

# Ecological Study of the Coastal Habitats in County Fingal Phase IV:

## Intertidal Habitats



**Fingal County Council  
December 2005**

SUPPORTED BY THE HERITAGE COUNCIL



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# **Ecological Study of the Coastal Habitats in County Fingal County Council Phase IV:**

## **Intertidal Habitats**

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## Summary

The coastal waters of Fingal contain a wide variety of plants and animal species and Phase IV of the Ecological Study of the Fingal Coast aims to explore the marine environment with a focus on the intertidal habitats. The aims of the intertidal study were to establish which intertidal habitats and associated species can be found along the Fingal coast including the islands and to identify the most important sites and threats to this habitat.

Much of the tidal habitats along Fingal coast were surveyed during the Sensmap project in 1998-1999. The present study was designed to provide new data to fill the gaps on the islands off the Fingal coast and Howth Head and re-survey some of the mainland sites to allow for comparison between the islands and the mainland and to see if any changes had taken place in the intertidal flora and fauna community over the last 7 years.

Nine of the 10 intertidal habitats from the 'Guide to Habitats in Ireland' and 37 intertidal biotopes according to the 'Marine Biotope Classification for Britain and Ireland' were recorded. Coastal habitats ranged from exposed offshore rocky islands to sheltered muddy estuaries, with a gradient of moderately exposed rock, sheltered rock and other sediment shores between. Exposed rocky shore habitat was most common (26km), while gravel and shingle shores were only occasionally recorded (1km<sup>2</sup>). In general, moderately exposed or sheltered rock biotopes are the most species rich, while coarse mobile sediment biotopes such as barren sand tend to be relatively species poor. However, muddy estuaries also tend to be species poor but are among the most productive habitats of the intertidal zone.

The main differences between the mainland and the islands are the abundance of sheltered rocky shores on the islands and the presence of sedimentary estuaries and bays on the mainland. There are simple geographical reasons for this. The islands, while generally exposed, have one side that is sheltered from the full prevailing weather of the Irish Sea. The mainland on the other hand is generally facing east and subject to the full force of the waves. The presence of sedimentary habitats on the mainland can be attributed to the sand, gravel and mud input from the rivers. The study did not find significant differences of species composition between comparable biotopes on the islands and the mainland. This similarity can be attributed to the lifecycles of the tidal flora and fauna. With many species having a free-swimming or floating dispersive stage, the open water does not form a barrier to dispersion and the colonisation of new areas is not a problem.

Although none of the habitats and species recorded is particularly rare on the east coast of Ireland as a whole, they do represent a range of healthy intertidal habitats. The focus of Biodiversity Action should be on the protection and monitoring of existing habitats. Particular attention should be directed at achieving good water quality status for all waters entering the sea, because local water quality deterioration is one of the main threats to the intertidal habitats in Fingal.

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## INTRODUCTION

Having identified the ecological importance of the Fingal coast, Fingal County Council initiated an ecological study of the coastal habitats in the county in 2003. This study was the first large-scale ecological study undertaken as part of the county council's Local Biodiversity Action Plan Program. The study provides detailed and up-to-date information on the status of the coastal habitats and species. The ecological study was carried out in four phases between 2003 and 2005 and will allow for the action plans for the coastal habitats and associated species to be prepared in early 2006.

The coastal waters of Fingal contain a wide variety of plant and animal species and Phase IV of the coastal study aims to explore the diverse marine world of the Fingal coast. Over the last decade a number of studies have been carried out, such as the SensMap (EcoServe, 2005) and BioMar (EcoServe, 2005) projects that collected information on the marine habitats and species along the Fingal coast. The data collected by these studies can sometimes be difficult to access or understand by the general public. Furthermore, the islands off the Fingal coast (Shenick Islands, Lambay Island, Irelands Eye and Rockabill) and sections of Howth Head were not surveyed during the original SensMap and BioMar studies, leaving some important gaps in our knowledge on the intertidal and subtidal habitats of Fingal. It is envisaged that this study will create a more comprehensive and understandable picture of the diversity and status of the marine environment along the Fingal coast.

The objectives of Phase IV of the ecological study were as follows:

1. Establish which tidal and subtidal habitats and associated species can be found along the Fingal coast including the islands off the Fingal coast
2. Establish the current environmental status of tidal and subtidal habitats along the Fingal coast and on the islands off the Fingal coast
3. Identify the most important tidal and subtidal habitats and species
4. Identify threats to tidal and subtidal habitats and species of the Fingal coast and the islands
5. Identify sites and species for a future ecological monitoring programme

The report begins with a brief introduction to intertidal ecology. This is followed by an outline of the methodology used during the survey. The results are based on the marine habitats recorded in Fingal according to two classification systems 'A Guide to Habitats in Ireland' (Fossitt 2000) and the Marine Nature Conservation Review: marine biotope classification for Britain and Ireland (Connor, *et al.* 1997). The discussion that follows focuses on the important intertidal habitats recorded in Fingal and potential threats to these habitats. Recommendations for the inclusion of intertidal habitats in the Fingal Local Biodiversity Plan and a monitoring programme for these habitats are suggested. The appendices of the report include the site reports for each of the areas surveyed during this study and the relevant reports from the 1998/1999 SensMap survey.

## Introduction to intertidal ecology

The seashore is made up of a range of habitats that provide a home to a large diversity of **species**. A narrow definition of a seashore **habitat** is taken to encompass the substratum (rock, sediment or biogenic reefs such as mussels), its topography, and the particular conditions of wave exposure, salinity, tidal currents and other water quality characteristics that contribute to the overall nature of a place on the shore or seabed. A **community** of species is taken as where a similar association of species regularly recurs over a wider geographical area – degrees of similarity will vary depending on the scale considered. A community of species together with its associated habitat is termed a **biotope**. Thus, in practice the common use of the word ‘habitat’ corresponds to the ecological term of ‘biotope’.

Following the substratum type, there are two main forces behind the classification of habitats on the seashore. The first relates to the rise and fall of the tide while the second relates to wave exposure. The tidal cycle allows for an immediate classification of the shore into a number of zones. The splash zone is the highest up the shore and is not strictly an intertidal zone. It occurs above the high tide mark but is still heavily influenced by salt sea spray. The vertical height of the splash zone varies from a very small zone on very sheltered shores to a zone tens of metres in height on very exposed cliffs. The intertidal zone itself can be divided into the somewhat arbitrary upper, middle and lower shores depending on how long the areas are covered by the tide. The subtidal zone is below the low water tide mark. The subtidal zone can also be subdivided but is not discussed further here.

The upper shore is the harshest of the intertidal environments as it is uncovered by the tide for the longest. Thus it is subject to the greatest fluctuations of temperature, the longest drying times and the shortest feeding times for those species relying on submergence for their nutrient intake. Moving down the shore there is gradual lessening of these physical pressures until the almost stable subtidal environment is reached. While the intertidal area towards the subtidal is the most stable it is also there that there is the greatest competition between species. Similarly, there is the least competition on the upper shore. The tolerance to different environmental conditions varies between species; it can be rather broad for some very common species but much more tightly defined for others. A combination of these factors allows species to occupy a particular niche, and leads to a clear zonation of species and communities up the shore. The intertidal zonation diagram gives an indication of where species can be found on the rocky shore.

In addition to the tides, wave exposure plays a large part in the zonation of species and communities on the shore. In simple terms, sheltered shores are characterised by macroalgae communities while exposed shores are characterised by faunal communities. Macroalgae grow well in sheltered waters but their holdfast system cannot tolerate substantial repetitive wave action. Faunal associations with the algae are common and predator prey relationships often lead to a regular cycle of change within the habitat. Substrata hugging sessile fauna (such as barnacles and mussels) or slow moving substratum hugging mobile fauna (such as limpets) characterise exposed shores that cannot be colonised by algae. Exposed shore faunal dominated intertidal communities are an interesting contrast to typically floral dominated terrestrial ones.



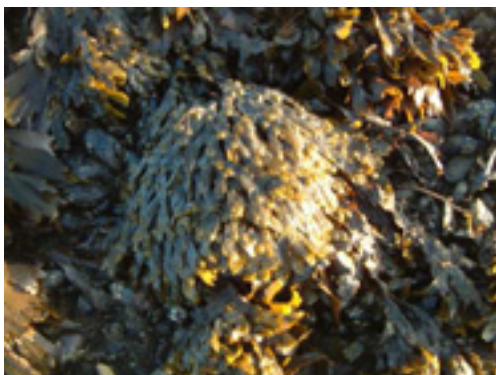
Splash Zone		Lichens
Intertidal Zone	Upper	Lichens, Channeled wrack, Spiral wrack
	Middle	Barnacles, Limpets, Knotted wrack, Bladder wrack
	Lower	Mussels, Red seaweeds, Serrated wrack
Subtidal Zone		Kelp, starfish, fish

### Rocky seashore zonation

Rocky shores often have species and biotopes characteristic of both exposed and sheltered shores. For example a shore with an irregular rocky profile in a wave exposed area. On such a shore, any rocks with a seaward aspect would be characterised by species typical of an exposed shore. However, any surfaces in the lee of these surfaces may form a sheltered microhabitat. Depending on the extent and stability of this microhabitat, it will be characterised by species and biotopes typical of a moderately exposed or sheltered shore.

Intertidal sediment communities occupy niches on the shore based on a similar set of factors to the rocky shore communities. However the differences between upper, middle and lower shores are much less distinct. Communities also tend to live in rather than on the substratum and are therefore much less easy to identify. Likewise sediment shores are often very gently sloping or even undulating so there may be no clear horizontal progression or zonation of species. Sediment communities also have the added difficulty of living in a mobile environment.

Examples of how species use their habitats:



Bladder wrack



Barnacles

*Bladder wrack (Fucus vesiculosus), a sheltered to moderately exposed rocky shore algae species*

Bladder wrack is common on the mid section of sheltered to moderately exposed shores although it is tolerant to a degree of wave exposure. It is also tolerant of a relatively long exposure to air and to large temperature fluctuations. While algae do not have a root system they have a 'holdfast' that physically attaches to the rock substratum. The bladders that give the algae its common name buoy up the fronds when it is submerged allowing for the maximum possible exposure to sunlight, and hence nutrient production leading to growth and reproduction potential. The bladder wrack is however responsive to the habitat in which it lives, and in areas of greater wave exposure it has less bladders, which creates less resistance to the water and in turn is less likely to be torn away. The bladder wrack itself becomes a habitat for a range of fauna and flora especially where it reaches high densities or covers large areas. The tidal cycle is used to assist reproduction and to disperse gametes. The other wrack species use their habitats in a similar way, and a mix of species is often found on the shore. However, *Fucus serratus* is generally found lower down the shore, while *Fucus spiralis* and *Pelvetia canaliculata* are found on the upper shore. *Ascophyllum nodosum* can replace *Fucus vesiculosus* on very sheltered rock shores.

*Barnacle, an exposed rocky shore crustacean species*

Barnacles are ubiquitous in the marine environment. There are a number of intertidal species that are commonly found in the intertidal zone. The barnacle, with its low profile and a solid hold cemented on the rock substratum is well suited for life on an exposed shore. Barnacles are often the dominating species in the intertidal of exposed rocky shores and form wide dense bands in this zone. Barnacles are filter feeders and can only feed when submerged. Their upper limit on the shore is defined by this requirement to feed. While reproduction generally takes place between two neighbouring individuals on the rocks, the tides and currents are used to disperse larvae.



Lugworm cast



Dwarf eelgrass

*Lugworm (Arenicola marina), a sedimentary shore worm species.*

The lugworm is common on many mid to lower shore sand and muddy sand habitats. They can tolerate a range of sediment substrata and are tolerant of salinities down to about 12 parts per thousand. The worm lives in a burrow in the sediment and feeds on detritus and other organic materials in the sediment. Reproduction is heavily reliant on the tidal cycle with sperm being released by the males, to be carried on the tide into

the burrows of female worms. The fertilised eggs undergo early development within the burrow before being dispersed into the tide to find firmer substrata for the next stage of development. Finally, the young worms still in a developing tube release into the surface water with the objective of being carried by the tide to suitable sediment sites where they settle.

*Dwarf eelgrass (Zostera noltii), a muddy shore plant species.*

Dwarf eelgrass is one of the few flowering plants of the intertidal zone. In Ireland dwarf eelgrass beds are found almost exclusively in sheltered muddy estuaries. While eelgrass requires this muddy habitat to root and grow, it will itself become a habitat as densities increase. The plant extends over large areas as a creeping root sends up leaves from the surface of the sediment. These firmly root and help bind the mud substratum creating a different habitat. The eelgrass plants allow for an epifaunal community to develop as well as the infaunal communities typical of estuaries. Leaves have air spaces within them so that, in a similar manner to bladder wrack, light absorption is increased during times of submergence. Both annual and perennial populations of eelgrass exist. For the annual populations the production of a seed that germinates from the sediment is important for the regeneration of the population.

## **METHODOLOGY**

In 1998-1999, during the SensMap project intertidal habitats, flora and fauna (biotopes) of Wales and the east coast of Ireland were surveyed in order to provide an assessment of the marine ecology present. Much of the Fingal coast was surveyed during that project. The Fingal Islands, the cliffs at Howth and the area around Sutton Creek were not surveyed allowing for significant gaps in the marine ecology data for the area. The objectives of the current survey were to fill in those gaps, compare the new island data with the previously collected mainland data and produce a general guide to the habitats of the Fingal seashore.

To conduct the current survey, marine ecologists walked along the shore where possible, or observed from a boat in the steeper cliff areas, in order to identify and map the extent and distribution of biotopes present. Techniques developed during the original SensMap project were employed during the survey. Flora and fauna were identified to species level in the field where possible.

Using the list of species recorded from each area and information on the habitat type (from the field survey results, aerial photographs and maps) biotopes were allocated by careful examination of the descriptions from the 'Marine Biotope Classification for Britain and Ireland' (Connor *et al.* 1997) and applying the principal of best fit. Individual site reports (see Appendices) were produced describing the distribution of the biotopes recorded. Each section of coast was then assigned a simplified code according to the 'Guide to Habitats in Ireland' classification (Fossitt, 2000) and a map produced based on those codes. The aim of this map is to provide approximate boundaries of habitats and an overall image that captures the types of the marine habitats that occur in the survey area, giving the reader an immediate impression of the diversity and location of these habitats in Fingal.

## RESULTS

### **The Fingal Coast – The Fossitt Classification System**

‘A Guide to Habitats in Ireland’ (Fossitt, 2000) is a broad guide to the classification of all the habitats in Ireland. As stated in the introduction of the guide,

“The classification is presented within a hierarchical framework and is designed for application at a variety of different levels in terms of scale, detail and user expertise. It is intended as a first-step approach for general habitat recording rather than as a basis for detailed study and evaluation. The availability and widespread use of a standard classification scheme is important in that it will help to standardise data collection on habitats which, in turn, will assist in the management and conservation of Ireland's natural heritage.”

In practice, the usefulness of the Fossitt classification relates to the positioning of habitats at a scale relative to the other habitats of Ireland.

This section of the ‘Intertidal Habitats Guide for the Coast of Fingal’ show examples of the habitats found, including a description according to the Fossitt classification and the general locations where they are found in Fingal. The equivalent habitat (the ‘higher biotope’) according to the ‘Marine Biotope Classification for Britain and Ireland’ (Connor *et al.*, 1997) is also stated. A list of biotopes recorded from Fingal that would be included under the Fossitt classification is included.

The biotopes according to the ‘Marine Biotope Classification for Britain and Ireland’ are, in general, easily converted into the habitats according to the ‘A Guide to Habitats in Ireland’. However, a lot of information on the habitat is lost when this is done, and it is not possible to convert the more general ‘A Guide to Habitats in Ireland’ into biotopes according to the ‘Marine Biotope Classification for Britain and Ireland’. There are also a number of specific biotopes that are common to a range of coasts and therefore to a number of habitats. These include the lichen dominated upper shore biotopes and various rockpool biotopes.

## Exposed Rocky Shore



An exposed rocky shore on Rockabill Island.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes extremely exposed to exposed bedrock and boulder shores of the open coast. The effects of sea spray and wave splash are usually far-reaching and the lichen zone may be up to 30-40 m wide on the most exposed shores. At the upper extreme, these shores may support some patchy cover of terrestrial vegetation with Thrift (*Armeria maritima*), Sea Aster (*Aster tripolium*) and Red Fescue (*Festuca rubra*). Snails such as *Littorina saxatilis* and *Melarhaphe neritoides* are common in the supralittoral zone. Below this, exposed rocky shores are typically dominated by communities of Common Mussel (*Mytilus edulis*) and barnacles (*Semibalanus balanoides*, *Chthamalus* spp.). Limpets (*Patella* spp.) are common throughout. Robust algae that can tolerate the physical stresses of wave wash are often abundant on the mid- and lower shore. These include red seaweeds such as *Corallina officinalis* and *Mastocarpus stellatus*, and the brown seaweed, Thongweed (*Himanthalia elongata*). Red seaweeds can form dense turfs that are resilient to wave wash; coralline crusts are also common.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Exposed Littoral Rock (ELR)

*Biotoypes recorded in Fingal that are included within the habitat category:*

ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.Coff	<i>Corallina officinalis</i> on very exposed lower eulittoral rock

*Biotoypes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools

**General locations of habitat around Fingal:**

Most of the seaward facing rocky shores of the mainland and the seaward sides of the islands are exposed rocky shores.

## Moderately Exposed Rocky Shore



A moderately exposed rocky shore on the south of Lambay Island.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes moderately exposed shores of bedrock, boulders and stable cobbles. The lichen zone is generally less extensive than on exposed rocky shores within this, there may also be some limited cover of terrestrial vascular plants. Moderately exposed rocky shores are dominated by communities of barnacles and fucoids on the mid- and upper shore, or by fucoids and red seaweeds on the lower shore. Cover of fucoids is typically incomplete and is less continuous than on **sheltered rocky shores - LR3**. Fucoids occur in distinct horizontal bands; the upper shore is characterised by Channel Wrack (*Pelvetia canaliculata*) and Spiral Wrack (*Fucus spiralis*), the mid-shore by Bladder Wrack (*Fucus vesiculosus*), and the lower shore by Serrated Wrack (*Fucus serratus*). Red seaweeds (including *Mastocarpus stellatus*, *Chondrus crispus*, *Palmaria palmata* and *Corallina officinalis*) may form dense turfs of single species, or mixtures of species. The variety of other associated species depends on the influence of microtopography, salinity (inputs of freshwater) and sand scour. Communities of Common Mussel (*Mytilus edulis*), limpets (*Patella* spp.), snails (*Littorina littorea*, *L. obtusata*, *Nucella lapillus*), amphipod crustaceans and crabs are common; ephemeral green and red seaweeds (*Enteromorpha*, *Ulva* and *Porphyra* spp.) may also be present. The sedentary polychaete worm, *Sabellaria alveolata*, may form honeycomb reefs if there is a plentiful supply of sediment. The presence of boulders and cobbles on the shore increases microhabitat diversity, which, in turn, may give rise to greater species richness.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Moderately exposed Littoral Rock (MLR)

*Biotoypes recorded in Fingal that are included within the habitat category:*

MLR.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MLR.MytFves	<i>Mytilus edulis</i> and <i>Fucus vesiculosus</i> on moderately exposed mid eulittoral rock
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Fser	Dense <i>Fucus serratus</i> on moderately exposed to very sheltered lower eulittoral rock



MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
MLR.Mas	<i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very to moderately exposed lower eulittoral rock
MLR.Osm	<i>Osmundea (Laurencia) pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock

*Biotopes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools

### **General locations of habitat around Fingal:**

The transitional zones between the exposed seaward facing rocky shores and the sheltered rocky shores in their lee are moderately exposed rocky shores.

## Sheltered Rocky Shore



A sheltered rocky shore near the Sutton Sailing Club.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes sheltered to extremely sheltered rocky shores of bedrock, and stable accumulations of boulders, cobbles and pebbles. At the upper extreme, the lichen zone is usually compressed to a narrow band as the influence of sea spray and wave action is greatly reduced in sheltered locations. The transition to terrestrial habitats above this is usually abrupt and distinct. Sheltered rocky shores are characterised by very dense growth of fucoids. Different species form distinct zones, typically with Channel Wrack (*Pelvetia canaliculata*) above Spiral Wrack (*Fucus spiralis*) on the upper shore, Knotted Wrack (*Ascophyllum nodosum*) and/or Bladder Wrack (*Fucus vesiculosus*) on the mid-shore, and Serrated Wrack (*Fucus serratus*) on the lower shore. On the mid-shore, Knotted Wrack (*Ascophyllum nodosum*) increases in abundance with increasing shelter, and may support a dense underturf of red seaweeds such as *Corallina officinalis*, *Mastocarpus stellatus* and *Chondrus crispus*. Snails (*Littorina saxatilis*, *L. littorea*, *Melarhaphe neritoides*), barnacles and limpets may be present in low numbers under the dense seaweed canopy. In situations where salinity is reduced through inputs of freshwater, Horned Wrack (*Fucus ceranoides*), and ephemeral green seaweeds (*Cladophora* spp.) may be common.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997):

Sheltered Littoral Rock (SLR)

*Biotoypes recorded in Fingal that are included within the habitat category:*

SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
SLR.BLitt	Barnacles and <i>Littorina littorea</i> on unstable eulittoral mixed substrata

*Biotoypes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools

**General locations of habitat around Fingal:**

The lees of the rocky islands are generally dominated by sheltered littoral rock. The generally seaward facing mainland has less expansive areas of sheltered littoral rock. However, there are areas particularly on medium profile shores where outer rocks reduce the force of the waves.

## Mixed Substrata Rocky Shore



A mixed rock shore near the Sutton Sailing Club.

### **Habitat category description** (extracted from Fossitt 2000):

This category should be used in situations where the shore comprises a mixture of rock and sediment, and where the sediment may include gravel, sand or mud. Mixed substrata shores occur in moderately exposed to sheltered locations and may support furoid communities that are similar in composition to those of sheltered rocky coasts, but usually with less dense canopy cover, and with a reduced variety of epifaunal species. Barnacles or dense aggregations of Common Periwinkle (*Littorina littorea*) or Common Mussel (*Mytilus edulis*) may also be present. In summer months, blankets of ephemeral green and red seaweeds (*Enteromorpha*, *Ulva* and *Porphyra* spp.) can dominate these shores. Horned Wrack (*Fucus ceranoides*) occurs in upper estuarine conditions and at stream outlets.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Fucoids, barnacles or ephemeral seaweeds on mixed substrata. (SLR.FX)

*Biotoypes recorded in Fingal that are included within the habitat category:*

SLR.AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
SLR.FvesX	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
SLR.BLitt	Barnacles and <i>Littorina littorea</i> on unstable eulittoral mixed substrata

*Biotoypes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock

### **General locations of habitat around Fingal:**

The most extensive area of the mixed rock substrata was recorded around the Sutton Creek area towards Bottle Quay.

## Shingle and Gravel Shore



A gravel sediment shore on the coast between Portmarnock and Malahide beaches.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes exposed or moderately exposed shores with accumulations of loose, coarse but usually rounded and mobile rocky material. Sediments comprise mainly shingle and gravel, where particle sizes are generally larger than coarse sand and smaller than boulders (mostly 4-256 mm in diameter). Shell fragments may also be common. Coastal accumulations of dead maerl, so-called 'coral beaches', are included in this category. The strandline at the upper limit of the shore may be characterised by open communities of terrestrial vascular plants including Annual Sea-blite (*Suaeda maritima*), oraches (*Atriplex* spp.), Sea Sandwort (*Honkenya peploides*), Sea Beet (*Beta vulgaris*) and Sea Mayweed (*Tripleurospermum maritimum*). Two rare perennial plants, Sea-kale (*Crambe maritima*) and Oysterplant (*Mertensia maritima*), are associated with shingle shores. Note that elevated ridges and banks of shingle and gravel are treated as a separate habitat in the coastland section (See **shingle and gravel banks - CB1**). Coarse, mobile sediments typically support little marine life other than opportunist amphipod and isopod crustaceans and oligochaete worms. Ephemeral green seaweeds (*Enteromorpha* spp.) may also be present in summer months.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Shingle (pebble) and gravel shores (LGS.Sh)

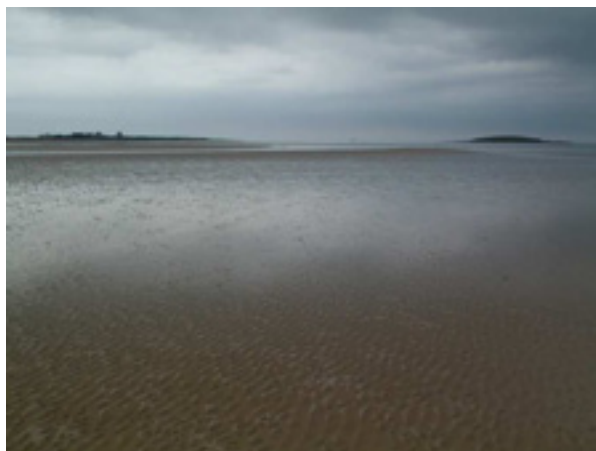
*Biotoypes recorded in Fingal that are included within the habitat category:*

LGS.BarSh      Barren gravel and shingle shores

### **General locations of habitat around Fingal:**

Medium profile shores allow for the creation of storm beaches on the upper shore. Shingle and gravel shores were recorded in such areas on the islands and on the coast between Portmarnock and Malahide beaches.

## Sand Shore



A sand shore south of Skerries head.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes exposed to sheltered shores of coarse, medium or fine-grained sand, usually with a very small proportion of gravel and mud (<10%). Most of the sediment particles should range from 0.063-4 mm in diameter for inclusion in this category but scattered shells or stones may occur on the surface. Bedrock and loose rock may also be exposed in places. Intertidal sandflats and strandlines are considered as part of the sand shore, but note that any ridges and mounds of sand should be considered under **embryonic dunes - CD1**. Strandlines may support open communities of annual terrestrial vascular plants such as oraches (*Atriplex* spp.), Sea Rocket (*Cakile maritima*), Saltwort (*Salsola kali*) and Annual Sea-blite (*Suaeda maritima*). There may also be some sparse cover of Sand Couch (*Elymus juncea*), Lyme-grass (*Leymus arenarius*), Sea Sandwort (*Honkenya peploides*) and Sea-holly (*Eryngium maritimum*). Lines of decaying seaweed are characterised by communities of beach fleas and sand hoppers. Mobile sand of the upper shore is typically impoverished of animal and plant life. The lower shore is characterised by amphipod (*Pontocrates* spp., *Bathyporeia* spp., *Haustorius arenarius*) and isopod (*Eurydice pulchra*) crustaceans, with some polychaete worms (*Scolelepis squamata*, *Nephtys cirrosa*, *Lanice conchilega*) and bivalve molluscs (*Angulus tenuis*). Eelgrasses (*Zostera* spp.) may colonise sand along the lower seashore.

*Links with Annex I:* Sand shores may contain examples of the annexed habitats, 'mudflats and sandflats not covered by sea water at low tide (1140)' and 'annual vegetation of drift lines (1210)'.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Sand shores (LGS.S)

*Biotoypes recorded in Fingal that are included within the habitat category:*

LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.AP	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line

**General locations of habitat around Fingal:**

The main sand habitats were recorded on the beach south of Skerries, Portmarnock beach and Malahide beach.

## Muddy Sand Shore



A muddy sand shore near Sutton Creek.

### **Habitat category description** (extracted from Fossitt 2000):

This category includes shores where most of the sand is medium or fine ( $<1\text{ mm}$  in diameter) and where muds (*the silt/clay fraction*) make up 10-30% of the sediment. Muddy sand usually occurs as gently sloping flats in sheltered areas and these remain water-saturated throughout the tidal cycle. Characteristic components of the fauna include communities of lugworms (*Arenicola marina*) and bivalve molluscs (particularly *Macoma balthica* and *Cerastoderma edule*). Mudflats may also support beds of eelgrasses (*Zostera* spp.), vascular plants that stabilise sediments and provide a colonising surface for other marine species. Muddy sand shores frequently occur at the seaward edge of salt marshes and may support open or discontinuous stands of cord-grasses (*Spartina* spp.) and glassworts (*Salicornia* spp.). Dense stands of any of these plants should be considered under lower salt marsh - CM1. At low tide, any channels that remain occupied by water, including estuarine channels with freshwater, should be considered under sublittoral sediments.

*Links with Annex I:* This category may contain examples of the annexed habitat, 'mudflats and sandflats not covered by sea water at low tide (1140)'.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Littoral Muddy Sand (LMS)

*Biotoypes recorded in Fingal that are included within the habitat category:*

LMS.MacAre     *Macoma balthica* and *Arenicola marina* in muddy sand shores

LMS.Znol        *Zostera noltii* beds in upper to mid shore muddy sand

### **General locations of habitat around Fingal:**

The main muddy sand habitats were recorded around Sutton Creek and Portrane Beach. A muddy sand habitat was also recorded from the east of Lambay Island.



## Mud Shore



A mud shore in the Baldoyle Estuary

### **Habitat category description** (extracted from Fossitt 2000):

Mud shores are formed primarily of very fine sediment and usually occur along the most sheltered sections of coastline. The silt/clay fraction of the sediment (particle sizes of <0.063 mm in diameter) should be at least 30%. Small amounts of coarser material, mainly gravel and pebbles, may also be present. This category includes some sandy muds (with 20-70% sand and 30-80% silt/clay), in addition to soft mud shores (>80% silt/clay) that are typically found in the upper reaches of estuaries. They are subject to variable, reduced or low salinity conditions. Mud shores are often characterised by elevated mudflats that are dissected by networks of shallow channels associated with flooding and drainage. They support communities of polychaete worms (*Hediste diversicolor*, *Nephtys hombergii*, *Pygospio elegans*), bivalve molluscs (*Macoma balthica*, *Scrobicularia plana*, *Cerastoderma edule*, *Mya arenaria*), mud snails (*Hydrobia* spp.) and amphipod crustaceans (*Corophium* spp.). Oligochaete worms are also characteristic if there is a significant freshwater influence. Mud shores may support open or discontinuous stands of glassworts (*Salicornia* spp.), and this may indicate the pioneer formation of salt marsh. Cord-grasses (*Spartina* spp.) may also be present. Dense stands of either of these two plants should be considered under **lower salt marsh - CM1** in the coastland section.

*Links with Annex I:* Mud shores may contain examples of the annexed habitat, 'mudflats and sandflats not covered by sea water at low tide (1140)'.

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Littoral muds (LMU)

*Biotoypes recorded in Fingal that are included within the habitat category:*

LMU.Sm              Saltmarsh

*Biotoypes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

LMS.Znol              *Zostera noltii* beds in upper to mid shore muddy sand

**General locations of habitat around Fingal:**

The main mud habitats were recorded from Rogerstown estuary, Baldoyle estuary and Malahide estuary.

## Mixed Sediment Shore



A mixed sediment shore just south of the Sutton Sailing Club.

### **Habitat category description** (extracted from Fossitt 2000):

This category should be used for sheltered shores that comprise poorly sorted mixtures of sediments of different grades, including pebbles, gravel, sand and mud. Larger stones and cobbles may be present and these often support some cover of fucoids (particularly *Fucus* spp.) or ephemeral green seaweeds (*Cladophora* spp.). Depending on substratum type, mixed sediment shores may support communities of polychaete worms (*Hediste diversicolor*, *Scoloplos armiger*, *Pygospio elegans*), bivalve molluscs (*Cerastoderma edule*, *Mytilus edulis*, *Mya arenaria*, *Macoma balthica*), oligochaete worms, amphipod crustaceans and mud snails (*Hydrobia* spp.).

### **Biotope Equivalence to Habitat Category**

*Higher Biotope equivalent* (Conner *et al.* 1997)

Littoral Mixed Sediments (LMX)

*Biotopes recorded in Fingal that can be included within the habitat category but also occur in other habitats:*

SLR.EphX      Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata

SLR.MytX      *Mytilus edulis* beds on eulittoral mixed substrata

### **General locations of habitat around Fingal:**

Limited examples of mixed sediment habitats were recorded along the Fingal coast and included areas around Sutton Creek, the lee of the Skerries Islands and other sedimentary shores where mixed sediment sizes were present. Where stable macro algae communities are present the biotope is generally identified as the mixed substrata variation of that biotope (e.g. SLR.FvesX or SLR.AscX).

## **The Fingal Coast - Marine Biotope Classification for Britain and Ireland**

The Marine Biotope Classification for Britain and Ireland (Conner *et al.*, 1997) is a more detailed classification than that of Fossitt. As described on the publications website:

“The marine habitat classification for Britain and Ireland provides a tool to aid the management and conservation of marine habitats. It is one of the most comprehensive marine benthic classification systems currently in use, and has been developed through the analysis of empirical data sets, the review of other classifications and scientific literature, and in collaboration with a wide range of marine scientists and conservation managers.”

The Connor *et al.* (1997) classification “provides an ecologically-based classification of seashore and seabed features”. It uses a combination of species composition and individual abundance in assigning biotopes. A biotope is defined “as the habitat (i.e. the environments physical and chemical characteristics) together with its recurring associated community of species operating together at a particular scale”. Abundance ratings are based on the Marine Nature Conservation Review (MNCR) SACFOR scale, where S is Superabundant, A is Abundant, C is Common, F is Frequent, O is Occasional and R is Rare. In this report, Rare has been replaced with Present (P). The MNCR cover/density scales provide a unified system for recording the abundance of marine benthic flora and fauna in biological surveys.

This section of the ‘Intertidal Habitats Guide for the Coast of Fingal’ show examples of the biotopes found. The full biotope name is stated, followed by the code that allows for easy reference. A biotope description extracted from the classification, the common species recorded from that biotope during the current survey and an example of where the biotope can be found in Fingal are then presented.

## Yellow and grey lichens on supralittoral rock

**Biotope code:** LR.YG



Patchy yellow and grey lichens (LR.YG) extending up the extreme upper shore of the cliffs at Howth Head. The black lichen biotope (LR.Ver) is present immediately below, with the barnacle biotope (ELR.BPat) showing a clear zone between LR.Ver and the mussel biotope (ELR.MytB).

### **Biotope description** (extracted from Conner *et al.*, 1997)

Rock in the supralittoral is typically characterised by a maritime community of yellow and grey lichens, such as *Xanthoria parietina* and *Caloplaca marina*. This band of lichens is usually found immediately above a zone of *Verrucaria maura* (Ver), a black lichen which is also present in this zone, though typically less than common. Damp pits and crevices are occasionally occupied by littorinid molluscs and acarid mites.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
	Yellow and grey lichens	S
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Verrucaria maura</i>	Black lichen	O

### **Locations where this biotope was recorded around the Fingal coast:**

Found on all upper shore rock areas with the exception of areas where bird colonies were established.

## ***Verrucaria maura* on littoral fringe rock**

**Biotope code:** LR.Ver



An example of the black lichen biotope (LR.Ver) biotope on an exposed shore on Lambay. The yellow and grey lichen (LR.YG) immediately above and the barnacle biotope (ELR.BPat) immediately below show clear zonation.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Bedrock or stable boulders and cobbles in the sublittoral fringe is typically covered by a band of the black lichen *Verrucaria maura*. It occurs below the yellow and grey lichen zone (YG) and above communities of barnacles and furoid algae. This biotope occurs in a wide range of wave exposures. Several variants are defined.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Fucus spiralis</i>	Spiral wrack	P
<i>Porphyra umbilicalis</i>		P
<i>Verrucaria maura</i>	Black lichen	S
<i>Semibalanus balanoides</i>	Species of barnacle	P

### **Locations where this biotope was recorded around the Fingal coast:**

Found on all upper shore rock areas with the exception of areas where bird colonies were established.

