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WEST**ISLAY**
TIDAL

# ENERGY PARK

## volume 2

## environmental statement

**2 of 4**

DP ENERGY MARINE

DBE DEME Blue Energy

**WEST ISLAY TIDAL ENERGY PARK**

**VOLUME 2 ENVIRONMENTAL STATEMENT**

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# Preface

This Environmental Statement (ES) is prepared, by DP Marine Energy Ltd (DPME), in support of an application for statutory consents for West Islay Tidal Energy Park (the Project).

The Project is being developed jointly by DPME and DEME Blue Energy (DBE) on the behalf of West Islay Tidal Energy Park Limited a special purpose Scottish Company which has been incorporated to build and operate the Project.

The Project consists of the installation of 30MW of Tidal Energy Converters and associated infrastructure including the export cables to landfall on Islay

The proposed array of tidal energy devices will be located approximately 6km (at its closest point) from the south west tip of the island of Islay in Argyll and Bute, Scotland. The proposed landfall for the associated electricity export cable will be located adjacent to Kintra Farm on the west coast of Islay.

The Regulatory Authority responsible for assessing the application for consent is Marine Scotland. They will be supported in the assessment process by a number of environmental bodies including Scottish Natural Heritage (SNH).

The Environmental Statement can be viewed during the statutory consultation period at the following locations:

| | | |
|---|---|---|
| Islay Energy Trust,<br>Custom House,<br>Bowmore, Isle of Islay,<br>PA43 7JJ<br>Tel: 01496 810873 | Portnahaven Post Office<br>Portnahaven<br>Isle of Islay<br>PA47 7SH<br>Tel: 01496 860264 | Bowmore Post Office,<br>Main Street,<br>Bowmore, Isle of Islay,<br>PA43 7JH<br>Tel: 01496 810366 |
| Port Ellen Post Office,<br>66 Fredrick Crescent<br>Port Ellen, Isle of Islay,<br>PA42 7BD<br>Tel: 01496 30238 | DP Marine Energy Ltd<br>Mill House<br>Buttevant<br>County Cork<br>Tel: +353 22 23955 | Scottish Government Library,<br>Victoria Quay,<br>Edinburgh,<br>EH6 6QQ |

During the consultation period copies of the Environmental Statement can be purchased from DPME either on CD for a charge of £15 or in hard copy form for £400. Copies of the Non-Technical Summary are available free of charge and a downloadable version is also be available on the West Islay Tidal website: www.westislaytidal.com. Requests for CD and or hard copies of the ES can be made to the DPME address above or by email islay@dpenergy.com

| Responsibility | Job Title | Name | Date | Signature |
|---|---|---|---|---|
| EIA Chapters | EIA Manager | Clodagh McGrath | Monday, 22nd July 2013 | [redacted] |
| Non EIA Chapters | Project Manager | Blair Marnie | Monday, 22nd July 2013 | [redacted] |
| Checked | Project Development Engineer | Damian Bettles | Monday, 22nd July 2013 | [redacted] |
| Approved | Director (DPME) | Simon De Pietro | Monday, 22nd July 2013 | [redacted] |
| Copyright: | DPME © | Document Reference: | West Islay Tidal Energy Park Environmental Statement | |

It should be noted that the NTS and ES has been prepared by DPME supported by DBE with significant input from external sub-consultants on specialist chapters. A review process for Quality Assurance was conducted on all chapters, whether produced by external consultants or internally by DPME.

The ES has been prepared by DPME with all reasonable skill and care and whilst every effort has been made to ensure the accuracy of the material published in this and associated documents, West Islay Tidal Energy Park Ltd, DPME or DBE will not be liable for any inaccuracies.



DPME would like to acknowledge the technical support provided by Siemens/MCT, Alstom/TGL and Bluewater/BlueTEC for their considerable assistance in enabling the design envelope to be defined.

The licence numbers for proprietary data referenced in diagrams and maps can be found on individual figures.

## Glossary of Terms:

| | |
|---|---|
| **Agreement for Lease** | Agreement entered into between West Islay Tidal Ltd and The Crown Estate for the rights to development on the seabed, named as West Islay Tidal, shown in Figure 5.1. |
| **Dynamic positioning vessel** | A Dynamic Positioning Vessel (DP) can safely maintain its position and heading in a tidal flow using a system of thrusters. DP vessels are able to work safely and efficiently in waters deeper than vessels using anchors. |
| **Export cables** | Cables used to export power generated by the tidal turbines to the onshore infrastructure. |
| **Gravity based structure (GBS)** | A structure which uses ballast to sit securely on the seabed without needing to be stabilized by piles or anchors. The GBS is used to support a tidal turbine. |
| **Monopile** | A single large diameter steel tube that is grouted into a hole bored into the seabed. The monopile is used to support a tidal turbine. |
| **Nacelle** | The enclosure of the tidal turbine's mechanical and electrical equipment. |
| **Pin pile** | The use of multiple small diameter steel tubes that are grouted into a hole bored into the seabed. The pin piles are used to support a tidal turbine. |
| **Project** | For the purpose of this ES, the Project refers to the West Islay Tidal Energy Project. |
| **Remotely operated vehicle (ROV)** | A Remotely Operated Vehicle (ROV) is an underwater vehicle able to undertake multiple subsea operations. ROVs are highly manoeuvrable and are controlled by operators on-board the DP vessel. |
| **Tidal turbine** | A device that converts hydrodynamic energy in the tidal flow into electrical energy. |
| **Tidal turbine array** | Term used to describe a group of tidal turbines. |
| **Turbine support structure (TSS)** | A turbine support structure is the structure placed on the seabed onto which a tidal turbine is installed. |
| **Wet mate connector** | A device used to connect electrical and data cables underwater. |

## List of Acronyms

**AA** Appropriate Assessment
**AADT** Annual Average Daily Traffic
**ABRA** Argyll & Bute Renewables Alliance
**AC** Alternating Current
**AD** Anno Domini
**ADCP** Acoustic Doppler Current Profiler
**AfL** Agreement for Lease
**AFT** Argyll Fisheries Trust
**AGLV** Areas of Great Landscape Value
**AHC** Active Heave Compensation
**AIS** Automatic Identification System
**ALARP** As Low as Reasonably Practicable
**AMAA** Ancient Monuments & Archaeological Areas Act
**AOD** Above Ordnance Datum
**AR4** Forth Assessment Report
**ASCOBANS** Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish & North Seas
**ASFB** Association of Salmon Fisheries Board
**AST** Atlantic Salmon Trust
**AWAC** Acoustic Wave and Current
**BADC** British Atmospheric Data Centre
**BAP** Biodiversity Action Plan
**BAT** Best Available Technique
**BERR** Department of Business, Enterprise & Regulatory Reform
**BGS** British Geological Survey
**BOCC** Birds of Conservation Concern
**BODC** British Oceanographic Data Centre
**BS** British Standard
**BSI** British Standards Institution
**CAA** Civil Aviation Authority
**CEFAS** Centre for Environment, Fisheries & Aquaculture Science
**CFA** Clyde Fishermen's Association
**CD** Chart Datum
**CIA** Cumulative Impact Assessment
**CIRIA** Construction Industry Research & Information Association
**CMACS** Centre for Marine and Coastal Studies
**CMS** Construction Method Statement
**COWRIE** Collaborative Offshore Wind Research into the Environment.
**CPA** Coast Protection Act
**CPT** Core Penetration Tests.
**CRM** Collision Risk Modelling
**dB** Decibel
**DBE** DEME Blue Energy
**DDV** Drop Down Video
**DECC** Department of Energy & Climate Change
**DEFRA** Department for Environment, Food & Rural Affairs
**DEME** Dredging, Environmental & Marine Engineering
**DFO** District Fisheries Office
**dGPS** Differentially corrected GPS
**DOE MD** Department of Environment, Marine Division
**DP** Dynamic Positioning
**DP** Decommissioning Programme
**DPME** DP Marine Energy
**DSFB** District Salmon Fisheries Boards
**EC** European Commission
**EcIA** Ecological Impact Assessment
**EEC** European Economic Community
**EIA** Environmental Impact Assessment
**EMEC** European Marine Energy Centre
**EMF** Electro Magnetic Field
**EMaP** Environmental Management Plan
**EMP** Environmental Monitoring Programme
**ENVID** Environmental Issue Identification
**EPS** European Protected Species
**ERCoP** Emergency Response Cooperation Plan
**ES** Environmental Statement
**ESAS** European Seabirds at Sea
**ETA** Estimated Time of Arrival
**EU** European Union
**EUNIS** European Nature Information System
**FAO** Food and Agriculture Organisation
**FCS** Favourable Conservation Status
**FEPA** Food and Environment Protection Act
**FLO** Fisheries Liaison Officer
**FREDS** Forum for Renewable Energy Development in Scotland
**FRS** Fisheries Research Services
**FSA** Formal Safety Assessment
**FTE** Full Time Equivilents
**GDP** Gross Domestic Product
**GHG** Greenhouse Gas Emissions
**GIS** Geographical Information Systems
**GPS** Global Positioning System
**HATT** Horizontal Axis Turbine
**HLV** Heavy Lift Shearleg Vessels
**HIAL** Highlands & Islands Airports Ltd
**HIRA** Hazard Identification & Risk Assessment
**HRA** Habitat Regulations Appraisal
**HS** Historic Scotland
**HSE** Health and Safety Executive
**ICES** International Council for the Exploration of the Sea
**ICOMOS** International Council on Monuments and Sites.
**IFA** Institute for Archaeologists
**IEMA** Institute of Environmental Management
**IMO** International Maritime Organisation
**IPCC** Intergovernmental Panel on Climate Change
**ISA** Immediate Study Area
**IUCN** International Union for Conservation of Nature
**JCP** Joint Cetacean Protocol
**JNAPC** Joint Nautical Archaeology Policy Committee.
**JNCC** Joint Nature Conservation Committee
**kg** Kilogram
**km** Kilometre
**km2** Square kilometre
**Km/h** Kilometre per hour
**kV** Kilovolts
**LAT** Lowest Astronomical Tide
**LBAP** Local Biodiversity Action Plan
**LCA** Landscape Character Assessment
**LDP** Local Development Plan
**LLA** Local Lighthouse Authority
**LSCA** Landscape Seascape Character Assessment
**LSE** Likely Significant Effect
**m** Metre
**MarLIN** Marine Life Information Network
**MAIB** Marine Accident Investigation Branch
**MARPOL** International Convention for the Prevention of Pollution from Ships
**MS** Marine Scotland
**MBES** Multibeam Echo Sounder
**MCA** Maritime and Coastguard Agency
**MCS** Marine Conservation Society
**MCT** Marine Current Turbines Limited
**MESH** Marine European Seabed Habitats
**MFA** Marine and Fisheries Agency
**MGN** Marine Guidance Note
**MHWS** Mean High Water Springs
**MLWS** Mean Low Water Springs
**MLURI** Macaulay Land Use Research Institute
**mm** Millimetre
**MMO** Marine Management Organisation
**MNCR** Marine Nature Conservation Review
**MNNS** Marine Non Native Species
**MoD** Ministry of Defence
**MP** Member of Parliament
**MPA** Marine Protected Area
**MPS** Marine Policy Statement
**MS** Marine Scotland
**MSFD** Marine Strategy Framework Directive
**MSFD** Marine Strategy Framework Directive
**MSL** Mean Sea Level
**MSP** Mean Spring Peak
**MSS** Marine Scotland Science
**ms** Metres per second
**MSW** Multi Sea Winter (adult salmon)
**MW** Megawatts
**NATS** National Air Traffic Service
**NMRS** National Monuments Records of Scotland
**NBN** National Biodiversity Network
**NCI** Nature Conservation Importance
**NGR** National Grid Reference
**NIEA** Northern Ireland Environment Agency
**NLB** Northern Lighthouse Board
**Nm** Nautical miles
**NPF** National Planning Framework
**NSA** National Scenic Area
**NSRA** Navigational Safety Risk Assessment
**OCFA** Offshore Cable Feasibility Assessment
**OSPAR** Oslo & Paris Conventions for the protection of the marine environment
**OREI** Offshore Renewable Energy Installation
**OS** Ordnance Survey
**PAD** Protocol for Archaeological Discoveries
**PAM** Passive Acoustic Monitoring
**PAN** Planning Advice Note
**PBR** Potential Biological Removal
**PEXA** Practice and Exercise Area
**PPG** Pollution Prevention Guidelines
**PHA** Preliminary Hazard Analysis
**PMF** Priority Marine Feature
**PSD** Power Spectral Density
**RCAHMS** Royal Commission for Ancient and Historical Monuments for Scotland
**ReDAPT** Reliable Data Acquisition Platform Tidal
**RES** Renewable Energy Strategy
**REZ** Renewable Energy Zone
**RNLI** Royal National Lifeboat Institution
**ROCs** Renewables Obligation Certificates
**ROS** Renewable Obligation Order for Scotland
**ROV** Remotely Operated Vehicle
**ROW** Receiver of Wreck, wreck administration department within the UK Maritime Coastguard Agency.
**RPM** Revolutions per Minute
**RSPB** Royal Society for the Protection of Birds
**RTP** Roger Tym and Partners
**RYA** Royal Yachting Association
**SAAR** Standard Annual Average Rainfall
**SAC** Special Area of Conservation
**SAM** Scheduled Ancient Monument
**SAMS** Scottish Association for Marine Science
**SAR** Search and Rescue
**SBL** Scottish Biodiversity List
**SCANS** Small Cetacean Abundance in the North Sea
**SCADA** Supervisory Control and Data Acquisition
**SCOS** Special Committee on Seals
**SEPA** Scottish Environment Protection Agency
**SEA** Strategic Environmental Assessment

**SFF** Scottish Fishermen's Federation
**SHEP** (Historic Scotland's) Scottish Historic Environment Policy
**SHETL** Scottish Hydro Electric Transmission Ltd
**SHEPD** Scottish Hydro Electric Power Distribution Ltd
**SIFAG** Scottish Inshore Fisheries and Advisory Group
**SLA** Scenic Landscape Area
**SLVIA** Seascape & Landscape Visual Impact Assessment
**SMA** Seal Management Area
**SMRU** Seal and Mammal Research Unit
**SMP** Survey Monitoring Plan
**SNH** Scottish Natural Heritage
**SNMP** Scotland's National Marine Plan
**SOLAS** International Convention for the Safety of Life at Sea
**SOS** Secretary of State
**SPA** Special Protection Area
**SPG** Supplementary Planning Guidance
**SPL** Sound Pressure Level
**SPP** Scottish Planning Policy
**SRSL** SAMS Research Services Limited
**SSA** Setting Study Area
**SSE** Scottish and Southern Energy
**SSER** Scottish and Southern Energy Renewables
**SSSI** Special Site of Scientific Interest
**TCE** The Crown Estate
**TAC** Total Allowable Catch
**TEC** Tidal Energy Converter
**TGL** Tidal Generation Limited
**THLS** Trinity House Lighthouse Service
**TOC** Total Organic Carbon
**TSS** Turbine Support Structure
**TSS** Traffic Separation Scheme
**TTS** Temporary Threshold Shift
**UK** United Kingdom
**UKBAP** UK Biodiversity Action Plan
**UKC** Under Keel Clearance
**UKHO** UK Hydrographic Office
**UKRES** UK Renewable Energy Strategy
**UNCLOS** United Nations Convention of the Law of the Sea
**UNESCO** United Nations Educational, Scientific & Cultural Organisation.
**VATT** Vertical Axis Turbine
**V** Volts
**VERs** Valued Ecological Receptors
**VHF** Very High Frequency
**VP** Vantage Point
**VMS** Vessel Monitoring System
**VTS** Vessel Traffic Services
**WANE** The Wildlife & Natural Environment (Scotland) Act (2011)
**WEWS** Water Environment & Water Services Act
**WITEP** West Islay Tidal Energy Park
**WGNAS** Working Group on North Atlantic Salmon
**WHO** World Health Organisation
**WFD** Water Framework Directive
**WSA** Wider study area
**ZAV** Zone of Actual Visibility
**ZTV** Zone of Theoretical Visibility

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WESTISLAY TIDAL

# ENERGY PARK

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# 7. Marine Mammals and Basking Sharks

## 7.1 Introduction

This chapter documents the findings of the EIA for potential impacts of the West Islay Tidal Energy Park ("Project") on marine mammals and basking sharks, to support an application for consent. Impacts that may occur throughout the construction, operation and decommissioning phases are considered here. The magnitude and significance of the potential impacts of the development is assessed.

Table 7.8 identifies the maximum ('worst case') Project parameters in line with the Rochdale Envelope approach in section 7.3.5.

### 7.1.1 Supporting Information

The list below details the supporting studies which were commissioned by DPME to support the assessment of impacts to marine mammals and basking sharks.

- SAMS Research Services Ltd (SRSL) (2012). Occurrence of Marine Mammals and Basking Sharks In and Around a Proposed Tidal Energy Site (Appendix 7.1);
- SAMS Research Services Ltd (SRSL) (2012). Summary of information on marine mammals and basking shark at the West Islay Tidal Energy Park (Appendix 7.2);
- Sea Mammal Research Unit Ltd (2013). DP Energy Seal Telemetry Report (Appendix 7.6);
- Sea Mammal Research Unit Ltd (2012). Summary of SMRU seal counts and telemetry tracks in the Islay area (Appendix 7.7);
- SAMS Research Services Ltd (SRSL) (2013). Modelling Encounter Rate Between turbines, Marine Mammals and Basking Sharks (Appendix 7.3);
- Xi Engineering (2013). Acoustic Modelling of a Tidal Turbine Array (MCT) – South West Islay (Appendix 7.4);
- Xi Engineering (2013). Acoustic Modelling of a Tidal Turbine Array (TGL) – South West Islay (Appendix 7.5); and
- Loughborough University and SAMS Research Services Ltd (SRSL) (2012). Underwater Sound in the Waters to the West of Islay: Ambient Sound Measurement and Acoustic Analyses (Appendix 7.8).

The following chapters should also be referenced as part of the review process:

- Project Description – Chapter 5; and
- Noise – Chapter 19

Limited information is available on the interactions between marine mammals and novel tidal technologies. Wherever possible, this assessment refers to published and grey literature, and relies on site-specific studies to enable predictive impact modelling. Until research has been undertaken at tidal energy developments, significant uncertainty will be inherent to any impact assessment process. This is treated appropriately, with transparency in the application of qualitative expert judgment, so that the risks are adequately assessed to support regulatory decision making.

Further, where monitoring is being undertaking at tidal turbines, available results have been used (e.g. from Strangford Lough and experience at the European Marine Energy Centre (EMEC) in Orkney). A number of on-going studies that should inform the assessment of impacts from tidal turbines may not have concluded to inform this EIA (e.g. the NERC RESPONSE Project), however any information arising during consideration of this application consent would be used to develop and define the Environmental Monitoring Programme (EMP) to be undertaken at the Project.

## 7.2 Legislative Framework and Regulatory Context

This section presents an overview of the national and international legislative requirements for assessing impacts to marine mammals and basking sharks. Legislation relevant to the development area is presented, i.e. applying to the jurisdiction within which it is located, and the species which are considered in this assessment.

Table 7.1 presents a summary of the species that are likely to occur at the project site and surrounding area, according to review of available data (as presented in Technical Appendix 7.2), along with a summary of their legal status at an international and national level. Detail of the legislation and the implications for the assessment of impacts arising from the project is explained in Section 7.2.1, and referred to throughout the subsequent sections.

| Species | Habitats Directive | WCA 1981 Schedule | HR 1994 Schedule | Bern Convention Appendices | Bonn Convention Appendices | Other |
|---|---|---|---|---|---|---|
| Harbour porpoise (*Phocoena phocoena*) | II and IV (EPS) | 5 | 2 | II | | IUCN Red List – Least Concern and PMF |
| Bottlenose dolphin (Tursiops truncatus) | II and IV (EPS) | 5 and 6 | 2 | II | | PMF |
| Risso's dolphin (*Grampus griseus*) | IV | | 2 | | | PMF |
| Minke whale (Balaenoptera acutorostrata) | IV (EPS) | | 2 | III | | PMF |
| Harbour (or common) seal (*Phoca vitulina*) | II and V | | 3 | III | (II but not local population) | PMF |
| Grey seal (Halichoerus grypus) | II and V | | 3 | III | II | PMF |

| Species | Habitats Directive | WCA 1981 Schedule | HR 1994 Schedule | Bern Convention Appendices | Bonn Convention Appendices | Other |
|---|---|---|---|---|---|---|
| Basking sharks (*Cetorhinus maximus)* | | 5 | | | I and II | PMF, CITES Appendix II, Nature Conservation (Scotland) Act 2004, OSPAR List of Threatened and/or Declining |

Table 7.1: Summary of Legal Status of Species Occurring at the Project Site.

7.2.1 International Legislation

Of the species occurring at the Project site, bottlenose dolphin and harbour porpoise are listed in Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention). In addition, harbour seal (the eastern Atlantic population), grey seal and minke whale are listed in Appendix III as 'protected faunal species,' whereby a limited amount of exploitation is allowed if the population can be sustained.

The convention of migratory species (Bonn Convention, CMS), 1979, operates as a framework for a range of multilateral Agreements for the conservation and management of migratory species, covering particular species groups. Common dolphin is listed in Appendix I as an endangered migratory species; grey seals and harbour seals (Baltic and Wadden Sea sub-populations only) are included in Appendix II, as migratory species that need or would significantly benefit from international co-operation. ASCOBANS (the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas) was established under the auspices of the Bonn Convention, and protects all toothed whales (odontocetes), except for the sperm whale.

The OSPAR convention lists species and habitats which require further protection; of the species encountered in this area (the Celtic Sea region), harbour porpoise is included in Annex IV, as threatened or declining.

The requirements of the Bern Convention, Bonn Convention and OSPAR in regard to marine mammals are principally addressed through the Habitats Directive (92/43/EEC) and associated legislation, detailed below.

7.2.1.1 Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the Conservation of natural habitats and of wild fauna and flora)

All species of cetaceans and seals addressed in this chapter are listed in one or more of Annex II, IV and V of the Habitats Directive, as species of 'Community interest'. This affords particular levels of protection through spatial measures to protect habitats that are fundamental to the survival of the species, and strict protection measures applied to individuals and populations. In combination, these measures address the primary objective of the Directive, i.e. to ensure that Favourable Conservation Status (FCS) of species listed in the Annexes is maintained.

For Annex II species (harbour seal, grey seal, harbour porpoise and bottlenose dolphin), spatial protection measures should be developed through designation of Special Areas of Conservation (SACs), that contribute to a 'coherent European ecological network' of protected sites (through Natura 2000).

Where it has been established that a plan or project is likely to have a significant effect on the integrity of an SAC, 'appropriate assessment' should be undertaken, relative to the conservation measures in place at the site, to ascertain whether the project can proceed without risk of an adverse impact on site integrity. Appropriate assessment is undertaken by the competent authority (in this case Marine Scotland) during consideration of an application for consent. The developer (in this case DPME) should collate information to support this assessment (termed 'Habitats Regulations Appraisal'; HRA). More detail on the HRA process, together with an assessment of the risks posed to Annex II species via impacts on SACs is presented in Appendix 7.9.

Further strict protection measures are required for European Protected Species (EPS), listed on Annex IV of the Directive (including all cetaceans). These species are afforded strict protection from all forms of deliberate capture or killing; deliberate disturbance, particularly during the period of breeding, rearing, hibernation or migration; and deterioration or destruction of breeding places or resting sites. This is the primary mechanism for providing protection to cetaceans and the transposition of this into UK law and mechanism for management is explained below, under 'Habitats Regulations.'

Grey seal and harbour seal are also protected under Annex V of the Habitats Directive which has particular implications for the exploitation of this species. These conservation requirements are now addressed in Scotland under the Marine (Scotland) Act (2010), described below.

7.2.1.2 Favourable Conservation Status (FCS)

Member States are required to maintain or restore European protected habitats and species listed in the Annexes at FCS. FCS, relative to species, is defined in Article 1 (i) of the Directive as follows:

"Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2. The conservation status will be taken as 'favourable' when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats;

- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis."

Member States are required (by Article 17 of the Directive) to report on implementation of the Habitats Directive every six years; including FCS for habitats and species. This is undertaken at bio-geographical level, which for the UK is the Atlantic Region.

7.2.2 National Legislation

The Wildlife and Countryside Act (WCA) 1981 (as amended) ratifies the Bonn Convention in Scotland, providing protection of all cetaceans found within territorial waters (to 12nm). Under Section 9 of the Act, it is an offence to intentionally kill, injure or take cetaceans; and to cause damage or destruction to certain areas used by cetaceans. In Scotland, the WCA (1981) Act was amended by the Nature Conservation (Scotland) Act 2004 which, in reference to the species of concern here, makes it an offence to "intentionally or recklessly disturb a dolphin, whale or basking sharks." Bottlenose dolphin, common dolphin and harbour porpoise are included in Schedule 6 of the WCA (1981) Act, with basking sharks listed in Schedule 5.

The Habitats Directive has been transposed into Scottish law through the Conservation (Natural Habitats, &c.) Regulations 1994 (the 'Habitats Regulations') (as amended), which implements the species protection requirements on land and inshore waters (within 12 nautical miles). The Habitats Regulations provide protection for Annex IV European Protected Species (EPS), which are those species listed in Schedule 2 and 4 and include all cetaceans (dolphins, porpoises and whales species).

Regulation 39 (1) and (2) and 43 of the Habitats Regulations provide protection by making it an offence to harm any EPS, through "deliberate" or "reckless" action resulting in death, injury, harassment or disturbance.

Pending the development of specific guidance for Scottish waters, the term "deliberate" has been interpreted in guidance for the offshore area (JNCC, 2010a) as including indirect but foreseeable actions. A deliberate injury offence may occur if a cetacean receives a sound exposure level which may cause permanent threshold shift in hearing.

A deliberate disturbance offence may occur if the level of disturbance is likely to:

- Impair the ability to survive, to breed or reproduce, or to rear or nurture their young;
- To impair the ability of hibernating or migratory species, to hibernate or migrate; or
- Affect significantly the local distribution or abundance.

A disturbance offence is more likely to occur when there is a risk of animals incurring sustained or chronic disruption of behaviour scoring 5 or more in the

Southall *et al.* (2007) 'behavioural response severity scale,' or of animals being displaced from the area, with redistribution significantly different from natural variation (JNCC, 2010a).

Regulation 41 of the Habitats Regulations prohibits the use of certain means, which are listed in the regulation, of "capturing" or killing wild animals listed on Schedule 3 to the Regulations (Annex V(a) of the Habitats Directive; including grey and harbour seals). The prohibition also applies to EPS, listed in Schedule 2 to the Regulations where the capturing or killing is permitted by virtue of a relevant licence (detailed below). Regulation 41(2)(c) adds a general prohibition on any means of capturing or killing which is indiscriminate and capable of causing local disappearance or serious disturbance to Schedule 3 animals or any EPS.

#### 7.2.2.1 European Protected Species Licence

Under Regulation 44 of the Habitats Regulations certain activities that might otherwise constitute an offence may be carried out under licence. Regulation 44(e) applies to activities relating to preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment and may apply to certain renewable projects (Marine Scotland, 2012).

An activity that might otherwise constitute an offence may only be granted a licence if it can be demonstrated that by granting the licence the licensing authority remains fully compliant with the requirements of the Habitats Regulations. In order to achieve this it must be demonstrated that:

- The activity is one of the licensable purposes listed in Regulation 44;
- There is no satisfactory alternative; and
- That the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range (SNH, 2011).

Information to support assessment of the requirement for licences associated with this development is provided in Section 7.5.8.

#### 7.2.2.2 Priority Marine Features

SNH, on behalf of Marine Scotland have identified a subset of marine habitats and species upon which to focus conservation efforts, named Priority Marine Features (PMFs). These include those which have been listed for protection under other statutory instruments, including the UK Biodiversity Action Plan (BAP) to support efficient and effective management. The assigning of PMFs will not replace the listing of species and habitats in other legislation, but will provide a new focus for marine conservation activities across the three pillar approach of the Nature Conservation Strategy (i.e. (i) species measures (ii) site protection measures (iii) wider seas policies and measures) (Marine Scotland, 2011).

A separate list of Marine Protected Areas (MPA) search features, comprising mostly of Priority Marine Features which will benefit from spatial protection measures, has been produced and will be used to guide the selection of search locations for Nature Conservation MPAs. Three species of cetaceans are included on the MPA search feature list for Scottish territorial waters - Risso's dolphin, white-beaked dolphin and minke whale, along with basking sharks. The Scottish MPA Project is currently reviewing Search Locations for Nature Conservation MPAs, in order to determine which to progress for further assessment against selection guidelines before developing formal proposals. At this stage, there are no proposals to designate sites for these species.

7.2.2.3 Specific Legislation Requirements for Seals

In addition to the protection outlined above (through the Habitats Regulations and protection of SACs), the Marine (Scotland) Act 2010 introduces increased protection for seals and a new seal licensing system, under the species pillar of the conservation strategy. Section 6 of the Act makes it an offence to kill, injure or take seals at any time of the year except to alleviate suffering, or where a licence has been issued to do so (by Marine Scotland). Licences to kill individual can be granted for the protection of fisheries and aquaculture and for scientific and welfare reasons.

The Act also made it an offence to intentionally or recklessly harass seals at haul-out sites which have been identified for protection under Section 117 of the Marine (Scotland) Act 2010. This includes proposed protection for significant haul-out sites, based on aerial count data, and a consultation document is currently available (Scottish Government, 2011). The Natural Environment Research Council (NERC), through the UK Special Committee on Seals (SCOS) and the NERC sponsored Sea Mammal Research Unit (SMRU), provides advice on all licence applications and haul-out designations.

To support the management of seals at a national level, seven 'Seal Management Areas' (SMAs) have been proposed based on advice from SMRU (Scottish Government, 2012). The development site falls within the West Highland Management Area (Cape Wrath to Mull of Kintyre), and specifically within the 'South' subdivision.

The management areas are used to define the levels of acceptable take from the population (Potential Biological Removal; PBR) which is calculated annually by SMRU using the latest counts and population estimates. The PBR approach has been used to define a threshold to support consenting of tidal energy projects according to a level of predicted mortality through collision. Assuming that collision will result in death, the PBR approach which was developed to assess impact of fisheries by-catch and direct harvesting on populations, is therefore considered relevant. The approach requires an estimation of the size of the population concerned together with an estimate of the intrinsic rate of increase. To account for uncertainty around population dynamics in defining a threshold, a safety factor is introduced according to work undertaken by SMRU for SCOS. This does not account for uncertainty in quantitative prediction of mortality through collision which needs to be considered when evaluating a level of predicted risk according to a defined threshold (see Section 7.5.4.3).

The PBR level is currently set at 442 for harbour seals and 297 for grey seals of the West Scotland Management Area (Scottish Government, 2012). These will be used to support assessment of the significance of impacts to seal species, in addition to other information on the population dynamics. The population of harbour seals is currently concluded as stable and grey seals populations are at historically high levels (Scottish Government, 2012).

In response to local declines in harbour seal numbers, the Scottish Government introduced conservation orders under the Conservation of Seals Act 1970 to provide additional protection on a precautionary basis for vulnerable local populations of common seals. This was augmented by the introduction of a Seal Conservation Area for harbour seals in the Western Isles under the Marine (Scotland) Act 2010. Licences may still be granted, but only if it can be established that there is no suitable alternative and that the granting of a licence will not be detrimental to the maintenance of the harbour seal population at favourable conservation status.

#### 7.2.2.4 Specific Legislative Requirements for Basking Sharks

Since March 1998, basking shark were afforded full protection under Schedule 5 of the Wildlife and Countryside Act (WCA) 1981, protecting the shark from intentional killing, capture, or disturbance out to 12 nm. The Nature Conservation (Scotland) Act (2004) also protects the species from 'intentional and reckless' disturbance in territorial waters. Furthermore, a UK Biodiversity Action Plan for the basking shark is now being taken forward by the Scottish Government as part of the Scottish Biodiversity Strategy. Basking sharks are listed as vulnerable worldwide and endangered in north-east Atlantic (International Union for Conservation Nature 2004 Red List) and are listed under CITES Appendix III in UK waters. European Council Regulation 2555/2001 provides protection with a zero total allowable catch in European waters.

