Accessing and developing the required biophysical datasets and data layers for Marine Protected Areas network planning and wider marine spatial planning purposes

Report No 24: Task 2i. Intertidal habitats datalayer

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Project Title: Accessing and developing the required biophysical datasets and data layers for Marine Protected Areas network planning and wider marine spatial planning purposes

Report No 24: Task 4. Intertidal habitats datalayer

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Executive Summary

The UK is committed to the establishment of a network of marine protected areas (MPAs) to help conserve marine ecosystems and marine biodiversity. MPAs can be a valuable tool to protect species and habitats and can also be used to aid implementation of the ecosystem approach to management, which aims to maintain the ‘goods and services’ produced by the healthy functioning of the marine ecosystem that are relied on by humans.

A consortium\(^1\) led by ABPmer have been commissioned (Contract Reference: MB0102) to develop a series of biophysical data layers to aid the selection of Marine Conservation Zones (MCZs) in England and Wales under the Marine and Coastal Access Act and the equivalent MPA measures in Scotland. Such data layers would also be of use in taking forward marine planning in UK waters. The overall aim of the project is to ensure that the best available information is used for the selection of MPAs in UK waters, and that these data layers can be easily accessed and utilised by those who would have responsibility for selecting sites.

The Marine and Coastal Access Act allows for the designation of MCZs for geological and geomorphological features of interest. As such there has been a need to identify those geological and geomorphological features of interest. To deliver this requirement, the project has been divided into a number of discrete tasks, one of which is to develop an intertidal habitats datalayer. This was achieved through a three stage process:

- Translation of existing habitat maps to Level 3 of the EUNIS 2007 classification;
- The production of a single intertidal habitat GIS layer containing the intertidal habitats of interest;
- A confidence assessment of the datalayer.

The final output of this process was a combined intertidal habitats datalayer covering approximately 86% of the intertidal area of English Territorial Waters. The derived data are freely available via Data Archive for Seabed Species and Habitats (DASSH) the appointed MEDIN Data Archive Centre.

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\(^1\) ABPmer, MarLIN, Cefas, EMU Limited, Proudman Oceanographic Laboratory (POL) and Bangor University.
1. Introduction

1.1 Biophysical Data Layers Project

1.1 The UK is committed to the establishment of a network of marine protected areas (MPAs) to help conserve marine ecosystems and marine biodiversity. MPAs can be a valuable tool to protect species and habitats and can also be used to aid implementation of the ecosystem approach to management, which aims to maintain the ‘goods and services’ produced by the healthy functioning of the marine ecosystem that are relied on by humans.

1.2 As a signatory of the OSPAR Convention the UK is committed to establishing an ecologically coherent network of well-managed MPAs. The UK is already in the process of completing a network consisting of Special Areas of Conservation (SACs) and Special Areas of Protection (SPAs), collectively known as Natura 2000 sites, to fulfil its obligations under the EC Habitats Directive (92/43/EEC) and EC Birds Directive. Through provisions in the Marine and Coastal Access Act, Marine Conservation Zones (MCZs) may be designated in English and Welsh territorial waters and UK offshore waters. The Scottish Government is also considering equivalent Marine Protected Areas (MPAs) in Scotland. These sites are intended to help to protect areas where habitats and species are threatened, and to also protect areas of representative habitats. For further information on the purpose of MCZs and the design principles to be employed see http://www.defra.gov.uk/environmentmarine/legislation/mcaa/index.htm (Defra, 2009).

1.3 MCZ selection will be undertaken via a participatory stakeholder engagement approach. Four regional MCZ projects have been established to lead this process and are expected to be fully functional by early 2010. The full stakeholder engagement process is anticipated to begin in February 2010, continuing until the end of 2011. A formal public consultation is expected in 2012.

1.4 Selection of MPAs should be based on the best available information from a wide range of sources including biological, physical and oceanographic characteristics and socio-economic data such as the location of current activities. To ensure such data are easily available to those who would have responsibility for selecting sites Defra and its partners\(^2\) commissioned a consortium lead by ABPmer Ltd and partners to take forward a package of work. New Geographical Information System (GIS) data layers to be developed include:

\(^2\) Joint Nature Conservation Committee (JNCC), Countryside Council for Wales (CCW), Natural England (NE), Scottish Government (SG), Department of Environment Northern Ireland (DOENI) and Isle of Man Government.
- Geological and geomorphological features;
- Habitats and species of conservation importance;
- Fetch and wave exposure;
- Marine diversity layer;
- Benthic productivity; and
- Residual current flow.

