% ascidians and bryozoans) on stipes and *Obelia geniculata* on fronds	6.1	11/08/05	612715	6403292
SB18	IR.MIR.KR.LhypTX.Pk	Pebbles with coarse sand infill and scattered boulders and cobbles. Strong current	*L. hyperborea* park (with forest on neighbouring rock area). Heavy fouling of stipes with *Halichondria*. *Pomatoceros* and *Balanus* on pebbles	11.5	11/08/05	613650	6403337
SB19	SS.SSA.IFiSa.IMoSa	Clean rippled fine sand	No visible surface fauna	0.6	11/08/05	613259	6402361
SB20	SS.SCS.ICS.MoeVen	Plain of medium sand with 10–20% shell fragments	Ensis and ephemeral algae	2.1	12/08/05	612321	6396849
SB21	SS.SMP.SSgr.Zmar	Medium sand with 10–20% shell fragments	Alternating bands of dense *Zostera* and bare sand	1.4	12/08/05	611956	6396519
SB22	IR.MIR.KR.Lhyp.Ft	Irregular bedrock	*L. hyperborea* forest with dense epibiota on stipes and *Obelia geniculata* on fronds. Rock surfaces fairly bare apart from coralline crusts	0.4	12/08/05	611673	6396170
SB23	SS.SCS.ICS.MoeVen	Plain of medium sand with ~1% shell fragments	*Ensis*, *Cerianthus* and ephemeral algae	1.6	12/08/05	611416	6396168
SB24	SS.SCS.ICS.MoeVen	Rippled medium sand with many shell fragments	Lanice present. Isolated small rock with *Furcellaria*	1.1	12/08/05	611423	6397059
SB25	SS.SMP.SSgr.Zmar	Fine sand	Alternating bands of dense *Zostera* and bare sand	0.9	12/08/05	610849	6397055
SB26	SS.SSA.IFiSa.TbAmPo IR.LIR.K.Lsac.Pk	Variable mosaic bedrock/ boulder outcrops (~50%) and fine slightly silty sand (~50%)	Patchy *L. saccharina* with *Chorda*, *Halidrys*. Sediment with *Ensis*	1.4	12/08/05	610120	6397707
SB27	SS.SSA.IFiSa.TbAmPo IR.LIR.K.Lsac.Pk	Mosaic of bedrock and boulder ridges and muddy fine sand	*Halidrys* and *L. saccharina* on rock, *Arenicola* and *Sabella* on sediment	2.7	12/08/05	609728	6398348
SB28	SS.SSA.IFiSa.TbAmPo IR.LIR.K.Lsac.Pk	Fine muddy sand with boulder/bedrock outcrop to south	*Arenicola* and drift algae on sediment. Rock with sparse *L. saccharina*, some *Halidrys* and *Chorda*	1.3	12/08/05	609027	6397664
SB29	SS.SMP.SSgr.Zmar	Fine sand	Alternating bands of dense *Zostera* and *Arenicola* sand	0.0	12/08/05	608821	6397271
SB30	SS.SMP.SSgr.Zmar	Plain of fine/medium unrippled sand	Irregular alternating bands of dense *Zostera* and sand	0.1	12/08/05	609489	6397105

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB31	SS.SSA.IFiSa.TbAmPo	Medium sand with hummocks and 1–5% shell fragments	*Amphiura* and *Ensis*	2.7	13/08/05	612800	6395685
SB32	SS.SMP.SSgr.Zmar IR.MIR.KR.Lhyp.Ft	Mosaic bedrock/boulder outcrops and medium sand with 1–5% shell fragments	*Zostera* on sand, *L. hyperborea* forest on rock	3.8	13/08/05	612447	6395493
SB33	SS.SSA.IFiSa.TbAmPo	Fine sand with slight hummocks	*Amphiura* and *Ensis*	2.7	13/08/05	611765	6395313
SB34	SS.SSA.IFiSa.TbAmPo	Fine sand with slight hummocks	*Amphiura* and *Ensis*	2.1	13/08/05	611316	6395330
SB35	SS.SMU.ISaMu.AmpPlon IR.LIR.K.LhypCape	Mosaic of silty bedrock/ boulder ridges and silty fine sand with hummocks	Sediment with *Ampelisca* tubes. Rock with mixed *L. hyperborea* and *Halidrys*	2.3	13/08/05	610636	6394459
SB36	IR.LIR.K.LhypLsac.Ft SS.SSA.IFiSa.TbAmPo	Bedrock/boulder outcrops and restricted patches of medium to fine sand	Rock with mixed *L. hyperborea* and *L. saccharina*. Sand with *Arenicola*	0.9	13/08/05	611118	6394539
SB37	IR.LIR.K.LhypLsac.Ft SS.SSA.IFiSa.TbAmPo	Bedrock/boulder outcrops and restricted patches of sand	Rock with mixed *L. hyperborea* and *L. saccharina*. Sand with *Arenicola*	2.8	13/08/05	611755	6394993
SB38	SS.SMU.ISaMu.AmpPlon	Muddy sand	*Amphiura*, *Arenicola* and algal turf	7.5	13/08/05	612020	6394629
SB39	SS.SMU.ISaMu.AmpPlon IR.LIR.K.Lsac.Gz	Sandy mud with boulder and bedrock outcrops	*Amphiura* and *Ampelisca* tubes in sediment. *L. saccharina* on rock	4.4	13/08/05	611590	6394383
SB40	IR.LIR.K.Lsac.Gz	Silty cobbles, boulders and bedrock	*L. saccharina* forest	1.7	13/08/05	611584	6393925
SB41	SS.SMP.SSgr.Zmar	Medium sand with ~1–5% shell fragments. Slight current	Alternating bands of dense *Zostera* and sand.	1.3	15/08/05	610632	6399143
SB42	SS.SSA.IFiSa.IMoSa	Medium sand, slight hummocks and ripples, shell debris <1%, very sparse fragments of dead maerl. Slight current	Sparse *Zostera*, *Lanice* and *Arenicola*	2.6	15/08/05	611354	6398307
SB43	IR.MIR.KR.LhypT.Ft	Bedrock with a few patches of coarse sand and pebbles. Strong current	*L. hyperborea* forest – stipes with dense epibiota, rock with encrusting sponges	–0.4	15/08/05	612122	6398206
SB44	SS.SMP.SSgr.Zmar	Medium to coarse sand with no rippling or hummocks, shell debris 10–20%	Alternating bands of dense *Zostera* and sand.	1.9	15/08/05	612939	6398444
SB45	IR.HIR.Ksed.XKScrR	Bedrock slabs (90%) and patches of sand (10%); almost total cover of drift weed (algae and *Zostera*) on sand patches	*L. hyperborea* forest – stipes with dense epibiota	1.2	15/08/05	613033	6398148
SB46	SS.SMP.SSgr.Zmar	Coarse sand plain (with shell debris)	Alternating bands of dense *Zostera* and sand	1.4	15/08/05	612743	6397527

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB47	SS.SCS.ICS.MoeVen	Coarse sand plain (with some shell debris and crab digging pits)	Lanice present	1.9	15/08/05	613400	6397705
SB48	SS.SMP.SSgr.Zmar	Medium sand and extensive *Zostera* beds	Alternating bands of dense *Zostera* and sand	1.4	15/08/05	613956	6397884
SB49	SS.SMP.SSgr.Zmar	Medium sand	*Zostera* (~80% cover but patchy) and sand	3.4	15/08/05	614094	6396809
SB50	SS.SSA.IFiSa.TbAmPo	Fine muddy sand; some drift algae	Sparse Zostera, *Amphiura* and Arenicola	3.1	15/08/05	613775	6396707
SB51	IR.HIR.Ksed.LsacSac	Boulders on coarse muddy shell sand	Mixed kelps	2.0	15/08/05	613659	6396364
SB52	IR.HIR.Ksed.XKScrR	Bedrock with a light coating of sand. Moderate current	Mixed kelps on scoured bedrock.	1.9	16/08/05	614208	6398593
SB53	IR.HIR.Ksed.XKScrR	Mixed substrate of boulders, cobbles, pebbles and coarse sand. Moderate current	Dense cover of mixed kelps	2.1	16/08/05	614402	6398984
SB54	SS.SCS.ICS.MoeVen SS.SMP.Mrl.Pcal	Medium to coarse shell sand with mega ripples (3–4m wavelength, 30–40cm amplitude)	Sparse maerl and no visible epibiota. Well developed maerl bed ~10m south	5.3	16/08/05	614548	6399245
SB55	SS.SCS.ICS.MoeVen IR.HIR.Ksed.XKScrR	Mixed boulders (50%) and fine clean sand (50%)	Dense *L. hyperborea*, *L. saccharina* and *Saccorhiza* on boulders. Sand with *Arenicola*	7.2	16/08/05	614877	6399514
SB56	IR.HIR.Ksed.XKScrR	Bedrock (95%) with patches of coarse sand (5%)	Mixed kelp forest with large patches of Ulva, sparse foliose reds on rock	–1.2	16/08/05	614324	6399797
SB57	SS.SMU.ISaMu.AmpPlon	Sandy mud; homogenous over fairly wide area	*Amphiura* and *Ampelisca* tubes	3.5	17/08/05	611958	6393283
SB58	CR.LCR.BrAs.AmenCio SS.SMP.Mrl.Pcal	Large boulders (~30% of area) with surrounding area of soft sandy mud. Moderate current	Boulders with dense cover of Ciona. Sediment with maerl bed and *Phyllophora crispa*	8.1	17/08/05	610258	6393918
SB59	SS.SMU.IFiMu.Are	Flat muddy sediment	Filamentous algal mats (inc. *Trailliella*) and *Anemonia*	0.5	17/08/05	609597	6392502
SB60	IR.MIR.KT.XKTX	Uneven silty bedrock and boulders with small areas of overlying sand	Patchy *L. hyperborea* forest with encrusting sponges and nodular *Lithothamnium glaciale* on pebbles	0.2	17/08/05	609754	6392024
SB61	SS.SMP.KSwSS.Tra	Soft, silty fine sand/mud with covering of red algal turf	*Trailliella* mat and *Anemonia*	–0.2	17/08/05	609382	6391828
SB62	SS.SMU.ISaMu.AmpPlon CR.LCR.BrAs.AmenCio	Gully of soft silty sand with boulders, 2 gentle gradients of bedrock to either side. Bedrock 40%, sand 60%	Rock with sparse *Phyllophora* sp., *Ophiocomina* and *Polymastia*. Sand with *Arenicola* and numerous *Sabella*	5.7	17/08/05	609351	6391677

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB63	SS.SCS.ICS.MoeVen	Clean fine sand with large ripples	*Lanice* present	3.5	18/08/05	615541	6403601
SB64	IR.MIR.KR.LhypT.Ft (58) SS.SCS.ICS.MoeVen	Fine sand and shell debris (75%) with bedrock outcrops (25%)	Rock with *L. hyperborea* forest	7.9	18/08/05	615423	6403889
SB65	SS.SMP.SSgr.Zmar	Fine unrippled sand	Alternating bands of dense *Zostera* (50%) and sand (50%)	0.9	18/08/05	614755	6403812
SB66	IR.MIR.KR.LhypT.Ft	Bedrock	Dense *L. hyperborea* forest	?	18/08/05	615056	6404445
SB67	IR.HIR.Ksed.XKScrR	Gravel and stones on medium sand with boulders	Mixed kelps	7.6	18/08/05	614574	6404878
SB68	SS.SMP.SSgr.Zmar	Fine sand	Patches of dense *Zostera* on sand	1.7	18/08/05	616019	6405527
SB69	IR.LIR.K.Lsac.Pk SS.SCS.ICS.MoeVen	Bedrock outcrop with coarse sand to one side and medium sand on the other, some shell debris on sand	Sparse fauna on sand. Sparse foliose reds and *L. saccharina* on rock.	12.5	18/08/05	616545	6404636
SB70	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Bedrock and boulders with limited patches of coarse sand and pebbles. Strong current	Mixed kelps	2.3	19/08/05	612225	6399313
SB71	SS.SSA.IFiSa.IMoSa IR.MIR.KR.LhypTX	Coarse sand (60%) with stones and outcrops of boulders and bedrock (40%)	Mixed kelps	5.8	19/08/05	611628	6399527
SB72	IR.HIR.Ksed.XKScrR SS.SCS.ICS.MoeVen	Bedrock/boulder outcrops with some sand patches. Strong current	Mixed kelps	4.5	19/08/05	613984	6399427
SB73	SS.SSA.IFiSa.TbAmPo	Fine muddy sand	*Arenicola* and some patches of algae	?	19/08/05	615056	6400083
SB74	SS.SCS.ICS.MoeVen	Very coarse sand with shell debris	Lanice and small patches of maerl	3.6	19/08/05	615441	6399486
SB75	SS.SSA.IFiSa.TbAmPo	Soft silty muddy sand	*Arenicola* present	4.4	19/08/05	615796	6398931
SB76	SS.SMU.CSaMu.VirOphPmax.HAs	Clean fine sand with 10–20% shell debris. Slight current	Hydroids on pebbles and shell fragments. Sparse *Virgularia* and *Arenicola*	17.4	19/08/05	616235	6399252
SB77	IR.HIR.Ksed.XKScrR	Bedrock reefs surrounding a patch (5mX5m) of coarse shell gravel covered by drift algae	Silty forest of mixed kelp	3.0	19/08/05	616409	6398518
SB78	IR.HIR.Ksed.XKScrR	Bedrock slope above a plain of medium sand	Dense mixed kelp	4.3	19/08/05	615971	6398099
SB79	SS.SSA.IMuSa.ArelSa	Hummocked fine sand, drift *Zostera* 1–5%, shell fragments <1%. Slight current	*Arenicola* and *Lanice*	3.9	20/08/05	609745	6396614
SB80	SS.SSA.IFiSa.TbAmPo CR.LCR.BrAs.AmenCio	Silty hummocked fine sand (80%) with bedrock/large boulder outcrops (20%). Slight current	Sand with diatom film and *Arenicola*; rock with *Echinus* and with abundant ascidians on vertical faces	6.7	20/08/05	608714	6396883

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SB81	SS.SSA.IMuSa.ArelSa	Hummocked fine sand with extensive areas of drift algae, shell fragments 1–5%	Sand with diatom film, *Arenicola* and *Lanice*.	2.4	20/08/05	608989	6396549
SB82	SS.SSA.IMuSa.ArelSa	Fine, slightly silty hummocked sand, shell fragments <1%, drift algae <1%	Sand with diatom film, *Arenicola* and *Lanice*	5.2	20/08/05	608298	6396048
SB83	SS.SSA.IMuSa.ArelSa	Fine silty sand	*Arenicola*, *Sabella* and *Ascidiella aspersa* on sediment	4.1	20/08/05	609007	6395041
SB84	SS.SMX.IMx.SpavSpAn	Fine silty sand	Dense *Sabella*	2.4	20/08/05	608773	6395599
SB85	SS.SMX.IMx.SpavSpAn	Fine hummocked sand	Extensive areas of drift fucoids. Numerous *Sabella*, *Arenicola* and *Lanice*	1.5	20/08/05	609420	6395453
SB86	SS.SMX.IMx.SpavSpAn	Medium fine sand	*Sabella*, *Arenicola* and *Lanice*	0.3	20/08/05	608132	6395687
SB87	SS.SSA.IMuSa.ArelSa	Flat, fine sand	Green filamentous algal mat with *Anemonia*	0.9	20/08/05	607895	6395857
SB88	SS.SSA.IFiSa.TbAmPo	Fine muddy sand with shell debris (<1%)	*Arenicola*	0.3	20/08/05	610372	6394909
SB89	IR.LIR.K.LhypCape SS.SMX.IMx.SpavSpAn	Boulders and bedrock ledges with a covering of mud/silt, muddy gullies separate the outcrops	*Halidrys* on rock. *Sabella* and *Arenicola* on sediment	0.4	20/08/05	610303	6393438
SB90	SS.SMU.ISaMu.AmpPlon IR.LIR.K.LhypLsac.Ft	Gradual slope of bedrock outcrops/very large boulders (30%) and areas of mixed substrates of cobbles and pebbles on mud (70%)	Mixed silty kelp park on rock. *Trailliella* and *Ampelisca* on sediment	2.4	21/08/05	611897	6391930
SB91	SS.SMU.IFiMu.Are	Soft mud	Filamentous green algal mat, burrowing holothurians and anemones	0.4	21/08/05	611207	6391020
SB92	SS.SMU.IFiMu.Are	Soft mud	Filamentous green algal mat, burrowing holothurians and anemones	1.0	21/08/05	611700	6390870
SB93	SS.SMU.IFiMu.Are SS.SMU.IFiMu	Soft mud	Patches of relatively bare mud (30%) with diatomaceous film are mosaiced with areas covered by an algal mat (70%) of *Furcellaria/ Polyides*	2.5	21/08/05	612333	6391218
SB94	CR.LCR.BrAs.AmenCio SS.SMU.CFiMu	Slope of large silty boulders (30–40%) with areas of soft mud (60–70%)	Silty rock with sparse fauna of hydroids, encrusting sponges and ascidians	14.1	21/08/05	612581	6391691
SB95	IR.LIR.K.Lsac.Ft	Silty bedrock and boulders	*L. saccharina* and *Halidrys Ascophyllum* above the waterline	0.5	21/08/05	612888	6391474

Table 7.1.1 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	UTM (E)	UTM (N)
SA74	SS.SMX.IMx.SpavSpAn	Slightly muddy sand	*Sabella*, *Lanice*, anemones and ephemeral algae	1.4	17/08/05	609634	6394683
SA75	SS.SMU.IFiMu.Are	Level mud plain	*Arenicola*, anemones and patches of *Beggiotoa*	4.5	17/08/05	610468	6392563
SA76	IR.LIR.K.LhypCape SS.SMP.KSwSS.Pcri	Bedrock and large boulders with mud pockets between, situated on a steep slope	Mixed kelp forest with an understory of *Phyllophora crispa*, ophioroids and anemones common; kelp stipes with rich epibiontic cover, especially red algae, crisiid bryozoans and sponges (*Esperiopsis* and *Halichondria panicea*)	3.2	17/08/05	609239	6392702
SA77	CR.LCR.BrAs.AmenCio SS.SMU.ISaMu.AmpPlon	Large (0.5–3m) boulders (50%) and soft mud (50%)	Dense *Ciona* on boulders; mud with sparse epifauna	5.9	17/08/05	610796	6392741