SNH have advised that it may be appropriate to consider the requirement for licensing for potential disturbance to basking shark under the Wildlife and Natural Environment (Scotland) Act 2011) (WANE). This Act brings the administration of licences for the protection of species under domestic law into line with the protection of similar species under European law. The assessment of potential disturbance is presented here within the EIA context, and would be included in an assessment of risks to inform licensing, through either EPS or WANE mechanisms.

### 7.2.3 Guidance

Key guidance documents that have been used in undertaking the marine mammal EIA, along with relevant scientific literature and experience at other comparable projects, are listed below:

- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland (EMEC and Xodus, 2010);
- Marine Scotland Licensing and Consents Manual: Covering Marine Renewables and Offshore Wind Energy Development; consultation draft (Marine Scotland, 2012);

- The protection of European protected species (EPS) from injury and disturbance. Guidance for the marine area in England Wales and UK offshore marine area (Joint Nature Conservation Committee (JNCC, 2010a); and
- Guidelines for Ecological Impact Assessment in Britain and Ireland, Marine and Coastal (Institute for Ecology and Environmental Management, 2010).

## 7.3 Impact Assessment Methodology

7.3.1 Scoping and Consultation

Scoping was initially undertaken in 2009; Table 4.2 (Chapter 4) summarises the main responses and references where those responses have been addressed in this ES. In relation to marine mammals a summary of pertinent issues raised during the consultation process and subsequent engagement is presented in Table 7.2.

| Consultation | Summary of Response | Where addressed |
|---|---|---|
| Islay Tidal Scoping Opinion (10th September, 2009) | A minimum of 2 full years (24 months) of survey work is required for cetaceans, seals, basking sharks and birds for each phase of development (SNH). | Undertaken and reported in SRSL (2012). |
| | Consider the risk of collision with mammals (SEPA). | Addressed in section 7.5.4.3. |
| Minutes of Scoping Meeting, 2009 | Undertake baseline assessment of relevant published data to inform detailed scope and methods proposal (SNH). | Undertaken and presented in Appendix 7.2, and summarised in Section 7.4. |
| Meeting Note (20th March, 2013). | Clarity required around the determination of density from the data gathered during the survey (SNH). | Addressed in Section 7.4. |
| | Provide justification for the scoping out of species, e.g. minke whale (SNH). | Addressed in Section 7.4. |
| | Include assessment of effects on haul-out sites for grey seals (under the Marine Scotland Act) (SNH). | Addressed in Section 7.5.3.2. |

Table 7.2: Key Consultation Comments Relevant to Marine Mammals.

7.3.2 Data Sources

A baseline assessment was compiled, utilising the results of specific survey work undertaken at the Project site, and other available information (presented in Appendix 7.2). A summary of the occurrence of species within the area using data gathered at the site and other relevant information is presented in Section 7.5. The following data sources were used in this assessment:

- SCANS II, 2008. Small Cetaceans in the European Atlantic and North Sea (SCANS II);
- Sightings data collected by the Hebridean Whale and Dolphin Trust (HWDT);

- The Atlas of cetacean distribution in north-west European waters (Reid *et al.* 2003);
- Data from the Joint Cetacean Protocol (JCP; JNCC 2012);
- Peer-reviewed journal articles on the abundance and distribution of marine mammals in the region;
- Marine renewables SEA environmental report (Faber Maunsell, 2007);
- Marine Mammal Scientific Support Research Programme MMSS/001/11: Grey and harbour seal density maps;
- Report to DPME Energy: Summary of SMRU seal counts and telemetry tracks in the Islay area (SMRU Ltd, 2012); and
- DPME Energy Seal Telemetry Report (SMRU Ltd, 2013).

7.3.3 Assessment of Significance

The general approach to impact assessment and defining significance within this EIA is outlined in Chapter 4: EIA/ES and Consultation. It has been developed with reference to the IEEM Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (IEEM, 2010), SNH Handbook for EIA and the draft consenting manual being developed by Marine Scotland (Marine Scotland, 2012). The approach is based on a matrix-based system to provide a logical and consistent framework for presenting impact assessment, but subjective judgments used in reaching conclusions are fully justified.

The significance of each impact is evaluated based on the sensitivity of the receptor, the nature and magnitude of the impact and the likelihood of the impact occurring. Criteria for sensitivity and magnitude are dependent on the pathway of the impact and the species at risk and are therefore described in this chapter, specific to marine mammals and basking sharks. The parameters used for making judgments on sensitivity, magnitude and consequence / significance in relation to marine mammals are presented below.

7.3.3.1 Sensitivity

Sensitivity is a measure of the tolerance of a receptor to a predicted impact to which they are exposed and its ability to recover. It is therefore species-specific, and dependent on the characteristics of the impact and associated predicted effect. Conservation status (i.e. the condition of a species as considered under protection measures) is relevant to sensitivity assessment as a measure of the health of a species at a defined scale (e.g. local / national / global). To some extent, this considers the sum of influences acting on the species concerned and inter-relationships that may affect the long-term distribution and abundance of its populations within a given geographical area.

Considering the conservation status of cetaceans, pinnipeds and basking sharks (see Section 7.2), the sensitivity of all species considered in this chapter, relevant to conservation importance, is considered initially to be high. This is then moderated to account for species-specific response to a particular impact (i.e. the capacity to avoid, adapt to, accommodate or recover) in accordance with the descriptions outlined in Table 7.3, to assess overall sensitivity. The categories of sensitivity of receptors, as per Chapter 4: EIA/ES and Consultation are presented as negligible, low, medium, high and very high.

| Sensitivity | Definition |
|---|---|
| Very High | Lethal consequences (i.e. no capacity to avoid, adapt to, accommodate or recover from the identified impact). |
| High | Potentially lethal consequences (i.e. very limited capacity to avoid, adapt to, accommodate or recover from the impact). |
| Medium | Non-lethal consequences identified (i.e. limited capacity to avoid, adapt to, accommodate or recover from the impact). |
| Low | No consequences identified (i.e. the species has capacity to avoid, adapt to, accommodate or recover from the impact). |
| Negligible | Species generally tolerant to the anticipated impact. |

Table 7.3: Categories for Determining Sensitivity.

7.3.3.2 Magnitude

The magnitude of impacts is based on the spatial extent, duration, frequency and severity of the change, considered against background variation and including the reversibility of the effect. Magnitude is quantified as far as possible, and where uncertainty exists and expert judgment applied, this is accounted for and explained. To support conclusions on magnitude *in lieu* of specific quantified assessment, a subjectivity scale has been used to assess impacts against available thresholds. The categories of magnitude used in this assessment are negligible, minor, moderate and major and the subjective considerations used when assessing magnitude are presented in Table 7.4 (adapted from Marine Scotland, 2012).

| Magnitude | Description |
|---|---|
| Major | Likely to lead to an irreversible impact on a proportion of the population / supporting habitat, through exposure of a large number of individuals (>1% of the reference population), on a frequent or permanent basis. |
| Moderate | Likely to lead to an irreversible impact on a proportion of the population / supporting habitat, through exposure of a small number of individuals (such as 0.5-1% of the reference population). |
| Minor | Likely to have an impact on a small proportion of the population / supporting habitat, through exposure of <0.5% of the reference population, or result in a temporary change which is recoverable. |
| Negligible | An imperceptible change to a low number of species / habitat of low ecological importance, or with immediate recovery rates. |

Table 7.4: Categories for Determining Magnitude.

7.3.3.3 Consequence

The sensitivity of receptor and magnitude of impact are combined to define the consequence of the impact (as presented in Table 7.5).

| Magnitude | Sensitivity | | | | |
|---|---|---|---|---|---|
| | Very High | High | Medium | Low | Negligible |
| Major | Major | Major | Major | Moderate | Minor |
| Moderate | Major | Major | Moderate | Minor | Negligible |
| Minor | Moderate | Moderate | Minor | Minor | Negligible |
| Negligible | Minor | Minor | Negligible | Negligible | Negligible |

Table 7.5: Matrix for Determining Consequence of Impact.

7.3.3.4 Residual Impact Significance

Where an impact of minor or greater consequence is identified, mitigation measures are applied and the impact reassessed to determine the residual impact significance. An overall conclusion on the significance of residual impacts is then drawn, relating this to the description given in the EIA Regulations (as in Table 7.6).

| Significance | Description | Interpretation under EIA Regulations |
|---|---|---|
| Major | Highly significant and requires immediate action | Significant impact under EIA Regulations |
| Moderate | Significant – requires additional control measures and/or management | |
| Minor | Not significant – however may require some management to ensure remains within acceptable levels | Insignificant impact under EIA Regulations |
| Negligible | Not significant | |

Table 7.6: Descriptions Used for Defining Overall Significance.

7.3.4 Cumulative Impact Assessment

Cumulative impact assessment (CIA) in the context of EIA, is considered to mean the assessment of the impact of the project on a receptor, where there are multiple stressors in action. This includes assessment of effects arising from sources outwith the project that could affect the predicted baseline, thereby contributing to an overall effect. This includes multiple projects of the same type, other activities and environmental stressors.

In-combination effects assessment is terminology specific to the HRA process, to consider 'other plans and projects' along with the proposed project, and the risk of an adverse impact being incurred through 'in-combination' effects. This is presented in the HRA report (Appendix 7.9).

The scope of cumulative assessment is defined by the spatial and temporal scale of the impact being assessed, relative to the activities which are occurring / proposed and the geographical range of species at risk. In general, it is necessary to consider any project which is in the planning system, i.e. those for which formal scoping exercises has begun, where information is publically available. For projects at an early stage in development, limited information will exist and therefore subjective assessments will be made. Within a reasonable geographical range of the species identified as being at risk of potential environmental impact from the Project, a number of activities were identified as relevant to CIA for marine mammals (Table 7.7).

| Project Name | Description of Project | Project Status | Relevant Impact for CIA |
|---|---|---|---|
| Sound of Islay | 10 MW project of 10 x1 MW tidal turbines in the Sound of Islay. | Consented (installation 2013 - 2015) | Collision risk |
| Kyle Rhea Tidal Energy Project | 8 MW tidal array, 4 x 2 MW devices in Kyle Rhea sea strait. | Submitted for consent | Collision risk to seals |

| Project Name | Description of Project | Project Status | Relevant Impact for CIA |
|---|---|---|---|
| Argyll Array Offshore Wind Farm | Up to 1800 MW capacity (up to 300 turbines), 5km off the coast of Tiree. | Scoping (on hold) | Noise during construction of the windfarm and operation of the Project |
| Islay Offshore Windfarm | 690MW windfarm, 13 km off the west coast of Islay | Scoping | Noise during construction of the windfarm and operation of the Project |
| Limpet | 500 kw wave energy device | Operational (installed in 2000) | Operational noise, collision risk |
| Argyll Tidal Array | 3 MW tidal array, 6 x 500kw turbines | Scoping | Operational noise, collision risk |
| Sanda Sound Demonstrator | Single 1/4$^{th}$ scale demonstrator wave device at Sanda Sound, South Kintyre | Consented | Operational noise, collision risk |
| Fair Head | 100 MW tidal energy array off the north coast of County Antrim | Agreement for Lease awarded October 2012 | Not included in CIA. |
| Torr Head | 100 MW tidal energy array off the north coast of County Antrim | Agreement for Lease awarded October 2012 | Not included in CIA. |

Table 7.7: Projects Relevant to Cumulative Impact Assessment for Marine Mammals.

Two exclusivity leases have been granted for the development of tidal energy off Northern Ireland in the Rathlin Island and Torr head Strategic Area; Fair Head (DPME Marine Energy / DBE) and Torr Head (Tidal Ventures). These projects have not yet reached the scoping phase and insufficient information exists to support an assessment of cumulative effects. These projects are therefore screened out of the CIA.

Potential further lease areas for marine renewables have been identified along the West coast of Scotland through the development of a further sectoral plan for marine renewables however no details are available to assess cumulative effects within this EIA. Cumulative effects of this project and others currently in the consenting process will be considered alongside the proposed further developments through the Strategic Environmental Assessment (SEA) process.

As per advice provided by SNH, there are currently no non-renewable developments currently in the planning process that would require inclusion in the cumulative impact assessment for the Project (SNH, 2013).

The potential for cumulative effects is assessed in Section 7.5.6.

7.3.5 Project Parameters Relevant to Marine Mammals and Basking Sharks

The approach to ensure the EIA addresses the project characteristics that would result maximum adverse impact is outlined in Chapter 5: Project Description. The project design envelope parameters which present maximum extents for impacts to marine mammals are presented in Table 7.8.

| Project Parameter | MCT Turbine | TGL Turbine | Explanation of maximum project parameter |
|---|---|---|---|
| Number of turbines | 15 | 30 | The project would include a minimum of 15 2MW MCT devices (with 2 rotors), up to a maximum of 30 single-rotor 1MW TGL devices; likely a mixture of both device types. Assessment of the potential interaction with turbines (through encounter risk modelling), and noise modelling, both consider a 15 MCT and 30 TGL scenario. As both are modelled, it is not necessary, at this stage, to conclude the worst case regarding the relative noise levels or potential for encounter risk, however the maximum number of each device type is considered to represent the maximum range of impact. The extent of impacts of a combination of device types will be different, but would fall within this assessed project envelope. |
| Number of rotors per turbine | 2 | 1 | This indicates the maximum number of rotors per turbine. The MCT turbine may represent the worst-case in the encounter modelling since there are 2 (larger diameter) rotors to each turbine, increasing the area within which marine mammals could be encountered. However at an array scale, the worst case is not apparent and relevant impacts such as the encounter risk (and noise modelling) considers both device types. |
| Rotor diameter | 20 m | 18 m | The maximum rotor diameter being considered for each rotor. This is relevant to encounter risk modelling and both device types are assessed. |
| Rotational speed (rated power) | 11.5 rpm | 14 rpm | This parameter is relevant to encounter risk assessment and both device types are assessed. |
| Rotor swept area | 628 $m^2$ | 380 $m^2$ | The maximum area through which the rotors turn in the water column, for each device noting that the device has 2 rotors per turbine. This is relevant to encounter risk modelling and both device types are assessed. |
| Cut-in speed | 1 m/s | 1 m/s | Both the MCT and TGL devices will be stationary in tidal flows of less than this speed, which is a relevant parameter for assessing encounter risk. |
| Seabed clearance from the blade tip | 3 m | 6 m | This is used to calculate the position of the rotor swept area in the water column, which is relevant to the assessment of encounter risk, in particular which species are more at risk according to their behaviour. Both device types are assessed. |
| Surface (LAT) clearance from blade tip | 3.5 m | 7 m | This is used to calculate the position of the rotor swept area in the water column, which is relevant to the assessment of encounter risk, in particular which species are more at risk according to their behaviour. Both device types are assessed. |
| Noise from pin-pile installation in foundations | 1.5 m | 1.3 m | Drilling associated with pin-piles produces the loudest noise during installation. Larger diameter drilling will be louder and therefore MCT is considered the worst-case and the impact assessment is focused on this. |

Table 7.8: Project Parameters Relevant to Marine Mammals and Basking Sharks.

### 7.3.6 Data Gaps and Uncertainties

Empirical evidence has been used where available however limited field data exists documenting the impacts of tidal stream projects on marine mammals and basking shark. Predictive modelling tools have therefore been undertaken to support this EIA, to enable assessment of impacts from the proposed project. However, there remains a level of uncertainty associated with predicting impacts, which is accounted for by transparent presentation of assumptions and expert opinion where made, and making precautionary judgments where appropriate. Where appropriate, uncertainties will be addressed through the development a targeted Environmental Monitoring Plan (EMP) (see Section 7.5.10).

Assumptions in the modelling are explained in detail within the technical appendices, however key aspects are summarised here. It is important to acknowledge that;

- There are challenges in obtaining robust density estimates from areas where there are low occurrences of marine mammals, and where there are often poor conditions for visual surveys (high sea state). A combination of methods were therefore used to obtain site-specific survey data for the development area to support the best available density estimates within reasonable cost, however in consequent assessment, it is important to acknowledge the confidence levels of the resulting density and how this uncertainty is accounted for in reaching conclusions.

- Although extensive work is underway to better understand the size, range and behaviour of marine mammal, and basking shark populations, limited information is available to support quantitative assessment of significance through EIA. Included is the most up to date information currently available (particularly for seals) to support interpretation of the significance of effects and applied expert judgment where appropriate.

- The development area was redefined adjacent to the original development area while EIA was being undertaken. The track lines of the visual survey were extensive enough as to cover the revised area and therefore the site-specific survey information remains valid. The ambient noise analysis was undertaken across the original site area and therefore does not directly transect the proposed development site, however the sound levels are regarded as comparable due to the similarities in environmental characteristics.

- Encounter risk modelling presents a mechanism for assessing the risk to marine mammals through collision, providing a guide for understanding how many individuals may pass through the swept area. This is not equivalent to the number of animals that would collide with the device blades and valid scientific approaches for calculating this number are not yet available. Drawing conclusions on the number of collisions and subsequent mortality must therefore be treated appropriately, with qualitative interpretation *in lieu* of confident numerical outputs.

## 7.4 Description of Marine Mammal and Basking Sharks Baseline

SRSL prepared a marine mammal baseline report (Appendix 7.2) using a combination of a desk-based study of literature and available data sources, and an analysis of the baseline data collected during two years of visual and acoustic surveys (SRSL, 2012). Acknowledging the wide spatial context relevant to consider for wide-ranging mobile species, including marine mammals and basking sharks, Appendix 7.2 presents a summary of available information on the distribution, abundance and behaviour within the project area and surrounding waters.

In general, marine mammal species occur in low numbers at the development site (SRSL, 2012). Table 7.9 presents species that were recorded within the development area during dedicated surveys, or are considered likely to be present within the area at certain times based on wider information. Species that were recorded at the site, or considered likely to occur regularly were considered relevant for impact assessment.

For certain species, it could not be concluded that they would never occur at the site, but their occurrence would be sufficiently low that a) any interaction resulting in impact would be likely to be insignificant and b) it would be difficult to undertake a meaningful assessment.

The supporting information used for the below summary table is presented in Appendix 7.2.

| Species | Observed During Survey | Summary of Occurrence Based on Species Biology | Considered in EIA |
|---|---|---|---|
| Harbour porpoise (*Phocoena phocoena*) | Y | Regularly occurring | Y |
| Bottlenose dolphin (*Tursiops truncatus*) | Y | Regularly occurring – but not an important area | Y |
| Common dolphin (*Delphinus delphis*) | N | Unlikely to be encountered at the site – habitat preferences elsewhere | N |
| Risso's dolphin (*Grampus griseus*) | Y | Seasonal visitor | Y |
| Killer Whale (*Orcinus orca*) | N | May occasionally be observed – a rare but wide ranging species | N |
| White-beaked dolphin (Lagenorhynchus albirostris) | N | Unlikely to be encountered at the site – habitat preference elsewhere | N |
| Striped dolphin (Stenella coeruleoalba) | N | Unlikely to be encountered at the site – rare in Scottish waters and habitat preference elsewhere. | N |
| Long-finned pilot whale (*Globicephala melas*) | N | Unlikely to be encountered at the site – habitat preference elsewhere | N |
| Minke whale (Balaenoptera acutorostrata) | N | Presumed regularly occurring | Y |
| Harbour (or common) seal (*Phoca vitulina*) | Y | Regularly occurring | Y |
| Grey seal (Halichoerus grypus) | Y | Regularly occurring | Y |

| Species | Observed During Survey | Summary of Occurrence Based on Species Biology | Considered in EIA |
|---|---|---|---|
| Basking shark (Cetorhinus maximus) | N | Presumed seasonal visitor | Y |
| Leatherback turtle (*Dermochelys coriacea*) | N | May occasionally be observed – rare but wide ranging | N |

Table 7.9: A Summary of Species Considered Relevant for EIA, Based on Recorded and Likely Occurrence at the Project.

The species therefore considered in this EIA are listed in Table 7.10.

| Species Group | Species |
|---|---|
| Cetaceans | Harbour porpoise (*Phocoena phocoena*) |
| | Bottlenose dolphin (*Tursiops truncatus*) |
| | Risso's dolphin (*Grampus griseus*) |
| | Minke whale (*Balaenoptera acutorostrata*) |
| Pinnipeds | Harbour (or common) seal (Phoca vitulina) |
| | Grey seal (*Halichoerus grypus*) |
| Basking shark (*Cetorhinus maximus*) | |

Table 7.10: Species Considered in this EIA, According to Species Group.

A summary of the baseline for each of the species selected for impact assessment is presented below (see Appendix 7.2 for more full description of all species).

7.4.1 Harbour Porpoise

Harbour porpoises (*Phocoena phocoena*) occur in cold temperate to subarctic waters in the Northern Hemisphere and are by far the most commonly encountered cetacean in Scotland (Goodwin and Speedie, 2008). Animals are frequently observed in most inshore areas, although sightings also occur in deeper waters (Reid *et al.,* 2003). Harbour porpoises in western Scotland appear to show a preference for waters within 15km from shore, and of 50-150m depth (Macleod *et al.* 2007; Marubini *et al.,* 2009). Despite porpoises' prevalence, population substructure and migratory behaviour remain largely unknown in most areas. Population estimates based on the 2005 SCANS-II dedicated aerial survey suggest a total of 12,076 animals in inshore waters in western Scotland, including Islay, during summer (Block N; 95% confidence interval (C.I.) = 4,685 – 27,239; SCANS-II 2008). Based on existing survey data, porpoises are present year-round in the area around Islay (Embling *et al.,* 2010).

Surveys in western Scotland suggest that harbour porpoises are widely distributed, but particular concentrations of porpoise abundance have been identified in several areas including the Sound of Jura, Firth of Lorne, the area between Mull and the Treshnish Isles, and the Sound of Sleat (Marubini *et al.* 2009; Embling *et al.,* 2010). Research on satellite-tagged porpoises in the Bay of Fundy / Gulf of Maine has revealed that porpoises inhabit relatively restricted focal areas for extended periods, but may then quickly move across considerable distances (>100 km) before occupying a different focal area (Read and Westgate, 1997; Johnston *et al*., 2005). It is not presently clear to what extent porpoises move around in Scottish waters, or whether porpoises display interannual philopatry to particular sites, but permanent occupation of specific areas by particular porpoises has not been demonstrated to date.

Harbour porpoises in Scottish waters are known to forage on a range of small benthic and pelagic shoaling fish species, particularly sandeels (Ammodytidae) and small gadoid species such as whiting (*Merlangius merlangus*; Santos *et al.,* 2004). Chapter 11 (Natural Fish) suggests that whiting occurs at the site, although in declining numbers in recent years. Reproduction of harbour porpoise occurs annually, with mating and calving reported between May and September with a peak between June and July (Lockyer, 2003). There are currently no indications that specific areas anywhere in UK waters, much less the proposed development site, are crucial for harbour porpoise reproduction.

At present it is unclear whether porpoises either target or avoid marine habitats subject to high rates of tidal flow, such as found within the proposed development site. Studies carried out in numerous sites in UK waters and elsewhere (e.g. Calderan, 2003; Pierpoint, 2008, Marubini, *et al*., 2009) all indicate that porpoises are found in elevated densities in areas of high tidal-streams. In marked contrast, however, Embling *et al.* (2010), analysed results from dedicated cetacean surveys from the southern Inner Hebrides, and found that porpoise distribution was best explained by tidal currents with the higher densities predicted in areas of low current. A subsequent study encompassing the entire Hebrides area (Booth, 2010) found that depth (especially waters between 50-150 m), steep slopes and proximity to land were all important in explaining areas of high porpoise density, but that relationships with current speed were less important. Further work is therefore necessary to clarify the relationship between harbour porpoise distribution and strong tidal currents, particularly at small spatiotemporal scales. It has been suggested that the tidal current speeds in the southern Inner Hebrides are considerably higher than elsewhere, to the point of being undesirable to harbour porpoises, which could explain this apparent difference (SMRU Ltd, 2010). Current speeds at the proposed development site are considerable (up to >2m/s at spring tides), though not as strong as some sites in the vicinity (e.g. the Gulf of Corryvreckan) that also attract porpoises.

A series of monthly dedicated surveys in the immediate vicinity of the proposed development site over a period of two years was undertaken to assess marine mammal presence, distribution and, where possible, density. Attempts to assess density were complicated by extremely low sighting rates of all marine mammal species including harbour porpoise, the most abundant cetacean (12 sightings of 18 individuals; see Appendix 7.1 for more details).

It is considered unrealistic to calculate a defensible density estimate on the basis of as little as 12 observations (Buckland *et al*. 2001). Acoustic detection rates using a towed hydrophone array were better, with a total of 41 detections over the course of the two years of surveying. Although sample sizes were still small, using these data suggests that, on average, harbour porpoise densities at the proposed development site were on the order of 0.034 animals/$km^2$ (95% C.I.: 0.022 – 0.054 animals/$km^2$; CV = 0.22). This is an order of magnitude lower than the (summer-only) estimate from the SCANS-II survey of the entire Minch (Block N; SCANS-II 2008) of 0.3943 animals/$km^2$ (95% C.I.: 0.1530 – 0.8894 animals / $km^2$). This suggests that the proposed development site may not be especially significant for harbour porpoise.

Harbour porpoise were considered to be at 'favourable conservation status' on the basis of the species' range, population, habitat and future prospects (JNCC 2007).

7.4.2 Bottlenose Dolphin

Bottlenose dolphins (*Tursiops truncatus*) are widely distributed in tropical to temperate waters in both hemispheres, occurring both in coastal areas and far offshore. In inshore Scottish waters, three resident populations have been identified to date; one on the northeast coast of Scotland from the Moray Firth to Fife (~200 individuals), one on the west coast concentrated on the Sound of Barra (~15 individuals) and one on the west coast distributed more widely amongst the Inner Hebrides (~30 individuals) (*e.g.*, Hammond and Thompson, 1991; Grellier & Wilson, 2003; Cheney *et al.,* 2012). The two populations on the west coast are considered to be segregated behaviourally (Cheney *et al.,* 2012). There is evidence that bottlenose dolphins from the east coast occasionally travel around the north to western Scottish waters as well as coastal waters off Ireland (Robinson *et al.* in press, cited in Cheney *et al.,* 2012), suggesting that the various populations may not be completely isolated. The SCANS-II aerial survey data suggested a bottlenose dolphin abundance of 246 individuals (95% C.I. = 41 – 1,479; SCANS-II 2008) for this area. There are also numerous sightings of bottlenose dolphins in offshore northeast Atlantic waters, suggesting substantial offshore populations. There is no information on the extent to which inshore and offshore populations might interact, but studies in the northwestern Atlantic suggest that such populations are largely discrete (Hoelzel *et al.,* 1998).

Bottlenose dolphins can occur in groups of more than a hundred, but group sizes in western Scotland are typically much smaller (up to 20 or so individuals; Mandleberg, 2006). They may approach boats and are generally inquisitive around human activities. Elsewhere in Scotland, bottlenose dolphins have been shown to seek out tidal fronts, presumably as an aid to foraging (Wilson *et al.,* 1997; Mendes *et al.,* 2002). Prey items include a wide range of benthic and pelagic fish species as well as (to a far lesser extent) cephalopods and other invertebrates (Santos *et al.,* 2001).

Bottlenose dolphins have good hearing at high frequencies with a peak at around 50dB re 1μPa at 50kHz becoming insensitive to sounds above 200kHz. Hearing is generally considered to be poor at lower frequencies although social vocalisations at frequencies of <1kHz have been reported, suggesting relevance of low-frequency hearing (Simard et al. 2011).

Sightings of bottlenose dolphins have been reported in the vicinity of southwestern Islay (Mandleberg, 2006), however it is unclear whether these sightings are of animals belonging to the Inner Hebrides population. There is currently no evidence of seasonality in the sighting records, suggesting year-round presence amongst the Inner Hebrides. During monthly dedicated surveys in the immediate vicinity of the proposed development site over a period of two years, bottlenose dolphins were reported on only a few occasions (see Appendix 7.1 for more details). Considering the wide-ranging nature of bottlenose dolphins in the Inner Hebrides population, this result suggests that the site is not especially significant for this species. Insufficient data were available to generate robust density estimates.

Bottlenose dolphin conservation status was considered 'unknown' (JNCC, 2007).

7.4.3 Risso's Dolphin

Risso's dolphin (*Grampus griseus*) is widespread in warm to temperate waters in all oceans, but is nowhere known to be abundant. In UK waters, the species appears to be distributed across the continental shelf, with a preference for waters >50 m (Reid *et al.*, 2003). Most sightings have been reported off western Scotland, particularly in the Minch and around the Outer Hebrides, although other areas of higher abundance also exist in the southern Irish Sea and elsewhere (e.g. off southwestern Ireland). Risso's dolphins often occur in small to medium-sized groups of up to 50 animals, although 6-20 is more common (Reid *et al.*, 2003). The species feeds mainly on pelagic and benthic cephalopods with fish forming a minor dietary component. Risso's dolphins are considered to be somewhat wary around vessels but may approach and bow-ride like other dolphin species.

No abundance estimates are available for Risso's dolphin in western Scottish waters. Sightings of Risso's dolphin in the Minch tend to peak between May and September (Reid *et al.*, 2003), but are less prevalent amongst the southern Inner Hebrides. The species was reported on several occasions during monthly dedicated surveys in the immediate vicinity of the proposed development site, but only during summer months, suggesting that the species is a seasonal visitor here. Insufficient data were available to generate robust density estimates.

7.4.4 Minke Whale

The minke whale (*Balaenoptera acutorostrata*) is the only species of baleen whale likely to be encountered regularly in inshore Scottish waters. The species is widespread in the northeast Atlantic and likely to be encountered in continental shelf waters of <200m, although offshore sightings have also been reported in deep oceanic environments (Reid *et al.,* 2003). Sightings in inshore waters are most often of solitary whales or small groups in sites where feeding conditions are good, and show a peak between May and September. SCANS-II survey data suggest that the minke whale population across the entire survey area is 18,614 (95% C.I. = 10,455 - 33,171). Minke whales feed on a wide range of small pelagic or benthopelagic fish species as well as invertebrates (Haug *et al.,* 1995).

The Inner Hebrides represent one of several areas in Scottish waters with a concentration of minke whale sightings, suggesting this area is of at least regional significance. There is evidence of seasonal site fidelity (Gill *et al.,* 2000) and several seasonally important feeding areas have been identified within this area (Macleod *et al.,* 2004). The distribution of minke whales may change considerably over the summer in response to changes in prey abundance and distribution (Macleod *et al.,* 2004). Minke whales have been reported to exploit tidal currents at small spatial scales for foraging (Anderwald *et al.,* 2012), suggesting that locations of strong tidal currents such as those found near the proposed development site might be attractive to them.

No minke whales were recorded during monthly dedicated surveys in the immediate vicinity of the proposed development site over a period of two years (see Appendix 7.1 for more details). A minke whale was sighted on an extended survey track towards Colonsay, suggesting that minke whales inhabit the wider area off western Islay. Considering the species' comparative abundance and wide-ranging habits, minke whales may occur within the proposed development site at certain times but in very low numbers.

7.4.5 Harbour Seal

Harbour (or common) seals (*Phoca vitulina*) are widespread in temperate to subarctic coastal waters of the Northern Hemisphere, where they typically occur in waters of <200 m deep. Harbour seals haul out in many inshore locations around Scotland, which hosts approximately 79% of the UK population (estimates run up to 20,000 seals for Scotland as a whole; SCOS, 2011). These haul-out sites can contain up to several hundred seals but are usually smaller, on the order of several tens of individuals or less. Populations in some parts of Scotland have declined significantly in recent years (Lonergan *et al.,* 2007; SCOS, 2011), with numerous potential causes being suggested including killer whale predation (Deecke *et al.,* 2011), biotoxin exposure (Hall & Frame, 2010) and impacts from ducted propellers on oceangoing vessels (Bexton *et al.,* 2012).

Harbour seals show a degree of fidelity to haul-out sites in particular areas (Cunningham *et al.,* 2008) but may switch haul-out sites at least occasionally, possibly under influence of prey movements (Thompson *et al.,* 1994). They often remain relatively close (generally within 50 km) to the haul-out site for foraging and show fidelity to specific underwater locations (Thompson *et al.* 1994; Cunningham *et al.* 2009).

Harbour seal foraging trip extent is geographically variable around the UK; Sharples et al., (2008) provides an overview of the variability in foraging strategies of harbour seals from different regions of the UK which demonstrated that longer and farther trips occurred in the Wash, St Andrews Bay and the Moray Firth, compared to other regions (the Thames, Shetland, Orkney and the Outer Hebrides). Despite the occasional long distance trip, the harbour seals from the West coast of Scotland (Outer Hebrides) undertook shorter trips than those on the East coast. In Cunningham et al., (2009) harbour seals tagged in Islay and on Skye also undertook generally shorter trips than harbour seals on the east of the UK, with half of all trips being less than 50 km, with a mean trip distance of between 10 - 20 km.

