Scottish Aquaculture Research Forum

SARF090: Impact of Salmonid Pen Aquaculture on Hard Substrates

Factsheet for Stakeholders

Report R.2127 (App H)

January 2014

Creating sustainable solutions for the marine environment





Appendix H. Factsheet for Stakeholders

H1. Introduction

Marine fish farming in Scotland is mostly carried out in areas where seabeds are dominated by sediments. A considerable body of information is available on potential impacts and their assessment for these environments. Such assessment is normally required at two stages in the development of a marine fish farm site in Scotland - during the planning application process as part of an Environmental Impact Assessment (EIA), and during periodic environmental monitoring as part of the requirements of the Controlled Activities Regulations (CAR) licence granted by SEPA.

As the industry expands there is potential for marine fish farming to move into different types of environments so affecting coastal hard substrate seabeds, which have fundamentally different environmental properties and ecological interactions. This presents a challenge to stakeholders in terms of assessing impacts here. In addition, expansion could lead to more overlap with areas considered to be of conservation importance.

This Factsheet provides information for stakeholders of the different assessment needs for these environments in terms of the survey methods used, the knowledge gaps for these environments and their relationship to fish farming, and where to obtain existing data for use in initial site selection, planning and subsequent assessment.

H2. Methods for Investigation of Hard Substrates

Initial site selection for marine cage aquaculture often involves the use of existing information on the seabed features, and associated animal and plant communities. Consideration is also given to proximity of designated sites of conservation and environmental importance. Methods for collecting the available data for hard substrate environments, consequent data usage and search methods are given in Section H4.

The nature of hard substrates, rather than sedimentary environments, requires that different methods of environmental assessment and characterisation are used, largely consisting of observational quantitative and qualitative techniques. Examples of such methods, and following standard protocols described in the Marine Monitoring Handbook (Davies, 2001) are:

1. SCUBA diver surveys:
    a. Quantitative identification using fixed sized quadrats and abundance scales by expert divers along pre-determined transects;
    b. Video or photographic surveys with visual or image analysis quantification along pre-determined transects, with specific methods and results validated by NMBAQC scheme; and
    c. Rapid “skilled eye” qualitative methods using expert divers through defined area “search methods” or spot dives.

2. Remote video and photographic methods:
   a. Use of Remote Operated Vehicles (ROV) to quantitatively characterise substrates or biotopes using visual or image analysis methods, with specific methods and results validated by NMBAQC scheme;
   b. Use of ROV and video mosaic techniques to characterise wider areas of hard substrate seabed;

3. Remote acoustic methods for wide-field rapid qualitative characterisation of the seabed (e.g. sidescan sonar/AGDS); and

4. Quantification of sedimentation on hard substrates using sediment traps for quantification of particulate waste and chemical treatment residues, to allow comparison with designated EQSs.

These quantitative, transect based survey methods can be used for initial characterisation of the seabed environments within the areas for aquaculture development and also, in conjunction with modified computer models of nutrient and chemical treatment waste distribution and fate, to define locations of likely impacts and designate site specific allowable zones of effect to ensure rigorous environmental monitoring under CAR licence.

H3. Data Gaps and Considerations

There are a number of gaps in data available for determining the potential impacts of marine fish farming on hard substrate seabeds. These can be characterised under:

- Information on sensitivity of relevant epibiotic species to marine fish farm effluents:
  - Aquaculture nutrient and treatments wastes are likely to impact on species for which there is little previous direct information available, especially which is relevant in the field;
  - There is a need to investigate these sensitivities in the laboratory and the field;
- Limited number of quantitative assessments of features within biotopes for hard substrates in relevant areas of future aquaculture development:
  - Though there is good general coverage for biotope maps and substrate classification in Scotland, this has largely been developed in areas considered of conservation importance; and
  - Some of these gaps are filled from interpolated or modelled information, which would require validation or ground-truthing;
- Pre-production prediction of effects of aquaculture on hard substrate environments.
  - The computer models for estimation of waste distribution should be re-developed.

Data gaps should be filled where possible, especially at locations relevant to further aquaculture development. This could be achieved over a long time period as required, but must be done in consultation and collaboration with all relevant stakeholders. Gaps can be filled using many of the methods outlined in Section H2, as well as field and laboratory investigations. Indicative costs for such gap filling investigations are given in Table H1.