Table 7.1.2 Details of ground truth survey stations surveyed by drop down video

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA3	SS.SSA.IMuSa.FfabMag	Sand, fine/medium, rippled, ~5% shell debris	Nothing seen, ~5% drift algae	23.4	9/8/05	615595E 6396813N	615594E 6396824N
SA4	SS.SCS.ICS.MoeVen IR.LIR.K.LhypLsac.Pk	Poorly sorted medium-coarse sand, slight rippling, pebbles 5–10%, outcrops of boulders/bedrock. Moving onto fine/medium rippled/hummocked sand with fewer pebbles	Sparse tufts of hydroids and algae (inc.*Scinaia turgida*) on pebbles. Rock with sparse *L. saccharina* and *L. hyperborea*, also *Ascidia mentula*, *MarthAsterias* and *Echinus*. Sand plain with *Amphiura*	18.1–15.9	9/8/05	616507E 6396839N	616531E 6396853N
SA5	IR.LIR.K.LhypLsac.Pk SS.SCS.ICS.MoeVen	Bedrock with a dusting of sand. Patches of fine/medium sand. Current	*L. hyperborea* O–F, foliose red algae F, *Echinus* F–C, *Balanus* R, *Suberites*, encrusting sponge, *L. saccharina*, *Alcyonium*. Diatom film on sand patches	17.4–13.9	9/8/05	616074E 6397309N	616093E 6397295N
SA6	SS.SCS.ICS.MoeVen	Medium sand with ripples and megaripples. Strong current	Very sparse tufts of algae including *Desmarestia*	11.7–12.3	9/8/05	615251E 6397618N	615346E 6397556N
SA7	SS.SMP.KSwSS.LsacR.Sa SS.SCS.ICS.MoeVen	Sand with slight ripples. Patches of rock/pebbles. Strong current	Sand with occasional small burrows, *Arenicola* present Patches of *L. saccharina* (30–40% of area C), *Desmarestia* amongst *L. saccharina*, *Plocamium* and *Ulva*	9.8–10.4	9/8/05	615172E 6398297N	615207E 6398250N
SA8	SS.SSA.IMuSa.FfabMag	Medium/fine sand with slight rippling and occasional pebbles	*Carcinus* and Sand gobies	18.6–18.5	9/8/05	617203E 6398157N	617240E 6398156N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA9	SS.SMU.CSaMu.AfilMysAnit	Poorly sorted sand with slight rippling, some pebbles and shell debris	Filiform algae 1–5% O, *Liocarcinus* sp	13.1–10.2	9/8/05	617979E 6397595N	618024E 6397587N
SA10	IR.MIR.KR.LhypTX.Pk	Cobbles, pebbles and boulders	*L. hyperborea* C, *Corallinacea* A, *Echinus* F, hydroids, foliose red algae, *Desmarestia*	13.8–12.5	10/8/05	614502E 6402487N	614488E 6402455N
SA11	IR.MIR.KR.LhypT.Ft SS.SCS.ICS.MoeVen	Bedrock/boulders with sand patches	*L. hyperborea* A (loc C), *Desmarestia* R, *Echinus*, *Nemertesia antennina*, *Pomatoschistus* sp. Kelp stipes with *Phycodrys*, fronds with *Obelia geniculata*, *Membranipora* and *Calliostoma*	13.5–11	10/8/05	615872E 6401505N	615885E 6401483N
SA12	SS.SCS.ICS.MoeVen	Medium sand, well sorted, clean, ripples and megaripples	No visible fauna, slight diatom film in troughs of megaripples	2.4–2.4	10/8/05	616843E 6400857N	616860E 6400845N
SA13	SS.SCS.ICS.MoeVen	Medium sand, ripples and megaripples, shell debris 1–5%	Diatom film on ripple slopes. *L. saccharina*, filiform algae, *Ulva* (all drift?)	7.2–7.9	10/8/05	616922E 6400052N	616934E 6400030N
SA14	SS.SCS.ICS.MoeVen	Medium sand, poorly sorted with scattered shell debris and pebbles	Filiform algae (inc *Furcellaria/Polyides*) O (1–5%), *Nemertesia ramosa* (on pebbles), *Lanice*, *Liocarcinus* depurator	15.7–15.2	10/8/05	618013E 6399359N	618030E 6399336N
SA15	IR.HIR.Ksed.XKScrR	Rock	*Saccorhiza* A (dominant), *L. hyperborea*, *L. saccharina*. *Echinus*, *Ulva*. *L. hyperborea* stipes with foliose reds, fronds with *Obelia geniculata* and *Membranipora*. *Saccorhiza* with *Crisids* and Spirobids	5–5.6	10/8/05	618649E 6399077N	618656E 6399066N
SA16	SS.SCS.ICS.MoeVen	Medium sand with slight rippling	*Arenicola* hummocks F, diatom film	18.4–18.3	10/8/05	618947E 6398804N	618950E 6398785N
SA17	SS.SMU.CSaMu.AfilMysAnit CR.HCR.Xfa.SwiLgAs	Slightly muddy sand with hummocked uneven surface, pebbles and shell debris. Patches of cobbles and small boulders	Rock with hydroids (inc *Nemertesia antennina* and *Abietinaria*), *Alcyonidium diaphanum*, *Swiftia*, *Caryophyllia*	41.3–45.4	10/8/05	619644E 6397605N	619667E 6397535N
SA18	SS.SMU.CSaMu.AfilMysAnit CR.HCR.Xfa.SwiLgAs	Slightly muddy sand with hummocks. Patches of medium and small boulders	Rock with hydroid turf S (70–80%), *Alcyonidium diaphanum*, *Echinus*, *Munida*, *Swiftia* and *Caryophyllia*	45.7–49.5	10/8/05	619284E 6397084N	619305E 6396965N
SA19	CR.HCR.Xfa.SwiLgAs	Rock with silt cover	Hydroid turf A (30–40%), *Swiftia* C, axinellid sponges, *Alcyonidium diaphanum*, *Ascidia mentula*	29.3–17.7	10/8/05	618950E 6396602N	618952E 6396545N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA20	SS.SMU.CSaMu.AfilMysAnit	Slightly muddy sand, shell debris 1–5%	*Turritella* C, *Cerianthus*, *Cancer*, *Liocarcinus depurator*	40.9–32.9	10/8/05	618300E 6397909N	618362E 6397862N
SA21	SS.SSA.IFiSa.IMoSa	Medium sand, clean, well sorted, rippled	*Lanice* present	8.7–8.6	11/8/05	610586E 6403049N	610611E 6403043N
SA22	SS.SSA.IFiSa.IMoSa	Medium sand, well sorted, rippled	No visible fauna.	11.8–11.5	11/8/05	609632E 6403924N	609652E 6403915N
SA23	IR.MIR.KR.LhypT.Ft	Rock	*L. hyperborea* A, *Desmarestia* O, *Odonthalia* O. Kelp stipes with foliose red algae and *Ascidiella scabra*, fronds with *Obelia geniculata* and *Membranipora*	9.1–6.6	11/8/05	610746E 6404003N	610768E 6403977N
SA24	SS.SSA.IFiSa.IMoSa IR.HIR.KSed.ProtAhn	Patches (70–80% cover) of rounded cobbles and small boulders on sand. Areas of medium sand, clean, rippled	Sparse life. Boulders – *Alcyonidium diaphanum* and foliose algae. Sand – no visible fauna except *Liocarcinus depurator*	15.7–15.4	11/8/05	610280E 6404924N	610316E 6404884N
SA25	IR.MIR.KR.LhypT.Ft	Boulders/bedrock	*L. hyperborea* A, *Desmarestia* and *Echinus*. Kelp stipes with foliose red algae and *Alcyonidium diaphanum*, fronds with *Obelia geniculata* and *Membranipora*	8.6–9.5	11/8/05	610915E 6405645N	610923E 6405621N
SA26	IR.MIR.KR.LhypT.Ft	Rock (with limited sand patches)	*L. hyperborea* A (loc C), *Desmarestia*, foliose red algae O (1–5%). Kelp stipes with foliose red algae, *Halichondria* and *Alcyonidium diaphanum*, fronds with *Obelia geniculata* and *Membranipora*	9.5–8.7	11/8/05	612156E 6405542N	612163E 6405532N
SA27	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Boulder patches with areas of clean sand. Wave surge	*L. hyperborea* A (loc C), *Alaria*. Kelp stipes with foliose red algae, fronds with *Obelia geniculata* and *Membranipora*	12.8–12.4	11/8/05	611959E 6406624N	611969E 6406606N
SA28	SS.SSA.IFiSa.IMoSa	Medium/fine sand, clean, well sorted, rippled	Slight diatom film	7.5–7.5	11/8/05	613401E 6405032N	613415E 6405020N
SA29	SS.SSA.IFiSa.IMoSa	Medium sand, clean, well sorted, rippled	No visible fauna	8.7–8.7	11/8/05	613363E 6407293N	613387E 6407275N
SA30	SS.SSA.IFiSa.IMoSa	Medium sand, rippled. Boulder/bedrock outcrops	Slight diatom film	7.2–7.6	11/8/05	612317E 6407245N	612361E 6407198N
SA31	SS.SSA.IFiSa.TbAmPo	Slightly silty, poorly sorted medium sand, slight rippling	Filiform algae O (1–5%), Sand gobies, *Chorda*, *Ulva*, *Amphiura*	4.3–4.4	12/8/05	612059E 6395846N	612060E 6395839N
SA32	SS.SSA.IFiSa.TbAmPo	Medium sand, poorly sorted with slight hummocks and some shell debris	Filiform algae O (1–5%), *Chorda*, *Ulva*, *Amphiura*, *Carcinus*, *L. saccharina*	4.4–4.3	12/8/05	612847E 6395963N	612849E 6395952N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA33	SS.SMU.CSaMu.AfilMysAnit	Poorly sorted sand with scattered pebbles (1–10%)	Filiform algae R (~1%), *Amphiura*, hydroids, *Asterias*. *Pomatoceros* on some pebbles	18.9–18.5	12/8/05	614956E 6395761N	614991E 6395745N
SA34	SS.SMU.CSaMu.AfilMysAnit	Slightly muddy sand with hummocks. Patches of medium and small boulders	None recorded	54.5–52.6	12/8/05	618285E 6395539N	618301E 6395579N
SA35	SS.SMU.CSaMu.AfilMysAnit	Muddy sand	None recorded	42.7–42.4	12/8/05	617439E 6395069N	617485E 6395070N
SA36	CR.HCR.Xfa.SwiLgAs	Boulders/bedrock outcrops with coating of muddy sediment	*Swiftia*, axinellid sponges, *Diazona*, hydroids/ *Tubularia* stumps, *Porella*, *Caryophyllia*, A. *mentula*, *Protanthea*, *Nemertesia*	57.7–75.1	12/8/05	617825E 6394254N	617926E 6394238N
SA37	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with pebbles and shell debris	None recorded	36.3–36.8	12/8/05	616999E 6392429N	617035E 6392434N
SA38	SS.SMU.CSaMu.AfilMysAnit	Fine sand, slight rippling, some shell debris and pebbles	*Cancer* (in digging pit)	31.1–30.1	12/8/05	616882E 6393428N	616937E 6393400N
SA39	SS.SMU.CSaMu.AfilMysAnit	Fine sand with patches (~5%) of pebbles, cobbles and boulders	*Alcyonidium diaphanum* C, *Nemertesia*, *Myxicola infundibulum*, *Pomatoceros*, *Alcyonium*	30.7–32.5	12/8/05	617126E 6393708N	617178E 6393689N
SA40	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with hummocks	Macrofaunal burrows, *Turritella* and *Amphiura*	35.8–36	12/8/05	616823E 6394333N	616828E 6394333N
SA41	IR.MIR.K.Lhyp.Pk SS.SCS.CCS.MedLumVen	Large boulders and patches (some extensive) of medium/coarse sand	Rock with sparse *L. hyperborea* and *Echinus* Patches of *L. saccharina* near sand boundary. Sediment with *Cerianthus* and small restricted patches of maerl	15.2–13.1	12/8/05	616582E 6394979N	616632E 6394982N
SA42	IR.LIR.K.Lsac.Pk	Silty bedrock (sand beyond)	*L. saccharina* loc. C (upper part of rock), low turf filamentous red algae S (~70%), foliose red alga R (~1%), *Corallinacea* C–A (30–50%), *Echinus*, *Asterias*, hydroids	13.8–10.6	13/8/05	614051E 6394864N	
SA43	SS.SMU.ISaMu.AmpPlon	Muddy sand with scattered pebbles	Filiform algae F, *L. saccharina* O–F, terebellid mounds F, *Liocarcinus depurator*, *Carcinus*, Sand gobies, diatom film	5.6–5.6	13/8/05	613907E 6394364N	613906E 6394372N
SA44	IR.MIR.KR.Lhyp.Ft	Boulders/bedrock	*L. hyperborea* A–S, Kelp stipes with foliose red algae (inc *Phycodrys*), fronds with *Obelia geniculata* and *Membranipora*	3.5–3.8	13/8/05	615428E 6395082N	615433E 6395085N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA45	SS.SMU.CSaMu.AfilMysAnit	Fine sand, poorly sorted, slight rippling/hummocks	*Turritella* loc. A, *Asterias*, polychaete tubes, *Amphiura*	12.4–12.6	13/8/05	615842E 6393616N	615859E 6393596N
SA46	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with burrows and slight hummocks	Small (not Nephrops) burrows C–A, *Turritella*, *Carcinus*	22.7–22.7	13/8/05	615912E 6393274N	615976E 6393233N
SA47	IR.HIR.Ksed.LsacSac	Silty boulders/bedrock	*L. saccharina* A, *Saccorhiza* loc A, *Halidrys*, *Chorda*, *Echinus*, *Ulva*, *Ectocarpacea*. Spirobids on fronds	2.8–1	13/8/05	614819E 6393206N	614861E 6393188N
SA48	SS.SCS.CCS.MedLumVen CR.MCR.EcCr.FaAlCr.Pom	Sand, slightly muddy, poorly sorted, shell debris 5–10% (loc 20%), hummocks. Patch of boulders	Sand – algal turf, *Echinus*. Rock – *Echinus* C loc A, *Corallinacea* A, Foliose red algae R, *Alcyonium*, *Pomatoceros* loc C	14.5–11.4	13/8/05	614212E 6393445N	614281E 6393402N
SA49	SS.SCS.CCS.MedLumVen	Coarse shell sand with shell debris, pebbles and cobbles (40–50%)	Sparse turf of filiform algae, *Echinus* F, *Asterias* F-C, *Balanus* O (~5%) on some pebbles, *Pomatoceros*, hydroids	13.3–14.4	13/8/05	614350E 6392556N	614400E 6392483N
SA50	SS.SMP.KSwSS.LsacR.Mu	Muddy sand	*Amphiura*, *Asperococcus* loc S (70%), *L. saccharina*, *Desmarestia*, *Chorda*, *Ophiura*, diatom film	5.9–3.8	13/8/05	613837E 6391966N	613906E 6391916N
SA51	SS.SMU.CSaMu.AfilMysAnit	Muddy sand/mud	Numerous *Turritella* and macrofaunal burrows	17–14.3	13/8/05	614573E 6391762N	614625E 6391708N
SA52	SS.SMP.KSwSS.LsacR.Mu	Mixed, boulders/cobbles, sand patches with pebbles and shell debris	*L. saccharina* A (~80%), *Desmarestia*, *Ulva*. Kelp fronds with Spirobids	7.1–6.9	13/8/05	615132E 6391119N	615165E 6391090N
SA53	SS.SCS.CCS.MedLumVen	Muddy sand with surface gravel and pebbles	*Cerianthus* F–C, Terebellid mounds, Serpulidae on pebbles, *Liocarcinus depurator*, *Alcyonidium diaphanum*	19.4–19.6	13/8/05	615755E 6391524N	615818E 6391489N
SA54	SS.SSA.IFiSa.IMoSa IR.MIR.KR.LhypT.Ft	Medium sand, clean, well sorted, irregular ripples. Outcrops of boulders/ bedrock dusted with sand. Strong current	Sand – no visible biota except at rock margin (*Furcellaria/Polyides*). Rock – *L. hyperborea*, *Echinus*, *Desmarestia*, *Corallinacea*, *Callophyllis*. Kelp stipes heavily fouled in some areas inc *Palmaria*, didemnids. Fronds with *Obelia geniculata* and *Porphyra*	6.9–7.7	15/8/05	612093E 6401418N	612185E 6401321N
SA55	SS.SSA.IFiSa.IMoSa	Very well sorted clean rippled sand – some shell gravel in troughs. Strong current	No visible biota	9.6–9.9	15/8/05	611133E 6401936N	611185E 6401880N
SA56	SS.SSA.IFiSa.IMoSa	Clean rippled sand	No visible biota	2.9–3.1	15/8/05	610627E 6402484N	610686E 6402419N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA57	SS.SSA.IFiSa.IMoSa IR.HIR.KSed.ProtAhn	Rippled sand, patch of cobbles and pebbles. Current	Sand – no visible biota. Cobble and pebble area – *L. saccharina* (small) F, *Asterias*, ephemeral algae (inc *Furcellaria/Polyides*)	11.9–11.3	15/8/05	609882E 6403305N	609918E 6403269N
SA58	IR.HIR.Ksed.XKScrR	Mixed, boulders and coarse sand with areas of rounded cobbles and pebbles	*L. hyperborea* A, *Saccorhiza*, *Halidrys*, *Desmarestia*, *Echinus*. Understory of ephemeral (some drift?) algae, includes *Ulva* and *Furcellaria/* Polyides. Kelp stipes with didemnids, *Ascidiella scabra*. Fronds with *Membranipora*	6.5–6	15/8/05	608392E 6401599N	608443E 6401593N
SA59	SS.SSA.IFiSa.IMoSa	Clean rippled sand	No visible biota	2.7–3.1	15/8/05	608538E 6402121N	608579E 6402128N
SA60	IR.MIR.KR.LhypTX.Ft SS.SSA.IFiSa.IMoSa	Cobbles/boulders with limited patches of coarse sand. Wave surge	*L. hyperborea* forest, stipes heavily fouled. Sparse *Odonthalia* on rock surfaces	8.1–8.8	15/8/05	608933E 6402479N	608999E 6402479N
SA61	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible biota	6.6–6.9	15/8/05	609534E 6401656N	609582E 6401641N
SA62	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible biota	2.3–3.5	15/8/05	610119E 6401360N	610161E 6401347N
SA63	SS.SSA.IFiSa.IMoSa IR.HIR.Ksed.XKScrR	Medium – coarse sand, rippled. Scattered outcrops of boulder/bedrock, scour pits in sand at rock margins. Current	Sand – no visible biota. Rock – *L. hyperborea* A, *L. saccharina*, *Desmarestia*, ephemeral filamentous algae, *Balanus* loc F (scoured faces of some rocks). *L. hyperborea* stipes heavily fouled, *Alcyonidium diaphanum*, *Dilsea*. Fronds with *Obelia geniculata* and *Membranipora*	4.5–5.2	15/8/05	610728E 6401048N	610786E 6401013N
SA64	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand. Small area of rock	Sand – no visible biota. Rock – sparse algae inc *Desmarestia*	5.2–5.4	15/8/05	610686E 6400581N	610729E 6400543N
SA65	SS.SSA.IFiSa.IMoSa IR.HIR.Ksed.XKScrR	Medium – coarse sand, rippled, clean. Some patches of cobbles/pebbles	Sand – no visible biota. Rock – *L. hyperborea*, *L. saccharina*, *Desmarestia*	6.2–6.1	15/8/05	611320E 6400601N	611341E 6400594N
SA66	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Mosaic of boulders/ bedrock (~50%) and patches of medium sand	Sand – *Asterias*, *Furcellaria/ Polyides* (near rock margin) Rock – *L. hyperborea* A, *L. saccharina* F–C, *Desmarestia* F–C, *Saccorhiza*, *Ulva*. *L. hyperborea* stipes fouled, *Alcyonidium diaphanum*, didemnids. Fronds with *Obelia geniculata* and *Membranipora*	6.3–5.9	15/8/05	611518E 6401013N	611535E 6401004N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA67	SS.SMP.Mrl.Pcal	Coarse-medium sand, megaripples, surface gravel of maerl and shell debris	Maerl C–A (20–60%) well developed bed, *Desmarestia* C, *L. saccharina*, *L. hyperborea*, Lanice, Dictyota, Ulva. Desmarestia with crisids and Electra	10.1–9.8	16/8/05	613173E 6400565N	613335E 6400530N
SA68	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Rock with areas of medium sand, clean, rippled. Scour pits in sand at rock margins. Sparse fragments of dead maerl	Sand – no visible biota. Rock – *L. hyperborea* C–A, *Saccorhiza* C–A, *L. saccharina*, *Desmarestia*, *Alaria*, *Ulva*	4.5–3.8	16/8/05	613038E 6401361N	613093E 6401348N
SA69	SS.SSA.IFiSa.IMoSa	Coarse-medium sand, clean, rippled	No visible biota	7.6–8	16/8/05	612446E 6400522N	612490E 6400518N
SA70	IR.HIR.Ksed.XKScrR SS.SSA.IFiSa.IMoSa	Mixed ground of pebbles and boulders with limited patches of coarse sand	Sand – no visible biota (some *Lanice*). Rock – *L. hyperborea* C–A, *Saccorhiza* C–A, *Desmarestia*, *Alaria* F, *Ulva*. *L. hyperborea* stipes with *Alcyonidium diaphanum*, fronds with *Obelia geniculata*	5.1–6.1	16/8/05	612724E 6399760N	612794E 6399776N
SA71	IR.HIR.Ksed.XKScrR	Bedrock with a dusting of sand and small sand patches	*L. hyperborea* A–S, *Saccorhiza* loc C, *Desmarestia*. Kelp stipes heavily fouled with *Alcyonidium diaphanum* and foliose red algae (inc *Phycodrys* and *Palmaria*), fronds with *Obelia geniculata* and *Membranipora*	0.4–2.1	16/8/05	613323E 6399945N	613378E 6399965N
SA72	IR.MIR.KR.LhypT.Ft SS.SSA.IFiSa.IMoSa	Outcrops of boulder/bedrock. Limited patches of poorly sorted medium sand with pebbles and cobbles.	Sand – ephemeral algae, *Desmarestia*, *Ulva*, *L. hyperborea*. Rock – *L. hyperborea* A–S, *Ulva*, *Desmarestia* (crisids on fronds). Kelp stipes fouled with *Alcyonidium diaphanum* and foliose red algae (inc *Phycodrys* and *Plocamium*), fronds with *Obelia geniculata* and *Membranipora*	5.6–4.3	16/8/05	613984E 6400378N	614054E 6400412N
SA73	SS.SSA.IFiSa.IMoSa IR.HIR.Ksed.XKScrR	Medium sand (60–80%), rippled with areas of pebbles and cobbles. Outcrops of boulder/bedrock (20–40%)	Sand – no visible biota. Rock – *L. hyperborea*, *Saccorhiza*, *L. saccharina*, *Desmarestia*, *Ulva*, *Furcellaria/Polyides*. *L. hyperborea* fronds with *Membranipora*	4.6–4.3	16/8/05	613496E 6399612N	613542E 6399625N
SA79	SS.SSA.IMuSa.FfabMag	Fine sand (no ripples), shell debris ~1%	*Turritella*	27.3–29.4	18/8/05	619721E 6401045N	619860E 6401009N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA80	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with hummocks	*Pennatula* F, *Turritella*, burrows, *Amphiura*.	42.9–43.2	18/8/05	620222E 6399345N	620292E 6399293N
SA81	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with hummocks	*Pennatula*, *Amphiura*, burrows, *Liocarcinus depurator*	35.1–37	18/8/05	619376E 6399808N	619441E 6399786N
SA82	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with hummocks	*Amphiura* A, *Pennatula*, burrows, *Turritella*, *Cerianthus*, *Ophiura*, *Cancer*, *Sabella*	34.7–36.9	18/8/05	619544E 6400359N	619683E 6400283N
SA83	SS.SSA.IMuSa.FfabMag	Fine, slightly muddy sand, slight rippling, shell debris <1%. Current	Diatom film	25.8–25.6	18/8/05	618949E 6401225N	619043E 6401218N
SA84	IR.MIR.KR.Lhyp.Ft	Silty bedrock	*L. hyperborea* A, *Saccorhiza*, *Desmarestia*, very sparse cover foliose red algae. Kelp stipes foliose reds (inc *Phycodrys*). Fronds with *Obelia geniculata*	4.7–2.6	18/8/05	618652E 6402265N	618715E 6402271N
SA85	SS.SCS.ICS.MoeVen	Medium/fine rippled sand	*Cerianthus*	18.6–18.5	18/8/05	618159E 6401987N	618197E 6401992N
SA86	SS.SCS.ICS.MoeVen	Clean rippled medium sand with megaripples. Rock outcrops	No visible biota	8.8–9.9	18/8/05	617371E 6402471N	617391E 6402494N
SA87	SS.SCS.ICS.MoeVen	Clean rippled medium sand	No visible biota (x1 juvenile flatfish)	4.9–4	18/8/05	616504E 6403255N	616500E 6403264N
SA88	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible biota	5.1–5.4	19/8/05	613280E 6408638N	613300E 6408639N
SA89	IR.MIR.KR.LhypT.Ft SS.SSA.IFiSa.IMoSa	Boulder/bedrock outcrops. Limited patches of rippled medium sand. Current and wave surge	*L. hyperborea* A–S, *Corallinacea*, sponge crusts (1%), sparse algae inc *Odonthalia* and *Callophyllis*. *L. hyperborea* stipes heavily fouled with *Phycodrys*, *Palmaria*, *Alcyonidium diaphanum*, didemnids. Fronds with *Obelia geniculata* and *Membranipora*	7.6–10	19/8/05	612775E 6408355N	612837E 6408299N
SA90	IR.MIR.KR.LhypT.Ft SS.SSA.IFiSa.IMoSa	Mixed ground of rock and limited sand patches. Heavy wave surge	*L. hyperborea* A, *Dilsea*, *Delesseria*, *Desmarestia*, *L. saccharina*, *Sagartia*, *Phycodrys*, *Callophyllis*. *L. hyperborea* stipes fouled with *Alcyonidium diaphanum*, didemnids, *Halichondria*	8.3–10.5	19/8/05	612712E 6407790N	612762E 6407747N
SA91	IR.MIR.KR.LhypTX.Pk SS.SSA.IFiSa.IMoSa	Boulders on coarse sand/gravel with cobbles and pebbles	*L. hyperborea* A (loc C), *L. saccharina*, *Cancer*, *Ulva*, *Echinus*. *L. hyperborea* stipes fouled	6.7–7.9	19/8/05	614094E 6407989N	614128E 6407975N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA92	IR.MIR.KR.LhypTX.Pk SS.SSA.IFiSa.IMoSa	Boulders, cobbles and pebbles on coarse sand. Strong current	*L. hyperborea* A, *L. saccharina*, *Dictyota*, *Desmarestia*, sponge crusts on some rocks. *L. hyperborea* stipes fouled, *Phycodrys*, *Halichondria*	6.1–7.7	19/8/05	613057E 6406391N	613130E 6406363N
SA93	SS.SSA.IFiSa.IMoSa	Clean rippled medium sand	No visible biota	3.1–4.4	19/8/05	614805E 6406097N	614809E 6406129N
SA94	IR.MIR.KR.LhypTX.Pk SS.SCS.ICS.MoeVen	Boulders/bedrock outcrops (70–80%) with sand patches (20–30%). Strong current	*L. hyperborea* C (locally F), *Alcyonium* S (40–50%), *L. saccharina*, *Nemertesia*, *Sagartia*, *Echinus* C, hydroids, *Balanus* loc F, *Pomatoceros* loc F. *L. hyperborea* stipes fouled, *Palmaria*	13.3	19/8/05	615064E	6405401N
SA95	SS.SCS.ICS.MoeVen IR.MIR.KR.LhypT.Ft	Clean rippled medium sand with megaripples. Rock outcrops	Sand – no visible biota. Rock – *L. hyperborea* A	11–15.5	19/8/05	615736E 6404221N	615796E 6404167N
SA96	SS.SCS.ICS.MoeVen IR.HIR.Ksed.XKScrR	Medium sand, poorly sorted, uneven surface. Rock outcrop	Sand – filiform algae O (1–5%), *Carcinus*, *Ulva*. Rock – *Saccorhiza* and *L. saccharina*	5.6–5.8	19/8/05	617369E 6403332N	617362E 6403328N
SA97	IR.LIR.K.LhypLsac.Ft	Silty rock with sand patches	*L. hyperborea* A (loc C), *L. saccharina* F–C, *Saccorhiza*, *Echinus*, *Dilsea*, turf of filamentous red algae on rock. *L. hyperborea* fronds with abundant *Obelia geniculata* and *Membranipora*	13.3–13.8	20/8/05	616226E 6394867N	616229E 6394872N
SA98	IR.HIR.Ksed.XKScrR SS.SSA.IMuSa.FfabMag	Fine sand, hummocks. Rock outcrops	Sand – diatom mat. Rock – *L. hyperborea* A (loc C), *Desmarestia* O (fronds with *Crisids* and *Electra*), *Saccorhiza*, *L. saccharina*, *Phycodrys*, *Ulva*. *L. hyperborea* stipes slightly fouled, *Dictyota*, *Ascidiella scabra*. Fronds with *Obelia geniculata* and *Membranipora*	8.7–10.4	20/8/05	615771E 6396189N	615799E 6396228N
SA99	SS.SCS.ICS.MoeVen IR.HIR.Ksed.XKScrR	Medium sand, poorly sorted, slightly hummocked, pebbles, shell debris 1–5%. Patches of rock	Sand – *Arenicola*, 5–10% algal cover, *Ulva*, filiform algae, *Furcellaria/Polyides*. Rock – *L. hyperborea*, *Saccorhiza*, *Gibbula cinerea*, *Desmarestia*	3–3.8	20/8/05	615799E 6397129N	615793E 6397140N
SA100	SS.SSA.IMuSa.FfabMag	Medium/fine sand, slightly hummocked, shell fragments	Diatom mat (~60%), *Desmarestia* <<1%, *Chorda* <<1%, *Ulva* <<1%	7.8–7.8	20/8/05	614225E 6397563N	614242E 6397602N