Harbour seals feed upon a wide range of benthic fish and invertebrates, and prey selection appears to be heavily influenced by local habitat availability (Tollit *et* *al.,* 1998). Pupping occurs in June-July while moulting takes place from August to September, both of which necessitate hauling out for extended periods.

In contrast to harbour seal populations in Orkney and eastern Scotland, populations among the western Highlands and Strathclyde appear to have remained stable in recent years (SCOS, 2011; Scottish Government, 2012). Several harbour seal haul-out sites occur in the vicinity of the proposed development site, and the largest are being considered for protection under the Marine (Scotland) Act 2010 (Scottish Government, 2012). Those within the West Highland Management Area relevant to this impact assessment are presented in Table 7.13 where impacts of disturbance are addressed.

An in-depth spatial modeling analysis of harbour seal distribution around the UK predicted clear areas of high and low at-sea density (Jones *et al*., 2013). On the basis of the data presented by Jones *et al.* (2013), predicted harbour seal densities were low in the immediate vicinity of the proposed development site, with seals concentrated in waters near the Skerries SAC (see also SMRU Ltd, 2013).

A total of 15 harbour seals were sighted during two years of monthly survey effort in the immediate vicinity of the proposed development site which does not enable estimation of robust at-sea density estimates. Haul-out data combined with the small number of recorded sightings suggest that harbour seals are not especially abundant at this site. An in-depth spatial modeling analysis of harbour seal distribution around the UK predicted clear areas of high and low at-sea density (Jones *et al.,* 2013). On the basis of the data presented by Jones *et al.* (2013), predicted harbour seal densities were low in the immediate vicinity of the proposed development site, with seals concentrated in waters near the South-East Islay Skerries SAC (see also Sparling *et al*., 2013).

Harbour seals have been shown to forage in tidal currents (Zamon, 2001) and the proposed development site could represent a foraging area used by local seals; however there is currently no evidence to suggest that the proposed development site is heavily used by large numbers of harbour seals for foraging and/or as a travelling corridor (see also Cunningham *et al.* 2009).

7.4.6 Grey Seal

Grey seals (*Halichoerus grypus*) are widespread in temperate to subarctic waters of the northern Atlantic Ocean, where they typically occur in shelf waters of <200m deep. About 38% of the world population of grey seals is found in the UK, of which 88% occur in Scottish waters, particularly in Orkney and the Outer Hebrides (SCOS, 2011). The total UK grey seal population at the start of the 2010 breeding season was estimated to have been 111,300 animals (95% CI: 90,100 – 137,700; SCOS, 2011). Population growth in Orkney and the Outer Hebrides appears to be slowing down, suggesting that grey seals may be approaching carrying capacity in these regions (Duck and Thompson, 2007). Grey seals feed on a wide range of benthic fish species. They remain on land at the haul-out site to breed (October-November) and to moult (January-March) but otherwise forage at sea, typically within 100 km from the haul-out site. Habitat use models on the basis of satellite telemetry data imply a significant concentration of grey seal habitat usage at various locations in western Scotland (Matthiopoulos *et al.,* 2004). Grey seals show some degree of fidelity to haul-out sites but are clearly also capable of extensive travels, implying that different haul-out sites should not be treated as independent management units.

Several grey seal haul-out sites occur in the vicinity of the proposed development site, and the largest are being considered for protection under the Marine (Scotland) Act 2010 (Scottish Government, 2012). Those within the West Highland Management Area relevant to this impact assessment are presented in Table 7.13, where impacts of disturbance are addressed. A total of 14 grey seals were sighted during two years of monthly survey effort in the immediate vicinity of the proposed development site which does not enable estimation of robust at-sea density estimates.

An in-depth spatial modeling analysis of grey seal distribution around the UK predicted clear areas of high and low at-sea density (Jones *et al*., 2013). Based on the data presented by Jones *et al*. (2013), the proposed development site sits on the edge of an area of relatively high predicted at-sea grey seal density off the northwestern coast of Islay. A significant proportion of seals using this area would be expected to originate from haul-out sites on Colonsay /Oronsay as well as South-East Islay (SMRU Ltd, 2013).

Available data suggest that grey seals are not especially abundant at the site, however the results presented by Jones *et al*. (2013) suggest that waters adjacent to the site could represent a foraging area used by grey seals from Islay and elsewhere. There is, however, currently no further evidence to suggest that the proposed development site is itself heavily used by grey seals for foraging and/or as a travelling corridor.

### 7.4.7 Basking Shark

The basking shark (*Cetorhinus maximus*) is the largest shark found in UK waters and the second largest species in the world. The species occurs worldwide in temperate to cold waters and is known to undertake extensive migrations (up to and including across ocean basins; Gore *et al.,* 2008, Skomal *et al.,* 2009). In UK waters, the species is seasonally not uncommon in particular areas, including the Clyde Sea and the Inner Hebrides, where large concentrations of a hundred or more individuals can be observed (Witt *et al.,* 2012). Basking sharks filter-feed on zooplankton and seek out areas where prey is likely to be concentrated, such as tidal and shelf-edge fronts (Sims and Quayle 1998; Sims *et al.* 2003). No credible population estimates are available, although basking sharks are considered to have been historically overexploited in many areas. Sightings of basking sharks in Scottish waters typically occur between May and October, with a pronounced peak in August (Witt *et al.,* 2012).

Visual sighting records indicate fewer sharks occur west of Islay compared with areas slightly further north, particularly around Tiree, Coll and Mull. Since around 2000 there was an increase in the number of reported sightings in the area, although sightings have declined somewhat since 2006. Of the records of sightings submitted to the Shark Trust during 2012, no basking sharks sighted within a 50km radius of the Project site.

No basking sharks were seen during monthly dedicated surveys in the immediate vicinity of the proposed development site over a period of two years. One animal was sighted on an extended survey track north towards Colonsay, suggesting that basking sharks may occur in the wider area off western Islay.

Scottish Natural Heritage (in collaboration with the University of Exeter) are currently tracking a number of basking sharks and a real-time display of the data can be viewed at http://www.wildlifetracking.org/?project_id=753 (SNH, 2012). Some tracks have passed close, or through the proposed development site, however, the number of tagged animals is relatively small.

Considering the available evidence from satellite tagging and the presence of basking shark concentrations in the Inner Hebrides and the Clyde Sea, as well as further south along the Isle of Man and Cornwall, basking sharks are likely to pass through the western Islay area, but there is no indication that the development site is an important area for basking sharks.

7.4.8 Summary

Based on existing data and recent dedicated survey effort, the proposed development site appears to host a representative selection of cetacean and seal species which are widely distributed in the northeast Atlantic. Certain species (e.g. minke whale) were not observed in the area during the surveys but might occasionally occur in or near the development site. The site does not appear to be a significant hotspot for large numbers of marine mammals or other species. Population structure of marine mammals and other species in the area would suggest that all species range widely across a large area that may include the development site, but there are currently no data to suggest that particular individual animals or subpopulations are preferentially associated with the site. It should be noted that the species composition and relative abundance of the large marine vertebrate fauna in this area may change over time, including under direct or indirect influence of anthropogenic climate change.

7.4.9 Underwater Noise

For many marine industrial activities producing high-intensity noise and with potential to injure acoustically sensitive species, the ambient background noise is of little relevance. However for operating tidal turbines which are more likely to produce low level but continuous noise, information on the background acoustic environment is needed to determine over what range these turbines may be detectable. To quantify background noise and accordingly provide some context for considering operational device noise, baseline data on the underwater sound profile of the Project site were collected. These measurements were made using drifting acoustic recorders (Wilson *et al.*, In Press) with hydrophones 5 m below the surface, sampling at 312 kHz and repeatedly deployed over a two day period in October 2012. Drifting recorders were released at a variety of locations both in association with the development footprint and up to 4 km distant immediately to the north, south and west. Recordings were made in a variety of sea-states (Beaufort 1-5) and with distant shipping present. Full details are supplied in Appendix 7.8.

To account for flow velocities outside of those at which recordings were made, the relationship between flow velocity and the ambient noise was investigated. This was to ensure that the presented baseline accounted for higher flow speeds at which the turbines would predominantly be operating. No significant positive relationship between flow speed and ambient noise was identified (see Appendix 7.8), however examination of the surface conditions (Beaufort sea state) during the recording period indicated that, at intermediate frequencies, ambient noise increased along with sea state. This supports the conclusion that ambient noise is fairly consistent at the site across the tidal cycle and at varying flow speeds (and therefore assessment of impacts is independent of the timing of operations), and that variation in ambient noise is principally influenced by sea state.

From the recorded data, levels in frequency bands below 30-40 Hz were consistent with very low sea states in the deep sea. Variation in broadband Power Spectral Density (PSD) averaged levels ranged from 79 dB re 1 $\mu Pa^2/Hz$ for sea-states 1 to around 83 dB re 1 $\mu Pa^2/Hz$ at sea-state 4. At frequencies from a few 10's Hz to several kHz, levels were again relatively consistent with proximity to other potential sources such as nearby shipping, weather related effects and/or natural sources such as biological (crustacean) or physical (seabed flow noise) being evident. Occasional strong tonal components were also observed and were correlated with distant ship traffic. Similarly the data also showed average levels in bands from 3- 30 kHz at levels 20-30 dB higher than classic deep water noise curves for equivalent bands. Much of the data showed occasional but strong transients potentially from biological sources (perhaps alpheid "snapping" shrimps) which showed as higher occasional maximum levels compared to the arithmetic means calculated.

Overall, the lowest observed levels occurred with broadband mean PSD levels of around 77 dB re 1 $\mu Pa^2/Hz$. Average levels were around 82 dB re 1 $\mu Pa^2/Hz$. Higher sea-states (up to Beaufort 5) and water flow speeds did not produce the highest sound levels observed, instead it resulted from shipping with broadband levels of around 104 dB re 1 $\mu Pa^2/Hz$ being directly correlated to a boat passage at around 350 m from the recorders. These levels were used as a baseline against which to compare the sound footprints created by the MCT and TGL tidal turbines (Section 7.5.4.1).

## 7.5 Assessment of Potential Impacts and Possible Mitigation Measures

### 7.5.1 Introduction

This assessment addresses the potential impacts arising from all stages of development of the Project, i.e. construction, operation (and maintenance) and decommissioning. Although specific decommissioning activities are as yet unknown, impacts are considered comparable to those arising from construction and are discussed, although not in detail, within this ES. This ensures that at the end of the operational life of the project, activities will not be proposed that will cause unforeseen negative impacts to arise. Prior to decommissioning and to inform the development of a Decommissioning Programme, further EIA will be undertaken in line with relevant guidance (DECC, 2011).

Based on analysis of site-specific and data from the surrounding area, the potential sensitive receptors considered in this EIA are presented in Table 7.11. Due to comparable mechanism of impact, assessment is considered generally applicable to marine mammal species and basking sharks. Where differences in impact are anticipated, this is discussed according to respective species group (i.e. cetaceans, pinnipeds and basking shark; Table 7.11). For assigning of sensitivity to represent the entire receptor group, a sensitivity rating based on the most sensitive species is used. Impacts to particular species are presented where relevant.

7.5.2 Summary of Potential Impacts

Potential impacts arising from the different phases of development have been identified and refined through discussion with the regulator and their advisors. Impacts relating to marine mammals which were considered relevant for EIA are presented in Table 7.11.

| **CONSTRUCTION (temporary)** | | |
|---|---|---|
| **Impact** | | **Effect** |
| 7.5.3.1 | Injury and disturbance due to noise and presence of construction vessels and activities | Potential for injury and disturbance of marine mammals, leading to displacement from the area (with potential for habitat exclusion and barrier effects). |
| 7.5.3.2 | Disturbance from haul-out sites | Potential for seals to be disturbed from haul out sites during construction operations. |
| 7.5.3.3 | Collision risk with construction vessels (including 'corkscrew seal' issue) | Potential for death / injury through interaction with installation vessels, including the 'corkscrew seal' issue. |
| 7.5.3.4 | Increased turbidity | Potential for increased turbidity through elevated levels of suspended sediments, with consequent effects on behaviour of marine mammals. |
| 7.5.3.5 | Accidental release of contaminants | Potential for release of materials required during construction with consequent effects on water quality. |
| 7.5.3.6 | Indirect impacts of changes to prey resource | Possible impacts on marine mammal predators due to changes in food source such as reduction in prey availability. |
| **OPERATION (permanent over the lifetime of the project)** | | |
| **Impact** | | **Effect** |
| 7.5.4.1 | Injury and disturbance caused by operational noise | Potential for injury and disturbance leading to behavioural impacts. |
| 7.5.4.2 | Displacement leading to habitat exclusion and barrier effects | Potential for noise or presence of the array to displace mammals from the area leading to habitat exclusion or barrier effect for transiting individuals. |
| 7.5.4.3 | Collision with operating turbines | Potential for injury or sub-lethal effects through collision with the development. |
| 7.5.4.4 | Collision risk with maintenance vessels | Potential for death / injury through interaction with maintenance vessels. |
| 7.5.4.5 | Electromagnetic Fields (EMF) | Possible effects on behaviour due to the EMF emitted from the inter-array and export |

| | | |
|---|---|---|
| | | cables. |
| 7.5.4.6 | Accidental release of contaminants | Possible effects following accidental release of contaminants. |
| 7.5.4.7 | Indirect effects on prey populations | Possible impacts on marine mammal predators due to changes in food source such as reduction in prey availability. |
| **DECOMMISSIONING (temporary)** | | |
| 7.5.5 | Considered comparable to those presented in the construction phase. | |

Table 7.11: Summary of Potential Impacts to Marine Mammals and Basking Sharks.

These results of EIA for these impacts are presented in the following sections.

7.5.3 Assessment of Potential Impacts during Construction Phase

7.5.3.1 Injury and Disturbance Due to Noise and Presence of Construction Vessels and Activities

Background

There is potential for construction activities associated with the installation of the turbine array, inter-array cabling and cabling to the landfall, to cause behavioural changes in marine mammals present in the area. Details of potential installation activities are outlined in Chapter 5: Project Description. Reactions are primarily evoked in response to vibration and noise generated by vessels, and during drilling required to secure foundations to the seabed. Physical presence of the vessels may also cause displacement, particularly of seals from haul-out sites (Brasseur and Reijinders (1994, in Scottish Executive, 2007). This section assesses the effects of noise; disturbance to haul-out sites from the physical presence of vessels is presented in Section 7.5.3.2.

As raised through consultation with SNH, a level of noise would arise from the placement of rock for protection of cables, which may be used for lengths of cable at the Project. Due to the short-term and localised noise anticipated from these activities, a noticeable impact on marine mammals or basking sharks is considered very unlikely and not addressed further in this chapter.

Anthropogenic sound has the potential to mask biologically significant sounds such as echolocation (affecting navigation and foraging capability), communication vocalisations, or other relevant environmental sounds, resulting in disruption of behaviour, displacement from noisy areas, physiological injury /stress, or altered distribution patterns. The level of response depends on distance of individuals from the noise source and radial zones of the influence of noise on marine mammals were presented in Richardson *et al*. (1995) as:

| Zone | Definition | |
|---|---|---|
| Zone of Audibility | The area in which animals may detect the sound. | Increasing dista |
| Zone of Responsiveness | The region within which the animal reacts behaviourally or physiologically. | |

| Zone | Definition |
| --- | --- |
| Zone of Masking | The region within which noise is strong enough to interfere with detection of other sounds which are biologically relevant. |
| Zone of Hearing loss/discomfort/injury | The area near the noise source where the received sound level is high enough to cause discomfort / tissue damage to auditory or other systems. |

Table 7.12: Zones of Influence of Noise on Marine Mammals (Richardson et al., 1995).

Underwater sound at sufficiently high levels, particularly where there is repeated high level exposure from activities such as impact pile driving, has the potential to cause hearing impairment. This can take the form of a temporary loss in hearing sensitivity (Temporary Threshold Shift; TTS), or a permanent loss of hearing sensitivity (Permanent Threshold Shift; PTS). The type of response depends also on whether the sound type is pulsed, non-pulsed or continuous (Southall, *et al.*, 2007).

At lower intensity sounds a behavioural response may occur; this will be species, time and location specific. The behavioural response will depend on the level perceived by particular species, according to hearing thresholds (the average sound pressure level that is just audible to a subject under quiet conditions.

Assessment of the likely responses to noise depends on the availability of information regarding hearing sensitivity of individual species (i.e. an audiogram). Sufficient audiogram information exists for species which are likely to be present in the Project site, i.e. bottlenose dolphin, harbour porpoise, harbour seal and grey seal (e.g. presented in Nedwell and Brooker, 2008) to support assessment. This information is however treated with appropriate caution, as methods of retrieval of audiograms may differ and therefore not be directly comparable.

The underwater hearing sensitivities of several small odontocete cetaceans (reviewed in Richardson *et al.*, 1995) are reasonably well understood (although not the case for all species). Bottlenose dolphin hearing is relatively poor at low frequencies but extends to as low as 40-70 Hz as long as the amplitude is high. Hearing improves steadily with increasing frequency, with a peak sensitivity of around 50 dB re 1 μPa at around 50 kHz. At higher frequencies, hearing sensitivity declines and bottlenose dolphins are insensitive to sounds above 200 kHz. The audiogram for harbour porpoise follows a broadly similar shape but peak sensitivity (of around 33 dB re 1 μPa) was found to occur at higher frequencies between 100-140 kHz (Kastelein, 2002).

The underwater hearing capabilities of seals are relatively well known with harbour seals, in particular, being extensively studied. The spectrum of sounds audible to harbour seals range from around 100 Hz to 60 kHz with peak sensitivities from 1 to 30-50 kHz at around 70 dB re 1 μPa. These seals also have higher frequency capabilities but only if sounds are very loud. Hearing of harbour seals is marginally more sensitive than grey seal and is therefore considered conservative for estimating impacts to this species (Nedwell and Brooker, 2008).

Very little is known about the hearing sensitivities of mysticete whales (e.g. minke whale) primarily because of the technical difficulties of performing hearing tests on them. However their auditory anatomy, vocalisations and responses to man-made sounds strongly suggest that they are low frequency specialists (Ketten, 1994; Richardson *et al*. 1995). They are likely to best hear sounds below 1 kHz but can probably hear sounds up to 8 kHz or higher. Details on the sensitivity of this hearing across different frequencies are currently unknown.

Based on the above characteristics of impact and receptor, the behavioural response of certain species can be assessed using available information on the responses to specific received sound levels. Southall, *et al*., (2007) provide the primary reference for predicting effects of noise on marine mammals according to noise exposure criteria for five functional groups, with an 'M-weighting' adjustment system to account for noise frequencies which fall outwith the sensitive range of hearing, but may exert an effect at sufficiently high intensity.

Nedwell et al. (2005) proposed using audiograms as a surrogate weighting function for marine species exposed to underwater sound and suggested threshold values for mild and strong behavioural reactions in fish and marine mammals as 'deciBel values above hearing threshold' (termed dBht). However the absolute audiogram threshold function (audiogram), which their values are reliant on, has not been tested empirically and as such has received very little support from the scientific community. It is informative and remains a strongly validated approach for human noise impacts, but the dBht metric will not be the subantial basis of this assessment.

A measure of the ambient noise environment is of key importance in assessing the impact of noise from an activity. Ambient noise levels were calculated for the proposed development site and are summarised in Section 7.4.9 (full report at Appendix 7.8).

Potential sound sources arising during the construction phase are identified and characterised below (using published literature), along with a conclusion on the expected impact, based on the duration and extent of possible auditory or behavioural responses.

<u>Noise from the Installation of Devices - Drilling Activities</u>
For the project, a degree of flexibility is appropriate to enable the development process and technology selection to continue until project definition is complete. The development will consist of between 15 and 30 turbines, depending on the relative number of MCT (double rotor, 2 MW) devices and TGL (single rotor, 1 MW) devices (see Chapter 5: Project Description for more details). Turbine array configuration is yet to be determined as it is dependent on the devices selected, hydrodynamic conditions and the characteristics of the seabed.

Both the MCT and TGL devices would be installed on a foundation utilising a steel frame multi-leg structure, fixed to the sea-bed by drilled and grouted pin-piles. Detailed design will determine the number of legs to be used (either quadrapod or tripod), and the size and depth of the piles. Due to the significantly longer duration of activities, an array comprising 30 TGL devices is taken to be the worst case, requiring a maximum of 124 drilled foundation piles to a depth of 5 m. A standard subsea drilling rig that would be considered for the works includes the Bauer Renewables Ltd seabed drill, capable of drilling a 2.3 m diameter hole of 11m depth in one day (see Chapter 5: Project Description for details).

Drilled foundations involve drilling of a socket and insertion of a pile, which is then fixed in place with grout material. This does not involve hammer impact and acoustic output is therefore significantly lower than conventional piling. The primary noise sources during construction are drilling noise generated through the action of the drill bit on the seabed and that arising from the vessels (see below).

Relevant available information on drilling noise has been assessed to inform this EIA. A report commissioned by COWRIE (Nedwell & Brooker, 2008) published received noise levels from the pin-pile drilling operation which were measured during installation of SeaGen at Strangford Lough to be 139 dB re. 1 µPa at 28 m, and 105 dB re. 1 µPa at a distance of 2130 m. These were used to model the predicted potential received levels of drilling noise by species at varying distances from the source.

Modelling of installation of the MCT device indicated a Sound Pressure Level (SPL) of 162 dB re. 1 µPa @ 1 m which is comparable to the noise generated by small vessels such as small tugs and crew boats (Richardson *et al.*,1995), and considerably lower than that measured during activities such as blasting and impact piling (Nedwell and Brooker, 2008). These measured levels of underwater noise from the pin pile drilling indicate that the noise levels are much lower than those that may cause fatality, physical injury or audiological injury to the species of marine mammal considered (below 180 dB RMS re 1 µPa for cetaceans and 190 dB RMS 1 µPa for pinnipeds).

From available information including the results of Nedwell and Brooker (2008), it can be concluded that the drilling activities required to install the foundations for turbine devices proposed at the site generate noise levels which are below those that are predicted to inflict mortality or hearing damage on marine mammals, and would dissipate to within background noise levels over short distances. During drilling operations, behavioural reactions may be expected, although animals would need to be in close proximity of the drilling activity (within 1 m according to Kongsberg, 2010) to experience noise levels that would result in avoidance behaviour. Nedwell and Brooker (2008) conclude that there is a low likelihood of disturbance to marine mammals up to 115 m from the noise source at Strangford Lough.

Based on the average ambient noise levels measured at the project site, i.e. around 82 dB re 1 $\mu Pa^2/Hz$ (Appendix 7.8) drilling noise will propagate a short distance before dropping below background levels. Considering the thresholds for avoidance presented above, avoidance would be expected close to the drilling activities at the Project site for marine mammal species.

The duration of the produced noise is also relevant to establishing the level of impact, as generally, the longer the duration of disturbed behaviour, the greater the risk of individual consequences (through reduced fitness, navigational errors and other consequential effects). Drilling activities during installation would be intermittent, considering the restricted windows of weather suitable for operations, movement between foundation locations, etc. Assuming the worst case of 124 drilled piles, at one pile per day, 124 days of drilling may be required (these are unlikely to be consecutive due to weather windows).

During drilling operations, some avoidance of the array site could be expected. However, due to the unlikely residence of species in close proximity to the operations necessary to elicit a behavioural response of significance, the overall impact of drilling noise on seals, cetaceans and basking sharks is not considered to be significant.

Barrier effects and habitat exclusion due to disturbance elicited by drilling noise are not considered a concern at this location, as it is an open ocean situation and evidence does not suggest that it is an important foraging area or migration route for any species.

<u>Installation of Devices – Vessel Noise</u>
During the construction phase, vessels will be present at the site for preparation works (pre-installation and foundation preparation), foundation installation, turbine installation and commissioning. The installation works will most likely be executed by jack-up vessels, DP vessels or heavy lift vessels (HLV). Ancillary barges, tugs, safety vessels and personnel transfer vessels will also be required. There are different implications of vessel noise arising from cable route installation, as the propagation parameters of the environment change with bathymetry, seabed type, etc.

The nature of the activities varies depending on the conditions at the site, foundation type and turbine technology and it is therefore not feasible to quantify or model the expected noise levels at this stage. However, anticipated effects can be judged based on the likely character of the impact and available evidence. Subsea noise levels generated by surface vessels used during the construction phase would be lower than the levels at which injury and physiological damage could be expected.

Regarding other responses, it can be assumed that noise arising from vessels during installation may cause local disturbance of sensitive marine fauna in the immediate vicinity of the vessel. However, due to the occurrence of marine mammals in low numbers at the site, the likelihood of individuals being within range of the sound source at the time of the activity in order to be exposed to sound levels of sufficient duration to result in a significant disturbance impact is negligible. This is particularly unlikely considering that the vessel presence will be intermittent (due to the range of activities required, weather windows, etc.), installation will occur at different locations across the development area, and the ambient noise levels are relatively high. The area also appears to be of low importance for marine mammals and avoidance behaviour during the temporary construction phase would in all likelihood not lead to a significant effect on any species.

Conclusion

It is not predicted that there will be any lethal or sub-lethal injury caused to marine mammals from noise emitted during construction activities (drilling and vessel noise). Drilling noise presents the highest sound level to be emitted during installation activities. Behavioural impacts may be elicited in individuals that are in close vicinity of drilling operations and individuals may move away from the activity, whether due to the noise of drilling or noise emitted by the vessels present at the development area.

The sensitivity of species is considered to be low, due to the ability of species to avoid, adapt to, accommodate and / or recover from the impact (according to criteria provided in Table 7.3). Considering the estimated low abundances of species at the site, the magnitude of an impact is minor, as any impact would affect a small proportion of the population and result in temporary changes which are recoverable (Table 7.3). Based on this, and considering the temporary nature of the construction phase, combined with understanding of the baseline occurrence of species at the development site, it is concluded that the likelihood of significant impact to marine mammals and basking sharks during construction is minor.

| **Potential Effect** | **Receptor Sensitivity** | **Impact Magnitude** | **Consequence of Impact** | **Residual Impact Significance** |
|---|---|---|---|---|
| 7.5.3.1 | Low | Minor | Minor | Minor |
| Mitigation<br><br>No mitigation deemed necessary, although a Marine Mammal Observer (MMO) may be used during construction activities to halt operations if marine mammals (or basking sharks) are observed within close range of the construction activities. | | | | |

7.5.3.2 Disturbance at Haul-out Sites

Physical disturbance of seals hauled out on land can occur during installation of devices and cables, as a result of the presence of installation vessels and equipment, and the noise they produce in the vicinity of operations. Haul-out sites are areas where seal populations rest between foraging, so they can avoid predators, socialise and maintain general health and wellbeing. Some are also used for rearing pups (such as Eilean nan Ron, Oronsay).

Seals hauled out on land are known to be sensitive to approaching vessels, ranging from kayaks to powerboats to large cruise ships (Johnson and Acevedo-Gutierrez 2007; Jansen *et al*. 2010; Andersen *et al.* 2011; Skeate *et al.*, 2012). It is considered by the Scottish Government that ships more than 1500 m away from hauled out grey or common seals are unlikely to evoke any reaction; between 900 and 1500 m seals could be expected to detect the presence of vessels and at closer than 900 m a flight reaction could be expected (Scottish Executive, 2007). Flushing responses appear to be at least partially dependent on the behaviour of the vessel in question, but flushing of seals has been reported over distances of up to 800 m, with response rates increasing significantly at shorter distances (Jansen *et al*. 2010; Andersen *et al.* 2011).

This would be most significant for breeding and moulting seals, hauled out on the coast and on intertidal banks. Disturbance of breeding seals into the water may result in separation of pups from their mothers, temporarily or permanently, as has been observed in harbour seals elsewhere (Osinga *et al.*, 2012). Any impacts resulting from disturbance would therefore be greater during the breeding season. Moulting seals also spend more time out of the water to retain heat while shedding their fur, and if scared into the water they may lose condition as a result of additional energetic costs.

A secondary risk is possible loss of condition through repeated disturbance of pups during suckling. Outwith the breeding season, disturbance of seals that are undertaking the annual moult may result in increased energetic costs and a consequent loss of condition, but these effects are not considered to be as great as in the cases described above.

Several haul-out sites occur in the vicinity of the proposed development site for both grey and harbour seals. Within the West Highland Management area there are 25 haul-out sites being considered for protection under the Marine (Scotland) Act 2010. Table 7.13 presents a list of those within 100 km of the development, along with the shortest distance to the development area, including the cable route.

| Site Number | Site Name and Location | Species | % WHMA (South) | Minimum Dist: Array | Minimum Dist: Cable |
|---|---|---|---|---|---|
| (SAC) | SE Islay Skerries SAC | Harbour | 11% | ~ 37 km | ~ 30 km |
| 11 | Small Isles, E Jura | Harbour | 2% | ~ 62 km | ~ 54 km |
| 13 | Gartbreck Skerries, Loch Indaal, Islay | Harbour | 2% | ~ 19 km | ~ 6 km |
| 20 | Glenbatrick Rocks, Sound of Jura N | Harbour | 2% | ~ 57 km | ~ 56 km |
| 111 | Eilean nan Ron, SW Oronsay | Grey | 15% | ~ 43 km | ~ 42 km |
| 112 | Nave Island, NW Islay | Grey | 10% | ~ 34 km | ~ 32 km |
| 113 | Frenchman's Rocks (Portnahaven, W Islay) | Grey | 9% | ~ 5 km | ~ 4 km |

Table 7.13: Minimum Distance Between Potential Vessel Activities and the Nearest Proposed Haul-out Sites within the West Highland Management Area.

Figures 7.1 and 7.2 in volume 3 - figures present the development area, including cable route, in relation to significant haul out sites in the area, with the mean estimate of at-sea density from the recent report (Jones *et al.,* 2013). These include haul-out sites which have been proposed for designation (labelled) and all haul-outs where 10 or more seals were recorded during the latest 2 years of surveying.

The proposed development area, including array and cable, is approximately 4km from the nearest haul-out site and there is no potential risk of disturbance of seals on land at this range. HRA has been undertaken to assess impacts on the integrity of the South-East Islay SAC, and is presented in Appendix 7.9.

Seals tend to be dispersed when breeding in June and July and aggregate when moulting. The greatest and most consistent numbers of harbour seals haul out ashore during their annual moult in August. The sensitivity of the seals hauled out is concluded as medium due to the possible consequences of disturbance during these significant periods. However, due to the distance between the activities and the site and the temporary nature of the activities, magnitude is negligible, leading to an overall conclusion of negligible.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.3.2 | Medium | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.3.3 Collision with Construction Vessels (including the 'Corkscrew Seal' Issue)

Vessels present during construction present a risk of collision with marine mammals, involving interaction with the hull of the vessel or propellers (discussed below). Risk of interaction is affected by vessel type and speed, the sounds emitted by the vessel relative to ambient noise, local weather conditions and marine mammal behaviour (Laist *et al*. 2001). Vessels travelling at 7 $ms^{-1}$ or greater present the greatest risk of mortality or serious injury through collision (Laist *et al*., 2001).

The vessels associated with the construction of the Project would be travelling at less than $7ms^{-1}$ and therefore would be less likely to present a risk to marine mammals through collision (when compared to commercial shipping, for example). Further, as identified in Section 7.5.3.1, vessel noise and construction activities may elicit avoidance reactions in mammals and basking sharks if they are present in the area. The risk of direct collision with vessels involved in construction activity at the proposed site is therefore considered to be minimal.

Since 2008, a number of severely damaged harbour and juvenile grey seal carcasses have been found on the UK coast (Thompson *et al*., 2010; Bexton *et al*. 2012), including the North Norfolk coast, eastern Scotland and Northern Ireland. The carcasses display a spiral laceration which may be consistent with a seal being drawn through propellers housed within cylindrical nozzles or other thrust-augmenting devices (e.g. kort nozzles or azimuth thrusters; Bexton *et al*., 2012). These are used in the dynamic positioning systems of vessels used in association with a number of activities within the marine environment where maintaining a position without anchoring is required (e.g. marine construction). Understanding of the extent of the problem remains difficult, as unaccounted carcasses may not have been recovered; to date, no direct links have yet been made to specific activities or vessel types.

