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NORTHERN IRELAND LITTORAL SURVEY

JANUARY 1984 - MARCH 1988

M. Wilkinson, I.A. Fuller, T.C. Telfer,
C.G. Moore and P.F. Kingston

Institute of Offshore Engineering
Heriot-Watt University
Research Park
Riccarton
EDINBURGH EH14 4AS

Tel: 031-449 3393/3794
Telex: 727918 IOEHWU G
Fax: 031-449 6254

A CONSERVATION-ORIENTED SURVEY OF THE INTERTIDAL SEASHORE OF NORTHERN IRELAND

IOE/83/206

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Client: Department of the Environment
(Northern Ireland)

by

M. Wilkinson, I.A. Fuller, T.C. Telfer, C.G. Moore,
and P.F. Kingston

April 1988

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1. INTRODUCTION

The Northern Ireland Littoral Survey is a study for nature conservation purposes of the intertidal zone around the Northern Ireland coastline. Field and laboratory work was carried out from January 1984 to December 1987 by the Institute of Offshore Engineering (IOE) of Heriot-Watt University under contract to the Department of the Environment (Northern Ireland) (DOE(NI)). This survey is intended to be an intertidal marine nature conservation review; it was preceded by a similar subtidal survey carried out by the Ulster Museum (1982-1986). The aim of the intertidal survey is to furnish DOE(NI) with descriptions of the types of intertidal habitats and the associated biotic communities around the coast of Northern Ireland. This information can then be used, together with that from the subtidal survey, to determine localities around the coast which merit protection as nature conservation areas, such as marine nature reserves or areas of special scientific interest, on the basis of the marine fauna and flora present at the sites.

In order to collect the necessary information on the littoral zone three approaches were initially taken:

(i) collection of biological data, and also of physical data which might be relevant to conservation, from published scientific papers, monographs and reports;

(ii) discussions with interested parties, both amateur and professional;

(iii) direct field survey by IOE.

It soon became apparent that there was a dearth of published information and that the field survey would be the over-riding component of the work. Much of the earlier part of this report is concerned with the description of methods and the reporting and analysis of results for our direct field survey. The appendices to this report include summaries of relevant information gained from consultation with interested parties. They also include brief reviews of the available literature concerning impacts on the seashore which might conflict with conservation, namely water quality, bioresource exploitation and coastal conservation. Information from all these sources is brought together in Section 6 of this report to give an overview of the habitats and associated biotic communities of the Northern Ireland coastline and their conservation potential.

Previous to these studies there had not been any systematic survey of the Northern Ireland seashore; nor had there been a completed marine nature conservation review in the United Kingdom. In the 1970s a review of Great Britain had been commenced. This was carried out by the Marine Biological Association and the Scottish Marine Biological Association (the MBA/SMBA survey) for the Nature Conservancy Council (NCC). It was not completed and it was only in 1987 that a new Great Britain survey was started on a 10 year timescale by the NCC.

Accordingly it was not possible to use fully tried and tested methods for the field survey. The strategy and methods adopted for the Northern Ireland Littoral Survey were developed against the background of the earlier Great Britain survey, and in turn it is hoped that lessons learned from the Northern Ireland survey may be of value for the new Great Britain survey.

2. STRATEGY FOR THE FIELD SURVEY

Since little was known from the literature concerning the Northern Ireland seashore, the first requirement was to gain an overview of the habitats and communities from as much of the coastline as possible. Following on from that overview, a detailed biological survey could be carried out at a number of sites chosen to represent the range of habitat and community variation in Northern Ireland. Accordingly a two-stage survey technique was devised.

Stage I

Habitat appraisal of as many sites as possible in as short a time as possible. This would lay stress on physical and social (ie. human usage) aspects of sites with only outline superficial biological assessment. Data from this stage would enable classification of sites and selection of a large number of sites for detailed biological survey.

Stage II

A biological survey of sites chosen from Stage I to give a full coverage of habitat types. The data collected would include semi-quantitative (rocky shores) or quantitative (sedimentary shores) information on common species at each site, and on normally common species whether abundant at that particular site or not. The fullest possible species lists, in addition to those quantitatively recorded, covering all sub-habitats, would be collected.

From the Stage II data, it would be possible to rank sites according to their marine conservation importance and, at some future time, DOE(NI) could carry out a Stage III survey, a very detailed, seasonal, biological study for management purposes, of those sites selected for conservation.

The proposal for this strategy was outlined at a meeting in spring 1984 held at IOE with Dr R Mitchell (NCC) and Mr J Furphy (DOE(NI)) and was further detailed and discussed at a meeting in summer 1984 held at the Ulster Museum with J Furphy and some of his staff. Also present were Dr P Boaden (Queen's University Belfast Marine Station). The strategy received general approval. The strategy was also discussed at a workshop at Orielton Field Centre in spring 1984, organised by British Petroleum and the Field Studies Council. This workshop was attended by Dr M Wilkinson (IOE), Dr R Mitchell (NCC) and representatives of all known groups undertaking contract monitoring or long-term surveillance of the littoral zone of Great Britain. Again it was agreed to be the best approach. The feeling at this workshop was also that semi-quantitative abundance recording was sufficient for rocky shore work to assess conservation status, although most groups would not accept it for environmental impact monitoring.

In arriving at this strategy we considered experience in previous surveys, particularly the MBA/SMBA Littoral Survey of Great Britain. It was decided, in the light of this experience, to collect much more detailed biological data than was collected in the MBA/SMBA survey. Effectively our Stage I is a "skilled eye" appraisal of the shore which

involves only a brief visit to each shore, in order to cover a large number of sites in a short time. Even so the data collected were comparable with the data produced by the MBA/SMBA survey teams. In arriving at our recording and data handling methods we considered the MBA/SMBA survey, as revealed in its survey sheets and instructions and in various summary publications, as well as its published reports. We also considered the NCC recording sheets, developed from those of the MBA/SMBA survey, and the Ulster Museum sublittoral recording sheets. We produced our own recording sheets, detailed in later sections of this report, based on experience of these earlier workers, and maintaining a similarity to the Ulster Museum approach, with a view to eventual data transfer to their computer. We have borne in mind that the NCC recording sheets are intended for wide usage, including informed amateurs. We have taken the biological description of shores in our Stage I further although we have also maintained the NCC shore classification side-by-side with our approach to allow maximum future use of the data.

The importance of the "skilled eye" cannot be underestimated even when there is a rigid quantitative or semi-quantitive sampling strategy as in our Stage II. Accordingly we considered it important to spend a considerable part of the first year in training the project staff while using them to develop and test all our methods prior to visiting Northern Ireland. Our original plan involved carrying out Stage I in summer 1984 and that Stage II would then follow on for about two years. In practice, the level of detail in the Stage II work was such that it was decided by DOE(NI) to extend the contract by one year rather than carry out a more superficial survey.

The first five months of 1984 were spent training the field team and in conjunction with them, developing the methods.

The Stage I survey was carried out between 9th June and 30th July 1984 and covered a total of 332 sites (112 sedimentary and 220 rocky) as detailed later in the relevant sections and appendices.

After collation and computer processing of the data from this Stage I survey, a further field work period was held in Northern Ireland from 12th September until 9th November 1984. This was to initiate the Stage II survey on a limited number of sites, without prejudice to the future Stage II site selection, and to obtain an idea of the effectiveness and practicality of our Stage II methods under Northern Ireland field conditions.

The main field work for the Stage II survey took place throughout 1985 and 1986 and was completed in the spring of 1987. Field visits were timed so as to be made when suitable tides occurred during daylight hours and the intervening periods were spent on laboratory work-up in Edinburgh, and occasionally in Northern Ireland, of the samples collected. Because of the need to obtain the fullest possible species lists, the laboratory work-up was extensive and was completed at the end of 1987.

A total of 204 sites (76 sedimentary and 128 rocky) was surveyed in Stage II, representing an intensive coverage for the length of coastline of the country.

3. STAGE I SURVEY

3.1 INTRODUCTION

The purpose of the Stage I survey was to describe the littoral region of Northern Ireland, in as short a time as possible, primarily in terms of physical features, with only superficial biological data. This required methods which were quick, efficient and provided all the necessary information. The results of the Stage I survey would be used to select suitable locations for more detailed biological inspection during the Stage II survey. A sheet was specifically developed on which all the relevant information could be recorded. It was formatted in such a way as to facilitate data transfer to the computer. The in situ survey methods varied depending on whether the substratum was rocky or sedimentary. Data were stored on computer, and sorted on specifically written software. The use of the computer made hard printed copies of sorted data readily available.

3.2 RATIONALE

To assess the conservation value of the coastline of Northern Ireland it was necessary to undertake a Stage I survey with the aim of classifying all the major habitats and associated communities of the littoral region. The strategy requirements and the time limitations imposed made this initial survey necessarily superficial, with enough locations visited to encompass all major shore and habitat types of the whole of the coastline in as short a time as possible. The data collected during the Stage I survey were used in selecting the sites for the Stage II survey, with the aid of computer sorting techniques. The locations visited were chosen, using 1:50,000 Ordnance Survey maps, as being both apparently representative of a certain area of coastline and, wherever possible, readily accessible.

Three types of data were collected based on the NCC criteria for coastal surveillance. These were (i) physical data, (ii) scientific and conservation data and (iii) human influence. Each was incorporated onto a single recording sheet, one of which was completed for each site visited. The data from the Stage I survey were stored in the Heriot-Watt University (HWU) mainframe computer for our own data sorting purposes, although they will also be later supplied as part of the contract to the Ulster Museum Computer.

3.3 METHODS

The methods of the Stage I survey were concerned with both the development of the recording sheets and the in situ operations carried out on the shore.

3.3.1 Development of Recording Sheets

To increase the efficiency of the Stage I survey it was essential to develop a recording sheet that was quick and easy to complete but comprehensive enough to record the information necessary to fulfil the aims of the Stage I survey, and to select sites for the more detailed Stage II survey. It was also formulated to allow easy transfer of data to computer files.

Two recording sheets were developed, one for bed rock and boulder shores and one for sedimentary shores. Both had a similar format to that of the Ulster Museum Sublittoral Recording Cards where each feature is described by a number of attributes, one or more of which may be 'ticked' by the recorder. Each attribute was assigned a number which was used for computer storage and sorting. Many of the features and attributes used on the recording sheets were taken from the NCC survey cards.

The recording sheets were divided into five sections:

(i) Location data - including locality name and the information required for the accurate relocation of the site. Tidal data and photo numbers were also given.

(ii) Physical data - gave an indication of the physical habitat at each location. These included the coastal situation, substrate nature, physical dimensions, salinity, features relating to exposure, features of interest from a conservation view point and other features such as coastal backing and method of access.

(iii) Scientific and Conservation interest - describes the type and diversity of communities found and the subhabitats that may break their continuity.

The communities were given a single word name according to the NCC classification scheme (see Appendix II). Additional names were devised in situ to include communities found that were not covered by the NCC classification. The rocky shore sheet also included a table on which the zonation pattern could be described. The conservation considerations included a rough guide to types and activities of birds found and the present Nature Reserve status of the location. A subjective rating of conservation importance of each location was awarded by the recorder, based largely on the superficial richness of the biotic communities.

(iv) Human Influence - when assessing a location for conservation value it was necessary to include the influence of humans on the habitat, especially shore utilisation. The features used on the sheet indicated shore usage, the presence of amenities and the occurrence and types of any pollutants.

(v) The final page was divided into three areas to provide space for a sketch map, a shore profile and a short shore description.

3.3.2 In-situ methods

Surveillance generally began two hours before low water and ended two hours after low water, in which time generally eight locations were visited. A recording sheet was filled in for each habitat (rocky or sedimentary) found at the location. Two colour slide photographs were taken at each site; general views from the top and from the bottom of the shore.

The survey method varied depending on the substrata of the site. On rocky and boulder shores observations were made whilst walking along the vertical and horizontal extent of the habitat. On sedimentary shores initial observations of the physical features and human influence were followed by digging to obtain an idea of the major species or community types present. Several trenches were dug at various shore heights, and the sediment sieved through a 7mm riddle. One trench was always dug as near to low water as possible.

At both types of habitat an approximation of salinity of the seawater was calculated from the conversion of specific gravity and temperature. These were measured using a hydrometer and thermometer respectively. The sketch map, shore profile sketch and written shore description were completed after walking the extent of the location.

The recording cards used for rocky and sedimentary shores are presented as Appendices 1 and 2 and the instructions issued for their completion as Appendix 3. This last Appendix provides further detail of the precise features recorded.

3.4 DATA STORAGE, SORTING AND RETRIEVAL

All of the location, physical, scientific and conservation and human influence data were stored in two sequential data files (one for rocky and one for sedimentary) on the Heriot-Watt University mainframe computer (at that time a Burroughs B6930).

Using software developed for this contract by Dr C G Moore, and written in FORTRAN the sites could be sorted more efficiently and the results given as a hard copy printout in any of three forms:

(i) the names of sites and their location data;
(ii) the names of sites and their scientific and conservation data including human influence;
(iii) the names of sites and their physical data.

The scientific and conservation data and the physical data are printed out as tables with abbreviations of the attributes in columns with the appropriate section headings at the top of the column corresponding to the sections on the Stage I recording card. A complete set of Stage I survey results is given in Appendix III.

The sorting routines allow any number of attributes or any number of groups of attributes to be sorted for. Thus sites fulfilling certain criteria or groups of criteria can be quickly obtained from the mass of data.

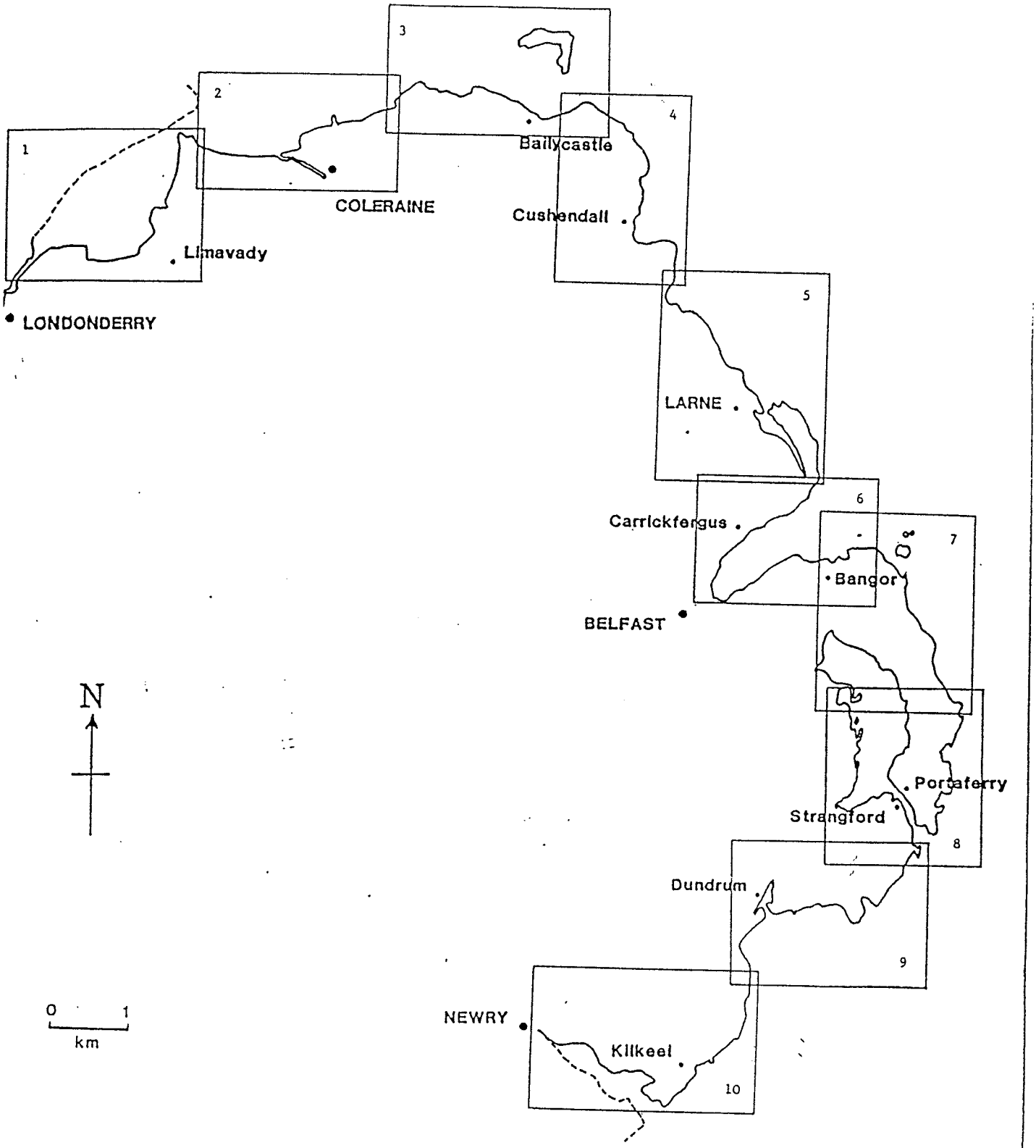
The storage and sorting facility is primarily for our own use in selecting the locations for the Stage II survey.

3.5 RESULTS

The findings of the Stage I survey are given in the form of annotated maps. The coastline of Northern Ireland was divided into ten geographically distinct areas and an accurate map drawn for each (due to its size, position and complexity Strangford Lough was

extended over two maps). The positions of all the Stage I sites are given on the maps in Figures 3.2 to 3.11 inclusive. The communities found at the sites are shown on the maps in Figures 3.12 to 3.21 for the sedimentary sites and Figures 3.22 to 3.31 for the rocky sites.

Results in this form show the changing biological nature of the whole coastline from Londonderry to Warrenpoint but no detailed analysis is attempted at this stage.



ıre 3.1 Key to maps of the coastline of Northern Ireland

Figure 3.2

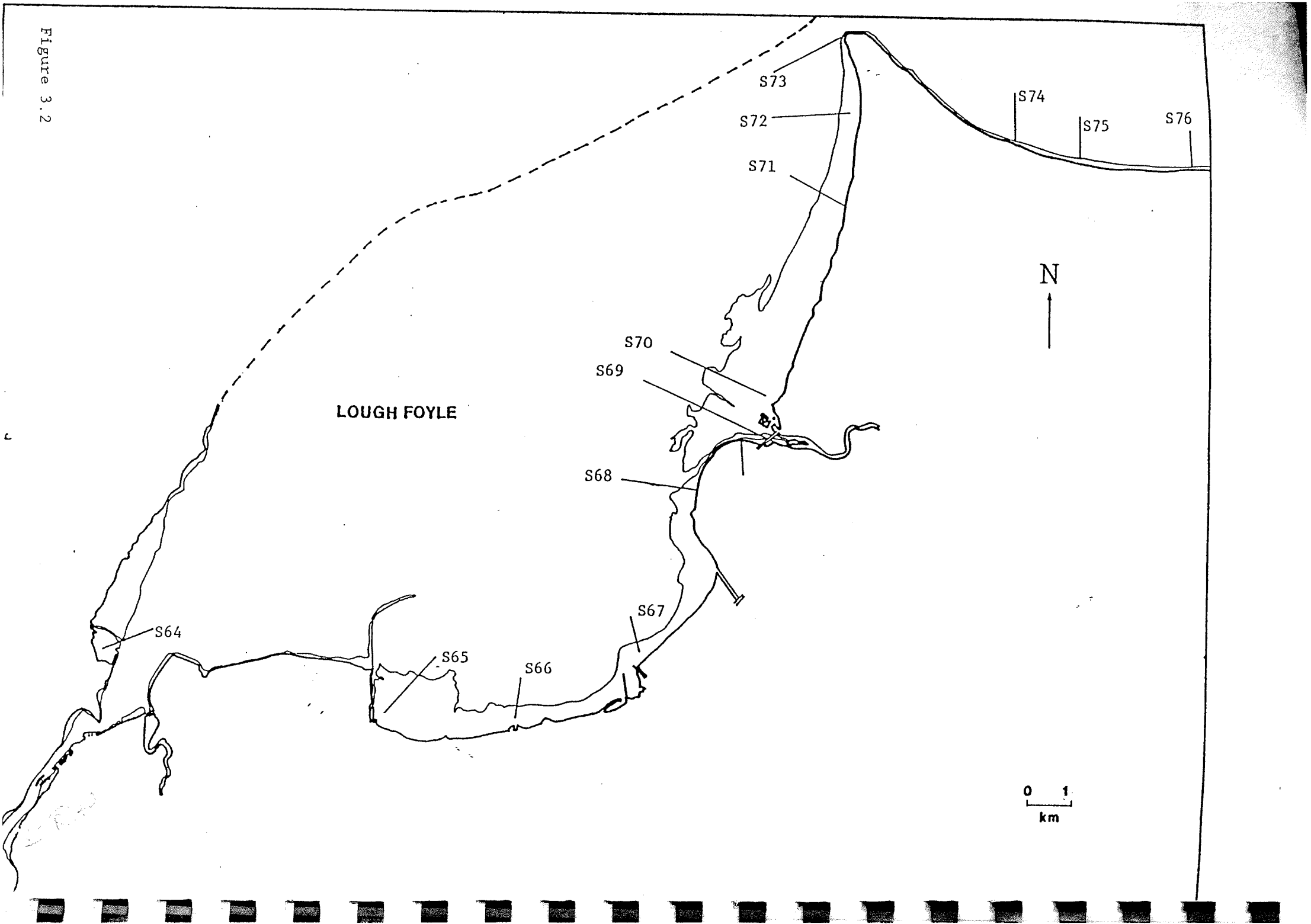

S73
S74
S75
S76
S72
S71
N
S70
S69
LOUGH FOYLE
S68
S67
S64
S65
S66
0 1
km

Figure 3.3

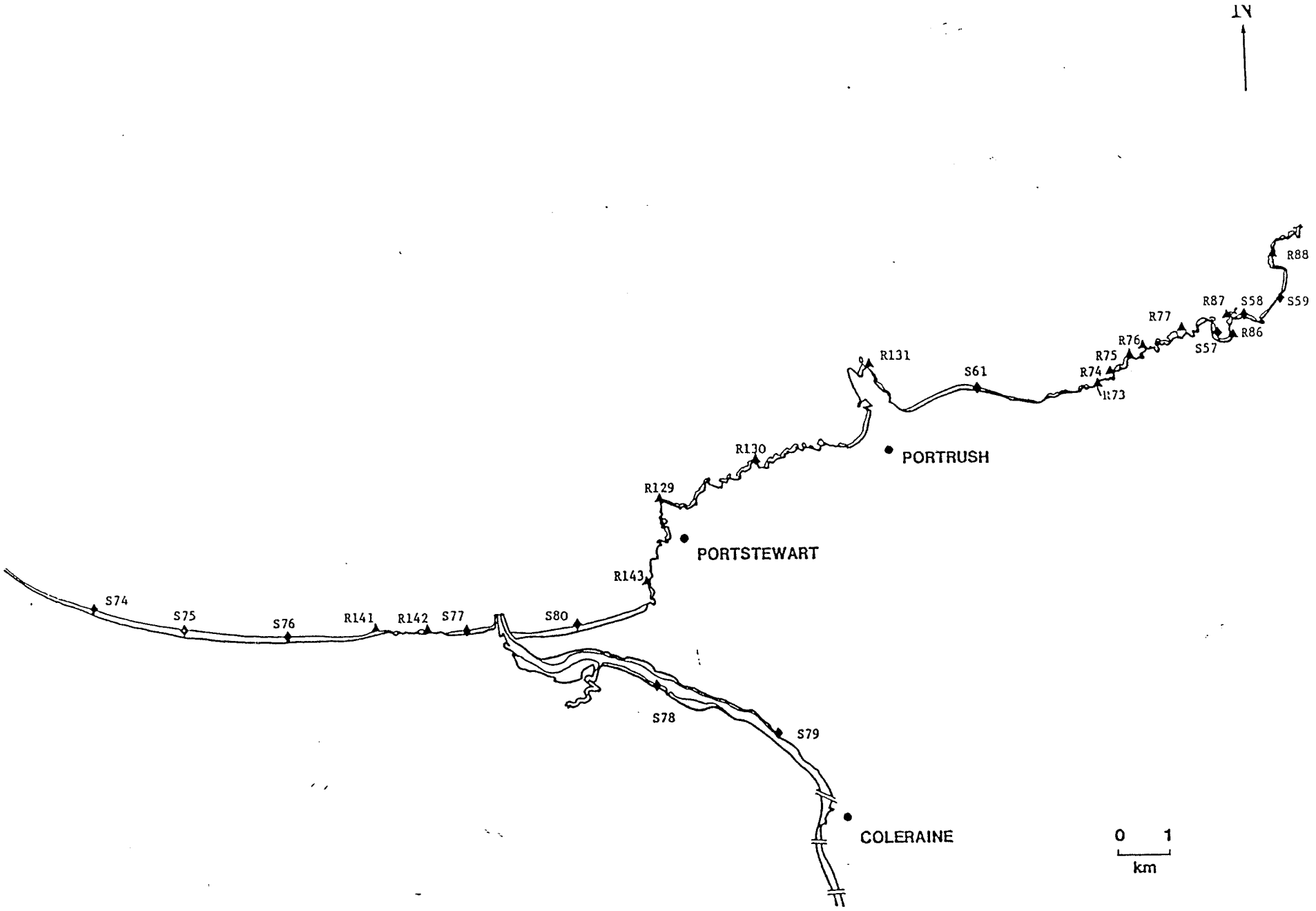
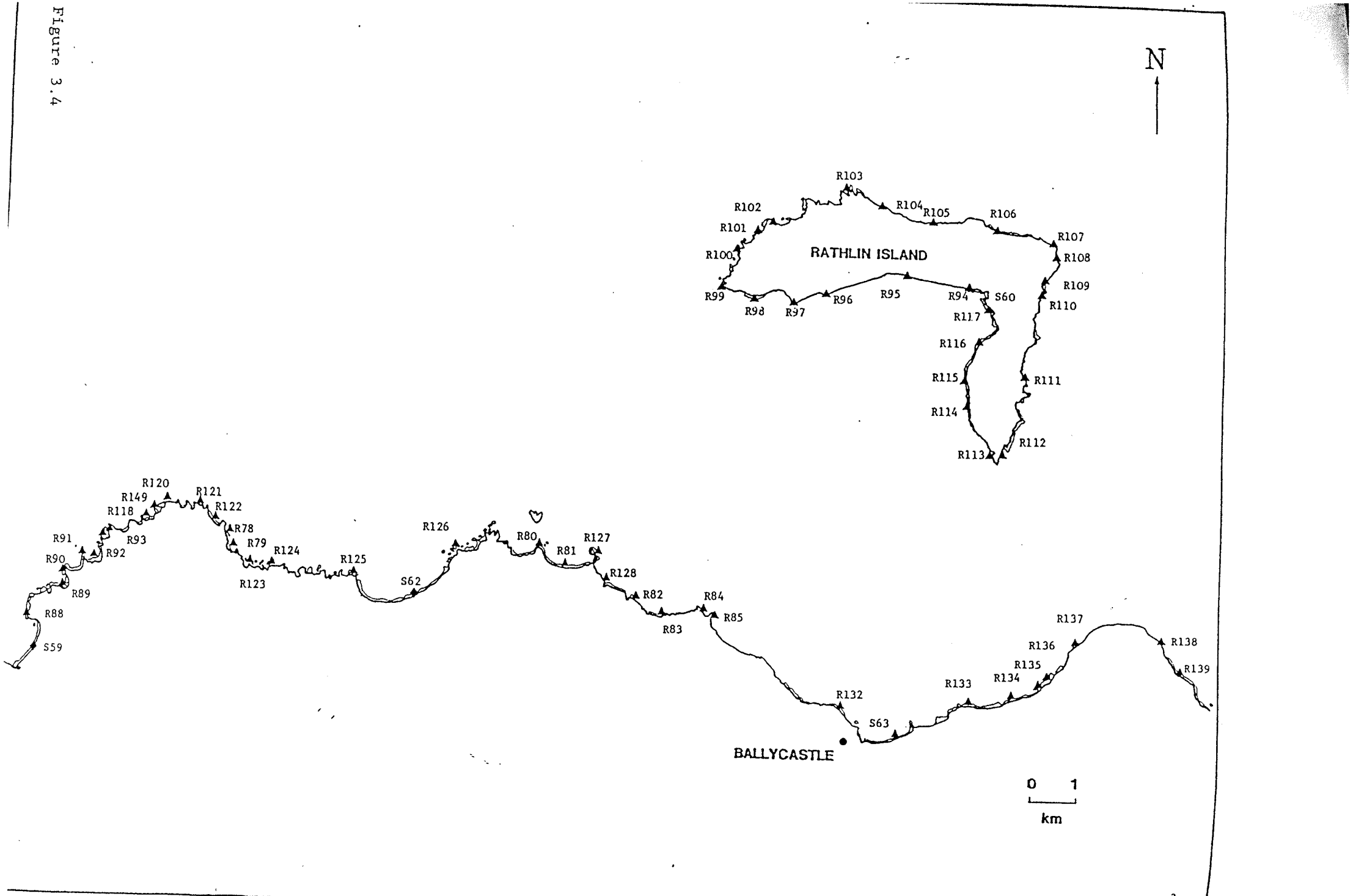

N
R88
S59
S58
R87
R77
R86
S57
R76
R75
R74
R73
S61
R131
R130
PORTRUSH
R129
PORTSTEWART
R143
S74
S75
S76
R141
R142
S77
S80
S78
S79
COLERAINE
0 1
km

Figure 3.4


N
RATHLIN ISLAND
R103
R102
R104
R105
R106
R101
R107
R100
R108
R109
R99
R96
R95
R94
S60
R110
R98
R97
R117
R116
R115
R111
R114
R112
R113
R120
R149
R121
R118
R122
R91
R78
R93
R126
R80
R127
R90
R92
R79
R124
R125
R81
R123
S62
R128
R89
R82
R84
R88
R85
R83
R137
R136
R138
R135
R134
R139
R133
R132
S63
S59
BALLYCASTLE
0 1
km

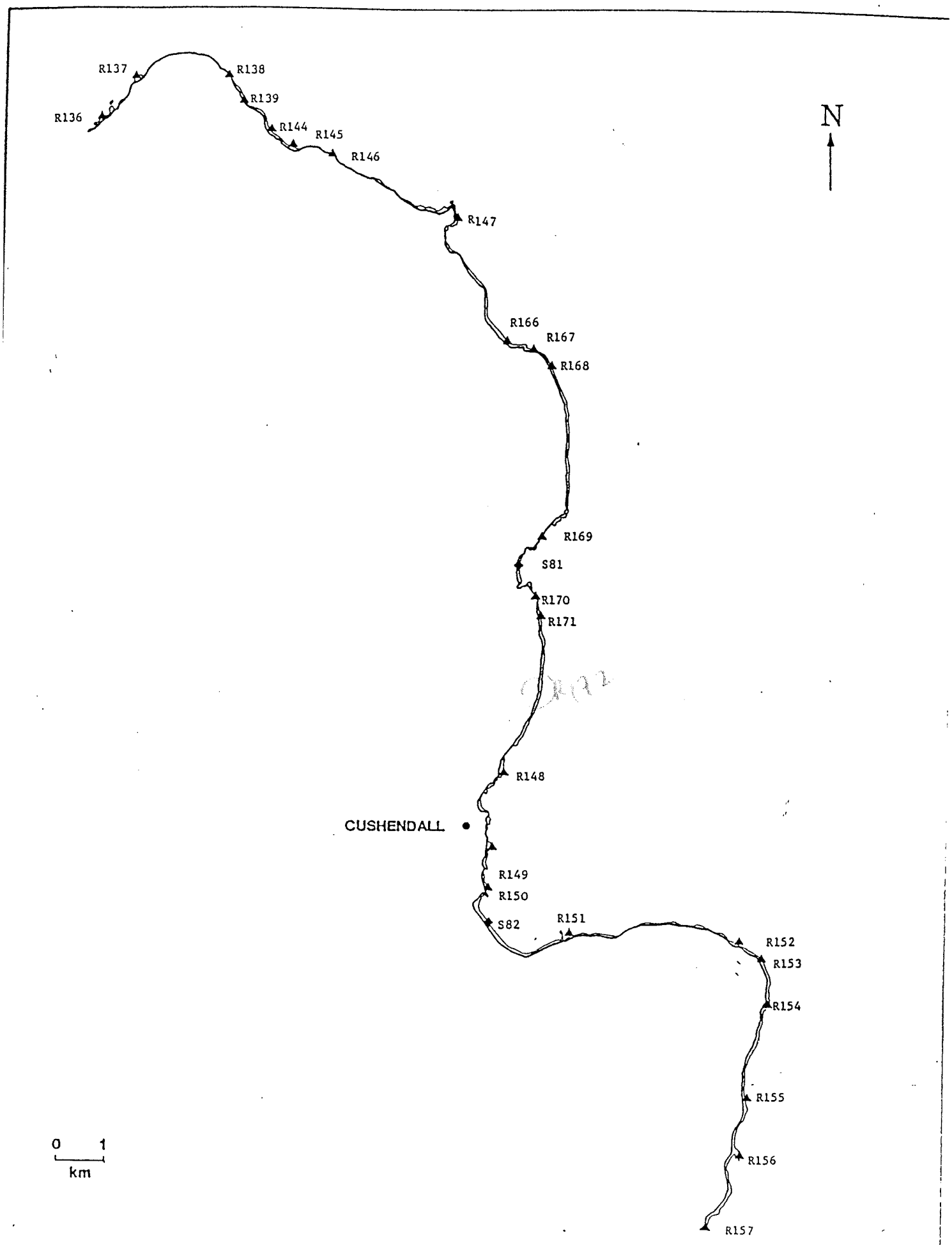

R137
R138
R139
R136
R144
R145
R146
R147
N
R166
R167
R168
R169
S81
R170
R171
R148
CUSHENDALL
R149
R150
S82
R151
R152
R153
R154
R155
R156
R157
0
1
km

Figure 3.5

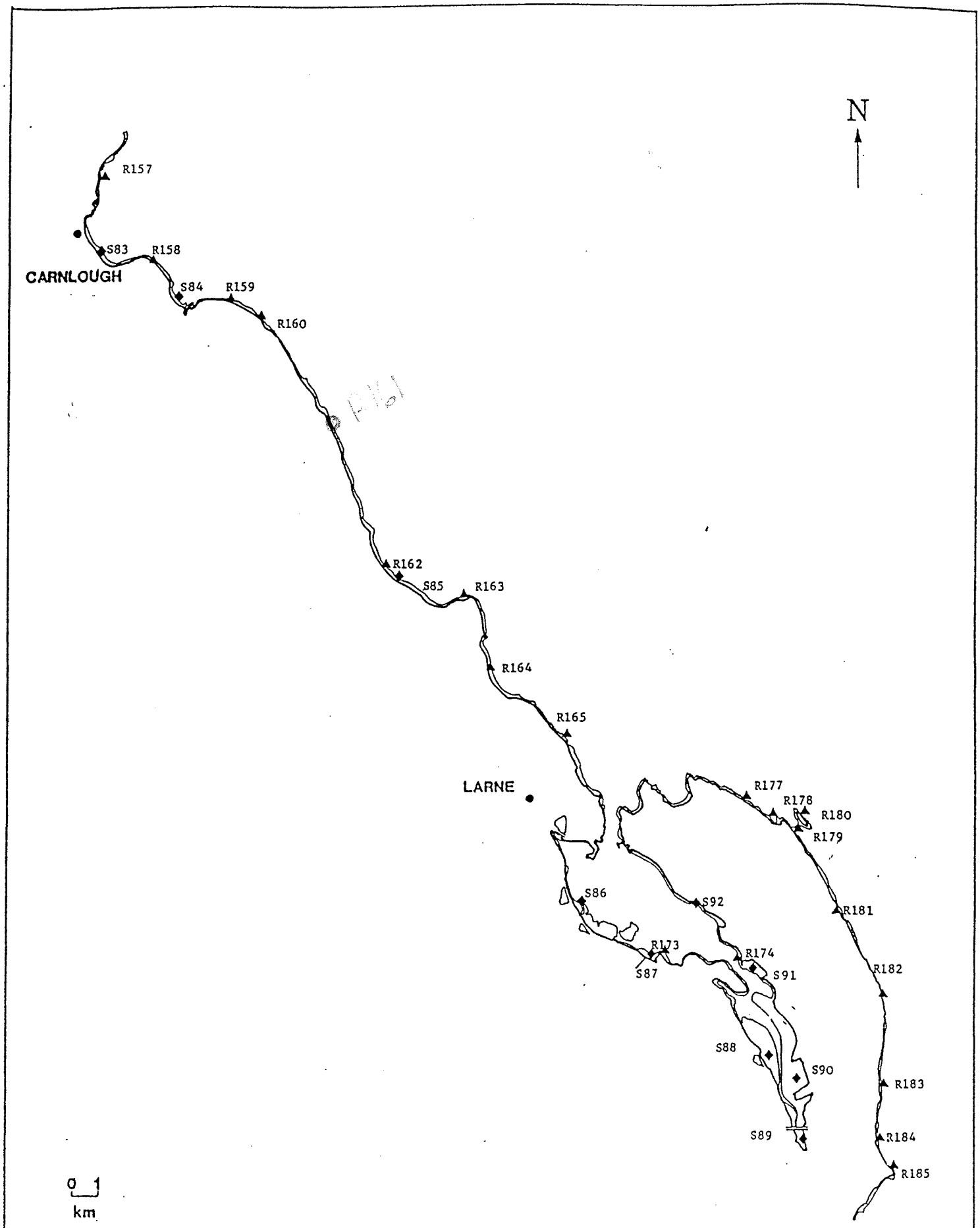
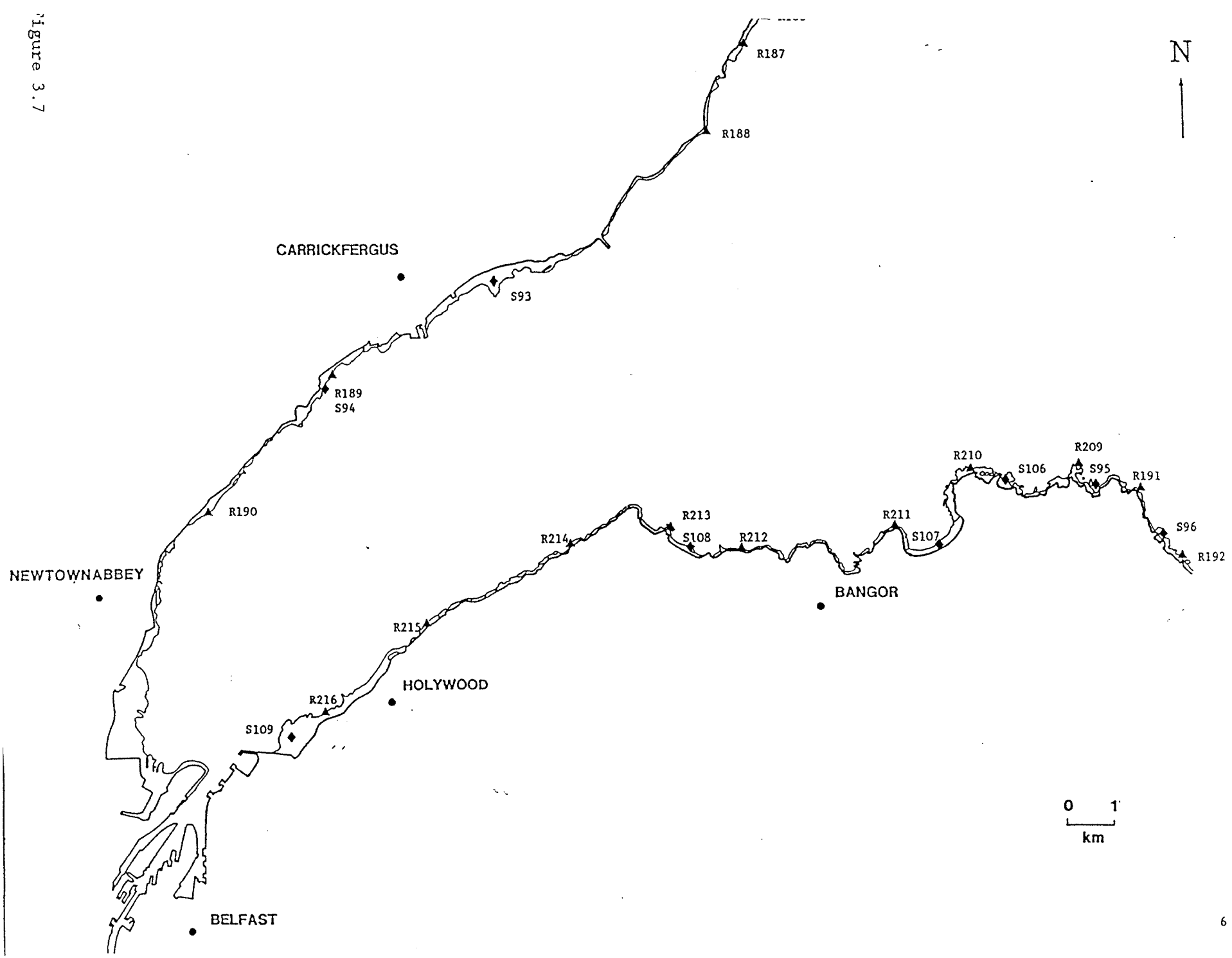

N
R157
S83
R158
CARNLOUGH
S84
R159
R160
R162
S85
R163
R164
R165
LARNE
R177
R178
R180
R179
S86
S92
R181
R173
R174
S87
S91
R182
S88
S90
R183
S89
R184
R185
0 1
km

Figure 3.6

Figure 3.7


N
R187
R188
CARRICKFERGUS
S93
R189
S94
R190
NEWTOWNABBEY
R214
R213
S108
R212
R211
S107
R210
S106
R209
S95
R191
S96
R192
BANGOR
R215
HOLYWOOD
R216
S109
BELFAST
0 1
km

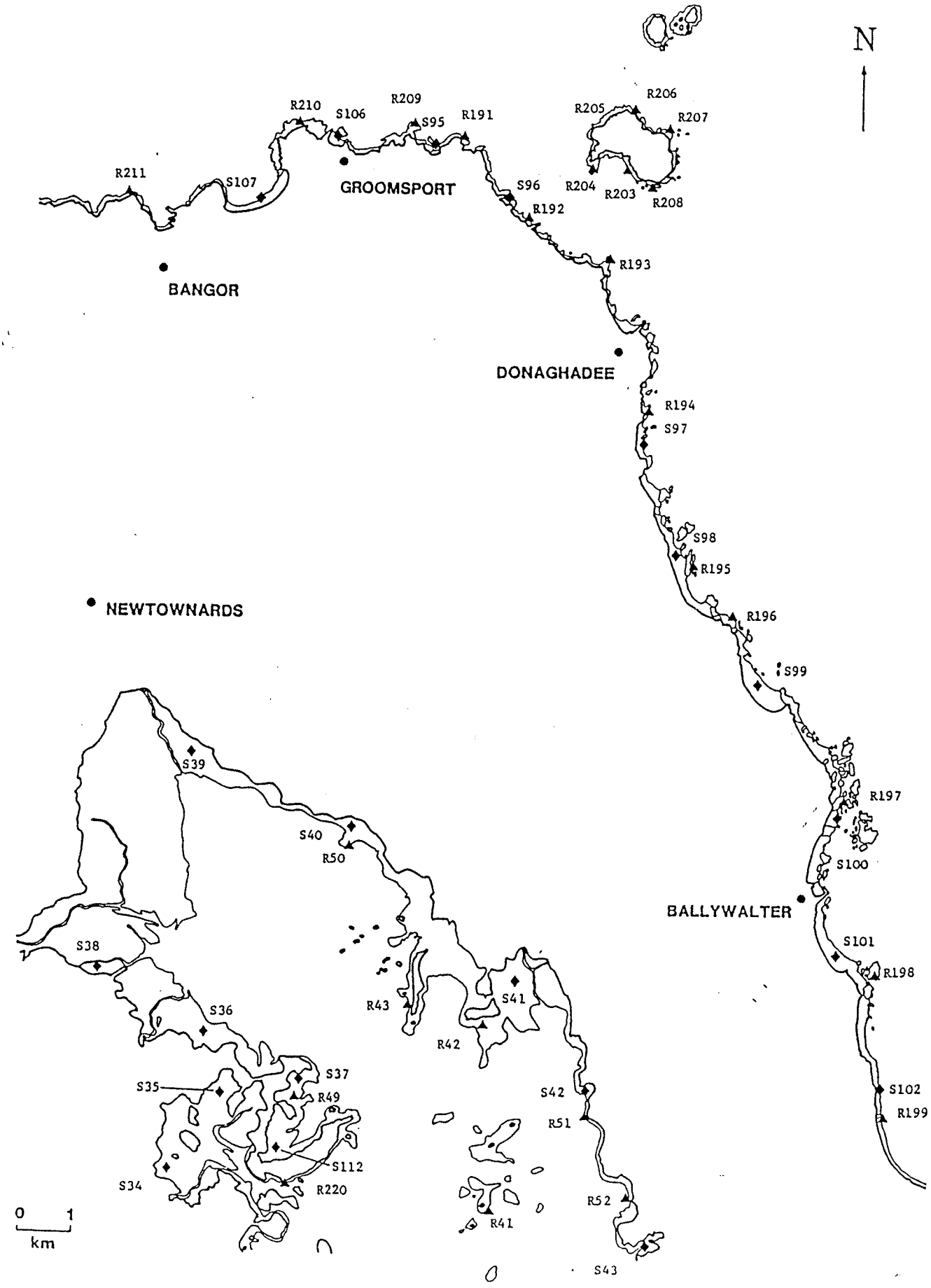
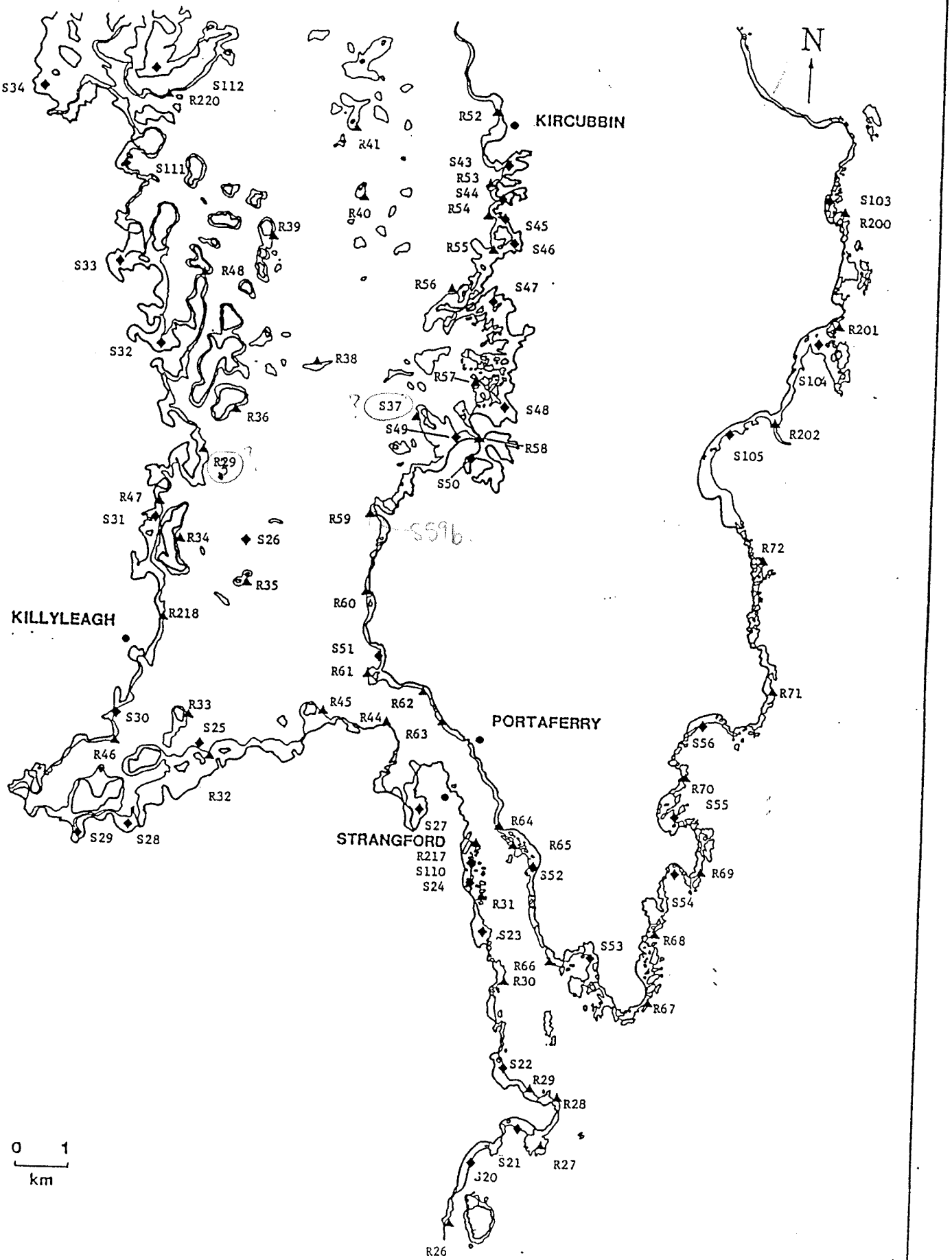

N
R210
S106
R209
S95
R191
R205
R206
R207
R211
S107
GROOMSPORT
S96
R204
R203
R208
R192
BANGOR
R193
DONAGHADEE
R194
S97
S98
R195
NEWTOWNARDS
R196
S99
S39
R197
S40
R50
S100
BALLYWALTER
S38
S101
R198
S36
R43
S41
R42
S37
S35
R49
S42
S102
R51
R199
S112
S34
R220
R52
R41
S43
0
1
km

Figure 3.8


N
KIRCUBBIN
KILLYLEAGH
PORTAFERRY
STRANGFORD
S34
S112
R220
S111
R39
S33
R48
S32
R38
R36
R29
R47
S31
R34
S26
R35
R218
S30
R33
S25
R46
R32
S29
S28
R45
R44
R62
R63
S27
R217
S110
S24
R64
R65
S52
R31
S23
R66
R30
S22
R29
R28
S21
R27
J20
R26
R41
R40
S43
R53
S44
R54
S45
R55
S46
R56
S47
R57
S48
S37
S49
R58
S50
R59
S59b
R60
S51
R61
R52
S103
R200
R201
S104
R202
S105
R72
R71
S56
R70
S55
R69
S54
R68
S53
R67
0
1
km

igure 3.9

Figure 3.10

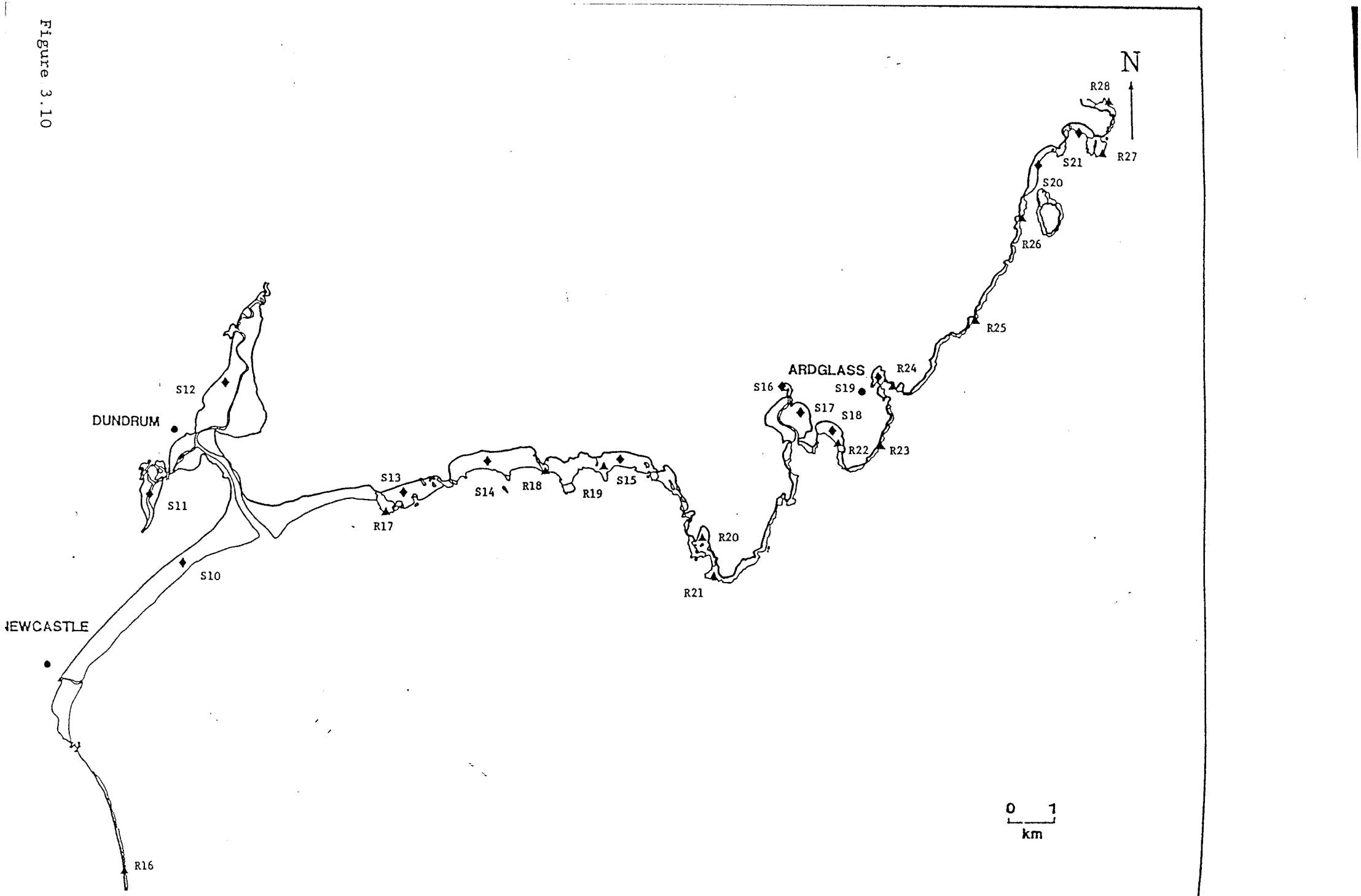
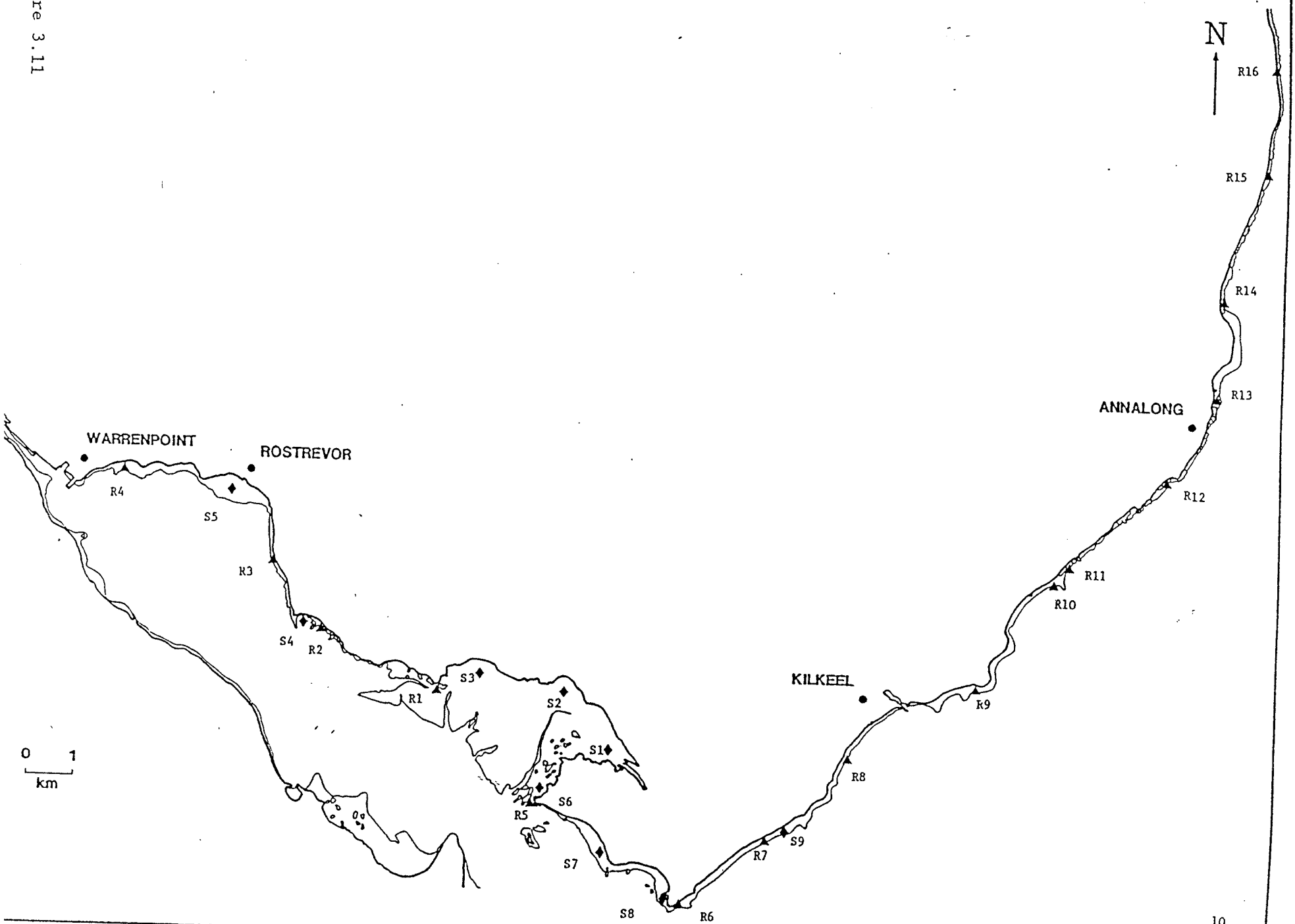

N
R28
R27
S21
S20
R26
R25
ARDGLASS
R24
S16
S19
S17
S18
R22
R23
S12
DUNDRUM
S13
S14
R18
R19
S15
S11
R17
R20
R21
S10
NEWCASTLE
R16
0
1
km

Figure 3.11


N
WARRENPOINT
ROSTREVOR
ANNALONG
KILKEEL
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
S1
S2
S3
S4
S5
S6
S7
S8
S9
0
1
km

Figures 3.12-3.21: Communities found on sedimentary sites (Stage I survey)

Key to abbreviations:

CP - Crustacea/Polychaete (General)
A - Arenicola + Corophium + Hydrobia
M - Macoma
L - Lanice
T - Tellina
Sc - Scrobicularia
P - Pullastra
NP - Nemertines and Polychaetes
N - Nephthys dominated
NC - Nereid/Corophium
S - Spisula
ES - Echino Sili

Figure 3.12

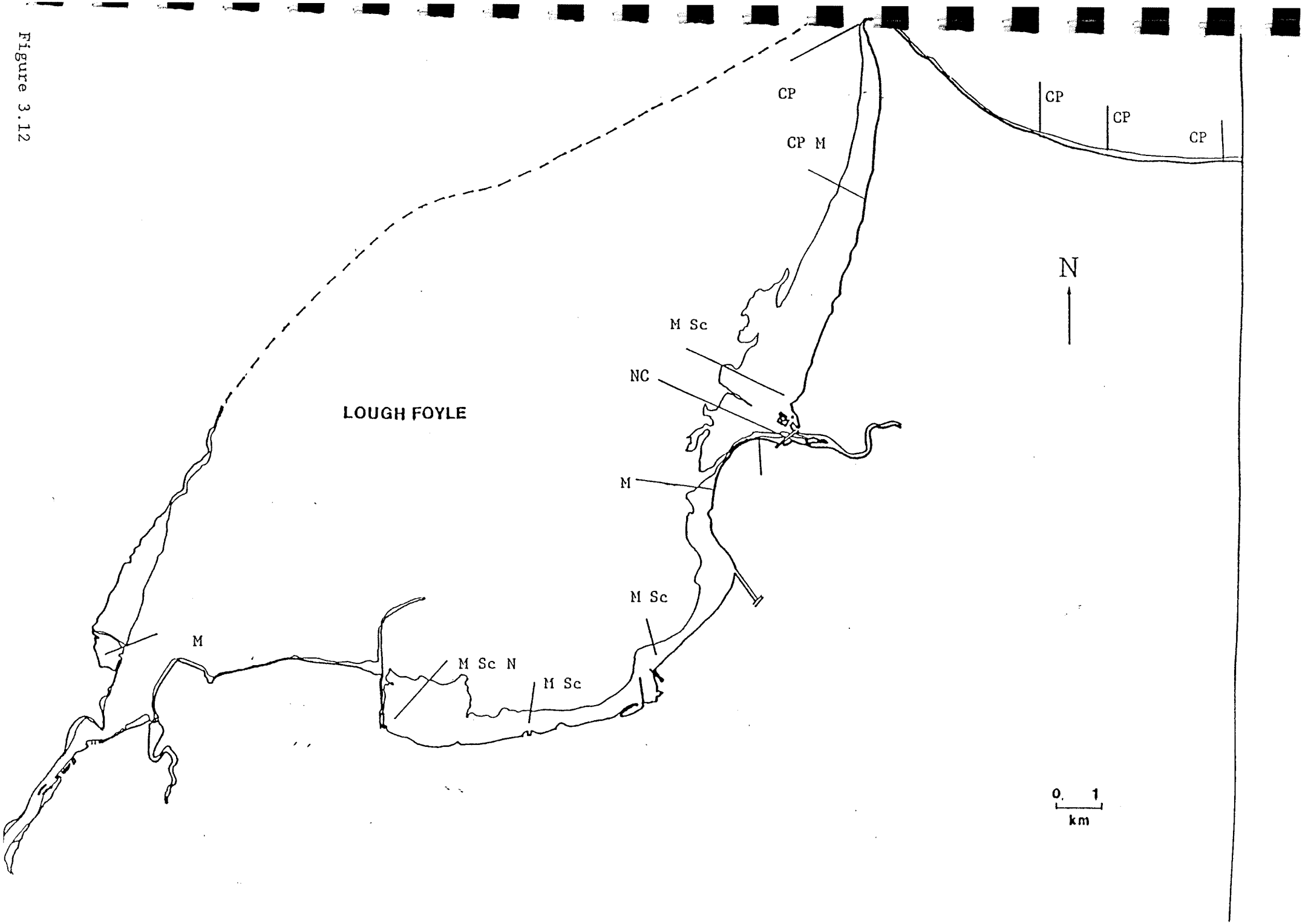


Figure 3.13

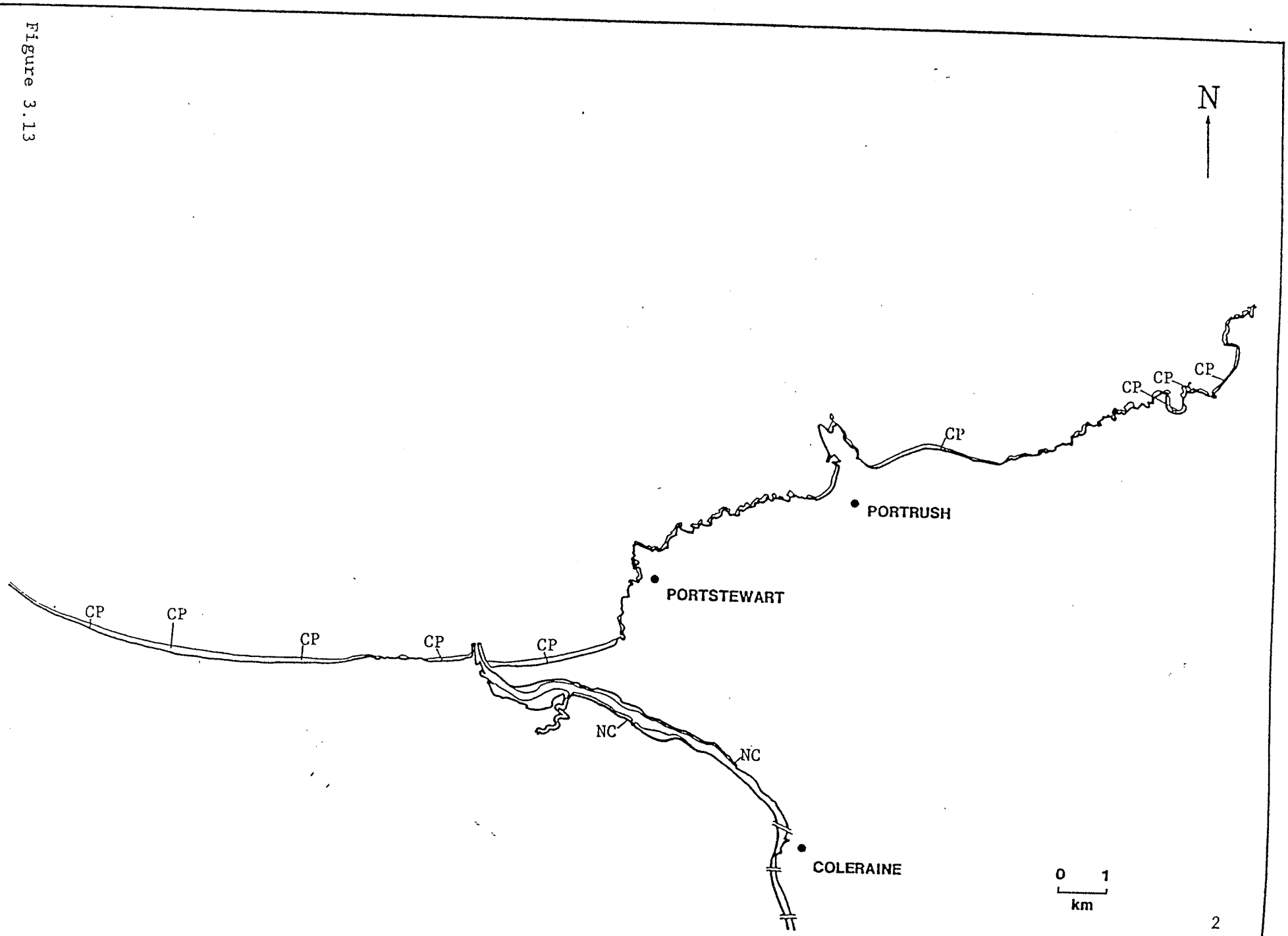
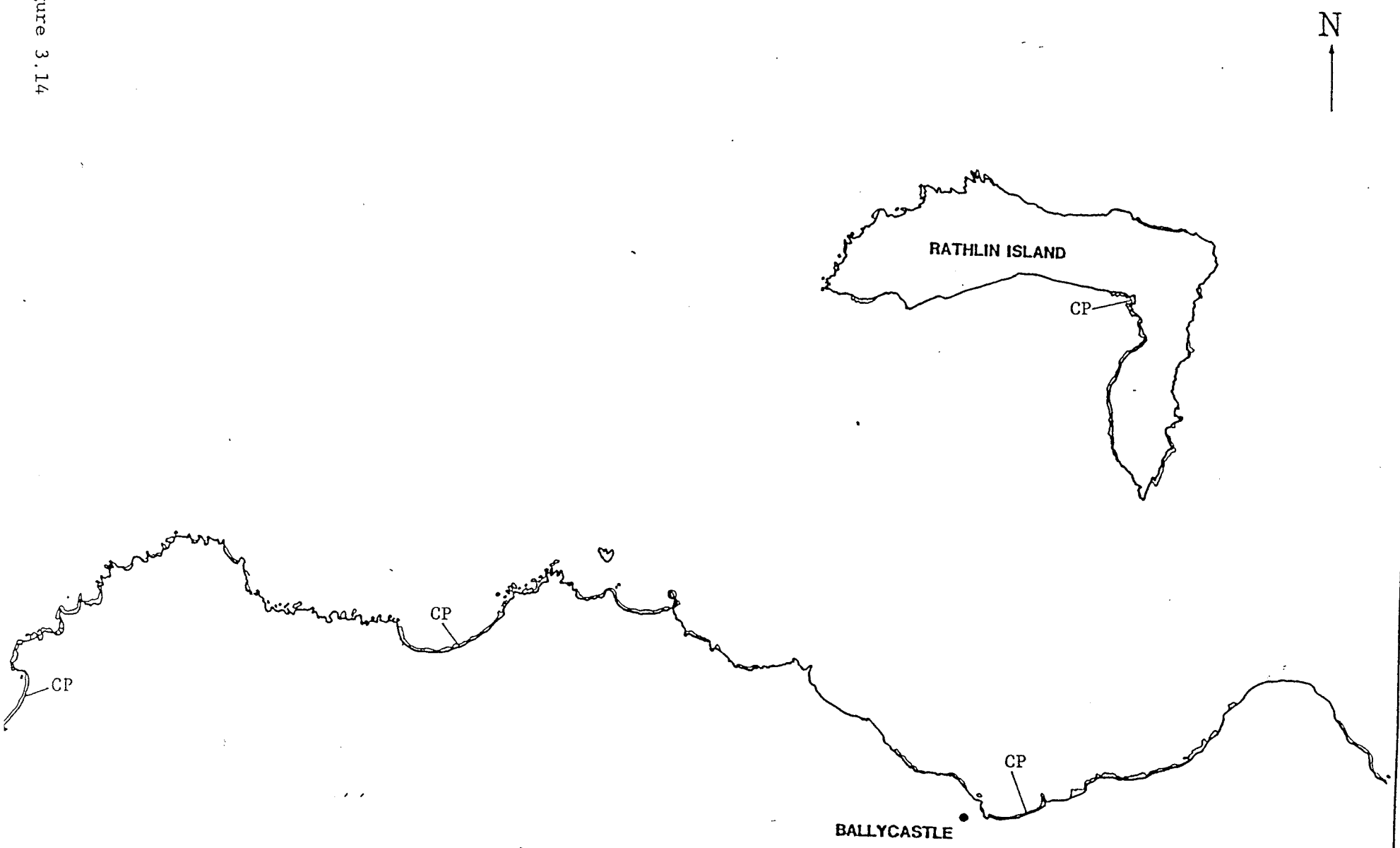

N
CP
CP
CP
CP
CP
CP
PORTRUSH
PORTSTEWART
CP
CP
CP
CP
CP
NC
NC
COLERAINE
0 1
km
2

Figure 3.14



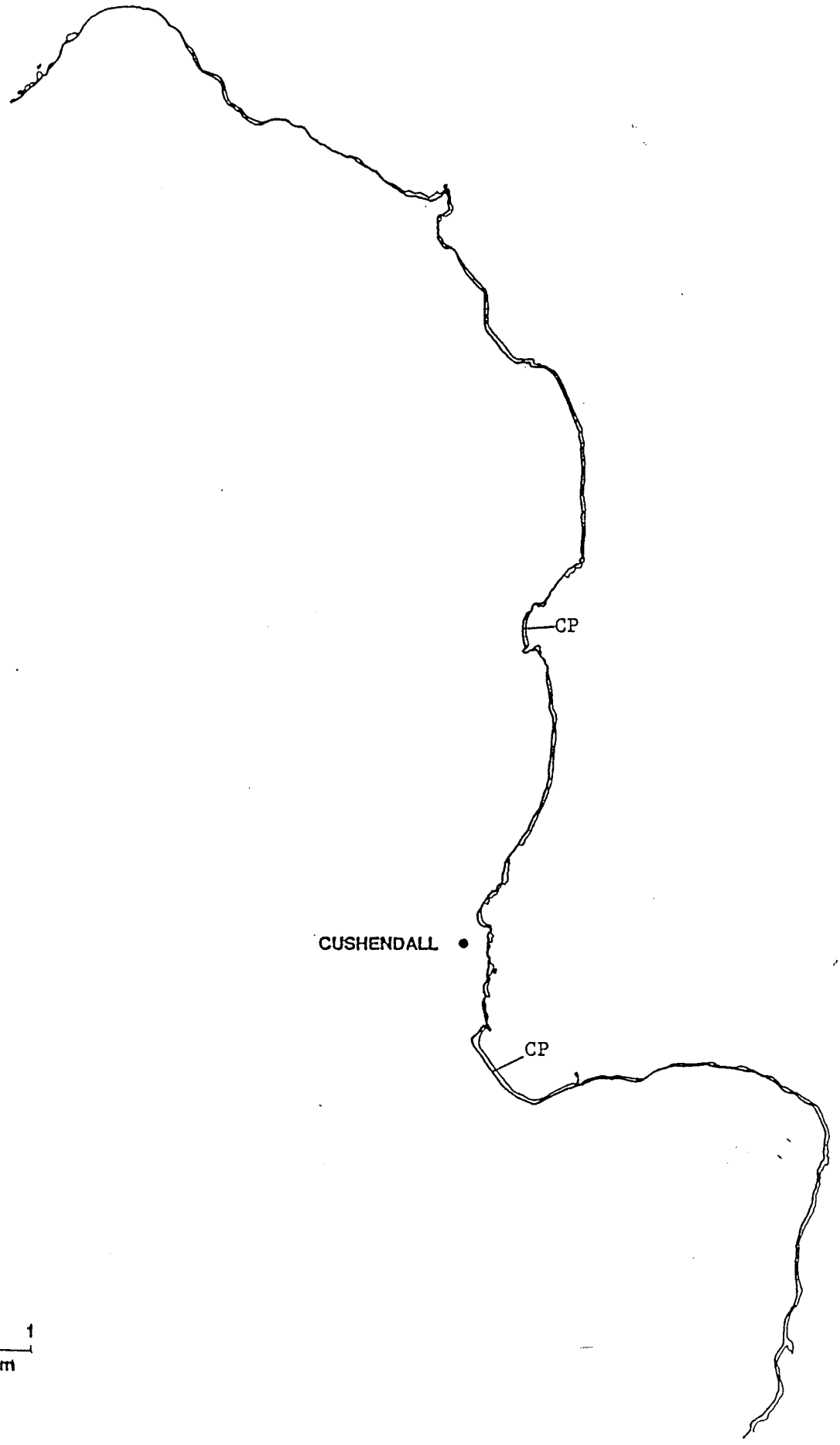


Figure 3.15

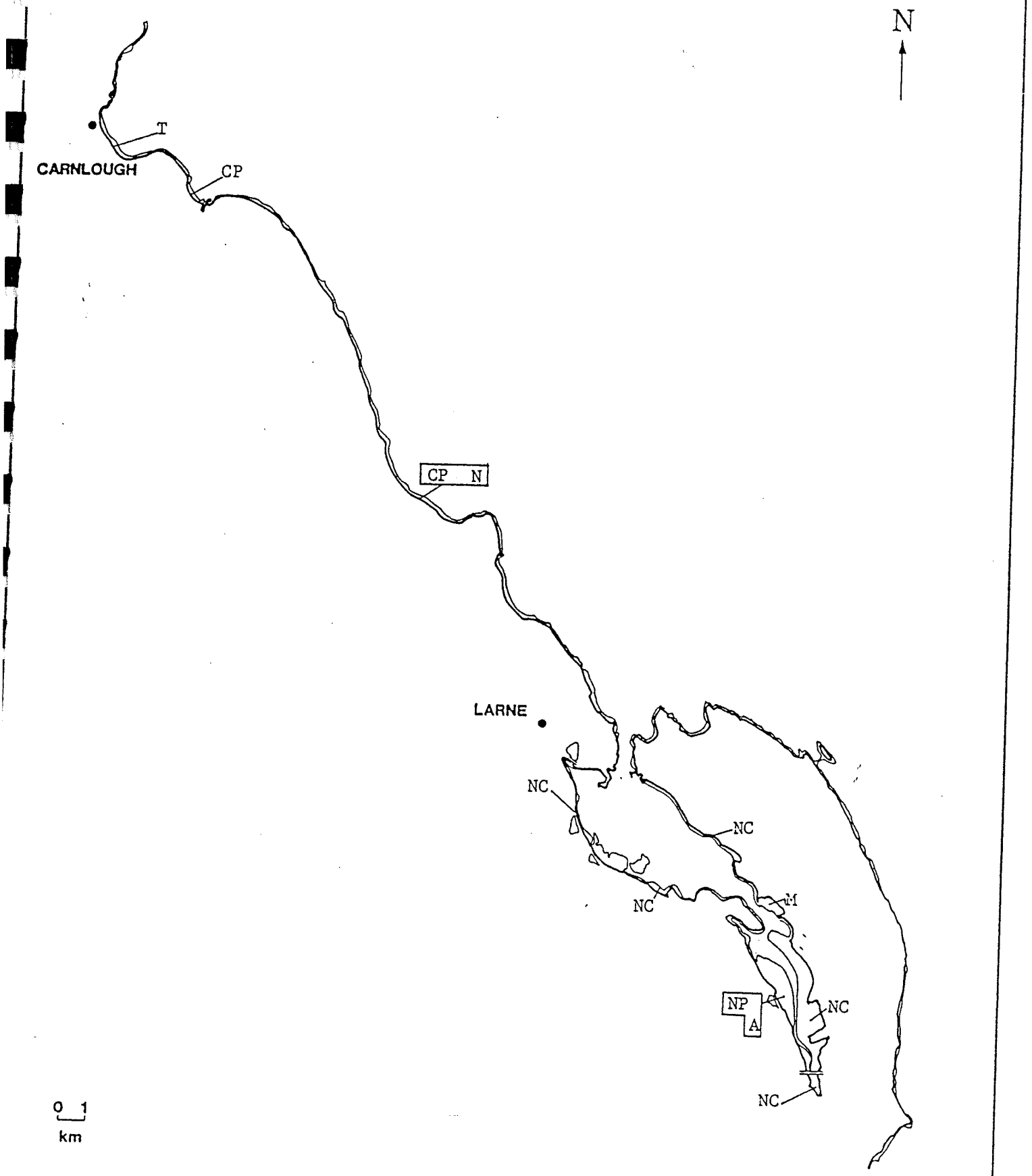
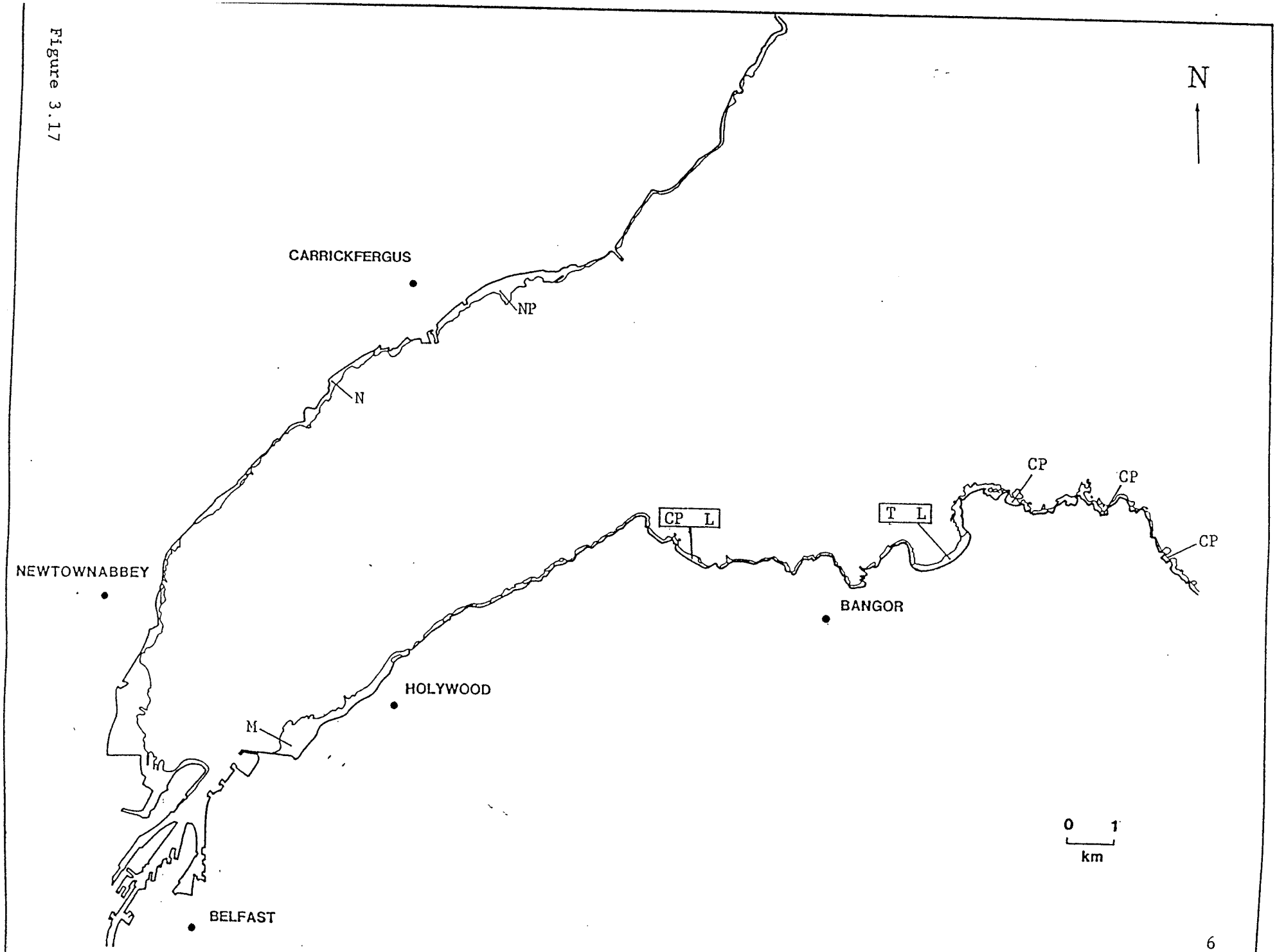


Figure 3.16

Figure 3.17


N
CARRICKFERGUS
NP
N
CP
CP
CP
CP L
T L
NEWTOWNABBEY
BANGOR
HOLYWOOD
M
BELFAST
0 1
km

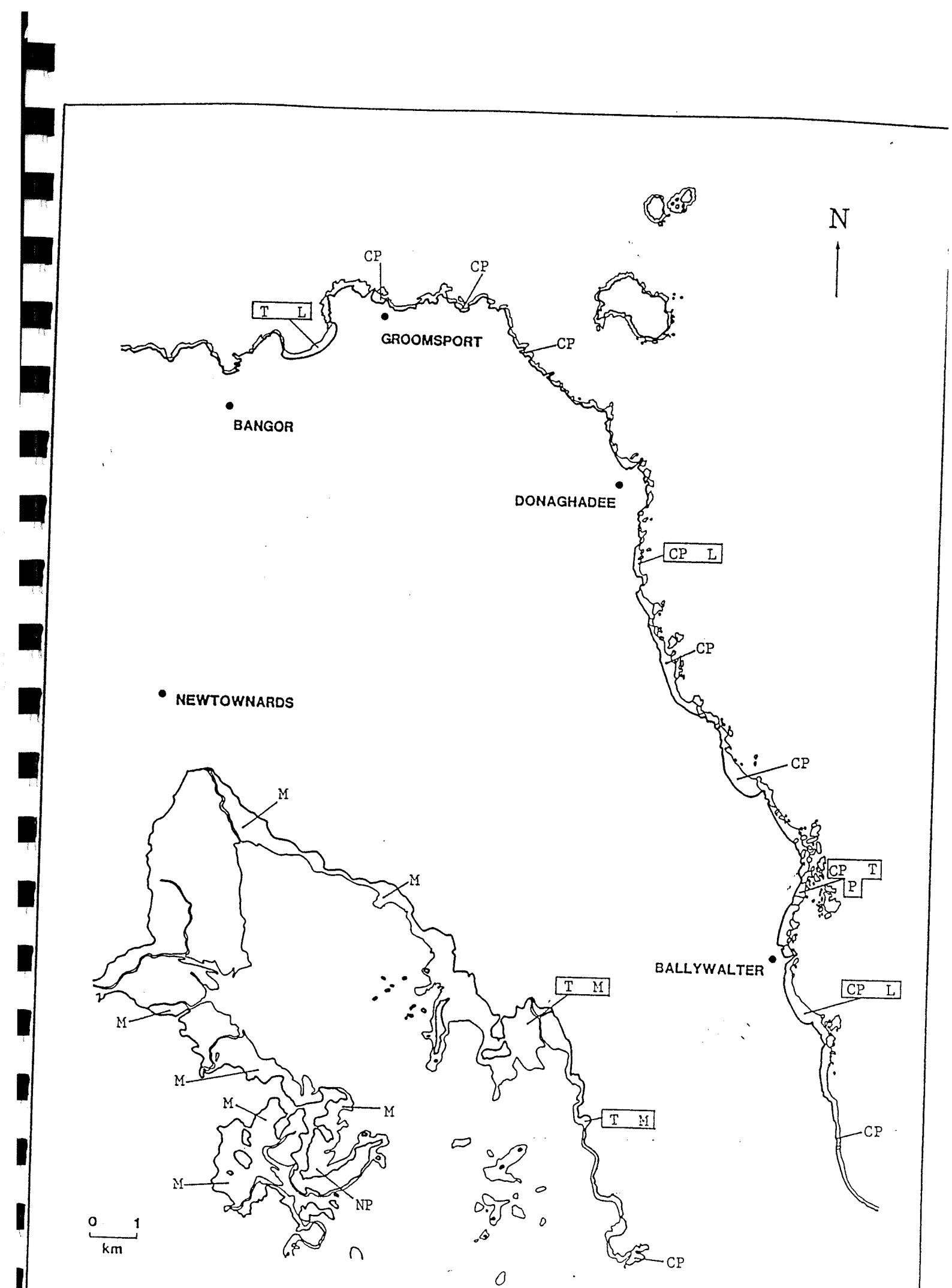

N
CP
CP
CP
T L
GROOMSPORT
BANGOR
DONAGHADEE
CP L
CP
NEWTOWNARDS
CP
M
M
CP T
P
BALLYWALTER
M
T M
CP L
M
M
M
M
T M
M
NP
CP
0 1
km

Figure 3.18

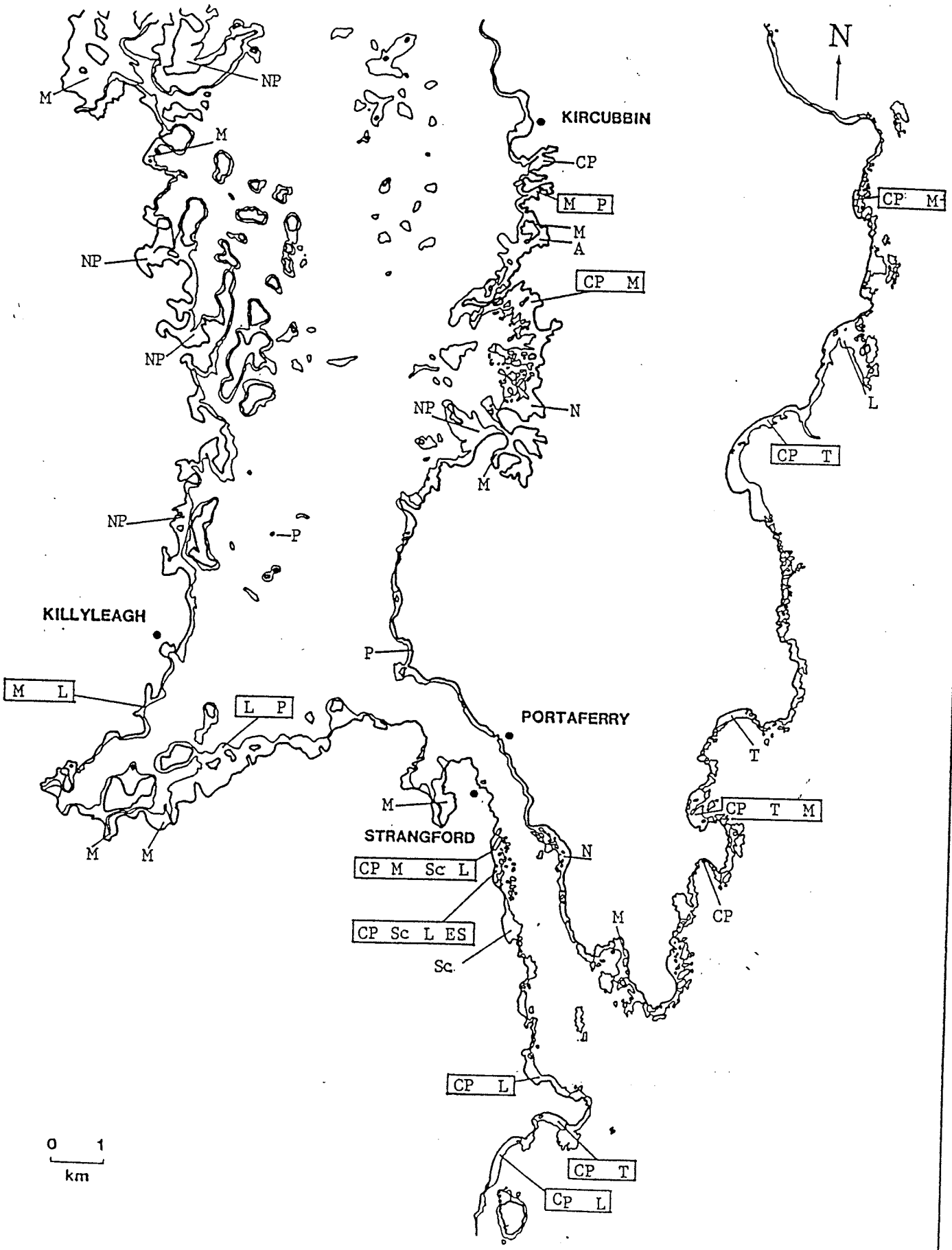

N
KIRCUBBIN
KILLYLEAGH
PORTAFERRY
STRANGFORD
M
NP
M
NP
NP
NP
P
M L
L P
M
M
M
CP
M P
M
A
CP M
N
M
P
M
N
CP M
L
CP T
T
CP T M
CP
M
N
CP M Sc L
CP Sc L ES
Sc
CP L
CP T
Cp L
0 1
km

Figure 3.19

Figure 3.20

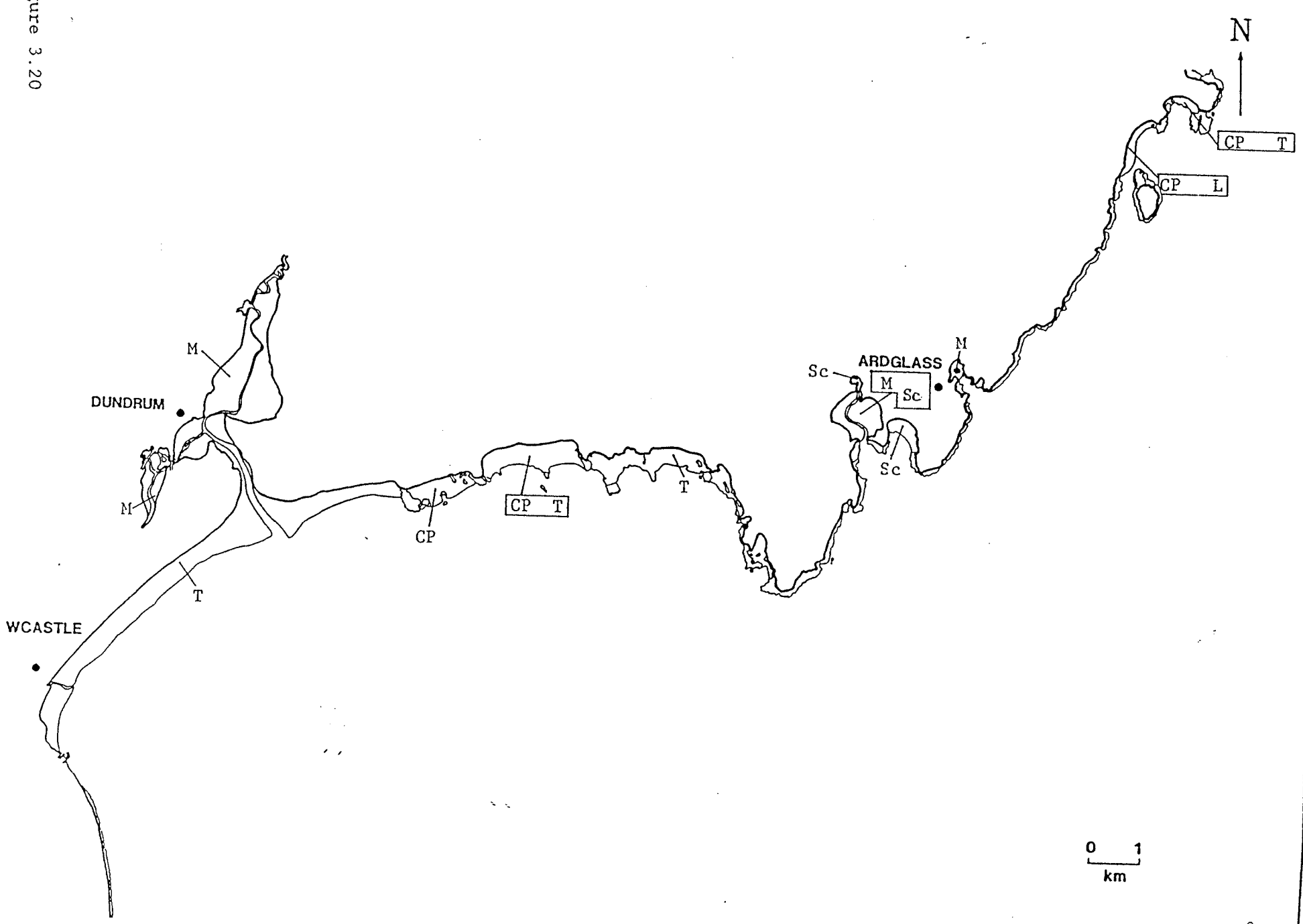
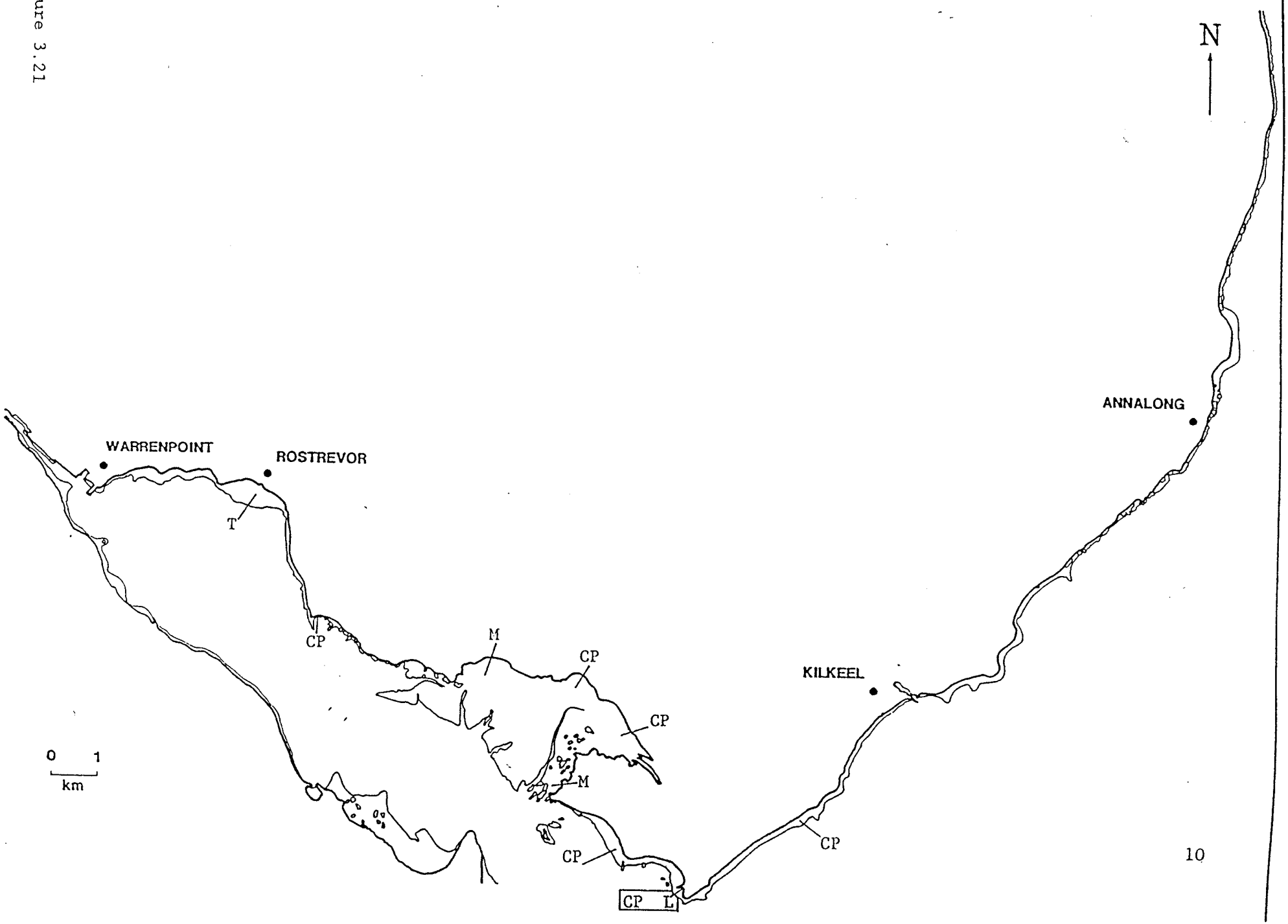

N
CP T
CP L
M
DUNDRUM
M
M
ARDGLASS
Sc
M Sc
Sc
CP
CP T
T
T
WCASTLE
0 1
km

Figure 3.21


N
WARRENPOINT
ROSTREVOR
ANNALONG
KILKEEL
T
CP
M
CP
CP
M
CP
CP
CP L
0 1
km

Figures 3.22-3.31: Communities found on rocky sites (Stage I survey)

Key to abbreviations:

As - Ascophyllum
F - Fucoids
FP - Fucopatella
FB - Fucobarnacle
FM - Fucomytilus
C - Chlorophytes
R - Rhodophytes
RB - Rhodobarnacle
RM - Rhodomytilus
M - Molluscs
MB - Mytilobarnacle
B - Barnacle
PB - Patellobarnacle

Figure 3.22

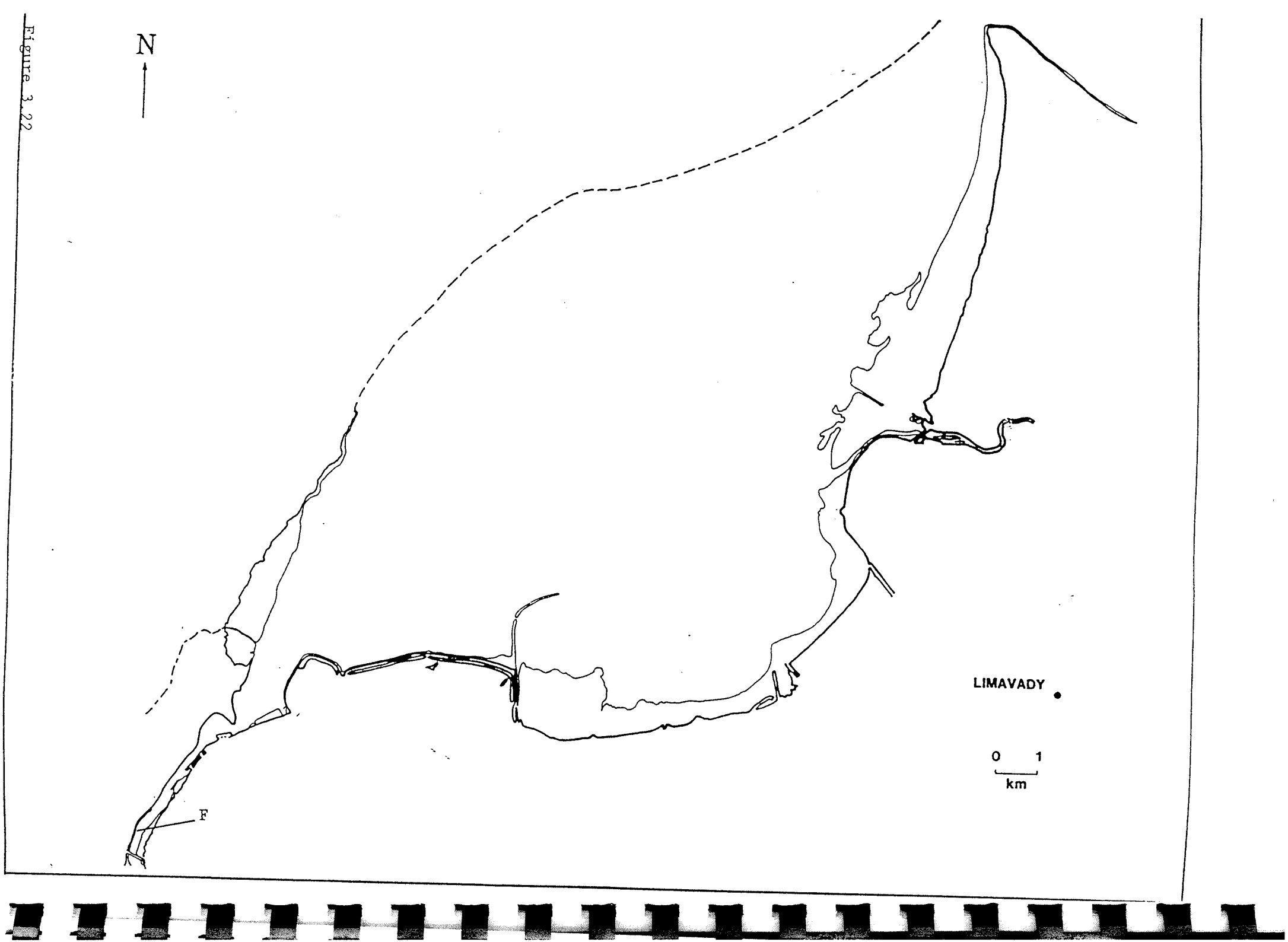


Figure 3.23

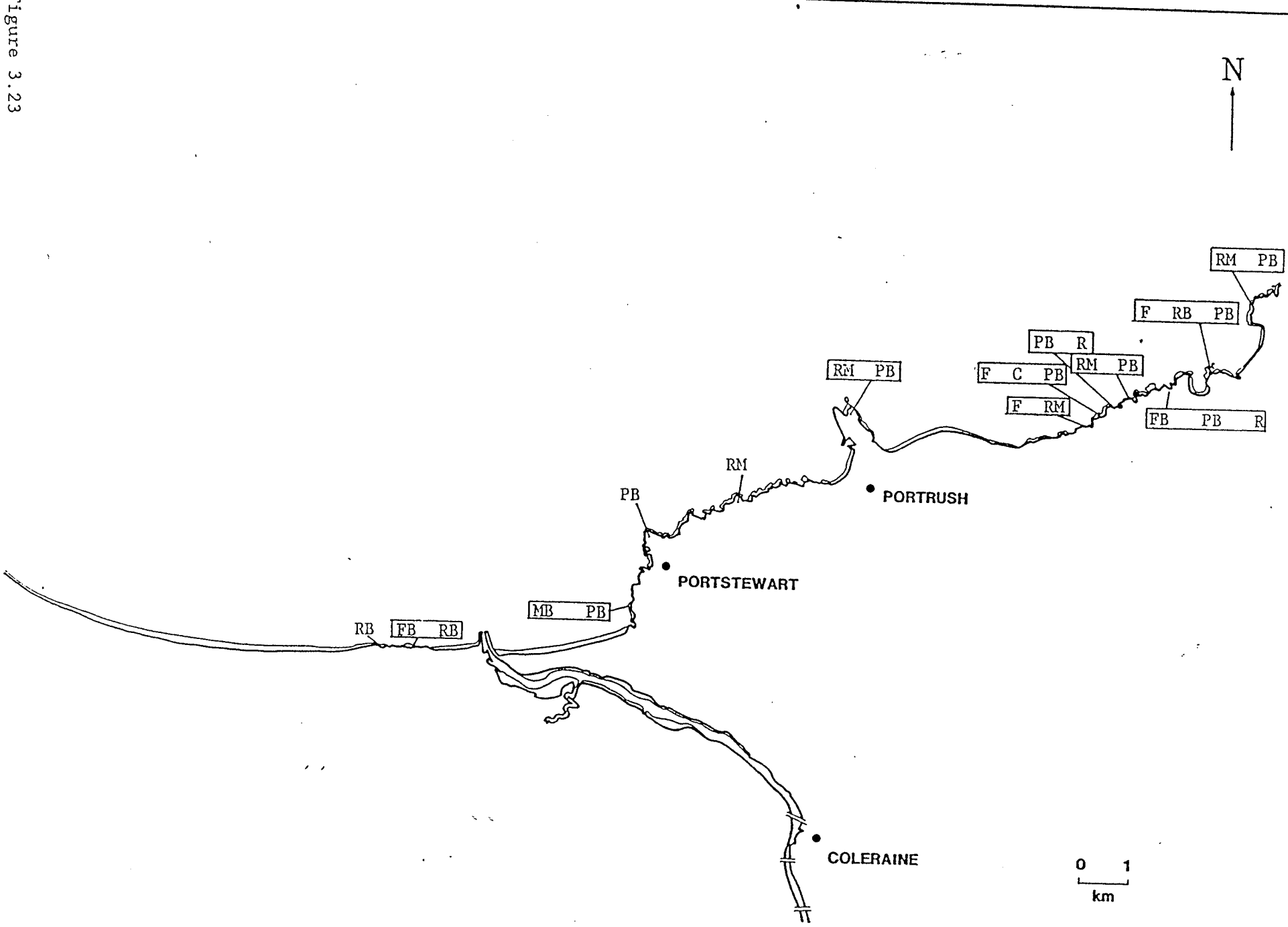
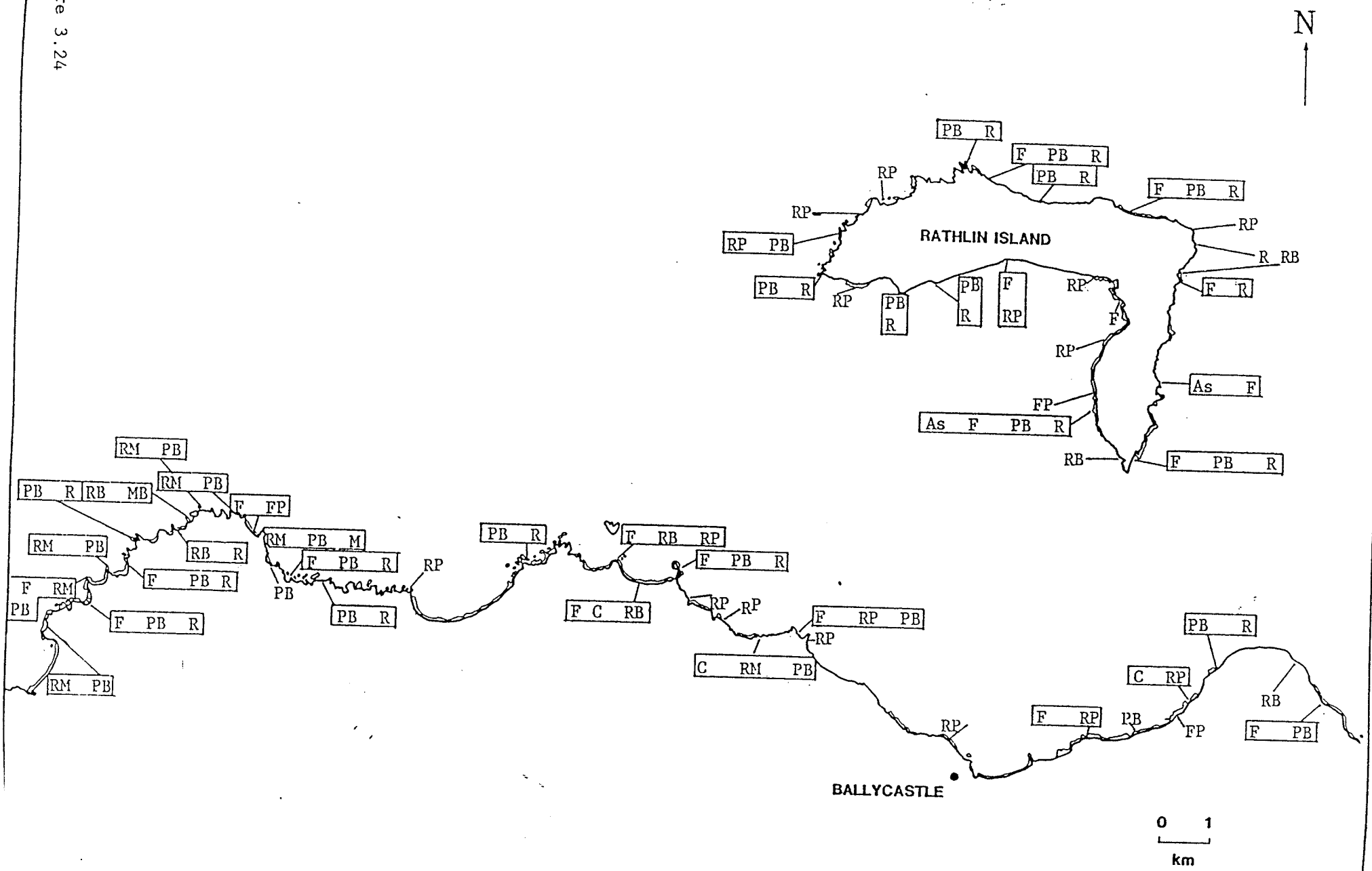

N
RM PB
F RB PB
PB R
RM PB
F C PB
F RM
FB PB R
RM PB
RM
PB
PORTRUSH
PORTSTEWART
MB PB
RB FB RB
COLERAINE
0 1
km

Figure 3.24



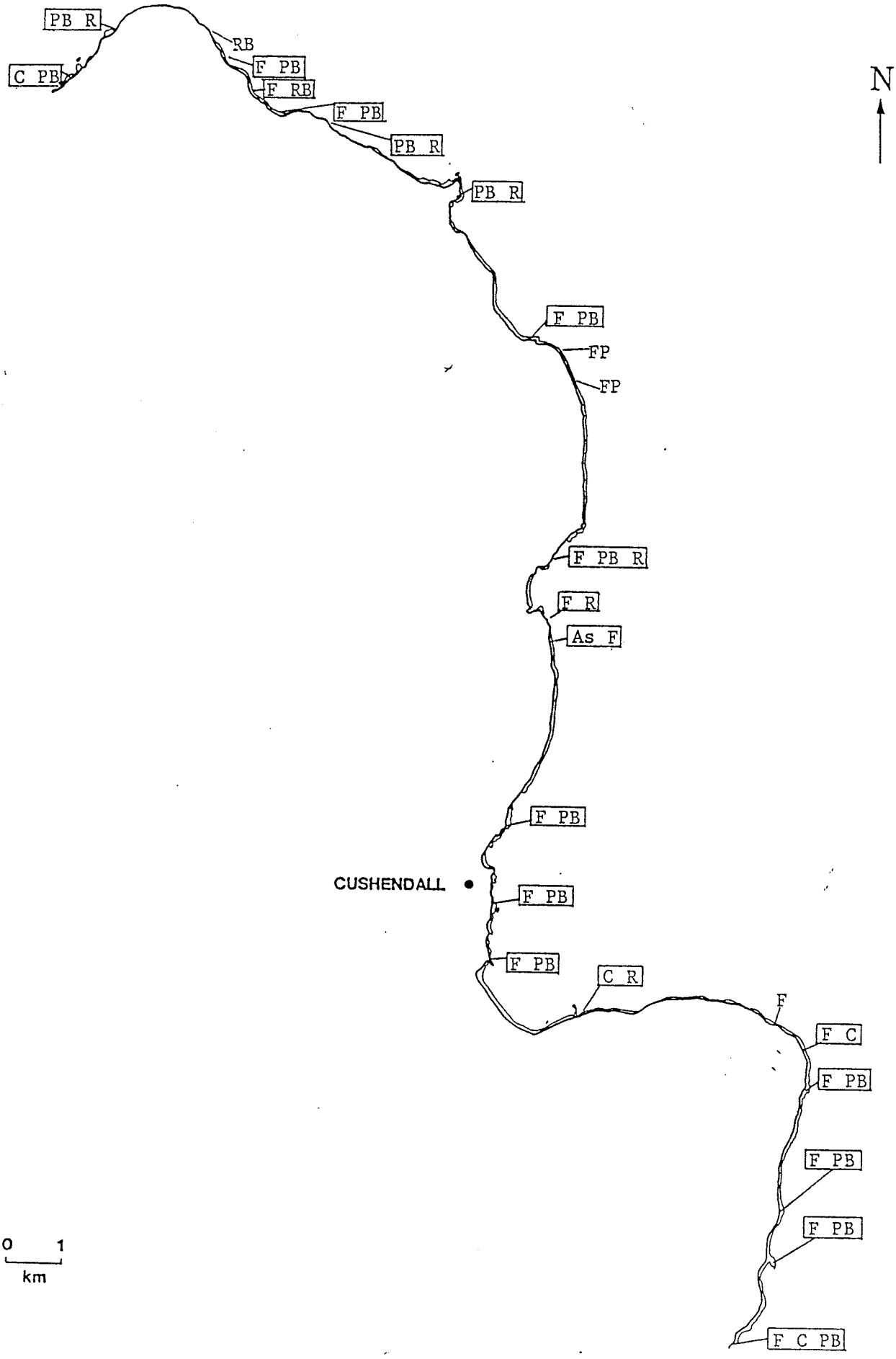

PB R
RB
C PB
F PB
F RB
F PB
PB R
PB R
F PB
FP
FP
F PB R
F R
As F
F PB
CUSHENDALL
F PB
F PB
C R
F
F C
F PB
F PB
F PB
F C PB
N
0
1
km

Figure 3.25

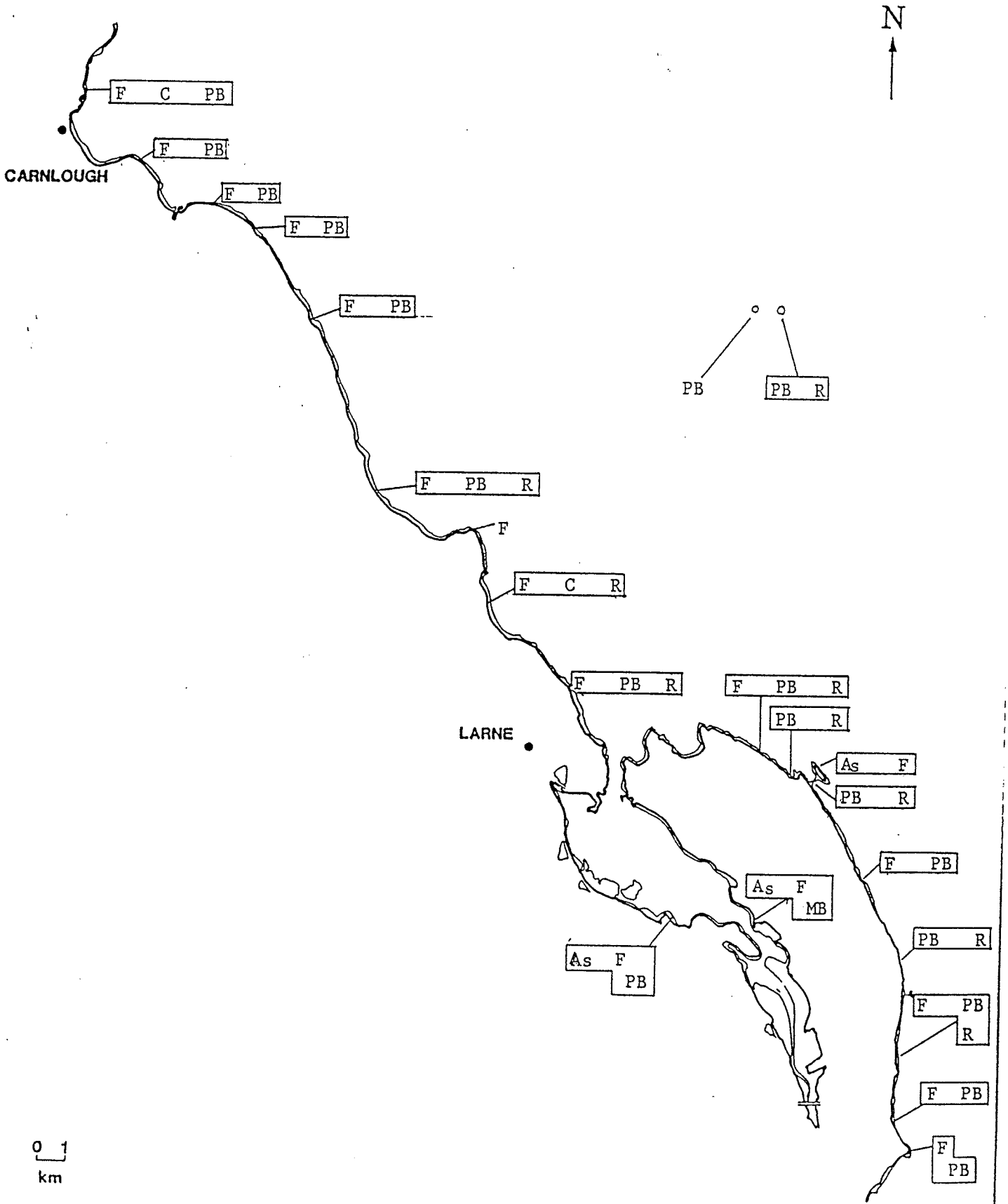
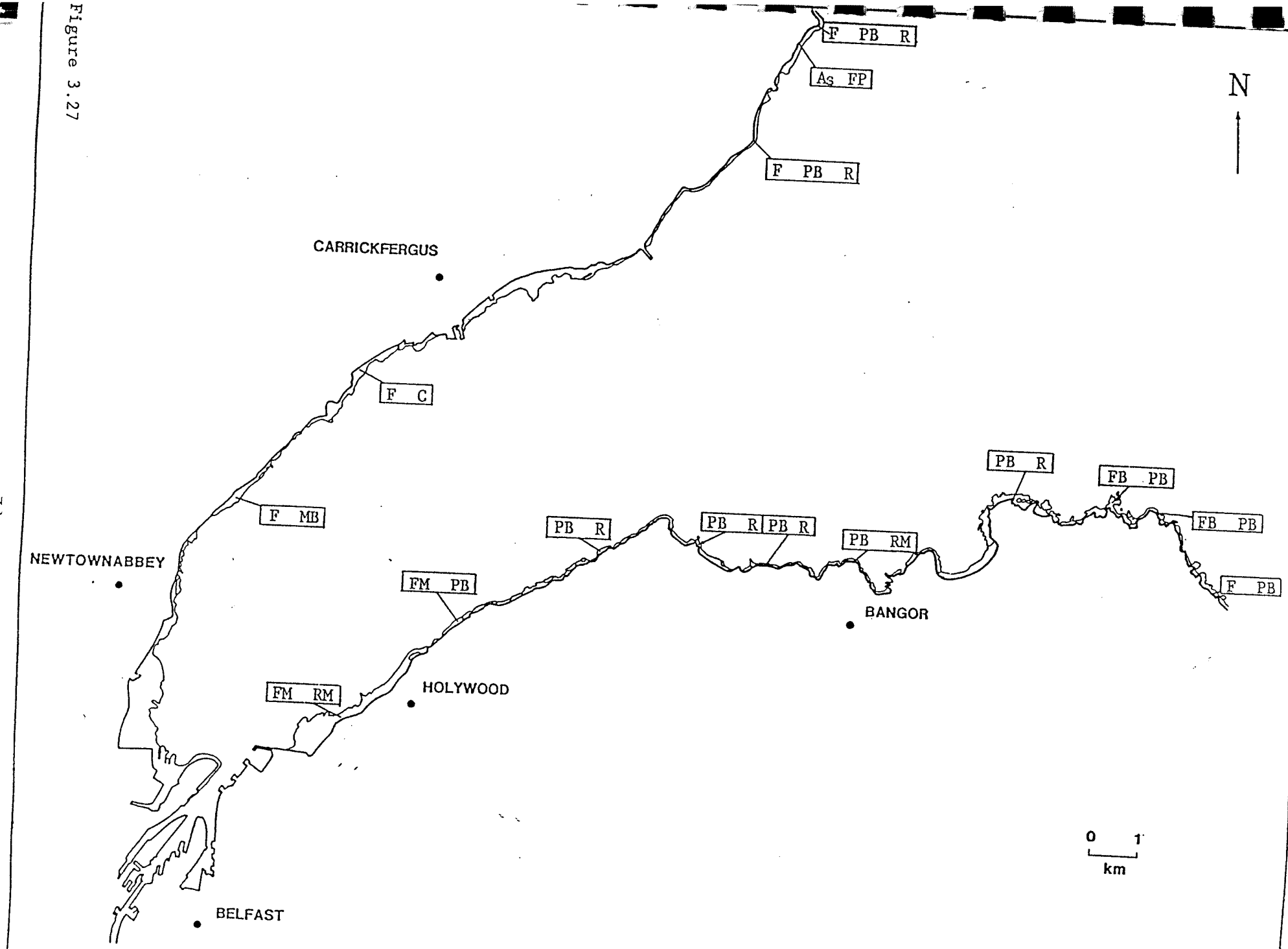

N
F C PB
F PB
CARNLOUGH
F PB
F PB
F PB
PB
PB R
F PB R
F
F C R
F PB R
F PB R
PB R
LARNE
As F
PB R
F PB
As F MB
PB R
As F PB
F PB R
F PB
F PB
0 1
km

Figure 3.26

Figure 3.27


F PB R
As FP
F PB R
N
CARRICKFERGUS
F C
F MB
NEWTOWNABBEY
PB R
PB R PB R
PB RM
PB R
FB PB
FB PB
F PB
FM PB
BANGOR
FM RM
HOLYWOOD
BELFAST
0 1
km

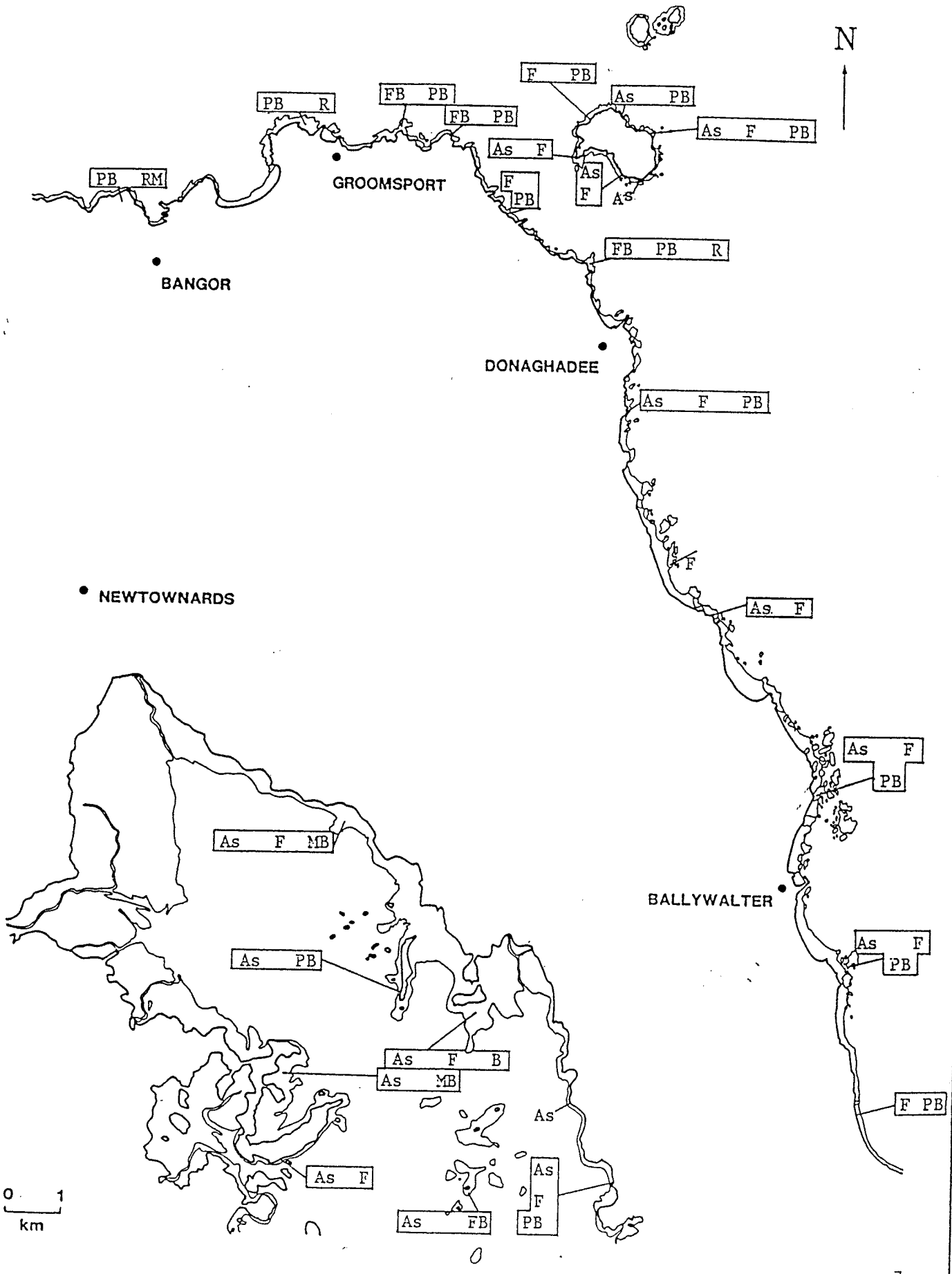

N
F PB
As PB
As F PB
FB PB
FB PB
PB R
As F
PB RM
GROOMSPORT
F
PB
As
F
As
FB PB R
BANGOR
DONAGHADEE
As F PB
F
NEWTOWNARDS
As F
As F
PB
As F MB
BALLYWALTER
As F
PB
As PB
As F B
As MB
As
F PB
As F
As
F
PB
As FB
0 1
km

Figure 3.28

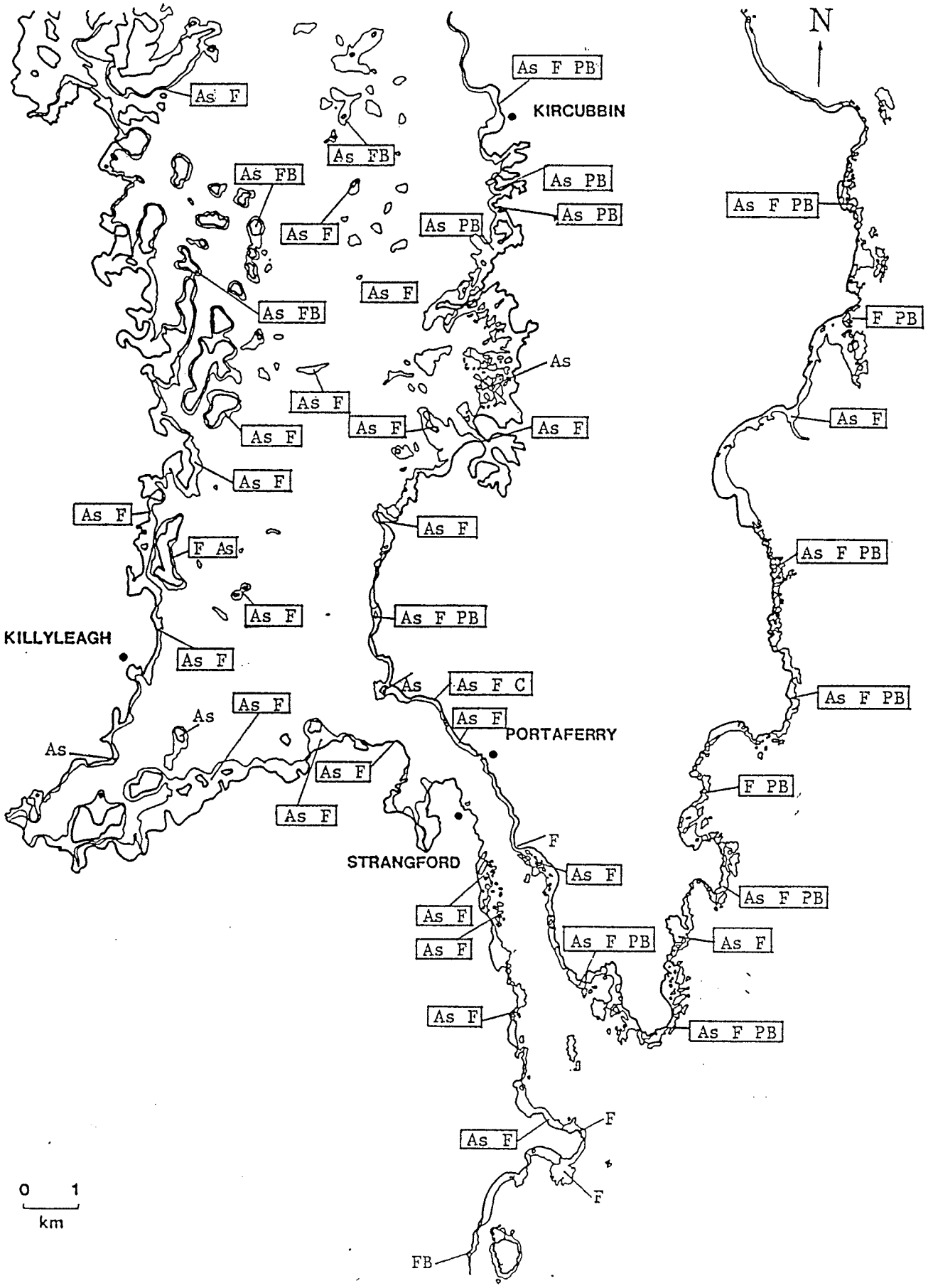

N
As F
As FB
As F PB
KIRCUBBIN
As PB
As F
F PB
As
F As
KILLYLEAGH
As F C
PORTAFERRY
F
STRANGFORD
FB
0 1
km

Figure 3.29

Figure 3.30

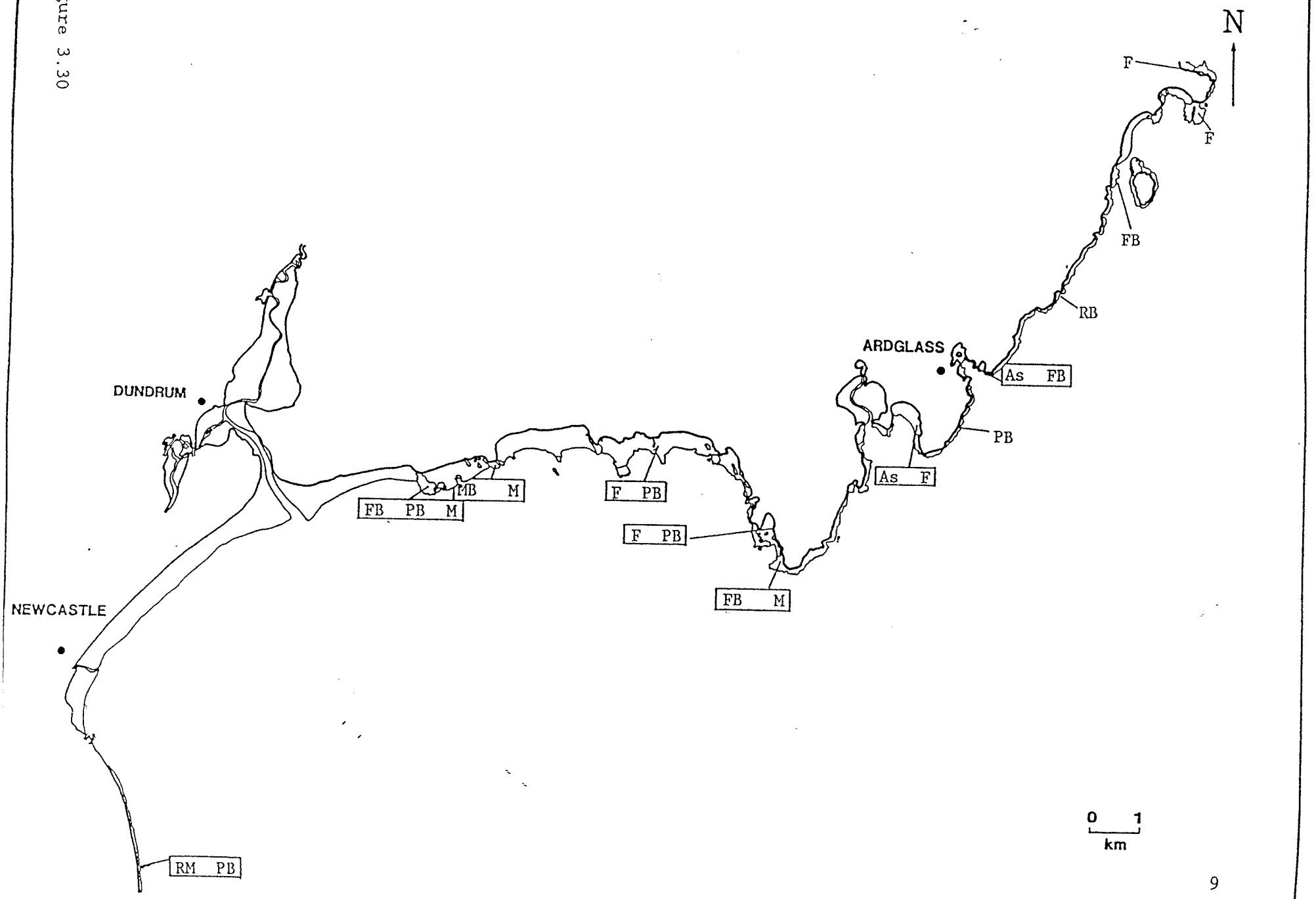
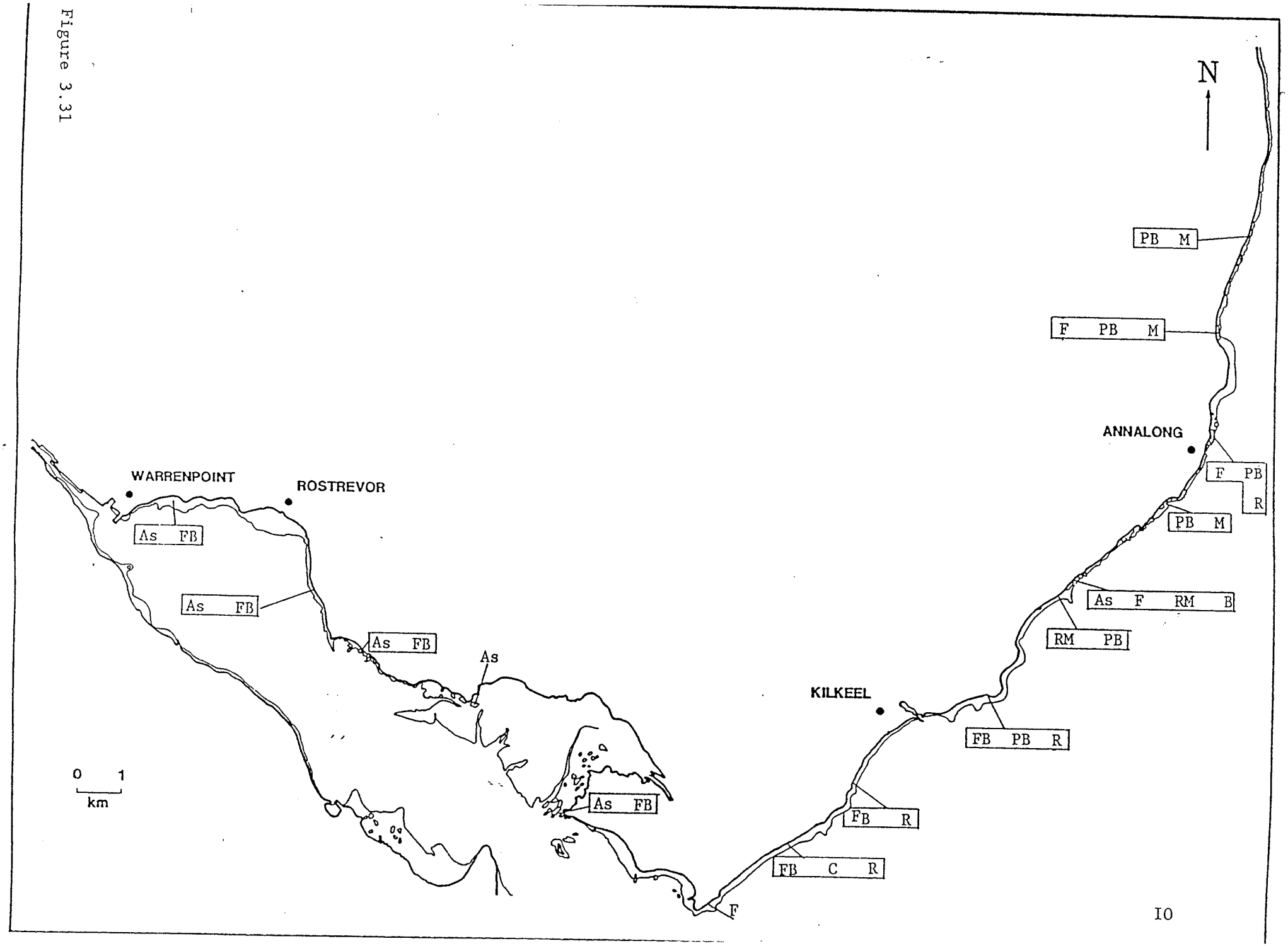

N
F
F
FB
RB
ARDGLASS
As FB
PB
As F
DUNDRUM
MB M
FB PB M
F PB
F PB
FB M
NEWCASTLE
RM PB
0 1
km

Figure 3.31


N
WARRENPOINT
ROSTREVOR
ANNALONG
KILKEEL
As FB
As FB
As FB
As
As FB
F
FB C R
FB R
FB PB R
RM PB
As F RM B
PB M
F PB R
PB M
F PB M
0 1
km

4. SELECTION OF SITES FOR STAGE II

4.1 INTRODUCTION

During the Stage I Survey, 332 sites were visited, of which 220 were rocky sites, and 112 sedimentary in nature. Approximately 200 Stage II sites were to be chosen from this group (a high proportion of the original 332 sites), representing the range of variation in physical habitats and their associated biological communities around the Northern Ireland coastline. This entailed examining, for each type of habitat identified from the Stage I data, not only the biologically rich sites, but also "typical" and "poor" sites.

Two different methods of site selection procedure were employed, both of which utilised computer sorting software developed specifically for this project by Dr C. Moore.

(i) the coastline was divided into five major regions on the basis of fundamental physical criteria; approximately forty sites were allocated to each region;

(ii) the sorting techniques were applied to the entire set of Stage I data, without division of the coastline into regions.

4.2 SITE SELECTION BASED ON COASTAL REGIONS

4.2.1 Background

Division of the terrestrial environment into major regions on the basis of physical features was used in the "Nature Conservation Review" (Ratcliffe, 1977) which covered mainland Britain.

A similar approach has been utilised in the marine environment. As part of a project to identify Nordic marine reserves (Anon, 1984; quoted in Mitchell, 1986), Denmark was divided into eight coastal regions, Norway into six, Iceland four, Finland five and Sweden eight.

Mitchell (1986) provides a description of the main characteristics of the three regions which lie along the Norwegian North Sea coast; they are distinguished from one another on the basis of three main headings: topography, hydrography and biology.

It must be stressed that these are not biogeographic regions, ie. do not represent distinct floral and faunal boundary areas. The regions are defined in terms of both physical and biological factors, a recognition of the fact that physical factors strongly influence coastal biology. This is particularly true of the littoral region, where physical factors play a major role in determining the distribution of intertidal animals and plants.

4.2.2 Northern Ireland Coastal Regions

During the course of the Stage I survey in Northern Ireland a large amount of physical data was collected, together with a subjective note of the principal biological community types present at each site and an estimate of species richness.

On the basis of this information it was possible to divide the coastline subjectively into five major regions (some more strongly defined than others) using the following characteristics:

(i) exposure;

(ii) substrate type;

(iii) tidal range;

(iv) land form and major shore type;

(v) biology.

The regions are described in Table 4.1.

Forty Stage II sites were provisionally allocated to each region. This figure was a guideline only, to help in site selection; some regions were more homogeneous in terms of habitat than others, and required fewer sites, while the more heterogeneous areas required more detailed investigation.

4.2.3 Site Choice Within Each Region

Within each region the individual Stage II sites were chosen in the following manner.