Table H1. Estimated Indicative per Study Costs to Investigate the Different Knowledge Gaps for Hard Substrates and Aquaculture Development

No.	Description	Range of Costs
1	Lab-based ecotoxicity test for epibiota sensitivity	£10K - £30K
	Field-based trial of impact on hard substrate of particulate nutrient wastes under commercial use conditions	£40K - £60K[1]
	Field-based trial of impact on hard substrates of chemical treatment wastes under commercial use conditions – over 2 years	£80K - £150K[1]
2	Survey for characterisation of biotopes within a relevant/pre-defined area, using standard methods	£30K - £60K
3	Development/re-development of environmental models	£50K - £100K

[1] It is presumed these will be undertaken in collaboration with fish farms, using their vessels. Costs could also vary with location and logistical requirements.

These cost ranges have been estimated based on author experience and confidential discussions with stakeholders involved in design and operation of such studies.

H4. Where Do I Get Existing and Available Data?

Considerable quantities of data on coastal substrates and biological communities and information on conservation issues are available through compiled public sources, many of which are readily available online. This information is invaluable for both planning and development processes for new aquaculture site developments, including those in locations over hard substrates. Such information can also be used as a basis for initial site selection/feasibility assessment, inclusion in an EIA and as the basis of a CAR application. Tables describing the major publically available data is given in Table H2, along with a User Guide on how to gain access and use this data.

Further publically available data sources available in the near future are given in Table H3. Information relating to upcoming data from surveys commissioned from 2010 to provide information for the Scottish MPA project, is given in Table H4.

H5. User Guide for Publically Available Environmental Data

The user guide relates to the data sources described in Table H2.

1. Start by viewing the study area within an interactive map to identify overlap with protected areas (e.g. Natura 2000 sites), industry and priority marine feature distribution.

There are multiple interactive maps available to view different types of data. For Scotland the best interactive map available is the Marine Scotland NMPi, which allows you to view multiple data layers to identify any overlaps (e.g. with designated sites, seabed habitats, other marine activities) within your

study area. The button within NMPi will provide a link to extra information concerning that dataset. The NMPi interactive map displays all spatial data of interest however if you are only concerned with one type of overlap it may be quicker to go straight to the interactive map that displays the specific data. For example, when solely concerned with protected sites the Natura 2000 and Ramsar interactive maps provide a higher level of detailed information on these designations. When identifying seabed habitats the MESH Atlantic and EUSeaMap maps will provide the best source, however the distribution of both these maps are patchy within Scottish intertidal areas. Both the EUSeaMap and MESH data layers can be viewed through the MESH Atlantic website. Extra information on specific species can be viewed via the NBN gateway interactive map; it is easier to navigate this web page if you know which species you are interested in. Species data available from the NBN may vary to that which is displayed through the NMPi.

2. **Once overlapping data has been identified this information can be downloaded and viewed within a GIS system. Open source GIS software is available through Quantum GIS and can be downloaded from http://www.qgis.org/en/site/.**

The information displayed within the Marine Scotland NMPi is not all freely available or available to download from the site; using the button may provide a link to where the data can be downloaded from. However it is possible to download a lot of the data from other websites including other interactive maps. Protected site data can be downloaded from multiple websites including Magic, SNH Information Service, JNCC UK Protected Sites, Natura 2000 and Ramsar information service. Seabed habitat data is available for download from the MESH Atlantic and EUSeaMap interactive map websites. Species records can be downloaded via the NBN gateway, access restrictions apply to different data sets depending on the source origin and confidentiality of the data. It is necessary to register on many of these web sites prior to downloading the data however this will not incur a cost. Information on data update procedures will relate to the specific data sets and will be available via the metadata of the specific data set which is usually displayed on the web page before the data is downloaded.

3. **Gain extra information for the overlapping data from the downloaded GIS files or relevant reports. Then check for any data gaps where data is not publicly available yet.**

All downloaded data will contain metadata and attribute tables and these can be used to obtain the relevant information needed when considering the overlapping data. The NMPi contains links to the relevant reports and extra information where possible via the information button . Each data download site will also provide extra information on the specific data set prior to download. The MEDIN data portal can be used to search for any reports and data gaps for a specific area or topic.