This issue differs from collision with turbine blades, as ship propellers move much more quickly and generate a suction that can pull animals towards the ship and increase the likelihood of a strike. Seals may be attracted to the activity, and / or aggregations of fish around the vessel, and may also be influenced by increased turbidity and disturbance.

Sensitivity of the receptor is considered medium due to the potential lethal consequences of collision with propellers. To account for the lack of clarity around the mechanism of impact, the magnitude of the impact is assumed to be moderate for spiral injuries to seals. Overall this results in a moderate level of impact, which it is considered feasible to address through mitigation, pending to guidance that will be developed as further evidence is gathered.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.3.3 | Medium | Moderate | Moderate | Minor |
| Mitigation<br><br>The risk of collision between marine mammals and construction vessels is considered negligible and therefore mitigation is not proposed. In lieu of the results of further research on the links between propellers and mortality risk to seal species, DPME commit to following forthcoming advice and guidance to be developed by Marine Scotland and advisors, including application of monitoring and mitigation measures as deemed appropriate. Recent agency advice (SNCAs, 2012) suggests that it may be appropriate in particular to apply mitigation to operations within 4 km of significant haul-out sites / SACs, and that this may include timing of operations and monitoring the area during operations. This will be agreed and developed within the Construction Method Statement.<br><br>It is considered that appropriate mitigation measures will reduce the risk to marine mammals from interaction with vessels or propellers (including the 'corkscrew' seal issue) to an acceptable level. The overall potential impact to marine mammals from interaction with construction vessels is therefore minor. | | | | |

7.5.3.4 Increased Turbidity

Installation (and decommissioning) activities may directly disturb seabed sediments, or result in the release of sediments from drilling activities, leading to temporary increase in turbidity in the water column. This is addressed in Chapter 6: Physical Environment and 8: Benthic) but is discussed here due to the potential for impacts on marine mammals through reduced visibility, which could affect foraging, social and predator/prey interactions.

Due to the high velocity tidal regime at the development site, fine sediments are unlikely to occur in appreciable quantities, with a resulting predominance of hard substrate with little overlying fine sediment. Disturbance of volumes of *in situ* material that would result in an impact through increased turbidity is therefore unlikely.

Assuming the worst case of 4 drilled sockets per turbine, a maximum of 120 rock sockets is possible for the installation of 30 devices, plus 4 sockets for a subsea marshalling device resulting in an approximate volume of 2500$m^3$ over the period of installation. Drill cuttings would be released directly into the water column at the seabed, as is standard practice. A worst case of 5% leakage of grout material through overfilling has also been assumed, resulting in a potential leakage of 0.5 $m^3$ per foundation (a maximum worst case of 15 $m^3$ over the duration of drilling activities.

Seals are generally assumed to be sensitive to poor visibility (e.g. Hobson, 1966; Scottish Executive, 2007), although the presence of well-fed (sometimes even blind) seals foraging in estuaries and other turbid sites suggests that vision may not be the sole sensory modality used for foraging in these environments (Newby *et al.*, 1970; Dehnhardt *et al.* 1998; Weiffen *et al.*, 2006). Additionally the high energy tidal regime at the site will ensure that any cuttings that are released are dispersed rapidly. Overall sensitivity of seals, cetaceans and marine mammals is low as they are able to avoid, accommodate and recover from the impact. Porpoises and dolphins are less sensitive to effects on visibility through turbidity as they rely on sound for foraging (Southall *et al.* 2007). There is no information available on sensitivity to turbidity in baleen whales or basking sharks.

The magnitude of the impact is negligible due to the temporary nature of the activity and the environmental conditions preventing local increases in turbidity from persisting. Specifically in relation to foraging, the low numbers of marine mammals observed at the site, and the limited importance of the area for feeding individuals, suggests that the likelihood of hunting individuals being exposed to any increases in turbidity, with significant effect, is minimal.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.3.4 | Low | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.3.5 Accidental Release of Contaminants

There is small risk of the accidental release of contaminants during the installation phase, including diesel fuel, oil hydraulic fluids etc. This risk will be minimised by following best practice and procedures outlined in the Construction Method Statement (CMS), to be developed. Any releases would be dispersed quickly, and the species concerned have the capacity to avoid the area should contaminants enter the water column in significant quantities.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.3.5 | Low | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary other than standard best practice to be presented and agreed within the CMP. | | | | |

7.5.3.6 Indirect Impacts of Changes to Prey Resource

There is the potential for indirect effects on marine mammals, through impacts on prey resources (fish) as a result of the presence of the installation vessels and equipment (and associated noise) during operations. In addition, the noise generated by drilling may cause a disturbance impact.

Construction impacts have been assessed as negligible or minor (see Chapters 8: Benthic and 11: Natural Fish), due primarily to the temporary nature of the activities, the very localised nature of any impact and the low importance of the site for fish. No consequent effects on marine mammals and basking sharks are therefore considered likely, and are concluded as negligible.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.3.6 | Low | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.4 Assessment of Impacts during Operation Phase (including Maintenance)

7.5.4.1 Injury and Disturbance Caused by Operational Noise

Noise from tidal stream turbines that is in the audible range of marine species is associated with vibrations produced by the drive train components such as the gearbox and generator. These vibrations travel through the drive train to the rotor, nacelle walls and support structure where it interacts with the surrounding water and is released as noise.

Operational vibration and noise is generated on a cyclic nature during each flood and ebb tide, with hydrodynamic noise generated from the rotating blades, the support structure and mechanical noise from the rotating machinery (i.e. hub bearings, gearbox and generator). With the exception of periods of slack water and when operation and maintenance activities are being undertaken this will be generated throughout the 25 year life of the project.

Appendices 7.4 and 7.5 provide a technical analysis of the noise which could be emitted from the devices during operation, and how this would propagate through the environment. This has been considered along with the measured ambient noise (reported in Appendix 7.8) and audiograms of species to determine potential zones of impact for marine mammals and basking sharks, including injury and behavioural responses.

The Project will consist of up to 30 turbines; a minimum of 15 2MW MCT devices up to a maximum of 30 1MW TGL devices, to a project capacity of 30MW. Turbine array configurations are yet to be finalised, based on the devices selected, hydrodynamic conditions and the characteristics of the seabed.

Acoustic modelling was undertaken for a 15 MCT array, and for a 30 TGL device option as these are considered to represent the extremes of the envelope for this impact. MCT devices are louder given that they have twice the rated power and twice as many components that produce noise such as gearboxes and generators, and the maximum number of MCT devices therefore presents the loudest option within a smaller footprint. The TGL devices are quieter, but to achieve project capacity, twice as many devices would be installed across a wider footprint (see Chapter 5 for possible array configurations) and therefore may represent a worst case in terms of spatial extent of impact.

Propagation was modelled at 5m below the surface, as a representative depth where most species (such as seals and porpoises) are likely to spend the majority of their time, and at 16m where the nacelles will be positioned and hence the highest sound levels. Sound pressure level (SPL) levels are higher directly up- and down- stream of the turbines, a function of the directionality of noise produced by the tidal turbines and the bathymetry of the seabed.

MCT Array

At the time of modelling, the triple-bladed 20m rotor diameter MCT turbine to be installed was not in production and therefore the modelling relies on a scaled-up version of the two bladed 18m MCT currently operating in Strangford Lough, the noise of which was reported by Kongsberg (2010).

As reported in Appendix 7.4, considering the 15 MCT scenario, the highest noise levels would be associated with the 2$^{nd}$ Gear Stage meshing (the teeth in the gearbox coming into contact with each other) at 140 Hz, with an average SPL of 147.5 dB at 30 m from the turbine. Highest noise levels are concentrated around the nacelles, boom, support structure and blade tips, with levels between 165 and 173.8 dB.

The sound field was compared to ambient noise levels measured by SRSL (Appendix 7.8) to determine where tones produced by the tidal array could be detected above the ambient noise and therefore available to be detected by marine species. For an array of 15 MCT devices, the tones produce by the 2$^{nd}$ and 3$^{rd}$ gear stage meshing could be detectable by marine species above ambient background noise in the loudest measured sea conditions (based on the ambient noise levels reported in Appendix 7.8) across most of the 10 km by 10 km modelled soundscape.

TGL Array

The sound-field surrounding the TGL turbine is dominated by the frequencies related to gear meshing at each step-up stage and their multiples. The mean SPL at 27.5m from the TGL turbine showed strong peaks at 25 Hz, 150 Hz and 780 Hz which relate to the 1$^{st}$, 2$^{nd}$ and 3$^{rd}$ gear stages, respectively. In comparison to the MCT device, the TGL turbine is quieter with peaks related to gear meshing 10 to 15 dB lower than equivalent peaks produced by MCT. At some frequencies, the TGL device produces significantly more noise, such as 1200 Hz; these frequencies are produced by structural resonances in the TGL turbine.

SPL associated with the 1$^{st}$ gear stage at 25 Hz is greatest close to the nacelle, where it reaches 138 dB. The highest SPL was associated with the 2$^{nd}$ gear stage at 150 Hz and reaches 165 dB in the immediate vicinity of the device.

As it is unclear at precisely which relative levels (just above, at or just below) animals can detect sounds in relation to ambient sound we have defined a maximum range of audibility to be where the model far-field SPL equals the ambient background noise. Accordingly, beyond this range the noise from the turbines is considered to be masked by the background noise; within that range, the sound of the devices would be detectable.

Sound propagation modelling indicates that the noise produced by the array of 30 TGL devices at 31 Hz is higher than the maximum ambient noise measured and could therefore be detected by marine species in the loudest sea conditions. The TGL array can be heard above the background noise at greater than 12 km in the quietest sea conditions, and over 10 km in the loudest conditions.

The TGL turbine tends to produce lower SPL than the MCT turbine at frequencies higher than 100 Hz (an exception is the 1250 Hz one-third octave band although this may be an anomalous result). An individual TGL turbine tends to produce higher SPL at lower frequencies than the MCT, specifically 25 Hz and 50 – 80 Hz, however as these bands are generally high in the ambient environment, it would tend to be masked by background noise.

Acoustic impacts from the turbine noise leading to death or temporary / permanent threshold shifts in hearing sensitivity ('injury') are not considered likely due to the combination of sub-auditory damage threshold noise levels emitted by the turbines and the brief periods that animals are likely to be in close proximity to them. At slack tide when animals have the potential to maintain station near the turbines, they will not be turning due to the minimum cut-off speed of 1 m/s) and therefore be near silent. However, when the current is flowing and the turbines are operational, animals will be entrained in the water and therefore be proximal to the devices only briefly.

The audibility of the array provides animals with the opportunity to perceive the turbines and take avoiding or evasive action, which would reduce the risk of collision with turbine blades. The device acoustic emission modelling of both turbine types, in combination with the existing background sound measurements, has shown that the operational noise will exceed upper and lower background sound levels well beyond the array itself. Acoustically sensitive species will therefore be able to hear the turbines at sufficient range to take avoiding action. Additionally, as the acoustic footprint of each turbine will span more than the inter-turbine spacing, it will provide animals the perceptual information needed to avoid the entire development, rather than each turbine individually. The contribution of noise is therefore likely to reduce collision risk, with risk concentrated at the turbines on the perimeter, rather than equal across the number of devices in the whole array.

Overall, considering the sensitivity of marine mammals to sound in the environment, but noting the capacity to avoid, adapt to, accommodate and recover from the impact, sensitivity is accordingly low. The indications from available evidence that marine mammal densities are relatively low in this area, exposure to levels of sound that would result in disturbance effects of any significance is concluded as minor.

| Potential | Receptor | Impact | Consequence of | Residual Impact |
|---|---|---|---|---|

| Effect | Sensitivity | Magnitude | Impact | Significance |
|---|---|---|---|---|
| 7.5.4.1 | Low | Minor | Minor | Minor |
| Mitigation<br>No mitigation deemed necessary. | | | | |

7.5.4.2 Displacement Leading to Habitat Exclusion and Barrier Effects

Aversive reactions to operational noise (see Section 7.5.4.1) or perceptions of infrastructure may result in displacement of species from the site, and potentially present a barrier to transiting individuals. Devices may exclude mammals from foraging habitats, nursery or breeding areas, migration / travelling routes and socialising areas.

At tidal locations, movement of animals is generally associated with the movement of the water volume and therefore the spatial extent of any displacement impact will be spread over an elongated area extending upstream and downstream of the array. The degree of this effect will be directly influenced by the breadth of the aversive stimulus relative to the width of the habitat. The magnitude of the effect will therefore be greater in constrained areas such as within tidal narrows, rather than open tidal stream sties (such as the waters west of Islay).

Due to the low densities of marine mammals and basking sharks present, it is not possible to present detailed fine-scale usage of the site. Analysis of site-specific and wider baseline data does not indicate that the Project area is of particular importance to individual species, for transiting, feeding, etc.

The sensitivity of species is determined to be negligible considering that the site does not appear to be of particular importance for any species. The open ocean nature of the project site means that alternative habitat / transit routes are less restricted and any altered habitat use is unlikely to compromise the ability of individuals to survive.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.4.2 | Low | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.4.3 Collision with Operating Turbines

Potential collision between marine mammals and basking sharks moving through the tidal energy site may result in injury or death to individuals. The speed of underwater turbine rotors is generally low compared with wind turbines or ship propellers because of a need to avoid cavitation (typical tip velocities will be below 12 m/s). Ship propellers also exhibit a violent force on the water column, releasing over 100 $kW/m^2$ into the water column, compared to a typical tidal turbine rotor which absorbs about 4 $kW/m_2$ of swept area from the current (see Chapter 5: Project Description). Solely considering the mechanism of impact, collision with tidal turbine blades is therefore much less likely to pose a risk to marine mammals and basking sharks than ship propellers.

Collision risks between marine mammals and tidal turbines can be considered as a function of encounter rates, modified by probabilities of 1) animals avoiding a collision just before impact ("evasion", or "near-field avoidance") and 2) animals avoiding the larger area surrounding the devices altogether ("avoidance" or "far-field avoidance"). Distinction between the two types of avoidance terms is not strict and there is lack of information about how the two terms relate to each other.

To support assessment of possible collision risk, a 3-dimensional model for estimating encounter rates between marine mammals and tidal turbines was developed on the basis of previous modelling approaches quantifying potential capture events between aquatic planktonic predators and their prey (Gerritsen and Strickler, 1977) that was adapted for the essentially passive collision dependent predation mechanism of medusa feeding on fish larvae (Bailey and Batty, 1983). Annual encounter rates per turbine rotor were estimated on the basis of a number of parameters including:

- Overall animal density (per $km^2$);
- Depth distribution (Time Allocation with Depth);
- Local animal density in the water column (per $m^3$) at the range of depth swept by the rotor;
- Animal encounter radius (based on animal length and assuming a randomised orientation to the blade trajectory);
- Animal routine swimming speed ($m/s^{-1}$);
- Volume of water swept by the turbine blades;
- Number, length and width of blades per turbine;
- Velocity of blade tips relative to the water and how it changes with current speed;
- Number and type of turbines;
- Turbine hub height above the sea bed;
- Water depth; and
- Current speeds.

This modelling exercise was applied to the proposed Project to inform this EIA and is included as a technical appendix to this ES (Appendix 7.3). It is important to emphasise that the robustness of model outputs depend heavily on accuracy of input parameters, many of which are estimated or derived from external sources in the absence of appropriate local datasets. In particular, the density estimate for species likely to be found in the water column at the array site is of key significance in affecting the overall results. For some species, such as bottlenose dolphin, Risso's dolphin, minke whale and basking sharks, insufficient data was available to produce density estimates with any reasonable level of confidence for assessment (see Section 7.4 / Appendix 7.2). As these species are considered to occur in low numbers at the site based on site-specific information, and contextual understanding of the species, it was concluded that for these species, the risk of collision with turbine blades is insignificant.

For harbour porpoise, density estimates were available from visual survey, acoustic and SCANS-II aerial survey data. The levels of confidence around these estimates were not insubstantial and for the for the purpose of this assessment, the selected density was derived from acoustic detections obtained during the site-specific survey. This provided the greater number of credible detections, with reduced sensitivity of the technique to high sea states, resulting in lower variance around the mean, relative to visual sightings (see baseline survey report in Appendix 7.1 for details). Estimated results calculated for densities obtained from the visual survey and SCANS-II aerial survey data are presented for reference in Appendix 7.1, although it is important to acknowledge the low confidence in these numbers.

Given the difficulties with the visual sightings baseline survey outlined above, at-sea densities of both seal species were derived from modelled density distributions (based on data from satellite-tagged seals; Jones *et al.*, 2013). Local animal densities at depth, animal dimensions, dive profiles and travelling velocities were derived from the scientific literature. The modelling is predicated upon the assumption that seals near the proposed development will mainly be undertaking foraging dives (U-dives) during which they spend minimal time at the intermediate depths where the risk of collision is greatest. The proportion of V-dives, which are higher risk, has been estimated as no greater than 5-13% in other areas and is generally expected to be low (Lesage *et al.*, 1999; *Beck et al.*, 2003; Prof. D. Thompson, SMRU, pers.comm.), suggesting that the total estimated number of animals expected to collide with turbines will largely be driven by the U-dive profile. The encounter estimates based on 100% V-dives in Appendix 7.3 therefore represent a biologically unrealistic extreme scenario and are not discussed here.

Encounter rates are calculated for both the MCT and TGL devices (individual and array), to ensure that the worst case was accounted for in the assessment. The estimates provided below are based on the MCT turbine design as the resulting encounter rates were slightly higher than the TGL turbine design, therefore representing the maximum possible impact (see Appendix 7.3 for details).

Using this model, mean annual encounter rates were estimated for harbour seal, grey seal and harbour porpoise (see Table 7.14). The confidence intervals are high, particularly for seals, reflecting principally the poor understanding of small-scale habitat usage within the proposed development site. This was due to both the low number of observations at the site, difficult survey conditions and the limitations of standard survey methodologies for achieving statistically robust results at reasonable cost. These results are considered sufficient to provide a guide to the anticipated relevant risk for this EIA.

| **Species** | **Data source** | **Mean annual encounter rate (per turbine rotor)** | **95% C.I. of annual encounter rate (per turbine rotor)** |
|---|---|---|---|
| Harbour seal (*Phoca vitulina*) | At-sea density model/U-dives | 11.784 | 0.000 – 23.976 |
| Grey seal (*Halichoerus grypus*) | At-sea density model/U-dives | 13.888 | 0.000 – 30.111 |

| | | | |
|---|---|---|---|
| Harbour porpoise (*Phocoena phocoena*) | Acoustic surveys | 2.578 | 1.580 - 4.242 |

Table 7.14: Summary of Estimated Annual Encounter Rates per Turbine Rotor for the Most Commonly Encountered Marine Mammal Species at the Proposed Development Site.

It is important to note that an encounter does not equate to a collision (assumed to result in mortality), as the rotors only occupy part of the swept disc area. Additionally, animals would be able to evade collision, or avoid encounter, depending on their capacity to detect the turbines (see Section 7.5.4.1). Even if not evaded or avoided, some collisions may result in no significant injury, however there is no information at the moment on which to base any correlation between impact velocity and injury. There remains considerable uncertainty, regarding the rates of near-field or far-field avoidance and no robust estimates of these rates (i.e. supported by evidence) were available for the present analysis. This limits the ability to determine with confidence the levels of collision arising from the development with a high degree of scientific certainty.

However, acknowledging recent approaches to assessment of collision risk within other consent applications for tidal energy projects (Marine Scotland, 2011; Xodus Group, 2012 and Royal Haskoning, 2012), and to support decision making around prescribed thresholds for acceptable levels of mortality (to seals in particular), it is relevant to quantify the number of collisions, rather than encounters. Although there are key methodological differences (making direct comparison difficult; see Section 7.5.6), calculations of collision events has been based on a range of avoidance rates, as commonly used in the calculation of collision between seabirds and offshore wind farm turbine blades (Band, 2012). This approach has not been supported by evidence and these calculations are included here to support discussion on the risks to species; however, to preserve scientific integrity in the conclusions drawn, the outputs are discussed qualitatively, with appropriate recognition of the uncertainties inherent within the modelling exercises.

The assumption is made that some animals avoid collision during most encounters (using the lower figure of ≥95%), resulting collision estimates for the entire development appear to be relatively low (Table 7.15). Assuming that each collision results in a mortality event, and given existing population estimates for these species in this region, the population-level impacts also appear comparatively minor (0.03-0.42% of local populations, assuming at least 95% avoidance rates).

| Species | Mean annual encounter rate per rotor | Assumed avoidance rate (%) per encounter | Total est. N of collisions for 30 rotors/yr | Est. local population size | Est. % of local population impacted |
|---|---|---|---|---|---|
| Harbour seal | 11.784 | 0.0% | 353.52 | 10530 | 3.36 |
| | | 95.0% | 17.68 | (based on SMRU | 0.17 |

| | | | | | |
|---|---|---|---|---|---|
| | | 97.0% | 14.14 | haul-out survey data) | 0.13 |
| | | 99.0% | 10.61 | | 0.10 |
| | | 99.5% | 7.07 | | 0.07 |
| | | | | | |
| Grey seal | 13.888 | 0.0% | 416.63 | 4956 (based on SMRU haulout survey data) | 8.41 |
| | | 95.0% | 20.83 | | 0.42 |
| | | 97.0% | 16.67 | | 0.34 |
| | | 99.0% | 12.50 | | 0.25 |
| | | 99.5% | 8.33 | | 0.17 |
| | | | | | |
| Harbour porpoise | 2.578 | 0.0% | 77.35 | 12076 (based on SCANS-II aerial survey data) | 0.64 |
| | | 95.0% | 3.87 | | 0.03 |
| | | 97.0% | 3.09 | | 0.03 |
| | | 99.0% | 2.32 | | 0.02 |
| | | 99.5% | 1.55 | | 0.01 |

Table 7.15: Estimated Annual Collision Levels for the Proposed Development, for Varying Assumed Avoidance Rates (see discussion for limitations in this method).

For both seal species, the Scottish Government has set regional Potential Biological Removal (PBR) limits of 442 (harbour) and 297 (grey; Scottish Government 2012), representing the total number of seals that could be removed annually from each population without endangering those populations' long-term survival (see Section 7.2.2). If the above assumptions on avoidance and mortality are considered appropriate, the present proposed development would contribute up to 4% (harbour) and 7% (grey) of the total PBR values for this management region. It is important to note that other sources of anthropogenic mortality e.g. shooting of seals near aquaculture sites, also contribute towards the total PBR. For cumulative assessment with other tidal energy developments, see Section 7.5.6.1.

There is a level of uncertainty inherent to the assessment of collision risk as outlined above. Although this could mean that predictions overestimate actual collision risk, no precautionary assumptions have been directly applied to the modelling exercise. However, there are a number of additional factors that would support an assumption that the actual level of mortality observed is less than that predicted. These can only be treated qualitatively at this stage until monitoring programmes and research is progressed.

Principally, as outlined in Section 7.5.4.1, the audibility of the array provides animals with the opportunity to perceive the turbines and take avoiding or evasive action, reducing the risk of collision with turbine blades. Avoidance of the whole array would be likely due to the acoustic footprint of each turbine spanning the interturbine spacing. Aversion of the project site would therefore concentrate the risk of collision at the turbines on the perimeter, rather than equally across the number of devices in the whole array, reducing the encounter rate accordingly.

The sensitivity of the species assessed is concluded to be high, due to the assumption of an interaction with turbine blades resulting in death to the individual. Considering the low predicted encounter rates for species identified relative to local population levels which are stable within this management area, and the likely overestimate of collision rates due to the reasons outlined above, the magnitude of this impact is considered to be minor. This leads to an overall consequence of impact of 'moderate' which is appropriate for the level of uncertainty regarding this impact.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.4.3 | High | Minor | Moderate | Moderate |
| Mitigation<br><br>It is not considered that mitigation measures would be necessary at this site. However DPME commit to sensitive development, and in line with Scottish Government policy, a monitoring programme will be developed to assess the actual level of impact arising from the West Islay Tidal Energy Park. Appropriate mitigation measures would be applied in light of an adverse impact being detected. | | | | |

7.5.4.4 Collision with Maintenance Vessels

Vessels which are required for maintenance during the operational period of the project may also pose a risk of interaction with marine mammals, including collision with vessels and the particular concern of seals interacting with propellers. The mechanism of impact and sensitivity of species is the same as that described above within construction impacts (Section 7.6.3.3). However vessel presence at the site will be of much shorter intervals than during construction and the impact is therefore of much lower magnitude.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.4.4 | Medium | Minor | Minor | Minor |
| Mitigation<br>The risk of collision between marine mammals and vessels is considered negligible and therefore mitigation is not proposed. In lieu of the results of further research on the links between propellers and mortality risk to seal species, DPME commit to following forthcoming advice and guidance to be developed by Marine Scotland and advisors, including application of monitoring and mitigation measures as deemed appropriate. Recent agency advice suggests that it may be appropriate in particular to apply mitigation to operations within 4km of significant haul-out sites / SACs, and that this may include timing of operations and monitoring the area during operations. This will be agreed and developed within the Construction Method Statement.<br><br>It is considered that appropriate mitigation measures will reduce the risk to marine mammals from interaction with vessels or propellers (including the 'corkscrew' seal issue) to an acceptable level. The overall potential impact to marine mammals from interaction with vessels during operation is therefore minor. | | | | |

7.5.4.5 Electromagnetic Fields (EMF)

Electromagnetic fields (EMF) produced by cables associated with the project have the potential to cause behavioural responses in marine mammals and basking shark. Matrices of cables within arrays may produce a more concentrated EMF effect than individual export cables.

There is limited evidence available regarding the impact, with possible effects reported for benthic elasmobranches Gill *et al.*, (2009) and Kimber, *et al.*, (2011) which are addressed in Chapter 11: Natural Fish. Although also taxonomically classed as an elasmobranch, the basking shark is a pelagic species and therefore considered to be of low sensitivity.

There is no apparent evidence that existing electricity cables have influenced migration of cetaceans. Migration of the harbour porpoise in and out of the Baltic Sea necessitates several crossings over operating subsea HVDC cables in the Skagerrak and western Baltic Sea without any apparent effect on its migration pattern (Walker, 2001). Recent studies suggest that some cetaceans might possess some form of electroreception, but the implications regarding sensitivity to artificial EMF remain poorly understood to date (Czech-Danal *et al.*, 2012). There is no evidence that seals are sensitive to electromagnetic fields.

As presented in Chapter 20: EMF, the strength of both magnetic and electric fields decays rapidly with horizontal and vertical distance from the cables, and is therefore dependent on the depth to which export cables are buried.

Water depth at the project site varies from 35 – 50 m, and as the greatest proportion of animal movements through the site would occur in the upper part of the water column, exposure is reduced. Further, due to the risk of cable abrasion and damage due to the high current and constantly reversing flow, cables will be protected through burial, further reducing emission of EMF. Given the likely scale of propagation of EMF, it is likely that any effects which may occur would be highly localised.

The spatial extent of any impact is small, particularly considering that the amount of cabling required for the Project is significantly less than that required for other renewable energy projects (such as offshore wind farms). Any likely impact is therefore considered to be negligible for this project.

| **Potential Effect** | **Receptor Sensitivity** | **Impact Magnitude** | **Consequence of Impact** | **Residual Impact Significance** |
|---|---|---|---|---|
| 7.5.4.5 | Negligible | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.4.6 Accidental Release of Contaminants

There is risk of the accidental release of contaminants during operation and maintenance, including antifouling paints, lubricating oils, diesel fuel, hydraulic fluids etc. The quantities and toxicities associated with sacrificial anodes and antifouling coatings are generally expected to be extremely small, and it is therefore considered that this potential effect will be of negligible significance

Accidental leakage of hydraulic fluids may be more significant, should they occur through storm damage, device malfunction or collision with navigating vessels. Devices which use hydraulic systems will normally be designed such that at least two seal or containment failures are required before a leaking fluid reaches the sea.

Oil pollution could result from leaks from turbine nacelles and through collision of ships with infrastructure. Risk will be minimised by following best practice and procedures outlined in a Construction Management Plan (CMP), including minimising the use of antifoulants, use of non-toxic antifoulants, risk assessment and contingency planning.

Quantities of the above pollutants are low relative to other marine industries, including shipping. Additionally, due to the huge tidal flow and mixing at the site, any releases would rapidly disperse, and the species concerned have the capacity to avoid the area should contaminants enter the water column in significant quantities.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.4.6 | Low | Negligible | Negligible | Minor |
| Mitigation<br><br>No mitigation deemed necessary other than standard best practice to be presented and agreed within the CMP. | | | | |

7.5.4.7 Indirect Impacts of Changes to Prey Resource

Potential impacts on fish species may indirectly affect marine mammals by affecting the availability of prey resources. Impacts on fish were assessed in Chapter 11: Natural Fish and were concluded to be minor, particularly as low abundances of fish were found at the site and it was not considered important for nursery, spawning or migration behaviour.

Hydrodynamic changes such as the creation of downstream wakes, impacts on the homogeneity of the water column and features such as shadow could cause habitat changes affecting fish distribution (e.g. prey-concentrating eddies). Fish aggregation around hard structures is also known however, these effects would be very localised and small scale, and based on the apparent low importance of the site for feeding of marine mammals and basking sharks, indirect effects are not expected.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Significance |
|---|---|---|---|---|
| 7.5.4.7 | Negligible | Negligible | Negligible | Negligible |
| Mitigation<br><br>No mitigation deemed necessary. | | | | |

7.5.5 Assessment of Impacts during Decommissioning Phase

No novel impacts are expected during decommissioning, and the extent and scale of impacts are expected to be similar to those assessed during the construction phase. Drilling will not be required, and depending on how much of the infrastructure will be left in situ, the release of materials into the water column will be significantly reduced. We note that explosives will not be used during decommissioning activities.

No significant effects can therefore be identified which present a conservation concern for the full lifespan of the project. Prior to decommissioning, a refined EIA will be undertaken which will account for developments in knowledge regarding the possible impacts identified, with mitigation and monitoring identified as appropriate.

7.5.6 Cumulative Impact Assessment

As per Section 7.3.4, a number of projects were identified as relevant to CIA for marine mammals and basking sharks. These projects and the impact to which they are relevant are presented in Table 7.16.

| Project Name | Description of Project | Project Status | Relevant Impact for CIA |
|---|---|---|---|
| Sound of Islay | 10 MW project of 10 x1 MW tidal turbines in the Sound of Islay. | Consented (installation 2013 - 2015) | Collision risk |
| Kyle Rhea Tidal Energy Project | 8 MW tidal array, 4 x 2 MW devices in Kyle Rhea sea strait. | Submitted for consent | Collision risk |
| Argyll Array Offshore Wind Farm | Up to 1800 MW capacity (up to 300 turbines), 5 km off the coast of Tiree. | Scoping (on hold) | Noise during construction of the windfarm and operation of the Project |
| Islay Offshore Windfarm | 690 MW windfarm, 13km off the west coast of Islay | Scoping | Noise during construction of the windfarm and operation of the Project |
| Limpet | 500 kw wave energy device | Operational (installed in 2000) | Operational noise, collision risk |

Table 7.16: Projects Relevant to Cumulative Impact Assessment for Marine Mammals.

Considering the projects that are proposed within a reasonable range of the Project, the impacts therefore considered in this CIA are:

- the potential additional risk of mortality to marine mammals through collision;
- the cumulative effects of noise through construction and operational activities; and
- the potential cumulative risk of interaction with propellers (‘corkscrew seal’ issue).

No other impacts were identified as higher than negligible, and are therefore sufficiently small and localised that contribution to an overall negative impact on marine mammal or basking sharks at either an individual or a population level area not anticipated.

A 35 kW prototype tidal stream device is currently proposed in Sanda Sound off the South Kintyre coast. Impacts from this development are anticipated to be of a very low level and would not contribute to cumulative effects with the West Islay Tidal Energy Park. Also proposed, but unconsented, is the 3 MW Argyll Tidal project off the western coast of the Mull of Kintyre, and similarly, due to the small scale of potential effects and the distance to the Project, no risk of cumulative effects are identified. These demonstration projects are not considered further in this CIA.

7.5.6.1 Cumulative Risk of Mortality to Marine Mammals through Collision with Turbines

The Sound of Islay development (consented) and the Kyle Rhea proposal (submitted for consent) would be constructed within the same Seal Management Area at which the PBR threshold approach to consenting tidal energy projects has been applied. This recognises the wide-ranging behaviour of seal species (particularly grey seals), and the propensity to use multiple haul-out sites across the area. It is therefore a more biologically relevant scale at which to assess effects.