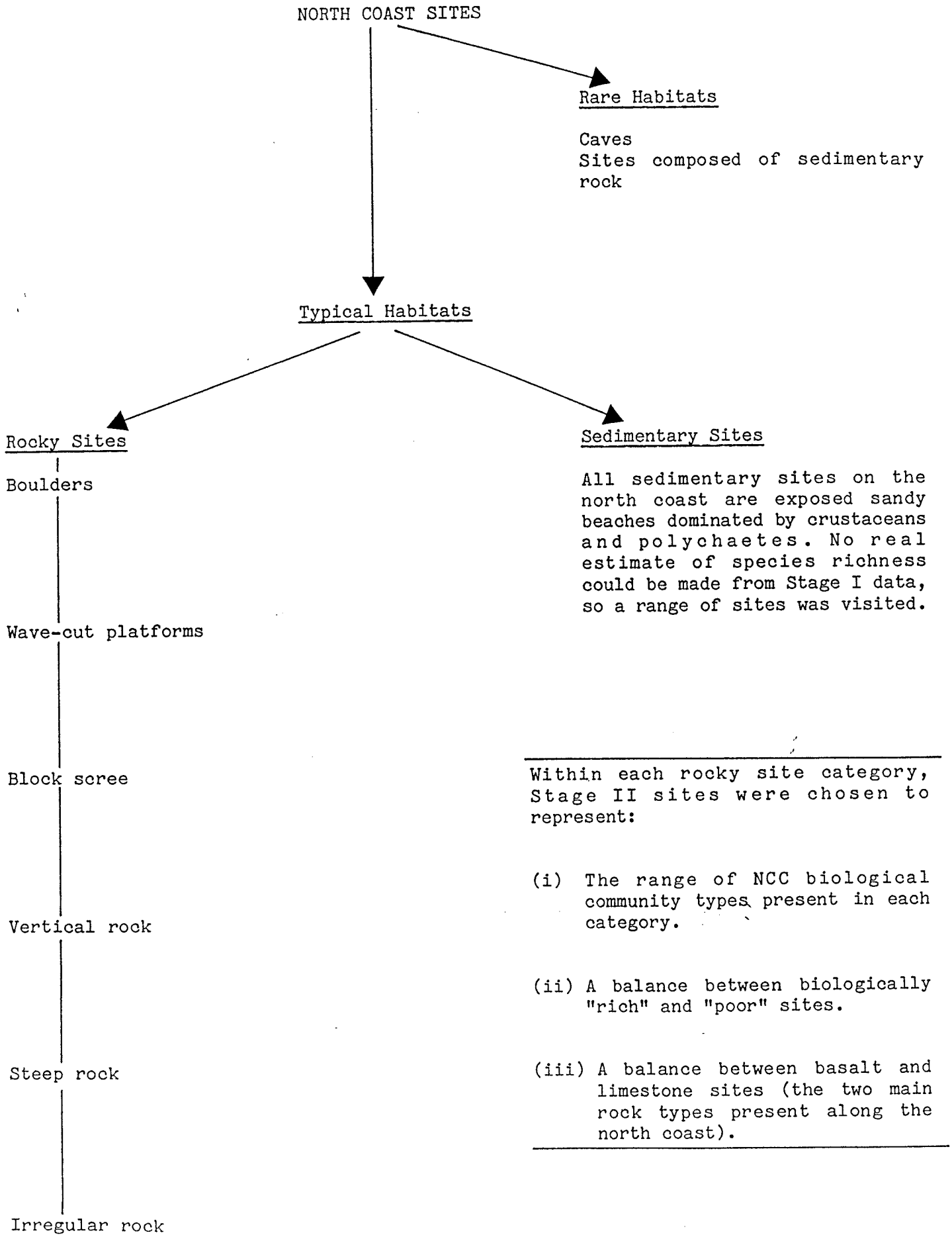
Firstly the sites were grouped into representative and rare habitat types which were defined on the basis of the physical information contained in the Stage I survey sheets. The rare habitat types were included in the Stage II survey as a matter of course.

Within each region, where tidal range and exposure tended to be similar along the same stretch of coastline, all the sites belonging to each representative habitat type tended to support the growth of very similar biological communities, ie. only a small number of NCC community types (see Appendix II) were represented between all the sites of a representative habitat type.

A number of sites belonging to each representative habitat were chosen, covering the range of variation in community types present and also, as far as possible, representing a continuum from biologically poor to biologically rich sites. Whether a site was "poor" or "rich" was determined mainly from information relating to relative species richness and diversity of subhabitats contained in the Stage I sheets (see Section 3).

This approach is illustrated in Figure 4.1, using the north coast of Northern Ireland as an example.

FIGURE 4.1 Stage II Site Choice Along the North Coast of Northern Ireland



When deciding on the relative number of sites allocated to each representative habitat, it was necessary to take into account that some habitats may have had a disproportionately large occurrence in the Stage I data simply because access to these sites was easier than access to other types of habitat. Therefore, the final decision as to the number of Stage II sites for each habitat type was based on:

(i) number of sites of each type visited;

(ii) subjective appraisal of the relative importance of each "typical" habitat within the region.

A particular problem regarding site choice was that it could be difficult to estimate in the field whether or not a site was "richer" or "poorer" than a similar site several miles away. In addition the species richness of any site varied with time, although this factor was more stable along some parts of the coastline than others.

However, by examining a number of physically similar sites in equal biological detail during the Stage II survey it would be possible to cover the range of variation in species richness and species composition which existed for each habitat type.

4.3 SITE SELECTION BASED ON THE COASTLINE AS A WHOLE

This method was attempted as a result of discussions with the Department of the Environment (Northern Ireland) representatives, and with representatives from the Ulster Museum sublittoral survey team.

Sites were chosen in a similar manner to that applied to each region of the coastline in Section 4.2, but the procedure was applied to all Stage I sites together. They were divided into representative and rare habitats and communities; again the rare sites were selected as a matter of course and a balance was struck between biologically "rich" and "poor" examples of the representative sites.

The resulting list was broadly similar to that obtained in Section 4.2. The final list of sites produced as a result of both approaches, is given in Tables 6.1 and 6.2.

TABLE 4.1 Regions or sectors of the Northern Ireland Coastline used in Selecting Sites for the Stage II Survey

Area Number	Location	Major shore types and land form	Exposure to wave action	Rock Type	Sediment Type	Tidal range (m)	Biology (characteristic N.C.C. classification* types)
1	The north coast from Magilligan Point to Torr Head including Rathlin Island.	High cliffs, exposed headlands, wave cut platforms, block scree, boulder bays. High energy sandy beaches.	Exposed to very exposed.	Mainly basalts and other igneous/ metamorphic rocks plus hard limestone. Small outcrops of sedimentary rocks.	Medium and coarse grained sand.	1.0 - 1.7	Communities characteristic of high wave exposure; Rhodomytilus, Rhodobarnacle Patellobarnacle; Fucoids may be present in more sheltered areas. All sedimentary shores Crustacean/Polychaetes in nature.
2	The East Antrim coast from Torr Head to Black Head at the mouth of Belfast Lough.	Extensive boulder bays with rock outcrops. Some block scree. Steep cliffs outside Islandmagee. Sedimentary beaches rare.	Moderate to exposed.	Basalts and other igneous/ metamorphic rocks plus hard limestone. Outcrops of sedimentary rocks more common than on north coast.	Medium grained sand.	1.4 - 2.8	Mixture of Fucoids, Fucobarnacle and Patellobarnacle. (More exposed shore types present on outer Islandmagee). The few sedimentary beaches are either Crustacean/Polychaete or Tellina.
3	Outer coast of County Down.	Extensive platforms of creviced sedimentary rock separated by sandy beaches outside the Ards Peninsula. Further south the intertidal is composed of sedimentary rock or boulders.	Sheltered to moderate outside Ards peninsula. Moderate to exposed elsewhere.	Mainly highly creviced sandstones and shales in the north, with boulder shores becoming more common in the south.	Fine, medium and coarse grained sand.	3.2 - 4.6	Ascophyllum and Fucoids along outer Ards peninsula. Fucobarnacle and Patellobarnacle to the south. Sedimentary shores mainly Tellina, with some Crustacean/Polychaetes.
4	The sea loughs and estuaries (Foyle, Larne, Belfast, Carlingford, Dundrum Bay and the River Bann estuary).	An assemblage of fairly diverse areas, grouped together as an aid to site selection. However, most of these areas contain extensive intertidal sand and mud flats, at least in part.	Sheltered to very sheltered.	-	Fine mud to medium sand.	Variable	Any rocky shores usually Ascophyllum. Sedimentary shores usually Macoma or Scrobicularia, but Lanice, Pullastra, Tellina, Echino Sili are sometimes present.
5	Strangford Lough.	Extensive intertidal sand and mud flats, especially along the north and south coasts. Extensive boulder shores with wide areas of muddy gravel. Some sedimentary ridges and platforms, especially in narrows.	Sheltered to very sheltered; some areas moderately exposed.	Creviced sedimentary rocks and boulders.	Many types of sediment, from fine mud to coarse sand and muddy gravel.	Unknown	Rocky shores usually Ascophyllum and very rich in fauna. Sedimentary shores extremely diverse: Tellina, Macoma, Scrobicularia, Spisula, Lanice, Pullastra, Echino Sili are all present.

* see Appendix 2

5. STAGE II SURVEY

5.1 INTRODUCTION

The Stage II survey was conceived as being the main component of the littoral survey, and that which would be allocated the majority of the field work time.

The aim was to supply a detailed picture of the biological communities present at about two hundred sites, representing a cross section of intertidal habitat types around Northern Ireland. It was decided (at a meeting involving representatives from the DOE (NI), NCC and IOE) that, from a conservation point of view, detailed community descriptions were more important than searching for rare species, as discussed in Section 2.

The methods adopted were designed to fulfil two aims within the time limit of one low tide per site (if possible). A site was defined as a length of coastline within a uniform physical habitat.

The aims were:

(i) to maximise the number of species found per site;

(ii) to give an estimate of the abundance of the more dominant species and those usually common around the U.K.

The methods varied depending on whether the substrate was rocky or sedimentary in nature. Specially designed Stage II recording sheets were used to record physical and biological data for each site. Two types of sheets were developed, one for rocky and another for sedimentary shores. Species data was analysed by multivariate techniques, on a mainframe computer (DEC Vax Cluster) to enable an objective approach towards defining biologically distinct areas of the Northern Ireland coastline.

The methods to be used were agreed at a meeting with DOE (NI) and NCC in Belfast, on February 1984. Particle size analysis was not thought necessary.

The sampling methods varied depending on the substrate. Four different methods were used:

(i) rocky shores;

(ii) firm sediment shores, where it was possible to fully sample on foot in a single tide;

(iii) extensive areas of firm sediment, where it was not possible to fully sample in a single tide due to the distances involved;

(iv) soft mud, where it was not possible to sample on foot.

The rocky shore method incorporated a semiquantitative abundance scale and the sedimentary methods involved counting individual animals within a defined area.

5.2 METHODS

5.2.1 Sampling Methods

5.2.1.1 Rocky shore methods

An 8 m wide belt transect was set up between low water and the uppermost marine zone, usually the top of the Pelvetia zone or bottom of the perceived splash zone where no Pelvetia was present, on the most representative part of the location. Where more than one habitat type occurred more than one transect was surveyed. The physical and biological features of the location as a whole, and then of each individual zone within the transect, were described in detail including the subhabitats. Photographic slides were taken, in duplicate, using standard views of the shore to enable comparison between locations. The slides were:

- general views of the location (along the shore, in both directions);
- from the top of the shore down;
- from the bottom of the shore up;
- a general view of the transect from height if possible;
- views of each biological zone;
- close-ups of subhabitats.

All slides were taken using an Olympus OM20 camera with Kodachrome 64 slide film. Sketch maps of the location and site were drawn.

A profile of the shore surface was plotted from the calculated low water to the top of the uppermost marine zone along the transect. The low water was calculated from the Admiralty Tide Tables. The profile was plotted by measuring the vertical heights of the tops and bottoms of all biological zones and any prominent peaks or depressions, using a surveyor's level (Carl Zeiss, Jena, N1050). Distances along the shore surface were taken using a tape measure. A white painted square was used to mark the transect at the top of the shore.

For each biological zone within the transect the abundance was recorded for species which were:

- normally common, zone forming and characteristic of the general shore type;
- other species present which were abundant and identifiable in the field;

Abundance was estimated over the whole zone bounded by the transect and recorded using an 8-point semiquantitative abundance scale (details in Appendix V). Where necessary due to high density of certain species, eg. barnacles, quadrats were used to estimate the abundance grade. Species found in subhabitats within each zone were

simply noted as being present. Any species not identifiable *in situ* was collected and identified in the laboratory. A bag of algae was collected from each zone for laboratory workup to search for epiphytes, small prosobranchs and arthropods.

The recording sheets made it possible to record abundances or presence of each species within each zone and of species in each type of subhabitat within each zone.

A general shore search was also undertaken outside the transect sites over the rock surface and in a range of subhabitats. Species found only outside the transect were noted as present for a particular zone or subhabitat. Usually this method obtained as comprehensive species list in a single tide, but sometimes it was necessary to revisit particularly rich sites.

5.2.1.2 Sedimentary sites

Three different methods were used depending on the shore type.

(i) **Firm Sedimentary Shores**

The survey began just before calculated low water when a location description was made and sketch maps were drawn. Photographic slides were taken in duplicate. These tended to be more general in nature than those taken at the rocky sites, with photographs of shore top to bottom and along the shore in both directions. Some close-ups of the surface and subhabitats were also taken. A profile was plotted between high water and low water, using a surveyors level and tape measure. Five stations were marked at equal vertical intervals on the lower two-thirds of the shore. Shore extent was defined as from the calculated low water to the highest distinct strand line. The lowest station was as near as practicable to low water.

Four 0.1 m^2 x 10 cm box quadrats were taken in a row at each station and the contents sieved through a 1 mm mesh. The retained material was collected for laboratory examination. The depths of water table and the sulphur reducing layer were taken at each station and a note was made of sediment type (eg. muddy sand, gravel). Several small trenches were dug at random, including the upper third of the shore, to search for conspicuous macrofauna which were not represented in the quadrat samples.

(ii) **Extensive Areas of Firm Sediment**

Where the horizontal distance from high to low water was great (usually more than 1 km), which prohibited sampling in a single tide, a group of five box quadrats was taken on the lower shore and on the middle shore. These were sieved through a 1 mm mesh and the animals collected were worked up in the laboratory. Often these sampling areas would be chosen from charts or O/S maps (First Series, 1:50,000) beforehand. Where the distance to low water was excessive an amphibious vehicle or shallow draught boat was used to transport personnel and equipment. Positions of the groups of quadrats were drawn on a map in the recording card. Distances were measured using charts or O/S maps.

Descriptions of sampling areas and locations as a whole were made and slides of general views of the site taken.

(iii) **Soft Mud Shores**

The nature of soft mud necessitated the use of a different method. Ten randomly placed grab samples (Ekman Grab, sampling area 0.025 m^2) were taken over what was estimated to be the lower two-thirds of the shore. This was done from a shallow draught boat at high tide. All samples were sieved through a 1 mm mesh and the animals retained were stored for laboratory workup. Slides and shore descriptions were made as soon as possible, during low water, from the shore.

All field data for both rocky and sedimentary shores were recorded using a small tape recorder and subsequently transferred to specially designed record cards. Examples of these and detailed instructions on their use are given in Appendix V.

5.2.2 Laboratory Methods

5.2.2.1 Rocky shore

The samples were transferred from 4% formalin preservative in plastic bags and sampling tubes into a large sorting tray. Each sample was sorted into: algae, arthropods, polychaetes, molluscs and miscellaneous. This facilitated an efficient working up procedure as groups from several sites were pooled for examination at the same time.

All algae sorted were identified including small epiphytes. All macrofaunal animals sorted were identified. Macrofauna were defined as all those animals which were 1 mm or larger in length. Nematodes and copepodes were not included. Flora and fauna identified in the laboratory only were recorded as present on the data sheets.

5.2.2.2 Sedimentary shores

(i) **Firm Sediment Shores (transect method)**

All sediment retained on the 1 mm mesh in the field was sorted a little at a time in plastic trays. Rose Bengal was used to aid picking. Each quadrat sample was sorted into: arthropods, worm-like organisms, molluscs and miscellaneous.

Each of the five shore stations were represented by four quadrats, A, B, C, and D. The A sample was analysed quantitatively with all animals identified and counted and the B, C and D samples used to find additional species, which were recorded as present only.

(ii) **Muddy Shores**

These were sorted as for firm sediment. Animals from two of the ten grab samples were counted and the remaining eight used to find additional species which were recorded as present only.

(iii) **Extensive Intertidal Sand Flats**

Sorted as for firm sediment. The animals from one of the five quadrats were counted and those from the remaining four quadrats used to find additional species which were recorded as present only.

Voucher specimens of all unusual or rare taxa were retained for rocky and sedimentary sites. For many of the sedimentary sites all animals sorted were retained for possible further examination.

Refereeing of Specimens

Sections of the species lists were sent, at various times during the Stage II workup, to relevant referees. A list of referees is given in Appendix XIII. Each referee was asked to annotate the list and give comments on species they considered unusual for Northern Ireland or difficult to identify. The voucher specimens for these species were sent to the referees for verification. Where possible referees were chosen who had a knowledge of the flora and fauna of the Northern Ireland coastline. A set of voucher specimens will be kept at the Ulster Museum.

5.3 COMPUTER CLASSIFICATION OF SHORE COMMUNITIES

5.3.1. Methods

The species composition of littoral communities is strongly influenced by physical factors, such as exposure to wave action and shore topography, which tend to vary along continua. Consequently the formulation of a classification scheme for shore communities is essentially an artificial exercise. Where sharp gradients in physical controlling factors separate extensive areas of homogeneous habitat then a robust classification system should emerge, irrespective of the methods adopted. On the other hand the presence of gradations in physical structuring factors or the complex interplay of several important factors will necessitate the dissection of the range of biota into artificial categories or community types. Classification practices based on statistical analysis of species abundance data from sample sites is a useful approach in both cases. It avoids preconceived or biased, subjective interpretation and will provide a practically useful classification scheme. In the absence of natural coherent community types, different statistical analyses can produce different classification schemes. Hence, it is useful to apply a variety of statistical methods to assess the extent to which distinct classes of shore types can be recognised and to assess the validity of suggested biogeographical boundaries. Three types of multivariate analysis have been adopted here.

The form of the data analysed consisted of the maximum abundance of each species at each site or transect. The rocky shore biota was measured on an abundance scale of 2-8, which was used without modification for all the analyses. The sedimentary shore abundances were converted to numbers per 0.1 m^2; this density was then logged, except for indicator species analysis, where raw density was used.

Cluster Analysis

These methods group sample sites into clusters of similar sites on the bases of their biota. The methods used here are agglomerative in the sense that sites are first formed into clusters, which then group with other clusters in a hierarchical fashion, producing a dichotomous classification scheme. Different strategies are available for assessing the similarity between sites (similarity coefficients) and for linking the clusters of sites together (linkage or sorting methods). The following combinations of strategies have been adopted here:

(a) Bray/Curtis similarity coefficient with group average sorting. A widely-used approach in the classification of biological communities;

(b) Bray/Curtis similarity coefficient with Lance-Williams flexible sorting. Group average sorting is sometimes found to fail in the production of distinct clusters of sites (instead of producing so-called chaining). Lance-Williams' method permits a choice in the intensity of clustering by selection of the clustering intensity coefficient, beta. this was set at -0.25, generally regarded as the optimum value;

(c) Euclidean distance coefficient with Ward's method. This is also known as the Error sum of Squares method. It was chosen as representing a quite different algorithm from the methods above and as an example of a tightly clustering technique. Its chief disadvantage is that in its enthusiasm to form sites into clusters, not only similar sites can be formed into clusters but also groups of atypical (or outlier) sites.

Ordination

By mathematical derivation of site scores, ordination techniques order sites along axes according to their similarity to one another. Different trends or patterns in the species abundance data are represented by different axes, with the strengths of the patterns decreasing in the order axis 1, 2, 3.....n. It is often found that much of the variation in the data, and the similarity of the sites, can be usefully summarised by plotting the ordination scores of the sites on the first two axes of variation. Ordination techniques are not designed to perform classifications but can be of great value in assessing the validity of classification schemes and in understanding the causes of variation in communities. The ordination method used was detrended correspondence analysis (DECORANA).

Indicator Species Analysis

Two-way indicator species analysis (TWINSPAN) uses ordinations to produce a classification and identifies species that are characteristic of the resultant classes (indicator species). Briefly, an ordination is first performed which orders sites along a single axis of variation. The ordination is then repeated but using species that are characteristic of sites towards the poles of the first ordination. The refined ordination is then dichotomized and the process is repeated for each branch of the dichotomy.

TWINSPAN analysis is performed on abundance data that are transformed by TWINSPAN to a range of abundance categories, termed pseudospecies. These are selected by the user initially. Rocky shore data were originally recorded using a semi-quantitative abundance scale, while raw sedimentary data were abundances per 0.1 m^2. The correspondence between original data and pseudospecies was chosen to be as follows:

TWINSPAN Pseudospecies	Rocky data	Sedimentary data
1	2	1-4
2	3	5-19
3	4	20-99
4	5	100-999
5	6	1000
6	7	
7	8	

In TWINSPAN, sites are regarded as possessing pseudospecies and these are used as indicator or characteristic attributes. Thus a sedimentary site possessing 'Species A' with real abundance of 10 per 0.1 m^2 is regarded as possessing two pseudospecies or abundance categories, 'Species A1' and 'Species A2'. If pseudospecies, 'Species A2', is identified by TWINSPAN to be an indicator species of a site grouping, this means that members of the grouping tend to differ from the alternative site grouping by possessing at least a moderate density of Species A (i.e. 5-19 specimens per 0.1 m^2). The identification of pseudospecies, 'Species A1', as an indicator implies that one grouping merely possesses the species, at any density, whereas the other does not. Individual indicators are not infallible in their indication of site class membership.

Presentation of results

The results of cluster and TWINSPAN analyses are presented as dendrograms, which illustrate the hierarchical similarities of sites and groups of sites. The groupings are colour coded and the distribution of the constituent sites mapped.

Software and Hardware

Available software was not capable of processing the large data matrices generated by the project, necessitating the writing of new or modification of existing software.

Data entry and checking was performed on IBM PC microcomputers. Logarithmic transformations, where necessary, and conversion of data into appropriate matrices for further analysis were also performed on micros before transmission to a VAX mainframe.

Cluster analyses were performed by submitting similarity coefficient matrices to the package CLUSTAN (Wishart, 1987). The Bray/Curtis matrix was generated by a redimensioned version of a clustering program (name CL@) from the Institute of Marine Environmental Research, Plymouth. The euclidean distance matrix was produced by custom-written software. Dendrogram output from CLUSTAN was plotted on a laser printer.

DECORANA and TWINSPAN were performed using redimensioned versions of the programs from the Cornell Ecology Program series (Gauch, 1982). Another program from this source, DATEDIT, was used to produce summarial profiles of community types.

5.3.2. Results

Rocky Shores

Cluster analysis

Group average analysis (Figure 5.1) produces two major groupings of sites and four outliers (sites 1-4). The major groupings correspond, to an outstanding degree, to two geographical stretches of coastline, Co. Antrim and County Down (Figure 5.2). Geographical clusters of sites can be discerned within the major divisions but thse are more clearly shown by the more tightly-clustering techniques below.

The existence of a sharp, transitional zone in the vicinity of Belfast Lough, separating two broad classes of shore communities is also clearly shown by Lance-Williams analysis (Figures 5.3 and 5.4). Only one site is misplaced, the exposed steep shore at Black Rock, Co. Down (site 116), where the community has greater affinities with those of Co. Antrim. Within each of the major groupings are clusters of sites exhibiting similar communities. The cluster of southern sites is clearly composed of a tight group of sites (blue) from Strangford Lough and a slightly more diverse group from the rest of the Down coast (black and green/black). Within this latter group is a tight cluster of similar sites from the Ards peninsula (green/black). The sites within the Antrim group represent a more diverse range of community types; however, within the group we can recognise a cluster of very similar sites (red) corresponding to much of the east Antrim coast down to Larne. Two farther clusters, composed of more distantly related sites, can be recognised. These sites are found principally along the north Antrim coast, Rathlin Island and outer Islandmagee. One cluster (yellow) is predominantly composed of exposed, steep rock faces, while sites in the other grouping contain more gently sloping surfaces (orange),

The more strongly clustering method, Ward's error sum of squares, produces a very similar classification (Figures 5.5 and 5.6). The first dichotomy distinguishes the Co. Down sites from the Co. Antrim sites. The Co. Down sites are then subdivided into Strangford Lough and Carlingford lough sites (blue) and open coast sites (black and green/black) which are farther split into outer Ards and south Down groupings. Note that the exposed Black Rock site (116) again clusters with the Antrim sites and the more exposed northerly outer Ards sites Ballymacormick Point and Orlock Point (73 and 74 respectively) show a similarity with the south Down sites. The classification of the Antrim coast is not so clear-cut on a geographical basis, although the same basic patterns are clearly evident.

Twinspan analysis

Analysis of the full data set produced poor classification of the sites, presumably due to the great range in variation of shore types and distortion by the presence of outliers. It was therefore decided to employ TWINSPAN on more homogeneous data sets.

All the cluster analyses suggest the presence of a biogeographical transition zone at Belfast Lough. To confirm the sharpness of such a zone an ordination of all eastern open coast sites was performed (Figure 5.7). This clearly shows that there is not a gradual change in the community along the eastern coast but a sharp discontinuity in the vicinity of Bangor at the northern end of the Ards peninsula.

This substantiation of the cluster results validated the examination of the two major geographical areas separately by TWINSPAN. The boundary between the areas was taken as Bangor, being an average of the cluster analysis results. Heterogeneity was further reduced by excluding sites which had been clearly identified as outliers (Newbridge, site 1, in the north and Blackrock, 116, in the south).

TWINSPAN analysis of the Co. Down sites identifies two major groupings as before (Figures 5.8 and 5.9). The first includes the Strangford Lough sites. The inner Carlingford site, North of Killowen (128), is identified as intermediate in nature between this grouping and the next. The Strangford sites are then subdivided into a predominantly northern group (blue triangles) and a southern group (blue circles). The other major grouping includes the open coast sites, which are then split into an outer Ards (green/black) and a south Down grouping (black), with the boundary actually lying a little south of the mouth of Strangford Lough, around Ardglass. One of the inner Strangford sites, Mahee Island (102), which lies in a region of strong rapids, appears most similar to the exposed south Down shores.

The same groupings are occurring in TWINSPAN as with the cluster analyses; however, the boundaries vary, suggesting gradual rather than steep boundaries. This was investigated using ordination on all the Co. Down sites (Figure 5.10). The main trend in variation in the community (as represented by the horizontal axis) appears related to exposure, with the sheltered Strangford Lough sites (red triangles

and circles) to the left, followed by the outer Ards (green/black) and then the south Down sites (black), with the very exposed Black Rock site (116) (orange) to the extreme right. The more exposed northern Ards sites (73, 74) appear similar to the south Down shores. The ordination also shows the inner Strangford Lough site, Mahee Island (102), to be similar to the south Down sites. Within Strangford Lough the northern and southern sites are separated on the second axis, with the inner Carlingford site North of Killowen (128) again appearing similar to the north Strangford Lough sites.

The variation in the rocky shore community within Strangford Lough was further analysed by ordination of Strangford sites only, excluding the outlier rapids site, 102. The main trend in variation is shown in Figure 5.11. There is a distinct north-south gradient in the community along the more intensively studied east shoreline. The communities of the central island sites do not appear to follow this trend, but are similar to those of the southern end of the lough.

TWINSPAN analysis of the Co. Antrim coast first separates the more sheltered and predominantly boulder sites (red) along the east coast from the northern sites (orange and yellow) (Figures 5.12 and 5.13). The indicator species are characteristic of sheltered shores on the one hand and expcsed shores on the other. The east coast grouping is further divided into a group representing much of the Antrim coast from Fair Head to Larne (as well as some of the more sheltered northern sites) (red circles) and a small grouping of sheltered sites from Belfast and Larne loughs (red triangles). The north coast grouping is composed of two subgroups, which differ in shore topography, one consisting of predominantly steep or vertical rock faces (yellow), the other of more gently sloping or varied topography (orange). TWINSPAN identifies many borderline sites along the northern coast, indicating the lack of distinct community types.

Ordination of the Antrim sites again indicates the relationship between exposure and the nature of the community (Figure 5.14). The more exposed, steep northern sites (yellow) lie to the left of the plot and the more sheltered eastern sites to the right (red triangles). The east Antrim sites from Fair Head to Larne form a tight cluster (red circles) in the centre of the plot showing their comparatively high degree of similarity. The wide scatter of the remaining sites (orange) reflects their heterogeneous nature.

Classification Summary

Despite the wide variety of statistical approaches employed, recurring patterns of distribution of community types emerge. A classification system of the Northern Ireland rocky coastline can be defined which incorporates these patterns and which can be used as a basis to describe the rocky shore communities of the area. Moreover, the system can be used to identify both unusual and representative sites and to identify areas exhibiting high diversity of community types.

The classification scheme, which is essentially that of TWINSPAN, can be summarised as follows: (Figure 5.15).

1. **Antrim**

1A exposed and very exposed steep north and east coast shores (this includes mostly north coast sites).

1B exposed gently sloping or mixed topography shores (again mostly along the north coast).

1C moderately exposed, gently sloping shores. Predominantly boulder shores along the east coast.

2. **Co. Down**

2A moderately exposed shores of S. Down

2B sheltered shores of the Ards peninsular

2C very sheltered sea loughs (Strangford and Carlingford).

A more detailed description of the biological and physical characteristics of these shore types will be given in Section 6.

Atypical sites

Newbridge (Foyle) Site 1 - is the most distinctive site, being a clear outlier in most of the analyses in which it is included.

Ringree Point Site 2 - is also an outlier in most analyses, though not in TWINSPAN.

Burnfoot A and B Sites 3 and 4 - are outliers in some of the cluster analyses. As ordination and TWINSPAN show them to be fairly typical north coast communities, the cause of the cluster results is presumably due to their similarity with site 2, with which they fuse early in the clustering process and hence become more distant from the other north coast sites.

Black Rock Site 116 - closer to north coast sites.

Mahee Island Site 102 - most unusual Strangford site - bears similarities with open coast sites.

Sedimentary Shores

Cluster analysis

Group average analysis fails to produce a useful classification. there is excessive chaining and no evidence of the formation of distinct clusters. The more strongly clustering technique, Lance-Willaims analysis, provides little improvement. Some loose clusters are formed but some of these contain collections of widely different sites. These results are due to the fact that there is no natural, distinct classification of shore types.

Twinspan Analysis

TWINSPAN is more successful at dissection of the gradient into a series of community types (Figure 5.16). TWINSPAN first separates the sandy from the predominantly muddy shores, identifying indicator species that are typical of each type of habitat (Figure 5.17).

The sandy shores are split into the exposed north Antrim shores (yellow) and the less exposed clean sandy shores (red), characterised by the lugworm, Arenicola marina. Subsequent levels of division produce site groupings whose differences are rather subtle.

The grouping of muddy shores is split into a group of predominantly mud shores (black) and a group of shores composed largely of sediments containing a mixture of mud and sand (blue) and with indicator species, such as Tellina tenuis and Nephthys hombergi, which reflect the sand influence.

Subsequent divisions of the mud grouping show only slight differences. The muddy grouping dichotomizes to isolate a sole gravel outlier, the Dorn.

Ordination of the sedimentary sites confirms the pattern identified by TWINSPAN Figure 5.18. The main trend in variation is clearly related to exposure, with the exposed north coast sandy beaches on the extreme right (yellow), followed by the more sheltered sandy beaches (red), then the mixed sediment beaches (blue) and the mud sites near the left side of the first axis (black). The ordination shows that, although the least exposed of the northern beaches Magilligan Point (site 7) has the indicator species of the exposed sand grouping, it broadly resembles the Arenicola beaches. The Dorn (site 32) and Dundrum E (65) are clearly identified as unusual sites.

Classification Summary (Figure 5.19)

1. Very exposed sandy beaches (confined to north Antrim).

2. Moderately exposed and sheltered sandy beaches (mostly east coast).

3. Mixed mud/sand sites.

4. Mud sites.

Atypical Sites

Cushendun Bay Site 13	apparently an open coast site, which has a mud fauna.
Robin's Rock Site 27	As site 13
The Dorn Site 32	see above
Dundrum E Site 65	see above.

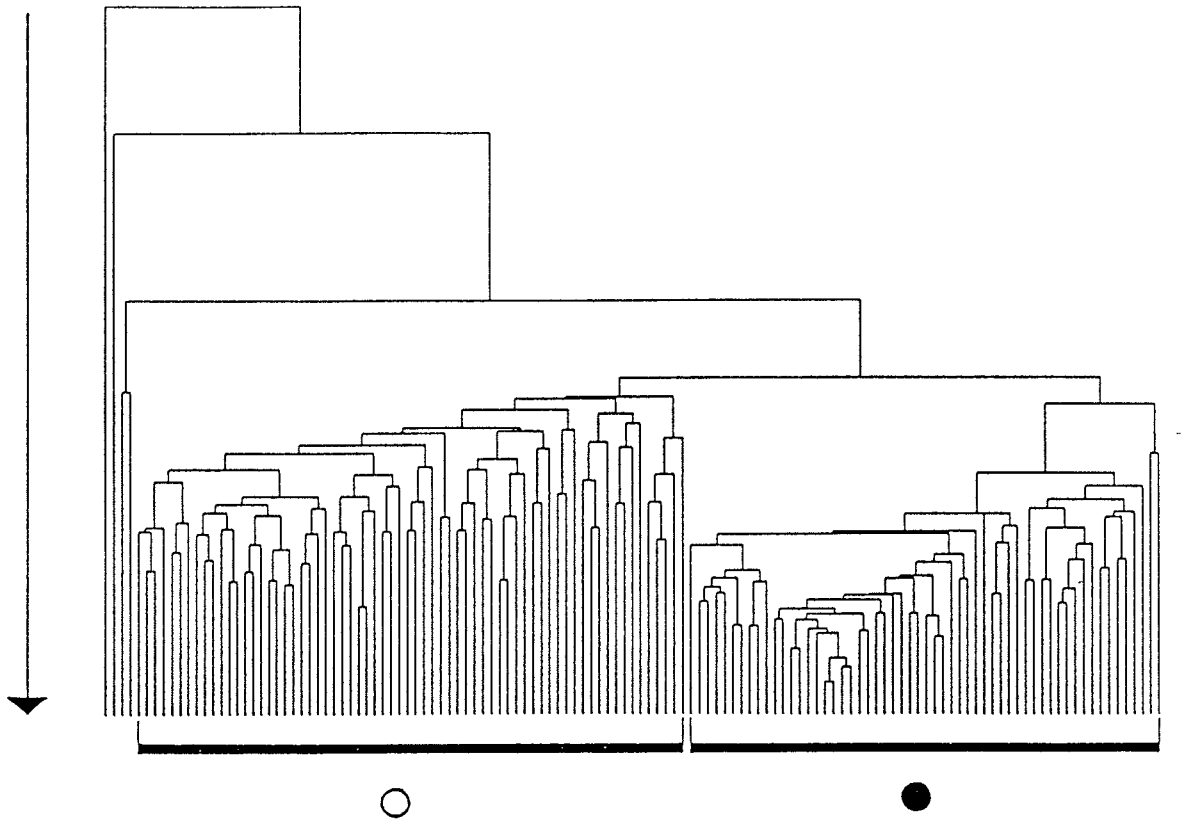


Figure 5.1 : Dendrogram of Bray Curtis Analysis for all Rocky sites. The groupings are coded and mapped in figure 5.2. The arrow shows increase in similarity.

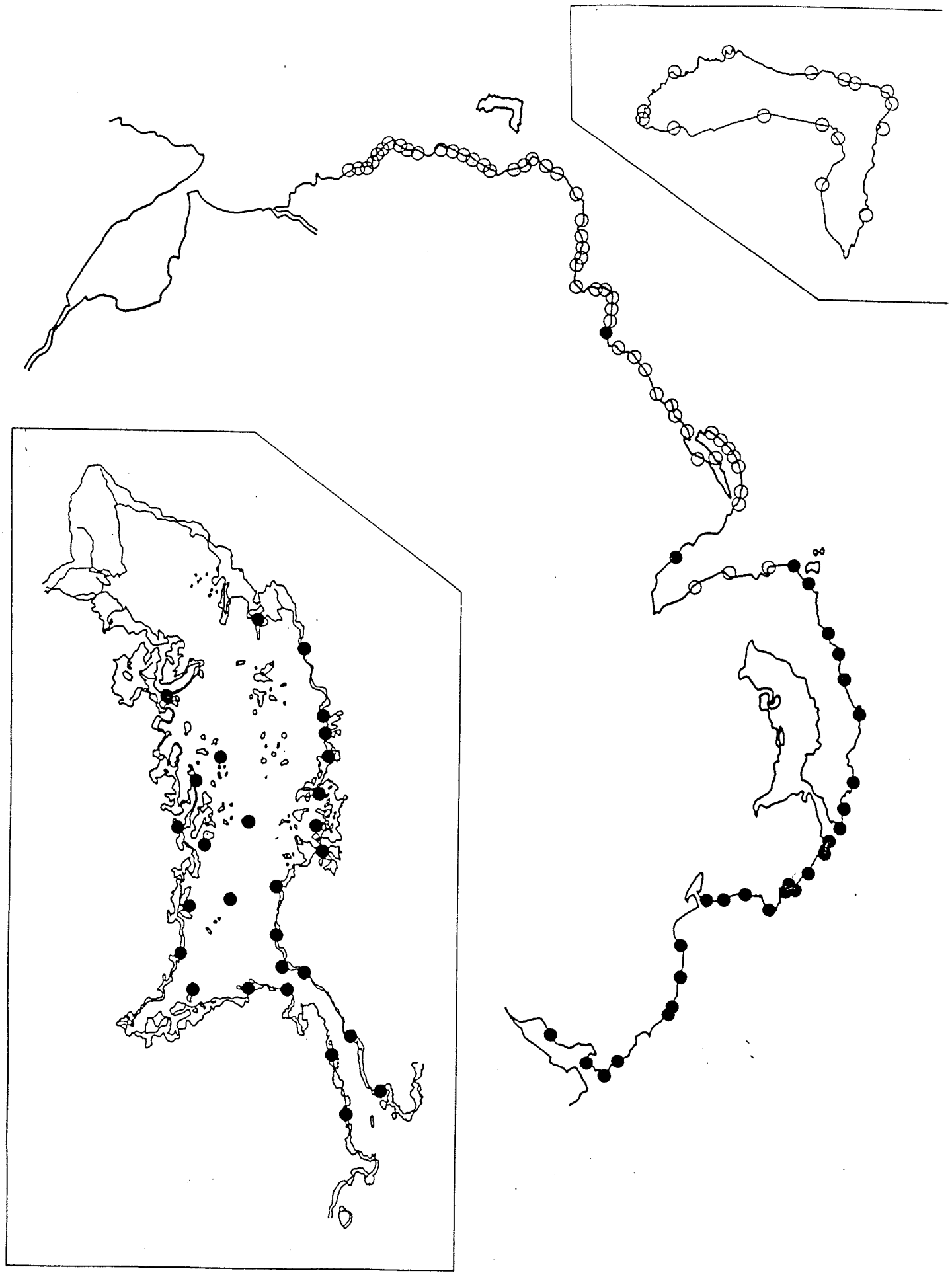


Figure 5.2 : Map of the geographic distribution of Bray Curtis Analysis groupings for Rocky sites. Symbols correspond to those in figure 5.1. Outliers have been omitted.

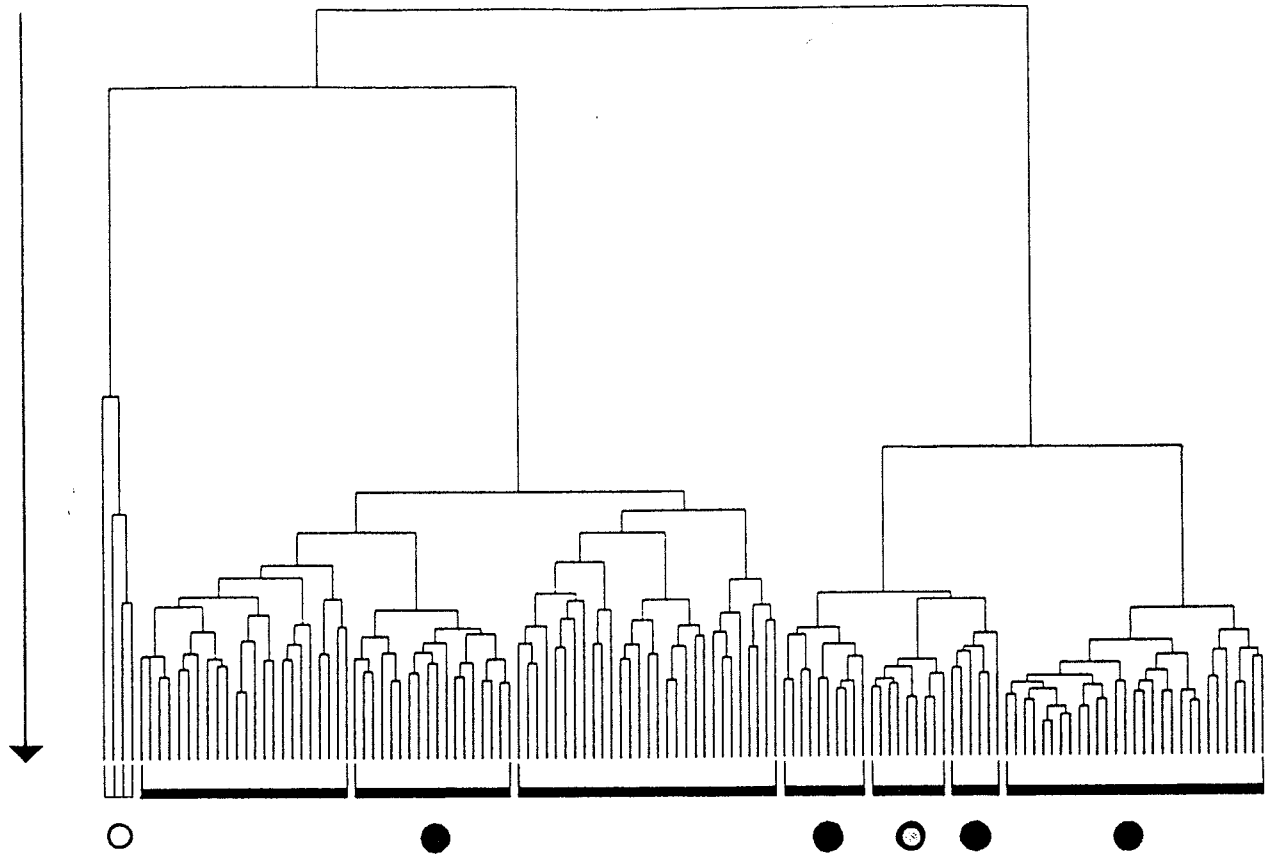


Figure 5.3 : Dendrogram of Lance-Williams Analysis for all Rocky sites. The groupings are colour coded and mapped in figure 5.4. The arrow shows increase in similarity.

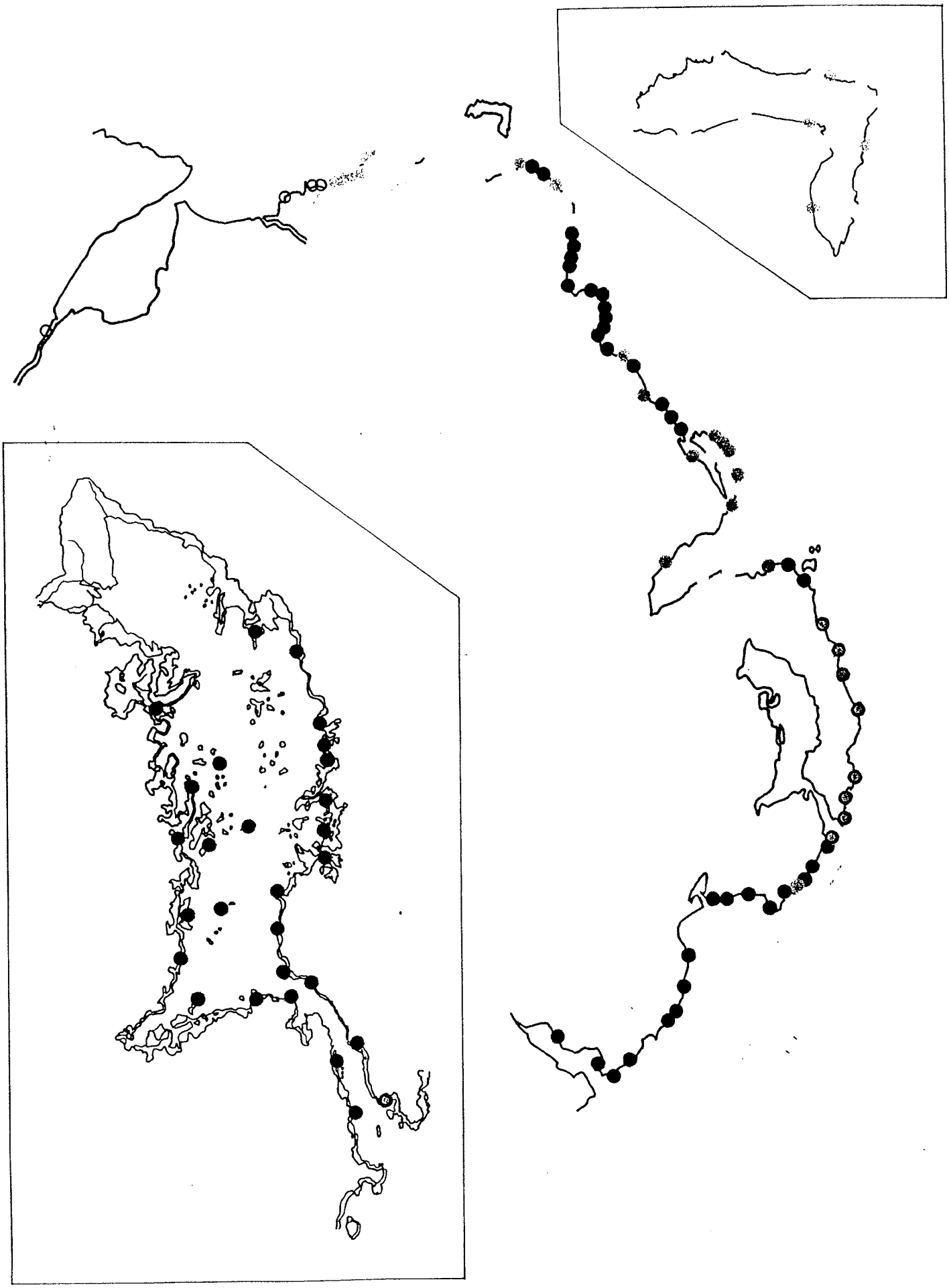


Figure 5.4 : Map of geographic distribution of Lance-Williams Analysis groupings for all Rocky sites. The colours correspond to those in figure 5.3.

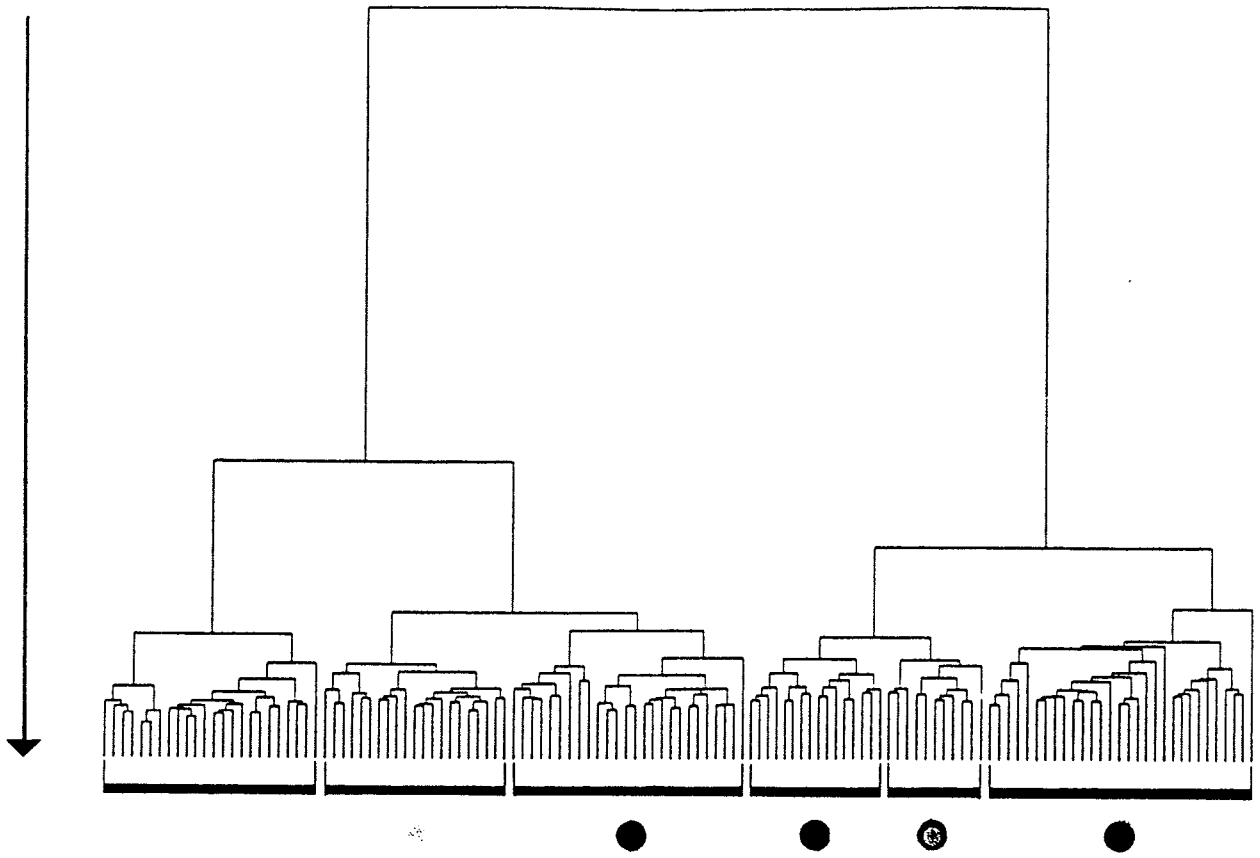


Figure 5.5 : Dendrogram of Wards Analysis for all Rocky sites. The groupings are colour coded and mapped in figure 5.6. The arrow shows increase in similarity.

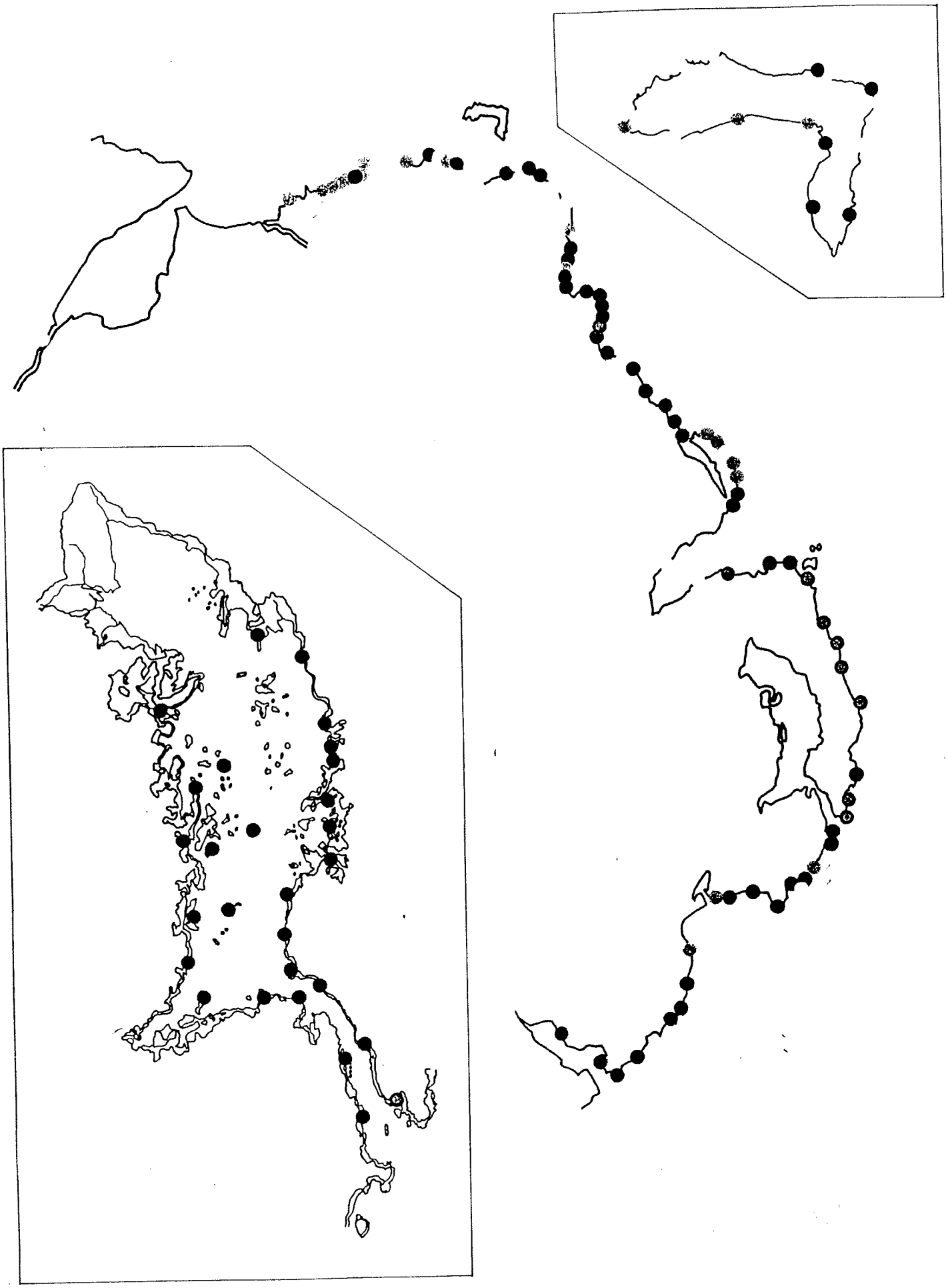


Figure 5.6 : Map of geographic distribution of Wards Analysis groupings for all Rocky sites. The colours correspond to those in figure 5.5.

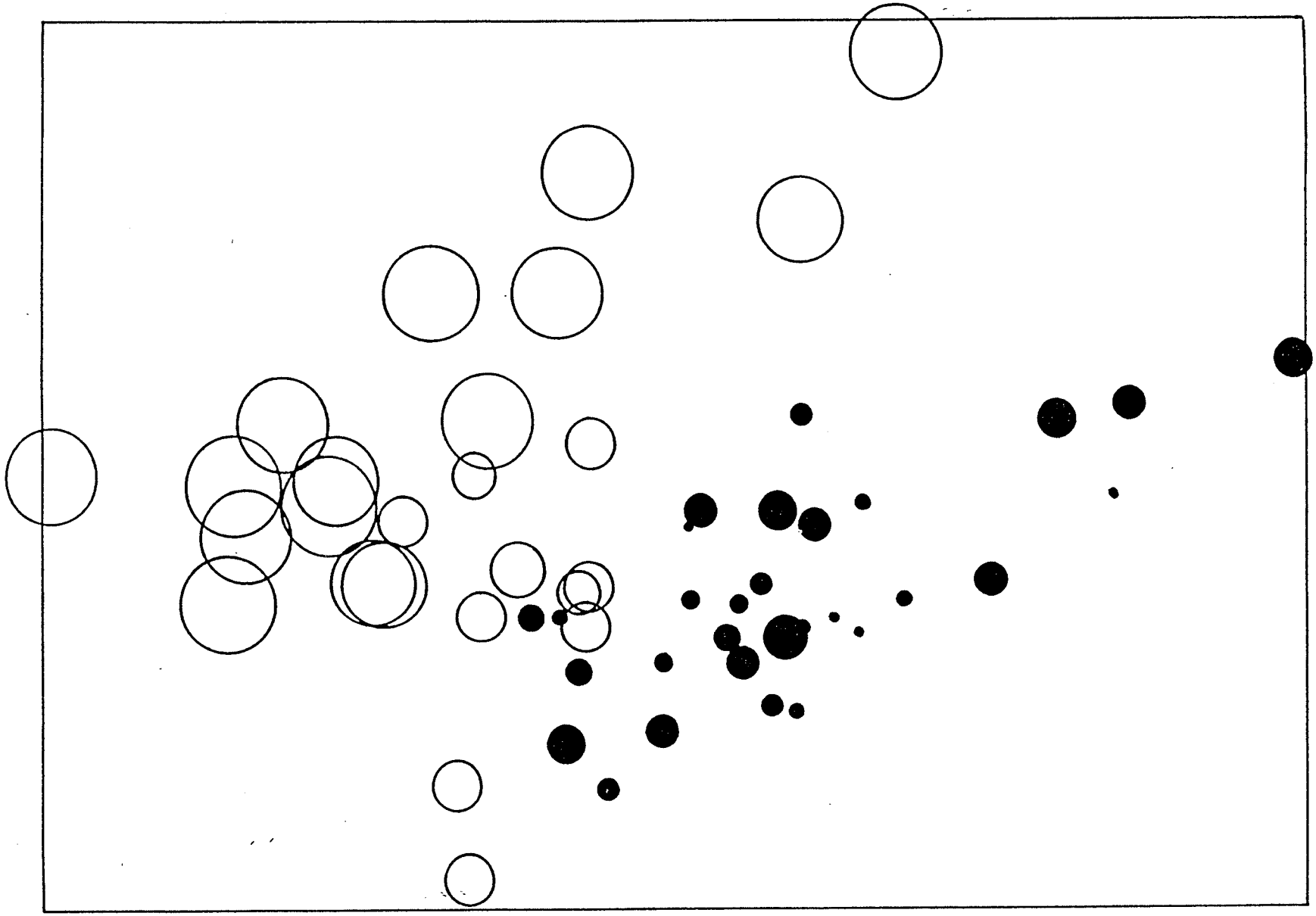


Figure 5.7 : DECORANA plot of the first two axes for east coast Rocky sites. This clearly illustrates the split between northern (black) and southern (hollow) sites. The size of the circle is proportional to the site number, showing that there is no gradation between the groups.

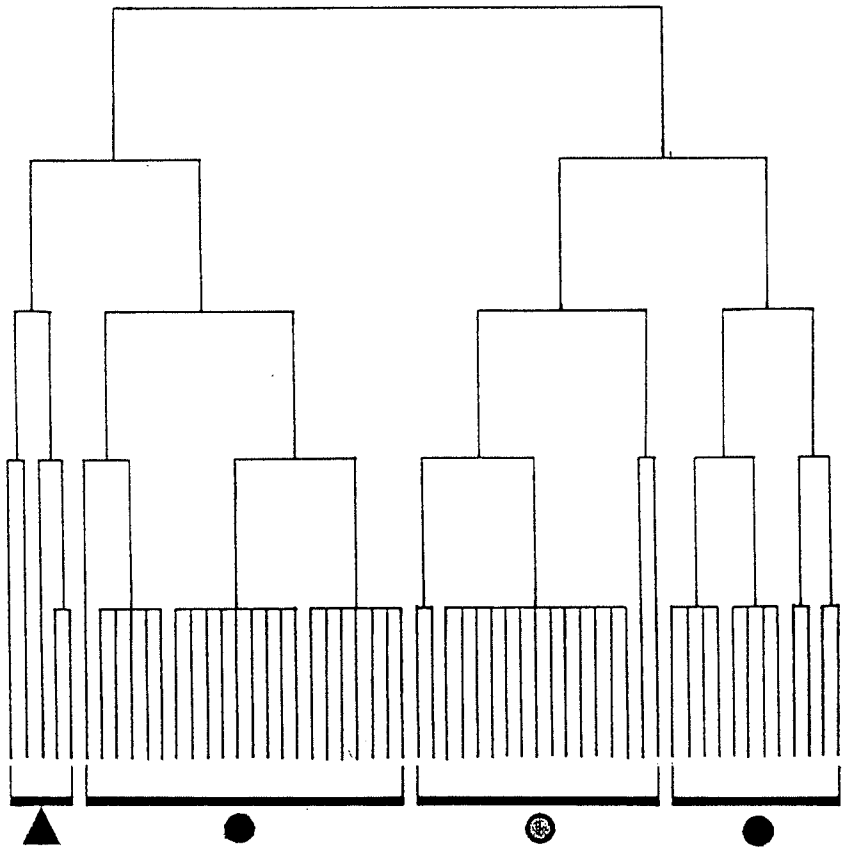


Figure 5.8 : TWINSPAN diagram for Rocky sites 73 - 128 (excluding outlier site 116). The groupings are colour coded and mapped in figure 5.9.

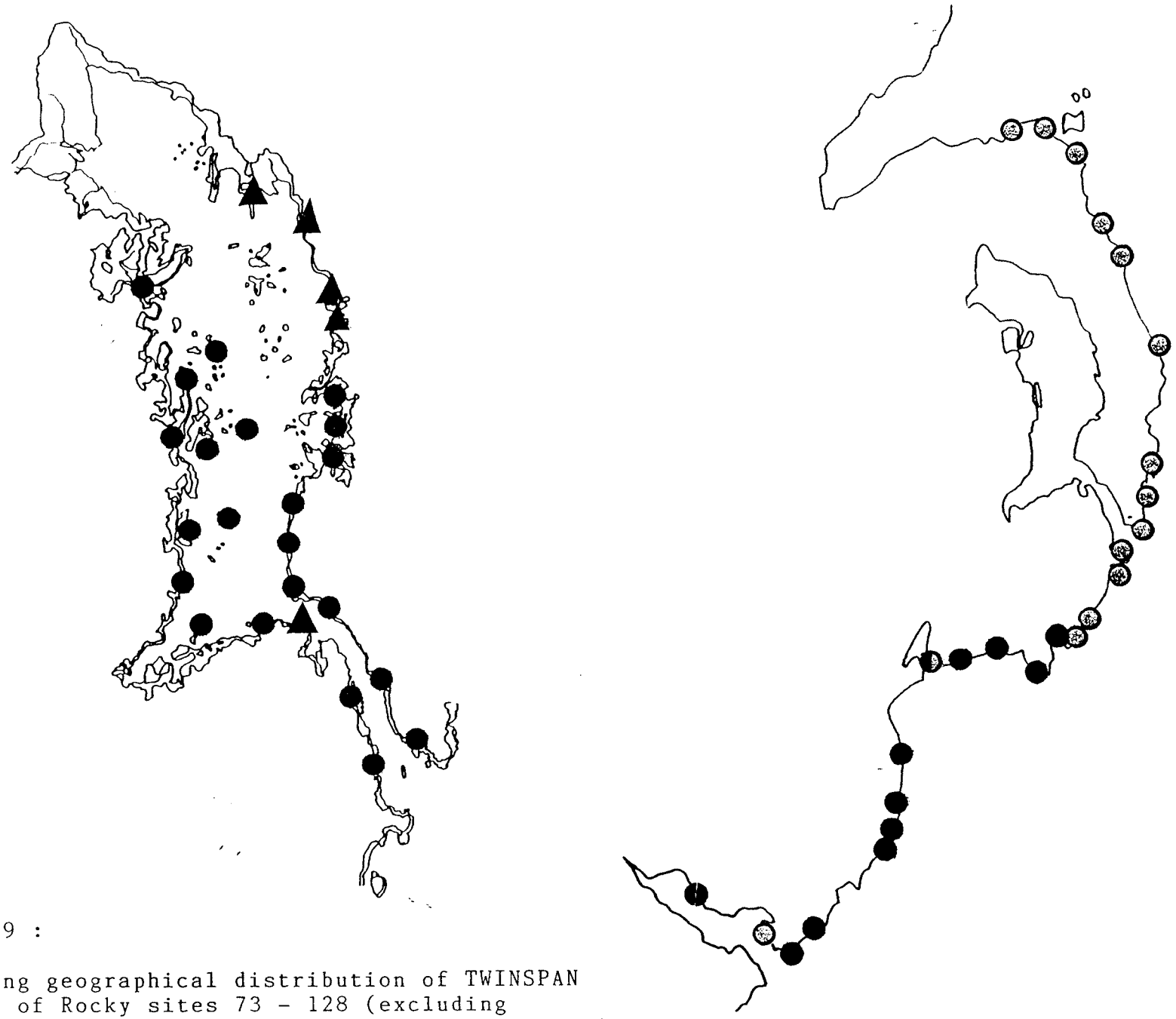


Figure 5.9 :

Map showing geographical distribution of TWINSPAN groupings of Rocky sites 73 - 128 (excluding outlier site 116). Colours correspond to figure 5.8.

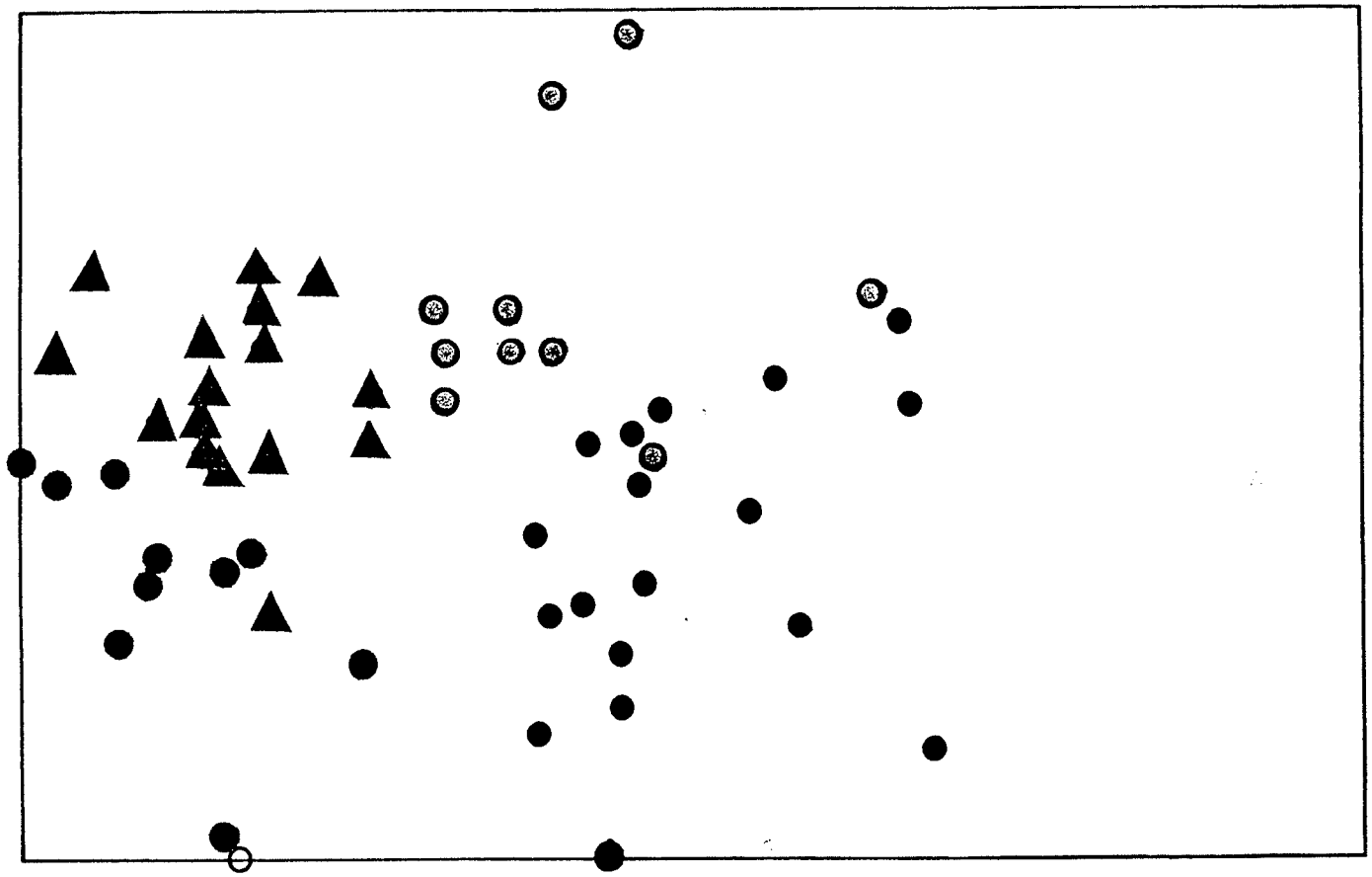


Figure 5.10: DECORANA plot of the first two axes for Rocky sites 73 - 128. Colours correspond to those on figure 6. Site 128 is shown as a hollow circle and outlier site 116 as an orange circle.

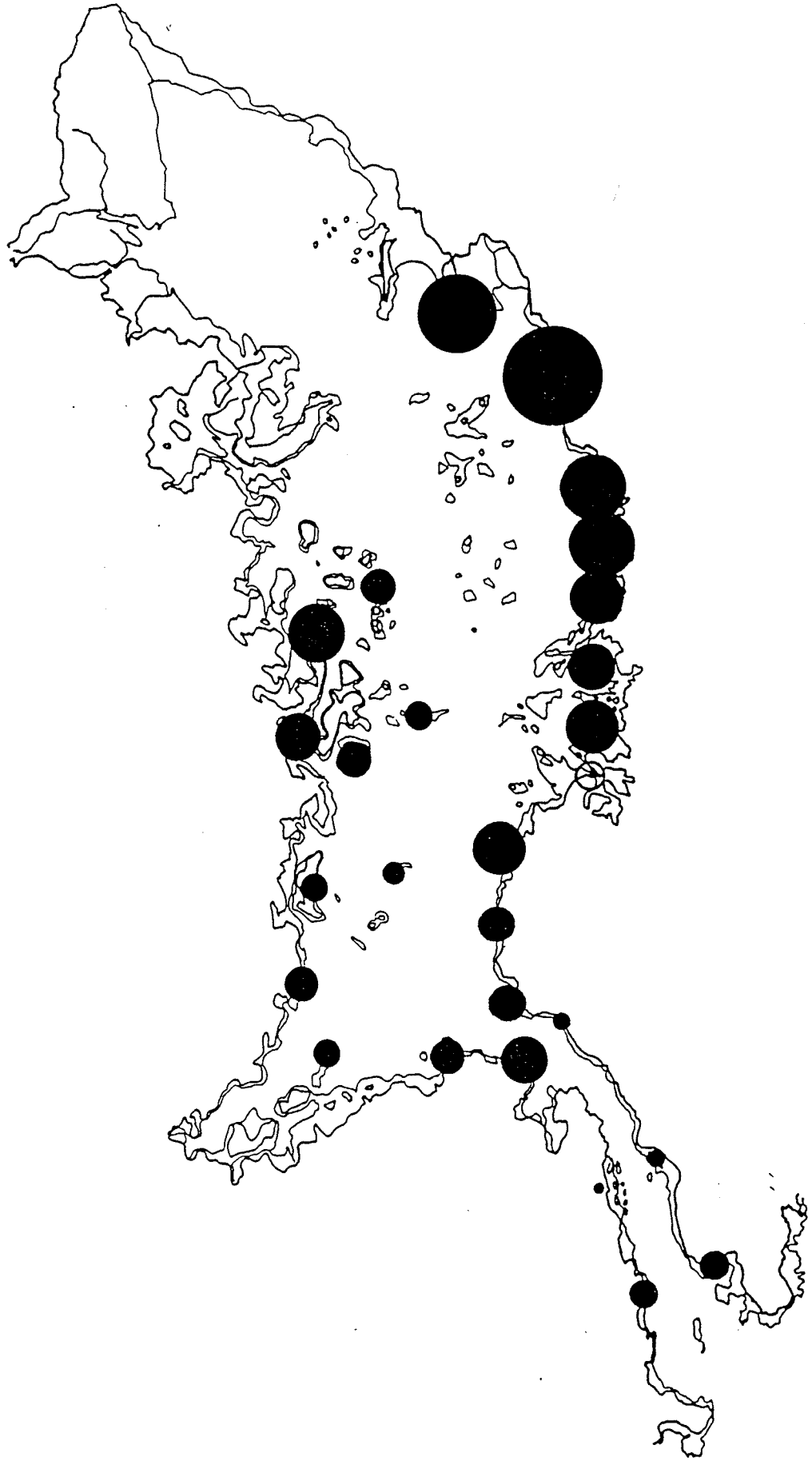


Figure 5.11: Plot of DECORANA scores for Strangford Lough rocky sites. The size of the circles are proportional to the score along the most significant axis. This shows a distinct gradation up the eastern side of the lough.

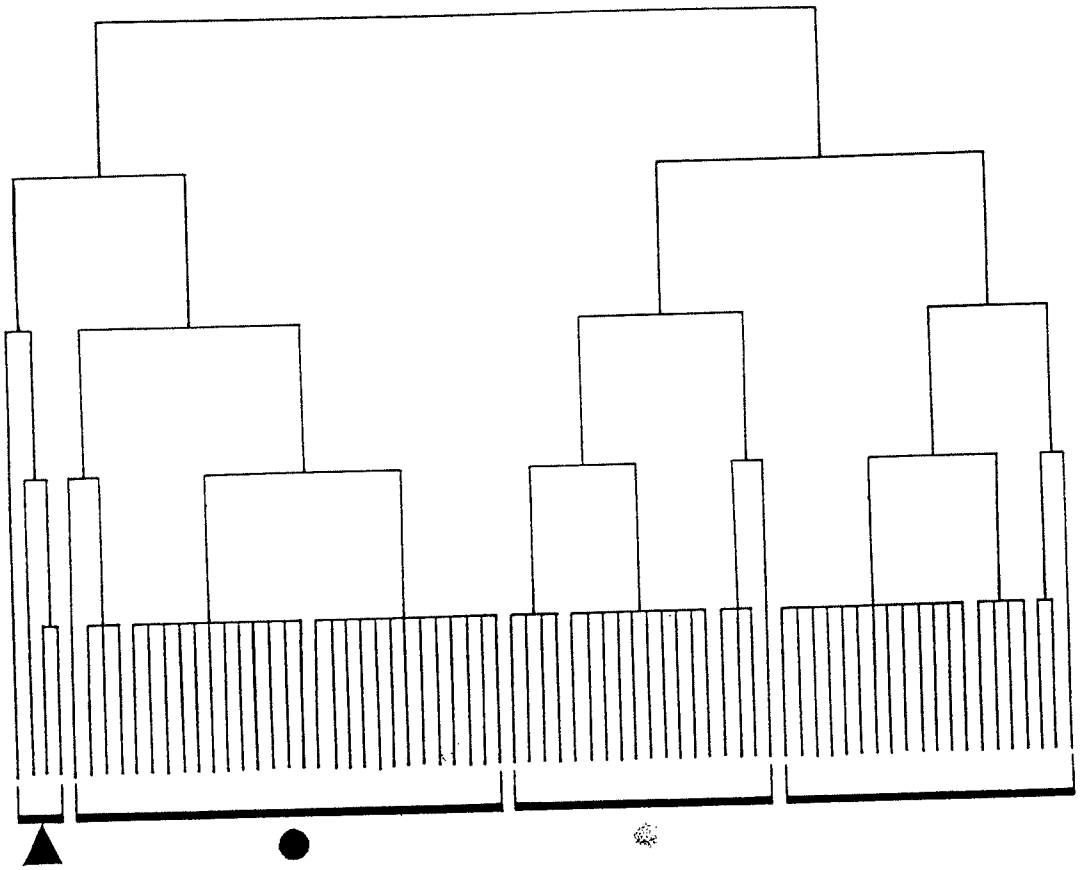


Figure 5.12: TWINSPAN diagram for Rocky sites 2 - 72 (excluding outlier site 1). The groupings are colour coded and mapped in figure 5.13.

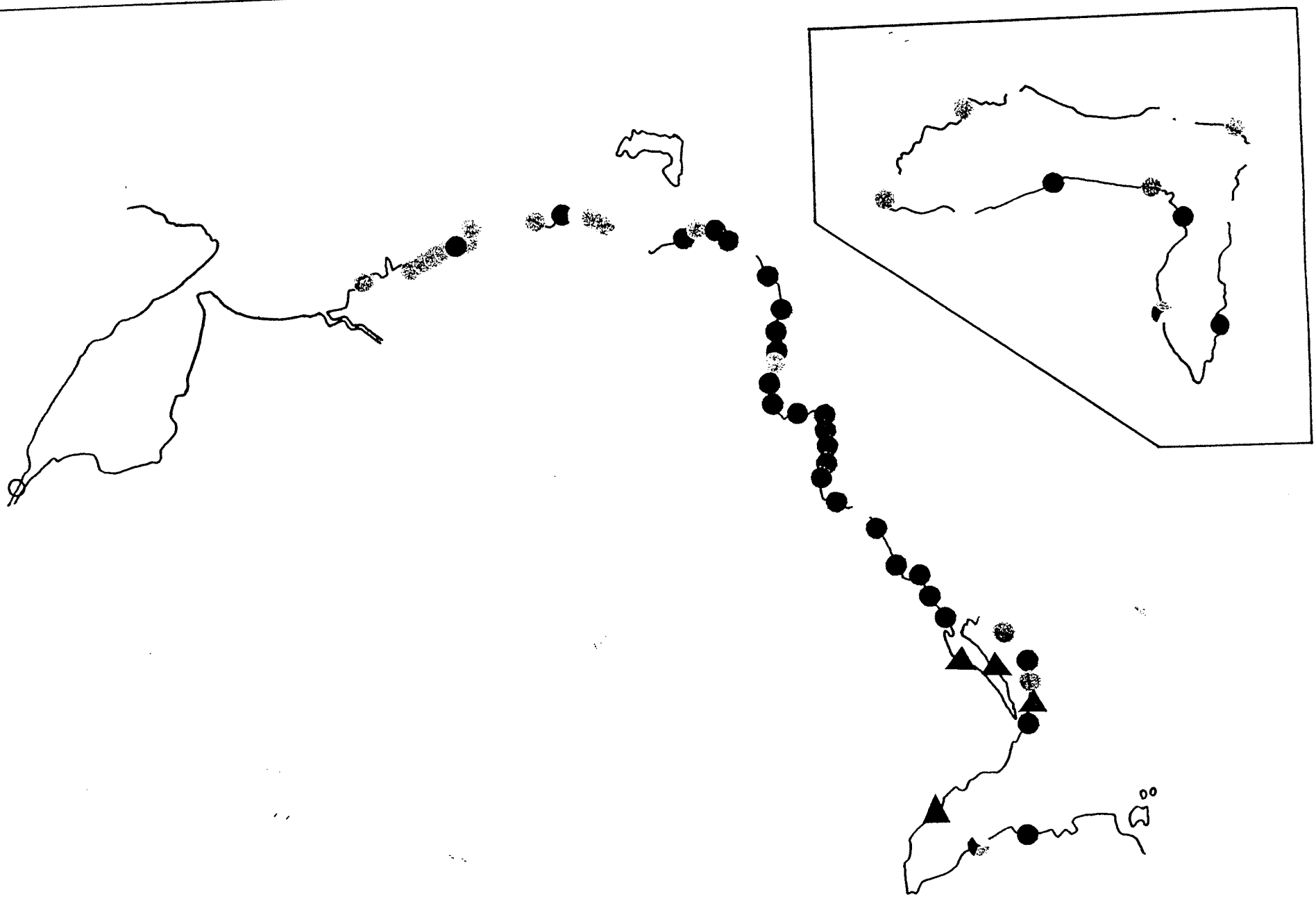


Figure 5.13: Map showing geographic distribution of TWINSPAN groupings of Rocky sites 2 - 72 (outlier site 1 is excluded). Colours correspond to figure 5.12.

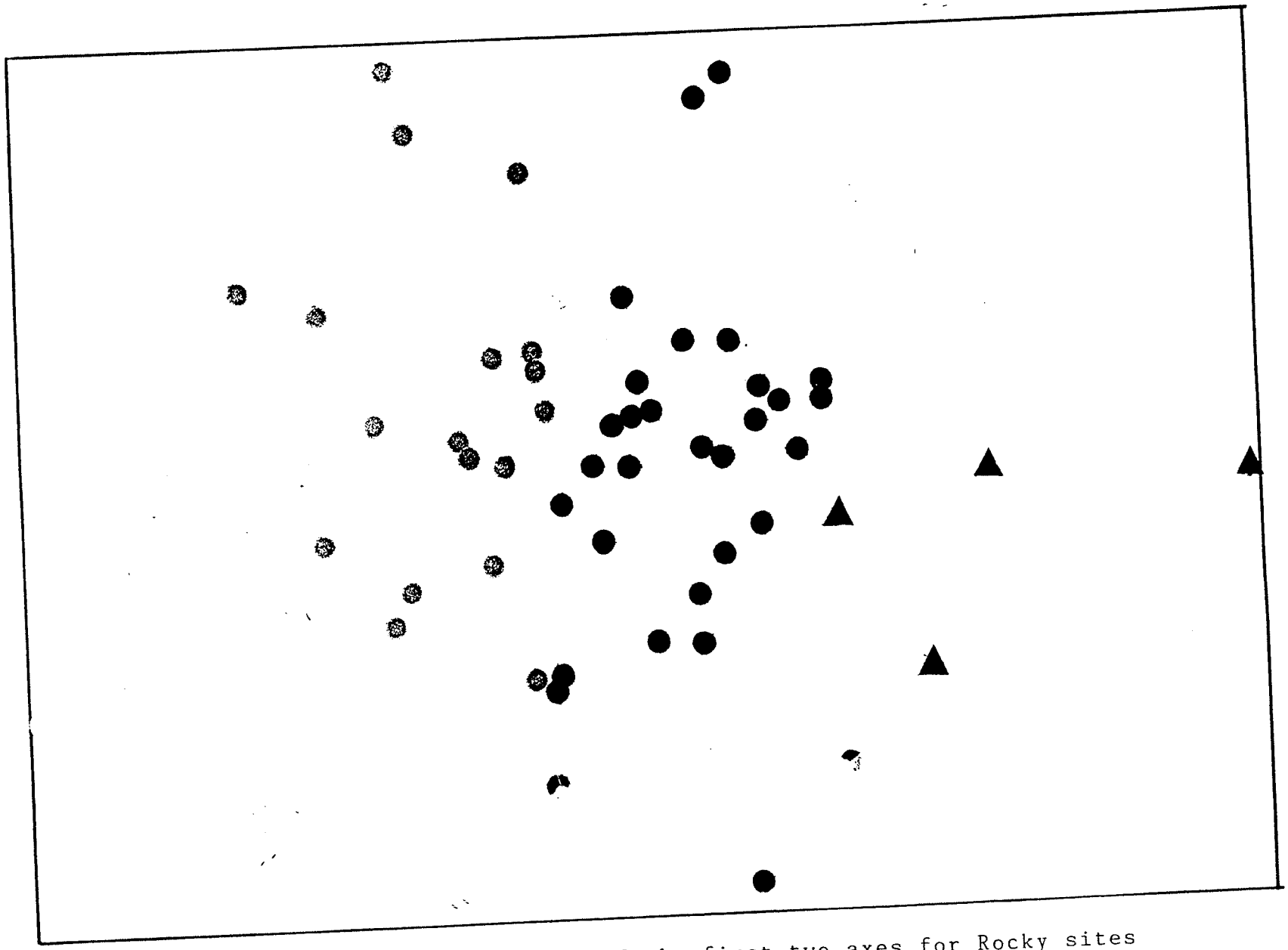


Figure 5.14: DECORANA plot of the first two axes for Rocky sites 2 - 72 (outlier site 1 is excluded). The colours correspond to those used for TWINSPAN in figure 5.12 Borderline sites between groups are shown in multiple colours.

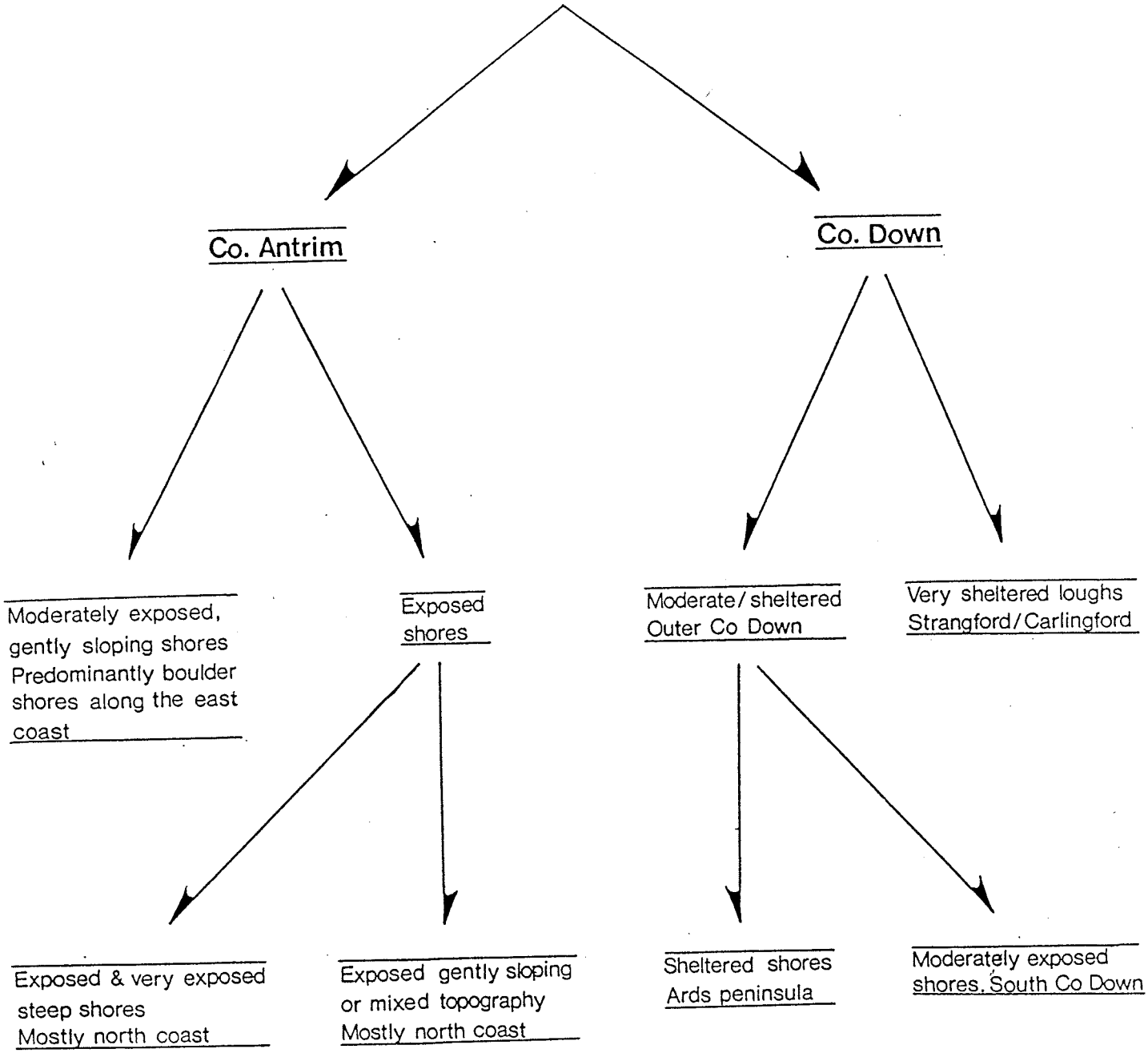


Figure 5.15: Summary diagram of computer classification of rocky shores.

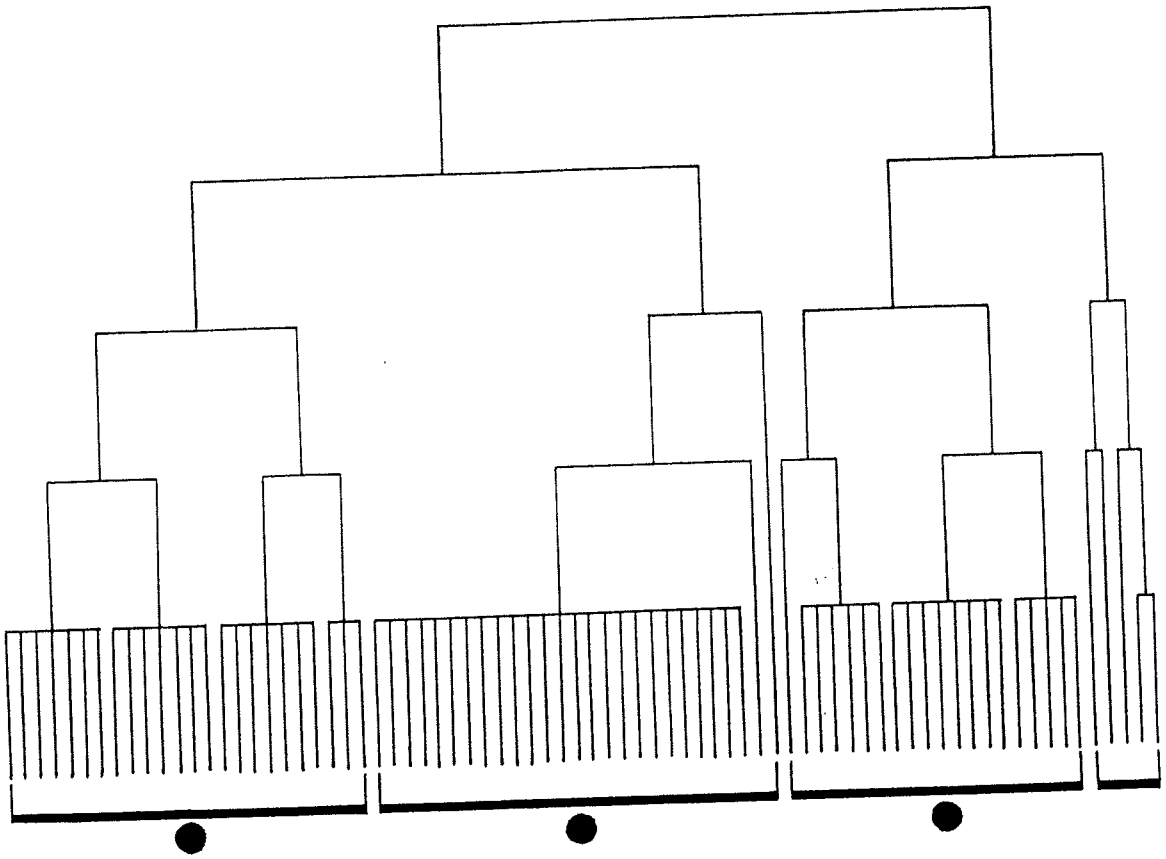


Figure 5.16: TWINSPAN diagram for all Sedimentary sites. The grouping are colour coded and mapped in figure5.17.

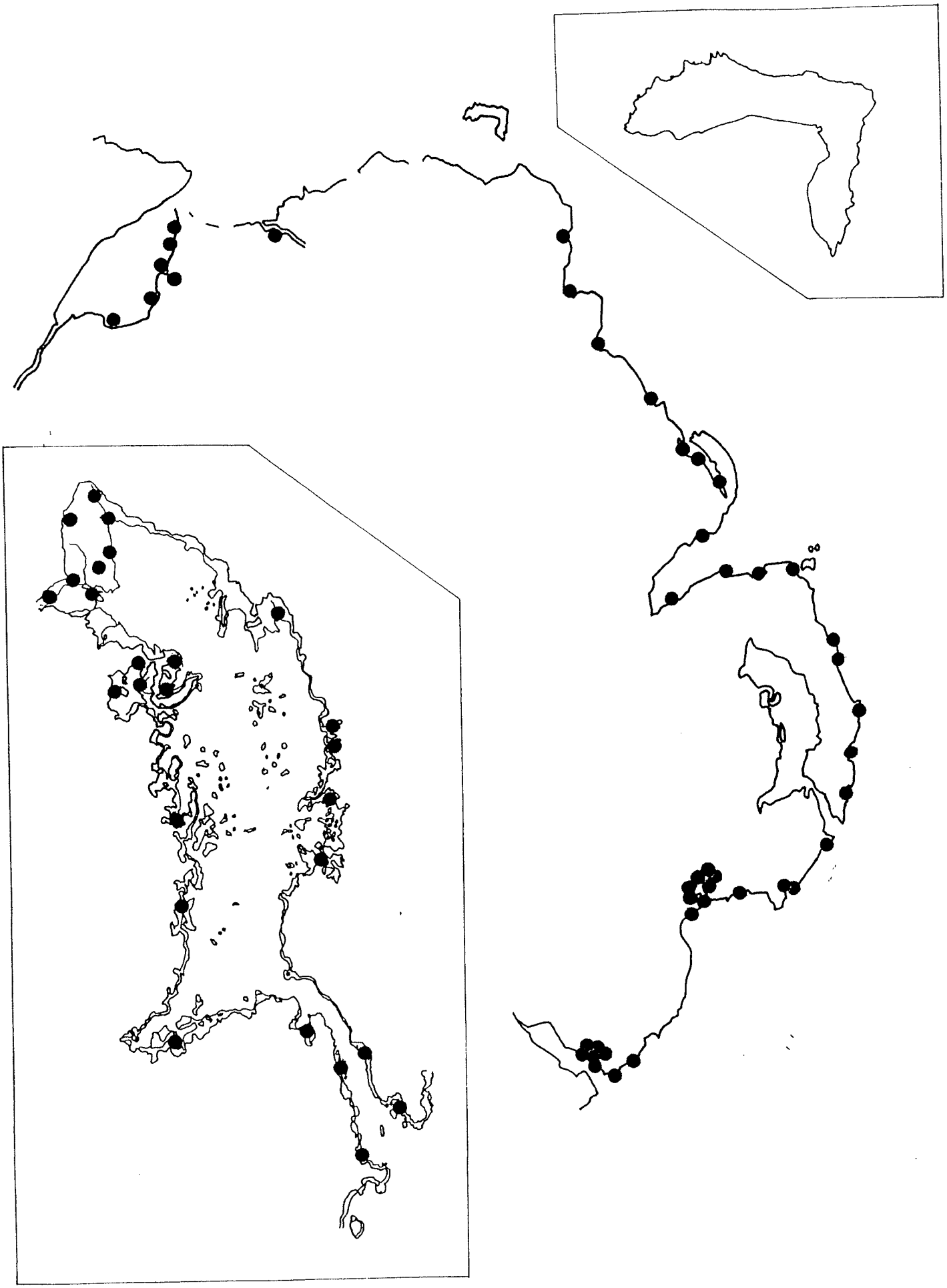


Figure 5.17: Map of geographic distribution of TWINSPAN groupings for all Sedimentary sites. The colours correspond to those in figure 5.16.

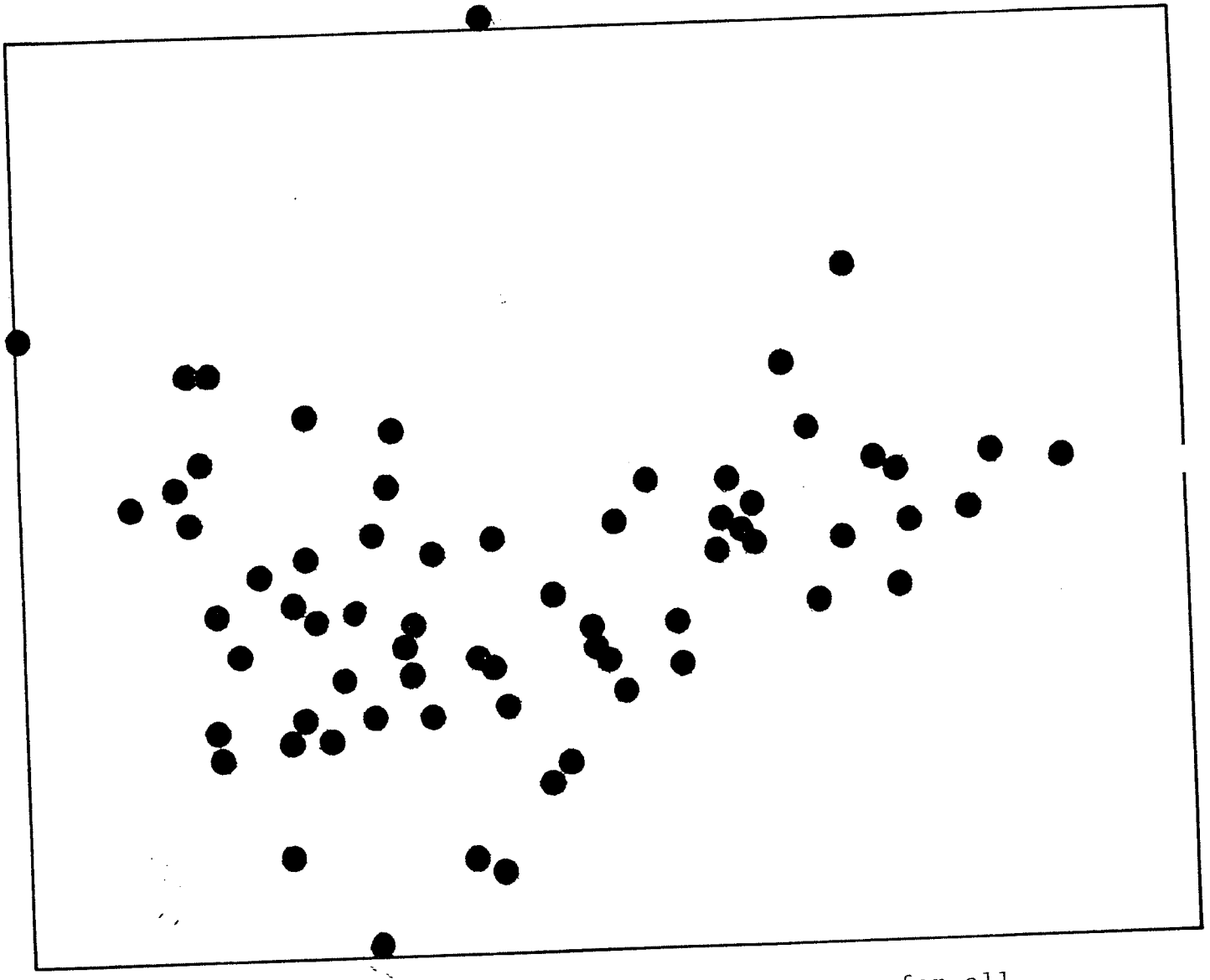


Figure 5.18: DECORANA plot of the first two axes for all Sedimentary sites. The colours correspond to those used for TWINSPAN in figure 5.16.

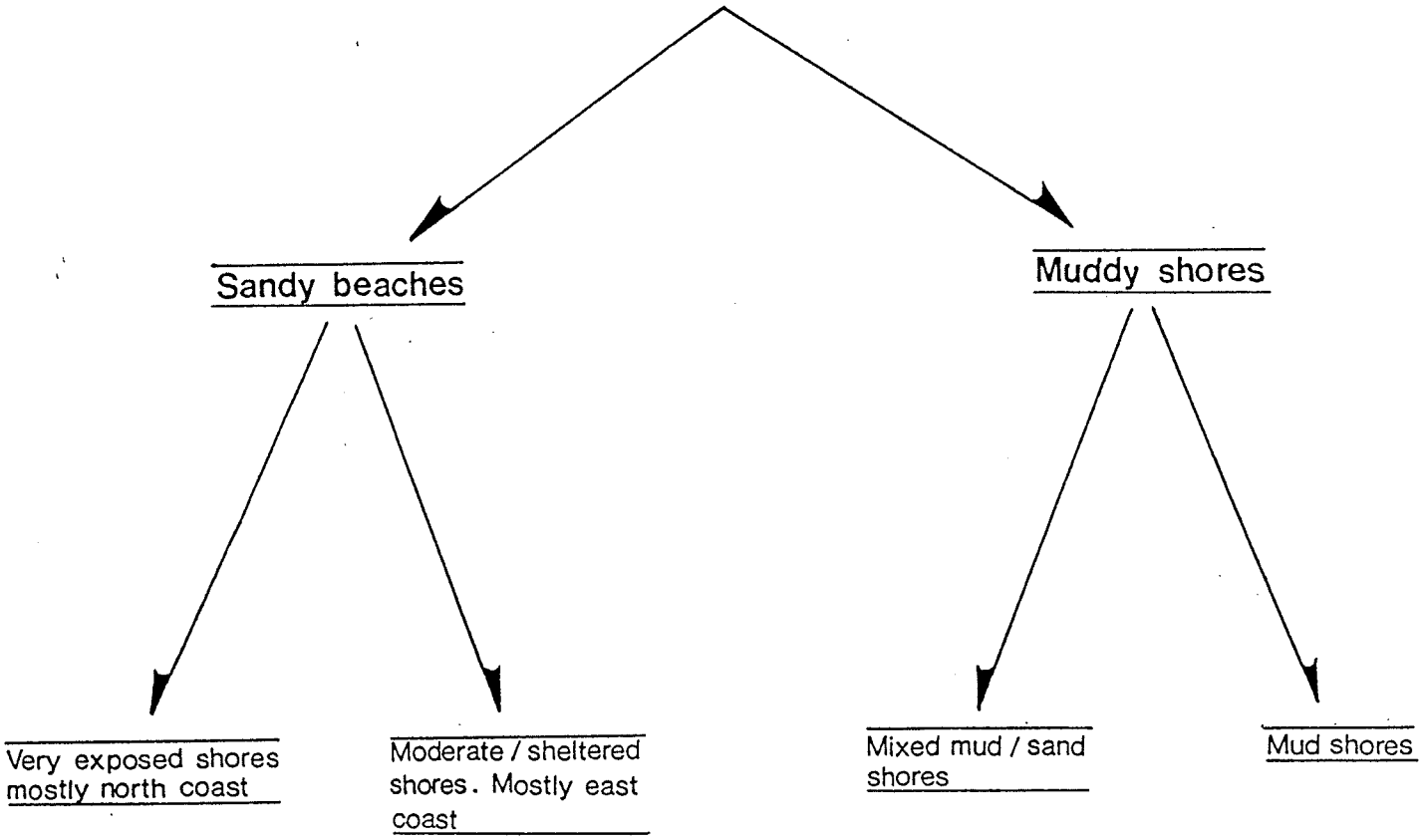


Figure 5.19: Summary diagram of computer classification of sedimentary shores.

6. THE COAST - PHYSICAL HABITATS AND BIOLOGICAL COMMUNITIES

This section is divided into three. Section 6.1 is a brief, summary description of each of the major biological community types which computer analyses of the Stage II data has indicated exist round the coastline, and of the physical habitats with which they are associated.

Sections 6.2 and 6.3 describe coastal habitats and communities in more detail. The coastline is divided into two areas, north and south of the major split in rocky shore community type detected by computer analyses in the vicinity of Bangor (see Section 5). Section 6.2 describes the coastline from Belfast Lough northwards as far as Londonderry. Section 6.3 describes with the area from Bangor to Warrenpoint.

After each region of the coastline has been described in physical and biological detail, a brief assessment of its conservation potential is given. Conservation assessment of the region north of Belfast Lough is summarised in the discussion at the end of Section 6.2 and assessment of the region south of Belfast Lough is summarised at the end of Section 6.3.

6.1 SUMMARY DESCRIPTION OF COASTAL HABITATS AND COMMUNITIES

Rocky and sedimentary habitats are described separately.

Rocky Sites

General Physical Background

Around the coastline, intertidal rocky habitats available to biological communities are largely formed from a combination of four main factors:

(i) exposure to wave action;
(ii) tidal range;
(iii) rock type;
(iv) major shore form eg. boulders, steep cliff, bedrock platforms.

(i) Exposure

Wave exposure round the coast varies along a continuum, and is strongly influenced by local shore topography, so the following statements are generalisations.

Exposure is strongest along the north coast, which faces the Atlantic Ocean. The east coast, which faces the Irish Sea, is in general more moderately exposed, although there are exposed areas, such as outer Islandmagee and parts of southern Co. Down. The most sheltered part of the open coast lies along the outer Ards Peninsula. The sea loughs are generally sheltered or very sheltered, apart from the mouth of Belfast Lough, which is exposed.

The level of wave exposure around different parts of the coastline is summarised in Figure 6.1.

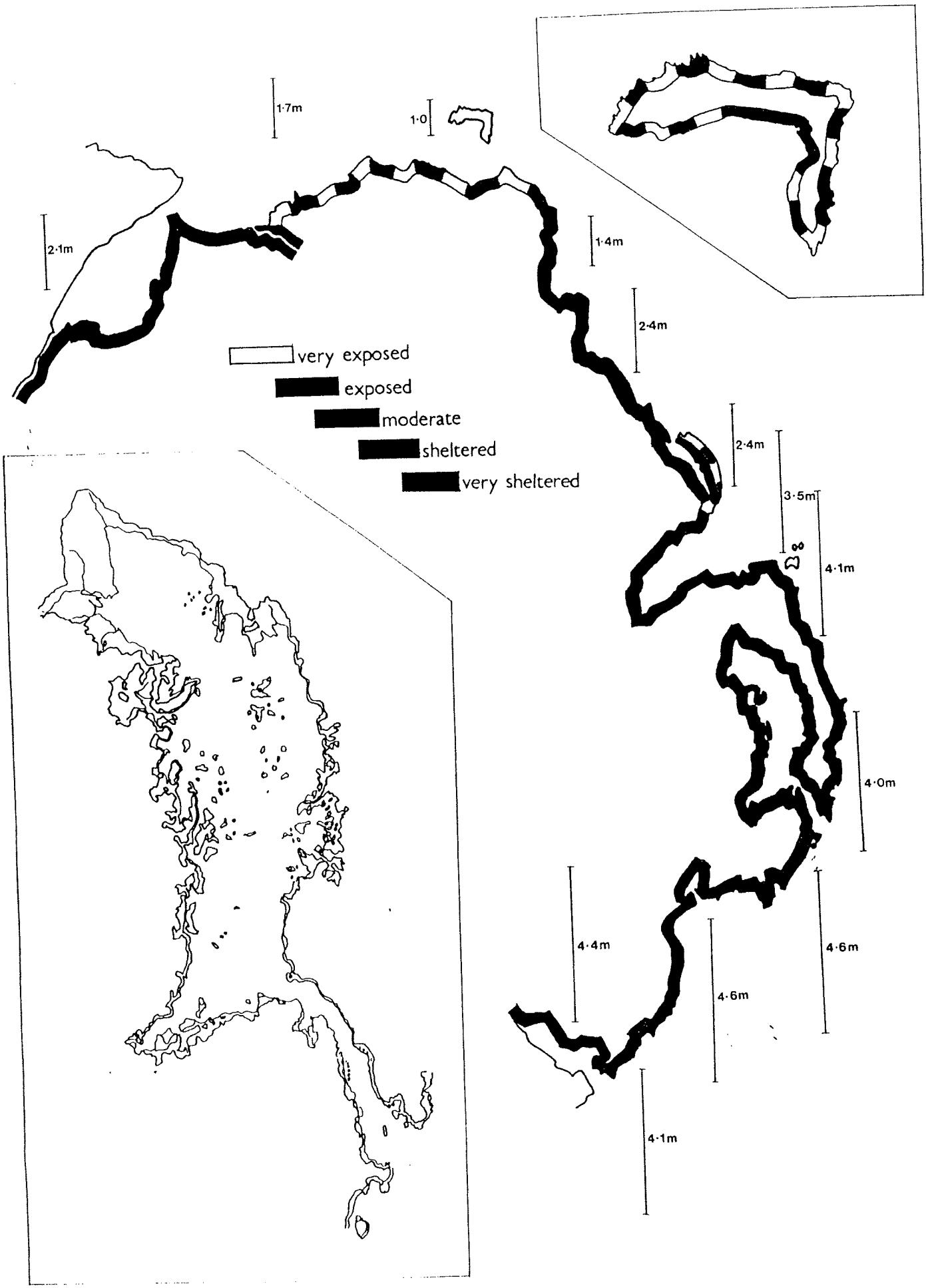


Figure 6.1 : Estimated exposure grades (see key) and mean tidal ranges for the coastline of Northern Ireland.

(ii) **Tidal range**

The mean spring tidal range of sites around Northern Ireland is also illustrated in Figure 6.1. The narrowest ranges are found along the Londonderry and Antrim coasts, with the minimum being 1.0 m around Ballycastle and Rathlin Island. At this point the mean neap tidal range is 0.4 m.

South of Belfast Lough the tidal ranges are far wider than north of the lough, with a maximum MSTR of 4.6 m along the coastline adjacent to outer Dundrum Bay.

(iii) **Rock type** and
(iv) **Major shore form**

These factors vary together round the coastline; different rock types result in different characteristic shore forms.

The major rocky shore types present north of Belfast Lough are the sheer basalt and hard limestone cliffs, block scree, boulder bays and wave cut platforms of the exposed north coast, and the extensive boulder shores, interrupted by outcrops of limestone or basalt bedrock and block scree, of the more moderately exposed east Antrim coast. Boulder shore is particularly prevalent along the stretch of coastline between Cushendall and Larne. Localised outcrops of sedimentary rock are present; these are more common on the east Antrim coast than the north.

South of Belfast Lough the major open coast rocky substrate changes from the hard basalt and limestone of the Antrim coast to highly creviced sedimentary rock with a wide number and variety of subhabitats. Localised igneous outcrops are also present all along the Co. Down coast.

Intertidal extent is determined by the orientation of the sedimentary rock outcrops. Outside the Ards Peninsula they form long, low intertidal platforms, as much as 200 m across, which are separated by wide sedimentary areas; however in other parts of Co. Down they form a relatively narrow intertidal.

Along the open coast south of Newcastle the main rocky substrates are boulder and outcrops of creviced sedimentary rock. In general the intertidal extent is narrower than that of northern Co. Down.

The remaining major rocky habitat found in Co. Down encompasses the sheltered and very sheltered boulder shores of Strangford and Carlingford Loughs.

For each physical factor discussed above, there are major differences north and south of Belfast Lough. Co. Antrim is generally more exposed to wave action than Co. Down, and has a narrower tidal range. The major rocky substrates of the Antrim coast are relatively hard and impervious basalts and limestone, which support a far lower diversity of subhabitats than the fractured and creviced sedimentary rocks of outer Co. Down and the boulder shores of the sheltered sea loughs.

These major physical differences are reflected in the major split between sites to the north of Belfast Lough and sites to the south of Belfast Lough indicated by computer analyses of the biological Stage II data. The major types of rocky shore biological communities found north and south of Belfast Lough will be described separately.

Biological Communities

County Antrim

The classification scheme outlined by computer analyses for major rocky shore communities round the Co. Antrim coast recognises three main divisions:

(i) exposed and very exposed steep north and east coast shores (these sites are found mainly on the north coast);

(ii) exposed gently sloping or mixed topography (again mostly along the north coast);

(iii) moderately exposed, gently sloping shores (Predominantly boulder shores along the east coast).

(i) **Exposed and very exposed steep north and east coast shores**

These shores occur mostly on the north coast, but also include sites along outer Islandmagee. The rock type is usually basalt or hard limestone. They are steep or vertical rock sites, found at the base of cliffs or on steep rocky headlands or on a substrate of steeply angled block scree (block scree boulders are very large and in places descend so steeply to the sea that they have much in common with steep bedrock sites). A typical transect from these sites would contain four to five zones.

Zone 1

Very wide splash zone, stretching many metres up the cliff. Blanket coverage of Verrucaria maura, with littorinids (including Littorina neritoides) in rock crevices.

Zone 2

Sometimes exists as a narrow zone dominated by Porphyra umbilicalis, with V. maura as an understorey.

Zone 3

Dominated by limpets and barnacles, present in different proportions at each site. V. maura understorey. Mussels and tufted filamentous red algae (eg. Ceramium shuttleworthianum) possibly present in crevices.

Zone 4

Dominated by encrusting calcareous and non calcareous red algae, together with Corallina officinalis. Other red algae and the brown alga Himanthalia elongata sometimes present.

Zone 5

The sublittoral fringe. Understorey of encrusting calcareous algae with an overstory of Laminaria digitata and Alaria esculenta, the latter being more common.

Exposure to strong wave action combined with a narrow tidal range and a scarcity of subhabitats on the steep rock surface makes this type of site the most species poor found around the coastline.

The next group of sites are also affected by the narrow tidal range and strong wave exposure of the Antrim coast, but have a wider intertidal extent.

(ii) **Exposed gently sloping or mixed topography**

This is a very heterogeneous group of sites which do not, in general, cluster as tightly in the analyses as some of the other community types.

These sites are a mixture of shore types, again composed of hard basalt and limestone and again occurring mostly along the north Antrim coast or along outer Islandmagee. They are affected by heavy wave exposure but the effect of this is reduced compared to the sites described in (i) above by their topography, which dissipates the force of the waves to a different extent at each site.

These sites all provide stable substrates and a comparatively wide variety of subhabitats for Co. Antrim. They include wave cut platforms along cliff bases, irregular rock outcrops, block scree shores which slope gently down to the sea, and shores composed of large, relatively immobile boulders which allow the formation of sheltered subhabitats and stable communities between them.

The basic zonation pattern is broadly similar to that described for (i) above, but the wider intertidal extent, the existence of stable subhabitats such as rock pools or crevices and of localised areas of shelter from wave action results in a more species rich shore.

Zonation varies between sites, but a general picture of the communities found on a wave cut platform would follow this pattern:

Zone 1

Mixed green algae (Enteromorpha and Blidingia spp.) with Porphyra umbilicalis and Porphyra linearis in the higher part of the zone. V. maura understory with L. neritoides and other littorinids in crevices. Pelvetia canaliculata and/or Fucus spiralis may be present in more sheltered areas.

Zone 2

The widest intertidal zone: up to 70 m across on a particularly large, gently sloping platform. Usually dominated by limpets and barnacles with tufts of filamentous red algae and clumps of mussles which may be extensive in rock crevices. The exposed shore form of Fucus vesiculosus may also be present on the surface. Rock pools are rich in algal species and may contain animals which could not exist on steeper

shores, such as Gibbula umbilicalis. Sheltered subhabitats may contain fucoids. The rock surface sometimes has a heavy coverage of Bangia atropurpurea.

Zone 3

Major zone formers vary depending on degree of exposure.

- most exposed areas: understorey of encrusting coralline algae with Corallina officinalis and filamentous red algae;
- moderately exposed: H. elongata dominant, with Gigartina stellata and C. officinalis important;
- least exposed: Fucus serratus, Palmaria palmata and Cladophora rupestris dominant.

Zone 4

Coralline encrusting algae beneath L. digitata and A. esculenta, but with a good animal and algal species richness in less exposed areas.

(iii) Moderately exposed, gently sloping shores

These sites are mostly east Antrim boulder shores, usually less exposed than the north coast sites. The boulders are usually basalt, but may be hard limestone. They can be mobile, especially during storms. Stable subhabitats, such as rock pools, are rare, which reduces algal species richness compared to bedrock sites. Animal diversity beneath boulders is lower than that found in more sheltered boulder areas, such as the sea loughs. The shores are usually fucoid dominated, although some are limpet and barnacle dominated. Zonation usually follows the pattern:

Zone 1

Narrow zone. Patchy to blanket coverage of P. canaliculata, with an understory of V. maura. Large numbers of littorinids, Ligia oceanica, littorinids and amphipods under stones.

Zone 2

Narrow zone. F. spiralis replaces P. canaliculata; otherwise similar to zone 1.

Zone 3

Widest zone. Dominant species variable, depending on exposure. Dense Ascophyllum nodosum coverage at more sheltered sites; F. vesiculosus or limpet (Patella sp.) and barnacles (Chthamalus sp. Balanus sp.) with Nucella lapillus at more exposed sites. All three types of coverage may appear along the same stretch of coastline. Littorina littorea, Carcinus maenas and amphipods live under the algal blanket and under boulders.

Zone 4

Usually a narrow mixed zone of coralline encrusting algae, F. serratus and red algae, including Laurencia pinnatifida, C. officinalis and G. stellata. The algae are slightly richer in epifauna than those in the equivalent zone along the north coast.

Zone 5

Laminaria digitata with an understorey of encrusting coralline algae. Generally species poor.

County Down

Computer analysis identified three major groupings of sites in Co. Down:

(i) moderately exposed shores of south Down;

(ii) sheltered shores of the outer Ards Peninsula;

(iii) very sheltered sea loughs (Strangford and Carlingford).

(i) **Moderately exposed shores of south Down**

These sites are composed mainly of creviced sedimentary rock, usually with boulder areas between the rock ridges. In some areas boulders are the dominant shore type. The sites are usually exposed; higher parts of the ridges are dominated by limpets, barnacles and N. lapillus. Fucoids usually appear only in shelter between the ridges. Supralittoral regions at these sites which are composed of undisturbed rock ridges generally support a large number of lichen species.

The sites usually possess a wide variety of subhabitats, including rock crevices and a large number of rock pools of varying sizes throughout the intertidal region. The high diversity of stable subhabitats and wide tidal range permits the existence of a greater species richness than that found along those parts of the Antrim coast which have a similar range of exposure to wave action. The species richness is generally smaller than that found along the Ards Peninsula, which has a similar tidal range and rock type, but is the most sheltered part of the open coast round Northern Ireland.

A general zonation pattern at these sites would be:

Zone 1

V. maura and littorinids on the higher parts of the ridges; scattered P. canaliculata in shelter between ridges, and pools containing filamentous and filiform green and brown algae and small crustaceans.

Zone 2

V. maura, limpets, barnacles and N. lapillus on the upperparts of the ridges; F. spiralis in shelter.

Zone 3

Widest zone. Dominant community depends on exposure and changes with the topography of each site. In shelter F. vesiculosus and A. nodosum would be major zone formers, but these are usually present only between ridges dominated by limpets, barnacles and N. lapillus. Rock pools are usually common, and boulder areas exist between ridges.

Zone 4

The major plant species present are F. serratus, G. stellata, P. palmata and mixed red algae. M. edulis may be present, and animal species richness is high under boulders.

Zone 5

The sedimentary rock on the bottom two zones is usually more worn down by wave action and hence smoother and less creviced and fractured than that of the upper zones. L. digitata grows over an understorey of encrusting coralline algae, with a rich algal flora on more stable substrates and a good animal diversity under boulders.

(ii) **Sheltered shores of the outer Ards Peninsula**

These sites possess a similar substrate type and tidal range to the southern Co. Down sites, but are more sheltered. They also have a wider extent; some of the creviced sedimentary rock platforms are more than 200 m across. These include the most species rich open coast sites visited during the course of the survey.

The general zonation pattern and substrate description is similar to that described for (i) above, except that fucoid growth at all levels is more luxuriant and zone 3 is usually dominated by A. nodosum and F. vesiculosus, and is wider than the corresponding zone from southern Co. Down.

The more sheltered conditions permit the existence of a generally richer flora and fauna. Epifauna are more common on fucoids; sediment filled crevices are a more stable habitat than further south, and support more burrowing animals; boulders and stones on the lower shore are less affected by wave action, permitting the existence of a more diverse encrusting fauna.

(iii) **Very sheltered sea loughs (Strangford and Carlingford)**

All of these sites are very sheltered from wave action compared to the open coast. They are the richest sites for intertidal invertebrates in Northern Ireland; algal species richness is lower than many open coast sites, but the sea loughs have their own distinctive algal flora.

The majority of the sites have a boulder substrate, although creviced sedimentary rock outcrops are also important components of the substrate at a minority of sites.

The boulders lie on a wide variety of sediments, ranging from mud to gravel at different sites. At some sites the boulders are tightly packed together, while at other sites they may be widely dispersed on the sediment surface.

The main fucoid present is Ascophyllum nodosum. Most sites follow a similar zonation pattern:

Zone 1

A narrow, dense zone of P. canaliculata; L. oceanica, amphipods and littorinids present under stones and boulders.

Zone 2

Similar to zone 1, but slightly broader and characterised by F. spiralis.

Zone 3

The widest zone, with a blanket coverage of A. nodosum, sometimes including F. vesiculosus. There is usually an algal understorey of Chondrus crispus, Plumaria elegans, Cladophora rupestris, Phyllophora pseudoceranoides and other algae. Epifauna, such as Dynamena pumilla, Flustrellidra hispida and, in more sheltered parts of the zone Halichondria panicea, are common, and become more diverse towards the lower part of the zone. Animal diversity, including many species of sponges, ascidians, bryozoans, polychaetes and arthropods, under the algal canopy and beneath boulders also becomes richer towards the lower part of the zone.

Zone 4

The dominant alga present is usually F. serratus, together with an understorey of mixed red algae and filamentous and filiform brown algae. Epifauna and under boulder fauna are again particularly rich, the latter including Eupolymnia nebulosa, Ascidia conchilega, Asterina gibbosa and many species of sponge and bryozoan.

Zone 5

The sublittoral fringe usually has a wider extent in the sea loughs compared to the open coast. The dominant algae are L. digitata, L. saccharina and L. hyperborea; the algal understorey is usually not as rich as that of zone 4, but includes more calcareous encrusting algae. Invertebrate species richness under boulders is again very high.

Sedimentary Sites

Computer analyses of sedimentary communities resulted in a classification scheme related to an exposure and sediment type rather than to a geographical area, which was the case with the rocky sites.

Four types of community were identified:

(i) very exposed sandy beaches (confined to north Antrim);

(ii) moderately exposed and sheltered sandy beaches (mostly east coast);

(iii) mixed mud/sand sites;

(iv) mud sites.

(i) **Very exposed sandy beaches**

These were found only along the north Antrim coast and are the most species poor sedimentary sites. The infauna are dominated by crustaceans and polychaetes; no molluscs are present. Characteristic species include Bathyporeia pelagica, Haustorius arenarius, Eurydice pulchra and Nephtys caeca.

(ii) **Moderately exposed and sheltered sandy beaches**

These are mostly clean sandy beaches found along the east coast. Crustaceans, polychaetes and molluscs are all usually present. Species present include Arenicola marina, Scolopolos armiger, Bathyporeia pelagica, Eurydice pulchra and Tellina tenuis.

(iii) **Mixed mud/sand sites**

These include several sites with a gravel component in addition to mixed mud and sand. They are found mainly in the sea loughs. Characteristic species include Macoma balthica, Cerastoderma edule, Tellina tenuis, Corophium volutator, Crangon crangon, Spio filicornis and Nephtys hombergi.

(iv) **Mud sites**

These sites contain little or no sand, but may include a gravel component. Species include Macoma balthica, Cerastoderma edule, Corophium volutator, Fabricia sabella and Pygospio elegans.

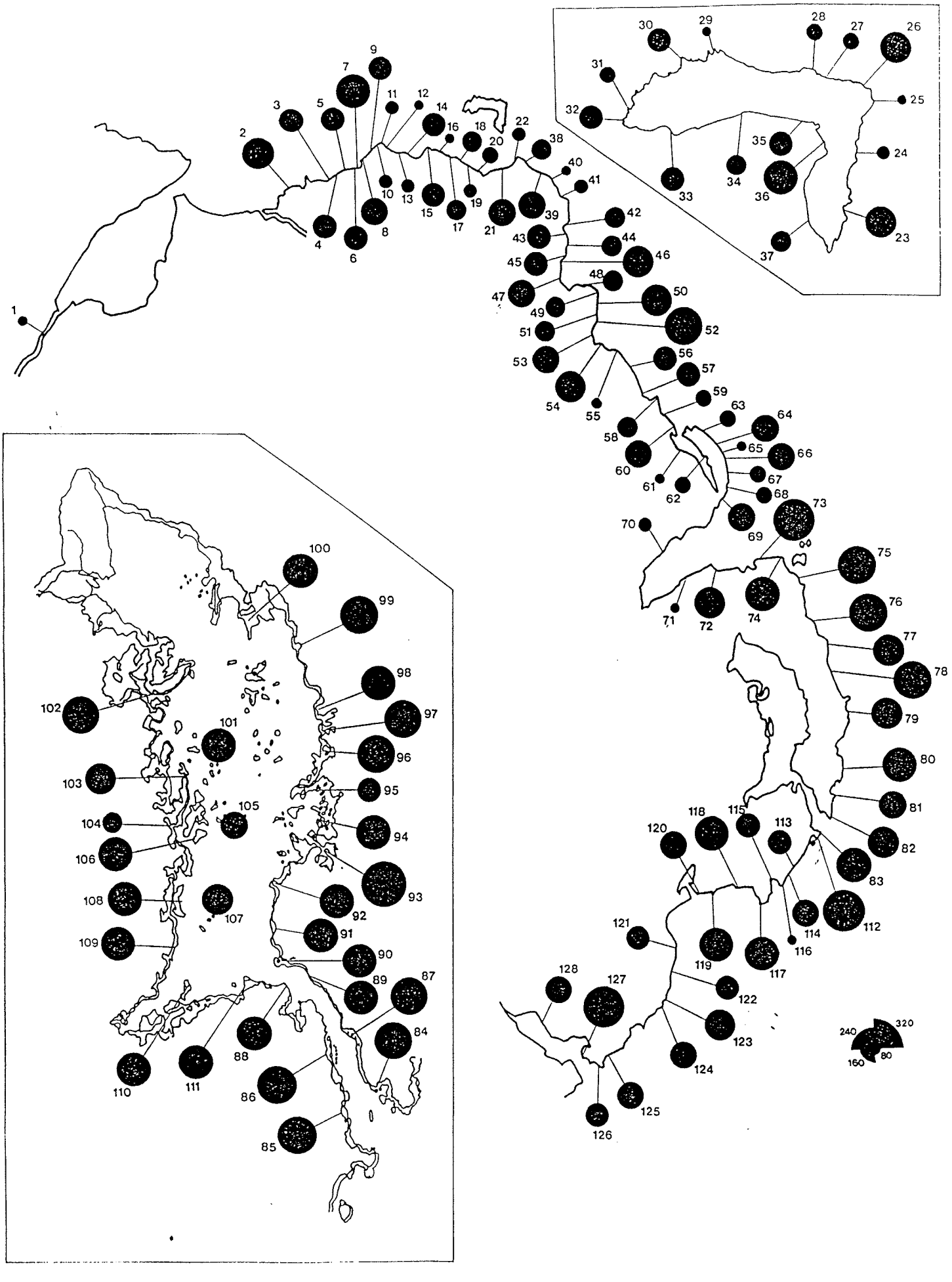


Figure 6.2 : Diagrammatic representation of species number for rocky site. The numerical labels refer to site numbers, see Table 6.1.

TABLE 6.1 Stage II Rocky sites with number of species recorded and equivalent Stage I site number.

Stage II Site Number	Site Name	Number of Species Recorded During Stage II Survey	Equivalent Stage I Site Number
1	Newbridge (Foyle)	46	140
2	Rinagree Point	173	130
3	Burnfoot A	148	74
4	Burnfoot B	144	73
5	Peggy's Hole A	141	75
6	Peggy's Hole B	133	76
7	Port Gorm A	204	77
8	Port Gorm B	167	77
9	The Ladle	131	88
10	Great Stookan	89	90
11	Port na Tober	90	118
12	Port na Tober Headland	53	119
13	Port Moon	87	78
14	Port Moon Bay	138	79
15	Carricknaford	149	126
16	Larry Bane Head	54	80
17	Larry Bane Bay	129	81
18	Carrick-a-rede	122	127
19	Kinbane Head	79	85
20	Dunimeny Castle	95	132
21	Carrick-more	154	136
22	Fair Head West	83	137
23	Doon Bay	187	-
24	Portawillin	78	109
25	Bruce's Cave	24	108
26	East Lighthouse-Platform	177	107
27	Stackamore A	103	106
28	Stackamore B	90	106
29	Kinrea	38	103
30	Marie Isla	149	105
31	Portandoon A	93	-
32	Portandoon B	147	-
33	Black Head (Rathlin)	142	97
34	Killeany	127	95
35	Dutchman	134	94
36	Beddag	192	117
37	Oweydoo	112	114
38	Portdoo	121	139
39	Murlough Bay	151	145
40	Ruebane Point	50	146
41	Port More	74	167
42	Cushendun North	123	169
43	Cushendum South	135	170
44	Cave House Shore	116	171
45	Layd Church	145	172

TABLE 6.1 Continued.

TABLE 6.1 Continued.

Stage II Site Number	Site Name	Number of Species Recorded During Stage II Survey	Equivalent Stage I Site Number
46	Port Vinegar	176	148
47	Red Arch	152	150
48	Old Pier	124	151
49	White Lady East	92	153
50	Garron Harbour	183	154
51	Turnly's Port	128	155
52	Ringfad	212	156
53	Campbeltown	164	157
54	Straidkilly Point	178	158
55	Whitebay Point	55	160
56	Drumnagreagh Port	143	161
57	Halfway House	135	162
58	Ballygalley Head	129	163
59	Carnfunnock Bay	104	164
60	Seacourt	153	165
61	Dalariada Point	66	173
62	Barney's Point	110	174
63	McIlroy's Port	110	177
64	Riding Stone	154	178
65	Isle of Muck East	69	179
66	Chapmans Rock	155	181
67	Gobbins	100	182
68	Marchburn Port	99	184
69	Black Head East	155	185
70	Loughshore Park	77	190
71	Culloden Hotel	58	215
72	Swinely Point	177	212
73	Ballymacormick Point	211	210
74	Orlock Point	209	191
75	Foreland Point	217	193
76	Barkley Rocks	225	196
77	Whitechurch Rocks	181	197
78	Wallaces Rocks	222	198
79	Robins Rock	174	200
80	Kearney	195	71
81	Down Rock	168	69
82	Ballyquintin Point	188	67
83	Mill Quarter Bay	191	29
84	Carrstown Point	228	66
85	Kilclief Rocks	221	30
86	Isle O'Valla	211	217
87	Granagh Bay Rocks	227	65
88	Audleys Castle Rocks	204	44
89	Ballyhenry Bay	201	62
90	Selk Rock	208	61

TABLE 6.1 Continued.

Stage II Site Number	Site Name	Number of Species Recorded During Stage II Survey	Equivalent Stage I Site Number
91	Marlfield Rocks	201	60
92	Ringburr Point	185	59
93	The Dorn	258	58
94	Yellow Rocks	203	57
95	Mid Island Bay	144	-
96	Horse Island	226	55
97	Black Neb	217	53
98	Kircubbin Point	201	52
99	Herring Bay Boulders	211	51
100	South Island	192	42
101	Drummond Island	200	39
102	Mahee Island	211	220
103	Castle Island Point	181	48
104	Ringhaddy Rapids	123	-
105	Long Sheelah	169	38
106	Pawle Island	205	36
107	Limestone Pladdies	181	-
108	Taggart Island	194	24
109	Holm Bay	202	218
110	Green Island	194	33
111	Chapel Island Causeway	202	45
112	Craiglewey	234	27
113	Sheepland Harbour	140	25
114	Ardglass Bay Rocks	166	24
115	Coney Island Bay	145	22
116	Black Rock	64	23
117	St Johns Point	190	21
118	Ringboy Boulders	196	19
119	Rathmullan Point	208	18
120	Craigalea	156	17
121	Bloody Bridge	141	16
122	Glassdrumman Port	143	14
123	Wreck Port A	189	12
124	Wreck Port B	161	12
125	South of Nicholson's Point	166	7
126	Cranfield Point	141	6
127	Greencastle Rocks	232	5
128	North of Killowen	151	3

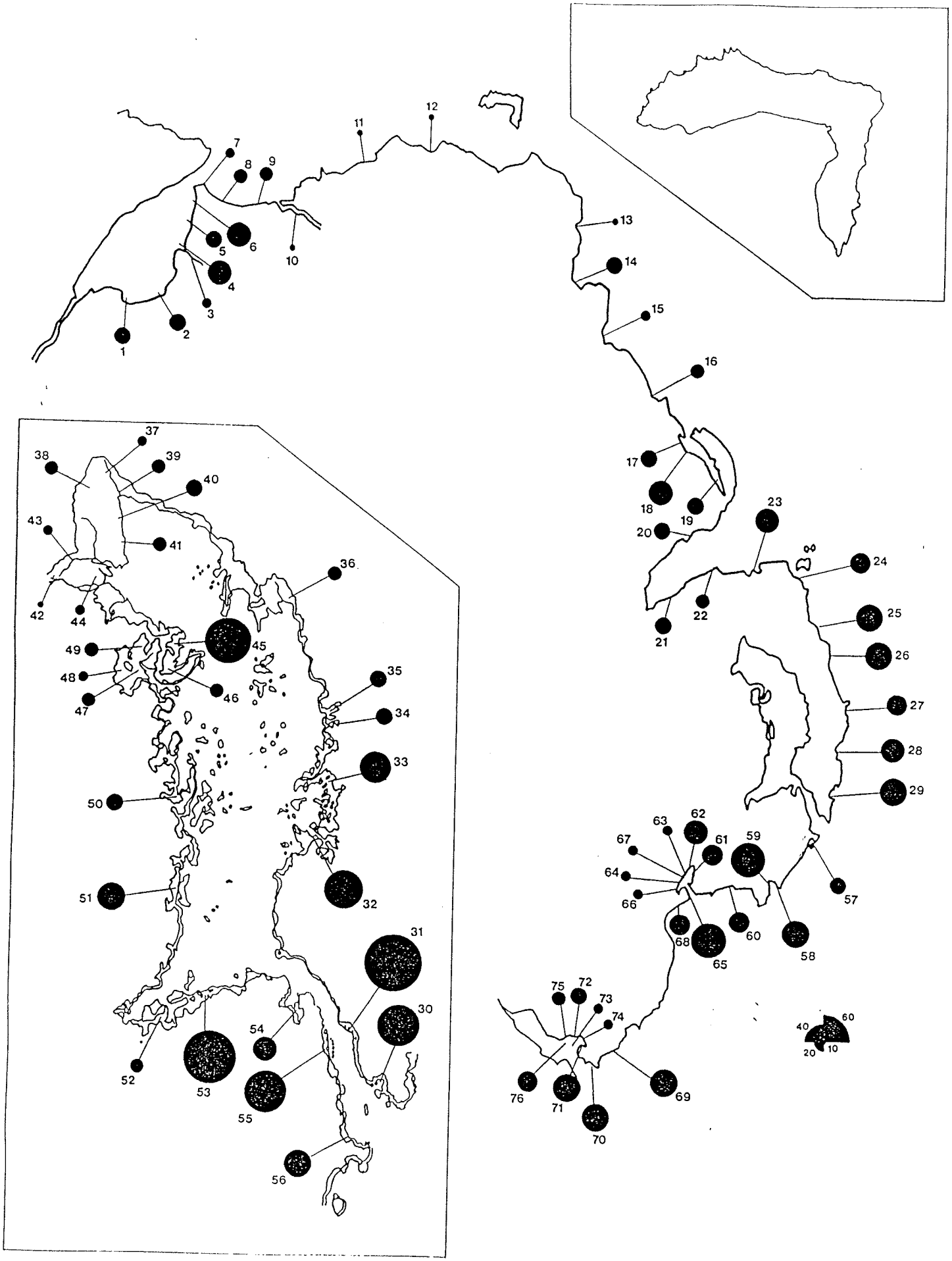


Figure 6.3 : Diagrammatic representation of the number of species for sedimentary sites. The numerical labels refer to site numbers, see Table 6.2.

TABLE 6.2 Stage II Sedimentary site with number of species recorded and equivalent Stage I site numbers.

Stage II Site Number	Site Name	Number of Species Recorded During Stage II Survey	Equivalent Stage I Site Number
1	Longfield	20	65
2	Ballykelly Bank	23	67
3	Sheep Mash	9	69
4	Balls Point	29	70
5	Ballymulholland	21	71
6	Lower Doaghs	27	72
7	Magilligan Point	9	73
8	Magilligan Strand	11	74
9	Downhill Strand	15	76
10	Bann Estuary	6	78
11	Bushfoot Strand	6	59
12	White Park Bay	4	62
13	Cushendun Bay	3	81
14	Red Bay	19	82
15	Carnlough Bay	12	83
16	Halfway House	15	85
17	Glynn	21	86
18	Dalariada Bay	27	87
19	Oldchurch Bay	18	89
20	Carrickfergus	22	93
21	Ordnance factory	18	109
22	Crawfordsburn Beach	15	108
23	Ballyholme Bay	29	107
24	Sandy Bay	23	96
25	Whitechurch	33	100
26	Wallaces Rocks Sand	32	101
27	Robins Rock Sand	24	103
28	Cloghy	28	105
29	Millin Bay	33	55
30	Bar Hall Bay	47	53
31	Granagh Bay	67	52
32	The Dorn	43	49
33	Mid Island Bay	35	47
34	Black Neb	22	44
35	Herring Bay	18	42
36	Greyabbey Bay	17	41
37	Newtownards A	12	39
38	Newtownards B	15	39
39	Newtonwards C	14	39
40	Newtownards D	22	39
41	Newtownards E	14	39
42	Castle Espie A	7	38
43	Castle Espie B	9	38
44	Castle Espie C	12	38
45	Reagh Island	52	37

TABLE 6.2 Continued.

TABLE 6.2 Continued.

Stage II Site Number	Site Name	Number of Species Recorded During Stage II Survey	Equivalent Stage I Site Number
46	Mahee Island North	13	112
47	Ringneill Bay A	12	35
48	Ringneill Bay B	14	35
49	Ringneill Bay C	14	35
50	Quarterland Bay	21	32
51	Taggart Island Quay	32	31
52	Castle Island	16	29
53	Launches Little	59	25
54	Black Causeway	29	27
55	Isle O'Valla	49	110
56	Mill Quarter Bay	31	22
57	Benderg Bay	19	21
58	Coney Island Bay	27	18
59	Killough Harbour	40	17
60	Stinker Rock Beach	26	13
61	Dundrum A	10	12
62	Dundrum B	18	12
63	Dundrum C	17	12
64	Dundrum D	13	12
65	Dundrum E	40	12
66	Dundrum F	12	11
67	Dundrum G	13	11
68	Murlough Sands	25	10
69	South of Nicholson's Point	31	9
70	Cranfield Point	32	8
71	Greencastle	34	6
72	Mill Bay A	20	2
73	Mill Bay C	11	6
74	Mill Bay B	11	1
75	Mill Bay E	26	3
76	Mill Bay D	17	2

6.2. NORTH OF BELFAST LOUGH

6.2.1. Sea Loughs and Inlets

6.2.1.1 LOUGH FOYLE

Lough Foyle is a large, very sheltered, shallow, narrow necked sandy bottomed body of water in Co. Londonderry, on the northwest of the coastline of Northern Ireland. The water within the lough has a widely ranging salinty regime, depending on the time of the year (Parsons, 1971), with two rivers discharging into it causing a strong fresh water influence. Only the eastern shore of the lough concerns this survey as the majority of the western shore is in the Republic of Ireland.

Physical Description

Only one rocky site was visited in Lough Foyle during the survey and this was an outlier on the multivariate analyses for rocky shores; the estuarine site at Newbridge on the River Foyle (site 1, Figure 6.2). The area consists of low fissured platforms of sedimentary rock covered by a layer of silt with gravelly mud between the platforms. The water is very turbid throughout the whole tidal cycle. The River is a very busy shipping channel and bow waves from the larger vessels tend to cover much of the intertidal region even at low water. Salinity varies but is brackish in nature and the site is truly estuarine.

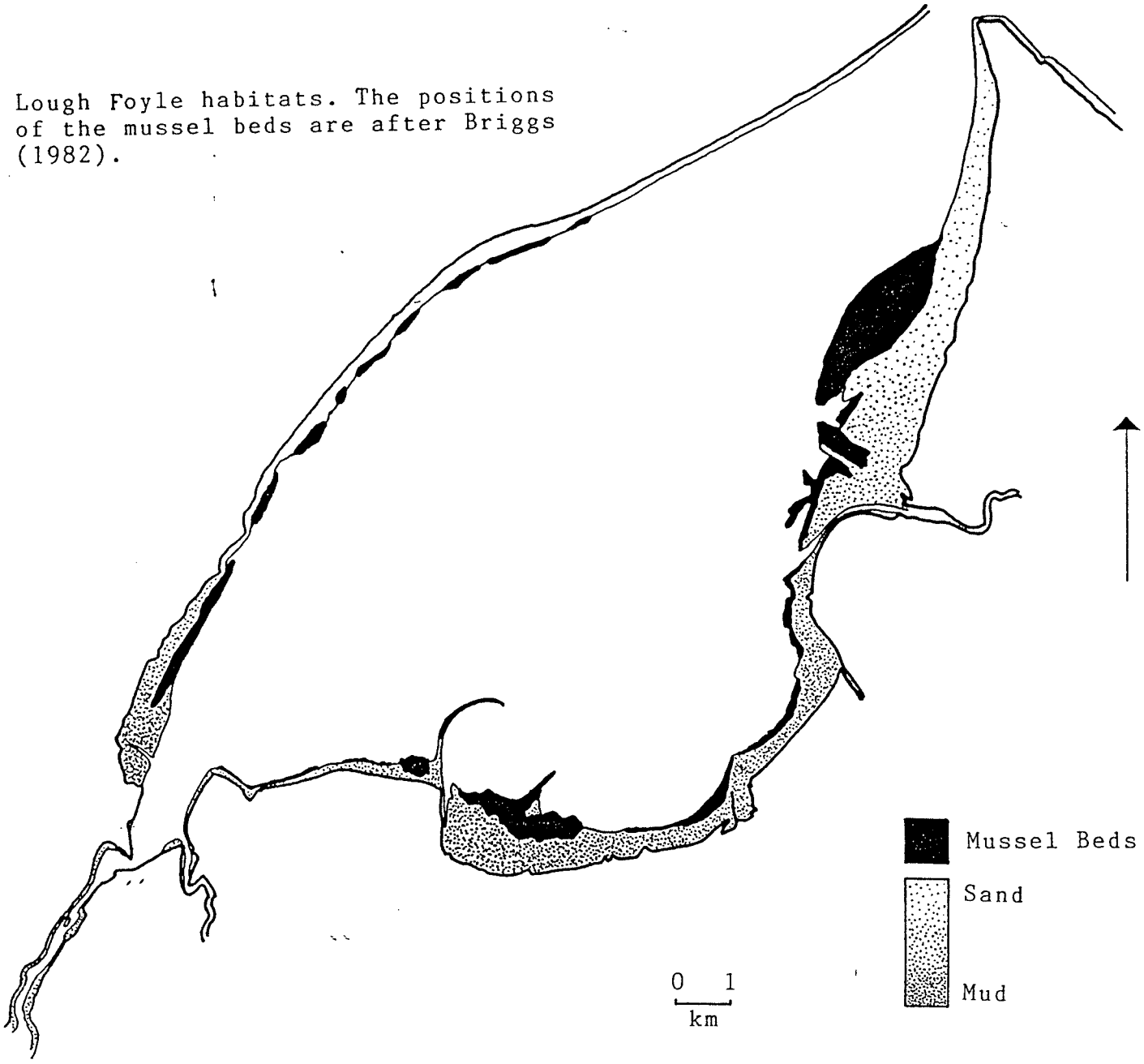
In Lough Foyle sediment type varies along a continuum, with the northern end of the eastern shore consisting of clean sand and the southern end of mud with little sand influence. TWINSPAN of sedimentary sites (Figures 5.16, 5.17) shows the gradation of sediments up the lough as the infaunal community changes with sediment type.

