



MERC Consultants
environmental and conservation services

Project Report

Irish Sea Reef Survey



On behalf of:
National Parks and Wildlife Service
Department of the Environment, Heritage and Local Government

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1. Introduction

The Department of the Environment, Heritage & Local Government, through the National Parks & Wildlife Service (NPWS), is responsible for the conservation of natural habitats and species and the protection of biological diversity in Ireland. It is also responsible for providing advice to Licensing Authorities in that regard.

Marine habitats requiring conservation in Ireland under the 1992 EU Habitats Directive include *inter alia* the Annex I Habitat *Reefs* Annex I (Habitat Code 1170). This habitat is often host to species or communities that may be sensitive to ecological change and may also make a very significant contribution to ecological diversity. Reef habitat on the east coast of Ireland is not as prevalent as it is on other parts of the Irish coastline. Indeed the feature is largely limited to a number of islands and islets and several headlands, all of which are surrounded by relatively shallow waters, often less than 10 meters deep. Accordingly, along the east coast of Ireland the biological communities that are often associated with reefs are not only limited in distribution and extent, but also in biological characteristics on account of the predominantly shallow water.

A limited number of biological investigations have taken place on east of Ireland reefs, for which data are available. Picton & Costello (1997) report on a number of dives carried out on reef habitat in the Dublin area – mainly on Lambay Island as part of an EU *Life* funded programme (BioMar). Numerous smaller studies have examined reef habitat as part of development related impact assessments in a localized context on the east coast. The results of these projects are not widely available and in any event they are unlikely to directly focus on the sites that have been selected for the present study, which are on offshore islands and as such have not been the focus of significant developments in recent times.

This report presents the findings of detailed biological investigations of littoral and sublittoral geogenic reef communities on a number of islands on the east coast of Ireland. The investigations have been carried out by a team of marine ecologists working on contract to the NPWS. The overall objective of the study was undertake fully geo-referenced littoral and sublittoral transect surveys at three locations off the Dublin coast with the intention of identifying areas with the habitat feature *Reefs* as per Council Directive 92/43/EC, while also determining the biological characteristics of the communities associated with the habitat in this area.

The investigations carried out under this study comprised two distinct strategies:

- Subtidal SCUBA transect-survey undertaken at three distinct locations off the Dublin coast. These surveys were targeted to maximise likelihood of returning sublittoral geogenic reef features. Survey locations were:
 - 2 sublittoral survey transects in the Dalkey Island/Muglins area
 - 3 sublittoral survey transects at Lambay Island
 - 1 sublittoral survey transect at Rockabill

- Littoral transect surveys at two locations off the Dublin coast from mean high to low water marks. These surveys included reference to the underlying substrate and were designed to maximise returns of data in relation to geogenic littoral reef. Survey locations were:
 - 3 littoral survey transects at Lambay Island
 - 1 littoral survey transect at Rockabill

2. Materials and Methods

2.1 General

Surveys took place over a period of 3 days of fieldwork from April 28th - May 1st 2010. The surveys were designed to maximise the data generated within the three field days available. A team of four experienced marine field ecologists professionally trained in scuba techniques and using an appropriate sampling vessel conducted all fieldwork.

Before undertaking any fieldwork, considerable effort was invested in researching the sites selected for survey and in preparing for the study. A combination of mapping data including Admiralty hydrographic charts, high resolution orthographic images, Discovery and 6inch series Ordnance Survey of Ireland maps and several Nautical almanacs were consulted for a variety of mainly hydrographic data in relation to the sites. The BioMar dataset (Picton & Costello, 1997) was reviewed and provided some useful data in relation to the biological aspects of reef communities on a limited number of east coast sites that were surveyed as part of that study. Having reviewed all existing available information, potentially suitable littoral and sublittoral reef sites at each location were selected and a proposed schedule of sites for survey was drawn up and agreed with NPWS Research.

Permission to land on and traverse Lambay Island for the purpose of conducting littoral surveys was obtained from the owners of the island. Their co-operation with this study is gratefully acknowledged.

2.2 Techniques

2.2.1 Sublittoral surveys

Established survey methodologies for the survey of temperate geogenic reefs are limited. However, the Marine Monitoring Handbook (Davies, *et al* 2001) recommends a number of techniques that are designed to help implement the UK's Common Standards for Monitoring programme for Littoral rock and inshore Sublittoral rock habitats (JNCC, 2004). As detailed techniques have not been further developed for the survey of reef habitats in Ireland, and in particular techniques that will allow their Conservation Status to be monitored into the future, the techniques employed during the present study drew on the experience of the UK Common Standards Monitoring guidelines and the evaluation of some of these techniques assessed by the UK Marines SACs project, which included the inter-comparability of some of these techniques (recording biotope richness, species counts).

At each site, data in relation to faunal and algal species assemblages and abundance in both the circalittoral and infralittoral were recorded by teams of two or three experienced ecologists working together on transects using scuba. Start and end points of transects were identified by dGPS and marked with a buoy. Where conditions permitted, dive teams commenced surveys by descending a line to the deepest part of the reef, although on a

number of occasions it was necessary to reverse this profile due to significant tidal currents that made descent in deeper waters difficult. On reaching the seabed, dive teams made their way up (or down) the reef in a straight line following a compass bearing. While crossing the reef profiles, divers spaced themselves between one and two meters apart. This permitted divers to remain within visual contact of each other while allowing each diver to survey an approximately 2-meter wide swathe of reef.

The following data were recorded in-situ by ecologists during dives:

- Species encountered together with their abundance (using the SACFORP¹ scale).
- Conspicuous features and description of the habitat.
- Description of each zone/biotope (MNCR classification)
- Transition from one biotope complex/zone to the next
- Stills images of conspicuous and characterising species where underwater conditions permitted

All taxa were identified to species level in-situ where possible and samples were returned to the surface for identification if identification to species level could not be accomplished in-situ. In some cases, specimens were photographed using a digital SLR and strobe and this also facilitated identification of species in some cases.

Initially it had been proposed to conduct more detailed investigations of species and abundance at each site by conducting a series of 1m x 1m underwater quadrats at fixed locations along each transect and within each biotope identified during survey. This however proved impossible with the prevailing tidal conditions and underwater visibility. As a consequence the methodology was revised in order to focus on gaining sufficient data to allow the identification of habitats to at least EUNIS level 5.

GPS positions were recorded using a satellite differential enabled Thales Mobile Mapper. Biological and reef characterising data were recorded in-situ on underwater slates. Together with additional data generated from examination of samples or specimens collected during dives, all data were used to complete electronic MNCR sublittoral survey forms for each biotope encountered during each transect, at the end of each survey day.

¹ SACFORP- Superabundant, Abundant, Common, Frequent, Occasional, Rare, Present

2.2.2 Littoral surveys

Littoral transects were completed during periods equating to one hour before and/or after low water. Low tides for the sampling dates were in the region of 1.2 to 1.4 meters above Chart datum, close to the maximum range encountered at the sites. A four-person team completed survey transects from mean high water to low water mark. During an initial transect walkover, zones were clearly identified on the shore according to species assemblage and algal cover and the approximate extent of each zone was estimated by recorded using a differential GPS enabled Thales Mobile Mapper.

Following initial walkover, each zone of the littoral shore was examined in detail and characterising species were recorded for the purposes of biological habitat classification according to MNCR protocols and to EUNIS level 5 or higher where possible. A more detailed examination was then carried out of each zone including faunal species presence and abundance and algal understory.

The following data were recorded for each transect:

- Species encountered together with their abundance for each zone (SACFORP scale).
- Conspicuous features and description of the habitat.
- Detailed description of each zone and biotope (MNCR classification)
- Transition from one biotope complex/zone to the next
- Physical characteristics of the transect area.
- Physical appearance of the site using a digital camera, to assist with future relocation of the survey site

Biological data were recorded on waterproof slates and transferred to electronic MNCR forms at the end of each day.

2.3 Classification schemes

All biotopes were classified according to The Marine Nature Conservation Review Classification Scheme for Britain and Ireland. ~~was the selected for initial description of communities and designation of biotopes.~~ MNCR habitat biotope descriptions and codes were later converted to EUNIS habitat descriptions and codes using the conversion table provided by the Joint Nature Conservation Committee (JNCC, 2009).

3. Results

3.1 General

The survey successfully completed collection of biological data in relation to sublittoral geogenic reef communities at 2 sites in Dalkey Island/Muglins area, 3 sites at Lambay Island and 1 site at Rockabill.