Table H2. Current Publically Available Sources of Spatial Information on Hard Substrate Benthic Habitats and Species, Designated Sites and Features, Aquaculture and Other Marine Industries

Information Source	Description	Access	Relevance
Scottish Government - Marine Scotland Interactive Marine Planning Tool	**Interactive Map**: The tool allows the user to view different types of spatial data and where appropriate provides links to further information including "Scotland's Marine Atlas". The data layers are grouped into 5 sub headings: "Physical Characteristics", "Clean & Safe", "Healthy & Biologically Diverse", "Productive" and "Administrative". The data layers include conservation designations, priority marine features (including "hard substrate" features defined within the current study), locations of finfish and shellfish aquaculture sites and other marine industry sectors. The NMPi data portal is continually updated and individual data sets are added or updated when the information is available from the data provider. By using the information tool within the map more information regarding each datasets origins and update schedule where applicable can be accessed.	http://www.scotland.gov.uk/Topics/marine/seamanagement/nmpihome/nmpi	Very useful tool to check spatial overlap for the majority of relevant data.
Scotland's Aquaculture Database	**Interactive map and Spatial Data downloads:** Scotland's Aquaculture Database is the product of a partnership between aquaculture regulatory and administrative bodies - SEPA, Marine Scotland. The website provides an integrated, geographic and up to date view of aquaculture activity in Scotland including industry location, types of aquaculture, leases, licences and reports on controlled activities and shellfish hygiene monitoring. The information can be viewed and used in a number of ways. There is an interactive map which can be customised for area of interest, a searchable database of information about finfish farms and shellfish harvesting areas; a view of how farm sites, leases and licences relate together; and fully downloadable data for use in spreadsheets and analysis tools. The Food Standard's Agency and Marine Scotland will supply updates of their data to the website on a weekly basis. SEPA and the Crown Estate's data will be updated every quarter.	http://www.aquaculture.scotland.gov.uk.	Information on the location of aquaculture businesses, leases, licenses, reports on controlled activities.
Marine Scotland Interactive (MSI)	**Spatial Data Downloads:** Marine environmental data obtained through Marine Scotland Science survey and monitoring work can be accessed through Marine Scotland Interactive. This resource can be used for making complex layered spatial datasets of the marine environment available to download in formats compatible with freely available software (Google Earth	http://www.scotland.gov.uk/Topics/marine/science/MSInteractive/datatype	Information on habitats (substrate types and biotopes), Marine Protected Areas, Special Protected areas.

Information Source	Description	Access	Relevance
	and ArcGis Desktop Explorer) and social media sites (Picasa and YouTube). A variety of file formats (maps, video clips, photographs, geodatabases and text) can be viewed with differing levels of functionality and interactivity. Data is presented by "theme" (renewable energy, monitoring, conservation and marine spatial planning, with new themes to be added in future) and by data type (bathymetry, habitat, video & photographs, sub-bottom profiling). Users can be informed about updates and changes to available data by registering their email address.		
Defra – Magic Data Portal	**Interactive Map & Spatial Data Downloads:** The website provides authoritative geographic information about the natural environment. The data can be viewed via the interactive map and subsequently downloaded. The website is UK based and doesn't hold specific species, habitat or industry data for Scotland.	http://magic.defra.gov.uk/home.htm	UK protected area data sets available for download.
European Environment Agency - Natura 2000 Protected Areas	**Interactive Map & Spatial Data Downloads**: European wide Natura 2000 spatial and descriptive data is available to view via the interactive map and subsequently downloadable via the website. The downloadable database on Natura 2000 sites consists of data submitted by Member States to the European Commission. This data is subject to a regular validation and updating process.	http://www.eea.europa.eu/themes/biodiversity/interactive/natura2000gis/index_html http://natura2000.eea.europa.eu/	Specific information on European Natura 2000 sites (SPA and SAC).
Ramsar Sites Information Service	**Interactive Map & Spatial Data Downloads:** The Ramsar Sites Information Service (RSIS) provides access to information on wetlands designated as internationally important under the Convention on Wetlands 1971. The spatial data and information covers worldwide sites.	http://ramsar.wetlands.org/Database/SearchforRamsarsites/tabid/765/Default.aspx	Specific information on worldwide Ramsar sites.
MESH Atlantic webGIS	**Interactive Map & Spatial Data Downloads:** This interactive mapping portal contains seabed habitat maps (EUNIS Classification) for western European waters, specifically the project areas of the EU-funded MESH (2004-2008) and MESH Atlantic (2010-2014) projects. The layer is a compilation of habitat maps from surveys in the MESH and MESH Atlantic study areas. The habitat maps have patchy distribution across Scottish inshore areas.	http://www.searchmesh.net/default.aspx?page=1974	Information on detailed habitat maps created from surveys in European waters.
EU SeaMap webGIS	**Interactive Map & Spatial Data Downloads:** This interactive mapping portal contains predicted broadscale seabed habitat maps (EUNIS classification) for over 2 million square kilometers in the Celtic, North, Baltic and western Mediterranean Seas. The predicted maps do not cover the littoral zone and are coarse in resolution.	http://jncc.defra.gov.uk/page-5040	Information on the distribution of broad-scale modelled seabed habitats within European waters.
National Biodiversity Network (NBN Gateway)	**Interactive Map and Spatial Data Downloads:** This data portal provides data on species, habitats and conservation designations across the UK. The data is provided by individual data set with background information on survey techniques and data supplier. It has an interactive map feature allowing for the data to be viewed prior downloading. The NBN Gateway is due for update in	http://data.nbn.org.uk/	Additional species data supplied as individual datasets.