The River Roe discharges fresh water approximately halfway down the eastern side. To the north of the Roe the shore is backed by a dune system much of which is used for farming. To the south of the Roe the lough is contained largely by a series of banks (or dykes) behind which the land is also used for farming. These banks are to prevent flooding of the drained farmland at spring tides.

The shore between the mouth of the River Foyle and Longfield Bank (site 1, Figure 6.3) is reclaimed and used for agriculture. Longfield Bank is a long curved boulder spit which extends approximately 2 km into the lough. Inside the spit the soft mud sediment is surrounded on two sides causing a very sheltered habitat. Patches of gravel occur in the mud especially in the freshwater streams running across the shore from agricultural drainage ditches behind the banks. Extensive mussel beds (Mytilus edulis) form an important physical habitat at low water by providing a hard substrate for attachment of organisms and shelter from small wind driven waves. The banks along the shore are made from stone blocks and concrete and provide a substrate for supralittoral species.

At Ballykelly Bank (site 2, Figure 6.3) the sediment becomes firmer, with an increase in sand content, and the mussel beds patchier in distribution. Intertidal extent is narrower in this part of the lough

Figure 6.4 : Lough Foyle habitats. The positions of the mussel beds are after Briggs (1982).



decreasing from about 1.5 km at Longfield to about 0.5km at Ballykelly. Mud flats occur in the lower littoral and the uppershore is steeper and sandier and includes the bottom of the concrete bank. Most of the flats are covered at half tide. The sulphur reducing layer occurs only a few centimetres below the surface, indicating high organic content.

The Roe Estuary (site 3, Figure 6.3) represents a different habitat type. The sediment is mainly coarse sand and gravel interspersed with the occasional soft mud area in the uppershore. The salinity varies from very low levels to near full seawater giving true estuarine conditions in the immediate vicinity of the river channel.

Balls Point (site 4, Figure 6.3) at the mouth of the River Roe consists of a huge intertidal sand flat with an extent of 2 km between high and low spring tides. The sediment is mostly fine and medium sand with small areas of muddy sand. Shell gravel is common at low water. Rows of large boulders extend from the salt marsh at the top of the shore to near low water indicating some past maricultural activity. Huge mussel beds, several hundred metres across and up to 1 m thick, are present on the lowershore. Surface water collects in the depressions immediately shorewards of the mussel beds.

The sandy substrate extends to Magilligan Point (site 7, Figure 6.3) at the narrow neck of the lough; the muddy influence decreases and the mussel beds stop to the north of Balls Point (Figure XI.i). The sand becomes coarser towards the entrance of the lough with Magilligan Point consisting of a layer of coarse sand on top of shell gravel. The horizontal extent of the intertidal region also decreases towards the north until it is only about 50 m wide.

Biological Description

The rocky site at Newbridge on the River Foyle is typically estuarine with flora and fauna present which are indicative of brackish conditions. Four zones are apparent even though the community is impoverished. The sublittoral fringe community, usually dominated by laminarians on the open coast, is absent due to the lack of a suitable substrate. The lowest zone is characterised by Fucus serratus and Gigartina stellata with some Mytilus edulis. The middle shore, zones 3 and 2, are dominated by a patchy distribution of Ascophyllum nodosum and Fucus vesiculosus although towards the top of zone 2 Fucus ceranoides becomes abundant, (a brackish water species common in estuaries). The uppershore has an abundance of green algae including, Entermorpha spp., Rhizoclonium riparium and Blidingia spp. which are tolerant to low salinities. Sphaeroma rugicauda (Isopoda), Gammarus duebeni (Amphipoda) and Electra crustulenta (Bryozoa), all characteristic of estuarine habitats, were also found here associated with fucoids. Newbridge was the only rocky estuarine site incuded in the survey. The estuarine nature of the community is the reason for it consistently being classed as an outlier in the multivariate analyses.

TWINSPAN shows that the sediment of Lough Foyle has three main community types (Figure 5.17), the composition of which is dependant on the sediment type. The varying salinity regime of the lough is probably a modifying factor.

Longfield Bank is a mud shore with large mussel beds growing at low water and it contains both infaunal and surface living communities characteristic of the intertidal sedimentary flats to the south of Lough Foyle. Species found include the bivalve Macoma balthica, annelids Ampharete acutifrons and oligochaete spp. and the amphipod Corophium volutator. These are all characteristic of and common in mud influenced shores. The presence of the polychaete Hediste diversicolor, which is usually found in conditons of reduced salinity (Barnes, 1974) illustrates the influence of the fresh water streams running across the shore. The mussel beds are largely overcrowded (Briggs 1978) and form a substrate for a community dominated by the barnacle Balanus balanoides and littorinids especially Littorina littorea. The polychaete Eulalia viridis commonly occurs between the mussels. The dab, Limanda limanda, is common in shallow pools in the lowershore. The muddy sand uppershore contains many lugworm, Arenicola marina. A well defined fucoid zonation with successive bands of Fucus spiralis, Ascophyllum nodosum, F. vesiculosus and F. serratus occurs on the banks at the shoreward limit of the flats. The boulder spit at Longfield also exhibits fucoid zonation and has extensive mussel beds at the seaward end. The community described for Longfield Bank extends northwards as far as the River Roe.

The Roe Estuary has a typical estuarine infauna with oligochaetes abundant in the muddy areas and Hediste diversicolor abundant in coarser sediment towards the lowershore. Corophium volutator, the polychaete Fabricia sabella and prosobranch Hydrobia ulvae are common throughout the shore.

Balls Point, which is adjacent to the Roe estuary, has the highest diversity of sediment and community types in Lough Foyle. The fine sand of the lowershore contains a community characterised by Macoma balthica with an abundance of polychaetes Scoloplos armiger, Pygospio elegans and Sphaerodoridium minutum, with the occasional Arenicola marina.

The middleshore of muddy sand contains a community dominated by the bivalve Mya arenaria. The uppershore of sandy mud is characterised by the bivalve Scrobicularia plana, together with Corophium volutator and Hediste diversicolor, indicating a brackish influence. The surface of the uppershore has an abundance of Hydrobia ulvae. These communities are typical for the substrate. The mussel beds form a distinct habitat which extends through much of the intertidal range. The community associated with the mussels is similar to that found at Longfield. Pools are formed on the surface of the beds, especially near the midshore level, which have a distinct flora and fauna. A few species are very common, these include the shore crab Carcinùs maenas, together with Littorina rudis, the algae Pilayella littoralis and Polysiphonia elongata and the amphipod Melita palmata. Melita palmata was only encountered in Lough Foyle and Strangford Lough during this survey. The shells of the mussels provide a substrate for Electra crustulenta, the estuarine bryozoan, at the midshore level.

To the north of Balls Point the influence of the muddy component is reduced with relatively "clean" sand becoming the dominant substrate. The community type reflects this change (TWINSPAN Figure 5.17). Open

coast species are present eg. the polychaete Paraonis fulgens, the cumacean Cumopsis goodsiri and the amphipod Bathyporeia guilliamsoniana. It should be noted that the latter is not found on the exposed sandy beaches of the north coast but is present on the less exposed beaches of outer Co. Down.

Lough Foyle - Conservation

Substrates within Lough Foyle range from sand to soft mud, each of which contains a characteristic biological community. Due to the gradual change in sediment types no single area is representative of the lough as a whole.

Areas of conservation importance in the lough should therefore have a high diversity of sediment and community types, covering as many as possible of the communities present in the lough. Balls Point with the Roe Estuary has a high diversity of sediments and communities, from sand to sandy mud and estuarine coarse sand and mud. Mya and Scrobicularia are found in large numbers only at this site in the lough, and the mussel beds at Balls Point are good examples of "Foyle beds" and contain a rich associated community. Balls Point and the Roe Estuary have long been known for their international importance as winter feeding areas for birds and a section is already a DOE nature reserve.

The northern end of the lough is unusual as it is a very sheltered sandy shore with little mud influence, which is rare for Northern Ireland.

6.2.1.2 BANN ESTUARY

Only one site was surveyed on the River Bann during the survey (site 10, Figure 6.3).

Physical Description

The estuary has a gently sloping shore with an extent of about 75 m at low water. The sediment consists of medium sand at the top of the shore with wet coarse muddy sand towards the lowershore. A layer of shell gravel was prominent below the sediment surface. The shore was backed by saltmarsh. Small soft mud bays occurred in the salt marsh of the uppershore. The salinity is brackish and varies throughout the tidal cycle.

Biological Description

Both mud and coarse muddy sand were dominated by an infauna of Hediste diversicolor and Corophium volutator but contained little else. Some boulders on the uppershore were covered with Enteromorpha sp. and Fucus ceranoides.

Bann Estuary - Conservation

The Bann Estuary is a typical sedimentary estuary and very similar to the Roe Estuary in Lough Foyle. However, large estuaries are not common in Northern Ireland. It is known as being important for winter feeding of migratory birds and, for this reason, a section is already a National Trust Nature Reserve.

6.2.1.3 LARNE LOUGH

Larne Lough is a small shallow sea lough approximately 4 miles long by 1.5 miles wide at its widest point. It is situated at the southern end of the east Antrim coast. It can be divided into two physically distinct areas, with the boundary at Magheramorne spoil tip.

The northern area is wide and relatively deep, especially at the narrow mouth of the lough. The narrows were not visited during the survey. The town of Larne on the western bank of the narrows has a large harbour used for freight and car ferry docking. Ballylumford power station, on the eastern bank, uses the lough as a source and sink for cooling water. Magheramorne cement works, about halfway down the western shore, also uses the lough water as a clay lubricant. The southern area is relatively narrow, very shallow and affected by siltation.

Much of the lough has been reclaimed (see Figure X.i), including a small bay near Larne, for harbour development, and railway embankments have been built on the top of the shore on the western side of the lough. These embankments enclose four brackish water lagoons which fill and empty with the tide through small tunnels.

Physical Description

The major intertidal substrate in Larne Lough is mud with areas of boulders and stones. The top of the shore all around the lough is shingle on gravelly and stoney mud, and is backed by grassland, farmland or woodland.

The northern area:

The shore between Larne and Glynn consists of narrow muddy area with shingle at the top of the shore.Between Glynn and Dalariada Point the shore consists of wide soft mud flats with an uppershore of shingle below railway embankments. Beneath the mud is a layer of clay which occasionally outcrops to form smooth dried patches on the surface. Towards Dalariada Point the surface of the mud is strewn with widely spaced small and medium boulders. The water from the emptying lagoons flows through boulder and stone filled channels on the uppershore but spreads out over the mud of the lowershore, collecting as surface water. Swan Island is adjacent to the Point and consists of boulders on stones and muddy gravel. It may be connected with the mud flats at low spring tides. Dalariada Point (site 61, Figure 6.2) is a boulder shore with medium and small boulders widely spaced on the middle and lowershore and shingle and pebbles on the uppershore.

The eastern shore is subjected to a stronger tidal current than the western shore, resulting in shores which are narrower in intertidal extent. The lowershore consists of mud and the middle and uppershores of muddy gravel beneath small boulders. Shingle occurs in the supralittoral fringe.

The southern area of the lough is joined to the northern area by a narrow channel, approximately 100 m wide, between the cement works spoil tip, which reaches almost across the lough, on the east bank and Barney's Point on the west bank. The spoil tip has a steep shore of shingle on mud and stones. Barney's Point (site 62, Figure 6.2) is a

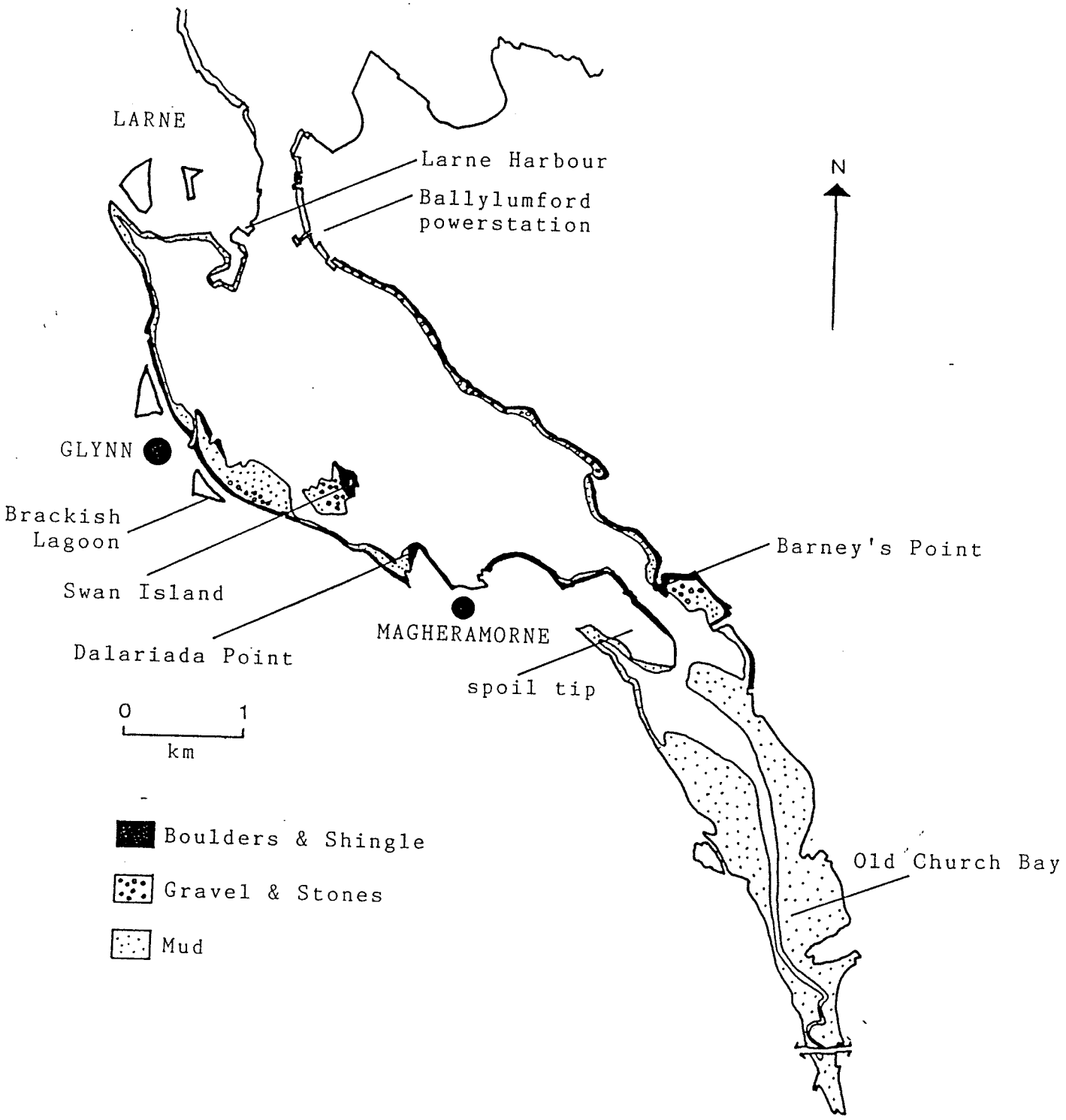


Figure 6.5 : Larne Lough
Physical habitat types and places mentioned

boulder promontory with a shingle uppershore. The lowershore consists of stones, pebbles and gravel, and small patches of mud. This habitat seems to be the result of high tidal flow through the narrows; it may be affected by scouring.

The southern area:

The southern part of Larne Lough is affected by siltation and is almost filled with glutinous mud. At low tide a narrow channel winds its way through the mud southwards from the narrows between the spoil tip and Barney's Point. It has steep sides which may be a metre or more height at low water, incorporating much of the lower intertidal. The uppershore is of gravelly mud and the supralittoral fringe of shingle at the northern end of the southern mudflats but is composed of gravel and salt marsh at the southern end.

Biological Description

Rocky shores:

Only two rocky shores were surveyed in Larne Lough; Dalariada Point and Barney's Point. The relative difference in tidal current strengths at the two sites cause different shore and community types to occur on the lower eulittoral at each shore. The biology of the shingle uppershore is similar all around the lough with patchy zones of Pelvetia canaliculata above Fucus spiralis. Littorina littorea and L. obtusata are common in these zones. The middle shores of both sites are similar with an impoverished zone of Fucus vesiculosus and Ascophyllum nodosum on tops of the boulders and Balanus balanoides, Patella vulgata and Littorina littorea below the algal canopy. Impoverished communities of this sort are well known from sheltered Scottish sea lochs and are thought to be caused by scouring from turbid tidal currents (Lewis, 1964).

At Barney's Point the lowershore contains a zone of widely dispersed Fucus serratus on the boulders with thick mats of the sponge Hymeniacidon sp. on stones and pebbles. The sponge supports an associated fauna of bivalves, polychaetes and ascidians, including Mytilus edulis, Polydora ciliata, Ascidiella scabra and A. conchilega. This community is associated with turbid tidal currents (Ackers et al, 1985). Bryozoans and amphipods are common on the boulders in association with the algae. In marked contrast the lowershore at Dalariada Point is mainly mud with occasional tufted fucoid plants on stones dispersed over the surface.

The impoverished community of tufted fucoids caused by scouring may explain the differences in the grouping of these sites in the various multivariate analyses. TWINSPAN, with its emphasis on indicator species, groups the sites in a separate sub-class closely associated with the east Antrim sites, whereas the clustering techniques, which look at the community as a whole, group these impoverished sites with the more exposed but also impoverished north coast sites.

Sedimentary shores:

TWINSPAN places the sedimentary sites of Larne Lough within the mud sites group. Species characteristic of mud such as the polychaetes Exogone naidina, Ophryotrocha sp., Sphaerosyllis sp. and Melinna

palmata, the amphipod Corophium volutator and the bivalve Macoma balthica are found all over the lough. The northern area of the lough has an abundance of the polychaetes Tharyx marioni and Hediste diversicolor; the latter is usually associated with reduced salinities, and is found near the outflows of the brackish lagoons. Nephtys hombergi is found in the muddy gravel in the uppershores. Priapulus caudatus is present in the mud of Old Church Bay (site 19, Figure 6.3) in the southern area of the lough and is found at low water in Dalariada Bay. This is the only recording of this species during this survey. Williams (1956) has recorded Priapulus from Larne Lough and Boaden (pers comm.) has noted it in Strangford Lough at the Dorn.

Larne Lough - Conservation

Rocky Shores

Rocky shores are relatively rare in Larne Lough, and only two sites were visited during the course of the survey. However, one of these sites, at Barney's Point, supports a very unusual community, influenced by currents of turbid water, which is characterised by the presence of large thick mats of Hymeniacidon sp. on the lowershore.

According to Boaden (pers comm.) a similar community exists at a site in Strangford Lough, although this was not visited during the survey. Barney's Point is of potential conservation interest. Boulder shores which exist between Barney's Point and the lough entrance were not surveyed, but may be worth investigation in the future.

Sedimentary shores

Sedimentary shores in Larne Lough contain a single type of community as identified by TWINSPAN; that associated with mud sites. Other sedimentary areas around the coastline (eg. Lough Foyle and Strangford Lough) contain a wider diversity of sedimentary community types. In addition Larne Lough is very much affected by industrial activity. Therefore, on balance, Larne Lough should be considered of relatively low conservation priority compared to the other sea loughs.

One unusual species, Priapulus caudatus, was discovered in the lough during the survey. In addition the infaunal community is a good example of a typical mud community. The brackish water lagoons, which are cut off by the railway embankments from the lough on the western shore (see Figure 6.5) were not included in the remit for the littoral survey. However they are likely to be of conservation importance since no other brackish lagoons were noted during the survey. They are said to contain an unusual bryozoan community (Boaden pers comm.) There are bird sanctuaries on Swan Island (see Figure 6.5) and on the mud flats and salt marsh at the south end of the lough.

6.2.1.4 BELFAST LOUGH

Belfast Lough has been the object of pollution studies for many years and these have left no doubt that it is grossly polluted (Maxwell, 1978). Belfast Lough is used as a transport medium and as a sink for various industrial and domestic effluents (see Appendix X for a detailed description of pollution of the lough). The sampling effort

during this survey was deliberately concentrated on the southern shore, beyond what the literature notes to be the most polluted areas (see Figure X.ii).

Physical Description

The lough has two current systems (Maxwell, 1978); an inner "in and out" system which is tidal and an outer anticlockwise gyre. These effectively divide the lough into inner and outer regions (Figure X.ii).

Inner Lough:

The River Lagan empties into the lough causing a reduced salinity effect on the inner reaches of the lough (Parker, 1980). The shores of the inner lough near Belfast Docks are largely reclaimed land used for industrial development. The intertidal region of the inner lough consist of mud, muddy gravel and muddy sand areas which are often extensive. The uppershore is of shingle or stones against banks adjacent to reclaimed land. On the southern shore the muddy habitat gradually changes eastwards to gravel and coarse sand through which small flat sedimentary rock ridges outcrop. The inner lough is sheltered from wave action though the southern shore tends to be relatively more exposed from Helen's Bay eastward.

Outer Lough:

The outer lough is characterised by boulder strewn fine sand areas on the northern shore with cliffs at the eastern end, and by fissured sedimentary rock ridges with high energy coarse sand pocket beaches on the southern shore. The northern shore is sheltered from wave exposure whereas the southern shore ranges from moderate to exposed from west to east.

Biological Description

Rocky shores

Inner Lough:

The inner lough is predominantly sedimentary with a shingle uppershore and areas of boulders and stones forming the only "rocky" substrate eg. Loughshore Park, near Whiteabbey (site 70, Fig. 6.2). The supralittoral is dominated by green algae and Littorina littorea. The eulittoral has a very patchy tufted fucoid zonation with Ascophyllum nodosum on the midshore. The lowershore is dominated by Mytilus edulis and Gigartina stellata which form mats on the stones and gravel, and patchy Fucus serratus and Balanus balanoides on the boulders. On the northern shore Fucus is the major lower shore zone former (eg. Loughshore Park) whilst on the southern shores it is Balanus (e.g. Culloden Hotel, site 71, Figure 6.2). A thin layer of silt covers the flora and fauna throughout the inner lough. The difference in lowershore dominance may be due to scour by the turbid tidal waters in the more exposed shores of the southern shore (see Section 6.2.1.3).

Outer Lough:

The supralittoral fringe of the southern rocky shores consists of a patchy zone of the green algae Blidingia sp. and Enteromorpha sp. with a zone of the red alga Porphyra umbilicalis and brown Fucus spiralis below. Many littorinids occurred in the crevices. The eulittoral is dominated by the barnacle Balanus balanoides, the limpet Patella vulgata and the whelk Nucella lapillus. The red alga Gigartina stellatus and Mytilus edulis occur on the laminarian dominated lowershore, with an understorey of encrusting coralline algae. This community is typical of exposed fissured rock shores, with the zonation being reminiscent of some of the less exposed platforms of the north Antrim coast. Crevices and rockpools in the fissured rock contain an abundance of sponges such as Halichondria panicea and colonial ascidians such as Botylloides leachii. These subhabitats are significant in increasing the species numbers occurring on these shores.

Sedimentary shores

Inner Lough:

The muddy sand and muddy gravel shores were dominated by the bivalves Macoma balthica, Cerastoderma edule and Mya arenaria, and the polychaetes Capitella sp., Scolelepis squamata, Scoloplos armiger and oligochaetes. These polychaetes and oligochaetes while not uncommon are known to be tolerant to high organic concentrations and therefore may be opportunistic towards these conditions. Hediste diveriscolor is also common indicating a possible reduced salinity effect on the sediment. The Ordnance Factory (site 21, Figure 6.3) on the southern shore has an abundance of mussels lying on muddy gravel at the top of the shore.

Outer Lough:

These are high energy sandy pocket beaches with an infauna dominated by amphipods Bathyporeia pelagica and Pontocrates arenarius, isopod Eurydice pulchra and polychaete Scolelepis squamata and oligochaetes. This community is reminiscent of the north Antrim sandy beaches though there is some organic effect indicated by the presence of Scolelepis and large numbers of oligochaetes.

Belfast Lough - Conservation

Inner Belfast Lough is grossly polluted (Maxwell, 1978; Boaden, 1982) due to industrial and domestic effluent (see Appendix X). It is therefore a low priority in consideration of marine nature conservation. The southern shore of the lough is of national interest to ornithologists (Murphy, 1987). The exposed southern shore of the outer lough is of greater marine conservation interest, and will be discussed with the north Co. Down sites in Section 6.3.2.1.

6.2.2 The Open Coast

The physical and biological nature of the open coast shores north of Belfast Lough will be described in this section. They are grouped in accordance with the results of the multivariate analyses given in Section 5. The two groups occuring on the north coast and outer Islandmagee are discussed separately but placed under a general heading to aid description as the physical habitats and biological communities in both areas are very similar (see Figures 5.3 to 5.6). The biology of the rocky shores will be discussed by describing and comparing the supralittoral, eulittoral and sublittoral fringe zones, for each shore type. These are as defined by Lewis (1964).

6.2.2.1. THE NORTH COAST AND OUTER ISLANDMAGEE

The North Coast of Northern Ireland is exposed to high energy wave action from the North Atlantic. Communities change with exposure; the highly exposed shores tend to have a relatively poor species richness and diversity due to the physical force of the waves damaging (directly or indirectly ie. abrasion by moving sediments), removing or preventing attachment of the species which are not adapted to this environment (Lewis, 1964). The topography of shores changes the exposure on a local scale giving rise to different community types.

The north coast is very heterogeneous in nature with a wide range of habitat types each changing local exposure levels to a different degree. Multivariate analysis shows (see Section 5.3.) that the North Coast can be divided into two main rocky shore types:

(i) very exposed steep rock shores;

(ii) exposed shores of mixed topography and a single sedimentary type; very exposed sandy shores.

The rocky shore classes are not closely grouped in the analyses and some sites are be placed in different groups by different analyses, these sites are transitional and will be considered as such in the discussion.

The north coast of Northern Ireland has one of the narrowest tidal ranges in the United Kingdom with the mean tidal range between 1.7 m and 1 m (see Section 6.1). This compresses the eulittoral zone into a narrow area.

Physical Description

Rocky Shores

Three rock types occur on the North Coast. Basalt is a tertiary igneous rock which is the product of volcanic lava cooling quickly. White limestone or chalk is a cretaceous rock arising from sedimentation. Sandstone (only found near Fair Head on the North Coast) occurs due to sedimentation on a hard ironstone layer beneath (Wilson, 1972). It should be noted that the chalk of Northern Ireland differs from the contemporaneous English upper chalk in that it is exceptionally hard and impervious, as a result of diagenetic recrystallisation of calcite in the pore spaces of the original matrix (Wilson, 1972).

(i) **Very exposed steep rock shores**

The sites making up this group are steep or vertical headlands, steep northerly facing shores with no local shelter, vertical sided inlets with wave washed sides and block scree shores. These generally occur in the region of the Causeway Coast and between Larry Bane Head and Ballycastle and along the northwestern coast of Rathlin Island.

Very exposed headlands of the North Coast are either of vertical rock at the base of high cliffs (eg. Kinrea on Rathlin Island, site 29, Figure 6.2) or high rock outcrops extending from the bases of high cliffs (eg. Port na Tober Headland on the Causeway Coast, site 12, Figure 6.2). The intertidal region of these sites are all similar, with steep or vertical rock containing small crevices and ledges which provide relatively sheltered subhabitats. The tops of the ridges form a subhabitat in the splash zone with small rock pools forming in depressions. At vertical cliff sites the splash extends several metres up the cliff.

Limestone shores of this type (eg. Kinbane Head, site 19, Figure 6.2) are very similar in nature to the basalt shores with the same range of subhabitats. The major difference between the two rock types is that on limestone shores the open rock has a rough, textured, pitted surface with small cracks due to wave action on the hard but relatively brittle limestone. These provide small but readily used subhabitats that help attachment of organisms.

Great Stookan on the Causeway Coast (site 10, Figure 6.2) is an example of a very exposed habitat with a sloping northerly facing shore. The narrow intertidal region is wholly situated on the steep sides of the large platforms, with the splash forming large pools on their tops. The sides of the platforms have a relatively smooth rock surface with only very small crevices. The pools on the tops of the platforms are often either hyposaline due to fresh water seepage from the cliffs at the shore back or hypersaline due to evaporation.

Narrow vertical sided inlets with wave washed sides provide another very exposed habitat type (eg. Port Moon, site 13, Figure 6.2). The swell is often amplified by shallows and washes along the vertical sides preventing attachment of many organisms. This effect is most noticeable where the inlet is orientated towards the north and receives the full effect of the swell. The sides of the inlets are smooth and only contain a few very small crevices as sheltered subhabitats. The inlets are generally backed by exposed boulder shores. The splash zone extends for many metres up the cliff especially at the back of the inlet where the force of the wave is amplified. Bruce's Cave on Rathlin Island (site 25, Figure 6.2) has a very similar habitat but is a sea cave with the added physical factor of low light intensities.

The final type of very exposed shore on the North Coast is block scree. This consists of large angular blocks usually several metres across which have fallen from cliffs above. Both basalt and limestone examples occur (eg. Ruebane Point and Larry Bane Head respectively, sites 40 and 16, Figure 6.2), the only difference between the two being the surface textures. The surfaces of the blocks form a steep sided habitat which may extend throughout the whole of the eulittoral zone due to the narrow tidal range. The level of exposure of the sides

of the blocks varies with orientation to wave action. The sublittoral fringe is usually formed from rounded, wave eroded blocks or boulders. The splash zone extends several metres over blocks or up the cliffs at the back.

The Gobbins and East Isle of Muck on Outer Islandmagee (sites 67 and 65, Figure 6.2) and Black Rock in Co. Down (site 116, Figure 6.2) are also examples of very exposed shores, and have been classed in this group by all multivariate techniques.

(ii) **Exposed gently sloping shores of mixed topography**

These sites were not closely grouped by multivariate analyses and should be considered a highly diverse group of shore types. Essentially the common feature of this group of rocky shores is that the topography of the shore or of the surrounding area is such that it modifies the exposure on a local scale thus affecting the community. These shores are in general more gently sloping than those described in (i) above. Using TWINSPAN as a basis two major types of shore occur in this group; rock platforms/outcrops and boulder shores.

(a) Rock platforms and outcrops:

Wave cut platforms of basalt, limestone or (in a minority of cases) sandstone are only found along the north coast of Northern Ireland, often at the base of cliffs.

Topography varies between platforms. Some are steep sided, with a wide upper surface area which may which may only be affected by seawater through wave splash. In this case most of the intertidal region is restricted to the sides of the platform. Other platforms slope gently between high and low water, providing an extensive area for settlement of intertidal organisms, and a range of subhabitats including rockpools and crevices. The orientation of the platform varies, so that one side may be gently sloping while the other side presents a steep face to the sea. In some cases the seaward edge of the platform is higher than the landward edge; in this case sheltered subhabitats occur.

Platforms may be associated with other types of habitat on the north coast; these include boulders, block scree and irregular rock outcrops, all of which also form major intertidal habitats in their own right. Subhabitats associated with the platforms include rockpools (often of the pot hole type), crevices, small inlets eroded by wave action, areas of boulders which provide shelter, block scree and irregular rock outcrops.

Rock type affects platform topography and usefulness as a substrate for attachment of animals and plants. Basalt platforms have a relatively smooth rock surface, while the more brittle limestone platforms have a pitted, cracked surface. In general the few platforms which are formed from sandstone provide a better substrate for algal attachment than either limestone or basalt.

Three sites wil be described in detail in order to illustrate the range of intertidal platforms which exist on the north coast, and how topography affects exposure. One is an exposed basalt platform

associated with block scree, the second a sheltered limestone platform and the third a sandstone platform.

East Lighthouse Platforms (site 26, Figure 6.2), situated on the north-east corner, has basalt platforms in the lowershore with basalt block scree in the upper. The blocks and small inlets form sheltered subhabitats. The exposure of the platform varies; the lowershore being very exposed but the middleshore less so due to some of the wave energy being dissipated by the platform itself and the block scree. The splash zone extends several metres up the high cliff backing the shore.

Beddag (site 36, Figure 6.2) is an extensive limestone platform, in relatively sheltered Church Bay on Rathlin Island. The platform is wider than East Lighthouse Platforms and has a more irregular highly eroded surface with sharp ridges, deep crevices and large rockpools occurring in the highly eroded surface. The limestone has a typical pitted surface texture. Large depressions occur which have boulders or sand on the bottom. The platforms extend over the eulittoral zone with the supralittoral occurring on the extreme shoreward end of the platforms with limestone shingle behind.

Sandstone platforms only occurred at three locations surveyed on the North Coast; Carrick-more, Port Moon Bay and Murlough Bay (sites 21, 14 and 39, Figure 6.2). Only at Carrick-more, between Ballycastle and Fair Head, is it the dominant rock type on the shore. Essentially the platforms at all three locations are very similar in nature. Carrick-more will be used as an example. At Carrick-more the whole of the foreshore consists of soft sandstone, forming smooth stepped platforms throughout the eulittoral. The steps are angled downwards towards the back forming depressions which are water filled and contain boulders. Few crevices are present. The soft nature of the rock ensured easy erosion and may therefore influence the intertidal community.

(b) Boulder shores:

North Coast boulder shores tend to occur in small bays bounded by high steep rock headlands which provide some shelter from wave action, although this changes with shore aspect. Within the bays a stack may occur. The boulders are generally small or medium in size with large boulders occurring only rarely. The boulders provide a variable exposure habitat with the tops having similar physical conditions to the open rock surface whilst the sides and undersides are relatively sheltered. Small stones and pebbles occur between and beneath the boulders. Small boulders in relatively exposed conditions are mobile especially in storms. Basalt boulder shores are found all along the North Coast and on Rathlin Island but limestone boulder shores are comparatively rare, with the best example being at Larry Bane Bay (site 17, Figure 6.2).

Two block scree shores are also classed in this group of sites by multivariate analyses. These are the limestone blocks of The Dutchman on Rathlin (site 35, Figure 6.2) and the basalt blocks of Portdoo on the east side of Fair Head (site 38, Figure 6.2). These are physically similar to the block scree shores described previously but are in less exposed conditions being in the lee of Rathlin Island and Fair Head respectively. These therefore have a richer community than other steep rock sites.

Outer Islandmagee also has examples of each of these shore types (see Figures 5.3 to 5.6 and 5.12 and 5.13).

Sedimentary Shores:

The sedimentary shores on the North Coast are all closely grouped in TWINSPAN. They are all steeply sloping "clean" sand high energy beaches, usually with sand dune systems at the back. Magilligan Point to Portstewart, on the western end of the coast, consists of this type of shore, only interupted by the cliffs at Downhill and the mouth of the River Bann. Smaller stretches of beach occur along the north coast often at the seaward end of wide river valleys eg. Bushfoot Strand and Ballycastle Strand. Most of the smaller stetches of sandy beaches have a dune backing to varying degrees, with the exception of Portrush Strand which is contained by a seawall.

Each sandy shore along the north coast has the same basic sediment profile with a layer of medium sand on the surface and coarse sand or shell gravel beneath. The lowershore often only has coarse sand. The sand is highly mobile and hence forms a very unstable habitat. Often the shore profile or sediment composition will vary from tide to tide and may be dramatically changed during a storm.

Biological Description

Multivariate analyses indicated that biologically two main groups of rocky shore occurred on the north coast; related to the physical shore types described above. The biological comunities for each of these shore types will now be described. The basic biological plan for each shore type will be given and local variations discussed.

Rocky shores

The supralittoral, eulittoral and sublittoral fringe will by discussed for each shore type. The relative sizes of these areas vary with exposure to wave action (Lewis, 1964) and will therefore be different for each shore type. Comparison of heights of the biological zones on the record cards may give an idea of relative exposures of different locations.

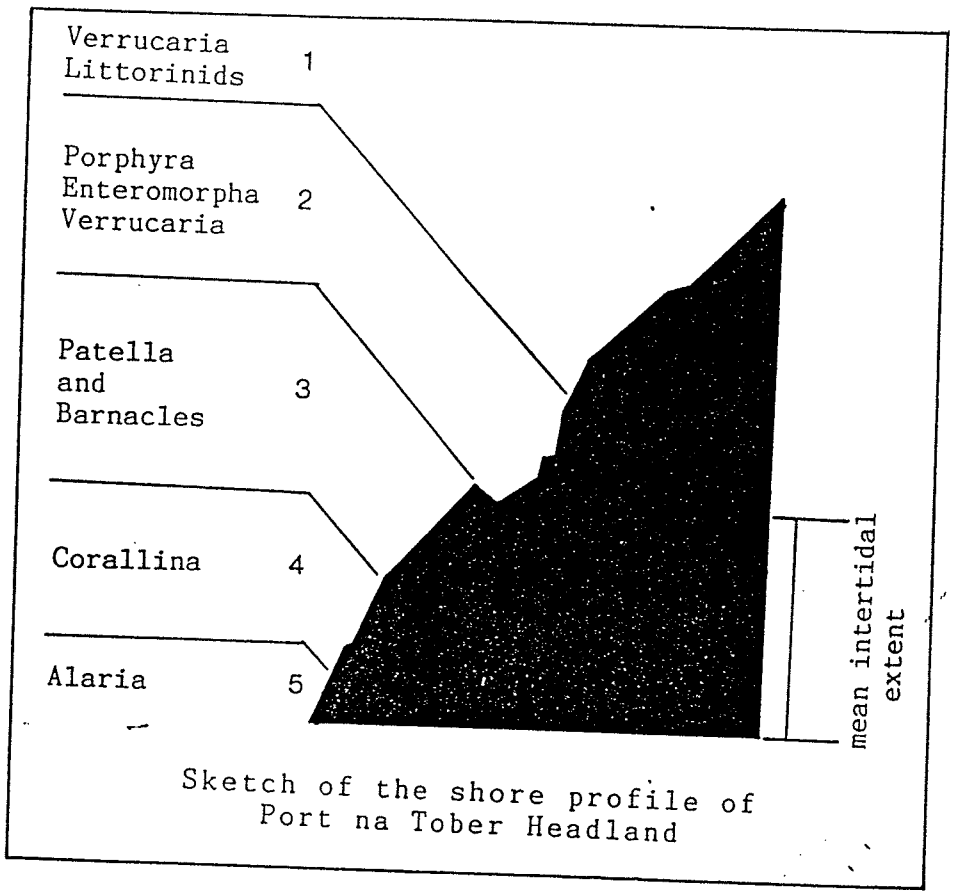
(i) **Very exposed steep rock shores**

A typical very exposed shore is the basalt headland at Port na Tober Headland, on the Causeway Coast (site 12, Figure 6.2). There are five biological zones including the splash zone. This is illustrated below.

Supralittoral Region (zones 1 + 2)

The supralittoral zone extends several metres up the cliff, influenced by wave splash. It is dominated by a total cover of the black encrusting lichen, Verrucaria maura, with patches of the black foliose lichen, Lichina pygmaea. The crevices have an abundance of Littorina neritoides with some L.rudis in the lower supralittoral. Limestone differs in that V.maura does not attach to limestone itself but only to exposed flint surfaces protruding from the limestone (eg. Kinbane Head, site 19, Figure 6.2). It is replaced in some places by a grey encrusting lichen which was unidentified.

The lower supralittoral is dominated by wave battered forms of the algae Porphya umbilicalis and Enteromorpha sp. This zone is transitional between supra- and eulittoral and is largely seasonal in occurrance. The supralittoral community is similar for most examples of this shore type, the exception being Bruce's Cave, Rathlin (site 25, Figure 6.2), where the wave wash and splash is channelled into the top of the cave which has very low light conditions, the result is that the encrusting red alga Hildenbrandia rubra inhabits the whole of the supralittoral. Littorinids still occur in crevices. This may be an extension of the eulittoral zone due to exposure conditions.



Sketch of the shore profile of
Port na Tober Headland

Eulittoral Region (zones 3 + 4)

The upper eulittoral (zone 3) is of very variable width and dominated at Port na Tober Headland by the barnacle Chthamalus stellatus and the limpet Patella vulgata. On the block scree shores (eg. Ruebane Head), barnacle cover is very patchy and confined to sheltered surfaces. On limestone shores barnacles are found rarely, with Balanus balanoides only found in crevices, probably due to attachment problems on the more brittle rock. Patella remains dominant on both of these shore types. Chthamalus montagui is found at Port na Tober Headland and Port Moon in this zone. Littorina rudis inhabits crevices in this zone and L.neglecta is commonly found in empty barnacle "shells". In larger crevices the mussel Mytilus edulis and red algae Ceramium shuttleworthianum and Polysiphonia spp. occur. Occasionally algae are attached to barnacles and limpet shells, these include; Asperococcus fistulosus, Ectocarpus fasciculatus, Callithamnion sepositum, Spongomorpha arcta and Enteromorpha spp. Rockpools occur in the upper eulittoral which are rich in brown and red algae.

Zone 4 is dominated by the red calcareous alga Corallina officinalis and brown alga Himanthalia elongata with an understorey of calcareous encrusters Lithophyllum incrustans and Phymatolithon polymorphum and encrusting algae Hildenbrandia rubra and Petrocelis cruenta. Some of the most exposed headlands (eg. Kinrea, Rathlin) have no Himanthalia present, whilst between block scree (eg. Ruebane Head, site 40, Figure 6.2) Mytilus edulis and Ceramium shuttleworthianum are the dominant zone formers. Rockpools occur in the lower eulittoral which are rich in algae especially Gigartina stellata, Pillayella littoralis and Cladophora rupestris and an understorey of encrusting algae. The algae in the pools contain the amphipods Parajassa pelagica and Hyale pontica and isopod Idotea pelagica; all are well adapted and characteristic of very exposed conditions.

The eulittoral of Bruce's Cave is again different being dominated by encrusting coralline Phymatolithon lenormandii with mats of the red algae Audouinella purpurea and Calithamnion sp. and the sponge Halichondria panicea in the small crevices. The small red algae Phyllophora trailli was also found in the lower eulittoral.

Sublittoral Fringe (zone 5)

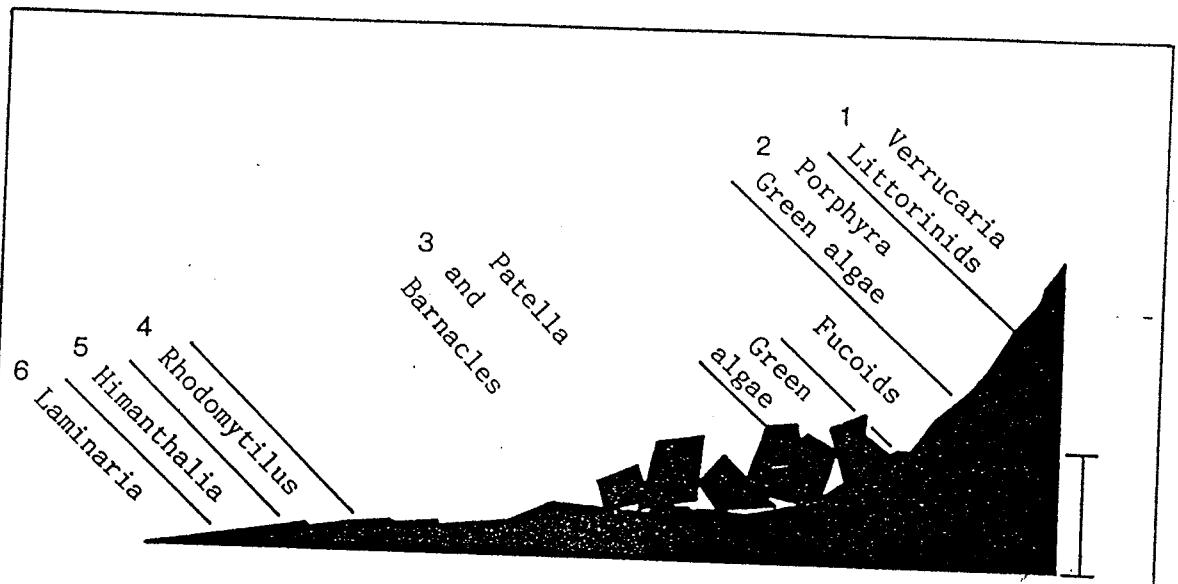
This zone is uncovered during spring tides. The major zone formers are the large brown alga Alaria esculenta with an understorey of Corallina officinalis and Lithophyllum incrustans, in sheltered gulleys or between block scree (eg. Ruebane Head and Port na Tober Bay, sites 40 and 11, Figure 6.2) the kelp, Laminaria digitata, and Gigartina stellata occur. On the very exposed shores this zone was difficult to survey unless the weather was very calm.

The outer coast of Islandmagee has examples of this type of community though it is spread over a greater intertidal extent, almost twice that of the North Coast.

(ii) **Exposed gently sloping shores of mixed topography**

Multivariate analyses did not cluster this group of shores closely, illustrating their heterogeneity. As discussed previously shore topography of this group is highly variable and community composition is largely dependent on the extent to which shore topography modifies exposure on a local scale.

An example of the basic zonation patterns shown by this group is found at East Lighthouse Platforms (site 26, Figure 6.2) on the north east corner of Rathlin Island. This is an extensive low basalt platform with a subhabitat of block scree towards the top of the shore. The zonation pattern for East Lighthouse Platforms is illustrated.



Sketch of the shore profile of East Lighthouse Platforms

The variation in intertidal zonation patterns found on these shores will now be described.

Supralittoral Region (zones 1 + 2)

The upper supralittoral is dominated by Verrucaria maura with Littorina neritoides on the open rock surface and in crevices. On boulder shores (eg. Burnfoot A, site 3, Figure 6.2) this zone has a lichen flora dominated by Xanthoria sp. and Caloplaca sp. on shingle. Maritime arthropods Ligia oceanica and Petrobius maritimus are common in crevices or under shingle. It is worth mentioning here that the boulder/platform shore at Oweydoo, on Rathlin (site 37, Figure 6.2), has an Oyster Plant in the maritime zone at the back of the shore, this is very rare being more usual of the south coast (pers comm. Bradley).

The lower supralittoral is dominated by the algae Porphyra umbilicalis, P.linearis and Prasiola stipitata with an understorey of V.maura. Enteromorpha intestinalis tends to occur in areas influenced by fresh water seepage from the cliff backing. On the more exposed sites in this group (eg. The Ladle and Portandoon A) Lichina pygmea inhabited by Littorina neglecta and L.neritoides is dominant in this zone. L.neritodes and L.rudis occurs in crevices and beneath boulders in the lower supralittoral. On boulder shores Littorina patula (syn: L.saxatilis) is common on top and beneath boulders. On shores where wave energy has been dissipated by platforms (eg. Peggy's Hole A, site 5, Figure 6.2) or by boulders (eg. Peggy's Hole B, Portdoo, sites 6 and 38, Figure 6.2) this zone is dominated by the fucoids Pelvetia canaliculata and Fucus spiralis. In more sheltered habitats such as behind block scree or in shores behind protective headlands these species form distinct zones.

In the supralittoral on large platforms (eg. The Ladle, site 9, Figure 6.2) very large deep pools may occur. These have a very rich algal flora and account for the very large algal species lists at some of these sites. In Rathlin (eg. East Lighthouse Platforms and Marie Isla, sites 26 and 30, Figure 6.2) some of the pools are sandy bottomed and contain the anemone Cereus pedunculatus.

Eulittoral Region (zones 3 + 4)

The upper eulittoral (zone 3) is usually very wide on gently sloping platforms or boulder shores, but narrow on block scree and the sides of steep platforms. At E. lighthouse platforms the zone is dominated by Patella vulgata and barnacles Chthamalus stellatus above Balanus balanoides. Patches of Mytilis edulis and Gigartina stellata, Palmaria palmata and Ceramium shuttleworthianum also occur on the surface. Where the platforms have a constant slope and are washed by waves (eg. The Burnfoot B, Rinagree Point, site 2, Figure 6.2 and The Ladle) the Rhodomytilus association forms a distinct zone below the limpet and barnacle dominated area. On limestone shores the barnacles are only found occasionally and Patella is the dominant zone former. On boulder shores (eg. Burnfoot A, Portdoo and Port Gorm A, sites 3, 38 and 7, Figure 6.2) the fucoids Fucus vesiculosus and Ascophyllum nodosum are

present as a subzone between the boulders. On block scree shores red algal mats of Audouinella floridula or Hildenbrandia rubra occur between the blocks. On the more sheltered shores where wave energy has been dissipated (eg. Beddag and Murlough Bay., sites 36 and 39, Figure 6.2). Fucus vesiculosus is the dominant zone former.

The lower eulittoral (zone 4) has a variety of zone formers depending on local exposure, which may vary on the same location. This is shown clearly by East Lighthouse Platforms. The most exposed areas on the steep sides of platforms are dominated by Corallina officinalis and filamentous red algae such as Callithamnion sepositum, C.arbuscula, Ceramium sp., Polysiphonia macrocarpa and P.urceolata. The understorey is of encrusting coralline algae. Less exposed shore have Himanthalia elongata, Laurencia pinnatifida and Gigartina stellata as dominant with the same understorey. On the lowershore of the least exposed locations in this group (eg. Murlough Bay, Beddag, Oweydoo, Doon Bay, Burnfoot A and Port Gorm) The major zone former is Fucus serratus which is characteristic of moderately exposed shores.

The increase in algal cover especially on the less exposed shores causes an increase in the flora and fauna associated with it. The algae contain, often in abundance, the molluscs Skeneopsis planorbis, Rissoa parva, Turtonia minuta, Lasea rubra and Gibbula umbilicalis and the polychaetes Nereis pelagica and Eulalia viridis and amphipods Ampithoe rubricata and Hyale nilssoni. Species associated with fucoids and corallines such as polychaetes Spirorbis spirorbis, S.rupestris and S.corallinae, bryozoans Alcyonidium hirsutum, Flustrellidra hispida and Electra pilosa, and the brown alga Elachista fucicola are common. A clear littorinid distribution up the eulittoral zone also becomes apparent.

Subhabitats within the eulittoral have a rich flora and fauna. Rockpools have a distinct zonation pattern with depth. Associated with the algae in pools are the molluscs Lacuna vincta, L.parva and Onoba semicostata and the amphipods Stenothoe monoculoides and Apherusa jurinei. The crevices contain the anemone Actinia equina.

Sublittoral Fringe (zone 5)

This region is dominated by Laminaria digitata with some Alaria esculenta on the more exposed faces. The understorey consists of encrusting corallines including Phymatoliton lenormandii and Corallina officinalis in the more exposed localities with Gigartina stellata, Palmaria palmata, Laurencia pinnatifida and Phyllophora pseudoceranoides at the bottom of gently sloping platforms and boulder shores. The subhabitats in this zone were very rich in flora and fauna for the north coast, especially in more sheltered areas, including a high diversity of sponges, hydroids, bryozoans, amphipods and polychaetes (especially in laminarian holdfasts).

Outer Islandmagee has examples of this group of shores; these are classified alongside those of the North Coast shore by multivariate techniques.

Sedimentary Shores

The high energy sandy shores of the North Coast are all very similar both physically and biologically. They are grouped very closely by TWINSPAN (Figure 5.17) and DECORANA (Figure 5.). Biologically they are characteristic of high energy shores, having a species poor community of crustaceans and polychaetes. Magilligan Strand (site 8, Figure 6.3) is a typical example of this type of shore.

The dominant species occurring in all the locations surveyed are the amphipods, Bathyporeia pelagica, Haustorius arenarius and Pontocrates arenarius, and the isopod Eurydice pulchra. The polychaete Scolelepis squamata is also common. The fauna seems to be more impoverished at Bushfoot Strand and Whitepark Bay (sites 11 and 12, Figure 6.3) possibly indicating a higher local exposure resulting in more mobile sediments. Downhill Strand (site 9, Figure 6.3) has the richest infauna, with the polychaetes Aonides oxycephala, Nephtys sp. and Paraonis fulgens being common. Lanice conchilega is common near rock outcrops at this site.

North Coast and Outer Islandmagee - Conservation

This can be looked at from two aspects;

(i) individual sites which are examples of particularly rich or unusual habitats;

  (a) caves are habitats that are relatively uncommon along the coastline north of Belfast Lough, and totally absent from the coastline south of Belfast Lough. Two areas where caves were present were noted, those near Bruce's Cave, at the north-east corner of Rathlin Island and those at the Gobbins, outer Islandmagee;

  (b) the limestone platforms at Beddag, Rathlin Island, are particularly species rich examples of relatively sheltered, very gently sloping intertidal limestone platforms.

(ii) larger areas containing a range of representative habitats.

Multivariate analysis indicates the existence of two groups of biological communities, associated with rocky sites on the north coast and outer Islandmagee; one group associated with very exposed steep rock and the other with more gently sloping relatively less exposed shores of mixed topography, including boulder shores and wave cut platforms.

Sites within the second group did not cluster closely together, showing the heterogeneous nature of the communities present. These communities exist all along the north coast and outer Islandmagee intermingled with steep sites of greater exposure.

The north coast rocky sites between Portstewart and Carrickarede Island contain a high diversity of shore types and communities. West of Portstewart the shore is mainly sedimentary. East of Carrickarede Island, as far as Ballycastle, the shore is mainly cliff. Species rich basalt platforms occur between Portstewart and Portrush, and from Port

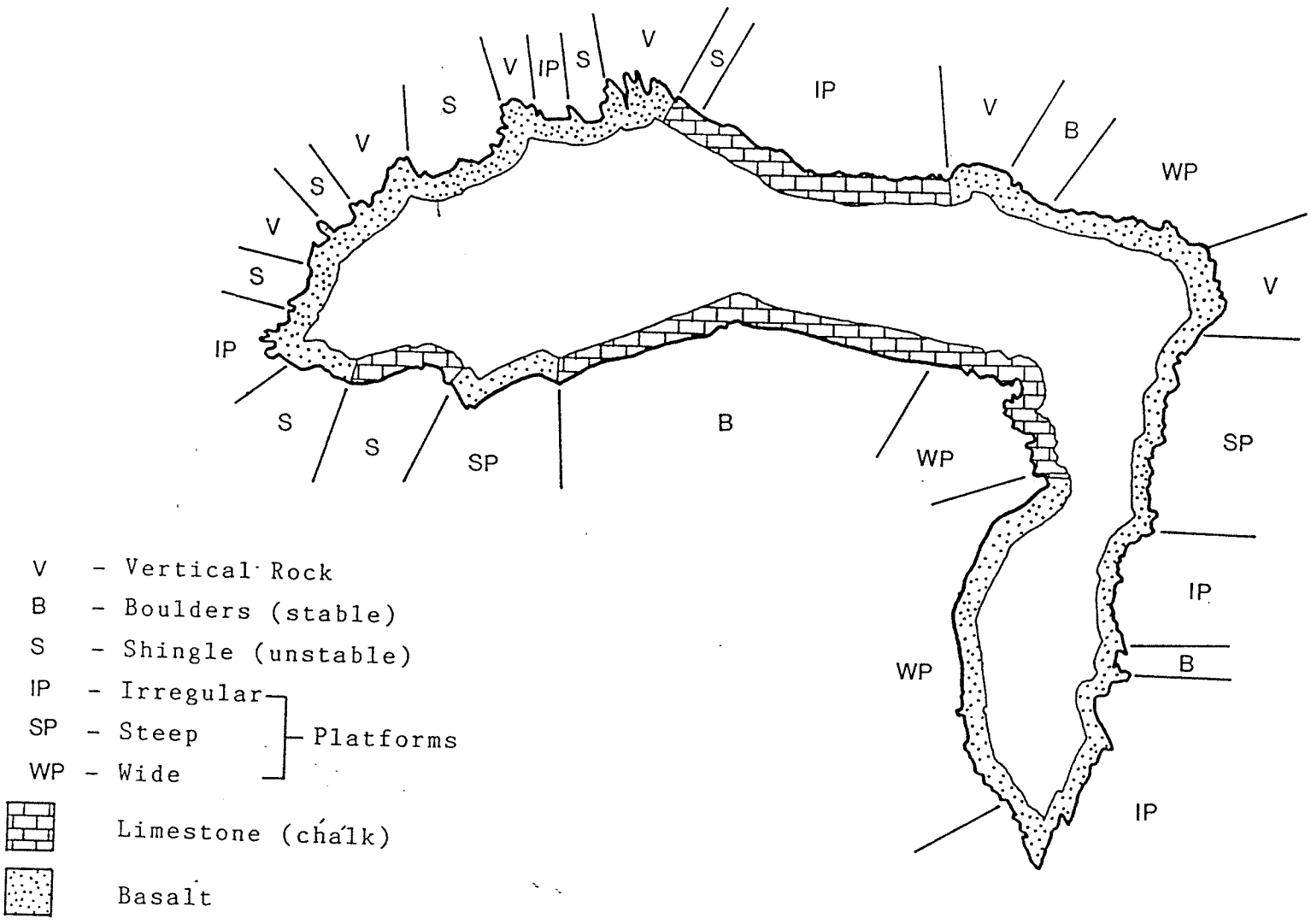


Figure 6.6 : Physical shore types of Rathlin Island.

Moon (site 13, Figure 6.2) to White Park Bay. Typical north coast basalt habitats and communities exist along the Causeway Coast, and typical examples of exposed limestone platforms occur between White Rocks (near Portrush) and Dunluce.

Computer analysis indicates that Rathlin Island contains a particularly wide range of representative north coast communities. It also has shores which group with the East Antrim sites,under TWINSPAN analysis, on the relatively sheltered southern shore of the Island. Even so, Rathlin does not have examples of all the north coast shore types, eg. there are no exposed sandy beaches or sandstone bedrock shores on the Island.

The exposed sandy shores on the north coast have very similar infaunal communities, as shown by TWINSPAN analysis. Consideration of any of these shores for conservation purposes should therefore be based on practical and pragmatic grounds.

Conservation of a representative sandy shore sited on the mainland would be advisable if the shores around Rathlin Island were taken as a basis for conservation of the north coast.

Outer Islandmagee also has a high diversity of very exposed and exposed communites. However, it is smaller than Rathlin Island, lacks the more sheltered southern facing shore present on Rathlin Island, and has a relatively wide tidal range which makes it atypical of the north coast.

6.2.2.2 EAST ANTRIM SHORES

The east Antrim Coast from Torr Head to Larne consist of a mixture of boulders, black scree rock outcrops, low sandstone platforms and sandy bays.

Multivariate analyses techniques group most of the rocky sites of the east Antrim Coast in a tight cluster showing a relatively homogeneous community (Figures 5.3-5.6). Port More, Layd Church and Whitebay Point (sites 41, 45 and 55, Figure 6.2) are grouped with the more exposed shores of the north coast. Ringfad and Halfway House boulders (sites 52 and 57, Figure 6.2) were grouped with the outer Co. Down sites. Most east Antrim rocky sites are moderately exposed and dominated by fucoids.

Most of the sedimentary shores were grouped as moderately exposed sandy beaches by TWINSPAN (Figure 5.17).

The shore road runs along the cliff base between Larne and Red Bay. Over much of this distance it is on an embankment which forms the substrate for a supralittoral region at many of the sites.

Physical Description

Rocky Shores

The rocky shores of east Antrim consist of two main physical types;

(i) **Boulder shores:**

These are usually of basalt boulders but may be of limestone (White Lady East, site 49, Figure 6.2) or red sandstone (Cave House Shore, site 44, Figure 6.2). They vary from small cobbles to large boulders, both on top of gravel and pebbles. The smaller boulders are mobile especially during storms. Rockpools or wet areas occur on the more locally sheltered shores (eg. Turnly's Port, site 51, Figure 6.2), and can often be very large and form important subhabitats eg. a pool on the boulders at Port More is approximately 30 m in diameter. Ringfad has similar pools but not as large. The supralittoral region of the boulder shore is generally shingle backed by grassy slopes or the road embankment.

Ringfad is a basalt boulder shore but is unusual for east Antrim. It is a wide low peninsula of boulders on gravel and stones which is joined to the adjacent sandy shore by a boulder causeway at low water but is almost totally submerged at high water. The boulders are stable and form pools. The boulders modify exposure so the outer point is relatively exposed whereas the sides of the peninsula are sheltered.

(ii) **Platforms and outcrops:**

The majority of platforms are composed of ridged red sandstone and extend over the eulittoral, with shingle in the supralittoral. The platforms at some sites have ridges which are parallel to the shore sloping gently on the seaward side and abruptly on the landward, forming sheltered subhabitats. Large, deep boulder filled gullies extend from the lowershore perpendicular to the shore. Shallow rockpools and boulders occur on the surface of the platforms.

Large outcrops of basalt and limestone also occur along the east Antrim coast (eg. at Cushendun North and Garron Harbour, sites 42 and 50, Figure 6.2). These are different in nature from the platforms as they are steep sided and often extend above the intertidal region. These habitats modify exposure locally, having relatively exposed steep sided surfaces on the seaward side and sheltered areas in cracks and crevices in the rock. Crevices and rockpools are the common subhabitats.

Sedimentary Shores

The sedimentary shores of east Antrim are moderately exposed sandy beaches contained in small bays at the seaward end of the glens. The sediment is generally coarse or medium sand, which is free of mud and relatively stable. No sulphide reducing layer was apparent at any site. The sediment at Cushendun Bay (site 13, Figure 6.3) is different, consisting of granules with some coarse sand. Three of the shores surveyed are backed by a sea wall (Cushendun Bay, Carnlough Bay and Halfway House, sites 13, 15 and 16, Figure 6.3) which forms a substrate for the supralittoral community. Red Bay (site 14, Figure 6.3) is backed by a low sand dune system.

Biological Description

Rocky shores

East Antrim shores group closely together under different multivariate analysis techniques, showing that the communities are homogeneous. In general the shores have a fucoid dominated community.

Supralittoral Region (zones 1 + 2)

The supralittoral has two zones;

Zone 1 at the top of the shore commonly consists of patchy coverage of Pelvetia canaliculata with an understorey of Verrucaria maura on small boulders and shingle. Littorina patula (syn; L.saxatilis), L.rudis, the isopod Ligia oceanica and large numbers of the amphipod Orchestia gammarellus occur beneath the boulders or shingle. Where this zone occurs on steep outcrops or sea wall embankments the algal cover is very patchy and only Ligia and L.rudis are present in crevices. V.maura does not occur on limestone.

Zone 2 is dominated by a distinct zone of Fucus spiralis, with an understorey of V.maura (not on limestone) on the boulders or shingle. The fauna beneath the shingle and boulders is similar to that found in zone 1.

Eulittoral Region (zones 3 + 4)

Two zones occur in this region:

On more sheltered shores zone 3 is dominated by a wide belt of Fucus vesiculosus and Ascophyllum nodosum on the surface of the platforms or on and between the boulders (eg. Turnley's Port and Port Vinegar, sites 51 and 46, Figure 6.2). On more exposed shores the fucoids become patchy; Patella vulgata and Balanus balanoides (not on limestone) occur on tops of the boulders and platforms. The whelk Nucella lapillus is also present.

The understorey includes Laurencia pinnatifida, Gelidium pusillum and Cladophora rupestris with patches of Ralfsia verrucosa. The amphipods Hyale nilssoni, Gammarus locusta, Stenothoe monoculoides, the tanaid Tanais dulongi, the molluscs Gibbula cineraria and G.umbilicalis and the isopod Jaera spp. are common beneath boulders or inhabiting the seaweed.

Zone 4, on the more sheltered shores has a near blanket cover of Fucus serratus with an understorey of Corallina officinalis, Gigartina stellata, Laurencia pinnatifida and small filamentous red algae. Where the platforms, outcrops or boulders are more exposed (eg. Straidkilly Point, site 54, Figure 6.2) the zone is dominated by long Himanthalia elongata. The isopod Idotea granulosa is abundant on the seaweed. The subhabitats are rockpools (on platforms or outcrops) under boulders and crevices; these have a rich flora and fauna, compared to the zone above, but are species poor compared to those found in the same zone along outer Co. Down.

Sublittoral Fringe (zone 5)

Dominated by large plants of Laminaria digitata with an understorey of Corallina officinalis and encrusting corallines. This zone is generally species poor compared to the sublittoral fringe around the remainder of the coastline, especially on mobile boulder shores.

Ringfad is classified with the outer Co. Down shores in Ward's Analysis (Figure 5.5). The shoreward region of this boulder peninsula is fucoid dominated with large pools containing a high diversity of flora and fauna. Towards the seaward end the tops of the boulders are covered by Patella and Balanus with the lower shore dominated by Fucus serratus and Gigartina stellata. This zone is notable for its high diversity of red algae especially encrusting species and for encrusting fauna such as bryozoans. Ringfad is an unusual habitat and an unusually species rich area for the east coast of Antrim.

Sedimentary Shores

TWINSPAN groups most of the sedimentary shores of east Antrim in the group of moderately exposed sandy beaches. These shores are characterised by the bivalve Tellina tenuis, the polchaete Arenicola marina, the amphipod Bathyporeia pelagica and the cumacean Cumopsis goodsiri. The polychaetes Scolelepis squamatus and Malacoceros fuliginosa are also common with Hediste diversicolor occurring near freshwater influences in Carnlough Bay and Red Bay.

Cushendun Bay is grouped with the muddy sites. The shore consists of granules and coarse sand with a very impoverished infauna dominated by oligochaetes and large nematodes which explains its classification, as these species are also characteristic of mud communities.

The community at Halfway House near Ballygalley Head, is different in nature. The rocky site is dominated by the green algae Enteromorpha intestinalis and Ulva lactuca and the sandy shore contains large numbers of Capitella capitata. This probably reflects the presence of a raw sewage outfall from a large hotel nearby, as these species are known to be opportunistic in conditions of high organic concentrations.

East Antrim Coast - Conservation

The shores between Torr head and Larne have a homogeneous community type and seem under little threat. It is therefore desirable to indicate an area for consideration as a potential conservation area which is a representative of the community type found and has representatives of that community on as wide a range of physical shore types as possible.

An area which has many of the shore types lies between Cushendun and Cushendall. This area has examples of basalt and sandstone boulder shores, red sandstone ridged platforms and basalt outcrops. It also

has an example of an exposed community which clusters with the north coast sites in some of the analyses, at Layd Church. By extending the area on either side the sedimentary shores of Cushendun Bay (described previously) and Cushendall Bay, a sandy Tellina/ Arenicola beach typical of east Antrim can be included.

Ringfad has been mentioned earlier as having a potentially high species diversity and an unusual shore type for east Antrim. This site is worthy of protection.

Other individual sites which exist along this stretch of coastline also exhibit a high species diversity, for example the limestone outcrop at Garron Harbour or the large rock pool at Port More. Ringfad is substantially richer in species than these sites, and is an example of a very unusual habitat.

Red Bay has the highest species diversity of the sandy bays along the east Antrim coast. This area has been noted as having an unusual sublittoral fauna (Erwin et al 1985). Conservation of East Antrim sedimentary shores will be further discussed in Section 6.2.3.

6.2.3 Discussion

Each type of multivariate analysis technique applied to Stage II rocky shore biological data resulted in a major split in community type between sites north and south of Belfast Lough, indicating that the types of community in each area are very different.

Species richness along the coast of Counties Antrim and Londonderry is generally lower than that found along the coast of Co. Down (see Section 6.3). However, this does not mean that sites north of Belfast Lough are any "better" or "worse" than sites south of Belfast Lough, only that the biological communities are different. In terms of protecting examples of each type of community found round the Northern Ireland coastline, they are equally as important from a nature conservation point of view.

However, having said that, the rocky shores of Co. Antrim are mostly in less danger from human impact (apart from rocky shores in sea loughs) than are the shores of Co. Down.

Much of the coastline along North Antrim, Rathlin Island and Outer Islandmagee is relatively inaccessible, protected by high cliffs. The boulder shores of East Antrim stretch for miles along the coastline, and all contain very similar biological communities.

Sandy shores are under relatively greater threat than rocky shores. They occur less frequently than rocky shores, they are popular with day trippers and holiday makers, and mechanised sand extraction takes place in many of them (see Appendix IX).

The sea loughs are also in greater danger from human impact than the open coast; water quality in Belfast Lough is poor, Larne Lough is becoming siltier due to dumping (see Appendix X), and all three sea loughs - Foyle, Larne and Belfast - have been affected by land reclamation in the past (see Appendix IX).

The aim of this section is to consider the conservation status of Counties Antrim and Londonderry as a whole, by summarising information already presented in Section 6.3 for each section of the coast. Sedimentary and rocky shores will be dealt with separately.

Sedimentary Shores

The Open Coast

A long stretch of exposed sandy beach occupies more than 16 km of the north coast, from Magilligan Point to Port Stewart. Otherwise sedimentary shores are uncommon on the north coast, occurring in a few sheltered bays. Open coast sedimentary beaches are almost non-existent on the East Antrim coast, restricted to small pocket beaches.

Different infaunal communities exist in the two areas: north coast shores are exposed, species poor sandy beaches, characterised by the presence of only a few polychaetes and crustaceans. East Antrim shores are moderate/sheltered sandy beaches, containing *A. marina* and *T. tenuis*, of the type common along the outer Co. Down coast.

In the case of East Antrim sites, similar types of shore would be protected under conservation measures applied to the generally more extensive intertidal beaches of Co. Down, so the East Antrim shores have a relatively low conservation priority (unless the addition of an East Antrim pocket beach could increase the relative value of another conservation area by increasing habitat diversity). In the case of north coast beaches, it is important to protect a representative area, because the exposed shore biological community only exists on the north coast in Northern Ireland. However there is a wide choice as to which area is protected, since infaunal communities in all sites are very similar.

Again it would be preferable to protect an area which is associated with other areas of conservation interest, such as sand dunes or an estuary.

Sea Loughs and Inlets

Lough Foyle

The area of Lough Foyle with the greatest habitat diversity and associated community diversity lies at the Roe Estuary and Balls Point. In terms of intertidal habitats the remainder of the lough is interesting, but relatively homogeneous in character compared to the sea loughs of Co. Down, which have a wider range of sheltered sedimentary and rocky habitat types.

The lough is also important for wildfowl and waders, especially on the muddier areas between the Roe Estuary and Longfield Bank, and may be important as a nursery for fish fry. However in terms of sedimentary intertidal habitats and infauna the most diverse area is the one mentioned above.

The Bann Estuary

The Bann Estuary is associated with a range of sedimentary habitats and salinity conditions. The estuary contains a range of habitats and communities, including mud and muddy gravel, which undergo variations in salinity regime at different states of the tide. It is associated with the sand dunes between Castlerock and Portstewart and with an exposed sandy beach.

From a practical point of view the area is under much human pressure. The river is used by small water craft entering and leaving Coleraine; parts of the dunes are used as a golf course, and Portstewart and Castlerock strands are very popular beaches with holiday makers. In addition the retaining walls of the Barmouth create a relatively unnatural habitat.

Larne Lough

The sediment of Larne Lough contains muddy infaunal communities. The area is relatively homogeneous in habitat and community terms compared to the sea loughs of County Down. In addition the lough is strongly affected by human impact. One unusual species, Priapulus caudatus, was found in the mud of the lough.

In comparison to other sea loughs, Larne Lough has a relatively low conservation priority in terms of intertidal habitats and communities. However large numbers of invertebrates live in the mud, and provide a food source for wildfowl and waders and for fish and fish fry. The lough may be of conservation importance from this point of view.

Finally, the brackish water lagoons along the west bank of the lough were outside the remit of the Northern Ireland Littoral Survey, but are definitely of potential conservation interest.

Belfast Lough

The flats of mud and muddy sand at the head of Belfast Lough are a declared ASSI (see Appendix IX) and are important as feeding grounds for waders. One site was visited in this area, at Holywood, which produced infauna of the "muddy" community type. Large numbers of invertebrates live in the mud, providing food for birds. However, in terms of range of intertidal sedimentary habitats and communities the area is relatively homogeneous, and the sedimentary community which is present is represented in other sea loughs and inlets round the coast which are not so polluted.

Sedimentary communities along the southern shore of the outer lough are similar in type to those found on the open coast along the eastern shore of Northern Ireland - moderate/sheltered sandy communities. Their conservation status will be considered alongside that of out Co. Down sedimentary shores.

Rocky Shores

The North Coast, Rathlin Island and Outer Islandmagee

Two major types of community were identified by computer analyses in these areas, one associated with steep rocky shores, and the second, a more heterogeneous group, associated with gently sloping shores of mixed topography, including wave cut platforms, irregular rock outcrops, block scree and boulder shores. Intertidal extent of the mixed topography shores is greater and local shore topography alleviates the effects of exposure to a different degree at different sites. In a sense, the biological communities at steep rock sites are impoverished examples of those found on mixed topography shores.

The community and habitat types are dispersed widely along the north coast, from Portstewart to Carrickarede, around Rathlin Island and along outer Islandmagee (although wave cut platforms are not present along outer Islandmagee). There are many areas which contain good examples of a particular habitat (eg. basalt wave cut platforms; Portstewart to Portrush and the eastern end of the Causeway Coast. Limestone wave cut platforms; White Rocks to Dunluce Castle) or of a range of communities and habitats (the Causeway Coast, Outer Islandmagee). From this point of view it is difficult to select any one area which is more representative of north coast habitats and communities than any other area.

However, Rathlin Island contains a particularly wide range of the habitats and communities found on the north coast and at two sites, Bruce's Cave and Beddag, supports the growth of communities associated with a cave (caves are also present on Outer Islandmagee) and a

relatively sheltered limestone platform, which are rare on the mainland. Rathlin does not contain examples of all habitats found on the north coast (eg. sandstone platforms, exposed sandy beaches). As stated earlier, it is important to protect a representative north coast exposed sandy beach. Good examples of sandstone platforms occur in Murlough Bay.

East Antrim

Long stretches of the East Antrim coast, from Cushendall southwards, are composed of moderately exposed boulder shores. North of here, from Cushendall to Torr Head, boulder shores are still important habitats, but outcrops of bedrock and block scree are relatively more common in the intertidal region than they are south of Cushendall.

The communities present on these habitats mostly group together under different methods of computer analysis. In selecting representative areas for conservation purposes there are two major considerations. Firstly, the area should have a range of habitats, and secondly, it should be relatively free from human influence. Since a road runs along the coastline all the way from Cushendall to Larne, and most of the intertidal along this area is a homogeneous stretch of boulder shore, the area should be selected from the more diverse stretch of coastline north of Cushendall.

The length of coastline between Cushendun and Cushendall is one such area: it also includes, at Layd Church, an example of the more exposed biological communities common on the north coast. If the sedimentary beaches at the two towns were also included, the area would contain examples of all the habitat types found on the East Antrim coast.

However any similar length of coastline on the east coast north of Cushendall would also hold a similar range of representative habitats. Practical and pragmatic criteria, such as the presence of adjacent terrestrial nature reserves or important sublittoral sites, could be important considerations when choosing a representative east coast area.

The conservation priority of East Antrim shores is low, as the same boulder habitat and associated community stretches for miles along the shore between Cushendall and Larne, and the areas north of Cushendall are relatively inaccessible. There is one site which particularly merits conservation protection however; the species rich stable boulder promontory at Ringfad, which was described in the text.

Larne Lough

Rocky shores are rare in Larne Lough and are most common in the north east of the lough, above Barney's Point. Barney's Point itself contains an unusual community, dominated by clumps of Hymeniacidon sp. on the lower shore, probably because the area is affected by turbid tidal currents. It may be worth applying conservation measures to this site, although Boaden (pers. comm.) mentions a similar community in Strangford Lough. The rocky shores north of Barney's Point were not visited during the course of the survey and merit further investigation.

Belfast Lough

The only rocky shores in Belfast Lough which are of any potential conservation value lie at the seaward end of the southern shore of the lough. These are discussed in Section 6.3.

Potential conservation areas along the north coast are mapped in Figure 6.8. Three types of area are indicated:

(i) individual sites of limited extent and of particular conservation importance;

(ii) larger areas of conservation importance in a Northern Ireland context;

(iii) larger areas representative of a range of habitats and communities found on the open coast.

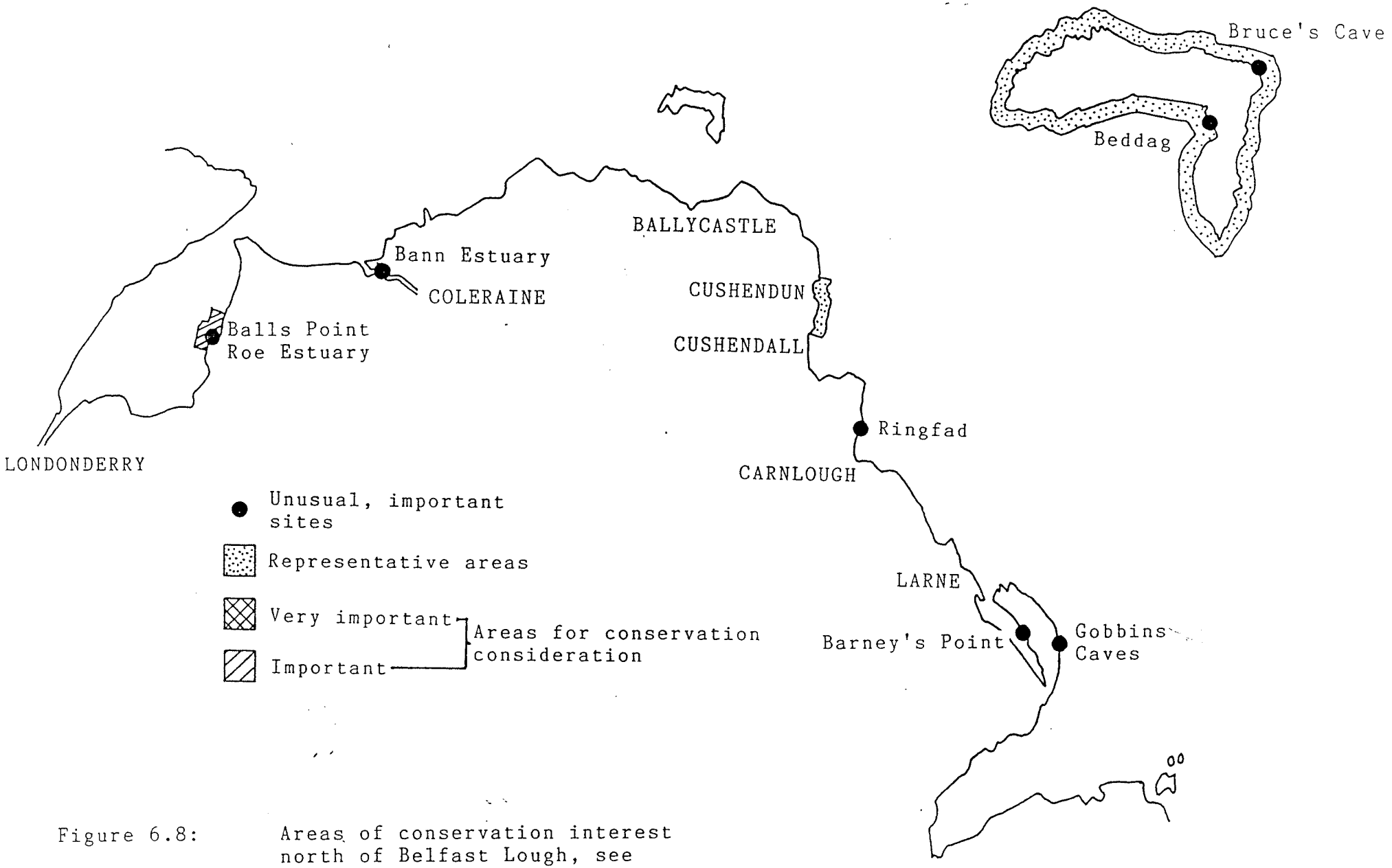


Figure 6.8: Areas of conservation interest north of Belfast Lough, see text for details.

6.3 SOUTH OF BELFAST LOUGH

6.3.1 Sea Loughs and Inlets

6.3.1.1 STRANGFORD LOUGH

Physical Description

Strangford Lough is a shallow sea lough which is approximately 24 km in length from north to south and 8 km from west to east at its widest point. The main body of the lough contains a large number of small islands (mainly on the western side) and pladdies (mainly on the eastern side). These are drowned drumlins, features characteristic of glacial terminal moraine.

A map of the lough, including areas of the lough mentioned in the text, is provided in Figure 6.9.

The lough is connected to the sea by a narrow channel, "The Narrows", in the south east. The Narrows are about 9 km long and less than 1 km wide in places. Tidal currents pass through the channel at velocities up to eight knots. There are other, smaller areas in the lough where tidal currents provide an unusual habitat; these habitats, and the Narrows, will be discussed in a separate section.

The lough as a whole is sheltered from wave action compared to the open coast. However within the lough there is a difference in wave exposure between the east and the west banks, due to the greater degree of shelter offered by the islands along the western shore, and because the prevailing wind blows from the west. The difference is slight compared to the extremes of exposure encountered on the open coast of Northern Ireland.

One major tributary flows into the lough, the River Comber, which forms an estuary in the northwest. Fresh water also enters through the Quoile Barrage in the south west (see Appendix IX) on the ebb tide. There are localised fresh water influences around these areas, and where small streams enter the lough, but otherwise the water in the lough is full seawater.

The main body of the lough and the Narrows contain a wide diversity of rocky and sedimentary habitats. Rocky and sedimentary substrates are more closely associated and intermingled with each other around the shores of Strangford Lough than around any other part of the coastline (apart from Carlingford Lough). This may be due to low wave exposure allowing the sediment, stones and boulders of the glacial moraine to remain in a relatively unsorted state compared to the open coast.

Another effect of the reduced wave exposure is to increase the range of stable substrate to which animals and plants may become attached. Small stones lying on the surface of sedimentary shores or in gaps between boulders support animal and plant growth to an extent impossible on more wave exposed shores. In the following discussion "rocky habitats" will be defined as those shores which can support the growth of attached animals and plants on the surface, and will include under boulder fauna. "Sedimentary habitats" are those which support populations of infaunal animals. The definitions are not necessarily mutually exclusive.

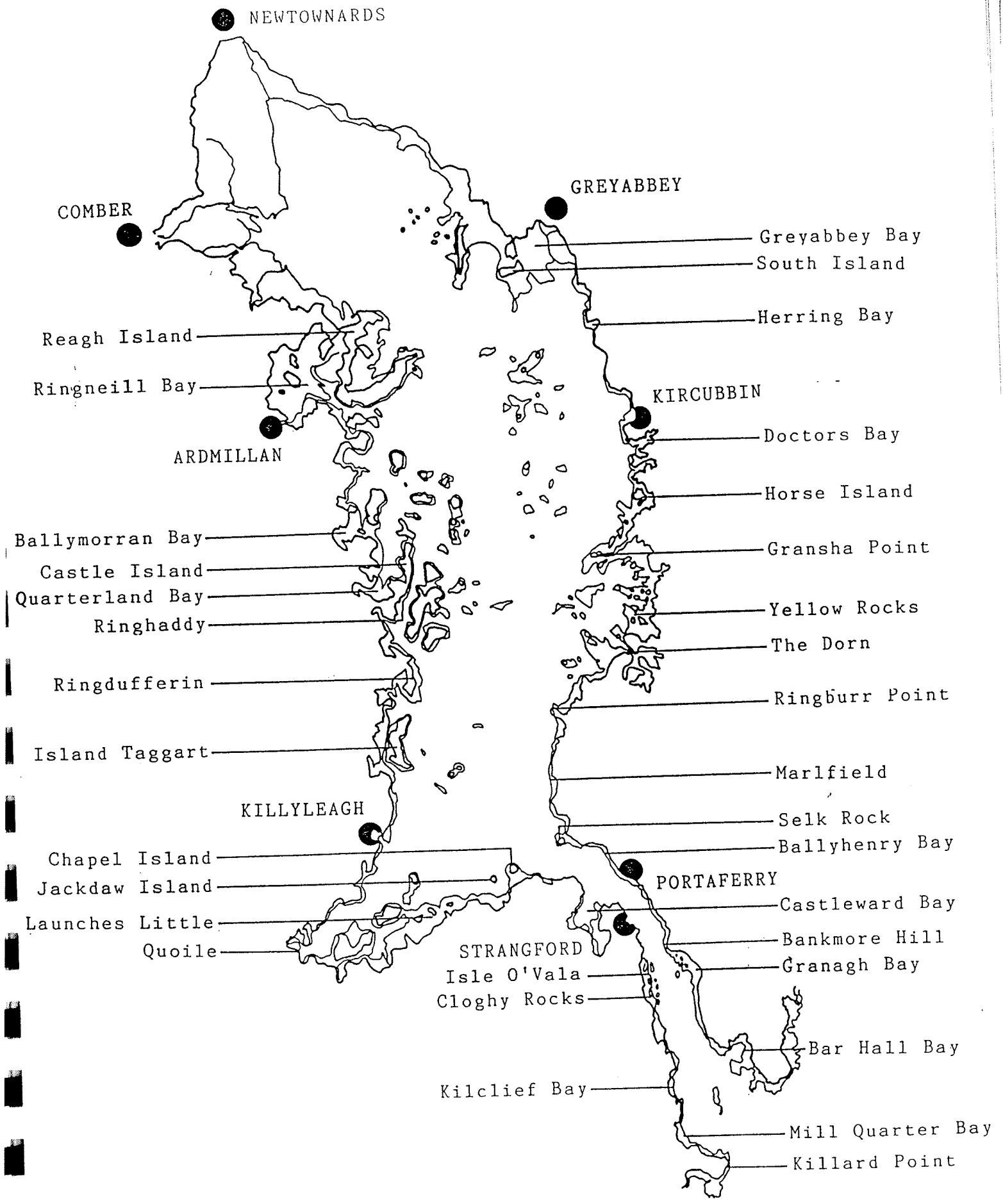


Figure 6.9 : Strangford Lough
Place names used in the text.

Rocky Shores

Boulder shore is the major rocky habitat present along the east and west banks of the lough, around the islands and along the north eastern shore of the Narrows. The boulders are of various sizes, ranging from cobbles to large boulders, well over a metre across. Boulder shores may be steep and narrow, as around Castle Island, or very extensive and gently sloping, as at South Island. The boulders may be closely packed together, or lying widely separated on a variety of sediments, from mud to muddy gravel and pebbles.

Changes in the type of boulder shore can occur within a short stretch of coastline, or even between high and low water. For example the upper shore at a site may be composed of closely packed cobbles or stones whereas the lower shore may be made up of boulders widely dispersed on a bed of sediment. The physical variation between sites is large; however it is possible to make some generalisations.

Along the northern part of the western mainland, from Ringhaddy to Reagh Island, boulder shores tend to be steep, narrow and strongly affected by silt. In addition there are many boulder shores around the extensive muddy areas from Island Taggart northwards which exist only as a narrow fringe along the upper part of the shore above muddy bays.

Boulder substrates around more open parts of the western shore, for example around the islands or the eastern facing shores at Ringdufferin, outer Island Taggart and Killyleagh are wider and less muddy than those described above.

The boulder shores of the pladdies, mainly in the middle and eastern side of the lough, are the shores least protected from wave action in the main body of the lough. The sediment under the boulders contains a lower proportion of fine silt and a greater proportion of coarse sediment than shores on the mainland.

The rocky shores on the eastern side of Strangford Lough are physically more diverse than those on the western side. Outcrops of bedrock are present in the intertidal region. Grits, sandstones, siltstones and shales, similar to substrates found along outer Co. Down, occur mainly along the southern part of the eastern shore and in the Narrows; localised intrusions of igneous rock are also present.

Bedrock outcrops are associated with sedimentary shores, mainly mud and muddy sand, between Yellow Rocks and Gransha Point, and with sedimentary and boulder shores between Horse Island and Kircubbin. Bedrock alone is the major substrate at only a small number of sites, such as Marlfield, along the southern part of the eastern shore.

Smaller outcrops of softer sedimentary rock are present along parts of the north east shore.

The Strangford Lough Narrows contains a wide variety of rocky substrates. On the eastern shore boulders are dominant from Ballyhenry Bay to Bankmore Hill. South of here, in Granagh Bay and Bar Hall Bay, where inlets in the current swept narrows allow the deposition of many types of sediment, there are also outcrops of creviced sedimentary rock which support a wide variation of subhabitats. The islands in the narrows are also formed of bedrock, unlike the drowned drumlins in the main body of the lough. Bedrock outcrops are the major intertidal rocky habitat along the western bank of the narrows, and around Killard Point, although boulder shores are also present.

Sedimentary Shores

There are wide sedimentary flats at the north end of the lough and narrower flats towards the western side of the southern shore. Those at the north end of the lough are mainly composed of muddy sand; the sand is muddier towards high water and sandier towards low water. There are localised outcrops of soft mud in this area; small regions around mussel beds and wider areas along the Comber estuary and in and around the semi-enclosed Ardmillan/Ringneill Bay complex.

Along the southern shore of the lough the intertidal to the west of Jackdaw Island is predominantly sedimentary in nature, becoming wider and muddier between Launches Little and Castle Island to form extensive mud flats.

In general the western shore of the lough is siltier than the slightly more wave exposed eastern shore. The western shore contains more muddy areas (in partially enclosed bays and in shelter between islands and the mainland), often with a steep, narrow Ascophyllum dominated boulder shore lining the upper part of the intertidal. Examples of this can be found between Island Taggart and the mainland, in Quarterland Bay and in Ballymoran Bay. Areas of muddy sand and muddy gravel and pebbles are also present, often associated with boulder shores, lying under the boulders or in clear patches within the boulder shores.

Sedimentary shores on the eastern side of the lough from Ringburr Point to Greyabbey Bay are more diverse in character than those on the western shore. Muddy areas are present, notably around the Dorn and Yellow Rocks, but there are fewer areas of very soft mud than on the west coast. There are areas of relatively clean sand (at the mouth of Greyabbey Bay and in Herring Bay along the northern part of the eastern shore), muddy sand (Gransha Point), gravel (Ringburr Point and Doctor's Bay) and areas of mixed sediment associated with boulder shores (from Horse Island to Kircubbin).

Sedimentary substrates in the Strangford Narrows are also diverse, particularly in the bays where a slackening of tidal current allows sediment deposition. There are clean sandy beaches in Mill Quarter Bay and Kilclief Bay; gravel, pebble, sand, mud and muddy sand habitats in Bar Hall Bay; a mixture of gravel, muddy gravel, pebble and coarse sediment habitats around Isle O'Valla and south to Cloghy Rocks, and a very wide diversity of rocky and sedimentary habitats in Granagh Bay.

Biological Description

Rocky Shores

One advantage gained by rocky shore organisms inhabiting a sheltered sea lough as opposed to the open coast, is that low wave action increases the range of stable substrata available for settlement to include small stones and even, in extremely sheltered areas, gravel. Another advantage is also related to low wave action, which allows an extension into the intertidal area of some more delicate species usually found only in the comparative stillness below low water (Lewis, 1964).

The lower shore all round Strangford Lough contains species of animals normally found only sublittorally on the open coast, but particularly good examples of emergence of sublittoral species may be found in current swept areas. These combine the benefits of shelter with the benefits of a constantly renewed supply of water, including a constant food supply for filter feeders, fresh, oxygenated water and immediate removal of wastes.

Examples of the "emergence phenomenon" have been noted from Strangford Lough in the past (Boaden, pers. comm.). It is very marked in the Narrows, in two large and one small set of tidal rapids, and in one current affected area, all of which have been visited during the course of the survey. Other small current swept areas may exist which have not been visited.

The negative factors affecting rocky shore organisms in sea loughs are, like the positive factors, related to low wave exposure and water movement (Lewis, 1964). Water exchange with the open sea may be infrequent, reducing the flow of fresh sea water to animal and plant species, and there may be greater temperature variation than along the open coast.

According to Boaden (1978) Strangford Lough contains two or three fairly distinct bodies of seawater. Conditions in the lower lough come close to those in the Irish Sea, but the upper reaches show evidence of increased turbidity, a wider temperature regime, and retention of various planktonic organisms .

This difference is reflected in the rocky shore communities. Twinspan analysis indicated that two groups of sites exist in Strangford Lough; one group to the north, and one to the south (see Figures 5.8, 5.9). This was investigated further using ordination (Figure 5.11) which showed the presence of a gradient in rocky shore communities from south to north up the more intensively sampled east coast.

The second negative factor affecting rocky shore sea lough biota according to Lewis (1964) is the presence of silt. This may be suspended in turbid water and thus influence community composition, or form a thin surface deposit on algae and other substrata, or lie as a deep soft layer between rocks and stones, greatly reducing the number and diversity of filter feeding animals.

The type of rocky shore populations present at different sites round Strangford Lough are determined by a balance between these beneficial and harmful factors, and by the type of substrates present at each site.

The biology of Strangford rocky sites will be described in the following manner:

(i) The zonation pattern of a representative rocky shore community will be discussed showing, with examples, how the fauna and flora change with substrate type, from bedrock through the more typical mixed boulder and sediment shores to small stones. Change in the biota caused by the modifying factors outlined above will also be described.

(ii) A stage II recording sheet from a site in Strangford Lough will be included to illustrate a specific example of the general description provided in (i).

(iii) The extreme example of the "emergence phenomenon" provided by tidal rapids and currents will be described separately.

(iv) A list of species will be provided which are characteristic of and largely confined to Strangford Lough.

(i) Biological Rocky Shore Communities

Each zone will be described in terms of the dominant species present in the algal canopy; examples of other species of algae and animals present will also be given. Strangford sites are the richest for intertidal invertebrates found round the coastline, commonly containing more than 200 species in total; for a more detailed description of how communities vary between different sites, it is necessary to refer to the Stage II recording sheets.

1. The Splash Zone

This zone is very narrow in Strangford compared to open coast sites, especially the metres wide supralittoral Verrucaria maura belt found along exposed north coast cliffs. In Strangford terrestrial vegetation can grow very close to the top of the Pelvetia zone.

2. The Pelvetia canaliculata Zone

Pelvetia canaliculata can grow on the small angular stones which occur on the upper shore at several Strangford sites (eg. Chapel Island, site 111) (rocky shore site numbers in this section refer to map numbers in Figure 6.2). These act as relatively stable substrates in Strangford compared to the open coast. However, Pelvetia distribution is still relatively patchy compared to that on boulder or bedrock substrates. V. maura is usually absent on stony beaches, but present in cases where the upper shore substrate is composed of boulders, or the most common upper shore type, a mixture of boulders and stones (Kircubbin Point, site 98; Green Island, site 110), or bedrock (Black Neb, site 97, Ringhaddy Rapids, site 104).

Algal development in this zone is at its greatest on creviced bedrock. Damp sediment filled crevices usually support the growth of Catenella caespitosa, Vaucheria spp. and, especially where there is a freshwater influence or a nearby salt marsh, filamentous green algae such as Rhizoclonium riparium and Ulothrix spp. Blue green algal mats may be present in creviced bedrock, but they are usually absent on stone or boulder substrates.

Small, upper shore pools, which usually only occur on bedrock sites, contain green algae including Enteromorpha intestinalis, littornids and small crustaceans. These pools have a lower floral and faunal diversity than similar pools on the open coast because sea spray is much reduced due to low wave action.

Littorina saxatilis is present on boulder and stone shores, but less so on bedrock. On hot, sunny days it hides under stones, but can be seen on the surface after rain or just after high tide when the rock is damp.

Other animals in this zone are also substrate dependant. Amphipods (including Eulimnogammarus obtusatus, Orchestia gammarellus and Gammarus spp.) and isopods (mostly Ligia oceanica but including Jaera spp. in damp areas) are common under boulders and stones, less so on bedrock. The insect Anurida maritima is more common on pools and in creviced bedrock areas than under stones. The amphipod Hyale nilssoni lives on the fronds of P. canaliculata, but is more common in the next zone down.

3. The Fucus spiralis Zone

This is usually just below, and in general slightly wider than, the P. canaliculata zone. The same considerations apply to F. spiralis distribution as to Pelvetia regarding substrate, except that the abundance and diversity of associated species is generally slightly larger, due to a greater seawater influence. However in more turbid areas (Mahee Island, site 102; Castle Island Point, site 103) this is often the first zone to be affected by silt deposition, which reduces the number of under boulder species.

4. The Ascophyllum nodosum Zone

Luxuriant growth of A. nodosum across a wide zone in the centre of the intertidal region is the single most characteristic feature of the sheltered rocky shores round Strangford Lough.

Ascophyllum is the major fucoid in this zone, but at some sites (Holm bay, site 109; Green Island, site 10) Fucus vesiculosus may form a narrow, more or less distinct layer near the top of the zone.

Ascophyllum is not necessarily dominant on all surfaces; it requires protection from desiccation when young, and so may be absent from steep bedrock faces (eg. at Black Neb, site 97; small patches at Marlfield Rocks, site 91). On these areas it is replaced by P. vulgata, B. balanoides and Nucella lapillus, giving an exposed, open coast appearance to part of an otherwise sheltered shore. Ascophyllum may also be rare or absent from more open aspected

islands and pladdies (eg. Limestone Pladdies, site 107), again being replaced by limpets and barnacles. However even at these sites, where the upper shore is usually species poor, the lower shore exhibits the wide diversity of invertebrates and the algal communities typical of Strangford Lough.

Ascophyllum is a large plant, and requires a more stable holdfast than other fucoids. It is particularly prevalent on bedrock and boulders, but less common on stones and muddy gravel. At some sites (eg. Horse Island, site 96) areas of small stones within an otherwise Ascophyllum dominated boulder shore will be covered by Fucus vesiculosus (towards the upper part of the zone) or Fucus serratus (towards the bottom). In other areas (eg. Ringburr Point, site 92) isolated scattered boulders may be covered by A. nodosum while stones and gravel between the boulders are covered by fucoids.

Areas of small stones and gravel exist which, because of the instability of the substrate, can only support the growth of more ephemeral algae.

These include large mats of Enteromorpha spp. (Enteromorpha mats may also be found lying on top of, and interwined with, the Ascophyllum canopy). This is a polymorphic genus which tends to appear in growth forms rarely encountered on the open coast in Strangford Lough, eg. Enteromorpha clathrata and Enteromorpha ramulosa, although the more common E. prolifera and E. compressa usually make up the bulk of the mats.

Mixed mats of filamentous and filiform green and brown algae also occur on muddy gravel areas; their composition probably varies seasonally. Common species include the green algae Chaetomorpha capillaris and Chaetomorpha linum, and the browns Asperococcus fitulosus, Dictyosiphon foeniculaceus, Ectocarpus spp., Pilayella littoralis and Isthmoplea sphaerophora.

A very characteristic understorey of smaller, mainly red algae, exists under the canopy formed on stable substrates by the larger fucoids in this zone. The understorey varies in composition from site to site, depending on silt load and heaviness of fucoid cover; it is usually more developed towards the lower part of the zone than towards the upper.

In very silty areas, such as the northern part of the western shore, the understorey is restricted to a small number of species: Audouinella floridula, Cladophora rupestris and Ulva lactuca are usually present. The mat-forming A. floridula and C. rupestris are usually dominant members of the understorey in less silty areas, but the number of red algal species present increases to include Lomentaria articulata, Plumaria elegans, Membranoptera alata, Phyllophora pseudoceranoides, Chondrus crispus, Gigartina stellata and numbers of smaller species.

Two final fucoids which occur in this zone must be mentioned. Fucus ceranoides grows in areas affected by a freshwater influence. It has been noted at the south end of Castleward Bay, around the Comber estuary, and at other locations in Strangford where fresh water

channels cross the intertidal region. Ascophyllum nodosum F. mackaii is an unattached growth form of Ascophyllum which occurs only on very sheltered areas between neap tide levels and on a substratum of muddy shingle, in areas with a slight freshwater influence. It is common at the head of the sea loughs along the west coast of Scootland, but rare in Northern Ireland; it is present at two sites in Strangford Lough (Boaden, pers. comm. - see Appendix XII).

Animal diversity increases from top to bottom of the zone. Rocky shore animal diversity is strongly reduced in areas of heavy silt deposition and in more muddy areas. For example at Holm Bay (site 109) boulders lie on a bed of muddy gravel, which is muddier in some areas and gravel dominated in other areas. Species diversity is greater under the boulders lying on a predominantly gravel substrate than under boulders lying on mud. This effect is very marked on the siltier boulder shores to the north of the western bank.

As was noted earlier, limpets and barnacles are the dominant species where areas of steep bedrock do not permit Ascophyllum growth, and on some of the less sheltered islands and pladdies. They may also be dominant on very large boulders in otherwise Ascophyllum covered shores, as at Taggart Island (site 108), again because the algal sporelings lack protection from desiccation on this substrate.

Animals living on the surface of the substrate are relatively rare on Ascophyllum dominated shores compared to the number of animals living beneath boulders, under overhangs or attached to the fucoid canopy or algal understorey. Bedrock shores have a low animal diversity in this zone compared to boulder shores. Barnacles are rare or absent, although in some areas Balanus balanoides occurs in a thin band along the bottom of the F. spiralis zone and top of the Ascophyllum zone (a good example is in Ballyhenry Bay). Isolated individuals of Balanus crenatus may be present under the algae in the lower part of the zone. Limpets are present as large individuals scattered on the surface of the substrate, more common at some sites than others. Littorina obtusata, L. mariae and L. littorea are fairly common on the surface, and Lepidochitona cinereus grows attached to the substrate. Smaller molluscs, such as Onoba semicostata, Skeneopsis planorbis and Turtonia minuta are also present.

Strangford shores, even those strongly affected by silt, support large populations of Carcinus maenas and numbers of Idotea granulosa. Amphipod diversity increases from top to bottom of this zone, as does polychaete diversity. The most common polychaetes found under stones near the top of the zone are Cirratulus cirratus and Audouinia tentaculata, while those near the bottom include Harmothoe spp., Lepidonotus squamatus, Ephesia gracilis and Nereidae spp.

Groups of species appear in this zone which reach their maximum diversity and abundance in the zone below. Sponges, such as Halichondria panicea, Grantia compressa and Scypha ciliata live on the surface. The latter two species usually grow attached to the algal understorey while the former, which grows on rock substrates along the open coast, often forms part of the epifauna on Ascophyllum in Strangford.

Dynamena pumila, Flustrellidra hispida and Bowerbankia imbricata are common epifaunal species on A. nodosum in this zone; epifaunal diversity on F. serratus in the zone below is richer.

The communities living under boulders on the surface and as epifauna on algae along the lower part of the Ascophyllum zone are similar to, but less species rich than, the communities of the Fucus serratus zone. They will be discussed in the next section.

5. **The Fucus serratus zone.**

Algal communities on the lower shore again vary with the type of rocky substrate present. At many sites in Strangford the lower Ascophyllum zone and the upper Fucus serratus zone merge gradually into one another over a distance of many metres, with Ascophyllum growing on large boulder tops and F. serratus occupying the small boulders and stones between the larger boulders. The fronds of Fucus serratus are wider than those encountered on the open coast and dotted with small "shaving brush" tufts of the epiphyte Elachista fucicola.

An algal turf grows on the boulders under Fucus serratus, which varies in composition from site to site. Several of the more common species in the turf occur in the understorey of the Ascophyllum zone above, while others are new. Some of the major species are: Gigartina stellata, Palmaria palmata var. sarniensis (a sheltered shore form of the plant which is not encountered on the open coast), Chondrus crispus, Furcellaria lumbricalis, Corallina officinalis, Cladophora rupestris, Leathesia difformis, Asperococcus fistulosus, Cystoclonium purpureum, Ceramium rubrum and Polysiphonia spp. Several members of the filamentous red algal genera Ceramium and Callithamnion are encountered which are not common on the open coast. Scattered plants of Codium spp. may be present.

The turf usually grows under F. serratus, but may replace it at some sites. In addition areas of muddy gravel and small stones may appear between scattered boulders. In these areas a community of ephemeral green and brown filiform and filamentous algae develops (including Enteromorpha spp) similar in composition to that described for the Ascophyllum zone. In extreme cases, where the entire lower shore is composed of small stones and muddy gravel, eg. at Ringhaddy Rapids (site 104) and some areas around Yellow Rocks, this type of algal community becomes dominant.

At some sites the brown alga Himanthalia elongata is present in this zone. During the course of the survey it has been found from two contrasting groups of sites. One is the very sheltered boulder shores of Strangford Lough, and the other is made up of the exposed and very exposed sites found round the Antrim coast.

The occasional appearance of Himanthalia elongata in the F. serratus zone of sheltered sea loughs was noted by Lewis (1964) who described it as an "anomalous feature". More recently (Tittley et al, reported in Earll and Erwin, 1983) the same phenomenon has been noted from the Faroes.

The lower shore fauna of Strangford Lough boulder shores is the richest round the coast of Northern Ireland, providing the boulders have not been choked by silt. On a typical shore the major habitats available for animals in this zone would be:- boulder surfaces; the sides of boulders; under the boulders; fronds of F. serratus (used by epifauna); algal tufts, and muddy gravel between boulders.

A detailed list of species found can be made by referring to the Stage II recording sheets. However examples of animals found in each habitat included:

Boulder surfaces. Space available tends to be limited, since most boulders are covered by algal mats, however several animal species do settle here, including Balanus crenatus, Pomatoceros triqueter, Spirorbis spp., Anomia ephippium, Verruca stroemia and Acmaea tessulata; Gibbula umbilicalis and many smaller molluscs also live on the surface. The white form of Calliostoma zizyphinum, C. zizyphinum F. llyonsi, is widespread on the lower shore in Strangford, but is not usually encountered on the open coast. Pagurus bernhardus is common at most sites.

Boulder sides; under boulders. These areas are particularly rich for encrusting sponges (eg. Clathrina coriacea, Leuconia nivea, Myxilla incrustans, Ophlitaspongia seriata), bryozoans (eg. Phaeostachys spinifera, Cribrilina cryptooecium, Alcyonidium mytili), attached animals including Acanthochitona crinitus, Diadora apertura, Chlamys varia, Filograna implexa and ascidians (solitary: Ascidia conchilega, Ascidiella scabra, and colonial: Polyclinum aurantium and Sidnyum turbinatum).

Unattached animals use the boulders for shelter such as the holothurian Ocnus planci, the starfish Leptasterias muelleri and Asterina gibbosa (both of which are common in Strangford, but absent or rare on the open coast), Eupolyminia nebulosa, Harmothoe spp. and other large polychaetes, and Porcellana longicornis, Porcellana platycheles and other arthropods.

Fucus serratus. Epifauna on Fucus include hydroids (Laomedia flexuosa, Obelia dichotoma), bryozoans (Electra pilosa, Alcyonidium hirsutum, Alcyonidium gelatinosum), solitary ascidians (Ascidiella scabra), colonial ascidians (Botryllus schlosseri, Botrylloides leachii, Tridemnum tenerum) and Spirobis spp. The anemone Anemonia sulcata is found attached to F. serratus fronds, particularly in more sheltered areas. It also grows attached to A. nodosum in the lower part of the zone above. This does not happen on the open coast.

Algal tufts. These provide a substrate for ascidians, amphipods (Dexamine spp, Tritaeta gibbosa, Lysianassa ceratina) many of which are characteristic of Strangford shores, but rare outside Strangford; isopods (Dynamene bidentata, Jaera spp.), pycnogonids and small molluscs.

Overhangs. Alcyonidium diaphanum (present in Strangford: rare on the open coast); large populations of Grantia compressa, Scypha coronata and hydroids.

Muddy gravel areas. These are discussed only in terms of obvious macrofauna which add components to the surface biota; sedimentary infauna will be described in a separate section. Sabella pavonina and Lanice conchilega are present at many Strangford sites, and Venerupis pullastra lives under boulders.

6. The Laminaria Zone

The Laminaria zone which forms the sublittoral fringe at all Strangford rocky sites is in general wider than the laminarian zone found on the open coast. Kelp fronds are particularly long and broad; the kelp holdfasts in this sheltered sea lough are more easily detached from their substrate than those on the more exposed open coast. As with the higher zones, the kelp zone tends to merge with the Fucus serratus zone over a distance of many metres, without any clear cut boundary between the two.

Laminaria digitata is common in Strangford Lough, and Laminaria hyperborea is the dominant kelp of the sublittoral fringe at a number of sites.

Laminaria saccharina is also present at many sites in Strangford Lough, growing on smaller stones and cobbles between boulders colonised by the larger Laminaria species. However it is only present as a dominant component of the flora in very sheltered areas where the major substrate is stones on muddy gravel, such as at Yellow Rocks (site 94). When stones are too small for Laminaria attachment, as at Ringhaddy Rapids (site 104), the ephemeral algae described earlier become the dominant plants present.

Another brown alga found in this zone, usually attached to small stones in muddy areas, is Chorda filum.

The algal understorey in this zone is similar to that described for the Fucus serratus zone. In areas of Strangford where conditions are particularly silty the flora is impoverished, but in cleaner areas it is relatively rich, with a greater diversity of calcareous and non-calcareous encrusting red algae than in the zone above. Encrusters may be the dominant cover on the small pebbles which lie between larger boulders on which Laminarians grow with a red algal understorey (eg. at South Island, site 100).

Kelp stipes act as an algal subhabitat in this zone. Attached species include large clumps of the strap-like Palmaria palmata var. sarniensis, Plocamium cartilagineum, Ceramium and Polysiphonia spp. However the relatively low algal species richness in Strangford compared to the open coast is illustrated by the fact that several red algal species which might be encountered on the open coast in this zone, such as Cryptopleura ramosa, Odonthalia dentata, Phycodrys rubens and Delasseria sanguinea are rare or absent from Strangford.

Animal diversity in this zone is as rich as, or richer than, that in the zone above on boulder shores. Most of the animals found in the F. serratus zone are present here, and kelp holdfasts provide a new

substrate for a diverse community of amphipods (including Caprella acanthifera, Ampithoe rubricata, Lysianassa ceratina and Erichthonius punctatus), small polychaetes (Syllidae spp., Nicolea spp., Fabricia sabella), bryozoans (Callopora lineata, Cellepora pumicosa, Escharoides coccinea) and some of the colonial ascidians already mentioned.

(ii) **Example Site**

The "example" site is Ringburr Point (Figure 6.10). It was chosen for two reasons:

- It is a typical Ascophyllum dominated Strangford boulder shore, with areas of sediment between the boulders, and illustrates how both rocky and sedimentary habitats were investigated at some sites.

- It also illustrates several points made in the previous section:

  - upper shore fucoids growing on small boulders and stones;

  - different algal communities on large boulders compared to a pebble/gravel substrate;

  - "merging" of lower shore zones, rather than distinct boundary lines between Ascophyllum, F. serratus and Laminaria zones;

  - reduction of animal species diversity under boulders in the Laminaria zone compared to the F. serratus zone, because the boulders are embedded in muddy sediment rather than lying on gravel.

(iii) **Areas Affected by Tidal Currents**

Areas affected by tidal currents are common in sea loughs along the west coast of Scotland (Lewis, 1964), but rare in Northern Ireland. During the course of the littoral survey, tidal currents which affect the intertidal region have only been noted from four areas: Larne Lough, the mouth of Carlingford Lough, the entrance to Dundrum Inner Bay and Strangford Lough.

Strangford Lough Narrows is the most extended area in Northern Ireland affected by tidal currents. Nine rocky sites in the Narrows were visited during the course of the littoral survey, including sites at Selk Rock (site 90) and Killard Point (site 83, 112), which are at the northern and southern limits respectively of the current affected area.

Three other current affected sites were visited: the tidal rapids at the Dorn, Ardkeen (site 93) and south of Mahee Island (site 102), and a low tide boulder causeway which has been built to allow access from Castle Island to Darragh Island (site 103); tidal currents flow through and over the boulders at low tide to create a unique habitat.

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Northern Ireland Littoral Survey Rocky Shore Recording Sheet
LOCATION DATA STAGE II

R59

LOCALITY c	RINGBURR POINT	GRID REF d	LONG e	LAT f	
SHEET No a	59	PUNCH CARD No b	J574555	05/35·10/W	54/25·10/N
SEDIMENTARY SHEET No (if any) k		PHOTO Nos XXIX	Ht. OF LW. g (m)	TIME OF LW. h 1128	DATE i 08 07 85
			ARRIVAL TIME l 1030	DEPARTURE m 1345	RECORDER IZ

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	19	35
Sheltered Coast	2	19 X	36
Headland	3 X	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42 X
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Vertical Rock	52	75	98
Steep Rock (>30° slope)	53	76	99
L. Rock Ridges	54	77	100
Rock Ridges	55	78	101
Rock Platforms	56	79	102
Rock Outcrop	57	80	103
Fissured Rock	58	81	104
Irregular Rock	59	82	105
Large Boulders (>1024mm)	60	83	106
Med. Boulders (512-1024mm)	61 X	84	107
Small Boulders (256-512mm)	62 X	85	108
Stones, Angular (64-256mm)	63	86	109
Shingle, Rounded (64-256mm)	64	87	110
Pebbles (5-63mm)	65 X	88	111
Gravel (2-4mm)	66 X	89	112
Sand	67	90	113
Mud	68	91	114
Muddy Sand	69	92 X	115
Muddy Gravel	70	93	116
Black Layer N.S.	71	94	117
Silt Covered Rock	72	95 X	118
Man Made	73	96	119
	74	97	120

ROCK TYPE	
Spec:	
Igneous/Metamorph.	121
Limestone	122
Hard Mudstone	123
Soft Mudstone	124
INTERTIDAL EXTENT (m)	
< 10	125
10 - 50	126
50 - 100	127
>100 (Spec: 180)	128 X
HORIZONTAL EXTENT (m)	
<100	129
100 - 500	130
500 - 1000	131 X
>1000	132
OFFSHORE FEATURES	
Islands	133
Reefs	134
Breakwaters	135
Sandbanks	136
Shoal	137
COASTAL BACKING	
Sand Dunes	138
Low Cliffs	139
Mod. Cliffs	140
High Cliffs	141
Saltmarsh	142
Grassland	143 X
Peat	144
Valley	145
Freshwater	146
Trees	147
Other:	148
STEEPNESS INLAND	
0	149 X
1	150
2	151
3 - 5	152
5 - 10	153
>10	154

PREVAILNG WIND/ASPECT	W	A
N	155	163
NE	156	164
E	157	165
SE	158	166
S	159	167
SW	160	168
W	161	169
NW	162	170 X
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	171
Exposed	172
Moderate	173
Sheltered	174 X
V. Sheltered	175

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
< 2	176 X	181 X
2 - 10	177	182
10 - 50	178	183
50 - 100	179	184
>100	180	185
SEA HORIZON	10 miles	40 miles
0	186 X	199 X
1	187	200
2	188	201
3	189	202
4	190	203
5	191	204
6	192	205
7	193	206
8	194	207
9	195	209
10	196	209
11	197	210
12	198	211

Time of ELWST n	6 T 09
Mean Spring Tide Range (m) o	
Mean Neap Tide Range (m) p	
Annual Rainfall (mm) q	

CURRENT STRENGTH (estimate)	
Strong	212
Moderate	213 X
Weak	214

SALINITY	
Normal	215 X
Slighty Reduced (28-33‰)	216
Low (<28‰)	217
Stream Flowing on S.	218

Spec:	
ACCESSIBILITY	
Car Useable to Near Shore	219
>10 min. Walk	220 X
Boat Only	221

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	222
100 - 500	223 X
500 - 1000	224
1000 - 5000	225
>5000	226
Absent	227

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	228
100 - 500	229 X
500 - 1000	230
1000 - 5000	231
>5000	232
Absent	233

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	234
100 - 500	235
500 - 1000	236
1000 - 5000	237
>5000	238
Absent	239 X

SCIENTIFIC & CONSERVATION INTEREST

BIOTA	Dom Z	Dom C	Dom P	2° Z	2° C	2° P
Fucoids						
Red Algae						
Green Algae						
Brown Algae						
Eel Grass						
Barnacle						
Mussel						
Limpet						
Other Molluscs (Spec:)						
Turf Formers						
Crustose Corallines						
Others: (Spec)						

N.C.C. CLASSIFICATION

Ascophyllum	240	X
Mackaii	241	
Fucoids	242	X
Fucobarnacle	243	
Fucomytilus	244	
Chloropatella	245	
Chlorophyta	246	
Rhodomytilus	247	
Rhodobarnacle	248	
Rhodopatella	249	
Mytilobarnacle	250	
Patellobarnacle	251	
Barnacle	252	
Mollusc	253	
Other: (Spec)	254	

PROMINENT SUBHABITATS

		H	M	L
Wide, Shallow Rock Pools	255		265 X	275 X
Deep Rock Pools	256		266	276
V. Large Rock Pools	257		267	277
Rock Pools	258		268	278
Crevices	259		269	279
Couloirs	260		270	280
Overhangs	261		271	281
Caves	262		272	282
Reef at Low Tide	263		273	283
Other: (Spec)	264	X	274 X	284 X
Under boulders		X	X	X
Gravel areas				

No./DIVERSITY OF SUBHABITATS

High	285	
Medium	286	X
Low	287	

RELATIVE SPECIES RICHNESS

	Flora	Fauna
Good	289 X	291 X
Average	288	292
Poor	290	293

ORNITHOLOGICAL INT

	Feed	Nest
Waders	294 X	298
Wildfowl	295 X	299
Gulls	296 X	300
Seabirds	297 X	301

SEAL HAULOUT	302
NAT. RES. STATUS	
Site Within NNR	303
NNR or ASI Nearby	304
NT, RSPB or Loc Res Nearby	305
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING

V. Good	306	
Good	307	X
Fair	308	
Poor	309	

HUMAN INFLUEN

Dist. to nearest Town (km) r

AMENITY VALUE

Attractive Beach or Surround	31
Resort Town Nearby	31
Toilets, Shops & Cafes Present	31
Toilets, Shops & Cafes Nearby	31
Car Park	31
Popular	31

INDUSTRY AND POLLUTION

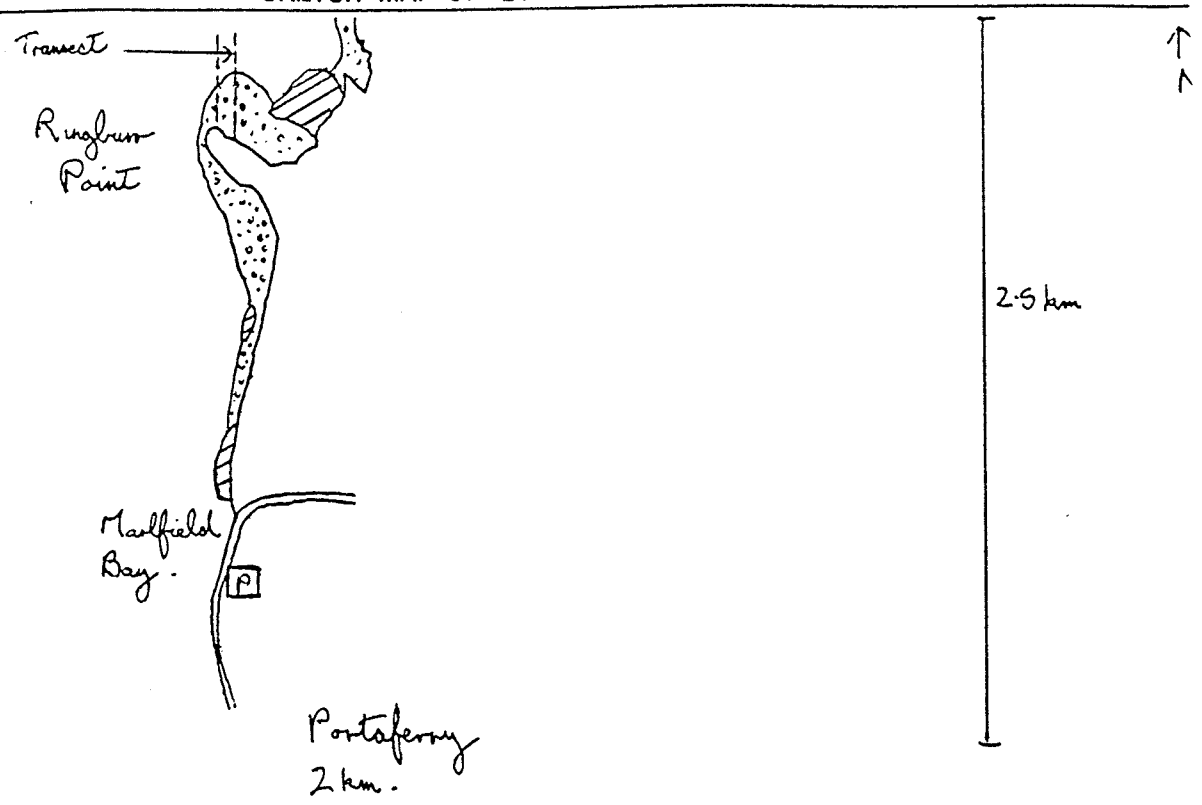
Factories Present	316
Evidence of Indust: Pollution	
—Toxic	317
—Suspended S	318
Sewage Pollution	319
Land Reclamation	320

SHORE USAGE

Beach Fishing	321
Bait Digging	322
Shellfish Collecting	323
Algal Harvesting	324
Aquaculture	325
Mooring	326
Watersports	327
Other: (Spec)	328
Shooting	

NOTES:

SKETCH MAP OF LOCATION



METHOD OF ACCESS

Parking in a lay-by at Marlfield Bay. The site may be reached by walking north along the foreshore.

LOCATION DESCRIPTION

The location is a wide boulder and gravel shore to the north of Ringbuoy Point, a headland on the eastern shore of Strangford Lough. To the north and south of the location the intertidal region is narrower, composed of boulder shores interspersed with rock ridge outcrops.

GENERAL PHOTOGRAPHS

XXIX 18, 19. General North.
20, 21. General South.

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Northern Ireland Littoral Survey Rocky Shore Recording Sheet
Transect Data Stage II

R 59

SITE NAME: RINGBURR POINT
FILM No:
TRANSECT No.: R59A
LOCATION No.: R59
SED. SHEET No. (if any):
Ht. OF L.W.:
TIME OF L.W.: 1128
DATE: 08078
TIME OF ARRIVAL: 1030
TIME OF DEPARTURE: 1345
RECORDER: IF

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Substrate Nature	Rock Type	Surface Texture	Surface Features	Total Algal Cover	
								Cover	Patchiness
1		North		7,10,11,14		4,5	9	1	1
2				7,10,11,14,15		4,5	9	2	3
3				6,7,11,14,16		4,5	9,7	3	3
4				6,7,9,11		4,5	7,9	3	3
5		North		6,7,12		4,5	9	4	3
6									
7									
8									

DESCRIPTION OF TRANSECT SITE

Photographs XXIX 16,17 : Sedimentary area in Ascophyllum zone.
22,23 : Top of transect down.
30,31 : Bottom of Transect up.

The site is an Ascophyllum dominated boulder and gravel shore to the north of a reclaimed land on the eastern shore of Strangford Lough. There is a wide intertidal region,

zone 1 : Small boulders on pebbles, gravel and course sand. Pelvetia cover is patchy and scattered, while there is a heavier covering of V. mamma. There were very many amphipods under the boulders, but few littorinids.

" 2 : Similar substrate to zone 1, but clay under some boulders. F. spiralis dominated.

" 3 : Medium and small scattered boulders separated by patches of gravel. Some of the boulders are sediment covered. Wide shallow pools on the sediment surface, containing many filamentous and filiform red and brown algae. The zone is Ascophyllum dominated, with an understory of F. serratus, more common in the lower part of the zone. Digging in the gravel areas (sometimes covered by a layer of sand) revealed Nephtys and other polychaetes.

" 4 : Widely spaced medium boulders with small boulders/stones and gravel between the boulders. F. serratus dominated : good for epifauna. Taller boulders at this height are covered by Ascophyllum rather than F. serratus. Many filamentous and filiform red and brown algae grow between the boulders. There is a good animal diversity beneath boulders.

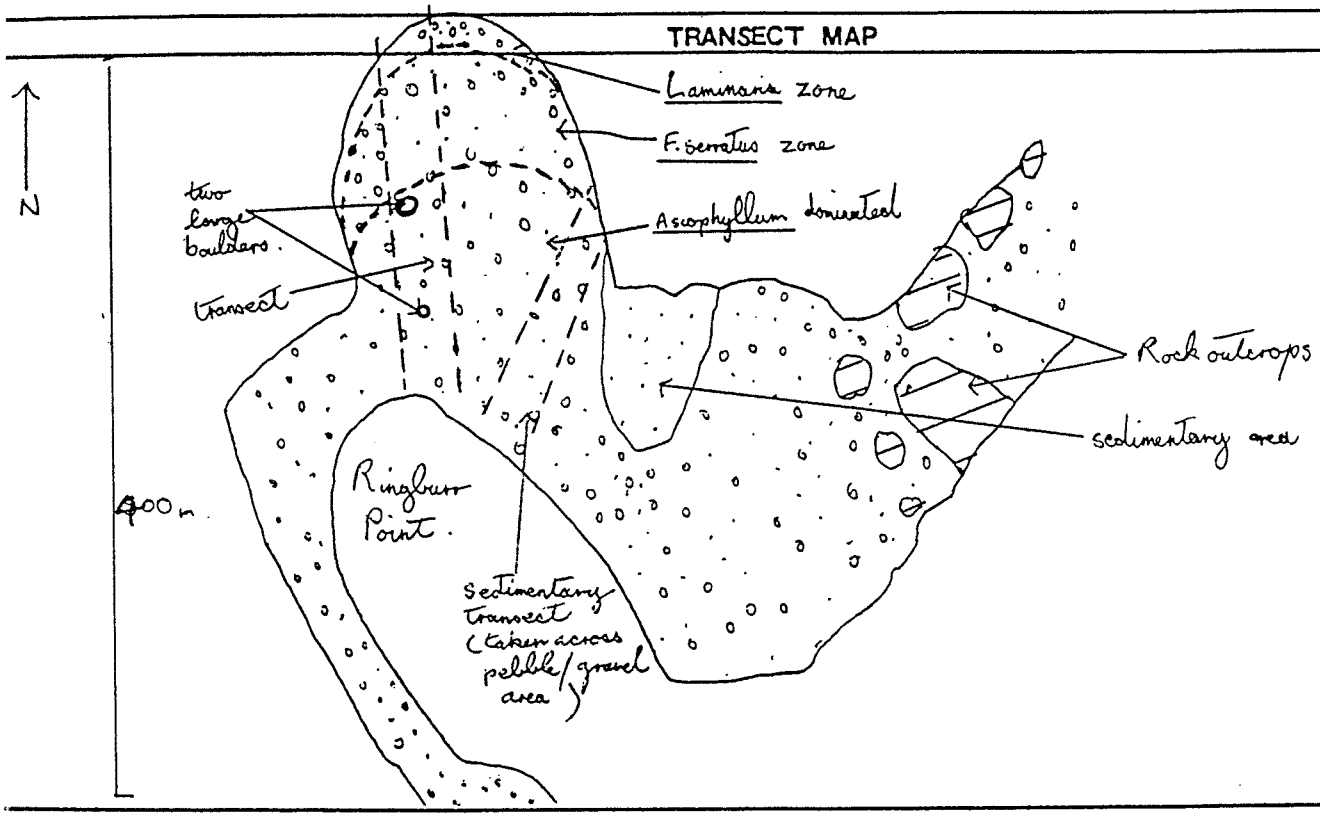
5 : Boulders embedded in muddy sand. Laminaria dominated with an understory of Cladophora and Gigartina. Taller boulders covered in F. serratus, Gigartina, Cladophora and Enteromorpha.

Laminaria zone was well exposed on the sampling date. Relative animal diversity, while in terms of the Northern Ireland coastline, was not high in comparison with other sites in Strangford of a similar intertidal extent, perhaps because the lower shore substrates in which the boulders are embedded is muddy.

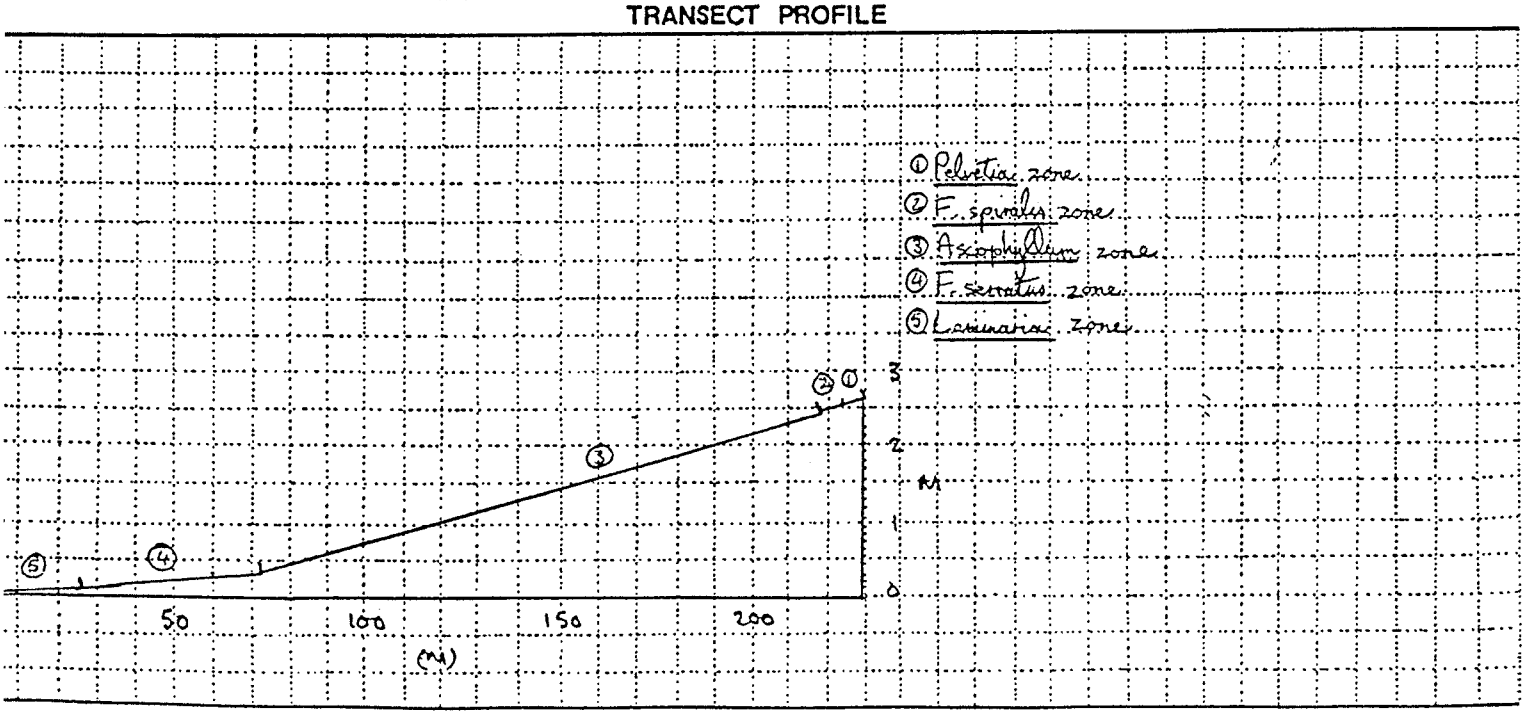
REFERENCE POINT:

It was not possible to mark the transect on the upper shore (composed of easily movable small gulders with a featureless grass backing). However the transect was taken north across the intertidal on the side of two very large, very obvious boulders towards the western edge of the boulder and cuvel peninsula.

TRANSECT MAP



TRANSECT PROFILE



Station	1	2	3	4	5	6	7	8	
ft. Top	3·1	2·7	2·4	0·3	0·1				
ft. Bottom	2·7	2·4	0·3	0·1	0·0				

| | | |

		1 1	2 2	3 3 3	4 4	5 2 2
Habitat		O U	O U	O U R	O U	O U L
Chthamalus stellatus	S33					
Elminius modestus	S48			1		1 1
Verruca stroemia	S27					
Idotea sp.						
Jaera sp.				1	1	
Ligia oceanica	S312	1				
Amphipoda sp.		1		1		
Cancer pagurus	S1240				1	
Carcinus maenas	S1225		3 1	3 1		
Galathea squamifera	S1157					
Galathea strigosa	S1158				1	1
Hyas araneus	S1271					
Macropipus depurator	S1220					
Macropipus puber	S1215					
Macropodia longirostris						
Palaemon elegans	S1015				1	1
Porcellana longicornis	S1162				1	1
Porcellana platycheles	S1163					
Pagurus bernhardus	S1172					4
Pagurus sp.						
Petrobius maritimus						
Nymphon rubrum	S3					
Pycnogonum littorale	S25					
Acanthochitona crinitus	W50			1		
Ischnochiton albus	W44					
Lepidochitona cinereus	W45			3 1	1	
Lepidopleurus asellus	W28					
Tonicella marimorea	W46					
Tonicella rubra	W47					
Acmaea tessulata	W80		1	1		3
Acmaea virginea	W81					1
Buccinium undatum	W440					
Calliostoma zizyphinium	W106				4	3 1
Cingula sp.						
Gibbula cineraria	W110			3 1	3	
Gibbula magus	W113					
Gibbula umbilicailis	W111			1	3	
Hydrobia ulvae	W162					
Lacuna vincta	W141					
Littorina littorea	W148			3		
Littorina neglecta	W153					
Littorina neritoides	W151					
Littorina obtusata	W149			5		
Littorina saxatilis sp.						
Monodonta lineata	W116					
Nassarius incrassatus	W450					
Nassarius reticulata	W449					
Nucella lapillus	W410			1		
Mytilus sp.						
Patella aspera	W86					
Patella intermedia	W					
Patella vulgata	W85	2 1	3	3 1	3	
Patina pellucida	W84					
Rissoii sp.						
Skeneopsis planorbis	W225					2
Trivia artica	W382					
Trivia Monacha	W381					
Acellisia papillosa	W870					
Archidoris pseudoargus	W816					
Corymphella verrucosa	W891					
Anomia ephippium	W1055				1	1
Barnea sp.						
Chlamys distorta	W1034					
Chlamys varia	W1037					

		1	2	3	4	5
		OU	OU	OUR	OU	OUL
Mittella arctica	W1200					
Lasaea rubra	W1098				2	1
Modiolus sp.						
Monia patelliformis	W1054					
Monia squama	W1055					
Musculus discors	W999					
Mytilus edulis	W991					1
Pholas dactylus	W1310			1		
Turitonia minuta	W1272					
Venerupis pullastra	W1265					1
Zirfaea crispata	W1313			1	1	
Asterias rubens	ZB85					
Henricia sanguinolenta	ZB69				3	1
Marthasterias glacialis	ZB85					
Amphipholas squamata	ZB138					
Ophinocommina nigra	ZB112					
Ophiothrix fragilis	ZB108			3	1	3 1
Ophiura texturata	ZB144					
Echinus esculentia	ZB170					
Strongylocentrotus sp.						
Cumaria sp.						
Alcyonidium gelatinosum	Y63			3 1	2 1	2 1
Alcyonidium hirsutum	Y59			2	3 1	2
Electra pilosa	Y338			2	2	1
Flustra foliacea	Y346					
Flustrellidra hispida	Y55			3	3	3 1
Membranipora membranacea	Y333					3
Aplidium/Marchellum sp.						
Ascidiella scabra	ZD62					
Ascidia conchilega	ZD64				2 1	
Ascidia mentula	ZD63					
Botrylloides leachii	ZD90				2	
Botryllus schlossrei	ZD89				2	2 1
Ciona intestinalis	ZD49					
Clavelina lepadiformis	ZD4					1
Dendrodoa grossularia	ZD86				3 1	2 1 1
Polyclinum aurantium	ZD11				1	2 1 1
Sidnyum turbinatum	ZD14					
Trididemnum tenerum						
Ammodytes tobianius	ZG518					
Blennius gattorugine	ZG474					
Ciliata mustela	ZG209					
Diplecogaster bimaculata	ZG170					
Gaidropsarus mediterraneus	ZG213					
Gobius paganellus	ZG535					
Hyperoplus lanceolatus	ZG521					
Lepidogaster candollei	ZG172					
Liparis liparis	ZG367					
Liparis montagui	ZG368					
Myxocephalus scorpius	ZG351					
Nerophis lumbriciformis	ZG316					
Pholis gunnellus	ZG500					
Spinachia spinachia	ZG301			1	1	
Sygnathus typhle	ZG314					
Taurulus bubalis	ZG352					
ANNELIDA						
Anaitides maculata	P320					
Arenicola marina	P177				1	
Glycera tridactyla	P537					1
Hamathoe imbricata	P262					1
Laonome kroyeri	P744				1	
Lepidonotus squamatus	P282				1	
					1	

		1		2		3		4		5	
		O	U	O	U	O	U	O	U	O	U
Malacoceros fuliginosa	P93									1	
Nephtys hombergii	P516									1	
Odontasyllis ctenostoma	P439										
Pennaresis cultifera	P507							1			
ARTHROPODA											
Ambithoe rubricata	S657					1				1	1
Caprella acanthifera	S840							3		1	
Chaetogammarus marinus	S497			1							
Dexamine spinosa	S649									1	1
Eulimnogammarus obtusatus	S502					1					
Hyale Nilssoni	S490	1		1							
Idotea granulosa	S259					1				1	
Jaera albifrons	S276					1		1			
Jaera nordmani	S274					1					
Janira maculosa	S281									1	
Jassa falcata	S726							1		1	1
Lembos websteri	S667							1		1	1
Lipura maritima				2							
Orchestia gammarellus	S479	1			1						
Phoxichilidium femoratum	Q37									1	
BRYOZOA											
Alcyonidium mytili	Y66							3		2	
Bowerbankia imbricata	Y120							2			
Callopora lineata	Y354							2		2	
Callopora pumicosa	Y301									2	
Cellepora hyalina	Y287							2		2	1
Cellepora pumicosa	Y301										1
Cellepora hyalina	Y287							2		2	1
Cellepora pumicosa	Y301										1
Cellepora hyalina	Y287							2		2	1
Cellepora pumicosa	Y301										1
Conopeum reticulum	Y334							2			
Cribrilina cryptooecium	Y149							2			
Escharoides coccinea	Y165										1
Phaenotachys spinifera	Y251							2			1
CHORDATA											
Blennius pholis	ZG475					1	1		1	1	
Didemnum sp.	ZD34							3	1		
CNIDARIA											
Obelia dichotoma	D158					2	1	2			
ECHINODERMATA											
Asterina gibbosa	ZB50								1		
~~Ectoprocta~~ (Ectoprocta)											
MOLLUSCA											
Cingula semicostata	W180									2	1
Jodinna tomentosa	W827							2		2	
Lacuna pallidula	W144							2		2	
Littorina mariae	W150					3		4		2	1
Littorina nigrolineata	W152		1							1	
Littorina patula			1		1						
Littorina rudis	W155		1		1	3	1				
NEMERTINEA											
Nemertine sp							1				

| PORIFERA | | |

		1 1	2 2	3 3 3	4 4	5 5 2
		O U	O U	O U R	O U	O U L
Blidingia sp.			3			
Blidingia marginata	ZS266					
Blidingia minima	ZS267		3		2	
Bryopsis hypnoides	ZS360					
Bryopsis plumosa	ZS361					
Chaetomorpha capillaris	ZS321				2	2
Chaetomorpha linum	ZS323					
Chaetomorpha melagonium	ZS325					
Cladophora albida	ZS328				2	
Cladophora pellucida	ZS340					
Cladophora rupestris	ZS346			4	4	4
Cladophora sericea	ZS347			2	2	2 1
Cladophora sp.					3	
Codium sp.						
Enteromorpha linza	ZS273					
Enteromorpha sp.	1 S 4			3		
Monostroma fuscum	ZS243					
Monostroma grevillei	ZS244			3		2
Monostroma oxyspermum	ZS246					
Prasiola stipitata	ZS178					
Rhizoclonium riparium	ZS352					
Rosenvingiella polyrhiza	ZS180					
Ulva lactuca	ZS260			3 1	3	1
Urospora/Ulothrix turf						
Ulothrix flacca	ZS219					
Ulothrix speciosa	ZS231					
Alaria esculenta	ZR254					
Ascophyllum nodosum	ZR280		2	6	3	
Bifurcaria bifurcata	ZR296					
Chorda filum	ZR221			3	4	
Chorda tormentosum	ZR222					
Cladostephus spongiosus	ZR263			3		
Cystoseira baccata	ZR297					
Cystoseira tamariscifolia	ZR301					
Cystoseira nodicaulis	ZR300					
Desmarestia aculeata	ZR207					
Dictyosiphon foeniculaceus	ZR178					
Dictyota dichotoma	ZR271					
Fucus ceranoides	ZR281					
Fucus serratus	ZR286			3 1	6	
Fucus spiralis	ZR287		5			
Fucus vesiculosus	ZR289			3		
Halidrys siliquosa	ZR305					
Himanthalia elongata	ZR293					
Laminaria digitata	ZR225				3	
Laminaria hyperborea	ZR227					
Laminaria saccharina	ZR229					
Leathesia difformis	ZR105					
Pelvetia canaliculata	ZR290	4				
Petalonia fascia	ZR187					
Pilayella littoralis	ZR33					
"Ralfsia" crusts	1 Z 7	3				
Scytosiphon lomentaria	ZR191					
Ahnfeltia plicata	ZR120				2	
Audouinella turf						
Bangia atro-purpurea	ZR465				2	
Bostrychia scorpioides	ZR327					
Callithamnion sp.						
Catenella caespitosa	ZR98			3		
Ceramium shuttleworthianum	ZR330					
Ceramium sp.					4	
Chondrus crispus	ZR138					1
Corallina officinalis	ZR154					2
Cystoclonium purpureum	ZR103			3	4	

		O	U	O	U	O	U	R	O	U	O	U	L
Dilsea carnosa	ZM201												
Dumontia incrassata	ZM205							1					
Furcellaria lumbricalis	ZM80												
Gastroclonium ovatum	ZM270												
Gelidium sp.													
Gigartina aciclularis	ZM139												
Gigartina stellata	ZM141					3			3		3		
Gracillaria verrucosa	ZM116												
Hildenbrandia rubra	ZM255			3		3		1	3				
Hypoglossum woodwardii	ZM575												
Laurencia hybrida	ZM405							1					
Laurencia pinnatifida	ZM407												
Lithothamnium glaciale	ZM184								2				
Lomentaria articulata	ZM272					3			3				
Lomentaria clavellosa	ZM273												
Membranoptera alata	ZM14					3			3		4		
Odonthalia dentículata	ZM411												
Palmaria palmata (strap form)	ZM260								2		2		1
Phycodrys rubens	ZM381												
Phyllophora truncata	ZM131												
Phyllophora crispa	ZM127												
Phyllophora pseudoceranoid	ZM128												
Phyllophora traillii	ZM130												
Phymatolithon lenormandii	ZM194					3	1		5				
Plocamium cartilagineum	ZM108							1				1	
Plumaria elegans	ZM349												
Polyides rotundus	ZM95												
Polysiphonia brodiaei	ZM412												
Polysiphonia lanosa	ZM422			2		3							
Polysiphonia nigrescens	ZM425												
Polysiphonia urceolata	ZM434												
Polysiphonia sp.	166					3					4		
Porphyra leucosticta	ZM485												
Porphyra linearis	ZM486												
Porphyra umbilicalis	ZM489												
Ptilota plumosa	ZM351												
Rhodomela confervoides	ZM442												
Non calc. encrusters											2		
Calc. encrusters													
Supralittoral blue-greens													
Vaucheria sp.													
Verrucaria maura		5		4									
Verrucaria mucosa		3											
Lichina confinis													
Lichina pygmaea													
Ruppia sp.													
Zostera angustifolia													
Zostera marina													
Zostera nana													
BACILLARIOPHYTA													
Berkeleya rutilans											2		
CHLOROPHYTA													
Enteromorpha compressa	ZS270							2			2		
Enteromorpha intestinalis	ZS272										2		
Enteromorpha prolifera	ZS274			2									
Spongomorpha arcta	ZS252										3		
Ulvaria sp	102							2					
Ulothrix flacca	ZS229			2									
CYANOPHYTA													
Lyella sp	153							2					

SPECIES CODE / HABITAT		1 1 O	1 1 U	2 2 O	2 2 U	3 3 3 O	3 3 3 U	3 3 3 R	4 4 O	4 4 U	5 5 5 O	5 5 5 U	5 5 5 L
PHAEOPHYTA													
Asperococcus sp.	ZR160					2							
Asperococcus fistulosus	ZR157					2			2		2	1	
Chordaria flagelliformis	ZR114					2							
Dictyosiphon foeniculaceus	ZR178					2			2		2		
Ectocarpus fasciculatus	ZR6										2		
Ectocarpus siliculosus	ZR7										2	1	
Elachista fucicola	ZR93								2				
Isthmoplea sphaerophora	ZR139					2			2				
						2			2				
Leathesia difformis	ZR103										2		
Pylaiella littoralis	ZR33					2		1					
Sphacelaria cirrosa	ZR247								2				
RHODOPHYTA													
Audouinella floridula	ZM18					4							
Audouinella purpurea	ZM25					2							
Audouinella secundata	ZM30								2		2		
Audouinella spongiosa	ZM32								2				
Callithamnion hookeri	ZM304								2				
Ceramium diaphanum	ZM321								2				
Ceramium rubrum	ZM328					2			4		2		
Erythrocladia irregularis	ZM468					2							
Erythrotrichia carnea	ZM474										2		
								1					
Melobesia membranacea	ZM188								2				
Nemalion helminthoides	ZM49								2				
Phymatolithon polymorphum	ZM195										2		
Polysiphonia nigrescens	ZM425								2				
Polysiphonia urceolata	ZM435								2				
Titanoderma pustulatum	ZM162								2			1	

One other current affected area is known from Strangford Lough (Boaden, pers. comm.). A very wide pool about 200 m across exists on the boulder/sediment area between Chapel Island, on the southern side of the lough, and the shore. At low tide this pool releases a flow of seawater through the boulders on its eastern side. This site was not visited during the survey. Other current swept areas may also exist.