Weather conditions throughout the survey period were calm and sea states were <Force 2 Beaufort with no significant ocean swell. In order to maximise the extent of littoral shores, a period of relatively large tides was selected for conducting the survey. While this facilitated conducting the littoral surveys, it is likely that tidal conditions impacted negatively on sublittoral surveys by contributing to scour which unsettled seabed sediments on a broad geographic scale in the Irish Sea, causing much of the reduced visibility encountered during dives.

On account of the extremely poor visibility, safety considerations meant that buddy lines were required on a number of occasions in order to keep teams together underwater. Furthermore, the original methodology proposed for the survey – the use of fixed line transects and replicate quadrats became impossible to execute. This became apparent on the first day, when it was attempted to employ the initially proposed methodology. On entering the water it quickly became apparent that it would not be possible to apply the methodology reliably and systematically across all sublittoral survey sites on account of the combination of extremely poor visibility and prevailing tidal streams. Accordingly, the methodology was revised as described in Section 2.

It is noteworthy that the team did not encounter any appreciable slack water in the sound between Dalkey Island and Muglins. This was despite extensive preparations and consultations with official sources of tidal information for the area as well as with the advice of experienced local divers. In an effort to avail of a period of slack water for diving, the team spent some 11 hours at the site, with no slack water being recorded and observed currents did not drop below c. 1.5kts. This rendered diving conditions difficult and greatly influenced the selection of sites for dive surveys. Visibility was extremely bad however and was reduced to <1m from depths of 5 meters onwards.

At Lambay Island, it is noteworthy that no significant tidal stream was encountered on the southern shore site and underwater visibility at this site was somewhat better, but remained at <1m. The transect location on the eastern side of the island was selected on arrival at the site as it lay out of the path of the main North-South ebb tidal current that prevailed. While visibility remained extremely poor, tidal streams were <1knot. The northern shore survey site was subject to considerable tidal flow that fluctuated in direction and intensity. Visibility here was <0.5m.

At Rockabill, the chosen survey site commenced adjacent to the landing steps and was to some extent located in the shadow of the northern islet, meaning that the initial part of the

dive in shallow water was relatively current free, despite diving mid-way through a rising tide. The current became noticeable beyond 10 meters and visibility deteriorated to c. <0.3m estimated again.

3.2 Sublittoral dive transect surveys

A total of eight sublittoral transects were completed. Summary details for sublittoral transects are given in Table 3.1. Figures 3.1 to 3.4 show the locations of sublittoral transects on Ordnance Survey 6" mapping.

Table 3.1 Summary data for sublittoral transects at all sites.

<i>Transect ID</i>	<i>Sublittoral transect location</i>	Dive Start		Dive end		<i>D max (m)</i>
		<i>Easting</i>	<i>Northing</i>	<i>Easting</i>	<i>Northing</i>	
Dalkey1	off east shore Dalkey Island	328162	226323	328069	226364	21
Muglins1	off southern point Muglins	328396	226553	328410	226650	21
Muglins2	off southeastern shore Muglins	328516	226576	328509	226638	16.5
Lambay1	off south shore Lambay Island	333050	251269	333068	251274	13
Lambay2	off east shore Lambay Island	332406	250730	332462	250741	13
Lambay3	off north shore Lambay Island	330998	250274	330967	250175	11
Lambay4	off north shore Lambay Island	330999	250275	330959	250212	17
Rockabill	off eastern shore Rockabill	332149	262695	332035	262784	17

All transects were commenced in the shallow infralittoral and transects directions were chosen so as to cross the main depth axis of the site, with the objective of acquiring data in relation to the different biotopes likely to be present at different depths.