## ***Corallina officinalis* and coralline crusts in shallow eulittoral rockpools**

**Biotope code:** LR.Cor



Two examples of LR.Cor. The plate on the left shows a pool dominated by coralline crusts on the rocky areas to the south of Portrane strand. The plate on the right shows a pool dominated by *Corallina officinalis* near the Sutton Sailing Club.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Shallow rockpools throughout the eulittoral zone may be characterised by a covering of encrusting coralline algae on which *Corallina officinalis* often forms a dense turf. These 'coralline' pools have a striking appearance as they are dominated predominantly by red algae. Filamentous and foliose red algae found in these pools include *Dumontia contorta*, *Mastocarpus stellatus* and *Ceramium rubrum*. The green algae *Cladophora rupestris* and *Enteromorpha* spp. can also occur. The pools may hold large numbers of grazing molluscs, particularly *Littorina littorea* (which often occurs in exceptionally high densities in upper shore pools), *Patella vulgata* and *Gibbula cineraria*. Gastropods may graze these pools to such an extent that they are devoid of any foliose red algae, and are reduced to encrusting coralline algae and large numbers of gastropods. Large brown algae are generally absent (compare with FK), although small *Halidrys siliquosa* may be present. Within the pools, pits and crevices are often occupied by the anemone *Actinia equina* and small *Mytilus edulis*. Similar sized pools in the littoral fringe generally lack the encrusting coralline algae and are characterised by green algae (see G).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Bifurcaria bifurcata</i>		O
<i>Mastocarpus stellatus</i>		P
<i>Chondrus crispus</i>	Carragheen moss	P
Corallinaceae indet.	Coralline algae crusts	S
<i>Corallina officinalis</i>	Coralline algae	F
<i>Osmundea pinnatifida</i>	Pepper Dulse	P
<i>Halichondria</i> sp.	Sponge	P
<i>Actinia equina</i>	Beadlet Anemone	C

Scientific name	Common name	Abundance
<i>Patella vulgata</i>	Common limpet	C
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Semibalanus balanoides</i>	Species of barnacle	F

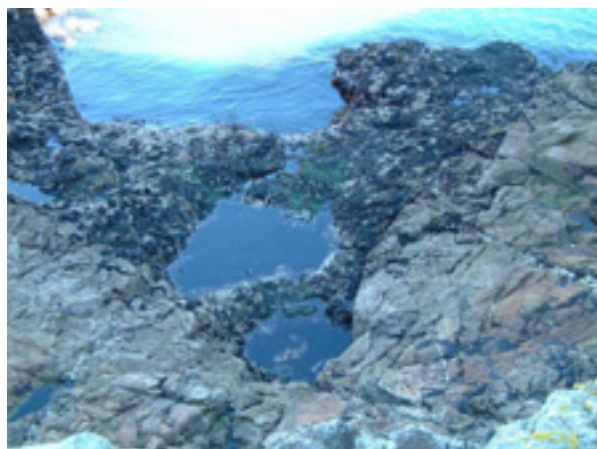
**Locations where this biotope was recorded around the Fingal coast:**

Commonly found on medium profile rock shores with cracks and crevices, including the Skerries Islands, Rockabill and many of the rock areas on the mainland excluding the high profile cliffs at Howth.



## Fucoids and kelps in deep eulittoral rockpools

**Biotope code:** LR.FK



An example of the fucoid and kelp rockpool biotope on Rockabill.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Deep rockpools in the mid to lower eulittoral zone often contain a community characterised by *Fucus serratus* and *Laminaria digitata*. Other large brown algae, including *Laminaria saccharina*, *Himanthalia elongata* and *Halidrys siliquosa*, may also occur. The rock surface is usually covered by encrusting coralline algae. A wide variety of filamentous and foliose algae, which are typical of lower shore and shallow sublittoral zones (e.g. *Palmaria palmata*, *Chondrus crispus*, *Ceramium* spp., *Membranoptera alata* and *Gastroclonium ovatum*) occur beneath the brown algal canopy. Algal-free vertical and overhanging faces often support the sponge *Halichondria panicea* and anemones *Actinia equina*. The abundance of grazing molluscs varies considerably. In some, large numbers of littorinids and limpets are probably responsible for the limited variety of red seaweeds present. In other pools, fewer grazers may result in an abundance of these algae. Where boulders occur in these pools they provide a greater variety of micro-habitats which support a variety of fauna. Mobile crustaceans (*Pagurus bernhardus* and *Carcinus maenas*), brittlestars (*Ophiothrix fragilis* and *Amphipholis squamata*), encrusting bryozoans and ascidians are typically found beneath and between boulders.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Laminaria digitata</i>	Oarweed	C
<i>Fucus serratus</i>	Toothed wrack	F
<i>Actinia equina</i>	Beadlet Anemone	F
<i>Patella vulgata</i>	Common limpet	F

### **Locations where this biotope was recorded around the Fingal coast:**

Recorded on Rockabill but not a common biotope in Fingal.

## Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in upper shore rockpools

**Biotope code:** LR.G



An example of the LR.G biotope within an area of LR.YG on the upper shore of the south west of Lambay Island.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Rockpools in the supralittoral, littoral fringe or upper eulittoral which are subject to variable salinity and widely fluctuating temperatures are characterised by the ephemeral green alga *Enteromorpha* spp. or the filamentous green alga *Cladophora* spp. Due to the physical stress imposed on these upper shore pools, grazing molluscs are generally in lower abundance than eulittoral pools, allowing the green algae to proliferate under reduced grazing pressures. The rock surface is often covered by the black lichen *Verrucaria maura*. On more exposed shores crevices in the rock may contain small *Mytilus edulis*. The bright orange copepod *Tigriopus fulvus* is tolerant of large salinity fluctuations and may also occur in large numbers in these upper shore pools.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	S
<i>Ulva lactuca</i>	Sea lettuce	C

### **Locations where this biotope was recorded around the Fingal coast:**

Often recorded from the upper sections of medium profile shores with cracks and crevices, including Lambay and much of the rock coasts on the mainland.

## ***Mytilus edulis* and barnacles on very exposed eulittoral rock**

**Biotope code:** ELR.MytB



An example of the ELR.MytB biotope on the exposed cliffs of Howth Head. A band of the barnacle biotope ELR.BPat is clearly visible immediately above, with the kelp biotopes still covered by the tide below.

### **Biotope description** (extracted from Conner *et al.*, 1997)

The eulittoral zone, particularly mid and lower shore zones, of very exposed rocky shores are typically characterised by patches of small mussels *Mytilus edulis* interspersed with patches of barnacles *Semibalanus balanoides*. Amongst the mussels small red algae including *Ceramium shuttleworthianum*, *Corallina officinalis*, *Mastocarpus stellatus* and *Aglaothamnion* spp. can be found. Two red algae in particular, *Porphyra umbilicalis* and *Palmaria palmata*, are commonly found on the *Mytilus* itself and can form luxuriant growths. The abundance of the red algae generally increases down the shore and in the lower eulittoral they may form a distinct zone in which mussels or barnacles are scarce (e.g. Coff). Where *Mytilus* occurs on steep rock, red algae are scarce, and restricted to the lower levels. The dog whelk *Nucella lapillus* and a few littorinid molluscs occur where cracks and crevices provide a refuge in the rock. Fucoids are generally absent. MytB is generally found above a zone of either mixed turf-forming red algae, *Himanthalia elongata* (Him) or above the sublittoral fringe kelp *Alaria esculenta* (Ala). Above MytB there is often a dense barnacle and limpet zone (BPat).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Laminaria digitata</i>	Oarweed	P
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Mastocarpus stellatus</i>		P
<i>Chondrus crispus</i>	Carragheen moss	P
<i>Corallina officinalis</i>		P
<i>Palmaria palmata</i>	Species of Dulse	P

Scientific name	Common name	Abundance
<i>Porphyra umbilicalis</i>		P
<i>Actinia equina</i>	Beadlet Anemone	P
<i>Semibalanus balanoides</i>	Species of barnacle	F
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina saxatilis</i>	Rough periwinkle	P
<i>Nucella lapillus</i>	Dogwhelk	P
<i>Mytilus edulis</i>	Common mussel	S

**Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded from very exposed rocks such as the cliffs at Howth, and the seaward side of the islands of Irelands Eye, Lambay and Rockabill.

## Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock

**Biotope code:** ELR.BPat



The plate on the left shows the ELR.BPat biotope between the black lichen (LR.Ver) biotope above and the still submerged kelp biotope below, on the cliffs at Howth. The plate on the right shows a close up of the barnacle biotope (ELR.BPat) on the exposed shores of Lambay Island.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Exposed or moderately exposed upper and mid eulittoral bedrock and boulders are characterised by dense barnacles *Semibalanus balanoides* and the limpet *Patella vulgata*. The barnacles may be covered by *Porphyra* on the upper shore of exposed sites. Patches of *Lichina pygmaea* may be prominent, especially in the south, where this may form a distinct *Lichina* zone (BPat.Lic). Cracks and crevices in the rock provide a refuge for small mussels *Mytilus edulis*, winkles *Littorina saxatilis* and the dogwhelk *Nucella lapillus*. Damp crevices are also frequently occupied by red algae, particularly *Osmundea pinnatifida*, *Mastocarpus stellatus* and encrusting coralline algae. With decreasing wave exposure *Fucus vesiculosus* is able to survive, gradually replacing the Barnacles and *Patella* biotope (see FvesB). On such moderately exposed shores BPat may occur on steep and vertical faces, while fucoids dominate the flatter areas.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Fucus spiralis</i>	Spiral wrack	P
<i>Palmaria palmata</i>	Species of Dulse	P
<i>Actinia equina</i>	Beadlet Anemone	O
<i>Semibalanus balanoides</i>	Species of barnacle	S
<i>Carcinus maenas</i>	Common Shore Crab	P
<i>Patella vulgata</i>	Common limpet	C
<i>Gibbula umbilicalis</i>	Flat top shell	P
<i>Littorina littorea</i>	Edible periwinkle	F
<i>Littorina saxatilis</i>	Rough periwinkle	F
<i>Nucella lapillus</i>	Dogwhelk	F

Scientific name	Common name	Abundance
<i>Mytilus edulis</i>	Common mussel	S

**Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded from exposed rocks such as the cliffs at Howth, and the seaward side of the islands of Irelands Eye, Lambay and Rockabill.



## ***Corallina officinalis* on very exposed lower eulittoral rock**

**Biotope code:** ELR.Coff



An picture of *Corallina officinalis*, the characterising species of the ELR.Coff biotope. The biotope is often associated with the exposed biotopes ELR.BPat and ELR.MytB. (No image of the biotope was available).

### **Biotope description** (extracted from Conner *et al.*, 1997)

Very exposed lower eulittoral rock on some shores supports a band of dense *Corallina officinalis* with low abundances of other turf-forming red algae such as *Lomentaria* spp., *Mastocarpus stellatus*, *Ceramium* spp. and *Osmundea* (=Laurencia) *pinnatifida*, the red encrusting alga *Callithamnion* spp. and the brown alga *Scytosiphon lomentaria*. The coralline turf also creates a micro-habitat for small animals such as spirorbid worms. This community usually forms a distinct band just above the kelp zone.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Mastocarpus stellatus</i>		P
Corallinaceae indet.	Coralline algae crusts	A
<i>Corallina officinalis</i>		A
<i>Patella vulgata</i>	Common limpet	F
<i>Semibalanus balanoides</i>	Species of barnacle	F

### **Locations where this biotope was recorded around the Fingal coast:**

Not commonly recorded along the Fingal coast. However, was recorded from the cliffs at Howth.

## ***Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock**

**Biotope code:** MLR.PelB



An example of the MLR.PelB biotope in the transitional from exposed to sheltered shores on Lambay Island.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed, or sheltered steep, lower littoral fringe rock characterised by the upper shore furoid *Pelvetia canaliculata* and barnacles (moderately exposed southern and western shores are typically characterised by *Chthamalus* spp., with *Semibalanus balanoides* on northern and eastern shores). The *Pelvetia* typically overgrows a crust of the black lichens *Verrucaria maura* and *Verrucaria mucosa*, in contrast to *Hildenbrandia rubra* on very sheltered shores (see Pel). This biotope differs from the sheltered shore *Pelvetia* biotope (Pel) by the presence of some typically exposed-shore species; these include the grazing molluscs *Littorina neritoides* and *L. neglecta* and the black lichen *Lichina pygmaea*. However, the striking difference exists in the greater number of barnacles by comparison to the sheltered shores.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Pelvetia canaliculata</i>	Channelled wrack	S
<i>Mastocarpus stellatus</i>		P
<i>Verrucaria maura</i>	Black lichen	F
<i>Semibalanus balanoides</i>	Species of barnacle	C
<i>Patella vulgata</i>	Common limpet	F

### **Locations where this biotope was recorded around the Fingal coast:**

Recorded from coasts in the transitional area between exposed and sheltered shores, including the south east of the island of Ireland Eye.



## ***Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock**

**Biotope code:** MLR.Myt.Fves



An example of the MLR.MytFves biotope south of the Portrane Strand.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Mid eulittoral exposed to moderately exposed bedrock, often with nearby sediment, may be covered by dense large *Mytilus edulis* which form a band or large patches and support scattered *Fucus vesiculosus* and occasional red algae. Ephemeral green algae such as *Enteromorpha* spp. and *Ulva lactuca* commonly occur on the shells of the mussels. The barnacle *Semibalanus balanoides* is common on both the mussel valves and on patches of bare rock, where the limpet *Patella vulgata* is also found, often at high abundance. The dog whelk *Nucella lapillus* and a range of littorinids also occur within the mussel bed.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Actinia equina</i>	Beadlet Anemone	P
<i>Semibalanus balanoides</i>	Species of barnacle	A
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina saxatilis</i>	Rough periwinkle	P
<i>Nucella lapillus</i>	Dogwhelk	P
<i>Mytilus edulis</i>	Common mussel	A

### **Locations where this biotope was recorded around the Fingal coast:**

Not commonly recorded along the Fingal coast. However, the biotope was recorded on the rocky areas to the south of Portrane beach.

## ***Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock**

**Biotope code:** MLR.FvesB



An example of the MLR.FvesB biotope near Skerries. Barnacles are present in a much greater abundance under the *Fucus vesiculosus* than in the SLR.Fves biotope.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed mid eulittoral bedrock and boulders are frequently characterised by a mosaic of barnacles (mainly *Semibalanus balanoides*, but *Chthamalus* spp. in the south-west) and the bladder wrack *Fucus vesiculosus*. The limpet *Patella vulgata* is also typically present, with small *Mytilus edulis* confined to crevices. This biotope forms an intermediate along the wave exposure gradient between the exposed-shore barnacle-*Patella* biotope (BPat) and the sheltered shore *Fucus vesiculosus* biotope (Fves). It is distinguished from BPat by the presence of short, but vesiculate *Fucus vesiculosus* (typically frequent-common in this biotope) and its greater variety of red algae and from Fves by its greater abundance of barnacles and lower abundance of *Fucus vesiculosus*. Vertical surfaces tend to be dominated by the barnacle-*Patella* biotope (BPat). On some shores, particularly those which are moderately exposed to wave action, long-term changes in the abundance of limpets, barnacles and fucoid algae may occur. As a result, over a number of years, a single shore may cycle between the barnacle-*Patella* dominated biotope (BPat), through this mosaic (FvesB) to a *F. vesiculosus*-dominated biotope (Fves).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	O
<i>Fucus vesiculosus</i>	Bladder wrack	A
<i>Fucus spiralis</i>	Spiral wrack	P
Corallinaceae indet.	Coralline algae crusts	A
<i>Sabellaria alveolata</i>	Honeycomb worm	P
<i>Patella vulgata</i>	Common limpet	O

Scientific name	Common name	Abundance
<i>Gibbula umbilicalis</i>	Flat top shell	P
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Littorina obtusata / mariae</i>		P
<i>Nucella lapillus</i>	Dogwhelk	P
<i>Semibalanus balanoides</i>	Species of barnacle	F
<i>Mytilus edulis</i>	Common mussel	O

**Locations where this biotope was recorded around the Fingal coast:**

Species abundances generally allowed for a different biotope designation according to the principle of best fit. However, the biotope was recorded on the rocky areas to the south of the southern Skerries beach.

## Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock

**Biotope code:** MLR.Fser.Fser



A close up example of a *Fucus serratus* biotope on Lambay Island. The differences between some of the *Fucus serratus* biotopes are indistinct, particularly those of SLR.Fserr and MLR.Fser. The separate biotopes are often assigned based on the presence of other characteristic biotope associations on the shore.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed to very sheltered lower eulittoral rock subject to fully marine conditions is typically characterised by a dense canopy of *Fucus serratus* (typically common - superabundant). There is a wide range of associated species, including barnacles, limpets *Patella vulgata*, littorinid molluscs, turf-forming red algae and the sponge *Halichondria panicea*. This biotope usually occurs immediately below a *Fucus vesiculosus*-barnacle mosaic (FvesB) on moderately exposed shores or a dense canopy of *F. vesiculosus* (Fves) or *Ascophyllum nodosum* (Asc) on sheltered shores; consequently low abundances of these species (typically less than frequent) may also occur in this biotope.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	O
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Laminaria digitata</i>	Oarweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	P
<i>Fucus serratus</i>	Toothed wrack	S
<i>Fucus vesiculosus</i>	Bladder wrack	O
Corallinaceae indet.	Coralline algae crusts	P
<i>Porphyra umbilicalis</i>		P
<i>Rhodothamniella floridula</i>		P
<i>Palmaria palmata</i>	Species of Dulse	P

Scientific name	Common name	Abundance
<i>Patella vulgata</i>	Common limpet	O
<i>Gibbula umbilicalis</i>	Flat top shell	P
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Littorina obtusata / mariae</i>		P
<i>Nucella lapillus</i>	Dogwhelk	O
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Carcinus maenas</i>	Common Shore Crab	P
<i>Mytilus edulis</i>	Common mussel	F
<i>Asterias rubens</i>	Common Starfish	P

**Locations where this biotope was recorded around the Fingal coast:**

Dense, lower shore *Fucus serratus* biotopes were recorded from all rock shores with the exception of the exposed to very exposed areas. It was recorded from the west and southwest of Lambay Island, from the less exposed shores of the Skerries Islands, the sheltered south of Irelands Eye and much of the mainland coast.

***Palmaria palmata* on very to moderately exposed lower eulittoral rock**

**Biotope code:** MLR.Pal



An example of the MLR.Pal biotope on the cliffs of Lambay. The associated biotope of ELR.BPat is also visible while the shallow sublittoral kelp biotope is still submerged.

**Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed lower eulittoral rock may support an often pure stand of dulce *Palmaria palmata* which forms a dense band or occurs in large patches above the main kelp zone (Ldig). *Palmaria* is a common component of adjacent biotopes; it should only be recorded as Pal where it forms a distinct band or occurs in large patches on the shore. *Palmaria* favours shaded or overhanging rock and often forms a band at the top of overhanging rock. Relatively low abundances of other red algae, such as *Osmundea pinnatifida*, *Chondrus crispus* and *Corallina officinalis*, may also occur in this biotope although *Palmaria* always dominates. It is likely that the *Palmaria* biotope represents an opportunistic assemblage of fast-growing species which occupy gaps within or between the canopies of longer-lived perennials such as *Fucus serratus*. *Palmaria* often forms a luxurious growth on *Mytilus edulis* on exposed shores in which case it should be recorded as MytB.

**Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Palmaria palmata</i>	Species of Dulse	A
<i>Actinia equina</i>	Beadlet Anemone	P
<i>Patella vulgata</i>	Common limpet	O
<i>Semibalanus balanoides</i>	Species of barnacle	O

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the cliffs of Howth, Irelands Eye and Lambay.

***Mastocarpus stellatus* and *Chondrus crispus* on very to moderately exposed lower eulittoral rock**

**Biotope code:** MLR.Mas



An example of the MLR.Mas biotope on Rockabill. An association with the exposed mussel biotope (ELR.MytB) is visible. Furoid growth is evident but does not directly relate to other biotopes present. It is possible that it is summer growth that will not survive winter wave exposure.

**Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed lower eulittoral bedrock on some shores is characterised by a dense turf of *Mastocarpus stellatus* and *Chondrus crispus* (either together or separately) which form a band above the main kelp zone or *Mytilus* (MytB). *Mastocarpus* is more resistant to wave action than *Chondrus*, and may therefore dominate much more exposed shores; it can dominate vertical rock at very exposed sites. On more sheltered shores *Mastocarpus* may give way to *Chondrus* which has a faster growth rate. Beneath these foliose algae encrusting coralline algae covers the rock surface.

**Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Mastocarpus stellatus</i>		C
<i>Chondrus crispus</i>	Carragheen moss	P
<i>Semibalanus balanoides</i>	Species of barnacle	P
<i>Mytilus edulis</i>	Common mussel	A

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the southern end of Rockabill.



## ***Osmundea (Laurencia) pinnatifida* and *Gelidium pusillum* on moderately exposed mid eulittoral rock**

**Biotope code:** MLR.Osm



A small example of the MLR.Osm biotope on the mixed exposure shores near the Sutton Sailing Club.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Exposed to moderately exposed lower eulittoral rock may be characterised by extensive areas or a distinct band of *Osmundea (Laurencia) pinnatifida* and *Gelidium pusillum* (either together or separately). This community usually occurs on shores on which a fucoid canopy is reduced in extent, or even absent. Other turf-forming red algae, such as *Ceramium* spp. and *Callithamnion hookeri* may be present, although *Osmundea* and/or *Gelidium* always dominate. On flatter, more sheltered shores, *Laurencia hybrida* may also occur. Small patches of bare rock amongst the algal turf are occupied by barnacles *Semibalanus balanoides*, the limpet *Patella vulgata*, dogwhelks *Nucella lapillus* and small mussels *Mytilus edulis*.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Osmundea pinnatifida</i>	Pepper Dulse	A
<i>Actinia equina</i>	Beadlet Anemone	O
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Patella vulgata</i>	Common limpet	O
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Nucella lapillus</i>	Dogwhelk	O

### **Locations where this biotope was recorded around the Fingal coast:**

Frequently recorded along most rocky mainland shores with the exception of the cliffs at Howth.



## Ephemeral green or red seaweeds (freshwater or sand-influenced)

**Biotope code:** MLR.Eph



An example of a freshwater influenced ephemeral green algae (MLR.Eph) biotope on Lambay Island.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Ephemeral algae often colonise disturbed littoral rock. On moderately exposed shores this can occur as *Enteromorpha* spp. on freshwater-influenced or unstable upper shore rock (MLR.Ent), *Porphyra purpurea* and/or *Enteromorpha* spp. on sand-scoured mid to lower eulittoral rock (MLR.EntPor) and dense mats of *Rhodothamniella floridula* on lower shore rock surrounded by sand (MLR.Rho).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	A
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Ceramium</i> sp		P
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Littorina obtusata</i> / <i>mariae</i>		P
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Mytilus edulis</i>	Common mussel	O

### **Locations where this biotope was recorded around the Fingal coast:**

Commonly found on rocks near significant freshwater outfalls such as storm drains. Patchy distribution with no excessive areas recorded during the survey.

***Porphyra purpurea* or *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock**

**Biotope code:** MLR.EntPor



An example of the biotope to the south of the Portrane strand.

**Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand which significantly affects the rock. As a consequence of sand-abrasion, fucoids are scarce and the community is typically dominated by ephemeral algae, particularly *Porphyra purpurea* and *Enteromorpha* spp. Under the blanket of ephemeral algae, barnacles and limpets occur in the less scoured areas. Few other species are present. In areas where sand abrasion is less severe, the sand-binding red alga *Rhodothamniella floridula* occurs with other sand-tolerant algae and fucoid algae (especially *Fucus serratus*) (Rho).

**Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	A
<i>Ulva lactuca</i>	Sea lettuce	O
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Porphyra umbilicalis</i>		A
<i>Rhodothamniella floridula</i>		P
<i>Verrucaria maura</i>	Black lichen	P
<i>Semibalanus balanoides</i>	Species of barnacle	P
<i>Littorina littorea</i>	Edible periwinkle	P

**Locations where this biotope was recorded around the Fingal coast:**

Examples of this biotope were recorded from the rocks to the south of Portrane strand.

## ***Rhodothamniella floridula* on sand-scoured lower eulittoral rock**

**Biotope code:** MLR.Rho



An example of the MLR.Rho biotope near Skerries on the rocky areas immediately to the south of the strand, which provides the sediment for the scouring influence.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Lower eulittoral and sublittoral fringe sand-scoured bedrock and boulders are often characterised by canopy algae (usually *Fucus serratus*), beneath which a mat of the sand-binding red alga *Rhodothamniella floridula* occurs. These mats can also form distinct areas without *F. serratus*. The small hummocks of *R. floridula* also contain other small red and brown algae and species of worm and amphipod may burrow into the *Rhodothamniella* mat. Other sand-tolerant algae, such as *Polyides rotundus*, *Furcellaria lumbricalis*, *Gracilaria verrucosa* and *Cladostephus spongiosus*, may be present. Ephemeral algae such as *Enteromorpha* spp., *Ulva* spp. and *Porphyra* spp. may occur. Where sand scour is more severe, fucoids and *Rhodothamniella* may be rare or absent and these ephemeral algae dominate the substratum (EntPor).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	C
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Fucus serratus</i>	Toothed wrack	O
<i>Chondrus crispus</i>	Carragheen moss	P
<i>Ceramium</i> sp		P
<i>Rhodothamniella floridula</i>		A
<i>Semibalanus balanoides</i>	Species of barnacle	P
<i>Carcinus maenas</i>	Common Shore Crab	P
<i>Patella vulgata</i>	Common limpet	P
<i>Nucella lapillus</i>	Dogwhelk	P
<i>Mytilus edulis</i>	Common mussel	P

**Locations where this biotope was recorded around the Fingal coast:**

Good examples of this biotope recorded on the rocky area beside the sediment shore of the beach south of Skerries.

## ***Laminaria digitata* on moderately exposed or tide-swept sublittoral fringe rock**

**Biotope code:** MIR.Ldig



An example of the kelp (MIR.Ldig) biotope partially exposed during a spring low tide on Lambay Island. Other exposed rock biotopes dominate the rocks to the foreground of the plate, with the barnacle biotope (ELR.BPat), the black lichen biotope (LR.Ver) and the yellow lichens (LR.YG) visible in the background. A shingle beach is also visible (LGS.BarSh).

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed to sheltered sublittoral fringe bedrock or boulders dominated by a dense canopy of *Laminaria digitata* often with a wide range of filamentous and foliose red seaweeds beneath. The rocky substratum is usually covered by encrusting coralline algae, on which occasional limpets *Patella vulgata* and topshells *Gibbula* spp. graze. A wide variety of fauna occurs, including the sponge *Halichondria panicea*, barnacles (*Balanus crenatus* and *Semibalanus balanoides*) and occasional small mussels *Mytilus edulis*. Kelp holdfasts provide a refuge for a varied assemblage of species including sponges (e.g. *Leucosolenia* spp.), anemones (*Urticina felina*), limpets (*Helcion pellucidum*), crustaceans, encrusting bryozoans and colonial ascidians. This biotope is usually found beneath the *Fucus serratus* zone (MLR.Fser) and above the truly sublittoral *Laminaria hyperborea* zone (MIR.Lhyp). Other canopy-forming kelps such as *Alaria esculenta* and *Laminaria saccharina*, may occur although never at high abundance.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Laminaria digitata</i>	Oarweed	A

(Sublittoral fringe does not allow for a full species list to be recorded from the shore)

### **Locations where this biotope was recorded around the Fingal coast:**

Common along all rocky shores where there was sufficient depth for the dominating shallow sublittoral species of kelp.

## ***Pelvetia canaliculata* on sheltered littoral fringe rock**

**Biotope code:** SLR.Pel



An example of the SLR.Pel biotope on a sheltered shore on Lambay Island. The black, and yellow and grey lichen biotopes are present immediately above the *Pelvetia* while the *Fucus spiralis* (SLR.Fspi) biotope can be seen associated with the lower parts of the biotope in the foreground of the plate. Low profile sheltered shores such as these often allow for a degree of mixing and there is no clear dividing line between biotopes. Medium to high profile sheltered shores allow for more definitive lines.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Lower littoral fringe bedrock or stable boulders on sheltered shores are characterised by a dense cover of the furoid *Pelvetia canaliculata*. The furoid overgrows a crust of black lichens *Verrucaria maura* and *Verrucaria mucosa*, or *Hildenbrandia rubra* on very sheltered shores. Though not typical, this biotope may occur on moderately exposed shores where local topography provides shelter

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Pelvetia canaliculata</i>	Channelled wrack	A
<i>Fucus spiralis</i>	Spiral wrack	O
<i>Verrucaria maura</i>	Black lichen	O
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina saxatilis</i>	Rough periwinkle	O

### **Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded on upper littoral rock in sheltered areas such as the west and south west of Lambay, the lee of the Skerries Islands and relatively sheltered pockets on the mainland.



## ***Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock**

**Biotope code:** SLR.Fspi



An example of the SLR.Fspi biotope on Lambay. SLR.Pel and LR.Ver biotopes are present above.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed to very sheltered upper eulittoral bedrock and boulders are typically characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichens *Verrucaria maura* and *V. mucosa*. Limpets *Patella vulgata*, winkles *Littorina* spp. and barnacles *Semibalanus balanoides* are usually present under the fucoid fronds and on open rock. During the summer months ephemeral green algae such as *Enteromorpha* spp. and *Ulva lactuca* may also be present. This zone usually lies below a *Pelvetia canaliculata* zone (Pel); occasional clumps of *Pelvetia* may be present (usually less than common) amongst the *F. spiralis*.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Pelvetia canaliculata</i>	Channelled wrack	O
<i>Fucus vesiculosus</i>	Bladder wrack	O
<i>Fucus spiralis</i>	Spiral wrack	S
<i>Patella vulgata</i>	Common limpet	P
<i>Semibalanus balanoides</i>	Species of barnacle	P

### **Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded on upper littoral rock in sheltered areas such as the west and south west of Lambay, the lee of the Skerries Islands and relatively sheltered pockets on the mainland.



## ***Fucus vesiculosus* on sheltered mid eulittoral rock**

**Biotope code:** SLR.Fves



An example of a mixed furoid sheltered shore area on Lambay. Included is the SLR.Fves biotope. Above the furoids the lichen biotopes dominate.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed to sheltered mid eulittoral rock characterised by a dense canopy of large *Fucus vesiculosus* plants (typically abundant to superabundant). Beneath the algal canopy the rock surface has a sparse covering of barnacles (typically rare-frequent) and limpets, with mussels confined to pits and crevices. *Littorina littorea* and *Nucella lapillus* are also found beneath the algae, whilst *Littorina obtusata* and *Littorina mariae* graze on the furoid fronds. The fronds may be epiphytised by the filamentous brown alga *Elachista fucicola* and the small calcareous tubeworm *Spirorbis spirorbis*. In areas of localised shelter, *Ascophyllum nodosum* may also occur, though never at high abundance (typically rare to occasional) - (compare with Asc). Damp cracks and crevices often contain patches of the red seaweeds *Osmundea* (*Laurencia*) *pinnatifida*, *Mastocarpus stellatus* and encrusting coralline algae. This biotope usually occurs between the *Fucus spiralis* (Fspi) and the *Fucus serratus* (Fser) zones; both of these furoids may be present in this biotope, though never at high abundance (typically less than frequent). In some sheltered areas *Fucus vesiculosus* forms a narrow zone above the *A. nodosum* zone (Asc).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	O
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	S
<i>Fucus spiralis</i>	Spiral wrack	P
Corallinaceae indet.	Coralline algae crusts	P
<i>Polysiphonia lanosa</i>		P

Scientific name	Common name	Abundance
<i>Actinia equina</i>	Beadlet Anemone	O
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Carcinus maenas</i>	Common Shore Crab	O
<i>Patella vulgata</i>	Common limpet	C
<i>Littorina littorea</i>	Edible periwinkle	C
<i>Littorina obtusata / mariae</i>		C
<i>Nucella lapillus</i>	Dogwhelk	C
<i>Mytilus edulis</i>	Common mussel	O
<i>Asterias rubens</i>	Common Starfish	P

**Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded on mid shore rock in sheltered areas such as the south west of Lambay, the lee of the Skerries Islands and relatively sheltered pockets on the mainland. These pockets are often allowed develop communities more typical of sheltered shores while exposed biotopes dominate the outer protecting rocks.

## ***Ascophyllum nodosum* on very sheltered mid eulittoral rock**

**Biotope code:** SLR.Asc



An example of the *Ascophyllum nodosum* biotope (SLR.Asc) on a sheltered Lambay Island shore. The epiphytic red algae *Polysiphonia lanosa* is often found growing on the *Ascophyllum*.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Bedrock, or stable boulders and cobbles, in the mid-eulittoral zone of sheltered to very sheltered shores, typically in fully marine or near fully marine conditions, are characterised by a dense canopy of *Ascophyllum nodosum*. *Fucus vesiculosus* also occurs and in some places may co-dominate the canopy. Such mixed canopies occur when clearings are formed in the *Ascophyllum*, since *F. vesiculosus* is able to colonise such clearings more rapidly. *Ascophyllum* (which may live for up to 25 years) will, however, eventually out-compete any *F. vesiculosus*. Such changes in the overlying canopy have little effect on the under-storey species. Beneath the canopy, filamentous and foliose red algae, including *Mastocarpus stellatus* and *Chondrus crispus*, and the green alga *Cladophora rupestris*, occur in moderate to low densities. The *Ascophyllum* is generally epiphytised by *Polysiphonia lanosa*. Very steep and vertical surfaces are often characterised by barnacles and limpets (BPat.), but by small fucoids in areas of extreme shelter. Large numbers of the winkle *Littorina obtusata* may be present. This biotope usually lies between the *Fucus spiralis* (Fspi) and *Fucus serratus* (Fser) zones, although on some shores a narrow zone of *Fucus vesiculosus* (Fves) may occur immediately above the *Ascophyllum*. With increasing wave exposure the *Ascophyllum* canopy is replaced by *F. vesiculosus* (Fves).

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	S
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	O
<i>Fucus spiralis</i>	Spiral wrack	P

Scientific name	Common name	Abundance
Corallinaceae indet.	Coralline algae crusts	P
<i>Polysiphonia lanosa</i>		P
<i>Actinia equina</i>	Beadlet Anemone	O
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Carcinus maenas</i>	Common Shore Crab	O
<i>Patella vulgata</i>	Common limpet	C
<i>Littorina littorea</i>	Edible periwinkle	C
<i>Littorina saxatilis</i>	Rough periwinkle	C
<i>Littorina obtusata / mariae</i>		C
<i>Nucella lapillus</i>	Dogwhelk	C
<i>Mytilus edulis</i>	Common mussel	O
<i>Asterias rubens</i>	Common Starfish	P

**Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded on mid shore rock in sheltered areas such as the west and south west of Lambay, the lee of the Skerries Islands and relatively sheltered pockets on the mainland. These pockets are often allowed develop communities more typical of sheltered shores while exposed biotopes dominate the outer protecting rocks.

## ***Fucus serratus* on sheltered lower eulittoral rock**

**Biotope code:** SLR.Fserr



An example of the SLR.Fserr biotope near the Sutton Sailing Club. The differences between some of the *Fucus serratus* biotopes are indistinct, particularly those of SLR.Fserr and MLR.Fser. The separate biotopes are often assigned based on the presence of other characteristic biotope associations on the shore.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Sheltered lower eulittoral rock subject to fully marine conditions is typically characterised by a dense canopy of *Fucus serratus* (typically common - superabundant). There is a wide range of associated species, including barnacles, limpets *Patella vulgata*, littorinid molluscs, turf-forming red algae and the sponge *Halichondria panicea*. This biotope usually occurs immediately below a dense canopy of *F. vesiculosus* (Fves) or *Ascophyllum nodosum* (Asc) on sheltered shores; consequently low abundances of these species (typically less than frequent) may also occur in this biotope.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	P
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Fucus serratus</i>	Toothed wrack	S
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Polysiphonia lanosa</i>		P
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Nucella lapillus</i>	Dogwhelk	C
<i>Mytilus edulis</i>	Common mussel	O
<i>Asterias rubens</i>	Common Starfish	P

### **Locations where this biotope was recorded around the Fingal coast:**

Dense, lower shore *Fucus serratus* biotopes were recorded from all rock shores with the exception of the exposed to very exposed areas. It was recorded from the west and southwest of Lambay Island, from the less exposed shores of the Skerries Islands, the sheltered south of Irelands Eye and much of the mainland coast.

## Barnacles and *Littorina littorea* on unstable eulittoral mixed substrata

**Biotope code:** SLR.BLlitt



An example of the SLR.BLlitt biotope near the Martello tower north of the Sutton Sailing Club. The upper surface of the cobbles were colonised to varying degrees by barnacles (plate on left), while periwinkle species took shelter underneath the cobbles (plate on right).