1.5 In addition to the development of data layers, there is a need to ensure such information can be easily accessed through a webGIS given the participatory nature of the MCZ process that is currently being planned.

1.6 This report provides a detailed description of the development of an intertidal habitats data layer, and the associated confidence assessment. This has included the translation of 12 datasets to Level 3 of the EUNIS 2007 classification. The geographical scope of the task was English Territorial Waters.

1.2 Aims and Objectives

1.7 The key aims of this task were defined as follows:

- Transfer intertidal habitat maps from their current habitat classification to the appropriate EUNIS 2007 type in the MESH (Mapping European Habitats) translated DEF;
- Produce a single intertidal habitat layer containing the broad scale habitat types (listed in Table 2) to be delivered in the MESH translated DEF; and
- Produce a confidence assessment of each of the habitat data sets used in the production of the overall intertidal habitat data layer.

1.3 Format of the Report

1.8 The report comprises four main sections:

- Section 1 delivers an introduction to this task;
- Section 2 details the habitat translation method that has been applied;
- Section 3 provides a summary of the results of the habitat translation; and
- Section 4 provides an overall conclusion including issues and considerations.
2. **Adopted Approach and Methodology**

2.1 The method used to produce the intertidal habitat map was divided into a number of subtasks as described below (Sections 2.1 to 2.4).

### 2.1 Define the Intertidal Area

2.2 The intertidal area has been defined using the 2009 Ordnance Survey (OS) Mastermap “Foreshore” layer. There are, however, currently gaps in the foreshore layer which has resulted in corresponding gaps in the intertidal habitats data layer.

### 2.2 Habitat Translation

2.3 A total of 12 datasets were provided to ABPmer (Table 1 and Annex A) for translation into the broad-scale EUNIS Level 3 intertidal habitat types (Table 2).

#### Table 1: Habitat maps for translation to EUNIS

<table>
<thead>
<tr>
<th>Dataset title</th>
<th>Data owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intertidal mudflat layer</td>
<td>Natural England</td>
</tr>
<tr>
<td>Thames 2100 project data</td>
<td>Environment Agency</td>
</tr>
<tr>
<td>Futurecoast</td>
<td>Defra</td>
</tr>
<tr>
<td>Intertidal data from task 2C of the MB0102 contract</td>
<td>Defra</td>
</tr>
<tr>
<td>ENSIS</td>
<td>Natural England</td>
</tr>
<tr>
<td>Channel Coastal Observatory data</td>
<td>Environment Agency</td>
</tr>
<tr>
<td>Humber Estuary intertidal habitat status report</td>
<td>Harbasins</td>
</tr>
<tr>
<td>Flamborough Head cSAC Intertidal Survey</td>
<td>Natural England</td>
</tr>
<tr>
<td>Wash and North Norfolk Coast intertidal survey</td>
<td>Natural England</td>
</tr>
<tr>
<td>Mczbiopes_england</td>
<td>Marine Recorder</td>
</tr>
<tr>
<td>Severn Estuary Intertidal Biotope Survey</td>
<td>Natural England</td>
</tr>
<tr>
<td>MESH Data</td>
<td>Joint Nature Conservation Committee</td>
</tr>
</tbody>
</table>

#### Table 2: Broad-scale intertidal habitats to be protected within the Defra area MPA network

<table>
<thead>
<tr>
<th>Broad-scale habitat types</th>
<th>EUNIS Level 3 habitat code</th>
</tr>
</thead>
<tbody>
<tr>
<td>High energy intertidal rock</td>
<td>A1.1</td>
</tr>
<tr>
<td>Moderate energy intertidal rock</td>
<td>A1.2</td>
</tr>
<tr>
<td>Low energy intertidal rock</td>
<td>A1.3</td>
</tr>
<tr>
<td>Intertidal coarse sediment</td>
<td>A2.1</td>
</tr>
<tr>
<td>Intertidal sand and muddy sand</td>
<td>A2.2</td>
</tr>
<tr>
<td>Intertidal mud</td>
<td>A2.3</td>
</tr>
<tr>
<td>Intertidal mixed sediments</td>
<td>A2.4</td>
</tr>
<tr>
<td>Coastal saltmarshes and saline reedbeds</td>
<td>A2.5</td>
</tr>
<tr>
<td>Intertidal sediments dominated by aquatic angiosperms</td>
<td>A2.6</td>
</tr>
<tr>
<td>Intertidal biogenic reefs</td>
<td>A2.7</td>
</tr>
</tbody>
</table>

2.4 The process of habitat translation (e.g. a label of “intertidal mud” to EUNIS Level 3 habitat code “A2.3”) was automated via a series of rules where each habitat in the original dataset was assigned to one of the EUNIS Level 3 codes with little post processing interpretation. To ensure consistency all instances
of each respective habitat type in the original dataset were assigned to the same Level 3 code.