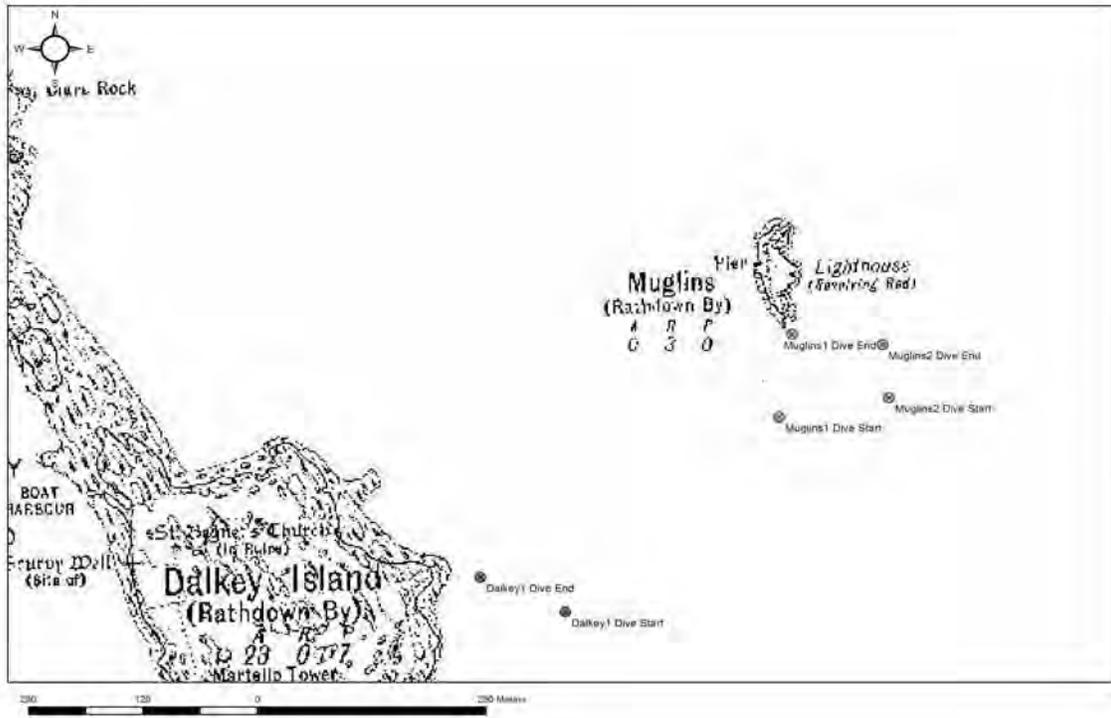


Figure 3.1 Location of sublittoral transects, Dalkey Island and Muglins

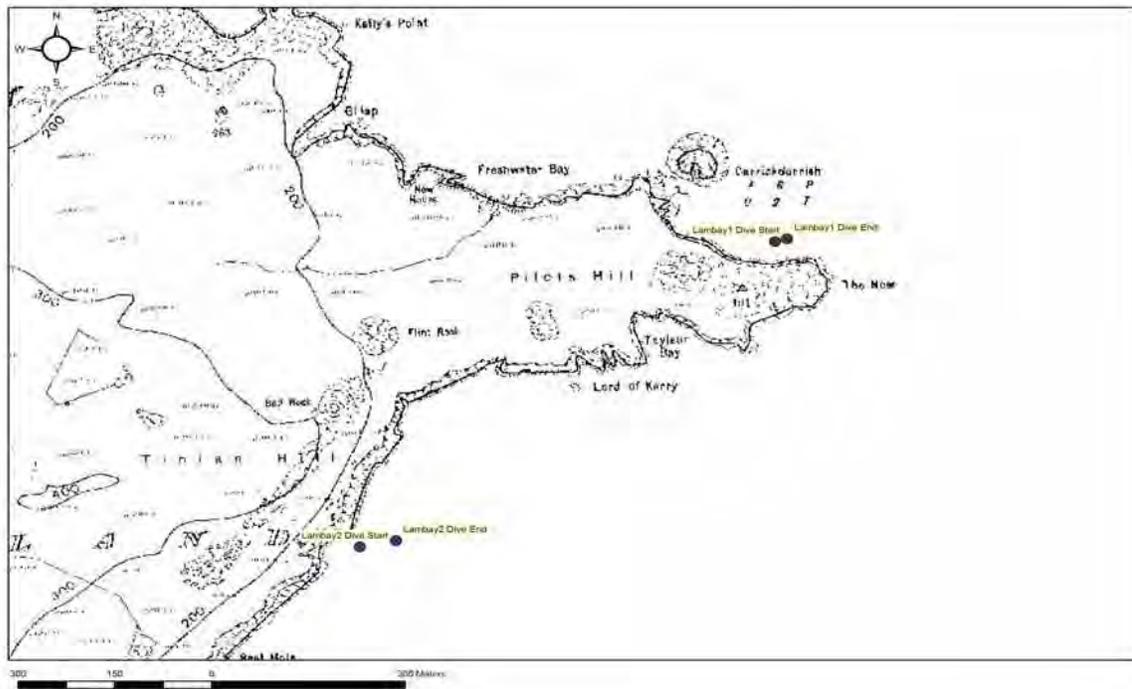


Figure 3.2 Location of sublittoral transects, north shore Lambay Island

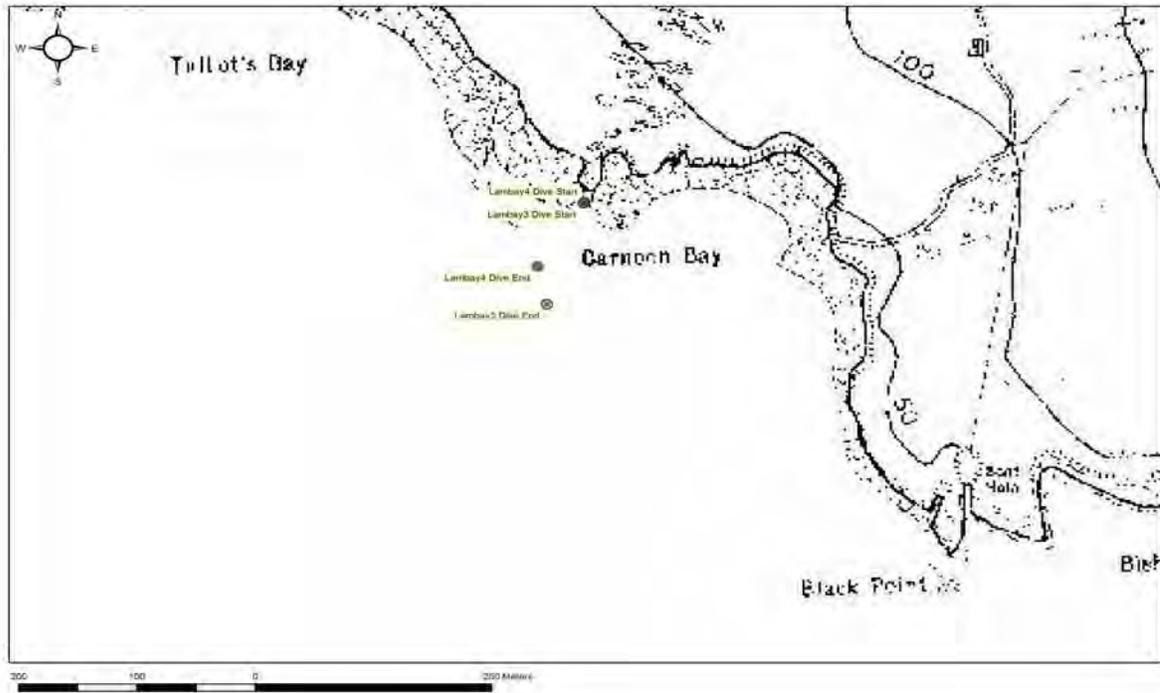


Figure 3.3 Location of sublittoral transects, south shore Lambay Island

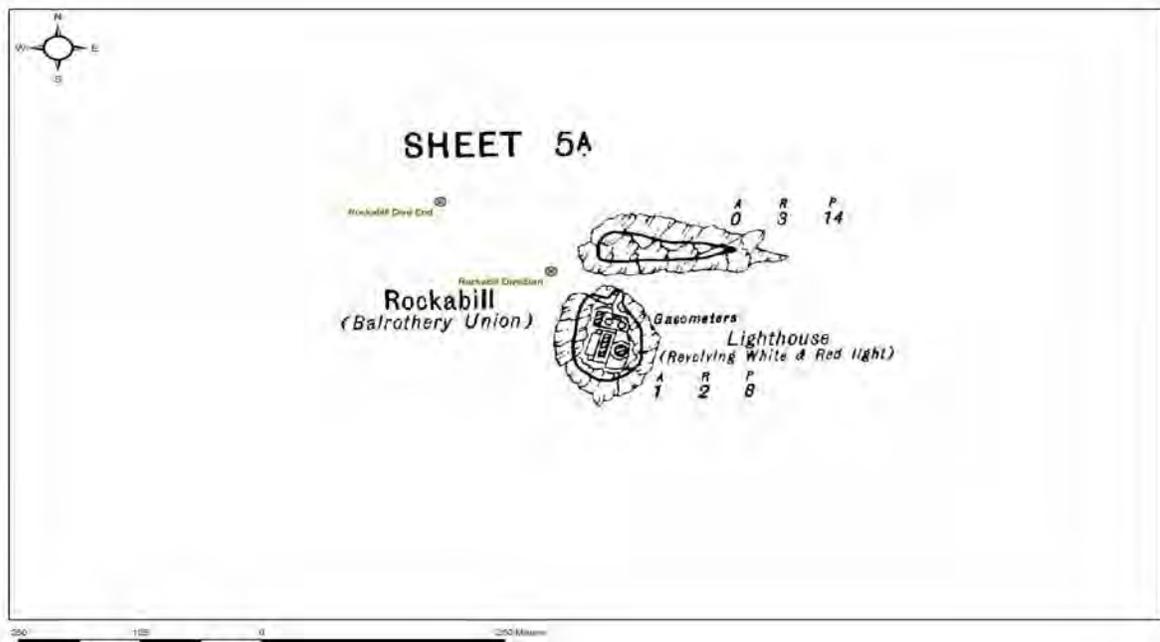


Figure 3.4 Location of sublittoral transects, south shore Lambay Island

Table 3.2 directs the reader to the relevant report section for acoustic reef profile images as well as completed MNCR form references for individual transects. Codes for EUNIS Level 5 and Level 6 habitats recorded at each site are also given. Table 3.3 presents full EUNIS habitat descriptions corresponding to EUNIS codes for sublittoral sites. Table 3.4 presents corresponding MNCR habitats and codes for sublittoral sites.

A range of electronic files accompany this report and provide more detail in relation to sublittoral transects.

- A series of five shapefiles provide datapoints and lines for all sublittoral sampling locations in ArcView 3.2.
- A short photographic catalogue provides some species records from dives along with some limited records of sampling methodologies and surface views of sublittoral sampling locations.
- Excel files summarising habitat classification results as presented in Tables 3.2, 3.3 and 3.4 within the text report
- Completed MNCR detailed sublittoral Habitat form for each biotope recorded at each sublittoral site surveyed.

Table 3.2 Location of more detailed information in respect of sublittoral transect surveys and EUNIS Habitat codes.

	Acoustic profile	Completed MNCR Form Reference	EUNIS Habitats	EUNIS Habitats
<i>Transect ID</i>	<i>Report section</i>	<i>PDF Filenames</i>	<i>Level 5</i>	<i>Level 6</i>
Dalkey1	3.4.1	Dalkey 1A, Dalkey 1B	A3.116	A4.1122
Muglins1	3.4.2	Muglins 1A, Muglins 1B, Muglins 1C	A3.115	A4.2141, A4.2145
Muglins2	N/A	Muglins 2A, Muglins 2B	A4.241	A3.1111
Lambay1	3.4.3	Lambay 1A, Lambay 1B	A3.126, A3.212	-----
Lambay2	3.4.4	Lambay 2A, Lambay 2B		A3.1152, A4.2145
Lambay3	3.4.5	Lambay 3A, Lambay 3B		A3.1152, A4.2145
Lambay4	N/A	Lambay 4A, Lambay 4B	A4.212	A3.1152
Rockabill	3.4.6	Rockabill1A, Rockabill 1B, Rockabill 1C	A4.721	A3.1152, A4.2142

Table 3.3 EUNIS habitats recorded during sublittoral surveys

Transect ID	EUNIS habitat	EUNIS level 5	EUNIS level 6
Dalkey1	<i>Tubularia indivisa</i> on tide-swept circalittoral rock		A4.1122
Dalkey1	Foliose red seaweeds on exposed lower infralittoral rock	A3.116	
Muglins1	<i>Laminaria hyperborea</i> with dense foliose red seaweeds on exposed infralittoral rock	A3.115	
Muglins1	<i>Flustra foliacea</i> on slightly scoured silty circalittoral rock		A4.2141
Muglins1	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock		A4.2145
Muglins2	<i>Alaria esculenta</i> , <i>Mytilus edulis</i> and coralline crusts on very exposed sublittoral fringe bedrock		A3.1111
Muglins2	<i>Mytilus edulis</i> beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	A4.241	
Lambay1	<i>Halidrys siliquosa</i> and mixed kelps on tide-swept infralittoral rock with coarse sediment	A3.126	
Lambay1	<i>Laminaria hyperborea</i> on tide-swept, infralittoral rock	A3.212	
Lambay2	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock		A3.1152
Lambay2	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock		A4.2145
Lambay3	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock		A3.1152
Lambay3	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock		A4.2145
Lambay4	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock		A3.1152
Lambay4	<i>Caryophyllia smithii</i> , sponges and crustose communities on wave-exposed circalittoral rock	A4.212	
Rockabill	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock		A3.1152
Rockabill	<i>Alcyonium digitatum</i> , <i>Pomatoceros triqueter</i> , algal and bryozoan crusts on wave-exposed circalittoral rock		A4.2142
Rockabill	<i>Alcyonium digitatum</i> and <i>Metridium senile</i> on moderately wave-exposed circalittoral steel wrecks	A4.721	