### **Biotope description** (extracted from Conner *et al.*, 1997)

Banks of cobbles and pebbles which are too unstable or too small to support fucoids are usually colonised by the barnacles *Semibalanus balanoides* (often with *Elminius modestus*) with *Patella vulgata* on larger rocks and often dense aggregations of *Littorina littorea*. Between the cobbles and pebbles *Mytilus edulis* often occurs, but always at low abundance (compare with MytX). Juvenile *Carcinus maenas* occur between pebbles, and where patches of sediment occur, infaunal species such as the lugworm *Arenicola marina* and cockle *Cerastoderma edule* may be present. Fucoids are rare in this biotope. This biotope covers a wide range of wave exposures from mobile exposed and unstable shores to more sheltered stony shores in which fucoids are unable to attach and *Mytilus edulis* is infrequent.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Semibalanus balanoides</i>	Species of barnacle	F
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina</i> spp.	Periwinkles	C

### **Locations where this biotope was recorded around the Fingal coast:**

Not commonly found although recorded from the upper shore between the Sutton Sailing Club and the Martello tower to its north.



## ***Ascophyllum nodosum* on mid eulittoral mixed substrata**

**Biotope code:** SLR.AscX



An example of *Ascophyllum nodosum*, the characterising species of this biotope. The epiphytic red algae *Polysiphonia lanosa* is often found growing on the *Ascophyllum*.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Very sheltered mixed substrata (cobbles, boulders and pebbles on sediment) in full or near fully marine conditions may be characterised by an *Ascophyllum nodosum* canopy. Like the *Ascophyllum* community that occurs on bedrock (Asc), *Fucus vesiculosus* may be co-dominant. In addition, however, this community also contains a selection of infaunal species, such as *Arenicola marina*, which occur in the sediment between the cobbles. Large mussels *Mytilus edulis* commonly occur in clumps, and provide further suitable substrata for the attachment of fucoids and barnacles. *Littorina littorea* is the most commonly occurring littorinid, and at some sites it may reach high densities. The spaces between cobbles and boulders provide a refuge for crustaceans, especially *Carcinus maenas*. On shores with a smaller proportion of cobbles and boulders, the large *Ascophyllum nodosum* plants become uncommon (presumably since they lack a suitable substrata for attachment) and *Fucus vesiculosus* dominates the canopy (FvesX). *F. vesiculosus* also tends to replace *Ascophyllum* in areas with greater freshwater influence.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	S
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	O
<i>Polysiphonia lanosa</i>		P
<i>Actinia equina</i>	Beadlet Anemone	O
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Carcinus maenas</i>	Common Shore Crab	O



Scientific name	Common name	Abundance
<i>Patella vulgata</i>	Common limpet	C
<i>Littorina littorea</i>	Edible periwinkle	C
<i>Littorina obtusata / mariae</i>		C
<i>Nucella lapillus</i>	Dogwhelk	C
<i>Mytilus edulis</i>	Common mussel	O

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the Sutton Creek, the mixed substrata shores of the Skerries Islands and other relatively sheltered areas with mixed sediments.

## ***Fucus vesiculosus* on mid eulittoral mixed substrata**

**Biotope code:** SLR.FvesX



An example of the SLR.FvesX biotope to the south of Skerries head.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Sheltered and very sheltered mid eulittoral pebbles and cobbles lying on sediment are typically characterised by *Fucus vesiculosus*. FvesX is usually subject to some variability in salinity from riverine input or, in more marine conditions, the habitat consists predominantly of smaller stones which are too unstable for *Ascophyllum nodosum* to colonise to any great extent (compare with AscX). This biotope typically differs from Fves in having a less dense canopy and reduced richness of epifaunal species, presumably as a result of the increased siltation, variable salinity and lack of stable substrata. In addition, the sediment between patches of hard substrata often contains the lugworm *Arenicola marina*, cockles *Cerastoderma edule* or the ragworm *Hediste diversicolor*. Littorinids, particularly *Littorina littorea*, commonly graze on the algae. Ephemeral algae such as *Enteromorpha* spp. are often present, especially on any more mobile pebbles during the summer. Limpets are less common than in AscX, because of the limited availability of larger rocks.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	P
<i>Fucus serratus</i>	Toothed wrack	P
<i>Fucus vesiculosus</i>	Bladder wrack	S
Corallinaceae indet.	Coralline algae crusts	P
<i>Lanice conchilega</i>	Sand mason	P
<i>Semibalanus balanoides</i>	Species of barnacle	F
<i>Carcinus maenas</i>	Common Shore Crab	P
<i>Pagurus bernhardus</i>	Hermit crab	P
<i>Patella vulgata</i>	Common limpet	P
<i>Gibbula umbilicalis</i>	Flat top shell	P

Scientific name	Common name	Abundance
<i>Littorina littorea</i>	Edible periwinkle	O
<i>Littorina saxatilis</i>	Rough periwinkle	C
<i>Littorina obtusata / mariae</i>		P
<i>Nucella lapillus</i>	Dogwhelk	F
<i>Mytilus edulis</i>	Common mussel	F

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the Sutton Creek, the mixed substrata shores of the Skerries Islands and other relatively sheltered areas with mixed sediments.

## ***Fucus serratus* on lower eulittoral mixed substrata**

**Biotope code:** SLR.FserX



A mixed substrata area on the south western tip of Lambay Island. The biotope of SLR.FserX dominated the lower shores of this area.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Sheltered and very sheltered lower eulittoral mixed substrata often supports *Fucus serratus*. This biotope differs from Fser.Fser in having a less dense canopy and reduced richness of epifaunal species, being subject to increased siltation and disturbance of unstable substrata. Amongst the pebbles and cobbles can be found shore crabs *Carcinus maenas*, numerous gastropods (*Littorina littorea*, *Littorina obtusata/mariae* and *Gibbula cineraria*) and large mussels *Mytilus edulis*, commonly occurring in clumps. Sediment in the spaces between the loose substrata may support infauna such as the lugworm *Arenicola marina* and the sand mason *Lanice conchilega*. FserX occurs below mid eulittoral furoids (FvesX or AscX) on mixed substrata shores, or on sediment shores where mixed substrata occurs in discrete patches on the lower shore.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ascophyllum nodosum</i>	Knotted wrack	P
<i>Pelvetia canaliculata</i>	Channelled wrack	P
<i>Fucus serratus</i>	Toothed wrack	S
<i>Fucus vesiculosus</i>	Bladder wrack	P
<i>Polysiphonia lanosa</i>		P
<i>Semibalanus balanoides</i>	Species of barnacle	O
<i>Nucella lapillus</i>	Dogwhelk	C
<i>Mytilus edulis</i>	Common mussel	O
<i>Asterias rubens</i>	Common Starfish	P

### **Locations where this biotope was recorded around the Fingal coast:**

Recorded from the Sutton Creek, the mixed substrata shores of the Skerries Islands and on the lower shores of other relatively sheltered areas with mixed sediments.

## Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata

**Biotope code:** SLR.EphX



An example of the SLR.EphX biotope on the mid to upper shore cobbles near Sutton Creek. It was recorded close to the SLR.BLitt biotope.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Eulittoral mixed substrata (pebbles and cobbles overlying sand or mud) that is subject to variations in salinity and / or siltation are often characterised during the summer months by dense blankets of ephemeral green and red algae. The main species present are *Enteromorpha* spp., *Ulva lactuca* and *Porphyra* spp. Although fucoid algae occur in these areas they are typically rare. Small numbers of other species such as barnacles *Semibalanus balanoides* and *Elminius modestus* and keel worms *Pomatoceros* spp. are confined to any larger cobbles and pebbles. This biotope may be a summer variation of BLitt, in which ephemeral algal growth has exceeded the capacity of the grazing molluscs. In common with the other biotopes found on mixed substrata, patches of sediment are typically characterised by infaunal species including bivalves (*Cerastoderma edule* and *Macoma balthica*) and polychaetes (*Arenicola marina* and *Lanice conchilega*). Occasional clumps of *Mytilus edulis* may also occur, although at considerably lower density than in MytX.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	S
<i>Ulva lactuca</i>	Sea lettuce	F
<i>Cladophora</i>		P
<i>Fucus spiralis</i>	Spiral wrack	P
<i>Semibalanus balanoides</i>	Species of barnacle	O
Amphipods		P
<i>Patella vulgata</i>	Common limpet	P
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Littorina saxatilis</i>	Rough periwinkle	C

Scientific name	Common name	Abundance
<i>Littorina obtusata / mariae</i>		P
<i>Mytilus edulis</i>	Common mussel	P

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from many mixed substratum upper shores.

## ***Mytilus edulis* beds on eulittoral mixed substrata**

**Biotope code:** SLR.MytX



An example of the SLR.MytX biotope near Sutton Strand. The extensive mussel beds here are only fully uncovered during spring low tides.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Moderately exposed to very sheltered mid and lower eulittoral mixed substrata (mainly cobbles and pebbles on muddy sediments) with dense aggregations of the mussel *Mytilus edulis*. In high densities the mussels bind the substratum and provide a habitat for many species more commonly found on rocky shores. *Fucus vesiculosus* is often found attached to either the mussels or the cobbles and it frequently occurs at high abundance. The mussels are usually encrusted with the barnacle *Semibalanus balanoides*. *Littorina littorea* and small *Carcinus maenas* are common amongst the mussels, whilst areas of sediment may contain *Arenicola marina*, *Lanice conchilega*, *Cerastoderma edule* and other infaunal species. In contrast with the mussel beds found on rocky shores this biotope contains few limpets or red algae.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	O
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Laminaria saccharina</i>	Seabelt	P
<i>Fucus serratus</i>	Toothed wrack	P
<i>Halichondria sp.</i>		P
<i>Semibalanus balanoides</i>	Species of barnacle	C
<i>Actinia equina</i>	Beadlet Anemone	P
<i>Arenicola marina</i>	Lugworm	P
<i>Lanice conchilega</i>	Sand mason	P
<i>Mytilus edulis</i>	Common mussel	S

### **Locations where this biotope was recorded around the Fingal coast:**

Extensive beds recorded from the Sutton Creek area and Rogerstown estuary. Also smaller beds recorded on the Skerries Islands.



## Barren coarse sand shores

**Biotope code:** LGS.BarSnd



An example of the LGS.BarSnd biotope on the strand south of Skerries head. Only the upper shore and raised ridges of the strand were barren, with the biotope of LGS.AP dominating the mid to lower shore.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Freely-draining coarse sandy beaches, particularly on the upper shore, which lack a macrofaunal community due to their continual mobility. Trial excavations are unlikely to reveal any macrofauna in these typically steep beaches on exposed coasts. Burrowing amphipods *Bathyporeia* spp. or *Pontocrates* spp. and the isopod *Eurydice pulchra* may be found in extremely low abundances. Other species that may be found in low abundance may be left behind by the ebbing tide.

### **Common species that characterise this biotope around the Fingal coast:**

No species recorded.

### **Locations where this biotope was recorded around the Fingal coast:**

Recorded from the upper shores of the southern Skerries beaches.

## Barren gravel and shingle shores

**Biotope code:** LGS.BarSh



An example of a barren shingle shore on the coast between Portmarnock and Malahide beaches.

**Biotope description** (extracted from Conner *et al.*, 1997)

Shingle or gravel shores, typically with sediment particle size from 4-256 mm, are normally only found on exposed open coasts in fully marine conditions. Such shores tend to have little associated finer sediment and due to their high degree of mobility support virtually no macrofauna. Larger 'sediment' is considered to be boulders and is addressed in the mixed shores section of the classification. Coarse sand, the next grade of sediment smaller than this size range is also found on exposed open coasts and has no distinct macrofaunal community as described in LGS.BarSnd. The shingle shore and mobile littoral sand biotopes are therefore distinguished solely on the basis of their substratum (i.e. particle size). Macrofauna are absent or extremely sparse in this very mobile and freely draining substratum. Trial excavations are unlikely to reveal macroscopic infauna. However, the few species that may be found are those washed into the habitat by the ebbing tide, including the occasional amphipod or small polychaete. There may be a temporary cover of the green algae *Enteromorpha* or *Ulva* during periods of stability in the summer.

**Common species that characterise this biotope around the Fingal coast:**

All species typically absent.

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the coast between Portmarnock and Malahide beaches, and the extreme upper shores of the islands.

## Dense *Lanice conchilega* in tide-swept lower shore sand

**Biotope code:** LGS.Lan



An example of the LGS.Lan biotope on the lower shore around Sutton. The plate shows a close up of the characterising species *Lanice conchilega*. The substratum includes pebbles and shell together with the fine sand, a variation of the clean sand biotope.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Medium to fine sand, which is usually clean but may contain some fines and supports dense populations of *Lanice conchilega*, usually on the lower shore but also sometimes on water-logged mid shores. The biotope occurs under tide-swept conditions in sheltered straits, sounds and fully marine sealochs or on shores moderately exposed to wave action. The biotope is distinguished from others in sandy beaches by the presence of *Lanice conchilega* at levels of common and above or as the main polychaete component. Other polychaetes present are tolerant of sand scour or mobility of the surface levels of the sediment and include glycerid polychaetes, *Anatides mucosa*, *Nephtys cirrosa*, *Nephtys hombergii* and *Pygospio elegans*. Few crustaceans are found regularly and the bivalve component is restricted to cockles *Cerastoderma edule* and more rarely *Macoma balthica*. Pebbles and cobbles may also be mixed in with lower shore tide-swept sand with dense *Lanice conchilega* between the cobbles, but the infaunal component is rarely sampled. The infaunal community under these circumstances, provided that the cobbles are not packed very close together, will be similar to that in areas of purer sand.

### **Common species that characterise this biotope around the Fingal coast:**

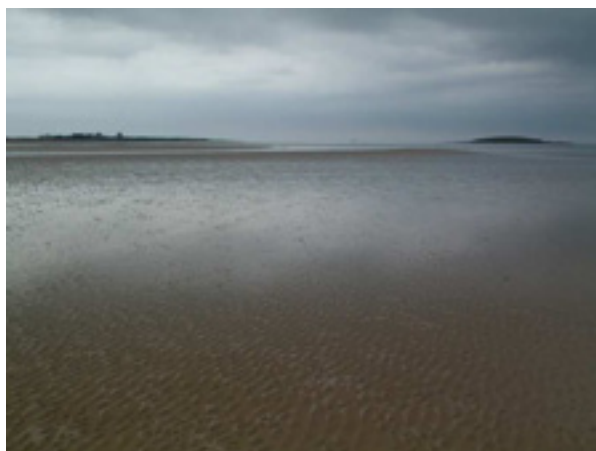
Scientific name	Common name	Abundance
<i>Nephtys</i> sp.		P
<i>Arenicola marina</i>	Lugworm	O
<i>Lanice conchilega</i>	Sand mason	A
<i>Crangon crangon</i>	Brown shrimp	P
<i>Angulus tenuis</i>	Thin tellin	P

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from the lower shores of the beaches south of Skerries head, Shenicks Island, and from the lower shores seaward of Sutton Creek, and Baldoyle and Rogerstown estuaries.

## Burrowing amphipods and polychaetes (often *Arenicola marina*) in clean sand shores

**Biotope code:** LGS.AP.P



An example of the LGS.AP biotope on the strand south of Skerries head. The mid to lower shore was dominated by this biotope.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Mid and lower shore clean sand on wave-exposed or moderately wave-exposed coasts support a community of burrowing amphipods and polychaetes. Amphipods *Bathyporeia pelagica*, *B. pilosa*, *B. sarsi*, *Pontocrates arenarius* and the isopod *Eurydice pulchra* are typically present. Polychaetes make the greater part of the community in terms of species richness and are dominated by *Nephtys cirrosa*, *Scolecopsis squamata* and *Arenicola marina*. The medium and fine sand remains damp throughout the tidal cycle and contains little organic matter. The lugworm *Arenicola marina* present are usually as a temporary recruitment that are likely to be washed out during storms. The presence of polychaetes may be seen as coloured burrows running down from the surface of the sediment. The sediment is often rippled and typically lacks an anoxic black sub-surface layer.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Nephtys</i> sp.		P
<i>Arenicola marina</i>	Lugworm	O
<i>Lanice conchilega</i>	Sand mason	P
<i>Crangon crangon</i>	Brown shrimp	P
<i>Angulus tenuis</i>	Thin tellin	P

### **Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded from the mid to lower shores of all clean sand areas including the beaches north and south of Skerries, and the beaches seaward of the Baldoyle, Malahide and Rogerstown estuaries.

## Talitrid amphipods in decomposing seaweed on the strand-line

**Biotope code:** LGS.Tal



An example of the LGS.Tal biotope below the Sutton Sailing Club. Litter and other debris often get washed up with the seaweed.

### **Biotope description** (extracted from Conner *et al.*, 1997)

A community of talitrid amphipods may occur on any shore where decomposing seaweed accumulates on the extreme upper shore strand-line. The community occurs on a wide variety of sediment shores composed of shingle and mixed substrata through to fine sands, but may also occur on mixed and rocky shores in some circumstances. The decaying seaweed provides cover and humidity for *Talitrus saltator* and other components of the community. The amphipods *Orchestia* spp. are also often present, as well as enchytraeid oligochaetes. Polychaetes, molluscs and other crustaceans may be brought in on the tide, but are not necessarily associated with the infaunal community.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
Talitrid amphipods	Sand hoppers	A

### **Locations where this biotope was recorded around the Fingal coast:**

Commonly recorded from the extreme upper shores of all sediment shores.

## ***Macoma balthica* and *Arenicola marina* in muddy sand shores**

**Biotope code:** LMS.MacAre



An example of the LMS.MacAre biotope on Sutton Strand. The lugworm *Arenicola marina*, whose casts are easily visible, dominates the biotope.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Muddy sand and fine sand flats on the mid and lower shore tend to occur on extensive moderately exposed shores and sheltered shores, on open coasts and in marine inlets. The sediment generally remains water-saturated during low water and the habitat may be subject to variable salinity conditions in marine inlets. The lugworm *Arenicola marina* and *Scoloplos armiger* are typically common along with the Baltic tellin *Macoma balthica* and cockle *Cerastoderma edule*. Amphipods such as the mud burrowing-amphipod *Corophium volutator* can be common, as well as polychaetes *Pygospio elegans* and *Nephtys hombergii*. The lugworm *Arenicola marina*, due to the variable recruitment success, may be absent, but *Scoloplos armiger* and other components of this biotope are still to be found. A black layer of anoxia is usually present within 5 cm of the sediment surface can be seen in the worm casts on the surface.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Arenicola marina</i>	Lugworm	A
<i>Cerastoderma edule</i>	Common cockle	P

### **Locations where this biotope was recorded around the Fingal coast include:**

Recorded from the muddy sand areas of Sutton Creek, the muddy sand areas of the outer estuaries and the beach south of the Lambay harbour.



## ***Zostera noltii* beds in upper to mid shore muddy sand**

**Biotope code:** LMS.Znol



An example of the biotope in Baldoye Estuary.

### **Biotope description** (extracted from Conner *et al.*, 1997)

Mid and upper shore wave-sheltered muddy fine sand or sandy mud with narrow-leaved eel grass *Zostera noltii* at an abundance of frequent or above. The infaunal community is characterised by polychaetes *Pygospio elegans* and *Arenicola marina*, mud amphipods *Corophium volutator* and bivalves *Cerastoderma edule*, *Macoma balthica* and *Scrobicularia plana*. Typically an epifaunal community is found that includes the mud snail *Hydrobia ulvae*, shore crabs *Carcinus maenas* and the green alga *Enteromorpha* sp.

### **Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	O
<i>Fucus ceranoides</i>	Horned wrack	P
<i>Zostera noltii</i>	Dwarf Eel Grass	S
<i>Hediste diversicolor</i>	Estuary ragworm	P
<i>Arenicola marina</i>	Lugworm	P
<i>Littorina littorea</i>	Edible periwinkle	O
<i>Littorina neritoides</i>	Small periwinkle	O

### **Locations where this biotope was recorded around the Fingal coast:**

Recorded from the mid sections of Baldoye estuary and from Malahide estuary.

## Littoral Muds

**Biotope code:** LMU.LMU



An example of the biotope in Baldoyle Estuary.

**Biotope description** (extracted from Conner *et al.*, 1997)

Shores of fine particulate sediment with a particle size less than 0.063 mm in diameter that typically forms extensive mudflats. Dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Also included in this higher division are sandy muds which have between 20% and 70% sand, the remainder being made up of mud with a particle size less than 0.063 mm. Small amounts of gravel or pebbles may be found within mud, having little effect upon the structure of the associated communities. Littoral muds support communities characterised by polychaetes, certain bivalves and oligochaetes. The ragworm *Hediste (Nereis) diversicolor*, the Baltic tellin *Macoma balthica* and the furrow shell *Scrobicularia plana* are conspicuous members of muddy shore communities.

**Common species that characterise this biotope around the Fingal coast:**

Scientific name	Common name	Abundance
<i>Enteromorpha intestinalis</i>	Gutweed	P
<i>Ulva lactuca</i>	Sea lettuce	P
<i>Fucus ceranoides</i>	Horned wrack	P
<i>Zostera noltii</i>	Dwarf Eel Grass	P
<i>Hediste diversicolor</i>	Estuary ragworm	P
<i>Arenicola marina</i>	Lugworm	P
Amphipods		P
<i>Littorina littorea</i>	Edible periwinkle	P
<i>Nucella lapillus</i>	Dogwhelk	P
<i>Hydrobia ulvae</i>	Laver spire shell	P
<i>Cerastoderma edule</i>	Common cockle	P
<i>Mytilus edulis</i>	Common mussel	P

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from Baldoyle, Rogerstown and Malahide estuaries.

## Saltmarsh

**Biotope code:** LMU.Sm



An example of the biotope in Baldoye Estuary.

**Biotope description** (extracted from Conner *et al.*, 1997)

Angiosperm-dominated stands of vegetation, occurring on the extreme upper shore of sheltered coasts and periodically covered by high tides. The vegetation develops on a variety of sandy and muddy sediment types and may have mixtures of coarser material. The character of the saltmarsh communities is affected by height up the shore, resulting in a zonation pattern related to the degree or frequency of immersion in seawater.

**Locations where this biotope was recorded around the Fingal coast:**

Recorded from Baldoye estuary.

## **DISCUSSION**

### **Important intertidal habitats, biotopes and species of the Fingal Coast**

Nine of the 10 intertidal habitats from the 'Guide to Habitats in Ireland' and 37 intertidal biotopes according to the 'Marine Biotope Classification for Britain and Ireland' were recorded from the coast of Fingal during the current survey. Coastal habitats range from exposed offshore rocky islands to sheltered muddy estuaries, with a gradient of moderately exposed rock, sheltered rock and other sediment shores between. Approximately 26 km of the Fingal coast is classified as exposed rocky shore, 10 km as moderately exposed rocky shore and 10 km as sheltered rocky shore. There is also approximately 8 km<sup>2</sup> of sand shore, 2.5 km<sup>2</sup> of muddy sand shore, 6.5 km<sup>2</sup> of mud shore and 1 km<sup>2</sup> of gravel or shingle shores.

A comparison of the original SensMap data and the new data from the 2005 survey showed a number of differences between the mainland and island sites. The larger sedimentary estuaries and bays are restricted to the mainland sites while the best examples of sheltered rocky shores are found on the islands. There are simple geographical reasons for this. The estuaries of Malahide, Rogerstown and Baldoyle are all associated with rivers of a size that do not occur on the islands. The islands, while generally exposed, have one side that is sheltered from the full prevailing weather of the Irish Sea. The mainland on the other hand is generally facing east and subject to the full force of the waves. However, some sheltered pockets do exist, particularly on medium profile rock shores where outer rocks reduce the force of incoming waves. The original and 2005 data does not show significant differences of species composition between comparable biotopes on the islands and the mainland. This is in contrast to the terrestrial vegetation of the mainland and islands where some significant and interesting differences were recorded during the vegetation surveys. The similarity of the intertidal species composition can be attributed to the lifecycles of the flora and fauna that lives there. With many species having a free-swimming or floating dispersive stage, the open water does not form a barrier to dispersion and the colonisation of new areas is not a problem.

#### *Designated sites*

Substantial sections of the Fingal coast are designated as Special Areas of Conservation (SAC) under the Habitats Directive and Special Protection Areas (SPAs) under the EU Birds Directive (NPWS website, consulted 2005). All Nature Reserves on the Fingal coast as designated under the Irish Wildlife Act (as amended) are now at least candidate SACs. In total there are seven SACs and nine SPAs with an intertidal component along the Fingal coastline. Many of the SACs and SPAs are common sites but their boundaries do vary significantly. The SACs and SPAs of Baldoyle Bay and estuary, Howth Head, Lambay Island, the Malahide/Swords estuary, North Dublin Bay/North Bull Island, Rogerstown estuary and the island of Ireland's Eye all share common areas. The islands off Skerries and Rockabill are only designated as SPAs. In addition the estuaries of Rogerstown, Malahide and Baldoyle, and the north of Bull Island are all wetlands of international importance and designated Ramsar sites.

Although the primary stated reasons for the designations for these sites are generally not for the marine ecology but other components of the fauna and flora, many have some intertidal element of note. However many of the sites are designated for the internationally and nationally important bird species that utilise the mudflats and the reason the birds are there is due to the intertidal infaunal communities on which they feed. Estuaries, and mudflats and sandflats not covered by seawater at low tide are Annex I habitats under the EU Habitats Directive and so SAC designation is required. Seacliffs such as those on Howth Head are also an Annex I habitat but the intertidal ecology element of the designation is limited. It is generally plant species and bird nesting sites that call for the protection under designation.

### *Habitats and species*

The diversity of Fingal coastal habitats includes both sediment and rock biotopes. While the larger sedimentary estuaries, sandy and gravel beaches are generally confined to the mainland, the rocky shores are represented well on both the mainland and the islands. There are a number of smaller sand, muddy sand and cobble beaches on the islands. The lower sand shore of Shenicks Island is of particular note as it joins up with the sand shore to the south of Skerries head at low tide. Although none of the habitats and biotopes recorded is particularly rare on the east coast of Ireland as a whole, they are of nature conservation importance from an ecological viewpoint as a range of healthy intertidal habitats is represented.



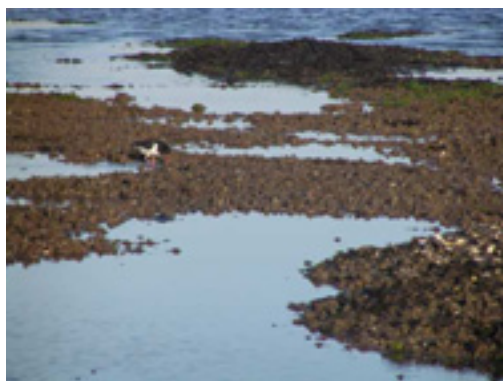
An example of exposed shore zonation on Lambay Island.



An example of sheltered lower shore zonation on Lambay Island.

Typical wave exposed, moderately wave exposed and sheltered rock habitats occur on both the islands and the mainland. Good examples of littoral rock biotope zonation up the shore are common. Exposed rock shores are particularly common on the Fingal coast, with the cliffs at Howth Head and the seaward sections of the islands of Lambay and Irelands Eye being particularly good examples. These shores showed typical zonation of kelp, mussel or barnacles, and lichens in progression up the cliffs. Sheltered littoral rock habitats are also common on the leeward side of the islands although extensive sheltered rock sites are less common on the mainland. However, sheltered rock habitats occur along the rocky coast wherever local conditions allowed. This is often on medium profile shores where the outer rocks reduced the force of wave action creating sheltered conditions within. Furoid zonation up the shore typical of sheltered rock coasts is also frequent. A typical zonation up the shore

consists of the shallow subtidal kelps followed by the serrated wrack, bladder or knotted wrack, spiral wrack, channelled wrack and finally lichen dominated biotopes.



An oystercatcher on the mussel beds of Sutton Strand.



The *Zostera* beds of Baldoyle Estuary with a small area of saltmarsh in the background.

While all the sedimentary bays and estuaries that are uncovered at low tide are protected habitats, a number of specific biotopes are of particular note and interest. There are significant beds of *Zostera noltii*, the dwarf eelgrass in Baldoyle and Malahide estuaries. While not a specifically protected species itself, *Zostera noltii* is one of the few intertidal flowering plants that are actually fully submerged at high tide. It is an important source of food for migrating birds and is considered sensitive to pollution including smothering by excessive siltation and reduced photosynthesis due to increased water turbidity. Also of specific note are the extensive beds of *Mytilus edulis*, the common mussel, that are found in the middle to lower shore of the Sutton Creek area and Rogerstown estuary. Smaller beds were recorded from the Skerries Islands. Mussel beds such as these develop on mud or mixed substrata. The mussels bind the substratum together forming a habitat with a species composition more typical of littoral rock than mud.

In general, moderately exposed or sheltered rock and boulder biotopes are the most 'species rich' (i.e. with the most species) habitats recorded from Fingal. This is because a number of microhabitats are available, creating a range of niches that species can occupy. Coarse mobile sediment biotopes such as barren sand tend to be very 'species poor' (i.e. with the least species) and may be considered a poor habitat. However, muddy estuaries also tend to be species poor but are also among the most productive habitats of the intertidal zone. It is important to note that perceived 'richness' of habitats is based predominantly on natural phenomena and not necessarily an indicator of environmental health.

## Threats to the intertidal habitats of Fingal

The threats to the intertidal habitats of Fingal are broad and generally in line with the threats to similar habitats in the British Isles and northern Europe. While compiling this section particular reference was made to the UK Biodiversity Action Plan website (UKBAP, 2004) and to the Marlin Maritime and Coastal Activities to environmental factors matrix (Marlin website, consulted 2005).



#### *Littoral sediment habitats*

The factors that combine to promote the deposition of sedimentary habitats also fail to disperse pollution in these areas. Thus threats to littoral sediment habitats often relate to the build up of pollutants. This is particularly true of muddy estuaries such as Baldoyle and Rogerstown, which are very sheltered and subject to limited natural cleaning by physical processes. The National Parks and Wildlife Service mention the refuse tip on the north shore of the Rogerstown Estuary in their site synopsis (NPWS, 2005 – SAC Site Synopsis 00208) as it poses a specific threat to habitats within the estuary. Sedimentary habitats in Fingal are not generally the focus of intense mechanical or dredge fishing operations, which can be a significant threat where they occur. However, dredging operations for the construction and maintenance of marina and harbour developments will directly disturb the immediate environment, and the surrounding habitats (including rock) through the suspension and settlement of sediments. This is true of the Malahide marina, Howth and Skerries Harbour and other areas subject to dredging. Any dredging operations must be suitably planned and licensed to ensure adverse impacts are limited. New harbour and marina developments can also change the energy regime of an area leading to a change in sedimentation including the creation of new sediment areas and the reduction of others. This is also true of coastal defence works. While bait digging occurs in several sediment areas along the coast it is not considered of a scale or intensity as to be a significant threat. Were the bait digging operations to become larger commercial ventures control may be necessary.

#### *Littoral rock habitats*

Littoral rock habitats such as those found in Fingal are generally robust. Biotope species composition is liable to change in areas subject to pollution, including increased nutrients. Impacts of increased nutrient loading would include an increase in the abundance of the ephemeral green algae such as *Enteromorpha* sp. The abundance of mollusc species such as the periwinkles, which graze on the green algae, could also increase. However, this is unlikely on a broad scale as wastewater treatment plants come online and water quality around the coast improves. The harvesting of algae from the shore can pose a threat to the balance of the species on the rocky habitats. However, this is not a common commercial activity in Fingal. The collection of periwinkles can pose a similar threat to the balance of species but is not generally undertaken at a large commercial scale. A more worrying threat to the littoral rock habitats come from diffuse sources of pollution that are more difficult to legislate for, although the Water Framework Directive is being implemented to try and address this. In the past the use of antifouling paints used on ships and boats, which can leach into the seawater, had an adverse impact on all coastal flora and fauna. Despite legislation banning the more toxic paints this threat still remains in some areas, as chemicals are persistent in the sediments.

#### *General*

Development pressure around the entire Fingal coast is growing. While significant improvements have been made regarding wastewater treatment in Dublin and surrounding areas over the years, there still are a number of sewage and wastewater outfalls entering the sea with significant loadings. Monitoring data for the bathing waters of Fingal in 2005 show that there is still significant sewage related pollution, particularly around Balbriggan, Skerries and Rush. The most serious threats to the intertidal ecology of Fingal are likely to arise from deterioration of local water quality



rather than the Irish Sea as a whole. Thus, any waste and storm water outfalls need to be monitored to ensure adverse impacts on the immediate receiving environment are limited. This includes waste and storm water outfalls entering the rivers of Fingal. Poor river water quality has an impact on coastal waters.

Marine traffic through any harbour or marina can also be a threat to the surrounding habitats through minor oil spills and other waste dumping. Suitable procedures for the prevention of spills and dumping of waste should already be in place. A major oil spill off the coast is always a possibility and would have significant adverse impacts on all littoral habitats and species. Plans should be in place at a national level to deal with such an event.

General litter is also a threat to all coastal habitats. Litter can have a smothering affect on species, be physically abrasive to attached flora and fauna, and depending on origin can leach dangerous compounds into the environment. The introduction of alien species that can upset the natural balance of the habitats is a growing and constant threat to all habitats, especially those close to major international ports. However, no impacts associated with alien species were recorded during the survey.

A further source of information on potential threats to the Fingal coast is from relevant Environmental Impact Statements (EISs). The primary objective of Environmental Impact Assessments (EIAs) and the subsequent EIS are to ensure that projects that are likely to have significant effects on the environment are subject to an assessment of their likely impacts. They are available from the County Council offices.

## **Biodiversity Action Plan**

The intertidal habitats and species of Fingal are of conservation importance and should be included within the county Local Biodiversity Action Plan. Habitat Action Plans should be the focus of conservation for the intertidal ecology of Fingal rather than the narrower scope of the Species Action Plans. Protecting the habitats will also provide direct protection for the species they contain. Such Habitat Action Plans can be divided between the 'Broad' and the 'Priority' habitat types.

Two broad habitat types were identified on the Fingal coast; littoral rock and littoral sediment. Three priority habitats were also identified; littoral mud, seagrass beds and coastal saltmarsh. While the seagrass beds and saltmarsh are already contained within the littoral mud priority habitat, they require more specific habitat management. Littoral mudflats not covered by water at low tide (which would include the estuaries of Baldoyle, Rogerstown and Malahide) are already protected as Special Areas of Conservation under the EU Habitats Directive but should still be included under the Biodiversity Action Plan.

The management of the coastal biodiversity of Fingal requires an integrated approach to coastal zone management. General suggestions for the inclusion of the intertidal habitats in the Fingal Biodiversity Action Plan are as follows:

- Maintain and manage the existing diversity of habitats and their communities in the intertidal areas of Fingal.

- Manage the intertidal areas of Fingal as part of a wider strategy for the management of the marine environment at a local, regional and national level. Strategies should be developed with relevant partners in order to achieve this.
- Ensure that all developments that may impact the coast, including those above the high tide mark and those that may impact the coast via their surface water drainage regimes (including those to rivers) complete a coastal ecology section in their EIA. The EIA should adequately address potential effects on the coastal ecology and implement remedial measures to offset any adverse impacts.
- Develop detailed Habitat Action Plans for the two ‘broad’ and three ‘priority’ habitats identified for the intertidal areas of Fingal.
- Specific and increased protection of all designated coastal conservation sites including the nine SPAs and seven SACs on the Fingal coast should be implemented. This can be incorporated in part into the Habitat Action Plans.
- Following the initial baseline study of intertidal habitats, a programme should be developed and implemented in order to quantitatively monitor the changes of intertidal habitat over time. Sites and methodology that could be included within a monitoring programme are suggested in the next section.

Overall, the focus of resources should be on the protection and monitoring of existing habitats. Particular attention should be directed at achieving good water quality status for all waters entering the sea, including storm and sewage outfalls. Local water quality deterioration is one of the main threats to the intertidal habitats of Fingal.

The UK Biodiversity Action Plan website (UKBAP, 2005) is a useful source of further information on many aspects of marine, terrestrial and freshwater habitats, and their conservation.

### **Sites for future monitoring**

It would be useful to set up a series of sites to monitor the state of intertidal ecology of the Fingal coast over time. Rather than the broader qualitative biotope mapping, monitoring sites should be permanent and quantitative. These could be marked using fixed markers or alternatively with an accurate GPS reading. A range of shore types should be selected to include the major habitat types. Monitoring should be undertaken during low water spring tides during the summer months to maximise the extent of shore surveyed and the species present. Methods should be specific and it is recommended that they be based closely on those described in the Procedural Guideline No. 3-1 “*In situ* intertidal biotope recording” (Davies *et al.* 2001).