Table 7.1.2 *(continued)*

Station	Biotopes	Notes on substrate	Notes on biota	Depth (BCD)	Date	Start UTM	End UTM
SA101	SS.SCS.ICS.MoeVen IR.MIR.KR.LhypTX.Pk	Medium sand, clean, rippled. Boulder/bedrock outcrops. Patch of cobbles and pebbles. Current	Sand – no visible biota. Rock – *L. hyperborea* F (loc C), *Echinus* C, *Asterias*, *Pomatoceros*	12.1–13.9	20/8/05	614315E 6398030N	614405E 6398006N
SA102	SS.SMU.ISaMu.Cap	Fine slightly muddy sand, poorly sorted, hummocked, scattered pebbles and shell fragments	Filiform algae O (1–5%), *Ulva* locally C (10–20%), diatom mat (10%), *Asterias*, *Pecten*, *Cancer*	8.3–9.5	20/8/05	617304E 6396803N	617315E 6396825N
SA103	SS.SMU.CSaMu.AfilMysAnit	Fine sand, poorly sorted, slightly hummocked, pebbles ~1%	Filiform algae O (1–5%), *L. saccharina* (drift?) 1%, *Asterias*, *Echinus*	14.1	20/8/05	617688E 6396754N	
SA104	SS.SMU.CSaMu.AfilMysAnit CR.HCR.Xfa.SwiLgAs	Muddy sand with shell fragments. Patches of boulders and cobbles	Sediment – *Cerianthus*, *Pecten*. Rock – *Swiftia* and *Alcyonidium diaphanum*	36.7–31.5	20/8/05	618664E 6396310N	618691E 6396422N
SA105	SS.SMU.CSaMu.AfilMysAnit	Muddy sand with hummocks	*Turritella*, *Pecten*, *Amphiura*, *Liocarcinus depurator* O.	40.7–39.4	20/8/05	618799E 6397379N	618823E 6397410N

Table 7.1.3 Details of intertidal ground truth survey station

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IA1	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.FLR.Rkp.G LR.LLR.F.Pel LR.HLR.MusB.Sem.Sem IR.HIR.KFaR.Ala.Ldig LR.HLR.FR.Him LR.FLR.Rkp.FK	Undulating bedrock ridges	Lichen dominated uppershore followed by zone of sparse *Pelvetia*, band of barnacles followed by sublittoral fringe of *Alaria* and *L. digitata*. Rockpools with *Enteromorpha* in upper shore and with kelp in lower shore	08/08/05	619188	6397729
IA2	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.X LR.LLR.F.Asc.FS LR.LLR.F.Asc.X LR.LLR.Fserr.FS LR.FLR.Rkp.FK	Wide bedrock ridges (2–3m high) running perpendicular to waterline, boulders, cobbles and pebbles in gullies	Fucoid dominated shore with most of the area covered by *Ascophyllum*. Fucoids cover both bedrock ridges and mixed substrates in the gullies	08/08/05	617097	6397610
IA3	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.FLR.Rkp.G LR.LLR.F.Pel LR.HLR.MusB.Sem.Sem LR.HLR.FR.Him IR.MIR.KR.Ldig.Ldig IR.MIR.KR.Lhyp.Ft	Inclined bedrock	Barnacle dominated shore with lichens in the supralittoral and kelp in the sublittoral fringe	09/08/05	615955	6396795
IA4	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Asc.FS LR.LLR.F.Asc.X LR.LLR.Fserr.FS IR.MIR.KR.Ldig.Ldig	Embayment with standing water in lower half. Irregular bedrock and boulders	Fucoid dominated shore with most of the area covered by *Ascophyllum*	10/08/05	617949	6399772

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IA5	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.HLR.MusB.Sem.FvesR LR.HLR.FR.Mas IR.MIR.KR.Ldig.Ldig	Inclined bedrock ridges	Mostly dominated by barnacles. Scoured zone at base of shore	10/08/05	618052	6399596
IA6	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.HLR.MusB.Cht LR.HLR.MusB.Sem.Sem IR.MIR.KR.Ldig.Ldig	Steep bedrock ridges	Barnacle dominated shore with lichens in the supralittoral and kelp in the sublittoral fringe	11/08/05	614404	6407486
IA7	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.HLR.MusB.Sem.FvesR IR.MIR.KR.Ldig.Ldig	Sloping bedrock ridges	Dominated by broad *Verrucaria* zone in the upper shore and barnacles with sparse fucoids lower down.	15/08/05	615426	6390706
IA8	LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Asc.X LR.MLR.BF.FvesB	Boulders, bedrock and mixed sediments	Lower lying areas dominated by *Ascophyllum* with barnacles on the boulders and projecting rock outcrops	15/08/05	613163	6394919
IA9	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi LR.LLR.F.Asc.FS LR.LLR.Fserr.FS	Slope of large boulders	Majority of shore dominated by *Ascophyllum*.	17/08/05	611687	6392929
IA10	LR.FLR.Lic.YG LR.LLR.F.Pel LR.LLR.F.Fspi LR.LLR.F.Asc.FS LR.LLR.F.Fserr.X	Bedrock upper shore with boulders in mid and lower shore	Majority of shore dominated by *Ascophyllum*	17/08/05	610349	6393323
IA11	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi LR.LLR.F.Asc.FS	Boulders, bedrock and cobbles on gravelly sand	Majority of shore dominated by *Ascophyllum*	17/08/05	609785	6394024
IA12	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.HLR.MusB.Cht LR.MLR.BF.FvesB IR.MIR.KR.Ldig.Ldig	Steeply sloping bedrock ridges with vertical faces	Supralittoral lichens above steep rock with barnacles and patches of fucoids	18/08/05	621032	6400231
IA13	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.HLR.MusB.Cht LR.MLR.BF.FvesB IR.MIR.KR.Ldig.Ldig	Irregular bedrock ridges	Supralittoral lichens above steep rock with barnacles and patches of fucoids	18/08/05	620025	6401502
IA14	Terrestrial LS.LSA.St.Tal LS.LSA.MoSa.BarSa	Broad, exposed steep sandy beach with dry berm in upper shore	No biota seen on surface or during digover. Very sparse fauna in sample	19/08/05	613761	6408926

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IA15	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.MLR.BF.PelB LR.HLR.MusB.Sem.Sem IR.MIR.KR.Ldig.Ldig	Very broken angular bedrock with some medium to large boulders	Majority of shore dominated by barnacles	19/08/05	613486	6408961
IA16	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Asc.FS LR.LLR.Fserr.FS IR.MIR.KR.Ldig.Ldig	Fissured bedrock with boulders	Majority of shore dominated by *Ascophyllum*	20/08/05	613330	6397213
IA17	LR.FLR.Lic.Pra LR.FLR.Lic.Ver.Ver LR.MLR.BF.FvesB LR.MLR.BF.Fser IR.MIR.KR.Ldig.Ldig LS.LSA.FiSa	Boulder shore with bedrock outcrops	Lower lying areas dominated by fucoids with barnacles on the boulders and projecting rock outcrops	20/08/05	613535	6398019
IB1	LR.MLR.BF.FvesB LR.LLR.F.Asc.FS LR.LLR.F.Fves.FS LR.MLR.BF.Fser IR.MIR.KR.Ldig.Ldig	Fairly low lying but extensive undulating rock reef. Mostly boulders with some broken bedrock	Overall 80–90% fucoid cover. *L. digitata* on lower shore. Extensive area with a mosaic of mixed fucoids (mostly *F. vesiculosus*, low lying areas with a high proportion of *F. serratus*, some *Ascophyllum*). Larger boulders and elevated areas with barnacle/fucoid mosaic	09/08/05	615183	6398908
IB2	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.FLR.Rkp.G LR.LLR.F.Pel LR.MLR.BF.FvesB LR.LLR.F.Asc.FS LR.HLR.FR.Him	Shore of bedrock ridges running parallel to the waterline. Boulders and cobbles in some areas between the ridges	Most of shore dominated by fucoids but raised rock ridges are dominated by barnacles and limpets or by lichens depending on the tidal height. *Ascophyllum* dominates most of the lower part of the shore and some of the lower gullies between rock ridges	09/08/05	615847	6399870
IB3	LS.LCS.Sh LS.LSA.St.Tal LS.LSA.FiSa.Po.Aten	Beach of smooth, unrippled medium sand with a narrow band of rounded cobbles at the top of the shore	Sparse *Lanice* and *Arenicola* seen on surface. Infauna includes *Angulus tenuis*, *Nephtys cirrosa* and amphipods	10/08/05	614680	6403240
IB4	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Fves.FS LR.LLR.F.Asc.FS LS.LSA.MuSa	Narrow embayment with bedrock slope (~10m wide) around margin and central area with soft fine sand covered by decomposing algae	Lichens in upper shore with remaining rock fucoid dominated. Sediment mostly covered by decomposing algae but bare patches with *Arenicola*	10/08/05	614648	6403118
IB5	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.MLR.BF.FvesB LR.MLR.BF.Fser IR.MIR.KR.Ldig.Ldig	Terraced bedrock with boulders on lower part of shore	Upper shore with lichens and *Pelvetia*, mid shore dominated by limpets and barnacles, lower shore dominated by fucoids and *L. digitata* in sublittoral fringe	10/08/05	614575	6402665

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IB6	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.MLR.BF.FvesB LR.MLR.BF.Fser LS.LSA.FiSa.Po	Upper and mid shore of elevated bedrock reefs, lower shore of rippled sand	Upper shore with lichens, mid shore dominated by a mosaic of fucoids and barnacle patches, sand beach with sparse *Arenicola* on lower shore	10/08/05	614600	6401660
IB7	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Asc.FS	Large area with an irregular topography of bedrock ridges and areas of boulders	Raised areas with terrestrial vegetation, lichens in upper shore, most of area with 90% fucoid cover dominated by *Ascophyllum*	10/08/05	614739	6401649
IB8	Barren rock LR.MLR.BF.FvesB LR.FLR.Eph.EntPor LS.LSA.MoSa.BarSa LR.FLR.Rkp.G	Irregular rounded bedrock ridges and cliffs. To the south-east are mid to lower shore rock reefs and an extensive sand beach	Barren sandblasted upper shore rock, mid shore rock reefs are barnacle dominated with dense *Enteromorpha* on lower rocks especially in areas close to the rock/sand boundary. Shallow water with kelp reefs. Rockpools with 100% *Enteromorpha*	11/08/05	613331	6401873
IB9	LS.LSA.St.Tal LS.LSA.MoSa.BarSa	Sand beach backed by dunes. Upper shore of very dry soft sand with wind rippling and dried out algal debris on surface with a steep slope of medium sand in the lower part of the beach	No biota found on surface, in dig over area or infaunal samples	11/08/05	613683	6402315
IB10	LR.FLR.Lic.Pra LR.HLR.MusB.Sem LR.HLR.MusB.Sem.FvesR IR.HIR.KFaR.Ala.Ldig	Elongate bedrock skerry	Rock reef with guano and *Prasiola* along crest. Remainder dominated by barnacles and limpets with juvenile mussels in rock crevices and a band of *Porphyra* in upper parts. *Alaria* and *L. digitata* in sublittoral fringe	11/08/05	612246	6403090
IB11	LS.LSA.St.Tal LS.LSA.MoSa.BarSa	Sand beach backed by dunes. Upper shore of dry soft sand with wind rippling and dried out algal debris on surface with a steep slope of medium sand in the lower part of the beach	*Talitrus* common in upper shore, no biota found on surface, in dig over area of lower shore	11/08/05	613770	6404685
IB12	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.X LR.LLR.F.Fves.X LR.LLR.F.Asc.X	Upper shore with bedrock ridges turning to cobbles and boulders in mid to lower shore	Majority of area with dense *Ascophyllum*. Other fucoids including *F. vesiculosus* forming zones in upper shore	12/08/05	609435	6399081
IB13	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Asc.FS LR.LLR.Fserr.FS	Shore of medium to very large boulders	*Ascophyllum* dominated	15/08/05	614063	6392375

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IB14	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.HLR.MusB.Sem.Sem IR.MIR.KR.Ldig.Ldig LR.HLR.FR.Him	Bedrock with 3m cliff in upper shore, sloping rock with a few very large boulders in mid and lower shore	Most of shore barnacle dominated. Lichens in supralittoral, patchy fucoids below the lichens then broad band of barnacles above a kelp dominated sublittoral fringe	15/08/05	615237	6392080
IB15	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.HLR.MusB.Sem.FvesR LR.HLR.MusB.Sem.Sem IR.MIR.KR.Ldig.Ldig LR.HLR.FR.Him	Bedrock slope, steep (>45deg) at top of shore, ~30deg mid to lower shore. Couple of gullies with large boulders and cobbles	Barnacle dominated with patchy fucoids and *Porphyra*	15/08/05	616580	6392554
IB16	LR.FLR.Lic.YG LR.LLR.F.Pel LR.FLR.Lic.Ver.Ver LR.LLR.F.Fspi.X LR.LLR.F.Fspi.FS LR.LLR.F.Asc.X LR.HLR.FR.Him	Intertidal reef of mixed cobbles, pebbles and boulders	Majority of shore with total cover of *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of reef	16/08/05	614033	6393729
IB17	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Asc.FS	bedrock slope	Majority of shore with total cover of *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of shore	16/08/05	612936	6394127
IB18	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fspi.X LR.LLR.F.Asc.X	Rounded cobbles (50%) and small to large boulders (50%)	Majority of shore with total cover of *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of shore	16/08/05	611836	6393677
IB19	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fves.X LR.LLR.F.Asc.X LR.LLR.F.Asc.FS LR.HLR.MusB.Sem.Sem LR.HLR.FR.Him	Irregular bedrock with ridges and gullies	Majority of shore with total cover of *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of shore	16/08/05	614721	6394672
IB21	LR.FLR.Lic.YG LR.LLR.F.Pel LR.LLR.F.Fspi.FS LR.LLR.F.Fserr.X LS.LSA.MuSa.MacAre (var. 1) LR.LLR.F.Asc.FS	Extensive boulder and bedrock reefs with shallow rocky channels and waterfilled depressions Restricted patches of muddy sand	Dominated by dense *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of shore. Muddy sand with *Arenicola*	17/08/05	610894	6393846
IB22	LR.LLR.F.Fspi.FS LR.LLR.F.Fves.X LR.LLR.F.Asc.FS LS.LSA.MuSa.MacAre (var. 1)	Extensive boulder shore with undulating topography and shallow channels with muddy sand	Dominated by dense *Ascophyllum*. Other fucoids on higher parts of shore. Muddy sand with *Arenicola*	17/08/05	609759	6394424

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IB23	LR.LLR.F.Asc.FS LR.LLR.F.Asc.X LS.LSA.MuSa.MacAre (var. 1) LS.LSA.MuSa.MacAre (var. 2)	Extensive area of undulating boulders and bedrock with a linked series of sediment basins containing soft muddy sand with pronounced hummocks	Sediment basins with *Arenicola* and macrofaunal burrows. All surrounding area dominated by *Ascophyllum*. Other fucoids and supralittoral lichens on higher parts of shore	17/08/05	609687	6394287
IB24	LR.FLR.Lic.YG LR.LLR.F.Pel LR.LLR.F.Asc.FS LS.LSA.MuSa.MacAre (var. 1)	Isolated basin of hummocked fine sand enclosed by boulders forming an intertidal reef separating the basin from the sea. Boulders on the shore	Sand basin with *Arenicola* and *Lanice*, surrounding area dominated by *Ascophyllum* with supralittoral lichens on upper shore	18/08/05	618181	6403295
IB25	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.MLR.BF.FvesB IR.MIR.KR.Lhyp.Ft	Steep bedrock	Dominated by a mosaic of barnacles and *F. vesiculosus* patches, supralittoral lichens on upper shore.	18/08/05	618162	6403263
IB26	LR.FLR.Lic.YG LR.LLR.F.Pel LR.LLR.F.Fspi.X LR.LLR.F.Fves.X LR.LLR.F.Asc.X SS.SSA.IMuSa.ArelSa	Bedrock in supralittoral zone Boulders and cobbles with muddy sand	Mainly dominated by *Ascophyllum*, mixed fucoids and supralittoral lichens in upper shore, Arenicola mud below waterline	18/08/05	617925	6403831
IB27	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.HLR.MusB.Sem.FvesR LR.MLR.BF.Fser IR.MIR.KR.Ldig.Ldig IR.MIR.KR.Lhyp.Ft LR.LLR.F.Pel LR.LLR.F.Asc.X	Bedrock terraces and slopes with a few small rockpools	Shore is largely barnacle dominated with patchy fucoids. Supralittoral lichens are well developed in upper shore. Sublittoral fringe with *F. serratus* and kelp	18/08/05	616234	6403752
IB28	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver Barren rock LR.LLR.F.Pel LR.MLR.BF.FvesB LS.LSA.MoSa.BarSa LS.LSA.FiSa.Po	Broad sandy beach with a shallow lagoon and extensive sand spit. Bedrock slope in the upper shore	Barnacles and patchy fucoids on upper shore rocks, some areas sand scoured. Sand beach with sparse *Arenicola* in some areas of lower shore. Sparse fauna present in samples	19/08/05	610402	6399929
IB29	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.HLR.MusB.Cht LR.LLR.F.Fspi.FS LR.HLR.MusB.Sem LR.HLR.MusB.Sem.FvesR LR.HLR.FR.Coff.Puly	Bedrock slope with some sand scoured bare areas. Bedrock meets sand at about chart datum	Upper shore with supralittoral lichens, barnacles and mussels in mid shore and scour tolerant algae on lower shore	19/08/05	609799	6400876
IB30	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Asc.FS LR.LLR.F.Fserr.X SS.SSA.IMuSa.ArelSa	Upper shore of bedrock with boulders in mid and lower shore. Plain of fine sand just below the waterline	Most of rocky shore dominated by *Ascophyllum*. Low shore sediments with *Arenicola* and *Lanice*	20/08/05	607988	6396290

Table 7.1.3 *(continued)*

Shore code	Biotopes	Notes on substrate	Notes on biota	Date	UTM (E)	UTM (N)
IB31	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fves LR.LLR.F.Asc.FS LR.LLR.F.Fserr.X LS.LSA.MuSa.MacAre (var. 1)	Upper shore of bedrock with boulders in mid and lower shore. Plain of medium sand just below the waterline	Most of rocky shore dominated by *Ascophyllum*	20/08/05	608906	6395884
IB32	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Fves LR.LLR.F.Asc.X LR.LLR.Fserr.FS LS.LSA.MuSa.MacAre (var. 2)	Extensive area of undulating bedrock and boulders and interlinked series of basins of soft sandy mud	Rock areas overwhelmingly dominated by *Ascophyllum*. Sediment with *Arenicola*, burrows, green algal mat and *Anemonia*	20/08/05	608946	6395026
IB33	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Fves LR.LLR.F.Asc.X SS.SMU.IFiMu.Are	Upper shore of bedrock with boulders in mid and lower shore. Plain of soft mud just below the waterline	Most of rocky shore dominated by *Ascophyllum*	21/08/05	611306	6390512
IB34	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel LR.LLR.F.Fves.X LR.LLR.F.Asc.X LS.LSA.MuSa.MacAre (var. 2)	Enclosed embayment of mud with a fringing shore of boulders and cobbles	Boulders and cobbles dominated by *F. vesiculosus* and *Ascophyllum*. Mud with *Arenicola*, *Corophium* and green algal mat	21/08/05	611235	6390499
IB35	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LS.Lp.Sm LS.L.Mx LR.LLR.F.Pel LR.LLR.F.Fspi LR.LLR.F.Fves.X LR.LLR.F.Asc.X LR.LLR.F.Fserr.X	Mixed bedrock, boulder, cobble and sediment shore with mud below waterline	Dominated by *F. vesiculosus* and *Ascophyllum*	21/08/05	612726	6391192

Table 7.1.4 Subtidal sediment biotopes

Biotope	Stations	Number of Stations	Image
SS.SCS.ICS.MoeVen	SA4, SA5, SA6, SA7, SA11, SA12, SA13, SA14, SA16, SA85, SA86, SA87, SA94, SA95, SA96, SA99, SA101, SB1, SB2, SB6, SB9, **SB20**, SB23, **SB24**, SB47, SB54, SB55, SB63, SB64, SB69, SB72, SB74	32	
SS.SCS.CCS.MedLumVen	**SA41**, SA48, SA49, SA53	4	

Table 7.1.4 *(continued)*

Biotope	Stations	Number of Stations	Image
SS.SSA.IFiSa.IMoSa	SA21, SA22, SA24, SA27, SA28, SA29, SA30, SA54, SA55, SA56, SA57, SA59, SA60, SA61, SA62, SA63, SA64, SA65, SA66, SA68, SA69, SA70, SA72, SA73, SA88, SA89, SA90, SA91, SA92, SA93, SB10, SB11, SB12, SB13, SB14, SB15, SB16, SB17, SB19, **SB42**, SB70, SB71	42	
SS.SSA.IFiSa.NcirBat	**SB4**	1	
SS.SSA.IFiSa.TbAmPo	SA31, SA32, SB26, SB27, **SB28**, SB31, SB33, SB34, SB36, SB37, SB50, SB73, SB75, SB80, SB88	15	

Table 7.1.4 *(continued)*

Biotope	Stations	Number of Stations	Image
SS.SSA.IMuSa.FfabMag	SA3, SA8, SA79, **SA83**, SA98, SA100	6	
SS.SSA.IMuSa.ArelSa	SB79, SB81, **SB82**, SB83, SB87, IB26, IB30	7	
SS.SMU.ISaMu.AmpPlon	SA43, SA77, SA78, **SB35**, SB38, SB39, SB57, SB62, SB90	9	
SS.SMU.ISaMu.Cap	SA102	1	No Image
SS.SMU.IFiMu	SB93	1	No Image

Table 7.1.4 *(continued)*

Biotope	Stations	Number of Stations	Image
SS.SMU.IFiMu.Are	SA75, SB59, **SB91**, SB92, SB93, IB33	6	
SS.SMU.CSaMu.AfilMysAnit	SA9, SA17, SA18, SA20, SA33, SA34, SA35, SA37, SA38, SA39, SA40, SA45, SA46, **SA51**, SA80, SA81, SA82, SA103, SA104, SA105	20	
SS.SMU.CSaMu.VirOphPmax.Has	**SB76**	1	
SS.SMU.CFiMu	**SB94**	1	

Table 7.1.4 *(continued)*

Biotope	Stations	Number of Stations	Image
SS.SMX.IMx.SpavSpAn	SH05 SA74, SH05 SB84, SH05 SB85, SH05 **SB86**, SH05 SB89	5	
SS.SMP.Mrl.Pcal	SA67, **SB54**, SB58	3	
SS.SMP.KSwSS.LsacR.Sa	**SA7**	1	
SS.SMP.KSwSS.LsacR.Mu	SA50, **SA52**	2	

Table 7.1.4 *(continued)*

Biotope	Stations	Number of Stations	Image
SS.SMP.KSwSS.Tra	**SB61**	1	
SS.SMP.KSwSS.Pcri	SA76	1	
SS.SMP.SSgr.Zmar	**SB3**, SB5, SB8, SB9, SB21, **SB25**, SB29, SB30, SB32, SB41, SB44, SB46, SB48, SB49, SB65, SB68	16	 

Table 7.1.5 Subtidal rock biotopes

Biotope	Stations	Number of Stations	Image
IR.HIR.KFaR.Ala.Ldig	IA1, IB10	2	No Image
IR.HIR.Ksed.LsacSac	**SA47**, SB51	2	
IR.HIR.Ksed.XKScrR	SA15, SA27, SA58, SA63, SA65, SA66, SA68, SA70, SA71, SA73, SA96, SA98, SA99, SB1, SB2, SB4, SB7, SB12, **SB14**, SB45, SB52, SB53, SB55, SB56, SB67, SB70, SB72, SB77, SB78	29	
IR.HIR.KSed.ProtAhn	SA24, **SA57**	2	