Table 3.4 MNCR habitats recorded during sublittoral transect surveys

Transect ID	MNCR Form	MNCR zone	MNCR Biotope classification	MNCR Classification Code
Dalkey1	Dalkey 1A	10-20, 20-30	<i>Alcyonium digitatum</i> with dense <i>Tubularia indivisa</i> and anemones on strongly tide-swept circalittoral rock	CR.HCR.FaT.CTub.Adig
Dalkey1	Dalkey 1B	5-10, 10-20	Foliose red seaweeds on exposed lower infralittoral rock	IR.HIR.KFaR.FoR
Muglins1	Muglins 1A	0-5, 5-10	<i>Laminaria hyperborea</i> with dense foliose red seaweeds on exposed infralittoral rock	IR.HIR. KFaR.LhypR
Muglins1	Muglins 1B	5-10, 10-20	<i>Flustra foliacea</i> on slightly scoured silty circalittoral rock	CR.MCR.EcCr.FaAlCr.Flu
Muglins1	Muglins 1C	20-30	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr.Pom
Muglins2	Muglins 2A	0-5, 5-10	<i>Alaria esculenta</i> , <i>Mytilus edulis</i> and coralline crusts on very exposed sublittoral fringe bedrock	IR.HIR.KFaR.Ala.Myt
Muglins2	Muglins 2B	10-20	<i>Mytilus edulis</i> beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock	CR.MCR.CMus.Cmyt
Lambay1	Lambay 1A	5-10	<i>Halidrys siliquosa</i> and mixed kelps on tide-swept infralittoral rock with coarse sediment	R.HIR.KSed.XKHal
Lambay1	Lambay 1B	10-20	<i>Laminaria hyperborea</i> on tide-swept, infralittoral rock	IR.MIR.KR.LhypT
Lambay2	Lambay 2A	0-5, 5-10	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock	IR.HIR.KFaR.LhypR.Pk
Lambay2	Lambay 2B	10-20	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr.Pom
Lambay3	Lambay 3A	0-5, 5-10	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock	IR.HIR.KFaR.LhypR.Pk
Lambay3	Lambay 3B	10-20	Faunal and algal crusts with <i>Pomatoceros triqueter</i> and sparse <i>Alcyonium digitatum</i> on exposed to moderately wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr.Pom
Lambay4	Lambay 4A	0-5, 5-10	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock	IR.HIR.KFaR.LhypR.Pk
Lambay4	Lambay 4B	10-20	<i>Caryophyllia smithii</i> , sponges and crustose communities on wave-exposed circalittoral rock	CR.MCR.EcCr.CarSp
Rockabill	Rockabill 1A	5-10	<i>Laminaria hyperborea</i> park with dense foliose red seaweeds on exposed lower infralittoral rock	IR.HIR.KFaR.LhypR.Pk
Rockabill	Rockabill 1B	5-10, 10-20	<i>Alcyonium digitatum</i> , <i>Pomatoceros triqueter</i> , algal and bryozoan crusts on wave-exposed circalittoral rock	CR.MCR.EcCr.FaAlCr.Adig
Rockabill	Rockabill 1C	10-20	<i>Alcyonium digitatum</i> and <i>Metridium senile</i> on moderately wave-exposed circalittoral steel wrecks	CR.FCR.FouFa.AdigMsen

3.3 Sublittoral geogenic reef sites - Acoustic Profiles

A Lowrance HDS-8m recording digital echosounder was used to acquire acoustically derived profile images of most sublittoral survey sites examined during the survey. The echosounder is GPS enabled thereby allowing a two dimensionally accurate depth profile of the reef to be recorded.

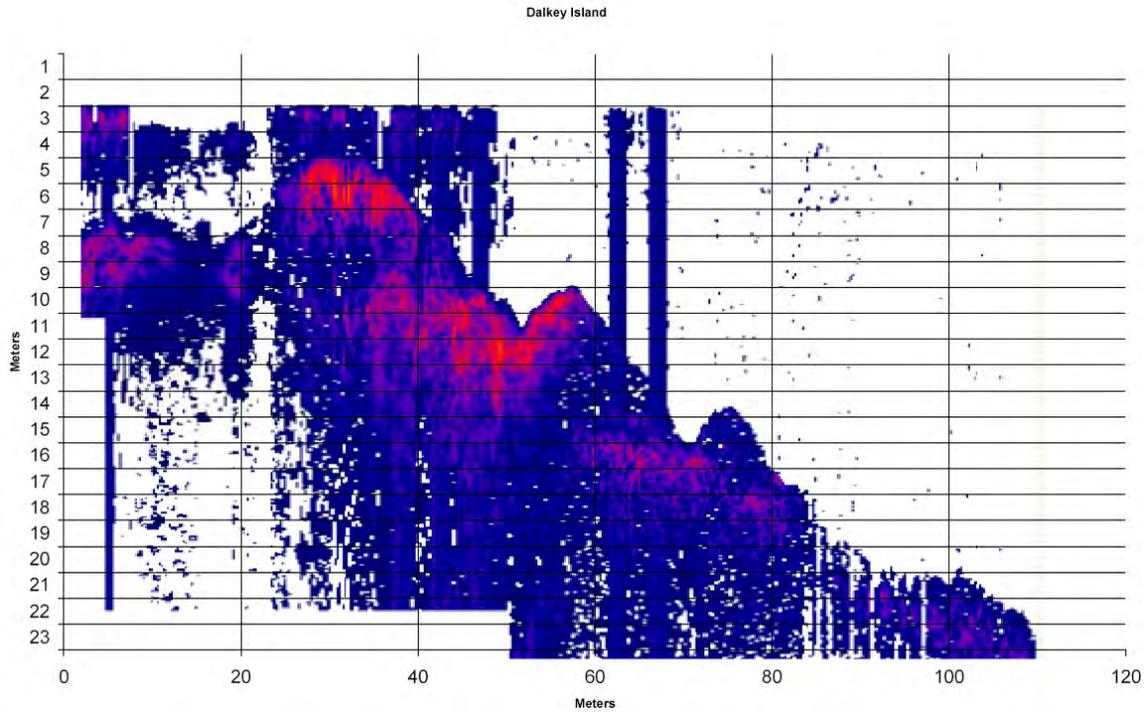
Acoustic profiles were acquired for geogenic reefs surveyed at six of eight sites surveyed during the study. Acoustic profiles were not acquired for two sites – Muglins Southeast (Transect ID *Muglins 2*) and one site of the two sites surveyed on the northern shore of Lambay Island (Transect ID *Lambay 4*). Attempts to collect acoustic data were made at both of these locations however this was unsuccessful, most likely due to extreme sediment loading and/or turbulence on account of tidal streams prevalent at both sites. It is suspected that strong tidal streams may have introduced air bubbles into the top layer of the water, preventing the acoustic signal from penetrating the water column.

Survey vessel safety considerations meant that in general reef profiles commenced in water depths no shallower than 3 meters, although on occasion it was not possible to survey shallower than 8 meters.

Depth profiles presented below have not been corrected to Chart Datum. Images have been cropped at the deepest point where hard substrate was confirmed (ground truthed) through dive surveys.