Each current swept area has its own individual character; biological communities differ between sites. However they all share two characteristics in common:

- The "emergence phenomenon", whereby sublittoral species appear on the lower shore, is very marked.

- The diversity and/or abundance of filter feeding species such as sponges, hydroids, bryozoans and ascidians is usually increased.

However the biology of these areas is still affected by the same factors of substrate type and turbidity which govern communities at other sites in Strangford Lough untouched by tidal currents.

Each area will be described separately.

(a) **The Strangford Narrows**

The biology of the intertidal region in the Narrows differs from that of the main body of the lough in three ways; the two factors common to all current swept areas mentioned above and one other, namely that several species of open coast algae which are not found in the main body of the lough extend into the narrows.

- Among the usually sublittoral rocky shore species which have been noted on the lower shore at Narrows sites during the course of the survey are Clavelina lepadiformis, Echinus esculentus, Psammechinus miliaris and Solaster endeca. Circeis spirillum, a sublittoral spirorbiid which rarely occurs intertidally around the rest of the coastline, is commonly found growing on the algal tufts, hydroids and erect bryozoans on the lower shore at Narrows sites. Low water fauna in the Narrows have been extensively studied by Dr. Boaden and other staff and students from the Q.U.B. Marine Biology Station in Portaferry. Some of the species which have been found are listed in Appendix XIII.

- Encrusting and erect bryozoans and hydroids are more common on the lower shore in the Narrows than elsewhere in the lough. Among the species found are Scrupocellaria scruposa, Crisia spp., Alcyonidium diaphanum, Tubularia spp., Hydrallmania falcata, Gonothyrea loveni and Lasmedia flexuosa. Sponges are also common.

- Open coast algae which appear in the Narrows but are rare or absent from the remainder of the lough include Cryptopleura ramosa, Gastroclonium ovatum, Odonthalia dentata, Phycodrys rubens and Ptilota plumosa. This is in part due to the

greater number of rock pools which appear on the sedimentary bedrock substrate in the Narrows, compared to the boulder shores in the remainder of the lough, and also because the Narrows is more influenced by fresh seawater from the Irish Sea than the remainder of the lough. Algal diversity on an open coast site at the entrance to the Narrows, at Craiglewey on Killard Point (site 12), is very high, possibly because of the residual current issuing from the Narrows.

(b) **The Dorn**

The number of rocky shore animal species found at this site was the largest encountered during the course of the littoral survey. The sedimentary infauna were also investigated, and will be described separately.

A detailed physical description and complete species list for the tidal rapids at the Dorn will not be included here, since details are available in the Stage II survey sheet. In addition the site has been extensively described and investigated by workers from the Portaferry marine biology station. Some of their records of emergent sublittoral species found at the Dorn are included in Appendix XII.

Algal distribution varies with substrate type and with distance from the main rapids area and fastest current flow. In general the algal population at the Dorn is qualitatively no different from that of any other Strangford site, but the lower two zones, dominated by F. serratus and L. digitata, extend further up the intertidal zone than at non-rapid sites. The flora in the most current swept area of the Laminaria zone is reduced compared to other Strangford sites, the bedrock and boulders being covered by calcareous and non-calcareous encrusting red algae at the expense of the algal turf found elsewhere.

The most striking feature of the rapids at the Dorn is the large invertebrate population which, like the algal community, varies in composition with current flow and substrate. Attached filter feeders are particularly diverse, including Tethya aurantium, Haliclona spp., Coryne muscoides, Hydrallmania falcata, Abietinaria abietina and many bryozoan species, some of which are more common in the Narrows than the main body of the lough. There are also large numbers of arthropods and molluscs present, many of the former inhabiting laminarian holdfasts. Molluscs found include Adalaria proxima, Bittium reticulatum, Diadora apertura and Facelina bostoniensis. The final animal which should be mentioned as an example of sublittoral emergence is the feather star Antedon bifida, which has only been found intertidally at two sites during the course of the survey; at the Dorn and in a current affected site near the entrance to Carlingford Lough.

(c) **Ringhaddy**

The rapids at Ringhaddy provide an interesting contrast to those at the Dorn.

The Dorn rapids are active throughout the low tide period, although current speed and water volume are reduced at the end of the cycle, before the tide rises to replenish the seawater reservoir behind the

rapids. At Ringhaddy there is a far smaller seawater reservoir above the rapids, and consequently current flow is reduced to a trickle towards the end of the period, and may cease altogether.

In addition, the channel which exhibits maximum current flow at Ringhaddy is high in the intertidal, just below the level of the F. spiralis zone on adjacent rock surfaces. Also the enclosed shallow pool which acts as a reservoir at Ringhaddy is smaller than that behind the Dorn rapids, and more affected by temperature fluctuations. The water flowing through the channel at Ringhaddy on the sampling date was warm.

These physical differences between the Dorn and Ringhaddy are reflected in the biological communities present at both sites. Ringhaddy exhibits the typical "emergence phenomenon" of current affected sites: F. serratus grows along the rapids channel up into the Ascophyllum zone (although no laminarians are present). It also exhibits the preponderance of filter feeders in the animal community found at other rapid sites.

However species diversity is much reduced compared to the Dorn. In contrast to the large numbers of sponge, hydroid, bryozoan and ascidian species found at the Dorn, the animals are reduced to large numbers of a small number of species at Ringhaddy. F. serratus fronds are covered by a dense growth of a mixture of three hydroid species (Gonothyrea loveni, Laomedia flexuosa and Obelia dichotoma), sponge diversity is low, and the major ascidian present under boulders is Dendrodoa grossularia. The algal community around the more gently moving current flowing across the lower shore at Ringhaddy is also affected by the flow: details are in the Stage II sheet.

(d) **Mahee Island**

This site is affected by a tide race caused by emptying of the Ardmillan/Ringneill Bay area at low tide. It exhibits both features common to current influenced sites; emergence of sublittoral species and a wide diversity of filter feeders.

However computer analyses of species data usually places this site on an outlier: Twinspan analysis (Figures 5.8 and 5.9) links the site with the more exposed sites of the southern outer Co. Down coast, and not with the sites from Strangford Lough. This may be explained by examining the nature of the widest community on the lower shore, which replaces the Fucus serratus zone and lower part of the Ascophyllum zone in the area most affected by current. The boulders in this area are dominated by limpets and barnacles with Nucella, while the spaces between the boulders are covered by a thick carpet of mussels. Mussel and limpet/barnacle dominated shores are common along outer Co. Down; one example may be found at Craigalea. This type of community has been noted in areas around the Menai Straits affected by "steady but not disturbing tidal flow" by Lewis (1964). Only in the laminarian zone does a more typical Strangford rapids community develop; L. digitata with an understorey of encrusting coralline and non coralline red algae, together with sponges, hydroids and bryozoans.

(e) Castle Island

The lower shore current affected area at this site is a boulder causeway linking Castle Island and Darragh Island, which is only visible at low tide. The Ascophyllum dominated upper boulder shore is strongly affected by silt, which reduces algal and animal diversity under the fucoid canopy. The causeway, in contrast, supports the growth of large numbers of filter feeders, including Ciona intestinalis and Ascidia mentula. Lewis (1964) noted that the presence of large numbers of Ascidia mentula was a feature of areas influenced by currents of turbid water.

(iv) **Species characteristic of Strangford Lough rocky shores**

Two groups of species can be identified under this heading. Firstly there are some species which were regularly found on the intertidal region round Strangford Lough during the course of the survey, but which are present only rarely on the open coast intertidally. The second group is composed of those species which were only encountered in Strangford or Carlingford Loughs.

(a) Present and common in Strangford Lough; rare on the open coast.

Enteromorpha ramulosa
Chorda filum
Erythrotrichia carnea
Ephesia gracilis
Filograna implexa
Perinereis cultifera
Pholoe inornata
Sabella pavonina
Sthenelais boa
Balanus crenatus
Dexamine thea
Ericthonius punctatus
Phoxichilidium femoratum
Tritaeta gibbosa
Alcyonidium diaphanum
Cellepora pumicosa
Phaeostachys spinifera
Tubulipora phalangea
Ascidia conchilega
Ascidiella scabra
Anemonia sulcata
Asterina gibbosa
Psammechinus miliaris
Calliostoma zizyphinum
Dysidea fragilis
Ophlitaspongia seriata
Golfingia minuta

(ii) Only found in Strangford or Carlingford Loughs. Species present in both areas are marked with an asterisk.

Codium fragile spp. tomentosoides
Cystoseira nodicaulis
Eupolymnia nebulosa*
Flabelligera affinis
Thelepus cincinnatus*
Ascidiella aspersa*
Clavelina lepadiformis*
Corella parallelogramma
Pyura microcosmus*
Caryophyllia smithii
Asterina phylactica
Henricia sanguinclenta*
Leptasterias muelleri
Ocnus lactea
Pawsonia saxicola
Acanthochitona crinitus
Chlamys varia*
Emarginula reticulata
Facelina bostoniensis
Ocenebra erinacea*
Tonicella marmorea
Acervochalina limbata

These are not exhaustive lists, but examples only. The significance of some species appearing in both Strangford and Carlingford Loughs, but not on the open coast, will be discussed in a later section.

Sedimentary Shores

Surface fauna and flora

The major surface fauna and flora on the wide flats of muddy sand at the north end of the lough are mussel beds, cockle beds (cockles live just under the surface of the sand, but are often exposed by water movement) and Zostera mats. Scattered fucoid dominated boulder areas are also present on the flats, and Fucus vesiculosus, Dumontia incrassata, Littorina littorea and Balanus balanoides are commonly associated with the mussel beds.

Cockle beds are present all over the flats, while extensive mussel beds exist along the lower, more seaward parts of the flats. Zostera distribution is seasonal, but the plant is widespread when it occurs.

A qualitative survey was made of the substrate and surface macrofauna and flora and the larger infaunal species of Greyabbey Bay in July 1986 (Figures 6.11(a) and 6.11(b)). The bay has many features in common with the wider muddy sand flats to the north east of the lough.

Sand is less muddy towards low water, where Zostera growth is reduced. Cockles and Hydrobia ulvae, a surface living prosobranch, are common on the muddy areas associated with Zostera. Mussel beds are not present on the inner sedimentary areas, but exist between mid and low water.

Macrofauna are rare or absent on the surface of the muddiest areas in the lough, such as the mud flats in the south west or the sheltered bays along the west coast. Zostera grows in some areas while in others the sediment may be covered by extensive growths of mat forming Enteromorpha species. This is particularly the case in enclosed areas affected by a freshwater influence, such as Castleward Bay (site 54. Sedimentary shore site numbers in this section all refer to map numbers in Figure 6.3).

Around the remainder of the lough sedimentary areas are often closely associated with rocky shores (as at Ringburr Point, the site used as an example in the rocky shore section).

These can take the form of bedrock outcrops (Mid Island Bay, site 33) or scattered boulders (as at Herring Bay, site 35) present in an otherwise sedimentary area. In other places the sediment surface itself, when composed of gravel and small stones, may serve as an attachment point for communities of ephemeral algae and their associated amphipods and molluscs (as at Isle O'Valla, site 55). In each case the surface biological communities are as described in the section on rocky shores.

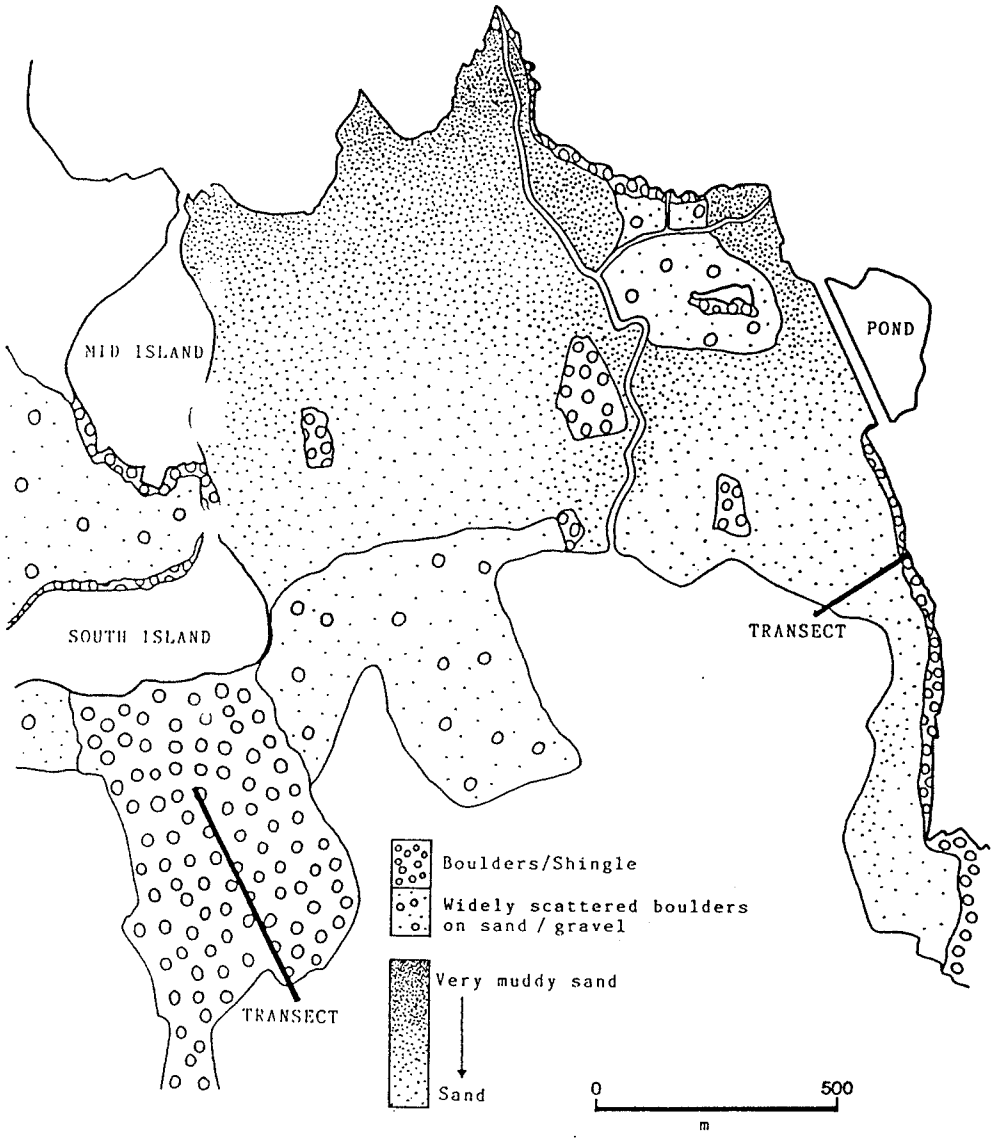


Figure 6.11a: Physical shore types of Greyabbey Bay, in Strangford Lough.

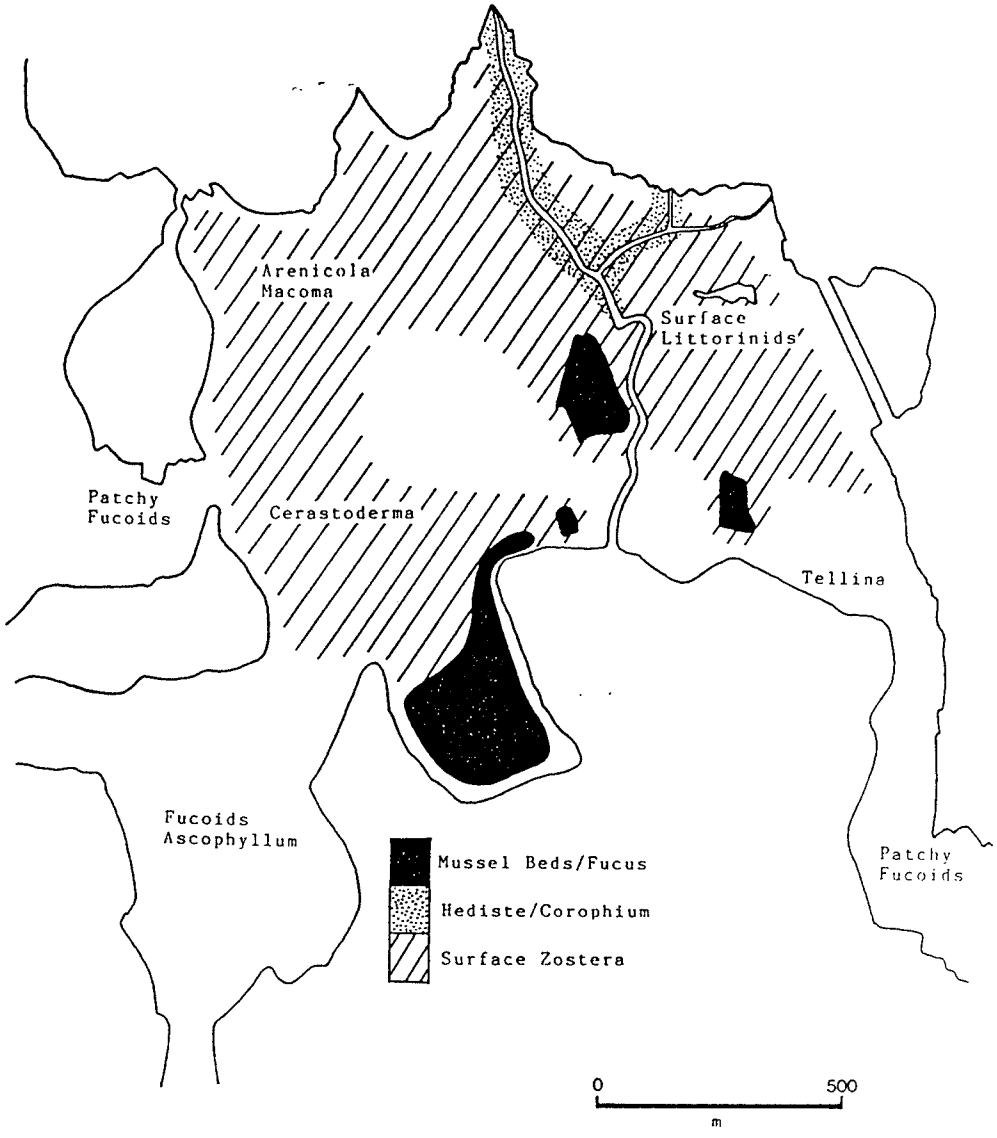


Figure 6.11b: Surface and infaunal communities of Greyabbey Bay, in Strangford Lough.

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Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
LOCATION DATA STAGE II

S41

LOCALITY c	GREYABBEY BAY	GRID REF d	J680672	LONG e	05/33·20/W	LAT f	54/31·30/N
SHEET No a		PUNCH CARD No b		Ht. OF LW. g (m)		TIME OF LW. h		DATE i	
ROCKY SHEET No (if any) k		PHOTO No		ARRIVAL TIME l		DEPARTURE m		RECORDER	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	19	36
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5 X	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Large Boulders (>1024 mm)	52	69	86
Med. Boulders (512–1024 mm)	53	70 X	87
Small Boulders (256–512mm)	54	71 X	88
Cobbles (64–256mm)	55	72	89
Pebbles (4–64 mm)	56	73	90
Granules (2–4 mm)	57	74	91
Coarse Sand (½–2 mm)	58	75	92
Med. Sand (¼–½ mm)	59 X	76	93
Fine Sand (1/16–¼ mm)	60 X	77	94
Shelly Sand (25% sh.)	61	78	95
Muddy Sand	62	79	96
Mud	63	80	97
Shingle	64	81	98
Storm Beach	66	82	99
Rock Layer N.S.	66	83	100
Man Made	67	84	101
	69	85	102

ROCK TYPE	
Spec:	
Igneous/Metamorphic	103 X
Limestone	104
Hard Mudstone	105
Soft Mudstone	106

SLOPE / INTERTIDAL EXTENT	
Steep (<50m)	107
Mod. (50 - 150m)	108
Gentle (>150m)	109
Mod. Upper Beach L.W. Flat	110
Flat (none of above)	111 X

HORIZONTAL EXTENT (m)	
<500	112
500 – 1000	113 X
1000 – 1500	114
>1500	115

OFFSHORE FEATURES	
Islands	116 X
Reefs	117 X
Breakwaters	118
Sandbanks	119
Shoal	120

COASTAL BACKING	
Sand Dunes	121
Low Cliffs	122
Mod. Cliffs	123
High Cliffs	124
Saltmarsh	125
Grassland	126 X
Peat	127
Valley	128 X
Freshwater	129
Trees	130 X
Other:	131 X
Town	

STEEPNESS INLAND	
0	132
1	133 X
2	134
3 – 5	135
5 – 10	136
>10	137

PREVAILNG WIND/ASPECT	W	A
N	138	146
NE	139	147
E	140	148
SE	141	149 X
S	142	150
SW	143	151
W	144	152
NW	145	153

Wind Data:

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	154
Exposed	155
Moderate	156
Sheltered	157 X
V. Sheltered	158

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
<2	159 X	164 X
2 – 10	160	165
10 – 50	161	166
50 – 100	162	167
>100	163	168
SEA HORIZON	10 miles	40 miles
0	169 X	182 X
1	170	183
2	171	184
3	172	185
4	173	186
5	174	187
6	175	188
7	176	189
8	177	190
9	178	191
10	179	192
11	180	193
12	181	194

Time of ELWST n	6 T 0 9
Mean Spring Tide Range (m) o	
Mean Neap Tide Range (m) p	
Annual Rainfall (mm) q	

CURRENT STRENGTH (estimate)	
Strong	195
Moderate	196
Weak	197 X

SALINITY	
Normal	198 X
Slighty Reduced (28-33‰)	199
Low (<28‰)	200
Stream Flowing on S.	201 X
Spec:	

ACCESSIBILITY	
Car Useable to Near Shore	202 X
>10 min. Walk	203
Boat Only	204

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	205
100 – 500	206
500 – 1000	207
1000 – 5000	208 X
>5000	209
Absent	210

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	211
100 – 500	212
500 – 1000	213
1000 – 5000	214
>5000	215
Absent	216 X

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	217
100 – 500	218
500 – 1000	219
1000 – 5000	220
>5000	221
Absent	222 X

SCIENTIFIC & CONSERVATION INTEREST

BIOTA

Barren	223	
Crustacea/ Poly.	224	
Tellina	225	X
Macoma	226	X
Scrobicularia	227	
Spisula	228	
Lanice	229	
Pullastra	230	
Echino. Sili.	231	
Other:(Spec)	232	
	233	
	234	
	235	
	236	
	237	
	238	
	239	
	240	
	241	

PROMINENT SUBHABITATS

Spec:	242	
	243	
BOULDERS	244	X
	245	
	246	
	247	
WET AREAS	248	X
	249	
	250	
	251	
	252	
	253	
	254	

No/ DIVERSITY OF SUBHABITATS

High	255	
Medium	256	X
Low	257	

RELATIVE SPECIES RICHNESS

Good	258	
Average	259	X
Poor	260	

ORNITHOLOGICAL INTEREST

	Feed.		Nest.	
Waders	261	X	265	
Wildfowl	262		266	
Gulls	263		267	
Seabirds	264	X	268	

SEAL HAUL OUT	269	

NATURE RESERVE STATUS

Site Within N.N.R. etc.	270	
N N R or A S I Nearby	271	
N T or R S P B or Loc. Res Nearby	272	
Nos. of Sub. Survey Sites Nearby		

SUBJECTIVE RATING

V. Good	273	
Good	274	X
Fair	275	
Poor	276	

NOTES

HUMAN INFLUENCE

DISTANCE TO NEAREST TOWN (km) r [ ][ ][5]

AMENITY VALUE

Attractive Beach or Surround	277	
Resort Town Nearby	278	
Toilet, Shops & Cafes Present	279	
Toilet, Shops & Cafes Nearby	280	
Car Park	281	X
Popular	282	

INDUSTRY & POLLUTION

Factories Present	283	
Evidence of Industrial Pollution		
— Toxic	284	
—Suspended S	285	
Sewage Pollution	286	
Land Reclamation	287	
Other:		

SHORE USAGE

Beach Fishing	288	
Bait Digging	289	
Shellfish Collecting	290	
Algal Harvesting	291	
Aquaculture	292	
Mooring	293	
Watersports	294	
Other:	295	

SKETCH MAP OF LOCATION

See insert.

METHOD OF ACCESS

Car may be parked in a NT carpark towards Greyabbey. Any part of the bay can be reached on foot.

LOCATION DESCRIPTION

A large sheltered expanse of sand habitats ranging from muddy sand to gravel, which is bounded on three sides by land. Extensive boulder areas occur which tend to be dominated by Ascophyllum and Mussel mats. The infauna communities are Tellina and Macoma dependent on substrata. Mud Zostera occurs on the surface over most of the bay thus it is an important feeding ground for birds etc. Streams flow into the shore, though there is little evidence of them bringing pollution.

GENERAL PHOTOGRAPHS

S41A

INSTITUTE OF OFFSHORE ENGINEERING
HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
Transect Data Stage II

NAME: GREY ABBEY BAY A	TRANSECT No: 41A	LOCATION No: 41	ROCKY SHEET No (if any):
M No	Ht. OF L.W.:	TIME OF L.W.: 1230	DATE: 13/07/86
	TIME OF ARRIVAL: 1210	TIME OF DEPART.: 1430	RECORDER: TCT

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Sediment Type	Surface Features	Depth of Black Layer c.m.	Depth of Water Table c.m.
1						–	–
2						3	>10
3						5	4
4						0	2
5						0	2

DESCRIPTION OF TRANSECT SITE

A large, flat, sheltered expanse of sandy habitats ranging from muddy sand to gravel. It is situated on the eastern shore of Strangford Lough bordered by two islands on one side and mainland on the other two. Extensive boulder areas occur which are dominated by Ascophyllum and for Mytilus the lower more towards low water. Zostera is common throughout the bay.

The transect was taken on a narrow end of the bay. See map. The upper shore is shingle with patchy zones of Pelvetia and F. spiralis below which a small belt of medium boulders occur with Mytilus and Balanus covering, the uppermost boulders had Ascophyllum attached Littorina littorea is abundant. Clay occurs beneath the boulders. The lower shore is flat and consists of fine sand with many Arenicola appearing relatively homogenous.

Transect backing was a wall to the road embankment though most of the bay is backed by wood and farm lands. Freshwater drains into the bay and three streams flow into it see map.

STATION 1 - Situated in shingle. No digging possible.

STATION 2 - Upper boulders, stones on surface with some medium sand ~~with~~ and gravel beneath. Ascophyllum dominates the boulders. A few Arenicola Clay layer 3 to 4 cm deep.

STATION 3 - Lower boulders, much shell gravel stones and pebbles Clay layer 10 to 5cm sediment sampled from above clay. Much organic detritus within the sediment

STATION 4 - } Fine sand with little organic detritus within Arenicola
STATION 5 - } casts common (30/m²)

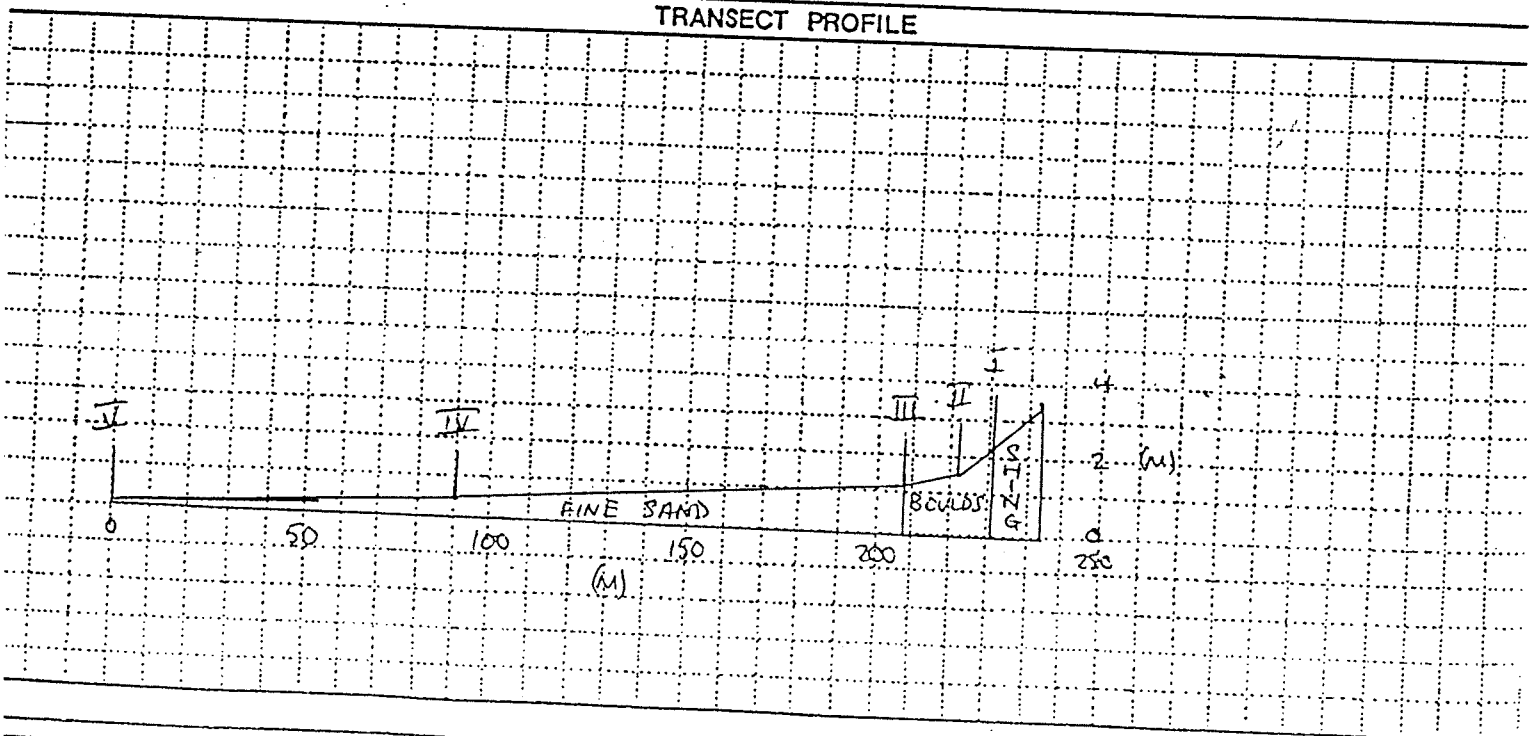
REFERENCE POINT

A white square painted on the road embankment wall at the top of the shore.

TRANSECT MAP

See Insert.

TRANSECT PROFILE



Station	1	2	3	4	5				
Height	2.20	1.65	1.10	0.55	0				

distances given in [illegible]

Station / Species	No.	1	2	3	4	5				
ANNELIDA										
Arenicola marina	P177			P	4	3				
Capitella capitata	P172					P				
Chaetozone setosa	P155		P	19						
Eteone longa/flava	P345		P							
Glycera tridactyla	P537		1							
Mysta picta	P352		2	1	2	P				
Nephtys hombergi	P516		1	6	4	6				
Pygospio elegans	P168		4	53	P					
Scoloplos armiger	P63			1						
Sigalion mathildae	P299					P				
Spio filicornis	P167		2							
ARTHROPODA										
Amphilisca brevicornis	S396			P	2	1				
Carcinus maenas	S1225			P						
Crangon crangon	S1074			1						
MOLLUSCA										
Cerastoderma edule (adult)	W1147		1	P	1					
Cerastoderma edule (juv)			1		1	P				
Spisula subtruncata	W1165			P						
Tellina tenuis	W1201		9	6	1	5				

Infauna

Twinspan analysis (Figures 5.16 and 5.17) indicated the existence of two major types of biological community in the sediment of Strangford Lough; one associated with muddy sand, which may contain a gravel and stone component, and the other associated with mud and muddy gravel.

These types of community can merge into one another, as on the northern flats, where the muddy sand community in the relatively clean sand at mid and low water (sites 37, 39, 40, 41) gives way to the muddy community in the very fine sediments near high water level (site 38).

This transition can also be illustrated in Greyabbey Bay (Figures 6.11a and 6.11b). The dominant bivalve in the cleaner muddy sand towards low water on the sampling date was Tellina tenuis, a species commonly found on unexposed open coast sites. In the muddier sand of the mid tide region and above the dominant bivalves were cockles (Cerastoderma edule) and Macoma balthica. Cockles were also present at low water, but became much more common in the muddier areas. The burrows of the amphipod Corophium volutator, a species characteristic of muddier sites, also became more common towards high water. Greyabbey Bay also illustrates one other feature associated with some sedimentary areas; the presence of large concentrations of the polychaete Hediste diversicolor in areas of reduced salinity, as around the small stream which enters the north of the bay. H. diversicolor is very common in the muddy sediment of the Comber estuary at site 42.

The wide flats at the north end of the lough may contain large numbers of individual animals per square metre. For example there are large numbers of Corophium volutator or Macoma balthica in the muddier areas towards high water. However species diversity in this area is poor.

Species diversity is also poor in the sheltered muddy bays on the western shore of the lough and in the mud flats of the south west, which contain a very fine, silty, glutinous mud (Quarterland Bay, site 50;, Castle Island Bay, site 52). The infauna of these areas is dominated by very large numbers of Manayunkia aestuarina, Fabricia sabella and Oligochaete species. Several other small polychaetes are also present, but amphipods and molluscs are rare.

Species diversity is greater in the shores composed of more mixed sediment associated with the rocky shores along the east and west banks of the lough, the islands and the Narrows. This is true whether sites belong to the "muddy sand" community type defined by Twinspan, or the "muddy" community type; the lough contains a good range of sites belonging to both community types.

The two example sites chosen are:

(i) A transect taken from high to low water in the south east of Greyabbey Bay, across an area of relatively clean muddy sand. This is an example of the type of muddy sand infaunal community which might be expected on the lower shore of the flats across the north of the lough (Figure 6.12).

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Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
LOCATION DATA STAGE II

S25

LOCALITY c LAUNCHES LITTLE (ISAND)	GRID REF d J541503	LONG e 05/38·05/W	LAT f 54/22·20/N		
SHEET No a	PUNCH CARD No b	Ht. OF LW. g (m)	TIME OF LW. h	DATE i	
ROCKY SHEET No (if any) k	PHOTO No.	ARRIVAL TIME l	DEPARTURE m	RECORDER LZ	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	19	36
Sheltered Coast	2 X	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24 X	41
Sea Lough	8	25 X	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Large Boulders (>1024 mm)	52	69	86
Med. Boulders (512–1024 mm)	53	70	87 X
Small Boulders (256–512mm)	54	71	88 X
Cobbles (64–256mm)	55	72	89
Pebbles (4–64 mm)	56	73	90
Granules (2–4 mm)	57	74	91
Coarse Sand (½–2 mm)	58	75	92
Med. Sand (¼–½ mm)	59	76	93
Fine Sand (1/16–¼ mm)	60	77 X	94
Shelly Sand (25% sh.)	61	78	95
Muddy Sand	62 X	79	96
Mud	63	80 X	97
Shingle	64	81	98
Storm Beach	66	82	99
Black Layer N.S.	66	83 X	100
Man Made	67	84	101
	68	85	102

ROCK TYPE	
Spec:	
Igneous/Metamorphic	103
Limestone	104
Hard Mudstone	105
Soft Mudstone	106

SLOPE / INTERTIDAL EXTENT	
Steep (<50m)	107
Mod. (50 - 150m)	108
Gentle (>150m)	109 X
Mod. Upper Beach L.W. Flat	110
Flat (none of above)	111
HORIZONTAL EXTENT (m)	
<500	112
500 - 1000	113
1000 - 1500	114 X
>1500	115
OFFSHORE FEATURES	
Islands	116 X
Reefs	117
Breakwaters	118
Sandbanks	119
Shoal	120
COASTAL BACKING	
Sand Dunes	121
Low Cliffs	122
Mod. Cliffs	123
High Cliffs	124
Saltmarsh	125
Grassland	126 X
Peat	127
Valley	128
Freshwater	129
Trees	130
Other:	131
STEEPNESS INLAND	
0	132 X
1	133
2	134
3 - 5	135
5 - 10	136
>10	137

PREVAILNG WIND/ASPECT	W	A
N	138	146 X
NE	139	147
E	140	148
SE	141	149
S	142	150
SW	143	151
W	144	152
NW	145	153
Wind Data:		
EXPOSURE TO WAVE ACTION		
estimate V. Exposed	154	
Exposed	155	
Moderate	156	
Sheltered	157 X	
V. Sheltered	158	

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
<2	159 X	164 X
2 - 10	160	165
10 - 50	161	166
50 - 100	162	167
>100	163	168
SEA HORIZON	10 miles	40 miles
0	169 X	182 X
1	170	183
2	171	184
3	172	185
4	173	186
5	174	187
6	175	188
7	176	189
8	177	190
9	178	191
10	179	192
11	180	193
12	181	194

Time of ELWST n	6709
Mean Spring Tide Range (m) o	
Mean Neap Tide Range (m) p	
Annual Rainfall (mm) q	
CURRENT STRENGTH	
estimate Strong	195
Moderate	196 X
Weak	197
SALINITY	
Normal	198 X
Slighty Reduced (28-33‰)	199
Low (<28‰)	200
Stream Flowing on S.	201
Spec:	
ACCESSIBILITY	
Car Useable to Near Shore	202
>10 min. Walk	203 X
Boat Only	204

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	205
100 - 500	206
500 - 1000	207
1000 - 5000	208 X
>5000	209
Absent	210
DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	211
100 - 500	212
500 - 1000	213
1000 - 5000	214
>5000	215
Absent	216 X
DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	217
100 - 500	218
500 - 1000	219
1000 - 5000	220
>5000	221
Absent	222 X

SCIENTIFIC & CONSERVATION INTEREST

BIOTA

Barren	223	
Crustacea/ Poly.	224	
Tellina	225	X
Macoma	226	X
Scrobicularia	227	
Spisula	228	
Lanice	229	X
Pullastra	230	
Echino. Sili.	231	
Other:(Spec)	232	
	233	
	234	
	235	
	236	
	237	
	238	
	239	
	240	
	241	

PROMINENT SUBHABITATS

Spec:	242	
	243	
	244	
	245	
	246	
	247	
	248	
	249	
	250	
Under Seaweeds	251	X
	252	
	253	
	254	

No/ DIVERSITY OF SUBHABITATS

High	255	
Medium	256	X
Low	257	

RELATIVE SPECIES RICHNESS

Good	258	X
Average	259	
Poor	260	

ORNITHOLOGICAL INTEREST

	Feed.		Nest.	
Waders	261	X	265	
Wildfowl	262		266	
Gulls	263	X	267	
Seabirds	264	X	268	

SEAL HAUL OUT	269	

NATURE RESERVE STATUS

Site Within N.N.R. etc.	270	
N N R or A S I Nearby	271	
NT or RSPB or Loc. Res Nearby	272	X
Nos. of Sub.Survey Sites Nearby		

SUBJECTIVE RATING

V. Good	273	
Good	274	X
Fair	275	
Poor	276	

HUMAN INFLUENCE

DISTANCE TO NEAREST TOWN (km) r 3

AMENITY VALUE

Attractive Beach or Surround	277	
Resort Town Nearby	278	
Toilet, Shops & Cafes Present	279	
Toilet, Shops & Cafes Nearby	280	
Car Park	281	
Popular	282	

INDUSTRY & POLLUTION

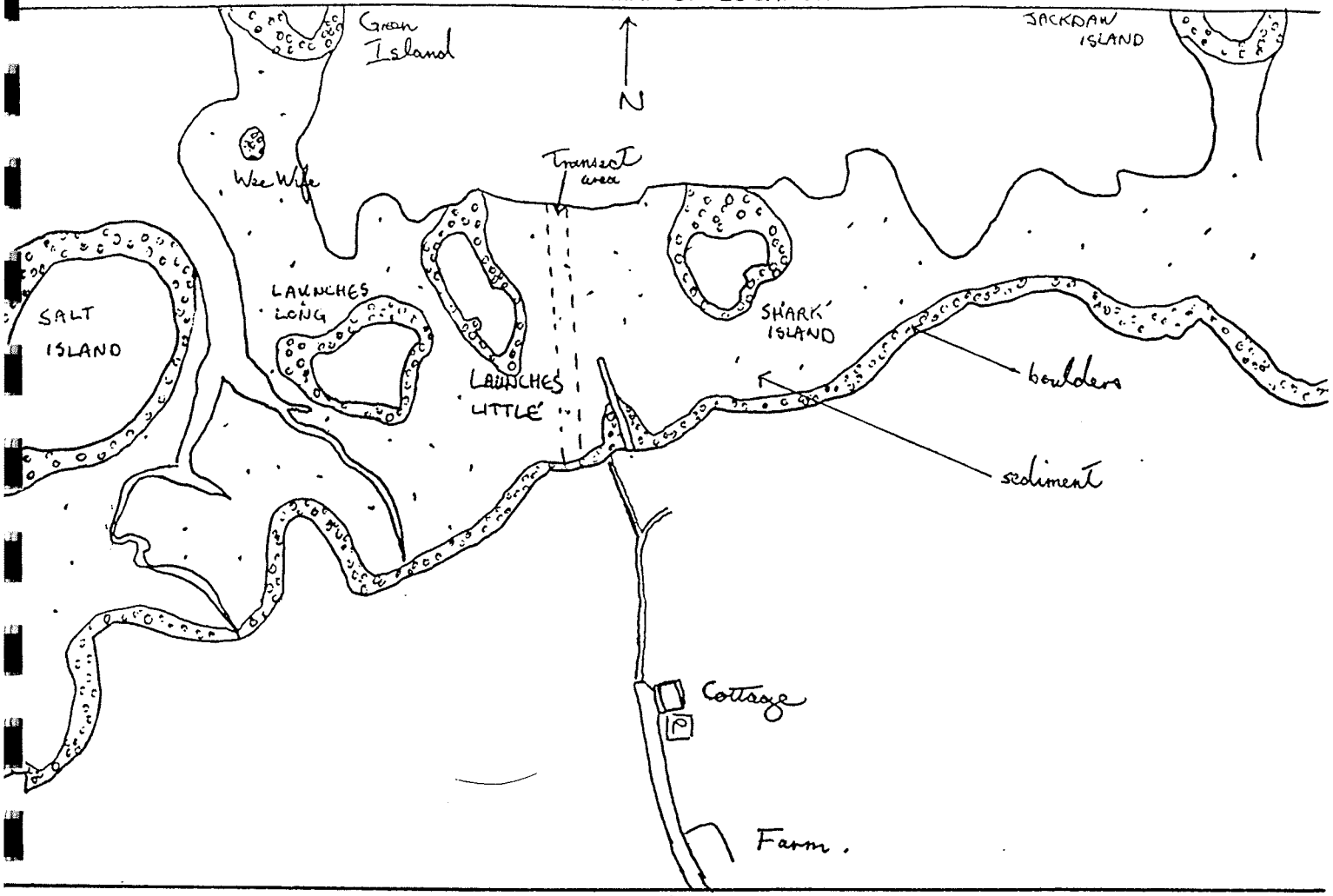
Factories Present	283	
Evidence of Industrial Pollution		
— Toxic	284	
—Suspended S	285	
Sewage Pollution	286	
Land Reclamation	287	
Other:		

SHORE USAGE

Beach Fishing	288	
Bait Digging	289	
Shellfish Collecting	290	
Algal Harvesting	291	
Aquaculture	292	
Mooring	293	
Watersports	294	
Other:	295	

NOTES

SKETCH MAP OF LOCATION



METHOD OF ACCESS

coming from Stranraer, Turn right down the side road which leads To Myra Castle. Bypass the old gateway and drive on past a large farm, To a cottage beside a gate marked 'Strictly Private'. Park at the cottage and follow the path down to the shore.

LOCATION DESCRIPTION

The location is the sedimentary area between Launches Little and Shark Island, the former of which are cut off from the mainland at high Tide. The upper shore around the islands and at the head of the transect is composed of muddy Ascophyllum dominated boulder areas. There are small outcrops of boulders and single boulders scattered throughout the area especially on the lower shore. The sediment on the lower shore is slightly muddy fine sand. The sediment becomes muddier Towards high water, while the sedimentary areas in the boulder shores are composed of pebbly, muddy gravel. A layer of clay is under the location.

GENERAL PHOTOGRAPHS

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Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
Transect Data Stage II

S25A

NAME: LAUNCHES LITTLE
No:
TRANSECT No: 525A
LOCATION No: 525
ROCKY SHEET No (if any):
Ht. OF L.W.:
TIME OF L.W.: Killyleagh 1356
DATE: 15 07 86
TIME OF ARRIVAL: 1345
TIME OF DEPART.: 1630
RECORDER: IV

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Sediment Type	Surface Features	Depth of Black Layer c.m.	Depth of Water Table c.m.
1		N		6,9	9,11	0.5 cm	—
2		N		6,9,12	9,11	0.5 cm	4
3		N		5,6,12	11,9	0.5 cm	4
4		N		5,12,8	11,9	0.5 cm	0
5		N		3,4,8	9	6 cm	0

DESCRIPTION OF TRANSECT SITE

The transect was taken across the sedimentary area lying between Launches Little Shuck Island. The lower shore sediment is fine sand (with small boulder outcrops covered on the surface); the mid shore sediment is muddy sand, becoming muddier towards high water, while the upper shore is composed of muddy gravel and pebbles between Ascophyllum dominated sediment covered boulders. A clay layer lies under the transect. General collections were taken from the boulder areas at low and high water. There were large numbers of Arenicola and Lanice on the lower shore, and sediment surface was covered by dense mats of brown filamentous algae (with Enteromorpha) which became less common higher up the intertidal. The black layer was near the surface in the higher sites.

el 1. Clay layer 6 cm below the surface, overlying sediment (between Ascophyllum covered boulders) composed of muddy pebbly gravel. Black layer about ½ cm down.

el 2. In lower part of Ascophyllum dominated upper boulder shore. Clay layer (softer clay than at level 1) from 4-10 cm below the surface. Overlying sediment similar to sediment at level 1. Black layer ½ cm.

l 3. Below upper boulder shore. Clay layer 3 cm, below muddy, gravelly sand. Black layer ½ cm. Small Enteromorpha mats on the surface, and F. vesiculosus on isolated boulders. Very few Arenicola casts.

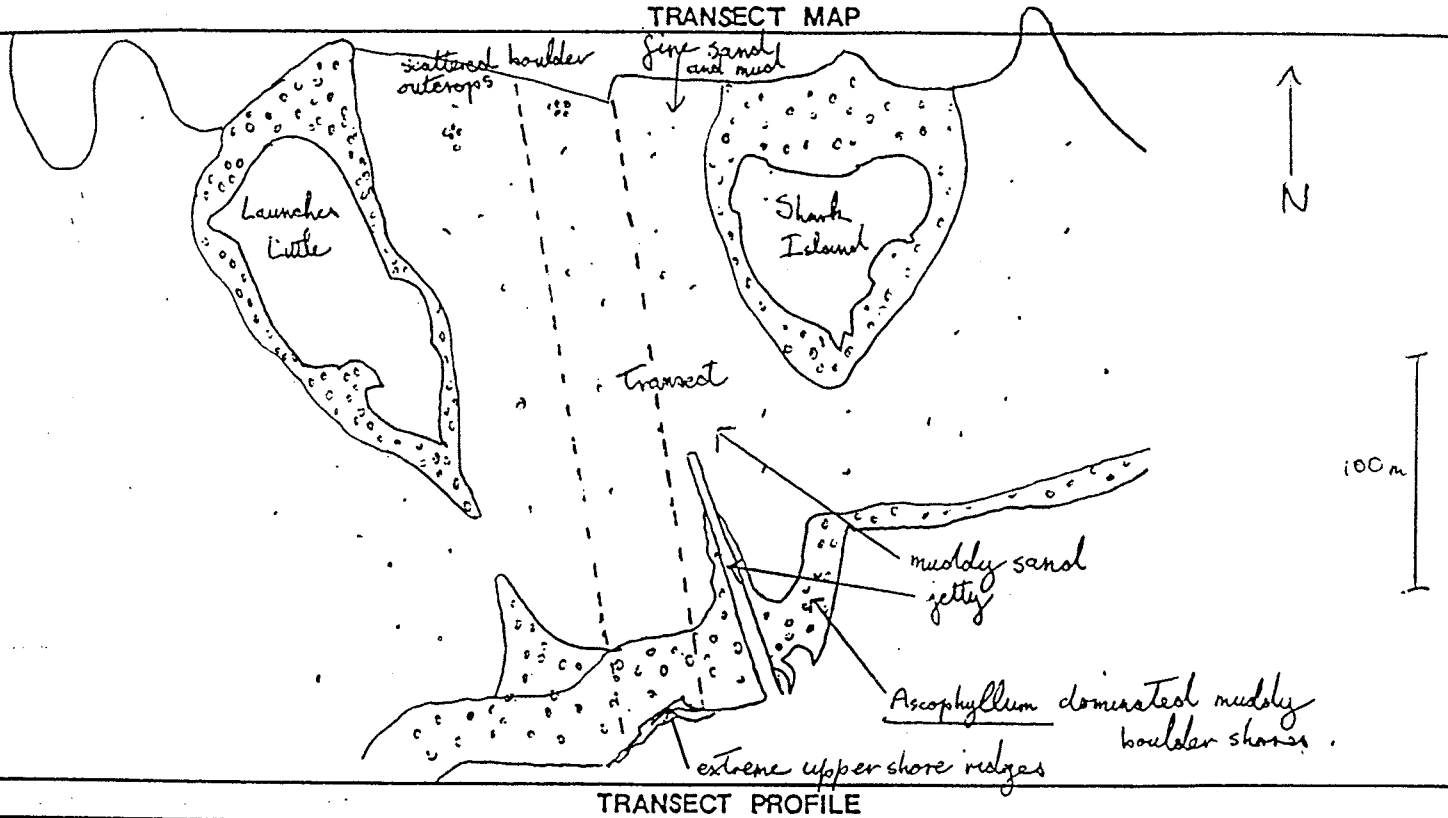
l 4. Patches of brown filaments and Enteromorpha on the surface. Up to 15 Arenicola casts/m². F. vesiculosus and F. serratus on isolated boulders. Muddy sand lying on a clay layer 6 cm down, slightly gravelly. Black layer ½ cm down.

l 5. Near blanket cover of brown filaments on the surface. F. serratus covered boulder outcrops with a good diversity of epifauna. Many Lanice (upto 50/m²) and Arenicola (their casts forming large mounds in the sediment — up to 30/m²)

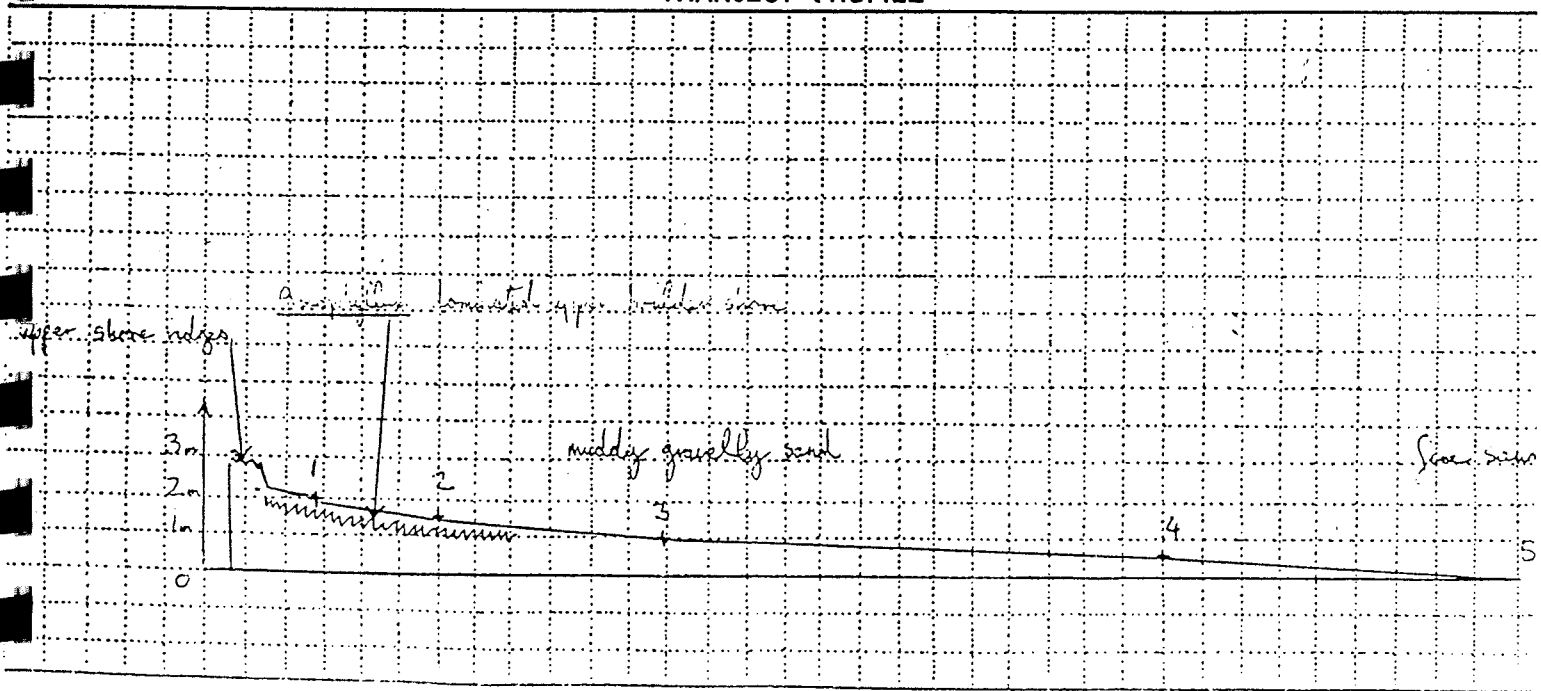
REFERENCE POINT

The Transect was taken across the intertidal about 50 m west of the jetty.

TRANSECT MAP



TRANSECT PROFILE



Station	1	2	3	4	5				
Height	2·0	1·5	1·0	0·5	L.W.				

Station		1	2	3	4	5				
Species	No.									
ANNELIDA										
Amphicteis acutifrons	P674	16	P	45	1	P				
Anaitides maculata	P320			P	P	2				
Arenicola marina	P177		2		P	P				
Aricidea minuta	P72		3	22	6					
Capitella capitata	P172	4	74	12	19	15				
Capitellidae sp	167									
Chaetozone setosa	P155			24	30	1				
Cirratulus cirratus	P147					2				
Eteone longa/flava	P345	2	2	9	1	4				
Euclymene oerstedii	P185					26				
Exogone hebes	P468			9	5	11				
Exogone naidina	P465			P	1	1				
Ealoncia sabella	P746	44	7	12	1					
Glycera tridactyla	P587				P	P				
Harmothoe imbricata	P262					P				
Magelona papillicornis	P125			P	1					
Malacoceros fuliginosa	P93				3	1				
Marphysa bellii	P588					1				
Nanaynkia aestuarina	P747	10								
Tediomastus fragilis	218			5	8	1				
Telisma cristata	P680					1				
Ticropthalmus Szelbowii	P410				P					
		84	24	12	4					
		4		4						
Nephtys hombergii	P516		P		2	2				
Notomastus latericeus	P168					2				
Oligochaete sp.	108	7010	1216	214	15	121				
Pygospio elegans	P108	16	114	169	216	121				
Scolelepis armiger	P63	164	3	214	314	113				
Sigalion mathildae	P299					P				
Sphaerosyllis erinaceus	P464				P	P				
Spio filicornis	P167			P	1	1				
Tholoe inornata	P306					P				
ARTHROPODA										
Apseudes bermudensis	S396	P	P	P	36	110				
Cheirocratus jurinei	S623	P								
Thyrocaris guilliamsoniana	S551				1	8				
Corophium acherusicum	S1225					1				
Corophium crassicorne	S700		P	1						
Corophium volutator	S703				4	7				
Crangon septemspinosa	S709	71								
Diastylis sculpta	S656				3					
Gammarus fasciatus	S536	3								
Gammarus locusta	S568		9	4	6	22				
Lysianassa granulosa	S259	P								
Monoculopsis macclatus	S692					2				
Ampelisca integer	S949				P					
Monoculodes borealis	S579				4					
Orchomene humilis	S1083				1					
Pontoporeia femorata	S946	P	1		2	1				
Protomedeia longicornis	S145				1	P				
Unciola irrorata	S561					4				

tation / pecies	No.	1	2	3	4	5				
MOLLUSCA										
Prostoderma edule	N1147		P		2					
Tellina marmorea	N150		1							
Lucinoma borealis	N1076				1					
Macoma balthica	N1286		P	P	P	P				
Mysella bidentata	N1107				4					
Tellina fabula	N1195			1	3	2				
Tellina tenuis	N861				2					
Tritonia nivosa	N1272		P							
Cowa striatula	N1267				P					
NEMATODA sp	215	8H	24	2	1					
NEMERTINEA sp	143	1		P						

(ii) A transect taken between Launches Little and Shark Island on the southern shore of the lough; an example of mixed muddy sediments (Figure 6.13).

Current Swept Areas

As with the rocky sites, communities on the lower shore in current swept areas show evidence of the emergence of sublittoral species.

Two low tide periods were spent on a quick survey of obvious large lower shore sedimentary macrofauna in the Strangford narrows. Among the species discovered were the burrowing anemone Cerianthus lloydi in the sand of Kilclief Bay, and Echinocardium cordatum and Ensis siliqua at Cloghy Rocks.

Sedimentary habitats in the narrows have been investigated by Dr Boaden and other workers from the QUB marine biology station at Portaferry. Some of their records are noted in Appendix XIII.

The infauna of the muddy gravel associated with the rocky habitats present at the tidal rapids site of the Dorn were also investigated. A diverse polychaete, arthropod and mollusc community was found, including Venerupis pullastra. Golfingia vulgaris was present in the sediment, but was found nowhere else round the coastline during the course of this survey. The echinoderm Leptosynapta inhaerens was also present. The Dorn is another area which has been investigated by workers from Portaferry; again some of their records are contained in Appendix XIII.

Strangford Lough - Conservation

The aim of this section is to discuss conservation within the context of Strangford Lough and the Narrows. The importance of Strangford in relation to the rest of Co. Down will be discussed in Section 6.3.3.

Conservation will be discussed only in terms of intertidal habitats and biological communities. For example north Strangford sedimentary flats are important for bird life, and other areas are seal haul-outs; these will not be considerations on the present discussion.

Two types of area will be listed:

(i) Individual sites or small areas which are particularly rich or are examples of unique habitats which merit protection.

(ii) Larger areas which contain a good diversity of habitat and community types typical of Strangford Lough.

Sites in category (i) may also be present in areas defined in category (ii).

The sites and areas are illustrated in Figures 6.14. The individual sites (which are described more fully in the text) have been chosen from a combination of results gained from the survey, and from information gained by speaking to Dr. Pat Boaden, of Q.U.B. Marine Biology Station, Portaferry.

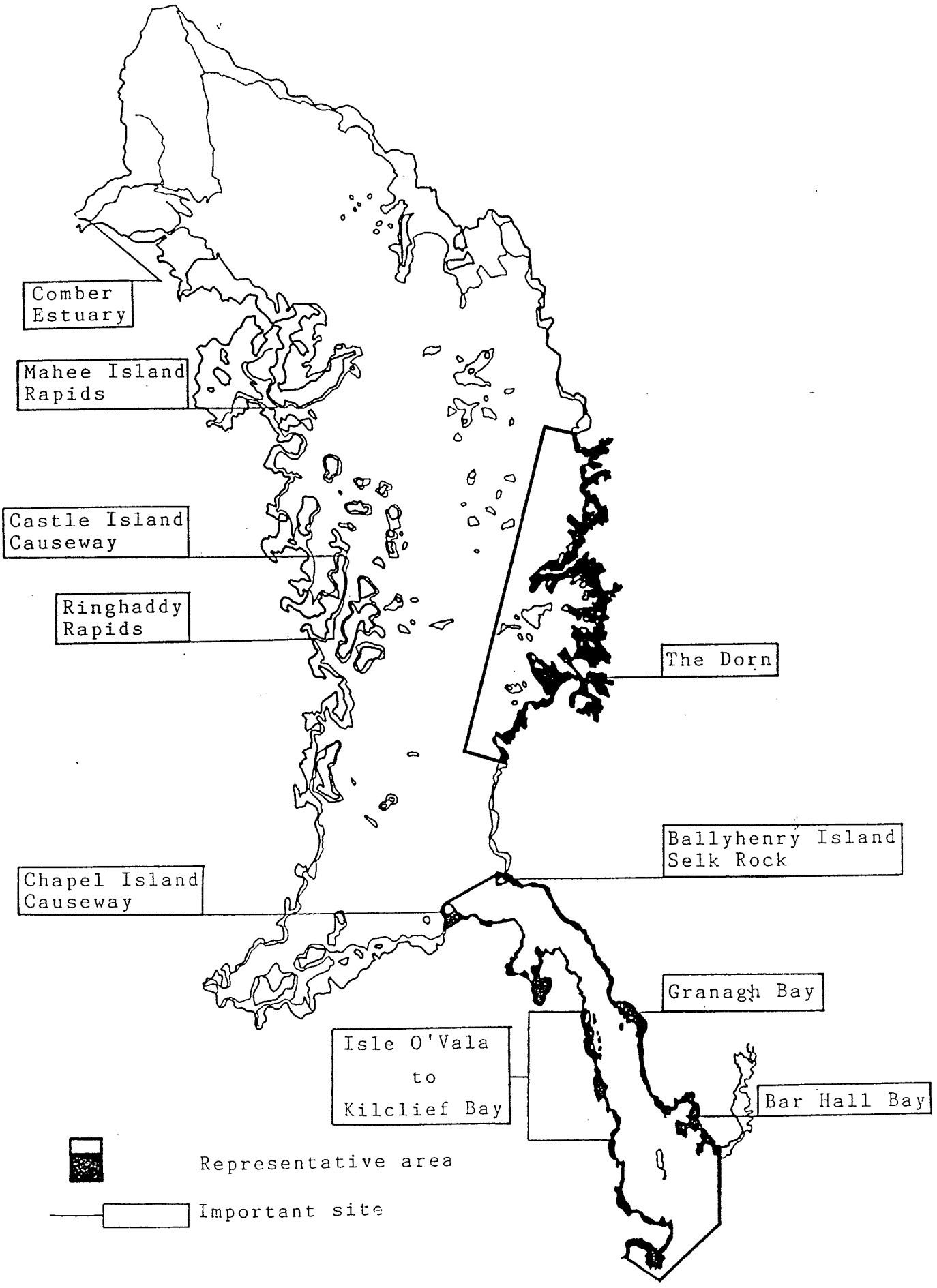


Figure 6.14: Areas of conservation importance in Strangford

(i) **The individual sites are:**

1. Kilclief Bay:- Sandy bay with good examples of the emergence phenomenon.

2. Cloghy Rocks - Isle O'Valla:- Good diversity of sediment types; examples of emergence phenomenon.

3. Chapel Island Causeway:- Affected by current flow.

4. Ringhaddy Rapids:- Unusual tidal rapids; species rich.

5. Castle Island Point:- Affected by strong current flow.

6. South of Mahee island:- Strong tidal currents. Current effects are probably also apparent between the western point of Rainey Island, the mainland and Sketrick Island.

7. The Comber Estuary:- Estuaries are not common in Northern Ireland.

8. The Dorn:- Tidal rapids. Richest rocky shore site for invertebrates visited during course of survey. Unusual sedimentary fauna.

9. Ballyhenry Island/Selk Rock:- Very rich fauna. Ascophyllum nodosum f. mackaii present on muddy gravel between island and shore.

10. Bankmore Hill:- Rocky shore animals include several examples of the emergence phenomenon. Sedimentary shore animals to the north of Bankmore Hill also include normally sublittoral species.

11. Granagh Bay:- Wide variety of sedimentary and rocky habitat types. Very rich fauna.

12. Bar Hall Bay:- Wide variety of sedimentary and rocky habitat types.

(ii) The two larger areas described below contain a good range of sedimentary and rocky habitats and their associated biological communities. They will be discussed in terms of the criteria outlined by Mitchell (1986) for the comparative evaluation of marine sites.

(a). The Strangford Narrows, including, at the northern end, Selk Rock and Ballyhenry Island on the east bank and Chapel Island on the west bank; extending as far south as Ballyquintin Point on the east bank, and including the rocky and sedimentary habitats around Killard Point on the west bank.

Three criteria defined by Mitchell (1986) are particularly applicable to the Narrows; representativeness, rarity and diversity.

Representativeness.

The Narrows area contains representatives of both the sedimentary biological community types defined by TWINSPAN as being characteristic of Strangford Lough; one associated with muddy sand and the other with mud. The rocky shore communities found in the Narrows are representative Strangford sites as determined by Wards analysis and Lance Williams analysis. However, TWINSPAN analysis and Decorana suggest that rocky sites to the north of the lough may be different from those in the south; sites in the Narrows are representative only of the southern groups of sites in this case.

Rarity

Two types of rarity exist; habitat rarity (which may be associated with rare biological communities) and species darity. These will be discussed separately.

Habitat rarity: Bedrock habitats are rare in the main body of the lough, but common in the Narrows, and subhabitats associated with bedrock, such as rock pools and crevices, are also more common. The Narrows contain an example of a habitat absent from the remainder of the lough; the clean sand of Mill Quarter Bay contains a community characteristic of the open coast rather than the mud and muddy sand communities of Strangford (according to TWINSPAN (see Figure 5.16)).

The tidal current passing through the Narrows is unique in Northern Ireland; other current affected areas exist in the country, but they are smaller in extent.

Species rarity:- The text included examples of filter feeding species which were foundo be absent along the outer coast, rare in the main body of the lough, but relatively common in the Narrows. Examples of usually sublittoral invertebrate species which were encountered intertidally only in the Narrows were also given. Finally, the Narrows is the only area in Strangford Lough where several characteristic open coast red algal species may be found.

Diversity

There are two components to diversity; habitat diversity and species diversity.

Habitat diversity: The Narrows contain a good range of rocky and sedimentary habitats. Rocky habitats include bedrock, boulders and also the small stones/gravel habitat which supports only the growth of ephemeral algae on the surface. Sedimentary habitats in particular are very diverse, from the clean, open coast type sand and gravel of Mill Quarter Bay to muddy sand in Granagh Bay to mud in Castleward Bay. Habitat diversity is particularly diverse in areas affected by variable currents due to local topography, as in Granagh Bay, Bar Hall Bay and the area between Cloghy Rocks and Isle O'Valla.

Species diversity:- Invertebrate species diversity is high, in common with that in the main body of the lough.

(b). The area from Ringburr Point to Kircubbin, including Doctor's Bay.

Four criteria are relevant to this area: naturalness, representativeness, rarity and diversity.

Naturalness

Land reclamation has taken place around much of the lough. However along this stretch of coastline large parts of the upper intertidal remain relatively undisturbed; there are good examples of coastal fringe habitats between Kircubbin and the Dorn (Bleakley pers. comm., Boaden pers. comm.) including areas of salt marsh.

Representativeness

The area includes several rocky shores of the type defined by TWINSPAN as being representative of Strangford Lough, eg. Ringburr Point, Yellow Rocks, Horse Island and Black Neb. It also includes mud (around the Dorn and at Yellow Rocks) and muddy sand habitats.

Rarity

This area includes the Dorn tidal rapids; a rare habitat which contains several rare species, both rocky and sedimentary.

Diversity

Habitat diversity and species diversity will be discussed.

Habitat diversity: This area exhibits a particularly wide range of habitats in comparison to the remainder of the lough. Sedimentary habitats include mud, muddy sand and gravel (often found in association with bouldder shores) and combinations of all three. Rocky habitats include bedrock, boulders and stony gravel.

Species diversity:- Species diversity at rocky sites is no greater and no less than found around the remainder of the lough. However species diversity in sediment is in general greater than that found in more homogeneous areas, such as the wide muddy sand flats to the north, or in the muddy bays and flats of the south west.

The Narrows were singled out because the tidal current represents a unique habitat which is reflected in the biology of the area, and because they exhibit a wide diversity of rocky and sedimentary habitats. They also show a slight open coast influence which is absent from the rest of the lough. The second area was selected

mainly because it contains a wide cross-section of the intertidal habitat types and associated biological communities found in Strangford Lough. Neither area was singled out because individual sites within these areas are richer or poorer in species than any other site within the lough. These areas are important from a nature conservation point of view within the context of Strangford Lough. However, the whole of Strangford Lough is important in a Northern Ireland context, including the wide sedimentary areas and the rocky and sedimentary shores round the remainder of the lough and the islands.

6.3.1.2 CARLINGFORD LOUGH

Physical Description

Carlingford Lough is a small shallow sea lough, about 15 km in length from the entrance to Warrenpoint (see Figure 6.15). Most of the lough is between 3 and 4 km wide. Only the northern shore is in Northern Ireland.

The wide sedimentary flats of Mill Bay are exposed at low tide four kilometres upstream of Cranfield Point. The shores at the entrance to the lough are mainly sandy with some rock outcrops. Rocky islands are present in the main channel near the lough entrance.

The shores near the entrance to the lough are exposed to moderate wave action, as is the seaward edge of Mill Bay for 2-3 km. Upstream of Mill Bay the shores become progressively more sheltered; there are wide muddy areas on the lower shore between Rostrevor and Warrenport.

The Newry River is the main freshwater input into the lough. There are three other freshwater inputs between Warrenpoint and Rostrevor. There are also two major freshwater inputs into Mill Bay, and several smaller streams. The effect of these inputs on the salinity of the lough in unknown.

The entrance to the lough is affected by strong tidal currents, which are particularly strong around Greencastle Point, partly due to the influence of the large volume of water which enters and leaves Mill Bay with each state of the tide.

Sedimentary habitats

The sediment shores between Greencastle and Cranfield Point are moderately exposed sandy beaches. The lower shore is affected by tidal currents.

Mill Bay contains a wide range of sediments. As with the sedimentary flats of north Strangford Lough, the seaward edge of the flats is sandy in nature, while the landward areas tend to be muddier. However, the Mill Bay sediment is in general more gravelly than that found in north Strangford. The sediment is particularly gravelly around the areas where the two major freshwater influences, White Water and Cassy Water, enter the bay, but areas of mud are also present. Mud is the main sedimentary habitat present towards the western end of the bay, around Carriganean. Rocky habitats are present in the Mill Bay area; these will be detailed in the next section.

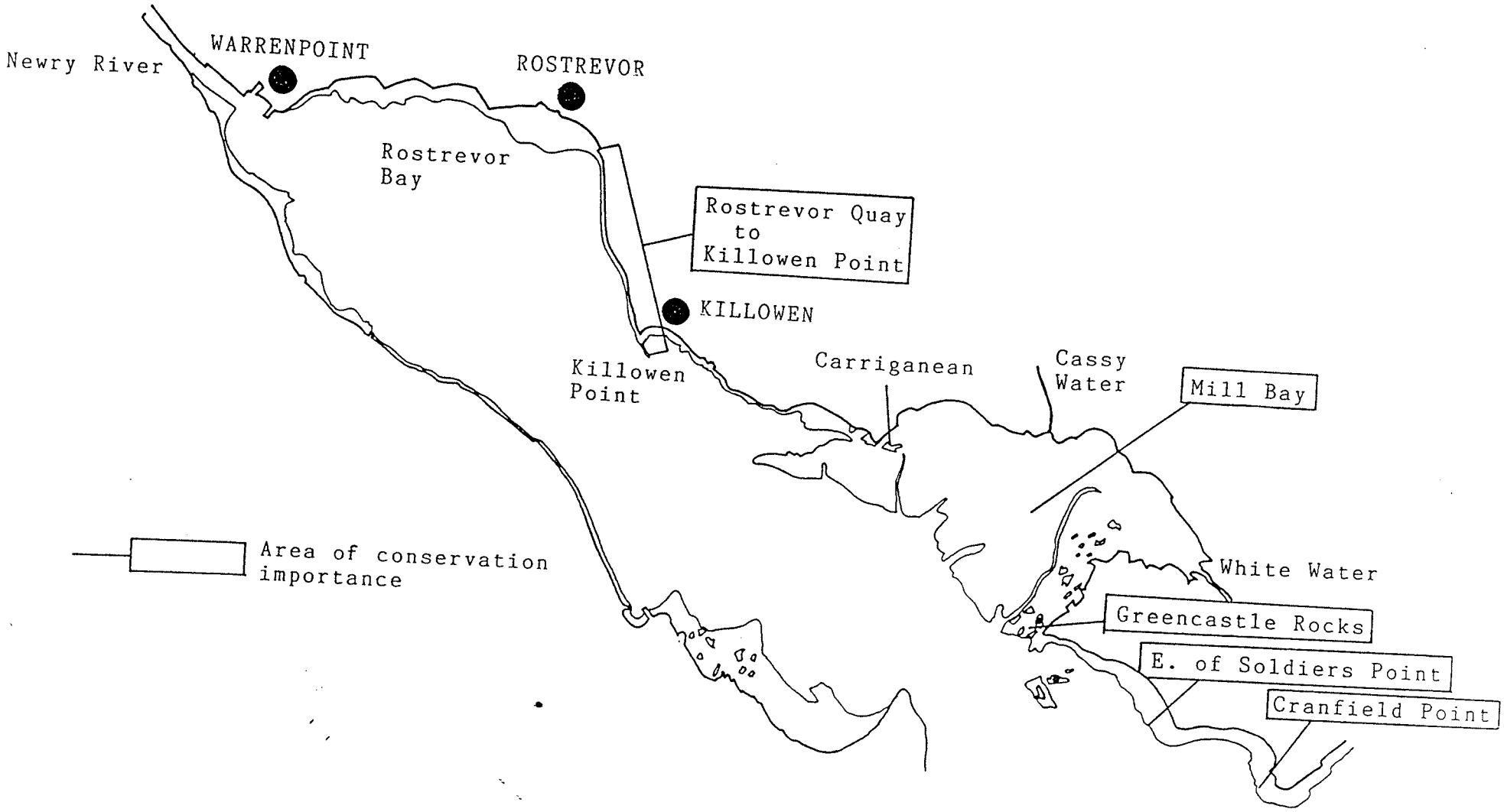


Figure 6.15: Carlingford Lough
Places refered to in text and
areas of conservation importance

The remaining sedimentary habitats present in the lough include muddy gravel and mud associated with the boulder and stone shores from Killowen Point northwards, and mud, which is present on the lower shore from Killowen to Mill Bay.

The area from Warrenpoint to Rostrevor was not investigated as thoroughly as the outer part of the lough. However along most of this stretch of the coast the upper part of the intertidal region is rocky in nature, apart from Rostrevor Bay, which contains an area dominated by muddy gravel. The lower shore along this stretch is mostly composed of mud.

Rocky habitats

There is a boulder shore at Cranfield Point (a continuation of the boulder shore on the open coast), igneous rock outcrops at Soldiers Point, with some associated boulders, and several outcrops of creviced sedimentary rock on the sediment at Greencastle Point, with stone and boulder areas on the lower shore. There are also several rock outcrops on the lower intertidal region of the sandy beaches between Cranfield Point and Greencastle Point. These are only visible during low water of spring tides; they are not visible on neap tides.

Rock outcrops are present towards the eastern end of Mill Bay. Boulders are present on the sediment surface over most of the Mill Bay area; these are widely scattered on the surface in some areas, but lie in close proximity to one another in other areas.

Rocky habitats (rock outcrops, stones and boulders) are present only along the upper part of the intertidal region between Mill Bay and Killowen; the lower shore is dominated by mud. An expanse of sheltered boulder shore exists for 2 km from Killowen Point to an area south of Rostrevor Quay, the substrate being a mixture of small boulders, stones, muddy gravel and mud. Upstream of here the shores as far as Warrenpoint are composed of gravel, small stones and boulders on the upper shore, with wide muddy areas on the lower shore.

Biological Description

Large mussel beds are present on the lower shore mud flats between Warrenpoint and Rostrevor.

Sedimentary shores

TWINSPAN analysis (Figures 5.16 and 5.17) groups the biological communities in the sedimentary site near the entrance to Carlingford Lough (Site 70) (sedimentary site numbers in this section refer to map numbers in Figure 6.2) and the two seaward sites on Mill Bay (sites 73 and 76) with clean sand, moderate/sheltered open coast beaches. This may be because these outer Carlingford Lough shores are affected by similar wave action to the open coast.

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Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
LOCATION DATA STAGE II

LOCALITY c	MILL BAY/CARRIGANEAN	GRID REF d	LONG e	LAT f	
SHEET No a	PUNCH CARD No b	Ht. OF LW. g (m)	TIME OF LW. h	DATE i	
ROCKY SHEET No (if any) k	PHOTO No.	ARRIVAL TIME l	DEPARTURE m	RECORDER	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	19	36
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4 X	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8 X	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Large Boulders (>1024 mm)	52	69	86
Med. Boulders (512–1024 mm)	53	70	87
Small Boulders (256–512mm)	54	71 X	88
Cobbles (64–256mm)	55	72	89
Pebbles (4–64 mm)	56	73 X	90
Granules (2–4 mm)	57	74 X	91
Coarse Sand (½–2 mm)	58	75 X	92
Med. Sand (¼–½ mm)	59	76	93
Fine Sand (1/16–¼ mm)	60	77 X	94
Shelly Sand (25% sh.)	61	78	95
Muddy Sand	62 X	79	96
Mud	63	80 X	97
Shingle	64	81	98
Storm Beach	65	82	99
Rock Layer N.S.	66	83 X	100
Man Made	67	84	101
	68	85	102

ROCK TYPE	
Sec:	
Igneous/Metamorphic	103
Limestone	104
Hard Mudstone	105 X
Soft Mudstone	106

SLOPE/INTERTIDAL EXTENT	
Steep (<50m)	107
Mod. (50–150m)	108
Gentle (>150m)	109
Mod. Upper Beach L.W. Flat	110
Flat (none of above)	111 X
HORIZONTAL EXTENT (m)	
<500	112
500 – 1000	113
1000 – 1500	114
>1500	115 X
OFFSHORE FEATURES	
Islands	116
Reefs	117
Breakwaters	118
Sandbanks	119
Shoal	120
COASTAL BACKING	
Sand Dunes	121
Low Cliffs	122
Mod. Cliffs	123
High Cliffs	124
Saltmarsh	125
Grassland	126 X
Peat	127
Valley	128
Freshwater	129
Trees	130
Other:	131
STEEPNESS INLAND	
0	132 X
1	133
2	134
3 – 5	135
5 – 10	136
>10	137

PREVAILNG WIND/ASPECT	W	A
N	138	146
NE	139	147
E	140	148
SE	141	149
S	142	150 X
SW	143	151
W	144	152
NW	145	153
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	154
Exposed	155
Moderate	156
Sheltered	157 X
V. Sheltered	158

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
< 2	159 X	164 X
2 – 10	160	165
10 – 50	161	166
50 – 100	162	167
>100	163	168
SEA HORIZON	10 miles	40 miles
0	169	182
1	170 X	183 X
2	171	184
3	172	185
4	173	186
5	174	187
6	175	188
7	176	189
8	177	190
9	178	191
10	179	192
11	180	193
12	181	194

Time of ELWST n	4 T 0 7
Mean Spring Tide Range (m) o	4 . 1
Mean Neap Tide Range (m) p	2 . 5
Annual Rainfall (mm) q	

CURRENT STRENGTH (estimate)	
Strong	195
Moderate	196 X
Weak	197

SALINITY	
Normal	198 X
Slighty Reduced (28–33‰)	199
Low (<28‰)	200
Stream Flowing on S.	201 X
Spec:	

ACCESSIBILITY	
Car Useable to Near Shore	202
>10 min. Walk	203 X
Boat Only	204

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	205
100 – 500	206
500 – 1000	207 X
1000 – 5000	208
>5000	209
Absent	210

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	211
100 – 500	212
500 – 1000	213
1000 – 5000	214
>5000	215
Absent	216 X

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	217
100 – 500	218
500 – 1000	219
1000 – 5000	220
>5000	221
Absent	222 X

SCIENTIFIC & CONSERVATION INTEREST

BIOTA

Barren	223	
Crustacea / Poly.	224	X
Tellina	225	X
Macoma	226	X
Scrobicularia	227	X
Spisula	228	
Lanice	229	
Pullastra	230	
Echino. Sili.	231	
Other:(Spec)	232	
	233	
	234	
	235	
	236	
	237	
	238	
	239	
	240	
	241	

PROMINENT SUBHABITATS

Spec:	242	
	243	
	244	
	245	
	246	
	247	
	248	
	249	
	250	
	251	
	252	
	253	
	254	

No/ DIVERSITY OF SUBHABITATS

High	255	X
Medium	256	
Low	257	

RELATIVE SPECIES RICHNESS

Good	258	X
Average	259	
Poor	260	

ORNITHOLOGICAL INTEREST

	Feed.		Nest.	
Waders	261	X	265	X
Wildfowl	262	X	266	X
Gulls	263	X	267	
Seabirds	264		268	
SEAL HAUL OUT			269	

NATURE RESERVE STATUS

Site Within N.N.R. etc.	270	
N N R or A S I Nearby	271	X
N T or R S P B or Loc. Res Nearby	272	
Nos. of Sub. Survey Sites Nearby		

SUBJECTIVE RATING

V. Good	273	X
Good	274	
Fair	275	
Poor	276	

HUMAN INFLUENCE

DISTANCE TO NEAREST TOWN (km) r 006

AMENITY VALUE

Attractive Beach or Surround	277	
Resort Town Nearby	278	
Toilet, Shops & Cafes Present	279	
Toilet, Shops & Cafes Nearby	280	
Car Park	281	
Popular	282	

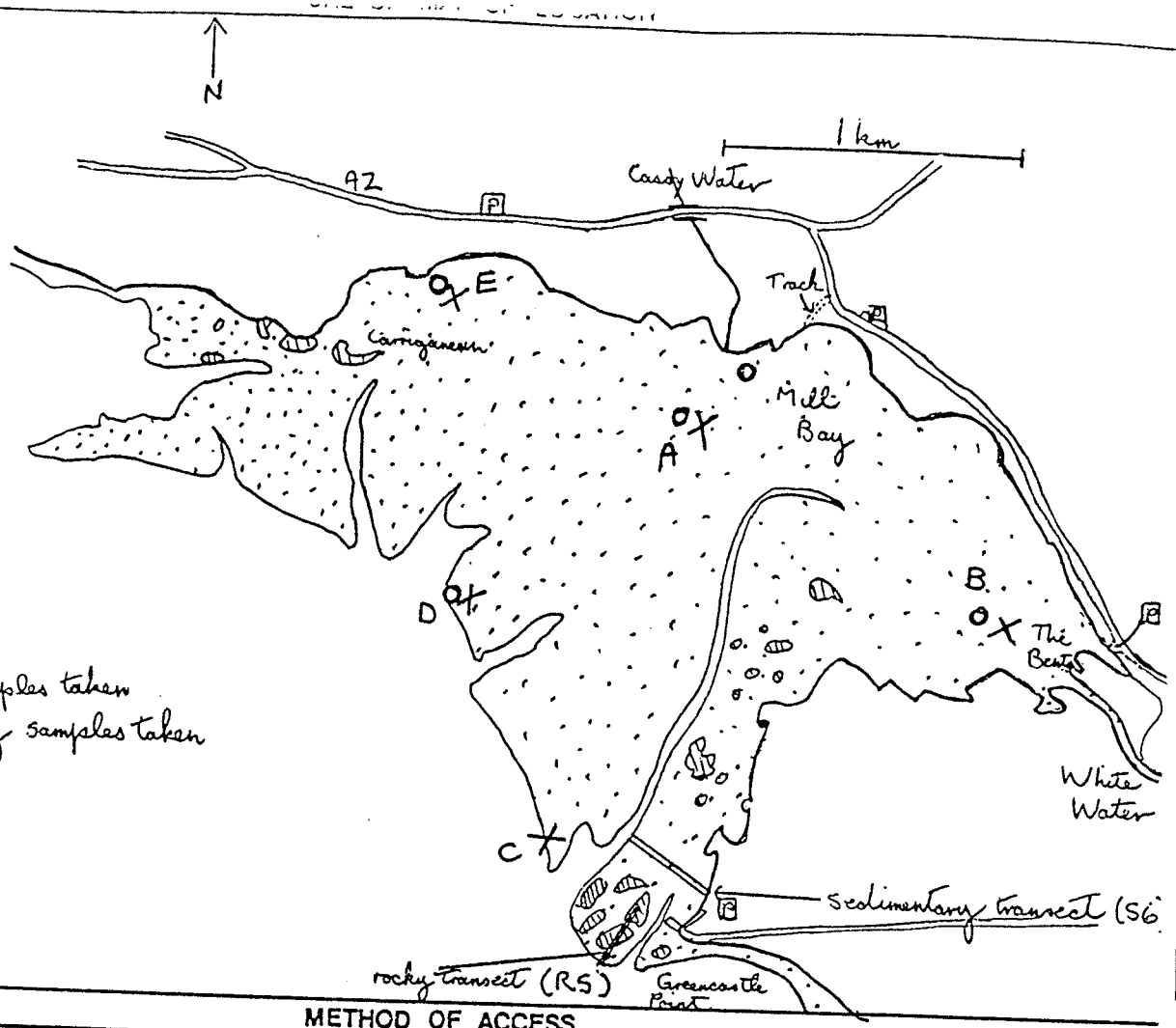
INDUSTRY & POLLUTION

Factories Present	283	
Evidence of Industrial Pollution		
— Toxic	284	
—Suspended S	285	
Sewage Pollution	286	
Land Reclamation	287	
Other:		

SHORE USAGE

Beach Fishing	288	
Bait Digging	289	
Shellfish Collecting	290	
Algal Harvesting	291	
Aquaculture	292	
Mooring	293	
Watersports	294	
Other:	295	

NOTES



METHOD OF ACCESS

Access is from the road in each case:
E – Parking by a telephone box on the main A2, walking down through fields.
A, D – Parking at a picnic spot in front of some new houses, following a Track between fields on to the shore, then walking out to the sites.
B – Parking in a lay-by at The Bents.
C – Parking at Greencastle Point.

In the case of C and D, be careful with the Tides.

LOCATION DESCRIPTION

This sheet should be read in conjunction with RS and S6, which describe transect sites at the southern end of Mill Bay. This sheet covers S1, S2, S3 from the Stage 1 survey – The Bents, Mill Bay and Carnganeun, and includes two extra sites, C and D, on the outer part of the Flats. Five Box grabs were taken at each sedimentary site, and a general collection made at the surface sampling points.

Most of the area is composed of muddy sand, with sand becoming coarser towards low water, and muddier towards high water. There are also large gravel areas around the entry points of the two main freshwater inflows, Cassy Water and White Water, which are used for gravel extraction. The gravel terraces in the case of the former are of national importance (fide R. Bleakley pers. comm.). The inner part of the bay is composed of mud, around Carnganeun.

An unusual occurrence for this wide sedimentary area, which may be observed by walking from site A to site D, is the presence of a clearly defined fucoid zonation, ~~one~~ from Pelvetia at high water to Ascophyllum at low water growing on boulders protruding above the flats. River channels on the sand are rich in mysids and flatfish. Bird life is important.

No. of Transects		Transect Nos.					

INSTITUTE OF OFFSHORE ENGINEERING
HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
Transect Data Stage II

SITE NAME	TRANSECT No	LOCATION No	ROCKY SHEET No (if any)
MILL BAY			
ILM No	Ht. OF L.W.	TIME OF L.W.	DATE *
	TIME OF ARRIVAL	TIME OF DEPART.	RECORDER IF

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Sediment Type	Surface Features	Depth of Black Layer c.m.	Depth of Water Table c.m.
1							
2							
3							
4							
5							

DESCRIPTION OF TRANSECT SITE

* 29/30th of May and 4th of June.

Five sedimentary sampling sites were visited around Mill Bay. Five quadrats were taken at each site.

A: Narrow salt marsh on upper shore, fringed by pebbles which give way to firm muddy gravel and pebbles. Walking out, the gravel becomes covered by muddy sand (visible as a layer of muddy sand above pebbly gravel along the banks of the river). The river has been recently straightened out and deepened mechanically, and is relatively species poor - only a few drifted clumps of *E. ceramoides* and brown filaments, although large numbers of flatfish young were present. The upper shore near the salt marsh had large numbers of *Corophium* burrows, together with hydroids and *Zostera*. There are still large numbers of *Corophium* at sampling point A, beside the river channel and about 200m out from shore, and large numbers of *Macoma* are also present in the sediment. *Ascophyllum* grows on barnacle encrusted boulders (some *Mytilus*) near to the channel. J240 137

B: The Beats. Muddy gravel and pebbles with a deep river channel. The river contains large clumps of *E. ceramoides*, many mysids and many small flatfish. Smaller clumps of *E. ceramoides* attached to small boulders lie scattered on the surface of the flats. In some areas the gravel beds are covered by a thin layer of mud. Here there are large numbers of *Corophium* burrows. Otherwise the pebbles support small clumps of *Mytilus* and large numbers of littorinids. The area is more gravelly towards the inner part of the shore becoming progressively muddier further out. Scattered cockles present, *Scrobicularia* in channels. ½ box quadrats taken. J255 130

C: Outer part of the bay, beside the main channel. Coarse, clean, mobile sand. *Nephtys* sp. found in sediment. J233 121

D: Walking across the flats from site A to site D, *Ascophyllum* gives way to *F. vesiculosus*, then *F. serratus*, then *F. serratus* + *L. saccharina*, all on boulders protruding above muddy sand with channels crossing their surface. These are many cockles and *Arenicola* casts. The sand becomes less muddy towards low water (Terns feeding), where *Tellina* and *Nephtys*

E. Carriganaun. The upper shore is composed of littorinid dominated small boulders and stones, with low lying sedimentary ridges also present, covered by Pelvetia, F. spiralis & Fasc... Below this rocky upper shore is a narrow belt of muddy sand with many Corophium bu... which in turn gives way to glutinous mud containing Macoma, Mya, Scrobicularia and Corop... and which supports hydroids on the surface. The samples were taken from the edge of the muddy area. Thick mud clots held wide Enteromorpha mats with clumps of Fucoids also visible on the surface - J 225 145.

TRANSECT MAP

TRANSECT PROFILE

Station	1	2	3	4	5				
Height									

Species	No.	1	2	3	4	5
SITE (A) MILL B-1A						
Annelida						
Arenicola marina	P177	6				
Capitella sp.	P072	1				
Capitomastus minimus	P173	2				
Eteone longa	P345	2				
Fabricia sabella	P746	1,8				
Hediste diversicolor	P506	1				
Nephtys caeca	P515	1				
Nephtys hombergii	P516	1				
Oligochaetes sp	108	1,4,2				
Pygospio elegans	P108	8,7				
Scoloplos armiger	P63	3,8				
Arthropoda						
Bathyporeia pilosa	S555	1,5,6				
Corophium arenarium	S700	2,6,7				
Corophium volutator	S709	2,9,3				
Carcinus maenas	S1225	1				
Mollusca						
Carasteloma retusa	W1147	3				
Macoma balthica	W1206	3,9				
Retusa obtusa	W572	2				
Nematoda sp	215	1,9				
Nemertinea sp	143	1				
SITE (B)	MILL B-1,B					
Annelida						
Fabricia sabella	P746	2,8				
Hediste diversicolor	P506	4,5				
Manayunkia aestuarina	P747	1,7				
Oligochaetes sp	108	2,2,2				
Pygospio elegans	P108	2,7				
Arthropoda						
Bathyporeia pilosa	S555	3				
Corophium volutator	S709	6,5				
Eurydice pulchra	S232	1				
Gammarus finmarchicus	S506	1				
Mysidopsis sp. juv?		6				
Mollusca		1				

Station

Species	No.	1	2	3	4	5
Nemertea sp	715	5.2				
SITE (C)	M11C34C					
Annelida						
Nephtys cascа	P515	2				
Oligochaeta sp	108	P				
Pebedorvillea bylerstaini	P628	P				
Pygospio elegans	P103	P				
Scoloplos armiger	P63	P				
Syllid sp indet	P421	1				
Travisia forbesii	P239	4				
Arthropoda						
Crangon crangon	S1074	1				
Urothoe brevicornis	S560	3				
Mollusca						
Abra sp (juv)?	W1167	P				
Tellina tenuis	W1201	3				
SITE (D)	M11C34D					
Annelida						
Amphaiteichas sp indet	P217	1				
Dentalium subtilifera	P319	1				
Eteone longa	P345	1				
Magelona minabilis	P125	3				
Nephtys cascа	P515	14				
Nephtys longisetis	P516	P				
Oligochaeta sp	108	1				
Pygospio elegans	P105	24				
Scoloplos armiger	P63	2				
Spio filicornis	P107	2				
Sthenelais boa	P105	1.5				
Arthropoda						
Ampelisca brevicornis	S396	P				
Bathyporeia elegans	S550	1				
Bathyporeia guilliamsoniana	S551	1				
Mollusca						
Littorina obtusata	W149	P				
Tellina fabula	W1199	3				
Tellina tenuis	W1201	1.7				

Species	No.	1	2	3	4	5
SITE (E)	MILLRYE					
Annelida						
Ampharete acutiflons	P674	6,1				
Aduncola vaninta	P177	1				
Eteone longa	P345	24				
Capitella sp	P172	30				
Fabricia sabella	P746	20,5				
Manayunkia aestuarina	P747	P				
Nephtys hombergii	P516	P				
Oligochaetes sp	108	8,6				
Pygospio elegans	P108	5,8				
Scoloplos armiger	P63	214,0				
Thaoyx marioni	P159	313				
Malacoceros fuliginosus	P93	P				
A-Thropoda						
Balthyporeia pilosa	S555	P				
Carcinus maenas	S1225	P				
Corophium arenarium	S700	3,9				
Corophium volutator	S709	5,4				
Gammarus pumex/chicus	S506	P				
Mollusca						
Crassostrea gigas	W1167	P				
Hydrobia ulvae	W162	P				
Macoma balthica	W1206	7,6				
Mya arenaria	W1289	6				
Mytilus edulis	W491	P				
Retusa obtusa	W572	P				
Scrobicularia plana	W1227	3				
Nemertea	215	2,8				
Nemertinea sp	143	P				

The Cranfield Point site (site 70) is particularly interesting because concentrations of Echinocardium cordatum were found on the lower shore. The only other area round the Northern Ireland coastline where Echinocardium occurs intertidally is in the Strangford Narrows. A quick survey of the area between Cranfield Point and Greencastle Point revealed that large numbers of Echinocardium were also present to the west of Soldiers Point. The animal was not found in the sediment to the east of Soldiers Point, which is relatively unsheltered from wave action compared with the region to the west.

Echinocardium cordatum is a normally sublittoral species, its appearance on the lower shore in the Strangford Narrows is thought to be an example of the "emergence phenomenon" associated with current swept shores. The shores between Greencastle Point and Cranfield Point are also current swept. These preliminary observations suggest that Echinocardium is present on the lower shore at the entrance to Carlingford in current swept areas which are also slightly sheltered from wave action. Other species which are found at Cranfield Point include Pectinaria (Lagis) koreni, which has been found by Boaden (Pers. comm.) in Strangford Lough, and Ensis siliqua.

The sedimentary communities present in Mill Bay include examples of three out of the four major communities which TWINSPAN analysis indicates exist in Northern Ireland: moderate/sheltered sandy communities, muddy sand communities and muddy communities.

Moderate/sheltered sand communities containing the bivalve Tellina tenuis exist along the seaward edge of Mill Bay. Travelling across the flats towards the coastal fringe the substrate changes, first to muddy sand, with communities such as those found north of the pier at Greencastle Point (site 71), including Cerastoderma edule, Macoma balthica, and a large polychaete diversity. At the landward edge of the flats the animals present are typical of muddy communities, including Hydrobia ulvae on the sediment surface, together with Scrobicularia plana, Mya arenaria, Fabricia sabella and Corophium volutator in the sediment. There is also evidence of freshwater influence in the muddy gravel sediment adjacent to the areas where the two major freshwater inflows enter Mill Bay; Hediste diversicolor is present in both areas.

No further sedimentary shores were investigated in Carlingford Lough. It would have been particularly interesting to examine the infauna present in the muddy gravel areas associated with the sheltered boulder shores north of Killowen.

The sedimentary shore recording sheet provided here as an example deals with Mill Bay (Figure 6.16). It is included as an example of how such wide sedimentary areas were dealt with during the course of the survey.

Rocky shores

Three Stage II rocky sites were examined in detail in Carlingford Lough. Computer analyses indicated that the two inner sites at Greencastle Point (site 127) (rocky shore site numbers in this section refer to map numbers in Figure 6.2) and North of Killowen (site 128) have biological characteristics in common with Strangford Lough, while the site at Cranfield Point (site 126) near the entrance to the lough, is similar to sites in southern County Down.

The site at Greencastle Point shows evidence of tidal current effects similar to those found in parts of Strangford Lough; a rich diversity of filter feeders including hydroids and bryozoans, and the presence on the lower shore of usually sublittoral species. These include Metridium senile, Antedon bifida, Solaster endeca and Psammechinus miliaris. This is the only site round the Northern Ireland coastline where Metridium was found intertidally. The boulder shores north of Killowen were examples of very sheltered shores of the type already described for Strangford Lough. The substrate on the lower shore at the transect site is a mixture of small stones and gravel in mud, with scattered small and medium boulders. The major alga present is Laminaria saccharina with a relatively species poor algal understorey on boulders, perhaps because the area is strongly affected by silt. However many invertebrate species are present, including Sabella pavonina, Ciona intestinalis, Clavelina lepadiformis and Marthasterias glacialis.

The final rocky community investigated in Carlingford lough occurs on the boulders lying embedded in the sediment of Mill Bay. On some areas of the flats the boulders lie close together while at other areas they are scattered. Fucoids grow on the boulders, and form a standard zonation pattern of successive bands of Pelvetia canaliculata, Fucus spiralis, Ascophyllum nodosum, Fucus vesiculosus and Fucus serratus between high and low water. Fucus ceranoides is common along the White Water channel for some distance from the point where it enters Mill Bay. Kelps are present on the lower shore beside the channel, but are rare because the major substrate is sand.

This situation, where a clear fucoid zonation pattern is superimposed on a wide intertidal sedimentary flat, is not present at any other site around Northern Ireland.

The rocky outcrops which were observed on the lower shore between Cranfield Point and Greencastle during low water of spring tides were not visited during the course of the survey, nor were the islands in the lough channel. These would be particularly interesting sites to investigate in the future because they are affected by tidal currents.

Carlingford Lough - Conservation

Two types of area will be described.

(i) unusual or particularly rich individual sites;

(ii) larger areas which contain representatives of a number of different habitat and community types.

(i) **Unusual or particularly rich individual sites**

a. Killowen Point, and northwards for 1½-2 km:- Sheltered boulder shore. Very rich in invertebrate species. Only example of this type of shore in Northern Ireland outside Strangford Lough.

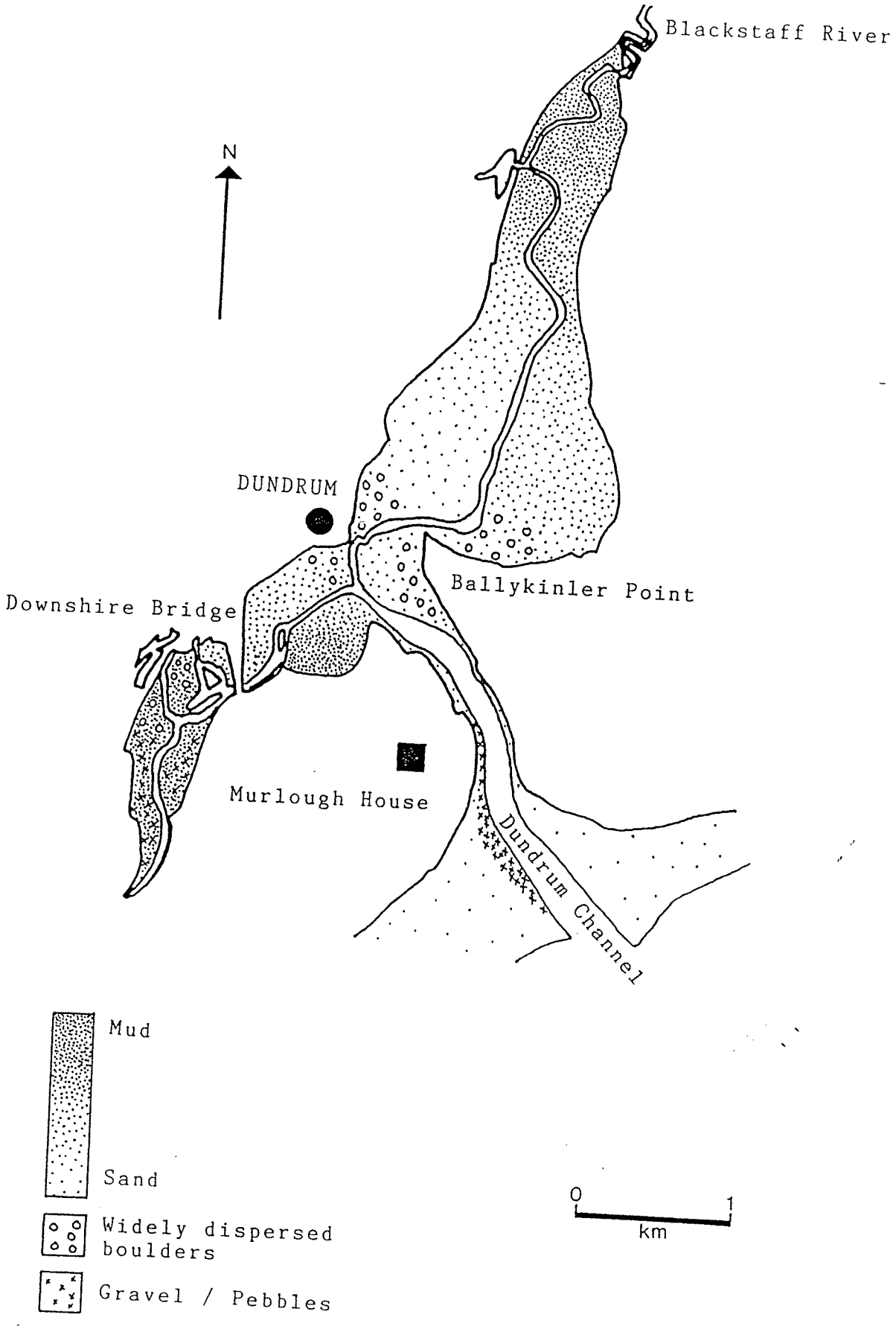


Figure 6.17: Dundrum Inner Bay
Physical nature of habitat and places

b. Greencastle Point:- Current affected rocky shore. Good diversity of filter feeders and examples of sublittoral emergence.

c. West of Soldiers Point and west of Cranfield Point. Emergence of usually sublittoral sedimentary infauna. Heaviest densities of intertidal Echinocardium cordatum found in Northern Ireland.

As stated in the previous section, lower shore sedimentary and rocky habitats along the stretch of coastline between Cranfield Point and Greencastle might repay further investigation.

(ii) **Larger areas**

Mill Bay. Three of Mitchell's (1986) criteria for the comparative evaluation of marine sites are applicable to Mill Bay: representativeness, rarity and diversity.

Representativeness Mill Bay contains representatives of three out of the four main sedimentary biological communities which TWINSPAN has indicated exist in Northern Ireland.

Rarity. The boulders on the sediment surface of Mill Bay support the widest example of fucoid zonation in Northern Ireland. However the attached "rocky shore" community on the boulders is species poor, perhaps due to sand scour.

Diversity.

Habitat diversity:- Mill Bay contains a wide range of sedimentary habitats, including sand, muddy sand, muddy gravel and mud. There are also two estuarine areas in the bay, and freshwater channels run across the sediment at low tide.

Species diversity:- species diversity in Mill Bay is no greater and no smaller than in other similar wide sedimentary areas around the coastline.

6.3.1.3. DUNDRUM INNER BAY

Physical Description

Dundrum Inner Bay is a sheltered sedimentary area which empties completely at low tide apart from the channels formed by its four main freshwater inflows. A narrow channel flows from the bay between sand dunes and over Murlough Sands to the sea (Figure 6.17).

The bay is divided into northern and southern legs, connected by a narrow neck at Downshire Bridge. The upper part of the northern leg is muddy in nature, and affected by a freshwater input from the Blackstaff River. Southwards from here the sediment becomes progressively less muddy and more sandy with areas of gravel and stones. Scattered boulders are present on the surface, especially in front of the town of Dundrum. The southern part of the northern inner bay, south west of Ballykinler Point, is also muddy.

The southern leg of the bay is smaller than the northern, and is influenced by two main freshwater inflows. The major substrates are mud and muddy gravel, with areas of stones and small boulders lying on the surface, particularly next to the road on the northern part of the bay.

The channel which connects the bay to the sea is an unusual habitat; a "river" of variable salinity which flows over a bed of gravel, pebbles and coarse sand.

Biological Description

Surface communities. The surface biological communities growing on top of the muddy gravel in the southern leg of the bay are markedly estuarine in character. Fucus ceranoides grows in the main river channel, and is also present on scattered boulders on the surface of the flats to nearly high tide level. Mats of Enteromorpha species are also present. Small clumps of Mytilus are present, as is Littorina littorea and Hydrobia ulvae. A narrow fringing salt marsh exists on the upper shore in some areas; algal species include Rhizoclonium riparium, Vaucheria spp., and blue green algae.

Enteromorpha mats are present on the mud surface to the north and to the south of the northern leg of Dundrum Inner Bay. On areas with small stones lying on the sediment surface, animals include Littorina littorea and small clumps of Mytilus edulis. patchy Zostera grows on the surface in some areas. One large mussel bed is present in the bay, growing on the bed of the river channel to the east of Downshire Bridge. The surface biology on the sand between Dundrum village and Ballykinler Point is more open coast in character; Lanice tubes are present on the lower shore, while fucoids grow on boulders scattered on the sediment surface.

An unusual community exists on the pebbles and sand beside and in the channel which flows from the bay to the sea. Sandy areas are carpeted with very dense concentrations of Lanice conchilega. On a pebbly area beside the channel to the south east of Murlough House Fucus serratus and Desmarestia aculeata are the dominant plants of fairly diverse alga community. A dense growth of hydroids covered the algal fronds; free living clumps of hydroids were also present. Details are in the Stage II recording sheet.

Infauna. Dundrum Inner Bay contains examples of two of the sedimentary communities identified by TWINSPAN; that associated with muddy sand that associated with mud. The muddy community was present in the sediment at the northern and southern extremities of the northern leg of the bay, and in both sites from the southern leg of the bay. A freshwater influence was apparent on the animals from the most northerly site and on those from both sites in the southern leg of the bay; large numbers of Hediste diversicolor were present in samples.

The remaining three sampling sites, from the middle of the northern leg of the bay and from beside the main channel on the shore south east of Murlough House, were examples of the "muddy sand" community

type. The infauna found in the gravel and pebble sediment beside the channel were particularly interesting; they contained a large number of polychaete and mollusc species, including Venerupis pullastra. TWINSPAN grouped the community found in this area with that found at the Dorn (Strangford Lough) which is also an example of a gravel/pebble sediment influenced by tidal currents.

Dundrum Bay - Conservation

The channel which connects Dundrum Bay to the sea is an unusual habitat; a "river" of variable salinity which runs over stones and coarse sediment. The channel would repay further investigation.

The southern leg of Dundrum Inner Bay is best described as a semi-enclosed estuary. The northern leg of the bay is also influenced by fresh water, but to a lesser extent. The bay as a whole contains a good diversity of sedimentary habitats, and exhibits a gradient of salinity effects on the infauna.

6.3.1.4 OTHER MARINE INLETS

The remaining sheltered marine inlets in the outer Co. Down coast are Ardglass Harbour and Killough Harbour (see Figure 6.18) which is closely associated with Coney Island Bay. One rocky site was visited in Ardglass Harbour which is the smallest inlet. It was similar to outer Co. Down sites. Three sites were visited in Killough Harbour and Coney Island; one rocky and two sedimentary. Coney Island Bay contained boulder and sandy shores similar to those along the outer Co. Down coast. The only unusual feature is that Coney Island Bay is the northern distribution limit in Northern Ireland of the reef-building polychaete, Sabellaria alveolata (this will be discussed further in Section 6.33); however, only a few small colonies were present.

The infauna present in the muddy sand and gravel of Killough Harbour are representatives of the "muddy sand" community identified by Twinspan. The sampling site is species rich, and shows evidence of a slight freshwater influence.

Other Marine Inlets - Conservation

Killough harbour contains a rich infaunal community of the TWINSPAN "muddy sand" type community. However this community is also present in other larger areas round the coastline (in Strangford and Carlingford Loughs and in Dundrum Bay), where it is usually associated with a variety of other sediment and community types. In addition both Killough and Ardglass Harbours are fishing ports, which reduces their potential conservation value. Coney Island Bay has rocky and sedimentary communities similar to those found along the outer Co. Down coast, and its conservation value will be assessed alongside that of the outer coast.

6.3.2. THE OPEN COAST

Lance Williams analysis (Figures 5.3 and 5.4), Wards Analysis (Figures 5.5 and 5.6) and TWINSPAN analysis (Figures 5.8 and 5.9) all identify the existence of two main groups of rocky sites along the outer Co. Down coast; one along the northern part of the coastline, and one along the southern.

TWINSPAN places the major split between north and south at Coney Island Bay (see Figure 6.18), however, results from the two clustering methods suggest a more gradual transition. Ordination of all the Co. Down sites (Figure 5.10) also indicated a gradual transition, with the main trend being related to exposure.

The rocky habitats and associated biological communities of northern and southern Co. Down will be described separately in this section. The dividing line between the two stretches of coastline will be set at the entrance to Strangford Narrows, at the northern end of the transitional area. Sedimentary habitats and communities from north and south Down will be described together, after the rocky shores have been dealt with. This is because Twinspan analysis (Figures 5.16 and 5.17) did not identify any difference between the open coast sedimentary communities of north and south Down.

6.3.2.1. NORTHERN CO. DOWN

Physical Description

The outer Ards Peninsula is the most sheltered stretch of open coast in Northern Ireland. The northern part of the peninsula, at the southern entrance to Belfast Lough, is exposed to stronger wave action than the east facing shores, and exposure levels also increase, but less dramatically, towards the southern tip of the peninsula.

The major rocky substrate present is highly creviced sedimentary rock-sandstones, siltstones and shales - although localised outcrops of igneous rocks also appear on the coast, more commonly south of Ballyhalbert (locations referred to in the text are mapped in Figure 6.18). The creviced sedimentary rock supports a wide diversity of subhabitats, including rock pools, crevices and areas of boulder and broken stone between rock ridges.

The extent of intertidal rocky habitats is, in general, wider along the outer Ards Peninsula than along any other stretch of coastline. Between Portavogie and Donaghadee the sedimentary rock forms wide rocky platforms, some over 200m across, which are separated by large sedimentary areas. North of Donaghadee intertidal extent becomes narrower, as the platforms and wide sandy areas give way to creviced sedimentary rock shores and pocket sandy beaches. However wide rocky shores still exist in this area, as at Foreland Point, Carn Point (on Copeland Island) and Ballymacormick Point. Rock platforms with associated wide sandy areas are not present towards the southern tip of the peninsula either. However rocky shore extent is particularly wide across the intertidal region from Millin Bay south to Ballyquintin Point.

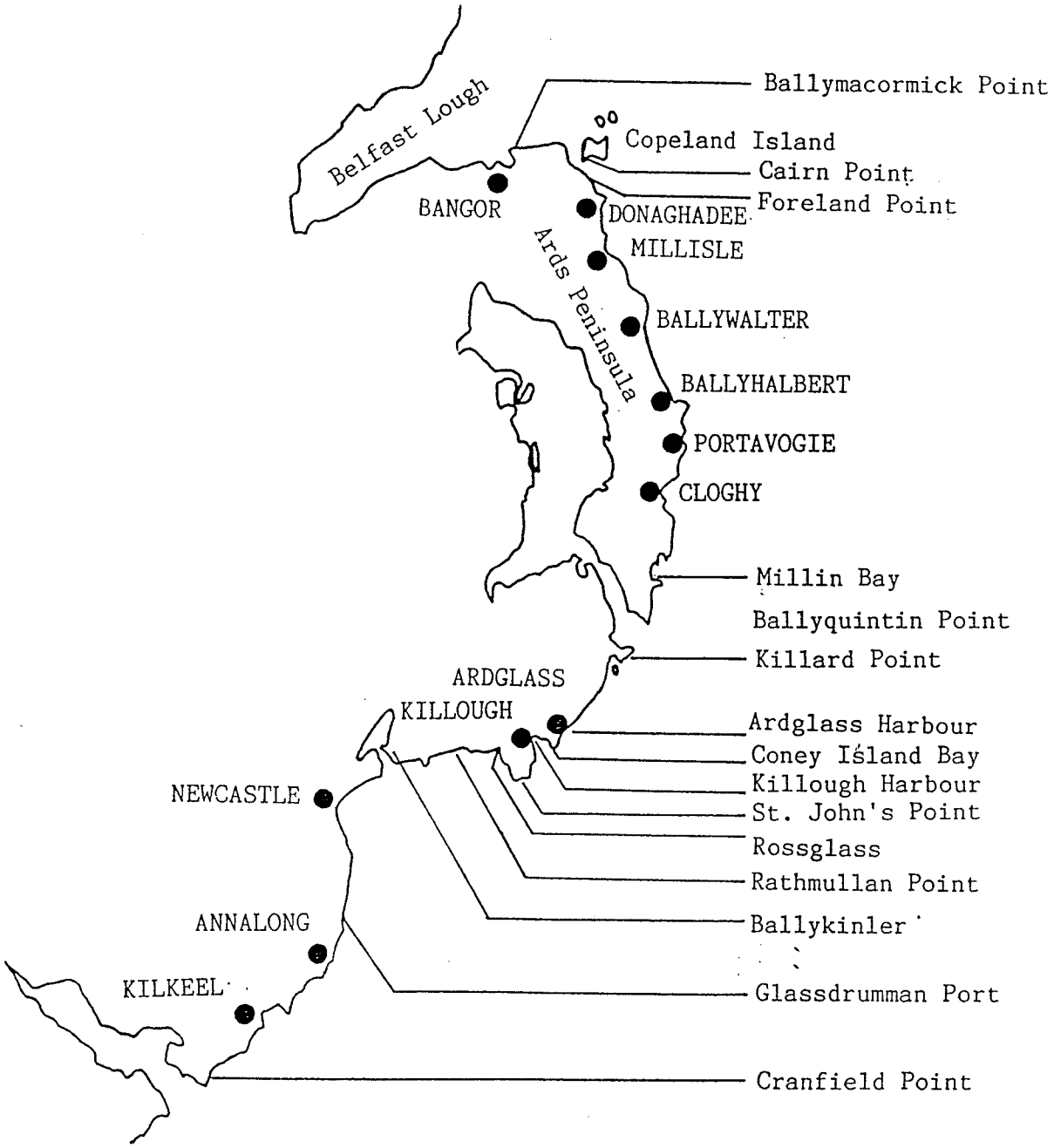


Figure 6.18: Outer Co. Down
places mentioned in text.

Biological Description

Species richness is greater along the outer Ards Peninsula than along any other stretch of open coast around Northern Ireland (Figure 6.2). The zonation pattern is very similar at each site visited, apart from the more exposed sites at the mouth of Belfast Lough to the north of the peninsula (which group with sites from southern Co. Down in both cluster analysis methods).

1. The Splash Zone

The splash zone exists on creviced sedimentary rock at most sites. The lower part of the zone is dominated by patchy V. maura, below a more diverse upper zone lichen community. Patchy Prasiola stipitata might also be present. Small pools in crevices contain Enteromorpha intestinalis.

2. The Pelvetia canaliculata Zone

Dominated by P. canaliculata on creviced sedimentary rock. Areas of broken stone between ridges do not support algal growth. The understorey is V. maura, with patches of Hildenbrandia rubra. Enteromorpha spp. Blidingia minima and Catenella caespitosa grow in crevices.

Littorina saxatalis inhabits crevices at this level and the amphipod Hyale nilsonii lives on Pelvetia fronds. Other arthropods are restricted to crevices including the amphipods Orchestia spp. and Gammarus spp., and the isopod Ligia oceanica.

Pools in this zone are more common, because of the substrate type, and relatively species rich compared to those which might be encountered in Strangford Lough, because wave splash renews the water more frequently. However, they are relatively species poor compared to those found along southern Co. Down sites, which are more wave exposed and have a more frequently renewed water supply. Algal species include: Chaetomorpha capillaris, Chaetomorpha linum, Cladophora sp. Ralfsia spp. Scytosiphon lomentaria and brown filamentous algae. Animal species include L. saxatilis, Carcinus maenas, Patella vulgata and Jaera spp.

3. The Fucus spiralis Zone

The substrate and subhabitats in this zone are similar to those found in the P. canaliculata zone. Animal and algal diversity are slightly greater than in the zone above.

4. The Ascophyllum nodosum Zone

This is the widest zone - more than 150 m across in the case of some platforms. The sedimentary rock ridges which form the substrate are irregular, which can cause the formation of extremely sheltered pockets within the zone, or "peaks" of rock which are dominated by representative communities from the upper two zones.

The zone is usually dominated by Ascophyllum nodosum with variable amounts of Fucus vesiculosus, but local variations in topography cause variations in exposure levels. Some peaks of rock may be covered by a limpet/barnacle community reminiscent of southern Co.

Down sites rather than by F. spiralis or P. canaliculata. Areas of broken rock or small boulders between the ridges may be covered by Fucus vesiculosus rather than A. nodosum, because the latter requires a more stable attachment point (as has already been described for Strangford Lough). In yet other areas Ascophyllum growth might be restricted to the tufted form typical of more exposed open coasts.

The algal understorey in this zone is as rich in terms of species number as that found in Strangford Lough with a similar group of species, but is not as heavily developed in terms of coverage and thickness.

Animal diversity on the rock surface and under the fucoid canopy is high compared to other open coast sites, but low compared to Strangford Lough. Common species include several species of littorinid, Patella vulgata, Idotea granulosa, Dynamena pumilla (growing on Ascophyllum), Actinia equina, Gibbula spp., amphipod spp. and Lepidochitona cinereus.

Both algal and animal species richness in this zone are increased by the large numbers of subhabitats usually present. Rock pools support a very high algal diversity, including Chaetomorpha melagonium, Polysiphonia spp., Corallina officinalis, Cystoclonium purpureum, Phyllophora spp., Rhodomela confervoides, Delesseria sanguinea, Gelidium pusillum, Heterosiphonia plumosa and Chylocladia verticillata.

Rock pools are relatively sheltered compared to those along other parts of the coastline. Algae in the rock pools provide a habitat for amphipods and small molluscs, while the relatively stable boulders and stones in the pool support the growth of a rich attached fauna, including sponges and bryozoans. Amphipods and polychaetes live under boulders and stones lying on the surface between the ridges, and in sheltered crevices filled with sand or gravel. Species in the pools include Cancer pagurus, Pagurus bernhardus, Amphipholas squamata, Botryllus schlosseri, Lanice conchilega (in sediment in pools), Spirorbis spp, Apherusa jurinei, Calliopius laeviusculus, Alcyonidium mytili, Celleporella hyalina and Haliclystus auricula.

5. The Fucus serratus Zone

Physically, the lower shore rocky substrate at most outer Ards sites is less creviced and irregular than the upper shore substrate, due to differential erosion by wave action. In addition boulders are the major lower shore substrate at some sites, while at others the substrate is a mixture of bedrock and boulders.

The degree of sand cover on the lower shore also varies between sites. The Laminaria zone may be absent (as at Wallaces Rocks, site 78 see Figure 6.2) because no suitable rocky substrate is present, or rock pools on the bottom two zones may be choked by sand.

The dominant alga in this zone, F. serratus, lies over an understorey of variable composition. The major species include Gigartina stellata, Corallina officinalis, Cladophora rupestris, Ceramium rubrum, Polysiphonia spp., Lomentaria articulata, Palmaria

palmata, Chondrus crispus, Cladostephus spongiosus, Leathesia difformis, Laurencia hybrida and Laurencia pinnatifida. In some areas this algal turf rivals F. serratus in importance.

Epifauna on the Fucus serratus is more diverse than that found on Ascophyllum in the zone above; however epifaunal species diversity is low compared to Strangford Lough. Species include Electra pilosa, Tridemnum tenerum, Flustrellidra hispida and Alcyonidium spp.. Animal diversity on the rock surface and in algal tufts is also higher than the zone above, with several additional species including Acmaea tessulata, Lacuna vincta and Halichondria panicea on the surface, and many amphipod and small mollusc species in the algae, such as Stenothoe monoculoides, Skeneopsis planorbis and Onoba semicostata.

Algal diversity in pools at this level may be impoverished by the presence of sand, which reduces diversity and encourages the growth of more tolerant species such as Ahnfeltia plicata and Furcellaria lumbricalis. However, if this is not the case several species of red algae may be found which are usually not present in the zone above. These include Ptilota plumosa, Plocamium cartilagineum and Odonthalia dentata.

Animal diversity in the zone is also high compared to other open coast areas round Northern Ireland. The low level of wave exposure allows the development of an attached encrusting fauna and the presence of filter feeders such as hydroids and ascidians which are relatively underrepresented round the remainder of the open coast. However, species richness is still low compared to that found in the equivalent zone in Strangford or Carlingford Loughs. Species include Verruca stroemia, Utricina felina, Crisia spp., Callopora lineata, Clathrina coriacea, Haliclona spp., Leuconia nivea and Coryne spp. Polychaetes and other animals, such as Porcellana longicornis and Porcellana platycheles, also live under boulders.

6. The Laminaria Zone

Laminaria digitata is the dominant kelp at most sites, with L. hyperborea and L. saccharina present in small amounts. Alaria esculenta is uncommon.

The mixed red algal understory of the F. serratus zone becomes less species rich with increasing kelp cover. Calcareous encrusting red algae become more prevalent on the rock surface, while Laminaria hyperborea stipes provide attachment for epiphytic red algae such as Palmaria palmata, Rhodymenia pseudopalmata, Ptilota plumosa and Phycodrys rubens. Kelp holdfasts are a habitat for bryozoans, amphipods, colonial ascidians and small polychaetes.

Example site

The Stage II recording sheet included as an example is that for Wallace's Rocks (site 78). It is a representative creviced sedimentary rock platform (see Figure 6.19).

HERIOT-WATT UNIVERSITY

Northern Ireland Littoral Survey Rocky Shore Recording Sheet

LOCATION DATA STAGE II

R198

LOCALITY c: WALLACES ROCKS	GRID REF d: J640674	LONG e: 05/27·5 W	LAT f: 54/33·20 N		
SHEET No g: 198	PUNCH CARD No b:	Ht. OF L.W. g: (m)	TIME OF L.W. h:	DATE i:	
SEDIMENTARY SHEET No (if any) k:	PHOTO Nos	ARRIVAL TIME l:	DEPARTURE m:	RECORDER: TCT	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1 X	18	35
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Vertical Rock	52	75	98
Steep Rock (>30° slope)	53	76	99
L. Rock Ridges	54	77	100
Rock Ridges	55 X	78	101
Rock Platforms	56 X	79	102
Rock Outcrop	57 X	80	103
Fissured Rock	58 X	81	104
Irregular Rock	59	82	105
Large Boulders (>1024mm)	60	83	106
Med. Boulders (512-1024mm)	61	84	107
Small Boulders (256-512mm)	62	85	108 X
Stones, Angular (64-256mm)	63	86	109 X
Shingle, Rounded (64-256mm)	64	87	110
Pebbles (5-63mm)	65	88	111 X
Gravel (2-4mm)	66	89	112
Sand	67	90 X	113
Mud	68	91	114
Muddy Sand	69	92	115
Muddy Gravel	70	93	116
Black Layer N.S.	71	94	117
Silt Covered Rock	72	95	118
Man Made	73	96	119
	74	97	120

ROCK TYPE	
Spec:	
Igneous/Metamorph.	121
Limestone	122
Hard Mudstone	123 X
Soft Mudstone	124
INTERTIDAL EXTENT (m)	
< 10	125
10 - 50	126 X
50 - 100	127
>100 (Spec:)	128
HORIZONTAL EXTENT (m)	
<100	129
100 - 500	130
500 - 1000	131
>1000	132 X
OFFSHORE FEATURES	
Islands	133 X
Reefs	134 X
Breakwaters	135
Sandbanks	136
Shoal	137
COASTAL BACKING	
Sand Dunes	138 X
Low Cliffs	139
Mod. Cliffs	140
High Cliffs	141
Saltmarsh	142
Grassland	143 X
Peat	144
Valley	145
Freshwater	146
Trees	147
Other: CARAVANS	148 X
STEEPNESS INLAND	
0	149 X
1	150
2	151
3 - 5	152
5 - 10	153
>10	154

PREVAILNG WIND/ASPECT	W	A
N	155	163
NE	156	164
E	157	165 X
SE	158	166
S	159	167
SW	160	168
W	161	169
NW	162	170
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	171
Exposed	172
Moderate	173
Sheltered	174 X
V. Sheltered	175

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
< 2	176	181
2 - 10	177	182
10 - 50	178 X	183
50 - 100	179	184 X
>100	180	185
SEA HORIZON	10 miles	40 miles
0	186	191
1	187	200
2	188	201
3	189	202
4	190	203
5	191 X	204
6	192	205
7	193	206
8	194	207
9	195	208
10	196	209
11	197	210
12	198	211

Time of ELWST n	4T07	
Mean Spring Tide Range (m) o	4·1	
Mean Neap Tide Range (m) p	2·5	
Annual Rainfall (mm) q		
CURRENT STRENGTH		
estimate: Strong	212	
estimate: Moderate	213 X	
estimate: Weak	214	
SALINITY		
Normal	215 X	
Slighty Reduced (28-33‰)	216	
Low (<28‰)	217	
Stream Flowing on S.	218	
Spec: 35‰		
ACCESSIBILITY		
Car Useable to Near Shore	219 X	
>10 min. Walk	220	
Boat Only	221	
DISTANCE TO 10m DEPTH CONTOUR (m)		
<100	222	
100 - 500	223	
500 - 1000	224 X	
1000 - 5000	225	
>5000	226	
Absent	227	
DISTANCE TO 30m DEPTH CONTOUR (m)		
<100	228	
100 - 500	229	
500 - 1000	230	
1000 - 5000	231 X	
>5000	232	
Absent	233	
DISTANCE TO 50m DEPTH CONTOUR (m)		
<100	234	
100 - 500	235	
500 - 1000	236	
1000 - 5000	237 X	
>5000	238	
Absent	239	

SCIENTIFIC & CONSERVATION INTEREST

BIOTA	Dom Z	Dom C	Dom P	2° Z	2° C	2° P
Fucoids						
Red Algae						
Green Algae						
Brown Algae						
Eel Grass						
Barnacle						
Mussel						
Limpet						
Other Molluscs (Spec:)						
Turf Formers						
Crustose Corallines						
Others: (Spec)						

N.C.C. CLASSIFICATION		
Ascophyllum	240	X
Mackaii	241	
Fucoids	242	X
Fucobarnacle	243	
Fucomytilus	244	
Chloropatella	245	
Chlorophyta	246	
Rhodomytilus	247	
Rhodobarnacle	248	
Rhodopatella	249	
Mytilobarnacle	250	
Patellobarnacle	251	
Barnacle	252	
Mollusc	253	
Other: (Spec)	254	

PROMINENT SUBHABITATS	H		M		L	
Wide, Shallow Rock Pools	255		265		275	
Deep Rock Pools	256		266		276	
V. Large Rock Pools	257		267		277	
Rock Pools	258	X	268	X	278	X
Crevices	259	X	269	X	279	X
Couloirs	260		270	X	280	X
Overhangs	261		271		281	
Caves	262		272		282	
Reef at Low Tide	263		273		283	
Other: (Spec)	264	X	274	X	284	X

ALGAL COVER

No./DIVERSITY OF SUBHABITATS		
High	285	
Medium	286	X
Low	287	

RELATIVE SPECIES RICHNESS	Flora		Fauna	
Good	288	X	291	X
Average	289		292	
Poor	290		293	

ORNITHOLOGICAL INT

	Feed		Nest	
Waders	294	X	298	
Wildfowl	295		299	
Gulls	296	X	300	
Seabirds	297		301	

SEAL HAULOUT	302

NAT. RES. STATUS	
Site Within NNR	303
NNR or ASI Nearby	304
NT, RSPB or Loc Res Nearby	305
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING		
V. Good	306	
Good	307	X
Fair	308	
Poor	309	

HUMAN INFLUENC

Dist. to nearest Town (km) r

AMENITY VALUE	
Attractive Beach or Surround	310
Resort Town Nearby	311
Toilets, Shops & Cafes Present	312
Toilets, Shops & Cafes Nearby	313
Car Park	314
Popular	315

INDUSTRY AND POLLUTION	
Factories Present	316
Evidence of Industri. Pollution	
— Toxic	317
— Suspended S	318
Sewage Pollution	319
Land Reclamation	320

SHORE USAGE		
Beach Fishing	321	
Bait Digging	322	
Shellfish Collecting	323	
Algal Harvesting	324	
Aquaculture	325	
Mooring	326	
Watersports	327	
Other: (Spec)	328	X

RECREATIONAL

NOTES:

SKETCH MAP OF LOCATION

METHOD OF ACCESS

Parking in caravan park near Ballywalter. The shore can be gained directly from here.

LOCATION DESCRIPTION

Large sandstone platforms interspersed with sand and surface boulders. The fucoid zonation appeared rich for both animals and plants with a good diversity of subhabitats. Large pools that continued to empty throughout the low tide through boulder filled gullies caused a limited "rapids" effect forming a rich subhabitat.
Shore is back by cultivated dune land.

GENERAL PHOTOGRAPHS

INSTITUTE OF OFFSHORE ENGINEERING
HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Rocky Shore Recording Sheet
Transect Data Stage II

R198A

SITE NAME: WALLACE'S ROCKS A
FILM No:
TRANSECT No.: 1 9 8 A
LOCATION No.: 1 9 8
SED. SHEET No. (if any):
Ht. OF L.W.: 0 - 6
TIME OF L.W.: 1 7 4 8
DATE: 2 3 / 1 0 / 8 4
TIME OF ARRIVAL: 1 5 0 0
TIME OF DEPARTURE: 1 8 0 5
RECORDER: TCT

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Substrate Nature	Rock Type	Surface Texture	Surface Features	Total Algal Cover	
								Cover	Patchiness
1		E		1,4,7,8,10	3	3,4,5	1,5,9	3	2
2		E		1,4,7,8,10	3	3,4,5	1,5,10	3	3
3		E		1,4,7,8,10	3	3	1,5,10	4	3
4		E		1,4,7	3	3	1,5,10	4	4
5									
6									
7									
8									

DESCRIPTION OF TRANSECT SITE

A location of rock outcrops and platforms interspersed with sandy shore. The platforms tend to form islands at mid water and are almost covered during high tide. They are composed of small sharp ridges of shale like rock with angular fissures giving many crevices. Stones, pebbles and small boulders covering coarse sand occur between the ridges of the middle and lowershore whereas towards the lowershore the ridges become larger with boulder filled gullies between them. Wide shallow rock pools with sand/stone bottoms occur in the midshore, which appear rich in flora and fauna. These pools empty slowly at low tide. Through the gullies give a gentle slide effect to a limited degree. The gullies were rich in flora and fauna especially ascidians and sponges.

The stones and boulders of the extreme lowershore are relatively barren, by amphipods seen in abundance. This is probably due to sand scour. Limpets occured on the bottom areas of the ridges.

Zone 1 – Pelvetia with Littorinids some small areas of Prasiola

Zone 2 – Fucus spiralis on ridges and boulders between them

Zone 3 – Ascophyllum nodosum and Fucus vesiculosus, the later confined stones between the ridges. This was the most extensive zone. Sand and ones between ridges in this zone contained many polychaetes. A small Pellobanacle subzone occured on exposed surfaces and maybe due to nd scour of the major zone. Large rockpools with sandy bottoms occured n the lowerzone.

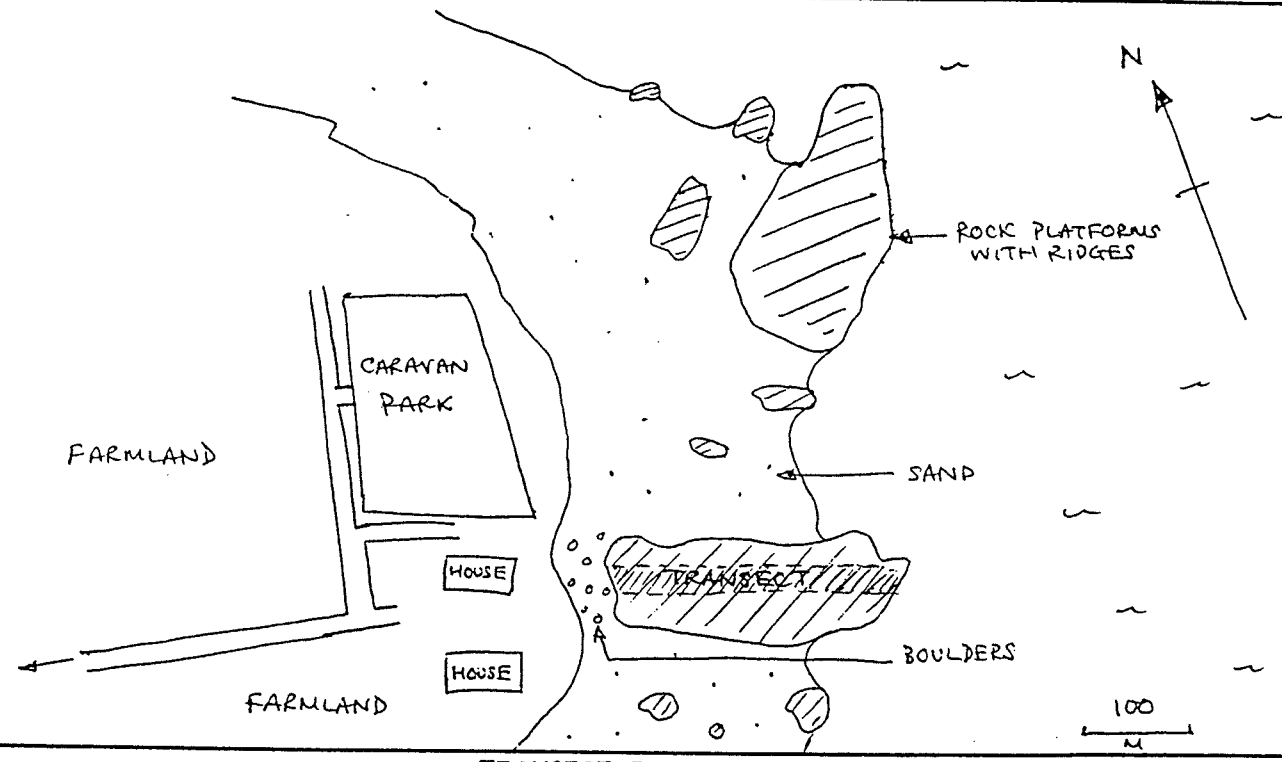
Zone 4 – A blanket cover of Fucus serratus with an understorey of ncrusting Corallines. This was situated on the lower reaches of the at forms near sand. The surface was more undulating with larger ges and gullies present.

REFERENCE POINT

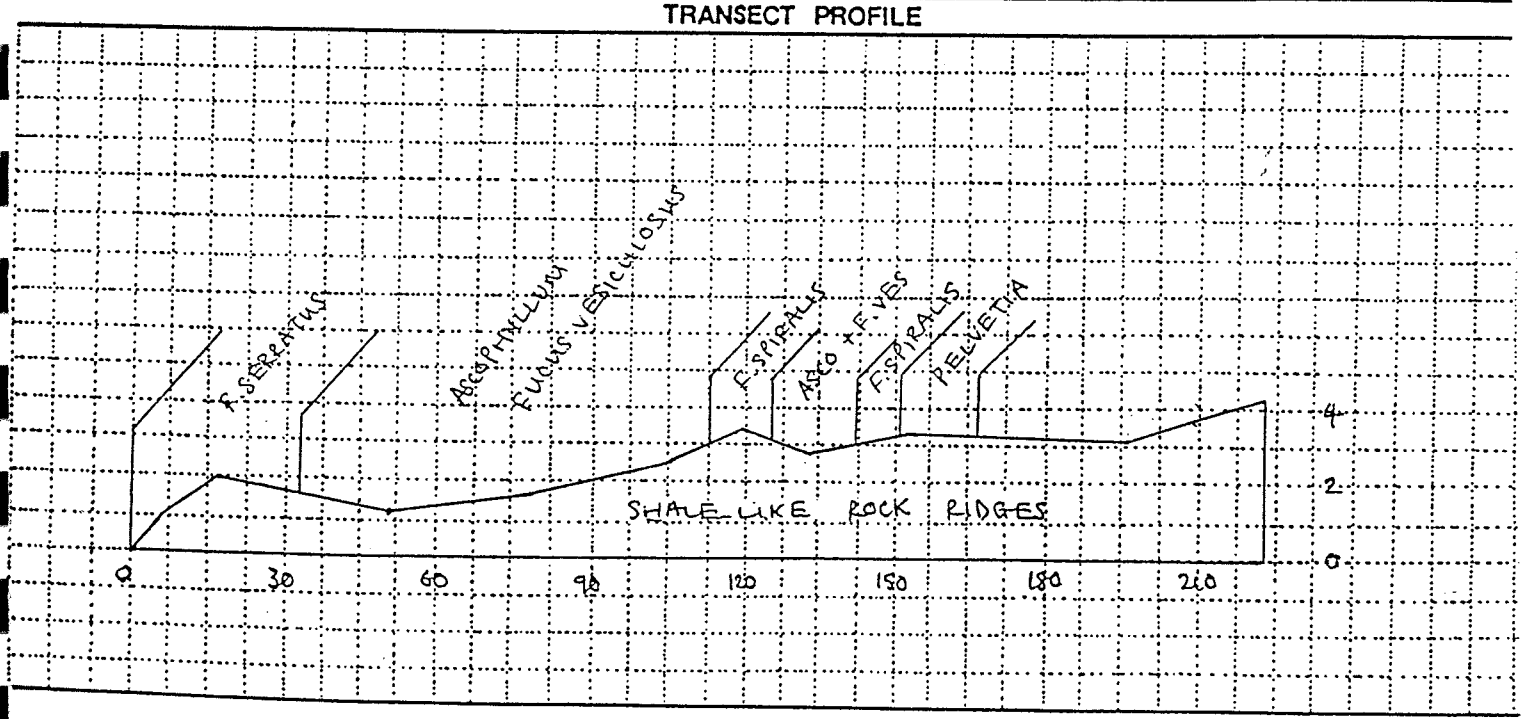
White square on large fixed boulder embedded in pebble and boulder area in upper shore.