2.5 When translating the original habitat codes it was not always possible to distinguish between Level 3 habitat codes. In these instances a judgement was made as to whether it was possible to assign a Level 3 code uniformly to that dataset (with the associated uncertainty reported in the supporting metadata) or whether a translation could be made at all.

2.6 A shapefile according to the MESH Translated Habitat Data Exchange Format (DEF) standard was created for each habitat dataset translated.

2.7 In the case of the ENSIS dataset there were a number of overlapping polygons (with exactly the same spatial coverage) containing different habitat types. In such circumstances a new polygon was created and described as a “MOSAIC” where the newly assigned habitat code was described as a mosaic of each of the respective EUNIS codes from the overlapping polygons (e.g. MOSAIC of A2.1, A2.3, A2.4). The underlying overlapping polygons were then deleted from the dataset prior to combining the individual datasets into an overall habitat layer.

2.3 Energy Level

2.8 Where the energy level for the rock biotopes was contained within the original habitat code this was maintained through the translation process into EUNIS Level 3. Where this was not possible, the rock habitats were initially translated to EUNIS Level 2 (i.e. A1). These polygons were then further categorised to Level 3 using point data contained within the Marine Recorder Database. This was undertaken using the Wave Exposure point data from the Marine Recorder which contains 14,653 points around the UK coast giving a fairly good coverage when compared with the rock polygon layer.

2.9 The wave exposure data is classified into seven wave exposure categories from “extremely sheltered” to “extremely exposed”. These were converted into the three EUNIS categories for rock (using the same method as JNCC has previously used), as follows (Table 3):

<table>
<thead>
<tr>
<th>Marine recorder</th>
<th>EUNIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed, Very Exposed, Extremely Exposed</td>
<td>High</td>
</tr>
<tr>
<td>Moderately Exposed</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sheltered, Very Sheltered, Extremely Sheltered</td>
<td>Low</td>
</tr>
</tbody>
</table>

2.10 The total number of polygons that were assigned as A1 in the individual input layers was 3250. Of the 3250 polygons 84 had at least one overlapping energy point. Energy was therefore assigned according to the rules outlined in Table 4 below. It should be noted that was an automated process and no post interpretation was applied.
Table 4: Determination of energy categories for each polygon

<table>
<thead>
<tr>
<th>Number of points within each polygon</th>
<th>Energy level assigned to polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Same energy level as point</td>
</tr>
<tr>
<td>2 or more of the same energy layer</td>
<td>Same energy level as points</td>
</tr>
<tr>
<td>2 or more with different energy layers</td>
<td>The energy level of the majority of points. Where there was an equal number of points with different wave exposure classes the EUNIS class remained at Level 2 due to the degree of uncertainty.</td>
</tr>
</tbody>
</table>

2.11 A large number of polygons (3166) did not contain any points and the wave exposure of the closest point was therefore assigned. However, in some instances the closest point was some distance from the polygon and as such the energy level was not considered to be a true representation of the location of the polygon. A buffer zone was therefore applied so that if a polygon was more than a certain distance from any of the exposure points it would remain classified to Level 2 of the EUNIS Habitat code. In defining a suitable zone the number of points at differing distances from the draft A1 polygons was calculated (Table 5). On this basis a buffer zone of 1km was applied. It should be noted that this was an automated process and no post interpretation was applied.

Table 5: Number of polygons that have at least 1 wave exposure point across a range of distances

<table>
<thead>
<tr>
<th>Distance</th>
<th>Number of polygons that would be assigned to EUNIS Level 3</th>
<th>Number of polygons that would remain assigned to EUNIS Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1km</td>
<td>618</td>
<td>2632</td>
</tr>
<tr>
<td>2km</td>
<td>1173</td>
<td>2077</td>
</tr>
<tr>
<td>5km</td>
<td>1397</td>
<td>1853</td>
</tr>
</tbody>
</table>

2.12 The DEF file for each of the datasets was updated to reflect any changes to the habitat translations that resulted from this process.