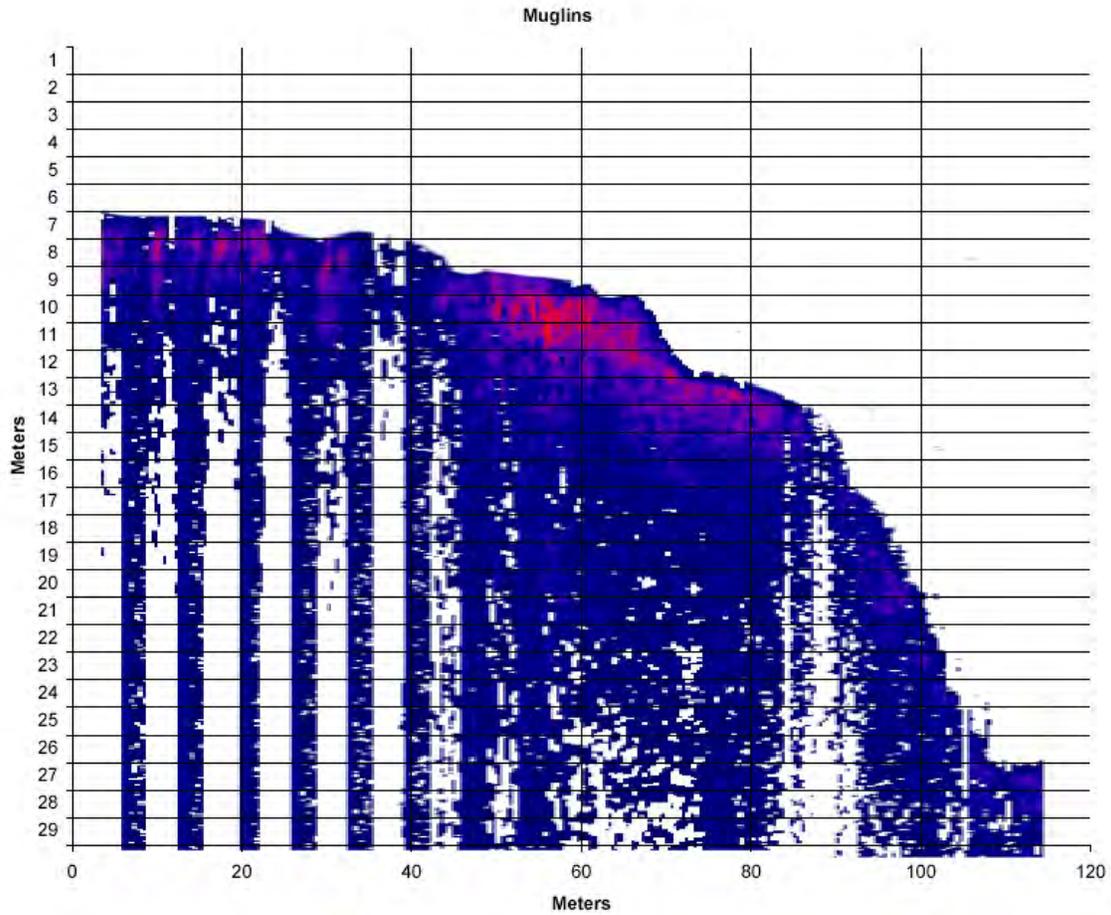
3.3.1 Profile of site off eastern shore of Dalkey Island

The site was characterised by a steep uneven slope of bedrock and large boulders leading from the littoral down to sandy sediments in the tide swept channel between Dalkey Island and Muglins. Indications are that sublittoral reef extends to a distance of approximately 110 meters from the shoreline.



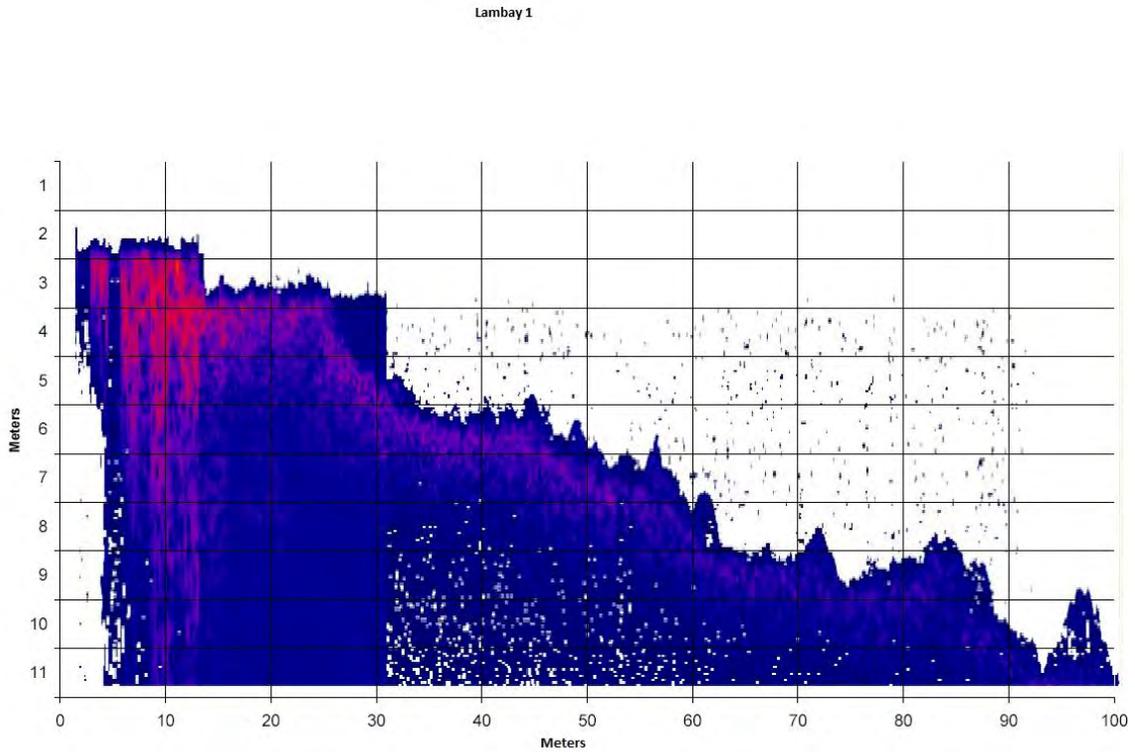
3.3.2 Profile of site off western shore of Muglins

The site was characterised by a gently sloping and relatively even area of what appears to be bedrock; ground truthing by diving confirmed the presence of boulders also. Indications are that sublittoral reef extends to a distance of approximately 110 meters from the shoreline.



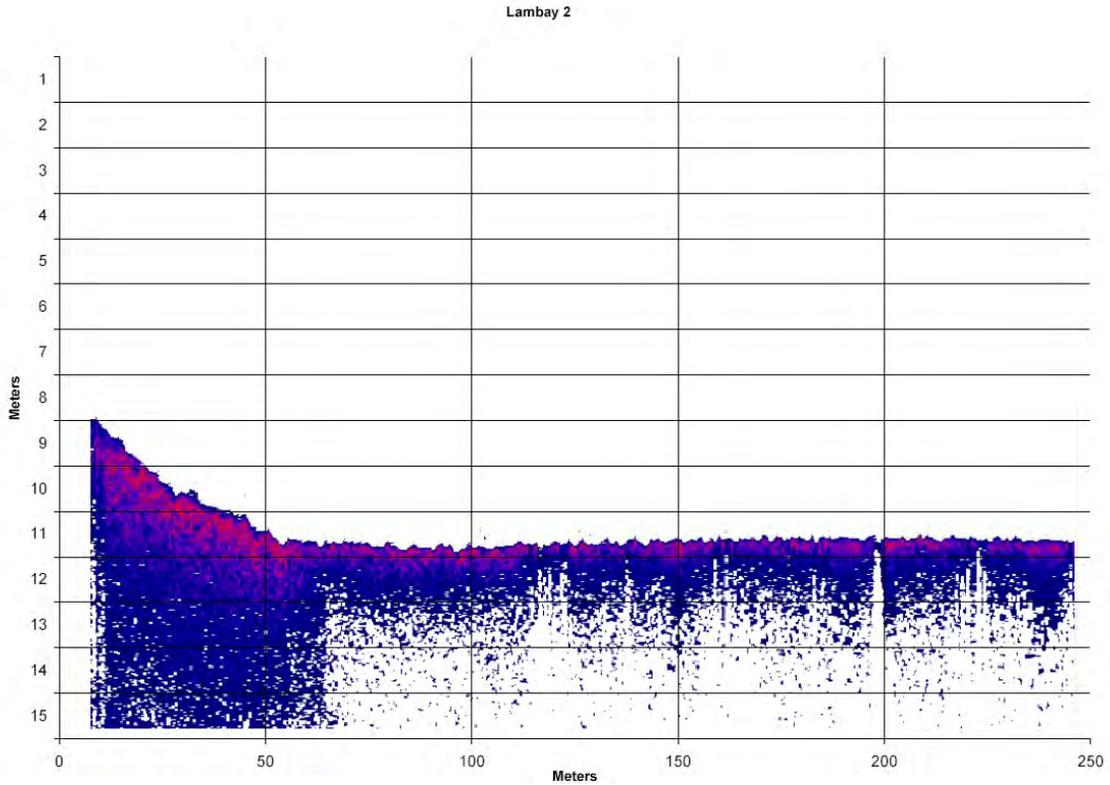
3.3.3 Profile of site off southern shore of Lambay Island

Observations taken during the dive transect revealed a dense canopy of kelp overlying bedrock and boulders, stones in the shallow sublittoral to 6 or 7 meters. This accounts for the jagged nature of the profile, while the red areas confirm hard substrate. Indications are that sublittoral reef extends to a distance of approximately 90 meters from the shoreline.