From the available data, it is possible that seals will range across more than one project site, and mortality of individuals at particular project sites may act cumulatively with resulting effects at a wider population level. An attempt is therefore made at evaluating the cumulative risk to both harbour and grey seals, to facilitate consenting under the PBR method.

The Sound of Islay was consented based on assessment of collision risk by Marine Scotland, and comparison of this figure to the PBR threshold. The recently submitted Kyle Rhea ES also presents collision risk, assuming a range of possible avoidance rates, based on an adapted version of a model used by Marine Scotland to support Appropriate Assessment for the Sound of Islay Demonstration Tidal Array (Marine Scotland, 2009). The numbers thus far presented for possible impacts to grey and harbour seals for the collective projects are presented in Table 7.17. Due to the variation in approaches, and the lack of validation of any applied method, it is not possible to provide a cumulative measure of the risk of collision to marine mammals from the three projects and emphasis on the quantitative outputs of this exercise is not appropriate.

| Tidal Energy Project | Harbour Seal 'Harvest' | Grey Seal 'Harvest' |
|---|---|---|
| West Islay | 11.8 (95% avoidance) | 13.9 (95% avoidance) |
| Kyle Rhea | 128 (95% avoidance) | 36 (95% avoidance) |
| Sound of Islay | 0.58 (98%) | -- |
| Shooting Licences | 184 (2012) | 126 (2012) |

Table 7.17: Predicted collisions that are considered in consenting, relevant to PBR thresholds (442 and 297 for harbour and grey seal, respectively). Note that

these figures were not collected using a consistent methodology and so cannot be compared directly.

What can be concluded from this, is that proportionally, the rates calculated for the Project are low and that the thresholds for acceptable levels of PBR are not exceeded, even assuming that the worst cases for the projects are presented. The PBR levels have been set with consideration for the status of the populations (see Section 7.4) and the high numbers are representative of the current stable condition of both harbour and grey seal populations in this area.

For impacts on harbour porpoise, based on understanding of the occurrence of the species, we consider harbour porpoise would not occur in the densities needed to support the levels of collisions predicted at Kyle Rhea. There is therefore negligible additional impact to be included in this assessment and the overall conclusion of minor for this species is maintained.

It would be appropriate to revise this table in light of further research, and the review process being undertaken by Marine Scotland, so that a refined understanding of the cumulative risk can be established, recognising that uncertainty will remain until field experiments are undertaken, reported and scientifically reviewed.

7.5.6.2 Cumulative Risk of Interaction with Propellers (‘Corkscrew Seal’ Issue)

The risk to seals from interaction with propellers is relatively generic, in that it is applicable to a range of industries. Due to the possibility that this risk is associated with vessels involved in the construction and maintenance of offshore renewable energy projects (both wind and wave / tidal) then possible mortality consequences should be considered at the relevant population scale. It is not possible to quantify the potential mortality consequences for the activities identified, but considering the temporary nature of the risk (mainly during construction), and the mitigation that may be applied in sensitive areas (for example within 4 km of haul-out sites), a cumulative risk is not anticipated.

7.5.6.3 Cumulative Risk of Noise during Construction and Operational activities

There is a widely considered risk to marine mammals from the noise emitted during the construction of offshore windfarms, particularly where hammer piling of monopiles is proposed. Considering the size of the windfarm projects being proposed, and the wide-ranging nature of marine mammals, there is potential for cumulative impact over a number of years. The effect may be greater where there is concurrent piling, or sequential activities within the same range of impact for marine mammal species.

The Argyll Array offshore windfarm off Tiree has undergone scoping and is therefore relevant for consideration in this CIA. The proposed windfarm would have a maximum capacity of 1800 MW but details on the composition of turbine types and sizes are not yet available. The Argyll Array lease area is over 50 km from the West Islay Tidal Energy site and considering the dispersed nature of marine mammals and basking sharks over this area, it is not considered that cumulative effects are likely. Potential impacts from the wind farm include disturbance during construction of turbine foundations. It is noted however that the seabed conditions at the Argyll Array site are likely to preclude the possibility of installation of monopiles using hammer piling and therefore this is unlikely to be an impact.

The Argyll Array has not yet been submitted for consent, and construction activities are unlikely to begin for a number of years. It is therefore unlikely therefore that the noise associated with construction activities will act in-combination with noise arising from drilling associated with the construction of the West Islay Tidal Energy Park. Operational noise of the West Islay Tidal Energy Park may interact with that of construction at the Argyll Array, however considering the distance between the project locations, and the low likelihood of piling activities being proposed off Tiree, the cumulative risk is considered low. We note that this risk will be further assessed by the Argyll Array proponent should the scheme be developed further, and DPME will ensure that any information regarding the assessment of effects and further evidence that may have arisen are available for this assessment.

The Islay Offshore Windfarm is a 690 MW proposal located 13 km off the west coast of Islay, and approximately 59 km from the West Islay Tidal Energy Park. Potential cumulative impacts arise from possible injury and disturbance of marine mammals during the construction of the offshore windfarm. Insufficient detail is presently available on whether this project will be progressed, or the method and timing of installation at the Islay windfarm to enable detailed assessment. The scoping document indicates that construction is expected to be over a three-year period. It is assumed that standard mitigation would be applied at the wind farm sites, such as 'soft-start' to piling operations enabling animals to leave the area and risk of injury is not anticipated. If the project proceeds as planned, it is likely that during the construction of the windfarm, the cumulative noise arising from the construction activities and the operational noise from the Project, some aversive behaviour would be observed from both development sites.

As marine mammals range across the wide area to the west of Scotland, there is potential for cumulative displacement of marine mammals from the Islay Offshore Windfarm and the West Islay Tidal Energy site, during construction of the windfarm. As outlined in Section 7.4, it is considered that due to the open ocean nature of the area to the south west and west of Islay, and the lack of apparent importance of any particular area for marine mammals, the use of alternative locations for behaviour such as foraging is considered feasible and sufficient to enable a conclusion that this risk is insignificant. At the point that this is investigated in greater detail to support the Islay Offshore Windfarm, DPME would provide information as required to enable a full assessment of cumulative risk.

### 7.5.7 Habitats Regulations Appraisal

In line with the requirements of the Conservation of Habitats and Species Regulations 2010, and the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations) ('the Habitat Regulations'), HRA was undertaken to evaluate the likely significant effects arising from the West Islay Tidal Energy Park. This is provided in a separate report addressing Special Areas of

Conservation for marine mammals, along with Special Protection Areas for birds (Appendix 7.9).

Based on the results presented in the report, it is concluded that there are no likely significant effects arising from the development, either alone, or in-combination with other plans or projects, and therefore appropriate assessment may not be required.

7.5.8 Other Licences

7.5.8.1 European Protected Species Risk Assessment

All cetaceans are listed as European Protected Species under Annex IV of the Habitats Directive, and it is therefore necessary to assess the likelihood of an offence arising from the project. Section 7.2.1 presents the definitions of 'injury' and 'disturbance' which are used in this assessment, and for which a licence would be required.

The impact assessment above outlines the risk to cetacean species, and is considered sufficient to ensure that the risk of injury and disturbance is sufficiently low, that a licence would not be required for the operations associated with the West Islay Tidal Energy Park. DPME would undertake a refined EPS Licensing Risk Assessment following further definition around the details of installation vessels (timing, vessel noise, etc).

7.5.8.2 Wildlife and Natural Environment (Scotland) Act 2011

During consultation, SNH advised that it may be appropriate to consider the requirement for licensing (from SNH and MS) for potential disturbance to basking sharks under the Wildlife and Natural Environment (Scotland) Act 2011. As no significant disturbance impacts were identified for basking sharks throughout this EIA, it is not considered that there is a risk of disturbance that would require licensing.

7.5.9 Summary of potential impacts mitigation and residual impacts

A summary of impacts before and after proposed mitigation measures is provided in Table 7.18 below. The differences in sensitivity between different marine mammal (and basking sharks) species was considered through EIA, and the representative category assigned in this table is applicable to all species (considering the most sensitive where relevant).

| Potential Effect | Residual Impact Significance | Mitigation |
|---|---|---|
| Injury and disturbance due to noise and presence of construction vessels and activities | Minor - insignificant | No mitigation deemed necessary, although a Marine Mammal Observer (MMO) may be used during construction activities to halt operations if marine mammals (or basking sharks) are observed within close range of the construction activities. |
| Injury and disturbance due to noise and presence of construction vessels and activities | Minor - insignificant | No mitigation deemed necessary, although a Marine Mammal Observer (MMO) may be used during construction activities to halt operations if marine mammals (or basking shark) are |

| Potential Effect | Residual Impact Significance | Mitigation |
|---|---|---|
| | | observed within close range of the construction activities. |
| Displacement leading to habitat exclusion and barrier effects | Negligible | No mitigation deemed necessary. |
| Collision with operating turbines | Moderate | No mitigation is deemed necessary. To the extent feasible at this site, DPME commit to undertaking monitoring studies to assess the actual level of impact arising from the West Islay Tidal Energy Park. |
| Collision with maintenance vessels | Minor | See above (corkscrew) |
| Electromagnetic Fields (EMF) | Negligible | No mitigation deemed necessary. |
| Accidental release of contaminants | Minor | No mitigation deemed necessary. |
| Indirect impacts of changes to prey resource | Negligible | No mitigation deemed necessary. |

Table 7.18: Summary of Potential Impacts, Mitigation Measures and Overall Significance

7.5.10 Environmental Monitoring Programme

Assessment of the proposed development did not identify any significant environmental effects. It is acknowledged that due to the lack of deployment of commercial tidal areas, there is a consequent lack of evidence and therefore uncertainty inherent within impact assessments of tidal energy projects. To account for this, conclusions have been drawn using the worst-case scenario of potential project design, and careful expert judgment applied where relevant, to ensure that no greater impact than that agreed through consenting, occurs.

However, to fulfill regulatory requirements post-installation monitoring studies will be considered and developed. This will provide field evidence of impacts to support the refinement of theoretical impact assessment techniques and mitigation approaches, and improving the evidence base to support further development of the sector.

An Environmental Monitoring Programme (EMP) will be developed through discussion with the regulatory authorities to ensure that the purpose of the monitoring is agreed; that objectives are set according to consensus on the ability to detect change attributable to the development; and that this is considered according to a reasonable cost / scale of studies, proportionate to the level of risk identified. This will be programme defined over an appropriate timescale, with defined reporting intervals.

DPME propose to undertake detailed statistical analysis based on the occurrence of species at the site and the scale of change anticipated, to determine feasible monitoring strategies at the site. Noting that the site is an open ocean location, with low densities of marine mammal species and basking sharks, it will be relevant to consider the feasibility, and associated cost of detecting changes attributable to the development. The results of this study will then need to be discussed relative to the anticipated risks at the site to determine the precise scope of the on-going monitoring strategy.

The development of an environmental monitoring programme for the West Islay Tidal Energy Park is likely to be undertaken by SRSL who propose to use the latest information gathered from the baseline studies in high energy locations combined with lessons from other marine industries to design an environmental monitoring framework that can be applied to across the tidal-stream sector.

The approach will involve a thorough, scientific design phase, to consider the specific tools required for monitoring impacts to marine mammals (and other receptors), including existing techniques and development of new techniques. The statistical power needed to detect change at the project site will be closely investigated, to ensure that experimental design is effective and cost-efficient. This will address the development of EMPs that can assess with a known degree of certainty levels of impact to marine mammals and whether re-design, mitigation or site adjustment are required / effective.

DPME recognise that monitoring of effects from tidal arrays is challenging and complex, considering the scale of impacts ranging from impacts upon individuals at the array site, and population level effects. For the regulator to accurately determine and assign effects at a project and sector level, and considering the commitments to do so through strategic assessment, etc, DPME support discussion on where collaborative effort may be initiated, so that collective resources are used efficiently. This would ensure cost-effective gains in evidence of impacts to support development of the sector. For example, resources may be contributed to large scale population level studies such as improving the annual haul-out studies currently undertaken by SMRU.

Additionally, certain project locations will be more amenable (more likely to demonstrate effects at reasonable cost) than others where it may be impossible to do so. Experience at Strangford Lough is helpful in demonstrating the level of investment and study required to provide evidence of effects occurring, and considering this relative to an open ocean tidal system will be relevant to determining likely costs and feasibility. In this regard, it may be considered appropriate for developers to share costs of undertaking monitoring at particular sites which are comparable to the proposed project.

## 7.6 Conclusions

The proposed turbine array is predicted to have a negligible or minor effect on marine mammals and basking sharks relative to most impacts. The assessment of collision risk resulted in a conclusion of moderate which is to a great extent due to the uncertainty inherent in the modelling exercises, and will be treated accordingly through the development of a monitoring plan. This will ensure that knowledge is gained regarding the actual level of impact, with mitigation measures applied as required.

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WESTISLAY TIDAL

# ENERGY PARK

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# 8. Benthic Ecology

## 8.1 Introduction

This section describes the baseline conditions and impact assessments for the benthic ecology of the Tidal Site and the Western Export Cable Route of the West Islay Tidal Energy Project ("the Project").

Benthic habitats and invertebrate communities are addressed in this chapter. Fish, skates and rays and commercial crustacean species, and their spawning and nursery areas, are addressed in the Natural Fish and Commercial Fisheries chapters (11 and 12 respectively).

This chapter is supported by the following technical documents and ES chapters:

- Benthic Baseline Report – Appendix 8.2
- Natural Fish – Chapter 11
- Commercial Fisheries – Chapter 12
- EMF – Chapter 20

### 8.1.1 Policy and Guidance

The relevant legislative frameworks covering marine ecology are common to all environmental receptors considered within the Environmental Impact Assessment (EIA) process. In addition, the following guidance documents have been considered in assessing the ecological effects associated with the Project on the benthic marine ecology:

- Guidelines for Ecological Impact Assessment (EcIA) in Britain and Ireland (Marine and Coastal) (IEEM, 2010);
- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland (EMEX and Xodus AURORA, 2010);
- Scottish Marine renewables; Strategic Environmental Assessment (SEA) Environmental report (Scottish Executive, 2007);
- Pentland Firth and Orkney waters; Enabling Actions report. Rochdale Envelope Workshop – Wave and Tidal, 2012 (The Crown Estate, 2012);
- Guidance on survey and monitoring in relation to marine renewables deployments in Scotland (SNH, 2011);
- Natura 2000 in UK Offshore Waters: Advice to support the implementation of the EC Habitats and Birds Directives in UK offshore waters (Johnston *et al.,* 2002);
- SNH guidance on Habitats Regulations Appraisal (HRA) of Plans (Tyldesley and Associates, 2012);
- The identification of the main characteristics of stony reef habitats under the Habitats Directive (Irving, 2009);

- Interpretation Manual of European Union Habitats (European Commission, 2007);
- Marine Protected Areas in Scotland's Seas: Guidelines on the selection of MPA's and development of the MPA network, (Marine Scotland, 2011);
- The code of practice on non-native species. (Scottish Government, 2012b);
- 2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species. Resolution MEPC.207 (62). MEPC 62/24/Add.1 Annex 26. (International Maritime Organisation, 2011), and;
- Alien invasive species and the oil and gas industry: Guidance for the prevention and management (IPIECA, 2010).

### 8.1.2 Stakeholder Engagement

DP Marine Energy Ltd (DPME) first consulted with the regulator and key statutory consultees in 2008. Consultation on various aspects of the project has continued as more information on the design parameters has become available. Advice received from consultees has been incorporated into all stages of the EIA process to minimise consenting risk associated with the Project. A summary of the stakeholder responses relevant to the benthic ecology assessment of the site and how these points have been resolved or incorporated into the final EIA are provided in Table 8-1 (summarised scoping opinion are provided in Table 4.2).

| **Key Concerns** | **EIA Actions** |
|---|---|
| Scottish Natural Heritage | |
| ES should contain information related to the current status of environmental monitoring of the selected device. | Where available monitoring outputs of tidal devices has been used to inform the EIA process (specifically Strangford Lough NI). |
| The environmental assessment must be EIA and HRA compliant. | The EIA was conducted in compliance with all statutory legislative frameworks and with reference to relevant guidance documents (Chapter 2). No HRA was required. |
| Include details of the proposed subsea cable installation methods. | Details of subsea cable installation methods are described in Chapter 5: Project Description. |
| Use the cable route surveys to determine installation options and methodologies along both cable routes. | Full details of the subsea cable design parameters are presented in Chapter 5: Project Description. Alternative design parameters that were considered are presented in Chapter 3: Site Selection |
| Present justification in the ES for the cable installation methodology | The justification of the final export cable design parameters are presented in Chapter 5: Project Description. |
| Advised against the use of matrix assessments for both EIA and HRA issues. | The EIA process was developed with reference to a number of guidance documents and is based on published scientific research and expert judgement. |
| Provide a proposed monitoring programme of the installation and operation of the project. | A proposed operational monitoring plan will be provided, post submission after consultation with SNH & MS. |

| Key Concerns | EIA Actions |
|---|---|
| Include an assessment of relevant Scottish nature conservation MPA's and search locations. | All MPA's search locations and PMF's have been identified and assessed for potential impacts. |
| Include Environmental mitigation measures. | Mitigation measures to reduce residual impacts have been incorporated into the project design. |
| Detail provisions for an operational monitoring plan. | A proposed operational monitoring plan will be provided, post submission after consultation with SNH & MS. |
| Include an assessment of the potential colonisation of infrastructure by non-natives. | An assessment of potential introduction of non-natives was undertaken in Sections 8.2.4.1, and 8.3.4.1, and an assessment of the potential for spread of MNNS was undertaken in Sections 8.2.4.2 and 8.3.4.2. |
| Refer to SNH guidance on marine wildlife surveys for designing site specific survey methodologies. | All surveys were agreed with SHN and Marine Scotland prior to commencing work. |
| Consider Annex I habitats, PMF's and BAP species during survey design. | All features relevant to national and international conservation legislation has been identified. |
| Ensure benthic habitats are mapped effectively. | Benthic habitats were effectively mapped through extensive benthic surveys using a stratified sampling regime based on available seabed data. Geophysical data was subsequently used to indicate the extent of the habitats identified though the benthic survey. |
| Conduct drop down video after geophysical data collection to inform survey stations | Geophysical data was not available at the outset of the surveys; however other seabed information was used to design the survey (e.g. UKSeaMap 2010). |
| Use geophysical data and/or DDV to identify sensitive species/habitats to avoid grab sampling at these locations. | Viewing of DDV images was undertaken in real time to determine the presence of sensitive habitats or species prior to deployment of the Day grab or beam trawl. |
| Continue video trawling transects to find full extent of habitats of high conservation value. | This was undertaken where practicably possible; however, areas of potential reef habitat and deep sea mud habitats were prohibitively extensive to map the full extent (Sections 8.2.2 and 8.3.2). |
| Caution against the use of video stills taken from DDV surveys. | Proven sampling techniques with high definition digital video equipment to ensure stills were of sufficient quality to characterise habitats and identify species present. |
| Recommend benthic survey data is analysed by experienced marine ecologists. | Benthic data was collected by & Natural Power Consultants Ltd and their subcontractors Envision Mapping Ltd have a proven track history in the renewables sector with over 20 years survey and analysis experience. |
| Marine Scotland | |
| The ES should indicate that the applicant has taken account of relevant wildlife legislation and guidance. | The EIA process has considered all relevant national and international legislation, guidance and conventions (Section 8.1.1). |
| The developer must be satisfied that the number of grabs and DDV will map habitats and PMF's sufficiently. | The survey program permitted accurate biotope and habitat identification of the seabed conditions within the development footprint. |

| Key Concerns | EIA Actions |
|---|---|
| Collect samples for contaminant analysis. | Grab samples were not possible at the site and only one was taken on the western cable route as the ground was unsuitable (i.e. no sediment). As no areas of potential contaminants were identified no contaminated sediment analysis was undertaken on this grab sample. |
| SEPA | |
| Assessment of potential impacts on the intertidal and subtidal habitats should be based on suitable site specific surveys. | Site specific surveys conducted during July 2012 were developed in coordination with DPME's engineering design team to adequately characterise the development footprint. |
| ES should provide a description of the site and the sensitive habitats and species. | All sensitive habitats and species were identified from the site specific survey data. |
| Damage to species and habitats should be minimised through appropriate project design. | Mitigation measures to reduce residual impacts have been incorporated into the project design. |

Table 8.1: Summary of stakeholder responses relevant to site benthic surveys.

## 8.1.3 Baseline Methodology

### 8.1.3.1 Desk Based Study

A desk based review of available literature was carried out, detailing the benthic ecology of the region around the proposed Tidal Site and Western Export Cable Route. Full details are provided in Technical Appendix 8.1, and a summary of the literature reviewed is provided in Table 8-2.

| Source | Summary of Information |
|---|---|
| Marine Nature Conservation Reviews (MNCR) | Review of data available on the benthic marine ecosystems along the Scottish west coast. |
| JNCC Coastal Directories South West Scotland (Barne *et al.*, 1997) | Overview of marine and coastal resources between Ballantrae and Mull (Region 14). |
| SNH and JNCC commissioned reports | Reports of marine ecology of specific areas around the Islay and the west coast of Scotland. |
| Draft Regional Locational Guidance – Tidal Energy in Scottish Waters (Scottish Government, 2012a) | Overview of Information at the SORER (Scottish Offshore Renewable Energy Region) level in relation to the relevant Areas of Search for tidal energy. |
| The Landscapes of Scotland (SNH, 2012) | Description of regions of Scotland, in relation to high level biological, sociological and geological features. |
| Scotland's Marine Atlas (Baxter *et al.*, 2011) | An assessment of the condition of Scotland's seas. |
| National Marine Environmental Monitoring Program (Marine Environment Monitoring Group (2004)) | A single study of the Benthic communities in sediments in the North Channel, and off the North Antrim Coast. |

| Source | Summary of Information |
|---|---|
| UKSeaMap 2010 (McBreen *et al.,* 2011) | Predictive seabed habitat map for the UK marine area. It builds on the previous work of MESH (2008), UKSeaMap 2006 and the Irish Sea Pilot (Vincent *et al.,* 2004). |
| British Geological Survey (BGS) data (BSG, 1991) | Data on the geological characteristics of the seabed. |
| Islay Seasearch Survey July/August 1999 (Ramsay, 2004) | Findings of diver surveys of 22 stations around the south coast of Islay, carried out in 1999. |
| 1982, Jura and Islay Sublittoral Survey (Contractor: Field Studies Council, Oil Pollution Research Unit) (Hiscock, 1983) | Results of diving surveys of nearshore sublittoral habitats and communities around the Hebridean islands of Jura and Islay in June and July 1982. |
| The benthic environment of the North and West of Scotland and the Northern and Western Isles (Wilding *et al.,* 2005). | SAMS Report to METOC - Overview of the benthic environment of North and West Scotland and the Northern and Western Isles. |
| Marine European Seabed Habitats (MESH, 2008) | General description of the benthic communities throughout an area (EUNIS habitat classification system). |
| Subtidal Survey of Rinns of Islay, Argyll, For DP Marine Energy Final Report (ERT Scotland Ltd., 2008) | Commissioned report summarising the results of a drop down video survey carried out on the proposed site in 2008. |
| Summary Commercial Fisheries Baseline (Brown and May Marine Ltd, 2012) | Commissioned report summarising the commercial fisheries in the region of the proposed site and cable routes. |

Table 8.2: Summary of previous studies & reviews in the vicinity of the proposed Islay Tidal Energy Project.

The review of the existing information and data was used to develop an appropriate survey strategy for site specific characterisation within and around the proposed Tidal Site and Western Export Cable Route, and to place the subsequent results in a regional context.

8.1.3.2 Site Specific Surveys

Site specific surveys were undertaken in and around the Tidal Site and Western Export Cable Route in July and August 2012.

The scope of survey work conducted to characterise the benthic ecology in the region of the Project was developed with reference to the following guidance and was agreed with SNH and Marine Scotland prior to commencing survey work:

- Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland, Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland;
- Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., Sanderson, W., Turnbull, C. & Vincent, M. (eds.) (2001). Marine Monitoring Handbook. 405 pp, ISBN 1 85716 550 0;

- DEFRA (2005). Nature conservation guidance on offshore wind farm development. Prepared in co-operation with the Scottish Executive, the National Assembly for Wales, Scottish Natural Heritage and the Joint Nature Conservation Committee; and
- Ware, S. J. and Kenny, A. J. (2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (2nd Edition). Marine Aggregate Levy Sustainability Fund, 80 pp.


Sampling techniques included Drop Down Video (DDV) survey, Epibenthic Beam Trawls and Benthic Grab Sampling, as well as intertidal biotope surveys (Table 8.3). A summary of survey and data analysis techniques is provided below, full details are provided in Technical Appendix 8.1: West Islay Tidal Energy Project, Benthic Baseline Report.

A summary of all site specific survey techniques is provided in Table 8.3.

| **Survey** | **Methods** | **Samples collected** | **Purpose** |
|---|---|---|---|
| Tidal Site | | | |
| Drop down video (DDV) | Underwater camera tow frame with live feed Sony HDR-HC9E camera and high definition GoPro digital camera. | Videos recorded from 31 station at the site (an additional 3 from the cable route survey were included). Three frame grabs analysed per station. | Obtain information on offshore epibenthic communities.<br>Identify sensitive habitats prior to grab or beam trawl deployment. |
| Western Export Cable Route | | | |
| Drop down video (DDV) | Underwater camera tow frame with live feed Sony HDR-HC9E camera and high definition GoPro digital camera. | Videos recorded from 24 stations on the cable route (an extra 4 from the site were also included). Three frame grabs analysed per station. | Obtain information on offshore epibenthic communities.<br>Identify sensitive habitats prior to grab or beam trawl deployment. |
| Benthic grabs | 0.01 $m^2$ Day grab | 1 station along cable route | Obtain information on offshore infauna and sediment characteristics |
| Epibenthic beam trawl | 2 m scientific beam trawl with 24 mm net and 5 mm mesh cod-end. | 1 station along cable route | Obtain information on mobile epibenthos (including fish and shell fish) |
| Intertidal surveys | 0.01 $m^2$ sediment box core, walkover surveys | 9 samples; plus walkover survey of rocky shore recorded on SACFOR scale. | Map the biotopes & sensitive habitats at each cable land fall. |

Table 8.3: Summary of site specific survey techniques employed

Sampling stations were stratified within each potential seabed type throughout the Tidal Site and wider reference area (Figure 8.1) and along the Western Export Cable Route (Figure 8.2) based on bathymetry, admiralty chart, British Geological Survey (BGS) data and UKSeaMap 2010 modelling outputs. Grab sample and beam trawl gear could not be deployed at the site due to ground conditions. Mixed sediment habitats were observed along the western export cable route however large quantities of pebbles and boulders prohibited successful recovery of the grab and epibenthic beam trawl gear. Only one successful grab sample and one successful beam trawl sample was recovered along the Western Export Cable Route.

DDV surveys were carried out by specialist seabed habitat mapping company, Envision Mapping Ltd. At each sampling station the camera system was lowered to the seafloor and allowed to drift, or be towed, behind the vessel for between 2 and 5 minutes. The required position of each drop was located using a dedicated differentially corrected GPS (dGPS) (with a published accuracy of ≤ 1m), and plotting system. Each video drop was numbered and recorded, for subsequent analysis, using a Sony DV tape recorder, and the actual position and time at the start and end of each deployment were logged. These positions were recorded using dGPS system whilst depth was recorded using the vessel's sounder.

Intertidal habitat surveys were conducted to map biotopes within 500 m either side of the Western Export Cable Route by Natural Power Consultants. The methodology was based on the Procedural Guidance No 3-2 - in situ ACE biotope mapping techniques and Procedural Guidance No 3-1 - in situ biotope recording techniques of the Marine Monitoring Handbook (Hiscock 2001; Wyn *et al.,* 2001 respectively). A $0.01m^2$ box core was used to retrieve sediment samples at each sample location. In addition walkover surveys of hard substrate areas at the landfall locations were completed and abundances recorded using the SACFOR scale.

Video analysis was undertaken by Envision Mapping Ltd., who adopted the protocol developed in collaboration with the JNCC marine monitoring handbook and CEFAS for the semi-quantitative analysis of video and stills. The substratum was described using a standard format based on the British Geological Survey Folks terminology. The biota were recorded to the lowest taxonomic level possible (species or genus) or life form (e.g. filamentous red algae) as appropriate. The abundance was estimated using the SACFOR system. A brief description of each of the sample sites was then written. Once this process was completed, it was possible to allocate biotopes to each of the sample (video drop) sites. This was done using the Marine Habitat Classification v. 04.05 (Connor *et al*., 2004).

PSA analysis of grab and intertidal sediment samples was undertaken by Northumbria Water Services and determined to eight size fraction based on the Wentworth Scale. Total Organic Carbon (TOC) content was also measured. Faunal identification in both subtidal grab samples and intertidal box cores was undertaken by Identichaete to lowest possible taxonomic level and enumerated.

Catch data from the one successful beam trawl was enumerated and used, along with grab PSA and infauna data, to assist with assignment of biotope data. Intertidal biotopes were assigned on the basis box core and walk over surveys.

Biotopes found at the Tidal Site and along the Western Export Cable Route were then superimposed onto both UKSeaMap 2010 predicted habitats (McBreen *et al*., 2011) and geophysical data results in order to estimate the extent of the biotopes. The ground types predicted by the geophysical survey were ground truthed by the DDV, benthic grab and epibenthic beam trawl survey results in order to assign the seabed substrate and habitat type.

### 8.1.4 Assessment Methodology

The EIA process and methodology are described in detail in Chapter 4, however each assessment is required to develop its own criteria for sensitivity of receptor (that is, the resource that would be affected) and magnitude of pressure (i.e. a change created by an activity) since the definition of these will vary between different topics.

#### 8.1.4.1 Identification of Key Receptors

For both the Tidal Site and Western Export Cable Route, key receptors were identified following baseline characterisation, with biotopes identified and grouped according to the similarity of habitat types and the ecological function of communities, e.g. sandy intertidal, rocky sublittoral or kelp dominated communities.

#### 8.1.4.2 Identification of Pressures

For both the Tidal Site and Western Export Cable Route pressures (i.e. potential effects) were identified from the activities described in the Rochdale Envelope.

#### 8.1.4.3 Sensitivity Assessment

The criteria for assessing the sensitivity of a receptor were based on the value of the receptor e.g. its rarity and conservation importance (taking into account international/national designation) and ecological vulnerability to a pressure including levels of preadaptation, tolerance and recoverability, at both the individual and population level. The population level assessment accounts for the wider geographical spread of a species or community and allows for factors such as fecundity to be taken into account. Few of the biotopes recorded during site specific surveys have been directly assessed for sensitivity within the MarLIN database, therefore where similar biotopes have been assessed the more general information has been coupled with sensitivity information of characterising species (where available) and expert judgement to provide an evaluation of their overall sensitivity.

As different receptor groups and different pressures were identified for the Tidal Site and Western Export Cable Route sensitivity has been assigned for each receptor group for each specific pressure that will be encountered within the individual assessments (Sections 8.2.4 and 8.3.4).

8.1.4.4 Magnitude

Magnitude of pressure was assessed in terms of the spatial extent, duration, reversibility, degree of change from baseline condition, and timing (e.g. seasonality and/or frequency of occurrence) (Table 8-4). These criteria have been used as a guide for assigning magnitude and have been coupled with expert knowledge and previous experience.

| **Magnitude of pressure** | **Definition** |
|---|---|
| Severe | A constant pressure that large results in permanent change from baseline conditions at a national or international scale. |
| Major | A persistent pressure that results in long term change from baseline conditions at a regional or national scale. |
| Moderate | An intermittent pressure that results in a long term change from baseline conditions at a regional or national scale. |
| Minor | An occasional pressure that results in short or long term change from baseline conditions at a local scale. |
| Negligible | A single or temporary short term pressure that will result in a change from baseline conditions at a highly localised scale within the footprint of a development. |

Table 8.4 Criteria used for assigning magnitude scores to pressures.