Top of boulder = 3.28 m above LW (0.6m) on sampling date.

TRANSECT MAP



TRANSECT PROFILE



Station	1	2	3	4	5	6	7	8	
Ht. Top	3.3	3.1	2.8	1.5					
Ht. Bottom	3.1	2.8	1.5	0.1					

all distances in 'm' from LW

| | | |

| | | |

		0 R C	0 R	0 R	0 R	RV
Mytella arctica	W1099					
Laevicardium ruora	W1098					
Modiolus sp.						
Monia patelliformis	W1054					
Monia squama	W1055					
Musculus discors	W999					
Mytilus edulis	W991			2 1		
Pholas dactylus	W1310					
Turitonia minuta	W1272					
Venerupis pullastra						
Zirfaea crispata	W1313					
Asterias rubens	ZB83					
Henricia sanguinolenta	ZB69					
Marthasterias glacialis	ZB85					
Amphipholas squamata	ZB136					
Ophinocommina nigra	ZB112					
Ophiothrix fragilis	ZB108			5 1		
Ophiura texturata	ZB144					
Echinus esculentia	ZB170					
Strongylocentrotus sp.						
Cumaria sp.						
Alcycnidium gelatinosum	Y63				2	
Alcyonidium hirsutum	Y59			1	2	
Electra pilosa	Y338		2			
Flustra foliacea	Y346	D				
Flustrellidra hispida	Y55				2	
Membranipora membranacea	Y333				4	
Aplidium/Marchellum sp.						
Ascidiella scabra	ZD62					1
Ascidia conchilega	ZD64			1	1	
Ascidia mentula	ZD63			1		
Botrylloides leachii	ZD90					
Botryllus schlossrei	ZD89					
Ciona intestinalis	ZD49					
Clavelina lepadiformis	ZD4					
Dendrodoa grossularia	ZD86					
Polyclinum aurantium	ZD11					
Sidnyum turbinatum	ZD14					
Tridiemnum tenerum						
Ammodytes tobianius	ZG518					
Blennius gattorugine	ZG474			1	1	
Ciliata mustela	ZG209					
Diplecogaster bimaculata	ZG170					
Gaidropsarus mediterraneus	ZG213					
Gobius paganellus	ZG535					
Hyperoplus lanceolatus	ZG521					
Lepidogaster candollei	ZG172					
Liparis liparis	ZG367					
Liparis montagui	ZG368					
Myxocephalus scorpius	ZG351					
Nerophis lumbriciformis	ZG316					
Pholis gunnellus	ZG500			1	1	
Spinachia spinachia	ZG301					
Sygnathus typhle	ZG314					
Taurulus bubalis	ZG352					
ANNELIDA						
Amphitrite sp	P695		1			
Fabricia sabella	P746			1		
Hamothoe imbricata	P262				1	
Halosydna gelatinosa ?					1	
Jasmineira sp	P749			1		
Lanice conchilega	P698		1			

		1 1 1	2 2	3 3	4 4	
		O R C	O R	O R	O R	RV
Leptonereis glauca	P494				1	
Micronephthys ornithochaeta	P212			1		
Nicolea zostericola	P703				1	
Nicomache maculata	P209			1		
Odontosyllis ctenostoma	P439		1			
Oligochaeta sp	108			1		
Perinereis cultifera	P507				1	
Phisidea sp	109				1	
Anaitides maculata	P320				1	
Platynereis dumerilii	P509			1		
Polyarnus denticulatus	P717					1
Spiorbis magestus	P782					1
Spiorbis spirorbis	P787			1	3	
Spiorbis tridentatus	P785					1
Spiorbis corallinae	P783				2	
Tauna zaguntechensis	P800					
ARTHROPODA						
Amphithoe gammaroides	S658				1	
Amphithoe neglecta	S659			1	1	
Amphithoe rubricata	S657					1
Anaitodactylus vivescens	Q41			1		
Aphelura hispanica	S619			1	1	
Aphelura cirrus	S620			1	1	
Aphelura juniae	S623	1	1	1	1	
Aphelura oralipes	S624			1	1	
Apra typica	S664			1	1	
Caprella acanthifera	S840			1	1	
Calliopius laeviusculus	S626			1	1	
Chaetogammarus marinus	S497	1	1		1	
Chironomid larvae	112				1	
Crangon crangon	S1074			1		
Dexamine spinosa	S649			1	1	
Eulimnogammarus obtusatus	S502	1	1		1	
Gammarus finmarchicus	S506		1	1	1	
Gammarus locusta	S508				1	
Hippolyte varians	S1042				1	
Hyale nilssoni	S490	1	1		1	
Idotea granulosa	S259			1	1	
Idotea pelagica	S263				1	
Jaera albifrons	S276				1	
Jassa falcata	S726				1	
Leucothoe incisteti	S667				1	
Lipura maritima	114		1	4		
Pleurus flexuosus	S944				1	
Stenothoe monoculoides	S467				1	
Sunamphitoe pelagica	S661				1	
Thoralthus crenellii	S1046				1	
BRYOZOA						
Alcyonidium mytili	Y66				1	
Bowerbankia imbricata	Y120				1	
Callopora lineata	Y354				1	
Celleporella hyalina	Y287		1	1	1	
Cribrilina annulata	Y150			1	1	
Crisia denticulata	117				1	
Crisia eburnea	141			1		
Conopeum pallasiana	Y179				1	
Membranipora membranacea	Y269		1		1	
Microporella ciliata	Y266				1	

HABITAT		11			22			33			44			
		O	R	C	O	R		O	R		O	R		RVI
Schizoporella unicornis	Y230													
Walkeria uva	Y97													1
CHORDATA														
Diplosoma listerianum	Z037													1
Gasterosteus aculeatus	ZG299								1					
CNIDARIA														
Clava multicornis	D95							1			1			
Bougainvillea loreni	D164													1
Halecium halecinum	D8										2			
Obelia dichotoma	D158													1
ENTOPROCTA														
Barentsia gracilis	K29													1
Pedicellina cernua	K26							1	1		1	1		
MOLLUSCA														
Limapontia capitata	W696													1
Littorina neglecta	W150							2	1		2			
Littorina patula type	120	3	1	1	3									
Littorina saxatilis	W155	2	1		3			4						
Onoba semicostata	W180							1			1			
Rissoa parva	W197								1		1			
NEMERTINEA														
Cephalothrix rufifrons	G18				1	1		1	1					
Lineus bilineatus	G32							1						
Nemertine sp.	L43										1			
PORIFERA														
Clathrina coriacea	C4													1
Haliclona viridis fucta	173													1
Haliclona sp	C518													1
Leucosolenia nixoa	C48													1
Leucosolenia sp.	C25													1

| | | |

		1		1		2		2		3		3		4		4		
		O	R	C		O	R			O	R			O	R		RV	
Dilsea carnosa	ZM201																	
Dumontia incrassata	ZM205																	
Furcellaria lumbricalis	ZM80	D												2				
Gastroclonium ovatum	ZM270																	
Gelidium sp.																		
Gigartina acicularis	ZM139																	
Gigartina stellata	ZM141											1		5		1		
Gracillaria verrucosa	ZM116																	
Hildenbrandia rubra	ZM255									3		1		2		1		
Hypoglossum woodwardii	ZM575																	
Laurencia hybrida	ZM405									4				4				
Laurencia pinnatifida	ZM407													3				
Lithothamnium glaciale	ZM184													1		1		
Lomentaria articulata	ZM272					2				4		1		4				
Lomentaria clavellosa	ZM275																	
Membranoptera alata	ZM14													2		1		
Odonthalia dentículata	ZM411																1	
Palmaria palmata	ZM260															1		
Phycodrys rubens	ZM381															1		
Phyllophora truncata	ZM131																	
Phyllophora crispa	ZM127																1	
Phyllophora pseudoceranoid	ZM128											1						
Phyllophora traillii	ZM130													1		1		
Phymatolithon lenormandii	ZM194									3		1		2		1		
Plocamium cartilagineum	ZM108															1		
Plumaria elegans	ZM349											1						
Polyides rotundus	ZM95																	
Polysiphonia brodiaei	ZM412									6		1		3		1		
Polysiphonia lanosa	ZM422											1				1		
Polysiphonia nigrescens	ZM425											1						
Polysiphonia urceolata	ZM434							1				1						
Polysiphonia sp.																		
Porphyra leucosticta	ZM485																	
Porphyra linearis	ZM486																	
Porphyra umbilicalis	ZM489									3								
Ptilota plumosa	ZM351											D						
Rhodomela confervoides	ZM442															1		
Non calc. encrusters																		
Calc. encrusters	125									5				6				
Supralittoral blue-greens																		
Vaucheria sp.	ZM196															1		
Verrucaria maura																		
Verrucaria mucosa	127					1				2								
Lichina confinis																		
Lichina pygmaea																		
Ruppia sp.																		
Zostera angustifolia																		
Zostera marina																		
Zostera nana																		
CHLOROPHYTA																		
Codium fragile ssp atlantic.	ZM370									2		1						
Enteromorpha compressa	ZM270	1				1				1		1						
Enteromorpha intestinalis	ZM272					1		1				1						
Enteromorpha prolifera	ZM274	1		1		1						1						
Percursaria percursa	ZM279	1																
Pringsheimiella scutata	ZM304											1						
Tellamia sp	102	1																
Ulvella lens	ZM310					1		1										
Urospora penicilliformis	ZM235									1								

TRANSECT/ZONE		1.1	2.2	3.3	4.4
STRAT		O R C	O R	O R	O R	Rv
PHAEOPHYTA						
Colpomenia sinuosa	ZR130			1		
Sphacelaria furcigera	ZR157		1		1	
Asperococcus fistulosus	ZR7		1	1	1	
Ectocarpus siliculosus	ZR93			1	1	
Lichina pygmaea	ZR22					1
Giffordia sp	ZR163				1	
Desmarestia ligulata	Z11			1		
Scytothamnus australis	ZR57				1	
~~Ectocarpus confervoides~~						
Sphacelaria radicans	ZR254			1		
RHODOPHYTA						
Audouinella floridula	ZM18	1	4	1		1
Audouinella purpurea	ZM25					1
Audouinella secundata	ZM30		1			
Audouinella sparsa	ZM32			1		
Gonimenia australis ? asparagoides	ZM61				1	
Callithamnion hookeri	ZM304					
Ceramium flabelligerum	ZM325			1		
Ceramium rubrum	ZM328				1	
Cryptopleura ramosa	ZM368			1	1	
Delesseria sanguinea	ZM369			D		
Dermatolithon corallinae	ZM157					
Erythrocladia irregularis	ZM468				1	
Erythrotrichia carnea	ZM474					1
Gelidium pusillum	ZM41			3	4	
Griffithsia flosculosa	ZM343		1		1	1
Heterosiphonia plumosa	ZM394		1	1	1	1
Laurencia obtusa ?	ZM406				1	
Lithophyllum incrustans	ZM178					1
Lithophyllum orbiculatum	ZM180					1
Nemastoma membranacea	ZM188					1
Nitrocladia granulosa ?	ZM346			1		
Polysiphonia brodiaei	ZM412			1		
Porphyra purpurea	ZM488			3		
Pterosiphonia parasitica	ZM438				1	
Titanoderma pustulatum	ZM162				1	1
CYANOPHYTA						
Rivularia sp	130	1	1			

Northern Co. Down - Conservation

The outer Ards Peninsula contains some of the most species rich rocky sites found along the open coast in Northern Ireland. However the sites visited were all very similar in terms of both species composition and habitat diversity.

Only one site, at Ballymacormick Point, stands out as being particularly diverse.

Firstly the rocky intertidal at Ballymacormick Point is associated with a range of other habitats, including a salt marsh, sedimentary areas and a Fucus ceranoides lined freshwater inflow.

Secondly the upper shore at this site, which merges into the saltmarsh, is very well developed for an open coast site, with mud filled crevices providing a habitat for green and blue-green algae and arthropod species not encountered round the remainder of the open Co. Down coast. A third characteristic, which it shares with other sites along the outer Ards, is that it exhibits a range of both sheltered and exposed rocky habitats, including sandstone ridge platforms and boulders.

The remaining rocky sites along the outer Ards Peninsula, while being particularly rich in terms of species number and subhabitat diversity compared to other sites round the open coast of Northern Ireland, are very similar to each other.

In terms of Mitchell's (1986) criteria for the comparative evaluation of marine sites:

Representativeness

All the sites are representative of the outer Ards Peninsula.

Diversity

All sites show a similar diversity of habitat, community and species. Rocky habitat diversity is slightly greater towards the southern tip of the Ards peninsula, where there are boulder shores in addition to bedrock platforms.

Rarity

No site, apart from Ballymacormick Point, exhibits a rarity of species or habitat to set it apart from the others. However, the stretch of coastline between Ballyquintin Point and Millin Bay contains boulder shores, which are otherwise uncommon outside the Ards peninsula.

Naturalness

Since an area unmodified by human influence is desirable, it would be best not to select sites near centres of population such as towns or caravan parks.

Size

The widest areas of rocky intertidal along the outer Ards Peninsula lie between Ballyquintin Point and Millin Bay, around Portavogie, and between Ballywalter and Millisle.

After these criteria have been considered, two areas emerge as possible conservation areas representative of the outer Ards peninsula. One lies between Ballyquintin Point and the northern end of Millin Bay, and the other lies between Ballywalter and Millisle (see Figure 6.18).

6.3.2.2. SOUTHERN CO. DOWN

Physical Description

The intertidal region along the open coast of southern Co. Down is more wave exposed than that along the outer Ards Peninsula, although there are localised areas where shore topography reduces the level of exposure, as at locations mentioned in the text mapped in Figure 6.18 Rossglass and Coney Island Bay.

The major bedrock substrate present in the creviced sedimentary rock which is found along the outer Ards Peninsula, although localised outcrops of igneous rock also exist. This substrate does not in general form the wide intertidal platforms associated with the outer Ards, however there are areas where extensive rocky intertidal shore exist, as around Killard Point and between St John's Point and Ballykinler. Intertidal rocky extent is narrower along the stretch of coast from Newcastle southwards to Cranfield Point than along the northern part of southern Co. Down.

Boulder shores are represented more frequently along this stretch of coast than they are along the outer Ards peninsula. They are often closely associated with bedrock outcrops and can be the dominant or subordinate component of the habitat. Particularly extensive boulder shores exist between St John's Point and Rathmullan Point. South of Glassdrumman Port boulders become the major rocky substrate, interrupted by stretches of sandy beach and headlands composed of creviced sedimentary rock.

The lower shore at many sites along southern Co. Down is affected by sand.

Biological Description

A generalised zonation scheme for sites along the south Down coast would take the following pattern:

1. **The Splash Zone**

The supralittoral region supports the growth of a rich lichen flora at some bedrock sites along southern Co. Down. Increased wave exposure results in a wider splash zone than that found along the outer Ards peninsula.

2. **The Verrucaria maura/Pelvetia canaliculata zone**

Pelvetia is, in general, very patchy compared to the equivalent zone found along the outer Ards Peninsula; it grows in shelter between rock ridges whereas V. maura covers most of the rock surface, Littorina rudis is the dominant littorinid and usually restricted to cracks in the rock surface, as are the small numbers of barnacles

and limpets sometimes present in this zone. Rock pools in this zone can support a more diverse flora and fauna than pools found in less exposed areas, because increased wave action tends to renew the seawater in the pools more frequently than is possible at sheltered sites. Lower shore algae such as Corallina officinalis are sometimes present in upper shore pools.

3. **The Verrucaria maura/Fucus spiralis zone**

Fucus spiralis grows in shelter while V. maura covers the rock surface. Lichina pygmaea may also occur in this zone, and on the upper section of the zone below. Barnacles are present in crevices and in shelter on the open rock surface, as are limpets. Littorinds are also present in crevices, and Nucella lapillus and Littorina littorea may occur in shelter.

Rock pools at this level can be particularly rich compared to those found in the F. spiralis zone at sites along the outer Ards Peninsula. The pale pink calcareous encrusting alga Lithophyllum orbiculatum is present in many pools, and other algal species include Chaetomorpha melagonium, Halidrys siliquosa, Laminaria digitata, Dictyota dichotoma, Gigartina stellata and Lomentaria articulata. Animals include Verruca stroemia, Pagurus bernhardus, Electra pilosa and Acmaea tessulata. These species are usually found in mid to lower shore pools at sites along northern Co. Down.

Species diversity of the exposed boulder shores which are common along the coastline south of Glassdrumman Port (site 122 site number of rocky sites refer to Figure 6.2.) is reduced compared to that of the bedrock sites, because sheltered subhabitats are rarer. The boulder surfaces of this zone and the zone below are dominated by limpets, barnacles and N. lapillus. However more sheltered boulder shores exist at Ringboy (site 118) and Coney Island Bay (site 115) which are dominanted by F. vesiculosus with some Ascophyllum. These sites are more species rich than the exposed sites.

4. **The Limpet/Barnacle/Nucella lapillus Zone**

This is the widest intertidal zone, and is the equivalent of the Ascophyllum dominated zone of the outer Ards Peninsula. The major subhabitats present at bedrock sites in this zone are rock pools, boulder and stone areas, and the shelter provided by rock ridges.

The rock surface is dominated by limpets, barnacles and Nucella lapillus, which are present in different proportions at different sites. Sometimes patches of ephemeral green algae (Ulothrix spp., Enteromorpha spp. and Porphyra umbilicalis also grow on the rock. Fucus vesiculosus and tufted Ascophyllum nodosum grow in shelter between ridges. At some sites small clumps of the reef building polychaete Sabellaria alveolata are also present between ridges.

At some sites (eg. Craigalea, site 120 and Cranfield Point, site 126), but not every site, mussels grow in crevices on the upper part of this zone, and spread out to cover the rock surface on the lower zone.

Damp crevices in this zone support the growth of turfs of algal species which are common on the lower shore. Species include Laurencia pinnatifida, Laurencia hybrida, Gigartina stellata, Dumontia incrassata and Corallina officinalis.

Rock pools contain a diverse flora and fauna.

5. The Fucus serratus/Red Algae/Mytilus edulis zone

This zone is dominated by F. serratus with a mixed red algal understorey at more sheltered sites (eg. Ringboy, site 118). However, F. serratus is not always the most common alga. At some sites (eg. Craigalea, site 120) Fucus serratus is present only in sheltered subhabitats, while at other, more exposed sites (eg. Sheepland Harbour, site 113) it may be absent from the lower shore. In this case the zone is dominated by a red algal turf.

Mytilus edulis is an important component of the lower shore fauna at some sites, including the two mentioned above. Mussel cover was found to reach its greatest extent at Cranfield Point, where a very dense mat covers the lower shore, binding boulders together and lining the bottoms of rock pools. Large numbers of Asteria rubens were present on the sampling date, feeding on the mussels.

The sand binding polychaete Sabellaria alveolata may form small clumps of animals and their tubes on the lower part of the limpet/barnacle/Nucella zone and the upper part of the F. serratus/red algae/M. edulis zone at sites which are sufficiently affected by water turbulence to allow sand suspension in the water column at high tide, as at Rathmullan Point (site 119) and Wreck Port (site 123). The largest Sabellaria reef in Northern Ireland is at Glassdrumman Port, (site 122) where the reef grows between mid- and lower shore boulders. Crevices in the reef provide shelter for a wide variety of animals (there is a fishery for edible crabs (Cancer pagurus) which live in holes in the reef).

6. The Laminaria zone

The lower shore at sheltered sites (eg. the boulder shore at Ringboy Point) is dominated by Laminaria digitata, while Alaria esculenta is the most common kelp at exposed sites (eg. Sheepland Harbour, site 113).

The sublittoral fringe is in general less diverse in terms of animal and plant species than at sites along northern Co. Down, because of the more hostile environment created by greater wave action. The main algal understorey is encrusting calcareous red algae, with a reduced diversity of other species. Encrusting animals such as bryozoans and sponges are less common along the south Down coast than along the outer Ards Peninsula.

The lower shore may be affected by sand scour, which also reduces biological diversity. South of Nicholson's Point Site 125, is a boulder shore lying on a bed of sand. It has a reduced species diversity. At Bloody Bridge (site 121) the lower two zones are absent, replaced by a band of only one algal species, Cladophora rupestris, on bedrock above a sublittoral fringe habitat of pebbles and sand.

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HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Rocky Shore Recording Sheet
LOCATION DATA STAGE II

R 12

LOCALITY c WRECK PORT		GRID REF d J372187	LONG e 05/55·05/W	LAT f 54/05·30/N
SHEET No g 12	PUNCH CARD No b	Ht. OF LW. g 0·7 (m)	TIME OF LW. h 1742	DATE i 03 06 85
SEDIMENTARY SHEET No (if any) k	PHOTO Nos	ARRIVAL TIME l 1530	DEPARTURE m 1830	RECORDER IT

COASTAL SITUATION	Dom	2°	3°
Open Coast	1 X	19	35
Sheltered Coast	2	19	36
Headland	3	20 X	37
Large Bay (>2km)	4	21	38
Small Bay	5	22 X	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Vertical Rock	52	75	98
Steep Rock (>30° slope)	53	76	99
L.Rock Ridges	54 X	77	100
Rock Ridges	55 X	78	101
Rock Platforms	56	79	102
Rock Outcrop	57	80 X	103
Fissured Rock	58	81 X	104
Irregular Rock	59	82	105
Large Boulders (>1024mm)	60	83	106 X
Med. Boulders (512-1024mm)	61	84	107 X
Small Boulders (256-512mm)	62	85	108
Stones, Angular (64-256mm)	63	86	109
Shingle, Rounded (64-256mm)	64	87	110
Pebbles (5-63mm)	65	88	111 X
Gravel (2-4mm)	66	89	112
Sand	67	90	113
Mud	68	91	114
Muddy Sand	69	92	115
Muddy Gravel	70	93	116
Black Layer N.S.	71	94	117
Silt Covered Rock	72	95	118
Man Made	73	96	119
	74	97	120

ROCK TYPE	
Spec:	
Igneous/Metamorph.	121
Limestone	122
Hard Mudstone	123 X
Soft Mudstone	124
INTERTIDAL EXTENT (m)	
< 10	125
10 - 50	126
50 - 100	127 X
>100 (Spec:)	128
HORIZONTAL EXTENT (m)	
<100	129
100 - 500	130 X
500 - 1000	131
>1000	132
OFFSHORE FEATURES	
Islands	133
Reefs	134
Breakwaters	135
Sandbanks	136
Shoal	137
COASTAL BACKING	
Sand Dunes	138
Low Cliffs	139
Mod. Cliffs	140
High Cliffs	141
Saltmarsh	142
Grassland	143 X
Peat	144
Valley	145
Freshwater	146
Trees	147
Other:	148
STEEPNESS INLAND	
0	149
1	150
2	151
3 - 5	152 X
5 - 10	153
>10	154

PREVAILNG WIND/ASPECT	W	A
N	155	163
NE	156	164
E	157	165
SE	158	166 X
S	159	167
SW	160	168
W	161	169
NW	162	170
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	171
Exposed	172 X
Moderate	173
Sheltered	174
V. Sheltered	175

FETCH	min	max
< 2	176	181
2 - 10	177	182
10 - 50	178	183
50 - 100	179 X	184
>100	180	185 X

SEA HORIZON	10 miles	40 miles
0	186	199
1	187	200
2	188	201
3	189	202 X
4	190	203
5	191 X	204
6	192	205
7	193	206
8	194	207
9	195	208
10	196	209
11	197	210
12	198	211

Time of ELWST n	1707
Mean Spring Tide Range (m) o	4·6
Mean Neap Tide Range (m) p	2·5
Annual Rainfall (mm) q	

CURRENT STRENGTH (estimate)	
Strong	212
Moderate	213
Weak	214 X

SALINITY	
Normal	215 X
Slighty Reduced (28-33‰)	216
Low (<28‰)	217
Stream Flowing on S.	218
Spec:	

ACCESSIBILITY	
Car Useable to Near Shore	219 X
> 10 min. Walk	220
Boat Only	221

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	222
100 - 500	223 X
500 - 1000	224
1000 - 5000	225
>5000	226
Absent	227

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	228
100 - 500	229
500 - 1000	230
1000 - 5000	231 X
>5000	232
Absent	233

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	234
100 - 500	235
500 - 1000	236
1000 - 5000	237
>5000	238 X
Absent	239

SCIENTIFIC & CONSERVATION INTEREST

BIOTA	Dom Z	Dom C	Dom P	2° Z	2° C	2° P
Fucoids						
Red Algae						
Green Algae						
Brown Algae						
Eel Grass						
Barnacle						
Mussel						
Limpet						
Other Molluscs (Spec:)						
Turf Formers						
Crustose Corallines						
Others: (Spec)						

N.C.C. CLASSIFICATION		
Ascophyllum	240	
Mackaii	241	
Fucoids	242	
Fucobarnacle	243	
Fucomytilus	244	
Chloropatella	245	
Chlorophyta	246	
Rhodomytilus	247	
Rhodobarnacle	248	
Rhodopatella	249	
Mytilobarnacle	250	
Patellobarnacle	251	X
Barnacle	252	
Mollusc	253	
Other: (Spec)	254	

PROMINENT SUBHABITATS	H		M		L	
Wide, Shallow Rock Pools	255	X	265	X	275	
Deep Rock Pools	256		266	X	276	X
V. Large Rock Pools	257		267		277	
Rock Pools	258	X	268	X	278	X
Crevices	259	X	269	X	279	X
Couloirs	260		270		280	X
Overhangs	261		271	X	281	X
Caves	262		272		282	
Reef at Low Tide	263		273		283	
Other: (Spec)	264		274		284	

No./DIVERSITY OF SUBHABITATS		
High	285	X
Medium	286	
Low	287	

RELATIVE SPECIES RICHNESS	Flora		Fauna	
Good	289	X	291	
Average	289		292	X
Poor	290		293	

ORNITHOLOGICAL INT

	Feed		Nest	
Waders	294		298	
Wildfowl	295		299	
Gulls	296		300	
Seabirds	297		301	

SEAL HAULOUT	302	
NAT. RES. STATUS		
Site Within N N R	303	
NNR or ASI Nearby	304	
NT, RSPB or Loc Res Nearby	305	
Nos. of Sub. Survey Sites Nearby		

SUBJECTIVE RATING		
V. Good	306	
Good	307	X
Fair	308	
Poor	309	

NOTES:

HUMAN INFLUENC

Dist. to nearest Town (km) r

AMENITY VALUE

Attractive Beach or Surround	310
Resort Town Nearby	311
Toilets, Shops & Cafes Present	312
Toilets, Shops & Cafes Nearby	313
Car Park	314
Popular	315

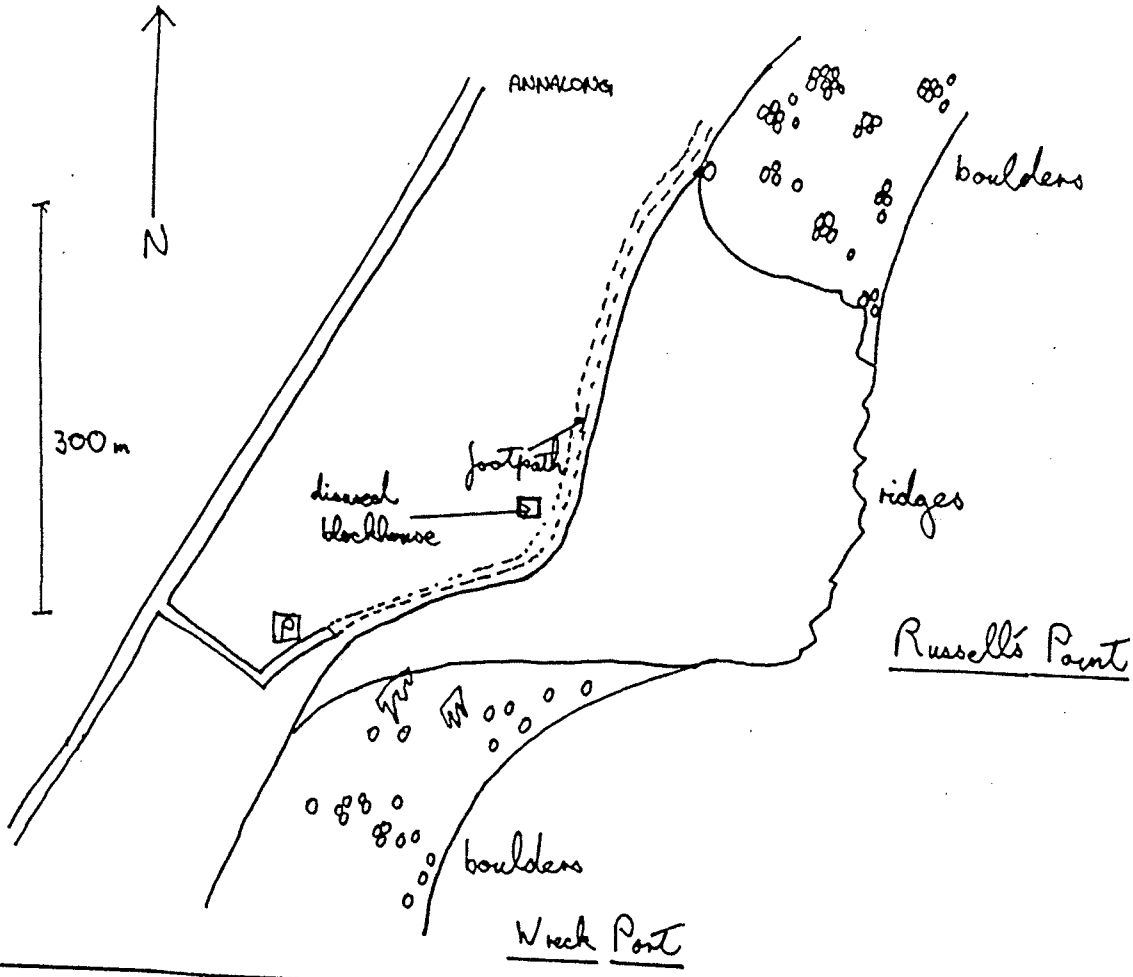
INDUSTRY AND POLLUTION

Factories Present	316
Evidence of Industri. Pollution	
— Toxic	317
— Suspended S	318
Sewage Pollution	319
Land Reclamation	320

SHORE USAGE

Beach Fishing	321
Bait Digging	322
Shellfish Collecting	323
Algal Harvesting	324
Aquaculture	325
Mooring	326
Watersports	327
Other: (Spec)	328 X

SKETCH MAP OF LOCATION



METHOD OF ACCESS

The site lies at the end of a side road to the east of the A2, south of Annalong. The rock ridges visited on this occassion are known as Russell's Point, rather than Wreck Point.

LOCATION DESCRIPTION

The location consists of a headland composed of crevassed rock ridges, and a boulder bay to the south. Both are patellid-barnacle dominated. The ridges are rich in rock pools.

Two transects were surveyed: R12A across the ridges at Russell's Point, and R12B across the boulders to the south.

GENERAL PHOTOGRAPHS

No. of Transects	

Transect Nos.	R12A				

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Northern Ireland Littoral Survey Rocky Shore Recording Sheet
Transect Data Stage II

R12A

E NAME: WRECK PORT A | TRANSECT No.: R12A | LOCATION No.: R12 | SED. SHEET No. (if any):
M No | Ht. OF L.W.: 0·7 m | TIME OF L.W.: 1742 | DATE: 03 06 85
TIME OF ARRIVAL: 1530 | TIME OF DEPARTURE: 1830 | RECORDER: IT

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Substrate Nature	Rock Type	Surface Texture	Surface Features	Total Algal Cover	
								Cover	Patchiness
1		S.E.		1,4,8	3	2,3	1,5,7	1	1
2				1,4,5	3	2,3	1,3,6,7	2	2
3				1,4	3	3	1,2,3,5,6,7	3	3
4		S.E.		1,4,5,6,10	3	3	1	3	3
5									
6									
7									
8									

DESCRIPTION OF TRANSECT SITE

The site is a patella/barnacle dominated rock ridge shore, with Enteromorpha and Porphyra overlying the limpets and barnacles on the seaward, more gently sloping faces of the ridges. There are many rock ridge pools and wide shallow rock pools. The mid tide region (zone 2) is very wide. There are large boulders scattered between some of the mid shore ridges and the lower zone is dominated by large boulders, although rounded rock ridges are also present at this level.

The top of the shore is composed of shingle, with small patches of grass. It lies beneath a concrete path which runs from Wreck Port to Annalong.

Zone 1: Sharp rock ridges with a wide, shallow rock pool. Dominated by V. mamma, with Enteromorpha in pools and littorinids in crevices.

Zone 2: The widest zone. Composed of sharp rock ridges, some about 2m high, with one area of very large boulders between the ridges. Wide, shallow rock pools and ridge pools are common in this zone. The zone is patella/barnacle dominated, with Enteromorpha and Porphyra overlying on seaward facing slopes. Small, scattered patches of Saldellaria exist between the ridges. The pools have a good animal and plant diversity.

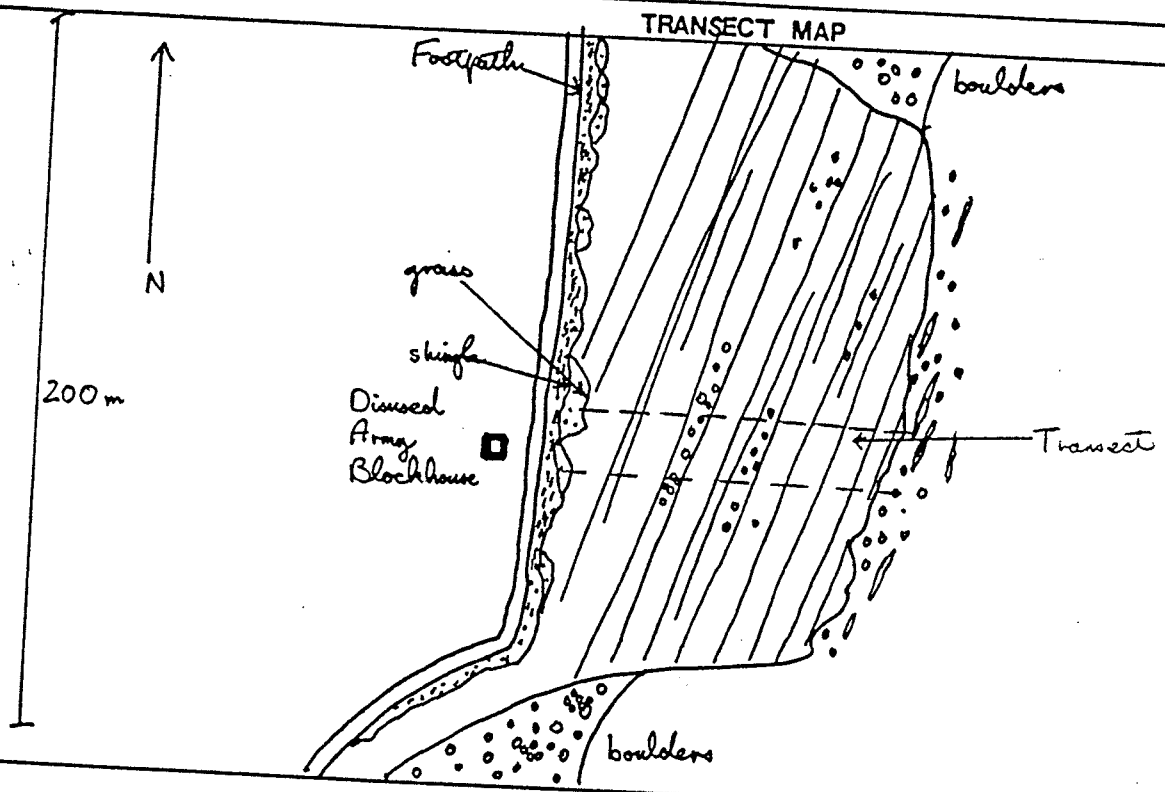
Zone 3: Rounded rock ridges with many pools. The open rock surface at this level is dominated by a diverse mixed red algal community. F. serratus also grows here, but is more apparent in sheltered spots between the ridges.

Zone 4: Mainly large and medium boulders with rounded pebbles underneath. Laminaria dominated. Neither algal nor animal diversity was as good as might have been expected from the rest of the shore.

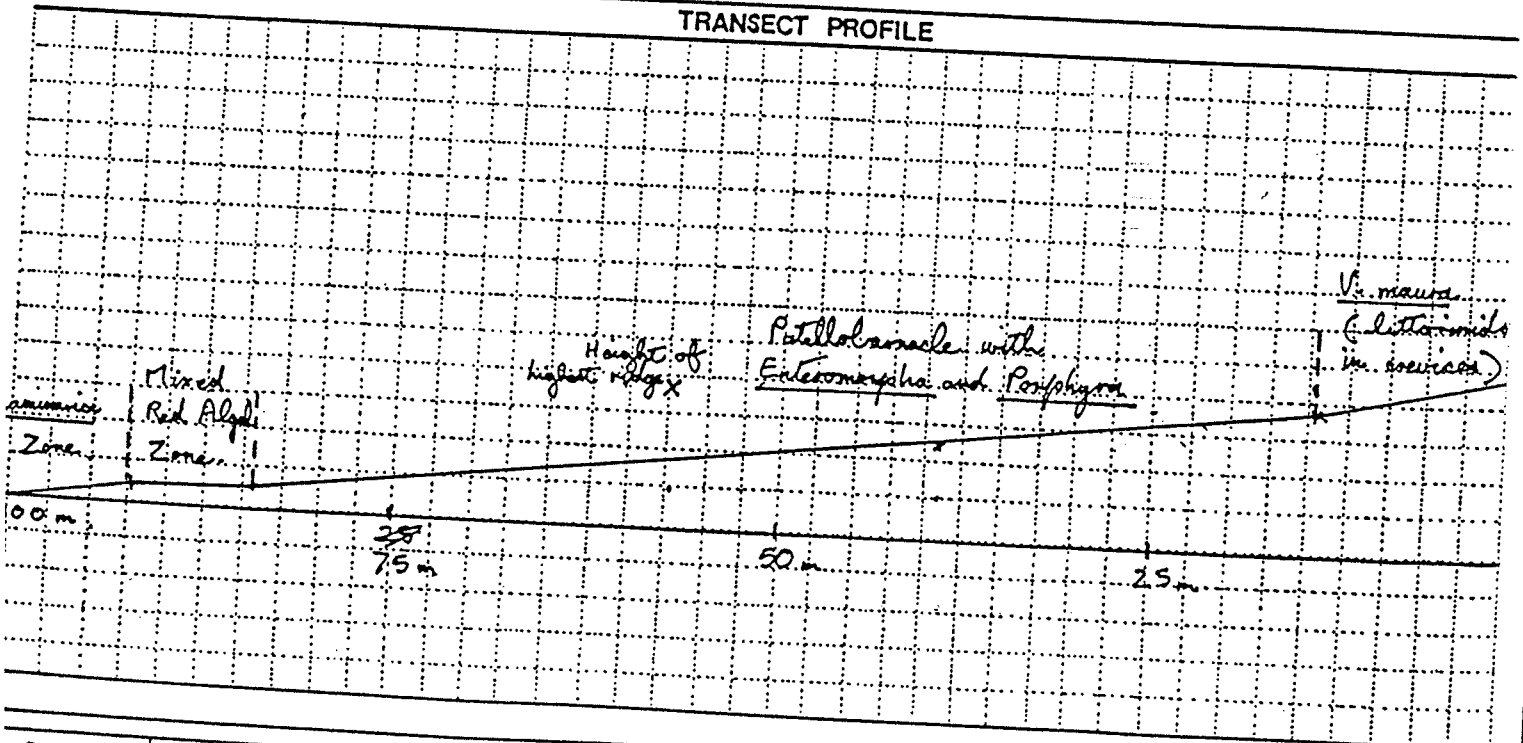
REFERENCE POINT

The transect stretches across the shore in front of a disused army blockhouse in a field. On the sampling date the transect marked was 5.04 m above low water.

TRANSECT MAP



TRANSECT PROFILE



Station	1	2	3	4	5	6	7	8	
Ht. Top	5·0	3·60	0·6m	0·5m					
Ht. Bottom	3·60	0·6m	0·9m	0·0m					

TION/ZONE		1	1	1	2	2	2	3	3	3	4	4	4
ITAT		O	R	C	O	R	C	O	R	C	O	U	L
ntia compressa	C55												
ichondria panicea	C283					1		4	1	1	4	1	1
isarca dujardini	C557								1				1
eniacidon sp													
illa incrustans	C375										3	1	
arella lobularis	C67												
on coronatum	C32												
panularia sp.													
va sp.													
yne sp.													
amena pumilla	D214							4	1	1	4	1	
othyraea loveni	D164												
lia geniculata	D159												
tularia sp.									1				
inia equina	D557		1			1	1	3	1	1	3	1	
inia fragacea	D558												
monia sulcata	D					1							
eus pedunculatus	D588												
ianthus lloydii	D525												
ardsiella carnea	D617												
campa chrysanthellum	D613												
artia elegans	D586												
artia troglodytes	D587												
alia felina	D561								1	1	3	1	
eus longissimus	G31						1						
eus ruber	G34												
ertopsis flavida	G62												
stedia dorsalis	G66												
latus annulatus	G9												
nitrite sp.													
louinia tentaculata	P145												
ellida sp.													
catulus cirratus	P147					1			1				
talia viridis	P336												
olymnia nebulosa	P700												
belligera affinis	P648												
ograna implexa	P773												
rmothoe sp.													
poides norvegica	P766												
sca extenuata	P261												
pidonotus sp.													
anid sp.													
ntys sp.													
eis diversicolor	P506												
reis pelagica	P495											1	1
ne sp.													
mastus latericens	P168												
nelia bicornis	P228												
inaria koreni	P669												
lodocidae sp.													
natoceros triqueter	P679					1			1			1	
ospio elegans	P108												
lla pavonina	P733												
elepis sp.													
pula vermicularis	P765												
filicornis	P107												
orbis borealis						1			1				
irorbis sp.													
ingia sp.													
nculus sp.													
nus balanoides	S37	2			6	1	1	5	1	1	5	1	
anus balanus	S41												
nus crenatus	S38												
amalus montagui	S34												

STATION/ZONE		1			2			3			4		
HABITAT		O	R	C	O	R	C	O	R	C	O	U	L
Ophthamalus stellatus	S55	3			5								
Elminius modestus	S48												
Verruca strcemia	S27												
Idotea sp.													1
Jaera sp.													
Ligia oceanica	S312												
Amphipoda sp.				1									
Cancer pagurus	S1240												
Carcinus maenas	S1225					1			1			3	1
Galathea squamifera	S1157	1				1			1				1
Galathea strigosa	S1158											2	
Hyas araneus	S1271												
Macropipus depurator	S1220					1			1				1
Macropipus puber	S1215												
Macropodia longirostris													
Palaemon elegans	S1015												
Porcellana longicornis	S1162												
Porcellana platycheles	S1163					1			1			1	
Pagurus bernhardus	S1172					1			1			1	
Pagurus sp.						1			1				
Petrobius maritimus													
Nymphon rubrum	Q3												
Pycnogonum littorale	Q25												
Acanthochitona crinitus	W50												
Ischnochiton albus	W44												
Lepidochitona cinereus	W45												
Lepidopleurus asellus	W28								1			1	
Tonicella marimorea	W46												
Tonicella rubra	W47												
Acmaea tessulata	W80												
Acmaea virginea	W81	1			1			4	1	1		3	1
Buccinium undatum	W440												
Calliostoma zizyphinium	W106												
Cingula sp.													
Gibbula cineraria	W110												
Gibbula magus	W113				1	1			1	1		3	1
Gibbula umbilicailis	W111												
Hydrobia ulvae	W162								1	1		3	1
Lacuna vincta	W141												
Littorina littorea	W148											2	
Littorina neglecta	W153	1		4	1	1			1				
Littorina neritoides	W151			4		1							
Littorina obtusata	W149												
Littorina saxatilis sp.					1			3	1	1			
Modiolus modiolus	W116												
Mytilus edulis	W450												
Mytilus reticulata	W449				1				1			1	
Mytilicella lapillus	W410												
Nucula sp.				4	1	1		4	1	1		3	1
Nucella aspera	W86												
Nucella intermedia	W			3	1	1		3	1	1		2	1
Nucella vulgata	W85												
Ostrea pellucida	W84	1		5	1	1		4	1	1		4	1
Ostroid sp.												3	1
Planeopsis planorbis	W225												
Pelvia artica	W382												
Pelvia Monacha	W381												
Philidia papillosa	W870												
Philidoris pseudoargus	W816			1			1						
Phyphella verrucosa	W851			1			1						
Pomia ephippium	W1053												
Porea sp.												1	
Pumys distorta	W1034												
Pumys varia	W1037												

STATION/ZONE		1	1	1	2	2	2	3	3	3	4	4	4
REPLICATE		O	R	C	O	R	C	O	R	C	O	U	L
Patella arctica	W1299								1			1	1
Tesaea rubra	W1098												
Modiolus sp.													
Mytilia patelliformis	W1054												
Mytilia squama	W1055												
Musculus discors	W999												
Mytilus edulis	W991		1			1	1		4	1	1	3	1	1
Modiolas dactylus	W1310												
Meritonia minuta	W1272												
Venerupis pullastra													
Arfaea crispata	W1313												
Asterias rubens	ZB83					1				1	1	4	1
Henricia sanguinolenta	ZB69												
Parthasterias glacialis	ZB95												
Amphipholas squamata	ZB138												
Amphinocommina nigra	ZB112												
Amphiothrix fragilis	ZB108												1
Amphiura texturata	ZB144												
Echinus esculentia	ZB170												
Strongylocentrotus sp.													
Gumaria sp.													
Alcyonidium gelatinosum	Y63					1				1		3	
Alcyonidium hirsutum	Y59					1				1		3	
Flustra foliacea	Y338					1				1		3	
Lustra foliacea	Y346												
Lustrellidra hispida	Y55									1		3	
Membranipora membranacea	Y333												
Didemnidium/Marchellum sp.													
Ascidiella scabra	ZD62												
Ascidia conchilega	ZD64												
Ascidia mentula	ZD63												
Botrylloides leachii	ZD90									1			
Botryllus schlossrei	ZD89									1		3	
Ciona intestinalis	ZD49					1				1			
Clavelina lepadiformis	ZD4												
Endrodoa grossularia	ZD86					1	1			1			
Polyclinum aurantium	ZD11												
Didnyum turbinatum	ZD14					1							1
Didemnum tenerum													
Ammodytes tobianius	ZG518												
Blennius gattorugine	ZG474												
Liliata mustela	ZG209												
Diplecogaster bimaculata	ZG170												
Gaidropsarus mediterraneus	ZG213												
Gobius paganellus	ZG535												
Hyperoplus lanceolatus	ZG521												
Lepidogaster candollei	ZG172												
Liparis liparis	ZG367												
Liparis montagui	ZG368												
Myxocephalus scorpius	ZG351												
Nerophis lumbriciformis	ZG316												
Pholis gunnellus	ZG500												
Spinachia spinachia	ZG301												
Syngnathus typhle	ZG314												
Taurulus bubalis	ZG352												
ANNELIDA													
Aphroditidae mediterranea	P265										1		
Eunicidae sp.	187									1			
Eunicia sabella	P746									1			
Hermathoe impar	P265					1						1	
Lepidonotus squamatus	P283											1	1

		ORC	ORC	ORC	ORC
ANNELIDA ctd.					
Lanice conchilega	P695		1		
Sabellaria alveolata	P662		2		
Spirorbis tridentatus	P785		1	1	3 1
ARTHROPODA					
Ampithoe rubricata	S697			1	2
Apherusa jurinei	S623		1	1	2 1
Chironomid larvae	112	1	1		2 1 1
Corophium bonnellii	S702				1 1
Gammarellus angulosus	S627				2
Hyale nilsonii	S690		1	1	
Idotea granulosa	S259		1	1	1
Idotea pelagica	S263		1	1	2
Jaera albifrons	S276		1		
Jassa falcata	S726		1	1	2
Jassa ocia	S728			1	
Lembos websteri	S667				2
Lipura maritima	114	3 1 1	4 1 1		
Pulaemon elegans	S1015	1	1		
BRYOZOA					
Bowerbankia imbricata	Y120		1		
Callopora lineata	Y354			1	
Celleporella hyalina	Y287			1	1
Scrupocellaria scabra	Y327		1		
CNIDARIA					
Clytia hemisphaerica	D155			1	
Obelia dichotoma	D158			1	1
ECHINODERMATA					
Asterias rubens	ZB50		1	1	
Psammechinus miliaris	ZB169		1	1	
~~NEMERTEA~~					
MOLLUSCA					
Littorina mariae	W150	4 1 1			
Littorina patula	120	4 1 1	4 1 1		
Littorina rudis	W155			2	
Margarites helicinus	W100		1		
Mytilus marmoratus	121			1	
Rissoa parva	W197			1	
NEMERTINEA					
PORIFERA					
Halichona sp.	C513			1	
Leucosolenia sp.	C48			1	
Leucosolenia sp.	C25			1	

Ectocarpus sp.	
Ectocarpus marginata	ZS266
Ectocarpus minima	ZS267
Myopsis hypnoides	ZS360
Myopsis plumosa	ZS361
Chaetomorpha capillaris	ZS321
Chaetomorpha linum	ZS323
Chaetomorpha melagonium	ZS325
Cladophora albida	ZS328
Cladophora pellucida	ZS340
Cladophora rupestris	ZS346
Cladophora sericea	ZS347
Cladophora sp.	
Codium sp.	
Enteromorpha linza	ZS273
Enteromorpha sp.	
Monostroma fuscum	ZS243
Monostroma grevillei	ZS244
Monostroma oxyspermum	ZS246
Prasiola stipitata	ZS178
Rhizoclonium riparium	ZS352
Rosenvingiella polyrhiza	ZS180
Ulva lactuca	ZS280
Urospora/Ulothrix turf	
Ulothrix flacca	ZS229
Ulothrix speciosa	ZS231
Alaria esculenta	ZR234
Ascophyllum nodosum	ZR280
Bifurcaria bifurcata	ZR296
Chorda filum	ZR221
Chorda tormentosum	ZR222
Cladostephus spongiosus	ZR263
Cystoseira baccata	ZR297
Cystoseira tamariscifolia	ZR301
Cystoseira nodicaulis	ZR300
Desmarestia aculeata	ZR207
Dictyosiphon foeniculaceus	ZR178
Dictyota dichotoma	ZR271
Fucus ceranoides	ZR281
Fucus serratus	ZR286
Fucus spiralis	ZR287
Fucus vesiculosus	ZR288
Halidrys siliquosa	ZR303
Himanthalia elongata	ZR293
Laminaria digitata	ZR225
Laminaria hyperborea	ZR227
Laminaria saccharina	ZR229
Leathesia difformis	ZR103
Pelvetia canaliculata	ZR290
Petalonia fascia	ZR187
Pilayella littoralis	ZR33
"Ralfsia" crusts	132
Scytosiphon lomentaria	ZR191
Ahnfeltia plicata	ZM120
Audouinella turf	
Bangia atro-purpurea	ZM483
Bostrychia scorpioides	ZM397
Callithamnion sp.	
Catenella : caespitosa	ZM98
Ceramium shuttleworthianum	ZM330
Ceramium sp.	
Chondrus crispus	ZM138
Corallina officinalis	ZM154
Cystoclonium purpureum	ZM103

HABITAT		1			2			3			4		
		O	R	C	O	R	C	O	R	C	O	U	C
Dilsea carnosa	ZM201												
Dumontia incrassata	ZM203					1			1				
Furcellaria lumbricalis	ZM80					1					4		
Gastroclonium ovatum	ZM270					1			4	1		2	
Gelidium sp.										1		3	
Gigartina aciicularis	ZM139					1			3	1	1		
Gigartina stellata	ZM141												
Gracillaria verrucosa	ZM116	1				1	1		5	1	1		4
Hildenbrandia rubra	ZM253												
Hypoglossum woodwardii	ZM373	1				1			3	1	1		4
Laurencia hybrida	ZM405												
Laurencia pinnatifida	ZM407					1	1		5		1		
Lithothamnium glaciale	ZM184					1	1		5		1		
Lomentaria articulata	ZM272					1			2	1	1	2	
Lomentaria clavellosa	ZM273					1	1		3	1	1	4	
Membranoptera alata	ZM14												
Odonthalia denticulata	ZM411					1			2	1		3	
Palmaria palmata	ZM260									1		4	
Phycodrys rubens	ZM381	D				1			3	1		4	
Phyllophora truncata	ZM131	D				1				1		3	
Phyllophora crispa	ZM127												
Phyllophora pseudoceranoid.	ZM128												
Phyllophora traillii	ZM130					1				1		3	
Phymatolithon lenormandii	ZM194												
Plocamium cartilagineum	ZM108					1				1	1	3	
Plumaria elegans	ZM349									1			
Polyides rotundus	ZM95								2	1	1		
Polysiphonia brodiaei	ZM412												
Polysiphonia lanosa	ZM422												
Polysiphonia nigrescens	ZM425												
Polysiphonia urceolata	ZM434									1			
Polysiphonia sp.	166					1	1		2	1		3	1
Porphyra leucosticta	ZM485					1				1	1	3	
Porphyra linearis	ZM486												
Porphyra umbilicalis	ZM489												
Ptilota plumosa	ZM351			3									
Rhodomela confervoides	ZM442								D			D	
Non calc. encrusters										1			
Calc. encrusters	125								5	1	1	4	
Supralittoral blue-greens									5	1	1	4	
Vaucheria sp.													
Verrucaria maura	126	8		3									
Verrucaria mucosa	127			3									
Lichina confinis													
Lichina pygmaea													
Ruppia sp.													
Zostera angustifolia													
Zostera marina													
Zostera nana													
BACILLARIOPHYTA													
Berkeleya rutilans			1			1							
CHLOROPHYTA													
Chlorochytium Cohnii	ZS187				2	1							
Cladophora Hutchinsiae	ZS336		1										
Enteromorpha compressa	ZS270							2	1				
Enteromorpha intestinalis	ZS272		1	1									
Enteromorpha prolifera	ZS274		1										
Spongomorpha aeruginosa	ZS251					1			1				
Spongomorpha arcta	ZS252		1		2	1	1	2	1		2		
Ulonema obscurum	ZS245					1							
Urospora penicilliformis	ZS235	3											

		1			2			3			4		
		O	R	C	O	R	C	O	R	C	O	R	C
CYANOPHYTA													
Dermocarpa sp.								2					
Lyngbya sp.		1											
PHAEOPHYTA													
Chordaria flagelliformis	ZR114				1								
Dictyosiphon chordaria	ZR176								1				
Ectocarpus fasciculatus	ZR6				1				1				
Ectocarpus siliculosus	ZR7				1								
Elachista fucicola	ZR93								1				
Eudesme virescens	ZR117				1								
Giffordia sp.	ZR22										2		
Isthmoplea sphaerophora	ZR139				1								
Litosiphon laminariae	ZR163				1				1		2		
Punctaria tenuissima	ZR169											1	
Ralfsia verrucosa	ZR61								1				
Sphacelaria fusca	ZR249				1				1		2		
Sphacelaria sp.	ZR256								1				
Spongonema tomentosum	ZR36				1								
RHODOPHYTA													
Acrosorium ciliatum	ZM365				1								
Audouinella floridula	ZM19		1										
Audouinella secundata	ZM30				1	1		2	1				
Callithamnion hookeri	ZM304				1	1			1				
Ceramium echionotum	ZM322				1			2	1				
Ceramium rubrum	ZM328								1				
Cruoria pellita	ZM94										2	1	
Delesseria sanguinea	ZM369								1				
Dermatolithon dermatinae	ZM157								1				
Dermatolithon pustulatum	ZM162											1	
Gelidium latifolium	ZM160				1								
Gelidium pusillum	ZM161	1			1			3	1	1			
Melobesia membranacea	ZM198								1				
Polysiphonia brodiaei	ZM417				1								
Polysiphonia nacrocarpa	ZM423				1			2					
Porphyra leucosticta	ZM485				1				1				
Porphyropsis coccinea	ZM490				1				1				
Pterosiphonia parasitica	ZM439				1				1				

Computer analyses (see Section 6) identified one atypical site from southern Co. Down. This was site 116, Black Rock, which has a community closer to those found along the north coast than to those found along southern Co. Down. This was the only cliff site visited in Co. Down during the course of the survey. This site is also exposed to strong wave action, which had resulted in a steep rock/exposed shore community being formed similar to those found along the Antrim coast and outer Islandmagee.

The Stage II recording sheet included here to illustrate representative southern Co. Down habitats and communities comes from Wreck Port (sites 123, 124). Two rocky transects were studied at this location; one across an exposed boulder shore and the other across an exposed headland of creviced sedimentary rock.

Sedimentary Shores - North and South Down

TWINSPAN analysis (Figures 5.8 and 5.9) indicates that all the outer Co. Down sedimentary shores contained biological communities characteristic of moderate/sheltered sandy shores, with one exception.

The exception is an open coast site at Robin's Rock (site 79, Figure 6.3). The infaunal community at this site is classified with the muddy communities more normally found in sea loughs.

The sediment at Robin's Rock is almost completely enclosed by rock outcrops at low tide, and is not exposed to wave action. Organic detritus collects in the sheltered embayment formed by the rock outcrops, and contributes towards high levels of detritus in the sediment. This in turn influences the composition of the infaunal community.

All the remaining sandy sites along the outer Co. Down coast, along the shore of both north and south Down, contain similar communities; moderate/sheltered open coast sandy communities. Characteristic species include Anaitides maculata, Arenicola marina, Scolelepis squamata, Bathyporeia pelagica, Eurydice pulchra, Gammarus locusta and Tellina tenuis.

Southern County Down - Conservation

The sedimentary shores of the outer Co. Down coast all contain similar infaunal communities. The siting of representative protected areas of sand for conservation purposes could be based solely on practical/pragmatic criteria, ie. on the basis of the proximity of sandy sites to other sites of nature conservation importance, whether terrestrial, intertidal or sublittoral. This applies to sedimentary shore of both north and south Down.

Conservation of the rocky shores of south Down will be discussed for two different types of area:

(i) individual sites or small areas which are particularly rich or are examples of unique habitats which merit protection;

(ii) larger areas which contain a good diversity of habitat and community types typical of south Down.

Only one site along the southern Co. Down coastline will be discussed as an example of category (i); that site is at Glassdrumman Port (site 122), and contains the largest reef in Northern Ireland formed by the sand binding polychaete Sabellaria alveolata.

Hawkins (1984) surveyed the status of S. alveolata on mainland Britain. He concluded that S. alveolata is an ecologically important species. The reefs lead to an increase in diversity of the littoral community; a rich crevice fauna is associated with cracks and cavities, especially in older reefs, and pools may form on the surface.

Sabellaria forms three types of colony; sheets, hummocks and reefs. Isolated outcrops of Sabellaria form patchy sheets and occasional hummocks along the rocky shores of south Down from Carlingford Lough to the animals' northern limit at Coney Island Bay (site 115). However, the only colony in Northern Ireland which has developed into the most massive growth form, the reef, exists at Glassdrumman Port.

One area will be described under heading (ii) above. A diverse range of characteristic southern Co. Down rocky habitats and communities exist between St John's Point and Rathmullan Point. It will be discussed in terms of the criteria defined by Mitchell (1986) for conservation evaluation of marine sites.

(i) **Representativeness**

The area contains two exposed limpet/barnacle and Nucella dominated headlands, at Rathmullan Point (site 119) and St John's Point (site 117), and one headland which was not visited. The area also contains sandy beaches (east of Rathmullan Point and west of Rossglass).

(ii) **Rarity**

The area contains a habitat which is under-represented along the southern Co. Down coastline; a relatively sheltered Fucus vesiculosus and Ascophyllum nodosum dominated boulder shore at Ringboy (site 118).

(iii) **Diversity**

The area contains a wider diversity of habitats, including exposed bedrock headlands, sheltered boulder shore and sandy beaches. The diversity of exposure grades is larger than along any other section of the southern outer Co. Down coast.

(iv) **Size**

The intertidal extent of this area is wider than most other sections of southern Co. Down.

6.3.3 Discussion

Intertidal species richness is greater along the Co. Down coast than along the shores of Co. Antrim and Co. Londonderry. Co. Down contains the two most species rich sea loughs in the country, Strangford and Carlingford Loughs, and the richest stretch of open coastline around Northern Ireland lies along north east Co. Down, outside the Ards Peninsula.

Easy accessibility from Belfast and other population centres and the presence of sandy beaches make the Co. Down coast attractive for holidaymakers. There are many caravan parks along the coastline, and beaches and adjacent landward areas are used by daytrippers. Pressure on the sea loughs and Dundrum Bay is potentially of a less intermittent and more long term nature, including for example creeping land reclamation, large scale algal harvesting or aquaculture, and a possible gradual decrease in water quality (see Appendices IX, X and XI). These semi-enclosed areas are probably more at threat from human activity than the open coast.

Co. Down is rich in intertidal species and intertidal habitats; human impact on the coastline is greater than that found north of Belfast Lough. In view of both these facts it is important to adopt a conservation strategy for intertidal habitats along the Co. Down coast.

The aim of this section is to consider the conservation status of Co. Down as a whole, by summarising information already presented in Section 6.3 for each section of the coast. Sedimentary and rocky shores will be dealt with separately.

SEDIMENTARY SHORES

The Open Coast

Sedimentary shores around the open coast of Co. Down nearly all contain similar infaunal communities. The only site which stands out as unique is the channel which flows from Dundrum Inner Bay to the sea. Otherwise site choice for conservation purposes can be based on pragmatic criteria; open coast sedimentary sites could be chosen because of their proximity to other sites of nature conservation value, whether terrestrial, intertidal or sublittoral.

The Sea Loughs and Dundrum Bay

Wide intertidal sedimentary flats

It is difficult to assess the wide sedimentary areas of Mill Bay (Carlingford Lough), Dundrum Bay and north and south west Strangford in relation to one another from the results of the present survey. This would have required a far more intensive sampling programme. Even if such a programme was carried out it would be impossible to say, for example, that Dundrum Bay is "better" than North Strangford.

Each of these areas is important within its local context. In addition all the flats are important as feeding grounds for wildfowl and waders and as nurseries for fish fry. The bird populations have been well studied, but the relative importance of the flats in each area as nurseries for young fish is unknown.

All the flats are important from a nature conservation point of view. Any order of importance would need to be decided, not on the basis of any intrinsic differences between the flats, but rather from the nature and extent of other habitats with which they are associated.

Carlingford Lough

The important sedimentary shores of Carlingford Lough in a nature conservation context are the moderately exposed current-affected sandy beaches at the entrance, which show evidence of the emergence of sublittoral species into the intertidal region, and the wide flats of mud, sand and gravel in Mill Bay. May Bay also has an unusually extensive, but relatively species poor, fucoid dominated boulder shore associated with the sediment surface, and an important salt marsh.

Dundrum Inner Bay

Dundrum Inner Bay is associated with a range of terrestrial, brackish and marine sedimentary habitats. The bay itself contains mud, muddy gravel and sand and shows a gradation of community type with salinity regime. It is next to the sand dunes of Murlough nature reserve, the sandy beach of the adjacent coast and the variable salinity channel which flows from the bay between Murlough and Ballykinler to the sea. All of these habitats contain distinct biological communities, which increases the potential conservation value of the whole area.

Strangford Lough

Strangford Lough contains the greatest diversity of sheltered sedimentary habitats, including wide flats of muddy sand and mud, and shores of mud, sand, gravel, and pebbles and combinations of these, found along both the Co. Down coast and the whole of the Northern Ireland coastline. The Comber estuary flows into the lough; sediments in the estuary contain brackish water infauna. There are also several current affected areas, such as the narrows and the Dorn, where lower shore sediments contain animals normally found only sublittorally. Salt marshes have developed at several areas round the shores of the lough.

ROCKY SHORES

Computer analyses of the biological communities found on the rocky shores of Co. Down divides them into three main groups. Two of these are northern Co. Down and southern Co. Down, with a gradual change in community character on the stretch of coastline between the two groups, and the other is a group of Strangford and Carlingford Lough communities.

The main trend in community variation is related to exposure; the sea loughs are the most sheltered areas, and southern Co. Down is the most exposed area. Other physical factors are also involved, as discussed in Section 6.1.

There may be a slight change in community structure between north and south Down caused by the existence of an ocean front which touches the coast between the entrance to Strangford Lough and St. John's Point during the summer. Water south of this line is stratified, with a warm surface layer and deeper cold layer, separated by a marked thermocline (Lee and Ramster, 1981; quoted in Erwin et al, 1986).

It has been known for some time that two southern species, Monodonta lineata and Sabellarina alveolata, reach their northern limit in Northern Ireland around St. John's Point (Boaden, Pers. Comm.) and that southern species occur in Strangford and Carlingford Loughs (eg. Cystoseira nodicaulis was found during the present survey). However the only species found during the course of the littoral survey which has a similar distribution pattern to Monodonta and Sabellaria on the open coast is the spider crab, Hyas araneus, which occurs frequently in Strangford and along the outer Ards Peninsula, but is common on the lower shore along southern Co. Down and Carlingford.

A more detailed analysis of species distribution from Northern Ireland Littoral Survey results should come at a later date. However, at the moment, it seems that while southern species are present in Strangford and Carlingford Loughs and southern Co. Down, they do not form a major component of the flora and fauna at most sites. The community differences found between rocky shores of north and south Down and the sea loughs can be more readily explained by differences in physical factors, notably exposure.

In this context, it is interesting to note that M. lineata commonly occurs in Carlingford Lough, and that a walk along the shore between Mill Bay and Killowen passes many small Sabellaria clumps. Both of these species are absent from Strangford. This could indicate that any southern influence on the flora and fauna of Co. Down is stronger in Carlingford Lough than in Strangford.

Northern County Down

The rocky shores of the outer Ards Peninsula are some of the richest open coast sites in Northern Ireland. In terms of species number they are only slightly less rich than Strangford Lough sites. While they lack the very large numbers of lower shore invertebrate species found in Strangford Lough, they contain a greater diversity of intertidal algae associated with the mid and lower shore rock pools found on the creviced bedrock substrate.

Apart from Ballymacormick Point, which has a particularly good range of rocky and sedimentary subhabitats and shows the development of an upper shore community unknown along the rest of the outer Ards Peninsula, the sites along this stretch of coastline are all very similar in terms of animals and plants present, and in terms of range of habitats.

This being the case, representative conservation areas along this stretch of coast should be chosen from areas which are relatively unaffected by human impact, and which are of larger extent. Associations with other sites of conservation importance, whether terrestrial of sublittoral, would also be an advantage. Two possible areas were indicated in the text.

Southern County Down

Sites along southern Co. Down are more exposed to wave action than outer Ards sites and are in general, less species rich. Boulder shores are commoner along southern Co. Down than they are along the outer Ards.

One site merits special protection from a nature conservation point of view; the Sabellaria reef at Glassdrumman Port.

Representative conservation areas should be chosen to include examples of sedimentary rock and boulders and sandy areas, with a range of exposures. One area was indicated in the text.

Strangford Lough

Strangford Lough is the richest single area around the Northern Ireland coastline for intertidal rocky shore invertebrates, including many species not found elsewhere and contains examples of current swept areas which are rare round the remainder of the coastline. However the lough has a relatively species poor, if distinctive, algal population. In addition the lough contains an example of only one type of rocky shore community out of the five major community types which computer analyses have indicated exist round the coastline. From this point of view, it is important to include examples of open coast rocky shores in any conservation scheme in addition to Strangford Lough.

Carlingford Lough

The rocky shores of Carlingford Lough are relatively under-represented in the data matrix in comparison to the importance of the lough as indicated by the three sites which were visited. In particular it would have been useful to visit the islands at the entrance to the lough and the lower shore platforms between Cranfield Point and Greencastle which are only visible during low water of spring tides.

The sites visited on the shores of the inner lough were similar to the most sheltered, Laminaria saccharina dominated and invertebrate rich sites of Strangford Lough. One of the sites visited near the lough entrance showed evidence of the emergence of sublittoral species due to current effects. In both cases the areas are of conservation importance.

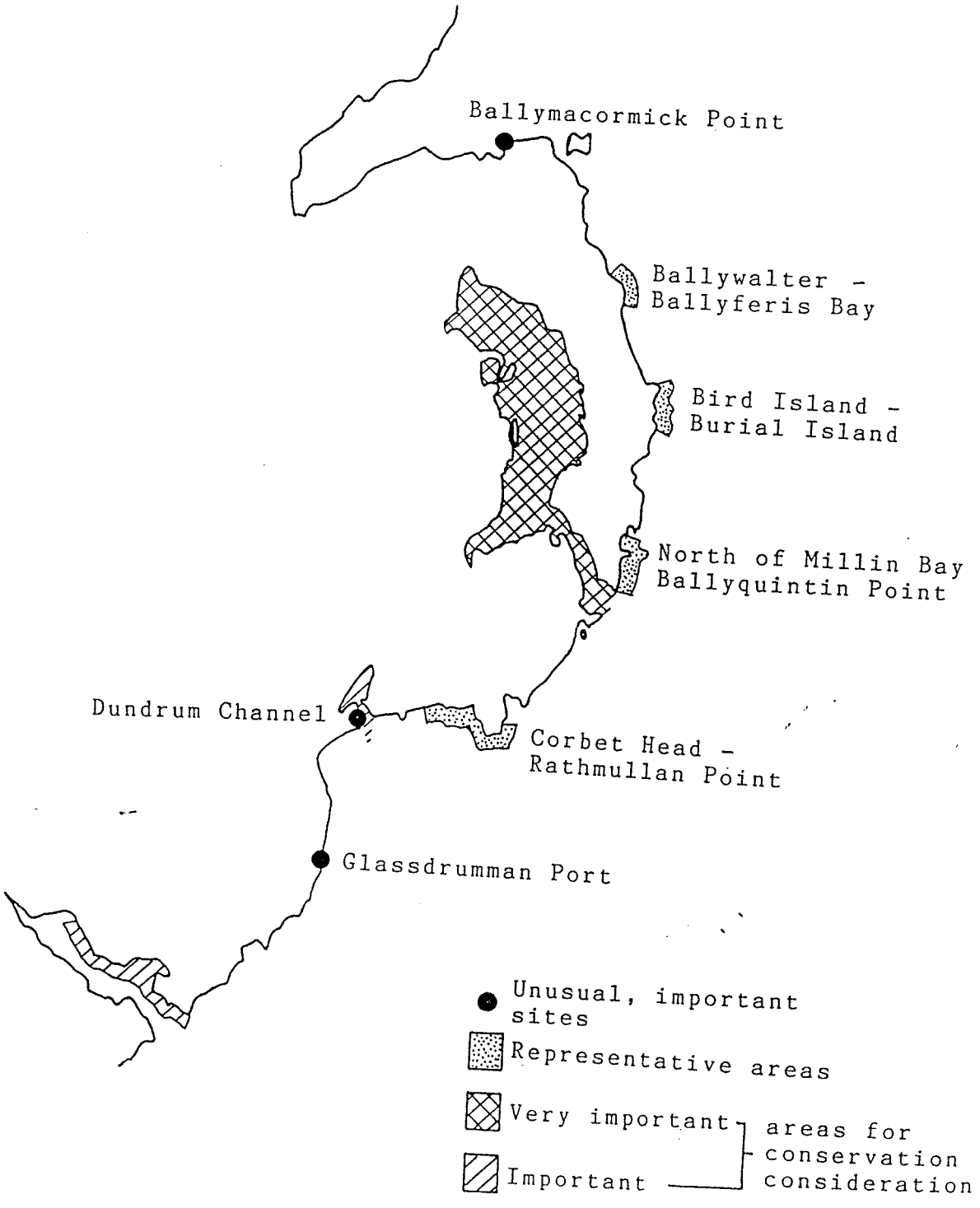


Figure 6.20: Areas of conservation interest South of Belfast Lough.

Figure 6.20 is a summary map of all the potential marine conservation areas of Co. Down. These come under three categories:

(i) individual sites of limited extent of nature conservation importance. Details of these sites are available in the appropriate chapters of Section 6.3;

(ii) larger areas of nature conservation importance around the Co. Down coast. There are three of these areas: Strangford Lough, Carlingford Lough and Dundrum Bay. Conservation assessment of each area has been made separately in Section 6.3. Strangford Lough is the most important of the three areas in terms of sheltered rocky and sedimentary habitat and community diversity, in terms of numbers of rare invertebrate species and in terms of size;

(iii) representative areas containing a range of typical habitats and communities from the open coast of northern and southern Co. Down.

7. DISCUSSION

This section will be divided into three main headings:

(i) application of survey results to nature conservation assessment;

(ii) lessons learned from the littoral survey;

(iii) possible future work.

7.1 USE OF SURVEY RESULTS IN NATURE CONSERVATION ASSESSMENT

Mitchell (1986) identifies fourteen criteria for use in the comparative evaluation of marine sites for conservation purposes.

The first six of these are defined as ecological/scientific; these are the criteria which have been used, implicitly or explicitly, as guidelines for scientific conservation assessment of the coastline throughout this report. The remaining eight are practical/pragmatic criteria which are concerned with practical aspects of site choice and management.

The aim of this section is to describe, with examples, how the criteria were applied to survey results, how useful each criterion was in relation to the others and finally how computer analyses of the Stage II results helped in conservation assessment.

The criteria are:

Ecological/Scientific:

(i) naturalness;

(ii) representativeness;

(iii) rarity;

(iv) diversity;

(v) fragility

(vi) size;

Practical/Pragmatic:

(vii) situation;

(viii) recorded history;

(ix) research and education potential;

(x) restoration potential;

(xi) intrinsic appeal;

(xii) vulnerability;

(xiii) urgency;

(xiv) feasibility.

Of the six scientific criteria, three were particularly useful for assessing conservation potential round the Northern Ireland coastline. These are representativeness, diversity and rarity. In addition, results from computer analyses of the Stage II data are particularly applicable to these three criteria.

Representativeness

"To a large extent the protection of representative biocenoses should be the core of any conservation strategy based on site protection. A resource survey is essential to produce the required classification of representative biocenoses ..." (Mitchell, 1986).

A robust classification scheme of intertidal rocky communities has been produced by using three different types of analysis - clustering, ordination and indicator species analysis. Distinct areas containing the major communities are confirmed by these analyses. This has been the most important result to come from computer analyses of the Stage II data. Conservation assessment could then be made within each sector of the coastline in the knowledge that different sectors contained different "community types".

A broadly similar classification scheme was produced subjectively at the end of the Stage I survey as an aid to site selection, based mainly on physical site attributes, however the computer scheme has several advantages:

(i) it is objective in nature and would carry more weight as part of the planning process;

(ii) it is based on biological attributes, rather than on physical attributes;

(iii) it provides a hierarchical classification of communities, which was not possible in the subjective assessment. The major split in each type of rocky shore analysis comes between sites north of Belfast Lough and sites south of Belfast Lough. This was an indication that these areas should be assessed separately for nature conservation purposes;

(iv) it also provides an indication of the degree of similarity between sites within each community type. For example the east Antrim boulder shores cluster closely together, indicating that, in this case, a long stretch of coast holds shores with similar biological communities;

(v) it is also, in some ways, more sensitive than the subjective assessment. For example, the outer coast of Co. Down was treated as a single unit for site selection purposes at the end of the Stage I survey. Computer analyses indicates that different communities exist to the north and south of Co. Down.

Diversity

There are three components to diversity: species diversity within a site; and habitat diversity and community diversity (one may be a reflection of the other) within a longer stretch of coastline.

Computer analysis does not pick out individual sites with a high species diversity. However it can point to areas which exhibit a variety of community types.

Because the distribution of rocky shore communities is related to broad geographical trends, no small extent of coastline exhibits the whole range of community types. However, some stretches are better than others in this respect. For example, the shores of Rathlin Island exhibit a range of communities typical of the Antrim coast.

Species diversity is an important criterion to be considered when assessing the nature conservation value of sites. However, it is possible to over-estimate the importance of high species diversity in conservation assessment. In the present survey, the emphasis has been placed on selecting examples of representative communities round the coastline, rather than on selecting only those areas of the coast with a high species diversity.

Rarity

The computer analyses which have been performed do not pick out rare species, but they pick out some rare communities associated with unusual habitats. For example the Dorn and the channel running from Dundrum Bay to the sea were picked as outliers under TWINSPAN analysis of sedimentary sites. However, in this case computer results must be treated with circumspection; computer analysis does not always pick out unusual communities.

The Dorn is the most species rich invertebrate rocky site investigated during the course of the survey. It is a tidal rapids site with several sublittoral species present; however under computer analyses it grouped closely with the remainder of the sites from Strangford Lough. In a similar way, most of the other current affected sites in Strangford Lough also group with non-current affected sites.

This may be explained by the fact that the overall community structure at these sites is characteristic of Strangford Lough. The unusual or rare species present at the current affected sites are usually found only on the lower shore and are not significant enough in terms of abundance to group the current affected sites separately from the non-current affected sites.

One way to overcome this would be to artificially weight the significance of certain species under computer analysis. However it is easier to assess conservation potential by taking account of this factor when the data are examined.

The presence of rare species was not assessed using computer analyses. However it was taken into account when assessing areas for conservation potential. Many sites have one or two species which are not encountered elsewhere, but sites in some areas are particularly rich in rare species, for example, many species of invertebrate are found intertidally in Strangford Lough which are not present round the remainder of the coastline.

Assessment of the three remaining ecological/scientific criteria was made without the aid of computer analysis. In the case of two of the criteria, Naturalness and Fragility, assessment was made by means of literature reviews examining human impact on the Northern Ireland coastline (Appendices IX, X and XI), including such factors as pollution, bioresource exploitation, tourism and land reclamation. Three general conclusions were reached:

(i) the sea loughs have sustained more impact than the open coast from human activity and are potentially more at risk than the open coast. Belfast and Larne Loughs have been particularly affected;

(ii) much of the intertidal region round the open coast at present is relatively unaffected by human activity;

(iii) the Co. Down coast is probably more at threat from human pressure than the Co. Antrim coast.

These considerations were borne in mind when assessing conservation potential.

The final criteria to be applied, that of size, was also the most difficult.

In considering the size of an area necessary to conserve a particular representative type of marine community, the vagaries of the recruitment of certain species need to be taken into account. An area chosen should ideally be large enough so that fluctuations in the occurrence of species due to differential settlement of the planktonic stages are, as far as is practical, encompassed by the area selected (Mitchell, 1986).

Unfortunately, the minimum size for a marine conservation area is unknown at present and probably varies depending on the type of community being protected. This being the case, it can only be said that, in general, the bigger the area, the better.

The size of protected areas will, in the final analysis, be based largely on practical/pragmatic criteria as much as an ecological/ scientific criteria.

The approach outlined above is not the only possible method for using Northern Ireland littoral survey results for conservation assessment, but the criteria provide a useful series of headings under which to evaluate different aspects of the survey results.

The intertidal areas which have been indicated for consideration as potentially worthy of protection from a nature conservation point of view in this report have been selected using information from five different sources:

(i) physical and superficial biological information from the 332 sites of the Stage I survey;

(ii) detailed biological information from the 204 Stage II sites round the coast;

(iii) discussions with interested parties;

(iv) studies on human impact round the coastline, as expressed in literature reviews;

(v) experience of the survey team after four field seasons in Northern Ireland.

The information collected for (i) and (ii) is available for consultation in the event of any other method of conservation assessment being adopted. The results from (iii) and (iv) are included in the present report.

Finally, it is hoped that results from the Stage II survey will be useful in the future for assessing the relative nature conservation value of intertidal locations round the coastline where development is about to take place, even if these locations are outside protected marine conservation areas.

The large number of Stage II transects which have been described in biological detail during the survey within the relatively small length of coastline round Northern Ireland provide a framework for assessing the relative importance of intertidal communities in areas about to undergo development.

When assessing the potential impact of any development on any environmental feature, three questions must be answered:

1. How significant is the environmental feature?

   - nationally;
   - internationally.

2. How significant is its comparative value with respect to potential benefits from the development?

3. How significant is the potential damage?

Results from the Stage II survey provide a framework for answering, at least in part, the questions posed in 1 and 3 above.

7.2 LESSONS LEARNED FROM THE LITTORAL SURVEY

The aim of this section is to provide feedback from the Northern Ireland Littoral Survey which may prove useful to any future conservation orientated intertidal survey.

The first major point is that it is important to assess intertidal and sublittoral habitats and communities separately. Important intertidal and sublittoral areas may lie in close proximity to one another, for example, in the Strangford Narrows, but this is not always the case.

For example, the most species rich stretch of open coast in Northern Ireland lies along the outer Ards Peninsula, yet in the sublittoral water quality is generally poor, with the infralittoral zone extending only to 10 m or less and most surfaces heavily silted (Erwin et al, 1986).

The second major point is that, should a future intertidal conservation assessment programme adopt the same strategy as the Northern Ireland Littoral Survey, then the importance of the Stage I survey should not be underestimated.

The Stage I survey is important for four reasons:

1. the brief "skilled eye appraisal" approach provides the only opportunity for visiting the whole coastline;

2. Stage II sites are chosen from Stage I data. Since a large number of Stage I sites may be visited within a relatively short time period, Stage II sites should be chosen from as wide a baseline as possible;

3. a very extensive Stage I programme would locate most of the unusual habitats and communities present round the coastline.

4. a more extensive Stage I survey could reduce the amount of time consuming Stage II transects requiring to be surveyed in the field and worked up in the laboratory. Stage I data can be used to differentiate between long stretches of coastline with a relatively homogeneous habitat and stretches with a heterogeneous range of habitats. The more homogeneous areas can then be surveyed by means of a smaller number of Stage II transects than the heterogeneous areas.

It is particularly important to ensure that both Stage I and Stage II sites are visited on good low tides. The lower shore is the richest part of the intertidal region and a large proportion of the individual sites of limited extent which have been indicated as being of nature conservation importance in the text are sites with a rich or unusual lower shore. For example, in Carlingford Lough the Laminaria saccharina dominated invertebrate rich lower shore boulder and stone flats between Rostrevor Quay and Killowen are not exposed on low water of neap tides, but are exposed on low water spring tides.

7.3 POSSIBLE FUTURE WORK

1. Analysis of Existing Data

Computer analysis of existing data as an aid to conservation assessment has been completed. However, from a scientific point of view, there are many possible uses for the large amount of data which has been collected. For example the distribution of individual intertidal species round the coastline was discussed briefly in this report, but a detailed analysis remains to be done.

2. Further Taxonomic Work on Specimens

Experts have been consulted on the taxonomy of individual groups and specimens (see Appendix XIII). This work will continue as far as possible after the end of the contract. In addition a collection of specimens will be deposited with the Ulster Museum.

3. Further Biological Recording Work

Any further biological recording work being considered should take the form of a detailed "Stage III" survey on areas of particular interest round the coastline.

APPENDIX I

STAGE I RECORDING SHEETS SPECIMENS

- Rocky Shore Sheet
- Sedimentary Shore Sheet

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Northern Ireland Littoral Survey Rocky Shore Recording Sheet

LOCALITY c | GRID REF d | LONG e W | LAT f N
SHEET No a | PUNCH CARD No b | Ht. OF LW. g (m) | TIME OF LW. h | DATE i
SEDIMENTARY SHEET No (if any) k | PHOTO Nos | ARRIVAL TIME l | DEPARTURE m | RECORDER

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	19	35
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	49
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Vertical Rock	52	75	98
Steep Rock (>30° slope)	53	76	99
L.Rock Ridges	54	77	100
Rock Ridges	55	78	101
Rock Platforms	56	79	102
Rock Outcrop	57	80	103
Fissured Rock	58	81	104
Irregular Rock	59	82	105
Large Boulders (>1024mm)	60	83	106
Med. Boulders (512-1024mm)	61	84	107
Small Boulders (256-512mm)	62	85	108
Stones, Angular (64-256mm)	63	86	109
Shingle, Rounded (64-256mm)	64	87	110
Pebbles (5-63mm)	65	88	111
Gravel (2-4mm)	66	89	112
Sand	67	90	113
Mud	68	91	114
Muddy Sand	69	92	115
Muddy Gravel	70	93	116
Black Layer N.S.	71	94	117
Silt Covered Rock	72	95	118
Man Made	73	96	119
	74	97	120

ROCK TYPE	
Spec:	
Igneous/Metamorph.	121
Limestone	122
Hard Mudstone	123
Soft Mudstone	124
INTERTIDAL EXTENT (m)	
< 10	125
10 - 50	126
50 - 100	127
>100 (Spec:)	128
HORIZONTAL EXTENT (m)	
<100	129
100 - 500	130
500 - 1000	131
>1000	132
OFFSHORE FEATURES	
Islands	133
Reefs	134
Breakwaters	135
Sandbanks	136
Shoal	137
COASTAL BACKING	
Sand Dunes	139
Low Cliffs	139
Mod. Cliffs	140
High Cliffs	141
Saltmarsh	142
Grassland	143
Peat	144
Valley	145
Freshwater	146
Trees	147
Other:	148
STEEPNESS INLAND	
0	149
1	150
2	151
3 - 5	152
5 - 10	153
>10	154

PREVAILNG WIND/ASPECT	W	A
N	155	163
NE	156	164
E	157	165
SE	158	166
S	159	167
SW	160	168
W	161	169
NW	162	170
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	171
Exposed	172
Moderate	173
Sheltered	174
V. Sheltered	175

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
< 2	176	181
2 - 10	177	182
10 - 50	178	183
50 - 100	179	184
>100	180	185
SEA HORIZON	10 miles	40 miles
0	186	193
1	187	200
2	188	201
3	189	202
4	190	203
5	191	204
6	192	205
7	193	206
8	194	207
9	195	208
10	196	209
11	197	210
12	198	211

Time of ELWST	n
Mean Spring Tide Range (m)	o
Mean Neap Tide Range (m)	p
Annual Rainfall (mm)	q

CURRENT STRENGTH (estimate)	
Strong	212
Moderate	213
Weak	214

SALINITY	
Normal	215
Slighty Reduced (28-33‰)	216
Low (<28‰)	217
Stream Flowing on S.	218
Spec:	

ACCESSIBILITY	
Car Useable to Near Shore	219
>10 min. Walk	220
Boat Only	221

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	222
100 - 500	223
500 - 1000	224
1000 - 5000	225
>5000	226
Absent	227

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	228
100 - 500	229
500 - 1000	230
1000 - 5000	231
>5000	232
Absent	233

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	234
100 - 500	235
500 - 1000	236
1000 - 5000	237
>5000	238
Absent	239

SCIENTIFIC & CONSERVATION INTEREST

BIOTA	Dom Z	Dom C	Dom P	2° Z	2° C	2° P
Fucoids						
Red Algae						
Green Algae						
Brown Algae						
Eel Grass						
Barnacle						
Mussel						
Limpet						
Other Molluscs (Spec:)						
Turf Formers						
Crustose Corallines						
Others: (Spec)						

N.C.C. CLASSIFICATION	
Ascophyllum	240
Mackaii	241
Fucoids	242
Fucobarnacle	243
Fucomytilus	244
Chloropatella	245
Chlorophyta	246
Rhodomytilus	247
Rhodobarnacle	248
Rhodopatella	249
Mytilobarnacle	250
Patellobarnacle	251
Barnacle	252
Mollusc	253
Other: (Spec)	254

PROMINENT SUBHABITATS	H	M	L
Wide, Shallow Rock Pools	255	265	275
Deep Rock Pools	256	266	276
V. Large Rock Pools	257	267	277
Rock Pools	258	268	278
Crevices	259	269	279
Couloirs	260	270	280
Overhangs	261	271	281
Caves	262	272	282
Reef at Low Tide	263	273	283
Other: (Spec)	264	274	284

No./DIVERSITY OF SUBHABITATS	
High	285
Medium	286
Low	287

RELATIVE SPECIES RICHNESS	Flora	Fauna
Good	291	291
Average	292	292
Poor	293	293

ORNITHOLOGICAL INT

	Feed	Nest
Waders	294	298
Wildfowl	295	299
Gulls	296	300
Seabirds	297	301

SEAL HAULOUT	302
NAT. RES. STATUS	
Site Within NNR	303
NNR or ASI Nearby	304
NT, RSPB or Loc Res Nearby	305
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING	
V. Good	306
Good	307
Fair	308
Poor	309

NOTES:

HUMAN INFLUENCE

Dist. to nearest Town (km) r

AMENITY VALUE

Attractive Beach or Surround	310
Resort Town Nearby	311
Toilets, Shops & Cafes Present	312
Toilets, Shops & Cafes Nearby	313
Car Park	314
Popular	315

INDUSTRY AND POLLUTION

Factories Present	316
Evidence of Industrial Pollution	
—Toxic	317
—Suspended S	318
Sewage Pollution	319
Land Reclamation	320

SHORE USAGE

Beach Fishing	321
Bait Digging	322
Shellfish Collecting	323
Algal Harvesting	324
Aquaculture	325
Mooring	326
Watersports	327
Other: (Spec)	328

SHORE PROFILE:

SKETCH MAP:

NOTES:

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Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet

LOCALITY c | GRID REF d | LONG e | LAT
SHEET No a | PUNCH CARD No b | Ht. OF LW. g (m) | TIME OF LW. h | DATE i
ROCKY SHEET No (if any) k | PHOTO Nos | ARRIVAL TIME l | DEPARTURE m | RECORDER

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	18	35
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Large Boulders (>1024 mm)	52	69	86
Med. Boulders (512–1024 mm)	53	70	87
Small Boulders (256–512mm)	54	71	88
Cobbles (64–256mm)	55	72	89
Pebbles (4–64 mm)	56	73	90
Granules (2–4 mm)	57	74	91
Coarse Sand (½–2 mm)	58	75	92
Med. Sand (¼–½ mm)	59	76	93
Fine Sand (1/16–¼ mm)	60	77	94
Shelly Sand (25% sh.)	61	78	95
Muddy Sand	62	79	96
Mud	63	80	97
Shingle	64	81	98
Storm Beach	66	82	99
Black Layer N.S.	66	83	100
Man Made	67	84	101
	68	85	102

ROCK TYPE	
Spec:	
Igneous/Metamorphic	103
Limestone	104
Hard Mudstone	105
Soft Mudstone	106

SLOPE / INTERTIDAL EXTENT	
Steep (<50m)	107
Mod. (50 - 150m)	108
Gentle (>150m)	109
Mod. Upper Beach L.W. Flat	110
Flat (none of above)	111
HORIZONTAL EXTENT (m)	
<500	112
500 – 1000	113
1000 – 1500	114
>1500	115
OFFSHORE FEATURES	
Islands	116
Reefs	117
Breakwaters	118
Sandbanks	119
Shoal	120
COASTAL BACKING	
Sand Dunes	121
Low Cliffs	122
Mod. Cliffs	123
High Cliffs	124
Saltmarsh	125
Grassland	126
Peat	127
Valley	128
Freshwater	129
Trees	130
Other:	131

STEEPNESS INLAND	
0	132
1	133
2	134
3 – 5	135
5 – 10	136
>10	137

PREVAILNG WIND/ASPECT	W	A
N	138	146
NE	139	147
E	140	148
SE	141	149
S	142	150
SW	143	151
W	144	152
NW	145	153
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	154
Exposed	155
Moderate	156
Sheltered	157
V. Sheltered	158

FETCH	min	max
<2	159	164
2 – 10	160	165
10 – 50	161	166
50 – 100	162	167
>100	163	168
SEA HORIZON	10 miles	40 miles
0	169	182
1	170	183
2	171	184
3	172	185
4	173	186
5	174	187
6	175	188
7	176	189
8	177	190
9	178	191
10	179	192
11	180	193
12	181	194

Time of ELWST n	
Mean Spring Tide Range (m) o	
Mean Neap Tide Range (m) p	
Annual Rainfall (mm) q	

CURRENT STRENGTH (estimate)

Strong	195
Moderate	196
Weak	197

SALINITY

Normal	198
Slighty Reduced (28–33‰)	199
Low (<28‰)	200
Stream Flowing on S.	201
Spec:	

ACCESSIBILITY

Car Useable to Near Shore	202
>10 min. Walk	203
Boat Only	204

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DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	205
100 – 500	206
500 – 1000	207
1000 – 5000	208
>5000	209
Absent	210

DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	211
100 – 500	212
500 – 1000	213
1000 – 5000	214
>5000	215
Absent	216

DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	217
100 – 500	218
500 – 1000	219
1000 – 5000	220
>5000	221
Absent	222

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Echino. Sill.	231
Other:(Spec)	232
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No/ DIVERSITY OF SUBHABITATS

High	255
Medium	256
Low	257

RELATIVE SPECIES RICHNESS

Good	258
Average	259
Poor	260

ORNITHOLOGICAL INTEREST

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Wildfowl	262	266
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SEAL HAUL OUT 269

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Site Within N.N.R. etc.	270
NNR or ASI Nearby	271
NT or RSPB or Loc. Res Nearby	272
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING

V. Good	273
Good	274
Fair	275
Poor	276

NOTES

HUMAN INFLUENCE

DISTANCE TO NEAREST TOWN (km) r

AMENITY VALUE

Attractive Beach or Surround	277
Resort Town Nearby	278
Toilet, Shops & Cafes Present	279
Toilet, Shops & Cafes Nearby	280
Car Park	281
Popular	282

INDUSTRY & POLLUTION

Factories Present	283
Evidence of Industrial Pollution	
— Toxic	284
—Suspended S	285
Sewage Pollution	286
Land Reclamation	287
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SHORE USAGE

Beach Fishing	288
Bait Digging	289
Shellfish Collecting	290
Algal Harvesting	291
Aquaculture	292
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Watersports	294
Other:	295

SHORE PROFILE

SKETCH MAP

NOTES

APPENDIX II

NORTHERN IRELAND LITTORAL SURVEY STAGE I RECORDING SHEET

INSTRUCTIONS

The recording sheets are presented in such a format that all the information may be entered onto FORTRAN coding forms and stored on a computer. Data manipulation and result processing is accomplished by the computer. Most of the categories on the recording sheets are self explanatory, but some are explained in greater detail.

GENERAL INFORMATION

The majority of the general information at the beginning of the recording sheet is entered into the computer. To facilitate this it is written on the sheet as a one character to one box format.

COASTAL SITUATION

The dominant, secondary and tertiary (if any) characteristics are entered. Where co-dominants etc. exist more than one 'tick' may be put in the same column.

Definitions: (most are self-explanatory)

(i) Narrows - an area where water is constricted between opposite shores.
(ii) Rapids - where a swift, river like, flow of seawater runs periodically over rocks etc.
(iii) Lagoon - a body of saline, water completely or almost completely cut off from the sea.

SHORE TYPE

Dominant, secondary and tertiary (if any) shore type are entered. Where co-dominants etc. exist, more than one 'tick' may be placed in the same column.

If the site is of mixed type i.e. rocky and sedimentary then two data sheets (one of each) should be completed and the numbers of each entered in the appropriate box on the other.

ROCK TYPE

The general type is entered while at site, whereas the actual name of the rock type, which is obtainable from geological maps, is entered under the heading "specify".

INTERTIDAL EXTENT

An estimation of the horizontal distance between high and low water. On the sedimentary shore this is also used as an indication of the slope.

HORIZONTAL EXTENT

The length of continuous coastline exhibiting the same type of community and habitat.

COASTAL BACKING

A description of the land immediately behind the shore.

STEEPNESS INLAND

The number of 10m contours occurring within 0.5km of MHW. This information was supplied by the Ulster Museum sublittoral survey team; in the case of sites not covered by the Ulster Museum the information was obtained from OS maps.

EXPOSURE TO WAVE ACTION

An estimation is made according to the descriptions of shore exposure given by J R Lewis (1964) in "The Ecology of Rocky Shores", Chapter 13.

FEATURE RELEVANT TO EXPOSURE

These are available from standard OS maps of varying scales and nautical charts. Most of this information was supplied by the Ulster Museum sublittoral survey team.

Definitions:

(i) Fetch - (a) minimum (b) maximum. The distance from the coast to an area shallower than 5m CD within a 45° arc measured perpendicular to the shore. Land subtending <15° is to be ignored. Minimum fetch takes into account any shelter provided by small islands or shoals directly offshore. Maximum fetch measures the maximum distance over which waves impinging directly onto the shore are able to build up.

(ii) Sea Horizons - (a) 10 miles (b) 40 miles. The number of 30° arc segments with no land for a given distance.

Fetch and sea horizons are both related to exposure to wave action. Sea horizon indicates the degree of openness of the coast. However the force of waves travelling along the coastline will be attenuated, therefore fetch indicates the extent of exposure to direct wave action.

(iii) Distance to Contours - (a) 10m (b) 30m (c)50m. This is measured as the minimum horizontal distance to the nearest contour within a 45°, arc perpendicular to the shore. Land subtending <15° is ignored. This measures the steepness of the seabed which is related to the strength of wave action.

BIOTA

Both rocky and sedimentary recording sheets have NCC keywords for biotic characterisation of shores. These are not exhaustive and more descriptive words may be developed if necessary. Each word attempts to define a community found and thus classifies the shore. More than one word can be 'ticked' if necessary.

Definitions: Sedimentary Shore

(i) Barren: Exposed, mobile or current-scoured beach in which permanent burrowing fauna are absent. (Talitrus may occur around the HW strand line).
(ii) Crust/Poly: Beaches containing a low density amphipod-isopod and/or Polychaete fauna. These are typically moderately exposed to wave action.
(iii) Tellina: Clean sand communities with characteristic species including Tellina tenuis, Arenicola marina, Donax vittatus, Nephthys caeca, Bathyporeia spp.
(iv) Macoma: Muddy sand communities with characteristic species including Macoma balthica, Cerastoderma edule, Arenicola marina, and Nephthys hombergi.
(v) Scrobicularia: Muddy communities, often brackish, characteristic species include Sc. plana, Nereis diversicolor and Mya arenaria.
(vi) Spisula: Coarse sand or gravel with Spisula spp.
(vii) Lanice: Coarse, often current swept, sand in which Lanice Conchilega is abundant.
(viii) Pullastra: Muddy gravel communities, with characteristic species, including Venerupis pullastra, Sabella, Myxicola and Golfingia.
(ix) Echino Sili: Low tide, sand or muddy communities, characterised by: Echinocardium cordatum, Ensis siliqua, and other species whose main zone is below low spring tide level.

Rocky Shores

(i) Ascophyllum: Blanket cover in full shelter.
(ii) Mackaii: Unattached Ascophyllum with reduced salinity.
(iii) Fucoids: Clear zones giving good cover.
(iv) Fucobarnacle: Mixed community of fucoids and barnacles in 'moderate' exposure.
(v) Fucomytilus: Fucoids and mussels. Barnacles and limpets less evident.
(vi) Chloropatella: Green algae and limpets. Indicates some disturbances, eg fresh water runoff, pollution.
(vii) Chlorophyta: Extensive green algal cover, indicating a disturbance.
(viii) Rhodomytilus: Typical of very exposed shores.
(ix) Rhodobarnacle: As above but mussels scarce.

(x) Rhodopatella: Barnacles and mussels scarce eg. in 'exposed' conditions.
(xi) Mytilobarnacle: 'Exposed' or 'very exposed' conditions.
(xii) Patellobarnacle: Limpets and barnacles abundant, mussels less so. As above.
(xiii) Barnacle: Usually on steep and exposed shores.
(xiv) Mollusca: Typical of boulder shores in exposure with little in the way of attached flora and fauna.

In addition the rock shore recording sheet has a scheme devised to give a more comprehensive idea of zonation patterns and cover. The scheme gives the dominant and secondary zone formers on the shore. The dominant organism that forms the zone nearest the terrestrial border is given the No. 1 in the Z (zone) column, and each zone below this to the LW is numbered consecutively. Co-dominants and co-secondary zone formers, in the same zone, are given the same number.

The cover of the zone forming organisms is entered as 1, 2 or 3 (as in Table 1) in the 'C' column and the patchiness of the zone forming organisms is entered as 0, 1 and 2 (as in the scale in Table 1) in the 'P' column.

TABLE 1 Cover and Patchiness Scales.

	C (cover)	P (patchiness)
1	<30% cover	Blanket cover
2	30-70% cover	Patchy
3	>70% cover	Very patchy

Z, C and P values for the dominants and co-dominants are entered in the 'Dom' columns and for the secondary zone formers in the '2o' columns.

PROMINENT SUBHABITATS

These are entered for Low, Mid and High water levels for rocky shores and are specified for the sedimentary shores. Most of the subhabitats given on the rocky shore recording sheet are self-explanatory but some that need defining are:

(i) Wide, shallow rock pools: those >3m wide and never more than 50cm deep.
(ii) Deep rock pools: those with at least 50% of their area >100cm in depth.
(iii) Very large rock pools: those >6m in length.
(iv) Rock pools: not as above.

ORNITHOLOGICAL INTEREST

This describes presence of various types of birds and whether they are feeding and/or nesting at the time of the survey. This is subsidiary information only; the main bird data will be gleaned from bird experts and from the literature.

SUBJECTIVE RATING

This is generally based on the species richness, but any unusual or anomalous communities, or particularly interesting rare species, would increase the rating. This is given in situ by the recorder.

AMENITY VALUE

These are designed to give some idea of the degree of attraction of the sites for tourists, and the extent to which they are catered for.

INDUSTRY AND POLLUTION

These are designed to give some idea of the presence of industry and the actual occurrence of industrial or domestic effluent at the site. Toxic pollution is recorded as present if obvious discharges can be observed. Land reclamation is also included in this category.

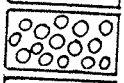
SHORE USAGE

These give some idea of the present usage of the shore. This may be recreational or the exploitation of biological or physical resource (eg. bait digging, aquaculture, mooring etc.).

SHORE PROFILE

A shore profile should be drawn from the low terrestrial region to the LW. Some indication of coastal backing should be given. The type of substrata should be shown (as in Table 2) beneath the profile.

TABLE 2 Key to substrates for shore profile and sketch map.

Symbol	Substrata Type
	Sand/mud etc
	Pebbles/stones/shale
	Boulders
	Large rocks and boulders*
	Bed rock

* should be drawn on the profile line

A scale should be given. The rocky shore profile should indicate major zones and label the organisms which form them, above the profile line.

SKETCH MAP

This should show the site in relation to its surroundings. Substrata is shown as in Table 2 and the direction of any rock ridges indicated. Other features to be included are:

(i) an arrow to indicate north,
(ii) a line to indicate the position of the drawn profile,
(iii) a scale,
(iv) any pipe or outfall or man made structure that is present,
(v) the point of access,
(vi) direction and distance to adjacent survey sites.

APPENDIX III

STAGE I DATA PRINTOUTS

- Rocky Shore

  (i) Location data
  (ii) Physical data
  (iii) Biological/Conservation data

- Sedimentary Shores

  (i) Location data
  (ii) Physical data
  (iii) Biological/Conservation data

List of Abbreviations for Data Printouts

(i) PHYSICAL DATA:

Coastal Situation

DOM	Dominant
SEC	Secondary
LOUGH	Sea Lough
SHELTD	Sheltered Coast
HDLAND	Headland
LINEAR	Linear Beach
L BAY	Large Bay (>2km)
SM BAY	Small Bay
OPEN	Open Coast
INLET	Marine Inlet
ISLE	Island
NARRWS	Narrows
AT ISL	Island Attached at LW

Rock Type

IG/MET	Igneous/Metamorphic
H MDST	Hard Mudstones
S MDST	Soft Mudstones
LMSTNE	Limestone

Coastal Backing

GRASS	Grassland
L CLFS	Low Cliff
VALLEY	Valley
M CLFS	Moderate Cliffs
DUNES	Sand Dunes
SMARSH	Saltmarsh
TREES	Trees

Accessibility

BY CAR	Car Useable to near Shore
WALK	>10 mins walk
BOAT	Boat Only

Shore Type

RK PLF	Rock Platforms
RK OUT	Rock Outcrops
S BLDS	Small Boulders
M BLDS	Medium Boulders
L BLDS	Large Boulders
STONES	Stones, Angular
PEBBLS	Pebbles
SAND	Sand
SHING	Shingle, Rounded
RK RGS	Rock Ridges
LRK RGS	Large Rock Ridges
GRAVEL	Gravel
VER RK	Vertical Rock
MUD	Mud
BL LAY	Black Layer near Surface
SLT RK	Silt covered Rock
M SAND	Muddy Sand
M GRVL	Muddy Gravel
STP RK	Steep Rock
IRR RK	Irregular Rock

Exposure

V SHLT	Very Sheltered
SHLT	Sheltered
MODRT	Moderately Sheltered
EXPD	Exposed
V EXPD	Very Exposed

Salinity

NORMAL	Normal (>33%)
REDUCD	Slightly reduced
LOW	Low (<28%)
STREAM	Stream Flowing on Shore

(ii) SCIENTIFIC AND CONSERVATION (including Human Influence)

Rocky:

Biota

ASCOPH	Ascophyllum
FC BARN	Fucobarnacle
FUCOID	Fucoid
CHLPHY	Chlorophyta
PATBAR	Patellabarnacle
RHMYTI	Rhodomytilus
BARNAC	Barnacle
MOLLUS	Mollusca
MYTBAR	Mytilobarnacle
RHBARN	Rhodobarnacle
RHPATE	Rhodopatella
FCMYTI	Fucomytilus

Nature Reserve Status

NR NNR	NNR or ASI Nearby
NR RES	NT RSPB or Local Reserve Nearby
IN NNR	Site Within NNR

SEAL

Amenity Value (Amenit Value)

CAR PK	Car Park
RESORT	Resort Town Nearby
AMENPR	Toilets, Shops and Cafes Present
AMENNR	Toilets, Shops and Cafes Nearby
POPULA	Popular
ATTRAC	Attractive Beach or Surrounds

Shore Usage

SPORTS	Watersport
MOORING	Mooring
SHFISH	Shellfish Collecting
BAIT	Bait Digging
ALGAE	Algal Harvesting
FISHING	Beach Fishing

Prominent Subhabitats

POOLS	Rockpools
CREVIS	Crevices
W POOL	Wide, Shallow Rockpools
O'HANG	Overhangs
L POOL	Very Large Rockpools
D POOL	Deep Rockpools
COULRS	Couloirs
CAVES	Caves
HABIT	
DIVER	Habitat Diversity

Bird Interest

FEEDG	Feeding
NESTG	Nesting
GULLS	Gulls
WADERS	Waders
SEABDS	Seabirds

HAUL	Seal Haulout

Industry and Pollution (Indus/Pollut)

SEWAGE	Sewage Pollution
RECLAM	Land Reclamation
FACTRS	Factories Present
SUSPS	Suspended Solids

Sedimentary

Biota

CR/POL	Crustacea/Polychaete
ARENIC	Arenicola/Corphium/Hydrobia
MACOMA	Macoma
LANICE	Lanice
TELLIN	Tellina
SCROBI	Scrobicularia
PULLAS	Pullastra
NEMERT	Nemertines and Polychaetes
NEPHTH	Nephthys only
NEREID	Nereid and Corphium
ECHINS	Echino Sili

Prominent Subhabitats

STREAM	Brackish/FW Stream Onshore
POOLS	Pools
BOULDS	Boulders
ROCKY	Rock Outcrops
INLET	Seawater Inlets
FUCOID	Under Fucoid Cover
ST WAT	Standing Water
MUSSEL	Mussel Beds
CLAY	Clay Layer near Surface
STRAND	Strandline
ALG MAT	Filamentons Algal Mats

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
DICKEYS ROCKS	1	0	J218142	06 08.30 W	54 04.00 N	100684	1537	1524	4T07	0.9	4.1	2.5
MAGGY'S ROCK	2	0	J193153	06 10.40 W	54 04.00 N	100684	1537	1635	4T07	0.9	4.4	2.7
NORTH OF KILLOWEN	3	0	J186163	06 11.30 W	54 04.20 N	100684	1627	1730	4T07	0.9	4.4	2.7
WARRENPOINT	4	0	J154182	06 14.20 W	54 05.20 N	100684	1627	1825	4T07	0.9	4.4	2.7
GREENCASTLE ROCKS	5	0	J239119	06 06.30 W	54 02.05 N	110684	1625	1450	4T07	0.9	4.1	2.5
CRANFIELD POINT ROCKS	6	0	J269099	06 03.50 W	54 01.08 N	110684	1625	1620	4T07	0.9	4.1	2.5
STH OF NICHOLSON'S PT	7	0	J292114	06 01.55 W	54 01.50 N	110684	1625	1706	4T07	0.9	4.1	2.5
SOUTH OF KILKEEL	8	0	J307131	06 00.25 W	54 02.50 N	110684	1605	1750	4T07	0.4	4.6	2.5
LEE STONE HARBOUR	9	0	J330143	05 58.10 W	54 03.30 N	120684	1648	1517	4T07	0.9	4.6	2.5
JANET'S ROCK(OUTCROP)	10	0	J353171	05 56.15 W	54 05.00 N	120684	1648	1557	4T07	0.9	4.6	2.5
JANET'S ROCK(BOULDERS)	11	0	J350168	05 56.30 W	54 04.50 N	120684	1648	1557	4T07	0.9	4.6	2.5
WRECK PORT	12	0	J372187	05 55.05 W	54 05.30 N	120684	1648	1654	4T07	0.9	4.6	2.5
ARTHUR'S PORT	13	0	J379203	05 53.50 W	54 06.40 N	120684	1648	1726	4T07	0.9	4.6	2.5
GLASSDRUMMAN PORT	14	0	J381223	05 53.20 W	54 07.45 N	120684	1648	1808	4T07	0.9	4.6	2.5
GREEN HARBOUR	15	0	J388248	05 52.35 W	54 10.10 N	140684	1845	1639	4T07	0.9	4.6	3.4
BLOODY BRIDGE	16	0	J391268	05 51.55 W	54 10.20 N	140684	1845	1630	4T07	0.9	4.6	3.4
CRAIGALEA	17	0	J450350	05 46.35 W	54 14.40 N	140684	1845	1945	4T07	0.9	4.6	3.4
RATHMULLAN POINT	18	0	J486355	05 46.40 W	54 15.00 N	140684	1845	2042	4T07	0.9	4.6	3.4
RINGBOY(BOULDERS)	19	0	J497357	05 42.00 W	54 15.00 N	150684	1928	1731	4T07	0.9	4.6	3.4
SANDY PORT	20	0	J522336	05 40.00 W	54 14.00 N	150684	1928	1845	4T07	0.9	4.6	3.4
ST.JOHN'S POINT	21	0	J523332	05 39.40 W	54 13.40 N	150684	1928	1844	4T07	0.9	4.6	3.4
CONEYISLAND BAY(BOULDER)	22	0	J552362	05 37.20 W	54 15.15 N	150684	1928	2031	4T07	0.9	4.6	3.4
BLACKROCK	23	0	J561361	05 36.20 W	54 15.00 N	170484	2043	1815	4T07	1.0	4.0	2.6
ARDGLASS BAY (ROCK)	24	0	J560377	05 36.25 W	54 15.30 N	170484	2043	1705	4T07	1.0	4.0	2.6
SHEEPLAND HARBOUR	25	0	J580390	05 34.40 W	54 15.30 N	170684	2043	1913	4T07	1.0	4.0	2.6
BONFIRE HILL SHORE	26	0	J593414	05 33.20 W	54 17.20 N	170684	2043	1958	4T07	1.0	4.0	2.6
CRAIGLEWEY	27	0	J607427	05 31.40 W	54 18.10 N	170684	2043	2110	4T07	1.0	4.0	2.6
CRAIGTHOMAS	28	0	J611437	05 31.45 W	54 18.40 N	150684	0708	0906	4T07	0.7	4.0	2.6
MILL QUARTER BAY(BOULD.)	29	0	J605436	05 32.20 W	54 18.40 N	150684	0708	0845	4T07	0.7	4.0	2.6
KILCLIEF POINT	30	0	J601462	05 32.40 W	54 20.40 N	150684	0708	0920	4T07	0.7	4.0	2.6
CLOGHY ROCKS	31	0	J595478	05 33.00 W	54 21.40 N	200684	1243	1130	6T09	0.7	3.2	2.2
LAUNCHES LITTLE	32	0	J541503	05 38.05 W	54 22.20 N	180684	1130	1000	6T09	0.0	0.0	0.0
GREENISLAND	33	0	J537512	05 37.20 W	54 22.50 N	180684	1130	1040	6T09	0.0	0.0	0.0
TAGGART ISLAND	34	0	J536540	05 37.30 W	54 25.00 N	180684	1130	1150	6T09	0.0	0.0	0.0
DUNNYNEILL ISLANDS	35	0	J548539	05 36.15 W	54 24.40 N	180684	1130	1050	6T09	0.0	0.0	0.0
RAWLE ISLAND	36	0	J542571	05 36.40 W	54 26.35 N	180684	1130	1145	6T09	0.0	0.0	0.0
LONG ISLAND	37	0	J583572	05 33.00 W	54 26.00 N	180684	1130	1325	6T09	0.0	0.0	0.0
LONG SHEELAH	38	0	J561592	05 35.00 W	54 27.10 N	190684	1230	1040	6T09	0.0	0.0	0.0
DRUMMOND ISLAND	39	0	J552608	05 36.00 W	54 28.40 N	190684	1230	1135	6T09	0.0	0.0	0.0
BIRD ISLAND	40	0	J570617	05 34.20 W	54 29.00 N	190684	1230	1130	6T09	0.0	0.0	0.0
LONG SKART ROCKS	41	0	J567630	05 34.30 W	54 29.40 N	190684	1230	1215	6T09	0.0	0.0	0.0
SOUTH ISLAND	42	0	J567662	05 34.20 W	54 38.30 N	190684	1230	1310	6T09	0.0	0.0	0.0
CHAPEL ISLAND	43	0	J555670	05 37.20 W	54 31.20 N	190684	1230	1325	6T09	0.0	0.0	0.0
AUDLEYS CASTLE ROCKS	44	0	J577511	05 34.50 W	54 22.50 N	200584	1313	1245	6T09	0.0	0.0	0.0
CHAPEL ISLAND CAUSEWAY	45	0	J563510	05 36.10 W	54 22.40 N	200684	1313	1250	6T09	0.0	0.0	0.0
MOORES POINT	46	0	J525506	05 38.50 W	54 25.00 N	210684	1406	1055	6T09	0.0	0.0	0.0
TAGGART QUAY (BOULDERS)	47	0	J531553	05 36.55 W	54 25.30 N	210684	1406	1150	6T09	0.0	0.0	0.0
CASTLE ISLAND POINT	48	0	J539599	05 37.05 W	54 28.05 N	210684	1406	1305	6T09	0.0	0.0	0.0
REAGH ISLAND (BOULDERS)	49	0	J530659	05 38.00 W	54 31.00 N	210684	1406	1510	6T09	0.0	0.0	0.0
PIG ISLAND	50	0	J541700	05 36.55 W	54 33.30 N	220684	1452	1351	6T09	0.0	0.0	0.0
HERRING BAY (BOULDERS)	51	0	J587652	05 32.40 W	54 30.30 N	220684	1452	1530	6T09	0.0	0.0	0.0
KIRCUBBIN POINT	52	0	J593625	05 32.00 W	54 28.50 N	220684	1452	1630	6T09	0.0	0.0	0.0
BLACK NELL	53	0	J594617	05 33.20 W	54 28.30 N	240684	1648	1415	6T09	0.0	0.0	0.0
ROWREAGH POINT	54	0	J595613	05 31.55 W	54 27.20 N	240684	1648	1540	6T09	0.0	0.0	0.0
HORSE ISLAND	55	0	J595608	05 33.05 W	54 28.00 N	240684	1448	1610	6T09	0.0	0.0	0.0
GRANSHA POINT	56	0	J586594	05 31.50 W	54 28.20 N	240684	1648	1745	6T09	0.0	0.0	0.0
YELLOW ROCKS	57	0	J595585	05 33.10 W	54 26.10 N	250684	1736	1555	6T09	0.0	0.0	0.0
THE DORN	58	0	J593568	05 33.40 W	54 25.50 N	250684	1736	1656	6T09	0.0	0.0	0.0

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME-ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
RINGBURR POINT	59	0	J574555	05 35.10 W	54 25.10 N	250684	1736	1830	6T09	0.0	0.0	0.0
MARLFIELD ROCKS	60	0	J573537	05 35.05 W	54 24.10 N	250684	1736	1805	6T09	0.0	0.0	0.0
SELK ROCK	61	0	J574521	05 35.10 W	54 23.20 N	250684	1736	1840	6T09	0.0	0.0	0.0
BALLYHENRY BAY	62	0	J584518	05 34.10 W	54 23.05 N	260684	1734	1900	6T09	0.6	3.2	2.2
THE WALTER ROCKS	63	0	J587511	05 34.00 W	54 22.50 N	260684	1736	1904	6T09	0.6	3.2	2.2
BANKMORE POINT	64	0	J599489	05 32.55 W	54 21.35 N	260684	1734	1810	6T09	0.6	3.2	2.2
GRANAGH BAY (ROCKS)	65	0	J604486	05 32.30 W	54 21.30 N	260684	1736	1820	6T09	0.6	3.2	2.2
CARRSTOWN POINT	66	0	J613463	05 31.40 W	54 20.15 N	260684	1623	1716	4T07	0.8	4.0	2.6
BALLYQUINTIN POINT	67	0	J625452	05 30.30 W	54 19.40 N	260684	1623	1605	4T07	0.8	4.0	2.6
THE TONGUE	68	0	J628467	05 30.10 W	54 20.15 N	260684	1623	1556	4T07	0.8	4.0	2.6
DOWN ROCK	69	0	J635480	05 29.30 W	54 21.00 N	260684	1623	1510	4T07	0.8	4.0	2.6
MILLIN BAY POINT	70	0	J635500	05 29.30 N	54 22.15 N	260684	1623	1355	4T07	0.8	4.0	2.6
KEARNEY	71	0	J652518	05 26.40 W	54 23.10 N	250684	1541	1420	4T07	0.8	4.0	2.6
HEMS ROCK	72	0	J649544	05 28.25 W	54 24.35 N	250684	1541	1500	4T07	0.8	4.0	2.6
THE BURNFOOT (CLIFF)	73	0	C903413	06 34.40 W	55 12.30 N	280684	1245	1130	1T04	0.5	1.7	0.3
THE BURNFOOT (BOULDERS)	74	0	C903413	06 34.40 W	55 12.30 N	280684	1245	1110	1T04	0.5	1.7	0.3
PEGGY'S HOLE	75	0	C908417	06 34.10 W	55 12.45 N	280684	1245	1210	1T04	0.5	1.7	0.3
PEGGY'S HOLE (PLATFORM)	76	0	C908416	06 34.15 W	55 12.40 N	280684	1245	1207	1T04	0.5	1.7	0.3
PORT GORM	77	0	C918421	06 33.25 W	55 13.00 N	280684	1245	1320	1T04	0.5	1.7	0.3
PORT MOON	78	0	C979454	06 27.30 W	55 14.40 N	280684	1245	1355	1T04	0.5	1.7	0.3
PORT MOON BAY	79	0	C979451	06 27.30 W	55 14.35 N	280684	1245	1423	1T04	0.5	1.7	0.3
LARRY BANE HEAD	80	0	D049452	06 20.45 W	55 14.50 N	290684	1404	1237	1T04	0.3	1.0	0.4
LARRY BANE BAY	81	0	D054448	06 20.10 W	55 13.50 N	290684	1404	1235	1T04	0.3	1.0	0.4
PORT MORE POINT	82	0	D074439	06 18.20 W	55 13.55 N	290684	1404	1400	1T04	0.3	1.0	0.4
PORT MORE	83	0	D074438	06 18.25 W	55 14.00 N	290684	1404	1350	1T04	0.3	1.0	0.4
KINBANE CASTLE (WEST)	84	0	D087439	06 17.10 W	55 14.00 N	290684	1404	1515	1T04	0.3	1.0	0.4
KINBANE HEAD	85	0	D088439	06 17.05 W	55 13.50 N	290684	1404	1515	1T04	0.3	1.0	0.4
PORTBALLINTRAE	86	0	C925420	06 32.40 W	55 13.00 N	10784	1453	1246	1T04	0.4	1.7	0.3
SEAGULL ROCKS	87	0	C927425	06 32.20 W	55 13.20 N	10784	1453	1325	1T04	0.4	1.7	0.3
THE LADLE	88	0	C935437	06 31.45 W	55 13.50 N	10784	1453	1420	1T04	0.4	1.7	0.3
PORTNABOE	89	0	C943443	06 31.00 W	55 14.00 N	10784	1453	1520	1T04	0.4	1.7	0.3
GREAT STOOKAN	90	0	C943446	06 30.50 W	55 14.25 N	10784	1453	1530	1T04	0.4	1.7	0.3
GIANT'S CAUSEWAY	91	0	C947448	06 30.40 W	55 14.25 N	10784	1453	1615	1T04	0.4	1.7	0.3
PORT NOFFER	92	0	C949448	06 30.20 W	55 14.30 N	10784	1453	1620	1T04	0.4	1.7	0.3
PORT REOSTAN (B)	93	0	C952453	06 30.00 W	55 14.55 N	10784	1453	1715	1T04	0.4	1.7	0.3
THE DUTCHMAN	94	0	D143511	06 12.00 W	55 18.00 N	30784	1802	1055	1T04	0.3	1.0	0.4
KILLEANY (B)	95	0	D127513	06 13.20 W	55 18.05 N	30784	1802	1105	1T04	0.3	1.0	0.4
THE SKEIR (B)	96	0	D115509	06 14.30 W	55 17.20 N	30784	1802	1115	1T04	0.3	1.0	0.4
BLACK HEAD (B)	97	0	D105506	06 15.30 W	55 17.10 N	30784	1802	1125	1T04	0.3	1.0	0.4
SROANAMADDY (B)	98	0	D096508	06 16.25 W	55 17.15 N	30784	1802	1135	1T04	0.3	1.0	0.4
BULL POINT (B)	99	0	D089509	06 17.00 W	55 17.50 N	30784	1802	1145	1T04	0.3	1.0	0.4
WEST LIGHTHOUSE BAY (B)	100	0	D094518	06 16.30 W	55 18.20 N	30784	1802	1200	1T04	0.3	1.0	0.4
FIDDOGE (B)	101	0	D097523	06 16.20 W	55 18.00 N	30784	1802	1205	1T04	0.3	1.0	0.4
DUNCAN'S BAY (B)	102	0	D101528	06 15.20 W	55 18.10 N	30784	1802	1215	1T04	0.3	1.0	0.4
KINREA (B)	103	0	D116531	06 14.30 W	55 18.25 N	30784	1802	1230	1T04	0.3	1.0	0.4
CARRICK (B)	104	0	D123528	06 13.50 W	55 18.20 N	30784	1802	1225	1T04	0.3	1.0	0.4
MARIE ISLA	105	0	D136526	06 12.40 W	55 18.10 N	30784	1802	1235	1T04	0.3	1.0	0.4
STACKAMORE (B)	106	0	D150524	06 11.15 W	55 18.00 N	30784	1802	1245	1T04	0.3	1.0	0.4
EAST LIGHTHOUSE	107	0	D163521	06 10.00 W	55 17.50 N	30784	1802	1250	1T04	0.3	1.0	0.4
BRUCE'S CAVE	108	0	D163520	06 10.00 W	55 17.50 N	30784	1802	1300	1T04	0.3	1.0	0.4
PORTAWILLIN	109	0	D162512	06 10.05 W	55 18.00 N	30784	1802	1310	1T04	0.3	1.0	0.4
PORTAWILLIN BAY	110	0	D161513	06 10.10 W	55 17.25 N	30784	1802	1315	1T04	0.3	1.0	0.4
ARKILL BAY	111	0	D157491	06 10.50 W	55 16.50 N	30784	1802	1345	1T04	0.3	1.0	0.4
RUE POINT EAST	112	0	D152473	06 11.00 W	55 15.20 N	20784	1653	2000	1T04	0.2	1.0	0.4
RUE POINT WEST	113	0	D151472	06 10.05 W	55 15.50 N	20784	1653	2115	1T04	0.2	1.0	0.4
OWEYDOO	114	0	D144485	06 11.50 W	55 15.55 N	20784	1653	1628	1T04	0.2	1.0	0.4
CLOGHADOO	115	0	D144490	06 11.50 W	55 16.50 N	20784	1653	1600	1T04	0.2	1.0	0.4

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
MILL BAY	116	0	D150501	06 11.15 W	55 16.50 N	20784	1653	1500	1T04	0.2	1.0	0.4
CHURCH BAY	117	0	D148506	06 11.30 W	55 17.45 N	20784	1653	1500	1T04	0.2	1.0	0.4
PORT NA TOBER	118	0	C962456	06 29.00 W	55 14.55 N	60784	0947	1034	1T04	0.5	1.0	0.4
PORT NA TOBER HEADLAND	119	0	C963458	06 29.00 W	55 15.00 N	60784	0947	1055	1T04	0.5	1.0	0.4
BENBANE HEAD (B)	120	0	C965460	06 28.50 W	55 15.15 N	60734	0947	1120	1T04	0.5	1.0	0.4
BENGORE HEAD	121	0	C974459	06 27.55 W	55 15.10 N	60784	0947	1240	1T04	0.5	1.0	0.4
PORT NA BROCK	122	0	C976457	06 27.40 W	55 15.00 N	60784	0947	1200	1T04	0.5	1.0	0.4
DUNSEVERICK WEST	123	0	C984446	06 26.55 W	55 14.30 N	60784	0947	1300	1T04	0.5	1.0	0.4
DUNSEVERICK PLATFORMS	124	0	C988446	06 26.30 W	55 15.30 N	60784	0947	1330	1T04	0.5	1.0	0.4
GID POINT (B)	125	0	D017446	06 24.00 W	55 14.30 N	60784	0947	1405	1T04	0.5	1.0	0.4
CARRICKNAFORD	126	0	D013452	06 22.55 W	55 14.50 N	60784	0947	1555	1T04	0.5	1.0	0.4
CARRICK-A-REDE	127	0	D062450	06 19.30 W	55 14.40 N	60784	0947	1440	1T04	0.5	1.0	0.4
GIANT'S CUT CLIFFS (B)	128	0	D069442	06 19.00 W	55 14.20 N	60784	0947	1515	1T04	0.5	1.0	0.4
PORTSTEWART POINT	129	0	C814389	06 43.00 W	55 11.10 N	80784	0933	0925	1T04	0.7	1.7	0.3
RINAGREE POINT	130	0	C832395	06 41.20 W	55 11.35 N	80784	0933	1000	1T04	0.7	1.7	0.3
REVIGGERLY	131	0	C856415	06 39.10 W	55 12.40 N	80784	0933	1058	1T04	0.7	1.7	0.3
DUNIMENY CASTLE	132	0	D116418	06 14.30 W	55 12.20 N	80784	1123	1400	1T04	0.5	1.0	0.4
COLLIERY BAY	133	0	D150420	06 10.20 W	55 12.30 N	100784	1242	1100	1T04	0.4	1.0	0.4
GRIBBIN	134	0	D157422	06 10.40 W	55 12.40 N	100784	1242	1145	1T04	0.4	1.0	0.4
CARRICK-MORE WEST	135	0	D161423	06 10.10 W	55 12.30 N	100784	1242	1215	1T04	0.4	1.0	0.4
CARRICK-MORE	136	0	D164427	06 10.00 W	55 12.50 N	100784	1242	1247	1T04	0.4	1.0	0.4
FAIR HEAD WEST	137	0	D168433	06 09.40 W	55 13.10 N	100784	1242	1320	1T04	0.4	1.0	0.4
FALL POINT	138	0	D189432	06 07.30 W	55 13.00 N	100784	1242	1615	1T04	0.4	1.0	0.4
PORTDOO	139	0	D192428	06 07.10 W	55 12.55 N	100784	1242	1640	1T04	0.4	1.0	0.4
NEWBRIDGE (RIVER FOYLE)	140	0	C452195	07 07.30 W	55 01.30 N	110784	1338	1535	1T04	0.5	2.1	0.9
DOWNHILL ROCKS	141	0	C760364	06 48.10 W	55 10.20 N	160784	1521	1405	1T04	0.5	1.7	0.3
CASTLEROCK	142	0	C771364	06 47.05 W	55 09.55 N	160784	1521	1500	1T04	0.5	1.7	0.3
THE BERRINS (PORTSTEW.)	143	0	C813375	06 43.00 W	55 11.00 N	160784	1521	1725	1T04	0.5	1.7	0.3
MURLOUGH BAY NORTH	144	0	D197423	06 06.50 W	55 12.35 N	150784	1853	1639	1T04	0.4	1.0	0.4
MURLOUGH BAY	145	0	D200418	06 06.30 W	55 12.20 N	150784	1853	1649	1T04	0.4	1.6	1.0
RUEBANE POINT	146	0	D209419	06 05.45 W	55 12.25 N	150784	1853	1750	1T04	0.4	1.0	0.4
TORR HEAD	147	0	D234404	06 03.10 W	55 11.40 N	150784	1853	1916	4T07	0.4	1.6	1.0
PORT VINEGAR	148	0	D246285	06 13.10 W	55 05.10 N	90784	1510	1300	4T07	0.9	1.4	1.2
CUSHENDALL LIFEBOAT HO.	149	0	D245270	06 03.10 W	55 04.20 N	90784	1510	1340	4T07	0.4	1.4	1.2
RED ARCH	150	0	D244262	06 03.20 W	55 04.00 N	90784	1510	1410	4T07	0.4	1.4	1.2
OLD PIER	151	0	D258249	06 01.50 W	55 02.55 N	130784	1741	1545	4T07	0.3	1.4	1.2
WHITE LADY	152	0	D297249	05 58.10 W	55 02.55 N	120784	1704	1546	4T07	0.3	1.4	1.2
WHITE LADY (EAST)	153	0	D300248	05 58.00 W	55 02.50 N	120784	1704	1545	4T07	0.3	1.4	1.2
GARRON HARBOUR	154	0	D302237	05 57.40 W	55 02.20 N	120784	1704	1620	4T07	0.3	1.4	1.2
TURLEY'S PORT	155	0	D298217	05 58.05 W	55 01.10 N	120784	1704	1640	4T07	0.3	1.4	1.2
RINGFAD	156	0	D296205	05 58.10 W	55 00.30 N	120784	1704	1712	4T07	0.3	1.4	1.2
CAMPBELTOWN	157	0	D289188	05 58.55 W	54 59.40 N	120784	1704	1745	4T07	0.3	1.4	1.2
STRAIDKILLY POINT	158	0	D302167	05 57.50 W	54 58.30 N	120784	1704	1815	4T07	0.3	1.4	1.2
PARK HEAD	159	0	D326155	05 55.30 W	54 57.50 N	130784	1752	1643	4T07	0.7	2.4	1.7
WHITEBAY POINT	160	0	D329152	05 55.20 W	54 57.40 N	130784	1752	1647	4T07	0.7	2.4	1.7
DRUMNAREAGH PORT	161	0	D344129	05 53.40 W	54 56.25 N	130784	1752	1715	4T07	0.7	2.4	1.7
HALFWAY HO.(BALLYGALLEY)	162	0	D365085	05 52.40 W	54 54.10 N	130784	1752	1750	4T07	0.7	2.4	1.7
BALLYGALLEY HEAD	163	0	D381081	05 51.00 W	54 54.00 N	130784	1752	1820	4T07	0.7	2.4	1.7
CARNFUNNOCK BAY	164	0	D388063	05 50.30 W	54 52.55 N	130784	1752	1805	4T07	0.7	2.4	1.7
SEACOURT	165	0	D405046	05 49.00 W	54 52.00 N	130784	1752	1855	4T07	0.7	2.4	1.7
LOUGHAN BAY	166	0	D246377	06 03.00 W	55 10.05 N	170784	2022	1800	4T07	0.4	1.6	1.0
PORT MORE (LOUGHAN)	167	0	D250377	06 02.40 W	55 10.10 N	170784	2022	1730	4T07	0.4	1.6	1.0
RUNABAY HEAD	168	0	D254377	06 02.10 W	55 10.10 N	170784	2022	1745	4T07	0.4	1.6	1.0
CUSHENDUN NORTH	169	0	D255337	06 02.10 W	55 07.55 N	170784	2022	1911	4T07	0.4	1.6	1.0
CUSHENDUN BAY SOUTH	170	0	D253326	06 02.25 W	55 07.30 N	170784	2022	1955	4T07	0.4	1.6	1.0
CAVE HOUSE SHORE	171	0	D254322	06 02.10 W	55 07.20 N	170784	2022	2033	4T07	0.4	1.6	1.0
LAYD CHURCH (CUSHENDALL)	172	0	D248290	06 03.00 W	55 05.30 N	190784	1217	1120	4T07	0.3	1.4	1.2

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
DALARADIA POINT	173	0	J430991	05 46.40 W	54 48.00 N	200784	1059	1037	4T07	0.6	2.4	1.7
BARNEY'S POINT	174	0	J451988	05 44.00 W	54 48.00 N	200784	1059	1310	4T07	0.6	2.4	1.7
MAIDENS LIGHTHOUSE WEST	175	0	D450116	05 43.55 W	54 55.45 N	250784	1530	1044	4T07	0.7	2.4	1.7
LIGHTHOUSE (MAIDENS) (B)	176	0	D457115	05 43.10 W	54 55.35 N	250784	1530	1150	4T07	0.7	2.4	1.7
MCILLROY'S PORT (B)	177	0	D453028	05 44.40 W	54 51.00 N	250784	1530	1502	4T07	0.7	2.4	1.7
RIDING STONE (B)	178	0	D462025	05 43.35 W	54 51.00 N	250784	1530	1447	4T07	0.7	2.4	1.7
ISLE OF MUCK (EAST) (B)	179	0	D466025	05 43.20 W	54 51.00 N	250784	1530	1425	4T07	0.7	2.4	1.7
ISLE OF MUCK WEST (B)	180	0	D465024	05 43.20 W	54 50.50 N	250784	1530	1200	4T07	0.7	2.4	1.7
CHAPMAN'S ROCK (B)	181	0	D474003	05 42.25 W	54 49.40 N	250784	1530	1345	4T07	0.7	2.4	1.7
THE GOBBINS (B)	182	0	J484980	05 41.30 W	54 48.25 N	250784	1530	1335	4T07	0.7	2.4	1.7
MARCHBURN PORT NORTH (B)	183	0	J484960	05 41.30 W	54 47.20 N	250784	1530	1320	4T07	0.7	2.4	1.7
MARCHBURN PORT (B)	184	0	J484945	05 41.30 W	54 46.20 N	250784	1530	1310	4T07	0.7	2.4	1.7
BLACK HEAD EAST (B)	185	0	J487938	05 41.20 W	54 45.55 N	250784	1530	1304	4T07	0.7	2.4	1.7
BLACKHEAD ROCKS	186	0	J489935	05 41.05 W	54 46.30 N	220784	1242	1130	4T07	0.8	2.8	1.8
BLACKHEAD BOULDERS	187	0	J488933	05 41.10 W	54 45.30 N	220784	1242	1120	4T07	0.8	2.8	1.8
WHITEHEAD	188	0	J475911	05 42.25 W	54 44.25 N	220784	1242	1215	4T07	0.8	2.8	1.8
TORY TOWN (BOULDERS)	189	0	J394863	05 50.00 W	54 42.40 N	220784	1248	1324	4T07	0.8	2.8	1.8
LOUGHSHORE PARK(BOULDER)	190	0	J365833	05 52.30 W	54 41.00 N	220784	1242	1352	4T07	0.8	2.8	1.8
ORLOCK POINT	191	0	J560837	05 34.25 W	54 40.30 N	240784	1500	1610	4T07	1.0	3.5	2.3
SANDYBAY POINT	192	0	J571823	05 33.10 W	54 39.40 N	240784	1500	1541	4T07	1.0	3.5	2.3
FORELAND POINT	193	0	J588814	05 31.55 W	54 39.10 N	240784	1500	1500	4T07	1.0	3.5	2.3
GALLOWAY'S ROCK	194	0	J595785	05 32.20 W	54 37.35 N	240784	1500	1438	4T07	1.0	3.5	2.3
MILLISLE	195	0	J604755	05 31.25 W	54 36.00 N	240784	1500	1340	4T07	1.0	3.5	2.3
BARKLEY ROCK	196	0	J612744	05 30.30 W	54 35.30 N	240784	1500	1306	4T07	1.0	3.5	2.3
WHITECHURCH (ROCKY)	197	0	J634710	05 28.35 W	54 33.40 N	240784	1500	1210	4T07	1.0	3.5	2.3
WALLACE'S ROCK	198	0	J640674	05 27.50 W	54 33.20 N	230784	1349	1507	4T07	1.3	4.1	2.5
QUAY ROCKS	199	0	J642650	05 27.40 W	54 30.20 N	230784	1349	1429	4T07	1.3	4.1	2.5
ROBIN'S ROCK	200	0	J661615	05 25.50 W	54 28.30 N	230784	1349	1335	4T07	1.3	4.1	2.5
PORTAVOGIE	201	0	J661591	05 25.45 W	54 27.05 N	230784	1349	1300	4T07	1.3	4.1	2.5
RINGBOY POINT	202	0	J653570	05 26.30 W	54 26.00 N	230784	1349	1227	4T07	1.3	4.1	2.5
CHAPEL BAY (COPELAND)	203	0	J592833	05 31.30 W	54 40.10 N	260784	1637	1435	4T07	0.8	3.5	2.3
CAIRN POINT	204	0	J586833	05 32.05 W	54 40.10 N	260784	1637	1458	4T07	0.8	3.5	2.3
BARNAGH BAY (COPELAND)	205	0	J584838	05 32.20 W	54 40.30 N	260784	1637	1524	4T07	0.8	3.5	2.3
BESSY'S POINT	206	0	J590844	05 31.40 W	54 40.45 N	260784	1637	1530	4T07	0.8	3.5	2.3
MATTHEW SCOTT ROCK	207	0	J598839	05 31.00 W	54 40.30 N	260784	1637	1613	4T07	0.8	3.5	2.3
HORSE POINT	208	0	J598828	05 31.00 W	54 40.00 N	260784	1637	1625	4T07	0.8	3.5	2.3
BRIGGS ROCK	209	0	J552840	05 35.05 W	54 40.40 N	270784	1657	1500	4T07	0.7	3.1	1.9
BALLYMACORMICK POINT	210	0	J528840	05 37.25 W	54 40.40 N	270784	1657	1550	4T07	0.7	3.1	1.9
WILSON'S POINT	211	0	J497826	05 40.20 W	54 39.40 N	270784	1657	1656	4T07	0.7	3.1	1.9
SWINELEY POINT	212	0	J480824	05 42.00 W	54 39.45 N	270784	1657	1719	4T07	0.7	3.1	1.9
CRAWFORDSBURN ROCKS	213	0	J465829	05 43.25 W	54 40.00 N	270784	1657	1755	4T07	0.7	3.1	1.9
HELEN'S BAY	214	0	J447827	05 45.00 W	54 40.00 N	270784	1657	1830	4T07	0.7	3.1	1.9
CULLODEN HOTEL	215	0	J413810	05 48.40 W	54 39.00 N	270784	1657	1900	4T07	0.7	3.1	1.9
HOLYWOOD ESPLANADE	216	0	J390790	05 51.10 W	54 38.40 N	280784	1740	1640	4T07	0.6	3.1	1.9
ISLE O'VALLA (ROCKS)	217	0	J594486	05 33.20 W	54 21.25 N	280784	2000	1840	6T09	0.6	3.2	2.2
HOLM BAY	218	0	J533531	05 37.35 W	54 24.50 N	280784	2025	1937	6T09	0.0	0.0	0.0
RINGDUFFERIN	219	0	J539566	05 38.00 W	54 26.35 N	280784	2025	2025	6T09	0.0	0.0	0.0
MAHEE ISLAND	220	0	J533636	05 37.30 W	54 30.10 N	280784	2025	2128	6T09	0.0	0.0	0.0