Table 7.1.5 *(continued)*

Biotope	Stations	Number of Stations	Image
IR.MIR.KR.Ldig.Ldig	IA3, IA4, IA5, IA6, IA7, IA12, IA13, IA15, IA16, IA17, IB1, IB5, IB14, IB15, IB27	15	No image
IR.MIR.KR.LhypT.Ft	SA11, SA23, SA25, SA26, SA54, SA72, SA89, SA90, SA95, SB17, **SB43**, SB64, SB66	13	
IR.MIR.KR.LhypTX	**SB71**	1	
IR.MIR.KR.LhypTX.Ft	**SA60**	1	

Table 7.1.5 *(continued)*

Biotope	Stations	Number of Stations	Image
IR.MIR.KR.LhypTX.Pk	SA10, SA91, SA92, SA94, SA101, **SB18**	6	
IR.MIR.KR.Lhyp.Ft	SA44, SA84, **SB22**, SB32, IA3, IB25, IB27	7	
IR.MIR.K.Lhyp.Pk	**SA41**	1	
IR.MIR.KT.XKTX	**SB60**	1	

Table 7.1.5 *(continued)*

Biotope	Stations	Number of Stations	Image
IR.LIR.K.LhypLsac.Ft	**SB36**, SB37, SB90, SA97	4	
IR.LIR.K.LhypLsac.Pk	**SA4**, SA5	2	
IR.LIR.K.Lsac.Ft	SB95	1	No Image
IR.LIR.K.Lsac.Pk	SA42, SA78, SB26, SB27, SB28, **SB69**	6	

Table 7.1.5 *(continued)*

Biotope	Stations	Number of Stations	Image
IR.LIR.K.Lsac.Gz	SB6, **SB39**, SB40	3	
IR.LIR.K.LhypCape	SA76, **SB35**, SB89	3	
CR.HCR.Xfa.SwiLgAs	SA17, SA18, **SA19**, SA36, SA104	5	
CR.MCR.EcCr.FaAlCr.Pom	**SA48**	1	

Table 7.1.5 *(continued)*

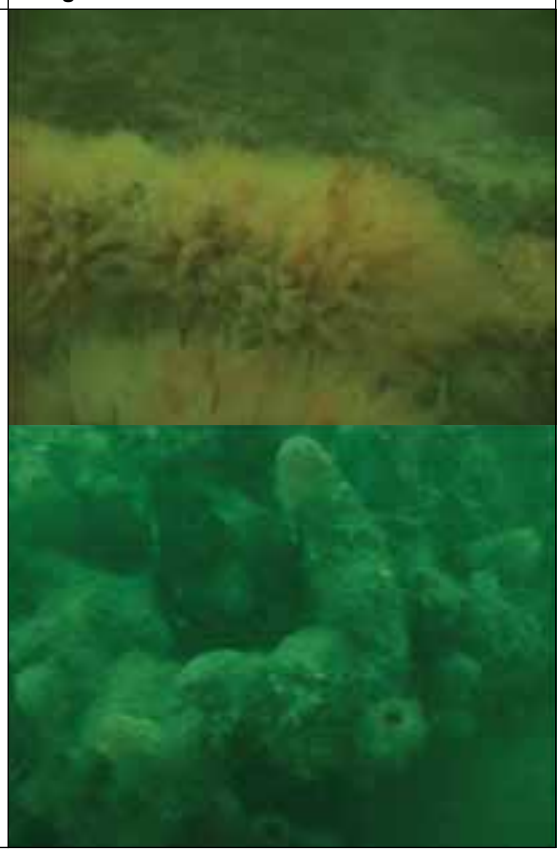
Biotope	Stations	Number of Stations	Image
CR.LCR.BrAs.AmenCio	SA77, **SB58**, SB62, SB80, SB94	5	

Table 7.1.6 Intertidal sediment biotopes

Biotope	Stations	Number of Stations	Image
LS.LCS.Sh	**IB3**	1	
LS.LSA.St.Tal	IA14, IB9, **IB11**	3	
LS.LSA.MoSa.BarSa	IA14, IB8, **IB9**, IB11, IB28	5	
LS.LSA.FiSa	IA17, **IB28**	2	

Table 7.1.6 *(continued)*

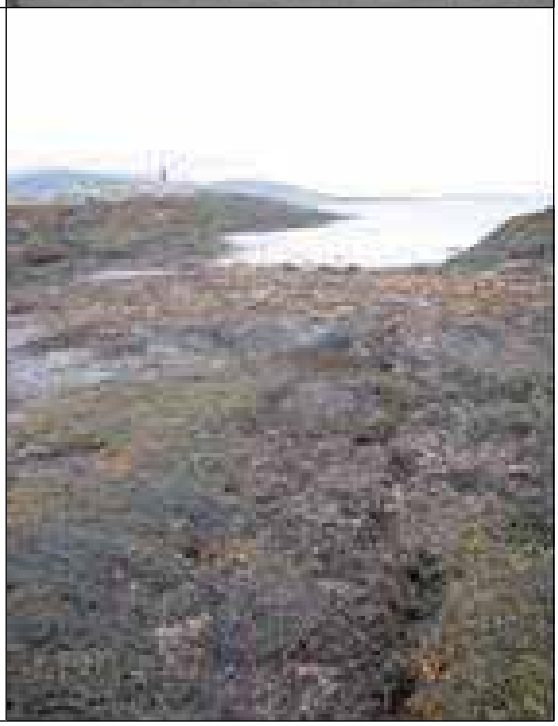
Biotope	Stations	Number of Stations	Image
LS.LSA.FiSa.Po	**IB6**	1	
LS.LSA.FiSa.Po.Aten	**IB3**	1	
LS.LSA.MuSa	**IB4**	1	

Table 7.1.6 *(continued)*

Biotope	Stations	Number of Stations	Image
LS.LSA.MuSa.MacAre (var 1)	IB21, IB22, IB23, **IB24**, IB31	5	
LS.LSA.MuSa.MacAre (var 2)	IB23, IB32, IB34	3	
LS.L.Mx	IB35	1	No Image
LS.Lp.Sm	IB35	1	

Table 7.1.7 Intertidal rock biotopes

Biotope	**Stations**	**Number of Stations**	**Image**
Barren rock	IB8, IB28	2	No Image
LR.HLR.MusB.Cht	IA6, IA12, **IA13**, IB29	4	
LR.HLR.MusB.Sem	**IB10**, IB29	2	
LR.HLR.MusB.Sem.Sem	IA1, **IA3**, IA6, IA15, IB14, IB15, IB19	7	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.HLR.MusB.Sem.FvesR	IA5, **IA7**, IB10, IB15, IB27, IB29	6	
LR.HLR.FR.Coff.Puly	**IB29**	1	
LR.HLR.FR.Him	IA1, **IA3**, IB2, IB14, IB15, IB16, IB19	7	
LR.HLR.FR.Mas	**IA5**	1	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.MLR.BF.PelB	**IA15**	1	
LR.MLR.BF.FvesB	IA8, IA12, IA13, IA17, **IB1**, IB2, IB5, IB6, IB8, IB25, IB28	11	
LR.MLR.BF.Fser	IA17, IB1, **IB5**, IB6, IB27	5	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.LLR.F.Pel	IA1, **IA2**, IA3, IA4, IA5, IA7, IA8, IA9, IA10, IA11, IA16, IB2, IB4, IB5, IB12, IB13, IB14, IB15, IB16, IB17, IB18, IB19, IB21, IB24, IB25, IB26, IB27, IB28, IB30, IB31, IB34, IB35	32	
LR.LLR.F.Fspi.FS	IA4, **IA7**, IA8, IA9, IA10, IA11, IA16, IB4, IB14, IB15, IB16, IB17, IB21, IB22, IB29, IB35	16	
LR.LLR.F.Fspi.X	IA2, IB12, IB16, IB18, **IB26**	5	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.LLR.F.Fves	IB31, IB32, IB33	3	No Image
LR.LLR.F.Fves.FS	IB1, **IB4**	2	
LR.LLR.F.Fves.X	**IB12**, IB19, IB22, IB26, IB34, IB35	6	
LR.LLR.F.Asc.FS	IA2, **IA4**, IA9, IA10, IA11, IA16, IB1, IB2, IB4, IB7, IB13, IB17, IB19, IB21, IB22, IB23, IB24, IB30, IB31	19	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.LLR.F.Asc.X	IA2, IA4, IA8, **IB12**, IB16, IB18, IB19, IB23, IB26, IB27, IB32, IB33, IB34, IB35	14	
LR.LLR.Fserr.FS	IA2, **IA4**, IA9, IA16, IB13, IB32	6	
LR.LLR.F.Fserr.X	IA10, IB21, IB30, **IB31**, IB35	5	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.FLR.Lic.YG	IA1, IA2, IA3, IA4, IA5, IA6, IA7, IA9, IA10, IA11, IA12, IA13, IA15, IA16, IB2, IB4, **IB5**, IB6, IB7, IB12, IB13, IB14, IB15, IB16, IB17, **IB18**, IB19, IB21, IB24, IB25, IB26, IB27, IB28, IB29, IB30, IB31, IB32, IB33, IB34, IB35	40	
LR.FLR.Lic.Pra	IA17, **IB10**	2	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.FLR.Lic.Ver.Ver	**IA1**, IA2, IA3, IA4, IA5, IA6, IA7, IA8, IA9, IA11, IA12, IA13, IA15, IA16, IA17, IB2, IB4, IB5, IB6, IB7, IB12, IB13, IB14, IB15, IB16, IB17, IB18, IB19, IB25, IB27, IB28, **IB29**, IB30, IB31, IB32, IB33, IB34, IB35	38	
LR.FLR.Rkp.G	IA1, **IA3**, IB2, IB8	4	

Table 7.1.7 *(continued)*

Biotope	Stations	Number of Stations	Image
LR.FLR.Rkp.FK	**IA1**, IA2	2	
LR.FLR.Eph.EntPor	**IB8**	1	

Table 7.1.8 Species abundance (no./0.1m²) for infaunal samples

Taxon	Authority	SA20	SA22	SA29	SA34
Astrorhiza sp					
Cerianthus lloydii	Gosse, 1859				
ACTINIARIA spp juv					
Edwardsia claparedii	(Panceri, 1869)	4			2
Edwardsia ?timida	de Quatrefages, 1842				
Caryophyllia smithii	Stokes and Broderip, 1828				3
TURBELLARIA spp indet					
NEMERTEA spp					1
Tubulanus polymorphus	Renier, 1804				
Cerebratulus spp	Renier, 1804	1			1
Cerebratulus marginatus	Renier, 1804				
?Oerstedia dorsalis	(Abildgaard, 1806)				
NEMATODA spp					
Priapulus caudatus	Lamarck, 1816				
CHAETOGNATHA sp					
Golfingia sp juv	Lankester, 1885				
Golfingia elongata	(Herubel, 1903)				
Thysanocardia procera	(Möbius, 1875)				1
Phascolion strombus	(Montagu, 1804)				
Maxmuelleria lankesteri	(Herdman, 1898)	2			
Pisione remota	(Southern, 1914)				
Aphroditidae sp juv					1
Eunoe nodosa	(M Sars, 1861)				
Harmothoe spp juv/indet	Kinberg, 1855				
Harmothoe imbricata	(Linnaeus, 1767)				
Harmothoe impar	(Johnston, 1839)				
Harmothoe (M) glabra	(Malmgren, 1865)				
Harmothoe (M) marphysae	McIntosh, 1876				
Harmothoe (M) arenicolae	(Saint-Joseph 1888)				
Pholoe synophthalmica	Claparède, 1868				
Pholoe baltica	Oersted 1843	3			
Sthenelais limicola	(Ehlers, 1864)				
Phyllodocidae sp juv					
Eteone longa	(Fabricius, 1780)				
Mysta picta	(Quatrefages, 1866)				
Pseudomystides limbata	(Saint-Joseph, 1888)				1
Anaitides mucosa	(Oersted, 1843)				
Eumida bahusiensis	Bergstrom, 1914				
Eumida sanguinea	(Oersted, 1843)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Paranaitis kosteriensis	(Malmgren, 1867)				
Glycera alba	(O F Müller, 1776)				
Glycera fallax (gigantea)	Quatrefages, 1850				
Glycera lapidum	Quatrefages, 1866				
Glycera oxycephala	Ehlers, 1887			2	
Glycera unicornis	Savigny 1818				
Glycinde nordmanni	(Malmgren, 1866)				
Goniada maculata	Oersted, 1843				
Sphaerodoropsis minuta	(Webster and Benedict, 1887)				
Podarkeopsis capensis	(Day, 1963)				
Kefersteinia cirrata	(Keferstein, 1862)				
Ophiodromus flexuosus	(Chiaje, 1827)				
Syllis sp E *(?cornuta)*	Savigny, 1818				1
Trypanosyllis coeliaca	Claparède, 1868				
Typosyllis hyalina	(Grube, 1863)				1
Eusyllis blomstrandi	Malmgren, 1867				
Odontosyllis ctenostoma	Claparède, 1868				
Odontosyllis gibba	Claparède, 1863				
Exogone hebes	(Webster and Benedict, 1884)				
Exogone naidina	Oersted, 1845				
Exogone verugera	(Claparède, 1868)				
Sphaerosyllis taylori	Perkins, 1980				
Autolytus spp	Grube, 1850				
Nereis spp juv	Linnaeus, 1758				
Platynereis dumerilii	(Audouin and Milne-Edwards, 1833)				
Nephtys spp juv	Cuvier, 1817	1			1
Nephtys assimilis	Oersted, 1843	1			
Nephtys caeca	(Fabricius, 1780)				
Nephtys cirrosa	Ehlers, 1868		1		
Nephtys hombergii	Savigny, 1818	1			
Nephtys kersivalensis	McIntosh, 1908				
Nephtys incisa	Malmgren, 1865				
Aponuphis bilineata	(Baird, 1870)				
Nematonereis unicornis	(Grube, 1840)				
Lumbrineris gracilis	(Ehlers, 1868)	2			1
Lumbrineris hibernica	(McIntosh, 1903)				
Notocirrus scoticus	McIntosh, 1869				
Ophryotrocha sp	Claparède and Mecznikow, 1869				
Protodorvillea kefersteini	(McIntosh, 1869)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Leitoscoloplos mammosus	Mackie, 1987				
Scoloplos armiger	(O F Müller, 1776)				1
Levinsenia gracilis	(Tauber, 1879)				1
Paradoneis lyra	(Southern, 1914)				
Paraonis fulgens	(Levinsen, 1884)				
Apistobranchus tullbergi	(Theel, 1879)				
Poecilochaetus serpens	Allen, 1904	1			
Aonides oxycephala	(M Sars, 1862)				
Aonides paucibranchiata	Southern, 1914				
Laonice bahusiensis	Soderstrom, 1920				1
Malacoceros sp indet	Quatrefages, 1843				
Malacoceros fuliginosus	(Claparède, 1868)				
Minuspio cirrifera	(Wiren, 1883)				
Minuspio cf. multibranchiata	(Berkeley, 1927)				
Polydora caeca	(Oersted, 1843)				
Polydora flava	Claparède, 1870				
Prionospio dubia	Maciolek, 1985				
Prionospio fallax	Soderstrom, 1920				
Prionospio banyulensis	Laubier, 1966				
Pseudopolydora cf. paucibranchiata	(Okuda, 1937)				
Pseudopolydora pulchra	(Carazzi, 1895)				
Pygospio elegans	Claparède, 1863				
Scolelepis bonnieri	(Mesnil, 1896)	2			
Scolelepis squamata	(Abildgaard, 1806)				
Scolelepis korsuni	Sikorski 1994				
Spio armata	Thulin, 1957				
Spio decorata	Bobretzky, 1870				
Spio filicornis	(O F Müller, 1766)				
Microspio mecznikowianus	Claparède, 1870				
Spiophanes bombyx	(Claparède, 1870)				
Spiophanes kroyeri	Grube, 1860				7
Magelona alleni	Wilson, 1958				2
Magelona filiformis	Wilson, 1959				
Magelona minuta	Eliason, 1962				
Magelona johnstoni	Fiege et al, 2000				
Cirratulidae spp indet					
Caulleriella alata	(Southern, 1914)				
Tharyx killariensis	(Southern, 1914)				
Caulleriella zetlandica	(McIntosh, 1911)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Chaetozone sp 'D'	Malmgren, 1867				
Chaetozone setosa	Malmgren, 1867	1			
Cheatozone christei	Chambers, 2000				1
Dodecaceria sp	Oersted, 1843	1			
Monticellina dorsobranchialis	(Kirkegaard, 1959)				
Diplocirrus glaucus	(Malmgren, 1867)	3			5
Flabelligera affinis	M Sars, 1829				
Macrochaeta sp	Grube, 1850				
Capitella spp	Blainville, 1828				
Dasybranchus caducus	(Grube, 1846)				1
Mediomastus fragilis	Rasmussen, 1973				
Notomastus latericeus	M Sars, 1851	1			
Arenicola marina (juv)	(Linnaeus, 1758)				
Arenicolides ecaudata	(Johnston, 1865)				
Maldanidae spp juv/indet					
Clymenura sp indet	Verrill, 1900				
Clymenura johnstoni	(McIntosh, 1915)				
Euclymene spp indet	Verrill, 1900				
Euclymene droebachiensis	(M Sars, 1872)				
Euclymene oerstedii	(Claparède, 1863)				
Praxillella spp indet	Verrill, 1881				
Praxillella affinis	(M Sars, 1872)				
Praxillella gracilis	(M Sars, 1861)				
Travisia forbesii	Johnston, 1840				
Armandia polyophthalma	Kukenthal, 1887				
Ophelina acuminata	Oersted, 1843				
Scalibregma celticum	Mackie, 1991				
Scalibregma inflatum	Rathke, 1843				
Polygordius spp indet	Schneider, 1868				
Polygordius appendiculatus	Fraipont, 1887				
Polygordius lacteus	Schneider, 1868				
Saccocirrus papillocercus	Bobretzky, 1871				
Myriochele danielsseni	Hansen, 1879				
Galathowenia oculata	Zaks, 1922				
Owenia fusiformis	Chiaje, 1842				2
Amphictene auricoma	(O F Müller, 1776)				1
Ampharetidae sp juv					
Melinna palmata	Grube, 1869				
Ampharete baltica	Eliason, 1955				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Ampharete lindstroemi	Hessle, 1917				
Amphicteis gunneri	(M Sars, 1835)				1
Amphicteis midas	(Gosse, 1855)				
Anobothrus gracilis	(Malmgren, 1866)				2
Sabellides octocirrata	(M Sars, 1835)				
Sosane sulcata	Malmgren, 1866				
Terebellides stroemi	M Sars, 1835				1
Trichobranchus glacialis	Malmgren, 1866				
Amphitritinae spp juv					
Lanice conchilega	(Pallas, 1766)				
Neoamphitrite figulus	(Dalyell, 1853)				
Nicolea zostericola	(Oersted, 1844)				
Phisidia aurea	Southward, 1956				
Pista cristata	(O F Müller, 1776)				
Lysilla loveni	Malmgren, 1866				
Polycirrus spp indet	Grube, 1850				
Polycirrus medusa	Grube, 1850				1
Polycirrus norvegicus	Wollebaek, 1912				
Polycirrus plumosus	Wollebaek, 1912				
Streblosoma intestinalis	M Sars, 1872				
Thelepus cincinnatus	(Fabricius, 1780)				
Sabellidae spp juv/indet		1			
Branchiomma bombyx	(Dalyell, 1853)				
Chone filicaudata	Southern, 1914				
Euchone rubrocincta	(M Sars, 1861)				
Euchone southerni	Banse, 1970				
Jasmineira caudata	Langerhans, 1880				
Jasmineira elegans	Saint-Joseph, 1894				
Pseudopotamilla reniformis	(Bruguiere, 1789)	1			
Sabella pavonina	Savigny, 1820				
Serpulidae spp indet					
Hydroides norvegica	Gunnerus, 1768				2
Serpula/Hydroides sp					
Serpula vermicularis	Linnaeus, 1767				1
Spirorbidae spp					
Tubificidae spp					
Tubificoides benedii	(Udekem, 1855)				
Enchytraeidae sp A					
Enchytraeidae spp					