8.1.4.5 Assessment of significance

The sensitivity of receptor and magnitude of impact are combined to define the consequence of the impact (Table 8-5). The significance of impacts in relation to the EIA Regulations is defined in Chapter 4, Table 4.5. For this assessment a moderate or major consequence is considered Significant in terms of EIA regulations.

| **Magnitude** | **Sensitivity** | | | | |
|---|---|---|---|---|---|
| | Very High | High | Medium | Low | Negligible |
| Major | Major | Major | Major | Moderate | Minor |
| Moderate | Major | Major | Moderate | Minor | Negligible |
| Minor | Moderate | Moderate | Minor | Minor | Negligible |
| Negligible | Minor | Minor | Negligible | Negligible | Negligible |
| Positive | Positive | Positive | Positive | Positive | Positive |

Table 8.5 Consequence of impacts

## 8.2 Tidal Site

8.2.1 Rochdale Envelope

In line with the Rochdale Envelope approach this assessment considers the maximum ('worst case') and most likely project parameters (Table 8-6), based on the proposed project which totals 30MW consisting of either 30 submerged 1MW Alstom TGL TEC's, or 15 surface piercing 2MW Siemens/MCT SeaGen TEC's, or a combination of the two (Chapter 5, Project Description).

As much detail as is feasibly possible needs to be provided in the consent application to allow a robust and informed assessment by regulators and advisors. What makes the Rochdale Envelope approach more challenging for both tidal and wave devices at this point is that there are still a number of different design concepts under development and there has been no consolidation of designs resulting in a common strategy, as had been the case for wind farms under the "Danish Wind Turbine" concept. Furthermore some parameters require detailed site investigation which can only commence following consent being granted, thus the detail of some elements may remain unknown at the consent application stage (The Crown Estate, 2012).

| **Design Parameter** | | **Maximum Project Parameter** | **Most likely scenario** |
|---|---|---|---|
| Construction | | | |
| Foundations | Drill cuttings released into marine environment | $2,500m^3$<br>Pin piling of 30 quadrapod 1MW TGL TEC's and 1 quadrapod subsea collection station (124 sockets of 2.3m diameter and around 5m depth) | $1,875m^3$<br>Pin piling of 30 tripod 1MW TGL TEC's and 1 tripod subsea collection station (93 sockets of 2.3m diameter and around 5m depth) |
| | Drill fluids | 30 1MW TGL TEC<br>(MCT TEC requires no drill fluids) | As per Maximum Project Parameter |
| | Grout leakage | $15.5m^3$<br>30 1MW TGL TEC's and 1 subsea collection station – with quadrapod foundation based on a worst case of 5% overfill. | As per Maximum Project Parameter |
| Mooring system | Seabed footprint | $17,360m^2$<br>The Innovation (large Jack up barge) has a footprint of $560m^2$. The vessel will Jack-up at least once at each TEC/subsea collection station. Maximum number of installation locations would be 30 TEC's and 1 Subsea collection station | Heavy lift shearleg vessels hold their position by means of anchors, therefore previously installed foundation piles will be used as anchors. |
| | Abrasion of sea bed from slack chains | $2480m^2$<br>Catenary of the anchor chain as the heavy lift shear leg vessels manoeuvres may | As per Maximum Project Parameter |

| Design Parameter | | Maximum Project Parameter | Most likely scenario |
|---|---|---|---|
| | | result in seabed abrasion for 80m along the seabed and 1m wide per anchor point. Maximum number of installation points would be 30 TGL TEC's and 1 subsea collection station | |
| Operation | | | |
| Foundations | Seabed footprint | $496m^2$<br>30 TGL TEC's and 1 subsea collection station with quadrapod pin piled foundations would result in a maximum seabed footprint (assuming the footprint of each pile is $4m^2$). | $372m^2$<br>30 TGL TEC's and 1 subsea collection station with tripod foundations |
| Inter array cabling | Seabed footprint | $0.16km^2$<br>20 km of 33kV cable 140mm diameter (including armouring) held in place by rock dumping 8m wide. | 20 km of 33kV cable 140mm diameter (including armouring), to be held in place by 2 tonne rock bags placed on cables at frequent intervals. |
| Turbines | Oil fluid inventory | 40,380L<br>Each TGL TEC contains approximately 1346L of oils. 30 TGL TEC's would result in approx. 40,380L. Inventories for other individual TEC options are likely to be between 1000 and 1530 litres. | As per Maximum Project Parameter |

Table 8.6: Rochdale envelope parameters defined for assessing impacts relating to construction, operation and decommissioning of the tidal array and inter-array cables.

8.2.2 Baseline Environment of Tidal Site

There is little historical site specific information available on the benthic habitats of the Tidal Site and its surrounding areas. Information is largely restricted to the UKSeaMap 2010 predictive habitat map (McBreen *et al.*, 2011) (which builds on the previous seabed habitat mapping work of MESH (2008), UKSeaMap 2006 and the Irish Sea Pilot (Vincent *et al.,* 2004)) and the findings of a DPME commissioned survey by ERT (2008), during which 23 video transects were carried out in the region of the proposed Tidal Site.

UKSeaMap 2010 predicted habitats in the high energy Tidal Site of rock and very tide swept faunal communities (Figure 8.3), and the survey carried out by ERT (2008), also indicated that the seabed throughout the area was dominated by hard rocky substrata.

The more recent site specific DDV surveys (Technical Appendix 8.1) provided further sound evidence that the benthic habitat at this location is predominantly rugged bedrock and boulders. Eight DDV stations were positioned within the

Tidal Site, which revealed the seabed to be broadly divided into a bedrock plateau to the south east, at approximately 30m depth, and a deeper, more cobbly region to the north west at approximately 40m. The DDV footage for the site confirms the presence of bedrock in the areas predicted by the geophysical survey to comprise of 'rocky outcrops' (Figure 8.4). Areas predicted as 'sandy gravel' in the geophysical surveys on examination of the DDV footage from the benthic survey recorded pebble and boulder over gravel with dense faunal turf and crusts. Therefore these areas have been assigned as course gravel, pebbles and boulders for the purpose of habitat prediction (i.e. boulders and pebbly overlaying course gravel).

These findings support the results of the earlier DDV survey within the site (ERT, 2008) and are broadly in line with the UKSeaMap 2010 (McBreen *et al.*, 2011) (Figure 8.3) although the results of the survey found deeper habitats (circalittoral rock) than those predicated by UKSeaMap 2010 predicts (high energy infralittoral rock).

Two biotopes were found within the Tidal Site (Table 8.7, Figure 8.3 and 8.4). *A mixed turf of bryozoans and erect sponges with Sagartia elegans on tide-swept ciraclittoral* rock (CR.HCR.XFa.ByErSp.Sag) was found on the shallower bedrock, and *Tubularia indivisa on tide-swept circalittoral rock* (CR.HCR.FaT.CTub) was noted in the deeper cobble area to the northwest. The communities are similar to those reported in other tide swept rocky habitats in the region, such as those in the sound of Jura, south of Port Askaig, where an array of sponges, dead man's fingers and hydroids are found (Ramsay, 2004).

| **Biotope Code and Description** | **Number of Video Stations** | **Video image** |
|---|---|---|
| CR.HCR.FaT.CTub<br><br>*Tubularia indivisa* on tide-swept circalittoral rock | 16 |  |
| CR.HCR.FaT.CTub.Adig<br><br>*Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock | 4 |  |

| Biotope Code and Description | Number of Video Stations | Video image |
|---|---|---|
| CR.HCR.XFa.ByErSp.Sag<br><br>Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock | 17 |  |

Table 8.7 Biotopes assigned in and around the Tidal Site following analysis of the DDV images collected during subtidal survey work.

CR.HCR.XFa.ByErSp.Sag, the biotope recorded on the bedrock area to the south east of the site, is described by Connor *et al*., (2004) as "species-rich and characterised by a dense sponge, hydroid and bryozoan turf and frequent dead man's fingers soft coral *Alcyonium digitatum*." DDV images of this area of the Tidal Site revealed encrusting epifauna (hydroids, anemones, bryozoans, sponges and ascidians) on boulders and rugged bedrock.

CR.HCR.FaT.CTub, the biotope recorded at three deeper sampling stations within the north west of the Tidal Site, is described by Connor *et al.,* (2004) as "typically found on the vertical and upper faces of strongly tide-swept, wave-exposed circalittoral bedrock and boulders, and characterised by a dense carpet of the robust hydroid *Tubularia indivisa*". Similar to the area of CR.HCR.XFa.ByErSp.Sag, this region was also seen to be also dominated by sessile invertebrates (including sponges, hydroids, and bryozoans) during the DDV survey.

DDV sampling stations in the 500m buffer zone demonstrated a continuation of the pattern of benthos and corresponding biotopes recorded within the Tidal Site, with shallower regions of bedrock to the south west supporting communities akin to that of CR.HCR.XFa.ByErSp.Sag, and the deeper cobble regions to the north east contain habitat and species characteristic of CR.HCR.FaT.CTub (Figures 8.4 & 8.5). One additional biotope was identified within the buffer zone, at a DDV station to the north of the bedrock plateau (Table 8-7). *Alcyonium digitatum with dense Tubularia indivisa and anemones on strongly tide-swept circalittoral rock* (CR.HCR.FaT.CTub.Adig) is sub biotope of CR.HCR.FaT.CTub. This station was in a channel of deeper water (39m), close to the proposed cable route, described as containing boulders.

The broader Site Survey Area, defined in Figure 8-1, provides a reference area and was coupled with UKSeaMap 2010 maps to establish an estimate of the extent of the benthic habitats (Figure 8.3). Seventeen DDV stations were placed outside the 500m buffer zone and demonstrated a continuation of the pattern of benthos and corresponding biotopes recorded within the Tidal Site with shallower regions of bedrock to the south east supporting communities akin to that of

CR.HCR.XFa.ByErSp.Sag, and the deeper cobble regions to the north west contain habitat and species characteristic of CR.HCR.FaT.CTub. Notably, the extent of CR.HCR.FaT.CTub recorded to the north western area of the Site Survey Area indicates that the corresponding habitat of deeper cobble covers a greater area than that of high energy rock predicted by the UKSeaMap 2010 data (Figure 8.3).

Due to the nature of the substrate no trawl surveys could be undertaken within the Site Survey Area, however information on mobile invertebrate species found in the region is available from commercial fisheries data (Chapter 12, Figure 12.3). Brown and May Marine Ltd (Commercial fisheries baseline – Appendix 12.1 provided an assessment of the commercial fisheries landings, within which the local study area is defined using ICES rectangles 40E3 and 40E4. Landings from 40E3, in which the Tidal Site is located, are comprised almost entirely of high value shellfish species, with edible crabs (*Cancer pagurus*) representing the highest value, followed by scallops (mixed species), velvet crab (*Necora puber*) and lobster (*Homarus gammarus*) (averaged 2006-2010). *Nephrops* landings are of low value in this rectangle, comprising 3% of total landings (averaged 2006-2010), (Brown and May Marine Ltd, 2012). Early commercial fisheries sensitivity maps suggest that the proposed site falls within spawning grounds and nursery areas for *Nephrops* (Coull *et al*., 1998), however given the substrate found during the surveys (rock) this is unlikely as *Nephrops* spawn where they live and live in muddy habitats.

8.2.2.1 Species and Habitats of Conservation Importance

The rugged bedrock and stony and boulder field areas observed across the Tidal Site represents an example of 'Reef' habitats, as listed on Annex I of the Habitats Directive. The UK statutory conservation agencies have identified three types of reef habitat for identification as Special Areas of Conservation (SAC's). Bedrock reef and stony reef are both present at the Tidal Site. Both of these reef types are extremely variable in structure and in the communities they support (Irving, 2009). Reefs are characterised by particular communities which vary according to local conditions. Habitats at the site are considered to be examples of bedrock and stony reef and so are potential Annex I habitats. However, no reef features identified during the site specific survey work are a designating feature of a notified or designated SAC, nor do they overlap any current Areas of Search for Annex I habitats.

No designated or notified sites for Annex I habitats have been identified around Islay that have any potential connectivity to the proposed project. This was confirmed in the Scoping Opinion received from Marine Scotland which incorporated comments from SNH.

No Priority Marine Features (PMF's) as listed on Annex III of the Guidelines on the selection of MPAs and development of the MPA network (Scottish Government, 2011) were identified at the Tidal Site. Furthermore no proposed nature conservation MPA's as recommended to Scottish Government in SNH and JNCC's (2012) formal advice to ministers will interact with the proposed project, and no UK Biodiversity Action Plan (BAP) priority species and habitats were identified at the Tidal Site.

## 8.2.3 Assessment Methodology

### 8.2.3.1 Identification of Key Receptors

Biotopes as identified through the detailed habitat mapping have been grouped, according to the similarity of habitat types and the ecological function of communities into key receptors.

All three biotopes identified in and around the proposed Tidal Site are rocky biotopes dominated by sessile species attached to the substratum (e.g. sponges, hydroids, bryozoans and anemones). Due to the broad similarities between their underlying habitats and ecological function of the characterising species, the three biotopes have been grouped into one receptor termed "Circalittoral rock and boulder communities" (Table 8-8).

| Receptor Group | Description | Biotopes |
|---|---|---|
| Circalittoral rock and boulder communities | Communities which are predominantly characterised by sessile invertebrates, with few mobile benthic species on tide swept rocky habitats | CR.HCR.FaT.CTub - *Tubularia indivisa* on tide-swept circalittoral rock<br><br>CR.HCR.FaT.CTub.Adig - *Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock<br><br>CR.HCR.XFa.ByErSp.Sag - Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept ciraclittoral rock |

Table 8.8 Receptor group found within the Site Survey Area of the Tidal Site

### 8.2.3.2 Overview of Key Receptor characteristics

Circalittoral rock and boulder communities

These benthic faunal communities are dominated by permanently attached erect faunal species that are likely to be sensitive to physical abrasion and disturbance. Typical species include *T. indivisa, S. elegans* and *A. digitatum*. Few mobile species were recorded during the DDV survey, one *Homarus gammarus* was recorded and it is expected the benthic echinoderms such as *Asterias rubens* will be present within the receptor group. MarLIN does not provide sensitivity assessments for the biotope complexes within this receptor group, however, a sensitivity assessment was available for *A. digitatum* which contributes to a high proportion of similarity within benthic assemblages assigned to this biotope group (Budd a2008). MarLIN sensitivity assessments for other frequently observed species within the biotope such as *Urticina felina* (Jackson and Hiscock, 2008), *Metridium senile* (Hiscock and Wilson, 2007), *A. rubens* (Budd, 2008b), *Balanus crenatus* (White, 2004) and *Nemertesia ramosa* (Jackson, 2004) were all considered within the final sensitivity scores.

It is recognised that this habitat is a potential Annex 1 reef, however as stated previously, no reef features identified during the site specific survey work are a designating feature of a notified or designated SAC, nor do they overlap any current Areas of Search for Annex I habitats. Given the wider extent of the habitats which support these communities (as indicated by UKSeaMap 2010 data (McBreen *et al.*, 2011); Figure 8.3) and the resulting potential for a local supply of larvae, recovery of these communities following impact such as substratum loss is likely to occur. It should also be noted that introduction of a hard substrate onto an existing area of rocky substrate will lead to a relatively small change from baseline conditions than if hard substrate were added to an area of soft sediment, and the introduction of substrate will facilitate recolonisation.

8.2.3.3 Identification of Pressures

The Tidal Site is predominantly comprised of bedrock, or boulders, pebbles and cobbles overlaying gravel. As a result, pressures related to sediment disturbance, such as disturbance of contaminants, scour, sediment suspension and turbidity, and consequent smothering of benthic species through re-settlement are not considered likely consequences the Project, and are not assessed in this section. However the release of drill cuttings is considered in terms of smothering effects on the benthos.

The electricity produced by the turbines will be transmitted using a series of inter array cables laid on the sea bed. The electric current that is carried in these cables generates Electro Magnetic Fields (EMF) that have the potential to interact with marine species and to affect their behaviour since some species use the magnetic field of the earth to orientate (Fisher and Slater, 2010). Bochert and Zettler (2004) report the outcome of experimental analysis on several benthic species (including a number of crustaceans) exposed to static magnetic fields of 3.7mT for an extended period of time. These results obtained no differences in survival rates between the experimental and control populations. Bochert and Zettler (2004) concluded that static magnetic fields of power cable transmissions do not appear to influence the orientation, movement or physiology of benthic species. In addition, even under the influence of anthropogenic fields, no negative impacts have been observed in crustaceans. Therefore the impact of EMF from the inter array cables within the Tidal Site has not been assessed within this chapter. (The impact of EMF from inter array cables on fish and shellfish is considered within the Chapter 7 - Natural Fish).

The pressures relevant to the benthic ecology of the Tidal Site have been identified based on the Rochdale envelope parameters and will be used to determine potential effects on receptors (Table 8-9).

| **Pressure** | **Causal Activities and Effect** |
|---|---|
| Construction Phase (and Decommissioning) | |
| Direct physical disturbance and temporary substratum loss | Disturbance to species and habitats during construction. A loss of substratum could occur due to the jacking-up and anchoring of construction vessels and the installation of inter array cables. The impacts caused by the permanent loss of benthic habitats from actual |

| Pressure | Causal Activities and Effect |
|---|---|
| | foundation structures are assessed within the operational phase impacts. |
| Smothering | Smothering of the benthos by drill cuttings may occur within the immediate vicinity of the work and will be temporary in nature. Natural hydrodynamic processes will re-suspend and distribute any material deposited around the turbine. The level and risk of smothering will vary depending on the construction methods used during installation. |
| Introduction of Marine Non Native Species (MNNS) | Non-native species can be transported within ballast water of construction vessels, on the surface of vessels and platforms, or may have already colonised a device structure if stored in the marine environment prior to transport to the site. The introduction of non-native species can change the biodiversity of the area with potential to cause secondary impacts on ecology and other users such as aquaculture. |
| Operation Phase | |
| Long term substratum loss and colonisation of introduced substrata | The degree of substratum loss will be dependent on many project specific factors and will vary with foundation type, cable installation and protection methods. Species will colonise underwater structures resulting in a change to local biodiversity. Any effects associated with substratum loss and colonisation will persist for the duration of the project. |
| Decrease in water flow | Any reduction in tidal energy as a result of the introduction of energy devices can affect flora and fauna that rely on strong tidal currents for feeding and carrying food and waste materials away. |
| Contamination | Contamination can result from leaching of sacrificial anodes, antifouling paint or hydraulic fluids. The sensitivity of benthic assemblages to heavy metals, chemical and hydrocarbon contamination varies and will need to consider the specific species present at the proposed site. |
| Potential facilitation of the spread of Marine Non Native Species (MNNS) | Structures within the marine environment may provide "stepping stones" for the movement of non-native species. The spread of non-native species can change the biodiversity of the area with potential to cause secondary impacts on ecology and other users such as aquaculture. |

Table 8.9 Summary of predicted pressures to be addressed in impact assessment at the Tidal Site

## 8.2.4 Impact Assessment

### 8.2.4.1 Construction Phase Impacts

I. Direct physical disturbance and temporary substratum loss

The extent of habitat lost temporarily during construction will depend upon the installation methodology and machinery used. However, installation of TEC's, inter array cables, and the use of associated machinery is likely to result in physical disturbance within the Tidal Site and the surrounding buffer zone and it is likely that there will be a reduction in area available for benthic organisms and extent of the biotopes present.

The worst case parameter for direct physical impact from installation vessels would be the use of The Innovation jack up barge with a footprint of 560m$^2$ required at each turbine location (totalling 17,360m$^2$ if the maximum number of turbine locations (30), and a subsea station were utilised). The most likely scenario however is the use of anchored heavy lift shear leg vessels which hold their position by means of anchors. Therefore there is some potential for catenary of the anchor chain as the barge manoeuvres. This may result in a 2,480m$^2$ area of seabed abrasion (Table 8-6).

The benthos of the Tidal Site is likely to be subject to high levels of physical disturbance due to the very fast tidal currents and as such a high level of natural variation can be expected of the benthic community. Boulders may be moved by strong currents which will disturb patches of community, thus keeping communities in a constant state of succession. This may be particularly common in the boulder field found to the north of the Tidal Site.

The habitat type (tide swept circalittoral rock) is well represented in west Scotland, as shown by UKSeaMap 2010 data (McBreen *et al.*, 2011) (Figure 8.2). The Tidal Site represents a relatively small area (2.28km$^2$) of the biotope's/habitats full extent within the region and so any effect represents only a small deviation from the overall baseline condition. Given the likely natural variability within the Tidal Site, coupled with the temporary (i.e. limited to construction phase) nature, and highly localised extent of the pressure, the magnitude is considered to be **negligible**.

Most of the characteristic species in the circalittoral rock and boulder communities are permanently attached to the substratum (e.g. sponges, hydroids, bryozoans and anemones) and will not re-attach once displaced, and those that protrude above the substratum will be damaged or killed by abrasion (e.g. hydroids, branching and cup sponges etc.). In addition to permanently attached species, mobile surface species such as the echinoderms *Echinus esculentus* and *A. rubens* are slow movers. Although *A. rubens* is able to migrate by crawling up to a distance of 5-7 m daily (Dare, 1982, as cited in Budd, 2008b), it is not considered sufficiently mobile to avoid the physical removal of the substratum to which it is attached.

For sessile, permanently attached organisms recovery through immigration of adults from surrounding areas is not possible, and thus recovery for these species would rely on a supply of larvae from a viable population nearby. Recruitment and subsequent recolonisation however, is likely to be rapid (less than 5 years) as most of the species present e.g. hydroids, colonial ascidians, sponges and *Metridium senile* are capable of asexual reproduction and colonise available space within a few years (Tyler-Walters, 2008d). Mobile species such as the echinoderms may be able to return to disturbed areas more rapidly following physical disturbance.

Given the high intolerance of individuals within circalittoral rock and boulder communities to substratum loss, coupled with the potential for recovery, the sensitivity to direct physical impact and substratum loss is considered to be **medium**.

Thus the consequence of direct physical disturbance and temporary substratum loss is minor, and therefore **not significant** under EIA regulations.

| Sensitivity of Receptor | Magnitude of Pressure | Consequence | EIA Significance |
|---|---|---|---|
| Medium | Negligible | Minor | Not Significant |

Table 8.10 Impact assessment summary of direct physical disturbance and temporary substratum loss due to construction activities

II. Smothering (from release of drill cuttings)

Drilling activities during the installation of TEC's will produce cuttings which will be discharged from the drilling rig into the marine environment in close proximity to the installation points. The cuttings are likely to consist predominantly of a fluid paste (as seawater with no additives is likely to be used to lubricate the drill bit), with occasional larger fragments up to pebble sized flakes. The design envelope based on the 30 Quadrapod TGL TEC's and 1 subsea collection station would produce the maximum volume of drill cuttings - 2,500$m^3$. There are no other anticipated solid discharges into the marine environment during the construction phase, as the TEC's will make use of the natural seabed topography and no seabed levelling, rock removal operations, trenching or dredging is planned.

The largest, heavier particles of the cuttings are likely to settle nearby, potentially smothering rocky habitat and associated species in close proximity to the drilling area. Additionally, finer particles of the drill cuttings may stay in suspension for some time. This may reduce light penetration through the water column, however, none of the species frequently recorded within the biotopes are light dependent algae.

Due to the dynamic, high energy nature of the environment into which the drill cuttings will be released, and the effects of dilution and dispersion, it is likely that the pressure will be short term (i.e. limited to construction) and localised (limited to the area around each installation point) and therefore is of **minor** magnitude.

Many of the species within the receptor group are suspension feeders and dispersion and re-settlement of drill cuttings beyond the immediate vicinity of drill cutting release may cause interference and blockages in benthic species, for example in sponge canals and pores. However, long-lived slow growing and infrequently recruiting species such as the anemone *Urticina felina* (frequently found across the receptor group biotopes) are likely to survive smothering, and are assessed as having very low sensitivity to this pressure (Jackson and Hiscock, 2008). CR.HCR.FaT.CTub and CR.HCR.FaT.CTub.Adig are characterised by dense covering of the robust hydroid *Tubularia indivisa*, and CTub.Adig also has aggregations *of A. digitatum* which protrude above the surface. The robust nature of *T. indivisa* and the more pronounced protrusion of characterising sponge species indicate these species within the biotopes may be more tolerant to smothering. Additionally, anthozoans and sponges produce mucus which is shed with attached silt to clean the external surface. Therefore some reduction in fitness may occur in these species found downstream of the release, as a result of increased energy being expended in cleaning, however mortality is not expected to occur beyond the immediate area of release.

Some characterising species of circalittoral rock and boulder communities demonstrate low or very low sensitivity to smothering (e.g. *A. digitatum, U. felina, and N. ramosa*) due to pre-adaptation to coarse substrata, sufficient protrusion above the surface, or adaptations such as mucus production. However, other species have been assessed as being moderately sensitive due to the permanent attachment to the substrate, and/or their low projection above the substrate. Therefore, in line with the precautionary principle, a sensitivity rating of **medium** has been applied. The consequence of smothering is minor, and **not significant** under EIA regulations.

| Sensitivity of Receptor | Magnitude of Pressure | Consequence | EIA Significance |
|---|---|---|---|
| Medium | Minor | Minor | Not Significant |

Table 8.11 Impact assessment summary of smothering (drill cutting release)

III. Introduction of Marine Non Native Species

Invasive marine non-native species (MNNS) pose a significant threat to biodiversity as they may have negative impacts on native species and threaten regional ecosystems; SNH reports a growing problem with MNNS in Scotland (SNH, 2011). Non-native species have the potential to be introduced in the local environment during construction through the use of vessels and equipment that has been used in other parts of the world; this is a particular risk with the use of ballast water.

A number of different vessels will be required during each phase of the Project, with most vessel traffic expected during the construction and decommissioning phases, including jack up barges, heavy lift shear leg vessels, DP vessels, and other support vessels such as crew change vessels and tugs. It is likely that much of the day-to-day traffic would be from Port Ellen on Islay to site.

The impact of MNNS could in theory extend, in the long term, over a large area. Any changes could be irreversible and represent a significant variation from the baseline. This could lead to a high ranking for magnitude of impact. However, this pressure is highly unlikely to occur and will be managed through strict adherence to an environmental management plan in accordance with various pieces of national and international legislation (IPIECA, 2010; IMO, 2011; Scottish Government, 2012b). As a result the impact is considered extremely unlikely to occur and to balance the scale of impact against the likelihood of impact occurring, a magnitude of **minor** is assigned.

Information on the sensitivity of these biotopes (and other similar biotopes within the MarLIN database) is considered to be insufficient to accurately assign a sensitivity rating to this pressure as there is no precedent of introduction of non-native species into a similar species assemblage on which to base a sensitivity rating. Uncertainty within this assessment relates to the type of organism that may be introduced and its potential for survival in this environment. Should a non-native species be introduced into the marine environment off the south west of Islay there is no guarantee that the introduced species will be tolerant of the conditions and it is in fact more likely that the species will be unable to reproduce and initiate a local population. For such a population to develop the species would need to be tolerant of the environmental conditions of the area (e.g. temperature, salinity, and suspended sediment), make use of existing food sources, and be able to out-compete the native species. Alternatively it must be able to exploit a previously unfilled ecological niche. Where these conditions are met then the native populations may experience a reduction in numbers or a complete failure. Note that the use of local or UK-based installation vessels would limit the potential for introduction of non-native marine species. Noting the lack of any conservation designation applied to habitats within the site survey area, but acknowledging that the habitat is a potential Annex I reef, but also recognising high stress environment of the Tidal site (i.e. difficulty of invasive species being able to survive) the receptor sensitivity is defined as **low**.

The consequence of introduction of MNNS is minor, and **not significan**t under EIA regulations, though the large degree of uncertainty (in terms of what species, if any, could potentially colonise and what effect this would have on the ecosystem) in this assessment should be noted.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | EIA Significance |
|---|---|---|---|
| Low | Minor | Minor | Not Significant |

Table 8.12 Impact assessment summary of introduction of MNNS

8.2.4.2 Operation Phase Impacts

I. Long term substratum loss and colonisation of introduced substratum

The area of seabed directly beneath the foundations/platforms and the inter-array cables will be excluded as potential benthic habitat for the operational life of the development. As the maximum footprint within the Tidal Site is 0.16km$^2$ (or 160,496 m$^2$) (496m$^2$ for 31 quadrapod foundations (including 1 subsea collection station) and 160,000m$^2$ area of inter array cable with rock dumping) there will be a reduction in extent of the two biotopes found within the Tidal Site - CR.HCR.XFa.ByErSp.Sag, and CR.HCR.FaT.CTub. This is likely to be an over estimation as rock dumping over 100% of the inter array cables is unlikely to occur.

While movement or 'sweeping' of mooring or electrical transmission cables along the sea bed have been shown to be a continual source of habitat disruption during operation (with minor effects on seafloor organisms (Kogan *et al.*, 2006)), the inter array cables are most likely to be ballasted with rock and therefore any abrasive action of cables will be minimised.

While the pressure will be felt throughout the operational life of the project, due to the necessary separation between turbines, a significant change to the existing benthic ecology over the entirety of the Tidal Site is not expected. The habitat type (tide swept circalittoral rock) is well represented in west Scotland, as and the Project footprint within the Tidal Site represents a small area of the habitats full extent within the region. In addition community changes will be localised to the new habitat and to those existing habitats immediately surrounding the new habitat. Furthermore, introduction of a hard surface onto the existing substrate represents only a small deviation from the overall baseline condition. Given the broader extent of the habitat type and the potential for re-colonisation, the magnitude of the pressure is considered to be **minor**.

As stated above, in 'direct physical disturbance and temporary substratum loss', the receptor biotopes are considered to be highly intolerant of substratum loss due to the sessile nature of many characterising species. However, due to the area of similar habitat in the region that will not be impacted, it is considered that recovery of many of the characterising species will be likely due to a local larval supply, or immigration of adults.

Furthermore, the introduction of new substrate will offset the potential habitat loss (Royal Haskoning, 2011). The presence of TECs and associated inter array cable scour protection may lead to increased heterogeneity and consequently provision of new habitat, which is of a similar character to the existing benthos, allowing development of a new biological community. Post-construction studies of offshore wind farms show that turbine foundations support dense populations of filter feeders, typically blue mussels *Mytilus edulis,* which has also been recorded on other structures projecting from the sea floor, such as oil platforms and pier pilings (Wilhelmsson and Malm, 2008). The environmental monitoring program (EMP) of the SeaGen MCT in Strangford Lough (a Special Area of Conservation (SAC) designated for Annex I subtidal reef) reported that the total footprint of the installation i.e. habitat lost (36.3m$^2$) had been offset by the provision of 72m$^2$ hard surface, of which 50% (37.6m$^2$) had been colonised (Royal Haskoning, 2011). Given the high recoverability of the species present at the Tidal Site is expected that new hard substrates will be recolonised by species present at the site relatively quickly.

The sensitivity to substratum loss is considered to be **medium,** however it is noted that the pre-existing adaptation of benthic communities to hard substrate indicates that a return to re-pressure baseline conditions due to a supply of larvae from surrounding colonies is likely. Thus the consequence of long term substratum loss and abrasion is minor, and **not significant** under EIA regulations.

| **Sensitivity of Receptor** | **Magnitude of Pressure** | **Consequence** | **EIA Significance** |
|---|---|---|---|
| Medium | Minor | Minor | Not Significant |

Table 8.13 Impact assessment summary of long term substratum loss and colonisation of introduced substratum

II. Decrease in water flow

The presence of the turbines in the tidal stream may impact upon the hydrodynamic characteristics of the immediate area surrounding, and downstream of the devices, through potential changes in turbulence, decrease in water flow and energy removal. This is considered relevant to the benthic ecology as a slower flow may lead to sediment coming out of suspension and smothering the benthos.

While a decrease of two categories in flow rate from e.g. moderately strong to very weak, is likely to result in significant changes in the community and possibly the loss of the dominant hydroid/bryozoans turf, it is noted that the reduction in water flow is likely to be well below the benchmark figures provided by MarLIN. Additionally, previous studies of tidal flow regimes around marine current turbines (MCT) (Royal Haskoning, 2011) have reported no evidence of significant deviation of the ambient velocity or flow direction subsequent to installation of a turbine. Thus, although a change in flow rate may occur throughout the life of the Project, no or just noticeable changes from the baseline conditions are predicted. In addition, the effects are likely to be felt at a limited distance around the development. Therefore the pressure is considered to be of **negligible** magnitude.

Many of the characterising species within the receptor group, such as the sponges, produce mucus which is shed with attached silt to clean the external surface, and are likely to be tolerant of small increases in particle supply. Mortality is not therefore expected with increased suspended sediment levels but some reduction in fitness may occur as a result of energy being expended in cleaning.