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LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
DICKEYS ROCKS	1	0	LOUGH	L BAY	RK PLF	M BLDS S BLDS STONES SHINGL PEBBLS MUD BL LAY SLT RK	IG/MET	10-50	<0.1	GRASS	V SHLT	WEAK	NORMAL	WALK
MAGGY'S ROCK	2	0	SHELTD LOUGH		RK OUT	L BLDS	IG/MET	50-100	.5-1	GRASS	SHLT	WEAK	LOW	WALK
NORTH OF KILLOWEN	3	0	LOUGH	LINEAR	S BLDS	M BLDS	IG/MET	10-50	>1	GRASS	SHLT	WEAK	REDUCD	BY CAR
WARRENPOINT	4	0	LOUGH	L BAY	STONES	S BLDS	IG/MET	10-50	>1	OTHER	SHLT	WEAK	NORMAL	BY CAR
GREENCASTLE ROCKS	5	0	HDLAND LOUGH		RK RGS L BLDS	PEBBLS GRAVEL	IG/MET	>100	.1-.5	GRASS	V SHLT	MODRT	NORMAL	BY CAR
CRANFIELD POINT ROCKS	6	0	HDLAND		M BLDS S BLDS STONES PEBBLS SAND	SHINGL	IG/MET	>100	.1-.5	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
STH OF NICHOLSON'S PT	7	0	OPEN	LINEAR	L BLDS	GRAVEL SAND	IG/MET	>100	.1-.5	L CLFS	MODRT	WEAK	NORMAL STREAM	BY CAR
SOUTH OF KILKEEL	8	0	OPEN		M BLDS	SHINGL	IG/MET	50-100	>1	M CLFS	MODRT	WEAK		BY CAR
LEE STONE HARBOUR	9	0	OPEN		SHINGL	S BLDS	IG/MET	50-100	>1	OTHER	EXPD	WEAK	REDUCD	BY CAR
JANET'S ROCK(OUTCROP)	10	0	OPEN		RK OUT	FIS RK	IG/MET	50-100	<0.1	L CLFS	EXPD	WEAK	NORMAL STREAM	BY CAR
JANET'S ROCK(BOULDERS)	11	0	OPEN		L BLDS M BLDS S BLDS	RK RGS PEBBLS SAND	IG/MET	>100		GRASS	MODRT	WEAK	STREAM	BY CAR
WRECK PORT	12	0	OPEN		L BLDS M BLDS S BLDS	RK RGS SHINGL PEBBLS	IG/MET	>100	>1	L CLFS GRASS	EXPD	WEAK		BY CAR
ARTHUR'S PORT	13	0	OPEN		RK RGS	L BLDS	IG/MET	50-100	.5-1	GRASS	MODRT	WEAK	NORMAL	BY CAR
GLASSDRUMMAN PORT	14	0	OPEN		L BLDS	RK RGS	IG/MET	50-100	>1	L CLFS	MODRT	WEAK	NORMAL	BY CAR
GREEN HARBOUR	15	0	OPEN		M BLDS L BLDS M BLDS S BLDS	STONES SHINGL PEBBLS GRAVEL	IG/MET	50-100	>1	GRASS L CLFS GRASS VALLEY	MODRT	WEAK	NORMAL STREAM	WALK
BLOODY BRIDGE	16	0	OPEN		LRKRGS	FIS RK	IG/MET	10-50	>1	M CLFS	EXPD	WEAK	NORMAL STREAM	BY CAR
CRAIGALEA	17	0	OPEN		LRKRGS L BLDS M BLDS S BLDS	STONES PEBBLS SAND	IG/MET	>100	.1-.5	DUNES GRASS	EXPD	WEAK	NORMAL	WALK
RATHMULLAN POINT	18	0	OPEN	HDLAND	RK RGS	FIS RK S BLDS STONES	H MDST	50-100	.5-1	GRASS	EXPD	WEAK	NORMAL	BY CAR
RINGBOY(BOULDERS)	19	0	OPEN	L BAY	M BLDS	RK OUT	IG/MET	>100	>1	GRASS OTHER	SHLT	WEAK		BY CAR
SANDY PORT	20	0	OPEN	SM BAY	L BLDS M BLDS S BLDS STONES PEBBLS GRAVEL	STONES RK RGS	IG/MET	50-100	.5-1	GRASS	MODRT	WEAK	NORMAL	WALK
ST.JOHN'S POINT	21	0	OPEN	HDLAND	RK RGS FIS RK	STONES	IG/MET	>100	>1	GRASS	MODRT	WEAK	NORMAL	BY CAR

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
CONEYISLAND BAY(BOULDER)	22	0	SM BAY	SHELTD	M BLDS	SHINGL	IG/MET	)100	.5-1	OTHER	SHLT	WEAK	NORMAL	BY CAR
BLACKROCK	23	0	HDLAND		VER RK	RK RGS	IG/MET	(10	)1	GRASS	V EXPD	WEAK	NORMAL	WALK
ARDGLASS BAY (ROCK)	24	0	INLET		RK OUT	FIS RK PEBBLS	IG/MET	10-50	.1-.5	GRASS	V SHLT	WEAK	NORMAL	BY CAR
SHEEPLAND HARBOUR	25	0	OPEN		FIS RK	GRAVEL				TREES			STREAM	
BONFIRE HILL SHORE	26	0	SHELTD	NARRWS	M SAND	SLT RK				OTHER				
					RK RGS	FIS RK	IG/MET	10-50	)1	GRASS	EXPD	WEAK	NORMAL	BY CAR
					RK OUT	RK RGS	IG/MET	50-100	.1-.5	L CLFS	MODRT	WEAK	NORMAL	BY CAR
						L BLDS				GRASS				
						M BLDS				VALLEY				
						S BLDS								
						PEBBLS								
CRAIGLEWEY	27	0	SHELTD	HDLAND	LRKRGS	L BLDS	IG/MET	10-50	.5-1	L CLFS	SHLT	MODRT	NORMAL	WALK
					FIS RK	M BLDS				GRASS				
CRAIGTHOMAS	28	0	HDLAND	OPEN		S BLDS								
					RK PLF		IG/MET	)100	)1	GRASS	MODRT	MODRT	NORMAL	WALK
MILL QUARTER BAY(BOULD.)	29	0	ISLE		IRR RK						SHLT	MODRT	NORMAL	WALK
KILCLIEF POINT	30	0	LINEAR SHELTD	NARRWS	RK OUT	L BLDS	H MDST	50-100	.5-1	SMARSH	SHLT	MODRT	NORMAL	BY CAR
						STONES				GRASS				
CLOGHY ROCKS	31	0	NARRWS	SHELTD	RK OUT	SAND	IG/MET	50-100	.1-.5	GRASS	SHLT	STRONG	NORMAL	BY CAR
						M SAND				OTHER				
LAUNCHES LITTLE	32	0	SHELTD		M BLDS	SLT RK								
						L BLDS	IG/MET	50-100	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
GREENISLAND	33	0	ISLE	LOUGH	GRAVEL	PEBBLS								
					SAND	M SAND								
						M BLDS	IG/MET	10-50	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
						S BLDS								
						PEBBLS								
TAGGART ISLAND	34	0	ISLE	LOUGH	L BLDS	M SAND								
					M BLDS	SLT RK								
					S BLDS	STONES	IG/MET	10-50	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
DUNNYNEILL ISLANDS	35	0	ISLE		M BLDS	GRAVEL								
					GRAVEL	L BLDS	IG/MET	50-100	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
						S BLDS				TREES				
PAWLE ISLAND	36	0	SHELTD	ISLE	M BLDS	STONES								
				LOUGH		SAND								
LONG ISLAND	37	0	ISLE	LOUGH		GRAVEL	IG/MET	50-100	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
					M BLDS	SAND								
					S BLDS	L BLDS	IG/MET	10-50	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
					STONES	GRAVEL								
					SHINGL									
					PEBBLS									
LONG SHEELAH	38	0	ISLE	LOUGH	L BLDS	M BLDS	IG/MET	50-100	.1-.5	OTHER	SHLT	MODRT	NORMAL	BOAT
						SHINGL								
						GRAVEL								
DRUMMOND ISLAND	39	0	ISLE	LOUGH	L BLDS	STONES	IG/MET	10-50	.5-1	GRASS	SHLT	WEAK	NORMAL	BOAT
					M BLDS	GRAVEL								
					S BLDS									
					SHINGL									
					PEBBLS									

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
BIRD ISLAND	40	0	ISLE	LOUGH	M BLDS	PEBBLS SAND	IG/MET	50-100	.5-1	GRASS	SHLT	WEAK	NORMAL	BOAT
LONG SKART ROCKS	41	0	ISLE	LOUGH	L BLDS M BLDS S BLDS SHINGL PEBBLS	GRAVEL M SAND	IG/MET	10-50	.1-.5		SHLT	WEAK	NORMAL	BOAT
SOUTH ISLAND	42	0	LOUGH	ISLE	M BLDS	PEBBLS SAND	IG/MET	)100	)1	GRASS	SHLT	WEAK	NORMAL	BOAT
CHAPEL ISLAND	43	0	ISLE	LOUGH	L BLDS M BLDS S BLDS STONES PEBBLS GRAVEL	SAND	IG/MET	10-50	.5-1	GRASS	SHLT	WEAK	NORMAL	BOAT
AUDLEYS CASTLE ROCKS	44	0	HDLAND	LOUGH	RK OUT	FIS RK L BLDS M BLDS S BLDS PEBBLS GRAVEL	IG/MET	10-50	.5-1	GRASS TREES	SHLT	STRONG	NORMAL	BY CAR
CHAPEL ISLAND CAUSEWAY	45	0	LOUGH	AT ISL	M BLDS	PEBBLS GRAVEL	IG/MET	)100	.5-1	GRASS	SHLT	MODRT	NORMAL	WALK
MOORES POINT	46	0	HDLAND	LOUGH	M BLDS S BLDS STONES SHINGL PEBBLS GRAVEL	L BLDS	IG/MET	10-50	.5-1	GRASS TREES	SHLT	WEAK	NORMAL	WALK
TAGGART QUAY (BOULDERS)	47	0	LOUGH	SHELTD	M BLDS	STONES SLT RK	IG/MET	10-50	.5-1	GRASS	SHLT	MODRT		BY CAR
CASTLE ISLAND POINT	48	0	HDLAND	LOUGH NARRWS	M BLDS S BLDS STONES SHINGL PEBBLS MUD M SAND SLT RK		IG/MET	10-50	.5-1	GRASS	SHLT	WEAK	NORMAL	WALK
REAGH ISLAND (BOULDERS)	49	0	HDLAND	ISLE LOUGH	M BLDS S BLDS SHINGL	SAND	IG/MET	10-50	.1-.5	GRASS TREES	SHLT	WEAK	NORMAL	BY CAR
PIG ISLAND	50	0	LOUGH	AT ISL	M BLDS PEBBLS	L BLDS	IG/MET	50-100	.1-.5	GRASS TREES	SHLT	WEAK	NORMAL	BY CAR
HERRING BAY (BOULDERS)	51	0	HDLAND	LOUGH	M BLDS S BLDS	STONES SHINGL PEBBLS GRAVEL SAND	IG/MET		.1-.5	GRASS	SHLT	WEAK	NORMAL	BY CAR
KIRCUBBIN POINT	52	0	LOUGH	HDLAND	M BLDS	SHINGL	IG/MET	50-100	.5-1	GRASS	MODRT	WEAK	NORMAL	BY CAR
BLACK NELL	53	0	HDLAND	LOUGH	STP RK RK RGS	SAND	IG/MET	10-50	(0.1	GRASS	MODRT	MODRT	NORMAL	WALK
ROWREAGH POINT	54	0	LOUGH	HDLAND	RK RGS	M BLDS	IG/MET	50-100	.5-1	GRASS	MODRT	MODRT	NORMAL	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
HORSE ISLAND	55	0	HDLAND AT ISL	LOUGH	RK OUT M BLDS STONES SHINGL PEBBLS GRAVEL	SAND	IG/MET	50-100	.5-1	GRASS	MODRT	MODRT	NORMAL	BY CAR WALK
GRANSHA POINT	56	0	LOUGH	SHELTD	RK OUT	SLT RK	IG/MET	)100		SMARSH GRASS	SHLT	MODRT	NORMAL	WALK
YELLOW ROCKS	57	0	LOUGH	SHELTD	RK PLF M BLDS S BLDS	STONES M GRVL	IG/MET	)100		GRASS	SHLT	MODRT	NORMAL	WALK
THE DORN	58	0	RAPIDS	LOUGH NARRWS	M BLDS	PEBBLS GRAVEL	IG/MET	)100	.5-1	GRASS	SHLT	MODRT	NORMAL	WALK
RINGBURR POINT	59	0	HDLAND LOUGH	SHELTD	M BLDS S BLDS	GRAVEL SAND	IG/MET	)100	.5-1	GRASS	SHLT	MODRT	NORMAL	WALK
MARLFIELD ROCKS	60	0	SHELTD	LOUGH	PEBBLS RK RGS FIS RK	SLT RK	IG/MET	10-50	.1-.5	GRASS	MODRT	MODRT	NORMAL	BY CAR
SELK ROCK	61	0	AT ISL	LOUGH	FIS RK	L BLDS M BLDS	IG/MET	50-100		GRASS TREES	SHLT	MODRT	NORMAL	BY CAR
BALLYHENRY BAY	62	0	SM BAY	LOUGH NARRWS	M BLDS S BLDS STONES SHINGL	PEBBLS	IG/MET	(10	.5-1	GRASS OTHER	SHLT	STRONG	NORMAL	BY CAR
THE WALTER ROCKS	63	0	NARRWS	LOUGH NARRWS	S BLDS SHINGL	GRAVEL SAND	IG/MET	10-50	)1	GRASS TREES OTHER	SHLT	MODRT	NORMAL	BY CAR
BANKMORE POINT	64	0	HDLAND	NARRWS	M BLDS S BLDS	PEBBLS GRAVEL	S MDST	10-50	.5-1	L CLFS GRASS	SHLT	STRONG	NORMAL	WALK
GRANAGH BAY (ROCKS)	65	0	SHELTD SM BAY	NARRWS	RK RGS RK OUT	M BLDS S BLDS PEBBLS SLT RK	IG/MET	50-100	.5-1	GRASS	SHLT	MODRT	NORMAL	BY CAR
CARRSTOWN POINT	66	0	SHELTD HDLAND	NARRWS	RK RGS RK OUT	M BLDS PEBBLS	IG/MET	50-100	.5-1	GRASS	SHLT	MODRT	NORMAL	WALK
BALLYQUINTIN POINT	67	0	HDLAND	OPEN	LRKRGS FIS RK L BLDS M BLDS	S BLDS	IG/MET	50-100	)1	SMARSH GRASS	MODRT	WEAK	NORMAL	WALK
THE TONGUE	68	0	SHELTD		M BLDS S BLDS	RK OUT	IG/MET	)100	)1	GRASS	SHLT	WEAK	NORMAL	WALK
DOWN ROCK	69	0	OPEN	HDLAND	RK RGS RK PLF	M BLDS S BLDS	IG/MET	)100	)1	GRASS	MODRT	WEAK	NORMAL	WALK
MILLIN BAY POINT	70	0	HDLAND	OPEN	LRKRGS IRR RK	M BLDS	IG/MET	10-50	.5-1	GRASS TREES	MODRT	WEAK	NORMAL	BY CAR
KEARNEY	71	0	OPEN		RK RGS FIS RK	L BLDS M BLDS PEBBLS	IG/MET	50-100	)1	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR
HEMS ROCK	72	0	OPEN		RK RGS FIS RK	L BLDS M BLDS S BLDS	IG/MET	50-100	)1	GRASS	MODRT	WEAK	NORMAL	BY CAR
THE BURNFOOT (CLIFF)	73	0	OPEN	SM BAY	STP RK RK PLF	SHINGL SAND	LMSTNE	10-50	)1	M CLFS	EXPD	MODRT	NORMAL STREAM	WALK
THE BURNFOOT (BOULDERS)	74	0	SM BAY	OPEN	RK PLF L BLDS M BLDS	S BLDS	LMSTNE	10-50	(0.1	M CLFS	EXPD	MODRT	NORMAL STREAM	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
PEGGY'S HOLE	75	0	OPEN	SM BAY INLET	L BLDS M BLDS	LRKRGS RK OUT	IG/MET	10-50	)1	H CLFS	EXPD	MODRT	NORMAL	BY CAR
PEGGY'S HOLE (PLATFORM)	76	0	OPEN		STP RK RK PLF		IG/MET	(10	.1-.5	M CLFS	EXPD	MODRT	NORMAL	BY CAR
PORT GORM	77	0	OPEN SM BAY		RK RGS RK OUT L BLDS	M BLDS	IG/MET	10-50	.5-1	L CLFS	EXPD	MODRT	NORMAL	BY CAR
PORT MOON	78	0	OPEN		STP RK	RK PLF RK OUT	IG/MET	(10	.1-.5	H CLFS	V EXPD	MODRT	NORMAL	WALK
PORT MOON BAY	79	0	SM BAY	L BAY	RK OUT L BLDS M BLDS	S BLDS	IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL STREAM	WALK
LARRY BANE HEAD	80	0	OPEN HDLAND		L BLDS	STP RK	LMSTNE	(10	.5-1	H CLFS	V EXPD	MODRT	NORMAL	BY CAR
LARRY BANE BAY	81	0	SM BAY	OPEN	L BLDS M BLDS	S BLDS SHINGL	LMSTNE	(10	.5-1	H CLFS	EXPD	MODRT	NORMAL	BY CAR
PORT MORE POINT	82	0	OPEN		RK PLF	L BLDS	LMSTNE	(10	)1	H CLFS	EXPD	STRONG	NORMAL STREAM	WALK
PORT MORE	83	0	OPEN L BAY		RK PLF RK OUT L BLDS	M BLDS	IG/MET	10-50	)1	H CLFS	EXPD	STRONG	NORMAL	WALK
KINBANE CASTLE (WEST)	84	0	OPEN SM BAY		RK OUT L BLDS	M BLDS	IG/MET LMSTNE	10-50	)1	H CLFS	EXPD	MODRT	NORMAL STREAM	WALK
KINBANE HEAD	85	0	HDLAND	OPEN	VER RK RK PLF		LMSTNE	(10	.1-.5	H CLFS	EXPD	STRONG	NORMAL	BY CAR
PORTBALLINTRAE	86	0	SM BAY	OPEN	RK OUT M BLDS S BLDS	L BLDS SAND	IG/MET	10-50	.5-1	L CLFS	MODRT	MODRT	NORMAL	BY CAR
SEAGULL ROCKS	87	0	HDLAND	OPEN	LRKRGS	M BLDS	IG/MET	(10	.1-.5	OTHER	MODRT	MODRT	NORMAL	BY CAR
THE LADLE	88	0	OPEN HDLAND		LRKRGS RK PLF	FIS RK	IG/MET	10-50	.5-1	M CLFS	EXPD	MODRT	NORMAL	BY CAR
PORTNABOE	89	0	OPEN SM BAY		L BLDS	RK OUT	IG/MET	10-50	.1-.5	M CLFS	EXPD	MODRT	NORMAL	WALK
GREAT STOOKAN	90	0	HDLAND	OPEN	STP RK LRKRGS RK PLF	FIS RK	IG/MET	(10	)1	L CLFS GRASS	EXPD	MODRT	NORMAL	BY CAR
GIANT'S CAUSEWAY	91	0	OPEN	HDLAND	RK OUT	FIS RK	IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL	WALK
PORT NOFFER	92	0	SM BAY	OPEN	RK RGS L BLDS M BLDS S BLDS	STONES SHINGL PEBBLS	IG/MET	10-50	.1-.5	H CLFS GRASS	MODRT	MODRT	NORMAL	WALK
PORT REOSTAN (B)	93	0	SM BAY	OPEN	VER RK	RK PLF L BLDS M BLDS	IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL	BOAT
THE DUTCHMAN	94	0	OPEN		VER RK RK OUT L BLDS M BLDS		LMSTNE	(10	)1	GRASS	EXPD	MODRT	NORMAL	BOAT
KILLEANY (B)	95	0	OPEN		L BLDS M BLDS S BLDS	STONES SHINGL	IG/MET LMSTNE	(10	.5-1	M CLFS	EXPD	MODRT	NORMAL STREAM	BOAT
THE SKEIR (B)	96	0	OPEN		VER RK STP RK	RK OUT L BLDS	IG/MET	(10	.1-.5	M CLFS	EXPD	MODRT	NORMAL	BOAT
BLACK HEAD (B)	97	0	OPEN		VER RK	RK RGS RK OUT	IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL	BOAT

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
SROANAMADDY (B)	98	0	OPEN		RK PLF L BLDS	M BLDS	LMSTNE	10-50	.5-1	H CLFS	EXPD	MODRT	NORMAL	BOAT
BULL POINT (B)	99	0	HDLAND	OPEN	STP RK IRR RK		IG/MET	(10	.5-1	M CLFS	EXPD	STRONG	NORMAL	BOAT
WEST LIGHTHOUSE BAY (B)	100	0	SM BAY	HDLAND	L BLDS M BLDS		IG/MET	(10	(0.1	H CLFS	EXPD	MODRT	NORMAL	BOAT
FIDDOGE (B)	101	0	OPEN	HDLAND	VER RK		IG/MET	(10	)1	H CLFS	V EXPD	MODRT	NORMAL	BOAT
DUNCAN'S BAY (B)	102	0	OPEN	SM BAY	VER RK	RK OUT L BLDS M BLDS	IG/MET	(10	)1	H CLFS	V EXPD	MODRT	NORMAL	BOAT
KINREA (B)	103	0	OPEN	SM BAY	VER RK		IG/MET	(10	)1	H CLFS	V EXPD	MODRT	NORMAL	BOAT
CARRICK (B)	104	0	OPEN		RK PLF L BLDS	M BLDS	IG/MET LMSTNE	10-50	.5-1	H CLFS	EXPD	MODRT	NORMAL	BOAT
MARIE ISLA	105	0	OPEN		VER RK	STP RK	LMSTNE	(10	)1	H CLFS	V EXPD	MODRT	NORMAL	BOAT
STACKAMORE (B)	106	0	L BAY	OPEN	RK OUT L BLDS	M BLDS	IG/MET	10-50	.5-1	H CLFS	EXPD	MODRT	NORMAL	BOAT
EAST LIGHTHOUSE	107	0	OPEN	HDLAND	VER RK		IG/MET	(10	.5-1	H CLFS	V EXPD	MODRT	NORMAL	BOAT
BRUCE'S CAVE	108	0	OPEN		VER RK		IG/MET	(10	(0.1	H CLFS	EXPD	MODRT	NORMAL	BOAT
PORTAWILLIN	109	0	HDLAND	OPEN	STP RK LRKRGS		IG/MET	(10	.5-1	GRASS	EXPD	MODRT	NORMAL	BOAT
PORTAWILLIN BAY	110	0	SM BAY	OPEN	RK PLF	L BLDS	IG/MET	10-50	(0.1	L CLFS	MODRT	MODRT	NORMAL	WALK
ARKILL BAY	111	0	OPEN		RK RGS IRR RK	M BLDS S BLDS	IG/MET	(10	.1-.5	L CLFS GRASS	SHLT	MODRT	NORMAL	BOAT
RUE POINT EAST	112	0	HDLAND	OPEN	RK OUT L BLDS	STONES	IG/MET	(10	.1-.5	GRASS OTHER	MODRT	MODRT	NORMAL	WALK
RUE POINT WEST	113	0	HDLAND	OPEN	M BLDS STP RK		IG/MET	(10	.5-1	M CLFS OTHER	EXPD	STRONG	NORMAL	WALK
OWEYDOO	114	0	OPEN		IRR RK RK PLF	L BLDS	LMSTNE	50-100	.5-1	M CLFS	EXPD	MODRT	NORMAL	BOAT WALK
CLOCHADOO	115	0	OPEN		RK OUT LRKRGS	M BLDS STONES	IG/MET	10-50	.5-1	M CLFS	EXPD	MODRT	NORMAL	BOAT BOAT
MILL BAY	116	0	OPEN	L BAY	L BLDS M BLDS S BLDS	SHINGL PEBBLS								
CHURCH BAY	117	0	SM BAY	OPEN	IRR RK RK PLF	RK RGS L BLDS M BLDS	IG/MET	(10	)1	L CLFS	EXPD	MODRT	NORMAL	BOAT
PORT NA TOBER	118	0	SM BAY	OPEN	STP RK	S BLDS SHINGL PEBBLS S BLDS	LMSTNE	10-50	.5-1	GRASS OTHER	MODRT	MODRT	NORMAL	BOAT
PORT NA TOBER HEADLAND	119	0	HDLAND	OPEN	L BLDS M BLDS		IG/MET	10-50	.1-.5	H CLFS	EXPD	MODRT	NORMAL	WALK
BENBANE HEAD (B)	120	0	HDLAND	OPEN	STP RK		IG/MET	(10	(0.1	H CLFS	EXPD	MODRT	NORMAL	WALK
BENGORE HEAD	121	0	HDLAND	OPEN	VER RK		IG/MET	(10	.5-1	H CLFS	EXPD	MODRT	NORMAL	BOAT
PORT NA BROCK	122	0	SM BAY	OPEN	STP RK L BLDS		IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL	BOAT
DUNSEVERICK WEST	123	0	SM BAY		M BLDS RK RGS		IG/MET	10-50	.1-.5	H CLFS	EXPD	MODRT	NORMAL	BOAT
					L BLDS M BLDS S BLDS		IG/MET	(10	(0.1	H CLFS	MODRT	MODRT	NORMAL	BOAT

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
DUNSEVERICK PLATFORMS	124	0	OPEN		STP RK	RK PLF	IG/MET	<10	.1-.5	M CLFS	EXPD	MODRT	NORMAL	BOAT
GID POINT (B)	125	0	HDLAND	OPEN	VER RK STP RK		IG/MET	<10	>1	M CLFS	EXPD	MODRT	NORMAL	BOAT
CARRICKNAFORD	126	0	ISLE	OPEN	STP RK LRKRGS		IG/MET	<10		OTHER	EXPD	MODRT	NORMAL	BOAT
CARRICK-A-REDE	127	0	ISLE	OPEN	VER RK STP RK RK RGS		IG/MET	<10	.1-.5	H CLFS	EXPD	STRONG	NORMAL	BOAT
GIANT'S CUT CLIFFS (B)	128	0	OPEN		VER RK RK PLF		LMSTNE	<10	>1	H CLFS	EXPD	STRONG	NORMAL	BOAT
PORTSTEWART POINT	129	0	HDLAND	OPEN	IRR RK	L BLDS	IG/MET	<10	.5-1	GRASS	EXPD	WEAK	NORMAL	BY CAR
RINAGREE POINT	130	0	OPEN		RK PLF	IRR RK	IG/MET	10-50	>1	L CLFS GRASS	EXPD	WEAK	NORMAL	BY CAR
REVIGGERLY	131	0	HDLAND	OPEN	LRKRGS RK PLF		IG/MET	<10	>1	OTHER	EXPD	MODRT	NORMAL	BY CAR
DUNIMENY CASTLE	132	0	OPEN		RK PLF	L BLDS M BLDS S BLDS PEBBLS	LMSTNE	10-50	>1	M CLFS H CLFS	EXPD	MODRT	NORMAL	WALK
COLLIERY BAY	133	0	OPEN		RK PLF RK OUT	L BLDS M BLDS	H MDST	10-50	>1	M CLFS	MODRT	MODRT	NORMAL STREAM	BY CAR
GRIBBIN	134	0	OPEN		L BLDS	M BLDS	IG/MET H MDST	<10	.5-1	H CLFS	EXPD	STRONG	NORMAL STREAM	WALK
CARRICK-MORE WEST	135	0	OPEN		RK OUT L BLDS	RK PLF	H MDST	10-50	.5-1	H CLFS	MODRT	MODRT	NORMAL	WALK
CARRICK-MORE	136	0	OPEN		RK PLF	L BLDS M BLDS	H MDST	10-50	.1-.5	M CLFS GRASS	EXPD	STRONG	NORMAL STREAM	WALK
FAIR HEAD WEST	137	0	OPEN		L BLDS		IG/MET	<10	>1	H CLFS	EXPD	MODRT	NORMAL	WALK
FALL POINT	138	0	HDLAND	OPEN	L BLDS M BLDS		IG/MET	<10	>1	H CLFS	V EXPD	MODRT	NORMAL	WALK
PORTDOO	139	0	OPEN		L BLDS		IG/MET	10-50	>1	H CLFS	MODRT	MODRT	NORMAL	WALK
NEWBRIDGE (RIVER FOYLE)	140	0	ESTUAR		RK RGS STONES PEBBLS GRAVEL SLT RK	M BLDS MUD	IG/MET	<10	.5-1	GRASS TREES OTHER	V SHLT	WEAK	LOW	BY CAR
DOWNHILL ROCKS	141	0	HDLAND	OPEN	VER RK STP RK LRKRGS	L BLDS M BLDS SAND	IG/MET	<10	.5-1	M CLFS	EXPD	WEAK	NORMAL	WALK
CASTLEROCK	142	0	OPEN		STP RK RK PLF	RK OUT	IG/MET	<10	.1-.5	M CLFS	EXPD	MODRT	NORMAL	WALK
THE BERRINS (PORTSTEW.)	143	0	OPEN		RK PLF IRR RK	L BLDS M BLDS STONES PEBBLS	IG/MET	<10	>1	L CLFS GRASS OTHER	EXPD	WEAK	NORMAL	BY CAR
MURLOUGH BAY NORTH	144	0	SM BAY	OPEN	L BLDS	RK OUT M BLDS	IG/MET LMSTNE	<10	<0.1	H CLFS GRASS TREES	EXPD	MODRT	NORMAL	BY CAR
MURLOUGH BAY	145	0	SM BAY	OPEN	RK RGS RK PLF M BLDS S BLDS	L BLDS	IG/MET H MDST	10-50	.1-.5	GRASS VALLEY TREES	SHLT	MODRT	NORMAL STREAM	BY CAR
RUEBANE POINT	146	0	HDLAND	OPEN	L BLDS		IG/MET	<10	>1	H CLFS	EXPD	MODRT	NORMAL	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
TORR HEAD	147	0	HDLAND	OPEN	VER RK STP RK LRKRGS	L BLDS	IG/MET	(10	.5-1	L CLFS GRASS	EXPD	MODRT	NORMAL	BY CAR
PORT VINEGAR	148	0	OPEN		STP RK RK RGS		IG/MET	10-50	.5-1	L CLFS GRASS	MODRT	MODRT	NORMAL	BY CAR
CUSHENDALL LIFEBOAT HO.	149	0	SHELTD		RK PLF M BLDS S BLDS		S MDST	10-50	.5-1	GRASS	MODRT	MODRT	NORMAL	BY CAR
RED ARCH	150	0	OPEN		RK RGS RK PLF		S MDST	10-50	.5-1	L CLFS GRASS	MODRT	MODRT	NORMAL	BY CAR
OLD PIER	151	0	L BAY	OPEN	M BLDS	S BLDS	IG/MET LMSTNE	(10	)1	M CLFS GRASS	MODRT	WEAK	NORMAL	BY CAR
WHITE LADY	152	0	HDLAND	SHELTD	L BLDS	M BLDS	LMSTNE	(10	.1-.5	L CLFS	MODRT	MODRT	NORMAL	BY CAR
WHITE LADY (EAST)	153	0	OPEN		L BLDS M BLDS S BLDS SHINGL PEBBLS		IG/MET LMSTNE	10-50	.5-1	L CLFS	MODRT	MODRT	NORMAL	BY CAR
GARRON HARBOUR	154	0	OPEN		LRKRGS	L BLDS	LMSTNE	10-50	.5-1	H CLFS GRASS	MODRT	MODRT	NORMAL	BY CAR
TURLEY'S PORT	155	0	SHELTD	LINEAR	M BLDS	SHINGL PEBBLS	IG/MET	10-50	.5-1	H CLFS GRASS	MODRT	MODRT	NORMAL	BY CAR
RINGFAD	156	0	HDLAND	OPEN	L BLDS M BLDS S BLDS SHINGL		IG/MET	10-50	.5-1	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
CAMPBELTOWN	157	0	SHELTD	L BAY	RK PLF	M BLDS	S MDST	10-50	.1-.5	OTHER	SHLT	WEAK	NORMAL	BY CAR
STRAIDKILLY POINT	158	0	SHELTD HDLAND		RK PLF	L BLDS M BLDS	H MDST	10-50	.1-.5	GRASS	MODRT	WEAK	NORMAL	BY CAR
PARK HEAD	159	0	OPEN HDLAND		L BLDS	SHINGL PEBBLS	LMSTNE	(10	)1	H CLFS OTHER	MODRT	MODRT	NORMAL	BY CAR
WHITEBAY POINT	160	0	OPEN		L BLDS M BLDS S BLDS SHINGL PEBBLS	GRAVEL	IG/MET LMSTNE	10-50	)1	H CLFS GRASS	MODRT	MODRT	NORMAL	BY CAR
DRUMNAREAGH PORT	161	0	OPEN	LINEAR	M BLDS	SHINGL	IG/MET	10-50	)1	M CLFS OTHER	MODRT	MODRT	NORMAL	BY CAR
HALFWAY HO.(BALLYGALLEY)	162	0	L BAY	OPEN	L BLDS M BLDS S BLDS PEBBLS	SHINGL SAND	IG/MET	10-50	)1	GRASS VALLEY	MODRT	MODRT	NORMAL	BY CAR
BALLYGALLEY HEAD	163	0	HDLAND	OPEN	L BLDS M BLDS S BLDS	RK OUT	IG/MET	10-50	.5-1	M CLFS GRASS	SHLT	MODRT	NORMAL	BY CAR
CARNFUNNOCK BAY	164	0	OPEN	L BAY	M BLDS	S BLDS SHINGL	IG/MET	10-50	)1	GRASS TREES	MODRT	MODRT	NORMAL	WALK
SEACOURT	165	0	OPEN		RK RGS	RK PLF L BLDS M BLDS	LMSTNE	10-50	)1	M CLFS	MODRT	WEAK	NORMAL	BY CAR
LOUGHAN BAY	166	0	OPEN L BAY		LRKRGS	M BLDS	IG/MET	(10	.1-.5	H CLFS	EXPD	MODRT	NORMAL STREAM	WALK
PORT MORE (LOUGHAN)	167	0	OPEN L BAY		L BLDS M BLDS		IG/MET	10-50	.1-.5	H CLFS GRASS	MODRT	MODRT	NORMAL	WALK
RUNABAY HEAD	168	0	HDLAND	OPEN	L BLDS	M BLDS S BLDS	IG/MET	(10	.5-1	M CLFS	MODRT	MODRT	NORMAL	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
CUSHENDUN NORTH	169	0	OPEN		LRKRGS IRR RK	L BLDS PEBBLS	IG/MET	10-50	)1	GRASS	EXPD	MODRT	NORMAL	WALK
CUSHENDUN BAY SOUTH	170	0	SM BAY	SHELTD	RK PLF RK OUT	M BLDS S BLDS	IG/MET H MDST	10-50	.1-.5	M CLFS	SHLT	MODRT	NORMAL	WALK
CAVE HOUSE SHORE	171	0	OPEN		L BLDS L BLDS M BLDS S BLDS	STONES SHINGL PEBBLS	H MDST	10-50	)1	M CLFS GRASS	SHLT	MODRT	NORMAL	WALK
LAYD CHURCH (CUSHENDALL)	172	0	OPEN		RK RGS	FIS RK	H MDST	(10	)1	M CLFS GRASS	MODRT	MODRT	NORMAL	WALK
DALARADIA POINT	173	0	L BAY HDLAND	LOUGH	L BLDS S BLDS STONES	M BLDS	IG/MET	10-50	.1-.5	TREES	SHLT	WEAK	REDUCD STREAM	WALK
BARNEY'S POINT	174	0	SM BAY	LOUGH	M GRVL SAND	M BLDS S BLDS STONES SHINGL PEBBLS GRAVEL SLT RK	IG/MET	50-100	.5-1	GRASS	SHLT	WEAK	REDUCD	BY CAR
MAIDENS LIGHTHOUSE WEST	175	0	OPEN		RK PLF IRR RK		IG/MET	(10	.1-.5	OTHER	V EXPD	MODRT	NORMAL	BOAT WALK
LIGHTHOUSE (MAIDENS) (B)	176	0	ISLE		RK PLF IRR RK		IG/MET	(10	.1-.5	OTHER	V EXPD	MODRT	NORMAL	BOAT
MCILLROY'S PORT (B)	177	0	OPEN		STP RK LRKRGS RK PLF L BLDS M BLDS S BLDS		IG/MET	(10	)1	GRASS	EXPD	MODRT	NORMAL	BOAT
RIDING STONE (B)	178	0	OPEN		RK RGS RK PLF	L BLDS M BLDS S BLDS	LMSTNE	(10	)1	GRASS	EXPD	STRONG	NORMAL	BOAT
ISLE OF MUCK (EAST) (B)	179	0	ISLE		VER RK STP RK		IG/MET	(10	.5-1	M CLFS	V EXPD	STRONG	NORMAL	BOAT
ISLE OF MUCK WEST (B)	180	0	ISLE	SHELTD	RK OUT	L BLDS M BLDS	IG/MET	(10	.1-.5	L CLFS	MODRT	STRONG	NORMAL	BOAT
CHAPMAN'S ROCK (B)	181	0	OPEN		RK OUT L BLDS	STP RK	IG/MET	10-50	)1	M CLFS	MODRT	MODRT	NORMAL	BOAT
THE GOBBINS (B)	182	0	OPEN		VER RK STP RK	RK OUT	IG/MET	(10	)1	H CLFS	EXPD	MODRT	NORMAL	BOAT
MARCHBURN PORT NORTH (B)	183	0	OPEN		L BLDS M BLDS	SHINGL PEBBLS	LMSTNE	10-50	)1	M CLFS	MODRT	MODRT	NORMAL	BOAT
MARCHBURN PORT (B)	184	0	OPEN		M BLDS	L BLDS	IG/MET LMSTNE	10-50	)1	M CLFS	MODRT	MODRT	NORMAL	BOAT
BLACK HEAD EAST (B)	185	0	SHELTD		RK OUT		IG/MET		.1-.5	M CLFS	MODRT	MODRT	NORMAL	BOAT
BLACKHEAD ROCKS	186	0	HDLAND	OPEN	L BLDS STP RK RK RGS		IG/MET	(10	.1-.5	M CLFS	MODRT	MODRT	NORMAL	WALK
BLACKHEAD BOULDERS	187	0	SHELTD		M BLDS	L BLDS	IG/MET	10-50	.1-.5	M CLFS	MODRT	MODRT	NORMAL	WALK
WHITEHEAD	188	0	OPEN HDLAND		RK RGS	M BLDS	IG/MET LMSTNE	10-50	.5-1	M CLFS OTHER	EXPD	WEAK	NORMAL	BY CAR

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
TORY TOWN (BOULDERS)	189	0	SHELTD	LOUGH	M BLDS S BLDS STONES SAND	SHINGL PEBBLS GRAVEL	IG/MET	)100	.1-.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
LOUGHSHORE PARK(BOULDER)	190	0	SHELTD	LOUGH	SLT RK STONES SHINGL PEBBLS GRAVEL	M BLDS S BLDS	IG/MET	)100		TREES OTHER		WEAK	NORMAL	BY CAR
ORLOCK POINT	191	0	OPEN HDLAND		RK RGS	S BLDS STONES	H MDST	10-50	)1	GRASS	EXPD	MODRT	NORMAL	WALK
SANDYBAY POINT	192	0	HDLAND	OPEN	RK RGS FIS RK	M BLDS S BLDS STONES	IG/MET	10-50	.5-1	OTHER	MODRT	MODRT	NORMAL	BY CAR
FORELAND POINT	193	0	HDLAND	OPEN	RK RGS	RK PLF FIS RK	IG/MET	10-50	)1	OTHER	MODRT	MODRT	NORMAL	BY CAR
GALLOWAY'S ROCK	194	0	OPEN		LRKRGS RK OUT L BLDS M BLDS S BLDS		IG/MET	50-100	)1	OTHER	MODRT	WEAK	NORMAL	BY CAR
MILLISLE	195	0	SHELTD	AT ISL	RK PLF RK OUT	S BLDS PEBBLS	H MDST	50-100	)1	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
BARKLEY ROCK	196	0	OPEN		RK RGS RK OUT	S BLDS STONES PEBBLS	IG/MET	50-100		GRASS	SHLT	WEAK	NORMAL	BY CAR
WHITECHURCH (ROCKY)	197	0	OPEN		RK RGS RK PLF	RK OUT SHINGL PEBBLS	H MDST	)100	)1	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
WALLACE'S ROCK	198	0	OPEN		RK RGS RK PLF RK OUT FIS RK	SAND	IG/MET	10-50	)1	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
QUAY ROCKS	199	0	SHELTD		M BLDS	RK OUT	IG/MET H MDST	50-100	)1	OTHER	SHLT	MODRT	NORMAL	BY CAR
ROBIN'S ROCK	200	0	SM BAY	OPEN	RK RGS RK PLF RK OUT M BLDS S BLDS	L BLDS STONES PEBBLS	IG/MET	50-100	.5-1	GRASS		MODRT	NORMAL	BY CAR
PORTAVOGIE	201	0	OPEN		RK RGS RK PLF	S BLDS STONES SHINGL	H MDST	50-100	.1-.5	OTHER	MODRT	MODRT	NORMAL	BY CAR
RINGBOY POINT	202	0	OPEN		L BLDS M BLDS S BLDS SHINGL PEBBLS	GRAVEL SAND SLT RK	IG/MET	)100	)1	GRASS OTHER	MODRT	MODRT	NORMAL	BY CAR
CHAPEL BAY (COPELAND)	203	0	SM BAY	ISLE	RK RGS FIS RK		H MDST	10-50	)1	GRASS	SHLT	MODRT	NORMAL	BOAT
CAIRN POINT	204	0	HDLAND	SHELTD	RK OUT	RK RGS IRR RK	H MDST	)100	.5-1	GRASS	SHLT	MODRT	NORMAL	BOAT
BARNAGH BAY (COPELAND)	205	0	OPEN	ISLE	STP RK RK RGS FIS RK		H MDST	10-50	.5-1	GRASS	MODRT	WEAK	NORMAL	BOAT

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
BESSY'S POINT	206	0	HDLAND	OPEN	RK RGS RK OUT	FIS RK	H MDST	10-50	.1-.5	GRASS	MODRT	MODRT	NORMAL	BOAT
MATTHEW SCOTT ROCK	207	0	OPEN	ISLE	LRKRGS FIS RK	SAND	H MDST	50-100	)1	GRASS	SHLT	MODRT	NORMAL	BOAT
HORSE POINT	208	0	SHELTD	ISLE	RK RGS RK OUT	FIS RK	H MDST	10-50	)1	M CLFS GRASS	SHLT	MODRT	NORMAL	BOAT
BRIGGS ROCK	209	0	HDLAND		RK RGS FIS RK	S BLDS STONES SHINGL	H MDST	10-50	.5-1	GRASS OTHER	EXPD	WEAK	NORMAL	WALK
BALLYMACORMICK POINT	210	0	HDLAND	OPEN	RK RGS RK PLF	FIS RK	H MDST	50-100	)1	GRASS	MODRT	WEAK	NORMAL	WALK
WILSON'S POINT	211	0	HDLAND	OPEN	RK OUT RK RGS FIS RK		H MDST	10-50	)1	GRASS TREES OTHER	EXPD	WEAK	NORMAL	BY CAR
SWINELEY POINT	212	0	OPEN		RK RGS	FIS RK	H MDST	10-50	)1	GRASS TREES	EXPD	WEAK	NORMAL	BY CAR
CRAWFORDSBURN ROCKS	213	0	OPEN	HDLAND	RK RGS	S BLDS STONES	H MDST	10-50	.1-.5	GRASS TREES	EXPD	WEAK	NORMAL	WALK
HELEN'S BAY	214	0	OPEN		RK RGS FIS RK		H MDST	<10	)1	GRASS TREES OTHER	V EXPD	WEAK	NORMAL	BY CAR
CULLODEN HOTEL	215	0	OPEN	LINEAR	RK RGS S BLDS PEBBLS GRAVEL		H MDST	10-50	)1	GRASS OTHER	EXPD	WEAK	NORMAL	BY CAR
HOLYWOOD ESPLANADE	216	0	SHELTD		L BLDS M BLDS S BLDS STONES PEBBLS	MUD	IG/MET	10-50	)1	OTHER	SHLT	WEAK	NORMAL	BY CAR
ISLE O'VALLA (ROCKS)	217	0	SHELTD	LOUGH	RK RGS RK OUT	STONES SHINGL PEBBLS	H MDST	10-50	)1	GRASS	SHLT	STRONG	NORMAL	WALK
HOLM BAY	218	0	SHELTD		M BLDS S BLDS STONES SHINGL GRAVEL SAND	SLT RK BL LAY SLT RK	IG/MET	50-100	)1	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
RINGDUFFERIN	219	0	SHELTD		M BLDS S BLDS	PEBBLS GRAVEL MUD	IG/MET	50-100	)1	GRASS TREES	SHLT	MODRT	NORMAL	BY CAR
MAHEE ISLAND	220	0	SHELTD	ISLE	M BLDS S BLDS STONES SHINGL PEBBLS	GRAVEL SAND	IG/MET	10-50	)1	GRASS	V SHLT	WEAK	NORMAL	WALK

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LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHAB(TATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
DICKEYS ROCKS	1	ASCOPH FCBARN	POOLS CREVIS OTHER	POOLS CREVIS OTHER	OTHER	LOW	POOR	POOR	GULLS	GULLS		NR NNR	FAIR			OTHER
MAGGY'S ROCK	2	ASCOPH FCBARN	POOLS			MEDIUM	AVRAGE	AVRAGE	WADERS GULLS				FAIR	CAR PK		SPORTS
NORTH OF KILLOWEN	3	ASCOPH FCBARN				MEDIUM	AVRAGE	AVRAGE	GULLS			NR NNR	FAIR	CAR PK	SEWAGE	
WARRENPOINT	4	ASCOPH FCBARN				LOW	POOR	POOR	WADERS GULLS				POOR	RESORT AMENPR CAR PK POPULA		OTHER SPORTS
GREENCASTLE ROCKS	5	ASCOPH FCBARN	W POOL POOLS CREVIS O'HANG	W POOL CREVIS O'HANG OTHER	CREVIS O'HANG OTHER	HIGH	AVRAGE	AVRAGE	WADERS GULLS SEABDS	SEABDS	SEALS		V GOOD	CAR PK		MOORNG
CRANFIELD POINT ROCK	6	FUCOID	POOLS OTHER	POOLS OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE	WADERS SEABDS				FAIR	ATTRAC AMENPR CAR PK POPULA	SEWAGE	OTHER MOORNG
STH OF NICHOLSON'S P	7	FCBARN CHLPHY OTHER				MEDIUM	GOOD	AVRAGE	GULLS				GOOD			
SOUTH OF KILKEEL	8	FCBARN OTHER	POOLS	POOLS	POOLS	MEDIUM	AVRAGE	AVRAGE					FAIR			
LEE STONE HARBOUR	9	FCBARN PATBAR OTHER		W POOL	WPOOL POOLS	MEDIUM	GOOD	GOOD					GOOD	POPULA RESORT CAR PK		
JANET'S ROCK(OUTCROP	10	RHMYTI CREVIS	POOLS CREVIS	D POOL POOLS CREVIS COULRS O'HANG	CREVIS COULRS O'HANG	HIGH	AVRAGE	AVRAGE					FAIR	CAR PK	SEWAGE	
JANET'S ROCK(BOULDER	11	ASCOPH FUCOID RHMYTI BARNAC MOLLUS	W POOL POOLS	POOLS	WPOOL POOLS OTHER	HIGH	GOOD	GOOD	GULLS				GOOD		SEWAGE	
WRECK PORT	12	PATBAR MOLLUS	L POOL CREVIS	POOLS	WPOOL	MEDIUM	AVRAGE	AVRAGE								
ARTHUR'S PORT	13	FUCOID PATBAR OTHER	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG								FAIR			OTHER
GLASSDRUMMAN PORT	14	FUCOID PATBAR MOLLUS	POOLS	POOLS CREVIS O'HANG	POOLS	HIGH	AVRAGE	AVRAGE					GOOD	AMENNR		
GREEN HARBOUR	15	PATBAR MOLLUS	POOLS	POOLS		LOW	POOR	POOR	GULLS SEABDS				FAIR			SHFISH
BLOODY BRIDGE	16	RHMYTI PATBAR	W POOL POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE		SEABDS		NR NNR	FAIR			MOORNG
CRAIGALEA	17	FCBARN PATBAR MOLLUS	POOLS CREVIS	W POOL D POOL L POOL POOLS CREVIS	WPOOL L POOL POOLS CREVIS	HIGH	GOOD	GOOD	WADERS GULLS SEABDS			NR RES	GOOD	POPULA CAR PK		
													GOOD	ATTRAC		

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
RATHMULLAN POINT	18	MYTBAR MOLLUS	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	AVRAGE	AVRAGE					FAIR	POPULA ATTRAC AMENNR CAR PK		
RINGBOY(BOULDERS)	19	FUCOID PATBAR	POOLS OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	GOOD	WADERS SEABDS		SEALS		GOOD	CAR PK		SHFISH
SANDY PORT	20	FUCOID PATBAR	D POOL POOLS CREVIS O'HANG	POOLS	POOLS CREVIS	MEDIUM	GOOD	GOOD	GULLS SEABDS				GOOD			SHFISH
ST.JOHN'S POINT	21	FUCOID OTHER	W POOL POOLS CREVIS	POOLS CREVIS	POOLS CREVIS O'HANG	HIGH			GULLS	WADERS			V GOOD			SHFISH
CONEYISLAND BAY(BOUL	22	ASCOPH FUCOID	W POOL POOLS	POOLS	WPOOL POOLS	HIGH	AVRAGE	GOOD	WADERS WFOWL GULLS SEABDS				GOOD	CAR PK		
BLACKROCK	23	PATBAR	POOLS CREVIS COULRS	CREVIS COULRS POOLS	POOLS CREVIS COULRS	MEDIUM	AVRAGE	AVRAGE	SEABDS				GOOD			
ARDGLASS BAY (ROCK)	24	ASCOPH FCBARN	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG		HIGH	AVRAGE	GOOD	GULLS SEABDS				FAIR	AMENPR CAR PK	SEWAGE RECLAM	BAIT MOORNG OTHER
SHEEPLAND HARBOUR	25	RHBARN	W POOL POOLS CREVIS COULRS	D POOL L POOL POOLS CREVIS COULRS	D POOL L POOL POOLS CREVIS COULRS	HIGH	GOOD	AVRAGE	SEABDS				GOOD			
BONFIRE HILL SHORE	26	FCBARN	W POOL L POOL POOLS CREVIS COULRS	D POOL POOLS CREVIS COULRS	POOLS CREVIS				GULLS SEABDS	SEABDS			GOOD GOOD			
CRAIGLEWEY	27	FUCOID	W POOL D POOL L POOL POOLS	D POOL L POOL POOLS	POOLS	HIGH	GOOD	AVRAGE	GULLS SEABDS	SEABDS		IN NNR	GOOD			
CRAIGTHOMAS	28	FUCOID	W POOL D POOL L POOL POOLS CREVIS	W POOL D POOL L POOL POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG				GULLS SEABDS	GULLS SEABDS		IN NNR	GOOD GOOD			
MILL QUARTER BAY(BOU	29	ASCOPH FUCOID	W POOL POOLS	W POOL POOLS	D POOL POOLS	HIGH	GOOD	AVRAGE	GULLS SEABDS			IN NNR	FAIR		SEWAGE	
KILCLIEF POINT	30	ASCOPH FUCOID	OTHER	W POOL OTHER	OTHER	HIGH	AVRAGE	GOOD	WADERS GULLS SEABDS		SEALS		GOOD			
CLOGHY ROCKS	31	ASCOPH FUCOID	OTHER	OTHER	OTHER	HIGH	AVRAGE	GOOD	WADERS GULLS SEABDS		SEALS		GOOD	CAR PK		
LAUNCHES LITTLE	32	ASCOPH FUCOID	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD	WADERS SEABDS			NR RES	GOOD			
GREENISLAND	33	ASCOPH OTHER	OTHER	OTHER	OTHER	HIGH	GOOD	GOOD	SEABDS			NR RES	GOOD			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	FROM. HIGH	SUBHABITATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
TAGGART ISLAND	34	FUCOID	POOLS	POOLS	POOLS	HIGH	GOOD	GOOD	GULLS							
			OTHER	OTHER	OTHER				SEABDS				GOOD			MOORNG
DUNNYNEILL ISLANDS	35	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	WADERS	SEABDS						
		FUCOID							SEABDS				GOOD			
PAWLE ISLAND	36	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	WADERS							
		FUCOID							GULLS				GOOD			
LONG ISLAND	37	ASCOPH	OTHER	POOLS	POOLS	MEDIUM	GOOD	GOOD	SEABDS							
		FUCOID		OTHER	OTHER				WADERS	WADERS						
LONG SHEELAH	38	ASCOPH	W POOL	OTHER	OTHER	MEDIUM	GOOD	GOOD	GULLS	GULLS		NR NNR	GOOD			
		FUCOID	OTHER													
DRUMMOND ISLAND	39	ASCOPH	POOLS	POOLS	POOLS	HIGH	GOOD	GOOD					GOOD			
		FCBARN	OTHER	OTHER	OTHER				GULLS	GULLS						
BIRD ISLAND	40	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD	SEABDS				GOOD			OTHER
		FUCOID							GULLS	GULLS						
LONG SKART ROCKS	41	ASCOPH	POOLS	POOLS	POOLS	HIGH	GOOD	GOOD	GULLS				GOOD			
		FCBARN	OTHER	OTHER	OTHER				SEABDS				GOOD			
SOUTH ISLAND	42	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD					GOOD			
		FUCOID														
		BARNAC														
CHAPEL ISLAND	43	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE	WADERS				FAIR			OTHER
		PATBAR							WFOWL							
									GULLS							
AUDLEYS CASTLE ROCKS	44	ASCOPH	POOLS	POOLS	POOLS	HIGH	AVRAGE	GOOD	SEABDS							
		FUCOID	CREVIS	CREVIS	CREVIS				WADERS				GOOD	ATTRAC		MOORNG
			OTHER	O'HANG	OTHER				GULLS					CAR PK		
CHAPEL ISLAND CAUSEW	45	ASCOPH	OTHER	OTHER					SEABDS							
		FUCOID		W POOL	WPOOL	MEDIUM	AVRAGE	GOOD	WADERS							
				OTHER	OTHER				WFOWL			NR RES	GOOD			
MOORES POINT	46	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE	SEABDS							
TAGGART QUAY (BOULDE	47	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	POOR	AVRAGE	WFOWL			NR RES	FAIR			
		FUCOID							WADERS			NR RES	FAIR			
CASTLE ISLAND POINT	48	ASCOPH	OTHER	OTHER	D POOL	MEDIUM	GOOD	GOOD	WFOWL							MOORNG
		FCBARN			POOLS				GULLS							
REACH ISLAND (BOULDE	49	ASCOPH			OTHER				WADERS				GOOD			
		PATBAR				LOW	AVRAGE	AVRAGE	WFOWL							
PIG ISLAND	50	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	SEABDS							
		FUCOID							SEABDS				FAIR			
		MYTBAR							WADERS	GULLS						
HERRING BAY (BOULDER	51	ASCOPH	POOLS	POOLS					GULLS				GOOD	CAR PK		MOORNG
			OTHER	OTHER		HIGH	AVRAGE	GOOD	WADERS							
KIRCUBBIN POINT	52	ASCOPH	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	SEABDS				GOOD			
		FUCOID							GULLS							
		PATBAR											GOOD	AMENNR		MOORNC
BLACK NELL	53	ASCOPH	W POOL	W POOL	POOLS	HIGH	GOOD	AVRAGE	SEABDS					CAR PK		
		PATBAR	POOLS	POOLS	CREVIS							NR RES	GOOD			
			CREVIS	CREVIS	OTHER											
ROWREACH POINT	54	ASCOPH	W POOL	POOLS	POOLS	MEDIUM	AVRAGE	AVRAGE	WADERS							
		PATBAR	CREVIS	CREVIS	CREVIS							NR RES	FAIR			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
HORSE ISLAND	55	ASCOPH PATBAR	POOLS CREVIS OTHER	W POOL POOLS OTHER	WPOOL OTHER	HIGH	AVRAGE	AVRAGE	GULLS SEABDS			NR RES	GOOD			ALGAE
GRANSHA POINT	56	ASCOPH FUCOID		CREVIS	CREVIS	LOW	POOR	AVRAGE	GULLS SEABDS				FAIR			
YELLOW ROCKS	57	ASCOPH	OTHER	OTHER	OTHER	LOW	AVRAGE	AVRAGE	WADERS SEABDS			NR NNR	FAIR			
THE DORN	58	ASCOPH FUCOID	OTHER	OTHER	OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS			IN NNR	V GOOD			OTHER
RINGBURR POINT	59	ASCOPH FUCOID	OTHER	W POOL OTHER	WPOOL OTHER	MEDIUM	GOOD	GOOD	WADERS WFOWL GULLS SEABDS				GOOD			OTHER
MARLFIELD ROCKS	60	ASCOPH FUCOID PATBAR	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS O'HANG OTHER	POOLS CREVIS O'HANG OTHER	HIGH	GOOD	AVRAGE	GULLS SEABDS				GOOD			MOORNG
SELK ROCK	61	ASCOPH	W POOL POOLS CREVIS OTHER	W POOL D POOL POOLS CREVIS OTHER	POOLS CREVIS OTHER	HIGH	AVRAGE	AVRAGE	WADERS GULLS SEABDS	SEABDS		NR RES	GOOD			OTHER MOORNG
BALLYHENRY BAY	62	ASCOPH FUCOID CHLPHY		OTHER	OTHER	MEDIUM	AVRAGE	GOOD	WADERS GULLS SEABDS				GOOD			OTHER MOORNG
THE WALTER ROCKS	63	ASCOPH FUCOID	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD	GULLS				GOOD	AMENNR POPULA	RECLAM	
BANKMORE POINT	64	FUCOID	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD	GULLS SEABDS				GOOD			
GRANAGH BAY (ROCKS)	65	ASCOPH FUCOID	CREVIS COULRS OTHER	L POOL CREVIS COULRS OTHER	CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS		SEALS	IN NNR	V GOOD			OTHER
CARRSTOWN POINT	66	ASCOPH FUCOID PATBAR	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	AVRAGE	GOOD	WADERS GULLS SEABDS		SEALS		GOOD			
BALLYQUINTIN POINT	67	ASCOPH FUCOID PATBAR	W POOL POOLS CREVIS COULRS	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS			NR RES	GOOD			
THE TONGUE	68	ASCOPH FUCOID	W POOL OTHER	POOLS CREVIS OTHER	WPOOL OTHER	HIGH	AVRAGE	GOOD	WADERS GULLS SEABDS			NR RES	GOOD			
DOWN ROCK	69	ASCOPH FUCOID PATBAR	W POOL CREVIS COULRS OTHER	W POOL L POOL CREVIS COULRS OTHER	WPOOL CREVIS COULRS OTHER	HIGH	GOOD	AVRAGE	WADERS WFOWL GULLS				GOOD			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
MILLIN BAY POINT	70	FUCOID PATBAR	D POOL L POOL POOLS CREVIS	D POOL POOLS CREVIS COULRS O'HANG OTHER	POOLS OTHER	MEDIUM	AVRAGE	GOOD	WADERS			NR RES	GOOD	ATTRAC	SEWAGE	OTHER
KEARNEY	71	ASCOPH FUCOID PATBAR	D POOL POOLS CREVIS COULRS	W POOL POOLS CREVIS COULRS	WPOOL POOLS CREVIS COULRS	HIGH	GOOD	AVRAGE	WFOWL GULLS			NR RES	GOOD	POPULA CAR PK		
HEMS ROCK	72	ASCOPH FUCOID PATBAR	W POOL POOLS CREVIS	W POOL POOLS CREVIS	POOLS CREVIS	HIGH	GOOD	GOOD	WADERS GULLS				GOOD			
THE BURNFOOT (CLIFF)	73	FUCOID RHMYTI		POOLS O'HANG		MEDIUM	GOOD	AVRAGE	GULLS SEABDS			NR NNR	GOOD	AMENNR CAR PK		
THE BURNFOOT (BOULDE	74	FUCOID CHLPHY PATBAR		POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	GOOD	GULLS	GULLS		NR NNR	GOOD	CAR PK		
PEGGY'S HOLE	75	PATBAR OTHER	OTHER	OTHER	OTHER	MEDIUM	GOOD	AVRAGE	GULLS	WADERS		NR NNR	GOOD			
PEGGY'S HOLE (PLATFO	76	RHMYTI PATBAR	W POOL D POOL L POOL POOLS CREVIS	D POOL L POOL POOLS CREVIS	CREVIS	HIGH	GOOD	AVRAGE	GULLS	GULLS		NR NNR	GOOD			
PORT GORM	77	FUCOID PATBAR OTHER	W POOL CREVIS COULRS	W POOL POOLS CREVIS COULRS O'HANG	CREVIS COULRS O'HANG	HIGH	GOOD	GOOD	WADERS WFOWL			NR NNR	GOOD			
PORT MOON	78	RHMYTI PATBAR MOLLUS	CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE	WADERS GULLS SEABDS	WADERS GULLS SEABDS		NR NNR	GOOD			
PORT MOON BAY	79	PATBAR	W POOL POOLS CREVIS	W POOL POOLS CREVIS	CREVIS	HIGH	GOOD	AVRAGE	WFOWL GULLS SEABDS	GULLS SEABDS		NR RES NR NNR	GOOD			MOORNG
LARRY BANE HEAD	80	FUCOID RHBARN RHPATE	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE	WFOWL GULLS SEABDS	WFOWL GULLS SEABDS		NR RES NR NNR	GOOD			MOORNG OTHER
LARRY BANE BAY	81	FUCOID CHLPHY RHBARN	D POOL POOLS O'HANG OTHER	W POOL D POOL O'HANG OTHER	WPOOL D POOL POOLS O'HANG OTHER	HIGH	GOOD	AVRAGE	GULLS	GULLS		NR NNR	GOOD	CAR PK	RECLAM	OTHER
PORT MORE POINT	82	RHPATE	W POOL L POOL POOLS	L POOL POOLS CREVIS O'HANG	L POOL POOLS CREVIS O'HANG	HIGH	AVRAGE	AVRAGE	GULLS SEABDS	SEABDS		NR NNR	GOOD			
PORT MORE	83	CHLPHY RHMYTI PATBAR	POOLS OTHER	POOLS OTHER	OTHER	MEDIUM	GOOD	AVRAGE	SEABDS	SEABDS		NR NNR	GOOD			
KINBANE CASTLE (WEST	84	FUCOID RHPATE PATBAR	POOLS OTHER	W POOL POOLS OTHER	POOLS OTHER	HIGH	GOOD	AVRAGE	SEABDS	SEABDS		NR NNR	GOOD	CAR PK POPULA		
KINBANE HEAD	85	RHPATE	POOLS CREVIS	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS	GULLS		NR NNR	GOOD			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
PORTBALLINTRAE	86	FUCOID PATBAR	POOLS OTHER	POOLS OTHER	OTHER	MEDIUM	GOOD	GOOD	GULLS			NR NNR	FAIR	AMENNR CAR PK POPULA		MOORNG SPORTS
SEAGULL ROCKS	87	FUCOID RHBARN PATBAR	D POOL L POOL POOLS CREVIS	D POOL L POOL POOLS CREVIS	D POOL POOLS CREVIS	HIGH	GOOD	AVRAGE	WFOWL GULLS			NR NNR	GOOD	ATTRAC RESORT AMENNR CAR PK POPULA		FISHNG MOORNG
THE LADLE	88	RHMYTI PATBAR	D POOL POOLS CREVIS COULRS	W POOL L POOL POOLS CREVIS COULRS	D POOL L POOL POOLS CREVIS COULRS	HIGH	GOOD	AVRAGE	GULLS	GULLS			GOOD	CAR PK	SEWAGE	SPORTS
PORTNABOE	89	FUCOID PATBAR OTHER	POOLS OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	AVRAGE	WADERS GULLS SEABDS	SEABDS		NR NNR	GOOD	AMENNR CAR PK POPULA		
GREAT STOOKAN	90	FUCOID RHMYTI PATBAR	W POOL D POOL L POOL POOLS CREVIS COULRS O'HANG	D POOL L POOL POOLS CREVIS COULRS O'HANG	POOLS CREVIS	HIGH	GOOD	AVRAGE	WFOWL GULLS SEABDS	GULLS		NR NNR NR RES	V GOOD	ATTRAC AMENPR CAR PK POPULA		FISHNG OTHER
GIANT'S CAUSEWAY	91	RHMYTI PATBAR	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	AVRAGE	POOR	GULLS			NR NNR	FAIR	AMENNR CAR PK POPULA		
PORT NOFFER	92	FUCOID PATBAR OTHER	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	D POOL POOLS O'HANG	HIGH	GOOD	GOOD	GULLS SEABDS	GULLS		NR NNR NR RES	POOR	ATTRAC AMENNR CAR PK POPULA	SEWAGE	FISHNG OTHER
PORT REOSTAN (B)	93	PATBAR OTHER	POOLS CREVIS	POOLS CREVIS	CREVIS	MEDIUM	AVRAGE	AVRAGE	GULLS	GULLS		NR NNR NR RES	FAIR	ATTRAC AMENNR CAR PK POPULA		
THE DUTCHMAN	94	RHPATE	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS	MEDIUM	GOOD	AVRAGE	GULLS	GULLS		NR NNR	GOOD			MOORNG
KILLEANY (B)	95	FUCOID RHPATE	POOLS O'HANG	POOLS O'HANG	POOLS O'HANG	MEDIUM	GOOD	AVRAGE	GULLS	GULLS		NR NNR	GOOD			MOORNG OTHER
THE SKEIR (B)	96	PATBAR OTHER	OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	AVRAGE	AVRAGE		GULLS		NR NNR	GOOD			
BLACK HEAD (B)	97	PATBAR OTHER		POOLS	POOLS	MEDIUM	AVRAGE	AVRAGE		GULLS		NR NNR	GOOD			
SROANAMADDY (B)	98	RHPATE	OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR NNR	GOOD			
BULL POINT (B)	99	PATBAR OTHER	POOLS CREVIS	POOLS CREVIS	CREVIS	MEDIUM	GOOD	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR NNR	GOOD			
WEST LIGHTHOUSE BAY	100	RHPATE PATBAR	O'HANG	O'HANG		MEDIUM	AVRAGE	AVRAGE				NR NNR	FAIR			
FIDDOGE (B)	101	RHBARN	OTHER	OTHER	OTHER	LOW	AVRAGE	AVRAGE	GULLS SEABDS	SEABDS		NR NNR	GOOD			
DUNCAN'S BAY (B)	102	RHPATE				LOW	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR NNR	GOOD			
KINREA (B)	103	PATBAR OTHER				LOW	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS	SEALS	NR NNR	GOOD			
CARRICK (B)	104	FUCOID PATBAR OTHER	POOLS	POOLS	POOLS	MEDIUM	GOOD	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR NNR	GOOD			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
MARIE ISLA	105	PATBAR OTHER	CREVIS O'HANG	CREVIS O'HANG	CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR	NNR	GOOD		
STACKAMORE (B)	106	FUCOID PATBAR OTHER	OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR	NNR	GOOD		
EAST LIGHTHOUSE	107	RHPATE				LOW	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR	NNR	GOOD		
BRUCE'S CAVE	108	OTHER	CAVES	CAVES	CAVES	MEDIUM	AVRAGE	POOR				NR	NNR	GOOD		
PORTAWILLIN	109	RHBARN	POOLS CREVIS	POOLS CREVIS O'HANG	POOLS CREVIS	MEDIUM	GOOD	AVRAGE	GULLS			NR	NNR	GOOD		
PORTAWILLIN BAY	110	FUCOID OTHER		W POOL POOLS	POOLS	MEDIUM	GOOD	AVRAGE		WADERS		NR	NNR	FAIR		MOORNG
ARKILL BAY	111	ASCOPH FUCOID	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	HIGH	AVRAGE	AVRAGE	GULLS	GULLS		NR	NNR	GOOD		
RUE POINT EAST	112	FUCOID PATBAR OTHER	OTHER	OTHER	POOLS OTHER	MEDIUM	GOOD	AVRAGE	WADERS GULLS SEABDS	WADERS GULLS SEABDS		NR	NNR	FAIR		OTHER
RUE POINT WEST	113	RHBARN	L POOL CREVIS O'HANG	CREVIS	CREVIS	MEDIUM	AVRAGE	AVRAGE	WADERS GULLS	WADERS GULLS		NR	NNR	GOOD		OTHER
OWEYDOO	114	ASCOPH FUCOID PATBAR OTHER	POOLS CREVIS COULRS	L POOL POOLS CREVIS COULRS O'HANG	L POOL POOLS CREVIS COULRS O'HANG	HIGH	GOOD	GOOD	WADERS WFOWL GULLS SEABDS	WADERS GULLS		NR	NNR	GOOD		
CLOGHADOO	115	OTHER	POOLS O'HANG OTHER	POOLS CREVIS O'HANG OTHER	POOLS CREVIS O'HANG OTHER	HIGH	AVRAGE	AVRAGE	GULLS	GULLS SEABDS		NR	NNR	GOOD		
MILL BAY	116	RHPATE	W POOL POOLS CREVIS OTHER	POOLS CREVIS OTHER	POOLS CREVIS OTHER	MEDIUM	AVRAGE	AVRAGE	WADERS SEABDS	WADERS SEABDS		NR	NNR	GOOD	AMENNR	
CHURCH BAY	117	FUCOID	L POOL POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE	WADERS	WADERS		NR	NNR	GOOD	AMENNR	MOORNG
PORT NA TOBER	118	RHBARN	POOLS O'HANG	POOLS O'HANG	POOLS O'HANG	MEDIUM	GOOD	AVRAGE	GULLS	GULLS		NR	NNR	GOOD		
PORT NA TOBER HEADLA	119	RHBARN MYTBAR	POOLS CREVIS	POOLS CREVIS O'HANG	CREVIS O'HANG	MEDIUM	AVRAGE		GULLS	GULLS		NR	NNR	GOOD		
BENBANE HEAD (B)	120	RHMYTI PATBAR	CREVIS	CREVIS O'HANG	CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE	GULLS	GULLS		NR	NNR	FAIR		
BENGORE HEAD	121	RHMYTI PATBAR	POOLS CREVIS	POOLS CREVIS O'HANG	CREVIS	MEDIUM	AVRAGE	AVRAGE	GULLS	GULLS		NR	NNR	FAIR		
PORT NA BROCK	122	FUCOID OTHER	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	HIGH	GOOD	AVRAGE	WADERS GULLS	WADERS GULLS		NR	NNR	GOOD		
DUNSEVERICK WEST	123	FUCOID PATBAR OTHER	POOLS CREVIS	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	GOOD	AVRAGE	GULLS	GULLS		NR	NNR	GOOD		
DUNSEVERICK PLATFORM	124	PATBAR OTHER	D POOL L POOL POOLS	CREVIS	CREVIS	HIGH	AVRAGE	AVRAGE	WADERS GULLS SEABDS	GULLS SEABDS		NR	NNR	GOOD		

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
GID POINT (B)	125	RHPATE	CREVIS	CREVIS	CREVIS	MEDIUM	AVRAGE	AVRAGE	WFOWL GULLS	WFOWL GULLS		NR	NNR FAIR			
CARRICKNAFORD	126	PATBAR OTHER	CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	AVRAGE	AVRAGE	WADERS GULLS	WADERS GULLS		NR NR	FAIR RES			
CARRICK-A-REDE	127	FUCOID PATBAR OTHER	CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	AVRAGE	AVRAGE	WFOWL GULLS SEABDS	WFOWL GULLS SEABDS		NR NR	NNR GOOD RES			
GIANT'S CUT CLIFFS (	128	RHPATE	CREVIS	CREVIS	CREVIS	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR	NNR FAIR			
PORTSTEWART POINT	129	PATBAR	D POOL POOLS CREVIS COULRS	POOLS CREVIS COULRS	CREVIS	HIGH	AVRAGE	AVRAGE	GULLS			NR	NNR FAIR	CAR PK POPULA		FISHNG
RINAGREE POINT	130	RHMYTI	W POOL D POOL L POOL POOLS CREVIS	D POOL POOLS CREVIS	POOLS CREVIS	HIGH	GOOD	AVRAGE	WADERS	WADERS		NR	NNR GOOD	CAR PK		
REVIGGERLY	131	RHMYTI PATBAR	POOLS CREVIS	CREVIS O'HANG	CREVIS	HIGH	AVRAGE	AVRAGE	WADERS SEABDS			IN	NNR FAIR	ATTRAC RESORT AMENPR CAR PK POPULA		FISHNG MOORNG OTHER
DUNIMENY CASTLE	132	RHPATE	POOLS CREVIS O'HANG	POOLS CREVIS	CREVIS	MEDIUM	GOOD	AVRAGE	WADERS WFOWL GULLS SEABDS	GULLS		NR	NNR FAIR	RESORT CAR PK	RECLAM	
COLLIERY BAY	133	FUCOID RHPATE	POOLS CREVIS	W POOL POOLS CREVIS O'HANG	WPOOL POOLS CREVIS O'HANG	MEDIUM	GOOD	AVRAGE	WADERS GULLS			NR	NNR GOOD	CAR PK		
GRIBBIN	134	PATBAR	O'HANG	O'HANG	O'HANG	MEDIUM	AVRAGE	AVRAGE	WADERS GULLS	GULLS		NR	NNR FAIR			
CARRICK-MORE WEST	135	OTHER	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	GOOD	AVRAGE	WADERS SEABDS	WADERS SEABDS		NR	NNR GOOD			
CARRICK-MORE	136	CHLPHY RHPATE	W POOL POOLS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE	WADERS WFOWL GULLS SEABDS	WADERS GULLS SEABDS		NR	NNR GOOD			MOORNG OTHER
FAIR HEAD WEST	137	PATBAR OTHER	O'HANG	O'HANG	O'HANG	MEDIUM	AVRAGE	AVRAGE	WADERS WFOWL SEABDS			NR	NNR FAIR			
FALL POINT	138	RHBARN	O'HANG	O'HANG	O'HANG	MEDIUM	AVRAGE	AVRAGE	WADERS GULLS			NR NR	NNR FAIR RES	CAR PK		
PORTDOO	139	FUCOID PATBAR	CREVIS O'HANG	W POOL CREVIS O'HANG	WPOOL CREVIS O'HANG	MEDIUM	GOOD	AVRAGE	WADERS			NR NR	NNR GOOD RES			
NEWBRIDGE (RIVER FOY	140	FUCOID	CREVIS OTHER	CREVIS OTHER	CREVIS OTHER	MEDIUM	AVRAGE	AVRAGE					FAIR			OTHER
DOWNHILL ROCKS	141	RHBARN	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	HIGH	AVRAGE	AVRAGE	WADERS GULLS SEABDS	GULLS			GOOD	CAR PK		
CASTLEROCK	142	FUCOID RHBARN	CREVIS	POOLS CREVIS O'HANG CAVES	POOLS CREVIS O'HANG CAVES	HIGH	GOOD	AVRAGE	GULLS	GULLS			GOOD	ATTRAC RESORT AMENNR POPULA		

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
THE BERRINS (PORTSTE	143	MYTBAR PATBAR	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE					FAIR	RESORT AMENNR		MOORNG SPORTS
MURLOUGH BAY NORTH	144	FUCOID RHPATE	CREVIS O'HANG	CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	GOOD	AVRAGE				NR RES	FAIR	CAR PK ATTRAC		
MURLOUGH BAY	145	FUCOID PATBAR	POOLS CREVIS O'HANG OTHER	POOLS CREVIS COULRS O'HANG OTHER	POOLS CREVIS COULRS O'HANG OTHER	HIGH	GOOD	AVRAGE	GULLS SEABDS			NR RES	GOOD	CAR PK POPULA ATTRAC CAR PK POPULA		MOORNG OTHER
RUEBANE POINT	146	PATBAR OTHER	CREVIS O'HANG	CREVIS O'HANG	CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE	WADERS	WADERS		NR NNR	FAIR			
TORR HEAD	147	PATBAR OTHER	CREVIS	CREVIS O'HANG	CREVIS	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS			NR RES				
PORT VINEGAR	148	FUCOID PATBAR	W POOL POOLS CREVIS	POOLS CREVIS COULRS OTHER	POOLS CREVIS	HIGH	GOOD	AVRAGE	WFOWL GULLS	GULLS			FAIR	CAR PK	SEWAGE	MOORNG OTHER
CUSHENDALL LIFEBOAT	149	FUCOID PATBAR	POOLS	POOLS CREVIS	CREVIS	MEDIUM	GOOD	AVRAGE	WADERS GULLS			NR NNR	GOOD	AMENNR CAR PK POPULA	SEWAGE	FISHNG OTHER
RED ARCH	150	FUCOID PATBAR	W POOL CREVIS COULRS	CREVIS COULRS	CREVIS COULRS	HIGH	GOOD	AVRAGE				NR NNR	FAIR	AMENNR CAR PK POPULA	SEWAGE RECLAM	FISHNG MOORNG SPORTS
OLD PIER	151	CHLPHY OTHER	OTHER	OTHER	OTHER	LOW	AVRAGE	POOR	SEABDS				GOOD			
WHITE LADY	152	FUCOID	CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	GOOD	AVRAGE					FAIR	CAR PK	RECLAM	
WHITE LADY (EAST)	153	FUCOID CHLPHY		O'HANG	O'HANG	MEDIUM	GOOD	AVRAGE					FAIR			
GARRON HARBOUR	154	FUCOID PATBAR	CREVIS	POOLS CREVIS	POOLS CREVIS COULRS	MEDIUM	GOOD	AVRAGE					FAIR	CAR PK		
TURLEY'S PORT	155	FUCOID PATBAR	OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	GOOD					GOOD	CAR PK		MOORNG
RINGFAD	156	FUCOID PATBAR	W POOL L POOL POOLS	W POOL L POOL POOLS	POOLS	MEDIUM	GOOD	GOOD					GOOD	CAR PK		
CAMPBELTOWN	157	FUCOID CHLPHY PATBAR	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	MEDIUM	GOOD	AVRAGE					GOOD			MOORNG OTHER
STRAIDKILLY POINT	158	FUCOID PATBAR	CREVIS	W POOL CREVIS	CREVIS	MEDIUM	GOOD	AVRAGE	WADERS				FAIR	RESORT AMENNR		
PARK HEAD	159	FUCOID PATBAR	O'HANG	O'HANG	O'HANG	MEDIUM	GOOD	AVRAGE	GULLS				GOOD			
WHITEBAY POINT	160	FUCOID PATBAR	CREVIS O'HANG	CREVIS O'HANG	CREVIS O'HANG	HIGH	AVRAGE	AVRAGE	SEABDS GULLS				FAIR	CAR PK POPULA	FACTRS RECLAM	FISHNG
DRUMNAREAGH PORT	161	FUCOID PATBAR	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE	SEABDS				FAIR	CAR PK	RECLAM	FISHNG
HALFWAY HO. (BALLYGAL	162	FUCOID PATBAR OTHER	POOLS	POOLS O'HANG	POOLS	MEDIUM	AVRAGE	AVRAGE	GULLS				FAIR	CAR PK		
BALLYGALLEY HEAD	163	FUCOID	CREVIS O'HANG	CREVIS O'HANG	O'HANG OTHER	MEDIUM	GOOD	AVRAGE	GULLS				FAIR	AMENNR CAR PK POPULA CAR PK	RECLAM SEWAGE	

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
CARNFUNNOCK BAY	164	FUCOID CHLPAT OTHER	OTHER	OTHER	OTHER	MEDIUM	GOOD	AVRAGE					FAIR			
SEACOURT	165	FUCOID PATBAR OTHER	POOLS O'HANG	POOLS CREVIS COULRS O'HANG	CREVIS COULRS O'HANG	MEDIUM	GOOD	AVRAGE	WFOWL GULLS				FAIR	RESORT	FACTRS	
LOUGHAN BAY	166	FUCOID PATBAR	COULRS	POOLS COULRS O'HANG	POOLS COULRS O'HANG	MEDIUM	AVRAGE	AVRAGE				NR NNR NR RES	FAIR			
PORT MORE (LOUGHAN)	167	OTHER	O'HANG OTHER	W POOL O'HANG OTHER	WPOOL O'HANG OTHER	MEDIUM	AVRAGE	AVRAGE	GULLS	WADERS GULLS		NR NNR NR RES	FAIR			
RUNABAY HEAD	168	OTHER	O'HANG	O'HANG	POOLS O'HANG	MEDIUM	AVRAGE	AVRAGE				NR NNR NR RES	FAIR			
CUSHENDUN NORTH	169	FUCOID PATBAR OTHER	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	POOLS CREVIS O'HANG	HIGH	GOOD	AVRAGE	GULLS			NR NNR	GOOD	RESORT CAR PK		
CUSHENDUN BAY SOUTH	170	FUCOID OTHER	OTHER	POOLS O'HANG OTHER	POOLS O'HANG OTHER	HIGH	GOOD	GOOD	GULLS			NR RES	GOOD	CAR PK RESORT POPULA		
CAVE HOUSE SHORE	171	ASCOPH FUCOID	POOLS O'HANG OTHER	POOLS O'HANG OTHER	POOLS O'HANG OTHER	MEDIUM	GOOD	GOOD	GULLS			NR RES	GOOD			
LAYD CHURCH (CUSHEND	172	FUCOID PATBAR OTHER	POOLS CREVIS COULRS	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS	MEDIUM	GOOD	AVRAGE	GULLS				GOOD			
DALARADIA POINT	173	ASCOPH FUCOID PATBAR	OTHER	OTHER		LOW	POOR	AVRAGE	WADERS GULLS SEABDS	SEABDS			FAIR		FACTRS SUSP S	SHFISH MOORNG
BARNEY'S POINT	174	ASCOPH FUCOID MYTBAR	OTHER	OTHER	OTHER	LOW	AVRAGE	AVRAGE					FAIR		FACTRS RECLAM	
MAIDENS LIGHTHOUSE W	175	PATBAR OTHER	CREVIS COULRS	CREVIS COULRS O'HANG	CREVIS COULRS O'HANG	MEDIUM	AVRAGE	AVRAGE		GULLS SEABDS	SEALS		GOOD			OTHER
LIGHTHOUSE (MAIDENS)	176	PATBAR OTHER	CREVIS COULRS	CREVIS COULRS	CREVIS COULRS	MEDIUM	AVRAGE	AVRAGE	GULLS SEABDS	GULLS SEABDS			GOOD			MOORNG
MCILLROY'S PORT (B)	177	FUCOID PATBAR OTHER	CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	HIGH	GOOD	AVRAGE	GULLS				GOOD			
RIDING STONE (B)	178	PATBAR OTHER	CREVIS	CREVIS COULRS	CREVIS COULRS	MEDIUM	GOOD	AVRAGE	GULLS SEABDS				GOOD			MOORNG SPORTS
ISLE OF MUCK (EAST)	179	PATBAR OTHER	CREVIS O'HANG	CREVIS O'HANG	CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE	GULLS	GULLS			GOOD			
ISLE OF MUCK WEST (B	180	ASCOPH FUCOID	CREVIS COULRS OTHER	CREVIS COULRS OTHER	CREVIS COULRS OTHER	MEDIUM	AVRAGE	AVRAGE	SEABDS	SEABDS			GOOD	CAR PK		SPORTS
CHAPMAN'S ROCK (B)	181	FUCOID PATBAR	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	HIGH	GOOD	AVRAGE	WADERS SEABDS	WADERS SEABDS			GOOD			
THE GOBBINS (B)	182	PATBAR OTHER	CREVIS COULRS CAVES	CREVIS COULRS CAVES	CREVIS COULRS CAVES	MEDIUM	GOOD	AVRAGE	GULLS SEABDS	GULLS SEABDS		NR RES	GOOD			

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
MARCHBURN PORT NORTH	183	FUCOID PATBAR OTHER	CREVIS O'HANG OTHER	CREVIS O'HANG OTHER	CREVIS O'HANG OTHER	MEDIUM	GOOD	AVRAGE					GOOD			
MARCHBURN PORT (B)	184	FUCOID PATBAR	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	AVRAGE					GOOD			
BLACK HEAD EAST (B)	185	FUCOID PATBAR	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	POOLS CREVIS O'HANG	MEDIUM	AVRAGE	AVRAGE					GOOD			
BLACKHEAD ROCKS	186	FUCOID PATBAR OTHER	CREVIS COULRS	POOLS CREVIS COULRS	CREVIS COULRS	MEDIUM	GOOD	AVRAGE	SEABDS	SEABDS			FAIR	POPULA		FISHNG
BLACKHEAD BOULDERS	187	ASCOPH OTHER	POOLS OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	AVRAGE	AVRAGE					FAIR	POPULA		MOORNG
WHITEHEAD	188	FUCOID PATBAR OTHER	POOLS CREVIS COULRS	POOLS CREVIS COULRS	POOLS CREVIS COULRS	MEDIUM	GOOD	AVRAGE					FAIR	AMENNR CAR PK	FACTRS RECLAM	
TORY TOWN (BOULDERS)	189	FUCOID CHLPHY				LOW	AVRAGE	AVRAGE	GULLS				POOR	AMENNR	FACTRS	
LOUGHSHORE PARK(BOUL	190	FUCOID MYTBAR				LOW	POOR	AVRAGE	SEABDS GULLS				POOR	AMENNR CAR PK	SEWAGE SEWAGE	MOORNG
ORLOCK POINT	191	FUCOID PATBAR	W POOL POOLS CREVIS COULRS	D POOL POOLS CREVIS COULRS	D POOL POOLS CREVIS COULRS	HIGH	GOOD	AVRAGE	SEABDS			NR RES	GOOD			
SANDYBAY POINT	192	FUCOID PATBAR	CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	MEDIUM	GOOD	AVRAGE	GULLS				FAIR		SEWAGE	FISHNG
FORELAND POINT	193	FUCOID PATBAR OTHER	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	CREVIS COULRS POOLS OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS	WADERS			GOOD	RESORT		MOORNG
GALLOWAY'S ROCK	194	ASCOPH FUCOID PATBAR	W POOL POOLS CREVIS COULRS O'HANG OTHER	W POOL POOLS CREVIS COULRS O'HANG OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS GULLS				GOOD	RESORT AMENNR CAR PK POPULA		ALGAE SPORTS OTHER
MILLISLE	195	ASCOPH FUCOID	POOLS CREVIS OTHER	POOLS CREVIS OTHER	POOLS CREVIS OTHER	MEDIUM	GOOD	GOOD	WADERS				FAIR	ATTRAC RESORT AMENNR CAR PK POPULA		ALGAE SPORTS
BARKLEY ROCK	196	ASCOPH FUCOID	POOLS CREVIS OTHER	W POOL L POOL POOLS CREVIS COULRS OTHER	WPOOL POOLS CREVIS COULRS OTHER	MEDIUM	GOOD	GOOD	WADERS GULLS SEABDS				GOOD	RESORT AMENNR CAR PK POPULA		MOORNG
WHITECHURCH (ROCKY)	197	ASCOPH FUCOID PATBAR	POOLS CREVIS	POOLS CREVIS	POOLS CREVIS	HIGH	GOOD	GOOD	WADERS SEABDS		SEALS		GOOD	ATTRAC AMENNR CAR PK POPULA		MOORNG

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	SUBHABITATS LOW	HABIT. DIVER.	SP. RICHNESS FLORA	SP. RICHNESS FAUNA	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
WALLACE'S ROCK	198	ASCOPH FUCOID PATBAR	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS OTHER	MEDIUM	GOOD	AVRAGE					FAIR	CAR PK POPULA		OTHER
QUAY ROCKS	199	FUCOID PATBAR	POOLS OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	GOOD	GOOD	WADERS SEABDS	WADERS	SEALS		GOOD		RECLAM	
ROBIN'S ROCK	200	ASCOPH FUCOID PATBAR	D POOL POOLS CREVIS COULRS O'HANG	D POOL POOLS CREVIS COULRS O'HANG	POOLS CREVIS O'HANG	HIGH	GOOD	GOOD	GULLS SEABDS				GOOD	CAR PK POPULA		OTHER
PORTAVOGIE	201	FUCOID PATBAR	L POOL POOLS CREVIS COULRS	POOLS CREVIS COULRS	POOLS CREVIS COULRS	HIGH	GOOD	AVRAGE	WADERS	WADERS			GOOD	AMENNR	RECLAM	MOORNG
RINGBOY POINT	202	ASCOPH FUCOID	W POOL L POOL POOLS	W POOL POOLS	POOLS	MEDIUM	GOOD	GOOD	WADERS SEABDS	SEABDS			GOOD			OTHER
CHAPEL BAY (COPELAND	203	ASCOPH FUCOID	CREVIS	CREVIS POOLS	CREVIS POOLS	MEDIUM	AVRAGE	AVRAGE	WADERS GULLS SEABDS	GULLS SEABDS			GOOD			MOORNG
CAIRN POINT	204	ASCOPH FUCOID	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS	WADERS GULLS SEABDS	SEALS		V GOOD	POPULA		
BARNAGH BAY (COPELAN	205	FUCOID PATBAR	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	AVRAGE	WADERS GULLS SEABDS	GULLS			GOOD			
BESSY'S POINT	206	ASCOPH PATBAR	POOLS CREVIS COULRS	POOLS CREVIS COULRS	POOLS CREVIS COULRS	MEDIUM	GOOD	GOOD	GULLS	GULLS			GOOD			
MATTHEW SCOTT ROCK	207	ASCOPH PATBAR FUCOID	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS O'HANG OTHER	POOLS CREVIS COULRS O'HANG OTHER	MEDIUM	GOOD	AVRAGE	WADERS GULLS	GULLS			GOOD			
HORSE POINT	208	ASCOPH	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS GULLS	GULLS			GOOD			
BRIGGS ROCK	209	FUCOID PATBAR	POOLS CREVIS	POOLS CREVIS COULRS O'HANG	POOLS CREVIS COULRS O'HANG	HIGH	AVRAGE	AVRAGE	WADERS GULLS				POOR		SEWAGE	OTHER
BALLYMACORMICK POINT	210	ASCOPH PATBAR OTHER	W POOL POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS SEABDS			NR RES	GOOD	AMENNR CAR PK POPULA		
WILSON'S POINT	211	RHMYTI PATBAR	D POOL POOLS CREVIS COULRS	POOLS CREVIS	POOLS CREVIS	MEDIUM	AVRAGE	AVRAGE					GOOD	POPULA		SPORTS

LOCATION OF SHORE	SHEET NO.	NCC CLASS	PROM. HIGH	SUBHABITATS MID	LOW	HABIT. DIVER.	SP. RICHNESS FLORA	FAUNA	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
SWINELEY POINT	212	PATBAR OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS O'HANG OTHER	POOLS CREVIS COULRS O'HANG OTHER	HIGH	GOOD	GOOD	GULLS				GOOD	POPULA		
CRAWFORDSBURN ROCKS	213	PATBAR OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	MEDIUM	GOOD	AVRAGE	GULLS			NR RES	GOOD	ATTRAC CAR PK POPULA		OTHER
HELEN'S BAY	214	PATBAR OTHER	POOLS CREVIS	POOLS CREVIS COULRS	POOLS CREVIS COULRS	MEDIUM	AVRAGE	AVRAGE	GULLS			IN NNR	FAIR	AMENNR CAR PK POPULA		OTHER
CULLODEN HOTEL	215	FCMYTI PATBAR OTHER	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	WADERS GULLS				FAIR	AMENNR CAR PK	SEWAGE	
HOLYWOOD ESPLANADE	216	FCMYTI RHMYTI	OTHER	POOLS OTHER	POOLS OTHER	MEDIUM	POOR	GOOD	WADERS GULLS				FAIR	CAR PK	SUSP S RECLAM	MOORNG SPORTS
ISLE O'VALLA (ROCKS)	217	ASCOPH FUCOID	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	POOLS CREVIS COULRS OTHER	HIGH	GOOD	GOOD	WADERS GULLS SEABDS		SEALS	NR NNR	V GOOD			
HOLM BAY	218	ASCOPH FUCOID	L POOL OTHER	L POOL OTHER	L POOL OTHER	MEDIUM	AVRAGE	GOOD	WADERS GULLS SEABDS			NR RES	V GOOD	CAR PK		MOORNG SPORTS
RINGDUFFERIN	219	ASCOPH FUCOID	OTHER	OTHER	OTHER	MEDIUM	GOOD	GOOD	WADERS SEABDS				GOOD			
MAHEE ISLAND	220	ASCOPH FUCOID	OTHER	OTHER	OTHER	MEDIUM	AVRAGE	GOOD	WADERS			NR RES	GOOD			MOORNG SPORTS

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
THE BENTS	1	0	J256132	06 05.20 W	54 03.00 N	100684	1537	1340	4T07	0.9	4.1	2.5
MILL BAY	2	0	J245137	06 06.00 W	54 03.40 N	100684	1537	1425	4T07	0.9	4.1	2.5
CARRIGANEAN	3	0	J227143	06 07.40 W	54 03.30 N	100684	1537	1520	4T07	0.9	4.1	2.5
KILLOWEN	4	0	J192153	06 10.50 W	54 04.40 N	100684	1627	1627	4T07	0.9	4.4	2.7
ROSTREVOR BAY	5	0	J175179	06 12.20 W	54 06.00 N	100684	1627	1800	4T07	0.9	4.4	2.7
GREENCASTLE	6	0	J239119	06 06.30 W	54 02.05 N	110684	1625	1450	4T07	0.9	4.1	2.5
GREEN ISLAND BAY	7	0	J237106	06 05.00 W	54 01.30 N	110684	1625	1535	4T07	0.9	4.1	2.5
CRANFIELD POINT	8	0	J269099	06 03.55 W	54 01.05 N	110684	1625	1618	4T07	0.9	4.1	2.5
SOUTH OF NICHOLSON'S PT	9	0	J290113	06 01.50 W	54 01.55 N	110684	1625	1706	4T07	0.9	4.1	2.5
MURLOUGH SANDS	10	0	J400330	05 51.55 W	54 13.50 N	140684	1845	1730	4T07	0.9	4.6	3.4
DUNDRUM INNER BAY(SOUTH)	11	0	J396354	05 51.20 W	54 14.55 N	140684	1845	1525	4T07	0.9	4.6	3.4
DUNDRUM INNER BAY(NORTH)	12	0	J411373	05 50.10 W	54 15.50 N	140684	1845	1840	4T07	0.9	4.6	3.4
STINKER ROCK BEACH	13	0	J455350	05 46.00 W	54 14.40 N	140684	1845	1920	4T07	0.9	4.6	3.4
TYRELLA BEACH	14	0	J480357	05 44.00 W	54 15.00 N	140684	1845	2042	4T07	0.9	4.6	3.4
RINGBOY BEACH	15	0	J506358	05 42.00 W	54 15.00 N	150684	1928	1735	4T07	0.9	4.6	3.4
KILLOUGH HARBOUR(INNER)	16	0	J540375	05 38.20 W	54 16.00 N	150684	1928	1940	4T07	0.9	4.6	3.4
KILLOUGH HARBOUR(OUTER)	17	0	J540368	05 38.00 W	54 15.30 N	150684	1928	2007	4T07	0.9	4.6	3.4
CONEYISLAND BAY	18	0	J550365	05 37.25 W	54 15.10 N	150684	1928	2105	4T07	0.9	4.6	3.4
ARDGLASS BAY (SAND)	19	0	J560377	05 36.40 W	54 15.50 N	170684	2043	1715	4T07	1.0	4.0	2.6
BALLYHORNAN BAY	20	0	J595424	05 33.10 W	54 18.00 N	170684	2043	2000	4T07	1.0	4.0	2.6
BENDERG BAY	21	0	J605432	05 32.20 W	54 18.25 N	170684	2043	2030	4T07	1.0	4.0	2.6
MILL QUARTER BAY	22	0	J600440	05 32.20 W	54 19.30 N	150684	0708	0837	4T07	0.7	4.0	2.6
TULLY HILL BAY	23	0	J597467	05 33.20 W	54 20.30 N	150684	0844	0955	6T09	0.6	3.2	2.2
CLOGHY ROCKS (SAND)	24	0	J595478	05 33.20 W	54 20.50 N	150684	0844	1035	6T09	0.6	3.2	2.2
LAUNCHES LITTLE (SAND)	25	0	J541503	05 38.05 W	54 22.20 N	180684	1130	1020	6T09	0.0	0.0	0.0
LIMESTONE PLADDIES	26	0	J555547	05 36.30 W	54 24.55 N	180684	1130	1210	6T09	0.0	0.0	0.0
BLACK CAUSEWAY	27	0	J582492	05 34.20 W	54 21.40 N	200684	1315	1200	6T09	0.0	0.0	0.0
RINGBANE BAY	28	0	J527489	05 39.30 W	54 21.30 N	200684	1313	1400	6T09	0.0	0.0	0.0
CASTLE ISLAND BAY	29	0	J517488	05 40.30 W	54 21.20 N	200684	1315	1400	6T09	0.0	0.0	0.0
CASTLEWILLIAM BAY	30	0	J523511	05 38.30 W	54 24.10 N	210684	1406	1015	6T09	0.0	0.0	0.0
TAGGART QUAY (SAND)	31	0	J531552	05 37.50 W	54 25.40 N	210684	1406	1150	6T09	0.0	0.0	0.0
QUARTERLAND BAY	32	0	J526587	05 38.20 W	54 27.30 N	210684	1406	1256	6T09	0.0	0.0	0.0
BALLYMORRAN BAY	33	0	J522601	05 38.40 W	54 28.20 N	210684	1406	1400	6T09	0.0	0.0	0.0
ARDMILLAN	34	0	J505635	05 40.10 W	54 30.00 N	210684	1406	1435	6T09	0.0	0.0	0.0
RINGNEILL BAY	35	0	J517655	05 39.05 W	54 31.10 N	210684	1406	1515	6T09	0.0	0.0	0.0
DRUM HILL BAY	36	0	J513660	05 39.30 W	54 31.20 N	210684	1406	1545	6T09	0.0	0.0	0.0
REAGH ISLAND	37	0	J532658	05 37.40 W	54 31.20 N	210684	1406	1510	6T09	0.0	0.0	0.0
CASTLE ESPIE	38	0	J495675	05 41.10 W	54 32.10 N	220684	1452	1225	6T09	0.0	0.0	0.0
NEWTOWNARDS	39	0	J506724	05 40.00 W	54 34.50 N	220684	1452	1310	6T09	0.0	0.0	0.0
PIG ISLAND BAY	40	0	J543702	05 36.40 W	54 33.35 N	220684	1452	1350	6T09	0.0	0.0	0.0
GREYABBEY BAY	41	0	J580672	05 33.20 W	54 31.30 N	220684	1452	1443	6T09	0.0	0.0	0.0
HERRING BAY	42	0	J586653	05 32.40 W	54 30.25 N	220684	1452	1520	6T09	0.0	0.0	0.0
DOCTOR'S BAY (SOUTH)	43	0	J595619	05 31.40 W	54 28.40 N	240684	1648	1445	6T09	0.0	0.0	0.0
BLACK NELL INLET	44	0	J600617	05 32.50 W	54 28.30 N	240684	1648	1530	6T09	0.0	0.0	0.0
HORSE ISLAND (SEDIMENT)	45	0	J595611	05 31.55 W	54 28.15 N	240684	1648	1610	6T09	0.0	0.0	0.0
HORSE ISLAND (EAST)	46	0	J600607	05 31.20 W	54 28.00 N	240684	1648	1640	6T09	0.0	0.0	0.0
MID ISLAND BAY	47	0	J590593	05 33.40 W	54 27.10 N	240684	1648	1740	6T09	0.0	0.0	0.0
YELLOW ROCKS	48	0	J595576	05 31.55 W	54 26.15 N	250684	1736	1555	6T09	0.0	0.0	0.0
THE DORN (SEDIMENTARY)	49	0	J592568	05 33.50 W	54 25.50 N	250684	1736	1700	6T09	0.0	0.0	0.0
THE DORN (INNER)	50	0	J591563	05 32.10 W	54 25.30 N	250684	1736	1730	6T09	0.0	0.0	0.0
BALLYWHITE BAY	51	0	J576525	05 35.00 W	54 23.30 N	250684	1736	1840	6T09	0.0	0.0	0.0
GRANAGH BAY (SEDIMENT)	52	0	J604486	05 32.30 W	54 21.30 N	260684	1736	1800	6T09	0.6	3.2	2.2
BAR HALL BAY	53	0	J617465	05 31.10 W	54 20.15 N	260684	1623	1705	4T07	0.8	4.0	2.6
SOUTH BAY	54	0	J633482	05 29.40 W	54 21.10 N	260684	1623	1455	4T07	0.8	4.0	2.6
MILLIN BAY	55	0	J633495	05 30.00 W	54 21.40 N	260684	1623	1356	4T07	0.8	4.0	2.6
KNOCKINELDER BAY	56	0	J640513	05 29.05 W	54 22.55 N	250684	1541	1345	4T07	0.8	4.0	2.6

LOCATION OF SHORE	SHEET NO.	CARD NO.	GRID REF.	LONGITUDE	LATITUDE	DATE	TIME LW	TIME ARR.	TIME ELWS	HT. LW	SPRING RANGE	NEAP RANGE
PORTBALLINTRAE (SAND)	57	0	C925420	06 32.30 W	55 13.00 N	10784	1453	1345	1T04	0.4	1.7	0.3
SEAGULL ROCK (SAND)	58	0	C927425	06 32.00 W	55 13.00 N	10784	1453	1330	1T04	0.4	1.7	0.3
BUSHFOOT STRAND	59	0	C934426	06 31.40 W	55 13.00 N	10784	1453	1320	1T04	0.4	1.7	0.3
RATHLIN HARBOUR	60	0	D148510	06 11.30 W	55 18.55 N	30784	1802	1005	1T04	0.3	1.0	0.4
CURRAN STRAND	61	0	C875411	06 37.20 W	55 12.30 N	80784	0933	1125	1T04	0.7	1.7	0.3
WHITE PARK BAY	62	0	D020441	06 23.30 W	55 13.35 N	80784	1123	1255	1T04	0.5	1.0	0.4
BALLYCASTLE BAY	63	0	D130413	06 13.10 W	55 12.05 N	80784	1123	1445	1T04	0.5	1.0	0.4
MUFF	64	0	C478239	07 15.10 W	55 03.30 N	110784	1338	1610	1T04	0.5	2.1	0.4
LONGFIELD	65	0	C547225	07 08.20 W	55 02.40 N	110784	1338	1430	1T04	0.5	2.1	0.9
TULLYVERRY	66	0	C582224	07 05.10 W	55 02.40 N	110784	1338	1400	1T04	0.5	2.1	0.9
BALLYKELLY BANK	67	0	C610240	07 02.40 W	54 03.30 N	110784	1338	1300	1T04	0.5	2.1	0.9
BALLYMACRAN BANK	68	0	C625280	07 01.20 W	55 05.40 N	110784	1338	1230	1T04	0.5	2.1	0.9
SHEEP MASH	69	0	C646293	06 59.00 W	55 06.25 N	40784	1800	1930	1T04	0.5	2.0	1.0
BALLS POINT	70	0	C643302	06 59.40 W	55 07.00 N	40784	1800	1845	1T04	0.5	2.0	1.0
BALLYMULHOLLAND	71	0	C657352	06 58.00 W	55 09.30 N	40784	1800	1750	1T04	0.5	2.0	1.0
LOWER DOAGHS	72	0	C662378	06 57.20 W	55 11.00 N	40784	1800	1655	1T04	0.5	2.0	1.0
MAGILLIGAN POINT	73	0	C660392	06 57.40 W	55 11.20 N	40784	1800	1625	1T04	0.5	2.0	1.0
MAGILLIGAN STRAND	74	0	C700367	06 53.55 W	55 10.05 N	160784	1521	1314	1T04	0.5	1.7	0.3
BENONE STRAND	75	0	C716364	06 52.20 W	55 10.20 N	160784	1521	1336	1T04	0.5	1.7	0.3
DOWNHILL STRAND	76	0	C748363	06 49.20 W	55 09.45 N	160784	1521	1400	1T04	0.5	1.7	0.3
CASTLEROCK BEACH	77	0	C777364	06 47.40 W	55 10.20 N	160784	1521	1455	1T04	0.5	1.7	0.3
BANN ESTUARY (W.BANK)	78	0	C813357	06 43.15 W	55 09.45 N	160784	1521	1600	1T04	0.5	1.8	0.9
BANN ESTUARY (N.U.D.)	79	0	C835347	06 41.40 W	55 09.00 N	160784	1521	1640	1T04	0.5	1.8	0.9
PORTSTEWART STRAND	80	0	C807368	06 43.40 W	55 10.05 N	160784	1521	1705	1T04	0.5	1.7	0.3
CUSHENDUN BAY	81	0	D250330	06 03.40 W	55 07.40 N	90784	1510	1200	1T04	0.9	1.6	1.0
RED BAY	82	0	D244255	06 03.10 W	55 03.30 N	120684	1704	1512	4T07	0.3	1.4	1.2
CARNLOUGH BAY (SOUTH)	83	0	D290168	05 58.50 W	54 58.30 N	120784	1704	1800	4T07	0.3	1.4	1.2
GLENARM BAY	84	0	D310156	05 57.00 W	54 57.50 N	130784	1752	1620	4T07	0.7	2.4	1.7
HALFWAY HOUSE (SAND)	85	0	D364085	05 52.45 W	54 54.05 N	130784	1752	1745	4T07	0.7	2.4	1.7
GLYNN	86	0	D409003	05 48.40 W	54 49.20 N	200784	1059	0933	4T07	0.6	2.4	1.7
BALARIADA POINT BAY	87	0	J428989	05 46.50 W	54 48.50 N	200784	1059	1040	4T07	0.6	2.4	1.7
OLDMILL BAY	88	0	J457963	05 44.00 W	54 47.25 N	200784	1059	1139	4T07	0.6	2.4	1.7
OLDCHURCH BAY	89	0	J465943	05 43.20 W	54 46.10 N	200784	1059	1455	4T07	0.6	2.4	1.7
TOMMY HILL'S BAY	90	0	J465597	05 43.30 W	54 47.10 N	200784	1059	1233	4T07	0.6	2.4	1.7
BARNEY'S POINT BAY	91	0	J453987	05 44.40 W	54 48.50 N	200784	1059	1310	4T07	0.6	2.4	1.7
CARNSPINDLE	92	0	D439003	05 45.50 W	54 49.40 N	200784	1059	1345	4T07	0.6	2.4	1.7
CARRICKFERGUS	93	0	J427882	05 47.00 W	54 53.40 N	220784	1242	1248	4T07	0.8	2.8	1.8
TORY TOWN (SAND)	94	0	J392862	05 50.05 W	54 41.40 N	220784	1242	1315	4T07	0.8	2.8	1.8
SANDEEL BAY	95	0	J555835	05 35.00 W	54 40.20 N	240784	1636	1621	4T07	1.0	3.5	2.3
SANDY BAY	96	0	J568825	05 33.45 W	54 39.50 N	240784	1500	1540	4T07	1.0	3.5	2.3
ST PATRICK'S WELL	97	0	J595777	05 32.15 W	54 37.10 N	240784	1500	1434	4T07	1.0	3.5	2.3
MILLISLE	98	0	J602755	05 31.40 W	54 36.00 N	240784	1500	1340	4T07	1.0	3.5	2.3
GANAWAY BAY	99	0	J617736	05 30.20 W	54 35.00 N	240784	1500	1250	4T07	1.0	3.5	2.3
WHITECHURCH	100	0	J633705	05 33.30 W	54 28.40 N	240784	1500	1217	4T07	1.0	3.5	2.3
WALLACES ROCKS (SAND)	101	0	J638674	05 27.55 W	54 31.35 N	230784	1349	1500	4T07	1.3	4.1	2.5
QUAY ROCKS (SAND)	102	0	J642650	05 27.30 W	54 30.20 N	230784	1349	1425	4T07	1.3	4.1	2.5
ROBIN'S ROCK (SAND)	103	0	J660615	05 25.50 W	54 28.25 N	230784	1349	1345	4T07	1.3	4.1	2.5
PORTAVOGIE	104	0	J657590	05 26.10 W	54 27.00 N	230784	1349	1300	4T07	1.3	4.1	2.5
CLOGHY	105	0	J643571	05 27.30 W	54 26.00 N	230784	1349	1150	4T07	1.3	4.1	2.5
GROOMSPORT	106	0	J536837	05 36.40 W	54 40.30 N	270784	1657	1542	4T07	0.7	3.1	1.9
BALLYHOLME BAY	107	0	J524827	05 37.50 W	54 39.55 N	270784	1657	1630	4T07	0.7	3.1	1.9
CRAWFORDSBURN BEACH	108	0	J467826	05 43.20 W	54 39.40 N	270784	1657	1754	4T07	0.7	3.1	1.9
ORDNANCE FACTORY	109	0	J388790	05 51.20 W	54 37.55 N	280784	1740	1645	4T07	0.6	3.1	1.9
ISLE O'VALLA (SAND)	110	0	J593487	05 33.20 W	54 21.30 N	280784	2000	1843	6T09	0.6	3.2	2.2
WHITEROCK BAY	111	0	J583623	05 34.30 W	54 29.30 N	280784	2025	2053	6T09	0.0	0.0	0.0
BEACH ISLAND	112	0	J576640	05 35.25 W	54 30.20 N	280784	2025	2117	6T09	0.0	0.0	0.0

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
THE BENTS	1	0	LOUGH	SMARSH	MUSAND	PEBBLS		FLAT	)1.5	SMARSH	V SHLT	WEAK	LOW STREAM	BY CAR
MILL BAY	2	0	LOUGH	L BAY	MUD	PEBBLS	IG/MET	FLAT	)1.5	SMARSH	V SHLT	MODRT	REDUCD STREAM	BY CAR
CARRIGANEAN	3	0	LOUGH	L BAY	MUSAND	MUD		FLAT	)1.5	GRASS	SHLT	MODRT	NORMAL	WALK
KILLOWEN	4	0	LOUGH	SM BAY	MUD SHINGL BL LAY	PEBBLS GRANUL	IG/MET	50-150	(.5	GRASS	V SHLT	WEAK	LOW	BY CAR
ROSTREVOR BAY	5	0	LOUGH	L BAY	C SAND SHSAND MUSAND	L BLDS M BLDS PEBBLS	IG/MET	)150	1-1.5	GRASS TREES	SHLT	WEAK	REDUCD	BY CAR
GREENCASTLE	6	0	SHELTD HDLAND	AT ISL	MUSAND			)150	)1.5	GRASS	SHLT	MODRT	NORMAL	BY CAR
GREEN ISLAND BAY	7	0		L BAY	C SAND M SAND	SHINGL BL LAY		)150	)1.5	GRASS	MODRT	MODRT	NORMAL	BY CAR
CRANFIELD POINT	8	0	SHELTD	LOUGH	M SAND			)150	)1.5	OTHER	SHLT	MODRT	NORMAL	BY CAR
SOUTH OF NICHOLSON'S PT	9	0	OPEN	LINEAR	M SAND	PEBBLS GRANUL C SAND		50-150	)1.5	GRASS	MODRT	WEAK	NORMAL STREAM	BY CAR
MURLOUGH SANDS	10	0	LINEAR	L BAY	M SAND F SAND	SHSAND		)150	)1.5	DUNES	MODRT	WEAK		BY CAR WALK
DUNDRUM INNER BAY(SOUTH)	11	0	INLET	SM BAY	MUD	BL LAY		)150	.5-1	GRASS	V SHLT	WEAK	NORMAL STREAM	BY CAR
DUNDRUM INNER BAY(NORTH)	12	0	INLET	L BAY	MUSAND	BL LAY		FLAT	)1.5	GRASS	SHLT	WEAK	REDUCD STREAM	BY CAR
STINKER ROCK BEACH	13	0	OPEN	LINEAR	M SAND	F SAND		)150	1-1.5	GRASS	EXPD	WEAK	NORMAL	WALK
TYRELLA BEACH	14	0	OPEN LINEAR		M SAND SHSAND			)150	)1.5	DUNES GRASS OTHER	EXPD	WEAK	NORMAL STREAM	BY CAR
RINGBOY BEACH	15	0	SM BAY	OPEN	M SAND	M BLDS S BLDS SHSAND		)150	.5-1	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
KILLOUGH HARBOUR(INNER)	16	0	INLET		MUD	SHINGL	IG/MET	(50	.5-1	GRASS FWATER	V SHLT	WEAK	LOW STREAM	BY CAR
KILLOUGH HARBOUR(OUTER)	17	0	INLET		GRANUL MUSAND MUD	M BLDS S BLDS BL LAY		FLAT	.5-1	GRASS TREES OTHER	V SHLT	WEAK	REDUCD STREAM	BY CAR
CONEYISLAND BAY	18	0	SM BAY	SHELTD	M SAND F SAND	M BLDS S BLDS	IG/MET	50-150	(.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
ARDGLASS BAY (SAND)	19	0	INLET	SHELTD	MUSAND	MUD		50-150	.5-1	GRASS OTHER	SHLT	WEAK	NORMAL STREAM	BY CAR
BALLYHORNAN BAY	20	0	SM BAY	OPEN	M SAND	C SAND		50-150	.5-1	L CLFS	MODRT	WEAK	NORMAL	BY CAR
BENDERG BAY	21	0	SM BAY	OPEN	M SAND			50-150	.5-1	M CLFS	MODRT	WEAK	NORMAL	WALK
MILL QUARTER BAY	22	0	SHELTD	POCKET	M SAND	M BLDS		50-150	(.5	GRASS	SHLT	MODRT	NORMAL STREAM	BY CAR
TULLY HILL BAY	23	0	NARRWS	SM BAY	MUSAND MUD BL LAY	L BLDS M BLDS S BLDS		)150	.5-1	GRASS	SHLT	STRONG	NORMAL	BY CAR
CLOCHY ROCKS (SAND)	24	0	NARRWS	SM BAY	F SAND MUSAND	SHSAND SHINGL		50-150	1-1.5	GRASS	V SHLT	STRONG	NORMAL	BY CAR
LAUNCHES LITTLE (SAND)	25	0	SHELTD	ISLE LOUGH	MUSAND	M BLDS		)150	1-1.5	GRASS	SHLT	MODRT	NORMAL	BOAT
LIMESTONE PLADDIES	26	0	ISLE	LOUGH	GRANUL C SAND SHSAND	S BLDS	IG/MET	(50	(.5	TREES OTHER	SHLT V SHLT	MODRT	NORMAL	WALK
BLACK CAUSEWAY	27	0	INLET	LOUGH	MUD BL LAY	GRANUL		LWFLAT	.5-1	GRASS TREES	V SHLT	STRONG	REDUCD STREAM	BY CAR

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
RINGBANE BAY	28	0	LOUGH	SM BAY	MUD BL LAY	M BLDS	IG/MET	LWFLAT	1-1.5	GRASS	V SHLT	WEAK		WALK
CASTLE ISLAND BAY	29	0	INLET	LOUGH	MUD	BL LAY		FLAT	.5-1	GRASS OTHER	V SHLT	WEAK	REDUCD	BY CAR
CASTLEWILLIAM BAY	30	0	LOUGH	SM BAY	MUSAND BL LAY	M SAND		50-150	.5-1	GRASS TREES	SHLT	MODRT	NORMAL	BY CAR
TAGGART QUAY (SAND)	31	0	SM BAY	LOUGH	MUD BL LAY	L BLDS M BLDS S BLDS	IG/MET H MDST	FLAT	(.5	GRASS	V SHLT	MODRT	NORMAL	BY CAR
QUARTERLAND BAY	32	0	LOUGH	INLET	MUD BL LAY	M BLDS		)150	.5-1	GRASS	V SHLT	WEAK	REDUCD STREAM	WALK
BALLYMORRAN BAY	33	0	LOUGH	SM BAY	MUD BL LAY			)150	.5-1	GRASS	V SHLT	WEAK	NORMAL	BY CAR
ARDMILLAN	34	0	L BAY	INLET LOUGH	MUD BL LAY			FLAT	)1.5	SMARSH GRASS	V SHLT	WEAK		BY CAR
RINGNEILL BAY	35	0	SM BAY	LOUGH	M SAND F SAND BL LAY			FLAT	.5-1	GRASS	V SHLT	WEAK	NORMAL	BY CAR
DRUM HILL BAY	36	0	LOUGH	SM BAY	MUSAND	M SAND		)150	)1.5	SMARSH GRASS	SHLT	WEAK		BY CAR
REAGH ISLAND	37	0	LOUGH	SM BAY	MUSAND	M BLDS		50-150	.5-1	GRASS	SHLT	WEAK	NORMAL	BY CAR
CASTLE ESPIE	38	0	L BAY	LOUGH	F SAND MUSAND			FLAT	)1.5	SMARSH GRASS	SHLT	WEAK	NORMAL STREAM	BY CAR
NEWTOWNARDS	39	0	LOUGH	L BAY	MUSAND STORM	F SAND		FLAT	)1.5	GRASS OTHER	SHLT	WEAK	REDUCD	BY CAR
PIG ISLAND BAY	40	0	L BAY	LOUGH	M SAND F SAND	S BLDS SHINGL	IG/MET	50-150	.5-1	GRASS TREES	SHLT	WEAK	NORMAL STREAM	BY CAR
GREYABBEY BAY	41	0	SM BAY	LOUGH	M SAND F SAND	M BLDS S BLDS	IG/MET	FLAT	.5-1	OTHER GRASS VALLEY TREES	SHLT	WEAK	NORMAL STREAM	BY CAR
HERRING BAY	42	0	LOUGH	SM BAY	M SAND	M BLDS BL LAY		50-150	(.5	OTHER GRASS	SHLT	WEAK	NORMAL	BY CAR
DOCTOR'S BAY (SOUTH)	43	0	LOUGH	SM BAY	M SAND F SAND	S BLDS		50-150	.5-1	GRASS	MODRT	MODRT		WALK
BLACK NELL INLET	44	0	INLET	LOUGH	M BLDS S BLDS COBBLS PEBBLS GRANUL C SAND M SAND SHINGL		IG/MET	50-150	(.5	GRASS	MODRT	MODRT	NORMAL	WALK
HORSE ISLAND (SEDIMENT)	45	0	LOUGH	INLET	MUSAND BL LAY			)150	.5-1	SMARSH GRASS	SHLT	MODRT	NORMAL	WALK
HORSE ISLAND (EAST)	46	0	LOUGH	INLET	F SAND MUSAND			)150	1-1.5	SMARSH GRASS	SHLT	MODRT	NORMAL STREAM	BY CAR
MID ISLAND BAY	47	0	SM BAY	LOUGH	F SAND MUSAND			FLAT	.5-1	SMARSH GRASS	SHLT	MODRT	NORMAL	WALK
YELLOW ROCKS	48	0	SHELTD LOUGH		MUD BL LAY			FLAT	)1.5	GRASS	SHLT	MODRT	NORMAL	WALK
THE DORN (SEDIMENTARY)	49	0	NARRWS	LOUGH	M BLDS S BLDS COBBLS PEBBLS GRANUL MUSAND MUD	BL LAY	IG/MET	(50	(.5	GRASS	SHLT	MODRT	REDUCD	WALK
THE DORN (INNER)	50	0	LOUGH	INLET	MUD	S BLDS	IG/MET	50-150	.5-1	GRASS	V SHLT	MODRT	REDUCD	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
BALLYWHITE BAY	51	0	SM BAY	LOUGH	COBBLS PEBBLS C SAND SHSAND MUSAND	BL LAY	IG/MET	<50	.5-1	GRASS TREES	SHLT	MODRT	NORMAL	BY CAR
GRANAGH BAY (SEDIMENT)	52	0	SHELTD SM BAY	NARRWS	MUSAND MUD	M BLDS BL LAY	IG/MET	50-150	.5-1	GRASS	SHLT	MODRT	NORMAL	BY CAR
BAR HALL BAY	53	0	SM BAY	NARRWS	GRANUL C SAND MUSAND	M BLDS M SAND S BLDS		50-150	.5-1	GRASS	MODRT	MODRT	NORMAL	BY CAR
SOUTH BAY	54	0	SM BAY	OPEN	M SAND			<50	<.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
MILLIN BAY	55	0	SM BAY	SHELTD	F SAND	C SAND M SAND	IG/MET	50-150	1-1.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
KNOCKINELDER BAY	56	0	SM BAY	OPEN	M SAND F SAND	C SAND		50-150	.5-1	GRASS OTHER	MODRT	WEAK	NORMAL STREAM	BY CAR
PORTBALLINTRAE (SAND)	57	0	SM BAY	OPEN	C SAND M SAND SHSAND	GRANUL	IG/MET	<50	<.5	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
SEAGULL ROCK (SAND)	58	0	SM BAY	OPEN	C SAND M SAND SHSAND	M BLDS S BLDS PEBBLS	IG/MET	<50	<.5	OTHER	MODRT	MODRT	NORMAL	BY CAR
BUSHFOOT STRAND	59	0	OPEN SM BAY	LINEAR	C SAND M SAND	S BLDS COBBLS	IG/MET	<50	.5-1	DUNES	EXPD	MODRT	NORMAL STREAM	BY CAR
RATHLIN HARBOUR	60	0	SM BAY		F SAND			<50	<.5	GRASS OTHER	MODRT	MODRT	NORMAL	BOAT
CURRAN STRAND	61	0	LINEAR	OPEN	C SAND F SAND SHSAND			50-150	>1.5	DUNES	EXPD	MODRT	NORMAL	BY CAR
WHITE PARK BAY	62	0	L BAY	OPEN	M SAND	C SAND F SAND	LMSTNE	<50	>1.5	DUNES M CLFS GRASS	EXPD	MODRT	NORMAL	BY CAR WALK
BALLYCASTLE BAY	63	0	L BAY	OPEN	C SAND M SAND F SAND			<50	1-1.5	GRASS OTHER	EXPD	MODRT	NORMAL	BY CAR
MUFF	64	0	SHELTD	LOUGH	MUD	BL LAY		>150	.5-1	SMARSH GRASS TREES	V SHLT	WEAK	LOW	BY CAR
LONGFIELD	65	0	LOUGH	SHELTD	MUD	GRANUL		FLAT	>1.5	SMARSH GRASS	V SHLT	WEAK	REDUCD STREAM	BY CAR
TULLYVERRY	66	0	SHELTD	LOUGH	GRANUL SHSAND MUSAND	COBBLS BL LAY		>150	>1.5	GRASS	SHLT	WEAK	REDUCD STREAM	BY CAR
BALLYKELLY BANK	67	0	SHELTD	LOUGH	GRANUL MUSAND	PEBBLS	IG/MET	>150	>1.5	SMARSH OTHER	SHLT	WEAK	REDUCD S	BY CAR
BALLYMACRAN BANK	68	0	SHELTD	LOUGH	MUSAND	M BLDS S BLDS		FLAT	1-1.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
SHEEP MASH	69	0	ESTUAR		C SAND	GRANUL MUSAND		50-150	.5-1	SMARSH GRASS	SHLT	WEAK	STREAM	BY CAR
BALLS POINT	70	0	LINEAR	LOUGH	M SAND MUSAND	BL LAY		FLAT	>1.5	GRASS	SHLT	WEAK	REDUCD	BY CAR
BALLYMULHOLLAND	71	0	SHELTD	LOUGH	F SAND	BL LAY		FLAT	>1.5	DUNES	MODRT	MODRT	LOW STREAM	WALK
LOWER DOAGHS	72	0	LINEAR	LOUGH	M SAND F SAND	SHSAND BL LAY		FLAT	>1.5	DUNES	MODRT	MODRT	NORMAL	BY CAR
MAGILLIGAN POINT	73	0	HDLAND	OPEN	F SAND	C SAND		<50	>1.5	DUNES	EXPD	MODRT	NORMAL	BY CAR
MAGILLIGAN STRAND	74	0	OPEN LINEAR		C SAND M SAND			<50	>1.5	DUNES	EXPD	MODRT	NORMAL	WALK

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALI	ACCESS
BENONE STRAND	75	0	LINEAR	OPEN	C SAND M SAND	SHSAND		50-150	)1.5	DUNES	EXPD	WEAK	NORMAL	BY CAR
DOWNHILL STRAND	76	0	OPEN		C SAND M SAND			50-150	)1.5	M CLFS	EXPD	WEAK	NORMAL STREAM	BY CAR
CASTLEROCK BEACH	77	0	LINEAR	OPEN	C SAND M SAND			30-150	1-1.5	DUNES OTHER	EXPD	WEAK	NORMAL STREAM	BY CAR
BANN ESTUARY (W.BANK)	78	0	ESTUAR		MUSAND	BL LAY		50-150	1-1.5	GRASS	SHLT	MODRT	LOW	WALK
BANN ESTUARY (N.U.U.)	79	0	ESTUAR		GRANUL C SAND MUSAND	S BLDS COBBLS PEBBLS BL LAY		(50	)1.5	GRASS	V SHLT	MODRT	LOW	WALK
PORTSTEWART STRAND	80	0	OPEN		M SAND			50-150	)1.5	DUNES	EXPD	MODRT	NORMAL	BY CAR
CUSHENDUN BAY	81	0	LINEAR SM BAY	OPEN	GRANUL C SAND M SAND	PEBBLS		(50	.5-1	GRASS OTHER	EXPD	MODRT	NORMAL STREAM	BY CAR
RED BAY	82	0	SM BAY	OPEN	M SAND F SAND	PEBBLS GRANUL		(50	.5-1	GRASS	MODRT	WEAK	NORMAL STREAM	BY CAR
CARNLOUGH BAY (SOUTH)	83	0	SM BAY	OPEN	M SAND	PEBBLS		50-150	.5-1	GRASS	SHLT	WEAK	NORMAL STREAM	BY CAR
GLENARM BAY	84	0	SM BAY	OPEN	PEBBLS GRANUL M SAND			(50	.5-1	GRASS VALLEY OTHER	MODRT	WEAK	REDUCD STREAM	BY CAR
HALFWAY HOUSE (SAND)	85	0	L BAY	OPEN	M SAND	M BLDS	IG/MET	(50	(.5	GRASS VALLEY	MODRT	MODRT	NORMAL	BY CAR
GLYNN	86	0	SHELTD	LOUGH	MUD	S BLDS PEBBLS GRANUL	IG/MET	50-150	1-1.5	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
DALARIADA POINT BAY	87	0	SM BAY	SHELTD	PEBBLS	S BLDS	IG/MET	50-150	.5-1	TREES	SHLT	WEAK	NORMAL STREAM	BY CAR
OLDMILL BAY	88	0	SM BAY	LOUGH SHELTD LOUGH	MUD MUD	BL LAY	IG/MET	)150	1-1.5	GRASS TREES OTHER	V SHLT	WEAK	NORMAL	WALK
OLDCHURCH BAY	89	0	LAGOON	LOUGH	MUD BL LAY			FLAT	1-1.5	SMARSH GRASS	V SHLT	WEAK	NORMAL	BY CAR
TOMMY HILL'S BAY	90	0	SM BAY	LOUGH	GRANUL MUD			FLAT	)1.5	GRASS	SHLT	WEAK	REDUCD	WALK
BARNEY'S POINT BAY	91	0	SM BAY	SHELTD LOUGH	MUD	M BLDS BL LAY	IG/MET	50-150	.5-1	GRASS	SHLT	WEAK	NORMAL	BY CAR
CARNSPINDLE	92	0	SHELTD	SM BAY	PEBBLS MUD	M BLDS S BLDS	IG/MET	(50	.5-1	TREES	SHLT	WEAK	NORMAL	BY CAR
CARRICKFERGUS	93	0	SHELTD	LOUGH	F SAND			FLAT	1-1.5	OTHER	SHLT	WEAK	NORMAL	BY CAR
TORY TOWN (SAND)	94	0	SHELTD	LOUGH	F SAND	BL LAY		50-150	.5-1	OTHER	SHLT	WEAK	NORMAL STREAM	BY CAR
SANDEEL BAY	95	0	POCKET	OPEN	M SAND	M BLDS		(50	(.5	GRASS	SHLT	WEAK	NORMAL	BY CAR
SANDY BAY	96	0	POCKET		C SAND	M SAND SHSAND	IG/MET	(50	(.5	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR
ST PATRICK'S WELL	97	0	SM BAY	SHELTD	F SAND	M SAND	IG/MET		.5-1	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR
MILLISLE	98	0	OPEN		M SAND	F SAND		)150	)1.5	OTHER	SHLT	WEAK	NORMAL	BY CAR
CANAWAY BAY	99	0	L BAY	OPEN	M SAND F SAND	M BLDS		)150	1-1.5	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR

LOCATION OF SHORE	SHEET NO.	CARD NO.	SITUATION DOM	SITUATION SEC	SHORE TYPE DOM	SHORE TYPE SEC	ROCK	WIDTH (M)	EXTENT (KM)	COASTAL BACKING	EXPOSUR	CURRENT	SALINITY	ACCESS
WHITECHURCH	100	0	OPEN		M SAND	F SAND		)150	1-1.5	GRASS OTHER	SHLT	MODRT	NORMAL	BY CAR
WALLACES ROCKS (SAND)	101	0	HDLAND		M SAND	C SAND F SAND		50-150	1-1.5	OTHER	MODRT	MODRT	NORMAL	BY CAR
QUAY ROCKS (SAND)	102	0	OPEN		M SAND			50-150	)1.5	GRASS OTHER	MODRT	MODRT	NORMAL	BY CAR
ROBIN'S ROCK (SAND)	103	0	SHELTD SM BAY		F SAND	PEBBLS MUSAND		50-150	.5-1	GRASS	SHLT	MODRT	NORMAL	BY CAR
PORTAVOGIE	104	0	SM BAY	OPEN	M SAND	C SAND		)150	1-1.5	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR
CLOGHY	105	0	L BAY		M SAND	PEBBLS		50-150	1-1.5	GRASS OTHER	MODRT	WEAK	NORMAL	BY CAR
GROOMSPORT	106	0	SM BAY	OPEN	PEBBLS GRANUL C SAND		IG/MET	50-150	.5-1	GRASS OTHER	SHLT	WEAK	NORMAL	BY CAR
BALLYHOLME BAY	107	0	L BAY	OPEN	M SAND			50-150	1-1.5	OTHER	MODRT	WEAK	NORMAL STREAM	BY CAR
CRAWFORDSBURN BEACH	108	0	SM BAY		C SAND M SAND SHSAND	S BLDS COBBLS		(50	.5-1	GRASS TREES	EXPD	WEAK	NORMAL STREAM	BY CAR
ORDNANCE FACTORY	109	0	SHELTD	L BAY	MUSAND	SHSAND BL LAY		50-150	1-1.5	OTHER	SHLT	WEAK	NORMAL	BY CAR
ISLE O'VALLA (SAND)	110	0	NARRWS		GRANUL M SAND SHSAND MUSAND	BL LAY		FLAT	.5-1	GRASS	SHLT	STRONG	NORMAL STREAM	BY CAR
WHITEROCK BAY	111	0	SM BAY		MUD	M BLDS S BLDS COBBLS GRANUL BL LAY		)150		GRASS OTHER	V SHLT	WEAK	NORMAL	BY CAR
REAGH ISLAND	112	0	SHELTD SM BAY		MUD	BL LAY		)150	1-1.5	GRASS TREES	V SHLT	MODRT	NORMAL	BY CAR

LOCATION OF SHORE	SHEET NO.	BIOTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD FEEDG	INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
THE BENTS	1	CR/POL	STREAM POOLS	MEDIUM	GOOD	WFOWL GULLS			NR NNR	GOOD	CAR PK		OTHER
MILL BAY	2	CR/POL ARENIC	STREAM POOLS		GOOD	WADERS GULLS			NR NNR	GOOD	CAR PK		BAIT
CARRIGANEAN	3	MACOMA	BOULDS POOLS	LOW	AVRAGE				NR NNR	FAIR			
KILLOWEN	4	CR/POL	BOULDS ROCKY	MEDIUM	AVRAGE	WADERS GULLS				FAIR	CAR PK		OTHER MOORNG
ROSTREVOR BAY	5	MACOMA	BOULDS	LOW	AVRAGE	WADERS				POOR	AMENNR CAR PK		SPORTS
GREENCASTLE	6	MACOMA	BOULDS POOLS INLET ROCKY	HIGH	AVRAGE	SEABDS	SEABDS	SEALS	NR RES	V GOOD	CAR PK		SPORTS MOORNG
GREEN ISLAND BAY	7	CR/POL	POOLS	LOW	POOR	SEABDS							
CRANFIELD POINT	8	CR/POL LANICE	BOULDS	LOW	AVRAGE	SEABDS			NR NNR	FAIR			
SOUTH OF NICHOLSON'S	9	CR/POL	BOULDS FUCOID	LOW	POOR					FAIR	AMENPR CAR PK POPULA	SEWAGE	MOORNG
MURLOUGH SANDS	10	TELLIN	ST WAT	LOW	AVRAGE	WADERS GULLS SEABDS			IN NNR	FAIR	ATTRAC POPULA ATTRAC RESORT AMENNR CAR PK	FACTRS	
DUNDRUM INNER BAY(SO	11	MACOMA	BOULDS	LOW	AVRAGE	WFOWL							
DUNDRUM INNER BAY(NO	12	MACOMA	STREAM	MEDIUM	GOOD				NR NNR	FAIR	CAR PK	SEWAGE	
STINKER ROCK BEACH	13	CR/POL	ROCKY	LOW	AVRAGE	WADERS GULLS SEABDS				GOOD FAIR	CAR PK ATTRAC		MOORNG
TYRELLA BEACH	14		STREAM	LOW	POOR	GULLS				POOR	ATTRAC AMENPR CAR PK POPULA		OTHER SPORTS
RINGBOY BEACH	15	TELLIN	BOULDS ST WAT	MEDIUM	AVRAGE	WADERS GULLS SEABDS		SEALS		GOOD			
KILLOUGH HARBOUR(INN	16	SCROBI	STREAM BOULDS	MEDIUM	AVRAGE	SEABDS				FAIR			
KILLOUGH HARBOUR(OUT	17	MACOMA SCROBI	CLAY STREAM	MEDIUM	AVRAGE	WADERS GULLS SEABDS	GULLS			GOOD	AMENPR CAR PK	SUSP S SEWAGE	MOORNG
CONEYISLAND BAY	18	SCROBI	BOULDS ST WAT	MEDIUM	GOOD	WADERS WFOWL GULLS SEABDS				GOOD			
ARDGLASS BAY (SAND)	19	MACOMA		MEDIUM	POOR	WADERS GULLS				POOR	RESORT AMENPR CAR PK	SEWAGE RECLAM	MOORNG OTHER
BALLYHORNAN BAY	20	CR/POL LANICE		LOW	AVRAGE	WADERS GULLS SEABDS			NR NNR	FAIR	ATTRAC CAR PK		
BENDERG BAY	21	CR/POL TELLIN		LOW	AVRAGE	WADERS WFOWL SEABDS	SEABDS		NR NNR	FAIR	POPULA ATTRAC POPULA		

LOCATION OF SHORE	SHEET NO.	BICTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
MILL QUARTER BAY	22	CR/POL LANICE	STREAM BOULDS	MEDIUM	GOOD	WADERS WFOWL GULLS			NR RES	GOOD	CAR PK		
TULLY HILL BAY	23	SCROBI	STREAM BOULDS		AVRAGE	WADERS GULLS			NR NNR	GOOD	CAR PK		
CLOGHY ROCKS (SAND)	24	CR/POL SCROBI LANICE ECHINO	BOULDS ST WAT	HIGH	GOOD	WADERS GULLS SEABDS	SEABDS	SEALS	IN NNR	V GOOD	ATTRAC CAR PK		
LAUNCHES LITTLE (SAN	25	LANICE PULLAS	CLAY	MEDIUM	GOOD	WADERS GULLS SEABDS			NR RES	GOOD			
LIMESTONE PLADDIES	26	PULLAS	BOULDS POOLS	MEDIUM	AVRAGE					FAIR			
BLACK CAUSEWAY	27	MACOMA	BOULDS CLAY	LOW	AVRAGE	GULLS SEABDS				FAIR			
RINGBANE BAY	28	MACOMA	BOULDS CLAY	MEDIUM	AVRAGE	WADERS SEABDS				FAIR			
CASTLE ISLAND BAY	29	MACOMA		LOW	POOR	WADERS WFOWL				FAIR		RECLAM	
CASTLEWILLIAM BAY	30	MACOMA LANICE	BOULDS CLAY	MEDIUM	GOOD				NR RES	FAIR		RECLAM	MOORNG
TAGGART QUAY (SAND)	31	NEMERT	BOULDS ST WAT	MEDIUM	POOR	WADERS WFOWL				FAIR			MOORNG
QUARTERLAND BAY	32	NEMERT		LOW	AVRAGE	WADERS				FAIR			MOORNG
BALLYMORRAN BAY	33	NEMERT	INLET ROCKY	MEDIUM	AVRAGE	WADERS WFOWL				FAIR	CAR PK		MOORNG
ARDMILLAN	34	MACOMA		MEDIUM	AVRAGE	WADERS SEABDS				FAIR		SEWAGE	MOORNG SHFISH MOORNG
RINGNEILL BAY	35	MACOMA		MEDIUM	AVRAGE	WADERS GULLS				FAIR			
DRUM HILL BAY	36	MACOMA	CLAY	MEDIUM	GOOD	WADERS WFOWL			NR RES	GOOD			
REAGH ISLAND	37	MACOMA	BOULDS	MEDIUM	AVRAGE	WADERS SEABDS			NR RES	FAIR	ATTRAC		MOORNG
CASTLE ESPIE	38	MACOMA	STREAM ST WAT	MEDIUM	AVRAGE	WADERS SEABDS			NR RES	GOOD	CAR PK		OTHER
NEWTOWNARDS	39	MACOMA		MEDIUM	AVRAGE	WADERS WFOWL				FAIR	CAR PK	RECLAM SEWAGE	
PIG ISLAND BAY	40	MACOMA	BOULDS ST WAT	MEDIUM	AVRAGE	WADERS SEABDS				GOOD	CAR PK		MOORNG
GREYABBEY BAY	41	TELLIN MACOMA	BOULDS ST WAT	MEDIUM	AVRAGE	WADERS SEABDS			NR RES	GOOD	CAR PK		
HERRING BAY	42	TELLIN MACOMA	BOULDS CLAY	MEDIUM	AVRAGE	WADERS WFOWL				FAIR			
DOCTOR'S BAY (SOUTH)	43	CR/POL	BOULDS CLAY	MEDIUM	GOOD				NR RES	GOOD			
BLACK NELL INLET	44	MACOMA PULLAS	BOULDS ST WAT CLAY	HIGH	AVRAGE	GULLS			NR RES	FAIR			
HORSE ISLAND (SEDIME	45	MACOMA	ROCKY	MEDIUM	AVRAGE	WADERS SEABDS			NR RES	FAIR FAIR			
HORSE ISLAND (EAST)	46	ARENIC		MEDIUM	AVRAGE	WADERS GULLS			NR RES	FAIR		RECLAM	OTHER
MID ISLAND BAY	47	CR/POL MACOMA	ST WAT	MEDIUM	POOR	GULLS SEABDS				FAIR			
YELLOW ROCKS	48	NEPHTH	ROCKY	LOW	AVRAGE	WADERS SEABDS			NR NNR	FAIR			

LOCATION OF SHORE	SHEET NO.	BIOTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
THE DORN (SEDIMENTAR	49	NEMERT	BOULDS CLAY	HIGH	AVRAGE	WADERS GULLS SEABDS			IN NNR	GOOD			
THE DORN (INNER)	50	MACOMA		MEDIUM	AVRAGE				NR NNR	FAIR			OTHER
BALLYWHITE BAY	51	PULLAS	BOULDS	HIGH	AVRAGE	WADERS GULLS SEABDS			NR RES	FAIR			MOORNG
GRANAGH BAY (SEDIMEN	52	NEMERT	BOULDS ROCKY CLAY	HIGH	AVRAGE	WADERS GULLS SEABDS		SEALS	IN NNR	GOOD			OTHER
BAR HALL BAY	53	MACOMA	MUSSEL BOULDS ST WAT CLAY	HIGH	AVRAGE	WADERS GULLS SEABDS			NR RES	GOOD			
SOUTH BAY	54	CR/POL	POOLS ROCKY ST WAT	MEDIUM	AVRAGE	WADERS				FAIR	ATTRAC POPULA		MOORNG
MILLIN BAY	55	CR/POL TELLIN	ROCKY ALGMAT	HIGH	GOOD	WADERS GULLS SEABDS				GOOD			MOORNG
KNOCKINELDER BAY	56	MACOMA TELLIN	BOULDS	LOW	AVRAGE	GULLS			NR RES	FAIR	CAR PK		
PORTBALLINTRAE (SAND	57	CR/POL	ROCKY	MEDIUM	AVRAGE				NR NNR	POOR	AMENPR	RECLAM	MOORNG
SEAGULL ROCK (SAND)	58	CR/POL	BOULDS ST WAT	HIGH	AVRAGE	WFOWL GULLS			NR NNR	FAIR	ATTRAC RESORT AMENPR CAR PK POPULA		SPORTS FISHNG
BUSHFOOT STRAND	59	CR/POL	STREAM BOULDS ROCKY	MEDIUM	POOR	SEABDS			NR NNR	FAIR	ATTRAC RESORT AMENNR CAR PK POPULA		
RATHLIN HARBOUR	60	CR/POL	FUCOID	LOW	POOR				NR NNR	POOR	AMENNR POPULA	SEWAGE	MOORNG
CURRAN STRAND	61	CR/POL		MEDIUM	POOR	WADERS GULLS SEABDS			NR NNR	FAIR	ATTRAC RESORT AMENNR CAR PK POPULA		SPORTS OTHER
WHITE PARK BAY	62	CR/POL		MEDIUM	POOR				NR NNR NR RES	FAIR	ATTRAC AMENNR CAR PK POPULA		SPORTS OTHER
BALLYCASTLE BAY	63	CR/POL		MEDIUM	POOR	GULLS			NR NNR	FAIR	ATTRAC RESORT AMENNR CAR PK POPULA		SPORTS OTHER
MUFF	64	MACOMA		MEDIUM	GOOD	WADERS GULLS				GOOD	CAR PK	RECLAM	OTHER
LONGFIELD	65	MACOMA SCROBI		MEDIUM	GOOD	WADERS				GOOD	CAR PK	RECLAM	
TULLYVERRY	66	NEPHTH MACOMA SCROBI	STREAM	MEDIUM	AVRAGE					GOOD			MOORNG