When selecting sites for monitoring it is important to look at both the nature of the shore types to ensure a good range of habitats and species are present, and to select sites which are currently ‘unimpacted’ as well as those that are modified. In addition the practical aspects of monitoring should be taken into account. Selecting a location that is only accessible for a brief period of the year should be avoided. Where the first choice monitoring site is located on an island, a second site on the mainland is also suggested to allow for the design of a more practical and accessible monitoring programme.

The suggested monitoring sites could also be used for general educational site visits.

### *Sediment habitats*

Quantitative replicate core samples should be taken down transects on sedimentary shores. Samples should be taken at each of the main habitats down the shoreline and should be identified on the initial monitoring trip. Samples should be passed through a 1 mm mesh sieve or (0.5 mm mesh if the substratum is muddy) and the material collected and returned to the laboratory for identification and counting. Species should be identified to species level where possible and a voucher collection of specimens retained. Separate samples of sediment from sand sites should be retained for granulometric analysis (2 mm – 0.063µm fractions). The total organic content of the sediment should be calculated using loss on ignition (LOI) techniques. This analysis provides further information regarding the infaunal habitat. Grain size and organic content affect the organisms that live in the sediments.

### *Seagrass bed habitat*

In addition to the quantitative sampling of the infaunal communities from the sedimentary habitats it would also be useful to accurately map the extent of the seagrass habitats in Baldoyle and Malahide. The natural variation and recovery, if any, of the seagrass beds in Rogerstown should also be monitored.

### *Rock habitats*

Quantitative quadrat surveys should be deployed along a transect down the shore at sites which are predominantly rocky. Species within each quadrat should be counted and identified where possible in the field. Three to four stations down the shore should be sufficient for the monitoring. Stations along the transect should be based on differences in dominant species and identified on the initial monitoring trip. Taxa that cannot be identified in the field should be preserved and returned to the laboratory for identification.

A range of proposed sites for monitoring and the rationale for their selection are as follows (also refer to the map on the following page).

### *Exposed littoral rock*

#### Irelands Eye

Irelands Eye itself is an SAC and SPA. The exposed cliffs to the north of Irelands Eye show good examples of exposed shore rock biotopes. Any sea cliffs, which are the best examples of exposed shore biotopes in Fingal, will need to be accessed by boat. Sea conditions could pose obstacles for the monitoring of an exposed coast, especially when the work will need to be done from a boat. Irelands Eye is relatively close to the mainland and sea conditions can be monitored from Howth Harbour before travel, thus ensuring a trip is not wasted.

#### Loughshinny north

The rocky areas to the north of Loughshinny show good examples of moderately exposed to exposed shore rock biotopes. They are relatively easy to access from both Skerries beach and Loughshinny. They are also a lower profile than the exposed cliffs of the island sites. Thus the deployment of a transect is simplified. They are also close to the mainland sheltered shore and sandy shore monitoring sites allowing for a compact monitoring programme to be developed.

### *Sheltered littoral rock*

#### Lambay Island

Lambay Island itself is an SAC and SPA. The sheltered rock areas to the north west of the island, just to the north of the harbour show typical sheltered rock zonation. There is a suitable landing point in the harbour itself. The leeward side of Lambay offers more extensive sheltered rock habitats than the mainland, which generally faces seaward.

#### Loughshinny north

Good examples of sheltered shore rock biotopes are not common on the mainland coast of Fingal. However, the rocky areas to the north of Loughshinny, immediately beside the south Skerries beach are an example. They are relatively easy to access from both Skerries beach and Loughshinny. They are also close to the mainland exposed shore and sandy shore monitoring sites allowing for a compact monitoring programme to be developed.

### *Mixed sediment shore*

#### Sutton Creek

The shore at Sutton Creek is composed of mixed substrata including rock, cobbles, gravel, muddy sand and sand. It is part of the North Dublin Bay SAC and North Bull SPA. The monitoring of a mixed substrata shore would allow for the identification of a range of impacts. It would also give the opportunity to monitor the state of the mussel beds in the area.

### *Sandy shore*

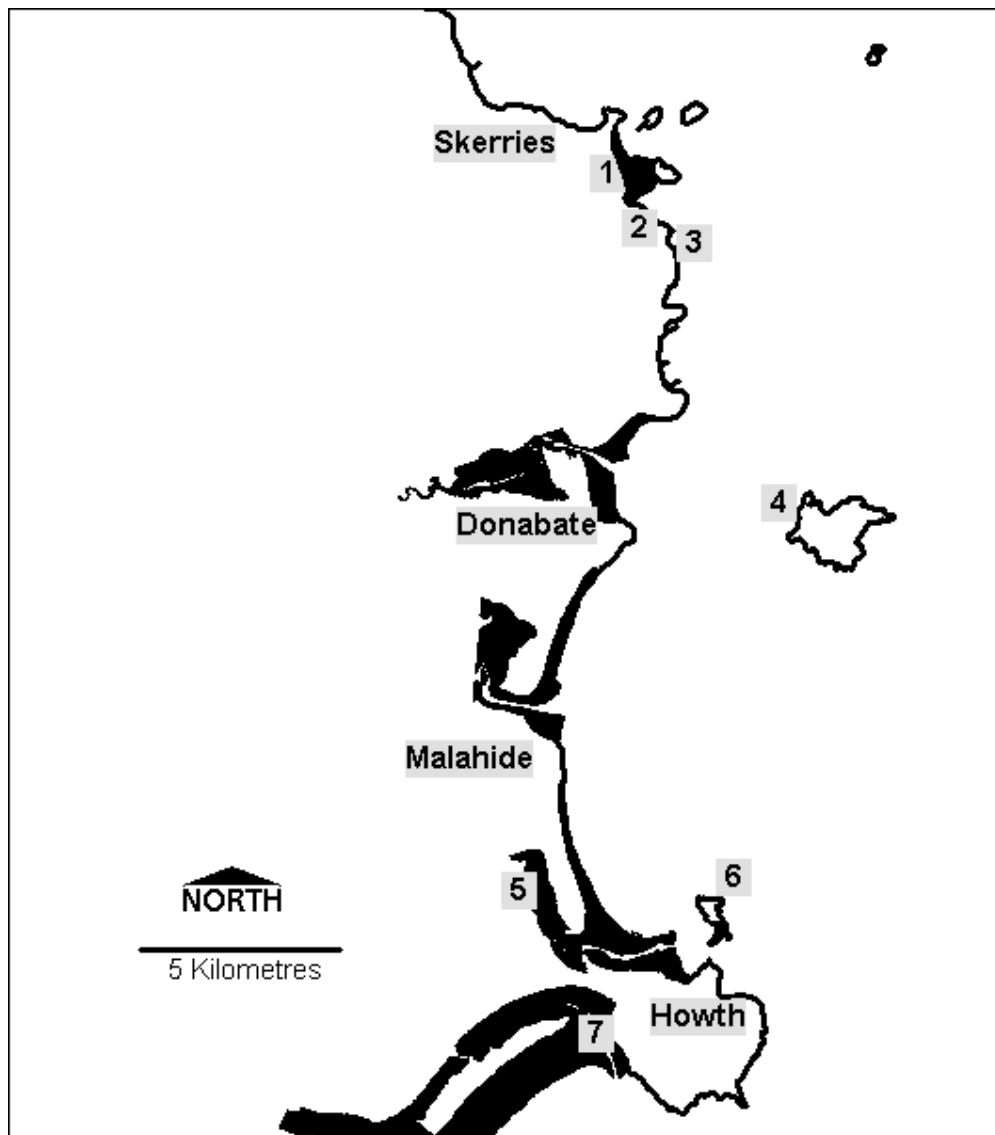
#### The beach south of Skerries

The beach south of Skerries is a wide sandy beach with typical clean sand infaunal communities. It is one of a number of clean sand beaches along the Fingal coast. It is easily accessible from the road.

### *Muddy shore*

#### Baldoyle estuary

Baldoyle estuary is a good example of a mud estuary and is a designated SAC, SPA and Ramsar site. The monitoring of the estuary would also allow for the monitoring of impacts, if any, from a number of developments within the estuary catchment. The monitoring stations should be positioned so as to include the sensitive seagrass biotope within the estuary.



Proposed intertidal ecology monitoring sites:

1. Sandy shore, Skerries.
2. Moderately exposed to exposed rock shore, Loughshinny north.
3. Sheltered rock shore, Loughshinny north.
4. Sheltered rock shore, Lambay Island.
5. Muddy shore, Baldoyle Estuary.
6. Exposed rock shore, Irelands Eye.
7. Mixed shore, Sutton Creek

## CONCLUSIONS

Nine of the 10 intertidal habitats from the ‘Guide to Habitats in Ireland’ and 37 intertidal biotopes according to the ‘Marine Biotope Classification for Britain and Ireland’ were recorded from the coast of Fingal during the current survey. Coastal habitats range from exposed offshore rocky islands to sheltered muddy estuaries, with a gradient of moderately exposed rock, sheltered rock and other sediment shores between.

Substantial sections of the Fingal coast are designated as Special Areas of Conservation (SAC) under the Habitats Directive and Special Protection Areas (SPAs) under the EU Birds Directive (NPWS website, consulted 2005). Although the primary stated reasons for the designations for these sites are generally not for the marine ecology but other components of the fauna and flora, many have some intertidal element of note, including the provision of feeding and nesting sites for important bird species. Although none of the habitats and biotopes recorded is particularly rare on the east coast of Ireland as a whole, they are of nature conservation importance from an ecological viewpoint as a range of healthy intertidal habitats is represented. The intertidal habitats of Fingal should form part of the county Biodiversity Action Plan. Habitats should be managed and maintained, with Habitat Action Plans developed in order to help achieve this. Overall, the focus of resources should be on the protection and monitoring of existing habitats. Particular attention should be directed at achieving good water quality status for all waters entering the sea, including storm and sewage outfalls. New developments that may impact on coastal ecology should be required to complete adequate assessments and to implement remedial measures to offset any adverse impacts. A programme should be developed and implemented in order to quantitatively monitor the changes of intertidal habitat over time. Results from this programme should be used to dictate the direction of further conservation work.

Threats to the ecology of the Fingal coast are generally consistent with threats to coastal habitats in Ireland and the rest of Europe. Many of the threats are of local origin and relate to an expanding population and the pressures that brings to the local environment. Other threats are remote and difficult to manage although the Water Framework Directive has been introduced in part to address this.

The coasts of Fingal have a healthy and diverse of habitats and species. They should be managed and maintained for the benefit of all.

### **Assessment of coastal habitat classifications**

Both the habitat classifications used in this report have uses in the assessment and monitoring of the coastal habitats of Fingal. However, they vary substantially on the detail they provide on the habitats, and hence in their usefulness as specific monitoring tools.

A Guide to Habitats in Ireland (Fossitt, 2000) is a broad guide to the classification of all the habitats in Ireland. As stated in the introduction of the guide,

“The classification is presented within a hierarchical framework and is designed for application at a variety of different levels in terms of scale, detail and user expertise.

It is intended as a first-step approach for general habitat recording rather than as a basis for detailed study and evaluation. The availability and widespread use of a standard classification scheme is important in that it will help to standardise data collection on habitats which, in turn, will assist in the management and conservation of Ireland's natural heritage.”

In practice, the usefulness of the Fossitt classification relates to the positioning of habitats at a scale relative to the other habitats of Ireland. It helps those responsible for the drafting of management plans to understand the basis of further classifications while not necessarily being an expert in all areas. As a broad scale visual tool, a coast mapped using the Fossitt classification will highlight different habitat types and allow for the drafting of a programme to collect further data from each habitat should this be required. Alternatively a coast mapped using a more detailed classification can be visually confusing. If simplified to the Fossitt classification an immediate visual impression of the habitat types present is obtained even though habitat quality will not be. While the Fossitt classification is a useful tool to help managers understand the habitats, it cannot be used directly for monitoring purposes. The classification does not give any information about the quality of the habitat. As a basic example, an exposed rock will remain as an exposed rock whether in a pristine natural state or devoid of life in grossly polluted waters. A more detailed classification system is required as a basis for monitoring.

The Marine Biotope Classification for Britain and Ireland (Conner *et al.*, 1997) is one such more detailed classification. As described on the publications website:

“The marine habitat classification for Britain and Ireland provides a tool to aid the management and conservation of marine habitats. It is one of the most comprehensive marine benthic classification systems currently in use, and has been developed through the analysis of empirical data sets, the review of other classifications and scientific literature, and in collaboration with a wide range of marine scientists and conservation managers. It is fully compatible with and contributes to the European EUNIS habitat classification system” (JNCC, 2005).

The EUNIS habitat classification is a similar concept to the Fossitt classification in that it attempts to include all European habitats although at a much greater detail. According to their website,

“EUNIS Habitat types classification is a comprehensive pan-European system to facilitate the harmonised description and collection of data across Europe through the use of criteria for habitat identification; it covers all types of habitats from natural to artificial, from terrestrial to freshwater and marine.” (EUNIS, 2005).

The biotope classification system takes account of habitat types and the species that are commonly found there. Thus a much greater level of detail is obtained on the coastal habitats mapped using it. It allows for the identification of species and habitats of specific conservation importance and thus the drafting of targeted habitat and species action plans to manage them. However, broad scale biotope mapping still only gives a general indication of boundaries and so is not suitable for direct monitoring of change. The biotope classification system can be used for monitoring but only if suitable methods are used on specific sites.



It is recommended that for monitoring work, the methods in the Procedural Guideline No. 3-1 “In situ intertidal biotope recording” (Davies *et al.* 2001) be followed more closely. This provides for the selection of specific sites and a specific limited area at each site of 1m<sup>2</sup> allowing for more accurate monitoring.

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**APPENDIX 1 – SUMMARY REPORTS FOR EACH SECTION OF  
THE FINGAL COAST SURVEYED IN 2005**

## SensMap intertidal summary report: Colt Island

### Site details:

County: Dublin  
Littoral width: 10- 50 m  
Wave exposure: Exposed to sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

05 August 2005  
Time: 18.30 to 19.30  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and particular interest:

Included in SPA of Skerries Island.  
Good zonation  
Representative

### Uses and Impacts:

Litter and debris  
Fishing – Potting

### Site Description:

This site includes the extent of Colt Island. The east of the island was characterised by biotopes typical of exposed rocky shores, while the west of the island was characterised by biotopes typical of sheltered rock shores. The south west of the island was dominated by sedimentary biotopes with a moderately exposed transitional zone characterising the south east.

The upper shore of the east of the island was characterised by the lichen biotopes (LR.YG, LR.Ver), immediately followed by the barnacle biotope (ELR.BPat), and in the northeast by mussels (ELR.MytB). The kelp biotope (MIR.Ldig) was present along the shallow sublittoral of much of the east, north and west of the island. The north east of the island supported transitional moderately exposed biotopes including *Pelvetia* and barnacles (MLR.PelB) and *Fucus serratus* (MLR.Fser) on the lower shore before been dominated by the sheltered biotopes. Coralline rockpools were recorded from the north east also. Transitional mixed biotopes dominated the south shores where barnacles (ELR.BPat) dominated the more exposed higher vertical surfaces of the boulders and *Fucus vesiculosus* (SLR.Fves) dominated the more sheltered areas between. Ephemeral algae (MLR.EntPor) were also recorded.

The sheltered areas also showed typical zonation, with the upper shore characterised by the lichen biotopes, immediately followed by those dominated by *Pelvetia canaliculata* (SLR.Pel), *Fucus spiralis* (SLR.Fspi), *Ascophyllum nodosum* (SLR.Asc) and *Fucus serratus* (SLR.Fserr). The exposed barnacle biotope (ELR.BPat) was also present indicating that the shores are subject to more severe wave action at times. There were well developed mussel beds (SLR.MytX) on the western side of the island between the *Ascophyllum* and *Fucus serratus* biotopes, and forming a transitional area between the sediment biotopes (LGS.BarSnd and LGS.BarSh) of the south west and the sheltered rock biotopes of the west.

### Biotopes found:

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock

MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
LGS.BarSh	Barren gravel and shingle shores
LGS.BarSnd	Barren coarse sand shores

## SensMap intertidal summary report: Shenicks Island

### Site details:

County: Dublin  
Littoral width: 50 to 100m  
Wave exposure: Sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

22 August 2005  
Time: 07:15 to 12:30  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and Particular Interest:

Included in SPA of Skerries Islands group.  
Representative sheltered shore biotopes  
Attached to mainland at extreme low tide

### Uses and Impacts:

Recreational – Access at low tide  
Sewage outfall

### Site Description:

This site includes the extent of Shenicks Island. The island was characterised by sheltered shore rock and mixed substrata biotopes that dominated all but the northern tip of the island. During low water spring tides the west of the island joins up with the strand on the mainland.

The east and south east of the island were characterised by low profile sheltered littoral rock biotopes. The lichen biotopes (code LR.YG and LR.Ver) dominated the upper shore, immediately above the *Pelvetia canaliculata* (SLR.Pel) and *Fucus spiralis* (SLR.Fspi) biotopes. Below this there was a mixed *Fucus vesiculosus* (SLR.Fves) and *Ascophyllum nodosum* (SLR.Asc) biotope. A narrow band of barnacles (ELR.BPat / MLR.FvesB) was present between the SLR.Fves / SLR.Asc and the lower *Fucus serratus* biotope (SLR.Fserr) indicating that the shore was somewhere between sheltered and moderately exposed. A kelp biotope (MIR.Ldig) was recorded from the sublittoral fringe.

The south west coast of the island was characterised by a similar species composition and distribution. However, the substratum was of boulders and cobbles rather than bedrock. Thus, the biotope progression down the shore became LR.YG, LR.Ver, SLR.Pel, SLR.Fspi, SLR.FvesX / SLR.AscX and SLR.FserX where “X” indicates mixed substrata. This side was shallower and did not support the kelp biotopes. The extreme lower shore was characterised by sediment biotopes including *Lanice conchilega* (LGS.Lan).

The west coast was characterised by sediment biotopes that extended to the mainland. The upper shore was dominated by barren cobbles (LGS.BarSh) including small areas with talitrids under rotting seaweed (LGS.Tal). The mid to lower shore was dominated by sand including the *Lanice conchilega* biotope (LGS.Lan).

There was a sewer discharging a discoloured odorous effluent on the west side of the island. The ephemeral green algae biotopes (MLR.Eph) recorded nearby are probably influenced by the discharge.

### Biotopes found:

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
SLR.FvesX	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata
LGS.BarSh	Barren gravel and shingle shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line

## SensMap intertidal summary report: Saint Patricks Island

### Site details:

County: Dublin  
Littoral width: 10 - 50 m  
Wave exposure: Exposed to sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

05 August 2005  
Time: 17.15 to 18.15  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and Particular Interest:

Included in the Skerries Islands SPA  
Good zonation  
Representative  
Abundant seal and bird life

### Uses and Impacts:

Litter and debris  
Fishing – Potting

### Site Description:

This site includes the extent of St. Patricks Island. The island was characterised by exposed shore rock biotopes that dominated all but the south eastern tip of the island. The southeastern part of the island was characterised by the sheltered rock biotopes and the moderately exposed rock biotopes that formed the transition between exposed and sheltered areas.

The relatively high profile east to northeast side of the island, the north and the west of the island was characterised by a low diversity of exposed rock biotopes. These were dominated by the barnacle (ELR.BPat) and mussel (ELR.MytB) biotopes. A narrow band of the black lichen (LR.Ver) was recorded from the upper shore while the extreme upper shore lichen biotope (LR.YG) was present only where birds tended not to colonise. The lower shore and shallow sublittoral was dominated by kelp (MIR.Ldig). The medium profile and relatively wide northern shore allowed for some of the biotopes more characteristic of sheltered and moderately exposed shores to develop as the outer rocks reduced the force of the incoming waves. A mixture of *Fucus serratus* (MLR.Fser) and *Ascophyllum* (SLR.Asc) biotopes developed here. A number of small but well developed mussel beds were also recorded in the lee of exposed rocks on the west side. A cobble storm beach (LGS.BarSh) was recorded from the upper shore of the western side of the island.

The southeastern end of the island was characterised by biotopes typical of sheltered to moderately exposed rock shores. The black lichen (LR.Ver) characterised the upper shore followed closely by a band of *Pelvetia* (SLR.Pel). Depending on the degree of exposure one of a number of biotopes then dominated. The stable sheltered areas were characterised by *Ascophyllum nodosum* (SLR.Asc) or *Fucus vesiculosus* (SLR.Fves), with the more moderately exposed areas dominated by barnacles and *Fucus* (MLR.FvesB). *Fucus serratus* (MLR.Fser) dominated the lower shore with kelp (MIR.Ldig) in the shallow sublittoral. Occasional coralline rockpools (LR.Cor) were also recorded around the island. A large mound of rotting seaweed was recorded from mid shore bedrock to the west of the moderately exposed biotopes.

### Biotopes found:

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)



MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
LGS.BarSh	Barren gravel and shingle shores

## SensMap intertidal summary report: Rockabill Island

### Site details:

Littoral width: 1 - 10 m  
Wave exposure: Exposed to moderately exposed  
Salinity: Full (30-40 ppt)

### Survey dates:

13 October 2005  
Time: 12.15 to 15.00  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation Particular Interest:

Forms the Rockabill SPA  
Good zonation  
Representative  
Abundant seal and bird life

### Uses and Impacts:

Lighthouse  
Fishing - Potting  
Site Description:

### Site Description:

This site includes the extent of the two small islands of Rockabill. The islands were characterised by exposed shore rock biotopes that dominated all but a small area to the southwest of the northern island and a few scattered patches around the south island. These areas were characterised by the moderately exposed shore rock biotopes.

All areas were relatively high profile but were not characterised by sheer cliffs. The extensive bird colonies that nest on Rockabill during the summer months, and the input of nutrients associated with the colony, inhibit lichen growth. Thus Rockabill is unusual in that only scattered yellow lichens (LR.YG) were recorded from the extreme upper shore and the black lichen biotope (LR.Ver) was predominantly absent. The upper shore was characterised by the barnacle and limpet biotope (ELR.BPat) that formed an almost unbroken band around each island. Below the ELR.BPat biotope, the mussel biotope (ELR.MytB) formed a wider band which was also almost unbroken around each island. The shallow sublittoral was characterised by a broken and patchy band of kelp (MIR.Ldig). Coralline rockpools (LR.Cor), and the kelp and furoid rockpools (LR.FK) were also recorded from both sides of the south island. The steps on each side of the south island were characterised by ephemeral algae (MLR.Eph). Two red algae biotopes were also recorded. There was a short band on the eastern side of the south island, between the ELR.BPat and ELR.MytB biotopes characterised by *Palmaria palmata* (MLR.Pal). The flatter areas of the southern tip were characterised by *Mastocarpus stellatus* (MLR.Mas). While *Mastocarpus stellatus* and *Chondrus crispus* were recorded elsewhere on the island it was only on the south that it was considered to be of an abundance where a specific biotope could be assigned. A small area of the southwestern area of the northern island appeared less exposed than other parts of the islands and was characterised by a furoid growth in association with the mussel biotope. It was possible that this was a summer growth and may be dislodged during the winter months. However, a biotope of *Fucus serratus* on moderately exposed lower eulittoral rock (MLR.Fser) was assigned to the area.

### Biotopes found:

LR.YG	Yellow and grey lichens on supralittoral rock
LR.FK	Furoids and kelps in deep eulittoral rockpools
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)

MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
MLR.Mas eulittoral rock	<i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very to moderately exposed lower
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock

## SensMap intertidal summary report: Lambay Island

### Site details:

Littoral width: 1 - 50 m  
Wave exposure: Very exposed to sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

18 August 2005  
Time: 16.30 to 18.30  
Surveyors: Damian Allen, Anke Struve, John Brophy

19 August 2005  
Time: 15.30 to 18.00  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and Particular Interest:

Forms both the Lambay Island SPA and SAC  
Good zonation  
Representative  
Both very exposed and sheltered habitats present

### Uses and Impacts:

Mooring/launching/beaching  
Recreational - private  
Litter and debris – including dumping off cliffs  
Fishing – Potting

### Site Description:

This site includes the full extent of Lambay Island. Very exposed cliffs characterised by the exposed littoral rock biotopes dominated the north and east of the island. Lower profile rock shores characterised by the moderately exposed rock biotopes dominated to the south, while sheltered rock biotopes dominated to the south west and north west of the island. Beaches characterised by muddy sand biotopes dominated the area just to the south of the harbour on the west coast.

There was little variation in the zonation along the length of the cliffs to the north and east of the island. The upper zone was characterised by relatively wide lichen biotopes (LR.YG and LR.Ver). Immediately below this was the zone characterised by barnacles and the limpet *Patella vulgata* (ELR.BPat) that was more or less continuous along the length of the cliffs. Below the ELR.BPat biotope was the zone characterised by mussels (ELR.MytB). The ELR.MytB biotope characterised the more extremely exposed areas and was replaced by a wider band of ELR.BPat where it was less extremely exposed. The slightly less exposed areas were also characterised by a band of *Pelvetia canaliculata* (MLR.PelB) in the ELR.BPat zone, or by the red seaweed *Palmaria palmata* (MLR.Pal) below the ELR.BPat zone. The infralittoral fringe and shallow sublittoral was characterised by the kelp biotope MIR.Ldig along almost the entire length of the cliffs.

There was a moderately exposed transition zone between the exposed east and sheltered south west of the island. This was characterised by the lichen biotopes at the top of the shore followed the upper sheltered shore biotope of *Pelvetia canaliculata* (SLR.Pel), a combined barnacle and *Fucus vesiculosus* biotope (MLR.FvesB), the exposed shore mussel biotope (ELR.MytB) and kelp (MIR.Ldig). The ephemeral algae biotopes of MLR.Rho and MLR.Eph were also recorded in this area.

The south western rocky shore showed typical sheltered shore zonation. The shore was characterised by the upper lichen biotopes, quickly followed by the biotopes dominated by *Pelvetia canaliculata* (SLR.Pel), *Fucus spiralis* (SLR.Fspi), *Fucus vesiculosus* (SLR.Fves) or *Ascophyllum nodosum* (SLR.Asc), *Fucus serratus* (SLR.Fserr) and kelp species (SIR.Lsac.Ldig). The north western sheltered rocky shore was characterised in a similar manner with the only notable difference being the absence of the *Fucus vesiculosus* biotope where the more stable *Ascophyllum nodosum* dominated. The extreme south western shore was dominated by a mixed cobble and bedrock substratum. Similar sheltered

biotopes were recorded from this area as the rocky shore. However, as mixed substrata they were recorded as SLR.AscX and SLR.FserX accordingly.

The west of the island south of the pier was characterised by a number of substratum types. Cobble beaches (LGS.BarSh) dominated the upper shores, with a beach dominated by the lugworm (LMS.MacAre) immediately below, and *Lanice conchilega* (LGS.Lan) dominating the extreme lower sediment shore. Sheltered rock biotopes were also present here. The sediment within the harbour walls was also characterised by LMS.MacAre, with the upper strandline containing rotting seaweed (LGS.Tal).

**Biotopes found:**

LR.YG	Yellow and grey lichens on supralittoral rock
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
MLR.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
LMS.MacAre	<i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand shores
LGS.BarSh	Barren gravel and shingle shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line

## SensMap intertidal summary report: Irelands Eye

### Site details:

Littoral width: 1 - 50 m  
Wave exposure: Very exposed to sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

18 September 04 August 2005  
Time: 17.45 to 19.15  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and Particular Interest:

Forms both the Ireland Eye SAC and SPA  
Varied exposure  
Good zonation  
Representative

### Uses and Impacts:

Recreational – day trips  
Litter and debris  
Fishing – Potting

### Site Description:

This site includes the full extent of the island of Irelands Eye. Cliffs characterised by the exposed and moderately exposed littoral rock biotopes dominated the north and east of the island. Lower profile rock shores characterised by the moderately exposed rock biotopes dominated to the south east littoral extension to the main island, while sheltered rock biotopes dominated to the south west behind the moderately exposed area. Beaches characterised by gravels, sands and barren cobbles dominated much of the west coast of the island.

There was a degree of variation in the zonation along the length of the cliffs to the north and east of the island. The upper zone was generally characterised by relatively wide lichen biotopes (LR.YG and LR.Ver) except in the bird colonies that prevented lichen growth. Immediately below this was the zone characterised by barnacles and the limpet *Patella vulgata* (ELR.BPat) that was more or less continuous along the length of the cliffs. Below the ELR.BPat biotope was the zone of most variation. The mussel biotope (ELR.MytB) characterised what was probably the slightly more exposed areas to the east of the island while the slightly less exposed areas to the north were characterised by the red seaweed *Palmaria palmata* (MLR.Pal). There were also areas that contained either both or none of these two biotopes. The infralittoral fringe and shallow sublittoral was characterised by the kelp biotope MIR.Ldig along almost the entire length of the cliffs.

The littoral extension to the south of the island provided a different level of wave exposure. The east facing side of the extension was characterised by the moderately exposed biotope of *Pelvetia canaliculata* (MLR.PelB) followed by the barnacle and limpet biotope (ELR.BPat) and kelp (MIR.Ldig) which underwent a transition to the sheltered kelp biotope (SLR.LsacLdig) before being replaced by *Fucus serratus* in the shallower east side. Behind this moderately exposed barrier on the west side of the island, the rock habitats were characterised by mixed mid to lower shore sheltered rock biotopes (SLR.Fves, SLR.Asc, SLR.Fserr). The rock areas on the west coast and the sheltered area around the jetty behind the sea stack to the northwest of the island were characterised by typical sheltered rock zonation (SLR.Pel, SLR.Fspi, SLR.Fves, SLR.Asc, SLR.Fserr). There was also a cobble beach (LGS.BarSh) with rotting seaweed and talitrids (LGS.Tal) on the west coast that was joined by a gravel and sand beach (LGS). Ephemeral green and red algae (MLR.EntPor) were present in the sand and gravel cove to the north east of the island.

### Biotopes found:

LR.YG Yellow and grey lichens on supralittoral rock  
LR.Ver *Verrucaria maura* on littoral fringe rock  
ELR.MytB *Mytilus edulis* and barnacles on very exposed eulittoral rock

ELR.BPat eulittoral rock	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered,
MLR.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
MLR.EntPor rock	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock
LGS	Littoral gravels and sands
LGS.BarSh	Barren gravel and shingle shores
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line

## SensMap intertidal summary report: Pucks Rocks to the Baily Lighthouse

### Site details:

Littoral width: 1 - 10 m  
Wave exposure: Very exposed  
Salinity: Full (30-40 ppt)

### Survey dates:

03 August 2005  
Time: 16.30 to 18.00  
Surveyors: Damian Allen, Anke Struve, John Brophy

### Conservation and Particular Interest:

Forms the Howth Head SAC and SPA  
Good zonation  
Representative

### Uses and Impacts:

Recreational – Cliff walk  
Fishing – Potting  
Litter and debris

### Site Description:

This site extends from the Baily Lighthouse at the southern end of Howth Head, to the Puck Rocks at the northern end. Very exposed cliffs characterised by the exposed littoral rock biotopes dominate the site.

There was little variation in the zonation along the length of the cliffs. The upper zone was characterised by relatively wide lichen biotopes (LR.YG and LR.Ver). Immediately below this was the zone characterised by barnacles and the limpet *Patella vulgata* (ELR.BPat) that was more or less continuous along the length of the cliffs. Below the ELR.BPat biotope was the zone characterised by mussels (ELR.MytB). The ELR.MytB biotope characterised the more extremely exposed areas and was replaced by a wider band of ELR.BPat where it was less extremely exposed. The infralittoral fringe and shallow sublittoral was characterised by the kelp biotope MIR.Ldig. along almost the entire length of the cliffs.

Other, smaller biotopes recorded included an area of barren shingle (LGS.BarSh) with a talitrid zone under rotting seaweed (LGS.Tal) and ephemeral algae (MLR.Eph) in Freshwater Bay. There were also small areas characterised by *Pelvetia canaliculata* (MLR.PelB), red seaweeds (MLR.R) and by *Corallina officinalis* (ELR.Coff).

### Biotopes found:

LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
ELR.BPat	Barnacles and <i>Patella</i> spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
ELR.Coff	<i>Corallina officinalis</i> on very exposed lower eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.R	Red seaweeds (moderately exposed shores)
MLR.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LGS.BarSh	Barren gravel and shingle shores



## SensMap intertidal summary report: Sutton sailing club to Fingal south border

### Site details:

Littoral width: 100-500 m  
Wave exposure: Sheltered  
Salinity: Full (30-40 ppt)

### Survey dates:

22 August 2005  
Time: 06.45 to 10.30  
Surveyors: Damian Allen, Anke Struve

### Conservation and Particular Interest:

Forms part of the North Bull Island SPA and the North Dublin Bay SAC  
Extensive mussel beds  
Mixed substrata  
Uses and Impacts:  
Mooring/launching/beaching  
Recreational – Sailing club  
Litter and debris

### Site Description:

This site extends from the Sutton Sailing Club to the Fingal border with Dublin City Council. The biotopes in this area are influenced by Bull Island, with sheltered sedimentary biotopes dominant. Fucoid biotopes generally dominated any hard substrata such as groynes and seawalls present.

Sheltered muddy sand, mud and sand biotopes dominate this site. The biotopes characterised by *Lanice conchilega* in sand (LGS.Lan) was recorded along much of the extreme lower shore. The mid shore on the west side was characterised by well developed mussel beds on mud. While the mussel beds developed on muddy sand or mud, their stabilising influence allows for a hard substratum classification in some literature (SLR.MytX). *Lanice* and mussels became sparse towards the drier north of the site and were replaced with littoral sand that had low abundance and diversity of organisms. The mid to upper shore of the northern part of the site was characterised by lugworms in muddy sand (LMS.MacAre). The extreme upper shore in the northern section was characterised by barren cobbles (LGS.Bar.Sh) and a narrow band of *Fucus vesiculosus* on cobbles (SLR.FvesX). There were also areas characterised by talitrid amphipods in decomposing seaweed on the strandline (LGS.Tal).

The groynes extending seaward near the Sutton Sailing Club showed typical sheltered littoral rock zonation. A narrow *Pelvetia canaliculata* biotope (code SLR.Pel) was recorded on the upper part of the groyne followed immediately by a *Fucus spiralis* zone (SLR.Fspi), and either an *Ascophyllum nodosum* (SLR.Asc) or *Fucus vesiculosus* (SLR.Fves) zone. Further down the shore there is a mixed substratum area dominated by *Fucus serratus* (SLR.FserX).

### Biotopes found:

MLR.Eph Ephemeral green or red seaweeds (freshwater or sand-influenced)  
SLR.Asc *Ascophyllum nodosum* on very sheltered mid eulittoral rock  
SLR.Fspi *Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock  
SLR.Fves *Fucus vesiculosus* on sheltered mid eulittoral rock  
SLR.Pel *Pelvetia canaliculata* on sheltered littoral fringe rock  
SLR.FvesX *Fucus vesiculosus* on mid eulittoral mixed substrata  
SLR.MytX *Mytilus edulis* beds on eulittoral mixed substrata  
SLR.FserX *Fucus serratus* on lower eulittoral mixed substrata  
LGS Littoral gravels and sands  
LGS.Lan Dense *Lanice conchilega* in tide-swept lower shore sand  
LGS.BarSh Barren gravel and shingle shores  
LGS.Tal Talitrid amphipods in decomposing seaweed on the strand-line  
LMS.MacAre *Macoma balthica* and *Arenicola marina* in muddy sand shores

**APPENDIX 2 – SUMMARY REPORTS FOR EACH SECTION OF  
THE FINGAL COAST SURVEYED IN 1998/1999**

## SensMap intertidal summary report: Balbriggan to Skerries:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Sub-coastal type: Linear coast  
Littoral width: 10 - 100 m  
Aspect: North  
Wave exposure: Moderately exposed  
Tidal streams: Negligable  
Salinity: Full (30-40 ppt)

### Survey dates:

28 April 1998  
Time: 06:15 to 08:20  
Surveyors: Louise Collier, Chris Emblow  
29 April 1998  
Time: 06:20 to 08:10  
Surveyors: Louise Collier, Chris Emblow  
30 April 1998  
Time: 07:50 to 09:30  
Surveyors: Louise Collier, Chris Emblow  
29 April 1999  
Time: 17:00 to 19:32  
Surveyors: Louise Collier, Chris Emblow  
30 April 1999  
Time: 16:00 to 16:35  
Surveyors: Louise Collier, Chris Emblow

### Particular Interest:

Others  
Red algae  
Brown algae

### Conservation:

High biotope richness

### Geology:

Metamorphic

### Uses and Impacts:

Recreational - Water sports  
Recreational - Popular beach  
Recreational - Marina  
Litter and debris  
Sewage discharge  
Coastal defence - Groynes  
Coastal defence - Sea walls  
Collection – Shellfish

### Site Description:

The site begins south of Issacs Bower in Balbriggan. There is a patch of sand on the upper shore here dominated by LGS.Tal and LGS.BarSnd. Below this jagged and broken rock strata supports ELR.BPat.Sem, SLR.FserX, with MLR.R.R, SIR.L.Sac.Ldig and MIR.LdigLdig on the lower shore. A rich red algal zone supports a variety of species such as *Porphyra*, *Ceramium*, *Palmaria*, *Chondrus*, *Mastocarpus*, *Lomentaria*, *Rhodothamionella*, *Phycodrys rubens*, sponges and anemones. There are some narrow bands of SLR.Fspi, SLR.Asc and SLR.Pel on the upper shore. There is extensive *Enteromorpha* throughout the different biotopes and scattered rockpools (LR.FK). SIR.L.sacL.dig occurs in a more sheltered sandy inlet. *Nucella lapillus* is abundant on rocks, which is broken up with shelly gravel between rock outcrops. There are small patches of *Sabellaria alveolata* throughout.