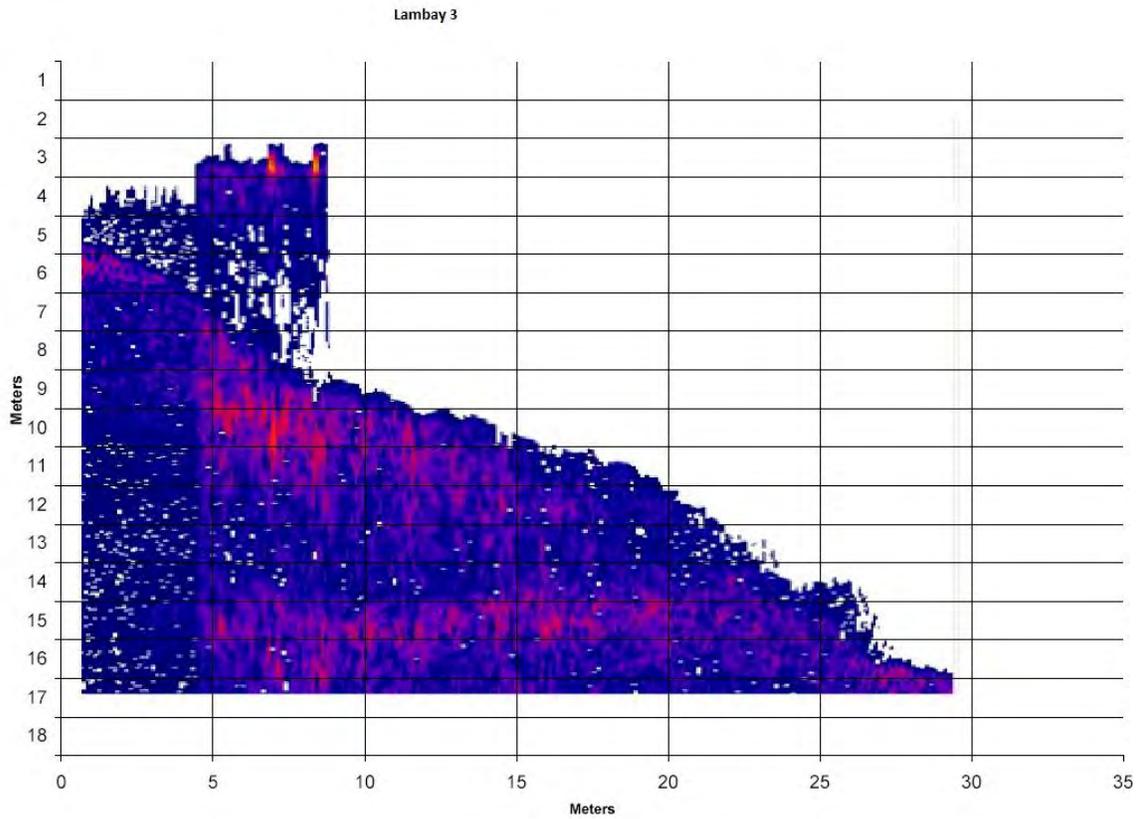
3.3.4 Profile of site off eastern shore of Lambay Island

The site was characterised by a moderate and even hard substrate slope that gave way to an extended area of level seabed from 11m onwards. Indications are that sublittoral reef extends to a distance of 50-60 meters from the shoreline.



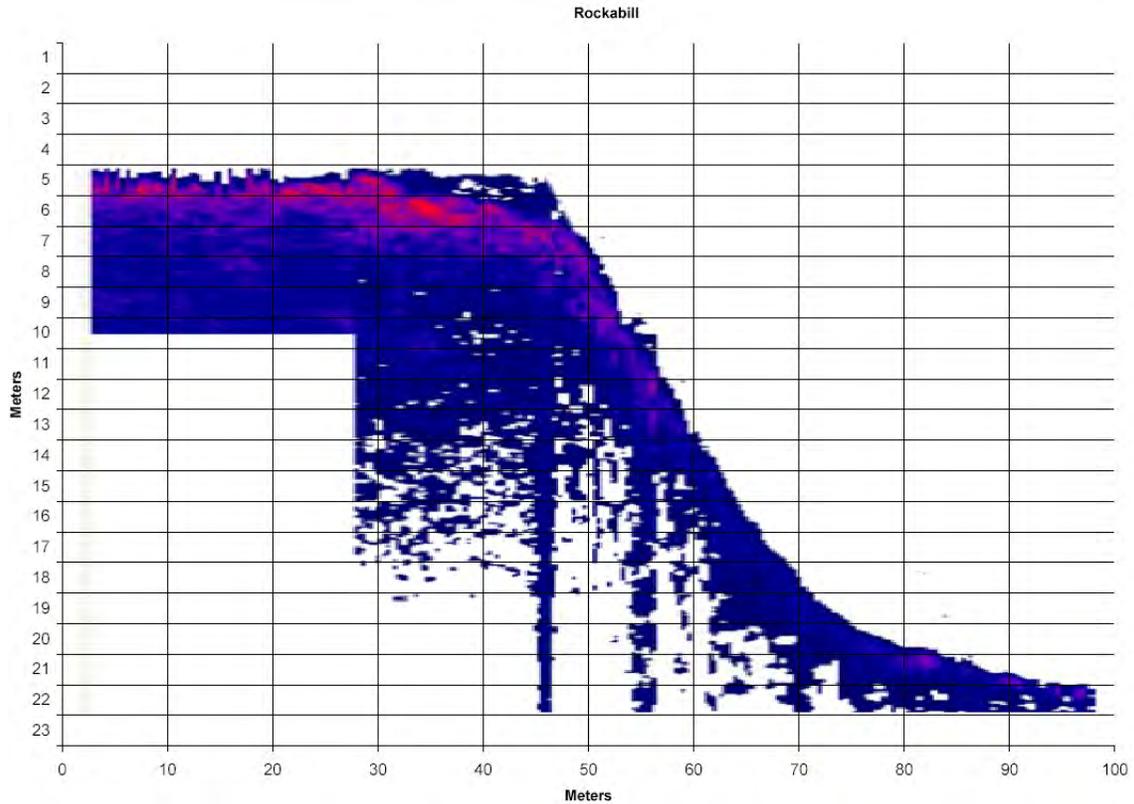
3.3.5 Profile of site off northern shore of Lambay Island

The littoral site comprised a near vertical cliff that extended into the sublittoral. From 5 meters onwards the site was characterised by a steep slope and acoustic signal returns confirmed the presence of hard substrates to 17 meters. Indications are that sublittoral reef extends to a distance of approximately 30 meters from the shoreline.



3.3.6 Profile of site off western shore Rockabill

The site was characterised by an extended area of level seabed in the shallow sublittoral (<6m). Indications are that sublittoral reef extends to a distance of approximately 70-80 meters from the shoreline. This was confirmed during dive transects where it was observed that seabed substrates became increasingly sedimentary and tide swept from 16 -17 meters onwards.



3.4 Littoral transect surveys

The survey successfully completed collection of biological data in relation to littoral geogenic reef communities at 3 sites on Lambay Island and 1 site on Rockabill, as per the terms of the study.

Weather conditions throughout the survey period were calm and sea states were <Force 2 Beaufort with no significant ocean swell. In order to maximise the extent of littoral shores, a period of relatively large spring tides was selected for conducting the survey. Summary details for littoral transects are given in Table 3.5. Figures 3.5 and 3.6 show the locations of littoral transects on Ordnance Survey 6" mapping.

Table 3.5 Summary data for littoral transects.

<i>Transect ID</i>	<i>Littoral transect location</i>	Transect start		Transect end	
		<i>Easting</i>	<i>Northing</i>	<i>Easting</i>	<i>Northing</i>
Lambay L1	eastern shore Lambay Island	330759	251165	330712	251234
Lambay L2	northwestern shore Lambay Island	330952	251435	331025	251464
Lambay L3	southern shore Lambay Island	331016	250325	330967	250305
Rockabill L1	western shore Rockabill	332137	262668	332132	262668

At each transect, zonation of the intertidal area corresponding to individual biotopes was noted and dGPS readings at the start and end of each biotope taken. All taxa recorded were identified to species level in-situ where possible. Samples that could not be identified in the field were collected for further examination and identification at a later stage.

Standard MNCR detailed littoral habitat forms were completed for each biotope recorded within the transect. In this way, a clear and thorough picture of the species composition and diversity as well as species abundance could be estimated.