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Nymphon brevirostre	Hodge, 1863	1			
Achelia echinata	Hodge, 1864				
Endeis spinosa	(Montagu, 1808)				
Anoplodactylus petiolatus	(Kröyer, 1844)				
COPEPODA spp					
Mesnilia cluthae					
OSTRACODA spp					
Nebalia sp ♂	(O Fabricius, 1780)				
Nebalia borealis	Dahl, 1985				
Nebalia herbstii	Leach, 1814				
Sarsinebalia typhlops	(G O Sars, 1870)				
GAMMARIDEA spp indet					
Apherusa bispinosa	(Bate, 1856)				
Monoculodes carinatus	(Bate, 1856)				
Monoculodes subnudus	Norman, 1889				
Perioculodes longimanus	(Bate and Westwood, 1868)				
Pontocrates altamarinus	(Bate and Westwood, 1862)			1	
Pontocrates arenarius	(Bate, 1858)				
Synchelidium maculatum	Stebbing, 1906				
Westwoodilla caecula	(Bate, 1856)				1
Leucothoe incisa	Robertson, 1892				
Leucothoe lilljeborgi	Boeck, 1861				
Stenothoe marina	(Bate, 1856)				
Urothoe elegans	(Bate, 1856)	1			
Urothoe marina	(Bate, 1857)				
Harpinia antennaria	Meinert, 1890	5			
Harpinia crenulata	(Boeck, 1871)				
Harpinia pectinata	G O Sars, 1891				
Parametaphoxus fultoni	(T Scott, 1890)				
Phoxocephalus holbolli	(Kröyer, 1842)				
Lysianassidae sp indet					
Hippomedon denticulatus	(Bate, 1857)				
Lysianassa ceratina	(A O Walker, 1889)				
Lysianassa plumosa	Boeck, 1871				
Orchomene nanus	(Kröyer, 1846)				
Socarnes erythrophthalmus	Robertson, 1892				
Tmetonyx similis	(G O Sars, 1891)				
Tryphosella sarsi	Bonnier, 1893				
Tryphosites longipes	(Bate and Westwood, 1861)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Iphimedia minuta	G O Sars, 1882				
Atylus swammerdamei	(H Milne-Edwards, 1830)				
Atylus vedlomensis	(Bate and Westwood, 1862)				
Dexamine spinosa	(Montagu, 1813)				
Dexamine thea	Boeck, 1861				
Guernea coalita	(Norman, 1868)				
Ampelisca spp indet	Kröyer, 1842				
Ampelisca brevicornis	(Costa, 1853)	1			
Ampelisca diadema	(A Costa, 1853)				
Ampelisca tenuicornis	Liljeborg, 1855				
Ampelisca typica	(Bate, 1856)				
Bathyporeia spp indet	Lindström, 1855				
Bathyporeia guilliamsoniana	(Bate, 1856)				
Bathyporeia pelagica	(Bate, 1856)				
Bathyporeia tenuipes	Meinert, 1877				
Gammaridae sp ♀/juv					
Gammarus locusta	(Linnaeus, 1758)				
Megaluropus agilis	Hoek, 1889				
Melitidae spp ♀/juv/indet					
Abludomelita obtusata	(Montagu, 1813)				
Cheirocratus spp ♀/juv	Norman, 1867				
Cheirocratus intermedius	G O Sars, 1894				
Maera othonis	(H Milne-Edwards, 1830)				
Amphithoe rubricata	(Montagu, 1808)				
Sunamphithoe pelagica	(H Milne-Edwards, 1830)				
Gammaropsis maculata	(Johnston, 1828)				
Gammaropsis cornuta	(Norman, 1869)				
Photis longicaudata	(Bate and Westwood, 1862)				
Ericthonius sp indet	H Milne-Edwards, 1830				
Ericthonius punctatus	(Bate, 1857)				
Ischyrocerus anguipes	Kröyer, 1838				
Jassa falcata	(Montagu, 1808)				
Aoridae/Isaidae spp ♀/indet					
Aora gracilis	(Bate, 1857)				
Leptocheirus hirsutimanus	(Bate, 1862)				
Leptocheirus pectinatus	(Norman, 1869)				
Microdeutopus anomalus	(Rathke, 1843)				
Microdeutopus versiculatus	(Bate, 1856)				
Corophium spp indet	Latreille, 1806				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Corophium affine	Bruzelius, 1859				
Corophium arenarium	Crawford, 1937				
Corophium bonnellii	(H Milne-Edwards, 1830)				
Corophium crassicorne	Bruzelius, 1859				
Siphonoecetes kroyeranus	Bate, 1856		1		
Caprella acanthifera	Leach, 1814				
Pariambus typicus	(Kröyer, 1845)				
Phtisica marina	Slabber, 1769				1
Pseudoprotella phasma	(Montagu, 1804)				
Gnathia sp (praniza)	Leach, 1814				
Cymodoce truncata	Leach, 1814				
Idotea spp juv	Fabricius, 1798				
Idotea baltica	(Pallas, 1772)				
Idotea linearis	(Pennant, 1777)				
Idotea neglecta	G O Sars, 1897				
Arcturella dilatata	(G O Sars, 1882)				
Tanaopsis graciloides	(Liljeborg, 1864)				1
Apseudes talpa	(Montagu, 1808)				
Iphinoe serrata	Norman, 1867				2
Iphinoe trispinosa	(Goodsir, 1843)				
Eudorella truncatula	(Bate, 1856)				
Campylaspis legendrei	Fage, 1951				
Diastylis sp indet	Say, 1818				
Diastylis laevis	Norman, 1869				
Diastylis lucifera	(Kroeyer, 1841)				
Diastylis rugosa	G O Sars, 1865				
Diastyloides biplicata	(G O Sars, 1865)				
DECAPODA sp juv/indet					
CARIDEA spp juv/indet					
Hippolyte varians	Leach, 1814				
Thoralus cranchii	(Leach, 1817)				
Processa nouveli holthuisi	(Al-Adhub and Williamson, 1975)				
Paguridae spp juv/indet					6
Pagurus bernhardus	(Linnaeus, 1758)	1			
Galathea intermedia	Liljeborg, 1851				
Pisidia longicornis	(Linnaeus, 1767)				
Liocarcinus pusillus	(Leach, 1815)				
Goneplax rhomboides	(Linnaeus, 1758)				
Pilumnus hirtellus	(Linnaeus, 1761)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
?Scutopus ventrolineatus	Salvini-Plawen, 1968				
Chaetoderma nitidulum	Lovén, 1844				
Leptochiton asellus	(Gmelin, 1791)				
Lepidochitona cinerea	(Linnaeus, 1767)				
Helcion pellucidum	(Linnaeus, 1758)				
Tricolia pullus	(Linnaeus, 1758)				
Lacuna vincta	(Montagu, 1803)				
Rissoa interrupta	(J Adams, 1800)				
Turritella communis	(Risso, 1826)	17			4
Polinices pulchellus	(Risso, 1826)				
Philine spp	A Adams, 1865				2
Hinia reticulata	(Linnaeus, 1758)				
OPISTHOBRANCHIA spp indet					
Acteon tornatilis	(Linnaeus, 1758)				
Cylichna cylindracea	(Pennant, 1777)				
Retusa obtusa	(Montagu, 1803)				
Retusa umbilicata	(Montagu, 1803)				
Berthella plumula	(Montagu, 1803)				
Antalis entalis	(Linnaeus, 1758)				1
PELECYPODA spp juv/indet					
Nucula nitidosa	(Winckworth, 1930)				1
Nucula nucleus	(Linnaeus, 1758)				
Mytilidae spp juv					
Crenella decussata	(Montagu, 1808)				
Modiolarca tumida	(Hanley, 1843)				
Chlamys varia	(Linnaeus, 1758)				
Myrtea spinifera	(Montagu, 1803)	1			17
Lucinoma borealis	(Linnaeus, 1767)	2			1
Thyasira flexuosa	(Montagu, 1803)				2
Thyasira ?polygona	(Jeffreys 1884)				
Devonia perrieri	(Malard, 1904)				
Mysella bidentata	(Montagu, 1803)	11			
Tellimya ferruginosa	(Montagu, 1808)				
Goodallia triangularis	(Montagu, 1803)				
CARDIACEA spp juv/indet					1
Acanthocardia aculeata	(Linnaeus, 1758)				
Parvicardium scabrum	(Philippi, 1844)				2
Spisula elliptica	(Brown, 1827)				
Spisula solida	(Linnaeus, 1758)				

Table 7.1.8 *(continued)*

Taxon	Authority	SA20	SA22	SA29	SA34
Ensis arcuatus	(Jeffreys, 1865)				
Ensis ensis	(Linnaeus, 1758)				
Phaxas pellucidus	(Pennant, 1777)			1	
Angulus tenuis	(da Costa, 1778)				
Fabulina fabula	(Gmelin, 1791)	3			
Moerella pygmaea	(Lovén, 1846)	3		2	
Gari fervensis	(Gmelin, 1791)	1			
Gari tellinella	(Lamarck, 1818)				
Gari depressa	(Pennant, 1777)				1
Abra spp juv/indet	Lamarck, 1818				
Abra alba	(W Wood, 1802)	3			1
Abra nitida	(O F Müller, 1776)	8			28
Abra prismatica	(Montagu, 1808)	1			
Gouldia minima	(Montagu, 1803)	1			
Dosinia lupinus	(Linnaeus, 1758)	6			2
Dosinia exoleta	(Linnaeus, 1758)				
Tapes rhomboides	(Pennant, 1777)				
Chamelea gallina	(Linnaeus, 1758)	5			1
Timoclea ovata	(Pennant, 1777)	15			6
Mysia undata	(Pennant, 1777)				
Mya truncata	(Linnaeus, 1758)				
Corbula gibba	(Olivi, 1792)	4			3
Hiatella arctica	(Linnaeus, 1767)	3			
Thracia spp juv					
Thracia phaseolina	(Lamarck, 1818)	4			
Thracia villosiuscula	(Macgillivray, 1827)				
Cochlodesma praetenue	(Pulteney, 1799)	4			
Phoronis spp	Wright, 1856	1			5
ASTEROIDEA spp juv					
Amphiuridae spp juv		3			3
Amphiura brachiata	(Montagu, 1804)				
Amphiura chiajei	Forbes, 1843				23
Amphiura filiformis	(O F Müller, 1776)	19			7
Amphipholis squamata	(Chiaje, 1829)				
Ophiuridae spp juv					
Ophiura affinis	Lütken, 1858			1	
Ophiura albida	Forbes, 1839				
ECHINOIDEA spp juv/indet					
Echinocyamus pusillus	(O F Müller, 1776)				2
Echinocardium cordatum	(Pennant, 1777)		1		
Leptopentacta elongata	(Duben and Koren, 1845)				
Leptosynapta inhaerens	(O F Müller, 1776)				2
Labidoplax media	(Ostergren, 1905)				

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Astrorhiza sp								
Cerianthus lloydii		2	4			2	1	
ACTINIARIA spp juv								3
Edwardsia claparedii	3	33	13			12		1
Edwardsia ?timida								
Caryophyllia smithii								
TURBELLARIA spp indet								
NEMERTEA spp	2	1			1	1		
Tubulanus polymorphus	1		1			2	2	1
Cerebratulus spp	1	1	1				1	
Cerebratulus marginatus								
?Oerstedia dorsalis								
NEMATODA spp		1	6				4	
Priapulus caudatus								
CHAETOGNATHA sp								
Golfingia sp juv								
Golfingia elongata			1					
Thysanocardia procera	1	1	2	1		3		3
Phascolion strombus	2	1	2	1		2	1	
Maxmuelleria lankesteri								
Pisione remota								
Aphroditidae sp juv								
Eunoe nodosa								
Harmothoe spp juv/indet	1							
Harmothoe imbricata								
Harmothoe impar								
Harmothoe (M) glabra		1						
Harmothoe (M) marphysae						2		
Harmothoe (M) arenicolae							1	
Pholoe synophthalmica		1					3	
Pholoe baltica		1	1		1			1
Sthenelais limicola								
Phyllodocidae sp juv								
Eteone longa								
Mysta picta								
Pseudomystides limbata								
Anaitides mucosa								
Eumida bahusiensis								
Eumida sanguinea							2	

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Paranaitis kosteriensis				2		1		
Glycera alba		3	1			2	2	
Glycera fallax (gigantea)							1	
Glycera lapidum			1				8	
Glycera oxycephala							1	
Glycera unicornis				1				
Glycinde nordmanni		2	1			1	1	
Goniada maculata		2	1			1		
Sphaerodoropsis minuta								
Podarkeopsis capensis			1			3		
Kefersteinia cirrata								
Ophiodromus flexuosus					1	1		1
Syllis sp E *(?cornuta)*								
Trypanosyllis coeliaca								
Typosyllis hyalina								
Eusyllis blomstrandi								
Odontosyllis ctenostoma								
Odontosyllis gibba								
Exogone hebes					2	1	2	1
Exogone naidina								
Exogone verugera		1	3			1	1	
Sphaerosyllis taylori								
Autolytus spp								
Nereis spp juv								
Platynereis dumerilii							1	
Nephtys spp juv		1						
Nephtys assimilis								
Nephtys caeca								
Nephtys cirrosa								
Nephtys hombergii		1				4		
Nephtys kersivalensis			1		1		3	
Nephtys incisa	2							7
Aponuphis bilineata			3					
Nematonereis unicornis								
Lumbrineris gracilis		2	7			1	6	
Lumbrineris hibernica		1						
Notocirrus scoticus								
Ophryotrocha sp					1			
Protodorvillea kefersteini								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Leitoscoloplos mammosus						1		
Scoloplos armiger								
Levinsenia gracilis	1					1	3	2
Paradoneis lyra						2	5	
Paraonis fulgens								
Apistobranchus tullbergi						2	15	
Poecilochaetus serpens	2							
Aonides oxycephala							5	
Aonides paucibranchiata							1	
Laonice bahusiensis		1	2					
Malacoceros sp indet								
Malacoceros fuliginosus								
Minuspio cirrifera								
Minuspio cf. multibranchiata								2
Polydora caeca						1		
Polydora flava						1		
Prionospio dubia	2					1		
Prionospio fallax			1	1	5	3	1	
Prionospio banyulensis			5				1	
Pseudopolydora cf. paucibranchiata							2	
Pseudopolydora pulchra					1			
Pygospio elegans								
Scolelepis bonnieri								
Scolelepis squamata								
Scolelepis korsuni	1							
Spio armata								
Spio decorata								
Spio filicornis					1			
Microspio mecznikowianus								
Spiophanes bombyx								
Spiophanes kroyeri	2	4	2	2		3		1
Magelona alleni	2	3	4	2		1		
Magelona filiformis								
Magelona minuta	1					3		4
Magelona johnstoni								
Cirratulidae spp indet		2	2					
Caulleriella alata								
Tharyx killariensis								
Caulleriella zetlandica			1					

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Chaetozone sp 'D'		4			1		4	1
Chaetozone setosa				1				1
Chaetozone christie								
Dodecaceria sp								
Monticellina dorsobranchialis				1			1	
Diplocirrus glaucus	7	6	2	7	2	33	4	11
Flabelligera affinis								
Macrochaeta sp								
Capitella spp					1			
Dasybranchus caducus						1		
Mediomastus fragilis							42	
Notomastus latericeus		1	7	5	6	11		5
Arenicola marina (juv)					1			
Arenicolides ecaudata								
Maldanidae spp juv/indet	1							
Clymenura sp indet								
Clymenura johnstoni					3	1		
Euclymene spp indet			1		10	1	1	
Euclymene droebachiensis								
Euclymene oerstedii					5			
Praxillella spp indet						2	1	
Praxillella affinis					1			
Praxillella gracilis								
Travisia forbesii								
Armandia polyophthalma								
Ophelina acuminata								
Scalibregma celticum							7	
Scalibregma inflatum				3			7	3
Polygordius spp indet								1
Polygordius appendiculatus								
Polygordius lacteus								
Saccocirrus papillocercus								
Myriochele danielsseni								
Galathowenia oculata			3			2		
Owenia fusiformis	1	1		1	1	1	1	
Amphictene auricoma		1						
Ampharetidae sp juv								
Melinna palmata		1			30	1		3
Ampharete baltica								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Ampharete lindstroemi		2			1		3	
Amphicteis gunneri		3						1
Amphicteis midas							1	
Anobothrus gracilis		1	2					
Sabellides octocirrata		1						
Sosane sulcata	1	2						
Terebellides stroemi		1	1		16	2	2	
Trichobranchus glacialis							1	
Amphitritinae spp juv								
Lanice conchilega					1		1	
Neoamphitrite figulus								
Nicolea zostericola								
Phisidia aurea								
Pista cristata							4	
Lysilla loveni								
Polycirrus spp indet		1						
Polycirrus medusa							4	
Polycirrus norvegicus							2	1
Polycirrus plumosus	1					3		3
Streblosoma intestinalis		3	1					
Thelepus cincinnatus							1	
Sabellidae spp juv/indet							1	
Branchiomma bombyx								
Chone filicaudata			1				1	
Euchone rubrocincta		2						
Euchone southerni							5	
Jasmineira caudata							1	
Jasmineira elegans								
Pseudopotamilla reniformis								
Sabella pavonina								
Serpulidae spp indet								
Hydroides norvegica							1	
Serpula/Hydroides sp								
Serpula vermicularis								
Spirorbidae spp								
Tubificidae spp					2		3	
Tubificoides benedii								
Enchytraeidae sp A								
Enchytraeidae spp							8	

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Nymphon brevirostre								
Achelia echinata								
Endeis spinosa								
Anoplodactylus petiolatus		3						
COPEPODA spp			2					
Mesnilia cluthae								
OSTRACODA spp					3	6	3	1
Nebalia sp ♂								
Nebalia borealis								
Nebalia herbstii							1	
Sarsinebalia typhlops								
GAMMARIDEA spp indet							1	1
Apherusa bispinosa								
Monoculodes carinatus							1	
Monoculodes subnudus								
Perioculodes longimanus								
Pontocrates altamarinus								
Pontocrates arenarius								
Synchelidium maculatum								
Westwoodilla caecula								
Leucothoe incisa								
Leucothoe lilljeborgi					1			
Stenothoe marina							1	
Urothoe elegans								
Urothoe marina								
Harpinia antennaria	3			2	2			
Harpinia crenulata								1
Harpinia pectinata					2	2		
Parametaphoxus fultoni					1		1	
Phoxocephalus holbolli								
Lysianassidae sp indet								
Hippomedon denticulatus								
Lysianassa ceratina								
Lysianassa plumosa		1					6	
Orchomene nanus							1	
Socarnes erythrophthalmus								
Tmetonyx similis								
Tryphosella sarsi								
Tryphosites longipes								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Iphimedia minuta								
Atylus swammerdamei								
Atylus vedlomensis					1		1	
Dexamine spinosa								
Dexamine thea								
Guernea coalita								
Ampelisca spp indet					1			
Ampelisca brevicornis								
Ampelisca diadema								
Ampelisca tenuicornis		1			30	2		1
Ampelisca typica					1	1	10	
Bathyporeia spp indet								
Bathyporeia guilliamsoniana								
Bathyporeia pelagica								
Bathyporeia tenuipes								
Gammaridae sp ♀/juv								
Gammarus locusta								
Megaluropus agilis								
Melitidae spp ♀/juv/indet								
Abludomelita obtusata	5					3		
Cheirocratus spp ♀/juv								
Cheirocratus intermedius								
Maera othonis							2	
Amphithoe rubricata								
Sunamphithoe pelagica								
Gammaropsis maculata							3	
Gammaropsis cornuta								
Photis longicaudata						1	4	
Ericthonius sp indet								
Ericthonius punctatus								
Ischyrocerus anguipes								
Jassa falcata								
Aoridae/Isaidae spp ♀/indet							1	
Aora gracilis								
Leptocheirus hirsutimanus								
Leptocheirus pectinatus		1		1				
Microdeutopus anomalus								
Microdeutopus versiculatus								
Corophium spp indet								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Corophium affine								
Corophium arenarium								
Corophium bonnellii							3	
Corophium crassicorne								
Siphonoecetes kroyeranus								
Caprella acanthifera							4	
Pariambus typicus		2				2		
Phtisica marina		1			2		8	
Pseudoprotella phasma							1	
Gnathia sp (praniza)							1	
Cymodoce truncata							1	
Idotea spp juv								
Idotea baltica								
Idotea linearis								
Idotea neglecta								
Arcturella dilatata						1		
Tanaopsis graciloides							9	
Apseudes talpa								
Iphinoe serrata								
Iphinoe trispinosa								
Eudorella truncatula					1			
Campylaspis legendrei		1						
Diastylis sp indet								
Diastylis laevis					1	2		
Diastylis lucifera		1						
Diastylis rugosa		2					1	
Diastyloides biplicata			1					
DECAPODA sp juv/indet						1		
CARIDEA spp juv/indet								
Hippolyte varians								
Thoralus cranchii								
Processa nouveli holthuisi				2				
Paguridae spp juv/indet								
Pagurus bernhardus								
Galathea intermedia							9	
Pisidia longicornis			1				2	
Liocarcinus pusillus		1						
Goneplax rhomboides								
Pilumnus hirtellus								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
?Scutopus ventrolineatus				1				
Chaetoderma nitidulum	1	1		1				
Leptochiton asellus								
Lepidochitona cinerea								
Helcion pellucidum								
Tricolia pullus								
Lacuna vincta								
Rissoa interrupta								
Turritella communis	34	4	1	14		31		10
Polinices pulchellus		1						
Philine spp	1							
Hinia reticulata								
OPISTHOBRANCHIA spp indet						1		
Acteon tornatilis								
Cylichna cylindracea								
Retusa obtusa								
Retusa umbilicata								
Berthella plumula								
Antalis entalis								
PELECYPODA spp juv/indet								3
Nucula nitidosa		1				1		
Nucula nucleus								
Mytilidae spp juv							1	
Crenella decussata							1	
Modiolarca tumida								
Chlamys varia								
Myrtea spinifera	3	6	1	2		2		1
Lucinoma borealis		2	2			1	1	1
Thyasira flexuosa	13	6		6	7	1	3	13
Thyasira ?polygona		1						
Devonia perrieri						1		
Mysella bidentata		1	1	1	35	2	1	2
Tellimya ferruginosa								
Goodallia triangularis								
CARDIACEA spp juv/indet								
Acanthocardia aculeata								
Parvicardium scabrum							1	
Spisula elliptica				1				
Spisula solida								

Table 7.1.8 *(continued)*

Taxon	SA35	SA37	SA38	SA40	SA43	SA46	SA48	SA51
Ensis arcuatus								
Ensis ensis							1	
Phaxas pellucidus		2	1			1		
Angulus tenuis								
Fabulina fabula								
Moerella pygmaea								
Gari fervensis								
Gari tellinella							1	1
Gari depressa								
Abra spp juv/indet						3		
Abra alba	1	3	1		2	5		
Abra nitida	71	10	1	37	11	35		55
Abra prismatica								
Gouldia minima								1
Dosinia lupinus		24	1		3	2	1	4
Dosinia exoleta	1						2	
Tapes rhomboides								
Chamelea gallina			1					3
Timoclea ovata	1	25	8	5			20	6
Mysia undata		1						1
Mya truncata							1	
Corbula gibba	1	3	1	1	1	5	1	3
Hiatella arctica	1							
Thracia spp juv					2	3		
Thracia phaseolina								
Thracia villosiuscula		4					2	
Cochlodesma praetenue		1						
Phoronis spp	1		1			5		
ASTEROIDEA spp juv							1	
Amphiuridae spp juv		4			3	5	5	2
Amphiura brachiata								
Amphiura chiajei		5			6	3		2
Amphiura filiformis		55	18		6	6		3
Amphipholis squamata				1			4	
Ophiuridae spp juv		1						
Ophiura affinis							1	
Ophiura albida								
ECHINOIDEA spp juv/indet							2	
Echinocyamus pusillus		3	2			1		
Echinocardium cordatum								
Leptopentacta elongata		1						
Leptosynapta inhaerens		1	1			2		
Labidoplax media					6			

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Astrorhiza sp								
Cerianthus lloydii	1							
ACTINIARIA spp juv			1					
Edwardsia claparedii	1			4	4			2
Edwardsia ?timida								
Caryophyllia smithii								
TURBELLARIA spp indet					1			
NEMERTEA spp	2			1				1
Tubulanus polymorphus				1	2			
Cerebratulus spp	1		2					2
Cerebratulus marginatus				2				
?Oerstedia dorsalis								
NEMATODA spp			1		1		1	
Priapulus caudatus								
CHAETOGNATHA sp	1							
Golfingia sp juv								
Golfingia elongata	1							
Thysanocardia procera				3				
Phascolion strombus	1							1
Maxmuelleria lankesteri								
Pisione remota							5	
Aphroditidae sp juv				1				
Eunoe nodosa				1				1
Harmothoe spp juv/indet								
Harmothoe imbricata			1					
Harmothoe impar	1							
Harmothoe (M) glabra								
Harmothoe (M) marphysae								
Harmothoe (M) arenicolae				1				
Pholoe synophthalmica	3							
Pholoe baltica					1			9
Sthenelais limicola								2
Phyllodocidae sp juv								
Eteone longa								
Mysta picta								
Pseudomystides limbata								
Anaitides mucosa								
Eumida bahusiensis								
Eumida sanguinea	2							

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Paranaitis kosteriensis								
Glycera alba								
Glycera fallax (gigantea)								
Glycera lapidum	4		5				1	
Glycera oxycephala								
Glycera unicornis								
Glycinde nordmanni	2							
Goniada maculata								
Sphaerodoropsis minuta								
Podarkeopsis capensis								
Kefersteinia cirrata								
Ophiodromus flexuosus				1				1
Syllis sp E (*?cornuta*)								
Trypanosyllis coeliaca								
Typosyllis hyalina								
Eusyllis blomstrandi			6					
Odontosyllis ctenostoma			2					
Odontosyllis gibba			17					
Exogone hebes								1
Exogone naidina								
Exogone verugera								
Sphaerosyllis taylori								
Autolytus spp								
Nereis spp juv								
Platynereis dumerilii			1					
Nephtys spp juv								2
Nephtys assimilis								
Nephtys caeca			1					
Nephtys cirrosa			1					
Nephtys hombergii				3				10
Nephtys kersivalensis			1					
Nephtys incisa								
Aponuphis bilineata	2							
Nematonereis unicornis	1							
Lumbrineris gracilis	19			1				3
Lumbrineris hibernica								
Notocirrus scoticus								1
Ophryotrocha sp								
Protodorvillea kefersteini	1							

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Leitoscoloplos mammosus								
Scoloplos armiger			2					
Levinsenia gracilis								1
Paradoneis lyra				1				1
Paraonis fulgens								
Apistobranchus tullbergi								
Poecilochaetus serpens								
Aonides oxycephala								
Aonides paucibranchiata	1		2					
Laonice bahusiensis								
Malacoceros sp indet								
Malacoceros fuliginosus								
Minuspio cirrifera								1
Minuspio cf. multibranchiata								
Polydora caeca								2
Polydora flava								2
Prionospio dubia								
Prionospio fallax								
Prionospio banyulensis								
Pseudopolydora cf. paucibranchiata								
Pseudopolydora pulchra								1
Pygospio elegans								
Scolelepis bonnieri								
Scolelepis squamata		1						
Scolelepis korsuni								
Spio armata								
Spio decorata								
Spio filicornis			6		1			
Microspio mecznikowianus								
Spiophanes bombyx				1				1
Spiophanes kroyeri				6				
Magelona alleni				1	1			3
Magelona filiformis					3	1		
Magelona minuta								3
Magelona johnstoni					1			
Cirratulidae spp indet								
Caulleriella alata	1		1					1
Tharyx killariensis								3
Caulleriella zetlandica	1							