Information Source	Description	Access	Relevance
	2013.		
SNH Information Service	**Spatial Data Downloads, Site Reports and Interactive Map:** The SNH Information Service provides access to the information sources "Natural Spaces" and "Sitelink" and also an interactive map. Natural Spaces provides an online data download facility giving access to a wide range of datasets including protected areas. The data is also available in kml format which can be viewed within Google Earth open source software (http://www.google.com/earth/index.html). Sitelink provides access to data on protected sites and to downloadable documents showing site boundaries, site qualifying features and conservation objectives.	http://www.snh.gov.uk/publications-data-and-research/snhi-information-service/	Specific information on Scottish protected sites including Natura 2000, Ramsar sites and Marine Protected Areas.
Scottish Government Spatial File Download	**Spatial Data Downloads:** This data portal provides Scottish Government data representing planning boundaries. Available data includes marine closed areas, salmon fishing districts and shellfish growing waters.	http://crtb.sedsh.gov.uk/spatialDataDownload/dload.asp	Specific information on Scottish Government data including marine closed areas, salmon fishing districts and shellfish growing waters.
JNCC UK Protected Sites	**Spatial Data Downloads and Site Reports:** The JNCC acts on behalf of the statutory conservation agencies and associated government departments by collecting information on designated sites for nature conservation in the UK and the Overseas Territories and Crown Dependencies. The website supplies additional information on specific protected sites as well as providing a link via which the spatial data can be downloaded. Additional information regarding individual Scottish SPAs: http://jncc.defra.gov.uk/page-1402 Additional information regarding individual Scottish SACs: http://jncc.defra.gov.uk/ProtectedSites/SACselection/SAC_list.asp?Country=S	http://jncc.defra.gov.uk/page-4	Specific information on UK protected sites including Natura 2000, Ramsar sites and Marine Protected Areas.
Marine Environmental Data and Information Network (MEDIN)	**Data Portal:** Marine Environmental Data and Information Network, provides access to metadata and a large range of marine spatial data and reports. MEDIN is a partnership of UK organisations committed to improving access to marine data. The web page provides information on surveys which have been undertaken within a specified area; however the survey data is not always available to download.	http://www.oceannet.org/	Library catalogue of marine data detailing latest surveys and reports; however the data is not always freely available.

Table H3. Upcoming Sources of Information

Information Source	Description	Access	Relevance
GeMS	Spatial Data (Not yet available): Geodatabase managed by SNH. Contains habitat, species and geodiversity spatial data including priority marine features. Some data downloads may be constrained by copyright issues. It is intended that GeMS will be updated annually.	Data layers from GeMS will be made viewable through the National Marine Plan Interactive (NMPi) portal (http://www.scotland.gov.uk/Topics/marine/seamanagement/nmpihome/nmpi) dependent on copyright constraints, during 2014.	Information on habitats and species. Much of the data is already publically available from other sources.