There are extensive fucoid rockpools with sand, containing *Laminaria digitata*, red weeds and fucoids in between increasingly folded rock strata. Higher up the shore rockpools are more coralline in nature with *Bifurcaria*, *Corallina* and *Sabellaria*. There are sparse patches of fucoid zones. Further south the *Laminaria* zone is not as extensive and MLR.Fser.R occurs. Further south an area with extensive runoff contains MLR.Myt on boulders. South of this is more sheltered and supports SLR.L.sac.L.dig, SLR.Fves and SLR.Asc. An elevated pile of boulders supports a complex mixture of biotopes such as SLR.Fser.X, ELR.BPat. Sem, SLR.Asc, SLR.Pel, SLR.Fves. Relative abundance of *Laminaria digitata* and *Laminaria saccharina* depend on exposure. South of this boulders are more predominant and there is extensive washed up weed in the area. The predominant biotopes are SLR.FserX, and SIR.LsacLdig. This is progressively replaced by a beach (LGS.AP, LGS.BarSnd and LGS.BarSh) with a series of groynes used to stabilise sand in the past. There are plenty of *Arenicola* casts and occasional *Lanice* present here. Patches of boulders and rocks supports MLR.Eph.Por, SLR.Asc. MLR.Rho, MLR.Ept.Ent, MLR.Eph.Por with ELR.BPat.Sem and MIR.Ldig on one patch of lower shore rock. In the SLR.FserX zone here there is a rich under-boulder community with sponges and crabs. There is coastal runoff here and coastal protection in the form of walls, boulders and also rocks enclosed in a mesh. The lower shore consists of muddy sand but the upper shore sand is coarser. Bivalves, *Arenicola* and *Lanice* are abundant on the shore. The beach is replaced by boulders further south supporting MLR. FvesX, MLR.Fser and MIR.LdigLdig on the lower shore. ELR.BPat.Sem becomes more dominant further south. The kelp zone is rich with a profusion of species such as *Laminaria saccharina*, bryozoans, *Mastocarpus*, *Chondrus*, *Palmaria*, Littorinids and sponges. South of this the whole area is complex with a mixture of biotopes on rock and boulders with extensive areas of standing water. Mixtures of *Fucus vesiculosus* and *Fucus serratus* dominate. However, there are also patches of shingle, LR.YG, SLR.Fspi, SLR.Pel, ELR.BPat.Sem and SLR.Asc. Zonation is quite clear and there are rich assemblages of species throughout. One coralline rockpool contained *Codium*.

Further south *Laminaria digitata* is not as abundant, with a MLR.R.Osm zone developing. The whole area is comprised of boulders and running water between rock outcrops and a complex mixture of biotopes such as ELR.BPat.Sem, MLR.Fser, Fser.Fser.Bo, SLR.Fves and SLR.Asc. There are sparse patches of LR.Ver and LR.YG, and barren sand and shingle for much of the upper shore. Lower shore rockpools support *Bifurcaria bifurcata* and *Dictyota dichotoma* with a mixture of coralline and fucoid rockpools throughout. Red algae such as *Dumontia contorta*, *Gelidium*, *Lomentaria* and *Osmundea* are common throughout. There were people present on the shore collecting littorinids, which are very abundant here. There are a number of outfalls nearer to Skerries, and drainage channels from the road. There is lots of washed up algae and sewage in one inlet. Green algal pools occur on the upper shore and there are small patches of *Sabellaria*. Nearer to Skerries there is a shingly beach with cobbled patches supporting SLR.Myt.X and MLR.Eph.Ent. There is a dense *Lanice* zone on the lower shore with abundant infauna throughout. Species present include *Angulus tenuis*, *Nephtys* sp., *Arenicola* and *Cerastoderma*. Approaching the harbour, a backing wall supports sparse LR.YG, ELR.Eph.Ent, SLR.Pel, SLR.Fspi and Enteromorpha. Nearer to the pier an *Ascophyllum* zone develops at the bottom of the wall. Below this boulders support *Fucus vesiculosus*. There are extensive boating and recreational activities around Skerries Harbour. There is a slipway on both sides of the pier. There is a small shingle beach south of the pier with abundant driftweed. Uppershore rock here supports ELR.BPat.Sem, SLR.Fves, SURVer and LR.YG. *Angulus tenuis*, *Nephtys* sp. and other polychaetes dominate the lower shore sand, which is coarse with lots of shell debris. South of the beach ephemeral algae covers the biotopes on the rocks. Cobbles and boulders dominate the lower shore. The predominant biotopes here are SLR.EphX SLR.Pel, SLR.Fspi, MLR.Myt.Fves, MLR.MytR, SIR.Ldig, and ELR.BPat.Sem. However, SLR.Pel, LR.YG, LR.Ver and patches of barren sand occur on the upper shore. On the lower shore there is a rich community of red algae especially in the abundant rockpools verging between coralline and fucoid types. *Dumontia*, *Ceramium*, *Lomentaria*, and *Osmundia* are some of the more common species present here with lots of *Bifurcaria bifurcata* and *Dictyota dichotoma* in lower shore pools. Fucoid biotopes in sheltered patches are replaced by MLR.R.Osm on more exposed parts. There is a patch of very dense *Cladophora rupestris* on boulders at one point. There are a few outfalls in the area, and a bathing area south of the Martello Tower. South of this flatter rock allows development of SLR.Fspi and SLR.Asc zones above ELR.BPat.Sem. Steps lead onto the shore where rock strata break up. ELR.EphX occurs on boulders at the beginning of a beach with abundant driftweed and washed up tunicates. *Porphyra* and *Enteromorpha* dominate. The site ends as sandy beach replaces this mixed biotope.

#### **Biotopes found:**

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock some mixed with <i>Fucus vesiculosus</i>
LGS.AP	Burrowing amphipods and polychaetes in clean sand shores
LGS.BarSh	Barren shingle or gravel shores
LGS.BarSnd	Barren coarse sand shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand some also contains dense <i>Angulus tenuis</i>
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LMS.MacAre	<i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand shores
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools. Maybe with <i>Cystoseira</i> . Also contained <i>Codium</i> and <i>Anemonia viridis</i> .
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MIR.Ldig.Ldig	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.Fser.Fser	Dense <i>Fucus serratus</i> on moderately exposed to very sheltered lower eulittoral rock
MLR.Fser.Fser.Bo	<i>Fucus serratus</i> and under-boulder fauna on lower eulittoral boulders
MLR.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.MF	<i>Mytilus</i> (mussels) and fucoids (moderately exposed shores)
MLR.MytFR	<i>Mytilus edulis</i> , <i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.MytFves	<i>Mytilus edulis</i> and <i>Fucus vesiculosus</i> on moderately exposed mid eulittoral rock
MLR.Osm	<i>Osmundea</i> ( <i>Laurencia</i> ) <i>pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
MLR.XR	Mixed red seaweeds on moderately exposed lower eulittoral rock
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock with some <i>Ascophyllum</i> in one location
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock with <i>Ascophyllum</i> in one location.
SLR.FvesX	Fucoids, barnacles or ephemeral seaweeds (mixed substrata)
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

#### Target Notes:

1. There are lots of kelp rockpools with cobbles and some *Fucus*. Rockpools are more coralline on the upper shore.
2. Lots of *Enteromorpha* occurs on the tops of rocks over ELR.B.Pat.Sem.
3. There is an access point leading onto the shore from a housing estate. There is a sandy channel between rocks.
4. Extensive coralline rockpools occur here. The rock strata is becoming more jagged and *Fucus serratus* is replaced by red algae.
5. There is a stream flowing down onto the rocks.
6. Rockpools are more coralline with *Bifurcaria*. There are also patches of *Sabellaria* and lots of *Anemonia viridis* in one pool.
7. Extensive fucoid rockpools contain lots of sand at the bottom, with extensive red algae and *Ulva*.
8. Patches of *Mytilus* occur where there is runoff, especially around the central channel.

9. There is extensive freshwater runoff over boulders.
10. Freshwater runoff leads to an accumulation of *Enteromorpha* in pools.
11. There are a large number of coralline rockpools due to the folding nature of the bedrock.
12. Some coralline rockpools occur among the rock strata with *Halidrys*, *Bifurcaria* and *Dumontia*. Some patches of *Sabellaria* are also present.
13. A very mixed *Fucus serratus* community is found on a mixed substrate with some red algae and barnacles. Boulders merge into more continuous rock strata further north.
14. There is a massive pile of boulders that is quite elevated. Patches of *Pelvitia caniculata*, *Fucus spiralis*, barnacles and lots of *Nucella* and Littorinids are found here.
15. A sample was taken of *Ceramium* within SIR.L.sac.L.dig. Dense bryozoans and red weeds were also found here.
16. Steps lead down to the shore. Patches of seaweed are washed up onto the shore.
17. Boulders are covered in ephemeral *Enteromorpha* with sparse patches of *Audiouinella* and boulders becoming more sparse. A lot of freshwater seepage occurs over rocks at the top of the beach.
18. There is the presence of groynes used to stabilise sand in the past.
19. Very dense *Rhodothamniella* occurs on bedrock. There is a nice boulder community with *Nucella* eggs, sponges and *Porcelana placides*.
20. Coastal protection is in the form of a wall at the north end of the beach and there is also freshwater runoff in the area.
21. Freshwater runoff occurs to the south end of the beach. Coastal protection is in the forms of rocks in mesh and a wall along the top of the beach.
22. Coastal protection occurs at the top of the shore in the form of large boulders.
23. A beach profile was drawn. A sample was taken high up on the strand. There are lots of bivalves here.
24. A sample was taken at low shore. Lots of *Lanice* and some *Arenicola* casts are present on the beach where sediment is quite muddy.
25. Rockpools here are dominated by fucoids. There are remnants of *Sabellaria*.
26. A sample was collected from the EIR.L.dig.L.dig zone.
27. Broken bedrock and boulders contain lots of standing water between them. The zone is complicated with a mixture of biotopes.
28. There is lots of settlement of young barnacles in ELR.B.Pat.Sem with *Laminaria digitata* in wet patches between the rocks. Rich biotopes and good zonation occurs on the shore.
29. There is development of pools in between ridges of rock bearing *Fucus spiralis*. A coralline rockpool contains *Codium* (sample taken).
30. Lower lying patches of shore contain running water and rockpools.
31. Coralline rockpools are present (LR.Cor) with dense *Dumontia contorta*, fucoids, *Ceramium* sp., *Cladophora rupestris*, *Corallina officinalis*, *Lithothamnion* sp., *Hildenbrandia rubra*, *Actinia equina*, *Patella* and *Enteromorpha* sp.
32. Fucoid rockpools (LR.Fk) are present here and contain lots of *Fucus serratus*, *Laminaria digitata* and *Corallina officinalis*. There are abundant rockpools throughout the area.
33. There is running water through a boulder area here, with patchy and mixed biotopes (*Fucus vesiculosus* and *Fucus serratus*).
34. There is lots of washed up algae and rubbish in a sheltered area here, and possibly sewage waste too.
35. There is extensive runoff in the area coming from the road.
36. There is an outfall here which ends approximately midshore.
37. There is coarse sand between the boulders with mixed biotopes.
38. There is a drainage ditch at the top of the shore leading from the road.
39. There are small patches of *Sabellaria alveolata* here.
40. There is an outfall with liquid draining from it which flows onto a shingly beach. There is also lots of weed washed up onto the shore.
41. There are green rockpools (LR.G) among the *Ascophyllum*, *Fucus spiralis* and *Pelvitia caniculata* zones.
42. There is an outfall at the beginning of the beach.
43. There is an outfall halfway along the beach.
44. There is a patch of *Mytilus edulis* among dense *Enteromorpha*.
45. There is an outfall here.
46. A sample was taken here on the lower shore. It contained bivalves (*Angulus tenuis*) and *Lanice conchilega*.















47. A sample was collected midshore and contained *Nephtys* sp. and *Arenicola marina*.
48. A sample of coarse sand was collected from the lower shore and this contained *Lagis koreni*, *Cerastoderma edule*, *Nephtys* sp., *Lanice conchilega* and a brittlestar.
49. Profile of wall at the back of the beach beside the harbour. There were lots of boats here.
50. There is a slipway north of the pier.
51. There is a slipway south of the pier.
52. A sample was taken on the middle/lower shore and this contained *Angulus tenuis*, *Nephtys* sp., and other polychaetes. The sample consisted of coarse sand and shell debris.
53. There are abundant lower shore rockpools (LR.Fk) containing *Botryllus schlosseri*, *Laminaria digitata*, *Fucus serratus*, *Dumontia contorta*, *Nucella lapillus*, *Laminaria saccharina*, encrusting coralline crusts, *Ceramium* sp., *Bifurcaria bifurcata* and other red algae.
54. There are rockpools here which are a combination of LR.FK and LR.Cor. They contain lots of *Corallina officinalis*, *Bifurcaria bifurcata*, *Laminaria digitata*, *Fucus serratus*, *Laminaria saccharina*, coralline crusts, *Dumontia contorta*, Littorinids, *Ceramium* sp., *Dictyota dichotoma*, *Chondrus crispus* and some *Cladophora rupestris*.
55. There is a disused outfall here.
56. There is an outfall south of a Martello tower.
57. There is a green rockpool (LR.G) on the upper shore.
58. There is an old bathing place here with lots of *Enteromorpha* in the vicinity.
59. There are steps leading onto the beach covered in *Fucus spiralis* and *Enteromorpha*. The rock strata breaks up here.

**Photographs taken:**

1. Facing south
2. Of folding rock strata, facing east
3. Facing north
4. Of *Enteromorpha* on rocks facing west off beach
5. Facing north
6. Facing north (beach)
7. Facing north (boulders)
8. Facing north
9. At beginning (south) facing north.
10. North from Skerries
11. Facing south towards Skerries
12. South towards Skerries, broken bedrock with ELR.BPat.Sem and ELR.Fves.
13. Old bicycle on shore with *Ascophyllum nodosum*.
14. Beach north of Skerries
15. Outfall north of Skerries
16. Very dense *Lanice conchilega*.
17. Very dense *Lanice conchilega* towards the harbour.
18. View west towards Skerries Harbour
19. *Mytilus* and Red algae biotope.

## Maps

### LEGEND

-  Exposed littoral rock
-  Moderately exposed littoral rock
-  Sheltered littoral rock
-  Littoral gravels and sands
-  Littoral muddy sands
-  Littoral muds
-  Littoral mixed sediments
-  Littoral rock
-  Exposed infralittoral rock
-  Moderately exposed infralittoral rock
-  Sheltered infralittoral rock
-  Unclassified
-  Target notes
-  Photographs



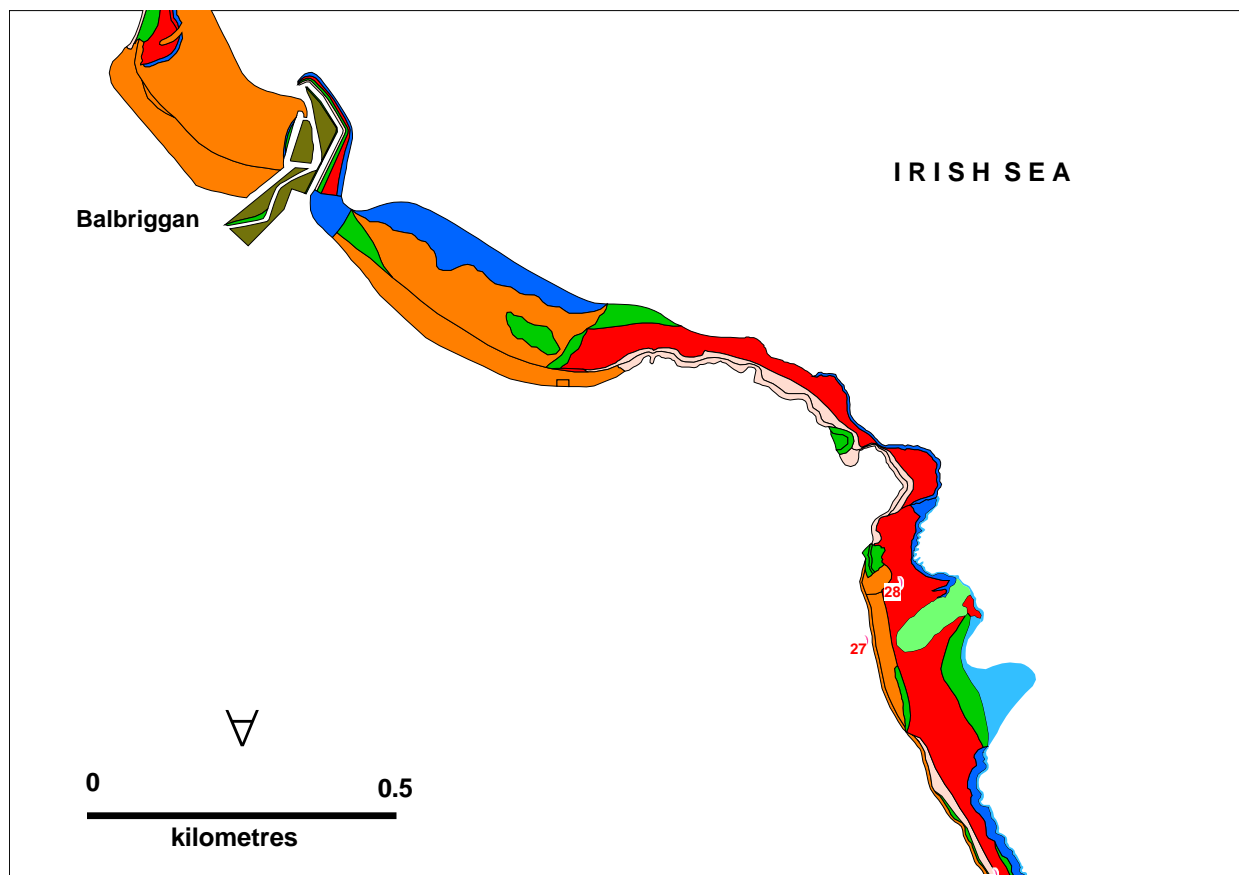


Figure 1. Littoral biotopes (higher biotope code) between Balbriggan and Skerries (Map 1).



Figure 2. Littoral biotopes (higher biotope code) between Balbriggan and Skerries (Map 2).

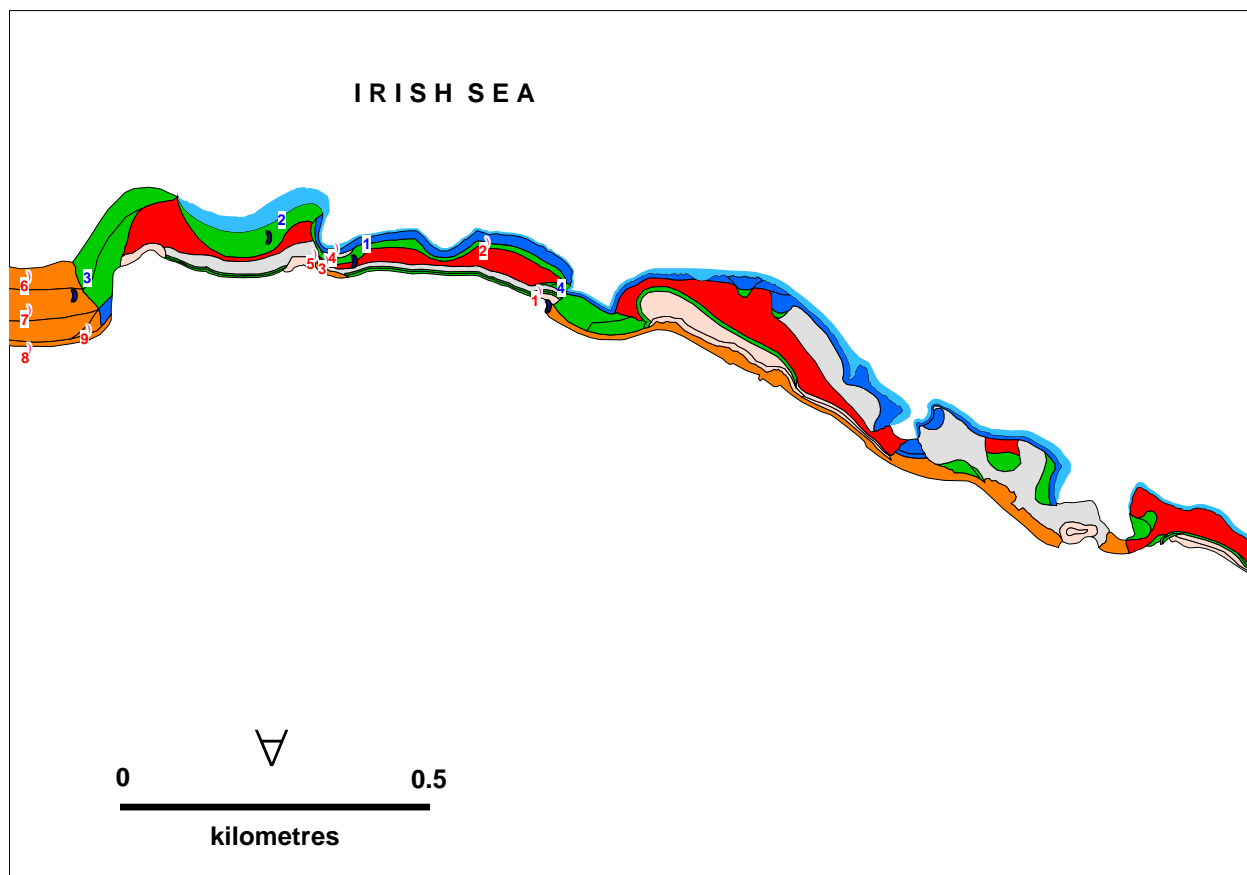


Figure 3. Littoral biotopes (higher biotope code) between Balbriggan and Skerries (Map 3).

## SensMap intertidal summary report: Skerries to Loughshinny:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Position derived: Ordnance Survey  
Sub-coastal type: Linear coast  
Littoral width: 10 - 100 m  
Aspect: East  
Wave exposure: Moderately exposed  
Tidal streams: Negligable  
Salinity: Full (30-40 ppt)

### Survey dates:

30 April 1999  
Time: 16:30 to 18:35  
Surveyors: Louise Collier, Chris Emblow  
29 May 1999  
Time: 15:51 to 18:57  
Surveyors: Louise Collier, Mona McCrea  
13 July 1999  
Time: 17:00 to 20:00  
Surveyors: Louise Collier, Mona McCrea

### Uses and Impacts:

Recreational - Wind surfing  
Recreational - Water sports  
Recreational - Popular beach  
Sewage discharge  
Coastal defence - Sea walls

### Site Description:

The site begins on the beach south of Skerries Harbour. This consists of LGS.AP.P containing *Nephtys* sp. and *Scoloplos armiger* with LGS.Tal and barren sand on the upper shore. There are patches of upper shore boulders and a sea wall at one point. At the southern extremity of the beach, a mixed substrata support MLR.Eph.Ent, and ephemeral mixes with *Fucus vesiculosus* and *Mytilus*, with *Lanice* on the sandy patches. South of the beach rock supports SLR.FvesB, SLR.Fves, MLR.Fserr and MIR.Ldig. There are also patches of juvenile *Mytilus edulis* present here. Further south, sparse ELR.BPat.Sem occurs with patches of *Fucus vesiculosus* within this. There are also patches of barren shingle, SLR.Pel, SLR.Fspi, LR.YG and LR.Ver here. Further south, red algae become more common within the *Fucus serratus* zone and there is development of a red algal zone (MLR.R.R) above this. Patches of *Ascophyllum* on rock and mixed substrata occur in patches. The area is characterised by slabs of limestone with a complex matrix of the various biotopes throughout the shore. Patches of *Sabellaria alveolata* occur throughout the biotopes. The rock strata is broken up and replaced by cobbles, boulders and gravel in patches. There are coralline and green rockpools throughout the area. Inside Loughshinney Harbour, fine sand supports dense *Arenicola marina*, with *Nephtys* sp., *Cerastoderma* and *Lanice*. LGS.AP.P supporting *Nephtys* sp. occurs above this. The site ends at Loughshinney harbour.

### Biotopes found:

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
LGS.AP	Burrowing amphipods and polychaetes in clean sand shores
LGS.BarSh	Barren shingle or gravel shores
LGS.BarSnd	Barren coarse sand shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools

LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Ver.Por	<i>Verrucaria maura</i> and <i>Porphyra umbilicalis</i> on very exposed littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock. Small patches
MLR.Fser.Fser	Dense <i>Fucus serratus</i> on moderately exposed to very sheltered lower eulittoral rock
MLR.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock with <i>Osmundea</i> , <i>Chondrus</i> and <i>Palmaria</i>
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock with <i>Mytilus edulis</i>
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
SLR.EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.FvesX	Fucoids, barnacles or ephemeral seaweeds (mixed substrata)
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

#### Target Notes:

1. Profile drawn of beach.
2. Sample taken with very fine sand containing *Nephtys* sp. and other polychaetes.
3. A stream flows onto the shore here.
4. There are three old outfalls on the upper shore (possibly drainage ditches for the road) covered in *Enteromorpha*.
5. There is a stream flowing through a mixed patch of biotopes with barnacles, *Mytilus*, ephemeral algae and patches of *Fucus vesiculosus* and *F.spiralis*.
6. There is extensive standing water between cobbles and boulders with *Chondrus*, *Dumontia*, *Ectocarpus*, *Fucus vesiculosus* and ephemeral green algae with dense *Lanice* on sandy patches between boulders. There are also patches of *Ascophyllum* and driftweed.
7. There are patches of *Sabellaria alveolata* and these are quite widespread in places.
8. There are fucoid rockpools containing *Fucus serratus*, *Fucus vesiculosus*, *Laminaria saccharina*, ephemeral green algae, *Corallina officinalis* and ascidians.
9. There is a stream flowing onto the shore
10. There are coralline rockpools with dense *Corallina officinalis*, *Dictyota dichotoma*, *Gelidium* sp., *Osmundea pinnatifida*, *Dumontia contorta*, and green algae. Littorinids are abundant.
11. There are barren cobbles with driftweed on them at the top of the shore.
12. There is a patch of *Ascophyllum* mixed with *Fucus serratus*, *Fucus vesiculosus* with lots of driftweed.
13. The ELR.BPat.Sem zone is very sparse and poor here with lots of ephemeral green algae throughout.
14. There are green rockpools here (LR.G) with ephemeral algae, *Ceramium* sp., and very sparse coralline crusts and *Corallina officinalis*.
15. There is a patch of *Sabellaria alveolata* here.
16. SLR.FvesX occurs here with *Fucus serratus* and *Ascophyllum nodosum* also present. This is a very mixed area in general with patches of *Sabellaria alveolata*, and fucoids in varying proportions depending on position on the shore.
17. The *Fucus serratus* zone contains lots of red algae, ephemeral algae and extensive driftweed. *Mastocarpus stellatus* is the predominant rhodophyte.
18. There is a coralline rockpool (LR.Cor) in the ELR.BPat.Sem zone containing *Corallina officinalis*, coralline crusts, *Cladophora* sp., ephemeral green algae, *Chondrus crispus* and various littorinid species. The rock stratum was sharply inclined.
19. There is a large cement platform on the upper shore, with an outfall leading onto the lower shore from this. There is a large accumulation of driftweed around this.











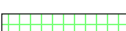



20. There are green rockpools (LR.G) on the upper shore with coralline crusts in them also.
21. There is an outfall on the seaward side of the harbour wall.

**Photographs taken:**

1. View south across beach from Skerries towards Shennicks Isle
2. Outfall on upper shore, towards Shennicks Isle
3. Upper shore cobbles with ephemeral *Enteromorpha*
4. Dense *Mytilus* (juveniles) and barnacles on mixed cobbles and pebbles
5. *Sabellaria alveolata* mound on middle shore
6. Upper shore eroded limestone
7. Facing south towards Loughshinny over a rocky shore with fucoids and lots of *Enteromorpha* with Lambay Island in the distance
8. Photo of Mona on the shore!
9. Patch of *Sabellaria alveolata*
10. Folded rock at Loughshinny.
11. Folded rock at Loughshinny.

## Maps

### LEGEND

-  Exposed littoral rock
-  Moderately exposed littoral rock
-  Sheltered littoral rock
-  Littoral gravels and sands
-  Littoral muddy sands
-  Littoral muds
-  Littoral mixed sediments
-  Littoral rock
-  Exposed infralittoral rock
-  Moderately exposed infralittoral rock
-  Sheltered infralittoral rock
-  Unclassified
-  Target notes
-  Photographs

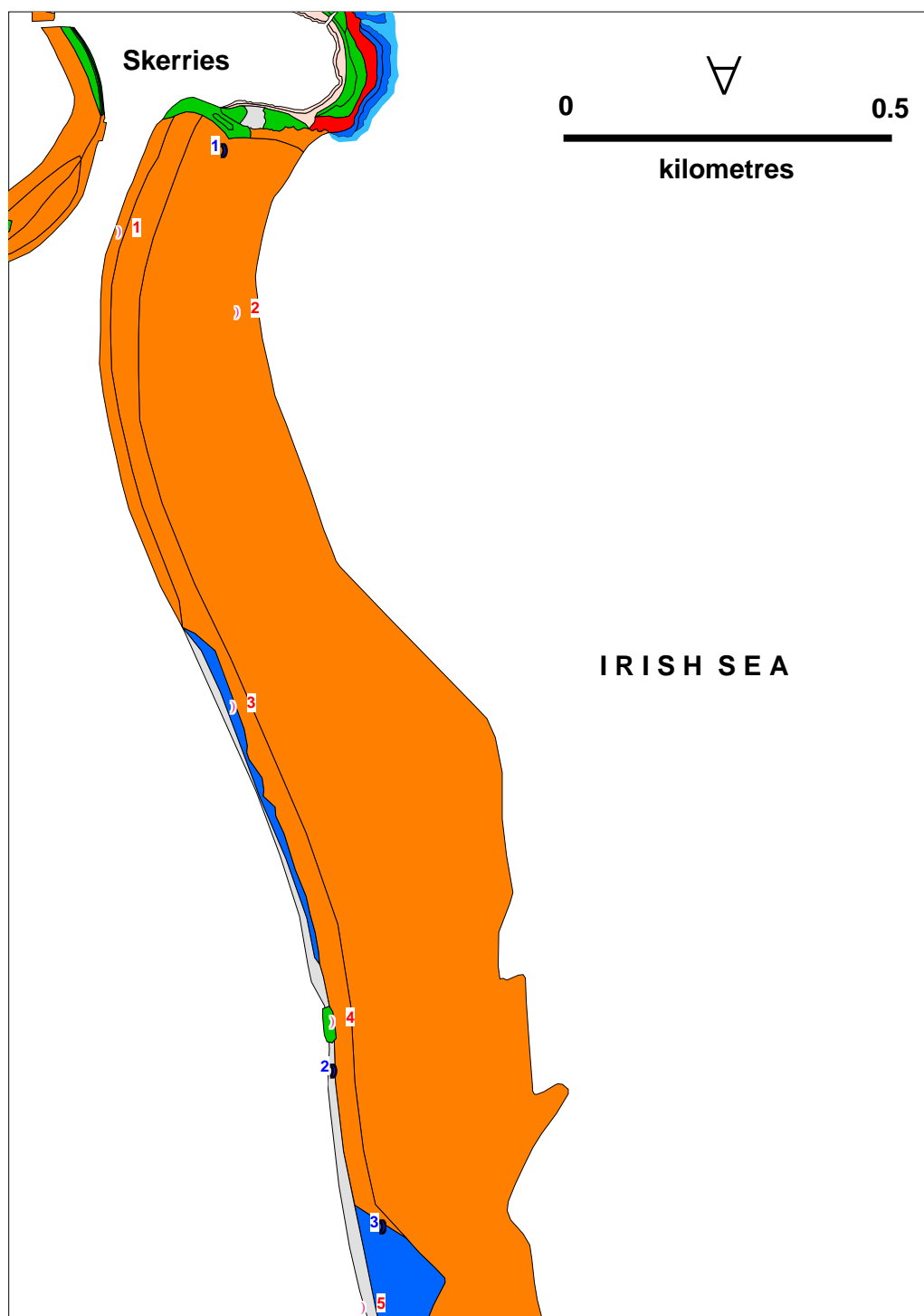


Figure 1. Littoral biotopes (higher biotope code) between Skerries and Loughshinny (Map 1).



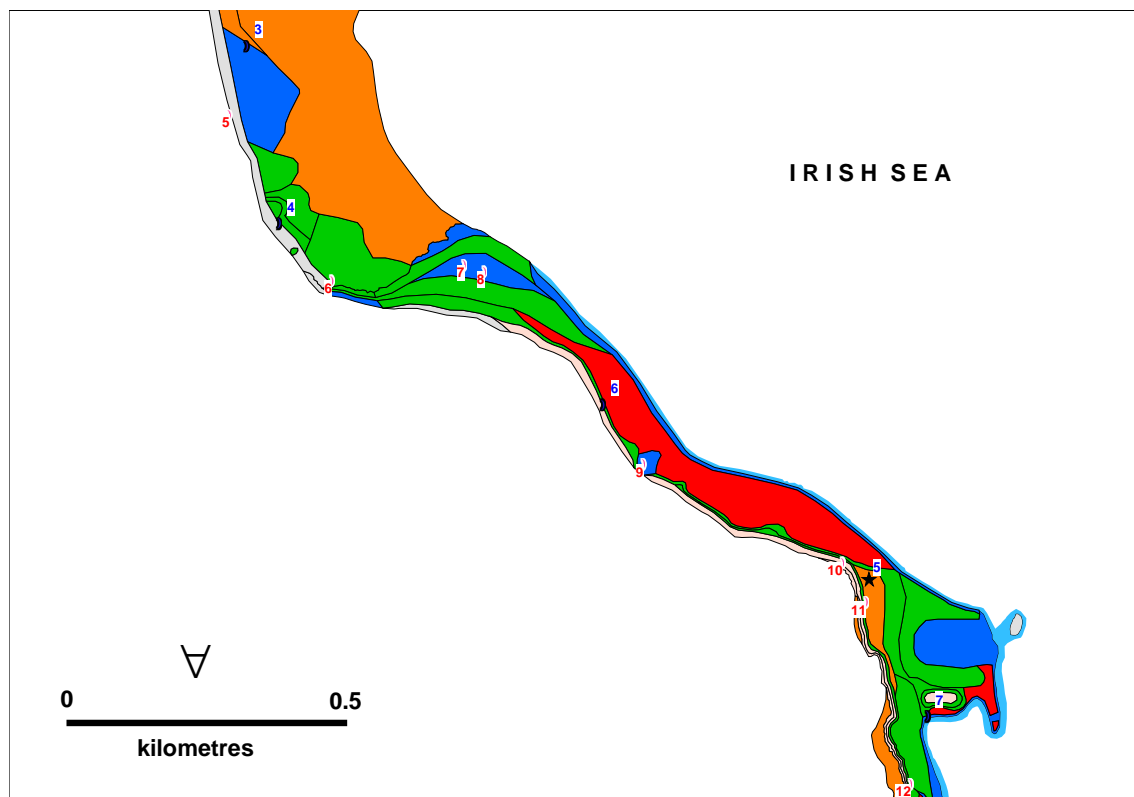


Figure 2. Littoral biotopes (higher biotope code) between Skerries and Loughshinny (Map 2).