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Chaetozone sp 'D'								1
Chaetozone setosa	1			2				
Chaetozone christie							1	
Dodecaceria sp								
Monticellina dorsobranchialis								1
Diplocirrus glaucus				4				8
Flabelligera affinis								
Macrochaeta sp								
Capitella spp			7					
Dasybranchus caducus								
Mediomastus fragilis	5		11					
Notomastus latericeus	1							
Arenicola marina (juv)								
Arenicolides ecaudata								1
Maldanidae spp juv/indet				2			1	
Clymenura sp indet			1					
Clymenura johnstoni								2
Euclymene spp indet								1
Euclymene droebachiensis			1					3
Euclymene oerstedii								6
Praxillella spp indet								4
Praxillella affinis			1					
Praxillella gracilis								
Travisia forbesii		4						
Armandia polyophthalma								
Ophelina acuminata								
Scalibregma celticum								
Scalibregma inflatum	1							
Polygordius spp indet								
Polygordius appendiculatus							1	
Polygordius lacteus			1					
Saccocirrus papillocercus								
Myriochele danielsseni					6			
Galathowenia oculata					2			4
Owenia fusiformis				2	2	1		3
Amphictene auricoma				1				
Ampharetidae sp juv								
Melinna palmata								15
Ampharete baltica								

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Ampharete lindstroemi	1							1
Amphicteis gunneri								
Amphicteis midas								
Anobothrus gracilis	1							
Sabellides octocirrata								
Sosane sulcata								
Terebellides stroemi	3							
Trichobranchus glacialis								
Amphitritinae spp juv	1							
Lanice conchilega								1
Neoamphitrite figulus								
Nicolea zostericola								
Phisidia aurea	1							
Pista cristata	1							
Lysilla loveni				1				
Polycirrus spp indet								
Polycirrus medusa			4					
Polycirrus norvegicus			1	1				
Polycirrus plumosus				1				1
Streblosoma intestinalis								1
Thelepus cincinnatus								
Sabellidae spp juv/indet								
Branchiomma bombyx								
Chone filicaudata			1					
Euchone rubrocincta	1							
Euchone southerni								
Jasmineira caudata	5							
Jasmineira elegans								
Pseudopotamilla reniformis								
Sabella pavonina								
Serpulidae spp indet	1							
Hydroides norvegica	3							
Serpula/Hydroides sp	1							
Serpula vermicularis			1					
Spirorbidae spp								
Tubificidae spp								
Tubificoides benedii			1					1
Enchytraeidae sp A								
Enchytraeidae spp								

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Nymphon brevirostre								
Achelia echinata	1		1					
Endeis spinosa			1					
Anoplodactylus petiolatus					2			
COPEPODA spp							2	
Mesnilia cluthae								
OSTRACODA spp	1							
Nebalia sp ♂								
Nebalia borealis								
Nebalia herbstii								
Sarsinebalia typhlops								
GAMMARIDEA spp indet			2					
Apherusa bispinosa			4					
Monoculodes carinatus								
Monoculodes subnudus								1
Perioculodes longimanus		1	1					
Pontocrates altamarinus								
Pontocrates arenarius								
Synchelidium maculatum		1						
Westwoodilla caecula								
Leucothoe incisa								
Leucothoe lilljeborgi								
Stenothoe marina								
Urothoe elegans			1		1			
Urothoe marina								
Harpinia antennaria					1			1
Harpinia crenulata								
Harpinia pectinata								
Parametaphoxus fultoni								
Phoxocephalus holbolli								
Lysianassidae sp indet								
Hippomedon denticulatus						1		
Lysianassa ceratina								
Lysianassa plumosa			1					
Orchomene nanus								
Socarnes erythrophthalmus			3					
Tmetonyx similis								
Tryphosella sarsi								
Tryphosites longipes								

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Iphimedia minuta			4					
Atylus swammerdamei								
Atylus vedlomensis	1							
Dexamine spinosa			6					
Dexamine thea								
Guernea coalita								
Ampelisca spp indet								
Ampelisca brevicornis					3			
Ampelisca diadema								
Ampelisca tenuicornis	1							6
Ampelisca typica	1		1					
Bathyporeia spp indet								
Bathyporeia guilliamsoniana								
Bathyporeia pelagica								
Bathyporeia tenuipes								
Gammaridae sp ♀/juv								
Gammarus locusta								
Megaluropus agilis								
Melitidae spp ♀/juv/indet		1						1
Abludomelita obtusata								
Cheirocratus spp ♀/juv								
Cheirocratus intermedius								
Maera othonis			1					
Amphithoe rubricata								
Sunamphithoe pelagica								
Gammaropsis maculata			1					
Gammaropsis cornuta								
Photis longicaudata	3							
Ericthonius sp indet								
Ericthonius punctatus								
Ischyrocerus anguipes			1					
Jassa falcata								
Aoridae/Isaidae spp ♀/indet			2					
Aora gracilis								
Leptocheirus hirsutimanus								
Leptocheirus pectinatus			1					
Microdeutopus anomalus								
Microdeutopus versiculatus			2					
Corophium spp indet			1					

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Corophium affine								
Corophium arenarium								
Corophium bonnellii								
Corophium crassicorne			1					
Siphonoecetes kroyeranus		4						
Caprella acanthifera			19	1				
Pariambus typicus								
Phtisica marina			3			1		2
Pseudoprotella phasma	1							
Gnathia sp (praniza)								
Cymodoce truncata								
Idotea spp juv								
Idotea baltica								
Idotea linearis								
Idotea neglecta								
Arcturella dilatata								
Tanaopsis graciloides								
Apseudes talpa								
Iphinoe serrata								
Iphinoe trispinosa						1		
Eudorella truncatula								
Campylaspis legendrei								
Diastylis sp indet								
Diastylis laevis				1				1
Diastylis lucifera								
Diastylis rugosa								
Diastyloides biplicata								
DECAPODA sp juv/indet			1					
CARIDEA spp juv/indet								
Hippolyte varians			1					
Thoralus cranchii			2		1			
Processa nouveli holthuisi								
Paguridae spp juv/indet			3					1
Pagurus bernhardus								
Galathea intermedia	2		9					
Pisidia longicornis			3					
Liocarcinus pusillus	3		1		1	1		1
Goneplax rhomboides				1				
Pilumnus hirtellus								

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
?Scutopus ventrolineatus								
Chaetoderma nitidulum				1				
Leptochiton asellus	2							
Lepidochitona cinerea								
Helcion pellucidum		1						
Tricolia pullus			1					
Lacuna vincta								
Rissoa interrupta								
Turritella communis				16	1			28
Polinices pulchellus	1							
Philine spp								
Hinia reticulata								
OPISTHOBRANCHIA spp indet								
Acteon tornatilis								
Cylichna cylindracea				2				1
Retusa obtusa								
Retusa umbilicata								1
Berthella plumula		1						
Antalis entalis								
PELECYPODA spp juv/indet				1				
Nucula nitidosa								
Nucula nucleus								
Mytilidae spp juv								
Crenella decussata								1
Modiolarca tumida								
Chlamys varia								1
Myrtea spinifera	2			5				6
Lucinoma borealis	1					1		1
Thyasira flexuosa	3			13				51
Thyasira ?polygona								
Devonia perrieri								
Mysella bidentata	2			11	4			84
Tellimya ferruginosa								1
Goodallia triangularis								
CARDIACEA spp juv/indet								
Acanthocardia aculeata				1	2			2
Parvicardium scabrum	1							
Spisula elliptica		1						
Spisula solida								

Table 7.1.8 *(continued)*

Taxon	SA53	SA61	SA67	SA80	SA83	SA85	SA95	SA103
Ensis arcuatus			6					
Ensis ensis								
Phaxas pellucidus								2
Angulus tenuis								
Fabulina fabula					2			
Moerella pygmaea					1	2	2	
Gari fervensis					1			
Gari tellinella			2					
Gari depressa								
Abra spp juv/indet								
Abra alba								
Abra nitida				49	1			6
Abra prismatica					4			
Gouldia minima								
Dosinia lupinus	2	1		7	7			5
Dosinia exoleta			1					
Tapes rhomboides	2							
Chamelea gallina	1		1					
Timoclea ovata	4		5		2			3
Mysia undata				1				
Mya truncata								
Corbula gibba	1							
Hiatella arctica				1				
Thracia spp juv								
Thracia phaseolina				1	1			2
Thracia villosiuscula	1							
Cochlodesma praetenue					1	3		4
Phoronis spp				2	1			2
ASTEROIDEA spp juv								
Amphiuridae spp juv	1		2	2				
Amphiura brachiata						1		
Amphiura chiajei					3			2
Amphiura filiformis				14	3			25
Amphipholis squamata								
Ophiuridae spp juv								
Ophiura affinis								4
Ophiura albida	1		3					
ECHINOIDEA spp juv/indet				1				
Echinocyamus pusillus	2			1	3	3		5
Echinocardium cordatum					1	1		1
Leptopentacta elongata								
Leptosynapta inhaerens				2				
Labidoplax media	1							22

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Astrorhiza sp	2							
Cerianthus lloydii								
ACTINIARIA spp juv	1							
Edwardsia claparedii	41			2				
Edwardsia ?timida								
Caryophyllia smithii								
TURBELLARIA spp indet								
NEMERTEA spp	1	1			2			
Tubulanus polymorphus	1							1
Cerebratulus spp	2						1	
Cerebratulus marginatus								
?Oerstedia dorsalis								
NEMATODA spp	1							
Priapulus caudatus								
CHAETOGNATHA sp								
Golfingia sp juv								
Golfingia elongata								
Thysanocardia procera								
Phascolion strombus	1							
Maxmuelleria lankesteri								
Pisione remota			4					
Aphroditidae sp juv								
Eunoe nodosa								
Harmothoe spp juv/indet								
Harmothoe imbricata								
Harmothoe impar								
Harmothoe (M) glabra								
Harmothoe (M) marphysae								
Harmothoe (M) arenicolae	1							
Pholoe synophthalmica								
Pholoe baltica	18							
Sthenelais limicola	2							
Phyllodocidae sp juv								
Eteone longa	1							
Mysta picta								
Pseudomystides limbata						1		
Anaitides mucosa					1			
Eumida bahusiensis	1							
Eumida sanguinea								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Paranaitis kosteriensis								
Glycera alba								
Glycera fallax (gigantea)								
Glycera lapidum						1		
Glycera oxycephala								
Glycera unicornis								
Glycinde nordmanni	1							
Goniada maculata								
Sphaerodoropsis minuta								
Podarkeopsis capensis								
Kefersteinia cirrata								
Ophiodromus flexuosus								
Syllis sp E (*?cornuta*)	1							
Trypanosyllis coeliaca								
Typosyllis hyalina								
Eusyllis blomstrandi								
Odontosyllis ctenostoma								
Odontosyllis gibba								
Exogone hebes					1			
Exogone naidina								
Exogone verugera								
Sphaerosyllis taylori								
Autolytus spp								
Nereis spp juv								
Platynereis dumerilii							1	2
Nephtys spp juv	3	1						
Nephtys assimilis								
Nephtys caeca								
Nephtys cirrosa		2			5	6		1
Nephtys hombergii	6						5	1
Nephtys kersivalensis								
Nephtys incisa								
Aponuphis bilineata								
Nematonereis unicornis								
Lumbrineris gracilis	4							
Lumbrineris hibernica								
Notocirrus scoticus								
Ophryotrocha sp								
Protodorvillea kefersteini								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Leitoscoloplos mammosus							6	
Scoloplos armiger					2			2
Levinsenia gracilis								
Paradoneis lyra								
Paraonis fulgens								
Apistobranchus tullbergi								
Poecilochaetus serpens	2							
Aonides oxycephala								
Aonides paucibranchiata								
Laonice bahusiensis								
Malacoceros sp indet								
Malacoceros fuliginosus								
Minuspio cirrifera								
Minuspio cf. multibranchiata								
Polydora caeca								
Polydora flava	1							
Prionospio dubia								
Prionospio fallax								
Prionospio banyulensis					2			
Pseudopolydora cf. paucibranchiata								
Pseudopolydora pulchra	1							
Pygospio elegans								
Scolelepis bonnieri								
Scolelepis squamata								
Scolelepis korsuni								
Spio armata		2				1		
Spio decorata								
Spio filicornis					2		2	
Microspio mecznikowianus								
Spiophanes bombyx	1							
Spiophanes kroyeri	5						1	
Magelona alleni	5							
Magelona filiformis								
Magelona minuta	1							
Magelona johnstoni								
Cirratulidae spp indet								
Caulleriella alata								
Tharyx killariensis								
Caulleriella zetlandica								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Chaetozone sp 'D'								
Chaetozone setosa	1							
Chaetozone christie		1					2	3
Dodecaceria sp								
Monticellina dorsobranchialis								
Diplocirrus glaucus	13							
Flabelligera affinis								
Macrochaeta sp								
Capitella spp								
Dasybranchus caducus								
Mediomastus fragilis								
Notomastus latericeus								
Arenicola marina (juv)								
Arenicolides ecaudata								
Maldanidae spp juv/indet								
Clymenura sp indet							1	
Clymenura johnstoni								2
Euclymene spp indet	2							
Euclymene droebachiensis								
Euclymene oerstedii								
Praxillella spp indet								
Praxillella affinis								
Praxillella gracilis								
Travisia forbesii				4		2		
Armandia polyophthalma					1	1		
Ophelina acuminata								
Scalibregma celticum								
Scalibregma inflatum								
Polygordius spp indet			2					
Polygordius appendiculatus								
Polygordius lacteus								
Saccocirrus papillocercus			1					
Myriochele danielsseni	5							
Galathowenia oculata							2	
Owenia fusiformis	1							
Amphictene auricoma								
Ampharetidae sp juv								
Melinna palmata								
Ampharete baltica								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Ampharete lindstroemi								
Amphicteis gunneri								
Amphicteis midas								
Anobothrus gracilis								
Sabellides octocirrata								
Sosane sulcata								
Terebellides stroemi								
Trichobranchus glacialis								
Amphitritinae spp juv								
Lanice conchilega	1							
Neoamphitrite figulus								
Nicolea zostericola								
Phisidia aurea								
Pista cristata								
Lysilla loveni								
Polycirrus spp indet								
Polycirrus medusa					26	1		
Polycirrus norvegicus	1							
Polycirrus plumosus	2							
Streblosoma intestinalis	3							
Thelepus cincinnatus								
Sabellidae spp juv/indet								
Branchiomma bombyx								
Chone filicaudata								
Euchone rubrocincta								
Euchone southerni								
Jasmineira caudata								
Jasmineira elegans								
Pseudopotamilla reniformis								
Sabella pavonina								
Serpulidae spp indet								
Hydroides norvegica								
Serpula/Hydroides sp								
Serpula vermicularis								
Spirorbidae spp								
Tubificidae spp								
Tubificoides benedii								
Enchytraeidae sp A								
Enchytraeidae spp								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Nymphon brevirostre								
Achelia echinata								
Endeis spinosa								
Anoplodactylus petiolatus								
COPEPODA spp	1	1						
Mesnilia cluthae	1							
OSTRACODA spp								1
Nebalia sp ♂		1						
Nebalia borealis								
Nebalia herbstii					1			
Sarsinebalia typhlops					4			
GAMMARIDEA spp indet							1	
Apherusa bispinosa								
Monoculodes carinatus								
Monoculodes subnudus								
Perioculodes longimanus	1	2			2	1		1
Pontocrates altamarinus				2				
Pontocrates arenarius				2				
Synchelidium maculatum	1							
Westwoodilla caecula	1							
Leucothoe incisa								
Leucothoe lilljeborgi								
Stenothoe marina								
Urothoe elegans								
Urothoe marina					2			
Harpinia antennaria								
Harpinia crenulata								
Harpinia pectinata								
Parametaphoxus fultoni								
Phoxocephalus holbolli								2
Lysianassidae sp indet								
Hippomedon denticulatus								
Lysianassa ceratina							1	
Lysianassa plumosa								
Orchomene nanus								
Socarnes erythrophthalmus								
Tmetonyx similis								
Tryphosella sarsi								
Tryphosites longipes							3	

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Iphimedia minuta								
Atylus swammerdamei								1
Atylus vedlomensis					1			
Dexamine spinosa								
Dexamine thea								
Guernea coalita								
Ampelisca spp indet								
Ampelisca brevicornis	7							4
Ampelisca diadema								
Ampelisca tenuicornis	1						14	
Ampelisca typica		1			15		10	7
Bathyporeia spp indet								
Bathyporeia guilliamsoniana		2			2			
Bathyporeia pelagica		2						
Bathyporeia tenuipes								
Gammaridae sp ♀/juv								
Gammarus locusta								
Megaluropus agilis		1						
Melitidae spp ♀/juv/indet								
Abludomelita obtusata							1	
Cheirocratus spp ♀/juv								
Cheirocratus intermedius								
Maera othonis								
Amphithoe rubricata								
Sunamphithoe pelagica								
Gammaropsis maculata								
Gammaropsis cornuta								
Photis longicaudata								
Ericthonius sp indet								
Ericthonius punctatus							2	2
Ischyrocerus anguipes								
Jassa falcata								
Aoridae/Isaidae spp ♀/indet								
Aora gracilis								
Leptocheirus hirsutimanus								
Leptocheirus pectinatus								
Microdeutopus anomalus					1		37	
Microdeutopus versiculatus							1	
Corophium spp indet								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Corophium affine								
Corophium arenarium								
Corophium bonnellii					2		6	2
Corophium crassicorne		2			10			1
Siphonoecetes kroyeranus					1			
Caprella acanthifera					3			
Pariambus typicus	2							
Phtisica marina	1				3		6	1
Pseudoprotella phasma								
Gnathia sp (praniza)								
Cymodoce truncata								
Idotea spp juv								
Idotea baltica								
Idotea linearis					1			
Idotea neglecta								
Arcturella dilatata								
Tanaopsis graciloides								
Apseudes talpa								
Iphinoe serrata	1							
Iphinoe trispinosa					2		1	1
Eudorella truncatula								
Campylaspis legendrei								
Diastylis sp indet								
Diastylis laevis	2							
Diastylis lucifera								
Diastylis rugosa								
Diastyloides biplicata								
DECAPODA sp juv/indet								
CARIDEA spp juv/indet								
Hippolyte varians								
Thoralus cranchii								
Processa nouveli holthuisi								
Paguridae spp juv/indet								
Pagurus bernhardus								
Galathea intermedia							1	
Pisidia longicornis								
Liocarcinus pusillus								
Goneplax rhomboides								
Pilumnus hirtellus								

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
?Scutopus ventrolineatus								
Chaetoderma nitidulum	1							
Leptochiton asellus								
Lepidochitona cinerea								
Helcion pellucidum								
Tricolia pullus								
Lacuna vincta								
Rissoa interrupta								
Turritella communis	10							
Polinices pulchellus								
Philine spp								
Hinia reticulata					1			
OPISTHOBRANCHIA spp indet								
Acteon tornatilis	1							
Cylichna cylindracea								
Retusa obtusa							2	
Retusa umbilicata								
Berthella plumula								
Antalis entalis	4							
PELECYPODA spp juv/indet								
Nucula nitidosa	1							
Nucula nucleus								
Mytilidae spp juv								
Crenella decussata								
Modiolarca tumida								
Chlamys varia								
Myrtea spinifera	1							
Lucinoma borealis	6				1		1	1
Thyasira flexuosa	81							
Thyasira ?polygona								
Devonia perrieri								
Mysella bidentata	72							
Tellimya ferruginosa								
Goodallia triangularis			6					
CARDIACEA spp juv/indet								
Acanthocardia aculeata	3							
Parvicardium scabrum								
Spisula elliptica				1	3			
Spisula solida						1		

Table 7.1.8 *(continued)*

Taxon	SA105	SB4	SB13	SB19	SB20	SB24	SB28	SB30
Ensis arcuatus					1			
Ensis ensis								
Phaxas pellucidus								
Angulus tenuis					4			
Fabulina fabula						1	1	
Moerella pygmaea					22	3		1
Gari fervensis								
Gari tellinella					2			
Gari depressa	1							
Abra spp juv/indet								
Abra alba	5							
Abra nitida	3				1		1	1
Abra prismatica	3							
Gouldia minima								
Dosinia lupinus	21					2		
Dosinia exoleta					20			
Tapes rhomboides								
Chamelea gallina	3				3			
Timoclea ovata	10				7			
Mysia undata								
Mya truncata					1			
Corbula gibba	2							
Hiatella arctica								
Thracia spp juv								
Thracia phaseolina	2				2			
Thracia villosiuscula								
Cochlodesma praetenue	3							
Phoronis spp	1							1
ASTEROIDEA spp juv								
Amphiuridae spp juv	5							
Amphiura brachiata								
Amphiura chiajei								
Amphiura filiformis	104							
Amphipholis squamata								
Ophiuridae spp juv								
Ophiura affinis	1							
Ophiura albida								
ECHINOIDEA spp juv/indet	2							
Echinocyamus pusillus	7							
Echinocardium cordatum	2							
Leptopentacta elongata	1							
Leptosynapta inhaerens	1							
Labidoplax media							3	

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Astrorhiza sp								
Cerianthus lloydii								
ACTINIARIA spp juv								
Edwardsia claparedii								
Edwardsia ?timida				4				
Caryophyllia smithii								
TURBELLARIA spp indet								
NEMERTEA spp							1	2
Tubulanus polymorphus								
Cerebratulus spp				1				
Cerebratulus marginatus								
?Oerstedia dorsalis								
NEMATODA spp							1	10
Priapulus caudatus								
CHAETOGNATHA sp								
Golfingia sp juv								
Golfingia elongata								
Thysanocardia procera								
Phascolion strombus								
Maxmuelleria lankesteri								
Pisione remota								
Aphroditidae sp juv				1				
Eunoe nodosa								
Harmothoe spp juv/indet								
Harmothoe imbricata								
Harmothoe impar								
Harmothoe (M) glabra								
Harmothoe (M) marphysae								
Harmothoe (M) arenicolae								
Pholoe synophthalmica				1				
Pholoe baltica								
Sthenelais limicola		1		1				
Phyllodocidae sp juv								
Eteone longa				1				
Mysta picta								
Pseudomystides limbata								
Anaitides mucosa		2	4		1	1		
Eumida bahusiensis								
Eumida sanguinea								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Paranaitis kosteriensis								
Glycera alba				2				
Glycera fallax (gigantea)								
Glycera lapidum								11
Glycera oxycephala								
Glycera unicornis								
Glycinde nordmanni								
Goniada maculata								
Sphaerodoropsis minuta								
Podarkeopsis capensis								
Kefersteinia cirrata								1
Ophiodromus flexuosus				2				
Syllis sp E (*?cornuta*)								
Trypanosyllis coeliaca								1
Typosyllis hyalina								
Eusyllis blomstrandi								
Odontosyllis ctenostoma								
Odontosyllis gibba								
Exogone hebes								
Exogone naidina								
Exogone verugera					2		1	
Sphaerosyllis taylori								
Autolytus spp						2		
Nereis spp juv								
Platynereis dumerilii			1			1	1	
Nephtys spp juv								
Nephtys assimilis								
Nephtys caeca								
Nephtys cirrosa					1			
Nephtys hombergii	2	1	1	2			2	
Nephtys kersivalensis								
Nephtys incisa								
Aponuphis bilineata								
Nematonereis unicornis								
Lumbrineris gracilis	1							
Lumbrineris hibernica								
Notocirrus scoticus								
Ophryotrocha sp								
Protodorvillea kefersteini								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Leitoscoloplos mammosus								
Scoloplos armiger								
Levinsenia gracilis								
Paradoneis lyra								
Paraonis fulgens								
Apistobranchus tullbergi								
Poecilochaetus serpens								
Aonides oxycephala								
Aonides paucibranchiata								
Laonice bahusiensis								
Malacoceros sp indet								
Malacoceros fuliginosus								
Minuspio cirrifera								
Minuspio cf. multibranchiata								
Polydora caeca								
Polydora flava								
Prionospio dubia								
Prionospio fallax	1	1		1				
Prionospio banyulensis								
Pseudopolydora cf. paucibranchiata								
Pseudopolydora pulchra		1	2		1			
Pygospio elegans		1	14				5	
Scolelepis bonnieri								
Scolelepis squamata								
Scolelepis korsuni								
Spio armata								
Spio decorata	1							
Spio filicornis		1						
Microspio mecznikowianus						1		
Spiophanes bombyx								
Spiophanes kroyeri				1				
Magelona alleni								
Magelona filiformis								
Magelona minuta								
Magelona johnstoni								
Cirratulidae spp indet								
Caulleriella alata								
Tharyx killariensis								
Caulleriella zetlandica								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Chaetozone sp 'D'								
Chaetozone setosa	1							
Chaetozone christie								
Dodecaceria sp								
Monticellina dorsobranchialis								
Diplocirrus glaucus		1		8				
Flabelligera affinis								
Macrochaeta sp								
Capitella spp		1						
Dasybranchus caducus								
Mediomastus fragilis								
Notomastus latericeus								
Arenicola marina (juv)								
Arenicolides ecaudata								
Maldanidae spp juv/indet							1	
Clymenura sp indet								
Clymenura johnstoni	3	1	24	12	2			
Euclymene spp indet	2	1	16	10				
Euclymene droebachiensis				2				
Euclymene oerstedii			6	6				
Praxillella spp indet		4	2	7				
Praxillella affinis		1		7				
Praxillella gracilis				2				
Travisia forbesii								
Armandia polyophthalma					4			
Ophelina acuminata				1				
Scalibregma celticum								
Scalibregma inflatum								
Polygordius spp indet			1					11
Polygordius appendiculatus						1		1
Polygordius lacteus								5
Saccocirrus papillocercus								
Myriochele danielsseni								
Galathowenia oculata	2	37					8	
Owenia fusiformis					1			
Amphictene auricoma								
Ampharetidae sp juv								
Melinna palmata				6				
Ampharete baltica								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Ampharete lindstroemi	1			7				
Amphicteis gunneri								
Amphicteis midas								
Anobothrus gracilis								
Sabellides octocirrata								
Sosane sulcata								
Terebellides stroemi				4				
Trichobranchus glacialis								
Amphitritinae spp juv						1		
Lanice conchilega								
Neoamphitrite figulus								
Nicolea zostericola							1	
Phisidia aurea								
Pista cristata								
Lysilla loveni								
Polycirrus spp indet								
Polycirrus medusa								
Polycirrus norvegicus								
Polycirrus plumosus								
Streblosoma intestinalis								
Thelepus cincinnatus								
Sabellidae spp juv/indet								
Branchiomma bombyx								
Chone filicaudata								
Euchone rubrocincta								
Euchone southerni								
Jasmineira caudata								
Jasmineira elegans								
Pseudopotamilla reniformis								
Sabella pavonina								
Serpulidae spp indet								
Hydroides norvegica								
Serpula/Hydroides sp								
Serpula vermicularis								
Spirorbidae spp								
Tubificidae spp				3				
Tubificoides benedii								
Enchytraeidae sp A	1							
Enchytraeidae spp								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Nymphon brevirostre								
Achelia echinata								
Endeis spinosa								
Anoplodactylus petiolatus								
COPEPODA spp								
Mesnilia cluthae								
OSTRACODA spp								
Nebalia sp ♂								
Nebalia borealis			1					
Nebalia herbstii						1		
Sarsinebalia typhlops								
GAMMARIDEA spp indet								
Apherusa bispinosa								2
Monoculodes carinatus								
Monoculodes subnudus								
Perioculodes longimanus								
Pontocrates altamarinus								
Pontocrates arenarius								1
Synchelidium maculatum								
Westwoodilla caecula								
Leucothoe incisa								
Leucothoe lilljeborgi								
Stenothoe marina								
Urothoe elegans				1				
Urothoe marina					3			
Harpinia antennaria			6					
Harpinia crenulata				1				
Harpinia pectinata							2	
Parametaphoxus fultoni								
Phoxocephalus holbolli					4			
Lysianassidae sp indet		1						
Hippomedon denticulatus					1	1		
Lysianassa ceratina								
Lysianassa plumosa								
Orchomene nanus								
Socarnes erythrophthalmus								
Tmetonyx similis								
Tryphosella sarsi								
Tryphosites longipes	2							