LOCATION OF SHORE	SHEET NO.	BIOTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD INTEREST FEEDG	BIRD INTEREST NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
BALLYKELLY BANK	67	MACOMA SCROBI	ROCKY CLAY	HIGH	GOOD	WADERS	WADERS			GOOD	CAR PK		BAIT SHFISH OTHER
BALLYMACRAN BANK	68	MACOMA	BOULDS MUSSEL	MEDIUM	GOOD				NR NNR	GOOD		RECLAM	
SHEEP MASH	69		BOULDS	MEDIUM	AVRAGE	WADERS GULLS			IN NNR	GOOD	CAR PK		OTHER
BALLS POINT	70	MACOMA SCROBI	STREAM POOLS ST WAT	HIGH	GOOD	WADERS			NR NNR	V GOOD	CAR PK	RECLAM	OTHER
BALLYMULHOLLAND	71	CR/POL MACOMA		MEDIUM	AVRAGE	GULLS				FAIR			
LOWER DOAGHS	72	CR/POL	ST WAT	MEDIUM	AVRAGE	WADERS GULLS			NR NNR NR RES	FAIR	CAR PK POPULA	RECLAM	OTHER
MAGILLIGAN POINT	73	CR/POL		MEDIUM	AVRAGE	GULLS	SEABDS		NR NNR	FAIR	ATTRAC CAR PK POPULA		OTHER
MAGILLIGAN STRAND	74	CR/POL		LOW	AVRAGE	GULLS			NR NNR	FAIR	ATTRAC CAR PK		OTHER
BENONE STRAND	75	CR/POL		LOW	AVRAGE	GULLS			NR NNR	FAIR	CAR PK		OTHER
DOWNHILL STRAND	76	CR/POL		MEDIUM	AVRAGE					FAIR	ATTRAC AMENPR CAR PK POPULA		OTHER
CASTLEROCK BEACH	77	CR/POL	STREAM	LOW	POOR	GULLS				POOR	RESORT AMENNR CAR PK POPULA		OTHER
BANN ESTUARY (W.BANK	78	NEREID	CLAY	MEDIUM	AVRAGE	WADERS GULLS SEABDS			IN NNR	GOOD			
BANN ESTUARY (N.U.U.	79	NEREID	BOULDS	MEDIUM	AVRAGE	WADERS			NR RES	GOOD			OTHER
PORTSTEWART STRAND	80	CR/POL		LOW	POOR				NR RES	FAIR	ATTRAC RESORT AMENNR CAR PK POPULA		OTHER
CUSHENDUN BAY	81	CR/POL	FUCOID	MEDIUM	POOR				NR NNR	FAIR	AMENPR CAR PK		MOORNG
RED BAY	82	CR/POL	STREAM ST WAT	MEDIUM	POOR	GULLS			NR NNR	FAIR	AMENNR CAR PK POPULA		BAIT MOORNG SPORTS
CARNLOUGH BAY (SOUTH	83	TELLIN	BOULDS	MEDIUM	AVRAGE	WADERS GULLS				FAIR	ATTRAC RESORT CAR PK POPULA		BAIT SPORTS OTHER
GLENARM BAY	84	CR/POL		LOW	POOR	GULLS				POOR	AMENNR CAR PK POPULA	FACTRS	FISHNG
HALFWAY HOUSE (SAND)	85	CR/POL NEPHTH	BOULDS	MEDIUM	AVRAGE					FAIR	AMENNR CAR PK POPULA	RECLAM	
GLYNN	86	NEREID	BOULDS CLAY ALGMAT	HIGH	GOOD	WADERS GULLS SEABDS			NR NNR	GOOD		FACTRS RECLAM	
BALARIADA POINT BAY	87	NEREID		MEDIUM	GOOD	WFOWL SEABDS			NR NNR	GOOD	CAR PK	FACTRS SUSP S	SHFISH

LOCATION OF SHORE	SHEET NO.	BIOTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
OLDMILL BAY	88		STRAND	MEDIUM	AVRAGE	WADERS			NR NNR	GOOD		FACTRS	
OLDCHURCH BAY	89	NEREID	MUSSEL STREAM POOLS	MEDIUM	GOOD	SEABDS WADERS			IN NNR	GOOD		RECLAM SUSP S	OTHER
TOMMY HILL'S BAY	90	NEREID		MEDIUM	AVRAGE	SEABDS GULLS			NR RES				
BARNEY'S POINT BAY	91	MACOMA	BOULDS CLAY	MEDIUM	AVRAGE	GULLS			NR NNR	FAIR			
CARNSPINDLE	92	NEREID		MEDIUM	GOOD	SEABDS GULLS				FAIR			
CARRICKFERGUS	93	NEMERT	POOLS	LOW	AVRAGE	SEABDS GULLS				FAIR	AMENNR	RECLAM	MOORNG
										POOR	RESORT AMENPR CAR PK	SEWAGE RECLAM	MOORNG SPORTS
TORY TOWN (SAND)	94	NEPHTH		MEDIUM	AVRAGE	WADERS GULLS	SEABDS			FAIR	POPULA AMENNR CAR PK	RECLAM	
SANDEEL BAY	95	CR/POL		MEDIUM	AVRAGE	SEABDS GULLS				FAIR	POPULA		FISHNG MOORNG SPORTS
SANDY BAY	96	CR/POL	MUSSEL	MEDIUM	AVRAGE					POOR	CAR PK POPULA	RECLAM	
ST PATRICK'S WELL	97	CR/POL LANICE	BOULDS ROCKY	HIGH	AVRAGE					FAIR	ATTRAC CAR PK POPULA		OTHER
MILLISLE	98	CR/POL	ST WAT ROCKY	MEDIUM	GOOD	WADERS				FAIR	ATTRAC RESORT AMENPR CAR PK POPULA		SPORTS OTHER
GANAWAY BAY	99	CR/POL	BOULDS INLET	MEDIUM	AVRAGE	WADERS GULLS SEABDS				FAIR	ATTRAC RESORT AMENNR POPULA		MOORNG
WHITECHURCH	100	CR/POL TELLIN PULLAS	ROCKY	MEDIUM	GOOD	WADERS SEABDS				GOOD	POPULA		MOORNG OTHER
WALLACES ROCKS (SAND	101	CR/POL LANICE		MEDIUM	GOOD	WADERS GULLS				GOOD	AMENNR CAR PK POPULA		
QUAY ROCKS (SAND)	102	CR/POL	POOLS ST WAT ALGMAT	MEDIUM	AVRAGE	WADERS GULLS				FAIR		RECLAM	
ROBIN'S ROCK (SAND)	103	CR/POL MACOMA		MEDIUM	GOOD	WADERS SEABDS				GOOD	ATTRAC CAR PK POPULA		
PORTAVOGIE	104	LANICE	BOULDS POOLS CLAY	MEDIUM	GOOD	WADERS GULLS SEABDS	WADERS GULLS SEABDS			GOOD	RESORT AMENPR	FACTRS RECLAM	MOORNG
CLOGHY	105	CR/POL TELLIN		MEDIUM	AVRAGE	WADERS GULLS SEABDS				FAIR	AMENNR CAR PK POPULA RESORT AMENNR CAR PK		MOORNG SPORTS
GROOMSPORT	106	CR/POL	STREAM		POOR	WADERS GULLS	WADERS GULLS						

LOCATION OF SHORE	SHEET NO.	BIOTA	PROMIN SUBHAB	SUBHAB DIVER.	SPECIE RICHNS	BIRD INTEREST FEEDG	NESTG	SEAL HAUL	NATURE RESERV	SUBJ RATING	AMENIT VALUE	INDUS/ POLLUT	SHORE USAGE
BALLYHOLME BAY	107	TELLIN LANICE	STREAM BOULDS MUSSEL	MEDIUM	GOOD	WADERS GULLS				GOOD	ATTRAC RESORT AMENNR CAR PK POPULA	RECLAM	FISHNG MOORNG SPORTS
CRAWFORDSBURN BEACH	108	CR/POL LANICE	STREAM BOULDS	MEDIUM	AVRAGE	GULLS			IN NNR	FAIR	AMENPR CAR PK POPULA		SPORTS OTHER
ORDNANCE FACTORY	109	MACOMA	ROCKY MUSSEL	MEDIUM	GOOD	WADERS GULLS SEABDS				GOOD	AMENNR CAR PK	FACTRS SUSP S SEWAGE RECLAM	
ISLE O'VALLA (SAND)	110	CR/POL MACOMA SCROBI LANICE	STREAM BOULDS ROCKY ST WAT CLAY	HIGH	GOOD	WADERS GULLS SEABDS		SEALS	NR NNR	V GOOD			
WHITEROCK BAY	111	MACOMA	BOULDS ST WAT CLAY	HIGH	GOOD	WADERS				GOOD	CAR PK POPULA		MOORNG SPORTS
REAGH ISLAND	112	NEMERT	BOULDS CLAY	MEDIUM	AVRAGE	WADERS	WADERS		IN NNR	GOOD			

APPENDIX IV

STAGE II RECORDING SHEETS SPECIMENS

- Rocky Shore

  (i) Location sheet
  (ii) Transect sheet

- Sedimentary Shore

  (i) Location sheet
  (ii) Transect sheet

INSTITUTE OF OFFSHORE ENGINEERING
HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Rocky Shore Recording Sheet
LOCATION DATA STAGE II

LOCALITY c		GRID REF d	LONG e	LAT f	
SHEET No a	PUNCH CARD No b	Ht. OF LW. g (m)	TIME OF LW. h	DATE i	
SEDIMENTARY SHEET No (if any) k	PHOTO No.	ARRIVAL TIME l	DEPARTURE m	RECORDER	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	18	35
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Vertical Rock	52	75	98
Steep Rock (>30° slope)	53	76	99
L.Rock Ridges	54	77	100
Rock Ridges	55	78	101
Rock Platforms	56	79	102
Rock Outcrop	57	80	103
Fissured Rock	58	81	104
Irregular Rock	59	82	105
Large Boulders (>1024mm)	60	83	106
Med. Boulders (512-1024mm)	61	84	107
Small Boulders (256-512mm)	62	85	108
Stones, Angular (64-256mm)	63	86	109
Shingle, Rounded (64-256mm)	64	87	110
Pebbles (5-63mm)	65	88	111
Gravel (2-4mm)	66	89	112
Sand	67	90	113
Mud	68	91	114
Muddy Sand	69	92	115
Muddy Gravel	70	93	116
Black Layer N.S.	71	94	117
Silt Covered Rock	72	95	118
Man Made	73	96	119
	74	97	120

ROCK TYPE	
Spec:	
Igneous/Metamorph.	121
Limestone	122
Hard Mudstone	123
Soft Mudstone	124
INTERTIDAL EXTENT (m)	
< 10	125
10 - 50	126
50 - 100	127
>100 (Spec:)	128
HORIZONTAL EXTENT (m)	
<100	129
100 - 500	130
500 - 1000	131
>1000	132
OFFSHORE FEATURES	
Islands	133
Reefs	134
Breakwaters	135
Sandbanks	136
Shoal	137
COASTAL BACKING	
Sand Dunes	138
Low Cliffs	139
Mod. Cliffs	140
High Cliffs	141
Saltmarsh	142
Grassland	143
Peat	144
Valley	145
Freshwater	146
Trees	147
Other:	148
STEEPNESS INLAND	
0	149
1	150
2	151
3 - 5	152
5 - 10	153
>10	154

PREVAILNG WIND/ASPECT	W	A
N	155	163
NE	156	164
E	157	165
SE	158	166
S	159	167
SW	160	168
W	161	169
NW	162	170
Wind Data:		

EXPOSURE TO WAVE ACTION (estimate)	
V. Exposed	171
Exposed	172
Moderate	173
Sheltered	174
V. Sheltered	175

FETCH	min	max
< 2	176	181
2 - 10	177	182
10 - 50	178	183
50 - 100	179	184
>100	180	185

SEA HORIZON	10 miles	40 miles
0	186	199
1	187	200
2	188	201
3	189	202
4	190	203
5	191	204
6	192	205
7	193	206
8	194	207
9	195	208
10	196	209
11	197	210
12	198	211

Time of ELWST n	
Mean Spring Tide Range (m) o	
Mean Neap Tide Range (m) p	
Annual Rainfall (mm) q	
CURRENT STRENGTH	
Strong (estimate)	212
Moderate (estimate)	213
Weak (estimate)	214
SALINITY	
Normal	215
Slighty Reduced (28-33‰)	216
Low (<28‰)	217
Stream Flowing on S.	218
Spec:	
ACCESSIBILITY	
Car Useable to Near Shore	219
>10 min. Walk	220
Boat Only	221

FEATURES RELEVANT TO EXPOSURE	
DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	222
100 - 500	223
500 - 1000	224
1000 - 5000	225
>5000	226
Absent	227
DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	228
100 - 500	229
500 - 1000	230
1000 - 5000	231
>5000	232
Absent	233
DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	234
100 - 500	235
500 - 1000	236
1000 - 5000	237
>5000	238
Absent	239

SCIENTIFIC & CONSERVATION INTEREST

BIOTA	Dom Z	Dom C	Dom P	2° Z	2° C	2° P
Fucoids						
Red Algae						
Green Algae						
Brown Algae						
Eel Grass						
Barnacle						
Mussel						
Limpet						
Other Molluscs (Spec:)						
Turf Formers						
Crustose Corallines						
Others: (Spec)						

N.C.C. CLASSIFICATION	
Ascophyllum	240
Mackaii	241
Fucoids	242
Fucobarnacle	243
Fucomytilus	244
Chloropatella	245
Chlorophyta	246
Rhodomytilus	247
Rhodobarnacle	248
Rhodopatella	249
Mytilobarnacle	250
Patellobarnacle	251
Barnacle	252
Mollusc	253
Other: (Spec)	254

PROMINENT SUBHABITATS	H	M	L
Wide, Shallow Rock Pools	255	265	275
Deep Rock Pools	256	266	276
V. Large Rock Pools	257	267	277
Rock Pools	258	268	278
Crevices	259	269	279
Couloirs	260	270	280
Overhangs	261	271	281
Caves	262	272	282
Reef at Low Tide	263	273	283
Other: (Spec)	264	274	284

No./DIVERSITY OF SUBHABITATS	
High	285
Medium	286
Low	287

RELATIVE SPECIES RICHNESS	Flora	Fauna
Good	290	291
Average	293	292

ORNITHOLOGICAL INT	Feed	Nest
Waders	294	298
Wildfowl	295	299
Gulls	296	300
Seabirds	297	301
SEAL HAULOUT	302	

NAT. RES. STATUS	
Site Within NNR	303
NNR or ASI Nearby	304
NT, RSPB or Loc Res Nearby	305
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING	
V. Good	306
Good	307
Fair	308
Poor	309

NOTES:

HUMAN INFLUENCE

Dist. to nearest Town (km) r

AMENITY VALUE

Attractive Beach or Surround	310
Resort Town Nearby	311
Toilets, Shops & Cafes Present	312
Toilets, Shops & Cafes Nearby	313
Car Park	314
Popular	315

INDUSTRY AND POLLUTION

Factories Present	316
Evidence of Industrial Pollution	
—Toxic	317
—Suspended S	318
Sewage Pollution	319
Land Reclamation	320

SHORE USAGE

Beach Fishing	321
Bait Digging	322
Shellfish Collecting	323
Algal Harvesting	324
Aquaculture	325
Mooring	326
Watersports	327
Other: (Spec)	328

SKETCH MAP OF LOCATION

METHOD OF ACCESS

LOCATION DESCRIPTION

GENERAL PHOTOGRAPHS

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Northern Ireland Littoral Survey Rocky Shore Recording Sheet
Transect Data Stage II

E	TRANSECT No.	LOCATION No.	SED. SHEET No. (if any)
	Ht. OF L.W.	TIME OF L.W.	DATE
	TIME OF ARRIVAL	TIME OF DEPARTURE	RECORDER

GENERAL NATURE OF TRANSECT STATIONS

	Photo Nos	Aspect	Slope	Substrate Nature	Rock Type	Surface Texture	Surface Features	Total Algal Cover	
								Cover	Patchiness

DESCRIPTION OF TRANSECT SITE

REFERENCE POINT

TRANSECT MAP

TRANSECT PROFILE

Station	1	2	3	4	5	6	7	8	
Ht. Top									
Ht. Bottom									

STATION/ [illegible]	
HABITAT	
Grantia compressa	C55
Halichondria panicea	C283
Halisarca dujardini	C557
Hymeniacidon sp	
Myxilla incrustans	C375
Oscarella lobularis	C67
Sycon coronatum	C32
Campanularia sp.	
Clava sp.	
Coryne sp.	
Dynamena pumilla	D214
Gonothyraea loveni	D164
Obelia geniculata	D159
Sertularia sp.	
Actinia equina	D557
Actinia fragacea	D558
Anemonia sulcata	D
Cereus pedunculatus	D588
Cerianthus lloydii	D525
Edwardsiella carnea	D617
Halcampa chrysanthellum	D613
Sagartia elegans	D586
Sagartia troglodytes	D587
Tealia felina	D561
Lineus longissimus	G31
Lineus ruber	G34
Nemertopsis flavida	G62
Oerstedia dorsalis	G66
Tubulatus annulatus	G9
Amphitrite sp.	
Audouinia tentaculata	P145
Caprellida sp.	
Cirratulus cirratus	P147
Eulalia viridis	P336
Eupolymnia nebulosa	P700
Flabelligera affinis	P648
Filograna implexa	P773
Harmothoe sp.	
Hydroides norvegica	P766
Lagisca extenuata	P261
Lepidonotus sp.	
Malanid sp.	
Nephtys sp.	
Nereis diversicolor	P506
Nereis pelagica	P495
Nerine sp.	
Notomastus latericens	P168
Ophelia bicornis	P228
Pectinaria koreni	P669
Phyllodocidae sp.	
Pomatoceros triqueter	P679
Pygospio elegans	P108
Sabella pavonina	P737
Scolelepis sp.	
Serpula vermicularis	P765
Spio filicornis	P107
Spirorbis borealis	
Spirorbis sp.	
Golfingia sp.	
Sipunculus sp.	
Balanus balanoides	S37
Balanus balanus	S41
Balanus crenatus	S35

STATION / ZONE	
HABITAT	
Chthamalus stellatus	S55
Elminius modestus	S48
Verruca stroemia	S27
Idotea sp.	
Jaera sp.	
Ligia oceanica	S512
Amphipoda sp.	
Cancer pagurus	S1240
Carcinus maenas	S1225
Galathea squamifera	S1157
Galathea strigosa	S1158
Hyas araneus	S1271
Macropipus depurator	S1220
Macropipus puber	S1215
Macropodia longirostris	
Palaemon elegans	S1015
Porcellana longicornis	S1162
Porcellana platycheles	S1163
Pagurus bernhardus	S1172
Pagurus sp.	
Petrobius maritimus	
Nymphon rubrum	S3
Pycnogonum littorale	S25
Acanthochitona crinitus	W50
Ischnochiton albus	W44
Lepidochitona cinereus	W45
Lepidopleurus asellus	W28
Tonicella marimorea	W46
Tonicella rubra	W47
Acmaea tessulata	W80
Acmaea virginea	W81
Buccinium undatum	W440
Calliostoma zizyphinium	W106
Cingula sp.	
Gibbula cineraria	W110
Gibbula magus	W113
Gibbula umbilicailis	W111
Hydrobia ulvae	W162
Lacuna vincta	W141
Littorina littorea	W148
Littorina neglecta	W153
Littorina neritoides	W151
Littorina obtusata	W149
Littorina saxatilis sp.	
Monodonta lineata	W116
Nassarius incrassatus	W450
Nassarius reticulata	W449
Nucella lapillus	W410
Nucula sp.	
Patella aspera	W86
Patella intermedia	W
Patella vulgata	W85
Patina pellucida	W84
Pisoid sp.	
Planeopsis planorbis	W225
Rivia artica	W382
Rivia Monacha	W381
Aeolidia papillosa	W870
Archidoris pseudoargus	W816
Cryphella verrucosa	W851
Doris ephippium	W1053
Tritonea sp.	
Adamys distorta	W1034
Adamys varia	W1037

Hiatella arctica	W1299
Lasaea rubra	W1098
Modiolus sp.	/
Monia patelliformis	W1054
Monia squama	W1055
Musculus discors	W999
Mytilus edulis	W991
Pholas dactylus	W1310
Puritonia minuta	W1272
Venerupis pullastra	
Zirfaea crispata	W1313
Asterias rubens	ZB83
Henricia sanguinolenta	ZB69
Marthasterias glacialis	ZB85
Amphipholas squamata	ZB138
Amphiura chiajei	ZB112
Ophiothrix fragilis	ZB108
Ophiura texturata	ZB144
Echinus esculentia	ZB170
Strongylocentrotus sp.	/
Cumaria sp.	/
Alcyonidium gelatinosum	Y63
Alcyonidium hirsutum	Y59
Electra pilosa	Y338
Flustra foliacea	Y346
Flustrellidra hispida	Y55
Membranipora membranacea	Y333
Aplidium/Marchellum sp.	/
Ascidiella scabra	ZD62
Ascidia conchilega	ZD64
Ascidia mentula	ZD63
Botrylloides leachii	ZD90
Botryllus schlossrei	ZD89
Ciona intestinalis	ZD49
Clavelina lepadiformis	ZD4
Endrodoa grossularia	ZD86
Polyclinum aurantium	ZD11
Sidnyum turbinatum	ZD14
Tridemnum tenerum	
Ammodytes tobianius	ZG518
Blennius gattorugine	ZG474
Ciliata mustela	ZG209
Diplecogaster bimaculata	ZG170
Gaidropsarus mediterraneus	ZG213
Gobius paganellus	ZG535
Hyperoplus lanceolatus	ZG521
Lepidogaster candollei	ZG172
Liparis liparis	ZG367
Liparis montagui	ZG368
Myxocephalus scorpius	ZG351
Nerophis lumbriciformis	ZG316
Pholis gunnellus	ZG500
Spinachia spinachia	ZG301
Syngnathus typhle	ZG314
Taurulus bubalis	ZG352

STATION/ZONE

HABITAT

lidingia sp.	
lidingia marginata	ZS266
lidingia minima	ZS267
ryopsis hypnoides	ZS360
ryopsis plumosa	ZS361
haetomorpha capillaris	ZS321
haetomorpha linum	ZS323
haetomorpha melagonium	ZS325
ladophora albida	ZS328
ladophora pellucida	ZS340
ladophora rupestris	ZS346
ladophora sericea	ZS347
ladophora sp.	
odium sp.	
nteromorpha linza	ZS273
nteromorpha sp.	
onostroma fuscum	ZS243
onostroma grevillei	ZS244
onostroma oxyspermum	ZS246
rasiola stipitata	ZS178
hizoclonium riparium	ZS352
psenvingiella polyrhiza	ZS180
lva lactuca	ZS280
rospora/Ulothrix turf	
lothrix flacca	ZS229
lothrix speciosa	ZS231
laria esculenta	ZR254
scophyllum nodosum	ZR280
furcaria bifurcata	ZR296
horda filum	ZR221
horda tormentosum	ZR222
ladostephus spongiosus	ZR263
ystoseira baccata	ZR297
ystoseira tamariscifolia	ZR301
ystoseira nodicaulis	ZR300
smarestia aculeata	ZR207
ctyosiphon foeniculaceus	ZR178
fotyota dichotoma	ZR271
cus ceranoides	ZR281
cus serratus	ZR286
cus spiralis	ZR287
cus vesiculosus	ZR288
alidrys siliquosa	ZR305
manthalia elongata	ZR293
minaria digitata	ZR225
minaria hyperborea	ZR227
minaria saccharina	ZR229
athesia difformis	ZR105
lvetia canaliculata	ZR290
talonia fascia	ZR187
layella littoralis	ZR33
alfsia" crusts	
ytosiphon lomentaria	ZR191
nfeltia plicata	ZM120
dcuinella turf	
ngia atro-purpurea	ZM483
strychia scorpioides	ZM397
llithamnion sp.	
tonella : caespitosa	ZM98
ramium shuttleworthianum	ZM330
ramium sp.	
ondrus crispus	ZM138
rallina officinalis	ZM154

SPECIES / CODE	
HABITAT	
Dilsea carnosa	ZM201
Dumontia incrassata	ZM205
Furcellaria lumbricalis	ZM80
Gastroclonium ovatum	ZM270
Gelidium sp.	
Gigartina acicularis	ZM139
Gigartina stellata	ZM141
Gracillaria verrucosa	ZM116
Hildenbrandia rubra	ZM253
Hypoglossum woodwardii	ZM373
Laurencia hybrida	ZM405
Laurencia pinnatifida	ZM407
Lithothamnium glaciale	ZM184
Lomentaria articulata	ZM272
Lomentaria clavellosa	ZM273
Membranoptera alata	ZM14
Odonthalia denticulata	ZM411
Palmaria palmata	ZM260
Phycodrys rubens	ZM381
Phyllophora truncata	ZM131
Phyllophora crispa	ZM127
Phyllophora pseudoceranoid.	ZM128
Phyllophora traillii	ZM130
Phymatolithon lenormandii	ZM194
Plocamium cartilagineum	ZM108
Plumaria elegans	ZM349
Polyides rotundus	ZM95
Polysiphonia brodiaei	ZM412
Polysiphonia lanosa	ZM422
Polysiphonia nigrescens	ZM425
Polysiphonia urceolata	ZM434
Polysiphonia sp.	
Porphyra leucosticta	ZM485
Porphyra linearis	ZM486
Porphyra umbilicalis	ZM489
Ptilota plumosa	ZM351
Rhodomela confervoides	ZM442
Non calc. encrusters	
Calc. encrusters	
Supralittoral blue-greens	
Vaucheria sp.	
Verrucaria maura	
Verrucaria mucosa	
Lichina confinis	
Lichina pygmaea	
Ruppia sp.	
Zostera angustifolia	
Zostera marina	
Zostera nana	

INSTITUTE OF OFFSHORE ENGINEERING

HERIOT-WATT UNIVERSITY

Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet

LOCATION DATA STAGE II

LOCALITY c		GRID REF d	LONG e W	LAT f N	
SHEET No a	PUNCH CARD No b	Ht. OF LW. g (m)	TIME OF LW. h	DATE i	
ROCKY SHEET No (if any) k	PHOTO No.	ARRIVAL TIME l	DEPARTURE m	RECORDER	

COASTAL SITUATION	Dom	2°	3°
Open Coast	1	18	35
Sheltered Coast	2	19	36
Headland	3	20	37
Large Bay (>2km)	4	21	38
Small Bay	5	22	39
Island	6	23	40
Island attached at L.W.	7	24	41
Sea Lough	8	25	42
Marine Inlet	9	26	43
Narrows	10	27	44
Rapids	11	28	45
River Estuary	12	29	46
Pocket Beach	13	30	47
Linear Beach	14	31	48
Saltmarsh	15	32	49
Lagoon	16	33	50
	17	34	51

SHORE TYPE			
Large Boulders (>1024 mm)	52	69	86
Med. Boulders (512–1024 mm)	53	70	87
Small Boulders (256–512mm)	54	71	88
Cobbles (64–256mm)	55	72	89
Pebbles (4–64 mm)	56	73	90
Granules (2–4 mm)	57	74	91
Coarse Sand (½–2 mm)	59	75	92
Med. Sand (¼–½ mm)	58	76	93
Fine Sand (1/16–¼ mm)	60	77	94
Shelly Sand (25% sh.)	61	78	95
Muddy Sand	62	79	96
Mud	63	80	97
Shingle	64	81	98
Storm Beach	65	82	99
Black Layer N.S.	66	83	100
Man Made	67	84	101
	68	85	102

ROCK TYPE	
Spec:	
Igneous/Metamorphic	103
Limestone	104
Hard Mudstone	105

SLOPE / INTERTIDAL EXTENT	
Steep (<50m)	107
Mod. (50–150m)	108
Gentle (>150m)	109
Mod. Upper Beach L.W. Flat	110
Flat (none of above)	111
HORIZONTAL EXTENT (m)	
<500	112
500 – 1000	113
1000 – 1500	114
>1500	115
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Islands	116
Reefs	117
Breakwaters	118
Sandbanks	119
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COASTAL BACKING	
Sand Dunes	121
Low Cliffs	122
Mod. Cliffs	123
High Cliffs	124
Saltmarsh	125
Grassland	126
Peat	127
Valley	128
Freshwater	129
Trees	130
Other:	131
STEEPNESS INLAND	
0	132
1	133
2	134
3 – 5	135
5 – 10	136
>10	137

PREVAILNG WIND/ASPECT	W	A
N	138	146
NE	139	147
E	140	148
SE	141	149
S	142	150
SW	143	151
W	144	152
NW	145	153
Wind Data:		
EXPOSURE TO WAVE ACTION		
estimate V. Exposed		154
Exposed		155
Moderate		156
Sheltered		157
V. Sheltered		158

FEATURES RELEVANT TO EXPOSURE		
FETCH	min	max
<2	159	164
2 – 10	160	165
10 – 50	161	166
50 – 100	162	167
>100	163	168
SEA HORIZON	10 miles	40 miles
0	169	182
1	170	183
2	171	184
3	172	185
4	173	186
5	174	187
6	175	188
7	176	189
8	177	190
9	178	191
10	179	192
11	180	193
12	181	194

Time of E L W S T	n
Mean Spring Tide Range (M)	o
Mean Neap Tide Range (M)	p
Annual Rainfall (mm)	q
CURRENT STRENGTH	
estimate Strong	195
Moderate	196
Weak	197
SALINITY	
Normal	198
Slighty Reduced (28–33‰)	199
Low (<28‰)	200
Stream Flowing on S.	201
Spec:	
ACCESSIBILITY	
Car Useable to Near Shore	202
>10 min. Walk	203
Boat Only	204

DISTANCE TO 10m DEPTH CONTOUR (m)	
<100	205
100–500	206
500–1000	207
1000–5000	208
>5000	209
Absent	210
DISTANCE TO 30m DEPTH CONTOUR (m)	
<100	211
100–500	212
500–1000	213
1000–5000	214
>5000	215
Absent	216
DISTANCE TO 50m DEPTH CONTOUR (m)	
<100	217
100–500	218
500–1000	219
1000–5000	220
>5000	221
Absent	222

SCIENTIFIC & CONSERVATION INTEREST

BIOTA

Barren	223
Crustacea / Poly.	224
Tellina	225
Macoma	226
Scrobicularia	227
Spisula	228
Lanice	229
Pullastra	230
Echino. Sili.	231
Other:(Spec)	232
	233
	234
	235
	236
	237
	238
	239
	240
	241

PROMINENT SUBHABITATS

Spec:	242
	243
	244
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	250
	251
	252
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	254

No/. DIVERSITY OF SUBHABITATS

High	255
Medium	256
Low	257

RELATIVE SPECIES RICHNESS

Good	258
Average	259
Poor	260

ORNITHOLOGICAL INTEREST

	Feed.	Nest.
Waders	261	265
Wildfowl	262	266
Gulls	263	267
Seabirds	264	268

SEAL HAUL OUT	269

NATURE RESERVE STATUS

Site Within N.N.R. etc.	270
N N R or A S I Nearby	271
N T or R S P B or Loc. Res Nearby	272
Nos. of Sub. Survey Sites Nearby	

SUBJECTIVE RATING

V. Good	273
Good	274
Fair	275
Poor	276

HUMAN INFLUENCE

DISTANCE TO NEAREST TOWN (km) r

AMENITY VALUE

Attractive Beach or Surround	277
Resort Town Nearby	278
Toilet, Shops & Cafes Present	279
Toilet, Shops & Cafes Nearby	280
Car Park	281
Popular	282

INDUSTRY & POLLUTION

Factories Present	283
Evidence of Industrial Pollution	
— Toxic	284
—Suspended S	285
Sewage Pollution	286
Land Reclamation	287
Other:	

SHORE USAGE

Beach Fishing	288
Bait Digging	289
Shellfish Collecting	290
Algal Harvesting	291
Aquaculture	292
Mooring	293
Watersports	294
Other:	295

NOTES

SKETCH MAP OF LOCATION

METHOD OF ACCESS

LOCATION DESCRIPTION

GENERAL PHOTOGRAPHS

INSTITUTE OF OFFSHORE ENGINEERING
HERIOT-WATT UNIVERSITY
Northern Ireland Littoral Survey Sedimentary Shore Recording Sheet
Transect Data Stage II

ITE NAME	TRANSECT No	LOCATION No	ROCKY SHEET No (if any)
ILM No	Ht. OF L.W.	TIME OF L.W.	DATE
	TIME OF ARRIVAL	TIME OF DEPART.	RECORDER

GENERAL NATURE OF TRANSECT STATIONS

Station	Photo Nos	Aspect	Slope	Sediment Type	Surface Features	Depth of Black Layer c.m.	Depth of Water Table c.m.
1							
2							
3							
4							
5							

DESCRIPTION OF TRANSECT SITE

REFERENCE POINT

TRANSECT MAP

TRANSECT PROFILE

ation	1	2	3	4	5				
ight									

Station		1	2	3	4	5				
Species	No.									

APPENDIX V

STAGE II SURVEY RECORDING SHEET INSTRUCTIONS

LOCATION DATA

The location data recording sheet is completed using the results from the stage I survey, although these details are amended if the details of the location altered at the time of the stage II survey.

The sketch map is to be drawn at the site showing, as accurately as possible, the position of the transect (s). It must also have an indication of (i) direction of north (ii) substratum type (iii) the names, direction and distance of the adjacent stage II survey locations (iv) a scale.

Photographs of the general locality should be noted in the appropriate box whereas the detailed photographs of the transect noted on the transect data sheet.

TRANSECT DATA

One recording sheet should be filled in for each transect surveyed.

The site name should be the same as the locality with the addition of a prefix letter in the box provided to the right of the site name.

The transect number should be the same as the locality number with the addition of the same prefix letter as the site name.

Table of the general nature of transect stations

This table is designed to give general information, including physical characteristics, for each station on the transect.

- Photo numbers: at least one photograph should be taken of each station, and the no(s) entered in this column.
- Aspect: entered as N, NE, E, SE, S, SW, W or NW.
- Slope: given as the number of degrees from the horizontal.
- Sediment type: entered as a number from Table V.I.
- Surface features: entered as a number from Table V.II.
- Depth of black layer: entered as the number of cm from the surface.
- Depth of water table: entered as the number of cm from the sand surface.
- Subtratum nature: entered as a number from Table V.III. This gives the 'shore types' of the individual stations.
- Rock type: entered as a number from Table V.IV
- Surface texture: entered as a number from Table V.V. This is the actual roughness/smoothness of the substrata at the transect station, this gives an idea of the conditions for attachment of organisms etc.
- Surface water: entered as present or absent
- Total biotic cover:
  (i) Cover: entered as a number from Table V.VI
  (ii) Patchiness: entered as a number from Table V.VII.

These give an impression of the biotic coverage and amount of open rock. This includes all the organisms as a whole and not just individuals as noted for the abundance data.

Position Marker

A white painted square positioned at the top of the shore, usually in the maritime lichen zone, marked the top of the transect.

Description of Transect Site

At least two photos should be taken from the top of (looking down) the transect and from the bottom of (looking up) the transect. Any general photos of the transect should also be entered here.

A detailed description of the transect site is recorded using a small cassette player. This is later transcribed onto the recording sheets.

Transect Profile

An accurate profile of the transect site should be drawn. This is calculated using a surveyor's level and graduated pole and tape measure. The distances and heights are recorded in note form, on site, and the profile is plotted on the graph paper later.

Station Heights

The heights of the bottom and top of each station (a zone for rocky shores and a sampling area for sedimentary shores), from calculated low water for the date and tide sampled are to be entered; these can be calculated from the profile or using the surveyor's level.

ABUNDANCE/SPECIES LIST TABLES

Sedimentary Shores

Four box quadrats are taken at each transect station only one of which is used for abundance. Species names are written in the first column and the number of individuals entered in the boxes provided. The columns for each station are divided by a heavy black line. The presence of species found in the box quadrats not used for abundance is recorded by entering the name and the abundance recording P.

On muddy shores the methods are modified so that ten grab samples are taken at random. Two of these are analysed quantitatively and the species names recorded. The numbers of individuals for these are entered in the first two columns. The remaining grabs are used to find additional species which are recorded on the sheet, and P (present) entered in the third column.

On extensive sand flats, groups of five box guadrats are taken. One is analysed quantitatively and the species recorded with the number of individuals entered in the first column. The remaining quadrats are used to find additional species which are recorded on the sheet, and P (present) entered in the second column.

Rocky Shores

A species list of the most common species is given, along with their computer index numbers, as defined by the Ulster Museum Thesaurus (1983). Where possible the identification and abundance ratings for the rocky shores should be done in situ, although samples of unrecognised species should be taken. The abundance of all species seen on the open rock surface should be estimated (even if not identified until later). The presence of the organisms in different sub-habitats (ie. rock pools, crevices, overhangs etc.) are denoted by 1 in separate columns. At the top of the table, the station is denoted by a number in the 'Zone' row and the sub habitat by a letter in the 'Habitat' row (see Table V.VIII).

The abundance is given by an 8 point abundance scale; with 2 denoting rarely found (R) and 8 denoting extremely abundant (Ex) and 1 denoting presence only (usually identified in the laboratory). The bracketed letters are the abundance rating equivalents on the seven point scale used by NCC and OPRU (see Table V.IX).

A bag of algae is collected on each shore to obtain a representative sample of amphipods, pycnogonids and epifauna and flora that may not be easily seen. Certain shells are also collected to detect and identify any shell boring algae.

TABLE I SEDIMENT TYPE

Coarse Sand (1/2 - 2mm)	1
Medium Sand (1/4 - 1/2mm)	2
Fine Sand (1/16 - 1/4mm)	3
Shelly Sand (25% Sh)	4
Muddy Sand	5
Muddy Gravel	6
Mud	7
Gravel	8
Pebbles (4 - 64mm)	9
Shingle (Rounded)	10
Stones (Angular)	11
	12
	13
	14

TABLE II SURFACE FEATURES

Crevices	1
Couloirs	2
L Rock Pools	3
D Rock Pools	4
Rock Pools	5
Overhangs	6
W.S. Rock Pools	7
Wet Areas (surface water)	8
Boulders	9
Rock Outcrops/Platforms	10
Drift Algae	11
	12

TABLE III - SUBSTRATE NATURE

Rock Ridges	1
Rock Outcrops	2
Irregular Rock	3
Fissured Rock	4
L Boulders (>1024mm)	5
M Boulders (512 - 1024mm)	6
S Boulders (256-512mm)	7
Stones, Angular (64-256mm)	8
Shingle, Rounded (64 - 256mm)	9
Pebbles (5 - 63mm)	10
Sand	11
Muddy Sand	12
Muddy Gravel	13
Gravel	14
Mud	15
Silt Covered Rock	16
Man Made	17
Rock Platforms	18

TABLE IV - ROCK TYPE

Igneous/Metamorphic	1
Limestone	2
Hard Mudstones + Sandstones	3
Soft Mudstones + Sandstones	4
Clays	5

TABLE V - SURFACE TEXTURE

Smooth Surfaces	1
Rough Granulated surface	2
Fissured Surface	3
Boulders	4
Stones	5
	6
	7
	8
	9
	10

TABLE VI - ALGAL COVER

>75%	4
50% - 75%	3
25% - 50%	2
<25%	1
No Cover	0

TABLE VII - PATCHINESS

V. Patchy	1
Patchy	2
Slightly Patchy	3
Blanket Cover	4
No Cover	0

TABLE VIII - SUBHABITATS CODE LETTERS

Wide, shallow Rock Pools	W
Deep Rock Pools	D
Rock Pools	R
Crevices	C
Couloirs	K
Overhangs	H
Fresh Water Inflow	F
Under Boulders	U
Open Rock Surface	O

TABLE IX Abundance scales used in Milford Haven

1. Live barnacles (exc. B. perforatus) (record adults, spat, cyprids seperately)
   Littorina neritoides
   Littorina neglecta

8	Ex	500 or more per $0.01m^2$-5+/cm^2
7	S	300-499 per $0.01m^2$ 3-4/cm^2
6	A	100-299 per $0.01m^2$ 1-2/cm^2
5	C	10-99 per $0.01m^2$
4	F	1-9 per $0.01m^2$
3	O	1-99 per m^2
2	R	Less than 1 per m^2
1	P	

2. Balanus perforatus

8	Ex	300 or more per $0.01m^2$
7	S	100-299 per $0.01m^2$
6	A	10-99 per $0.01m^2$
5	C	1-9 per $0.01m^2$
4	F	1-9 per $0.1m^2$
3	O	1-9 per m^2
2	R	Less than 1 per m^2
1	P	

3. Patella spp. 10mm
   Littorina littorea (juv & adults)
   Littorina littoralis (adults)
   Nucella lapillus (juv <3mm)

8	Ex	20 or more per $0.1m^2$
7	S	10-19 per $0.1m^2$
6	A	5-9 per $0.1m^2$
5	C	1-4 per $0.1m^2$
4	F	5-9 per m^2
3	O	1-4 per m^2
2	R	Less than 1 per m^2
1	P	

4. Littorina 'saxatilis'
Patella <10mm
Anurida maritima
Hyale nilsonni & other amphipods
Littorina littoralis juv.

8	Ex	50 or more per 0.1m^2
7	S	20-49 per 0.1m^2
6	A	10-19 per 0.1m^2
5	C	5-9 per 0.1m^2
4	F	1-4 per 0.1m^2
3	O	1-9 per m^2
2	R	Less than 1 per m^2
1	P	

5. Nucella lapillus (>3mm)
Gibbula spp., Monodonta lineata
Actinea equina
Idotea granulosa
Carcinus (juv & recent sett.)
Ligea oceanica

8	Ex	10 or more per 0.1m^2
7	S	5-9 per 0.1m^2
6	A	1-4 per 0.1m^2
5	C	5-9 per m^2, loc. sometimes more
4	F	1-4 per m^2, loc. sometimes more
3	O	Less than 1/m^2,loc. sometimes more
2	R	Always less than 1 per m^2
1	P	

6. Mytilus edulis, Dendrodoa grossularia

8	Ex	80% or more cover
7	S	50-79% cover
6	A	20-49% cover
5	C	5-19% cover
4	F	small patches <5%, 10+ sm. inds./0.1m^2, 1 or more lg./0.1m^2
3	O	1-9 sm./0.1m^2, 1-9 lg./m^2. No patches exc. sm. in crevices
2	R	Less than 1 per m^2
1	P	

7. Pomatoceros triqueter

6	A	50 or more tubes per 0.01m^2
5	C	1-49 tubes per 0.01m^2
4	F	1-9 tubes per 0.1m^2
3	O	1-9 tubes per m^2
2	R	Less than 1 tube per m^2
1	P	

APPENDIX VI

COMMENTS BY TAXONOMIC REFEREES

FLORA

Dr. M. Wilkinson was the main taxonomic referee for algae, and I. Tittley (British Museum, Natural History) identified several individual specimens. Ian Fuller spent several days, in January 1986, at the Hayling Island Marine Laboratory of Portsmouth Polytechnic, learning to identify the more common species of encrusting calcareous algae under the guidance of Dr. Y. Chamberlain (Mrs. Y. Butler). A collection of specimens of the calcareous encrusting algae will be sent to Dr. Chamberlain. All other algal specimens will be deposited at the Ulster Museum.

FAUNA

Several referees, of various groups, have been consulted and many specimens have been and will be confirmed. The groups refereed and comments of the referees include:

Polychaeta: Dr. B. O'Connor (University College, Galway)

New records for Ireland are:
- Nainereis quadricuspida (Fabricius 1780)
- Theostoma oerstedi (Claparede 1864)
- Aricidea suecica Eliasen 1916
  (this was known as A. jeffreysi previously)
- Micromaldane ornithochaeta Mesnil 1897
- Platynereis coccinea (delle Chiaje 1825)
- Spinther arcticus (M. Sars 1851)
- Polycirrus denticulatus St.-Joseph 1894

The range of Phisidea aurea Southward 1956 has been extended.

Some of these specimens are awaiting confirmation.

Pycnogonida: Dr. R. Bamber (CEGB, Fawley)

New record for Northern Ireland is:
- Anoplodactylus pygmaeus (Hodge 1864)

The present survey found Callipallene brevirostris (Johnston 1837) b. producta. This subspecies has not been recorded for Northern Ireland.

All specimens have been confirmed.

Amphipoda: Dr. D. McGrath (Regional Technical College, Galway)

New records for Ireland are:
- Orchestia cavimana Heller 1865
- Talorchestia brito Stebbing 1891
- Urothoe poseidonis Reibisch 1905
- Corophium acheruscum da Costa 1851
- Corophium insidiosum Crawford 1937

The range of Corophium sextonae Crawford 1937 has been extended.

Some of these specimens are awaiting confirmation.

Mollusca: Dr. S. Smith

No new records for molluscs were found though some range extensions may be apparent. This needs confirmation.

Bryozoa: Dr. P. Hayward (University College, Swansea)

Only Celleporina decipiens Hayward 1976 is a new record for Northern Ireland extending the known range of this species. It is suspected that the distribution of this species extends throughout the whole coastline of Ireland.

Before the present survey only in "Belfast Bay" (Hincks 1864) and in Strangford Lough (Boaden et al 1976) had distributions of bryozoans been accurately established. This has now been done for the whole intertidal region of Northern Ireland.

Porifera, Cnidaria, Nudibrancha and Tunicata: Dr. B. Picton (Ulster Museum)

Dr. Picton gave useful advice and confirmed several individual specimens in these groups.

APPENDIX VII

SPECIES LIST FOR THE INTERTIDAL REGION OF NORTHERN IRELAND
COMPILED FROM DATA COLLECTED 1984 - 1987 DURING
THE NORTHERN IRELAND LITTORAL SURVEY

FAUNA

PORIFERA

CLATHRINIDA
Clathrinidae
Clathrina coriacea (Montagu 1818)

LEUCOSOLENIDA
Leucosoleniidae
Leucosolenia sp. indet

SYCETTIDA
Sycettidae
Scypha ciliata (Fabricius 1780)
Grantiidae
Leuconia nivea (Grant 1826)
Grantia compressa (Fabricius 1780)

HOMOSCLEROPHORIDA
Oscarellidae
Oscarella lobularis (Schmidt 1886)

ASTROPHORIDA
Stellettidae
Stelletta grubii Schmidt 1862
Geodiidae
Pachymatisma johnstonia (Bowerbank 1842)

HADROMERIDA
Suberitidae
Suberites domuncula (Olivi 1792)
Suberites sp. indet.
Terpios fugax Duchassaing & Michelotti 1864
Tethyidae
Tethya aurantium (Pallas 1776)
Thoosidae
Cliona celata Grant 1826

AXINELLIDA
Desmacellidae
Biemna variantia (Bowerbank 1866)

HALICHONDRIDA
Halichondriidae
Halichondria panicea (Pallas 1766)
Hymeniacidonidae
Hymeniacidon perleve (Montagu 1818)
Hymeniacidon sp. indet.

POECILOSCLERIDA
Mycalidae
Mycale sp. indet.
Amphilectus fucorum (Esper 1794)
Myxillinae
Myxilla incrustans (Johnston 1842)
Clathriidae
Ophlitaspongia seriata (Grant 1826)

Microciona sp. indet.

HAPLOSCLERIDA
Haliclonidae
Haliclona oculata (Pallas 1766)
Haliclona simulans (Johnston 1842)
Haliclona fistulosa (Bowerbank 1866)
Haliclona indistincta (Bowerbank 1866)
Haliclona sp. idet.
Acervochalina limbata (Montagu 1818)

DICTYOCERATIDA
Dysideidae
Dysidea fragilis (Montagu 1818)

DENDROCERATIDA
Halisarcidae
Halisarca dujardini Johnston 1842

CNIDARIA

SCYPHOZOA

STAUROMEDUSEA
Eleutherocarpidae
Haliclystus auricula (Rathke)

HYDROZOA

ANTHOMEDUSAE
Tubulariidae
Tubularia indivisa Linnaeus 1758
Tubularia larynx Ellis & Solander 1786
Corynidae
Coryne pusilla Gaetner 1774
Coryne muscoides (Linnaeus)
Sarsia eximia (Allman 1859)
Myriothelidae
Candelabrum phrygium (Fabricius 1775)
Clavidae
Clava multicornis (Forskal 1775)
Clava squamata (O.F.Muller 1776)
Eudendriidae
Eudendrium sp. indet.

LEPTOMEDUSAE
Campanulariidae
Campanularia volubilis Linnaeus 1758
Rhizocaulus verticillatus Linnaeus 1767
Clytia hemisphaerica (Linnaeus 1758)
Obelia dichotoma (Linnaeus 1767)
Obelia geniculata (Linnaeus 1767)
Obelia sp. indet.
Gonothyraea loveni (Allman 1859)
Laomedea angulata (Hincks 1861)
Laomedea flexuosa Hincks 1864
Lovenellidae
Calycella syringa (Linnaeus 1767)
Phialellidae
Opercularella lacerata (Johnston 1847)
Lafoeidae
Lafoea sp. indet.
Haleciidae
Halecium sp. indet.
Sertulariidae
Diphasia attenuata (Hincks 1866)
Diphasia sp. indet.
Dynamena pumilla (Linnaeus 1758)
Abietinaria abietina (Linnaeus 1758)
Hydrallmania falcata (Linnaeus 1758)
Sertularella polyzonias (Linnaeus 1758)
Sertularia cupressina Linnaeus 1758
Sertularia sp. indet.
Plumulariidae
Kirchenpaueria pinnata (Linnaeus 1758)
Plumularia setacea (Ellis & Solander 1786)
Ventromma halecioides (Alder 1857)

CHONDROPHORA
Velellidae
 Velella velella (Linaeus)

ANTHOZOA

ALCYONACEA
Alcyoniidae
 Alcyonium digitatum (Grosse 1858)

CERIANTHARIA
Cerianthidae
 Cerianthus lloydii Grosse 1859

ACTINARIA
Actiniidae
 Actinia equina (Linnaeus 1758)
 Anemonia sulcata (Pennant)
 Urticina felina (Linnaeus 1761)
Metridiidae
 Metridium senile (Linnaeus 1761)
Sagartiidae
 Sagartia elegans (Dalyell 1848)
 Cereus pedunculatus (Pennant 1777)
 Actinothoe sphyrodeta (Grosse 1858)
Edwardsiidae
 Edwardsia sp. indet.

SCLERACTINIA
Caryophylliidae
 Caryophylla smithii Stokes & Broderick 1828

NEMERTINEA

PALAEONEMERTINI
Tubulanidae
Tubulanus sp. indet.
Cephalothrichidae
Cephalothrix rufifrons (Johnston 1829)

HETERONEMERTINI
Lineidae
Lineus longissimus (Gunnerus)
Lineus bilineatus (Reiner)
Lineus ruber O.F.Muller 1776
Micrura sp. indet.

HOPLONEMERTINI
Emplectonematidae
Emplectonema neesi (Oersted 1844)
Prosorhochmidae
Oerstedia dorsalis (Abildgaard 1804)
Amphiporidae
Amphiporus lactifloreus (Johnston)
Tetrastemmatidae
Tetrastemma flavidum Ehrenberg 1831

PRIAPULOIDEA

Priapulus caudatus Lamarck 1816

ENTOPROCTA

Loxosomatidae
Loxosomella phascolosomata (Vogt 1876)
Pedicellinidae
Pedicellina cernua (Pallas 1771)
Pedicellina sp. indet.
Barentsia gracilis (M.Sars)

SIPUNCULOIDEA

Golfingiidae
Golfingia (Golfingia) vulgaris (de Blainville 1827)
Golfingia (Phascoloides) minuta (Keferstein 1862)

ANNELIDA

POLYCHAETA

ORBINIIDA
Orbiniidae
Orbinia latreillii (Audouin & M.-Edwards 1834)
Scoloplos armiger (O.F.Muller 1776)
Nainereis quadricupsida (Fabricius 1780)
Theostoma oerstedi (Claparede 1864)
Paraonidae
Paraonis fulgens (Levinsen 1884)
Aricidea suecica Eliason 1916
Aricidea minuta Southward 1956

SPIONIDA
Spionidae
Malacoceros fuliginosa (Claparede 1868)
Scolelepis squamata (Muller 1787)
Aonides oxycephala (M.Sars 1862)
Spiophanes bombyx (Claparede 1870)
Spio filicornis Fabricius 1785
Pygospio elegans Claparede 1863
Polydora ciliata (Johnston 1838)
Polydora giardi Mesnil 1896
Polydora caulleryi Mesnil 1897
Polydora quadrilobata Jacobi 1883
Prionospio sp. indet.
Magelonidae
Magelona mirabilis. Johnston
Cirratulidae
Cirriformia tentaculata (Montagu 1808)
Cirratulus cirratus (O.F.Muller 1776)
Chaetozone setosa Malmgren 1867
Dodecaceria concharum Oersted 1834
Tharyx marioni (St.-Joseph 1894)

CAPITELLIDA
Capitellidae
Notomastus latericeus M.Sars 1894
Heteromastus filiformis (Claparede 1864)
Capitella capitata (Fabricius 1780)
Capitella sp. indet.
Capitomastus minimus (Langerhans 1880)
Capitellides giardi Mesnil 1897
Mediomastus fragilis Rasmussen 1973
Arenicolidae
Arenicola marina (Linnaeus 1758)
Arenicolides ecaudata (Johnston 1865)
Maldanidae
Euclymene oerstedi (Claparede 1863)
Euclymene sp. indet.
Praxillella affinis (M.Sars 1872)
Clymenura sp. indet.
Nicomache lumbricalis (Fabricius 1780)

Nicomache maculata Arwidsson 1911
Nicomache trispinata Arwidsson 1906
Micromaldane ornithochaeta Mesnil 1897

OPHELIIDA
Scalibregmidae
Scalibregma inflatum Rathke 1843
Lipobranchus jeffreysi (McIntosh 1915)
Opheliidae
Ophelia rathkei Mcintosh 1908
Travisia forbesi Johnston 1840

PHYLLODOCIDA
Polynoidae
Polynoe scolopendrina Savigny 1822
Harmothoe extenuata (Grube 1840)
Harmothoe imbricata (Linnaeus 1767)
Harmothoe impar (Johnston 1839)
Harmothoe lunulata (Delle Chiaje 1841)
Harmothoe mcintoshi Tebble & Chambers 1982
Lepidonotus squamatus (Linnaeus 1767)
Lepidonotus clava (Montagu 1808)
Sigalionidae
Sigalion mathildae Audouin & M.-Edwards 1832
Sthenelais boa (Johnston 1865)
Pholoe inornata Johnston 1839
Phyllodocidae
Anaitides subulifera Eliason 1962
Anaitides maculata (Linnaeus 1767)
Anaitides groenlandica (Oersted 1843)
Phyllodoce laminosa Savingy 1818
Pirakia punctifera (Grube 1860)
Eumida sanguinea (Oersted 1843)
Eulalia viridis (Linnaeus 1767)
Eulalia pusilla Oersted 1843
Eteone longa (Faricius 1780)
Mysta barbata Malmgren 1856
Mysta picta (Quatrefoges 1865)
Mystides sp. indet.
Hesionidae
Kefersteinia cirrata (Keferstein 1862)
Microphthalmus sczelkowii Mecznickow 1865
Syllidae
Syllis gracilis Grube 1855
Typosyllis krohnii (Ehlers 1864)
Typosyllis prolifera (Krohn 1852)
Typosyllis hyalina (Grube 1855)
Typosyllis vittata (Grube 1863)
Typosyllis armillaris (Malmgren 1867)
Typosyllis sp. indet.
Odontosyllis fulgurans (Audouin & M.-Edwards 1834)
Odontosyllis ctenostoma Claparede 1868
Streptosyllis websteri Southern 1914
Streptosyllis bidentata Southern 1914
Parapionosyllis longicirrata (St.-Joseph 1887)
Eusyllis assimilis Marenzeller 1875
Eusyllis blomstrandi Malgren 1867
Sphaerosyllis sp. indet.

Exogone naidina Oersted 1845
Exogone hebes (Webster & Benedict 1884)
Autolytus sp. indet.
Nereidae
Micronereis variegata Claparede 1863
Leptonereis glauca Claparede 1870
Nereis pelagica Linnaeus 1758
Nereis falsa Quatrefages 1865
Nereis sp. indet
Neanthes virens (M.Sars 1860)
Hediste diversicolor (O.F.Muller 1776)
Perinereis cultrifera (Grube 1869)
Platynereis dumerilii (Audouin & M.-Edwards 1834)
Platynereis coccinea (delle Chiaje 1825)
Nephtydidae
Nephtys caeca (Fabricius 1780)
Nephtys hombergi Savigny 1818
Nephtys cirrosa Ehlers 1868
Sphaerodoridae
Ephesia gracilis Rathke
Sphaerodoridium minutum (Webster & Benedict 1887)
Glyceridae
Glycera tridactyla Schmarda 1861
Goniada maculata Oersted 1843

SPINTHERIDA
Spintheridae
Spinther arcticus (M.Sars 1851)

EUNICIDA
Eunicidae
Marphysa belli (Audouin & M.-Edwards 1834)
Lumbrineridae
Lumbrineris gracilis (Ehlers 1868)
Dorvilleidae
Protodorvillea kefersteini (McIntosh 1869)
Ophryotrocha puerilis Claparede & Mecznikow 1869

OWENIIDA
Oweniidae
Owenia fusiformis Delle Chiaje 1841

FLABELLIGERIDA
Flabelligeridae
Flabelligera affinis M.Sars 1829
Pherusa plumosa (O.F.Muller 1776)

TEREBELLIDA
Sabellariidae
Sabellaria alveolata (Linnaeus 1767)
Sabellaria spinulosa Leuckart 1847
Pectinariidae
Pectinaria koreni (Malmgren 1866)
Ampharetidae
Ampharete acutifrons (Grube 1860)
Melinna cristata (M.Sars 1851)
Melinna palmata Grube 1869
Amage auricula Malmgren 1866

Terebellidae
Amphitrite cirrata O.F.Muller 1771
Amphitrite johnstoni Malmgren 1856
Amphitrides gracilis (Grube 1860)
Phisidea aurea Southward 1956
Lanice conchilega (Pallas 1766)
Eupolymnia nebulosa (Montagu 1818)
Nicolea venustula (Montagu 1818)
Nicolea zostericola (Oersted 1844)
Polycirrus denticulatus St.-Joseph 1894
Thelepus cincinnatus (Fabricius 1780)
Thelepus setosus (Quatrefages 1865)

SABELLIDA
Sabellidae
Sabella pavonina Savingy
Branchioma bombyx (Dalyell 1853)
Laonome kroyeri Malmgren 1865
Amphiglena mediterranea (Leydig 1851)
Fabricia sabella (Ehrenberg 1837)
Manayunkia aestuarina (Bourne 1883)
Oriopsis armandi (Claparede 1864)
Jasmineira caudata Langerhans 1880
Serpulidae
Serpula vermicularis Linnaeus 1767
Hydroides norvegica Gunnerus 1768
Pomatoceros triqueter (Linnaeus 1767)
Filograna implexa Berkeley 1828
Spirorbiidae
Spirorbis spirorbis (Linnaeus 1758)
Spirorbis rupestris Gee & Knight-Jones 1962
Spirorbis corallinae de Silva & Knight-Jones 1962
Spirorbis tridentatus Levinsen 1883
Circeis spirillum (Linnaeus 1758)
Janua pagenstecheri (Quatrefages 1865)

OLIGOCHAETA

Oligochaete spp. indet.

ARTHROPODA

CHELICERATA

PYCNOGONIDA
Nymphonidae
Nymphon brevirostre Hodge 1865
Nymphon gracile Leach 1814
Ammotheidae
Achelia echinata Hodge 1864
Achelia longipes (Hodge 1864)
Achelia simplex (Giltay 1934)
Endeidae
Endeis spinosa (Montagu 1808)
Pycnogonidae
Pycnogonum littorale (Stroem 1762)
Pallenidae
Callipallene brevirostris (Johnston 1837)
Phoxicilidiidae
Phoxichilidium femoratum (Rathke 1799)
Anoplodactylus petiolatus (Kroyer 1884)
Anoplodactylus pygmaeus (Hodge 1864)
Anoplodactylus angulatus (Dohrn 1881)
Anoplodactylus virescens Hodge 1864
Anoplodactylus sp. indet.

CRUSTACEA

CIRRIPEDIA

THORACICA
Lepadidae
Lepas anatifera Linnaeus 1767
Verrucidae
Verruca stroemia (O.F.Muller 1776)
Chthamalidae
Chthamalus stellatus (Poli 1791)
Chthamalus montagui Southward 1976
Balanidae
Balanus balanoides (Linnaeus 1767)
Balanus crenatus Brugiere 1789
Balanus improvisus Darwin 1854
Balanus sp. indet.
Elminius modestus Darwin 1854

RHIZOCEPHALA
Sacculinidae
Sacculina carcini Thompson

MALACOSTRACA

Nebalia bipes (Fabricius)

PERICARIDA

CUMACEA
Bodotriidae
 Iphinoe trispinosa (Goodsir 1843)
 Cumopsis longipes (Dohrn 1869)
 Cumopsis fagei Bacescu 1958
 Cumopsis goodsiri (van Beneden 1881)
Pseudocumatidae
 Pseudocuma longicornis (Bate 1858)

TANAIDACEA
Apseudidae
 Apseudes talpa (Montagu 1808)
Tanaidae
 Tanais dulongii (Audouin 1826)
 Pseudoparatanais batei (Sars 1882)

ISOPODA
Cirolanidae
 Eurydice pulchra Leach
Sphaeromatidae
 Sphaeroma monodi Bocguet & Hoestlandt & Levi
 Sphaeroma rugicauda Leach
 Dynamene bidentata (Adam)
Idoteidae
 Idotea baltica (Pallas)
 Idotea emarginata (Fabricius)
 Idotea granulosa Rathke
 Idotea neglecta G.O.Sars 1899
 Idotea pelagica Leach
Janiridae
 Jaera nordmanni (Rathke)
 Jaera albifrons Leach
 Jaera forsmani Bocquet 1953
 Janira maculosa Leach
 Janiropsis breviremis G.O.Sars 1899
Munnidae
 Munna kroyeri Goodsir, Bate & Westwood 1868
Ligiidae
 Ligia oceanica (Linnaeus)

AMPHIPODA
Lysianassidae
 Lysianassa ceratina (Walker 1895)
 Nannonyx goesi (Boeck 1871)
 Perrierella audouiniana (Bate 1857)
 Tryphosella sarsi Bonnier 1893
Ampeliscidae
 Ampelisca brevicornis (da Costa 1853)
 Ampelisca typica (Bate 1856)
Acanthonotozomatidae
 Iphimedea minuta G.O.Sars 1882
Leucothoidae
 Leucothoe spinicarpa (Abildgaard 1789)
Stenothoidae

Stenothoe monoculoides (Montagu 1815)
Stenothoe tergestina (Nebeski 1881)
Talitridae
Orchestia cavimana Heller 1865
Orchestia gammarellus (Pallas 1766)
Orchestia mediterranea da Costa 1857
Orchestia sp. indet.
Talitrus saltator (Montagu 1808)
Talorchestia brito Stebbing 1891
Talorchestia deshayesii (Audouin 1826)
Hyalidae
Hyale nilssoni (Rathke 1843)
Hyale perieri (Lucas 1846) ?
Hyale pontica Rathke 1837
Hyale stebbingi Chevreux 1888
Gammaridae
Chaetogammarus marinus (Leach 1815)
Chaetogammarus pirlotti (Sexton & Spooner 1940)
Chaetogammarus stoerensis (Reid 1938)
Eulimnogammarus obtusatus (Dahl 1938)
Gammarus chevreuxi Sexton 1913
Gammarus duebeni Lilljeborg 1852
Gammarus finmarchicus Dahl 1938
Gammarus locusta (Linnaeus 1758)
Gammarus oceanicus Segerstrale 1947
Gammarus salinus Spooner 1947
Melitidae
Cheirocratus sundevalli (Rathke 1843)
Melita palmata (Montagu 1804)
Haustoriidae
Bathyporeia elegans Watkin 1938
Bathyporeia guilliamsoniana (Bate 1856)
Bathyporeia pelagica (Bate 1856)
Bathyporeia pilosa Lindstom 1855
Bathyporeia sarsi Watkin 1938
Bathyporeia tenuipes Meinert 1877 ???
Haustorius arenarius (Slabber 1769)
Urothoe brevicornis Bate 1862
Urothoe elegans (Bate 1856)
Urothoe poseidonis Reibisch 1905
Oericerotidae
Perioculodes longimanus (Bate & Westwood 1868)
Pontocrates altamarinus (Bate & Westwood 1862)
Pontocrates arenarius (Bate 1858)
Phoxocephalidae
Harpinia antennaria Meinert 1890
Calliopiidae
Apherusa bispinosa (Bate 1856)
Apherusa cirrus (Bate 1862)
Apherusa jurinei (H.M.-Edwards 1830)
Apherusa ovalipes Norman & Scott 1906
Calliopius laeviusculus (Kroeyer 1838)
Gammarellus angulosus (Rathke 1843)
Atylidae
Atylus falcatus Metzger 1871
Atylus swammerdami (H.M.-Edwards 1830)
Dexaminidae
Dexamine spinosa (Montagu 1813)

Dexamine thea Boeck 1861
Tritaeta gibbosa (Bate 1862)
Ampithoidae
Ampitholina cuniculus Stebbing 1874
Ampithoe rubricata (Montagu 1808)
Ampithoe gammaroides (Bate 1856)
Ampithoe neglecta Lincoln 1976
Sunamphithoe pelagica (H.M.-Edwards 1830)
Aoridae
Aora gracilis (Bate 1857)
Lembos denticarpus Myers & McGrath 1978 ??
Lembos longipes (Lilljeborg 1852)
Lembos websteri Bate 1856
Leptocheirus tricristatus Chevreux 1887
Microdeutopus anomalus (Rathke 1843)
Isaeidae
Gammaropsis maculata (Johnston 1826)
Microprotopus maculatus Norman 1867
Corophiidae
Corophium arenarium Crawford 1937
Corophium acherusicum da Costa 1851 ??
Corophium bonnellii (H.M.-Edwards 1830)
Corophium crassicorne Bruzelius 1859
Corophium insidiosum Crawford 1937 ??
Corophium sextonae Crawford 1937
Corophium volutator (Pallas 1766)
Ischyroceridae
Ericthonius punctatus (Bate 1857)
Ischyrocerus anguipes Kroeyer 1838
Jassa falcata (Montagu 1808)
Jassa ocia (Bate 1862)
Jassa pusilla (G.O.Sars 1894)
Parajassa pelagica (Leach 1814)
Caprellidae
Phtisica marina Slabber
Caprella acanthifera Leach
Caprella dentifrons Latreille
Caprella linearis (Linnaeus)

MYSIDACEA
Mysidae
Gasteroceus sanctus (Van Beneden 1861)
Gasteroceus spinifera (Goes 1864)
Hemimysis lamornae (Couch 1856)
Paramysis arenosa (G.O.Sars 1877)
Schistomysis ornata (G.O.Sars 1864)
Praunus flexuosus (O.F.Muller 1776)
Praunus inermis (Rathke 1843)
Neomysis integer (Leach 1814)

DECAPODA
Palaemonidae
Palaemon elegans Rathke 1837
Palaemonetes varians (Leach 1814)
Hippolytidae
Hippolyte varians Leach 1814
Thoralus cranchi (Leach 1817)
Crangonidae

Crangon crangon (Linnaeus 1758)
Pontophilus trispinosus (Hailstone 1835)
Galatheidae
Galathea dispersa Bate
Galathea squamifera Leach
Porcellanidae
Porcellana longicornis (Linnaeus)
Porcellana platycheles (Pennant)
Paguridae
Pagurus bernhardus (Linnaeus)
Portunidae
Liocarcinus puber (Linnaeus 1767)
Liocarcinus depurator (Linnaeus 1758)
Carcinus maenas (Linnaeus 1758)
Atelecyclidae
Atelecyclus rotundatus (Olivi 1792)
Pirimelidae
Pirimela denticulata (Montagu 1808)
Canceridae
Cancer pagurus Linnaeus 1758
Xanthidae
Pilumnus hirtellus (Linnaeus 1761)
Xantho incisus Leach 1814
Majidae
Hyas araneus (Linnaeus 1758)
Inachus phalangium (Fabricius 1775)
Macropodia tenuirostris (Leach 1814)

INSECTA

Anurida maritima Laboulbene
Petrobius maritimus Leach
Chilopoda sp. indet.
Chironomid spp. indet.

MOLLUSCA

POLYPLACOPHORA

Ischnochitonidae
- Lepidochitona cinereus (Linnaeus 1767)
- Tonicella marmorea (Fabricius 1780)
- Tonicella rubra (Linnaeus 1767)
- Callochiton achatinus (Brown 1827)

Acanthochitonidae
- Acanthochitona crinitus (Pennant 1777)

GASTROPODA

FISSURELLACEA

Fissurellidae
- Emarginula fissura (Linnaeus 1758)
  ]E. reticulata Sowerby 1813°
- Diodora graeca (Linnaeus 1758)
  ]D. apertura (Montagu 1818)°

PATELLACEA

Acmaeidae
- Tectura testudinalis (Muller 1776)
  ]Acmaea tessulata°
- Tectura virginea (Muller 1776)
  ]Acmaea virginea°

Patellidae
- Patella ulyssiponensis Gmelin 1791
  ]P. aspera Roding 1798°
- Patella vulgata Linnaeus 1758
- Helcion pellucidum (Linnaeus 1758)
  ]Patina pellucida°

TROCHACEA

Trochidae
- Margarites helinicus (Fabricius 1780)
- Monodonta lineata (da Costa 1778)
- Gibbula cineraria (Linnaeus 1758)
- Gibbula umbilicalis (Philippi 1846)
- Calliostoma zizyphinum (Linnaeus 1758)
- Calliostoma zizyphinum var. lyonsii (Forbes & Handley 1850)

Phasianellidae
- Tricolia pullus (Linnaeus 1758)

CERITHIACEA

Diastomatidae
- Bittium reticulatum (da Costa 1778)

TRIPHORACEA

Triphoridae
- Marshallora adversa Bouchet 1984
  ]Triphora perversa (Linnaeus)°
- Cerithiopsis tubercularis (Montagu 1803)

LITTORINACEA
Lacunidae
Lacuna pallidula (da Costa 1778)
Lacuna parva (da Costa 1778)
Lacuna crassior (Montagu 1803)
Lacuna vincta (Montagu 1803)
Littorinidae
Littorina littorea (Linnaeus 1758)
Littorina neritoides (Linnaeus 1758)
Littorina mariae Sacchi & Rastelli 1966
Littorina obtusata (Linnaeus 1758)
Littorina neglecta Bean in Thorpe 1844
Littorina nigrolineata Gray 1839
Littorina saxatilis (Olivi 1792)
]Littorina patula Jefferys°
Littorina rudis (Maton 1879)

RISSOACEA
Rissoidae
Rissoa parva (da Costa 1778)
Rissoa membranacea (J.Adams 1800)
Alvania semistriata (Montagu 1808)
]Cingula semistriata°
Cingula sp. indet.
Cingula cingillus (Montagu 1803)
Onoba semicostata (Montagu 1803)
Hydrobiidae
Hydrobia ulvae (Pennant 1777)
Skeneopsidae
Skeneopsis planorbis (Fabricius 1780)

CYPRAECEA
Triviidae
Trivia monacha (da Costa 1778)

NATICACEA
Naticidae
Lunatia poliana (delle Chiaje 1826)
]Natica alderi (Forbes 1838)°

MURICACEA
Muricidae
Nucella lapillus (Linnaeus 1758)
Ocenebra erinacea (Linnaeus 1758)
Buccinidae
Buccinium undatum Linnaeus 1758
Nassaridae
Hinia incrassata (Strom 1768)

CONACEA
Turridae
Mangelia attenuata (Montagu 1803)

OPISTOBRANCHIA

PYRAMIDELLACEA
Pyramidellidae

Chrysallida obtusa (Brown 1827)

RISSOELLACEA
Rissoellidae
Rissoella diaphana (Alder 1848)
Rissoella opalina (jefferys 1848)

OMALOGYRACEA
Omalogyridae
Omalogyra atomus (Philippi 1841)

ACTEONACEA
Acteonidae
Acteon tornatilis (Linnaeus 1758)

BULLACEA
Retusidae
Retusa obtusa (Montagu 1803)

ELYSIACEA
Stiligeridae
Limapontia capitata (Muller 1774)
Limapontia senestra (Quatrefages 1844)
]Acteonia senestra°

APLYSIACEA
Aplysiidae
Aplysia punctata Cuvier 1803

PLEUROBRANCHACEA
Pleurobranchidae
Pleurobranchus membranaceus (Montagu 1815)
Berthella plumula (Montagu 1803)

ONCHIDORIDACEA
Onchidoridídae
Acanthodoris pilosa (Abildgaard in Muller 1789)
Adalaria proxima (Alder & Hancock 1854)
Onchidoris sp. indet.
Archidoridídae
Archidoris pseudoargus (Rapp 1827)
Kentrodoridídae
Jorunna tomentosa (Cluvier 1804)

AEOLIDIACEA
Flabellinidae
Coryphella verrucosa (M.Sars 1829)
Facelinidae
Facelina bostoniensis (Couthouy 1838)
Aeolodiidae
Aeolidia papillosa (Linnaeus 1761)

PELECYPODA

NUCULACEA
Nuculidae
Nucula sulcata Bronn 1831

MYTILACEA
Mytilidae
Mytilus edulis Linnaeus 1758
Musculus discors (Linnaeus 1767)
Modiolarca tumida (Hanley 1843)
]Musculus marmoratus (Forbes 1838)°
Modiolus modiolus (Linnaeus 1758)

OSTREACEA
Ostreidae
Crassostrea ap. indet.

PECTINACEA
Pectinidae
Chlamys varia (Linnaeus 1758)

ANOMIACEA
Anomidae
Anomia ephippium Linnaeus 1758
Pododesmus patelliformis (Linnaeus 1761)

LUCINACEA
Lucinidae
Lucinoma borealis (Linnaeus 1767)

GALEOMMATACEA
Lasaeidae
Lasaea rubra (Montagu 1803)
Kellidae
Kellia suborbicularis (Montagu 1803)
Montacutidae
Mysella bidentata (Montagu 1803)

CARDIACEA
Cardiidae
Cerastoderma edule (Linnaeus 1758)

MACTRACEA
Mactridae
Spisula solida (Linnaeus 1758)
Spisula subtruncata (da Costa 1778)

SOLENACEA
Cultellidae
Ensis siliqua (Linnaeus 1758)

TELINACEA
Tellinidae
Fabulina fabula (Gmelin 1791)
]Tellina fabula°
Angulus tenuis (da Costa 1778)
]Tellina tenuis°
Tellina sp. indet.
Macoma balthica (Linnaeus 1758)
Donacidae
Donax vittatus (da Costa 1778)
Scrobiculariidae

Scrobicularia plana (da Costa 1778)
Semelidae
Abra alba (Wood 1802)
Abra nitida (Muller 1776)

VENERACEA
Veneridae
Circomphalus casina (Linnaeus 1758)
Gouldia minima (Montagu 1803)
Tapes decussatus (Linnaeus 1758)
]Venerupis decussata°
Paphia rhomboides (Pennant 1777)
]Venerupis rhomboides°
Venerupis senegalensis (Gmelin 1791)
]V. pullastra (Montagu 1803)°
Chamelea gallina (Linnaeus 1758)
Turtonidae
Turtonia minuta (Fabricius 1780)

MYACEA
Myidae
Mya arenaria Linnaeus 1758
Sphenia binghami Turton 1822 ??

HIATELLACEA
Hiatellidae
Hiatella arctica (Linnaeus 1758)

THRACIACEA
Thraciidae
Thracia villosiuscula (Macgillivray 1818)

BRYOZOA

CYCLOSTOMATA
Crisiidae
Crisidia cornuta (Linnaeus)
Crisia eburnea (Linnaeus)
Crisia aculeata Hassall 1841
Crisia ramosa Harmer
Crisia denticulata (Lamarck)
Tubuliporidae
Tubulipora phalangea Couch 1844
Lichenoporidae
Lichenopora verrucaria (Fabricius 1780)

CTENOSTOMATA
Alcyonidiidae
Alcyonidium diaphanum (Hudson 1762)
Alcyonidium gelatinosum (Linnaeus 1767)
Alcyonidium hirsutum (Fleming 1828)
Alcyonidium mytili Dayell 1847
Flustrellidridae
Flustrellidra hispida (Fabricius 1780)
Walkeriidae
Walkeria uva (Linnaeus 1758)
Triticellidae
Triticella pedicellata (Alder 1857)
Vesiculariidae
Bowerbankia imbricata (Adams 1798)
Bowerbankia gracilis Leidy 1855
Bowerbankia pustulosa (Ellis & Solander 1786)

CHEILOSTOMATA (ASCOPHORA)
Cribrilinidae
Cribrilina punctata (Hassall 1841)
Cribrilina cryptooecium Norman 1903
Cribrilina annulata (Fabricius 1780)
Umbonulidae
Umbonula littoralis Hastings 1944
Exochellidae
Escharoides coccinea (Abilgaard 1886)
Cryptosulidae
Cryptosula pallasiana (Moll 1803)
Escharellidae
Escharella immersa (Fleming 1828)
Escharella ventricosa (Hassall 1842)
Schizoporellidae
Schizoporella unicornis (Johnston in Wood 1844)
Schizoporella dunkeri (Reuss 1848)
Schizomavella auriculata (Hassall 1842)
Schizomavella linearis (Hassall 1841)
Phaeostachys spinifera (Johnston 1847)
Microporellidae
Microporella ciliata (Pallas 1766)
Fenestrulina malusii (Audouin 1826)
Haplopoma impressum (Audouin 1826)
Haplopoma graniferum (Johnston 1847)
Hippothoidae

Celleporella hyalina (Linnaeus 1767)
Celleporidae
Cellepora pumicosa (Pallas 1766)
Celleporina hassallii (Johnston 1847)
Celleporina decipiens Hayward 1976
Turbicellepora avicularis (Hincks 1860)

CHEILOSTOMATA (ANASCA)
Aeteidae
Aetea anguina (Linnaeus 1758)
Aetea sica (Couch 1844)
Scruparidae
Scruparia ambigua (d'Orbigny 1841)
Scruparia chelata (Linnaeus 1758)
Eucrateidae
Eucratea loricata (Linnaeus 1758)
Membraniporidae
Membranipora membranacea (Linnaeus 1767)
Conopeum reticulum (Linnaeus 1767)
Electridae
Electra pilosa (Linnaeus 1767)
Electra crustulenta (Pallas 1766)
Flustridae
Flustra foliacea (Linnaeus 1758)
Carbasea carbasea (Ellis & Solander 1786)
Securiflustra securifrons (Pallas 1766)
Calloporidae
Callopora lineata (Linnaeus 1767)
Callopora dumerilii (AQudouin 1826)
Callopora rylandi Bobin & Prenant 1965
Callopora craticula (Alder 1856)
Cauloramphus spiniferum (Johnston 1832)
Membraniporella nitida (Johnston 1838)
Scrupocellariidae
Scrupocellaria reptans (Linnaeus 1767)
Scrupocellaria scruposa (Linnaeus 1758)
Bicellariellidae
Bicellariella ciliata (Linnaeus 1758)
Bugulidae
Bugula turbinata Alder

ECHINODERMATA

CRINOIDEA

COMATULIDA
Antedonidae
Antedon bifida (Pennant 1777)

ASTEROIDEA

SPINULOSA
Asterinidae
Asterina gibbosa (Pennant 1777)
Asterina phylactica Emson & Crump 1979
Solasteridae
Solaster endeca (Linnaeus 1771)
Crossaster pappopsus (Linnaeus 1767)
Echinasteridae
Henricia sanguinolenta (O.F.Muller 1776)

FORCIPULATA
Asteriidae
Asterias rubens Linnaeus 1758
Leptasterias mulleri (M.Sars 1846)
Marthasterias glacialis (Linnaeus 1758)

OPHIUROIDEA

OPHIURAE
Ophiotrichidae
Ophiothrix fragilis (Abildgaard 1789)
Ophiocomidae
Ophiocomina nigra (Abildgaard 1789)
Ophiactidae
Ophiopholis aculeata (Linnaeus 1766)
Ophiolepidae
Ophiura texturata Lamarck 1816

ECHINOIDEA

DIADEMATOIDEA
Echinidae
Psammechinus miliaris (Gmelin 1778)
Echinus esculentus Linnaeus 1758

SPATANGOIDEA
Spatangidae
Echinocardium cordatum (Pennant 1777)

DENDROCHIROTA
Cucumariidae
Pawsonia saxicola (Brady & Robertson 1872)
Ocnus lactea (Forbes & Goodsir 1867)

Ocnus planci (Brandt 1855)
Thyone fusus (O.F.Muller 1788)

APODA
Synaptidae
Leptosynapta inhaerens (O.F.Muller 1776)

CHORDATA (TUNICATA)

ASCIDIACEA

ENTEROGONA
Clavelinidae
Clavelina lepadiformis (O.F.Muller 1776)
Distaplia rosea delle Valle 1881
Polyclinidae
Polyclinum aurantium M.-Edwards 1841
Sidnyum turbinatum Savigny 1816
Aplidium pallidum (Verrill 1871)
Aplidium proliferum (M.-Edwards 1841)
Aplidium punctum (Giard 1873)
Didemnidae
Trididemnum tenerum Verrill
Didemnum maculosum (M.-Edwards 1841)
Diplosoma listerianum (M.-Edwards 1841)
Cionidae
Cionia intestinalis (Linnaeus 1767)
Perophoridae
Perophora listeri Forbes 1848
Corellidae
Corella parallelogramma (O.F.Muller 1776)
Ascidiidae
Ascidiella aspersa (O.F.Muller 1776)
Ascidiella scabra (O.F.Muller 1776)
Ascidia mentula O.F.Muller 1776
Ascidia conchilega O.F.Muller 1776

PLEUROGONA
Styelidae
Styela coriacea (Alder & Hancock 1848)
Dendrodoa grossularia (van Beneden 1846)
Botryllus schlosseri (Pallas 1766)
Botrylloides leachi (Savigny 1816)
Pyuridae
Pyura tessellata (Forbes 1848)
Pyura squamulosa (Alder 1863)
Pyura microcosmus (Savigny 1816)
Pyura sp. indet.
Molgulidae
Mogula manhattensis (De Kay 1843)

CHORDATA (OSTEICHTHYES)

TELEOSTEI

ANGUILLIFORMES
Anguillidae
 Anguilla anguilla (Linnaeus 1758)
Congeridae
 Conger conger (Linnaeus 1758)

GOBIESOCIFORMES
Gobiesocidae
 Lepadogaster lepadogaster (Bonnaterre 1788)

GADIFORMES
Gadidae
 Ciliata mustella (Linnaeus 1758)

GASTEROSTEIFORMES
Gasterosteidae
 Gasterosteus aculeatus Linnaeus 1758
 Spinachia spinachia (Linnaeus 1758)

SYNGNATHIFORMES
Syngnathidae
 Nerophis ophidion (Linnaeus 1758)
 Nerophis lumbriciformis (Jenyns 1835)

SCORPAENIFORMES
Cyclopteridae
 Cyclopterus lumpus Linnaeus 1758

PERCIFORMES
Blenniidae
 Lipophrys pholis (Linnaeus 1758)
Pholidae
 Pholis gunnellus (Linnaeus 1758)
Ammodytidae
 Ammodytes tobianus Linnaeus 1758
Gobiidae
 Gobius paganellus Linnaeus 1758
 Pomatoschistus pictus (Malm 1863)

PLEURONECTIFORMES
Pleuronectidae
 Limanda limanda (Linnaeus 1758)

FLORA

CHLOROPHYTA

Blidingia marginata (J.Ag.) P.Dang.
Blidingia minima (Nag. ex Kutz.) Kylin
Bryopsis hypnoides Lamour
Bryopsis plumosa (Huds.) C.Ag.
Capsosiphon fulvescens (C.Ag.) Setch. et Gardn.
Chaetomorpha capillaris (Kutz.) Borg.
Chaetomorpha linum (O.F.Mull.) Kutz.
Chaetomorpha melagonium (Web. et Mohr.) Kutz.
Chlorochytrium cohnii Wright
Cladophora albida (Huds.) Kutz.
Cladophora hamosa Kutz.
Cladophora hutchinsiae (Dillw.) Kutz.
Cladophora laetivirens (Dillw.) Kutz.
Cladophora oblitterata Soderstrom
Cladophora pellucida (Huds.) Kutz.
Cladophora retroflexa (Bonnem. et Crouan frat.) Hoek
Cladophora rupestris (L.) Kutz.
Cladophora sericea (Huds.) Kutz.
Codiolum sp. indet
Codium fragile spp. atlanticum (Cotton) Silva
Codium fragile spp. tomentosoides (Goor) Silva
Codium tomentosum Stackh.
Enteromorpha clathrata (Roth) Grev.
Enteromorpha compressa (L.) Grev.
Enteromorpha flexuosa (Wulf. ex Roth) J.Ag.
Enteromorpha intestinalis (L.) Link
Enteromorpha linza (L.) J.Ag.
Enteromorpha prolifera (O.F.Mull.) J.Ag.
Enteromorpha ramulosa (Sm.) Hook.
Enteromorpha torta (Mert. in Jurg.) Reinb.
Enteromorpha sp. indet.
Endoderma perforans Huber
Epicladia flustrae Reinke
Hormidium sp.
Monostroma fuscum (Post. et Rupr.) Wittr.
Monostroma grevillei (Thur.) Wittr.
Monostroma obscurum (Kutz.) J.Ag.
Monostroma oxyspermum (Kutz.) Doty
Percusaria percursa (C.Ag.) Rosenv.
Phaeophila dendroides (Crouan frat.) Batt.
Phaeophila viridis (Reinke) Burrows
Phaeophila wittrockii (Wille) Nielsen
Prasiola stipitata Suhr in Jenssen
Pringsheimiella scutata (Reinke) Marchew.
Rhizoclonium riparium (Roth.) Harv.
Rosenvingiella polyrhiza (Rosenv.) Silva
Spongomorpha aeruginosa (L.) Hoek
Spongomorpha arcta (Dillw.) Kutz.
Tellamia contorta Batt.
Tellamia intricata Batt.
Ulothrix flacca (Dillw.) Thur. in Le Jol.
Ulothrix palusalsa Lokhorst
Ulothrix speciosa (Carm. ex Harv. in Hook.) Kutz.
Ulothrix subflaccida Wille

Ulva lactuca L.
Ulvella lens Crouan frat.
Urospora bangioides (Harv.) Batt.
Urospora penicilliformis (Roth) Aresch.
Urospora wormskjoldii (Mert. in Hornem.) Rosenv.

PHAEOPHYTA

Acinetospora crinita (Carm. ex Harv. in Hook.) Kornm.
Alaria esculenta (L.) Grev.
Ascophyllum nodosum (L.) Le Jol.
Asperococcus compressus Griff. ex Hook.
Asperococcus fistulosus (Huds.) Hook.
Asperococcus turneri (Sm.) Hook.
Chorda filum (L.) Stackh.
Chorda tomentosum Lyngb.
Chordaria flagelliformis (O.F.Mull.) C.Ag.
Cladostephus spongiosus (Huds.) C.Ag.
Colpomenia peregrina Sauv.
Cystoseira nodicaulis (With.) Roberts
Desmarestia aculeata (L.) Lamour
Desmarestia viridis (O.F.Mull.) Lamour
Dictyosiphon chordaria Aresch.
Dictyosiphon foeniculaceus (Huds.) Grev.
Dictyota dichotoma (Huds.) Lamour
Ectocarpus fasciculatus Harv.
Ectocarpus siliculosus (Dillw.) Lyngb.
Elachista fucicola (Vell.) Aresch.
Elachista flaccida (Dillw.) Aresch.
Elachista scutulata (Sm.) Aresch.
Eudesme virescens (Carm. et Harv. in Hook.) J.Ag.
Feldmannia globifera (Kutz.) Hamel
Feldmannia sp. indet
Fucus ceranoides L.
Fucus serratus L.
Fucus spiralis L.
Fucus vesiculosus L.
Giffordia granulosa (Sm.) Hamel
Giffordia hincksiae (Harv.) Hamel
Giffordia ovata (Kjellm.) Kylin
Giffordia sandriana (Zanard.) Hamel
Giffordia secunda (Kutz.) Batt.
Giffordia sp. indet
Halidrys siliquosa (L.) Lyngb.
Himanthalia elongata (L.) S.F.Gray
Isthmoplea sphaerophora (Carm. ex Harv. in Hook.) Kjellm.
Laminaria digitata (Huds.) Lamour
Laminaria hyperborea (Gunn.) Fosl.
Laminaria saccharina (L.) Lamour
Laminariocolax tomentosoides (Farl.) Kylin
Leathesia difformis (L.) Aresch.
Leptonematella fasciculata (Reinke) Silva
Litosiphon filiformis (Reinke) Batt.
Litosiphon laminariae (Lyngb.) Harv.
Litosiphon pusillus (Carm. ex Hook.) Harv.
Myriactula sp. indet
Myrionema strangulans Grev.
Myriotrichia clavaeformis Harv.
Pelvetia canaliculata (L.) Dcne. et Thur.
Petalonia fascia (O.F.Mull.) O.Kuntze
Petalonia zosterifolia (Reinke) O.Kuntze
Pilayella littoralis (L.) Kjellm.
Pseudolithoderma extensum (Crouan frat.) S.Lund

Punctaria latifolia Grev.
Punctaria tenuissima (C.Ag.) Grev.
Ralfsia clavata (Harv. et Hook.) Crouan frat.
Ralfsia verrucosa (Aresch.) J.Ag.
Saccorhiza polyschides (Lightf.) Batt.
Scytosiphon lomentaria (Lyngb.) Link
Sphacelaria cirrosa (Roth) C.Ag.
Sphacelaria fusca (Huds.) S.F.Gray
Sphacelaria plumosa Lyngb.
Sphacelaria radicans (Dillw.) C.Ag.
Sphacelaria sp. indet
Spongonema tomentosum (Huds.) Kutz.
Streblonema sp. indet

RHODOPHYTA

Acrosorium reptans (Crouan frat.) Kylin
Acrosorium uncinatum (Turn.) Kylin
Ahnfeltia plicata (Huds.) Fries
Antithamnion cruciatum (C.Ag.) Nag.
Antithamnion spirographidis Schiffner
Audouinella alariae (Jones) Woelkerling
Audouinella concrescens (Drew) Dixon
Audouinella endophytica (Batt.) Dixon
Audouinella floridula (Dillw.) Woelkerling
Audouinella membranacea (Magn.) Papenf.
Audouinella microscopica (Nag. in Kutz.) Woelkerling
Audouinella purpurea (Lightf.) Woelkerling
Audouinella secundata (Lyngb.) Dixon
Audouinella sparsa (Harv.) Dixon
Audouinella virgatula (Harv.) Dixon
Audouinella sp. indet
Bangia atropurpurea (Roth) C.Ag.
Bonnemaisonia asparagoides (Woodw.) C.Ag.
Bonnemaisonia hamifera Hariot
Bostrychia scorpioides (Huds.) Mont.
Callithamnion byssoides Arnott ex Harv. in Hook.
Callithamnion corymbosum (Sm.) Lyngb.
Callithamnion granulatum (Ducluz.) C.Ag.
Callithamnion hookeri (Dillw.) S.F.Gray
Callithamnion roseum (Roth) Lyngb.
Callithamnion sepositum (Gunn.) Dixon et Price
Callithamnion spongiosum Harv. in Hook.
Callithamnion tetragonum (With.) S.F.Gray
Callithamnion tetricum (Dillw.) S.F.Gray
Callophyllis laciniata (Huds.) Kutz.
Catenella caespitosa (With.) Dixon et L.Irvine
Ceramium ciliatum (Ellis) Ducluz
Ceramium deslongschampsii Chauv.
Ceramium diaphanum (Lightf.) Roth
Ceramium echionotum J.Ag.
Ceramium flabelligerum J.Ag.
Ceramium rubrum (Huds.) C.Ag.
Ceramium shuttleworthianum (Kutz.) Rabenh.
Chondrus crispus Stackh.
Chylocladia verticillata (Lightf.) Bliding
Corallina officinalis L.
Cruoria pellita (Lyngb.) Fries
Cryptopleura ramosa (Huds.) Kylin ex Newton
Cystoclonium purpureum (Huds.) Batt.
Delesseria sanguinea (Huds.) Lamour
Dermatolithon confinis (Crouan frat.)
Dermatolithon corallinae (Crouan frat.) Fosl.
Dilsea carnosa (Schmidel) O.Kuntze
Dumontia incrassata (O.F.Mull.) Lamour
Erythrocladia irregularis Rosenv.
Erythrotrichia carnea (Dillw.) J.Ag.
Fosliella sp. indet
Furcellaria lumbricalis (Huds.) Lamour
Gastroclonium ovatum (Huds.) Papenf.
Gelidium latifolium (Grev.) Born. et Thur.

Gelidium pusillum (Stackh.) Le Jol.
Gigartina stellata (Stackh. in With.) Batt.
Goniotrichium alsidii (Zanard.) Howe
Gracilaria verrucosa (Huds.) Papenf.
Griffithsia corallinoides (L.) Batt.
Griffithsia flosculosa (Ellis) Batt.
Halurus equisetifolius (Lightf.) Kutz.
Heterosiphonia plumosa (Ellis) Batt.
Hildenbrandia rubra (Sommerf.) Menegh.
Hypoglossum woodwardii Kutz.
Laurencia hybrida (DC.) Lenorm. ex Duby
Laurencia pinnatifida (Huds.) Lamour
Lithophyllum crouanii Foslie
Lithophyllum incrustans Phil.
Lithophyllum orbiculatum (Fosl.) Fosl.
Lithophyllum sp. indet
Lithothamnion glaciale Kjellm.
Lomentaria articulata (Huds.) Lyngb.
Lomentaria clavellosa (Turn.) Gaill.
Lomentaria orcadensis (Harv.) Coll. ex Taylor
Melobesia membranacea (Esper.) Lamour
Membranoptera alata (Huds.) Stackh.
Mesophyllum lichenoides (L.) Lemoine
Nemalion helminthoides (Vell. in With.) Batt.
Odonthalia dentata (L.) Lyngb.
Palmaria palmata (L.) O.Kuntze
Petrocelis cruenta J.Ag.
Peyssonnelia dubyi Crouan frat.
Peyssonnelia sp. indet
Phycodrys rubens (L.) Batt.
Phyllophora crispa (Huds.) Dixon
Phyllophora pseudoceranoides (S.G.Gmel.) Newr. et A.R.A.Taylor
Phyllophora traillii Holm. ex Batt.
Phyllophora truncata (Pall.) Zinova
Phymatolithon laevigatum (Fosl.) Fosl.
Phymatolithon lenormandii (Aresch. in J.Ag.) Adey
Phymatolithon polymorphum (L.) Fosl.
Phymatolithon rugulosum Adey
Plocamium cartilagineum (L.) Dixon
Plumaria elegans (Bonnem.) Schmitz
Pneophyllum confervicolum (Kutz.) Y.Chamberlain
Pneophyllum sp. indet
Polyides rotundus (Huds.) Grev.
Polyneura sp. indet
Polysiphonia brodiaei (Dillw.) Spreng.
Polysiphonia elongata (Huds.) Spreng.
Polysiphonia fibrata (Dillw.) Harv. in Hook.
Polysiphonia fibrillosa (Dillw.) Spreng.
Polysiphonia lanosa (L.) Tandy
Polysiphonia macrocarpa Harv. in Mackay
Polysiphonia nigra (Huds.) Grev.
Polysiphonia nigrescens (Huds.) Grev.
Polysiphonia urceolata (Lightf. ex Dillw.) Grev.
Polysiphonia violacea (Roth) Spreng
Porphyra leucosticta Thur. in Le Jol.
Porphyra linearis Grev.
Porphyra purpurea (Roth) C.Ag.
Porphyra umbilicalis (L.) J.Ag.

Porphyropsis coccinea (J.Ag. ex Aresch.) Rosenv.
Pterocladia capillacea (S.G.Gmel.) Born. et Thur.
Pterosiphonia complanata (Clem.) Falkenb.
Pterosiphonia parasitica (Huds.) Falkenb.
Pterosiphonia thuyoides (Harv. in Mackay) Schmitz
Ptilota plumosa (Huds.) C.Ag.
Ptilothamnion pluma (Dillw.) Thur. in Le Jol.
Rhodomela confervoides (Huds.) Silva
Rhodomela lycopodioides (L.) C.Ag.
Rhodymenia pseudopalmata (Lamour) Silva
Schmitziella endophloea Born. et Batt. in Batt.
Titanoderma pustulatum (Lamour.) Woelk., Chamberlain et Silva
Trailliella intricata Bat. "tetrasp. of Bonnemaisonia sp."

CHRYSOPHYTA

Vaucheria sp. indet

"LICHENS"

Verrucaria maura
Verrucaria mucosa
Lichina pygmaea

"HIGHER PLANTS"

Zostera angustifolia (Hornem.) Reinchb.
Zostera marina L.

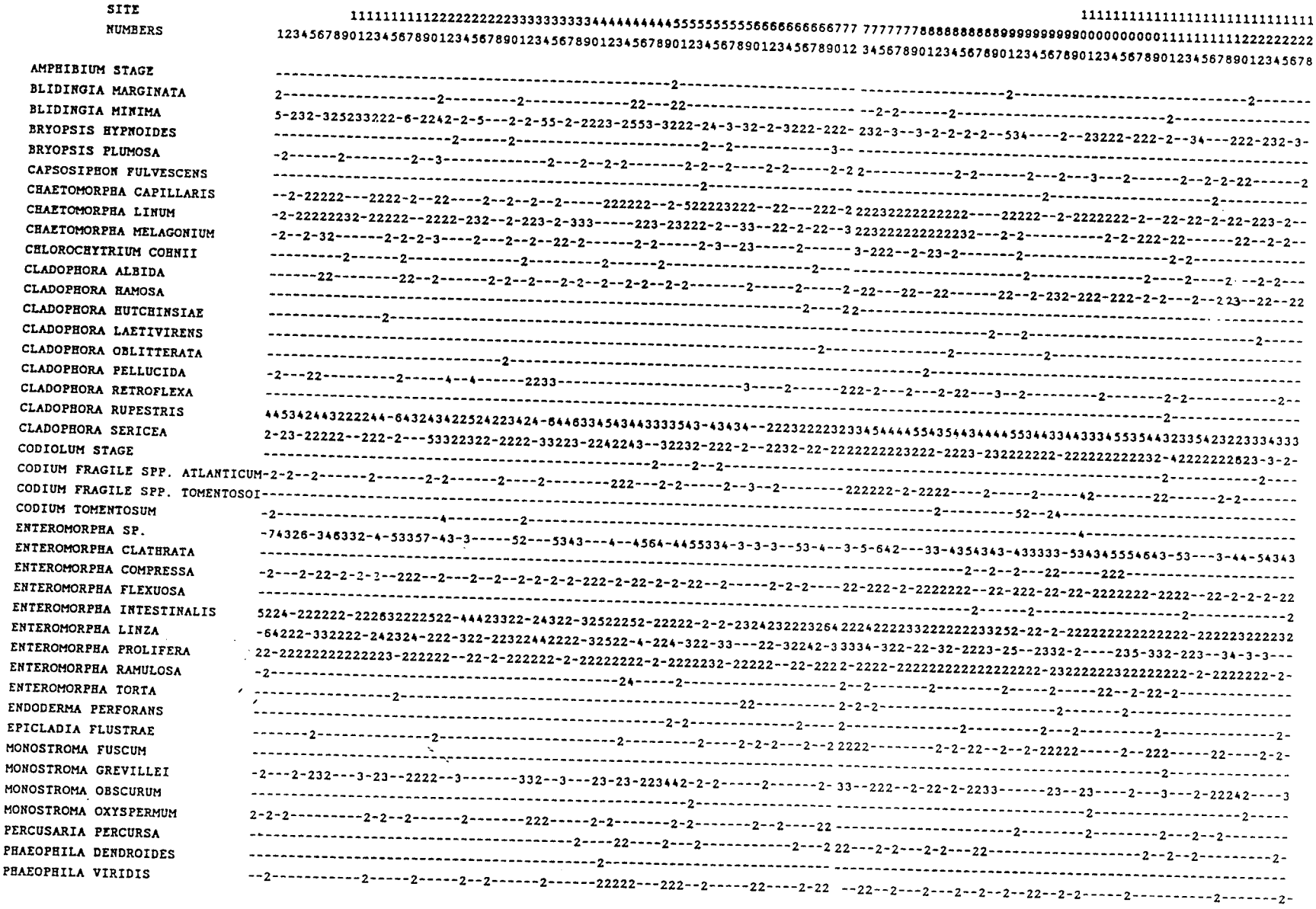
APPENDIX VIII

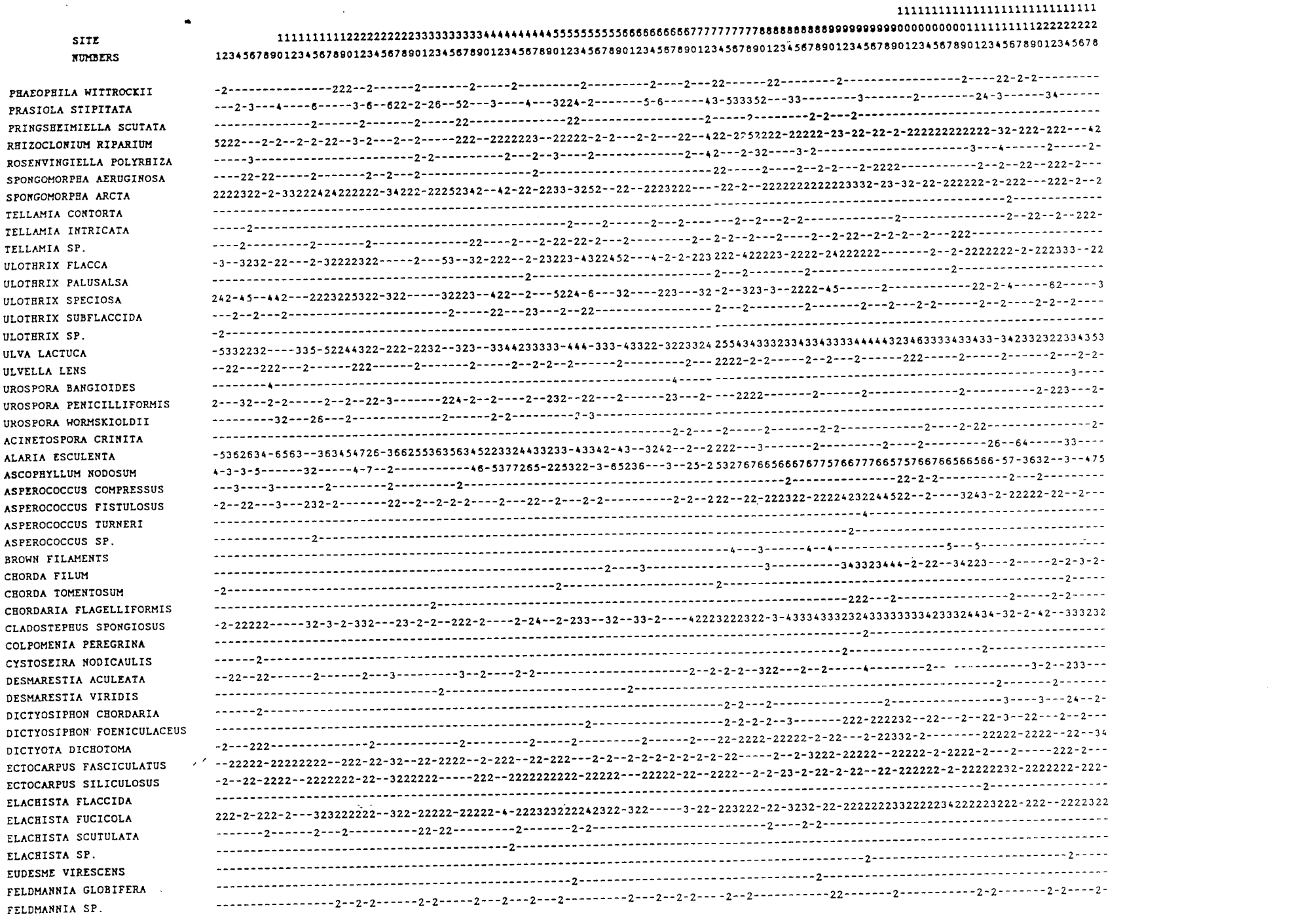
STAGE II DATA MATRICES FOR ROCKY AND SEDIMENTARY SHORES.

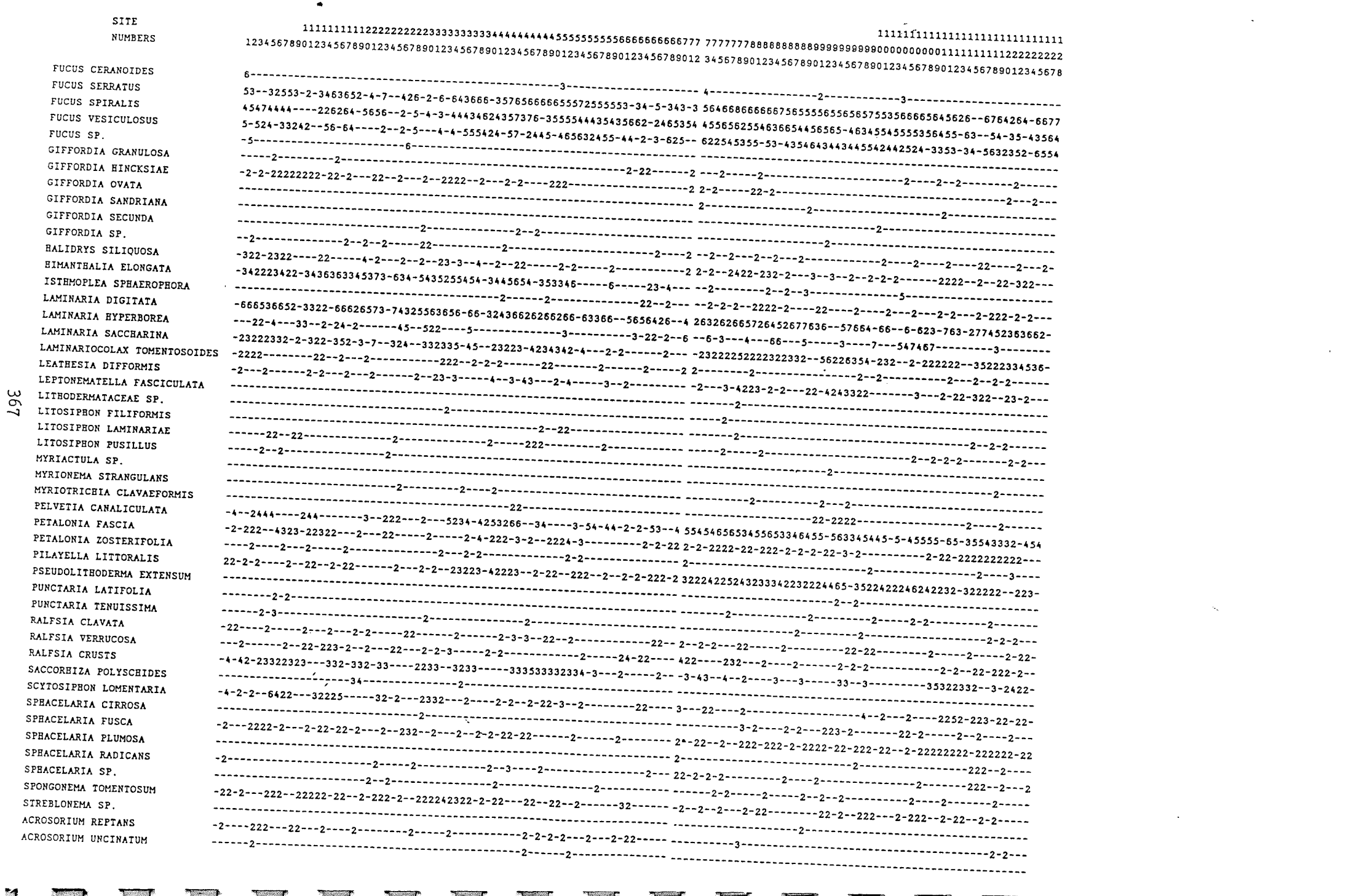
(i) Rocky shores

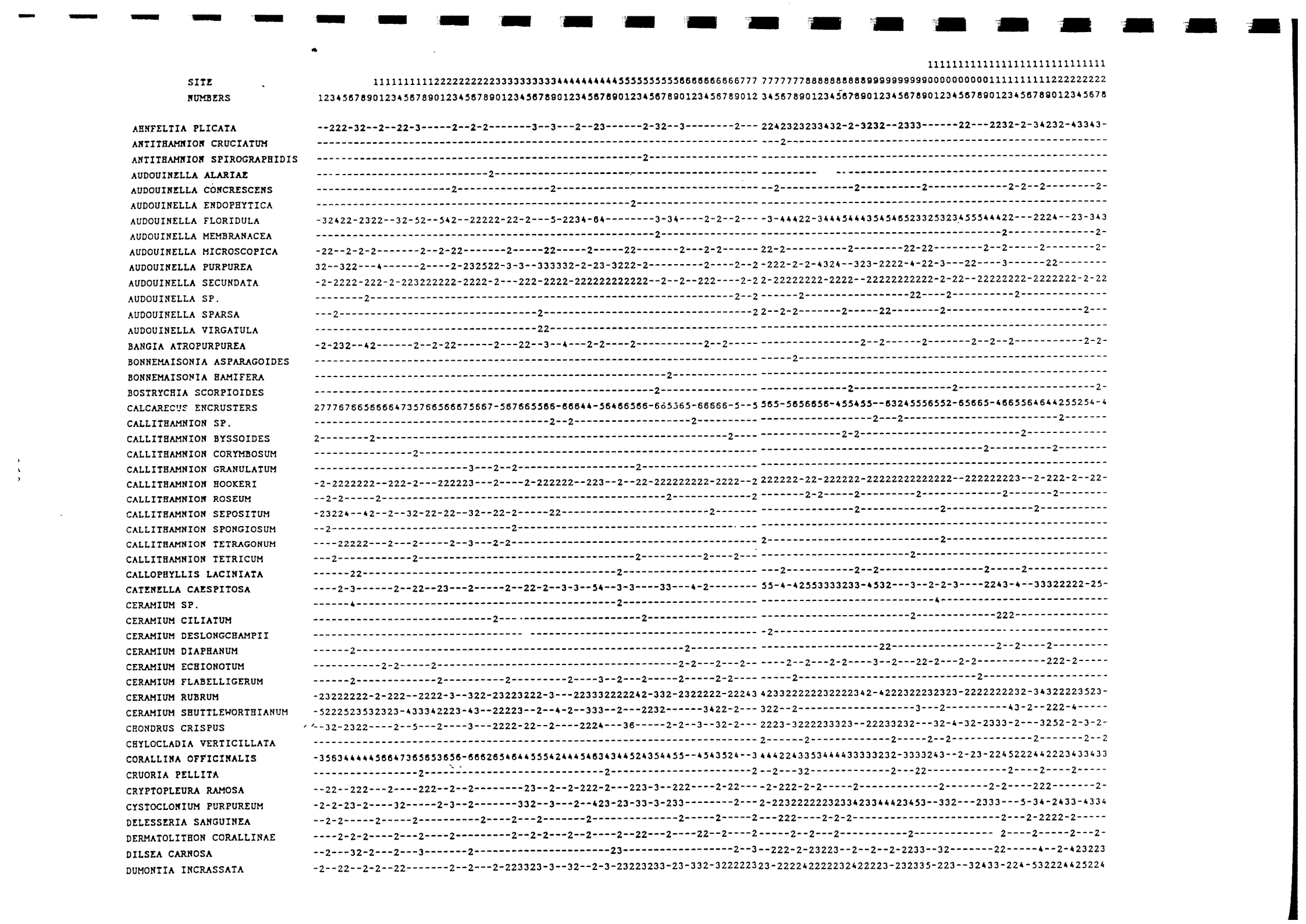
(ii) Sedimentary shores

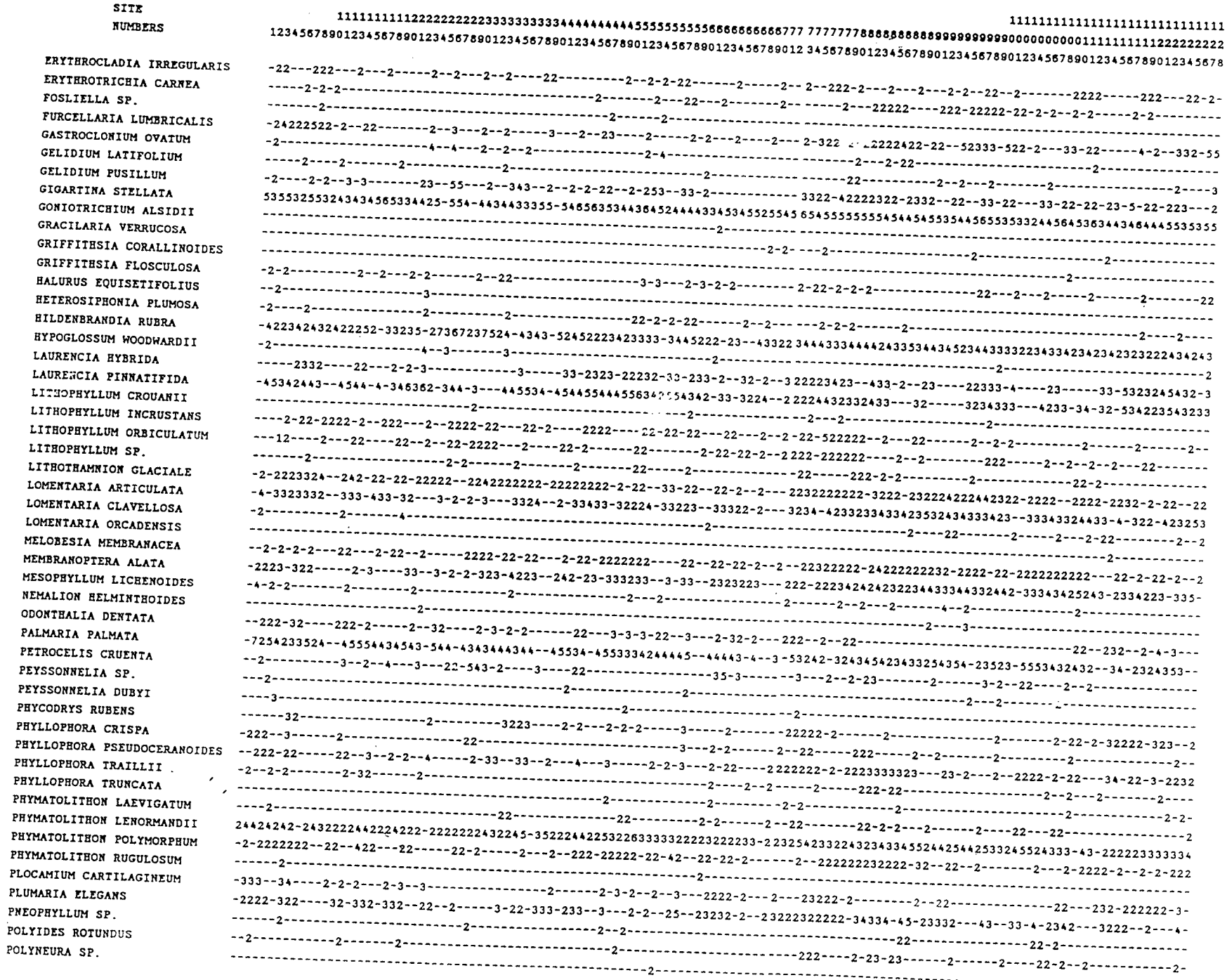
Stage II Survey Data Matrix of Site against Species.
The values in the table refer to the semi-quantitative abundance score
in Table V.IX, see Appendix V.



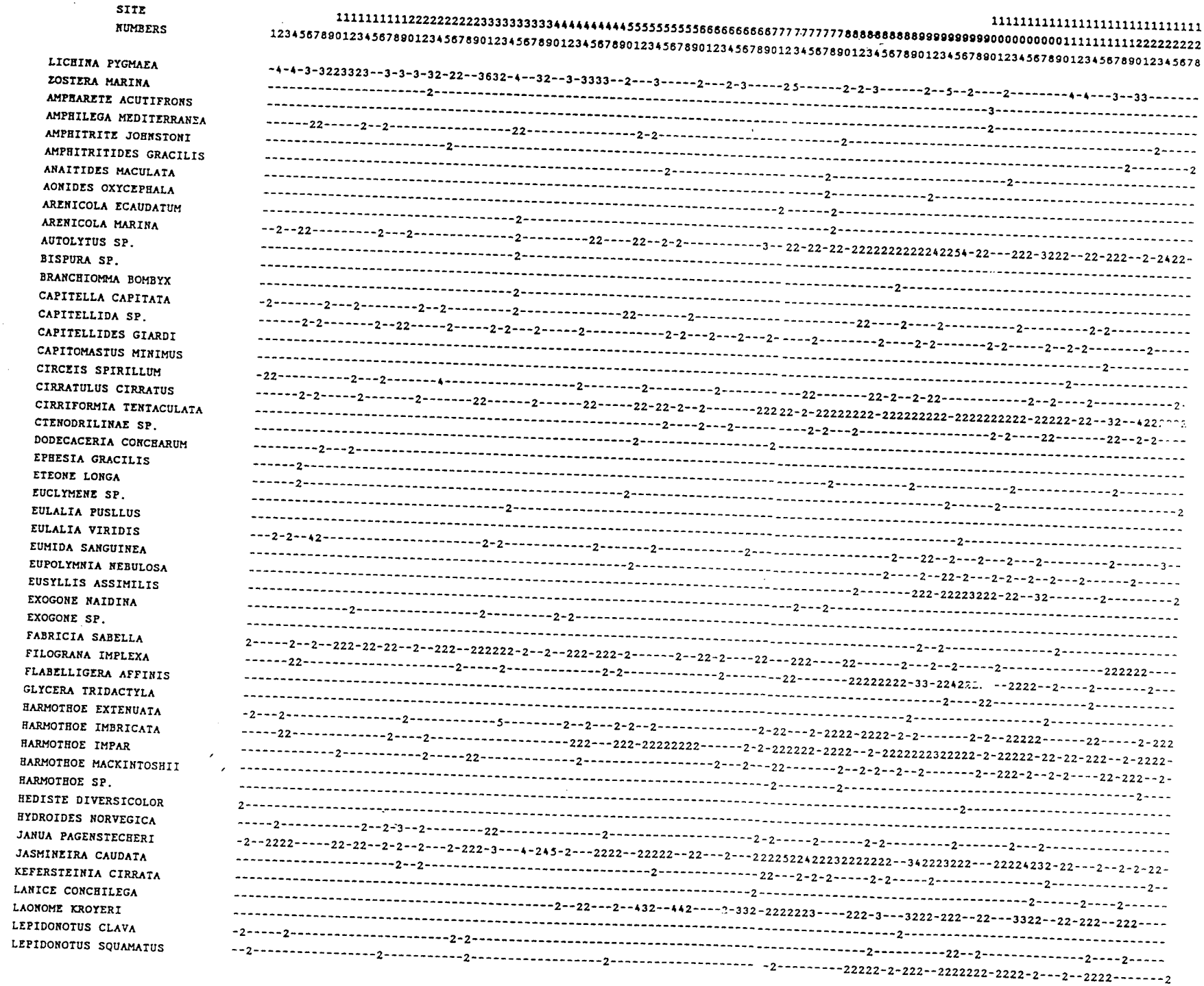

SITE NUMBERS
PHAEOPHILA WITTROCKII
PRASIOLA STIPITATA
PRINGSHEIMIELLA SCUTATA
RHIZOCLONIUM RIPARIUM
ROSENVINGIELLA POLYRHIZA
SPONGOMORPHA AERUGINOSA
SPONGOMORPHA ARCTA
TELLAMIA CONTORTA
TELLAMIA INTRICATA
TELLAMIA SP.
ULOTHRIX FLACCA
ULOTHRIX PALUSALSA
ULOTHRIX SPECIOSA
ULOTHRIX SUBFLACCIDA
ULOTHRIX SP.
ULVA LACTUCA
ULVELLA LENS
UROSPORA BANGIOIDES
UROSPORA PENICILLIFORMIS
UROSPORA WORMSKIOLDII
ACINETOSPORA CRINITA
ALARIA ESCULENTA
ASCOPHYLLUM NODOSUM
ASPEROCOCCUS COMPRESSUS
ASPEROCOCCUS FISTULOSUS
ASPEROCOCCUS TURNERI
ASPEROCOCCUS SP.
BROWN FILAMENTS
CHORDA FILUM
CHORDA TOMENTOSUM
CHORDARIA FLAGELLIFORMIS
CLADOSTEPHUS SPONGIOSUS
COLPOMENIA PEREGRINA
CYSTOSEIRA NODICAULIS
DESMARESTIA ACULEATA
DESMARESTIA VIRIDIS
DICTYOSIPHON CHORDARIA
DICTYOSIPHON FOENICULACEUS
DICTYOTA DICHOTOMA
ECTOCARPUS FASCICULATUS
ECTOCARPUS SILICULOSUS
ELACHISTA FLACCIDA
ELACHISTA FUCICOLA
ELACHISTA SCUTULATA
ELACHISTA SP.
EUDESME VIRESCENS
FELDMANNIA GLOBIFERA
FELDMANNIA SP.

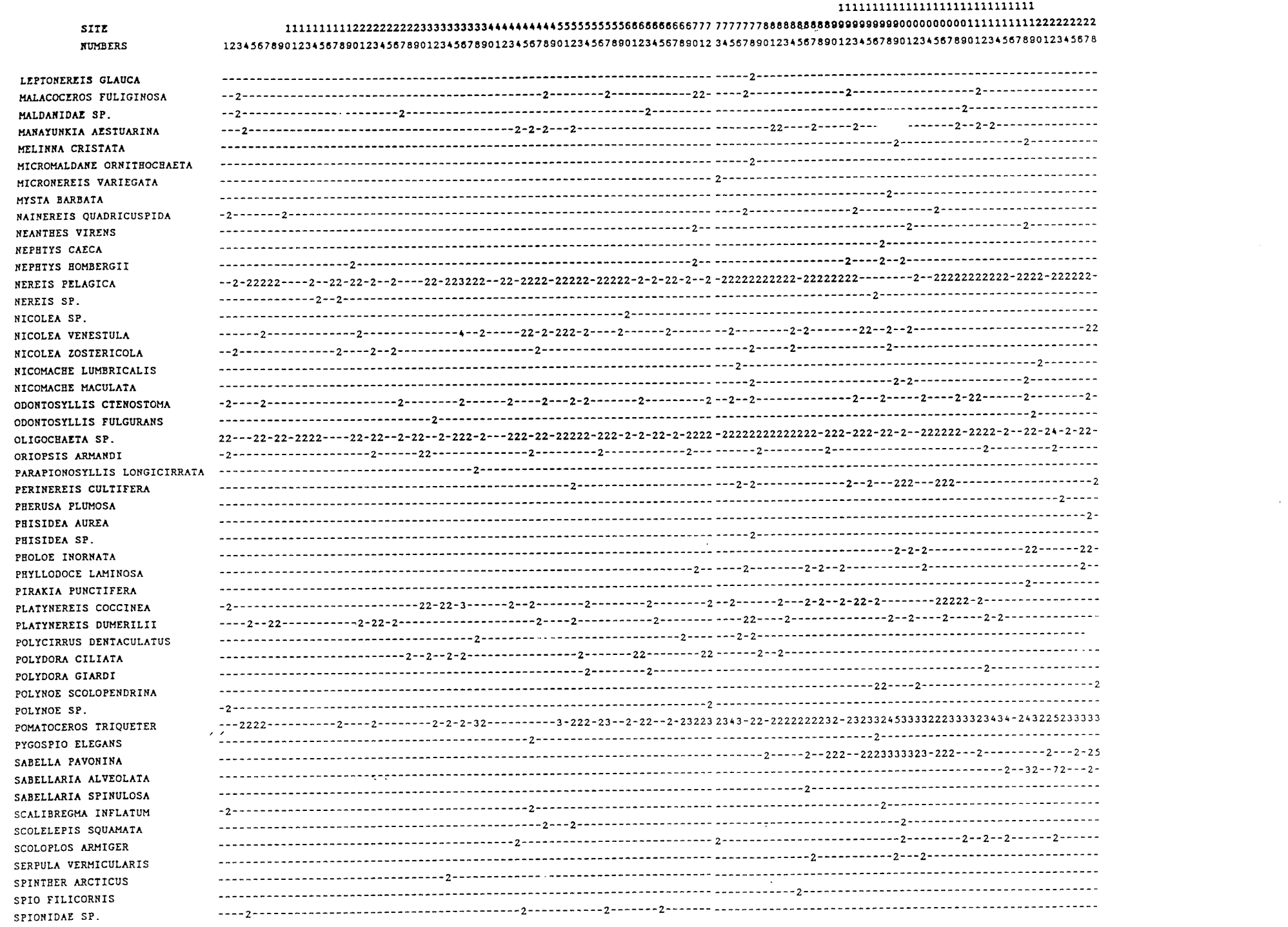

SITE
NUMBERS
FUCUS CERANOIDES
FUCUS SERRATUS
FUCUS SPIRALIS
FUCUS VESICULOSUS
FUCUS SP.
GIFFORDIA GRANULOSA
GIFFORDIA HINCKSIAE
GIFFORDIA OVATA
GIFFORDIA SANDRIANA
GIFFORDIA SECUNDA
GIFFORDIA SP.
HALIDRYS SILIQUOSA
HIMANTHALIA ELONGATA
ISTHMOPLEA SPHAEROPHORA
LAMINARIA DIGITATA
LAMINARIA HYPERBOREA
LAMINARIA SACCHARINA
LAMINARIOCOLAX TOMENTOSOIDES
LEATHESIA DIFFORMIS
LEPTONEMATELLA FASCICULATA
LITHODERMATACEAE SP.
LITOSIPHON FILIFORMIS
LITOSIPHON LAMINARIAE
LITOSIPHON PUSILLUS
MYRIACTULA SP.
MYRIONEMA STRANGULANS
MYRIOTRICHIA CLAVAEFORMIS
PELVETIA CANALICULATA
PETALONIA FASCIA
PETALONIA ZOSTERIFOLIA
PILAYELLA LITTORALIS
PSEUDOLITHODERMA EXTENSUM
PUNCTARIA LATIFOLIA
PUNCTARIA TENUISSIMA
RALFSIA CLAVATA
RALFSIA VERRUCOSA
RALFSIA CRUSTS
SACCORHIZA POLYSCHIDES
SCYTOSIPHON LOMENTARIA
SPHACELARIA CIRROSA
SPHACELARIA FUSCA
SPHACELARIA PLUMOSA
SPHACELARIA RADICANS
SPHACELARIA SP.
SPONGONEMA TOMENTOSUM
STREBLONEMA SP.
ACROSORIUM REPTANS
ACROSORIUM UNCINATUM

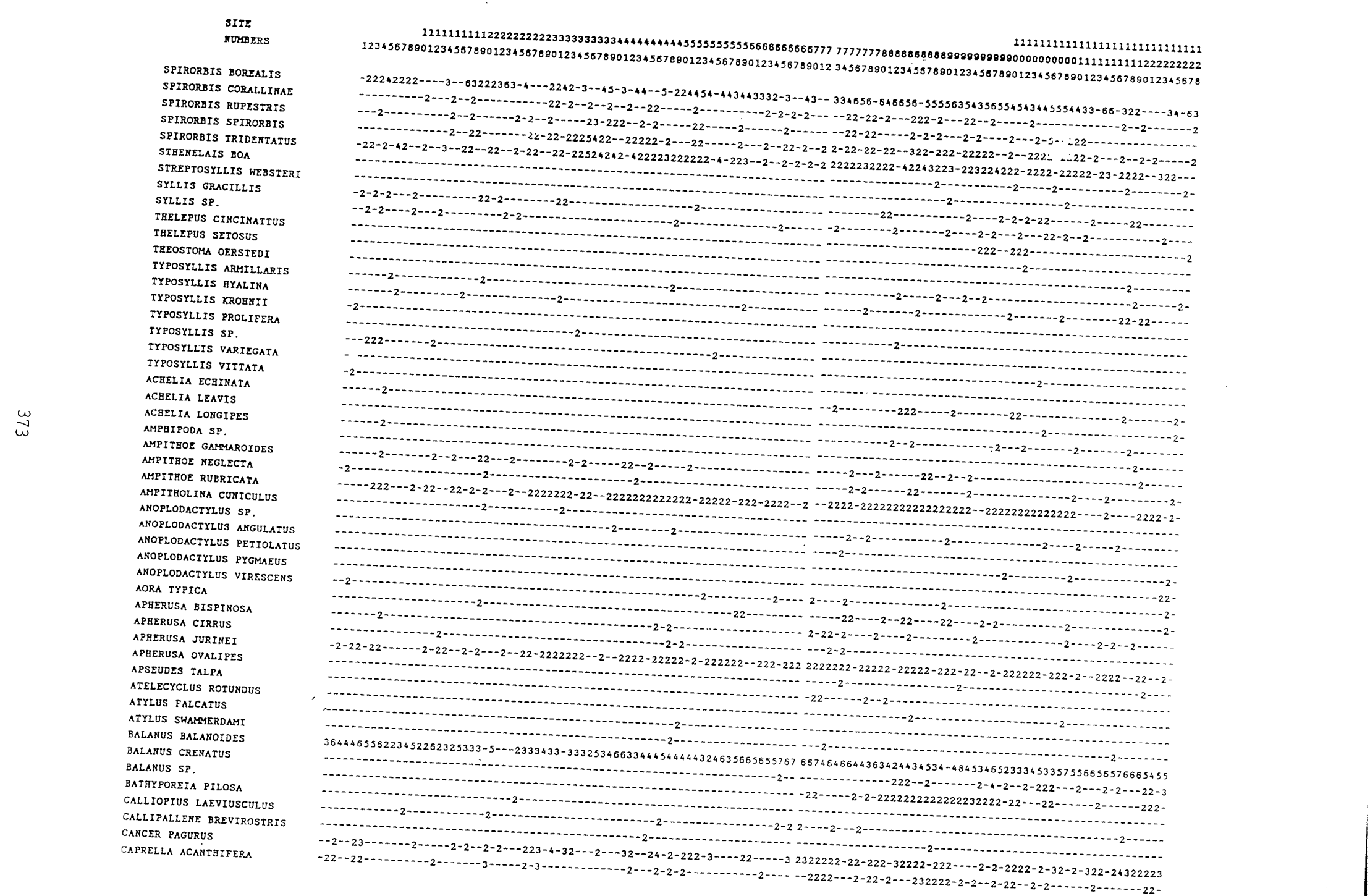

SITE
NUMBERS
AENFELTIA PLICATA
ANTITHAMNION CRUCIATUM
ANTITHAMNION SPIROGRAPHIDIS
AUDOUINELLA ALARIAE
AUDOUINELLA CONCRESCENS
AUDOUINELLA ENDOPHYTICA
AUDOUINELLA FLORIDULA
AUDOUINELLA MEMBRANACEA
AUDOUINELLA MICROSCOPICA
AUDOUINELLA PURPUREA
AUDOUINELLA SECUNDATA
AUDOUINELLA SP.
AUDOUINELLA SPARSA
AUDOUINELLA VIRGATULA
BANGIA ATROPURPUREA
BONNEMAISONIA ASPARAGOIDES
BONNEMAISONIA HAMIFERA
BOSTRYCHIA SCORPIOIDES
CALCARECUS ENCRUSTERS
CALLITHAMNION SP.
CALLITHAMNION BYSSOIDES
CALLITHAMNION CORYMBOSUM
CALLITHAMNION GRANULATUM
CALLITHAMNION HOOKERI
CALLITHAMNION ROSEUM
CALLITHAMNION SEPOSITUM
CALLITHAMNION SPONGIOSUM
CALLITHAMNION TETRAGONUM
CALLITHAMNION TETRICUM
CALLOPHYLLIS LACINIATA
CATENELLA CAESPITOSA
CERAMIUM SP.
CERAMIUM CILIATUM
CERAMIUM DESLONGCHAMPII
CERAMIUM DIAPHANUM
CERAMIUM ECHIONOTUM
CERAMIUM FLABELLIGERUM
CERAMIUM RUBRUM
CERAMIUM SHUTTLEWORTHIANUM
CHONDRUS CRISPUS
CHYLOCLADIA VERTICILLATA
CORALLINA OFFICINALIS
CRUORIA PELLITA
CRYPTOPLEURA RAMOSA
CYSTOCLONIUM PURPUREUM
DELESSERIA SANGUINEA
DERMATOLITHON CORALLINAE
DILSEA CARNOSA
DUMONTIA INCRASSATA

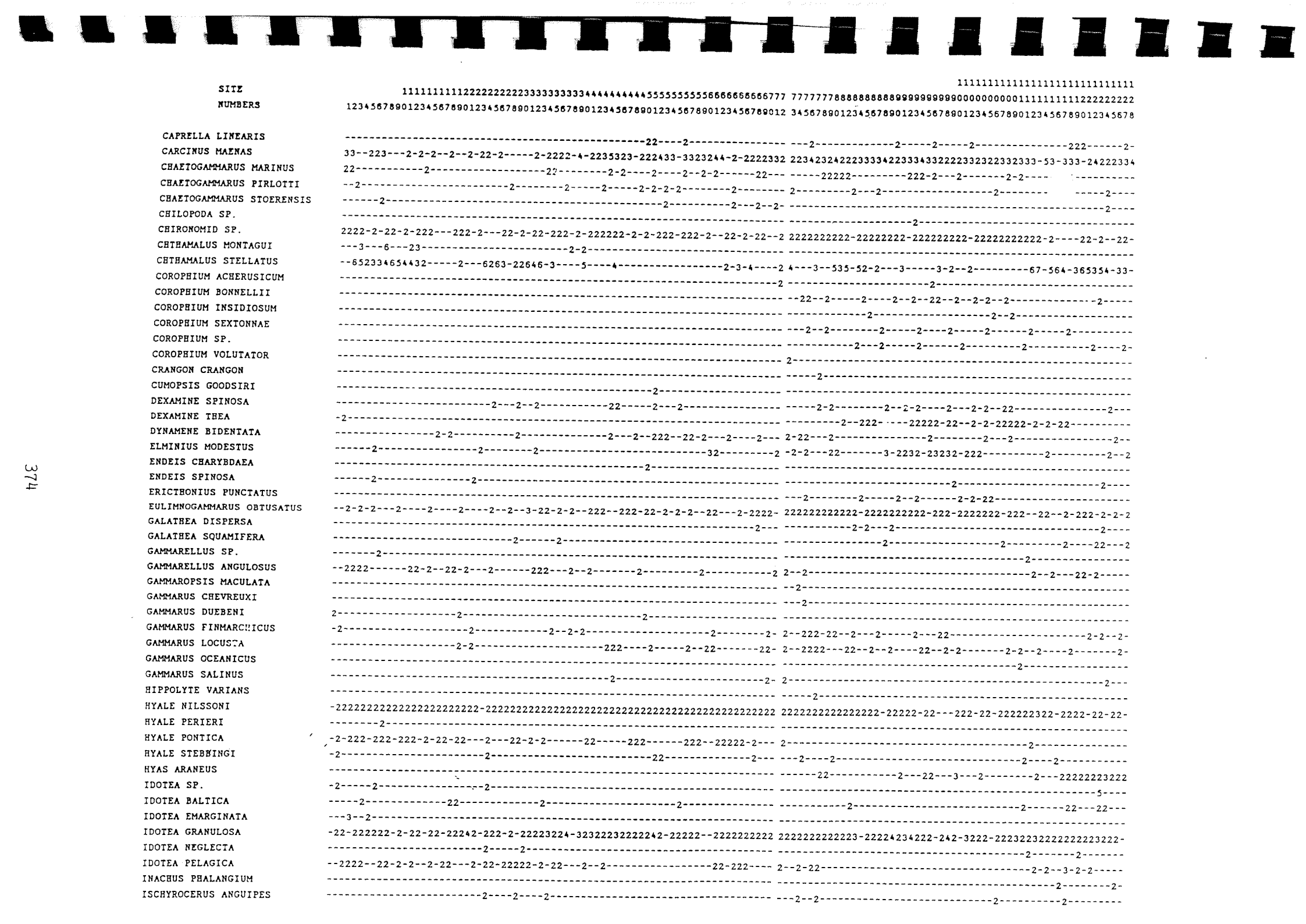

SITE
NUMBERS
ERYTHROCLADIA IRREGULARIS
ERYTHROTRICHIA CARNEA
FOSLIELLA SP.
FURCELLARIA LUMBRICALIS
GASTROCLONIUM OVATUM
GELIDIUM LATIFOLIUM
GELIDIUM PUSILLUM
GIGARTINA STELLATA
GONIOTRICHIUM ALSIDII
GRACILARIA VERRUCOSA
GRIFFITHSIA CORALLINOIDES
GRIFFITHSIA FLOSCULOSA
HALURUS EQUISETIFOLIUS
HETEROSIPHONIA PLUMOSA
HILDENBRANDIA RUBRA
HYPOGLOSSUM WOODWARDII
LAURENCIA HYBRIDA
LAURENCIA PINNATIFIDA
LITHOPHYLLUM CROUANII
LITHOPHYLLUM INCRUSTANS
LITHOPHYLLUM ORBICULATUM
LITHOPHYLLUM SP.
LITHOTHAMNION GLACIALE
LOMENTARIA ARTICULATA
LOMENTARIA CLAVELLOSA
LOMENTARIA ORCADENSIS
MELOBESIA MEMBRANACEA
MEMBRANOPTERA ALATA
MESOPHYLLUM LICHENOIDES
NEMALION HELMINTHOIDES
ODONTHALIA DENTATA
PALMARIA PALMATA
PETROCELIS CRUENTA
PEYSSONNELIA SP.
PEYSSONNELIA DUBYI
PHYCODRYS RUBENS
PHYLLOPHORA CRISPA
PHYLLOPHORA PSEUDOCERANOIDES
PHYLLOPHORA TRAILLII
PHYLLOPHORA TRUNCATA
PHYMATOLITHON LAEVIGATUM
PHYMATOLITHON LENORMANDII
PHYMATOLITHON POLYMORPHUM
PHYMATOLITHON RUGULOSUM
PLOCAMIUM CARTILAGINEUM
PLUMARIA ELEGANS
PNEOPHYLLUM SP.
POLYIDES ROTUNDUS
POLYNEURA SP.