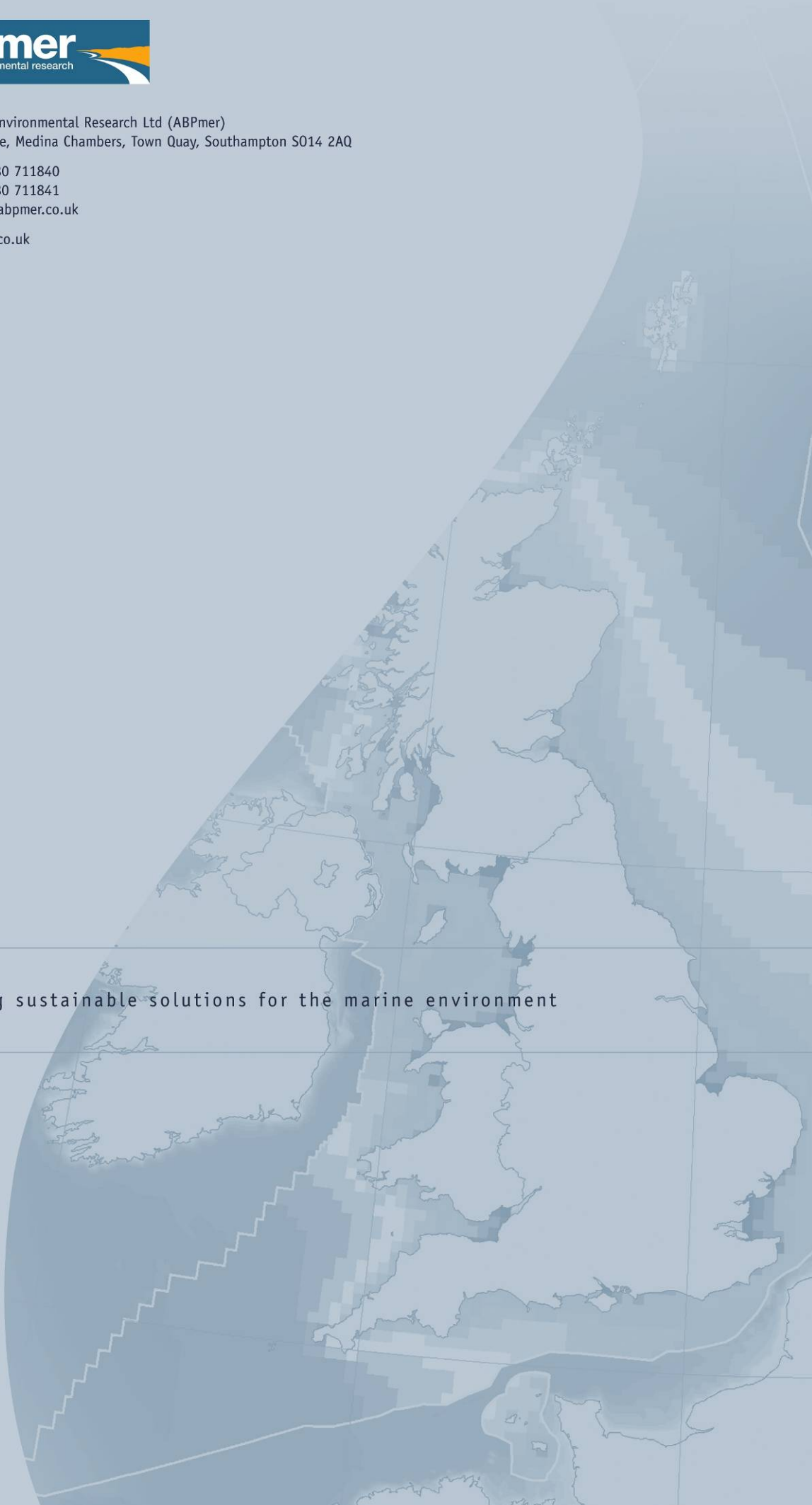
Table H4. Upcoming Survey Programmes That Will Provide Further Information

Information Source	Description	Access	Relevance
SNH MPA surveys	A programme of marine surveys began in 2010 to provide further information for the Scottish marine MPA project, including on the distribution, extent, quality and health of benthic features (habitats). For surveys that have already been conducted, it is anticipated that the data will be made available via GeMS and some survey reports are currently available for download on the SNH website. The survey programme is ongoing and will provide support for monitoring and management of the MPA network. This data will also be made accessible via GeMS and available in published report form in the interim.	Survey reports: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/marine-protected-areas-(mpa)/mpa-survey-research-reports/	Reports of surveys of Scotland's inshore waters charting the distribution, extent, quality and health of benthic features (habitats).

ABP Marine Environmental Research Ltd (ABPmer)
Quayside Suite, Medina Chambers, Town Quay, Southampton SO14 2AQ

T +44 (0)23 80 711840
F +44 (0)23 80 711841
E enquiries@abpmer.co.uk

www.abpmer.co.uk



Creating sustainable solutions for the marine environment