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Iphimedia minuta								
Atylus swammerdamei						3		
Atylus vedlomensis					1			
Dexamine spinosa						1		
Dexamine thea								
Guernea coalita								1
Ampelisca spp indet								
Ampelisca brevicornis		1	12		4		2	
Ampelisca diadema			3					
Ampelisca tenuicornis	4	6	278	40				
Ampelisca typica	4	3			7		2	
Bathyporeia spp indet								
Bathyporeia guilliamsoniana					3			
Bathyporeia pelagica								
Bathyporeia tenuipes	1							
Gammaridae sp ♀/juv								
Gammarus locusta								
Megaluropus agilis								
Melitidae spp ♀/juv/indet								
Abludomelita obtusata					1	1	1	
Cheirocratus spp ♀/juv	1						1	
Cheirocratus intermedius	1	3						
Maera othonis								
Amphithoe rubricata						2		
Sunamphithoe pelagica								
Gammaropsis maculata								
Gammaropsis cornuta								
Photis longicaudata			41	40	1			
Ericthonius sp indet					1			
Ericthonius punctatus								
Ischyrocerus anguipes								
Jassa falcata								
Aoridae/Isaidae spp ♀/indet								
Aora gracilis							1	
Leptocheirus hirsutimanus								
Leptocheirus pectinatus				3				
Microdeutopus anomalus				1				
Microdeutopus versiculatus	1		2					
Corophium spp indet								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Corophium affine								
Corophium arenarium								
Corophium bonnellii			10	1				
Corophium crassicorne			3	1	47		1	
Siphonoecetes kroyeranus	19		1		9			
Caprella acanthifera			1			1		
Pariambus typicus			1	3				
Phtisica marina	7	9	20	96			25	
Pseudoprotella phasma								
Gnathia sp (praniza)								
Cymodoce truncata								
Idotea spp juv								
Idotea baltica								
Idotea linearis								
Idotea neglecta								
Arcturella dilatata			2					
Tanaopsis graciloides								
Apseudes talpa								
Iphinoe serrata								
Iphinoe trispinosa					3	1	1	
Eudorella truncatula			1					
Campylaspis legendrei								
Diastylis sp indet			1					
Diastylis laevis								
Diastylis lucifera								
Diastylis rugosa	1	2	2					
Diastyloides biplicata								
DECAPODA sp juv/indet								
CARIDEA spp juv/indet								
Hippolyte varians								
Thoralus cranchii								
Processa nouveli holthuisi								
Paguridae spp juv/indet								
Pagurus bernhardus								
Galathea intermedia								
Pisidia longicornis								
Liocarcinus pusillus								
Goneplax rhomboides								
Pilumnus hirtellus								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
?Scutopus ventrolineatus								
Chaetoderma nitidulum								
Leptochiton asellus					1			
Lepidochitona cinerea								
Helcion pellucidum								
Tricolia pullus								
Lacuna vincta						2		
Rissoa interrupta						1		
Turritella communis								
Polinices pulchellus								
Philine spp								
Hinia reticulata								
OPISTHOBRANCHIA spp indet								
Acteon tornatilis								
Cylichna cylindracea								
Retusa obtusa								
Retusa umbilicata								
Berthella plumula								
Antalis entalis								
PELECYPODA spp juv/indet								
Nucula nitidosa								
Nucula nucleus			1					
Mytilidae spp juv								
Crenella decussata					2			
Modiolarca tumida						1		
Chlamys varia								
Myrtea spinifera								
Lucinoma borealis	4	3	9		1		5	2
Thyasira flexuosa		2		2				
Thyasira ?polygona								
Devonia perrieri								
Mysella bidentata	2			3				
Tellimya ferruginosa								
Goodallia triangularis								
CARDIACEA spp juv/indet								
Acanthocardia aculeata				1				
Parvicardium scabrum								
Spisula elliptica								6
Spisula solida								

Table 7.1.8 *(continued)*

Taxon	SB31	SB33	SB35	SB38	SB41	SB48	SB50	SB54
Ensis arcuatus	5					4		
Ensis ensis								
Phaxas pellucidus		1						
Angulus tenuis								
Fabulina fabula	4	1					1	
Moerella pygmaea					1			18
Gari fervensis								
Gari tellinella								10
Gari depressa								
Abra spp juv/indet								
Abra alba	1			1			1	
Abra nitida	2		1	3	2	1		
Abra prismatica	1			1				
Gouldia minima								2
Dosinia lupinus	3	1		3		1	1	
Dosinia exoleta					1			4
Tapes rhomboides								
Chamelea gallina	1	2		3	1		1	
Timoclea ovata	3				2			6
Mysia undata				1				
Mya truncata	1	1						
Corbula gibba								
Hiatella arctica								
Thracia spp juv								
Thracia phaseolina								4
Thracia villosiuscula								
Cochlodesma praetenue	1						2	
Phoronis spp								
ASTEROIDEA spp juv							1	
Amphiuridae spp juv		1	2	3				1
Amphiura brachiata								
Amphiura chiajei	2							
Amphiura filiformis				12				
Amphipholis squamata				1				
Ophiuridae spp juv								
Ophiura affinis	1							
Ophiura albida								
ECHINOIDEA spp juv/indet								
Echinocyamus pusillus								7
Echinocardium cordatum								
Leptopentacta elongata								
Leptosynapta inhaerens					1			
Labidoplax media			16					

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Astrorhiza sp								
Cerianthus lloydii								
ACTINIARIA spp juv								
Edwardsia claparedii								
Edwardsia ?timida								
Caryophyllia smithii								
TURBELLARIA spp indet								
NEMERTEA spp		1	1			2		
Tubulanus polymorphus								
Cerebratulus spp						2		
Cerebratulus marginatus								
?Oerstedia dorsalis	2							
NEMATODA spp	1		2	2	25			4
Priapulus caudatus								
CHAETOGNATHA sp								
Golfingia sp juv					1			
Golfingia elongata								
Thysanocardia procera								
Phascolion strombus								
Maxmuelleria lankesteri								
Pisione remota					5			
Aphroditidae sp juv								
Eunoe nodosa								
Harmothoe spp juv/indet						1		
Harmothoe imbricata						3		2
Harmothoe impar						1		
Harmothoe (M) glabra								
Harmothoe (M) marphysae								
Harmothoe (M) arenicolae								
Pholoe synophthalmica				1				
Pholoe baltica								
Sthenelais limicola						2		
Phyllodocidae sp juv				1				
Eteone longa								
Mysta picta						1		
Pseudomystides limbata								
Anaitides mucosa								
Eumida bahusiensis								
Eumida sanguinea								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Paranaitis kosteriensis								
Glycera alba								
Glycera fallax (gigantea)								
Glycera lapidum					19			
Glycera oxycephala								
Glycera unicornis								
Glycinde nordmanni								
Goniada maculata								
Sphaerodoropsis minuta					1			
Podarkeopsis capensis								
Kefersteinia cirrata					1			
Ophiodromus flexuosus						1		
Syllis sp E (*?cornuta*)					2			
Trypanosyllis coeliaca					7			
Typosyllis hyalina								
Eusyllis blomstrandi								
Odontosyllis ctenostoma			3					
Odontosyllis gibba					1	1		
Exogone hebes								
Exogone naidina				1				
Exogone verugera			1					
Sphaerosyllis taylori					2			
Autolytus spp								
Nereis spp juv			2					
Platynereis dumerilii						13		
Nephtys spp juv								
Nephtys assimilis								
Nephtys caeca								
Nephtys cirrosa								
Nephtys hombergii						1	1	2
Nephtys kersivalensis								
Nephtys incisa								
Aponuphis bilineata								
Nematonereis unicornis								
Lumbrineris gracilis								
Lumbrineris hibernica								
Notocirrus scoticus								
Ophryotrocha sp						1		
Protodorvillea kefersteini								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Leitoscoloplos mammosus								1
Scoloplos armiger			7	8		16		
Levinsenia gracilis								
Paradoneis lyra								
Paraonis fulgens								
Apistobranchus tullbergi								
Poecilochaetus serpens								
Aonides oxycephala								
Aonides paucibranchiata					1			
Laonice bahusiensis								
Malacoceros sp indet						1		
Malacoceros fuliginosus								1
Minuspio cirrifera								
Minuspio cf. multibranchiata								
Polydora caeca								
Polydora flava								
Prionospio dubia								
Prionospio fallax				1				
Prionospio banyulensis					2			
Pseudopolydora cf. paucibranchiata				1				
Pseudopolydora pulchra				1				
Pygospio elegans	2			28		16		
Scolelepis bonnieri				1				
Scolelepis squamata						2		
Scolelepis korsuni								
Spio armata								
Spio decorata								
Spio filicornis						8		1
Microspio mecznikowianus								
Spiophanes bombyx								
Spiophanes kroyeri								
Magelona alleni								
Magelona filiformis								
Magelona minuta								
Magelona johnstoni								
Cirratulidae spp indet								
Caulleriella alata								
Tharyx killariensis								
Caulleriella zetlandica								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Chaetozone sp 'D'								
Chaetozone setosa								
Chaetozone christie								
Dodecaceria sp								
Monticellina dorsobranchialis								
Diplocirrus glaucus				2				
Flabelligera affinis						1		
Macrochaeta sp					2			
Capitella spp						2		
Dasybranchus caducus								
Mediomastus fragilis						1		
Notomastus latericeus								
Arenicola marina (juv)								
Arenicolides ecaudata	1							
Maldanidae spp juv/indet		1						
Clymenura sp indet								
Clymenura johnstoni	4		3	1		1		
Euclymene spp indet	6			2		2		
Euclymene droebachiensis								
Euclymene oerstedii	5							
Praxillella spp indet	2			2				
Praxillella affinis								
Praxillella gracilis	1							
Travisia forbesii								
Armandia polyophthalma								
Ophelina acuminata								
Scalibregma celticum								
Scalibregma inflatum								
Polygordius spp indet								
Polygordius appendiculatus					6			
Polygordius lacteus					15			
Saccocirrus papillocercus								
Myriochele danielsseni								
Galathowenia oculata		54	6	22	1	2		
Owenia fusiformis				2				
Amphictene auricoma				1				
Ampharetidae sp juv								1
Melinna palmata			1					
Ampharete baltica								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Ampharete lindstroemi	1							
Amphicteis gunneri								
Amphicteis midas								
Anobothrus gracilis								
Sabellides octocirrata								
Sosane sulcata								
Terebellides stroemi								
Trichobranchus glacialis								
Amphitritinae spp juv						1		
Lanice conchilega								
Neoamphitrite figulus								
Nicolea zostericola				1		1		
Phisidia aurea								
Pista cristata					1			
Lysilla loveni								
Polycirrus spp indet								
Polycirrus medusa								
Polycirrus norvegicus								
Polycirrus plumosus								
Streblosoma intestinalis								
Thelepus cincinnatus								
Sabellidae spp juv/indet								1
Branchiomma bombyx								
Chone filicaudata					2			
Euchone rubrocincta								
Euchone southerni								
Jasmineira caudata								
Jasmineira elegans			1					
Pseudopotamilla reniformis								
Sabella pavonina								
Serpulidae spp indet								
Hydroides norvegica								
Serpula/Hydroides sp								
Serpula vermicularis								
Spirorbidae spp				2		14		
Tubificidae spp								
Tubificoides benedii								
Enchytraeidae sp A								
Enchytraeidae spp								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Nymphon brevirostre								
Achelia echinata								
Endeis spinosa								
Anoplodactylus petiolatus			1					
COPEPODA spp								
Mesnilia cluthae								
OSTRACODA spp	2			1	1			
Nebalia sp ♂								
Nebalia borealis	3							
Nebalia herbstii						2		
Sarsinebalia typhlops								
GAMMARIDEA spp indet						1		
Apherusa bispinosa					16	1		
Monoculodes carinatus								
Monoculodes subnudus								
Perioculodes longimanus						1		
Pontocrates altamarinus								
Pontocrates arenarius					1			
Synchelidium maculatum					1			
Westwoodilla caecula								
Leucothoe incisa					10	1		
Leucothoe lilljeborgi				1				
Stenothoe marina					1			
Urothoe elegans	12			1		4		
Urothoe marina					1			
Harpinia antennaria	7	1		6		19		
Harpinia crenulata				3				
Harpinia pectinata								
Parametaphoxus fultoni								
Phoxocephalus holbolli								
Lysianassidae sp indet								
Hippomedon denticulatus								
Lysianassa ceratina	10					6		
Lysianassa plumosa								
Orchomene nanus					1			
Socarnes erythrophthalmus	10				7			
Tmetonyx similis					1			
Tryphosella sarsi						14		
Tryphosites longipes						1		

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Iphimedia minuta						6		
Atylus swammerdamei								
Atylus vedlomensis					27	1		
Dexamine spinosa				2	1	17		
Dexamine thea				1		3		
Guernea coalita					6			
Ampelisca spp indet								
Ampelisca brevicornis		3	9	5		1		2
Ampelisca diadema	2		2					
Ampelisca tenuicornis	27	17	97	11				
Ampelisca typica				5	3	4		1
Bathyporeia spp indet								
Bathyporeia guilliamsoniana								
Bathyporeia pelagica								
Bathyporeia tenuipes				1				
Gammaridae sp ♀/juv								
Gammarus locusta						1		
Megaluropus agilis								
Melitidae spp ♀/juv/indet								
Abludomelita obtusata	1							
Cheirocratus spp ♀/juv								
Cheirocratus intermedius			2	1				
Maera othonis								
Amphithoe rubricata						1		
Sunamphithoe pelagica						13		
Gammaropsis maculata								
Gammaropsis cornuta					13			
Photis longicaudata	192	9	2					
Ericthonius sp indet	1				1			
Ericthonius punctatus	2						1	
Ischyrocerus anguipes								
Jassa falcata				1				
Aoridae/Isaidae spp ♀/indet	4	4		1	1			
Aora gracilis				1				
Leptocheirus hirsutimanus					27			
Leptocheirus pectinatus	13		1		3			
Microdeutopus anomalus	1	1	1			11		
Microdeutopus versiculatus	18			2		6		
Corophium spp indet								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Corophium affine	2							
Corophium arenarium			1					
Corophium bonnellii	32		5	1		4		
Corophium crassicorne	51		4	2				
Siphonoecetes kroyeranus	1			5				
Caprella acanthifera	12	5		4	1	105		
Pariambus typicus	2							
Phtisica marina	19	4	7			20		
Pseudoprotella phasma								
Gnathia sp (praniza)	1							
Cymodoce truncata								
Idotea spp juv								
Idotea baltica	1					1		
Idotea linearis								
Idotea neglecta						9		
Arcturella dilatata			1					
Tanaopsis graciloides			22					
Apseudes talpa	20	1						
Iphinoe serrata								
Iphinoe trispinosa								
Eudorella truncatula		1						
Campylaspis legendrei								
Diastylis sp indet	1							
Diastylis laevis				1				
Diastylis lucifera								
Diastylis rugosa	4			2		1		
Diastyloides biplicata								
DECAPODA sp juv/indet		1				2		
CARIDEA spp juv/indet				1				
Hippolyte varians				1				
Thoralus cranchii						1		
Processa nouveli holthuisi								
Paguridae spp juv/indet								
Pagurus bernhardus								
Galathea intermedia	1				1	3		
Pisidia longicornis								
Liocarcinus pusillus					1	1		
Goneplax rhomboides								
Pilumnus hirtellus		1						1

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
?Scutopus ventrolineatus								
Chaetoderma nitidulum								
Leptochiton asellus					1			
Lepidochitona cinerea					1			
Helcion pellucidum								
Tricolia pullus						1		
Lacuna vincta								
Rissoa interrupta								
Turritella communis								
Polinices pulchellus								
Philine spp								
Hinia reticulata								
OPISTHOBRANCHIA spp indet								
Acteon tornatilis								
Cylichna cylindracea								
Retusa obtusa								
Retusa umbilicata								
Berthella plumula								
Antalis entalis								
PELECYPODA spp juv/indet								
Nucula nitidosa				1		1		
Nucula nucleus								
Mytilidae spp juv								
Crenella decussata							1	
Modiolarca tumida						1		
Chlamys varia								
Myrtea spinifera								
Lucinoma borealis				32		6		
Thyasira flexuosa						1		3
Thyasira ?polygona								
Devonia perrieri								
Mysella bidentata				4		2		
Tellimya ferruginosa								
Goodallia triangularis								
CARDIACEA spp juv/indet								
Acanthocardia aculeata				1				
Parvicardium scabrum					1			
Spisula elliptica					5			
Spisula solida								

Table 7.1.8 *(continued)*

Taxon	SB57	SB59	SB62	SB73	SB74	SB75	SB79	SB81
Ensis arcuatus				1				
Ensis ensis								
Phaxas pellucidus				1		1		1
Angulus tenuis								
Fabulina fabula				2				
Moerella pygmaea					5			
Gari fervensis								
Gari tellinella					27			
Gari depressa								
Abra spp juv/indet								
Abra alba				4				
Abra nitida								
Abra prismatica				3		1		
Gouldia minima								
Dosinia lupinus	1			1				
Dosinia exoleta					8			
Tapes rhomboides					4			
Chamelea gallina							1	
Timoclea ovata				1	10	1		
Mysia undata								
Mya truncata								
Corbula gibba						2		
Hiatella arctica								
Thracia spp juv								
Thracia phaseolina								
Thracia villosiuscula					3			
Cochlodesma praetenue				2				
Phoronis spp								
ASTEROIDEA spp juv						1		
Amphiuridae spp juv	2			1	16	1		
Amphiura brachiata								
Amphiura chiajei				2		1		
Amphiura filiformis	1							
Amphipholis squamata					3	4		
Ophiuridae spp juv	2							
Ophiura affinis								
Ophiura albida	1					9		
ECHINOIDEA spp juv/indet								
Echinocyamus pusillus					1			
Echinocardium cordatum								
Leptopentacta elongata								
Leptosynapta inhaerens								
Labidoplax media		17	2	7				

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Astrorhiza sp						
Cerianthus lloydii						
ACTINIARIA spp juv						
Edwardsia claparedii						
Edwardsia ?timida						
Caryophyllia smithii						
TURBELLARIA spp indet						
NEMERTEA spp	1					
Tubulanus polymorphus						
Cerebratulus spp						
Cerebratulus marginatus						
?Oerstedia dorsalis						
NEMATODA spp	6			1		
Priapulus caudatus				2		
CHAETOGNATHA sp						
Golfingia sp juv						
Golfingia elongata						
Thysanocardia procera						
Phascolion strombus						
Maxmuelleria lankesteri						
Pisione remota						
Aphroditidae sp juv						
Eunoe nodosa						
Harmothoe spp juv/indet						
Harmothoe imbricata	1					
Harmothoe impar						
Harmothoe (M) glabra						
Harmothoe (M) marphysae						
Harmothoe (M) arenicolae						
Pholoe synophthalmica						
Pholoe baltica						
Sthenelais limicola						
Phyllodocidae sp juv						
Eteone longa						
Mysta picta						
Pseudomystides limbata						
Anaitides mucosa						
Eumida bahusiensis						
Eumida sanguinea						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Paranaitis kosteriensis						
Glycera alba						
Glycera fallax (gigantea)						
Glycera lapidum						
Glycera oxycephala						
Glycera unicornis						
Glycinde nordmanni						
Goniada maculata						
Sphaerodoropsis minuta						
Podarkeopsis capensis						
Kefersteinia cirrata						
Ophiodromus flexuosus						
Syllis sp E (?*cornuta*)						
Trypanosyllis coeliaca						
Typosyllis hyalina						
Eusyllis blomstrandi						
Odontosyllis ctenostoma						
Odontosyllis gibba						
Exogone hebes						
Exogone naidina						
Exogone verugera						
Sphaerosyllis taylori						
Autolytus spp						
Nereis spp juv						
Platynereis dumerilii						
Nephtys spp juv						
Nephtys assimilis						
Nephtys caeca						
Nephtys cirrosa					2	
Nephtys hombergii	1					1
Nephtys kersivalensis						
Nephtys incisa						
Aponuphis bilineata						
Nematonereis unicornis						
Lumbrineris gracilis						
Lumbrineris hibernica						
Notocirrus scoticus						
Ophryotrocha sp						
Protodorvillea kefersteini						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Leitoscoloplos mammosus	3					
Scoloplos armiger	3	1				
Levinsenia gracilis						
Paradoneis lyra						
Paraonis fulgens						1
Apistobranchus tullbergi						
Poecilochaetus serpens						
Aonides oxycephala						
Aonides paucibranchiata						
Laonice bahusiensis						
Malacoceros sp indet						
Malacoceros fuliginosus						
Minuspio cirrifera						
Minuspio cf. multibranchiata						
Polydora caeca						
Polydora flava						
Prionospio dubia						
Prionospio fallax						
Prionospio banyulensis						
Pseudopolydora cf. *paucibranchiata*						
Pseudopolydora pulchra	1					
Pygospio elegans	2	2		1		
Scolelepis bonnieri						
Scolelepis squamata						
Scolelepis korsuni						
Spio armata						
Spio decorata						
Spio filicornis						
Microspio mecznikowianus						
Spiophanes bombyx						
Spiophanes kroyeri						
Magelona alleni						
Magelona filiformis						
Magelona minuta						
Magelona johnstoni						
Cirratulidae spp indet						
Caulleriella alata						
Tharyx killariensis						
Caulleriella zetlandica						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Chaetozone sp 'D'						
Chaetozone setosa						
Chaetozone christie						
Dodecaceria sp						
Monticellina dorsobranchialis						
Diplocirrus glaucus						
Flabelligera affinis						
Macrochaeta sp						
Capitella spp						
Dasybranchus caducus						
Mediomastus fragilis						
Notomastus latericeus						
Arenicola marina (juv)						
Arenicolides ecaudata						
Maldanidae spp juv/indet		2				
Clymenura sp indet						
Clymenura johnstoni		1				
Euclymene spp indet						
Euclymene droebachiensis						
Euclymene oerstedii						
Praxillella spp indet						
Praxillella affinis						
Praxillella gracilis						
Travisia forbesii						
Armandia polyophthalma						
Ophelina acuminata				1		
Scalibregma celticum						
Scalibregma inflatum						
Polygordius spp indet						
Polygordius appendiculatus						
Polygordius lacteus						
Saccocirrus papillocercus						
Myriochele danielsseni						
Galathowenia oculata		8	62			
Owenia fusiformis						
Amphictene auricoma						
Ampharetidae sp juv						
Melinna palmata		1				
Ampharete baltica	13					