The tolerance of characterising species to increased suspended sediment as a potential result of decreased water flow indicates that the sensitivity of the receptor group is **low**, thus the consequence of decrease in water flow is negligible, and **not significant** under EIA regulations.

| **Sensitivity of Receptor** | **Magnitude of Impact** | **Consequence** | **EIA Significance** |
|---|---|---|---|
| Low | Negligible | Negligible | Not Significant |

Table 8.14 Impact assessment summary of decrease in water flow

III. Contamination

Throughout operation there are sources that have the potential to add contaminants to the site, e.g. accidental release of contaminants includes fuel, cleaning fluids, paints, sacrificial anodes, specialised chemicals and litter.

The antifoulant paint used on the turbine blades is likely to be a non-leaching variety which works through physical properties as opposed to the presence of biocides (Intersleek 737 Teflon based, Appendix 2a). The system will be anti-fouled during the manufacturing cycle and further treatments on site will not be necessary. With regard to water quality, the loss of oil is the biggest potential pressure identified. The oil fluid inventory for each TGL TEC is 1,346L (inventories for other individual TEC options are likely to be between 1000 and 1530 litres).

Modular design and appropriate valves should limit the volume of oil loss in the event of a structural failure or collision damage (Boehlert *et al.*, 2007), and following guidelines (e.g. OSPAR and The International Convention for the Prevention of Pollution from Ships (MARPOL)) regarding pollution at sea will reduce the risk of chemical contamination in the marine environment. Prevention methods include provision for storage of pollutants and the identification of substances suitable for use in the marine environment. Standard controls will be in place, including following best practice and guidelines for the prevention of pollution at sea, such as the establishment of an Environmental Management Plan (EMP) that will detail pollution prevention and response procedures. As such it is not predicted that contaminants from the operational plant will be introduced into the environment at a high level. Thus a magnitude of **minor** has been applied to this pressure.

Benthic communities within the proposed Tidal Site are unlikely to be pre adapted to increased levels of contaminants, as there are considered to be no known sources of contamination within the region (Appendix 8.1). However, biotopes with similar species assemblages to those of the receptor groups (e.g. CR.HCR.XFa.FluCoAs) are considered to have low sensitivity to contamination (Tyler-Walters, 2008d), and where sufficient information exists to assess sensitivity of characterising species within MarLIN, these are considered to be at worst moderately sensitive to contamination. Thus, **medium** sensitivity to contamination has been assigned to the receptor group. The consequence of contamination is minor, and **not significant** under EIA regulations.

| **Sensitivity of Receptor** | **Magnitude of Impact** | **Consequence** | **EIA Significance** |
|---|---|---|---|
| Medium | Minor | Minor | Not Significant |

Table 8.15 Impact assessment summary of contamination

IV. Facilitation of spread of Marine Non Native Species (MNNS)

As outlined in construction phase impacts, MNNS pose a significant threat to biodiversity as they may have negative impacts on native species and threaten regional ecosystems. Structures placed within the marine environment have the potential to facilitate the movement and spread of non-native species through a "stepping stone" effect.

The impact of MNNS could in theory extend, in the long term, over a large area, which could lead to a high ranking for magnitude of pressure. However, the pressure is considered extremely unlikely to occur and to balance the scale of pressure against the likelihood of impact occurring, a magnitude of **minor** is assigned.

While information on the sensitivity of these biotopes (and other similar biotopes within the MarLIN database) is considered to be insufficient to accurately assign a sensitivity rating to this pressure (as outlined above in construction phase impacts). Uncertainty within this assessment relates to the type of organism that may be introduced and its potential for survival in this environment. It is recognised that should a non-native species be introduced there is no guarantee that the species will be tolerant of the conditions and it is in fact more likely that the species will be unable to reproduce and initiate a local population. Noting the lack of any conservation designation applied to habitats within the site survey area, but acknowledging that the habitat is a potential Annex I reef, but also recognising high stress environment of the Tidal site (i.e. difficulty of invasive species being able to survive) the receptor sensitivity is defined as **low**.

The consequence of introduction of MNNS is minor, and **not significan**t under EIA regulations, though the large degree of uncertainty (i.e. what species, if any, could potentially colonise and what effect this would have on the ecosystem) in this assessment should be noted.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | EIA Significance |
|---|---|---|---|
| Low | Minor | Minor | Not Significant |

Table 8.16 Impact assessment summary of potential facilitation of spread of MNNS

8.2.4.3 Decommissioning

The life span of the project will be 25 years. Decommissioning techniques will be agreed with the regulator at the time of decommissioning and will consider the best environmental practice and technologies available at the time. It is assumed that in accordance with current legislation and guidance (Energy Act 2004 and OSPAR Decision 98/3) that decommissioning will involve complete removal of all structures that protrude above the seabed. Inter array cables that are buried or under rock armouring may be left in-situ. Leaving cables in-situ will reduce disturbance to the seabed during decommissioning.

Pressures arising from decommissioning activities are expected to be temporary and highly localised. Physical disturbance associated with foundation removal and vessel anchoring and mooring, and habitat loss where organisms have colonised installed artificial surfaces will occur across the Tidal Site. The impacts resulting from decommissioning activities are expected to be equivalent (or less) than impacts arising during construction.

8.2.5 Mitigation

No specific mitigation measures have been identified as being necessary during the construction, operation and decommissioning phases of the Project at the Tidal Site. Standard best practice for offshore construction (pollution prevention plans, environmental management plan) will reduce the likelihood of accidental contamination, and modern methods of antifouling will be utilised. In addition, all vessels will adhere to all relevant guidance regarding ballast water (IPIECA, 2010; IMO, 2011; Scottish Government, 2012b), in order to minimise risk of introduction and transfer of non-native marine species.

As it is not possible to mitigate impacts of construction and operation, monitoring of the impacts may be required. In order to do this a Survey Monitoring Plan (SMP) would be produced pre construction as part of the licence condition which would to stipulate how the monitoring of the potential impacts on habitats from construction and operational impacts will be undertaken. The SMP would be developed with advice from SNH & MS. Drop Down Video (DDV) is suggested as the most appropriate method for monitoring. Determination of biotopes present, their extent and their relative conservation importance will enable the habitat recovery to be assessed. The areas which should be monitored are the turbine bases, rock armour, and the areas surrounding the turbines to monitor for impacts of scour on habitats.

8.2.6 Cumulative Assessment

DPME has in consultation with Marine Scotland identified a list of other projects which together with the Project may result in potential cumulative impacts. The full list of these projects including details of their status at the time of the EIA and a map showing their location is provided in Chapter 4. From a benthic ecology perspective it is considered that due to the distances between them none of these projects are likely to interact with the Islay Tidal Energy Project and result in cumulative impacts.

8.2.7 Summary and conclusions – Tidal Site

Two biotopes (CR.HCR.XFa.ByErSp.Sag, and CR.HCR.FaT.CTub) were found within the Tidal Site and 500m buffer, and an additional sub biotope (CR.HCR.FaT.CTub.Adig) was found in the broader Site Survey Area. The biotopes found within the Tidal Site are listed under the European Habitats Directive as indicative of Reef Habitat. No UKBAP species were recorded during the DDV survey of the Site Survey Area, and no PMF or OSPAR habitats or species have been recorded. Thus, although some of the habitats may represent those listed under protection mechanism; the areas do not represent outstanding examples of these habitats, which are found throughout south west and western regions of Scotland.

The habitats on which these biotopes are recorded (high energy circalittoral rock) are widely represented along the west coast of Scotland, and as such the footprint of the turbines and inter array cable within the 2.28km$^2$ Tidal Site is considered to represent a very small proportion of the potential distribution of these biotopes. In addition, the benthic communities associated with these biotopes are adapted to high energy environments, and as such are likely to be subject to natural environmental change.

During construction and decommissioning of the Islay Tidal Energy Project pressures within the Tidal Site are expected to largely be localised to the foundations of the devices and inter array cable, and temporary in nature, and thus of minor or negligible magnitude.

During operation, while potential pressures are exerted over a longer term, they are considered to be of minor magnitude, and it should be noted that the presence of additional hard substrate available for colonisation may mitigate against loss of original habitat as reported within the Strangford Lough SeaGen Environmental Monitoring Programme (Royal Haskoning, 2011).

| **Impact** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Consequence** | **Significance** |
|---|---|---|---|---|
| Construction (and decommissioning) | | | | |
| Direct physical disturbance and temporary substratum loss | Medium | Negligible | Minor | Not significant |
| Smothering (release of drill cuttings) | Medium | Minor | Minor | Not significant |
| Introduction of Marine Non Native Species | Low | Minor | Minor | Not significant |
| Operational Phase | | | | |
| Long term substratum loss and colonisation of introduced substratum | Medium | Minor | Minor | Not significant |
| Decrease in water flow | Low | Negligible | Negligible | Not significant |
| Contamination | Medium | Minor | Minor | Not significant |
| Potential facilitation of the spread of MNNS | Low | Minor | Minor | Not significant |

Table 8.17 Summary of the Impact Assessment of the Tidal Site

## 8.3 Western Export Cable Route

8.3.1 Rochdale Envelope

At present definitive design parameters including cable type and installation methodology is not yet available. Therefore, in order to inform this EIA, infrastructure used in current marine renewable projects has been reviewed and the most likely technology appropriate for the proposed project identified. Based on this review the EIA process has identified a design envelope that represents the realistic worst case scenario in accordance with the Rochdale Envelope approach (Table 8.18)

| **Design Parameter** | | **Maximum Project parameter** | **Most likely scenario** |
|---|---|---|---|
| Construction | | | |
| Installation vessels | Anchoring during installation. | Vessel anchoring during cable installation along entire export cable | Dynamic positioning vessel, no anchoring would occur along cable route corridor |
| Laying of Export Cable from the array to landfall at Kintra | Disturbance to sediment | **21.7 km** of up to three 33 kV double armoured cables | Seabed disturbance over sedimentary habitats where trenching is used rather than rock armouring. |
| Rock Dumping along length of Western Export Cable Route | Graded, inert rock with a median stone diameter of 65 mm and bulk density of 1.65to 1.7 T/$m^{3.}$ | **0.17km$^2$** impact footprint will occur based on 100% rock armouring 8 metres wide. | Rock armouring minimised by trenching of the export cable within sedimentary habitats and the use of rock bags at frequent intervals on the western end of the export cable. |
| Landfall cable installation | Plough and burial | Disturbance within vicinity of export cable plus construction vehicle traffic | Disturbance within vicinity of export cable plus construction vehicle traffic |
| Operation | | | |
| Export Cable protection | Habitat change within cable footprint | **0.17km$^2$** area of habitat will be modified to homogeneous graded rock substrate. | This may be reduced over sedimentary habitats during trenching. |
| Export cable | Electro-magnetic Field | Will depend on number of cables, size and insulation. Magnetic B-fields will dissipate rapidly by the inverse square law with distance from the cable. Negligible limits are anticipated within a maximum of 5 metres from the cable (MORL, 2012). 33 kV, 300 A, 50 Hz (conducting132 kV) XLPe AC cable considered to be the worst case scenario | The magnetic B-fields estimates are based on modelling of 220 kV cables (MORL, 2012). Therefore, field strengths are likely to be much less. |

Table 8.18: Rochdale envelope parameters defined for assessing impacts relating to construction, operation and decommissioning of the Western Export Cable Route.

8.3.2 Baseline Environment of Western Export Cable Route

There are no historical benthic data collected along the Western Export Cable Route, and information on the benthic habitats of this area is largely restricted to UKSeaMap 2010 data (McBreen *et al*., 2011), and the findings of diver surveys carried out during a Seasearch survey in 1999 (Ramsay, 2004). Divers surveyed one station close to the Western Export Cable Route within Laggan Bay near Knockangle Rock, and reported dense brittle star beds that are likely to correspond to the biotope SS.SMx.CMx.OphMx (Ramsay, 2004). Mobile species recorded during these surveys of sites around the south coast of Islay were comprised of crab species (including the velvet swimming crab, *Necora puber*), squat lobsters (*Munida rugosa*), crawfish (*Palinurus elephans*), brittle stars (*Ophiothrix fragilis*), sea urchins (*Echinus esculentus*), and starfish (including *Crossaster papposus* and *Solaster endeca*). Octopus and fish species such as wrasse (*Labrus bergylta*), butterfish (or gunnel *Pholis gunnellus*), gobies and gadoids were also recorded by divers (Ramsay, 2004). High numbers of urchins have been reported as a feature common to many areas around the south coast of Islay, which coincide with a reduction in the number of flora and faunal species and an increase in areas of pink encrusting algae on rocks underlying kelp forests (Hiscock, 1983; Ramsay, 2004).

Predictive modelling conducted during the UKSeaMap 2010 project (McBreen *et al*.,2011) indicates a mosaic of fine sands, muddy sands and coarse sands at the western end of the cable route (Figure 8.5). Coarser substrates are predicted within Laggan Bay east of the Rinns of Islay (McBreen *et al.*, 2011)

Historical discharges from distilleries on Islay and Jura led to hydrographic and chemical surveys by the Clyde River Purification Board in 1984, and results indicated localised pollution of shore communities and some increase in heavy metal contaminants (Hiscock, 1998). However, it is considered that sediments, if present, in the region of the proposed Western Export Cable Route are unlikely to be contaminated due to the proximity to known discharge locations (Baxter *et al.,* 2011).

The site specific surveys (Appendix 8.1) revealed that the Western Export Cable Route close to the Tidal Site is comprised of bedrock and rocky substrate with sparse sedimentary materials. Moving east towards Laggan Bay the Western Export Cable Route crosses a deep water channel and the substrate here is predominately comprised of pebbles and shelly gravel. The sea floor gradually rises eastwards along the proposed Western Export Cable Route and large boulders become prevalent across the gravelly sand and pebble substrate. Some predominantly sandy stations were located along the route, but were scattered with boulders. The eastern end of the Western Export Cable Route within Laggan Bay lies at a depth of about 23m 2.5km from the shoreline and the substrate here is characterised by a large number of boulders. Geophysical data collected in March 2013 confirms the depth and distribution of substrate types along the Western Export Cable Route (Figure 8.6).

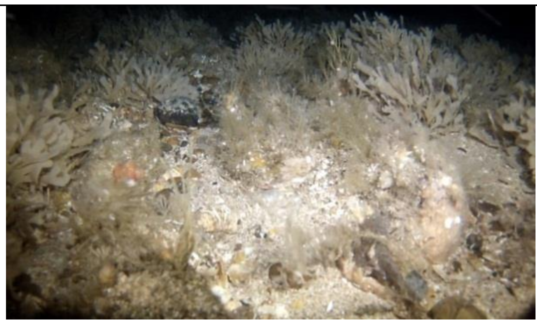
The most common biotope assigned from DDV data along the Western Export Cable Route was the mixed sediment biotope *Circalittoral mixed sediments* (SS.SMX.CMx) where pebbly sand habitats exhibited a sparse sessile faunal turf community (Table 8-19) were found along the central section of the Western Export cable route (Figure 8.6). Only one grab station was possible along the Western Export Cable Route; however, PSA and infaunal analysis supports the biotope determinations identified through video analysis confirming that the high level biotope at the station was Circalittoral mixed sediment (SS.SMX.CMx). At two stations in the central region of the Western Export Cable Route the higher level biotope was assigned due to the presence of moderately dense beds of the brittle stars (SS.SMX.CMx.OphMx).

Habitats closest to the Tidal Site were found to be dominated by upright sessile species such as the hydroid *Tubularia indivisa*, dead man's fingers *Alcyonium digitatum* and the anemones *Sagartia elegans* and *Urticina felina*. The physical and biological characteristics correspond to the biotopes *Tubularia indivisa on tide-swept circalittoral rock* (CR.HCR.FaT.CTub), *Alcyonium digitatum with dense Tubularia indivisa and anemones on strongly tide-swept circalittoral rock* (CR.HCR.FaT.CTub.Adig) and *Mixed turf of bryozoans and erect sponges with Sagartia elegans on tide-swept ciraclittoral rock* (CR.HCR.XFa.ByErSp.Sag) (Table 8-19).

The deep mixed substrate at the western central area of the Western Export cable route was found to be colonised by hydroids (*Nemertesia antennina* and *Nemertesia ramosa*) and bryozoans (*Flustra foliacea*) and encrusting species tolerant of scour, particularly the keel worm (*Pomatoceros* sp.). The assemblage corresponds to the biotopes *Flustra foliacea and colonial ascidians on tide-swept exposed circalittoral mixed substrata* (CR.HCR.XFa.FluCoAs.X) and *Sparse sponges, Nemertesia spp., and Alcyonidium diaphanum on circalittoral mixed substrata* (CR.HCR.XFa.SpNemAdia) (Table 8-19).The density of the faunal turfs and crusts were moderately sparse as compared to the rocky habitat in the Tidal Site itself.

Boulders closer inshore within Laggan Bay were characterised by faunal and algal crusts with numerous urchins (*E. esculentus*). Above 20m the macro-algae *Laminaria hyperborea* was present although heavily grazed by urchins. These communities correspond to the biotopes *Grazed Laminaria hyperborea park with coralline crusts on lower infralittoral rock* (IR.MIR.KR.Lhyp.GzPk) and *Faunal and algal crusts on exposed to moderately wave exposed circalittoral rock* (CR.MCR.EcCr.FaAlCr) respectively (Table 8-19).

| **Biotope Code and Description** | **Number of Video Stations** | **Video image** |
|---|---|---|

| Biotope Code and Description | Number of Video Stations | Video image |
|---|---|---|
| CR.HCR.FaT.CTub<br><br>*Tubularia indivisa* on tide-swept circalittoral rock | 1 | <br>Take 65.6 |
| CR.HCR.FaT.CTub.Adig<br><br>*Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock | 3 | <br>Take Aug 7.1 |
| CR.HCR.XFa.ByErSp.Sag<br><br>Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock | 2 | <br>Take 62.7 |
| CR.HCR.XFa.FluCoAs.X<br><br>Flustra foliacea and colonial ascidians on tide-swept exposed circalittoral mixed substrata | 2 | <br>Take Aug 4.3 |
| CR.HCR.XFa.SpNemAdia<br><br>Sparse sponges, Nemertesia spp., and *Alcyonidium diaphanum* on circalittoral mixed substrata | 1 | <br>Take Aug 1.3 |

| Biotope Code and Description | Number of Video Stations | Video image |
|---|---|---|
| CR.MCR.EcCr.FaAlCr<br><br>Faunal and algal crusts on exposed to moderately wave exposed circalittoral rock | 5 | <br>Take Aug 24.4 |
| IR.MIR.KR.Lhyp.GzPk<br><br>Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock | 3 | <br>Take 51.3 |
| SS.SMX.CMx<br><br>Circalittoral mixed sediment | 10 | <br>Take Aug 17.6 |
| SS.SMX.CMx.OphMx<br><br>*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment | 2 | <br>Take 24.1 |

Table 8.19 Subtidal biotopes identified along the Western Export Cable Route

At the location of the cable landfall the shore is comprised of a sandy beach with wave cut platforms rising from the sands and backed by low sand dunes. Fauna at the landfall location was sparse except along the strandline where sand hoppers were common amongst washed up marine algae (dominated by kelp species). The sediment at the landfall location comprised of generally homogenous fine sand however, there was a coarsening of sediments towards the top shore. Fauna within the sand comprised of only three species in low numbers: *Talitrus saltator*, *Malacoceros fuliginosus* and *Eurydice pulchra*. Some lugworm casts were also present although no live specimens were captured.

Biotopes assigned in the immediate vicinity of the cable landfall were: *Talitrids on the upper shore and strand-line* (LS.LSa.St.Ta), *Barren or amphipod-dominated mobile sand shores* (LS.LSa.MoSa) and *Barren littoral coarse sand* (LS.LSa.MoSa.BarSa). These biotopes are typical of exposed sedimentary shore where there is high sediment dynamics which prevents the establishment of a macrofaunal community.

To the south of the landfall site the shore is comprised of rocky skewers jutting into the sea backed by low rocky cliffs. The topography of the shore prohibited the mapping of biotopes. However, the biotopes present to the south of the cable landfall were identified as:

- *Verrucaria Maura* on very exposed to very sheltered littoral fringe rock (LR.FLR.Lic.Ver.Ver);
- Yellow and grey lichens on supralittoral rock (LR.FLR.Lic.YG);
- *Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock (LR.MLR.BF.FvesB);
- *Porphyra purpurea* and *Ulva* sp. on sand scoured mid or low eulittoral rock (LR.FLR.Eph.EntPor);
- *Semibalanus balanoides*, *Patella vulgate* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock (LR.HLR.MusB.Sem.FvesR);
- Coralline crusts and *Corallina officinalis* in shallow eulittoral rock pools (LR.FLR.Rkp.Cor.Cor);
- *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock (LR.MLR.BF.Fser.R);
- *Pelvetia canaliculata* on sheltered littoral fringe rock (LL.LLR.F.Peld);
- *Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock (IR.HIR.KFaR.Ala.Ldig).

The southern coast of Islay has the smallest tidal range in Britain due to the locations of an amphidromic point in the region (Dipper *et al.,* 2007). The result of this small tidal range leads to a compressed littoral zonation of biotopes (Dipper *et al.,* 2007), which manifested itself as most obviously on the lower shore/sublittoral fringe where the biotope found represented a mixture between lower shore, infralittoral and even mid shore communities. With the exception of these mixed habitats the biotopes identified were consistent with those typically found on west coast Scottish Islands (e.g. Barne *et al.,* 1997; Dipper *et al.,* 2007).

8.3.2.1 Species and Habitats of Conservation Importance

The rugged bedrock and stony and boulder field areas observed across the Tidal Site extends over the western periphery of the Western Export Cable Route. This habitat potentially represents an example of 'Reef', as listed on Annex I of the Habitats Directive and defined by Irving (2009). The area of rocky shore adjacent to the cable land fall is also a 'reef'. Similar to the substrate identified across the Tidal Site the habitats identified within the Western Export Cable Route are considered to be examples of bedrock and stony reef and so are potential Annex

I habitats. Although not currently designated or notified as part of the Natura 2000 network these habitat types are considered high conservation value.

No designated or notified sites for Annex I habitats have been identified around Islay that have any potential connectivity to the proposed Western Export Cable Route. No SAC's designated or proposed for Annex I habitats were identified in the Scoping Opinion received from Marine Scotland which incorporated comments from SNH (Table 4.2).

No Priority Marine Features as listed on Annex III of the Guidelines on the selection of MPAs and development of the MPA network (Scottish Government, 2011) were identified along the Western Export Cable Route. Furthermore no proposed nature conservation MPA's as recommended to Scottish Government in SNH and JNCC's (2012) formal advice to ministers will interact with the proposed project. No UK Biodiversity Action Plan (BAP) priority species and habitats were identified along the Western Export Cable Route or landfall locations.

### 8.3.3 Assessment Methodology

#### 8.3.3.1 Identification of Key Receptors

Following analysis of the data collected through characterisation surveys nine subtidal and twelve intertidal biotopes were identified. To ensure a robust and succinct assessment of potential impacts resulting from the construction, operation and decommissioning of the project, biotopes have been assigned to one of six receptor groupings based on habitat conditions, benthic community type and dominant species (Table 8.20).

| **Receptor Groups** | **Description** | **Biotopes** |
|---|---|---|
| Circalittoral rock and boulder communities | High Energy rock and boulder communities characterised by sessile scour resistant species. Epifaunal communities dominated *Tubularia indivisa*, *Alcyonium digitatum* and *Sagartia elegans*. | • CR.HCR.FaT.CTub *Tubularia indivisa* on tide-swept circalittoral rock<br>• CR.HCR.FaT.CTub.Adig *Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock<br>• CR.HCR.XFa.ByErSp.Sag Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept ciraclittoral rock |
| High energy mixed substrate circalittoral communities | Characterised by mainly sessile scour and wave tolerant species exposed to high tidal and wave energy on a heterogenic mixture of boulders, pebbles and gravel. | • CR.HCR.XFa.FluCoAs.X Flustra foliacea and colonial ascidians on tide-swept exposed circalittoral mixed substrata;<br>• CR.HCR.XFa.SpNemAdia Sparse sponges, *Nemertesia* spp., and *Alcyonidium diaphanum* on circalittoral mixed substrata |
| Circalittoral mixed sediment communities | Sublittoral mixed sediment habitats dominated by gravel habitats but with occasional pebbles. Epifaunal communities dominated by brittlestars, *Echinus esculentus* and *Munida rugosa*. | • SS.SMX.CMx Circalittoral mixed sediment;<br>• SS.SMX.CMx.OphMx Ophiothrix and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment |

| Receptor Groups | Description | Biotopes |
|---|---|---|
| Circalittoral algal dominated communities | Rocky habitats dominated by grazed coralline crusts and *Echinus esculentus* with shallower areas supporting *Laminaria hyperborea* parks. | • IR.MIR.KR.Lhyp.GzPk Grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock;<br>• CR.MCR.EcCr.FaAlCr Faunal and algal crusts on exposed to moderately wave exposed circalittoral rock. |
| Intertidal sediment communities | Exposed intertidal sedimentary habitats with species poor macrofaunal communities. | • LS.Lsa.St.Ta Talitrids on the upper shore and strand-line;<br>• LS.Lsa.MoSa Barren or amphipod-dominated mobile sand shores;<br>• LS.LSa.MoSa.BarSa Barren littoral coarse sand. |
| Intertidal rocky communities | This represents intertidal rocky habitat biotopes that exhibit a distinct zonation based on vertical position along the shore. The habitats are typical of an exposed rocky shore with various rocky outcrops resulting in areas of relative shelter. This receptor group does lie within the direct footprint of the Western Export Cable Route. | • LR.FLR.Lic.Ver.Ver *Verrucaria maura* on very exposed to very sheltered littoral fringe rock;<br>• LR.FLR.Lic.YG Yellow and grey lichens on supralittoral rock;<br>• LR.MLR.BF.FvesB *Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock;<br>• LR.FLR.Eph.EntPor *Porphyra purpurea* and *Ulva* sp. on sand scoured mid or low eulittoral rock;<br>• LR.HLR.MusB.Sem.FvesR *Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed or vertical sheltered eulittoral rock ;<br>• LR.FLR.Rkp.Cor.Cor Corraline crusts and *Corallina officinalis* in shallow eulittoral rockpools;<br>• LR.MLR.BF.Fser.R Fucus serratus and red seaweeds on moderately exposed lower eulittoral rock;<br>• LL.LLR.F.Peld *Pelvetia canaliculata* on sheltered littoral fringe rock;<br>• IR.HIR.KFaR.Ala.Ldig *Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock. |

Table 8.20 Receptor Groups incorporating biotopes with similar biological and physical characteristics considered in the EIA.

### 8.3.3.2 Overview of Key Receptor characteristics

Circalittoral rock and boulder communities

These benthic faunal communities are dominated by permanently attached erect faunal species that are likely to be sensitive to physical abrasion and disturbance. Typical species include *T. indivisa, S. elegans* and *A. digitatum*. Few mobile species were recorded during the DDV survey, one *Homarus gammarus* was recorded and it is expected the benthic echinoderms such as *Asterias rubens* will be present within the receptor group. MarLIN does not provide sensitivity assessments for the biotope complexes within this assessment or for *T. indivisa* which is a common species within two of the three biotopes. A sensitivity assessment was available for *A. digitatum* which contributes to a high proportion of similarity within benthic assemblages assigned to this biotope group (Budd, 2008a). MarLIN sensitivity assessments for other frequently observed species within the biotope such as *U. felina* (Jackson and Hiscock, 2008), *Metridium senile* (Hiscock and Wilson, 2007), *A. rubens* (Budd, 2008b), *Balanus crenatus* (White, 2004) and *N. ramosa* (Jackson, 2004) were all considered within the final sensitivity scores.

It is recognised that this habitat is a potential Annex I reef, however as stated previously, no reef features identified during the site specific survey work are a designating feature of a notified or designated SAC, nor do they overlap any current Areas of Search for Annex I habitats. Given the wider extent of the habitats which support these communities (as indicated by UKSeaMap 2010 data (McBreen *et al.*, 2011); Figure 8.3) and the resulting potential for a local supply of larvae, recovery of these communities following impact such as substratum loss is likely to occur. It should also be noted that introduction of a hard substrate onto an existing area of rocky substrate will lead to a relatively small change from baseline conditions than if hard substrate were added to an area of soft sediment, and the introduction of substrate will facilitate recolonisation.

<u>High Energy mixed substrate circalittoral communities</u>

These habitats are characterised by moderate wave exposure and strong tidal streams with a mixed substrate type of boulders, cobbles and pebbles interspersed with coarse gravel and sediment. The faunal community is predominately sessile erect species dominated by *F. foliacea*. Other typical species included *Alcyonidium diaphanum*, *A. digitatum* and *N. antennina* and the anemones *Cerianthus lloydii* and *U. felina*.

<u>Circalittoral mixed sediment communities</u>

Erect sessile fauna was rare across this receptor group and was predominately encrusting species and *Pomatoceros triqueter* on cobbles. However, a heterogenic mix of coarse sediment habitats ranging from stony to gravel substrate was common and a number of epifaunal species were recorded using drop down video and epibenthic beam trawls. Typical epifaunal species were the brittle stars *O. nigra* and *O. fragilis*, the squat lobster *M. rugosa*, the hermit crab *Pagurus bernhardus* and the cloaked crab *P. prideaux* and the star fish *Henricia oculata* and *Porania pulvillus*.

<u>Sublittoral algal dominated communities</u>

Habitats within this receptor group are exposed to strong wave events. Erect sessile species were absent from this receptor group with rocks being colonised by encrusting species and red coralline algal crusts. There was evidence of grazing on rock surfaces which corresponds to the presence of *E. esculentus* within the biotope. Further inshore within the infralittoral zone the kelp species *L. hyperborea* was common.

<u>Intertidal sediment communities</u>

The substrate is comprised of moderately sorted medium sands which supports an impoverished infaunal community. Low species richness and abundance is common in areas exposed to high wave energy. At the strandline the amphipod *T. saltator* was common.

Intertidal rocky communities

This receptor group is present to the south of the landfall location at the end of the sandy bay. Habitats in this zone have a substrate of bedrock ranging from the fringing sublittoral to upper littoral. There was clear zonation from the upper shore where there was a clear band of yellow and black lichens within the splash zone with a sparse distribution of the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. The barnacle and limpet community is dense in the mid-shore with *Littorina* spp. also present. Algal communities were varied in the mid-shore with more sheltered areas in the lee of vertical rocky outcrops dominated by the green algae *Ulva* sp., with more exposed rock pools full of red algae and fucoid species. Lower shore communities had a higher density of kelps and fucoids and rocks were colonised by encrusting red algae interspersed with areas of barnacle and limpet communities. All species are exposed to high wave energy and sediment scour.

8.3.3.3 Identification of Pressures

In addition to the pressures identified for assessment within this ES (Table 8-21) thermal radiation from subsea transmission cables was also considered. The Scottish Marine Renewables SEA did not identify thermal radiation as a potential pressure on benthic ecology from offshore renewable projects (Faber Maunsell & Metoc, 2007). It is considered that increases in temperatures around subsea cables would be "impossible" to detect above natural fluctuations in water temperature (BERR, 2008). Additionally, there is no evidence of chemical contamination within sediments along the Western Export Cable Route. As a result these pressures have been scoped out of the EIA.

| **Pressure** | **Causal Activities and Effect** |
|---|---|
| Construction Phase (and Decommissioning) | |
| Direct physical disturbance and temporary substratum loss | Habitat disturbance will arise through cable installation (either through trenching or rock dumping) along the length of the cable route. During anchoring of the installation vessel benthic habitats will be physically disturbed as a result of the anchor itself and the anchor chain. This will occur along the Western Export Cable Route during cable installation. |
| Increased suspended sediment | Increased suspended sediment will occur where sedimentary habitats are disturbed by anchoring, cable installation and installation of rock armouring. Due to the high energy tidal streams within the development area increased suspended sediment will be diluted quickly and may be carried significant distances from the Western Export Cable Corridor. |

| Pressure | Causal Activities and Effect |
|---|---|
| Introduction of Marine Non Native Species (MNNS) | Non-native species can be transported within ballast water of construction vessels, on the surface of vessels and platforms, or may have already colonised a structure if stored in the marine environment prior to transport to the site. The introduction of non-native species can change the biodiversity of the area with potential to cause secondary impacts on ecology and other users such as aquaculture. |
| Operational Phase | |
| Loss term substratum loss and colonisation of introduced substratum | Some sections of the Western Export Cable Route will be protected with rock armouring. The habitat within the direct footprint of the rock armouring will be lost for the duration of the project. Subsequent colonisation of introduced substrate will occur and any effects associated with substratum loss and colonisation will persist for the duration of the project. |
| Electromagnetic Fields | During electrical transmission there is potential for magnetic-B fields (and induced iE) to be produced around the export cable, this will dissipate rapidly with distance from the export cable. |
| Potential facilitation of the spread of Marine Non Native Species (MNNS) | Structures placed within the marine environment may provide “stepping stones” for the movement of MNNS. The introduction of MNNS can change the biodiversity of the area with potential to cause secondary impacts on ecology and other users such as aquaculture. |

Table 8.21 Summary of predicted pressures to be addressed in impact assessment at the Western Export Cable Route

## 8.3.4 Impact Assessment

The pressures identified during all phases of the project based on the Rochdale envelope parameters will be used to determine any potential effects on biotopes, habitats and species within the Western Export Cable Route (Table 8-22). This assessment will consider the magnitude of the pressure and the sensitivity of the receptor groups as described in the EIA methodology statement (Chapter 4).