Table 3.6 EUNIS habitats recorded during sublittoral surveys

<i>Transect ID</i>	Completed MNCR Form Reference <i>PDF Filenames</i>	EUNIS Habitats	EUNIS Habitats	EUNIS Habitats
		<i>Level 4</i>	<i>Level 5</i>	<i>Level 6</i>
Lambay L1	Lambay L1A, Lambay L1B, Lambay L1C, Lambay L1D, Lambay L1E	A2.21	A1.315	A1.3.121, A1.3141, A3.2112
Lambay L2	Lambay L2A, Lambay L2B, Lambay L2C, Lambay L2D, Lambay L2E	A2.21	A1.315	A1.3122, A1.3141, A3.2112
Lambay L3	Lambay L3A, Lambay L3B, Lambay L3C, Lambay L3D, Lambay L3E		A1.211, A1.315	A1.3.121, A1.3141, A3.2112
Rockabill L1	Rockabill L1A, Rockabill L1B		A1.113	A3.2112

Table 3.6 directs the reader to the relevant report section for completed MNCR form references for littoral transects. Codes for EUNIS Level 5 and Level 6 habitats recorded at each site are also given. Table 3.7 presents full EUNIS habitat descriptions corresponding to EUNIS codes for littoral sites. Table 3.8 presents corresponding MNCR habitats and codes for littoral sites.

A range of electronic files accompany this report and provide more detail in relation to littoral transects.

- A series of five shapefiles provide datapoints and lines for all sampling locations in ArcView 3.2.
- A short photographic catalogue provides some records from of sampling methodologies and surface views of littoral sampling locations.
- Excel files summarising habitat classification results as presented in Tables 3.6, 3.7 and 3.8 within the text report
- Completed MNCR detailed littoral Habitat form for each biotope recorded at each littoral site surveyed.

Table 3.6 EUNIS habitats recorded during sublittoral surveys

Transect ID / Zone	EUNIS habitat	EUNIS level 4	EUNIS level 5	EUNIS level 6
Lambay L1A	Strandline	A2.21		
Lambay L1B	[Fucus spiralis] on full salinity sheltered upper eulittoral rock			A1.3.121
Lambay L1C	[Ascophyllum nodosum] on full salinity mid eulittoral rock			A1.3141
Lambay L1D	[Fucus serratus] on sheltered lower eulittoral rock			A1.315
Lambay L1E	[Laminaria digitata] and under-boulder fauna on sublittoral fringe boulders			A3.2112
Lambay L2A	Strandline	A2.21		
Lambay L2B	[Fucus spiralis] on full salinity upper eulittoral mixed substrata			A1.3122
Lambay L2C	[Ascophyllum nodosum] on full salinity mid eulittoral rock			A1.3141
Lambay L2D	[Fucus serratus] on sheltered lower eulittoral rock		A1.315	
Lambay L2E	[Laminaria digitata] and under-boulder fauna on sublittoral fringe boulders			A3.2112
Lambay L3A	Pelvetia canaliculata] and barnacles on moderately exposed littoral fringe rock		A1.211	
Lambay L3B	[Fucus spiralis] on full salinity sheltered upper eulittoral rock			A1.3.121
Lambay L3C	[Ascophyllum nodosum] on full salinity mid eulittoral rock			A1.3141
Lambay L3D	[Fucus serratus] on sheltered lower eulittoral rock		A1.315	
Lambay L3E	[Laminaria digitata] and under-boulder fauna on sublittoral fringe boulders			A3.2112
Rockabill L1A	[Semibalanus balanoides] on exposed to moderately exposed or vertical sheltered eulittoral rock		A1.113	
Rockabill L1B	[Laminaria digitata] and under-boulder fauna on sublittoral fringe boulders			A3.2112

Table 3.7 MNCR habitats recorded during littoral transect surveys

Transect ID	<u>MNCR Form</u>	<u>MNCR Biotope classification</u>	<u>MNCR Classification Code</u>
Lambay L1	Lambay L1A	Strandline	LS.LSa.St
Lambay L1	Lambay L1B	<i>Fucus spiralis</i> on full salinity moderately exposed to very sheltered upper eulittoral rock	LR.LLR.F.Fspi.FS
Lambay L1	Lambay L1C	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock	LR.LLR.F.Asc.FS
Lambay L1	Lambay L1D	<i>Fucus serratus</i> on full salinity lower eulittoral mixed substrata	LR.LLR.F.Fserr.X
Lambay L1	Lambay L1E	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	IR.MIR.KR.Ldig.Bo
Lambay L2	Lambay L2A	Strandline	LS.LSa.St
Lambay L2	Lambay L2B	<i>Fucus spiralis</i> on full salinity upper eulittoral mixed substrata	LR.LLR.F.Fspi.X
Lambay L2	Lambay L2C	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock	LR.LLR.F.Asc.FS
Lambay L2	Lambay L2D	<i>Fucus serratus</i> on sheltered lower eulittoral rock	LR.LLR.F.Fserr
Lambay L2	Lambay L2E	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	IR.MIR.KR.Ldig.Bo
Lambay L3	Lambay L3A	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock	LR.MLR.BF.PelB
Lambay L3	Lambay L3B	<i>Fucus spiralis</i> on full salinity moderately exposed to very sheltered upper eulittoral rock	LR.LLR.F.Fspi.FS
Lambay L3	Lambay L3C	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock	LR.LLR.F.Asc.FS
Lambay L3	Lambay L3D	<i>Fucus serratus</i> on sheltered lower eulittoral rock	LR.LLR.F.Fserr
Lambay L3	LambayL3E	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	IR.MIR.KR.Ldig.Bo
Rockabill L1	Rockabill L1A	<i>Semibalanus balanoides</i> on exposed to moderately exposed or vertical sheltered eulittoral rock	LR.HLR.MusB.Sem
Rockabill L1	Rockabill L1B	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	IR.MIR.KR.Ldig.Bo