2.4 Confidence Assessment

2.13 A confidence assessment was undertaken on each of the respective input datasets (Annex B).

2.14 The confidence assessment used the methodology that was developed within the MESH project (MESH 2007a); this evaluation process addressed three main questions:

1. How good is the remote sensing?
2. How good is the ground truthing?
3. How good is the data interpretation?

2.15 A guide to the development and use of the confidence assessment can be found within the outputs of the MESH project website (MESH, 2007b).
2.16 The confidence assessment can only be undertaken if there is sufficient supporting information to accompany the habitat map. This includes a documented record of the survey techniques, post processing and analysis as well as any Quality Assurance (QA) steps that have been undertaken. In this respect a confidence assessment has been made of 5 of the 9 layers that were used to form the single intertidal habitats layer. A confidence assessment score had already been assigned to each of the polygons comprising the MESH dataset and these were carried through into this project.

2.5 Habitat Map

2.17 The datasets were combined into one overall intertidal habitats datalayer. Where this resulted in overlaps between polygons, the polygon from the dataset with the highest confidence score (as defined in the confidence assessment process, see Section 2.5) was considered to have the highest probability of occurrence. Where no confidence score was available for the dataset an overall score of 1 was assigned to each of the respective polygons. Where two overlapping polygons had the same score judgement was used (at the level of the dataset) to prioritise between the datasets. This resulted in different polygon boundaries in the final layer as compared to the original datasets and is consistent with the approach used in MESH.
3. Derived Datalayers for Intertidal Area

3.1 The datasets were combined into one overall intertidal habitats datalayer. It was not possible to include the following datasets within the single intertidal datalayer as they contain either descriptive boundaries, points and/or polyline features rather than polygons:

- Flamborough Head cSAC Intertidal Survey (no georeferenced data supplied);
- Wash and North Norfolk Coast intertidal survey (contains point and polyline features only); and
- Mczbiopes_england (contains point features only).

3.2 In addition the intertidal data from Task 2C: Habitat data of the MB0102 contract was not used in the final layer as it is duplicated in the MESH dataset. The resulting intertidal habitat map that has been produced under this Task (2I) therefore represents a more comprehensive set of data as compared to Task 2C.

3.3 Within each of the remaining datasets it was possible to assign EUNIS Level 3 codes to the majority of the habitat points. In a number of instances, however, it was not possible to distinguish between the EUNIS Level 3 habitat codes listed in Table 2, for example, between intertidal sediment types where this was the only descriptor given. The rationale used to assign a habitat code, or not, has been included within the respective metadata attached to each dataset.

3.4 The intertidal habitat datalayer created covers approximately 86% of the total intertidal area of English Territorial Waters.

3.1 Using the Datalayers

3.5 The output of this task is a datalayer which can be used to identify intertidal habitats at EUNIS Level 3 for English Territorial Waters (Figure 1).

3.2 Access and Restrictions

3.6 The layer is based on data from Channel Coast Observatory (CCO), Environment Agency, JNCC, NE, Defra, and Harbasins.

3.7 The derived data are freely available via Data Archive for Seabed Species and Habitats (DASSH) the appointed MEDIN Data Archive Centre. All reference should be made to Crown Copyright – Defra – MB0102.
Coverage of Intertidal Habitat Map at EUNIS Level 3

Figure 1

© ABPmer, All rights reserved, 2010
Derived dataset (MB0102 Task 2 Report No.24)
NOT TO BE USED FOR NAVIGATION
4. Issues and Considerations

4.1 This technical report provides a record of the datasets that have been translated and formatted into EUNIS Level 3 habitat codes. The methodology used to produce the intertidal habitat layer has also been documented along with details of the confidence assessment process.

4.2 It should be noted that a series of assumptions have been made throughout the task in order to automate a number of the computational steps required to produce the datalayer. This was necessary due to both the nature of the input data and the scale at which the datalayer was produced. There is currently incomplete coverage of geo-referenced intertidal habitat data for English Territorial Waters with only 86% covered by the available EUNIS Level 3 data.
Abbreviations

ABPmer   ABP Marine Environmental Research Ltd
CCO      Channel Coastal Observatory
Cefas    Centre for Environment, Fisheries and Aquaculture Science
DEF      Data Exchange Format
Defra    Department for Environment Food and Rural Affairs
ENSIS    Natural England Site Information System
EUNIS    European Nature Information Systems
GIS      Geographic Information System
JNCC     Joint Nature Conservation Committee
MarLIN   The Marine Life Information Network
MCZ      Marine Conservation Zone
MESH     Mapping European Seabed Habitats
MHWS     Mean High Water Springs
MLWS     Mean Low Water Springs
MPA      Marine Protected Area
NE       Natural England
OS       Ordnance Survey
POL      Proudman Oceanographic Laboratory
QA       Quality Assurance
SAC      Special Areas of Conservation
SPA      Special Protection Area
SRCMP    Strategic Regional Coastal Monitoring Programme
SSSI     Site of Special Scientific Interest
UK       United Kingdom
References