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Ampharete lindstroemi						
Amphicteis gunneri						
Amphicteis midas						
Anobothrus gracilis						
Sabellides octocirrata						
Sosane sulcata						
Terebellides stroemi				2		
Trichobranchus glacialis						
Amphitritinae spp juv	1					
Lanice conchilega						
Neoamphitrite figulus				1		
Nicolea zostericola						
Phisidia aurea						
Pista cristata						
Lysilla loveni						
Polycirrus spp indet						
Polycirrus medusa						
Polycirrus norvegicus						
Polycirrus plumosus						
Streblosoma intestinalis						
Thelepus cincinnatus						
Sabellidae spp juv/indet						
Branchiomma bombyx	2					
Chone filicaudata						
Euchone rubrocincta						
Euchone southerni						
Jasmineira caudata						
Jasmineira elegans						
Pseudopotamilla reniformis						
Sabella pavonina	2					
Serpulidae spp indet						
Hydroides norvegica						
Serpula/Hydroides sp						
Serpula vermicularis						
Spirorbidae spp						
Tubificidae spp						
Tubificoides benedii						
Enchytraeidae sp A						
Enchytraeidae spp						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Nymphon brevirostre						
Achelia echinata						
Endeis spinosa						
Anoplodactylus petiolatus						
COPEPODA spp						
Mesnilia cluthae						
OSTRACODA spp						
Nebalia sp ♂						
Nebalia borealis				1		
Nebalia herbstii						
Sarsinebalia typhlops						
GAMMARIDEA spp indet	1					
Apherusa bispinosa						
Monoculodes carinatus						
Monoculodes subnudus						
Perioculodes longimanus						
Pontocrates altamarinus						
Pontocrates arenarius						
Synchelidium maculatum						
Westwoodilla caecula						
Leucothoe incisa						
Leucothoe lilljeborgi						
Stenothoe marina						
Urothoe elegans				3		
Urothoe marina						
Harpinia antennaria			2	1		
Harpinia crenulata						
Harpinia pectinata						
Parametaphoxus fultoni						
Phoxocephalus holbolli						
Lysianassidae sp indet						
Hippomedon denticulatus						
Lysianassa ceratina						
Lysianassa plumosa						
Orchomene nanus						
Socarnes erythrophthalmus						
Tmetonyx similis						
Tryphosella sarsi				1		
Tryphosites longipes						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Iphimedia minuta						
Atylus swammerdamei						
Atylus vedlomensis						
Dexamine spinosa						
Dexamine thea						
Guernea coalita						
Ampelisca spp indet						
Ampelisca brevicornis		5	11	14		
Ampelisca diadema						
Ampelisca tenuicornis	2	4	23	4		
Ampelisca typica		1				
Bathyporeia spp indet					1	
Bathyporeia guilliamsoniana						
Bathyporeia pelagica						
Bathyporeia tenuipes						
Gammaridae sp ♀/juv					5	
Gammarus locusta						
Megaluropus agilis						
Melitidae spp ♀/juv/indet						
Abludomelita obtusata						
Cheirocratus spp ♀/juv						
Cheirocratus intermedius				4		
Maera othonis						
Amphithoe rubricata						
Sunamphithoe pelagica						
Gammaropsis maculata						
Gammaropsis cornuta						
Photis longicaudata			3	1		
Ericthonius sp indet						
Ericthonius punctatus	7					
Ischyrocerus anguipes						
Jassa falcata						
Aoridae/Isaidae spp ♀/indet						
Aora gracilis						
Leptocheirus hirsutimanus						
Leptocheirus pectinatus						
Microdeutopus anomalus	10			8		
Microdeutopus versiculatus				6		
Corophium spp indet						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Corophium affine						
Corophium arenarium						
Corophium bonnellii	3		1	3		
Corophium crassicorne						
Siphonoecetes kroyeranus		17				
Caprella acanthifera	11			11		
Pariambus typicus						
Phtisica marina	6		1			
Pseudoprotella phasma						
Gnathia sp (praniza)						
Cymodoce truncata						
Idotea spp juv					1	
Idotea baltica						
Idotea linearis						
Idotea neglecta						
Arcturella dilatata						
Tanaopsis graciloides						
Apseudes talpa						
Iphinoe serrata						
Iphinoe trispinosa						
Eudorella truncatula						
Campylaspis legendrei						
Diastylis sp indet						
Diastylis laevis						
Diastylis lucifera						
Diastylis rugosa		1				
Diastyloides biplicata						
DECAPODA sp juv/indet						
CARIDEA spp juv/indet						
Hippolyte varians						
Thoralus cranchii						
Processa nouveli holthuisi						
Paguridae spp juv/indet						
Pagurus bernhardus						
Galathea intermedia						
Pisidia longicornis						
Liocarcinus pusillus						
Goneplax rhomboides						
Pilumnus hirtellus						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
?Scutopus ventrolineatus						
Chaetoderma nitidulum						
Leptochiton asellus						
Lepidochitona cinerea						
Helcion pellucidum						
Tricolia pullus						
Lacuna vincta						
Rissoa interrupta						
Turritella communis						
Polinices pulchellus						
Philine spp						
Hinia reticulata						
OPISTHOBRANCHIA spp indet						
Acteon tornatilis						
Cylichna cylindracea						
Retusa obtusa						
Retusa umbilicata						
Berthella plumula						
Antalis entalis						
PELECYPODA spp juv/indet						
Nucula nitidosa						
Nucula nucleus						
Mytilidae spp juv						
Crenella decussata		3				
Modiolarca tumida						
Chlamys varia						
Myrtea spinifera						
Lucinoma borealis		2				
Thyasira flexuosa						
Thyasira ?polygona						
Devonia perrieri						
Mysella bidentata						
Tellimya ferruginosa						
Goodallia triangularis		1				
CARDIACEA spp juv/indet						
Acanthocardia aculeata						
Parvicardium scabrum						
Spisula elliptica						
Spisula solida						

Table 7.1.8 *(continued)*

Taxon	SB84	SB88	SB91	SB93	IB3	IB23
Ensis arcuatus						
Ensis ensis						
Phaxas pellucidus						
Angulus tenuis					3	
Fabulina fabula						
Moerella pygmaea						
Gari fervensis						
Gari tellinella						
Gari depressa						
Abra spp juv/indet						
Abra alba						
Abra nitida						
Abra prismatica						
Gouldia minima						
Dosinia lupinus						
Dosinia exoleta						
Tapes rhomboides						
Chamelea gallina						
Timoclea ovata						
Mysia undata						
Mya truncata						
Corbula gibba						
Hiatella arctica						
Thracia spp juv						
Thracia phaseolina						
Thracia villosiuscula						
Cochlodesma praetenue						
Phoronis spp						
ASTEROIDEA spp juv						
Amphiuridae spp juv						
Amphiura brachiata						
Amphiura chiajei						
Amphiura filiformis						
Amphipholis squamata						
Ophiuridae spp juv						
Ophiura affinis						
Ophiura albida						
ECHINOIDEA spp juv/indet						
Echinocyamus pusillus						
Echinocardium cordatum						
Leptopentacta elongata			5			
Leptosynapta inhaerens				9		
Labidoplax media			39			

Appendix B Digital data products

8.1 A. Sub directory Ground truthing

Description of contents

The digital survey data (including data files, GIS products, digital images and video footage) are held by SNH Maritime group; for access contact the nominated officer of this project (see title page). All the subdirectories and individual data files are described below including details of the contents of the individual files.

8.1.1 Sub directory: Ground truthing/Biological data

S of Harris infauna sample data.xls

Excel spreadsheet showing the species abundance data from the 50 infaunal sediment samples in the form of a species by site matrix. This is the source of appendix Table 7.1.8. Derived univariate parameters are shown in report Table 3.1.1.

S of Harris sediment sample data.xls

Excel spreadsheet showing the full granulometric data from the 50 grab samples. Tables show sediment fraction weights at half phi intervals as raw data, weight percentage and cumulative weight percentage. Cumulative weight percentages are also expressed graphically. Sediment parameters shown in the tables are quartile phis, median grain size (expressed in phi and microns), quartile deviation and weight percentages of silt/clay (>63μm), sand (63–4000μm) and gravel (>4000μm). These data are presented in summary form in report Table 3.1.2.

Station data drop down video surveys.xls

Excel spreadsheet showing the station data for sites surveyed by drop-down video. Includes station code, biotopes present, notes on substrate, notes on biota, depth BCD, date, time, geographic coordinates (start and end of run), initials of surveyor/leader of survey team (refer to Table 2.1.1 for full names), video tape ID number and time code for start of video footage (also see Video log.xls below). Selected data fields from this table are presented in appendix Table 7.1.2.

Station data subtidal diver surveys.xls

Excel spreadsheet showing the station data for sites surveyed by diving or snorkelling. Includes station code, biotopes present, notes on substrate, notes on biota, depth BCD, date, time, geographic coordinates, initials of surveyor (refer to Table 2.1.1 for full names), video tape ID number and time code for start of video footage (also see Video log.xls below). Selected data fields from this table are presented in appendix Table 7.1.1.

Station data intertidal surveys.xls

Excel spreadsheet showing the station data for intertidal sites. Includes station code, biotopes present, notes on substrate, notes on biota, date, time, geographic coordinates, initials of surveyor/leader of survey team (refer to Table 2.1.1 for full names), video tape ID number, time code for start of video footage and a list of digital photos taken at the location (also see Video log.xls and Image log.xls below). Selected data fields from this table are presented in appendix Table 7.1.3.

Station data intertidal zones.xls

Excel spreadsheet showing further details of the shores that are summarised in the above (Station data intertidal surveys.xls) file. Each shore location is separated into a series of zones and data are given for each zone at each shore location. Includes station code, zone number, biotopes present, notes on substrate, notes on biota, general notes, geographic coordinates, position of coordinates in relation to zone and a list of digital photos taken at the location (these are also included in the lists of images shown in Station data intertidal surveys.xls (also see Image log.xls below)).

8.1.2 Sub directory: Ground truthing/Field log

Event Log.xls

Spreadsheet of events of the field survey. Provided to enable the user to establish the sequence of sites surveyed and identify the individual team members associated with the surveying of specific sites.

8.1.3 Sub directory: Ground truthing/GIS Tables

Sub directory – Ground truthing/GIS Tables/All stations

All biotopes.xls

Excel spreadsheet showing all biotopes recorded with corresponding station codes and geographic coordinates. This is provided to allow users to plot the distribution of individual biotopes or groups of biotopes according to their needs.

Diver.txt

Table of sites surveyed by diver or snorkeller. Shows station code, geographic coordinates and survey method. This was used to produce report Figure 2.2.1.

Drop down video.txt

Table of sites surveyed by drop-down video. Shows station code, geographic coordinates and survey method. This was used to produce report Figure 2.2.1.

Intertidal stations.txt

Table of intertidal sites. Shows station code, geographic coordinates and survey method. This was used to produce report Figure 2.2.1.

Sub directory – Ground truthing/GIS Tables/Littoral biotopes

Text files containing tables for plotting the distribution of selected groups of biotopes. Tables contain biotope identity, station code and geographic coordinates.

File title	Biotopes	Corresponding report figure
Ascophyllum.txt	LR.LLR.F.Asc.FS LR.LLR.F.Asc.X	4.2.21
Exposed barnacle shores.txt	Barren rock LR.HLR.MusB.Cht LR.HLR.MusB.Sem.FvesR LR.HLR.MusB.Sem.Sem	4.2.18
Exposed sand beaches.txt	LS.LSA.MoSa.BarSa	4.2.13
Fucoid barnacle mosaic.txt	LR.MLR.BF.FvesB	4.2.19
Fucus serratus.txt	LR.LLR.F.Fserr.X LR.LLR.Fserr.FS LR.MLR.BF.Fser	4.2.23
Fucus vesiculosus.txt	LR.LLR.F.Fves LR.LLR.F.Fves.FS LR.LLR.F.Fves.X	4.2.20
Himanthalia.txt	LR.HLR.FR.Him	4.2.23
MacAre var1.txt	LS.LSA.MuSa.MacAre (var. 1)	4.2.15
MacAre var2.txt	LS.LSA.MuSa.MacAre (var. 2)	4.2.15
Pelvetia and Fucus spiralis.txt	LR.LLR.F.Pel LR.LLR.F.Fspi	4.2.17
Scoured lower shore.txt	LR.FLR.Eph.EntPor LR.HLR.FR.Coff.Puly LR.HLR.FR.Mas	4.2.22
Sheltered sand beaches.txt	LS.LSA.FiSa LS.LSA.FiSa.Po LS.LSA.FiSa.Po.Aten	4.2.14
Sublittoral fringe kelp.txt	IR.HIR.KFaR.Ala.Ldig IR.MIR.KR.Ldig.Ldig	4.2.24
Supralittoral lichens.txt	LR.FLR.Lic.YG LR.FLR.Lic.Ver.Ver LR.FLR.Lic.Pra	4.2.16
Talitrus sand.txt	LS.LSA.St.Tal	4.2.13

Sub directory – Ground truthing/GIS Tables/Sublittoral biotopes

Text files containing tables for plotting the distribution of selected groups of biotopes. Tables contain biotope identity, station code and geographic coordinates.

File title	Biotopes	Corresponding report figure
AfilMysAnit.txt	SS.SMU.CSaMu.AfilMysAnit	4.2.3
AmenCio.txt	CR.LCR.BrAs.AmenCio	4.2.12
AmpPlon.txt	SS.SMU.ISaMu.AmpPlon	4.2.4
ArelSa.txt	SS.SSA.IMuSa.ArelSa	4.2.6
Cap.txt	SS.SMU.ISaMu.Cap	4.2.5
CFiMu.txt	SS.SMU.CFiMu	4.2.6
FaAlCr.txt	CR.MCR.EcCr.FaAlCr.Pom	4.2.12
FfabMag.txt	SS.SSA.IMuSa.FfabMag	4.2.5
IFiMu Are.txt	SS.SMU.IFiMu SS.SMU.IFiMu.Are	4.2.6
IMoSa.txt	SS.SSA.IFiSa.IMoSa	4.2.1
Lhyp T.txt	IR.MIR.KR.LhypT.Ft IR.MIR.KR.LhypTX.Ft IR.MIR.KR.LhypTX.Pk	4.2.9
Lhyp.txt	IR.MIR.K.Lhyp.Pk IR.MIR.KR.Lhyp.Ft	4.2.10
Lsac on sediment.txt	SS.SMP.KSwSS.LsacR.Mu SS.SMP.KSwSS.LsacR.Sa	4.2.5
Lsac.txt	IR.LIR.K.Lsac.Ft IR.LIR.K.Lsac.Gz IR.LIR.K.Lsac.Pk	4.2.10
LsacSac.txt	IR.HIR.Ksed.LsacSac	4.2.11
Maerl.txt	SS.SMP.Mrl.Pcal	4.2.8
MedLumVen.txt	SS.SCS.CCS.MedLumVen	4.2.5
MoeVen.txt	SS.SCS.ICS.MoeVen	4.2.2
NcirBat.txt	SS.SSA.IFiSa.NcirBat	4.2.1
Pcri.txt	SS.SMP.KSwSS.Pcri	4.2.6
ProtAhn.txt	IR.HIR.KSed.ProtAhn	4.2.11
Sheltered Lhyp.txt	IR.LIR.K.LhypCape IR.LIR.K.LhypLsac.Ft IR.LIR.K.LhypLsac.Pk	4.2.10
SpavSpAn.txt	SS.SMX.IMx.SpavSpAn	4.2.6
swiftia.txt	CR.HCR.Xfa.SwiLgAs	4.2.12
TbAmPo.txt	SS.SSA.IFiSa.TbAmPo	4.2.4
Tra.txt	SS.SMP.KSwSS.Tra	4.2.6
VirOph.txt	SS.SMU.CSaMu.VirOphPmax.Has	4.2.5
XKScrR.txt	IR.HIR.Ksed.XKScrR	4.2.9
xktx.txt	IR.MIR.KT.XKTX	4.2.11
Zost.txt	SS.SMP.SSgr.Zmar	4.2.7

8.1.4 Sub directory: Ground truthing/Images and video

Images

A total of 432 digital stills images were taken at intertidal sites over the course of the survey. The images are held by SNH Maritime group, for access contact the nominated officer of this project (see title page). Images are available from the majority of shores visited during the survey but at a limited number of sites it was not possible to obtain images due to a combination of equipment failure and adverse weather conditions. Images are not available for the following sites, IA9 to IA11 and IB21 to IB23.

For ease of access, the images are stored within a series of subdirectories. The first level of subdirectories are named with the appropriate shore code. Within each of these subdirectories are a second level of subdirectories that are named to identify the zone on the shore that is featured in the image.

Image log.xls

Excel spreadsheet listing the individual images. Includes corresponding site codes, zone identity and biotopes present. For further information on specific site codes please refer to 'Station data intertidal surveys.xls'. For information on specific zones within an intertidal site please refer to Station data intertidal zones.xls (both files are described above and contained within the 'Biological Data' sub directory).

Video footage

Representative video footage was obtained from both subtidal and intertidal sites over the course of the survey. There are 231 sections of video footage recorded on a series of 18 Mini DV tapes. Each section of footage begins with a short section showing the corresponding site code on a slate. The footage is held by SNH Maritime group, for access contact the nominated officer of this project (see title page). Footage is available from the majority of sites visited during the survey but at a number of sites it was not possible to obtain footage due to a combination of equipment failure and adverse weather conditions. Footage is not available for the following sites, IA10, IA11, IB8 to IB11, IB21, IB22, IB29, IB32, IB34, IB35, SB57, SB75, SB77, SB89, SB92 and SB95.

Video log.xls

Excel spreadsheet listing the individual sections of video footage. Includes site codes, date, tape number and time code for start of footage section. For further information on specific site codes please refer to 'Station data intertidal surveys.xls' in the case of intertidal sites (IA or IB), 'Station data drop down video surveys.xls' in the case of drop-down video sites (SA) and 'Station data subtidal diver surveys.xls' in the case of sites surveyed by diver or snorkeller (SB) (these files are described above and contained within the 'Biological Data' sub directory).

8.2 B. Sub directory Satellite_data

8.2.1 Sub directory: Satellite_data\Imagery

The satellite data are presented as compressed .zip files to save file space. Files are in Erdas Imagine format. Filenames and an explanation of contents are as follows:

Raw_QuickBird_MS_Image.zip

Enclosed Filenames: 05jul06120306-m2as-005507616010_01_p001.img
05jul06120306-m2as-005507616010_01_p001.rrd

Explanation of contents: Raw QuickBird Multispectral image in Imagine (.img) format, with associated statistics file

Raw_QuickBird_Pan_Image.zip

Enclosed Filenames: 05jul06120306-p2as-005507616010_01_p001.img
05jul06120306-p2as-005507616010_01_p001.rrd

Explanation of contents: Raw QuickBird Panchromatic image in Imagine (.img) format with associated statistics file

Harris_image.zip

Enclosed Filenames: harris_ms_geo_paler_atm.img
harris_ms_geo_paler_atm.rrd

Explanation of contents: Geometrically and atmospherically corrected multispectral image with associated statistics file

harris_ms_geo_paler_atm_mask_snh_images.zip

Enclosed Filenames: harris_ms_geo_paler_atm_mask_snh_cloud_shadow.img
harris_ms_geo_paler_atm_mask_snh_cloud_shadow.rrd

Explanation of contents: Fully processed dataset, including:

- Geometric correction
- Atmospheric correction
- Land mask
- Cloud and cloud shadow mask

harris_depth_invariant_images.zip

Enclosed Filenames: harris_lyzenga_depth_invar_fieldkd.img
harris_lyzenga_depth_invar_fieldkd.rrd

Explanation of contents: Depth corrected image

8.2.2 Sub directory: Satellite_data\Classifications

Each dataset is saved as a grid which opens in ARCView 3.2. Each grid consists of two folders, one called 'info' with the second folder representing the actual name of the grid. To open them, add Theme in a View and from 'data source types' choose 'grid data source'. Add the grid from the individual folder as described above. When opened load the respective label for each theme with a unique value under 'legend type' and choose 'field as value'.

Sub directory: Satellite_data\Classifications\spectral_classification

Contents: Grid file of the purely spectral-based classification as displayed in Report Figure 3.2.6, containing two folders and one file

Sub directory: Satellite_data\Classifications\integrated_detailed_classification

Contents: Grid file of the detailed biotope classification, as displayed in Report Figure 4.3.1 containing two folders and one file

Sub directory: Satellite_data\Classifications\integrated_broader_classification

Contents: Grid file of the broader biotope classification, as displayed in Report Figure 4.3.2 containing two folders and one file

8.3 C. Sub directory Acoustic_data

8.3.1 Sub directory Acoustic_data\swath backscatter grids

Supplied in comma separated (.csv) text file

backscatter.csv – UTM zone 29 wgs84 csv file with column 1 = easting, column 2 = Northing and Column 3 = backscatter amplitude

8.3.2 Sub directory Acoustic_data\swath bathymetry grids

Supplied in comma separated (.csv) text file

despiked.csv – UTM zone 29 wgs84 csv file with column 1 = easting, column 2 = Northing and Column 3 = depth which has been despiked

filled and despiked.csv UTM zone 29 wgs84 csv file with column 1 = easting, column 2 = Northing and Column 3 = depths which have been despiked and small gaps have been interpolated over

8.3.3 Sub directory Acoustic_data\arc shape files

Shape files open in ArcView/ArcGis

agds tracks.shp – AGDS tracks data

biologyclass_map_region.shp – biological class map as a shape file ids are as supplied for images supplied previously

biotope_map_region.shp – biotope class map as a shape file ids are as supplied for images supplied previously

boulders_region.shp – boulder areas as identified from backscatter

despiked contours_polyline.shp = contour lines from despiked bathymetric data

GT sites_font_point.shp – Ground truth sample stations used from supplied data

mosaic_region.shp areas as identified from backscatter

rippled sand_region.shp – rippled sand areas as identified from backscatter

rock_region.shp – bedrock areas as identified from backscatter

sediment_region.shp – sediment areas as identified from backscatter

survey lines polyline.shp –

8.4 D. Sub directory The_report

8.4.1 Sub directory The_report\Report_Figures

49 Figures labelled to match figures in the report text.

8.4.2 Sub directory The_report\Text

Harris_Report_Final.doc	Word file containing the completed and final report text.
A3 report figures.doc	Word file containing separate A3 format graphics.
A3 report figures.pdf	Acrobat file containing separate A3 format graphics.