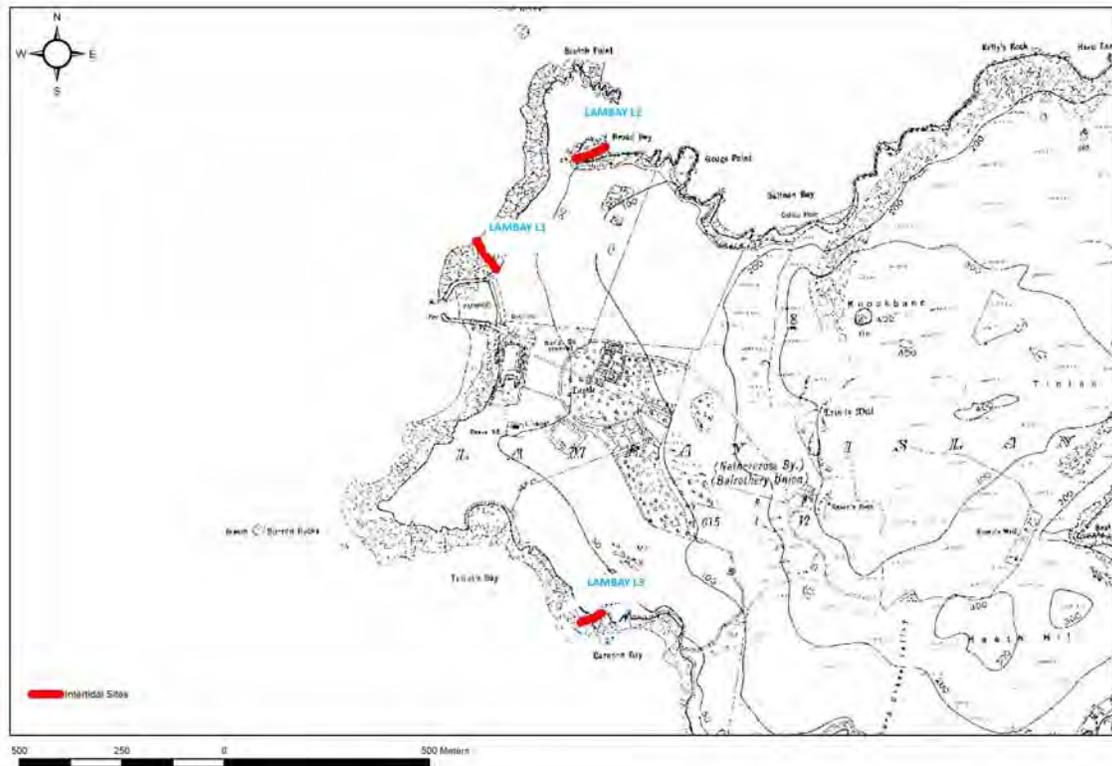


Figure 3.5 Locations of littoral transects, Lambay Island

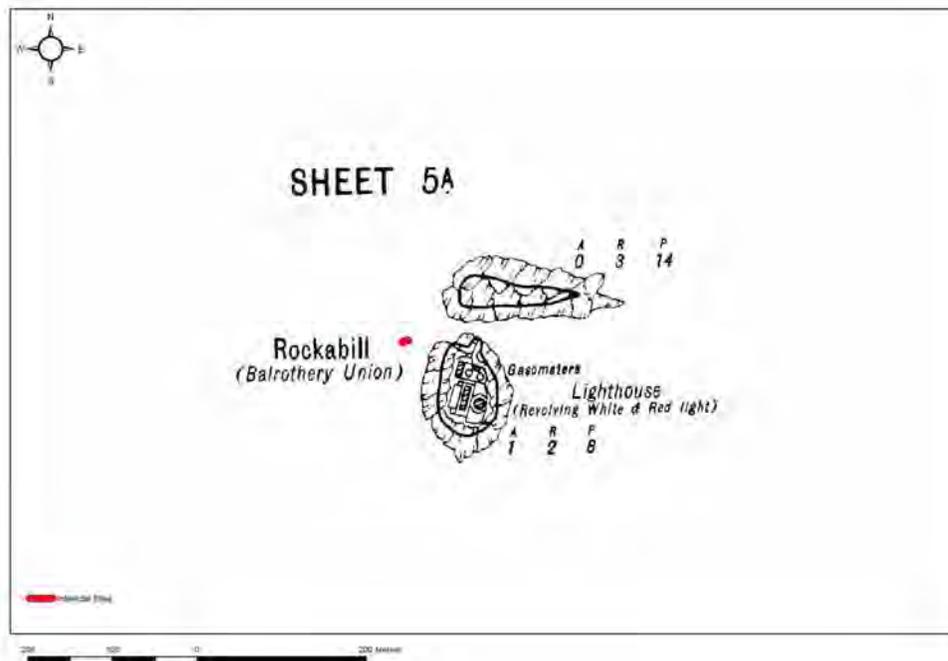


Figure 3.6 Locations of littoral transect, Lambay Island

4. Discussion

All of the sites surveyed at Dalkey Island/Muglins, Lambay Island and Rockabill, Co. Dublin conform to the EU definition of the habitat “Reefs (1170)” as described in the Interpretation Manual of European Union Habitats (Interpretation Manual - EUR27).

In all cases, the sites surveyed were of geogenic origin, consisting of either bedrock or large boulders and bedrock arising from the sea floor in the sublittoral and littoral zone. A clear zonation of benthic communities of algal and faunal species was recorded at all sites in both the littoral and sublittoral sections; however biotope diversity was generally low.

The presence of a thin veneer of mud on the sublittoral geogenic reef and many of the species recorded along with it was noted at a number of sites. These included Lambay Island (northern and eastern sites), Rockabill and to a lesser extent Dalkey Island (excluding Muglins). This feature was however most pronounced at the Lambay Island sites 3 and 4, where the veneer was estimated to be between 2 and 5cm thick. The presence of the veneer was apparently temporary, as suggested by the relatively abundant fauna which was recorded as lying beneath its surface, attached to reef substrate.

Species and biotope diversity was highest within the Dalkey Island/Muglins complex where communities characteristic of strong tidal streams were recorded. In general the sublittoral reefs at Dalkey Island were characterised by an infralittoral zone dominated by foliose red seaweeds on exposed infralittoral rock leading into a tide swept circalittoral zone dominated by *Alcyonium digitatum*. At Muglins a number of different biotopes were recorded including boulder slopes carpeted in seed mussel *Mytilus edulis*, *Flustra foliacea* on slightly scoured silty circalittoral rock, *Mytilus edulis* and coralline crusts on very exposed sublittoral fringe bedrock and faunal and algal crusts with *Alcyonium digitatum*.

At Lambay Island two of the sites surveyed were found in association with “Vegetated sea cliffs of the Atlantic and Baltic coasts” (habitats 1230), forming a continuum from the sea cliff above into the sublittoral zone. In these cases the sublittoral zone occurred as a vertical wall in the infralittoral zone, gradually sloping away into the circalittoral. It is likely that much of the sublittoral reef on the northern and eastern shores of Lambay Island is formed from a continuum with Vegetated Sea Cliffs. Submerged or partially submerged sea caves (Habitat code 8330) were also recorded adjacent to site 1 on the northern shore of Lambay Island.

In general species diversity at Lambay Island was very low and all of the sites surveyed were heavily silted. This concurred with the BioMar Survey of 1995, which also recorded low species diversity and heavy silting on sublittoral reefs at Lambay Island.

Five different biotopes were recorded on the sublittoral reefs surveyed at Lambay Island but within each site only two separate biotopes occurred corresponding to an infralittoral and circalittoral zone but with no inter zone variation.

At Rockabill, two subtidal biotopes were recorded corresponding to and infralittoral and circalittoral zone, again with no inter zone variation. Similar to Lambay Island, the sublittoral reef at Rockabill was very heavily silted and with very low species diversity.

In contrast to the sublittoral reefs on Lambay Island, all of the intertidal reefs showed a greater number of biotopes with a clear pattern of zonation from low water to high water. Characteristic intertidal reef biotopes on Lambay Island comprised an upper *Fucus spiralis* zone, followed by a zone dominated by a dense canopy of *Ascophyllum nodosum* and a lower *Fucus serratus* zone.

The intertidal reef surveyed at Rockabill consisted of only two zones, an upper zone dominated by *Semibalanus balanoides* with *Mytilus edulis* and a lower sublittoral fringe of *Laminaria digitata* and under-boulder fauna.

The present study successfully collected data in relation to geogenic reef communities at a number of sites in the Irish Sea using established reef surveying methodologies. Nevertheless, the study would have benefited greatly on a practical level from better hydrographic conditions. All sublittoral sites examined have characteristically low underwater visibility for most of the year. The relatively strong peak tidal flows during the survey period further reduced underwater visibility at all sites and restricting sublittoral work to periods of slack water did not result in appreciably better conditions of visibility. Accordingly, it is recommended that future littoral and sublittoral investigations at the sites be conducted during optimal tidal conditions for each survey i.e. sublittoral surveys should be conducted during periods of neap tides, while littoral surveys would best be conducted during spring tides if all littoral zones are to be investigated.

As a direct consequence of the conditions encountered during the survey, it was not possible to conduct sublittoral investigations using transect lines and quadrats for detailed studies and species abundance estimation as was originally proposed in the *statement of methods*. Tidal flows (and unreliability of slack water forecasts in particular) together with the poor visibility, created conditions under which it was only possible to conduct transects by free swimming on a compass bearing. Species abundance estimation was by subjective visual assessment of experienced field ecologists as the use of quadrats for abundance estimation and species counts was precluded on account of the prevailing conditions.

An objective of the study was to compile a photographic record of most elements of the survey and sampling techniques employed during the study. Apart from some faunal species photographic records that were taken using a macro lens, the survey team were unable to collect many photographic records due to the extremely poor prevailing underwater conditions at all sublittoral sites during the survey. Conditions of high turbidity made underwater visibility always less than 1 meter and at most times less than 0.5 meters. This renders photography impossible due to low ambient light and colour contrast. Use of strobe lighting was ineffective as suspended particles caused very high levels of backscatter.

It was noted that there are a significant number of seals (mainly Harbour) in the areas surveyed. These were highly curious of divers during the present study, so much so that they took to pulling at the fins of some team members during dives. Combined with almost zero visibility, this created

circumstances which some team members were uncomfortable with. While the team are unaware of any records of attacks by seals that led to injury of divers in the area, it is a potential source of distraction and may add to diver stress. Accordingly it is recommended that this matter be considered in future works and be accounted for in relevant health and safety considerations. Sites affected during the study were Lambay Island and Rockabill in particular.

5. Conclusions

Detailed surveying of the sites is complicated by pronounced tidal regimes in the Irish Sea as well as by characteristic poor or very poor underwater visibility. Observed high levels of suspended organic particulate material in the water column has not resulted in reef habitats being silted over at the sites surveyed, most likely on account of the effect of tidal streams and associated seabed scour. All of the sites surveyed conform to the EU definition of the habitat “Reefs (1170)” as described in the Interpretation Manual of European Union Habitats (Interpretation Manual - EUR27). Although species and habitat diversity was very low, this is likely to be typical of Irish East coast reefs. The sites surveyed are considered to provide a good representation of Irish east coast reefs.

6. References

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7. Acknowledgements

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