Acknowledgments

Thanks are due to Eddy Mayhew, Natural England, who has been of great assistance in providing datasets and chasing data from third parties. The project team are also grateful to Ian Saunders, Natural England (for helping with access to project data, in particular FutureCoast data), and Clare Marshall, Environment Agency (for supplying CCO data for South East Strategic Regional Coastal Monitoring Programmes).
## Annex A: Status of Datasets Included in Intertidal Habitat Data Layer

<table>
<thead>
<tr>
<th>Dataset title</th>
<th>Data owner</th>
<th>GUI Code</th>
<th>Data received</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intertidal mudflat layer</td>
<td>Natural England</td>
<td>GB001072</td>
<td>Yes</td>
<td>Included in data layer.</td>
</tr>
<tr>
<td>Thames 2100 project data</td>
<td>Environment Agency</td>
<td>GB001071</td>
<td>Yes</td>
<td>Intertidal habitat data included in data layer.</td>
</tr>
<tr>
<td>Futurecoast</td>
<td>Defra</td>
<td>GB001070</td>
<td>Yes</td>
<td>Foreshore geomorphology data included in data layer.</td>
</tr>
<tr>
<td>Intertidal data from Task 2C of the MB0102 contract</td>
<td>Defra</td>
<td>(see MESH)</td>
<td>No</td>
<td>This dataset is already included in the data layer as it forms part of the MESH dataset.</td>
</tr>
<tr>
<td>ENSIS (Marine SSSI data)</td>
<td>Natural England</td>
<td>GB001069</td>
<td>Yes</td>
<td>Intertidal habitat data included in data layer. Overlapping polygons described as mosaics.</td>
</tr>
<tr>
<td>CCO SRCMP Habitat Mapping data for SE region</td>
<td>Environment Agency</td>
<td>GB001073</td>
<td>Yes</td>
<td>Intertidal habitat data included in data layer.</td>
</tr>
<tr>
<td>CCO SRCMP Habitat Mapping data for SW region</td>
<td>Environment Agency</td>
<td>-</td>
<td>No</td>
<td>Dataset for the SW region is subject to ongoing licence discussions and as such could not be included in the layer.</td>
</tr>
<tr>
<td>Humber Estuary intertidal habitat status report</td>
<td>Harbasins</td>
<td>GB001068</td>
<td>Yes</td>
<td>Intertidal habitat data included in data layer.</td>
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<tr>
<td>Flamborough Head cSAC Intertidal Survey</td>
<td>Natural England</td>
<td>-</td>
<td>Yes</td>
<td>Dataset contains reports describing habitat types, which need to be converted into GIS data before inclusion in the data layer. Therefore, this data is not included in data layer.</td>
</tr>
<tr>
<td>Wash and North Norfolk Coast intertidal survey</td>
<td>Natural England</td>
<td>-</td>
<td>Yes</td>
<td>Dataset contains points and polyline features only therefore not included in the data layer.</td>
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<tr>
<td>Mczbiopes_england</td>
<td>Marine Recorder</td>
<td>-</td>
<td>Yes</td>
<td>Dataset contains points features only therefore not included in data layer.</td>
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<tr>
<td>Severn Estuary Intertidal Biotope Survey</td>
<td>Natural England</td>
<td>GB001067</td>
<td>Yes</td>
<td>Intertidal habitat data included in data layer.</td>
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| MESH          | JNCC       | GB000217, GB000223, GB000225, GB000226, GB000228, GB000229, GB000230, GB000232, GB000233, GB000234, GB000235, GB000236, GB000243, GB000244, GB000245, GB000247, GB000248, GB000249, GB000255, GB000281, GB000282, GB000283, GB000284, GB000286, GB000317, GB000318, GB000319, GB000326, GB000329, GB000331, GB000332, GB000333, GB000334, GB000335, GB000337, GB000338, GB000372, GB000487, GB000942, GB000979, GB100069, GB200013 | Yes | Intertidal habitat data included in data layer.
## Annex B: Confidence Assessment Scores

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