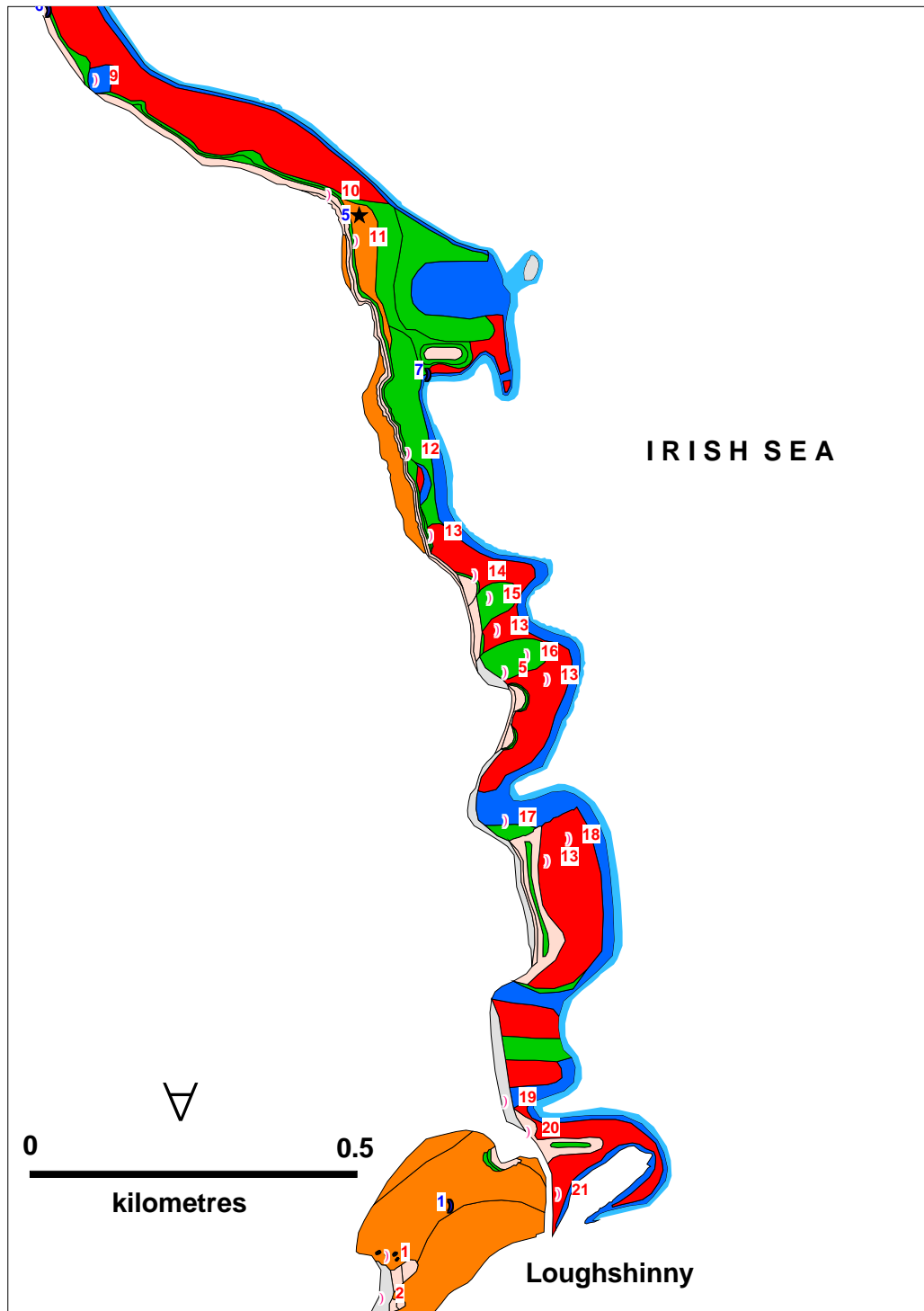


Figure 3. Littoral biotopes (higher biotope code) between Skerries and Loughshinny (Map 3).

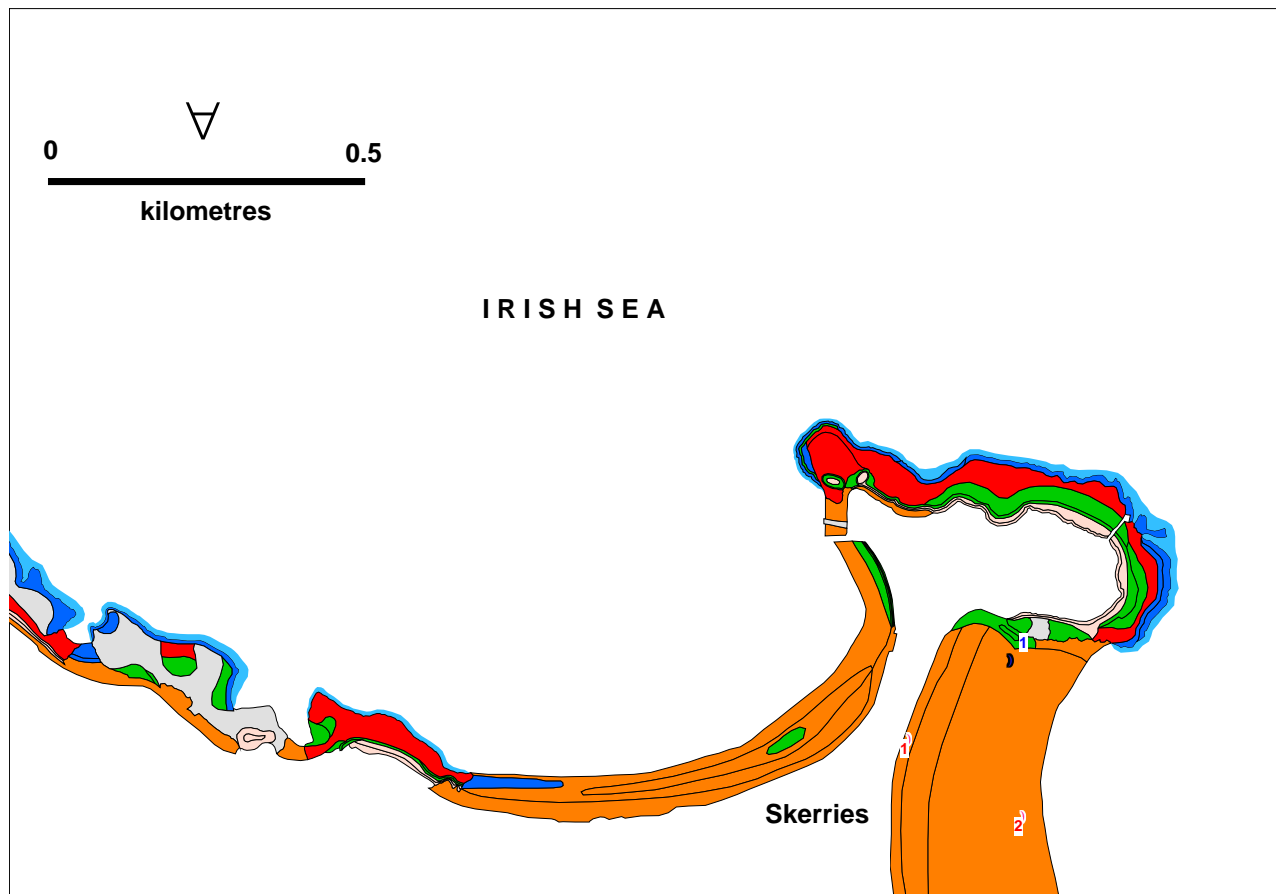


Figure 4. Littoral biotopes (higher biotope code) between Balbriggan and Skerries (Map 4).

## SensMap intertidal summary report: Loughshinny to Portrane:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Position derived: Ordnance Survey  
Sub-coastal type: Linear coast  
Littoral width: 10 - 100 m  
Aspect: East  
Wave exposure: Moderately exposed  
Tidal streams: Negligable  
Salinity: Full (30-40 ppt)

### Survey dates:

14 July 1999  
Time: 17:00 to 20:30  
Surveyors: Louise Collier, Mona McCrea  
15 July 1999  
Time: 07:30 to 09:30  
Surveyors: Mona McCrea

### Geology:

Limestone

### Uses and Impacts:

Recreational - Water sports  
Recreational - Popular beach  
Recreational - Marina  
Litter and debris  
Sewage discharge  
Collection – Shellfish

### Site Description:

The site begins on a beach in Loughshinny harbour. This beach is characterised by dense *Arenicola marina* on the lower shore below LGS.AP.P, LGS.BarSnd and LGS.Tal. There are patches of upper shore rock on the beach supporting LR.Ver, LR.YG, SLR.Fspi, ELR.BPat.Sem and MLR.Fser. This is replaced by rock at Drumanagh Head with SLR.Pel, SLR.Fspi, SLR.Asc, SLR.Fves and MLR.Fser.R on the less exposed sides and ELR.BPat.Sem, MLR.XR, MLR.Osm and MIR.Ldig on the more exposed outer part. Patches of ephemeral algae, LR.Ver, LR.YG and barren cobbles characterise the upper shore throughout. There is a small beach supporting dense *Lanice* and *Arenicola* south of this. Rock strata south of this supports mainly MIR.Ldig, MIR.Ldig.Ldig, MLR.Fser.R, SLR.Fves, SLR.Fspi, ELR.BPat.Sem and LR.Ver mainly with patches of ELR.MytB in patches. Rush beach consists predominantly of LGS.AP.P with a narrow talitrid zone. The rocky headland south of this beach consists of the same rocky biotopes as those found north of here. A large beach extends southwards to Portrane and this consists predominantly of coarse, mobile barren sand. There is a band of LGS.AP.P on the lower shore, LGS.Tal on the upper shore and a small band of LGS.Lan and MLR.Ent where the river enters at Rogerstown Estuary. The beach supports the same biotopes south of the estuary with dense *Arenicola marina* at the southern end of the beach. At Portrane, rock at the southern end of the beach supports LR.Ver, LR.YG, SLR.Fspi, SLR.Fves, MLR.Ent.Por, ELR.MytB and ELR.BPat.Sem.

### Biotopes found:

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
LGS.AP.P	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LGS.BarSh	Barren shingle or gravel shores
LGS.BarSnd	Barren coarse sand shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand

LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LR.Cor.Bif	<i>Bifurcaria bifurcata</i> in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Ver.Por	<i>Verrucaria maura</i> and <i>Porphyra umbilicalis</i> on very exposed littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MIR.Ldig.Ldig	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.Osm	<i>Osmundea</i> ( <i>Laurencia</i> ) <i>pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.R	Red seaweeds (moderately exposed shores)
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.FvesX	Fucoids, barnacles or ephemeral seaweeds (mixed substrata)
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

#### Target Notes:















1. A profile of the rocks was drawn
2. There is folded rock strata on the cliffline, with LR.Ver and LR.YG on this.
3. The shore is shingley with extensive driftweed present.
4. *Scoloplos armiger* was found in a sample taken
5. *Lanice conchilega* are present on the shore.
6. SLR.FvesX occurs on mixed substrata here with *Enteromorpha* sp. and *Fucus serratus* also present.
7. Fucoid rockpools (LR.FK) are present here containing *Laminaria digitata*, *Ectocarpus*, coralline crusts, *Corallina officinalis*, *Fucus serratus* and *Bifurcaria bifurcata*.
8. Green rockpools are present here (LR.G) within the ELR.BPat.Sem zone.
9. Coralline rockpools (LR.Cor) are present, containing ephemeral aglae, *Cladophora* sp. and coralline crusts.
10. There are fucoid pools present (LR.FK) containing *Laminaria digitata*.
11. The red algal zone here is dominated by *Ceramium* sp., *Mastocarpus stellatus*, and some *Osmundea* and *Colpomenia peregrina* occurring on juvenile *Mytilus edulis*. There are also green rockpools present here.
12. Gabions (boulders surrounded by mesh) have been used here for coastal protection.
13. Rockpools (LR.CorBif) here contain *Bifurcaria bifurcata*, *Enteromorpha*, *Chondrus crispus*, *Fucus serratus* and *Corallina officinalis*.
14. There are patches of *Sabellaria alveolata* here.
15. There are fucoid rockpools here (LR.FK) with sand on the bottom.
16. A sample was collected on the lower shore containing *Nephtys* sp., *Scoloplos armiger*, Spionidae, *Lanice conchilega*, *Arenicola marina* and *Chamelea gallina*.
17. There is a small sea wall as coastal defence, with a caravan park behind.
18. There are fucoid pools (LR.FK) present here, containing *Fucus serratus*, *Fucus vesiculosus*, coralline crusts, *Gibbula cinerea*, *Littorina littorea*, *Chondrus crispus*, *Colpomenia*, *Enteromorpha* sp., *Cladophora* sp. and *Mastocarpus stellatus*.
19. A profile was drawn of the north harbour wall.
20. The sediment is slightly anoxic inside the south harbour wall.
21. A profile was drawn of the south harbour wall. There is *Littorina* picking here. There are also green rockpools (LR.G) containing *Littorina littorea*, ephemeral green algae, *Fucus spiralis* and coralline crusts.
22. There is an outfall pipe present here.
23. There is extensive *Enteromorpha* sp. throughout the MLR.Fserr zone.

24. Samples were collected on the middle and lower shore, containing abundant *Angulus tenuis*, some *Nephtys* sp. and *Arenicola marina*.
25. A sample of a saltmarsh plant (*Halimione portulacoides*) was taken here.
26. A lower shore dig consisted of coarse sand and contained no infauna.
27. A lower shore sample was collected containing *Scoloplos armiger*, abundant *Lanice conchilega* tubes and *Enteromorpha* sp.
28. Wet areas consisted of coarse sand, and no infauna was found in samples collected.
29. A sample was collected containing *Crangon crangon* and *Nephtys* sp.
30. A sample was collected containing *Crangon crangon* and *Nephtys* sp.
31. An outfall pipe is located here.
32. *Arenicola* casts, *Cerastoderma edule*, Isopoda, *Lanice* and other polychaetes are present here.
33. Green rockpools (LR.G) are present here.

**Photographs taken:**

1. Folded rock strata.
2. Facing north from Drumanagh, with predominantly barnacles(ELR.BPat.Sem) covered in *Enteromorpha* sp., *Laminaria digitata*.
3. Taken facing south towards Rush, showing boulders, ELR.BPat.Sem, ephemeral algae and fucoids
4. Taken facing north across rocks, boulders supporting ELR.BPat.Sem with ephemeral algae.
5. Rush Harbour
6. Taken from Rush Harbour facing north across beach and rocky outcrops.
7. Facing towards Portraine in the distance

## LEGEND

-  Exposed littoral rock
-  Moderately exposed littoral rock
-  Sheltered littoral rock
-  Littoral gravels and sands
-  Littoral muddy sands
-  Littoral muds
-  Littoral mixed sediments
-  Littoral rock
-  Exposed infralittoral rock
-  Moderately exposed infralittoral rock
-  Sheltered infralittoral rock
-  Unclassified
-  Target notes
-  Photographs

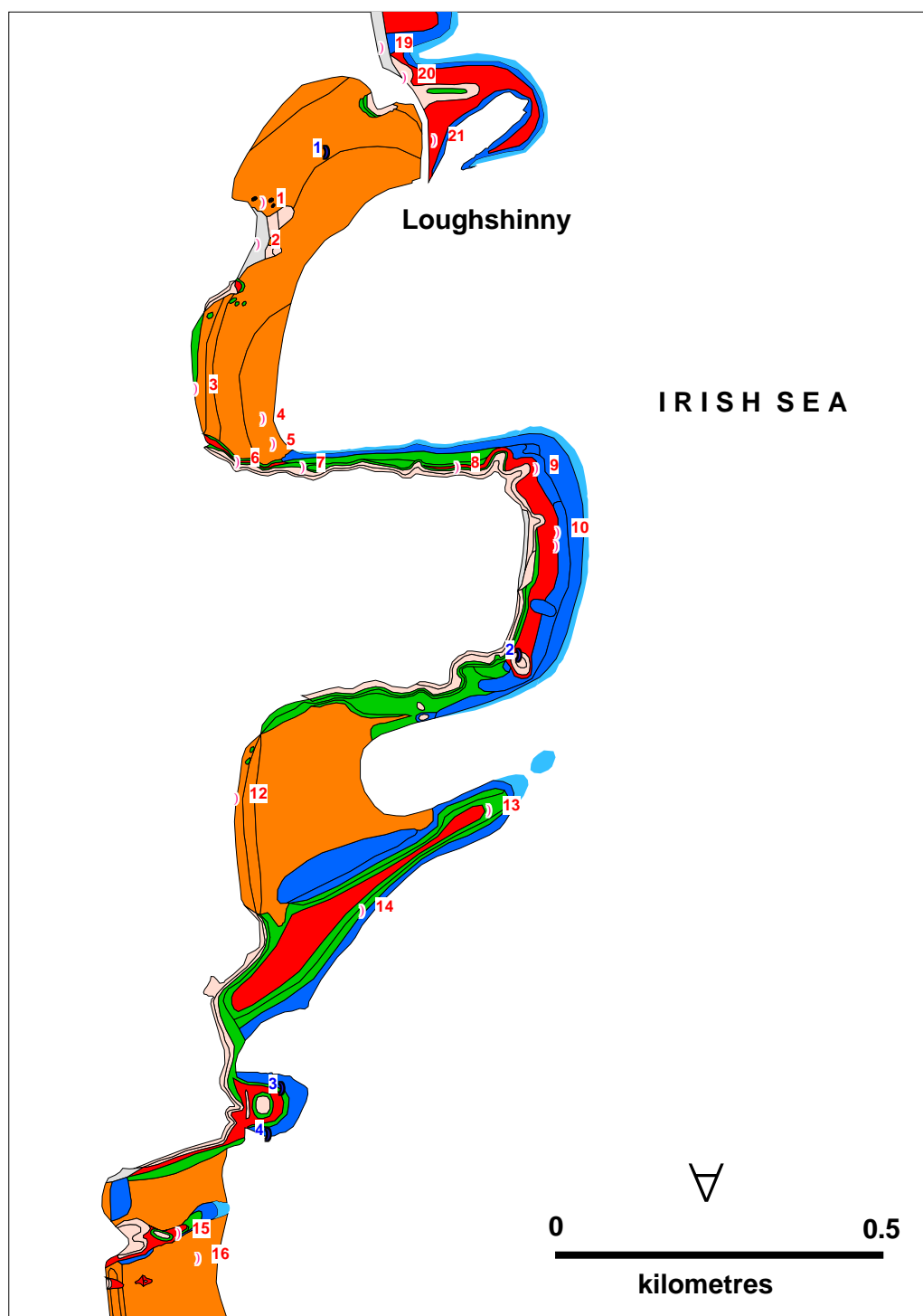


Figure 1. Littoral biotopes (higher biotope code) between Loughshinny to Portrane (Map 1).



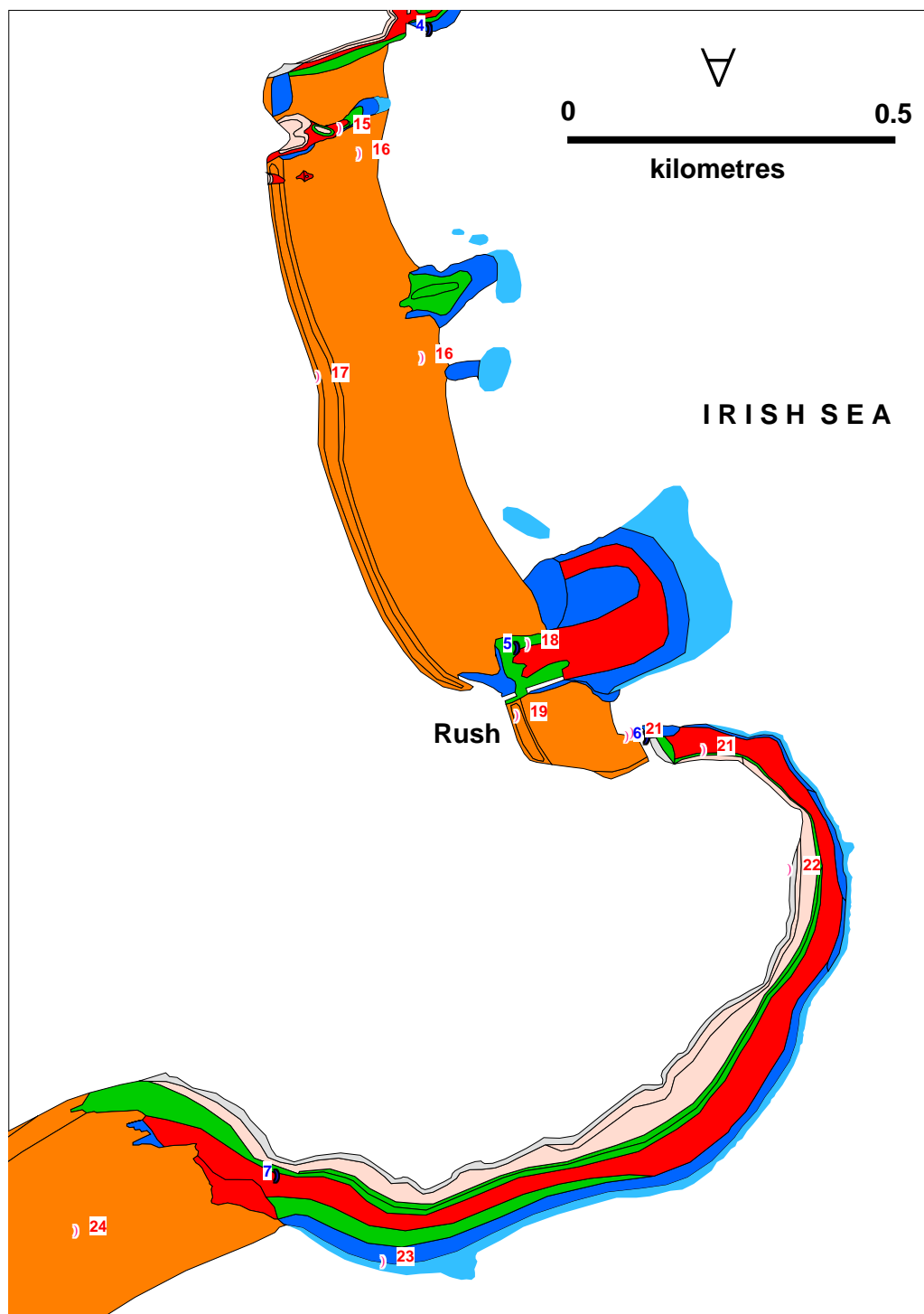


Figure 2. Littoral biotopes (higher biotope code) between Loughshinny to Portrane (Map 2).

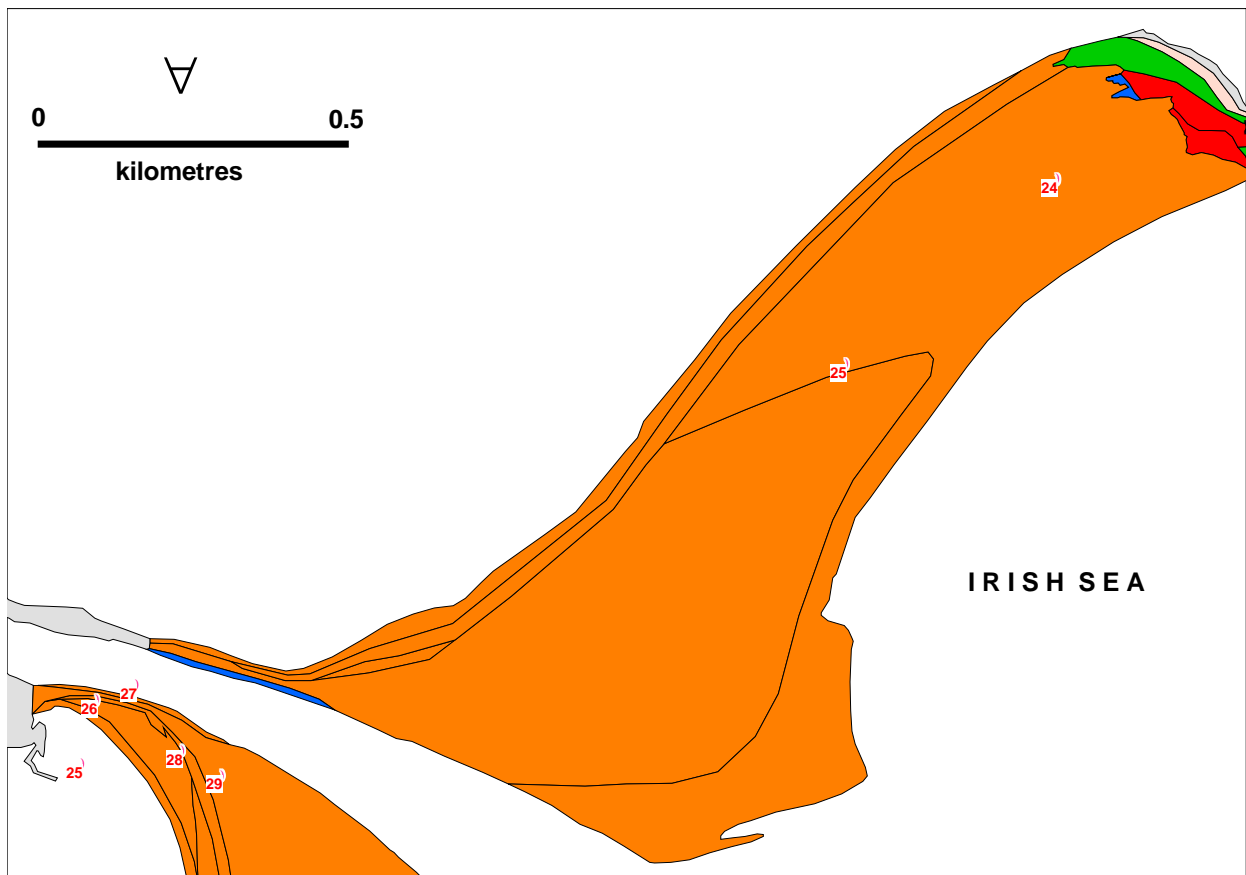


Figure 3. Littoral biotopes (higher biotope code) between Loughshinny to Portrane (Map 3).

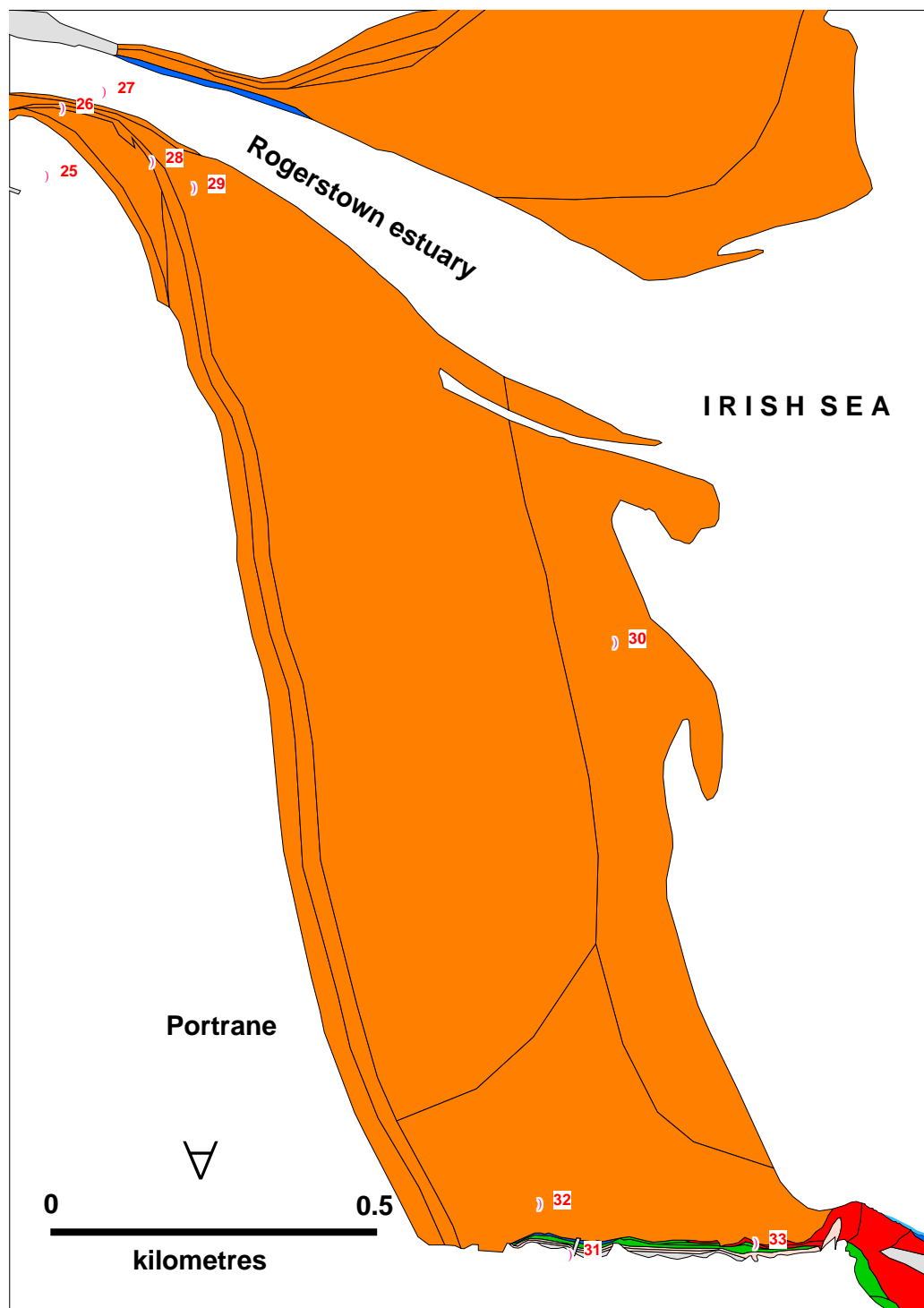


Figure 4. Littoral biotopes (higher biotope code) between Loughshinny to Portrane (Map 4).

## SensMap intertidal summary report: Portrane to Malahide:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Sub-coastal type: Linear coast  
Littoral width: 10 - 100 m  
Aspect: East  
Wave exposure: Moderately exposed  
Tidal streams: Not known  
Salinity: Full (30-40 ppt)

### Survey dates:

12 June 1998  
Time: 07:30 to 09:36  
Surveyors: Louise Collier, Chris Emblow  
26 July 1999  
Time: 16:40 to 20:00  
Surveyors: Leticia Merin, Mona McCrea

### Conservation:

Representative

### Geology:

Igneous  
Granite

### Uses and Impacts:

Sewage discharge

### Site Description:

The site begins at Portrane on rocky shore south of a beach. The rock here is characterised by a mixture of ELR.BPat.Sem, ELR.MytB and ephemeral algae, MIR.Ldig, MLR.XR and MLR.Osm with patches of ephemeral algae, *Ascophyllum* and *Fucus vesiculosus* above this. The area is sand influenced and this allows patches of MLR.Rho, LGS.Lan, LGS.BarSh and LGS.BarSnd in places. LR.Ver and LR.YG are also present. Further south the rock becomes broken up with patches of SLR.Fspi and SLR.Pel and eventually gives way to a long beach, which is characterised by alternative bands of LGS.BarSnd, LGS.AP.P (supporting *Angulus tenuis*) and LGS.Tal on the upper shore. This beach extends as far as the incoming river at where there is a small patch of LGS.Lan and MLR.Ent at Malahide where the site ends.

### Biotopes found:

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
LGS.AP.P	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LGS.BarSh	Barren shingle or gravel shores
LGS.BarSnd	Barren coarse sand shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.Cor.Cys	<i>Cystoseira</i> spp. in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.MF	<i>Mytilus</i> (mussels) and fucoids (moderately exposed shores)

MLR.Osm	<i>Osmundea (Laurencia) pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
MLR.XR	Mixed red seaweeds on moderately exposed lower eulittoral rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock. Mixed with SLR.Fves
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock















#### Target Notes:

1. There were coralline rockpools here (LR.Cor) with very abundant patches of *Cystoseira*, *Ceramium*, *Enteromorpha*, *Corallina officinalis*, *Littorina littorea*, *Hymeniacidon* sp., *Nucella lapillus*, *Dumontia contorta* and *Dictyota dichotoma* were also present.
2. There are dense beds of *Mytilus* and abundant *Littorina littorea*, *Nucella* and big patches of *Osmundea* and *Ceramium* on the lower shore.
3. Very large and deep coralline rockpools (LR.Cor) with *Corallina officinalis*, Corallinaceae crusts, *Hildenbrandia* and *Patella* occurred here.
4. There was scoured bare rock here with sparse ELR.BPat.Sem.
5. Fucoid rockpools (LR.F here contained *Laminaria digitata*, *Ceramium*, *Lithothamnion*, *Enteromorpha*, *Palmaria*, *Fucus serratus*, *Nucella*, *Actinia* and large patch of MLR.Ent.Por.
6. There was very barren scoured rock in the ELR.BPat.Sem zone and abundant *Enteromorpha* on cliffs and in caves.
7. Patchy bare rock here contained ELR.BPat.Sem and sparse *Mytilus* on lower parts. Large patches of MLR.Ent and patches of *Porphyra* occurred in the ELR.BPat.Sem.
8. There is a discharge coming from a wall. There are patches of *Enteromorpha*, *Osmundea* and some *Actinia equina* with ELR.BPat.Sem and a sparse area of *Chondrus crispus*. There are also patches of ELR.Myt.B, *Enteromorpha* and *Laminaria digitata* on
9. Coralline rockpools (LR.Cor) occur in patches with *Chondrus crispus*, *Corallina officinalis*, *Lithothamnion*, *Nucella lapillus*, *Actinia*, *Mytilus*, *Littorina littorea*, *Dumontia*, *Patella* and *Polysiphonia*. A sample of *Polysiphonia* was collected here.
10. There are sparse *Mytilus* beds mixed with ELR.BPat.Sem.
11. A sample was collected containing Terebellidae, *Carcinus maenas* and *Donax vittatus*.
12. A coralline rockpool (LR.Cor) here contained coralline crusts, *Corallina officinalis*, *Littorina littorea*, *Nucella lapillus*, *Ceramium* sp., *Dictyota dichotoma*, *Ulva* sp. and *Enteromorpha* sp.
13. There were green rockpools (LR.G) within the ELR.BPat.Sem.
14. There is an outfall pipe located here.
15. *Angulus*, *Donax*, Spionidae and Nephtyidae indet. and amphipoda were collected in a lower shore sample.
16. Samples of *Donax*, *Angulus tenuis*, *Nephtys* sp. and polychaetes were collected on the beach.
17. There was extensive driftweed on the beach.
18. A sample was collected here containing Spionidae

#### Photographs taken:

1. Patches of *Fucus vesiculosus* and *Pelvetia*. *Enteromorpha*, *Porphyra*, and *Ascophyllum*.
2. Facing south. Shore with a distinct lack of fucoids. Mixture of ELR.BPat.Sem and ELR.MytB3
3. Facing south towards Malahide, below Martello Tower, LR.FK with *Laminaria digitata*, *Corallina officinalis*, *Lithothamnion* and *Ceramium*.
4. Facing south, *Enteromorpha* in LR in target note no. 2.
5. Facing south showing *Enteromorpha* sp.