SITE
NUMBERS
POLYSIPHONIA SP.
POLYSIPHONIA BRODIAEI
POLYSIPHONIA ELONGATA
POLYSIPHONIA FIBRATA
POLYSIPHONIA FIBRILLOSA
POLYSIPHONIA LANOSA
POLYSIPHONIA MACROCARPA
POLYSIPHONIA NIGRA
POLYSIPHONIA NIGRESCENS
POLYSIPHONIA URCEOLATA
POLYSIPHONIA VIOLACEA
PORPHYRA LEUCOSTICTA
PORPHYRA LINEARIS
PORPHYRA PURPUREA
PORPHYRA UMBILICALIS
PORPHYROPSIS COCCINEA
PTEROCLADIA CAPILLACEA
PTEROSIPHONIA COMPLANATA
PTEROSIPHONIA PARASITICA
PTEROSIPHONIA THUYOIDES
PTILOTA PLUMOSA
PTILOTHAMNION PLUMA
RHODOMELA CONFERVOIDES
RHODOMELA LYCOPODIOIDES
RHODYMENIA PSEUDOPALMATA
SCHMITZIELLA ENDOPHLOEA
SPERMOTHAMNION REPENS
TITANODERMA PUSTULATUM
TRAILLIELLA INTRICATA
VAUCHERIA SP.
PHORMIDIUM SP.
RIVULARIA SP.
LYNGBYA SP.
DERMOCARPA SP.
GLOEOCAPSA SP.
HYELLA SP.
OSCILLATORIA SP.
SCHIZOTHRIX SP.
CALOTHRIX SP.
PLECTONEMA SP.
APHANOCAPSA SP.
SPIRULINA SP.
AMPHITHRIX SP.
ANACYSTIS SP.
MERISMOPOEDIA SP.
ANABAENA SP.
MICROCOLEUS SP.
VERRUCARIA MAURA
VERRUCARIA MUCOSA

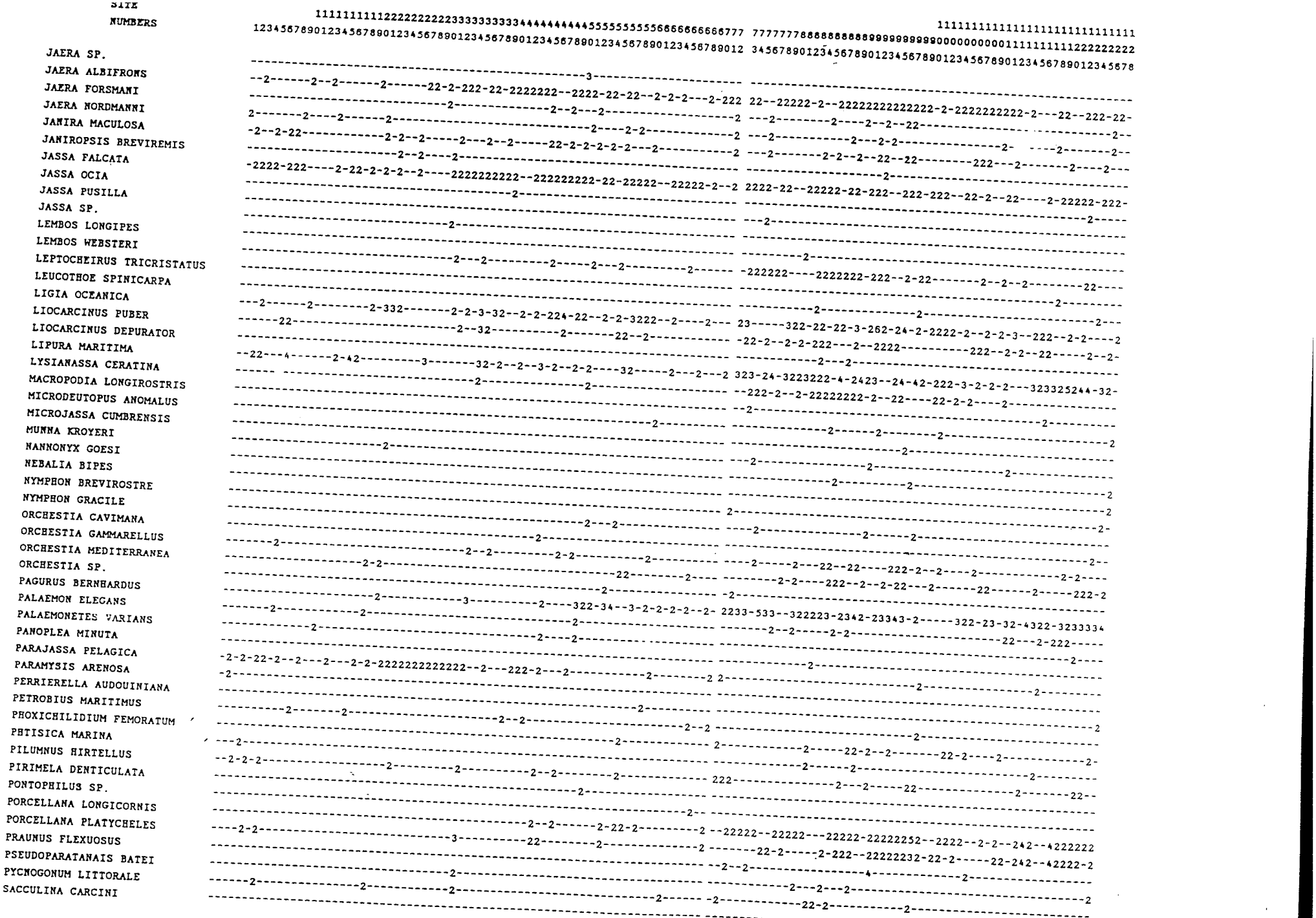

SITE
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LICHINA PYGMAEA
ZOSTERA MARINA
AMPHARETE ACUTIFRONS
AMPHILEGA MEDITERRANEA
AMPHITRITE JOHNSTONI
AMPHITRITIDES GRACILIS
ANAITIDES MACULATA
AONIDES OXYCEPHALA
ARENICOLA ECAUDATUM
ARENICOLA MARINA
AUTOLYTUS SP.
BISPURA SP.
BRANCHIOMMA BOMBYX
CAPITELLA CAPITATA
CAPITELLIDA SP.
CAPITELLIDES GIARDI
CAPITOMASTUS MINIMUS
CIRCEIS SPIRILLUM
CIRRATULUS CIRRATUS
CIRRIFORMIA TENTACULATA
CTENODRILINAE SP.
DODECACERIA CONCHARUM
EPHESIA GRACILIS
ETEONE LONGA
EUCLYMENE SP.
EULALIA PUSLLUS
EULALIA VIRIDIS
EUMIDA SANGUINEA
EUPOLYMNIA NEBULOSA
EUSYLLIS ASSIMILIS
EXOGONE NAIDINA
EXOGONE SP.
FABRICIA SABELLA
FILOGRANA IMPLEXA
FLABELLIGERA AFFINIS
GLYCERA TRIDACTYLA
HARMOTHOE EXTENUATA
HARMOTHOE IMBRICATA
HARMOTHOE IMPAR
HARMOTHOE MACKINTOSHII
HARMOTHOE SP.
HEDISTE DIVERSICOLOR
HYDROIDES NORVEGICA
JANUA PAGENSTECHERI
JASMINEIRA CAUDATA
KEFERSTEINIA CIRRATA
LANICE CONCHILEGA
LAONOME KROYERI
LEPIDONOTUS CLAVA
LEPIDONOTUS SQUAMATUS

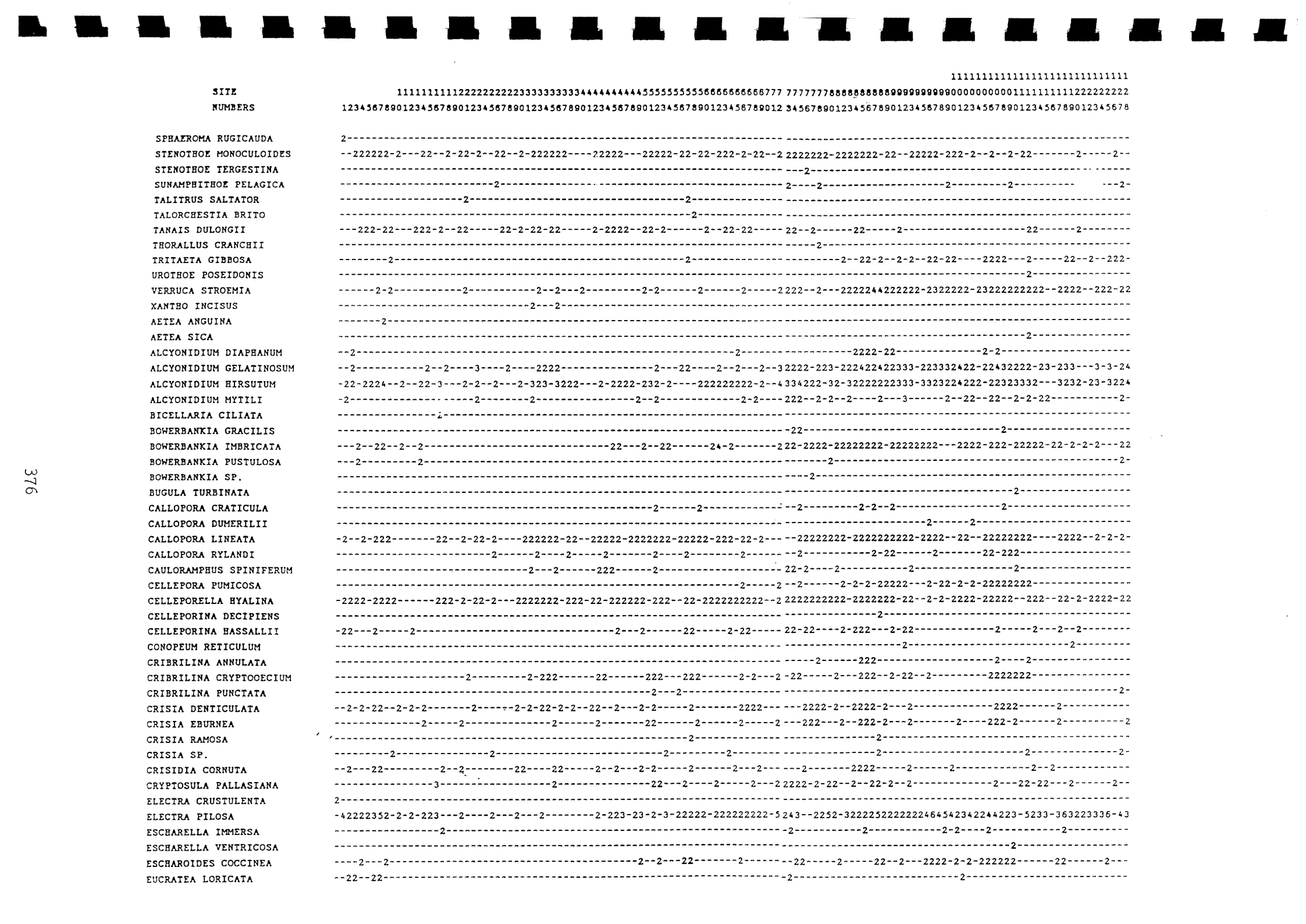

SITE
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MALACOCEROS FULIGINOSA
MALDANIDAE SP.
MANAYUNKIA AESTUARINA
MELINNA CRISTATA
MICROMALDANE ORNITHOCHAETA
MICRONEREIS VARIEGATA
MYSTA BARBATA
NAINEREIS QUADRICUSPIDA
NEANTHES VIRENS
NEPHTYS CAECA
NEPHTYS HOMBERGII
NEREIS PELAGICA
NEREIS SP.
NICOLEA SP.
NICOLEA VENESTULA
NICOLEA ZOSTERICOLA
NICOMACHE LUMBRICALIS
NICOMACHE MACULATA
ODONTOSYLLIS CTENOSTOMA
ODONTOSYLLIS FULGURANS
OLIGOCHAETA SP.
ORIOPSIS ARMANDI
PARAPIONOSYLLIS LONGICIRRATA
PERINEREIS CULTIFERA
PHERUSA PLUMOSA
PHISIDEA AUREA
PHISIDEA SP.
PHOLOE INORNATA
PHYLLODOCE LAMINOSA
PIRAKIA PUNCTIFERA
PLATYNEREIS COCCINEA
PLATYNEREIS DUMERILII
POLYCIRRUS DENTACULATUS
POLYDORA CILIATA
POLYDORA GIARDI
POLYNOE SCOLOPENDRINA
POLYNOE SP.
POMATOCEROS TRIQUETER
PYGOSPIO ELEGANS
SABELLA PAVONINA
SABELLARIA ALVEOLATA
SABELLARIA SPINULOSA
SCALIBREGMA INFLATUM
SCOLELEPIS SQUAMATA
SCOLOPLOS ARMIGER
SERPULA VERMICULARIS
SPINTHER ARCTICUS
SPIO FILICORNIS
SPIONIDAE SP.

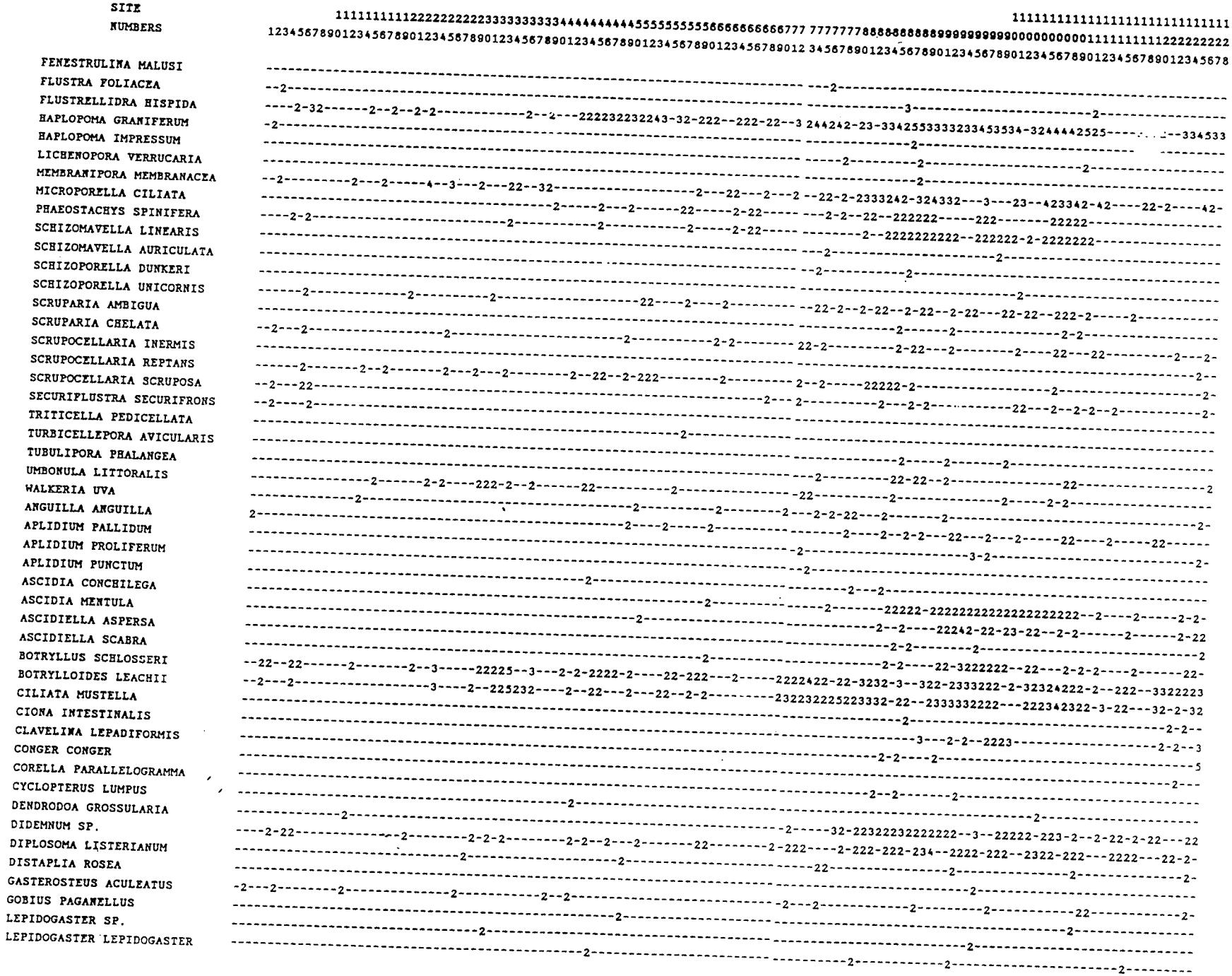

SITE
NUMBERS
SPIRORBIS BOREALIS
SPIRORBIS CORALLINAE
SPIRORBIS RUPESTRIS
SPIRORBIS SPIRORBIS
SPIRORBIS TRIDENTATUS
STHENELAIS BOA
STREPTOSYLLIS WEBSTERI
SYLLIS GRACILLIS
SYLLIS SP.
THELEPUS CINCINATTUS
THELEPUS SETOSUS
THEOSTOMA OERSTEDI
TYPOSYLLIS ARMILLARIS
TYPOSYLLIS HYALINA
TYPOSYLLIS KROHNII
TYPOSYLLIS PROLIFERA
TYPOSYLLIS SP.
TYPOSYLLIS VARIEGATA
TYPOSYLLIS VITTATA
ACHELIA ECHINATA
ACHELIA LEAVIS
ACHELIA LONGIPES
AMPHIPODA SP.
AMPITHOE GAMMAROIDES
AMPITHOE NEGLECTA
AMPITHOE RUBRICATA
AMPITHOLINA CUNICULUS
ANOPLODACTYLUS SP.
ANOPLODACTYLUS ANGULATUS
ANOPLODACTYLUS PETIOLATUS
ANOPLODACTYLUS PYGMAEUS
ANOPLODACTYLUS VIRESCENS
AORA TYPICA
APHERUSA BISPINOSA
APHERUSA CIRRUS
APHERUSA JURINEI
APHERUSA OVALIPES
APSEUDES TALPA
ATELECYCLUS ROTUNDUS
ATYLUS FALCATUS
ATYLUS SWAMMERDAMI
BALANUS BALANOIDES
BALANUS CRENATUS
BALANUS SP.
BATHYPOREIA PILOSA
CALLIOPIUS LAEVIUSCULUS
CALLIPALLENE BREVIROSTRIS
CANCER PAGURUS
CAPRELLA ACANTHIFERA

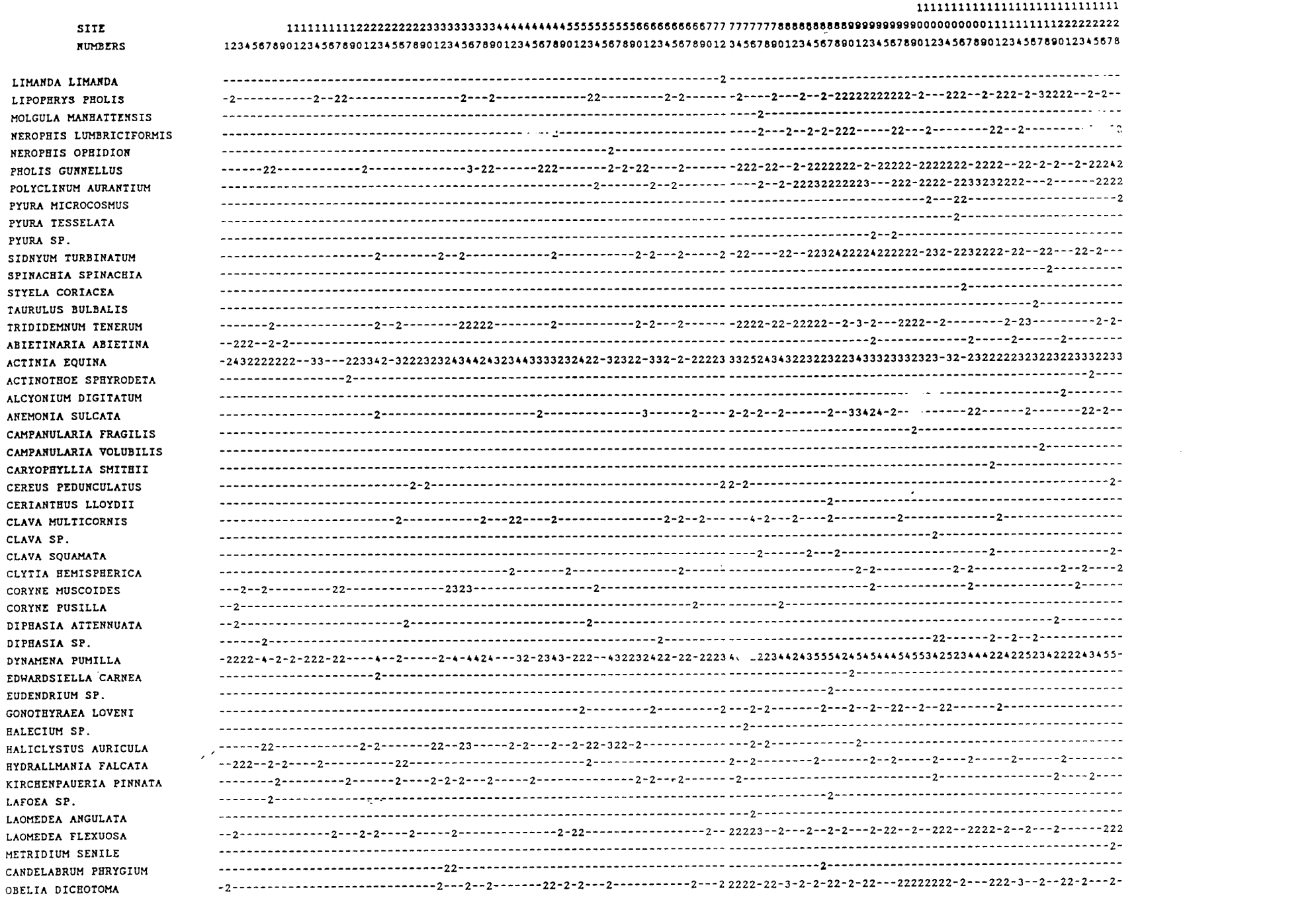

SITE
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CAPRELLA LINEARIS
CARCINUS MAENAS
CHAETOGAMMARUS MARINUS
CHAETOGAMMARUS PIRLOTTI
CHAETOGAMMARUS STOERENSIS
CHILOPODA SP.
CHIRONOMID SP.
CHTHAMALUS MONTAGUI
CHTHAMALUS STELLATUS
COROPHIUM ACHERUSICUM
COROPHIUM BONNELLII
COROPHIUM INSIDIOSUM
COROPHIUM SEXTONNAE
COROPHIUM SP.
COROPHIUM VOLUTATOR
CRANGON CRANGON
CUMOPSIS GOODSIRI
DEXAMINE SPINOSA
DEXAMINE THEA
DYNAMENE BIDENTATA
ELMINIUS MODESTUS
ENDEIS CHARYBDAEA
ENDEIS SPINOSA
ERICTHONIUS PUNCTATUS
EULIMNOGAMMARUS OBTUSATUS
GALATHEA DISPERSA
GALATHEA SQUAMIFERA
GAMMARELLUS SP.
GAMMARELLUS ANGULOSUS
GAMMAROPSIS MACULATA
GAMMARUS CHEVREUXI
GAMMARUS DUEBENI
GAMMARUS FINMARCHICUS
GAMMARUS LOCUSTA
GAMMARUS OCEANICUS
GAMMARUS SALINUS
HIPPOLYTE VARIANS
HYALE NILSSONI
HYALE PERIERI
HYALE PONTICA
HYALE STEBBINGI
HYAS ARANEUS
IDOTEA SP.
IDOTEA BALTICA
IDOTEA EMARGINATA
IDOTEA GRANULOSA
IDOTEA NEGLECTA
IDOTEA PELAGICA
INACHUS PHALANGIUM
ISCHYROCERUS ANGUIPES

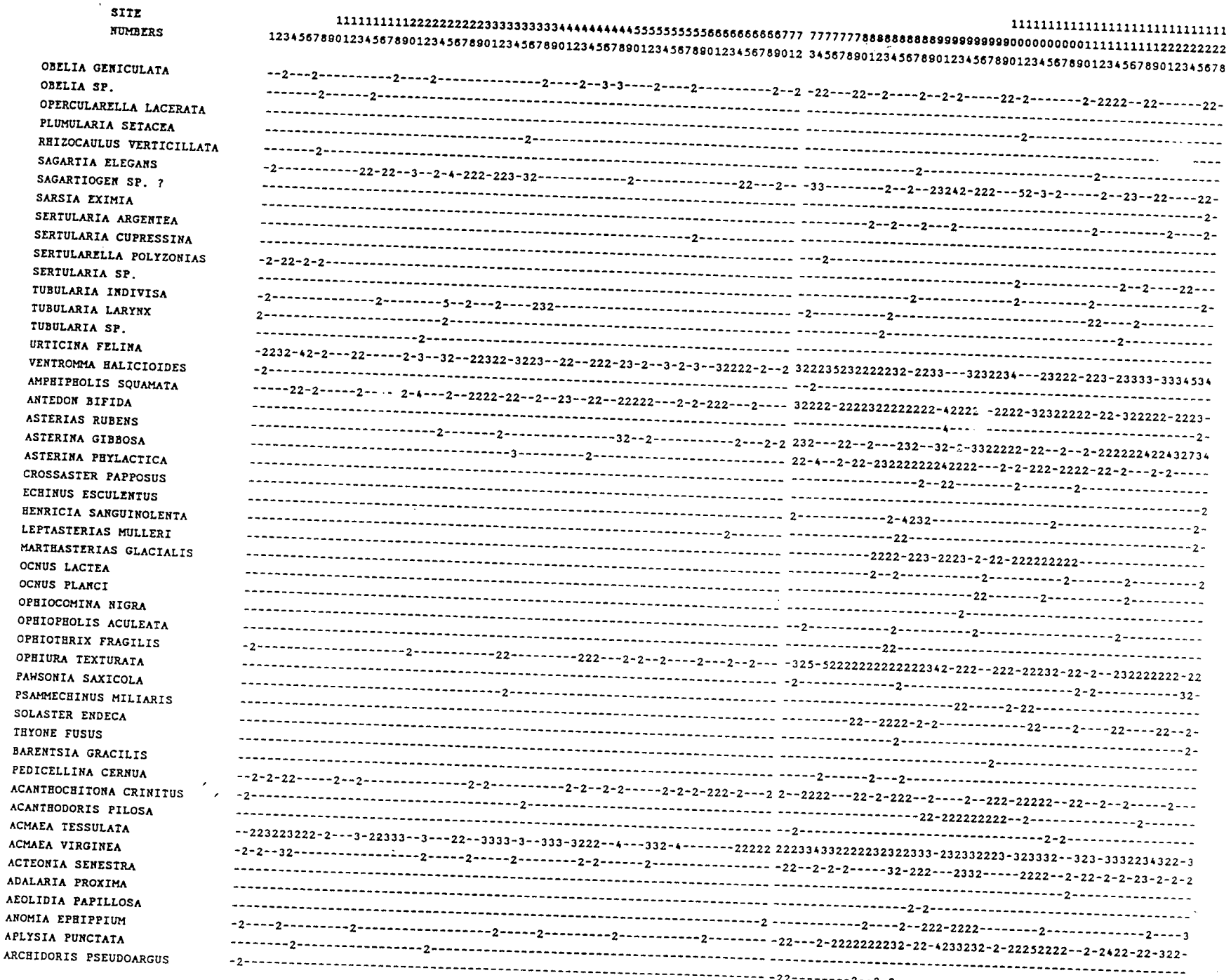
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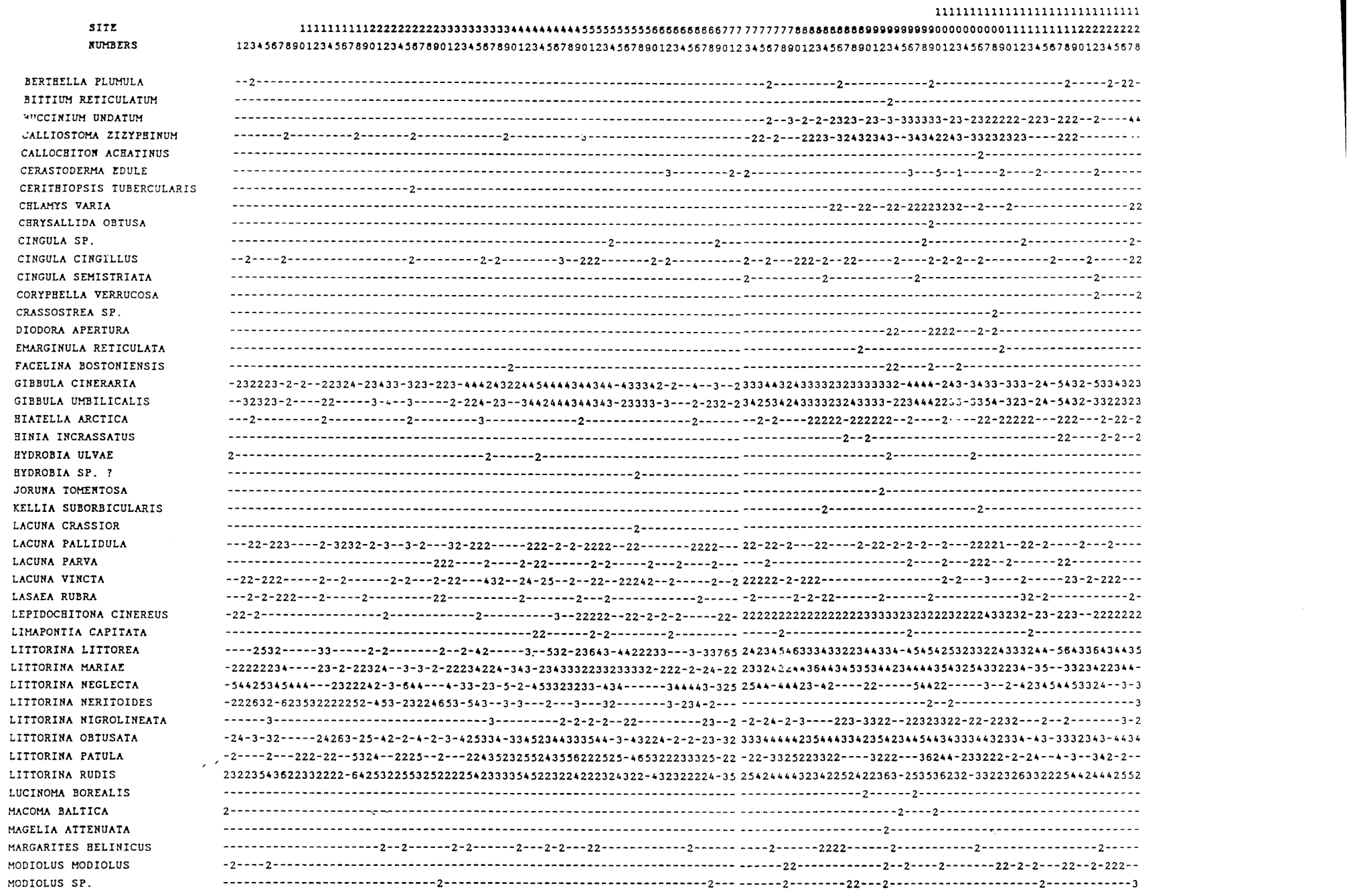


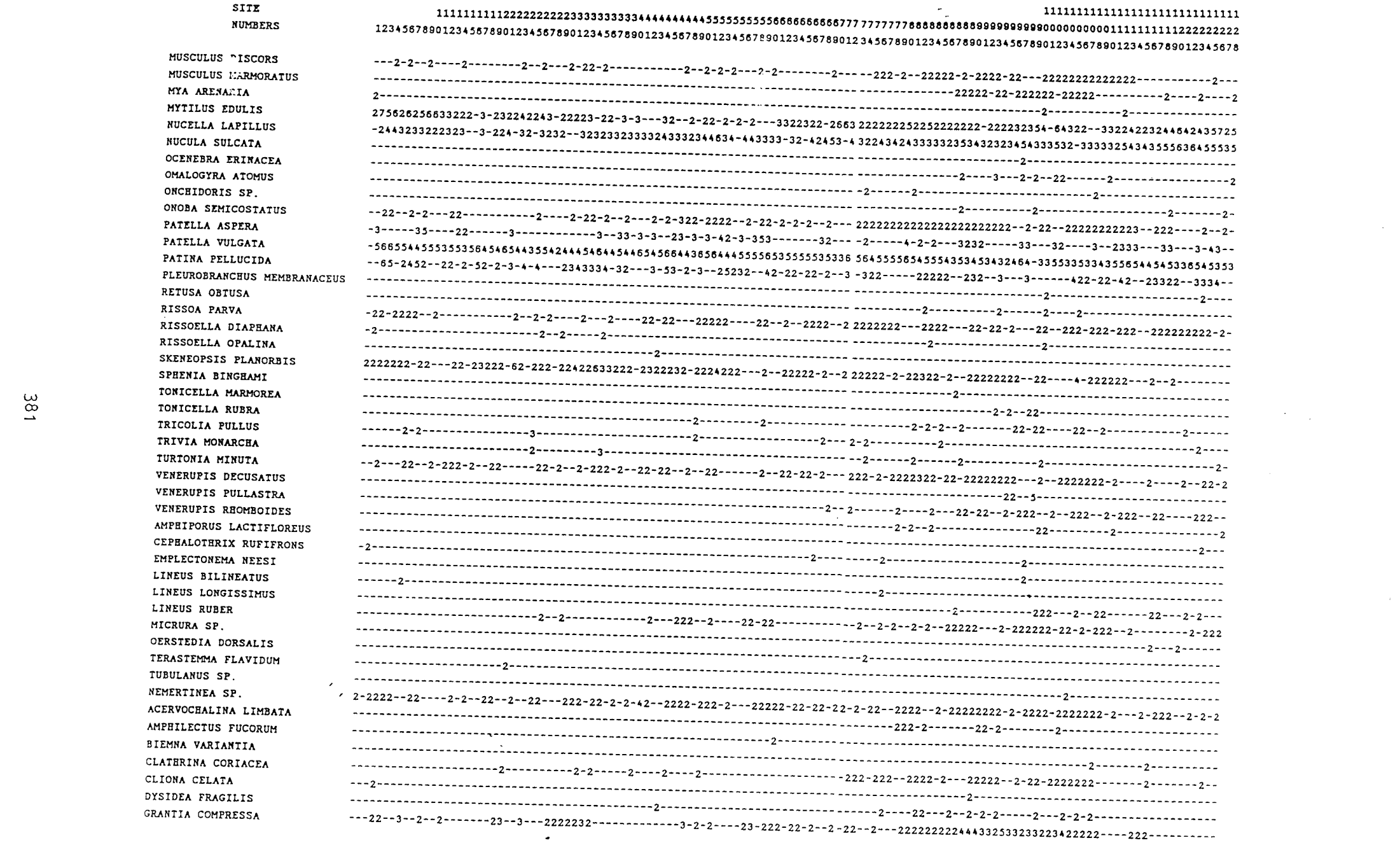

SITE NUMBERS
SPHAEROMA RUGICAUDA
STENOTHOE MONOCULOIDES
STENOTHOE TERGESTINA
SUNAMPHITHOE PELAGICA
TALITRUS SALTATOR
TALORCHESTIA BRITO
TANAIS DULONGII
THORALLUS CRANCHII
TRITAETA GIBBOSA
UROTHOE POSEIDONIS
VERRUCA STROEMIA
XANTHO INCISUS
AETEA ANGUINA
AETEA SICA
ALCYONIDIUM DIAPHANUM
ALCYONIDIUM GELATINOSUM
ALCYONIDIUM HIRSUTUM
ALCYONIDIUM MYTILI
BICELLARIA CILIATA
BOWERBANKIA GRACILIS
BOWERBANKIA IMBRICATA
BOWERBANKIA PUSTULOSA
BOWERBANKIA SP.
BUGULA TURBINATA
CALLOPORA CRATICULA
CALLOPORA DUMERILII
CALLOPORA LINEATA
CALLOPORA RYLANDI
CAULORAMPHUS SPINIFERUM
CELLEPORA PUMICOSA
CELLEPORELLA HYALINA
CELLEPORINA DECIPIENS
CELLEPORINA HASSALLII
CONOPEUM RETICULUM
CRIBRILINA ANNULATA
CRIBRILINA CRYPTOOECIUM
CRIBRILINA PUNCTATA
CRISIA DENTICULATA
CRISIA EBURNEA
CRISIA RAMOSA
CRISIA SP.
CRISIDIA CORNUTA
CRYPTOSULA PALLASIANA
ELECTRA CRUSTULENTA
ELECTRA PILOSA
ESCHARELLA IMMERSA
ESCHARELLA VENTRICOSA
ESCHAROIDES COCCINEA
EUCRATEA LORICATA

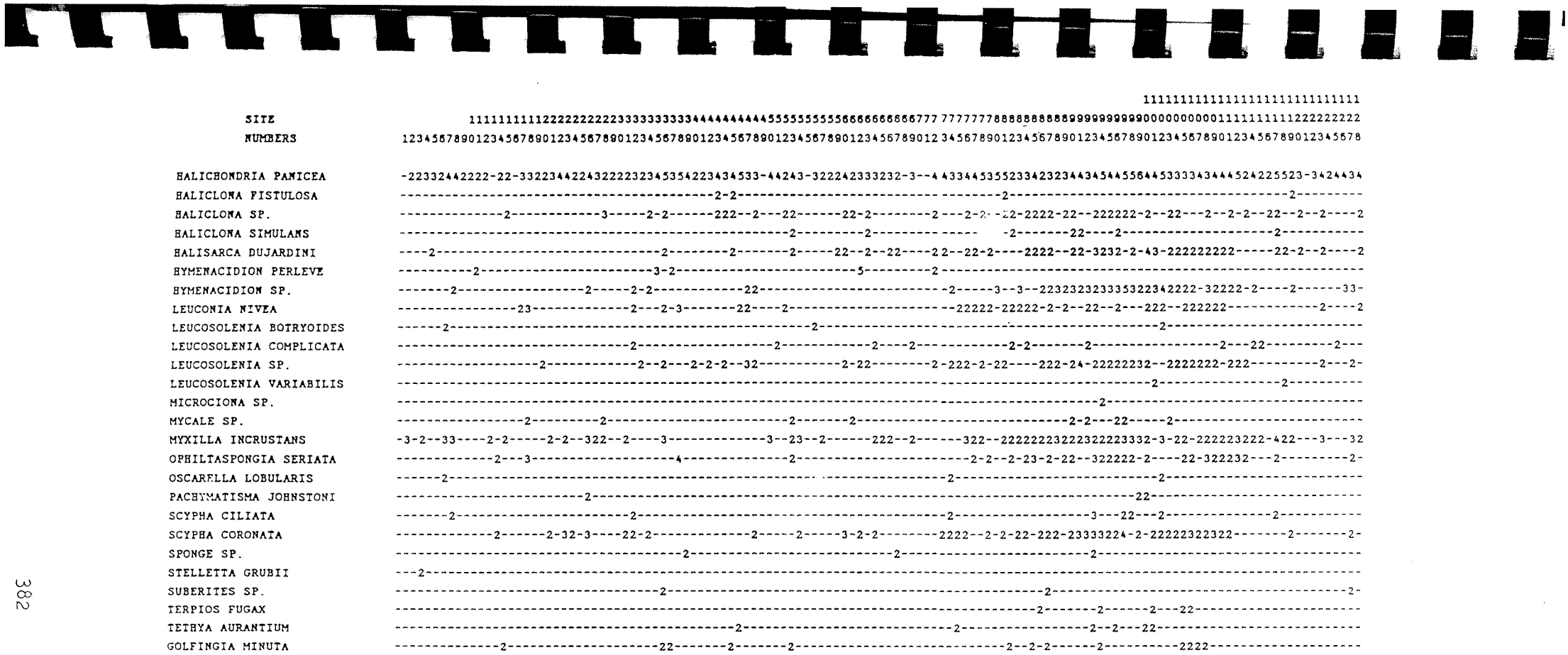

SITE NUMBERS
FENESTRULINA MALUSI
FLUSTRA FOLIACEA
FLUSTRELLIDRA HISPIDA
HAPLOPOMA GRANIFERUM
HAPLOPOMA IMPRESSUM
LICHENOPORA VERRUCARIA
MEMBRANIPORA MEMBRANACEA
MICROPORELLA CILIATA
PHAEOSTACHYS SPINIFERA
SCHIZOMAVELLA LINEARIS
SCHIZOMAVELLA AURICULATA
SCHIZOPORELLA DUNKERI
SCHIZOPORELLA UNICORNIS
SCRUPARIA AMBIGUA
SCRUPARIA CHELATA
SCRUPOCELLARIA INERMIS
SCRUPOCELLARIA REPTANS
SCRUPOCELLARIA SCRUPOSA
SECURIFLUSTRA SECURIFRONS
TRITICELLA PEDICELLATA
TURBICELLEPORA AVICULARIS
TUBULIPORA PHALANGEA
UMBONULA LITTORALIS
WALKERIA UVA
ANGUILLA ANGUILLA
APLIDIUM PALLIDUM
APLIDIUM PROLIFERUM
APLIDIUM PUNCTUM
ASCIDIA CONCHILEGA
ASCIDIA MENTULA
ASCIDIELLA ASPERSA
ASCIDIELLA SCABRA
BOTRYLLUS SCHLOSSERI
BOTRYLLOIDES LEACHII
CILIATA MUSTELLA
CIONA INTESTINALIS
CLAVELINA LEPADIFORMIS
CONGER CONGER
CORELLA PARALLELOGRAMMA
CYCLOPTERUS LUMPUS
DENDRODOA GROSSULARIA
DIDEMNUM SP.
DIPLOSOMA LISTERIANUM
DISTAPLIA ROSEA
GASTEROSTEUS ACULEATUS
GOBIUS PAGANELLUS
LEPIDOGASTER SP.
LEPIDOGASTER LEPIDOGASTER


SITE
NUMBERS
LIMANDA LIMANDA
LIPOPHRYS PHOLIS
MOLGULA MANHATTENSIS
NEROPHIS LUMBRICIFORMIS
NEROPHIS OPHIDION
PHOLIS GUNNELLUS
POLYCLINUM AURANTIUM
PYURA MICROCOSMUS
PYURA TESSELATA
PYURA SP.
SIDNYUM TURBINATUM
SPINACHIA SPINACHIA
STYELA CORIACEA
TAURULUS BULBALIS
TRIDIDEMNUM TENERUM
ABIETINARIA ABIETINA
ACTINIA EQUINA
ACTINOTHOE SPHYRODETA
ALCYONIUM DIGITATUM
ANEMONIA SULCATA
CAMPANULARIA FRAGILIS
CAMPANULARIA VOLUBILIS
CARYOPHYLLIA SMITHII
CEREUS PEDUNCULATUS
CERIANTHUS LLOYDII
CLAVA MULTICORNIS
CLAVA SP.
CLAVA SQUAMATA
CLYTIA HEMISPHERICA
CORYNE MUSCOIDES
CORYNE PUSILLA
DIPHASIA ATTENNUATA
DIPHASIA SP.
DYNAMENA PUMILLA
EDWARDSIELLA CARNEA
EUDENDRIUM SP.
GONOTHYRAEA LOVENI
HALECIUM SP.
HALICLYSTUS AURICULA
HYDRALLMANIA FALCATA
KIRCHENPAUERIA PINNATA
LAFOEA SP.
LAOMEDEA ANGULATA
LAOMEDEA FLEXUOSA
METRIDIUM SENILE
CANDELABRUM PHRYGIUM
OBELIA DICHOTOMA


SITE
NUMBERS
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OBELIA GENICULATA
OBELIA SP.
OPERCULARELLA LACERATA
PLUMULARIA SETACEA
RHIZOCAULUS VERTICILLATA
SAGARTIA ELEGANS
SAGARTIOGEN SP. ?
SARSIA EXIMIA
SERTULARIA ARGENTEA
SERTULARIA CUPRESSINA
SERTULARELLA POLYZONIAS
SERTULARIA SP.
TUBULARIA INDIVISA
TUBULARIA LARYNX
TUBULARIA SP.
URTICINA FELINA
VENTROMMA HALICIOIDES
AMPHIPHOLIS SQUAMATA
ANTEDON BIFIDA
ASTERIAS RUBENS
ASTERINA GIBBOSA
ASTERINA PHYLACTICA
CROSSASTER PAPPOSUS
ECHINUS ESCULENTUS
HENRICIA SANGUINOLENTA
LEPTASTERIAS MULLERI
MARTHASTERIAS GLACIALIS
OCNUS LACTEA
OCNUS PLANCI
OPHIOCOMINA NIGRA
OPHIOPHOLIS ACULEATA
OPHIOTHRIX FRAGILIS
OPHIURA TEXTURATA
PAWSONIA SAXICOLA
PSAMMECHINUS MILIARIS
SOLASTER ENDECA
THYONE FUSUS
BARENTSIA GRACILIS
PEDICELLINA CERNUA
ACANTHOCHITONA CRINITUS
ACANTHODORIS PILOSA
ACMAEA TESSULATA
ACMAEA VIRGINEA
ACTEONIA SENESTRA
ADALARIA PROXIMA
AEOLIDIA PAPILLOSA
ANOMIA EPHIPPIUM
APLYSIA PUNCTATA
ARCHIDORIS PSEUDOARGUS


SITE
NUMBERS
BERTHELLA PLUMULA
BITTIUM RETICULATUM
BUCCINIUM UNDATUM
CALLIOSTOMA ZIZYPHINUM
CALLOCHITON ACHATINUS
CERASTODERMA EDULE
CERITHIOPSIS TUBERCULARIS
CHLAMYS VARIA
CHRYSALLIDA OBTUSA
CINGULA SP.
CINGULA CINGILLUS
CINGULA SEMISTRIATA
CORYPHELLA VERRUCOSA
CRASSOSTREA SP.
DIODORA APERTURA
EMARGINULA RETICULATA
FACELINA BOSTONIENSIS
GIBBULA CINERARIA
GIBBULA UMBILICALIS
HIATELLA ARCTICA
HINIA INCRASSATUS
HYDROBIA ULVAE
HYDROBIA SP. ?
JORUNA TOMENTOSA
KELLIA SUBORBICULARIS
LACUNA CRASSIOR
LACUNA PALLIDULA
LACUNA PARVA
LACUNA VINCTA
LASAEA RUBRA
LEPIDOCHITONA CINEREUS
LIMAPONTIA CAPITATA
LITTORINA LITTOREA
LITTORINA MARIAE
LITTORINA NEGLECTA
LITTORINA NERITOIDES
LITTORINA NIGROLINEATA
LITTORINA OBTUSATA
LITTORINA PATULA
LITTORINA RUDIS
LUCINOMA BOREALIS
MACOMA BALTICA
MAGELIA ATTENUATA
MARGARITES HELINICUS
MODIOLUS MODIOLUS
MODIOLUS SP.
MONODONTA LINEATA

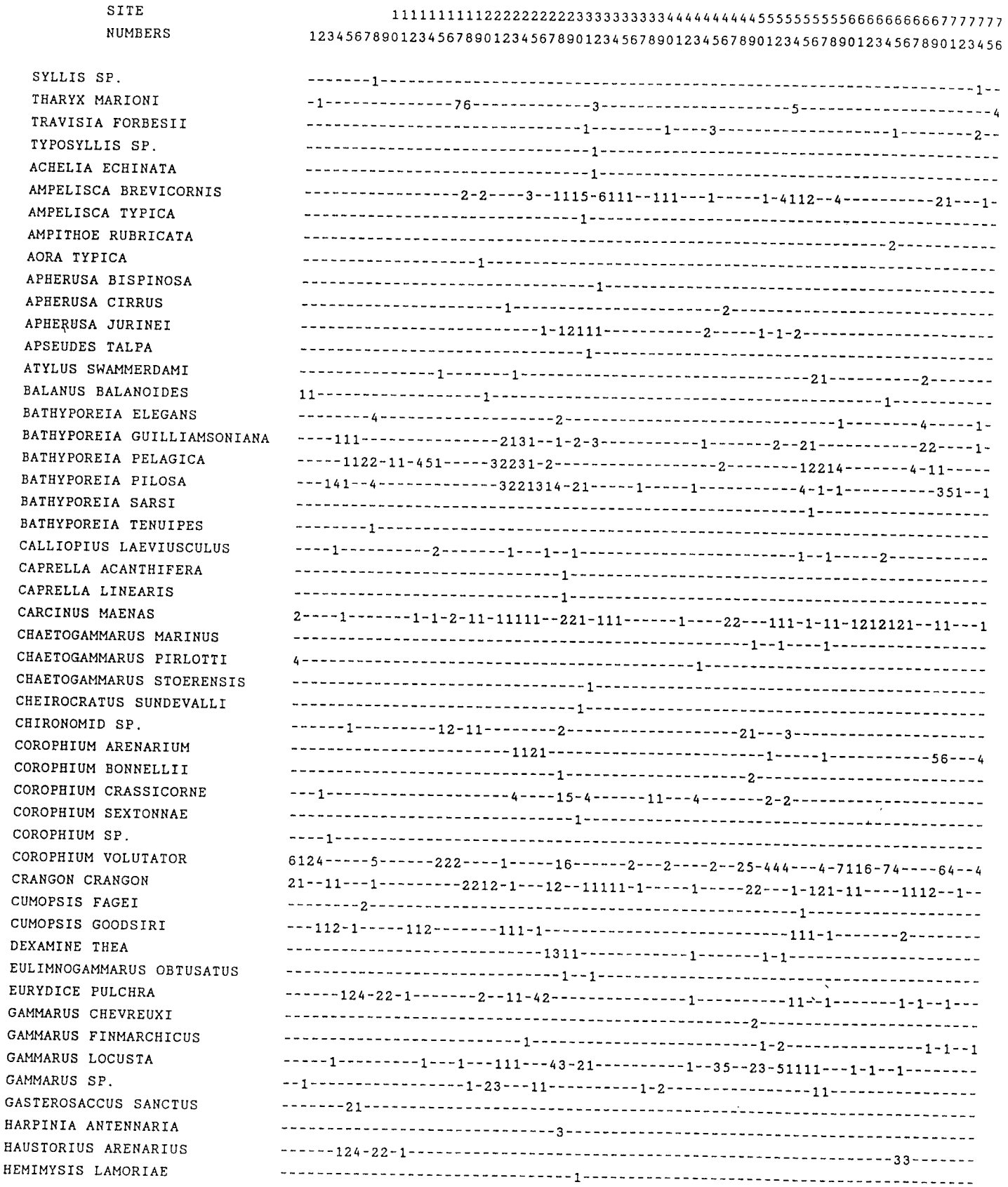

SITE
NUMBERS
MUSCULUS DISCORS
MUSCULUS MARMORATUS
MYA ARENARIA
MYTILUS EDULIS
NUCELLA LAPILLUS
NUCULA SULCATA
OCENEBRA ERINACEA
OMALOGYRA ATOMUS
ONCHIDORIS SP.
ONOBA SEMICOSTATUS
PATELLA ASPERA
PATELLA VULGATA
PATINA PELLUCIDA
PLEUROBRANCHUS MEMBRANACEUS
RETUSA OBTUSA
RISSOA PARVA
RISSOELLA DIAPHANA
RISSOELLA OPALINA
SKENEOPSIS PLANORBIS
SPHENIA BINGHAMI
TONICELLA MARMOREA
TONICELLA RUBRA
TRICOLIA PULLUS
TRIVIA MONARCHA
TURTONIA MINUTA
VENERUPIS DECUSATUS
VENERUPIS PULLASTRA
VENERUPIS RHOMBOIDES
AMPHIPORUS LACTIFLOREUS
CEPHALOTHRIX RUFIFRONS
EMPLECTONEMA NEESI
LINEUS BILINEATUS
LINEUS LONGISSIMUS
LINEUS RUBER
MICRURA SP.
OERSTEDIA DORSALIS
TERASTEMMA FLAVIDUM
TUBULANUS SP.
NEMERTINEA SP.
ACERVOCHALINA LIMBATA
AMPHILECTUS FUCORUM
BIEMNA VARIANTIA
CLATHRINA CORIACEA
CLIONA CELATA
DYSIDEA FRAGILIS
GRANTIA COMPRESSA

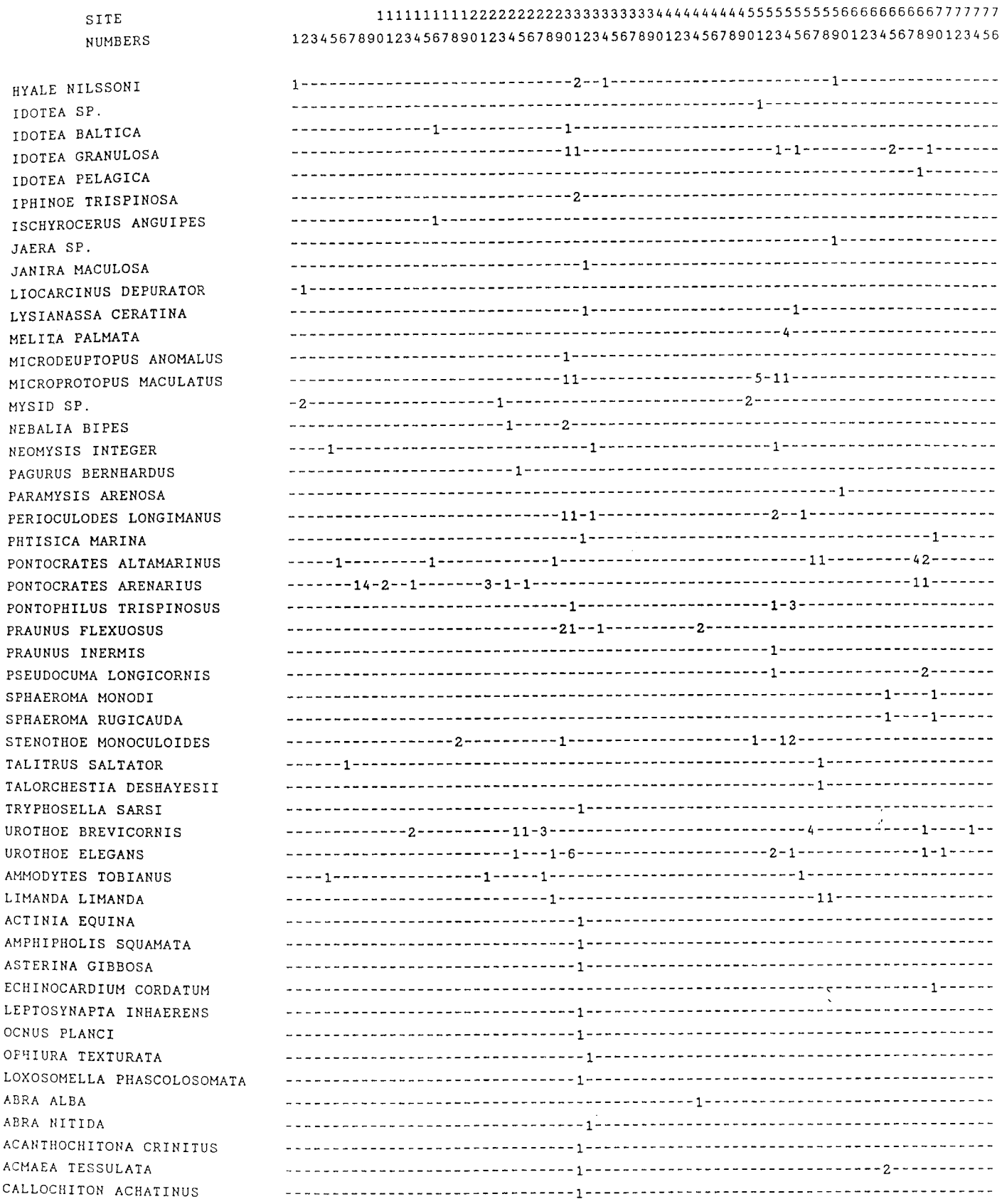

SITE
NUMBERS
HALICHONDRIA PANICEA
HALICLONA FISTULOSA
HALICLONA SP.
HALICLONA SIMULANS
HALISARCA DUJARDINI
HYMENACIDION PERLEVE
HYMENACIDION SP.
LEUCONIA NIVEA
LEUCOSOLENIA BOTRYOIDES
LEUCOSOLENIA COMPLICATA
LEUCOSOLENIA SP.
LEUCOSOLENIA VARIABILIS
MICROCIONA SP.
MYCALE SP.
MYXILLA INCRUSTANS
OPHILTASPONGIA SERIATA
OSCARELLA LOBULARIS
PACHYMATISMA JOHNSTONI
SCYPHA CILIATA
SCYPHA CORONATA
SPONGE SP.
STELLETTA GRUBII
SUBERITES SP.
TERPIOS FUGAX
TETHYA AURANTIUM
GOLFINGIA MINUTA

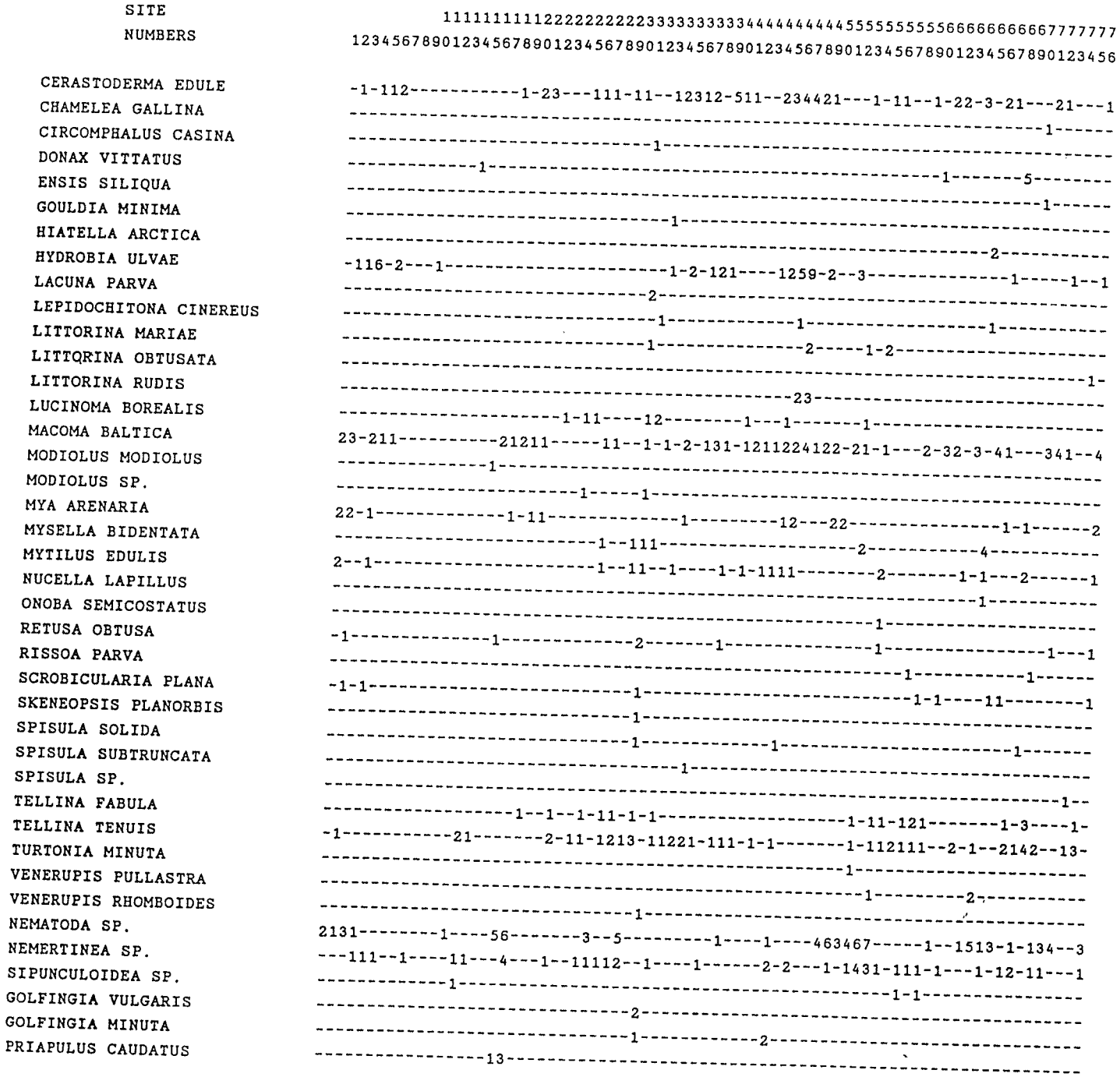
Stage II Survey Data Matrix of site against species.
Values in table refer to log. abundance (rounded)

SITE	1111111111222222222233333333334444444444555555555566666666667777777
NUMBERS	12345678901234567890123456789012345678901234567890123456789012345678901234567890123456
AMAGE AURICULA	-------1----------
AMPHARETE ACUTIFRONS	1----------42----------41----------2--1-2-141----2----------1----4
AMPHARETIDAE SP.	----------1-
ANAITIDES GROENLANDICA	----------1--1----------111------
ANAITIDES MACULATA	1----1---------4221---1-121-112-12--1-11--1-12-2-31-1-11--1--1-22--1--1-----
ANAITIDES SUBULIFERA	----------1----1-
AONIDES OXYCEPHALA	--------1----------
ARENICOLA MARINA	21-111-------113------11122121112212121---211---11--1-121111-12--1-11212---1
ARICIDEA MINUTA	---1-1----------1----------1----------3----------2-----
ARICIDEA SUECICA	----------1----------2----------
AUTOLYTUS SP.	----------2----------
CAPITELLA CAPITATA	11-11111----11151341223322515541--11-2----111---33435451133-112341--1131---3
CAPITELLIDA SP.	----------1---3----------1--11----------
CAPITOMASTUS MINIMUS	----------1----------1----------4----------1--1----
CHAETOZONE SETOSA	5----------3----------3---1----1-------3----------2-----
CIRRATULUS CIRRATUS	----------1----1-1----------224-1-1---1----------
CIRRIFORMIA TENTACULATA	----------2----------1-21----------4--211--------5----------
EPHESIA GRACILIS	----------1----------
ETEONE LONGA	-1-121-------1--11-1--111122132-11-112-231-12-3--344243111-111122-1-1121--13
EUCLYMENE OERSTEDII	----------2-----2---2----42---1-------3-1----------
EUCLYMENE SP.	----------1----------
EULALIA PUSILLA	----------2----------
EUMIDA SANGUINEA	----------1------1----------2---1-------1-5----------
EUPOLYMNIA NEBULOSA	----------1----------
EXOGONE NAIDINA	----------641----------11--------3----2----242142----------
EXOGONE HEBES	----------1-11----------2-----3-232---------2-----1-----
FABRICIA SABELLA	1----------3-7----------25------3---1--3--1-774454---1----------33--5
FLABELLIGERA AFFINIS	----------1----------
GONIADA MACULATA	----------11----------
GLYCERA TRIDACTYLA	----------1---------111111---23---1----1--1-1----------
HARMOTHOE IMBRICATA	----------1-1----------1----1----------
HARMOTHOE IMPAR	----------1---------1----------
HARMOTHOE LUNULATA	----------1---1----------
HEDISTE DIVERSICOLOR	214411---5---13-25--1-----31141-1----1---5----------3----3----25-1--14---
HETEROMASTUS FILIFORMIS	-1-1----------1----------1----------1----------
KEFERSTEINIA CIRRATA	----------1----------
PECTINARIA KORENI	----------1------
LANICE CONCHILEGA	--------1----------1111--1-11-1----------1-11-----4--1--1-----
LIPOBRANCHUS JEFFERYSII	----------1----------
LUMBRINERIS GRACILIS	----------1----------
MAGELONA PAPILLICORNIS	----------1-1----------1----1-1-------1342---1-
MALACOCEROS FULIGINOSA	----1---------16---1-213113-13-------1----------1--1-11-----2--1-------1

SITE NUMBERS	1111111111222222222233333333334444444444555555555566666666667777777 12345678901234567890123456789012345678901234567890123456789012345678901234567890123456
MALDANIDAE SP.	----------1--------1----------
MANAYUNKIA AESTUARINA	----------664----------28-5211----------3-----3--1
MARPHYSA BELLII	----------1----------1----------
MEDIOMASTUS FRAGILIS	----------2----------5----------5-232----------
MELINNA CRISTATA	----------1-----1----------
MELINNA PALMATA	----------24----------14-37141-1----------
MICROPHTHALMUS SCZELKOWI	---1----------1----------1----------
MYSTA PICTA	----------1--1----------11--------1----------211-----
NEANTHES VIRENS	--1------1----------1----------1----------
NEPHTYS CAECA	-------11----1-------11-11-1----------11--2-13-1--21111-12-
NEPHTYS CIRROSA	----------1-1----------1----------1-----
NEPHTYS HOMBERGII	3--111-------1--13-2311111111-2-32223-211-21333351221211112--122----1111--11
NEREIS PELAGICA	--1----------1-11---1----------1--1--1----------
NEREIS SP.	-----1----------4--1-2-------2----------1----1----------
NICOMACHE LUMBRICALIS	----------1----------1-----
NICOMACHE MACULATA	----------4----------
NICOMACHE SP.	---1----------1----------
NOTOMASTUS LATERICEUS	---1----------11------22---3-------1----------1-----
ODONTOSYLLIS CTENOSTOMA	----------1----------
OLIGOCHAETA SP.	4172-11--3114--1-46-4312-143-662-4--13-115-121-346667572--315116177-1-355114
OPHELIA RATHKEI	----------2----------1----------1----------1------
OPHELIA SP.	----------2----------1----------
OPHRYOTROCHA PUERILIS	----------36--------11--1----------1--4----------
ORBINIA LATREILLII	----------1----------
OWENIA FUSIFORMIS	----------6----------1-------1------
PARAONIS FULGENS	----13--1-----1----------1----------
PHOLOE INORNATA	----------2----------2-------1----------
PHYLLODOCE LAMINOSA	----------1----------1----------1----------
PLATYNEREIS COCCINEA	----------1----------
PLATYNEREIS DUMERILII	---1----------
POLYCIRRUS SP.	----------2----------
POLYDORA CAULLERYI	----------2----------
POLYDORA QUADRILOBATA	----------1-----
POLYDORA CILIATA	----------21--2---------1----------11-1231--311-------2----------
POMATOCEROS TRIQUETER	----------2----------
PRAXILLELA AFFINIS	----------3----------
PRIONOSPIO SP.	----------1----------
PROTODORVILLEA KEFERSTEINI	----------2--------1--
PYGOSPIO ELEGANS	33-332----------2341--212144264--12414133-1135-133544451-12-2335-55--2243134
SCALIBREGMA INFLATUM	----------111----11----2----------
SCOLELEPIS SQUAMATA	-----2133----11----1-332-1-11----------1----------3311-------233------
SCOLOPLOS ARMIGER	-4-333----------666511443343254-1131-3-1----2-2---5-4544-243-2313----134-115
SIGALION MATHILDAE	----------1---1-21---1----1-------1----1-1-------1-1------
SPHAERODORIDIUM MINUTUM	---1----------2----------1-----2--21----------
SPHAEROSYLLIS SP.	----------423----------152----------
SPIO FILICORNIS	-1-121-------11-----413-23122-2-2--1211-----1-------1--1-211-11-2--1211---1-
SPIONIDAE SP.	--1--1----1----------1----------
SPIOPHANES BOMBYX	----------1-1-1----------11----3--112----3-
STHENELAIS BOA	----------1--------1----------
STREPTOSYLLIS BIDENTATA	---1----------


SITE
NUMBERS
SYLLIS SP.
THARYX MARIONI
TRAVISIA FORBESII
TYPOSYLLIS SP.
ACHELIA ECHINATA
AMPELISCA BREVICORNIS
AMPELISCA TYPICA
AMPITHOE RUBRICATA
AORA TYPICA
APHERUSA BISPINOSA
APHERUSA CIRRUS
APHERUSA JURINEI
APSEUDES TALPA
ATYLUS SWAMMERDAMI
BALANUS BALANOIDES
BATHYPOREIA ELEGANS
BATHYPOREIA GUILLIAMSONIANA
BATHYPOREIA PELAGICA
BATHYPOREIA PILOSA
BATHYPOREIA SARSI
BATHYPOREIA TENUIPES
CALLIOPIUS LAEVIUSCULUS
CAPRELLA ACANTHIFERA
CAPRELLA LINEARIS
CARCINUS MAENAS
CHAETOGAMMARUS MARINUS
CHAETOGAMMARUS PIRLOTTI
CHAETOGAMMARUS STOERENSIS
CHEIROCRATUS SUNDEVALLI
CHIRONOMID SP.
COROPHIUM ARENARIUM
COROPHIUM BONNELLII
COROPHIUM CRASSICORNE
COROPHIUM SEXTONNAE
COROPHIUM SP.
COROPHIUM VOLUTATOR
CRANGON CRANGON
CUMOPSIS FAGEI
CUMOPSIS GOODSIRI
DEXAMINE THEA
EULIMNOGAMMARUS OBTUSATUS
EURYDICE PULCHRA
GAMMARUS CHEVREUXI
GAMMARUS FINMARCHICUS
GAMMARUS LOCUSTA
GAMMARUS SP.
GASTEROSACCUS SANCTUS
HARPINIA ANTENNARIA
HAUSTORIUS ARENARIUS
HEMIMYSIS LAMORIAE


SITE
NUMBERS
HYALE NILSSONI
IDOTEA SP.
IDOTEA BALTICA
IDOTEA GRANULOSA
IDOTEA PELAGICA
IPHINOE TRISPINOSA
ISCHYROCERUS ANGUIPES
JAERA SP.
JANIRA MACULOSA
LIOCARCINUS DEPURATOR
LYSIANASSA CERATINA
MELITA PALMATA
MICRODEUPTOPUS ANOMALUS
MICROPROTOPUS MACULATUS
MYSID SP.
NEBALIA BIPES
NEOMYSIS INTEGER
PAGURUS BERNHARDUS
PARAMYSIS ARENOSA
PERIOCULODES LONGIMANUS
PHTISICA MARINA
PONTOCRATES ALTAMARINUS
PONTOCRATES ARENARIUS
PONTOPHILUS TRISPINOSUS
PRAUNUS FLEXUOSUS
PRAUNUS INERMIS
PSEUDOCUMA LONGICORNIS
SPHAEROMA MONODI
SPHAEROMA RUGICAUDA
STENOTHOE MONOCULOIDES
TALITRUS SALTATOR
TALORCHESTIA DESHAYESII
TRYPHOSELLA SARSI
UROTHOE BREVICORNIS
UROTHOE ELEGANS
AMMODYTES TOBIANUS
LIMANDA LIMANDA
ACTINIA EQUINA
AMPHIPHOLIS SQUAMATA
ASTERINA GIBBOSA
ECHINOCARDIUM CORDATUM
LEPTOSYNAPTA INHAERENS
OCNUS PLANCI
OPHIURA TEXTURATA
LOXOSOMELLA PHASCOLOSOMATA
ABRA ALBA
ABRA NITIDA
ACANTHOCHITONA CRINITUS
ACMAEA TESSULATA
CALLOCHITON ACHATINUS


SITE
NUMBERS
1111111111222222222233333333334444444444555555555566666666667777777
1234567890123456789012345678901234567890123456789012345678901234567890123456
CERASTODERMA EDULE
CHAMELEA GALLINA
CIRCOMPHALUS CASINA
DONAX VITTATUS
ENSIS SILIQUA
GOULDIA MINIMA
HIATELLA ARCTICA
HYDROBIA ULVAE
LACUNA PARVA
LEPIDOCHITONA CINEREUS
LITTORINA MARIAE
LITTORINA OBTUSATA
LITTORINA RUDIS
LUCINOMA BOREALIS
MACOMA BALTICA
MODIOLUS MODIOLUS
MODIOLUS SP.
MYA ARENARIA
MYSELLA BIDENTATA
MYTILUS EDULIS
NUCELLA LAPILLUS
ONOBA SEMICOSTATUS
RETUSA OBTUSA
RISSOA PARVA
SCROBICULARIA PLANA
SKENEOPSIS PLANORBIS
SPISULA SOLIDA
SPISULA SUBTRUNCATA
SPISULA SP.
TELLINA FABULA
TELLINA TENUIS
TURTONIA MINUTA
VENERUPIS PULLASTRA
VENERUPIS RHOMBOIDES
NEMATODA SP.
NEMERTINEA SP.
SIPUNCULOIDEA SP.
GOLFINGIA VULGARIS
GOLFINGIA MINUTA
PRIAPULUS CAUDATUS

APPENDIX IX

COASTAL CONSERVATION

INTRODUCTION

The purpose of this review is twofold:

(i) To describe the nature and extent of human pressures on the Northern Ireland coastline, where these are relevant to coastal conservation.

(ii) To summarise the protective measures which are already in force around the coastline, including the presence of National Nature Reserves and other protected sites, and the activities of non-governmental bodies.

A third factor which is important when considering the conservation status of coastal sites is bird life. It is not proposed to deal with the subject here, since it is very large, and covered elsewhere (eg. Housden and Browne, 1979; Hutchinson, 1979; Watson 1980).

The main point to note is that Northern Ireland has an impoverished breeding landbird airfauna, whereas breeding seabirds and migrant and wintering waterfowl and waders are important. Large parts of the coastline are utilised by bird life; the cliffs of the north coast, Rathlin Island, and outer Islandmagee by breeding seabirds; the wide sand and mud flats of the sea loughs and estuaries by wildfowl and waders, and parts of the open coast (especially the outer Ards peninsula) are important for shore waders (Weyl pers. comm.).

HUMAN PRESSURES ON THE COASTLINE

Mitchell (1986) recognises eleven categories of activity which may potentially damage marine biocoenoses. These are:

(i) Exploitation of living resources.

(ii) Cultivation of living resources.

(iii) Waste disposal

(iv) Exploitation of non-living resources.

(v) Coastal defence and flood protection.

(vi) Reclamation.

(vii) Recreation.

(viii) Control of predatory species (seals, otters and birds).

(ix) Shipping and navigation.

(x) Military activities.

(xi) Educational and scientific studies.

Three of these categories are treated in separate appendices in the present report as being particularly relevant to coastal conservation: (i) and (ii) are dealt with in Appendix X under the heading Marine bioresource exploitation in Northern Ireland; (iii) in Appendix XI under the title Quality of inshore coastal waters around Northern Ireland.

A further four categories are particularly relevant to the Northern Ireland situation; (iv) (v) (vi) and (vii) are treated in this appendix under separate headings, as potential or actual major threats to the conservation status of parts of the coastline.

The remaining four categories are not major threats in Northern Ireland. No reference can be found to seal culls, possibly because finfish farming is undeveloped. Individual farmers may shoot predatory or scavenging birds, as has recently happened to several choughs on Rathlin Island (Bradley, pers. comm.) and nesting peregrines may be at risk from egg theft or theft of chicks for sale abroad; however it is difficult to quantify the relative impact of these activities on bird populations as a whole.

Military activity may in some respects be beneficial, in that it prevents public access to sensitive duneland at Magilligan (Co. Londonderry) and Ballykinler (Co. Down). The dunes are used as firing ranges rather than as a testing ground for explosives or large engines of war. However, it is still necessary for some outside agency to monitor military activity and ensure that damage to the environment is kept to a minimum (Greer, pers. comm.)

The effect of shipping and navigation on the Northern Ireland coastline presumably reached equilibrium long ago, with the main impact coming from building of dock and harbour facilities. No studies have been made on the effects of ships' wakes on the shores of Belfast and Carlingford Loughs, which experience suggests carry the heaviest traffic at present.

The impact of educational and scientific studies on the coastline would appear to be negligible, concentrating around field centres such as the Belfast Education and Library Board centre at Carnlough in Co. Antrim, and the Q.U.B. Centre at Murlough in Co. Down, and the Portaferry Marine Biology Station. A complete list of field study sites, together with the main points of interest at each site, may be found in Thomlinson (1974).

The remaining human pressures on the coastline will be discussed under the following four headings:

(i) Amenity use.

(ii) Mineral extraction.

(iii) Land reclamation.

(iv) Engineering works.

(i) Amenity Use

The heaviest pressure on the coastline which has been noted during the course of the littoral survey comes from amenity use. Activities are diverse, including trial-biking, diving, yachting (see Appendix X on the effects of anti fouling paints on water quality), rock climbing, bird watching, shooting (especially in Strangford Lough), walking along coastal foot-paths, playing golf and angling. The impact of most of these activities is difficult to assess. However, the activity which exerts most pressure on coastal habitats, and the one with most relevance to coastal conservation, is tourism.

Carter (1982) focuses on two aspects of Tourism in Northern Ireland which have changed dramatically in the last 30 years:

- The increasing numbers of day and half day trippers associated with fine weather.

- The phenomenal increase in coastal caravan parks in Northern Ireland.

Day trippers concentrate on sandy beaches close to main holiday towns, such as Portrush, or on "traditional" sites such as Tyrella; their influence on the coastline decreases with distance from these centres. Caravan parks, especially along the Co. Down coastline, are found wherever sandy beaches are present.

Sandy beaches and their traditional associated habitats, notably sand dunes, are the areas most affected by tourism. There have been several papers on the effect of human pressure on sand dunes (Carter 1975; Buchanan 1976) and on management of sand dunes (Wilcock and Carter 1977; Riley 1984).

Whatmough and Carter (1982) compare and contrast two similar sand dune sites in Co. Down. One site, at Murlough, is managed by the National Trust, while at the other site, Tyrella, there is no management plan. Both sites receive large numbers of visitors, although at Tyrella arrivals are concentrated into only a few days each summer, while Murlough has a far more even distribution throughout the year.

Access restrictions are in force at Murlough, and the public are directed along durable paths which have been laid through the dunes. At Tyrella on the other hand access is mostly unrestricted. Trampling pressures on sand dunes leads to selective wind erosion; paths and tracks become gullies. Cars park on the beach. The result is that progressive degradation is taking place at Tyrella, while much of Murlough remains undisturbed.

Little has been written on the effects of human recreational pressure on the intertidal region. Carter (1975) noted that car parking on the north coast beaches at Portstewart (up to 1500 cars/day on a sunny weekend), Castlerock, Downhill and Benone caused compaction of the sand below high water mark, leading to erosive damage of the beach profile.

During the course of the Northern Ireland littoral survey, it has been noted that localised Enteromorpha blooms, perhaps caused by eutrophication, are often associated with coastal caravan parks. The heaviest concentration of caravan parks lies along the outer Co. Down coast. The outer Ards peninsula and the entrance to Carlingford Lough are examples of areas which are highly diverse in terms of both rocky and sedimentary intertidal habitats and in species, but which are adjacent to heavy concentrations of caravans.

(ii) Mineral extraction

Sand removal is a problem at Castlerock, Portstewart, Portrush, Whitepark Bay, Cushendun, Cushendall and Tyrella (Carter 1982). Sand has been removed for agricultural purposes, to "lighten" heavy clay soils, for generations. However the amount that could be removed by hand was negligible; today mechanical excavators are used to remove sand for a wide range of purposes, including flooring material for intensive livestock rearing units, other agricultural uses and for use as a construction material.

At least 50,000 tonnes have been removed from the East Strand, Portrush, which led to abnormal dune erosion (Carter, 1975) and it is estimated that since 1960 over 56,000 tonnes have been removed from White Park Bay (about 2% of the total available sand). A major concern is the manner and location of the extraction; sand removal by front loading tractors from parts of seaward dune faces exacerbates wind and sand erosion.

Carter (1982) is of the opinion that beach and dune sand should not be viewed as a renewable resource as there are no processes providing major present day additions to the overall sediment budget and that the long term effects of sand removal are detrimental to coastal stability.

(iii) Land reclamation

Land reclamation is mainly confined to the sea loughs. The change in surface area of Larne lough between the early part of this century and today is illustrated in Appendix X, by comparing an outline map of the lough provided by Gough (1906) with a recent Ordnance Survey map. The reduction in surface area is due to land reclamation in the harbour area and spoil dumping from Magheramorne cement works. Records from the former Larne Marine Biological Station show that the lough was a biologically rich area at the turn of the century; this richness is now considerably less (Boaden 1982).

Hundreds of hectares of alluvial land were reclaimed by farmers from the sea in Lough Foyle during the last century (Hutchinson, 1979). Mud flats on the inner, northern part of Belfast Lough are slowly being reclaimed by the dumping of domestic refuse. There is also a refuse tip on mud flats on the west bank of Lough Foyle, north of Culmore.

It has been proposed in the past to generate electricity by constructing a tidal barrage across the Strangford narrows. Newbould and Carter (1981) deal with the physical and biological changes which could result from an ebb flow generation scheme. Among the main physical effects might be:

- Restriction of the tidal range to the upper half of the existing range.

- Reduction in average current velocity.

- Increased deposition of fine sediments.

- Overall no marked impact on salinity or pollutant concentration, but, particularly in more sheltered areas, there could potentially be locally significant accumulations of freshwater or pollutants.

Biological effects might include:

- Large reduction in intertidal sand and mud flat feeding areas available to wildfowl and waders.

- Reduction in current velocity would reduce availability of food to filter feeders.

The paper also charts the potential effects on recreation and tourism, oyster farming and drainage. At the present time it seems unlikely that the scheme will go ahead.

CONSERVATION ORGANISATIONS AND PROTECTED SITES

The Department of the Environment (Northern Ireland) Countryside and Wildlife Branch and the National Trust are the two most active Conservation bodies in the country; the Royal Society for the Protection of Birds and the recently founded Ulster Trust for Nature Conservation also own and manage protected sites. In some cases sites are owned or managed jointly between two of these organisations. Already about 80% of the coast is under some form of protection (Bleakley, 1987). The coastal sites protected by each organisation will be treated separately.

(i) The Department of the Environment (N.I.) Countryside and Wildlife Branch

The Amenity Lands Act (Northern Ireland) 1965 empowered government to acquire land for the establishment of Nature Reserves. Important sites could also be notified to the planning authorities as Areas of Scientific Interest (ASI's). Fine scenic areas could be notified as Areas of Outstanding Natural Beauty (AONB). The act was understood to extend to intertidal but not subtidal areas (Bleakley, 1987).

The Nature Conservation and Amenity Lands (Northern Ireland) Order came into force in 1985. This introduced the concept of National Nature Reserves (NNR's) and made provision for Marine Nature Reserves (MNR's). Provision was made to grant aid the voluntary

Spartina anglica has been planted along several stretches of coast in the past, probably as an aid to land reclamation (Carter, 1982), although it may also be used in coastal protection. This plant rapidly colonises intertidal sand and mud flats, often ousting Zostera in the process, and replaces diverse salt marsh communities with a monoculture of Spartina. It was planted in Lough Foyle at Ballykelly in 1935 and 1955, in Strangford Lough at Ardmillan in 1930, and in Belfast Lough at Kinnegar in 1932.

In order to remove the threat of Spartina colonisation, every plant must be removed or killed. Over the past fifteen years repeated attempts have been made to eradicate Spartina, including the use of herbicides, but the plant is very persistent and the problem remains today (Bleakley, pers. comm.).

(iv) Engineering Works

Major coastal engineering works are generally constructed near towns; examples include the sea walls which were constructed at Portrush, West Strand in 1961 (Carter 1975) to combat erosion and improve access, and the improved sea defences and extension to the harbour area recently completed in Ballycastle.

Two major engineering projects which were not constructed near towns are the canalization of the River Bann mouth by training walls, completed in 1887 and which, according to Carter (1975) has had negligible effect on coastal geomorphology, and the Quoile barrage.

The Quoile barrage was constructed in 1957 to (Hutchinson, 1979) improve drainage and reduce flooding around the River Quoile (Hutchinson, 1979) which flows into the south western extremity of Strangford Lough. The barrage opens only on the ebb tide, allowing the release of backed up river water into the lough, and closes on the flood, thus refusing entry to salt water. This has created new freshwater habitats in the Quoile pondage, which is now a nature reserve, although there are slight pollution problems (see Appendix XI). The overall reduction in current flow has resulted in increased silt deposition in south west Strangford Lough (Boaden, pers. comm.).

The cumulative effect of small scale engineering works, sometimes carried out without planning permission, may be a long term threat to the coast. For example a road has been built along the northern margins of Strangford Lough, cutting off stretches of fringing salt marsh from the sea (Boaden, pers. comm.). During the course of the littoral survey it has been noted that the Watergap river, which runs across the flats of Mill Bay in Carlingford Lough, has been canalized from the point where it enters Mill Bay for a substantial distance, perhaps in an attempt to improve drainage. There were also signs of gravel extraction in the immediate vicinity.

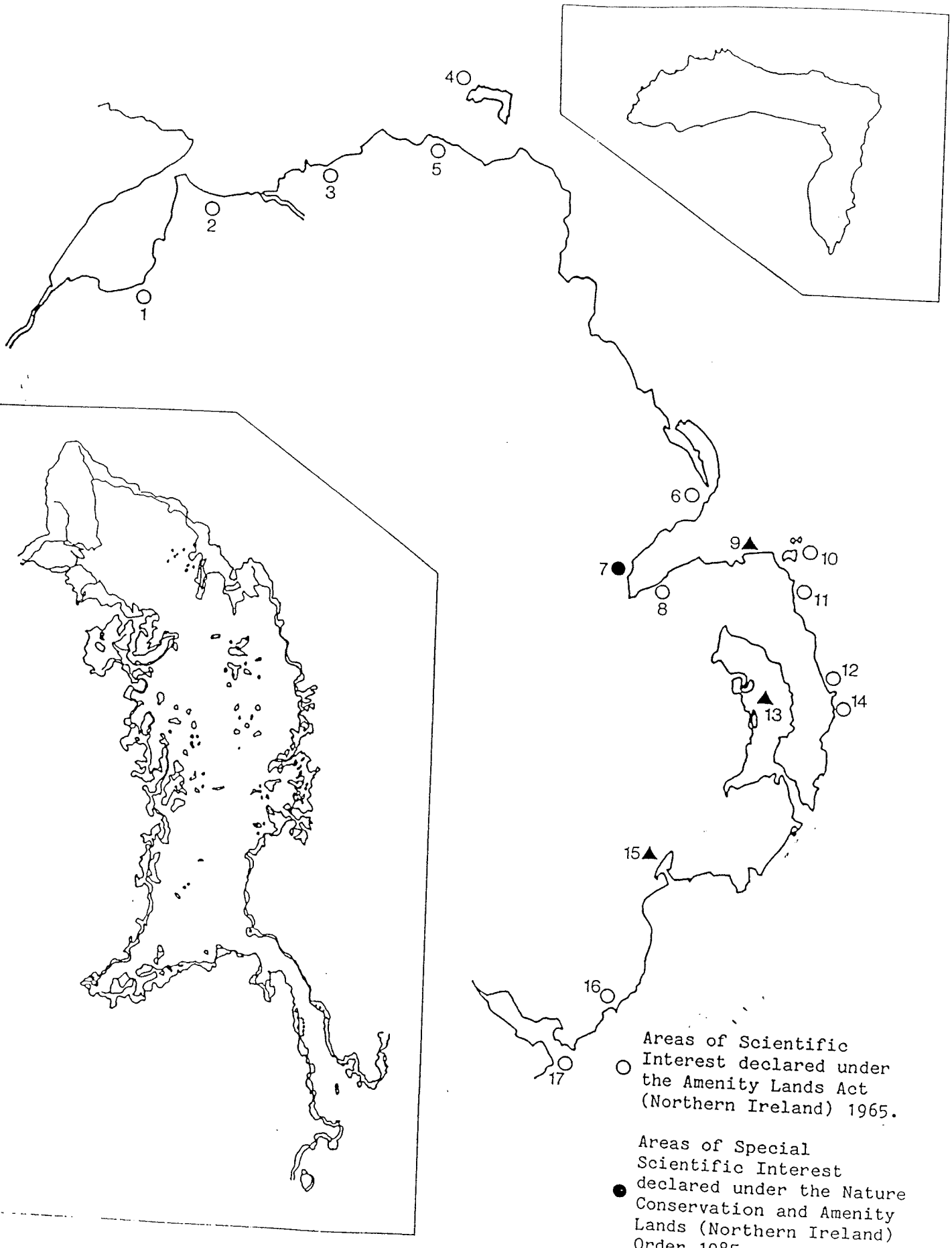


Figure IX(ii)(a) ASI's and ASSI's Around the Northern Ireland Coastline.

Figure IX(i)b National Nature Reserves around the Northern Ireland Coastline

List compiled from Nature Reserves Committee reports 1976-1979, from Baxter (pers. comm.) and from Bleakley (1987). Site numbers as in Figure IX(i)a.

1. Roe Estuary. C640295. Saltmarsh, sandbanks, other estuarine habitats. Rich bird life.

2. Magilligan Point. C665387. Sand dunes; Little Tern colony.

3. Ballymaclary. C697364. Sand dune system with wet slacks. Rich flora.

4. Portrush. C856412. Indurated lias shale. Historically significant geological site.

5. Giant's Causeway, C954453. Geological site (columnar basalt).

6. Kebble D095515. Grassland, lake and sea cliffs with fine basalt sections. Seabird breeding colonies.

7. Swan Island. J422993. Tern nesting site.

8. North Strangford Lough. J508706. Extensive sand and mud flats plus Comber estuary. Very important for wildfowl.

9. The Dorn. J593568. Foreshore, shore and sea bed with rich marine fauna. Tidal rapids present.

10. Granagh Bay. J504488. Mudflats and rocky shore. Rich in marine fauna and flora.

11. Quoile Pondage Basin. J500478. Freshwater lake and shore habitats; many wildfowl.

12. Cloghy Rocks. J594478. Rocky shore and mudflats. Seal breeding and nesting site.

13. Ballyquintin Point. J624456. Raised cobble beach with a distinctive flora of wind-dwarfed scrub and sparse grassland.

14. Killard Point, J610433. Dune grassland on lime rich soils with many calcifuge plants including orchids. Rich rocky and sandy foreshore.

15. Murlough Dunes J410350. Sand dune system over old shingle beaches. Varied flora; rich insect and bird life.

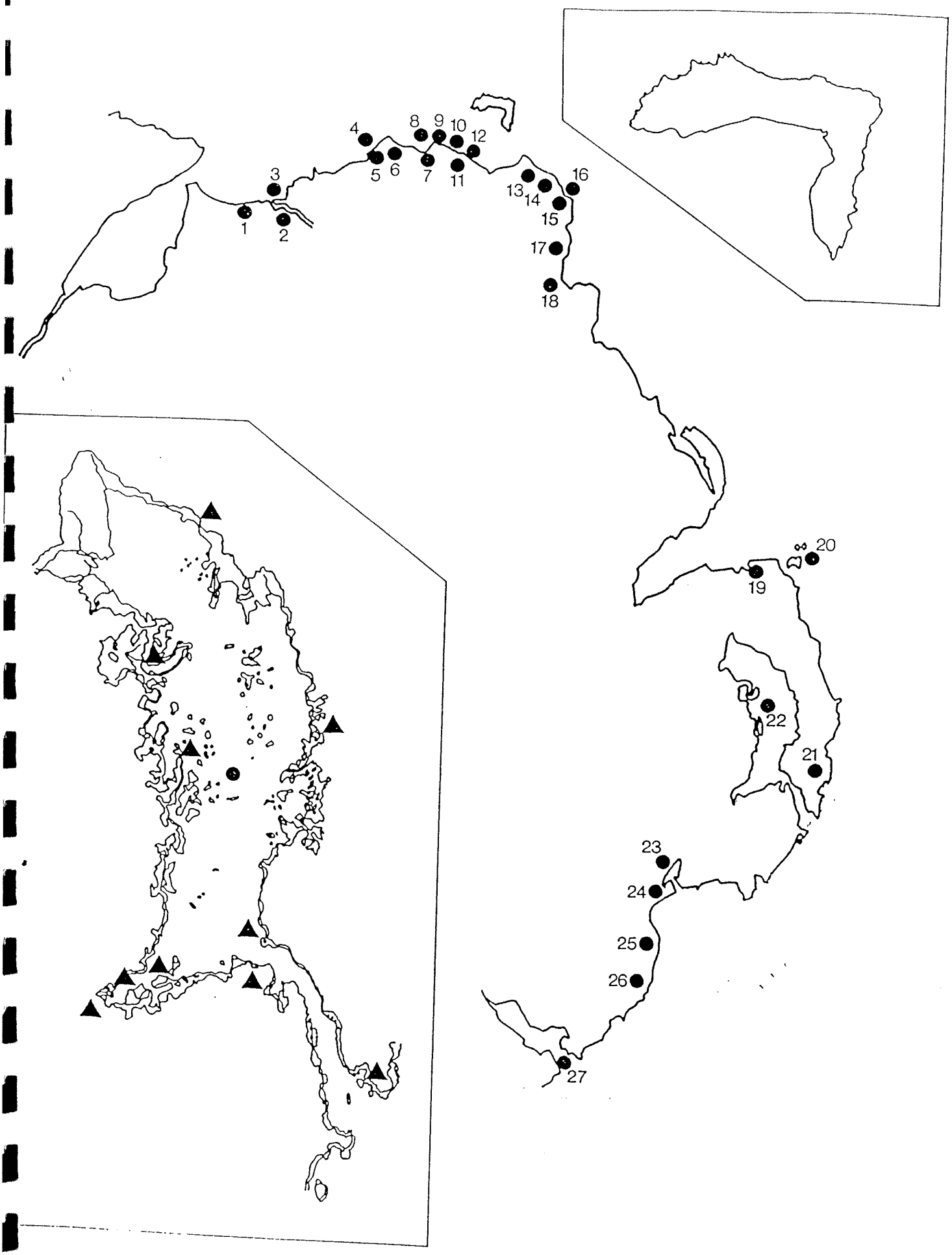


Figure IX(iii)(a) Coastal National Trust Property in Northern Ireland.

Figure IX(ii)b ASI's and ASSI's Round the Northern Ireland Coastline

List compiled from Nature Reserves Committee reports 1976-1979, from Baxter (pers. comm.) and from Bleakley (1987). All sites are Areas of Scientific Interest unless otherwise stated (for explanation see text). Site numbers as in Figure IX(ii)(a).

1. Carrickhugh. Coastal shingle bars and salt marsh with botanical interest.

2. North Derry. Variety of landforms and habitats between basalt escarpment and sea. Geological interest.

3. The Skerries. Baked Lias shale above dolerite sill; gull nesting sites.

4. Rathlin Island. Wide variety of landforms, habitats and fine geological sections. Outstanding seabird nesting site.

5. North Antrim Coast. Wide variety of landforms, habitats and fine geological sections.

6. Ballycarry. Saltmarsh and mudflats; feeding and roosting site for wildfowl and waders.

7. Inner Belfast Lough; from Macedon Point to the outer edge of Holywood mud bank. Declared Area of Special Scientific Interest. Waders and wildfowl on extensive mud flats.

8. Cultra. Lower Carboniferous and Permian strata on foreshore.

9. Ballymacormick Point. In the process of being declared an Area of Special Scientific Interest. Wide variety of rocky and sedimentary intertidal habitats. Good salt marsh.

10. Copeland Islands. Important site for breeding seabirds and migrating passerines. Geological interest.

11. Coalpit Bay. Fossil locality (graptolite) in lower Palaeozoic beds.

12. Roddam's Port. Clay coastline; post Pleistocene clay deposits.

13. Strangford Lough. In the process of being declared an Area of Special Scientific Interest. Diverse intertidal and sublittoral marine life; very important for wild fowl. Interesting glacial geological features.

14. Burial Island. Rocky island with ternery and seal breeding site.

15. Dundrum Bay. In the process of being declared an Area of Special Scientific Interest. Important for Wildfowl and waders.

16. Mourne Coast. Cliff, rocky shore, sandy shore, maritime grassland.

17. Green and Blockhouse Islands. Rocky islands with breeding terns.

conservation movement for site protection work. The designation of Wildlife Refuge was introduced, which give any specified group of animals and/or plants the sort of protection formerly limited to birds in bird sanctuaries. The upgraded notification of Area of Outstanding National Beauty (AONB) and the new category of Area of Special Scientific Interest added an element of management to that of development control (Bleakley, 1987).

The Countryside and Wildlife Branch owns and/or manages fifteen coastal NNR's. Their positions are indicated in Figure IX(i), together with the main reasons for their designation and whether they include intertidal habitats.

The Branch is also responsible for a large number of coastal ASI's. At present, in order to conform with the 1985 Order, these are in the process of being redesignated as ASSI's (Baxter, pers. comm.). In these areas owners are required to consult the Branch on planning matters, which may result in a nature conservation management agreement being drawn up. The presence of coastal ASI's is indicated in Figure IX(ii).

(ii) The National Trust

The National Trust owns approximately 1400ha of coastal property, and holds in covenant a further 160ha (Carter 1982). The Trust manages its properties with visitors in mind, but nature conservation has a high priority; for example the public are discouraged from visiting parts of Murlough reserve in Co. Down, to reduce pressure on sand dunes. The Trust, in concert with other organisations and individuals, also develops long distance footpaths, including the North Antrim and Mourne coastal paths. Trust properties are listed in Figure IX(iii).

The Trust owns or leases virtually all of the shoreline around Strangford Lough and, in co-operation with wildfowler's organisations, landowners and ornithologists, administers the Strangford Lough Wildlife Scheme (Hutchinson 1979). The scheme is aimed particularly at protecting bird life on the Lough. Permits are required to shoot on open areas, while there are seven major refuges where birds must not be disturbed. Certain nesting islands are denied to public access, and several of the islands jointly form a statutory bird sanctuary.

(iii) The Ulster Trust for Nature Conservation and the Royal Society for the Protection of Birds.

These two organisations own or manage eight coastal reserves between them (Baxter, pers. comm.). These are shown in Figure IX(iv).

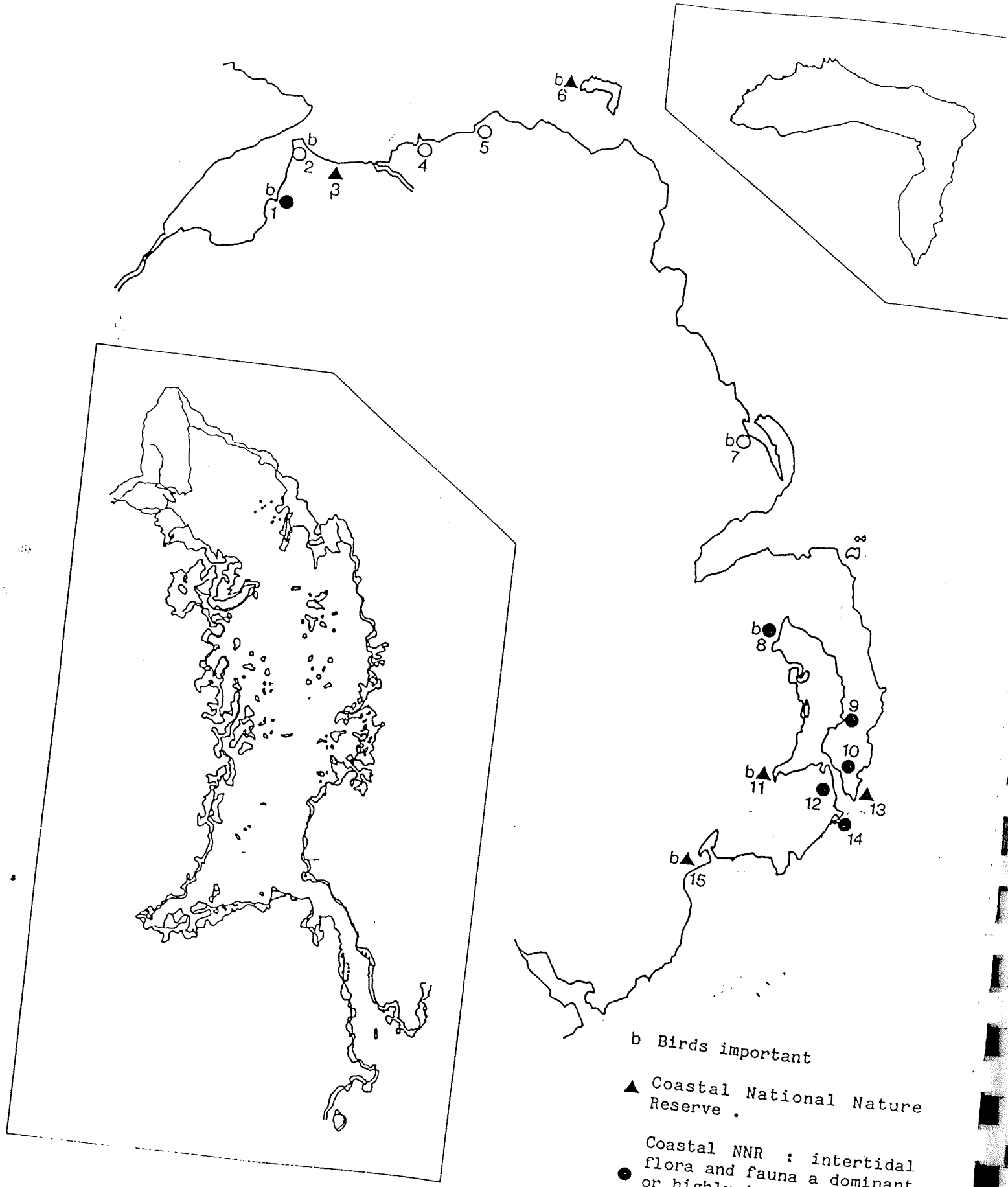


Figure IX(i)(a) National Nature Reserves round the Northern Ireland Coastline.

Figure IX(iii)(b) Coastal National Trust Property in Northern Ireland

List compiled from O.S. maps and from Anon. (1983). Site numbers as in Figure IX(iii)(a).

1. Downhill. C758363. 20 acres.
2. Bar Mouth. C792355. 19 acres + Covenants over 22 acres. Nature Reserve.
3. Portstewart Strand C720360. 185 acres duneland.
4. Giants Causeway. C952452. 96 acres of cliffland plus covenants over 30 acres.
5. North Antrim Cliff Path. 10 miles long. 104 acres and covenants over 45 acres.
6. Dunseverick Castle. C987445. 5 acres.
7. White Park Bay. D023440. 179 acres of sandy shore and dunes.
8. Carricknaford and Long Gilbert Islands. D029452. Small islands.
9. Islando. D038457. Small islands.
10. Sheep Island. D049458. Small inland.
11. Larry Bane Bay. D054447. 58 acres of coastline.
12. Carrick-A-Rede. D062450. 30 acres of grazing and cliff.
13. Fair Head and Murlough Bay. D185430 and D199418. 764 acres.
14. Altmore Burn. D233396. Small stream.
15. Torr Head to Coolranny Path. D243375. 7½ acres.
16. Loughan Bay. D244378.
17. Layde. D245289. Includes a small beach.
18. Cushendun. D248327. 64 acres, covenants over a further 5½ acres.
19. Ballymacormick Point. J525837. 44 acres of undisturbed coastline.
20. Lighthouse Island. J596858. 43 acre island.
21. Kearney and Knockinelder. J650517. 43 acres in total, including 39 acres of beach and foreshore. Covenants over a further 323 acres.
22. Strangford Lough Wildlife Scheme, Co. Down, J560615. The Trust owns a number of properties in and around Strangford Lough (the major ones indicated by black trangles on the map) and leases sections of the foreshore. It administers a conservation scheme which embraces all the lough foreshore (see text).

23. Dundrum Coastal Path. J417382. Short length of path along the north-western border of Dundrum Bay.

24. Murlough Nature Reserve. J410350. 938 acres of sand dune and heathland. Restricted access to public.

25. Mourne Coastal Path. J389269. 61½ acres.

26. Dunmore Head. J386245. Small headland.

27. Blockhouse Island and Green Island, J254097. 2 acres. Tern nesting sites.

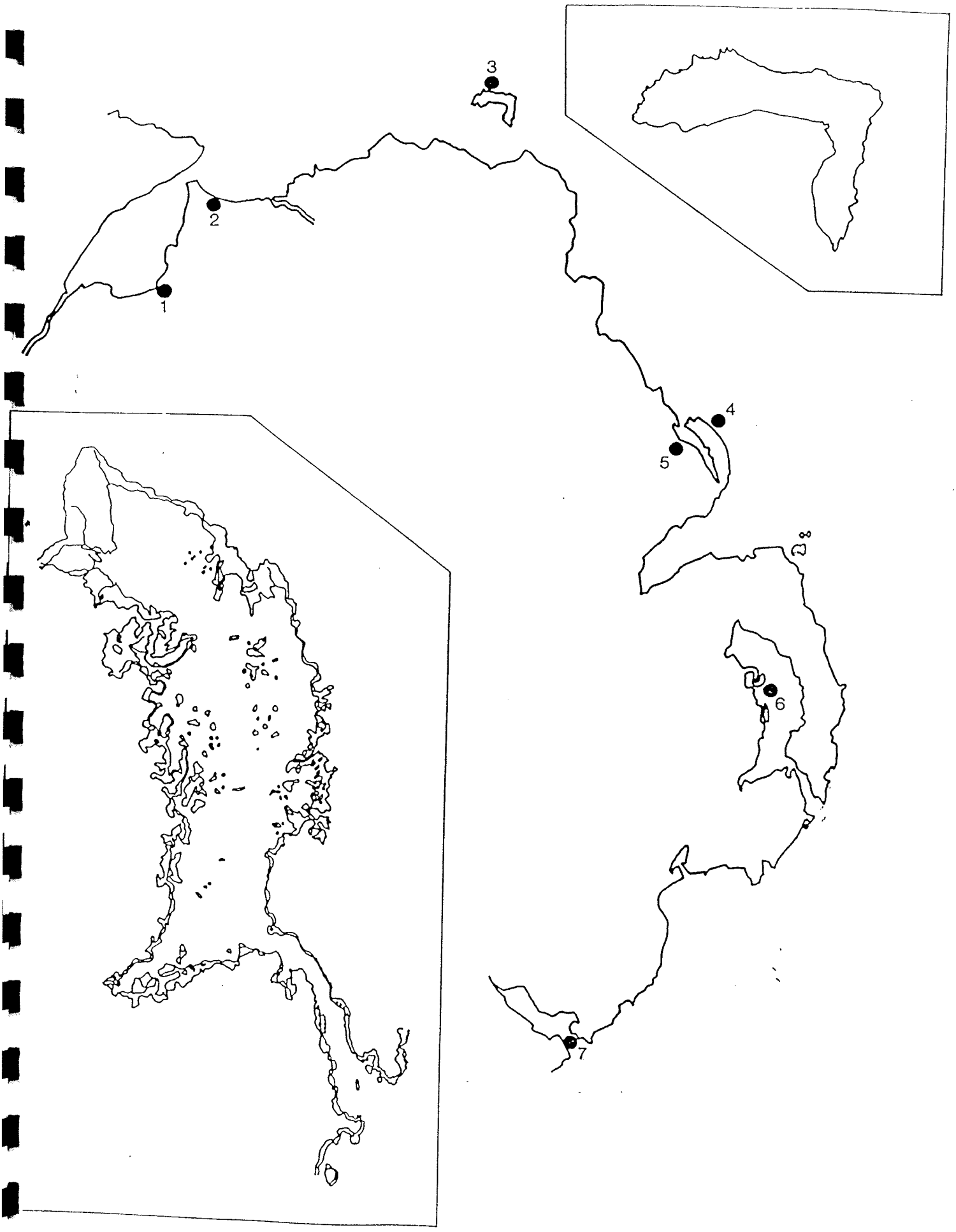


Figure IX(iv)(a) UTNC and RSPB Reserves around the coast of Northern Ireland.

Figure IX(iv)(b) UTNC and RSPB Reserves Around the Coast in Northern Ireland

Compiled from Baxter (pers. comm.). Site numbers as in Figure IX(iv)(a).

1. Ballykelly, Lough Foyle. C610225. RSPB. Wildfowl and waders.
2. The Umbra. C725356. UTNC. Sand dunes.
3. Rathlin North Cliffs. D130525. RSPB. Cliff nesting seabirds.
4. Isle of Muck. D466024. UTNC. Seabirds.
5. Swan Island. J424996 RSPB. Nesting Terns.
6. Rainey Island. J527628. UTNC.
7. Green Island. J240112. RSPB. Terns.

APPENDIX X

QUALITY OF INSHORE COASTAL WATERS AROUND NORTHERN IRELAND

INTRODUCTION

The review is deliberately brief with the aims of illustrating major pollution influences in coastal regions and giving some idea of their relative significance in terms of conservation. Special emphasis will be placed on the sea loughs.

GENERAL ASPECTS

The responsiblity for water pollution control lies with the Environmental Protection Division (EPD) of the Department of the Environment for Northern Ireland (DOE(NI)) under the Water Act (NI) 1972. This Department, again through EDP, is also the licensing authority for the sea disposal of waste under the Food and Environment Protection Act (1985). Measurement of water quality is generally carried out by the Industrial Science Division (ISD) of the Department of Economic Development (DED) on an agency basis to DOE(NI).

WATER QUALITY IN COASTAL AREAS

The literature available on water quality tend to be specific about certain localised areas. For convenience, the coastline is divided into areas for the purposes of this review. The studies quite naturally tend to concentrate on the areas where pollution is greatest, ie. Belfast Lough, although Strangford Lough is studied in detail due to its interest to researchers.

Lough Foyle

Lough Foyle is a large shallow sea lough on the north coast. It is predominantly a marine ecosystem but, at the landward limit of the Lough in the region of Culmore Point, freshwater inflows from the rivers Foyle and Faughan to create localised estuarine conditions.

The main polluting discharges are sewage flows from the city of Londonderry and industrial effluents from Du Pont (UK) Ltd. and Coolkeeragh power station. The industrial discharges enter the system in the vicinity of Culmore Point.

Prior to major works carried out by the Department of the Environment for Northern Ireland, untreated sewage from Londonderry was discharged to the Foyle some 5 miles landwards of Culmore Point. Despite this, minimal oxygen levels in the river never fell below 60% of the air- saturation value. Over recent years, the sewage from the city of Londonderry has been progressively transferred to a primary treatment works, just seaward of Culmore Point. At present, the on-going work programme provides treatment for 80% of the sewage flows. It has resulted in a marked improvement in the water quality of the River Foyle. The comparatively small pollution loadings to Lough Foyle and its large surface area/depth ratio currently preclude problems of gross pollution and oxygen depletion.

Du Pont Nemours comissioned a general biological and physical survey of the southern end of the lough during the establishmant of their Maydown factory and have since arranged monitoring studies of marine life (Anon 1960). Studies by the fisheries laboratories have shown that the lough is apparently not

adversly polluted and that salmon, which is very intolerant of pollution, is the most important fishery species. Studies of bioaccumulation in mussels have confirmed this (Gault, 1983) though there was a localised area at Coolkeeragh which showed increased nickel concentrations.

North and North-East Coast

Little pollution seems to be apparent on this coastline as a whole (Boaden, 1982), though a hydrographic investigation lead to the resiting of a sewage outfall at Portrush (Cooke, 1980) following complaints of sewage polluting a bathing beach nearby. This made the beach unpopular and caused concern as a health risk (Carter, 1987). A small oil spill occurred in Church Bay on Rathlin Island, and though showing some localised effects on the intertidal community after 7 months, recovery was complete after 2 years (Flower, 1983).

Larne Lough

Recent information on water quality of Larne Lough is scarce even though it is important for transport and disposal of heat from Ballylumford power station. It is also used as a source of clay lubricant and a tipping ground for Magheramore Cement Works. The latter has been found to depress biological activity (Boaden, 1982) especially due to increased water turbity. Comparison of maps from the early 1900s with modern Ordnance Survey maps show the amount of infilling due to the cement works and harbour development at Larne (see figure X.1). Historical evidence shows that Larne Lough was an area rich in species and a favourite sampling ground of Victorian naturalists.

Belfast Lough

This area has come under closest scrutiny for investigation into water quality. The presence of Belfast and many outlying towns cause the lough to be used as a convenient 'sink' for many types of effluent. The inner lough and the whole of the northern shore as far as Kilroot has been heavily exploited for dilution of industrial and domestic effluent, land reclamation and transport (Boaden, 1982). There are two water current patterns in the lough, an inner one of simple ebb and flood and an outer one of a clockwise circulation moving at about 1 knot (Maxwell,1978). Biochemical oxygen demand, 5 days at 20°C, is low during autumn and winter but substantially increases for March onwards. Inner stations give high readings in the summer. The nutrient levels in the lower reaches follow a well recognised pattern of winter build-up, spring decline and then a later summer diatom bloom. However the outer area of Belfast Lough has a nutrient cycle similar to the Northern Irish Sea (Parker and Rosell).

The lough receives primarily treated sewage effluent from about 632,000 people (Boaden, 1982). The River Lagan has been shown to carry considerable amounts of faecal waste into the tidal reaches where sedimentation occurs (Parker, 1979). In the 1970s a number of industrial effluents were discharged including cooling waters and waste water from man-made fibre manufacture, fertiliser effluent and bleach dye plant effluent. During the 1980s there has been a significant reduction in these discharges following several factory closures eg. ICI, Courtaulds and Whitehouse Fibre Dyeing Ltd. Recently oil spills have occurred of the north shore of the lough (pers comm Baxter), this has been washed ashore affecting the intertidal communty by direct action and causing the use of toxic oil dispersants.

Organic matter decreases in concentration in a seaward direction (Parker, 1981), and is generally within the normal range for sea bottom sediments (1-

5%), except for near the dock (12%) (Parker, 1981). The areas of higher organic concentration within Belfast Lough are shown in figure X.2. Primary treated sewage sludge is dumped on a site outside the entrance of the lough (Parker *et al*, 1980). In recent years 300,000 wet tonnes/year has been dumped at a different site in greater than 50m depth of water in strong tidal currents (Service, 1987). Some sludge has been shown to reach the seabed though analysis of the benthic communities shows no apparent pattern which could be attributed to sediment contamination (Service, 1987).

Several studies on metal pollution have been carried out using analysis of the sediments and bioaccumulation in *Mytlus edulis*, the common mussel. Levels of industrial metals showed a positive correlation with the content of organic matter in the sediment (see figure X.2) (Parker, 1980), this increases towards Belfast. The inner lough has zinc levels up to 800 ppm in the sediments (Parker, 1980). Manga (1980) reported that trace metals accumulated in mussels were: zinc 310 ppm, lead 51 ppm, copper 13 ppm, manganese 22 ppm and cadmium 7 ppm. The high levels of metals may be localised, as in general the lough is not thought to be extensively contaminated by metals (Gault 1983).

Organic pollution seems to affect bottom communities towards Belfast with the inner lough communities being dominated by oligochaetes, *Capitella* sp. and *Scolelepis fuliginosa* (syn: *Malacoceros*) all known to be tolerant of organic pollution. Over the remainder of the lough polychaetes dominate the benthic macrofauna and are evenly distributed. Amphipods, bivalves and echinoderms show statistically significant increases in abundance with distance from Belfast (Parker, 1980).

Outer County Down

This seems to be relatively unaffected by pollution though may be under some threat. Many caravan parks are being developed on the outer Ards Peninsula and discharging sewage, particularly in the summer months. Oil tankers are off-loaded in outer Dundrum Bay so small isolated spills may occur, although probably having little effect. South Down is unpolluted by trace metals (Gault, 1983). The levels of radioactivity at the Irish Coast are only about one-fifth to one-tenth of that in Morecombe Bay and thus considered negligible (Boaden, 1982). The annual dose to an average Irish fish eater as a consequence of radioactive effluent is less than 1% of the ICRP recommended principle dose, it is therefore difficult to assert that the levels of contamination in the western and north-western Irish Sea represent a significant hazard to health (Mitchell, 1987). There is no significant increase of radiation related diseases towards coastal areas over the whole of Northern Ireland in recent years (Telford, 1987).

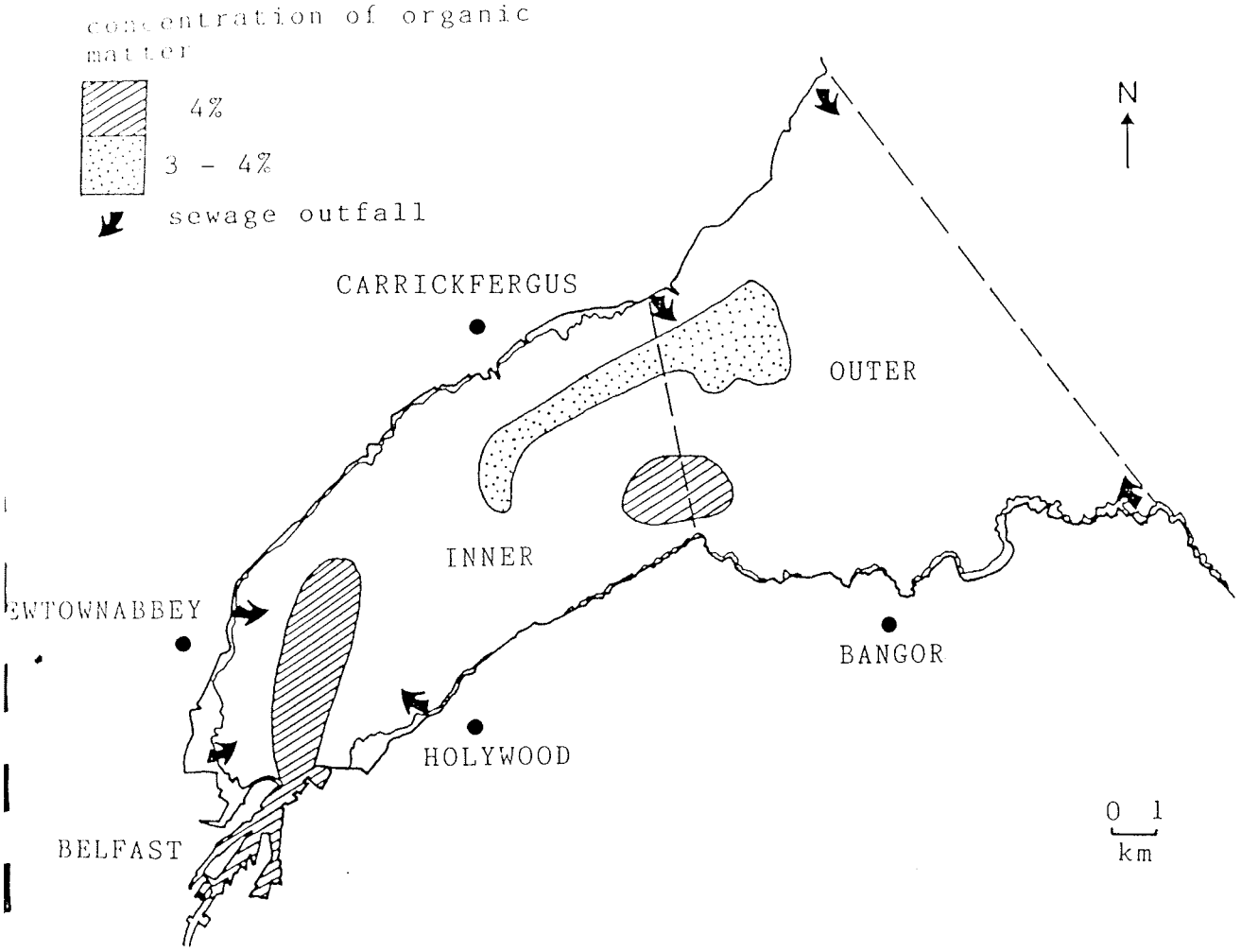


Figure X.ii: Belfast Lough
Levels of concentration of organic matter in the sediments. Major points of sewage input.
The lough can be divided into INNER and OUTER (Maxwell, 1978).

SUMMARY AND CONCLUSIONS

In general the inshore waters of Northern Ireland have a high quality being generally unpolluted at present.

The sea loughs, especially near towns, seem to be more polluted than the open coast and have generally poorer water quality. Belfast and Larne Loughs are considered to have the poorest water quality. Obviously when choosing areas for conservation of marine habitats it would be desirable to avoid regions of poor water quality unless they present an unusual habitat or community where a strict management plan would be essential.

APPENDIX XI

MARINE INTERTIDAL BIORESOURCE EXPLOITATION IN NORTHERN IRELAND

INTRODUCTION

This review will reflect present bioresource exploitation of the intertidal region of Northern Ireland.

Exploitation of bioresources may be divided into two types:

(i) use of naturally occurring stock - Harvesting;

(ii) introduction and cultivation of stock - Farming or Husbandry.

The intertidal region of Northern Ireland has examples of both types of exploitation ranging from casual picking of winkles and seaweed on the shore to the industrial scale cultivation of oysters. Inshore and offshore fisheries are also important in the marine environment and an important factor in the northern Irish economy, but are beyond the scope of this review. For more information on the fisheries of the Irish Sea see the Annual Reports of the Fisheries Research Laboratories, Coleraine, for statistics and Boaden (1982) for a general review.

SHORE COLLECTING - HARVESTING

Traditionally several species of animals and plants are collected from the seashore of Northern Ireland, although this generally takes place on a casual basis which is extremely difficult to monitor and obtain catch data. Most shore collection involves seaweeds or intertidal molluscs although in some areas edible crabs are caught.

Seaweeds may be used for human food, cattle fodder, or extraction of chemicals. In Northern Ireland various species are collected for the local market (Boaden, 1982); at present Palmaria palmata is the most popular and is eaten as dulse. This is mainly collected from County Down and the east coast of County Antrim, and dried on the foreshore above high tide level. Formerly kelp (Laminarians) was harvested for agricultural use although now this is used for the commercial extraction of alginates. Today much of this is undertaken in the Irish Republic though some is still collected on a local scale near Larne and dried at County Mayo, before being exported to Scotland (Boaden, 1982). Ascophyllum nodosum is extensively harvested in the Republic, being gathered all year round by hand and exported to Scotland for drying and processing to produce sodium alginate (Guiry, 1981). It was concluded that there is not enough tonnage to merit the building of a process plant locally. Trials at Rathcunningham Quay on the outer Ards peninsula in 1976-1979 showed a severe detrimental effect on the littoral ecosystem (Boaden and Dring, 1980). It has been estimated that Strangford Lough could yield 3000-4000 tonnes/yr of Ascophyllum, which might be attractive to the alginate industry.

Several other species of algae are collected for industrial use in the Republic, and it is thought that there is a great potential resource of these in Northern Ireland. These species include Fucus sp., Chondrus crispus, Laminaria digitata, Laminaria hyperborea and black-weed (total drift, usually large brown weeds) (Guiry and Blunden, 1981).

Edible winkles (Littorina littorea) are collected from the shore by hand chiefly in County Down (Boaden, 1982). Personal observation has shown that areas of particular interest to the collectorss are; the rock platforms of the outer Ards, St. Johns Point, near Kilkeel and Cranfield Point. Winkles are also collected from Dundrum Bay. Large quantities are exported to France via the Irish Republic. Statistics show that in 1980 390 tonnes, valued at £55,198, were collected (Boaden, 1982), though it is difficult to be accurate due to casual collecting. Management of winkle collecting is regarded as impossible.

Harvesting and culture of the common mussel (Mytilus edulis) offers considerable potential in Northern Ireland (Crowley and Briggs, 1977) with huge mussel beds in Lough Foyle. Management of the stock will have to be instigated to obtain mussels of marketable quality (Briggs, 1982) and will be discussed in a later section. Personal observation has shown that mussels are collected casually using small boats at Longfield Bank, Lough Foyle, and from inner Dundrum bay using agricultural equipment (pers. comm. Ellis).

Edible crab (Cancer pagurus) is collected on a casual basis from Glassdrumman Port, southern County Down. The extensive Sabellaria mats which occur here provide a habitat allowing the growth of edible crabs to marketable size, in the intertidal region. This may damage this rare habitat. Inshore fisheries of edible crab have been investigated by Watson (1972), who concluded that the north coast of Northern Ireland has ample stock to support a fishery but would not be economical without local processing facilities. At present, edible crabs are caught as a bycatch of the lobster fishery (pers. comm. Watson).

FARMING INTERTIDAL RESOURCES

Oyster farming in Northern Ireland had a long tradition with the exploitation of natural stocks in the sea loughs. These were fished to extinction in the 19th century (Boaden, 1982). Trials of rearing oysters intertidally and in the shallow sublittoral were undertaken in the early 1970s (Parson, 1971), initially with the european oyster, Ostrea edulis, and then with the faster growing pacific oyster, Crassostrea gigas which reach marketable size in two years rather than four years as for the former. The trials were undertaken in Lough Foyle and Strangford Lough. Against initial expectations the former was found to be unsuitable for commercial culture due to the widely ranging salinity regime. Strangford Lough, although tending to be rather turbid, showed good potential in the sheltered bays on the western side, especially in areas of high tidal current (Parsons, 1972). Initially the seed oysters were put in trays and transferred to the seabed for ongrowing when big enough to withstand predator attack, usually the shore crab (Parsons, 1972). The muddy seabed in the lower intertidal was covered with tonnes of gravel to provide a firm substrate for ongrowing.

Different methods of cultivation have been investigated including a comparison of raft and tray cultivation (Parsons, 1974) and comparing trays with Japanese Scallop Lanters (Briggs, 1978). The conclusions were essentially that tray cultivation gave better yields than rafts and that lanterns were more efficient than the trays being more resistant to

predators and less liable to fouling. Trays are still used as they seem to be more practical for the particular culture set-up. Crassostrea are not readily accepted by the gourmet but are more than adequate for processing and freezing (Parsons, 1971). It has been shown that even though Crassostrea gigas needs a water temperature of 22-24°C to spawn, this does not seem to affect the quality of the oysters grown in Strangford Lough (Parsons, 1974). The principle site of oyster culture in Northern Ireland is Ringneill Bay, Strangford Lough, near which a new jetty and packaging facility has recently been completed, at Whiterock. Oyster culture in Strangford Lough has increased by more than 500% since 1974 (Boaden, 1982). This is the largest commercial Crassostrea operation in the UK (Newbold, 1981). Interest has been expressed in oyster cultivation in Mill Bay, Carlingford Lough, although there is concern as to the effect this would have on the environment (pers. comm. Weyl).

Cultivation of the common mussel, Mytilus edulis, is still in its early stages in Lough Foyle where the the resource is thought to be in the region of 11,000 tonnes (Crowley and Briggs, 1977). The mussels in Lough Foyle have only arisen in the last 30 years, having taken over what were traditionally cockle beds, possibly by a succession type mechanism. The Foyle Fisheries Commission sponsored research into the possibilities of exploiting this resouce (Crowley and Briggs, 1977), which showed that the main beds are situated at; Balls Point, Longfield Bank, Ture Point and Quigleys Point. The intertidal mussels are grossly overcrowded and therefore of poor quality. The subtidal beds are almost of acceptable commercial quality. It was recommended that mussels should be transplanted from the intertidal to the sublittoral for ongrowing, which would improve the quality of the intertidal beds. Little infestation of the mussels occurs except by the polychaete Polydora ciliata at Longfield Bank (Crowley and Briggs, 1977). Growth of the beds is slow with recruitment from the seaward edge of the bed (Briggs, 1982). Evidence seems to indicate that the carrying capacity of the environment has been reached resulting in depressed mussel growth. Productivity of the mussels could be accelerated by cropping the beds (Briggs, 1982b). Commercial exploitation of these beds concentrates on grading and collection of the mussels, particularly from the more productive seaward edge and sublittoral sites.

Fish farming using cages in sea loughs is thought to have some potential although there is concern about environmental implications. Proposed fish cages in Strangford Lough have been turned down by the DOE (NI) on environmental grounds (pers. comm. Baxter), although cages may be placed on the open coast in the future.

APPENDIX XII

DISCUSSION WITH INTERESTED PARTIES

A large amount of information on the presence of rare species and unusual or particularly rich collecting sites around the coastline is contained in the private files of a few individuals. This information provides useful knowledge of species distribution. However, since it is anecdotal in nature, and does not cover the whole coastline in equal detail, it must be recorded separately from the results of the littoral survey.

The information is summarised here, in the form of annotated maps (Figure XII(i) and Figure XII(ii)). The greatest amount of information was provided by Dr Pat Boaden, Director of Queen's University Marine Biology Station, Portaferry, who has a detailed knowledge of the species and habitats of Strangford Lough. This sea lough is dealt with in a separate map from the remainder of the coastline.

The other people consulted were Bernard Picton, Osborne Morton and Helen Ross (all of the Ulster Museum), together with Bob Bleakley and John Greer of the Department of the Environment (Northern Ireland).

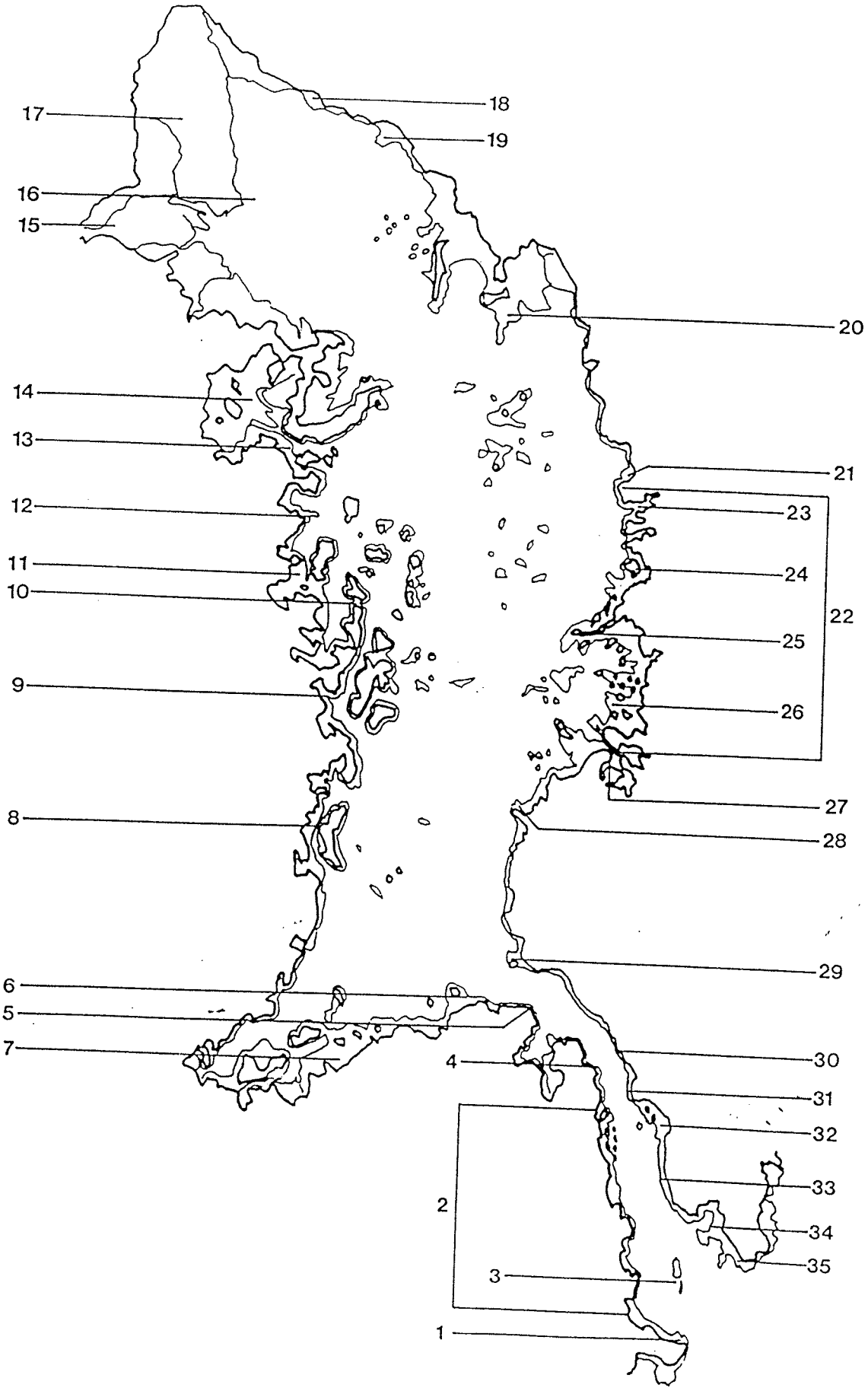


Figure XII.i : Sites in Strangford Lough referred to in Appendix XII.

Strangford Lough - See Figure XII(i)

1. Northern end of Killard Point. Influenced by the current from Strangford Narrows, and hence with a rich algal epifauna.

2. Mill Quarter Bay - Isle O'Valla. Rich under-boulder fauna including Leptasterias muelleri and Asterina gibbosa, and rich sedimentary shores, with species including Leptosynapta inhaerens, Cerianthus lloydi, and Echinocardium cordatum.

3. Angus Rock. Good diversity of algae and hydroids. Particularly dense Patina pellucida population.

4. Swan Island. Sheltered from wave action and exposed to strong current flow at the eastern end which has a rich low water fauna including Caryophyllia smithii.

5. Audley's Castle. Small area of maerl just offshore. Also species richness on a boulder spit just north of the castle is good.

6. Chapel Island. Large tide pool, with drainage from the pool running under the boulders on its eastern side, giving a rich under boulder fauna.

7. Mud and sand flats along southern boundary of lough. Intertidal fauna relatively unknown. However the area from Launches Little westwards is important for bird life.

8. Muddy areas to west and north of Island Taggart. Rich infauna, also moderately rich boulder shores.

9. Rathgorman. Small tidal rapids.

10. Castle Island Point. Boulder causeway between Castle Island and Darragh Island is strongly affected by tidal currents and supports a rich fauna, including large numbers of Ciona intestinalis. Gibbula magus sometimes found intertidally.

11. Muddy areas from Peaisland Point to Castle Island. Rich infauna. Ascophyllum nodosum f. mackaii present round Shamrock Island.

12. Bradock Island. Affected by slight tidal current. Large numbers of Ciona intestinalis.

13. Mahee Island. Tidal Rapids.

14. Ringneill Bay to Ardmillan. Wide area containing a large diversity of sediments. Mussel and cockle beds which have a rich infauna, including Leptoplana tremelaris and Amphitrite sp.

15. Comber Estuary. Good salt marsh. Spartina growth a problem here and in other areas of north Strangford.

16. North, West and South rocks are seal haul-outs; seals have only recently commonly travelled this far up the Lough.

17. Sediment flats at north end of Strangford Lough. Mussel and cockle beds; in general, not a diverse fauna. Enrichment around sewage works leading to large numbers of Perinereis sp. in the sediment. There has been a marked decrease in the amount of mud at the north end of the Lough since 1970. Interesting boulder areas are found at McKaigs Rocks and low water springs around Black Island. Zostera growth is reduced compared to 1970.

18. North East Strangford. Geologically interesting outcrops of sandstones and mudstones.

19. Mountstewart. Large pools on wide sedimentary areas, with boulder shores around Pig Island. Mussel and cockle beds on sediment. Very sheltered; Mytilus grows attached to seaweed, and large Anemonia sulcata are present. Zostera marina is exposed on good low tides near Pig Island.

20. South Island/The Ragheries. Lime rich soils on South Island. The intertidal is composed of boulders and coarse sediment. Rich fauna, including Venerupis sp., large Anomia ephippium and live intertidal Ostrea edulis sometimes found.

21. Kircubbin harbour. Pectinaria present.

22. Good examples of coastal fringe habitats exist between Kircubbin and the Dorn.

23. Doctor's Bay. Rich fauna. Good incipient salt marsh.

24. Horse Island. Rich boulder fauna. Protohydra present in high level muddy sand.

25. Gransha Point. Sand and mud areas with a rich infauna. Mya, Pectinaria and Ensis may be found to the north of the point.

26. Yellow Rocks. Seal haul out. Rich lower shore fauna, including Sabella pavonina and the ascidians Ascidiella, Ascidia and Ciona.

27. Ardkeen and the Dorn. The Dorn is an area of tidal rapids, and is the richest single site in Strangford. The rapids flow over boulders and coarse gravel, with some bedrock present at the sill. The emergence phenomenon is very marked, with large numbers of species which are normally found only sublittorally living in the intertidal. Among the animals which have been found are the starfish Crossaster papposus and Henricia sanguinolenta, the feather star Antedon bifida, the spider crab Inachus dorsettensis and a variety of sponge species. The alga Cystoseira nodicaulis has been recorded. The sediment contains Golfingia sp., Leptosynapta inhaerens and Priapulus caudatus (in mud). The southern part of the tidal reservoir behind the Dorn, to the west of Ballywallon Island, is influenced by freshwater. Limaponta sp. is present. To the west of the Dorn, on the mud between Long Island and the shore, are wide areas of Zostera.

28. Ringburr Point. The sediment to the north is composed of coarse sand and gravel, and contains Edwardsia carnea, Halcampa chrysanthellum, Leptosynapta inhaerens and Golfingia sp.

29. Selk Rock and Ballyhenry Island. Very rich fauna. On the north side of the island Edwardsia timida and Leptosynapta inhaerens are present in muddy gravel, while the lower shore boulders support a rich, if typical, Strangford fauna including Anemonia sulcata, Sabella pavonina and Eupolymnia nebulosa.

A gully exists between Selk Rock and Ballyhenry Island, which contains Psammechinus miliaris, Echinus esculentus, Caryophyllia smithii and Lineus longissimus. On a good spring tide in the bay to the north east Cerianthus lloydi, Ensis siliqua and Corystes cassivelaunus can be found. The southern part of the island is particularly rich; Chaetopterus variopedatus is found occasionally, as is Caryophyllia. This is also a good Trivia monacha area.

Ascophyllum nodosum f. mackaii lies on the mud between the island and the shore.

30. North of Bankmore Hill. Pectinaria sp. Balanoglossus sp. and Echinocardium cordatum may be found in sediment.

31. Bankmore Hill. Good site. Emergence phenomenon very much in evidence. Large numbers of Actinia equina and hydroids, with Alcyonium digitatum, Henricia sanguinolenta and Marthasterias glacialis at low water.

32. Granagh Bay, Wide range of intertidal rocky and sedimentary habitats. Very good site. Significant species include Cereus pedunculatus, Caryophyllia smithii, Cerianthus lloydi, Echinocardium cordatum, Labidoplax digitata, Maxmulleria lankestri and Trivia monacha.

33. North of Carrstown Point. Very large numbers of Dendrodoa grossularia.

34. Barr Hall Bay, Large numbers of Lanice; interesting meiofauna.

35. Ballyquintin Point. Wet flushes and Phragmites on the upper shore.

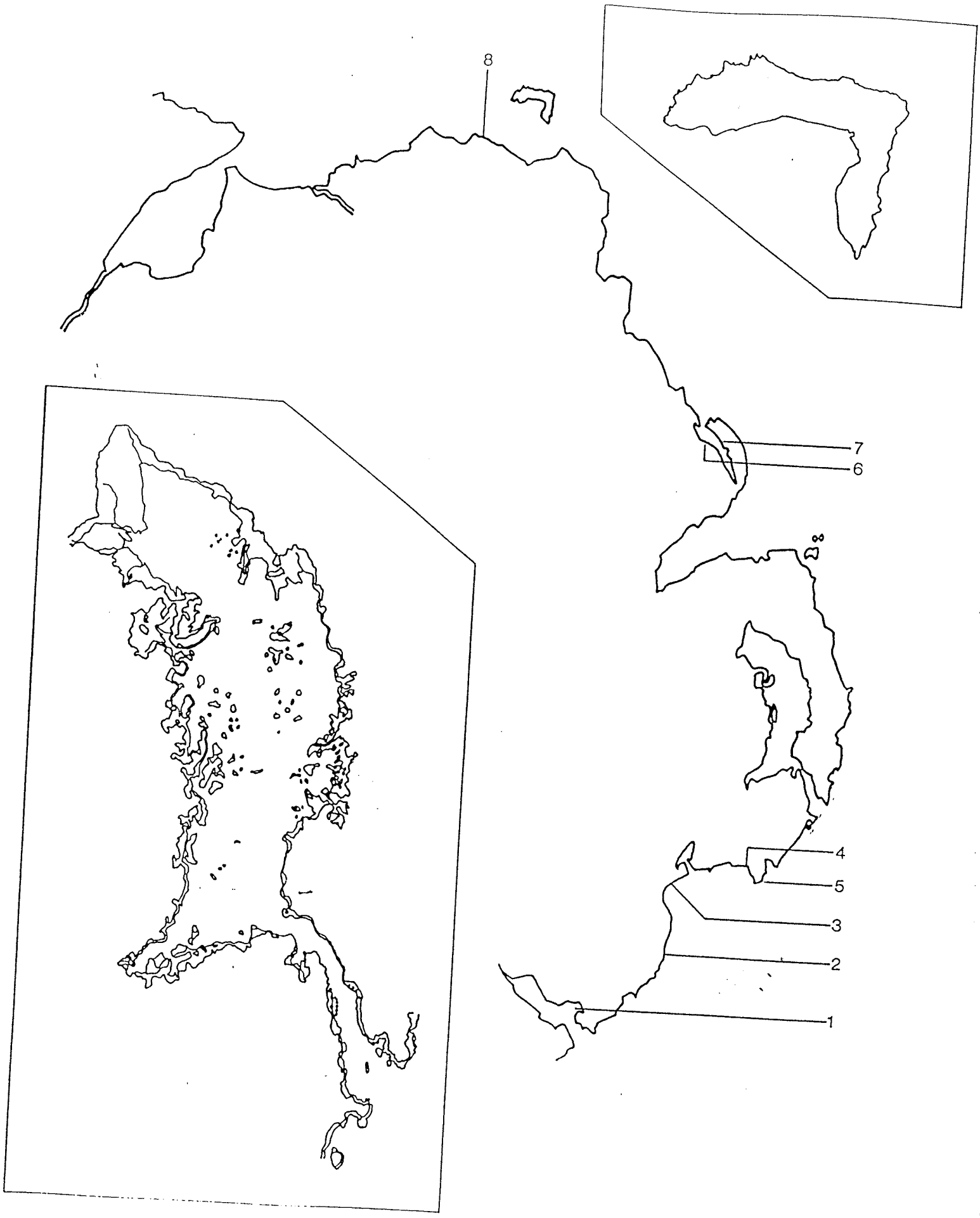


Figure XII.ii: Sites around the Northern Ireland coastline referred to in Appendix XII.

The Coastline Excluding Strangford Lough - See Figure XII(ii).

1. Mill Bay. Fucus muscoides recorded.

2. Glassdrumman Port. Contains a large area dominated by the reef building polychaete Sabellaria alveolata.

3. Newcastle Beach. The pholad Barnea candida has been reported from an area of shaley mud.

4. Rossglass. Northern limit of Sabellaria alveolata.

5. St John's Point. Northern limit of Monodonta lineata.

6. Larne Lough. Brackish lagoons on western side said to contain an unusual bryozoan community.

7. Larne Lough. Boulder and muddy gravel shores of the north east are dominated on the lower shore by large clumps of the sponges Hymeniacidon sp.

8. Sheep Island. The sea between Sheep Island and the shore is very shallow, and affected by strong tidal currents. There may be an interesting sublittoral biological community.

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(i) Distributed for use on British Phycological Society field meetings.

De Silva, M.W.R.N. and Burrows, E.: Key to the British species of Enteromorpha.

Irvine, L.M.: Provisional key to the common non-calcareous encrusting algae.

Price, W.M.: Key for separation of species of Chaetomorpha and Rhizoclonium.

Russell, G.: Key to the brown seaweeds.

Tittley, I.: Key to the Chlorophyceae.

Tittley, I.: Key to the Phaeophyceae.

Tittley, I.: Key to the Rhodophyceae.

(ii) From the Estuarine and Brackish-water Sciences Association workshop on errant polychaetes, Edinburgh 1985:

Keys (by various authors) for the families:

- Eunicidae
- Glyceridae/Goniadidae
- Hesionidae
- Nereidae
- Phyllodocidae
- Syllidae

(iii) Keys from notes or advice:

Baxter, J.: British Chitons
Chamberlain, Y.: Intertidal calcareous encrusting algae.
Taylor, C.: Capitellidae (Polychaeta).

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SUMMARY AND CONCLUSIONS

In general the inshore waters of Northern Ireland have a high quality being generally unpolluted at present.

The sea loughs, especially near towns, seem to be more polluted than the open coast and have generally poorer water quality. Belfast and Larne Loughs are considered to have the poorest water quality. Obviously when choosing areas for conservation of marine habitats it would be desirable to avoid regions of poor water quality unless they present an unusual habitat or community where a strict management plan would be essential.