## LEGEND

-  Exposed littoral rock
-  Moderately exposed littoral rock
-  Sheltered littoral rock
-  Littoral gravels and sands
-  Littoral muddy sands
-  Littoral muds
-  Littoral mixed sediments
-  Littoral rock
-  Exposed infralittoral rock
-  Moderately exposed infralittoral rock
-  Sheltered infralittoral rock
-  Unclassified
-  Target notes
-  Photographs

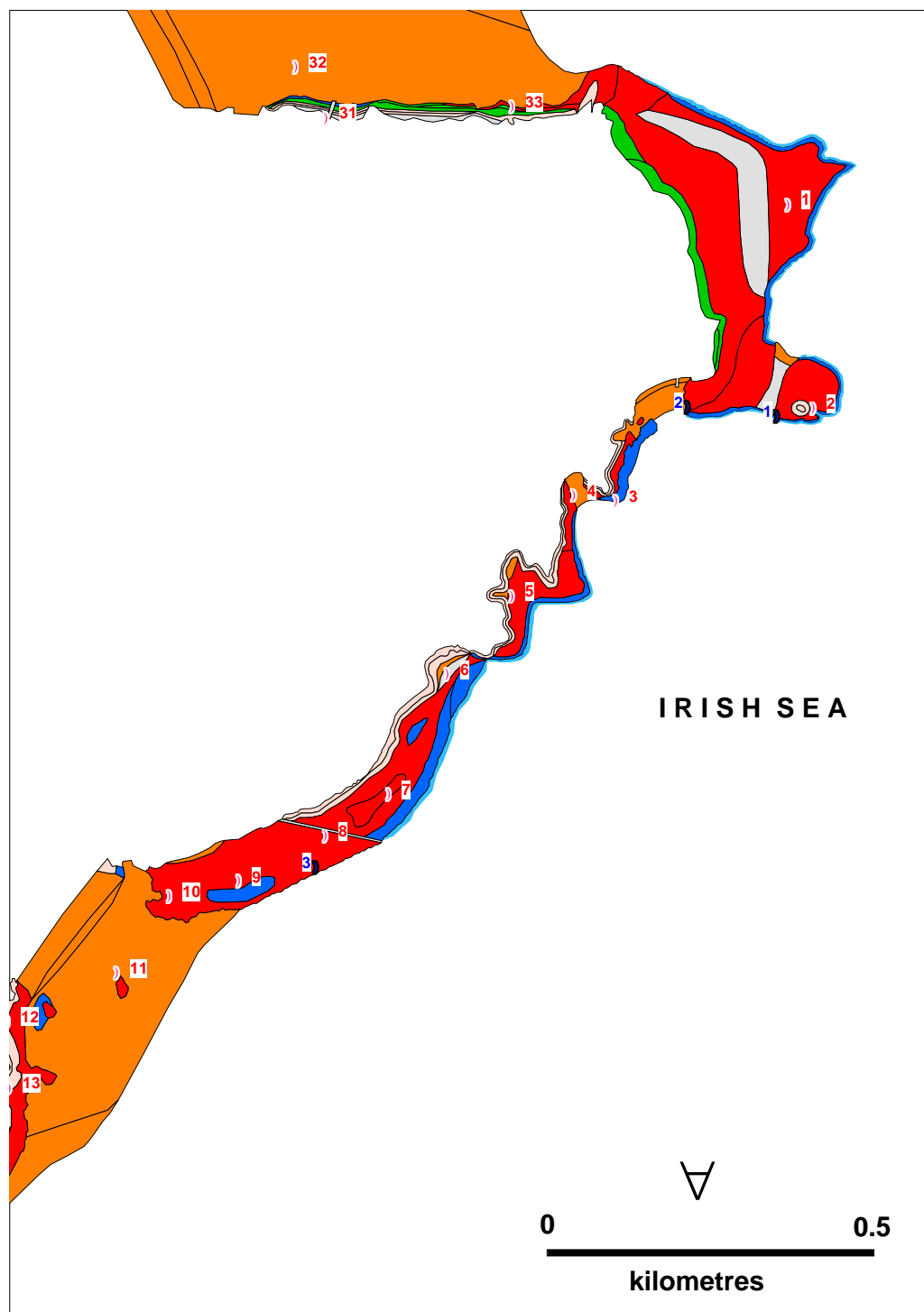


Figure 1. Littoral biotopes (higher biotope code) between Portrane and Malahide (Map 1).

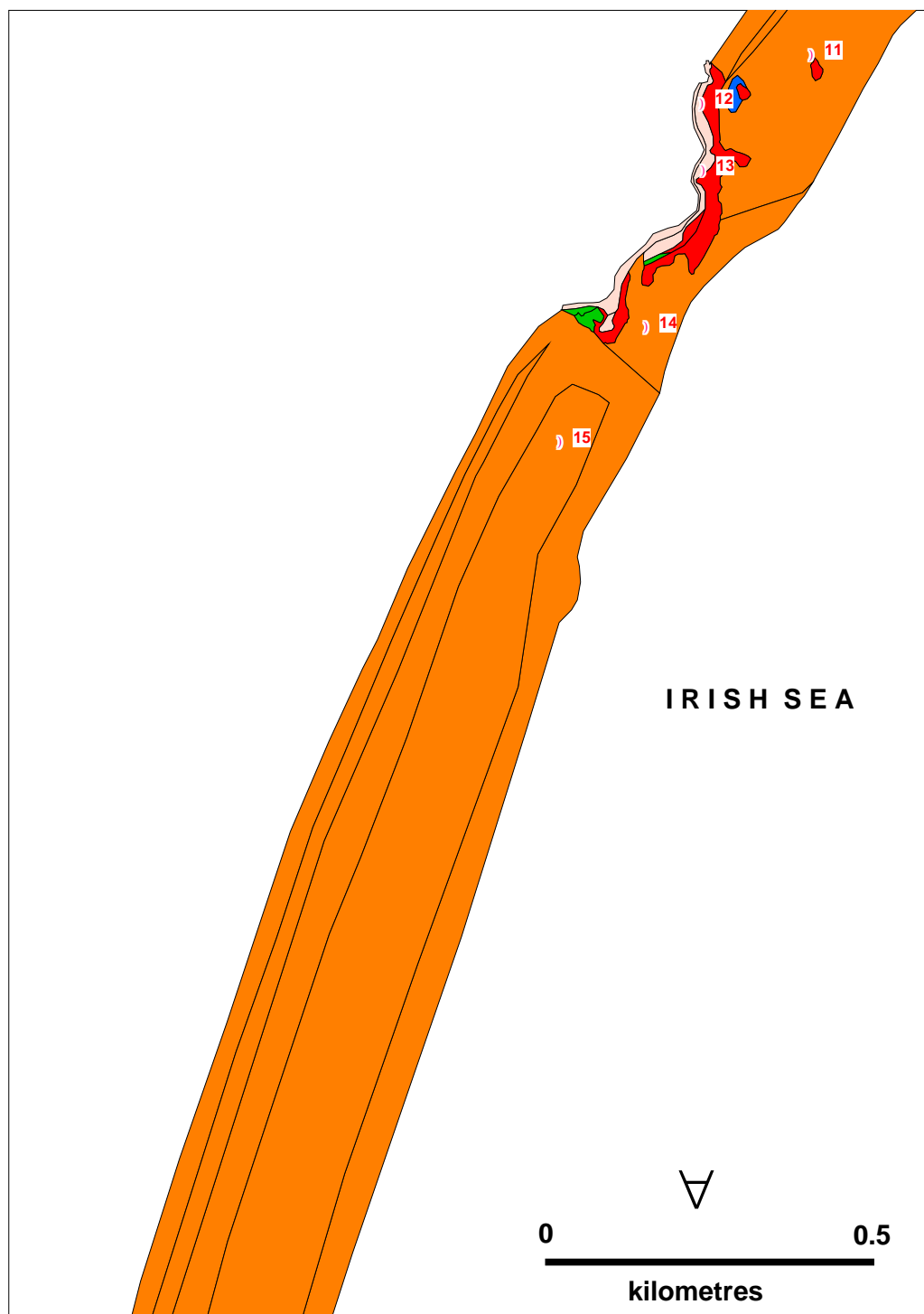


Figure 2. Littoral biotopes (higher biotope code) between Portrane and Malahide (Map 2).



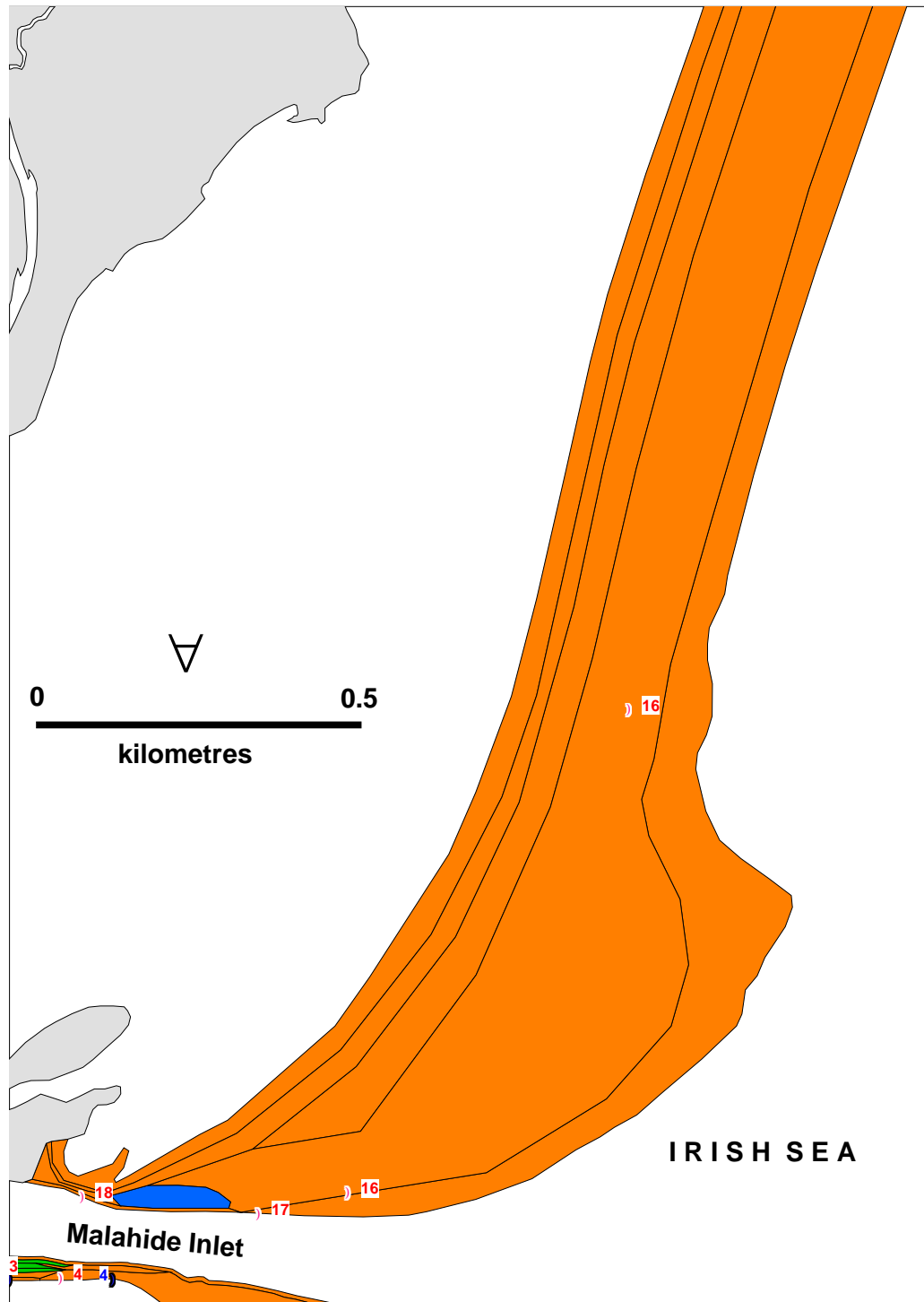


Figure 3. Littoral biotopes (higher biotope code) between Portrane and Malahide (Map 3)

## SensMap intertidal summary report: Malahide to Cush Point:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Position derived: Ordnance Survey  
Sub-coastal type: Linear coast  
Littoral width: 10 - 100 m  
Aspect: East  
Wave exposure: Moderately exposed  
Tidal streams: Not known  
Salinity: Full (30-40 ppt)

### Survey dates:

15 July 1998  
Time: 08:00 to 12:30  
Surveyors: Louise Collier, Jenny Dowse  
09 September  
Time: 18:00 to 20:40  
Surveyors: Louise Collier, Jenny Dowse  
18 April 1999  
Time: 18:00 to 20:30  
Surveyors: Louise Collier, Jenny Dowse

### Uses and Impacts:

Recreational - Popular beach  
Recreational - Marina  
Sewage discharge  
Coastal defence – Groynes

### Site Description:

The site begins east of Malahide beyond the second jetty. the shore is divided into 6 main biotopes with polychaete dominated LGS.AP on the lower shore and MLR.FserX, SLR.Fves.X, SLR.Asc.X, SLR.Fspi and LGS.BarSnd above this. East of the sewage outfall the biotopes become more complicated. On the upper shore LMS.MacAre occurs above SLR.Myt.X. *Enteromorpha* spp. and *Ectocarpus* spp. are abundant near the outfall. The *Fucus vesiculosus* zone widens out beyond the outfall. Beyond a second outfall barren sand and LGS.Tal replace the LMS.MacAre. The zonation becomes more constricted and SLR.EphX replaces lower shore *Mytilus*. A small channel contains *Fucus ceranoides*. Further east the shore widens out with a lower shore zone of LGS.Lan. There is a patch of LGS.Bar Sh above this and the other previous biotopes are replaced by LGS.AP.P. Narrow bands of LGS.BarSh and LGS.BarSnd occur at the top of the shore and the LGS.Lan zone eventually disappears on the lower shore. There are the remains of wooden groynes either side of the tower. East of the tower, upper shore rock supports patchy SLR.Fspi, MLR.Ent, SLR.Fves and ELR.BPat.Sem. Sparce SLR.Pel and LGS.Tal are also present. Beyond this rocks support sparce LR.Ver, ELR.BPat.Sem, MLR.Myt, MLR.Eph.Ent and MLR.Fves. Lower shore sand is replaced by MLR.Fserr and MLR.Rho with small patches of MLR.R.Osm. Scattered patches of LGS.BarSh occur between rocky outcrops which were difficult to map. Near to the coastguard station deep fucoid rockpools contain a mixture of kelps and red algae (LR.FK) There are also some LR.Cor present. A concrete walkway leads down the shore. For a substantial distance south, the rock strata shows clear zonation with MIR.Ldig, SLR.FserR, ELR.BPat.Sem, LR.Ver and LGS.BarSh. There are some patches of LR.YG, SLR.Fspi and MLR.Ent. Further south MLR.Myt begins to dominate midshore with zones of SLR.Pel and SLE.Fspi becoming more continuous on the upper shore. Rockpools (LR.G) occur near the Martello Tower with a patch of gravel supporting *Mytilus* and *Enteromorpha*. Further south the rock strata is increasingly broken up by sand with small patches of other biotopes (e.g. MLR.S.R. and SIR.Lsac.Ldig). The rock strata breaks up on reaching Velvet Strand. This beach is dominated by LGS.Lan and *Donax vittatus* on the lower shore, with a wide zone of LGS.AP.Ang above this dominated by *Nephtys* sp. and *Angulus tenuis*. *Corystes cassivelaunus* are common on the shore here. There is also a talitrid zone along the upper shore, which is backed by sand dunes. This extends as far as Portmarnock Point where the shore widens out. On the midshore here, there is a patch of rock supporting MLR.Myt and MLR.R.Osm with coralline rockpools (LR.Cor).

**Biotopes found:**

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
LGS.AP	Burrowing amphipods and polychaetes in clean sand shores
LGS.AP.P	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LGS.AP.Pon	Burrowing amphipods <i>Pontocrates</i> spp. and <i>Bathyporeia</i> spp. in lower shore clean sand
LGS.BarSh	Barren shingle or gravel shores
LGS.BarSnd	Barren coarse sand shores
LGS.Lan	Dense <i>Lanice conchilega</i> in tide-swept lower shore sand
LGS.Tal	Talitrid amphipods in decomposing seaweed on the strand-line
LMS.MacAre	<i>Macoma balthica</i> and <i>Arenicola marina</i> in muddy sand shores
LR.Cor	<i>Corallina officinalis</i> and coralline crusts in shallow eulittoral rockpools
LR.FK	Fucoids and kelps in deep eulittoral rockpools
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools
LR.SR	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock. Small patches present on sheltered inlets above Velvet Strand
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig	<i>Laminaria digitata</i> on moderately exposed or tide-swept sublittoral fringe rock
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.MF	<i>Mytilus</i> (mussels) and fucoids (moderately exposed shores)
MLR.Osm	<i>Osmundea</i> ( <i>Laurencia</i> ) <i>pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.AscX	<i>Ascophyllum nodosum</i> on mid eulittoral mixed substrata
SLR.EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.Fserr	<i>Fucus serratus</i> on sheltered lower eulittoral rock with red algae
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.FvesX	Fucoids, barnacles or ephemeral seaweeds (mixed substrata)
SLR.MytX	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

**Target Notes:**















1. There is a concrete structure running a few metres down from the top of the shore with an outfall.
2. There is another small outfall here.
3. A sample was taken here from the mud with *Mya arenaria* and *Nereis*
4. There is a narrow channel with a trickle of water running down the shore. There are patches of *Fucus ceranoides*, *Fucus vesiculosus* and *Enteromorpha* spp. in the channel.
5. There is the remains of a wooden groyne here on either side of the tower, with a narrow *Lanice conchilega* zone at the bottom of the shore.
6. There are coralline rockpools here (LR.Cor) containing *Ceramium* spp., littorinids, *Chondrus crispus* and lots of *Enteromorpha* spp. on a sandy bottom.
7. There is another coralline rockpool here (LR.Cor) with lots of *Mytilus edulis* at the bottom, *Enteromorpha* spp., *Ceramium* spp., *Polisiphonia* spp., *Dumontia contorta*, *Ulva lactuca*, *Ectocarpus* spp. and littorinids.

8. There are a series of narrow rockpools in deep hollow in bedrock (LR.FK) containing *Enteromorpha* spp., *Corallina officinalis*, *Osmundia pinnatifida*, *Chondrus crispus*, *Laminaria saccharina*, *Laminaria digitata*, lithothamnion crusts and *Hymenacidion perleve*.
9. There are fucoid rockpools here (LR.FK) containing *Laminaria saccharina*, *Corallina officinalis*, *Enteromorpha* spp., *Hymenacidion perleve*, *Ceramium* spp. and coralline crusts. A sample was taken here.
10. There is a concrete walkway leading to a lookout point.
11. The cliff has got LR.YG and LR.Ver on it.
12. There is a rockpool (LR.G) containing lots of *Enteromorpha* spp., coralline crusts, *Chondrus crispus*, *Ceramium* spp., *Patella* spp., *Carcinus maenas*, *Littorina littorea*, *Mytilus edulis*, on a gravel and rocky bottom. There are also lots of washed in seaweed in the pool.
13. Below the Martello Tower, there is a flat area of gravel and boulders with *Mytilus edulis* and *Enteromorpha* spp.
14. There is a rockpool (LR.FK) containing *Laminaria digitata*, *Laminaria saccharina*, *Ceramium* spp., *Chondrus crispus*, *Ectocarpus* spp. and *Fucus serratus* on a sandy/ silty substrate. A sample of algae was collected here.
15. There is a concrete wall here with an outfall inside it. There are lots of barnacles, *Patella* spp., and *Enteromorpha* on the wall and foamy water coming from the outfall.
16. There is a coralline rockpool here (LR.Cor) containing coralline crusts, *Chondrus crispus*, *Enteromorpha* spp., littorinids, *Ectocarpus* spp., *Fucus spiralis* and *Patella* and the substrate is silty.
17. There is a strip of rock on the mid and upper shore supporting *Fucus vesiculosus* and *Enteromorpha* on the lower part.
18. A sample containing *Donax vittatus*, *Angulus tenuis* and *Nephtys* sp. was taken here. The masked crab *Corystes cassivelaunus* was abundant on the shore.
19. A sample was taken on the lower shore containing *Donax vittatus*, *Angulus tenuis* and *Nephtys* sp.
20. There were small rockpools (LR.Cor) among the MLR.Myt biotope. These contained *Enteromorpha*, *Corallina officinalis*, *Lithothamnion*, *Dumontia contorta*, littorinids, *Chondrus crispus*, *Carcinus maenas*, *Ceramium* sp., and *Osmundia pinnatifida* which was quite dense in some of the pools.
21. A midshore sample was taken here containing abundant *Angulus tenuis*.

#### **Photographs taken:**

1. Taken from the top of the shore looking down at an angle. An outfall is shown and green patches of *Enteromorpha* can be seen below it. The photo was taken in a north-easterly direction, east of Malahide village.
2. A view towards Malahide from the east of an outfall.
3. A view from the second outfall towards the east, where the shore starts to get
4. A view to the west, towards Malahide. Taken on the lower shore, which is quite steep supporting a narrow *Lanice* zone.
5. A view to the southeast showing a zone of barren shingle and sand.
6. Taken facing north-westwards over a rocky area towards a large sandy area.
7. Facing south down Velvet Strand towards Howth Head.
8. Facing north towards the Martello Tower at the beginning of the rocky zone north of Velvet strand.

## LEGEND

-  Exposed littoral rock
-  Moderately exposed littoral rock
-  Sheltered littoral rock
-  Littoral gravels and sands
-  Littoral muddy sands
-  Littoral muds
-  Littoral mixed sediments
-  Littoral rock
-  Exposed infralittoral rock
-  Moderately exposed infralittoral rock
-  Sheltered infralittoral rock
-  Unclassified
-  Target notes
-  Photographs

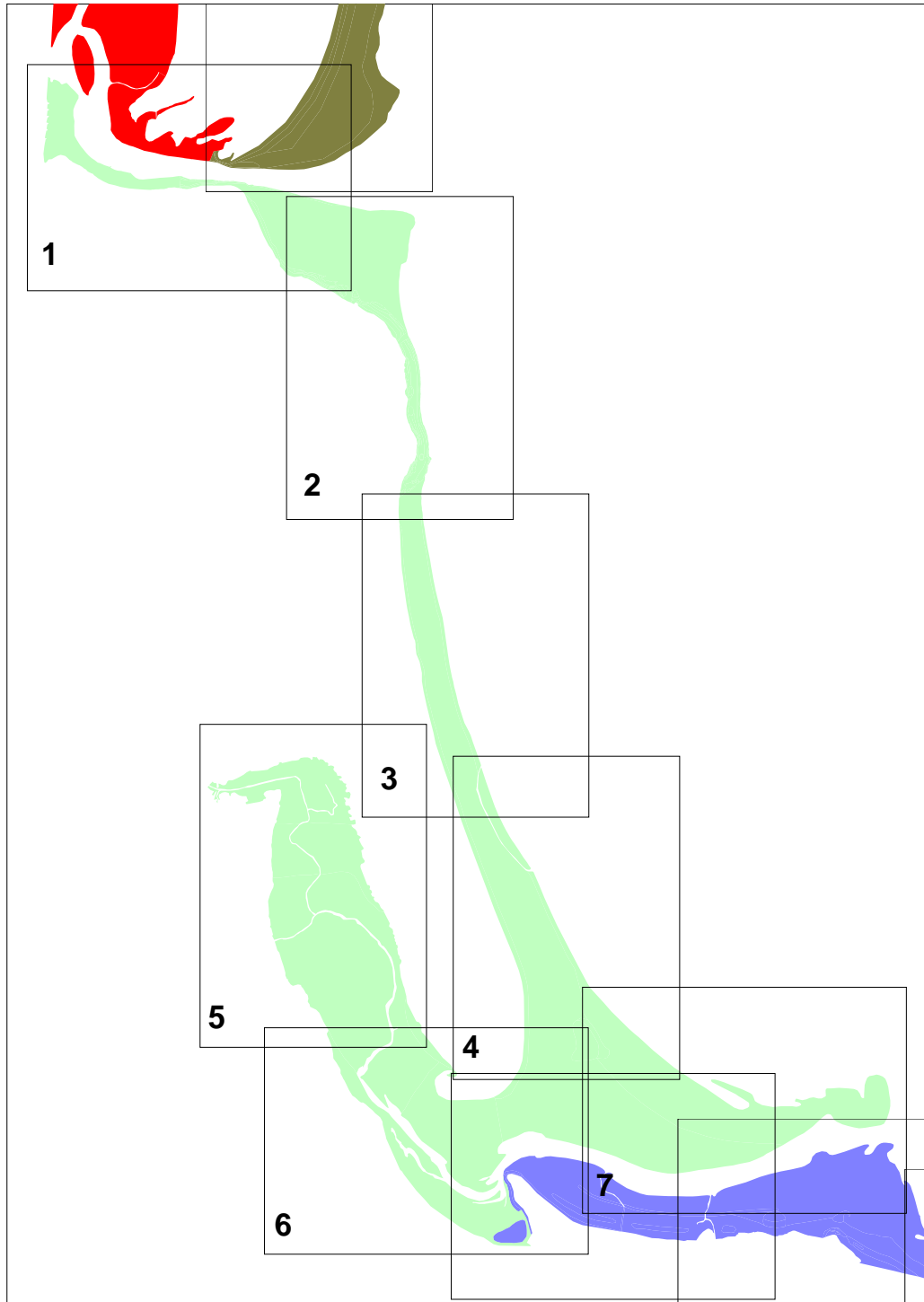


Figure 1. Map showing arrangement of biotope maps for the Malahide to Cush Point area (in green).

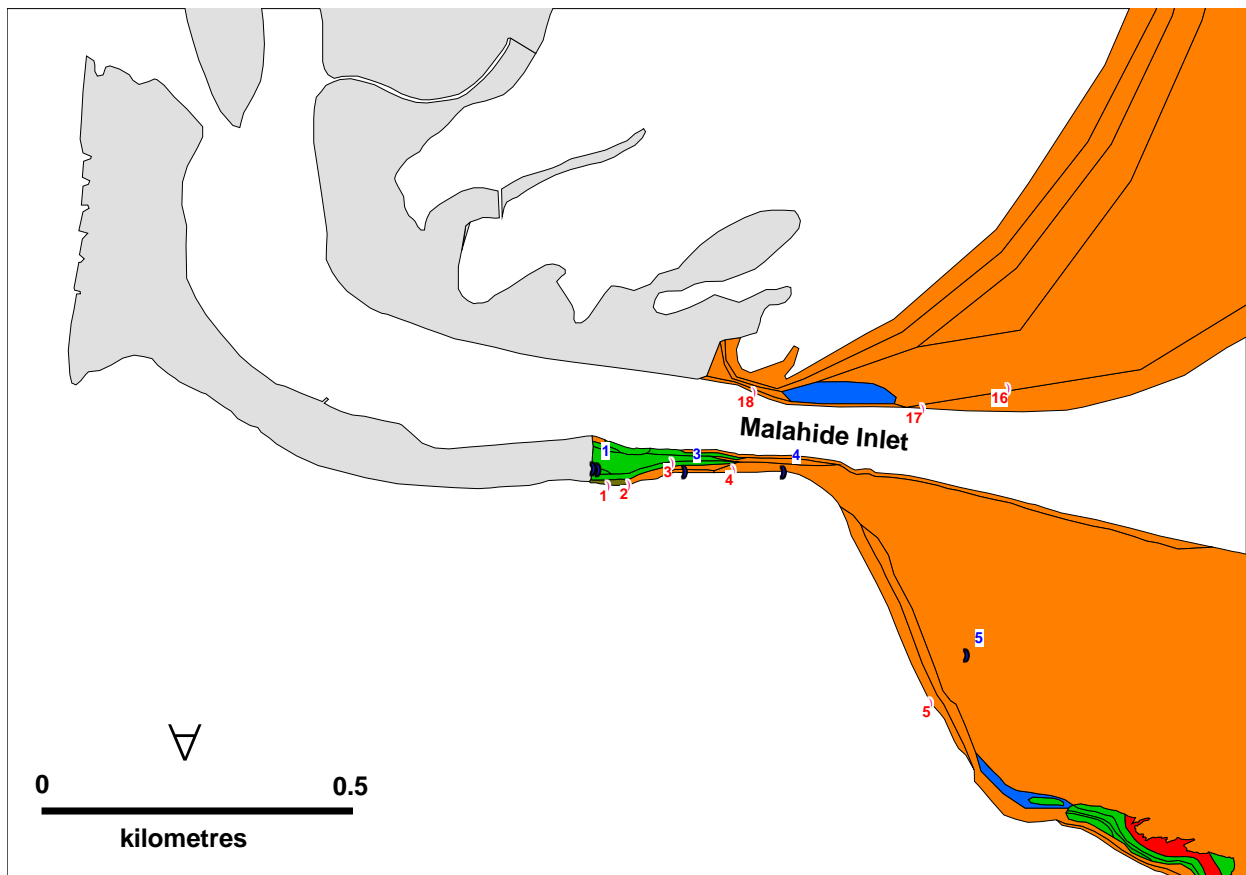


Figure 2. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 1).

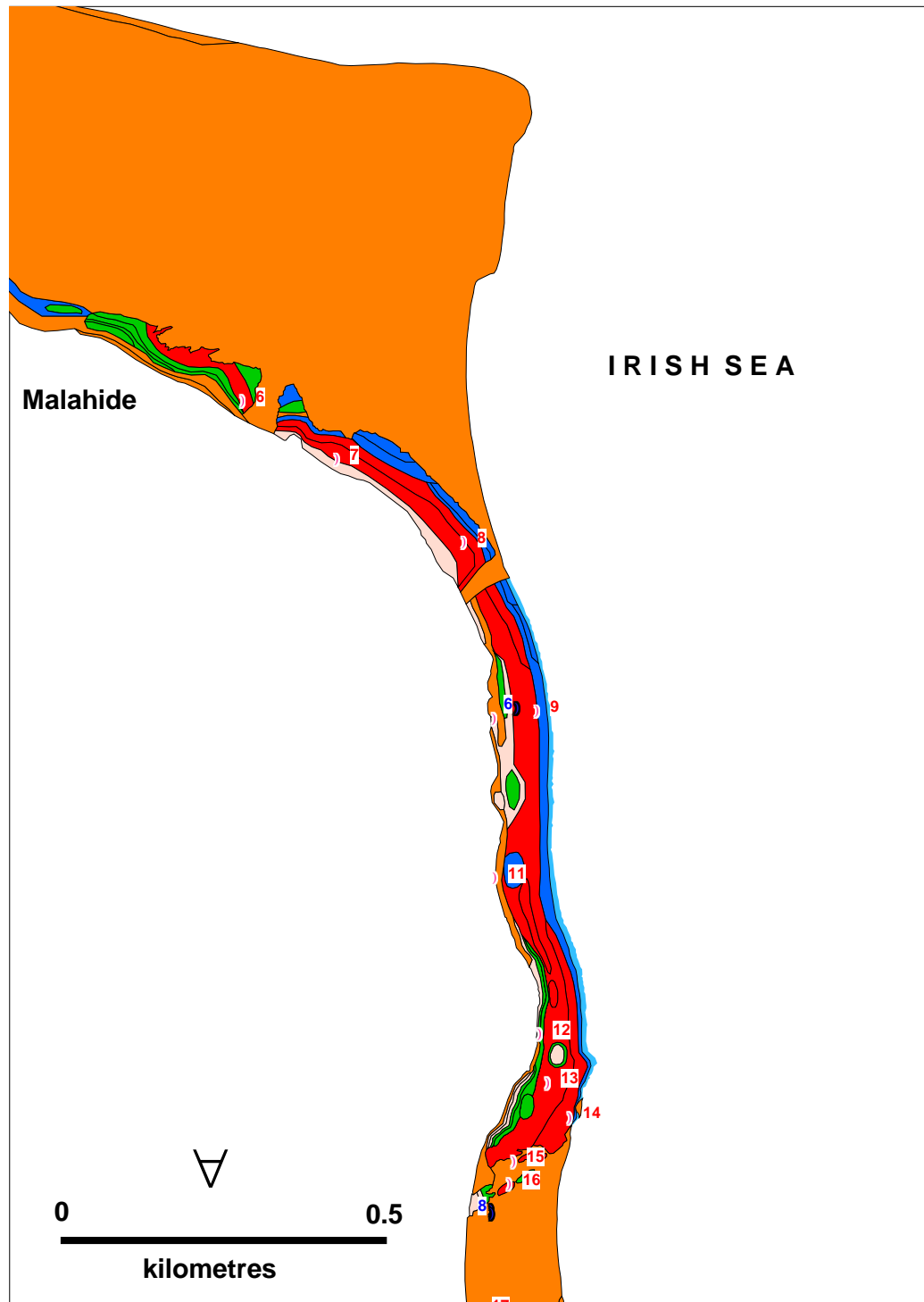


Figure 3. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 2).



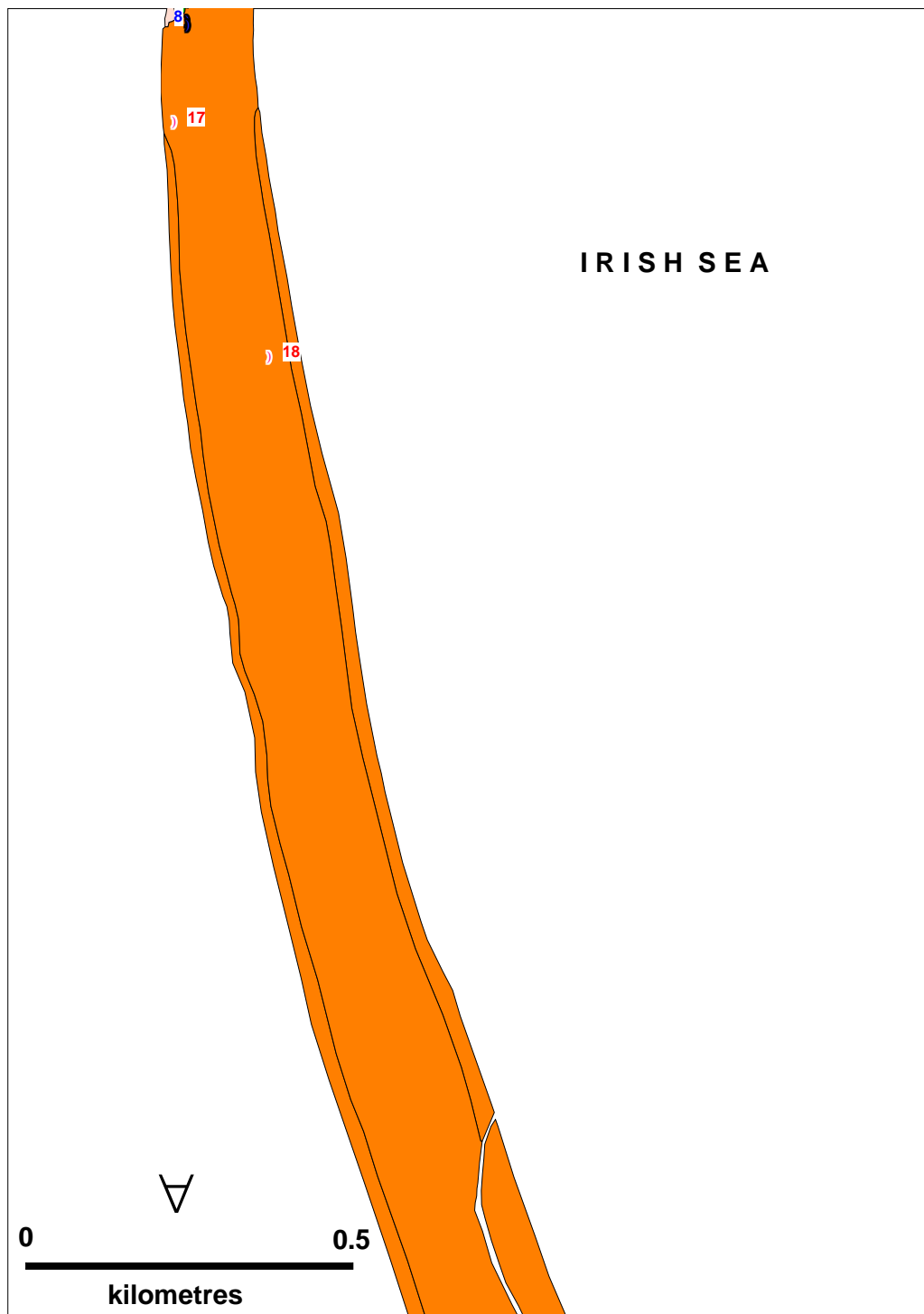


Figure 4. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 3).

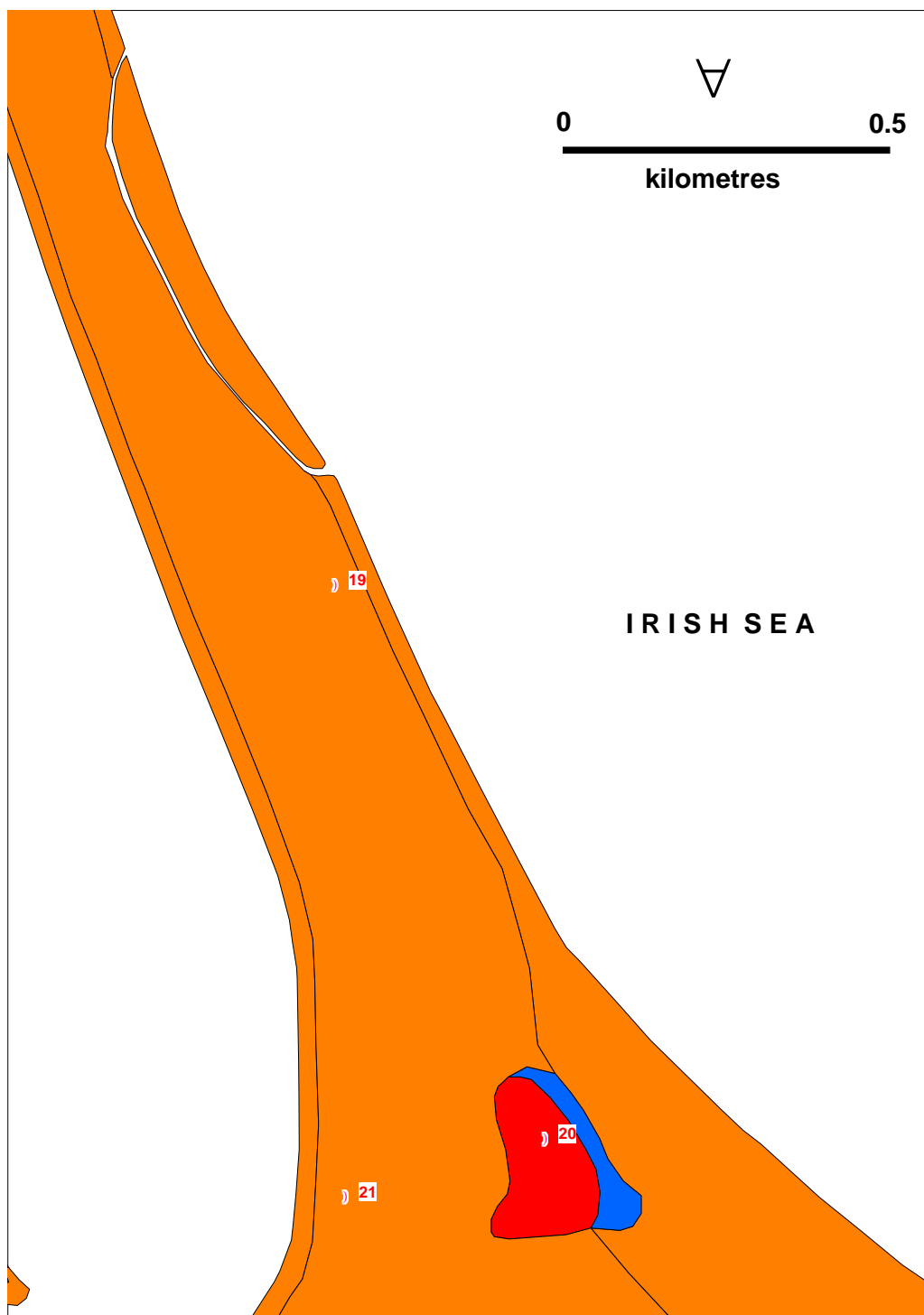


Figure 5. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 4).

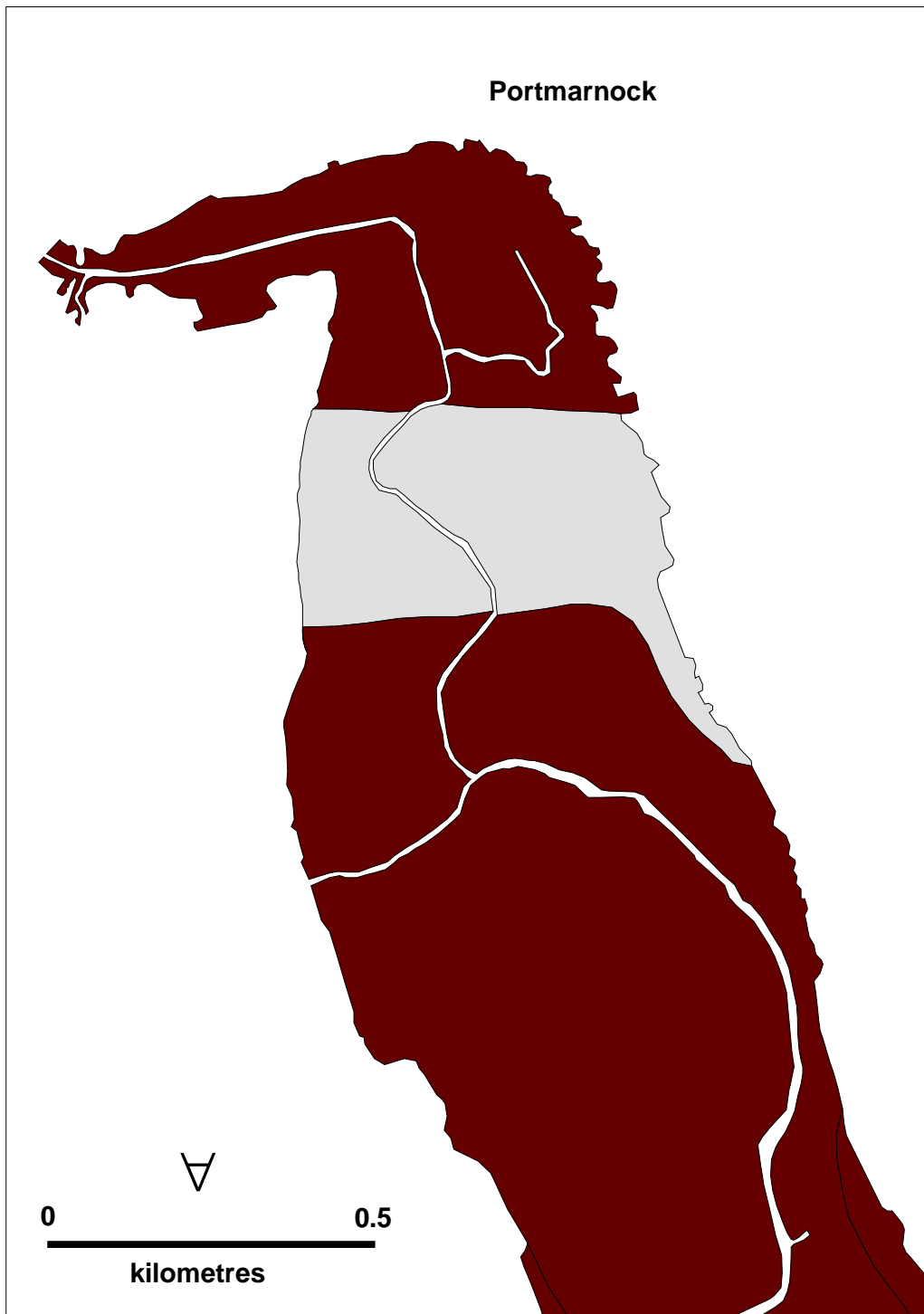


Figure 6. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 5)

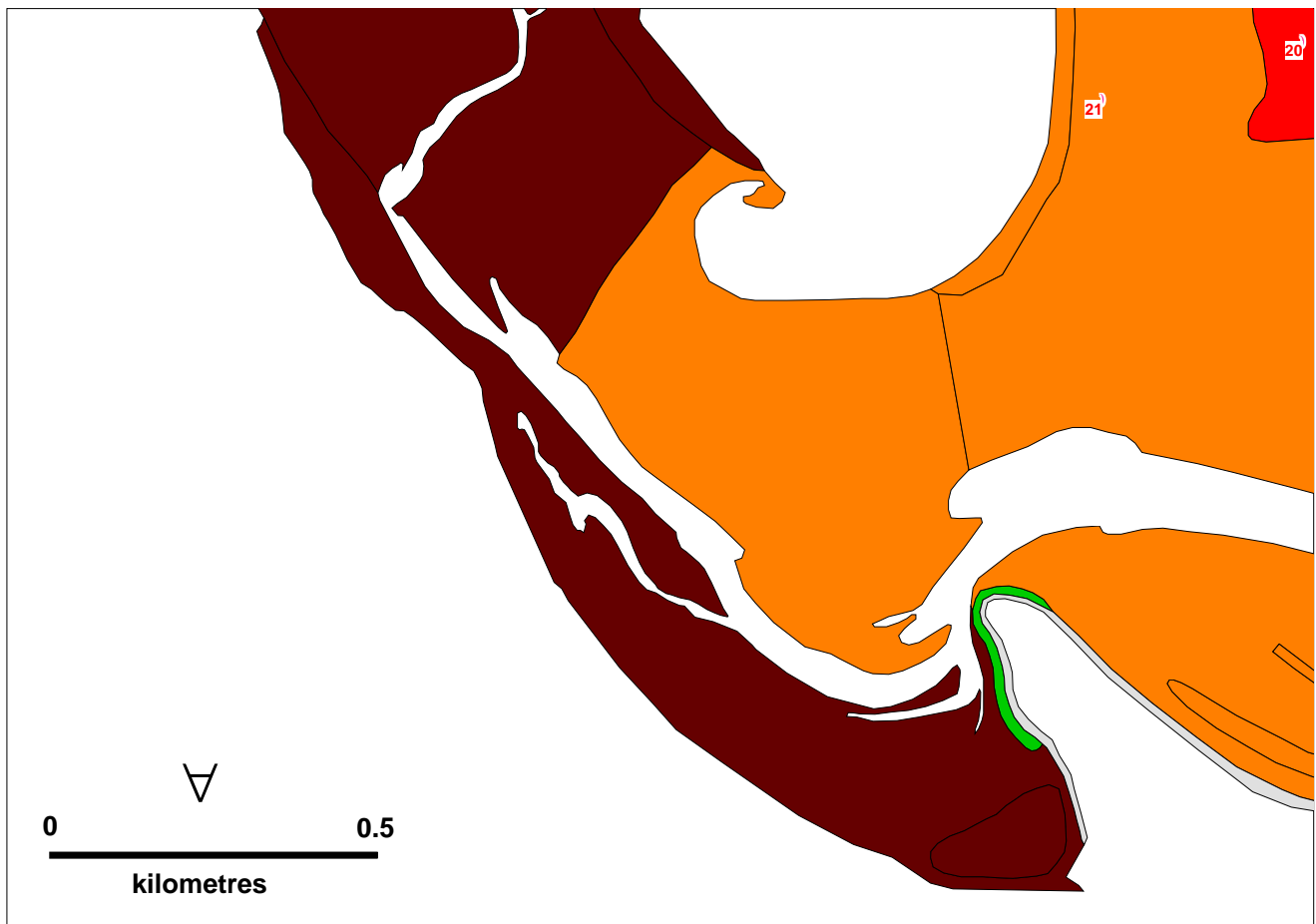


Figure 7. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 6).

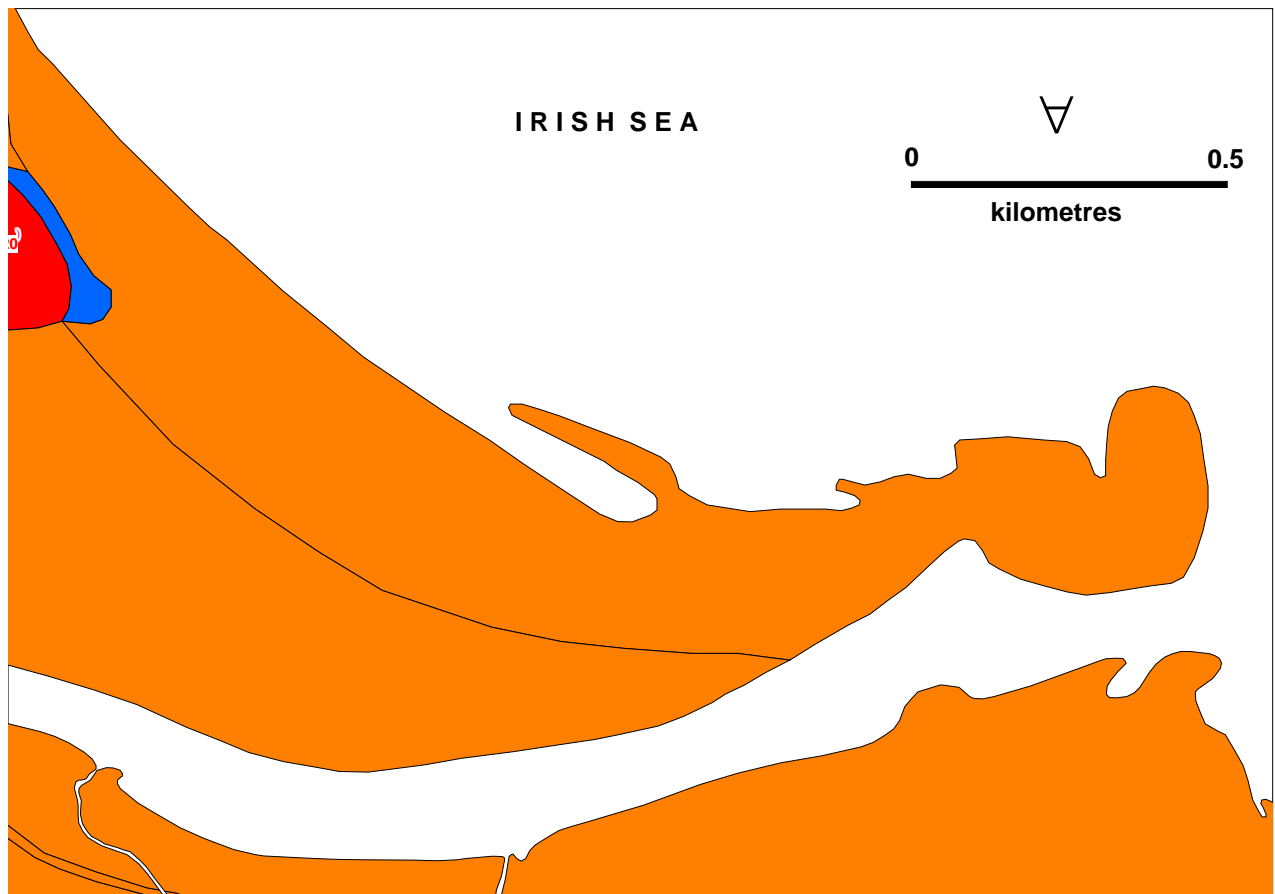


Figure 8. Littoral biotopes (higher biotope code) between Malahide and Cush Point (Map 7).

## SensMap intertidal summary report: Cush Point to Howth Harbour:

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Sub-coastal type:  
Littoral width: 100 - 1000 m  
Aspect:  
Wave exposure: Exposed  
Tidal streams: Not known  
Salinity: Full (30-40 ppt)

### Survey dates:

01 October 1997

Time: 16:45 to 19:00

Surveyors: Mona McCrea, Chris Emblow

### Conservation:

Representative

### Uses and Impacts:

Recreational - Popular beach

Recreational - Facilities

Coastal defence - Sea walls

### Site Description:

This site extends from Cush Point to Howth Harbour. The substratum along this stretch consists mainly of fine sand with coarse, shelly gravel underneath and slightly drier fine sand with less shell material. There are also a number of patches with bedrock, boulders and muddier sand.

There is a seawall and some houses backing much of this stretch and Sutton Golf Club backs Cush Point. A river marked on the map no longer runs across the shore, but remains of the flood gate can be seen. The existing channel has also changed considerably since the map was published.

There are two main biotopes in this site, LGS.AP.Ang (1) and ..... (2). Patches of LGS.AP.P occur on the upper shore and LGS.Lan occurs in the mid-shore in a long band adjacent to the channel. On the western shore of Cush Point (within Baldoyle estuary), the sediment is somewhat muddier with cobbles and pebbles. There is a patch of *Salicornia* sp. and other salt marsh spp. (LMU.NVC-SM8) in the far corner of the estuary with *Corophium volutator*. This grades into SLR.FvesX, SLR.EphX and the tip of the Point and then grades into the fine sand biotopes.

Any outcrop of rock is colonised by MLR.Fser, MLR.FvesB, ELR.BPat.Sem or MLR.Eph.Ent.

### Biotopes found:

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
LGS.AP.P	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LMS.HedMac.Mare	
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
SLR.BLit	<i>Mytilus</i> (mussel) beds (mixed substrata)
SLR.Fcer	<i>Fucus ceranoides</i> on reduced salinity eulittoral rock

### Target Notes:

1. Midshore fine sand contains coarse shelly gravel below. Areas of standing water contain sparse *Arenicola marina*, *Lanice conchilega*, *Angulus tenuis*, *Nephtys* spp. and one small *Cerastoderma edule*. A sample was taken.

2. A midshore raised area contains polychaetes and *Angulus tenuis*. This is drier with less shell material than target note 1.
3. The area is mostly composed of sand with some cobbles and *Enteromorpha* spp.
4. This is an area of rock with sand filled, shallow pools. Furoid rockpools ( RPK.FK) contain red algae but no kelp. The upper shore is covered in *Enteromorpha* spp., barnacles and fucoids.
5. There is a stone circle (bathing area) on the lower shore.
6. A river here no longer runs across the shore, and appears to run down an adjacent pipe. Remains of two walls were seen.
7. There is an old outfall pipe present.

**Photographs taken:**

1. View of target note 1 towards Howth Harbour.
2. Close up of *Arenicola marina* tubes. Diatom film over sediment.
3. Close up of *Arenicola marina* tubes. Diatom film over sediment.
4. Stone circle (bathing area) on lower shore.
5. Dense MLR.Fser on lower shore rock.

## **SensMap intertidal summary report: Howth Harbour to the Baily Lighthouse:**

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Sub-coastal type:  
Littoral width: 1 - 10 m  
Aspect:  
Wave exposure: Very exposed  
Tidal streams: Not known  
Salinity: Full (30-40 ppt)

### **Survey dates:**

18 September  
Time: 17:15 to 18:30  
Surveyors: Jenny Dowse, Mona McCrea  
19 September  
Time: 06:50 to 09:00  
Surveyors: Mona McCrea, Chris Emblow  
29 September  
Time: 16:35 to 18:00  
Surveyors: Mona McCrea, Chris Emblow

### **Conservation:**

Good zonation  
Representative

### **Uses and Impacts:**

Mooring/launching/beaching  
Recreational - Facilities  
Litter and debris  
Sewage discharge  
Fishing – Potting

### **Site Description:**

This site extends from Howth Harbour to the Baily Lighthouse, and includes a range of both sheltered and exposed biotopes. Access to the shore from the Harbour to Puck's Rocks is relatively easy in comparison to the rest of the headland which consists of sheer cliffs. There is however, a cliff walk along this stretch which enables one to roughly identify biotopes. Thorough mapping of this area would require a boat.

There is a large outfall pipe off the Nose of Howth which discharges raw sewage into the surrounding waters from the greater north Dublin catchment. Large plumes of sewage can be seen welling up and drifting northwards, attracting many seagulls, accounting for the large number of bird nests on the nearby cliffs.

The area from the Harbour to Puck's Rocks is relatively sheltered with extensive patches of bedrock, boulders and coarse, mobile sand shores, yielding a greater number of biotopes to the rest of the headland. Many changes have been made to the Harbour since these maps were published. Essentially, more land has been reclaimed and two shorter piers and a marina (approx. 300 berth) built. The barnacle, *Elminius modestus* was found on the inside wall of the east pier, most probably introduced through ballast water.

From Puck's Rocks to the Lighthouse, the shore is much more exposed, with vertical cliffs dropping into the sublittoral. The number of biotopes is significantly reduced and fairly similar the whole way around. The cliffs are grass covered with some exposed, barren rocks. The lichen zone, LR.YG, is relatively wide, particularly from the Nose of Howth southwards. There is a distinct LR.Ver band followed by distinct ELR.BPat.Sem zone. In some areas this looks to be covered by the coralline algae, Corallinaceae indet.



Below this zone a sparse band of red algae is present (MLR.R) which looks like *Mastocarpus stellatus*. It is presumed that a MIR.Ldig band is also present, but was not uncovered for this survey.

**Biotopes found:**

EIR.SCAN.Tub	Sponge crusts, anemones and <i>Tubularia indivisa</i> in shallow infralittoral surge gullies
ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
LGS.OI	Oligochaetes in reduced or low salinity gravel or coarse sand shores
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MIR.Ldig.Pid	
MLR.Ent	<i>Enteromorpha</i> spp. on freshwater-influenced or unstable upper eulittoral rock
MLR.EntPor	<i>Porphyra purpurea</i> or <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.Mas	<i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very to moderately exposed lower eulittoral rock
MLR.Osm	<i>Osmundea (Laurencia) pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.Pal	<i>Palmaria palmata</i> on very to moderately exposed lower eulittoral rock
MLR.R	Red seaweeds (moderately exposed shores)
MLR.Rho	<i>Rhodothamniella floridula</i> on sand-scoured lower eulittoral rock
MLR.XR	Mixed red seaweeds on moderately exposed lower eulittoral rock
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Fves	<i>Fucus vesiculosus</i> on sheltered mid eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

**Target Notes:**

1. Mixed boulders contain ephemeral algae, fucoids and sparse barnacles on the upper shore.
2. Extensive infilling occurs behind the harbour forming flat areas for boat and ship repair and warehouses. The shore is littered with debris (nets, cables and ropes).
3. There are drastic alterations to the Harbour from the existing map.
4. Slipway.
5. Dredge spoil is present.
6. There is an additional breakwater 'island', made of wire cages filled with stones (not surveyed).
7. Howth marina (approx. 300 berth).
8. The area contains mixed mud with stones and Harbour debris. Patches of *Fucus serratus* are found on the larger stones. The area adjacent to this is dredged by the marina.
9. Sparse *Fucus vesiculolus* occurs on inner Harbour wall.
10. *Fucus ceranoides* is present on the upper part of the shore with mixed fucoids lower down. Boulders forming an extension of seawall are not marked on the map.
11. Drainage runs over the seawalls.
12. Profile of Harbour wall. ELR.BPat.Sem with *Elminius modestus*, *Ascophyllum nodosum* with *Fucus serratus* are found on vertical walls.
13. *Elminius modestus* was collected from inside Howth Harbour entrance.
14. Boulders form much of the outside of Howth Harbour.
15. Extension to Howth Harbour.
16. There are large barren boulders backing the shore.
17. MLR.Fser.R contains patches of shallow coarse sand between and in pools. Red algae include *Palmaria palmata*, *Mastocarpus stellatus*, *Rhodothamniella* spp. and *Chondrus crispus*. There was a fair amount of *Rhodothamniella* spp., *Porphyra* spp. and *Enteromorpha* spp. present.
18. Shallow rockpools have a sand layer on bottom. Sand influenced the algae present.

19. Patches of coarse sand contain less dense *Fucus serratus*. Pools of standing water contain *Enteromorpha* spp. Raised areas of rock supported small, stunted *Fucus vesiculosus*.
20. A bathing place is present on upper shore.
21. Almost 50:50 of *Laminaria digitata*: *Laminaria saccharina* occurs here.
22. There is a concrete causeway across shore, all backed by coastal protection.
23. Very coarse sand/gravel contains a lot of drift weed.
24. Rockpools contain *Enteromorpha*, *Ulva* and fucoid species. Larger pools host *Laminaria digitata*.
25. There is a stream running down cliff with *Enteromorpha* on the rocks below.
26. There are rockpools (LR.G) and patches of *Ascophyllum nodosum*.
27. There is a major bathing place here.
28. Profile of cliffs.
29. There is a path down to sea with man made steps. Two square pedestal blocks are present at high water mark, perhaps the remains of a bridge.
30. A vertical rock profile supports LR.YG, LR.Ver, ELR.BPat.Sem, ELR.MtyB, MLR.R.R and MIR.Ldig. Zonation is very pronounced. Some patches of *Porphyra* spp. and *Fucus spiralis* occur on LR.Ver and ELR.BPat.Sem biotopes.
31. In some areas the ELR.MtyB is dominated entirely by *Mytilus edulis*. The mussels are covered by red (*Palmaria palmata*, *Mastocarpus stellatus* and *Ceramium* spp.) and green (*Enteromorpha* spp.) algae.
32. There is a vertical gully with an outfall pipe at the top. Lots of green plants and *Enteromorpha* spp. are also present.
33. Bedrock grades down into very large boulders. Sparse LR.YG occurs on bedrock followed by LR.Ver on bedrock and boulders (with some *Porphyra*). Below this there is a narrow band of SLR.Pel, SLR.Fspi, ELR.BPat.Sem, MLR.R.R. (with some patches of MLR.Fser.R and SLR.Asc) and MIR.Ldig.
34. Sparse bedrock and boulders with some chips of rock inbetween contain rockpools ( LR.G).
35. Dense growths of *Palmaria palmata* (MLR.R.Pal) occur at the base of cliff, approximately 8 metres in width.
36. There is an outfall at Nose of Howth with sea birds feeding.
37. There is a high lichen zone, approximately 20 metres above sea level. Many bird nests on the cliff.
38. Profile of cliffs. Grass with *Armeria maritima* leads to an extensive LR.YG followed by LR.Ver, ELR.BPat.Sem (may be covered with *Corallinaceae*), MLR.R (unidentified red algae, possibly *Mastocarpus stellatus*). In the sublittoral fringe MIR.Ldig likely to be present, although this was not confirmed.
39. Look up Gillians *Fucus* biotope for this area.
40. Profile of cliffs.
41. Profile of cliffs.

#### **Photographs taken:**

1. Entrance to Howth Harbour. Boulders with *Fucus* zonation.
2. *Elminius modestus* on Howth Harbour wall.
3. *Elminius modestus* on Howth Harbour wall.
4. *Elminius modestus* on Howth Harbour wall.
5. Howth marina.
6. Dredge spoil from marina adjacent to boulders with *Enteromorpha* spp.
7. Bedrock with ELR.BPat.Sem (Ireland's Eye beyond).
8. Howth Harbour from east of Puck's Rocks.
9. View south from the Nose of Howth.
10. Zonation of biotopes from Puck's Rocks to the Harbour.
11. View from Puck's Rocks towards the Nose of Howth.
12. View of the gully (last slide on roll).
13. Mona working south of Casana Rock.
14. Mona working south of Casana Rock.
15. The Baily Lighthouse from Highroom Bed.

## **SensMap intertidal summary report: Baily Lighthouse to Sutton Sailing Club:**

Survey area: Not applicable  
County: Dublin  
Area of search: IR3 - East  
Sub-coastal type:  
Littoral width:  
Aspect: South  
Wave exposure: Exposed  
Tidal streams: Not known  
Salinity: Full (30-40 ppt)

### **Survey dates:**

15 September  
Time: 16:45 to 18:20  
Surveyors: Mona McCrea, Chris Emblow  
16 September  
Time: 17:00 to 21:00  
Surveyors: Mona McCrea, Chris Emblow  
17 September  
Time: 17:00 to 20:00  
Surveyors: Mona McCrea, Chris Emblow  
18 September  
Time: 06:45 to 08:15  
Surveyors:

### **Uses and Impacts:**

Recreational - Water sports  
Recreational - Facilities  
Sewage discharge  
Coastal defence - Sea walls

### **Site Description:**

This site extends in a south-westerly direction from the Baily Lighthouse to Sutton Sailing Club, which forms the northern outer limit of Dublin Bay. The site is relatively exposed at the Baily Lighthouse, with sheer cliffs dropping into the sublittoral, becoming more sheltered, with extensive shores towards the Sailing Club.

The shores are mainly composed of bedrock headlands with a mixture of bedrock, boulders and coarse, mobile sand along stretches and in the many bays backed by steep cliffs.

There is a cliff walk extending the whole way along this site with a number of access points down to the bays. Other man-made features are also found which include slips, boathouses, steps, bathing pools, seawalls and outfall pipes.

Overall, this site is relatively rich in biotopes. There are examples of extremely exposed biotopes, such as LR.Ver.Por and ELR.MytB, moderately exposed biotopes (MLR.R.Osm) and sheltered biotopes (SLR.Pel, SLR.Fspi, SLR.Asc). In addition mixed substrata biotopes are present (SLR.FserX) and rockpools are common and in some cases extensive (LR.Cor). The sublittoral fringe biotope (MIR.Ldig) is very extensive and is present along the whole stretch.

Moving in a westerly direction from the Lighthouse to the Martello Tower at Sutton, the dominant biotopes are LR.YG, LR.Ver, ELR.BPat.Sem, MLR.R.Osm and MIR.Ldig. West of this point the shore is much more sheltered and extensive, hosting a range of sheltered biotopes.

### **Biotopes found:**

EIR.SCAN.Tub      Sponge crusts, anemones and *Tubularia indivisa* in shallow infralittoral surge gullies

ELR.BPat.Sem	<i>Semibalanus balanoides</i> on exposed or moderately exposed, or vertical sheltered, eulittoral rock
ELR.MytB	<i>Mytilus edulis</i> and barnacles on very exposed eulittoral rock
LGS.AP.P	Burrowing amphipods and polychaetes (often <i>Arenicola marina</i> ) in clean sand shores
LGS.OI	Oligochaetes in reduced or low salinity gravel or coarse sand shores
LR.G	Green seaweeds ( <i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in upper shore rockpools
LR.Ver	<i>Verrucaria maura</i> on littoral fringe rock
LR.Ver.Por	<i>Verrucaria maura</i> and <i>Porphyra umbilicalis</i> on very exposed littoral fringe rock
LR.YG	Yellow and grey lichens on supralittoral rock
MLR.Eph	Ephemeral green or red seaweeds (freshwater or sand-influenced)
MLR.Fser	<i>Fucus serratus</i> on moderately exposed lower eulittoral rock
MLR.Fser.R	<i>Fucus serratus</i> and red seaweeds on moderately exposed lower eulittoral rock
MLR.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock
MLR.Osm	<i>Osmundea</i> ( <i>Laurencia</i> ) <i>pinnatifida</i> and <i>Gelidium pusillum</i> on moderately exposed mid eulittoral rock
MLR.R	Red seaweeds (moderately exposed shores)
MLR.XR	Mixed red seaweeds on moderately exposed lower eulittoral rock
SIR.Lsac.Ldig	<i>Laminaria saccharina</i> and <i>Laminaria digitata</i> on sheltered sublittoral fringe rock
SLR.Asc	<i>Ascophyllum nodosum</i> on very sheltered mid eulittoral rock
SLR.AscX.mac	<i>Ascophyllum nodosum</i> ecad <i>mackaii</i> beds on extremely sheltered mid eulittoral mixed substrata
SLR.EphX	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.FserX	<i>Fucus serratus</i> on lower eulittoral mixed substrata
SLR.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock
SLR.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock

#### Target Notes:

1. The shore is more extensive than shown on map and is backed by a cliff and large boulders. Sparse MLR.Fser occurs on the boulders, ELR.BPat.Sem and MIR.Ldig.
2. ELR.BPat.Sem is found on boulders.
3. ELR.BPat.Sem occurs on boulders with pebbles/cobbles in between.
4. Boulders and rocks occur along the back of shore.
5. ELR.BPat.Sem occurs on bedrock and boulders with coarse gravel and sand in between. Some rock is covered by sand, MLR.Rho and *Enteromorpha* spp. Coraline rockpools (LR.Cor) are present.
6. There is an old (disused?) outfall pipe here.
7. LGS.BarSnd contains small boulders and rubble along the back.
8. Large jagged rocks with LR.YG, LR.Ver, ELR.BPat.Sem and MLR.R.R. occur here.
9. Rockpools (LR.Cor) are scattered throughout the zone.
10. Samples were taken from sand.
11. Patches of sand occur here.
12. There is a bathing place at the base of the cliff.
13. ELR.MytB (containing very small *Mytilus edulis*) with MLR.R.R (*Osmundia* spp., *Corallina officinalis*, *Palmaria palmata* and *Ceramium* spp.) are the dominant biotopes here.
14. Large and extensive low water coralline pools occur here.
15. MIR.Ldig contains dense, small *Mytilus edulis*. This is an exposed region of Howth Head.
16. Coraline rockpools (LR.Cor) are found here.
17. MLR.R.R is found here, with dense coverage of *Mytilus edulis* between boulders.
18. Small patches of LR.YG occur here.
19. There is an old bathing place with steps leading down to it. *Laminaria hyperborea* with *Corallina officinalis* are also present.
20. Dense *Mytilus edulis* is binding shingle together.
21. A mixture of MLR.R.Pal and ELR.MytB are found here.
22. Coarse sand and shingle has freshwater seeping through the beach.
23. Profile of shore.

24. There is a stream running over shore. The upper shore is characterised by *Enteromorpha* spp. (MLR.Eph).
25. Large barren cobbles are found on the upper shore with sparse flora and fauna.
26. Here there are remains of a boat house and slip with rails leading into the sea.
27. Coralline pools (LR.Cor) are found here.
28. Sparse ELR.BPat.Sem occurs on boulders with bedrock protruberences. Dense *Nucella lapillus* are found on top of the boulders with *Littorina littorea* in boulder holes.
29. Coralline pools (LR.Cor) have some drift fucoids present.
30. A breakwater, constructed of large boulders forms a small low water harbour.
31. Cobbles and boulders are found on fine sand with patches of cobbles, sparse *Fucus serratus*, *Ralfsia* sp. are presentpresent. There is a dense aggregation of *Littorina littorea*.
32. A zone of predominantly *Fucus serratus* also contains red algae (*Palmaria palmata*, *Mastocarpus stellatus*, *Lomentaria articulata*, *Ulva* spp.). *Halichondria panicea* is also present. There are sandy pools/standing water with *Cancer pagurus*, *Porcellana platycheles* and blennies present here.
33. Extensive *Laminaria digitata* occurs on boulders and cobbles with sponges underneath. Species present include *Palmaria palmata*, *Fucus serratus*, *Chondrus crispus*, *Electra pilosa*, *Semibalanus balanoides*, *Patella vulgata*, coralline crusts and standing water.
34. Muddy sand with *Arenicola marina* and boulders supporting *Fucus serratus*. Lots of drift weed with rock 'bar' across the entrance.
35. MLR.Osm is found on lower shore boulders with gravel between. Some boulders are scoured with ephemeral algae present. A patch of *Fucus serratus* is also present.
36. LR.Ver occurs on vertical cliffs with LR.YG also.
37. Rockpools (LR.Cor) are present. Some pools contain sponges and drain down into each
38. Shallow fucoid rockpools (LR.FK) occur but are not good examples as the floor of the pools are sand/cobble and slate covered and are quite barren.
39. LGS.Lan contains clumps of *Mytilus edulis* and *Fucus serratus* (SLR.Fser.Myt). The numbers of *Lanice conchilega* drop in the upper shore. The substrata consists of sand, shell and slate.
40. A line of boulders, may have been a pier.
41. Patches of *Fucus serratus* on rock contain sand in between with LGS.Lan seawards and *Arenicola marina* landwards.
42. ELR.BPat.Sem occurs on bedrock and cobbles with *Mytilus edulis*, red algae such as *Gellidium* spp. and *Fucus vesiculosus* in patches. This is not a typical ELR.BPat.Sem biotope.
43. A high sea wall is studded with many drainage pipes.
44. Extensive shore is backed by coastal protection. Sea walls are studded with drainage pipes.

#### Photographs taken:

1. View from the Bailly Lighthouse headland west towards Dublin Bay.
2. View west towards Dublin Bay.
3. Dense *Mytilus edulis* binding shingle together.
4. Mixed MLR.R.Pal and ELR.MytB on bedrock. View to lower shore.
5. *Mytilus edulis* binding substrata.
6. Zonation on the shore at Bishop's Hole.
7. Chris working.
8. Dense *Mytilus edulis* within MIR.Ldig.
9. View of Bishop's Hole through boathouse.
10. Shore north of boathouse showing zonation of ELR.BPat.Sem.
11. Breakwater and harbour.
12. Extensive *Laminaria digitata* in MIR.Ldig biotope.
13. Extensive *Laminaria digitata* in MIR.Ldig biotope.
14. View towards Martello Tower and Sutton.
15. Towards Howth Head. Boulders with ELR.BPat.Sem and distinct lichen zone.
16. Martello Tower.
17. LGS.Lan
18. SLR.MytX
19. ELR.BPat.Sem
20. *Mytilus edulis* clumps with *Fucus serratus* (SLR.Fser.Myt).
21. Towards Martello Tower and Howth.