### 8.3.4.1 Construction Phase Impacts

I. Direct physical disturbance and temporary substratum loss

Habitat disturbance will occur due to cable laying and protection (rock dumping or trenching). Trenching will result in the disturbance of sedimentary habitats. Across the Western Export Cable Route the seabed is made up of larger sediment fractions, with no areas of fine sand reported during either DDV survey or Geophysical survey. As a result, it is expected that large sediment fractions disturbed during trenching will re-settle quickly, particularly in areas of reduced tidal strength. Rock dumping will result in the detachment and mortality of sessile and slow moving fauna within the footprint of the cable protection, and a change in habitat type will result. The effect of changing habitat, long term substratum loss and recolonisation are assessed within operational phase impacts. Additional temporary impacts may occur if installation vessels anchor themselves to the seabed, however, anchoring may not occur if a dynamic positioning vessel is used during export cable installation.

These pressures will be geographically restricted to the immediate vicinity of the cable laying activities, and will occur once during construction. Rock dumping along the entire western export cable route will result in the loss of 0.17 $km^2$ of benthic habitat, representing the worst case scenario, however it is noted that there is likely to be a combination of cable protection measures utilised across the Western Export Cable Route, hence it is likely that this area is an overestimation, as it is unlikely that rock dumping would take place over the full length of the cable. Additionally the wider extent of habitat types present along the western export cable route indicates that the benthic communities found within them will not be affected on a local or regional scale. Therefore the magnitude of the overall impact will be **minor.**

<u>Circalittoral rock and boulder communities</u>
The dominant species within this receptor group, identified at the western end of the Western Export Cable Route, are sessile and protrude from the seabed. They are therefore vulnerable to physical disturbance associated with installation activities which will result in detachment or mortality of sessile invertebrates. Whilst they may be tolerant to physical disturbance occurring naturally during peak tidal movement and storm events faunal assemblages will be sensitive to heavy abrasion during construction. Based on this the receptor group has been assigned a **medium** sensitivity to physical abrasion. In addition the species are cable of recolonisation through larval settlement. The consequence of the pressure will be minor on this habitat as a whole, which is widely distributed, which is **not significant** in the context of the EIA regulations.

<u>High energy mixed substrate circalittoral communities</u>
Typical species associated with this receptor group, which was identified at three stations along the central section of the western export cable route to the south of the Rinns of Islay, are sessile and protrude from the seabed. The substrate type is likely to be subject to natural disturbance as a result of moving pebbles and cobbles during extreme storm events and strong tidal currents, therefore trenching activities are expected to result in only a minor, temporary change from baseline, which is likely to return to pre-disturbance state. Some species associated with this receptor group such as *A. digitatum* and *F. foliacea* are a robust species that will be resistant to a small level of physical disturbance associated with shifting substrata. Some species within the biotope have a high recovery potential as a result of pelagic larval phases in their lifecycle, *A. digitatum* and *N. antennina*. Other species may take longer to recover (MarLIN, 2006). Overall this receptor group has a **medium** sensitivity to this pressure.

This receptor group will recover following temporary disturbance. Species adjacent to any impacted areas will be unaffected and therefore promote recovery following rock dumping. The impact footprint will not affect a biologically significant proportion for this receptor group on a national or local scale. The consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

Circalittoral mixed sediment communities

This receptor group was the most prevalent receptor group recorded along the Western Export Cable Route and was predominately comprised of the high level biotope circalittoral mixed sediments. Within this receptor group dominant species associated with these habitats are generally more mobile. Sessile fauna that are likely to be vulnerable to direct physical disturbance was sparse within this receptor group. Highly mobile crustacean species will avoid the area during disturbance. Brittlestar species observed in within this receptor group are known to have regenerative properties and so may be able to regrowth following any damage from direct physical disturbance (Jackson, 2008). *H. oculata* and *P. pulvillus* are relatively robust species and will be tolerant of moderate physical disturbance (MarLIN, 2006). Overall due to the motility of benthic communities associated with this receptor group and the regenerative properties and tolerance of the less mobile species, sensitivity to direct physical disturbance will be **low**.

As this receptor group is highly tolerant of habitat disturbance, and given the highly localised geographical scale of the impact, the overall consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

Sublittoral algal dominated subtidal communities

Erect sessile fauna was absent from this receptor group possibly as a result of the exposure to high energy wave induced disturbance, as these communities are present on the eastern end of the Western Export Cable Route in the sublittoral zone within Laggan Bay. Encrusting organisms, coralline algae and kelp species within this receptor group are adapted to exist in areas with naturally high disturbance events (Tyler-Walters, 2007; 2008a; 2008b). The receptor group will therefore have a **medium** sensitivity to direct physical disturbance.

Sublittoral algal dominated communities will recover quickly following the cessation of construction operations such as trenching and vessel anchoring. Recolonisation of rock cable protection will also occur quickly. The pressure will be spatially restricted to the immediate vicinity of any installation activities and the biotopes associated with this receptor will therefore not be affected on a local or regional scale. The overall consequence of this pressure is minor which is **not significant** in the context of the EIA regulations.

Intertidal sediment communities

The biotopes within this receptor group, found to be present at the landfall location at the southern end of Laggan Bay are common within highly exposed bays. Regular disturbance from waves within Laggan Bay limits macrofaunal communities becoming established. The resultant impoverished community is able to recover rapidly from physical disturbance (Budd, 2008c). The sensitivity of this receptor group to direct physical disturbance is **low.**

Intertidal sediment communities will be affected by direct physical disturbance through trenching the Western Export Cable at landfall during installation and the presence of construction vehicles. Nonetheless impacts will be restricted to the landfall location around the western export cable route and so will not affect the benthic habitats and communities on a local or national scale. Furthermore, the impoverished community that exists at the landfall location will recover quickly. Therefore the consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

Intertidal rocky communities

This receptor group is comprised of nine biotopes, and was identified within the intertidal regions of the Western Export Cable Route. No direct physical disturbance will coincide with this receptor group. Therefore, there will be **no impact** on these habitats or species.

| Receptor Group | Sensitivity | Magnitude | Consequence | EIA Significance |
|---|---|---|---|---|
| Circalittoral rock and boulder communities | Medium | Minor | Minor | Not significant |
| High energy mixed substrate communities | Medium | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated communities | Medium | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | Minor | Minor | Not significant |
| Intertidal rocky communities | Medium | No impact | No Impact | Not significant |

Table 8.22 Impact assessment summary of direct physical disturbance

II. Increased suspended sediment and deposition

Along the eastern and western end of the Western Export Cable Route the substrate type is dominated by rock or mixed substrata with limited sedimentary habitats. Within the central section the habitats are comprised of mixed sediment. There is therefore some potential for suspension of sedimentary habitats. Where tidal streams are faster in shallower waters increased suspended sediment will be transported rapidly away from the Western Export Cable Route. Within the more sedimentary locations sediment in suspension will likely settle closer to the western export cable route. Within Laggan Bay where there is mixed substrate, suspended sediment will occur naturally during high energy storm events. The settlement distance is likely to be within Laggan Bay but will be more dependent on weather conditions than more offshore areas along the Western Export Cable Route. Geographic extent although variable will occur only at a local or regional scale. However, the pressure will occur only once for a short period of time and will represent only a minor variation from the baseline. Furthermore, upon completion of the construction operation habitat conditions will revert to pre-baseline conditions almost immediately. The overall magnitude of the pressure is therefore **minor**.

Circalittoral rock and boulder communities
During cable installation there may be a release of fine sediment during deposition of rock armouring. Species present within this receptor group are tolerant of high levels of scour associated with naturally occurring strong tidal streams. Therefore, the sensitivity of the receptor group to increased suspended sediment will be **low**.

At these location there is very little existing sedimentary habitats therefore increased suspended sediment will be limited. Increased suspended sediment will result in increased scour, for a short period of time in a highly localised area during construction. Due to the fast currents suspended sediment will disperse quickly and settle far from the construction location. The high tidal streams will result in a dilution effect and so settlement quantity will be low and not sufficient to impact on benthic communities within the wider region. Therefore, the overall consequence of this impact is minor which is **not significant** in the context of the EIA regulations.

High energy mixed substrate communities
Species associated with this receptor group have a high tolerance to scour due to adaptations that permit colonisation of highly dynamic environments. Biotopes within this receptor group will therefore have a **low** sensitivity to increased suspended sediment during construction.

As suspended sediment will be highly localised and will persist for over a short period of time with high dispersal and dilution effects the consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

Circalittoral mixed sediment communities
Shallower habitats within this receptor group are likely to be exposed to natural periods of increased suspended sediment. Passive filter or suspension feeders are likely to be more at risk during periods of increased suspended sediment and may suffer from blockage or increased energy expenditure on exposure. However, the most common suspension feeders within this receptor group *O. fragilis* and *O. nigra* are tolerant of increased suspended sediment (Jackson, 2008). While this has the potential to reduce the fitness of individuals all species will recover following installation. Other typical species such as *P. triqueter* and crustacea species are tolerant of increased suspended sediment (Riley & Ballerstedt, 2005). Therefore, the sensitivity of this receptor group to increased suspended sediment will be **low**.

Given the short term duration and localised impact area associated with this pressure the overall consequence will be minor which is **not significant** in the context of the EIA regulations.

Sublittoral algal dominated communities
No filter feeding species were recorded within this receptor group. In addition increased suspended sediment will occur naturally during extreme storm events

and therefore species present must be tolerant of intermittent increases in suspended sediment (Tyler-Walters, 2007; Tyler-Walters, 2008a). Species within these receptor groups will therefore have a **low** sensitivity to increased suspended sediment.

Therefore increased suspended sediment during installation will represent a small scale, temporary variation from the baseline. The overall consequence of the pressure will be minor which is **not significant** in the context of the EIA regulations.

Intertidal sediment communities

Increased suspended sediment occurs naturally during storm events when wave action results in suspension of beach sediments. Macrofaunal assemblages have adapted to tolerate disturbance and increased suspended sediment (Budd, 2008c). The sensitivity of the habitats and species within this receptor group are therefore **negligible**.

The intertidal sedimentary communities will be exposed to natural increases in suspended sediment during periods of increased wave energy. Therefore local, temporary increases in suspended sediment will not affect species present at the landfall location. Further, increased suspended sediment will be minimised by conducting construction operations at low tide. The overall consequence of the receptor group to the pressure will be negligible this is **not significant** in the context of the EIA regulations.

Intertidal rocky communities

Intertidal biotopes close to the landfall location may be exposed to increased suspended sediment during installation. All biotopes within this receptor group are regularly exposed to high energy wave action during storm events and thus intermittent increases in suspended sediment loads (Budd, 2008d; Hill, 2008; Tyler-Walters, 2008c). As a result of this high energy regime many of the associated species are ephemeral and have adapted high recovery rates. The sensitivity of these biotopes is therefore **low**.

The pressure will therefore be limited spatially and temporally and will not represent a significant variation from the baseline. Further, increased suspended sediment will be minimised by conducting construction operations at low tide. Therefore the overall consequence of the pressure will be minor which is **not significant** in the context of the EIS regulations.

| Receptor Group | Sensitivity | Magnitude | Consequence | EIA Significance |
|---|---|---|---|---|
| Circalittoral rock and boulder communities | Low | Minor | Minor | Not significant |
| High energy mixed substrate communities | Low | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated communities | Low | Minor | Minor | Not significant |

| | | | | |
|---|---|---|---|---|
| Intertidal sediment communities | Negligible | Minor | Negligible | Not significant |
| Intertidal rocky communities | Low | Minor | Minor | Not significant |

Table 8.23 Impact assessment summary of increased suspended sediment and deposition

III. Introduction of Marine Non Native Species

All receptor groups
MNNS pose a significant threat to biodiversity as they may have negative impacts on native species and threaten regional ecosystems; SNH reports a growing problem with MNNS in Scotland (SNH, 2011). Non-native species have the potential to be introduced in the local environment through the use of vessels and equipment that has been used in other parts of the world; this is a particular risk with the use of ballast water.

Fewer vessels are required for a shorter period of time during installation of the Western Export Cable Route compared to the Tidal Site. Nonetheless there is potential for introduction of non-natives through the presence of construction vessels and operation and maintenance vessels. It is likely that much of the day-to-day traffic would be from Port Ellen on Islay to site. Note that the use of local or UK-based installation vessels would limit the potential for introduction of non-native marine species.

This pressure has the potential to occur over a national spatial extent, on a permanent basis. Any changes could be irreversible and represent a significant variation from the baseline. This could lead to a high ranking magnitude of impact. However, this pressure is highly unlikely to occur and will be managed through strict adherence to an environmental management plan in accordance with various pieces of national and international legislation (IPIECA, 2010; IMO, 2011; Scottish Government, 2012b). As a result the impact is considered extremely unlikely to occur and to balance the scale of impact against the likelihood of impact occurring, a magnitude of **minor** is assigned.

Information on the sensitivity of the biotopes within the receptor groups is considered to be insufficient to accurately assign a sensitivity rating to this pressure as there is no precedent of introduction of non-native species into a similar species assemblage on which to base a sensitivity rating. Uncertainty within this assessment therefore relates to the type of organism that may be introduced, and its potential for survival in the local environment. Should a non-native species be introduced into the marine environment off the south west of Islay there is no guarantee that the species will be tolerant of the conditions and it is in fact more likely that the species will be unable to reproduce and initiate a local population. Where these conditions are met then the native populations may experience a reduction in numbers or a complete failure. Therefore noting the lack of any conservation designation applied to habitats along the western export cable route, but adopting the precautionary approach, the receptor sensitivity is defined as **low**. Thus the consequence of introduction of MNNS is minor, and **not significant** under EIA regulations, though the uncertainty in this assessment should be noted.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | EIA Significance |
|---|---|---|---|
| Low | Minor | Minor | Not Significant |

Table 8.24 Impact assessment summary of introduction of MNNS

8.3.4.2 Operation Phase Impacts

I. Long term substratum loss and colonisation of introduced substratum

Using the worst case scenario Western Export Cable Route will be surface laid and then protected by rock armouring from the Tidal Site to the landfall location. The cable will be rock dumped with graded inert rock with a median grain size of 65 mm. In line with the Rochdale principle the worst case scenario is assumed to be the installation of rock armouring for 21 km along the entire length of the export cable. The footprint of this impact will be approximately 8 m wide and involve the installation of 9,375 $m^3$ of graded rock. The geographical extent of this pressure is restricted to the immediate vicinity of the export cable equating to an area of 0.168 $km^2$. In reality it is likely that some sections of the cable will be trenched (or ploughed in) in areas of soft sediment or pinned to the seabed to prevent movement. These most likely scenarios have less of an impact on the seabed, however are difficult to quantify, hence the assessment has been based on worst case.

The area of seabed directly beneath the rock armour will be excluded as potential benthic habitat for the operational life of the development. Substrate type will have a minor or moderate variation from baseline conditions where the original habitat conditions are rocky or sedimentary respectively. For example, at the eastern and western ends of the Western Export Cable Route habitat change will be limited, as rock and mixed substrata habitats at these locations will have similar habitat characteristics as graded rock armouring. Within the deeper central area of the western export cable route where mixed sedimentary habitats are more prevalent substrate type will be changed to a rocky habitat. Given the highly restricted geographic extent of the pressure, and the area of existing similar habitats that will remain within the region (Figure 8.5) the overall impact magnitude will be **minor**.

Circalittoral rock and boulder communities

As stated above, under 'direct physical disturbance and temporary habitat loss', the receptor biotopes are considered to be highly intolerant of substratum loss due to the sessile nature of many characterising species. While species within this receptor group have a varied potential for recovery following substratum loss e.g. *T. indivisa* has brooded larvae which limits recovery potential (MarLIN, 2006), whereas *A. digitatum* has a planktonic larval phase which promotes fast colonisation, the change in habitat type from areas of bedrock, boulders and cobbles to a more homogeneous substrate of graded rock will provide a similarly hard substrate for recolonisation of benthic organisms (MarLIN, 2006). Furthermore, due to the small area of habitat lost relative to the area of similar habitat in the region, it is considered that recovery of many of the characterising species will be likely, as directly adjacent to the rock armouring similar benthic communities will remain, providing a local supply of larvae and the allow immigration of adults of more mobile species. As previously stated no sensitivity assessments are available for the biotopes within this receptor group. However, based on the assessments of characterising or frequently recorded species the receptor group has been assigned a sensitivity of **medium** to loss of original habitat. The overall consequence of the pressure will be minor which is **not significant** in the context of the EIA regulations.

High energy mixed substrate communities

Habitats within the direct footprint of the rock armouring will change from variable mixed substrata to homogeneous graded rock. Species such as *N. antennina* and *F. foliacea* have a short larval duration and the latter is slow growing, however species such as *A. diaphanum, N. antennina* and *A. digitatum* have longer pelagic larval phases and can colonise habitats quickly following any impact (MarLIN, 2006). Furthermore, since directly adjacent to the rock armouring similar benthic communities will remain these, recovery is expected to be quick for these species (MarLIN, 2006). This receptor group therefore has **medium** sensitivity to substratum loss.

The introduced substrate will represent only a small change from the baseline with lower levels of small pebbles and gravel present within the area of rock armouring. In addition, the area of impact will not significantly reduce the natural range of the biotopes within the receptor group. Therefore, the overall consequence of the pressure will be minor which is **not significant** in the context of the EIA regulations.

Circalittoral mixed sediment communities

Very few sessile species were recorded within this biotope with larger motile species more common. Many of the receptor species will be able to avoid the area during construction, and less motile species such as *O. fragilis* have high regeneration potential and recovery ability (Jackson, 2008). The highly localised long term shift from mixed sedimentary substrate to homogeneous graded rock substrate will not affect the distribution of species characteristic of this receptor group, as motile crustacea and echinoderms will adapt to the introduced substrata. For sessile species such as *F. foliacea* and *N. antennina* available hard surfaces will be prevalent for recolonisation and *P. triqueter* will colonise surfaces of introduced rock. Brittlestars, *H. oculata*, *P. pulvillus* and hermit crabs are common on a variety of habitat types around the UK ranging from sedimentary habitats to bedrock. The addition of hard substrate will not therefore reduce the habitat available for the species to colonise, and the benthic community is likely to recover quickly to this pressure. The sensitivity of this receptor group to habitat change is therefore **medium**. The overall consequence of the pressure will be minor which is **not significant** in the context of the EIA regulations.

Sublittoral algal dominated communities

The introduced substrata will be similar to the naturally occurring hard boulder and cobble substrate associated with this receptor group. Many of the species associated with this receptor group have adapted to recover quickly or moderately quickly to disturbance (Tyler-Walters, 2007; 2008a; 2008b). Furthermore it is expected that the introduced hard substrata will be sufficiently stable for colonisation by algal and coralline crusts. MarLIN report that where there is breeding colonies of species typically associated with this biotope adjacent to areas of disturbance recolonisation to baseline conditions could occur as quickly as 6 months. Species of encrusting bryozoans such as *Parasmittina trispinosa* are good initial colonisers of hard substrata capable of rapid growth. *E. esculentus* also exhibits fast recovery potential and is a mobile species that will quickly move into an area following colonisation by encrusting bryozoans and macro algae (Tyler-Walters, 2007; 2008b). *L. hyperborea* has a medium recovery potential and may take longer to reach baseline conditions (Tyler-Walters, 2007; 2008a). Since adjacent habitats will be relatively undisturbed recolonisation is expected to occur quickly. Therefore this receptor group will have a **medium** sensitivity to loss of original habitat, and the overall consequence of this pressure is minor which is **not significant** in the context of the EIA regulations.

Intertidal sediment communities

The Western Export Cable Route will be trenched and backfilled within areas of intertidal sediment communities. Therefore there will be no habitat change or introduction of new substrata. Therefore, there will be **no impact** on these habitats or species.

Intertidal rocky communities

There will be no direct overlap with intertidal rocky communities and the Western Export Cable Route. Therefore, there will be **no impact** on these habitats or species.

| **Receptor Group** | **Sensitivity** | **Magnitude** | **Consequence** | **EIA Significance** |
|---|---|---|---|---|
| Circalittoral rock and boulder communities | Medium | Minor | Minor | Not significant |
| High energy mixed substrate communities | Medium | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Medium | Minor | Minor | Not significant |
| Sublittoral algal dominated communities | Medium | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | No impact | No Impact | Not significant |
| Intertidal rocky communities | Medium | No impact | No Impact | Not significant |

Table 8.25 Impact assessment summary of long term substratum loss and recolonisation

II. Electromagnetic fields

The Western Export Cable Route from the Tidal Site to the landfall location at Kintra, Islay, will be comprised of multiple 33 kV 3-core AC cable or a single 132 kV 3-core AC cable. Electric fields produced during transmission will likely be shielded by manufacturers armouring around the cable. However, there is potential for magnetic B-fields and induced E-fields to be produced during transmission.

Based on the sparse empirical evidence including field measurements and modelling magnetic fields produced by cable similar in size to those proposed for the project magnetic fields are likely to dissipate quickly within metres of the cable surface (BOEMRE, 2011; Faber Maunsell & Metoc, 2007; MORL, 2012). Further, the earth's geomagnetic field is estimated to be between 48 and 50 μT, this is greater than reported values associated with offshore AC cabling used for subsea energy transmission.

Induced electric field strength is dependent on a number of site specific characteristics such as orientation and speed of adjacent water flow and the orientation and bundling of cables. Reports provide indicative induced field strengths of 91.25 μV/m for 132 kV cables (CMACS, 2003) and 2.5 μV/m for 33 kV cables (Gill *et al.*, 2005). It is estimated that induced E-field will reduce rapidly to approximately 10 μV/m at 8 m.

EMF's will have a highly localised geographical extent that will occur frequently over the life time of the project. The pressure represents a minor variation from baseline conditions that are immediately reversible upon cessation of energy transmission. The overall magnitude of the pressure resulting from EMF's will be **minor**.

<u>Circalittoral rock and boulder communities</u>
Studies have identified crustacean species including European Lobster (*H. gammarus*) (Bochert and Zettler, 2004), crabs and shrimps as potentially sensitive to magnetic fields around electrical cables (Gill *et al.*, 2005). Evidence suggests that this will cause localised behavioural effects rather than an increase to mortality. as no effect, was found on the survival of the species exposed to magnetic fields (Bochert and Zettler, 2004).The sensitivity to electromagnetic field of benthic species associated with these receptor groups is considered **low**.
There is the potential for some crustacean species to occur within this receptor group. *H. gammarus* and *Cancer pagurus* are the most likely species to be present within the rocky and bedrock habitat observed. The pressure may result in behavioural response but is unlikely to result in increased mortality. Any impacts will occur at a localised scale. As the area is not considered a particularly important resource for crustacean species EMF's will not result in an impact on a local or regional scale. The overall consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

<u>High energy mixed substrate communities</u>
No species observed within habitats associated with this receptor group are known to be sensitive to electromagnetic fields. Crustacean species particularly European lobster may be present within these areas (Gill *et al.*, 2005). Therefore this receptor group is expected to have a **low** sensitivity to electromagnetic fields produced around the export cable.

Almost all species observed within this receptor group were sessile and there is no evidence to suggest they will be sensitive to EMF's. The presence of some crustacean and molluscs in the area is possible and they may exhibit behavioural effects in response to EMF's. However, the area is not an important resource for crustacea or mollusc species and any behavioural effects will occur at such a small spatial scale that there is no risk at the population level. Therefore the overall consequence of this pressure is minor which is **not significant** in the context of the EIA regulations.

Circalittoral mixed sediment communities

Crustacea species are common within this receptor group. Whilst there is the potential for behavioural responses to be evoked in these species (Gill *et al.*, 2005) there is no evidence of any reduced fitness or increased mortality as a result of exposure to magnetic fields (Bochert and Zettler, 2004). Therefore species within this receptor group are considered to have a **low** sensitivity to electromagnetic fields.

Crustacea species were observed within this receptor group although not in dense aggregations. This may evoke behavioural responses during periods of electrical transmissions. Any effects will be highly localised and will not result in any population level effects. The overall consequence of the pressure will be minor which is **not significant** in the context of the EIA regulations.

Sublittoral algal dominated communities

No species were observed within this receptor groups that are likely to be sensitive to electromagnetic fields. Whilst some smaller crustacean might be present effects from EMF will be limited. This receptor group will have **low** sensitivity to EMF induced effects.

If any crustacean or mollusc species does occur in the vicinity of the export cable they will not occur in aggregations that would be required to result in a population level effect. Therefore, the overall consequence of this pressure will be minor which is **not significant** in the context of the EIA regulations.

Intertidal sediment communities

There was no species observed that have been reported as being sensitive to electromagnetic fields. However, during high tides crustacean species may be present along the Western Export Cable Route. However, distribution of these species is likely to be limited due to the highly wave exposed environment. Therefore, this receptor group is expected to have **low** sensitivity to this pressure.

Due to the impoverished community, the limited spatial extent and the reduced exposure time due to changing tides the overall consequence of this impact will be minor which is **not significant** in the context of the EIA regulations.

Intertidal rocky communities

Intertidal molluscs were present at the rocky shore, whilst there is no evidence to suggest that they will be affected by EMF's they may be able to detect fields associated with the export cable. These species lie to the south of the Western Export Cable Route and are likely to be exposed during low tides, therefore the potential for these species to interact with any EMF's are limited. Therefore, this receptor group is expected to have a **negligible** sensitivity to this pressure.

Reports on EMF's suggest that field strengths will dissipate in a non-linear relationship with distance (Faber Maunsell & Metoc, 2007; Gill *et al.*, 2005; MORL, 2012). Therefore, impacts within the intertidal zone will be limited due to the distance from the source. Impacts on species within the rocky intertidal communities will be negligible which is **not significant** in the context of the EIA regulations.

| Receptor Group | Sensitivity | Magnitude | Consequence | EIA Significance |
|---|---|---|---|---|
| Circalittoral rock and boulder communities | Low | Minor | Minor | Not significant |
| High energy mixed substrate communities | Low | Minor | Minor | Not significant |

| Receptor Group | Sensitivity | Magnitude | Consequence | EIA Significance |
|---|---|---|---|---|
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated communities | Low | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | Minor | Minor | Not significant |
| Intertidal rocky communities | Negligible | Minor | Negligible | Not significant |

Table 8.26 Impact assessment summary of electromagnetic field effects

III. Facilitation of the spread of Marine Non Native Species

As stated previously in Construction Phase impacts, MNNS pose a significant threat to biodiversity as they may have negative impacts on native species and threaten regional ecosystems; SNH reports a growing problem with MNNS in Scotland (SNH, 2011). Non-native species have the potential to be introduced in the local environment through the use of vessels and equipment that has been used in other parts of the world; this is a particular risk with the use of ballast water.

Structures placed in the marine environment may also facilitate the spread on MNNS through a "stepping stone" effect. Therefore all biotopes along the Western Export Cable Route could be exposed to this throughout the duration of the project. This pressure has the potential to occur over a national spatial extent, on a permanent basis, and any changes could be irreversible and represent a significant variation from the baseline, which could lead to a high ranking magnitude of impact. However, this pressure is highly unlikely to occur and will be managed through strict adherence to an environmental management plan in accordance with various pieces of national and international legislation (IPIECA, 2010; IMO, 2011; Scottish Government, 2012b). As a result the impact is considered extremely unlikely to occur and to balance the scale of impact against the likelihood of impact occurring, a magnitude of **minor** is assigned.

All receptor groups

While information on the sensitivity of the biotopes identified along the western Export Cable Route is considered to be insufficient to accurately assign a sensitivity rating to this pressure (as there is no precedent of introduction of non-native species into a similar species assemblage on which to base sensitivity rating), and this assessment is subject to large uncertainty relating to the type of organism which could be introduced, it is recognised that should a non-native species be introduced there is no guarantee that the species will be tolerant of the conditions and it is in fact more likely that the species will be unable to reproduce and initiate a local population. Therefore the assessment considers all biotopes to have **low** sensitivity to colonisation by MNNS. The consequence of introduction of MNNS is minor, and **not significan**t under EIA regulations, though the uncertainty in this assessment should be noted.

| Receptor Group | Sensitivity | Magnitude | Consequence | EIA Significance |
|---|---|---|---|---|
| All receptor groups | Low | Minor | Minor | Not significant |

Table 8.27 Impact assessment summary of facilitation of the spread of MNNS

8.3.4.3 Decommissioning

The life span of the project will be 25 years. Decommissioning techniques will be agreed with the regulator at the time of decommissioning and will consider the best environmental practice and technologies available at the time. It is assumed that in accordance with current legislation and guidance (Energy Act 2004 and OSPAR Decision 98/3) Surface laid cables will be removed. Cables that are buried in the seabed or under rock armouring will be left *in-situ*. Leaving cables in-situ will reduce disturbance to the seabed during decommissioning. Impacts along the western export cable route will therefore be minimal during decommissioning. The impacts resulting from decommissioning activities are expected to be equivalent (or less) than impacts arising during construction.

8.3.5 Mitigation

No specific mitigation measures have been identified as being necessary during the construction, operation and decommissioning phases of the Project at the Western Export Cable Route. Standard best practice for offshore construction (pollution prevention plans, environmental management plan) will reduce the likelihood of accidental contamination, and utilising modern methods of antifouling are encouraged. In addition, ensuring all vessels adhere to all relevant guidance regarding ballast water (IPIECA, 2010; IMO, 2011; Scottish Government, 2012b), is strongly advised in order to minimise risk of introduction and transfer of non-native marine species.

8.3.6 Cumulative Assessment

DPME has in consultation with Marine Scotland identified a list of other projects which together with the Project may result in potential cumulative impacts. The full list of these projects including details of their status at the time of the EIA and a map showing their location is provided in Chapter 4. From a benthic ecology perspective it is considered that none of these projects are likely to interact with the Islay Tidal Energy Project and result in cumulative impacts.

8.3.7 Summary and conclusions – Western Export Cable Route

Biotopes identified during characterisation surveys are common throughout the west of Scotland and in some cases around the UK where there are similar environmental conditions. Within the region previous survey work and the predictive mapping project UKSeaMap 2010 (McBreen *et al.*, 2011) indicate that the biotopes assigned using the survey data are not restricted to the survey area. The habitats and associated species are widely distributed throughout the region. The footprint of the proposed project therefore represents a small proportion of the habitats and species natural range.

Biotopes found at the western end of the Western Export Cable Route may represent examples of Annex I habitats as listed under the European Habitats Directive (Irving, 2008). No UKBAP species were recorded during the DDV survey of the Site or Export Cable Route Survey Area, and no PMF or OSPAR habitats or species have been recorded either. Reef habitats may represent those listed under international protection mechanisms; however, the areas do not represent outstanding examples of these habitats and are widespread in the waters west of Islay.

An assessment of potential pressures relevant to benthic ecology was carried out for the construction, operation and maintenance and decommissioning phases of the Western Export Cable Route for the Project. This assessment identified a number of key pressures, including loss of habitat and associated species through direct physical impact and substratum loss (both temporarily during construction and installation, and for the operational life of the project), introduction of MNNS, smothering, hydrodynamic change, contamination and habitat change.

The area of seabed habitat which will be impacted by the Western Export Cable Route is considered to be very small, and the habitat is represented widely across west and south west Scotland. The biotopes present vary in sensitivity to pressures that are likely to occur during construction, operation and maintenance and decommissioning of the project. Many of the species present are sedentary and so are vulnerable to many of the pressures. However, in an inherently high energy environment such as a tidal energy site, it is likely that there is frequent movement of bounders, and associated habitat disturbance leading to continual successional development. The quick recovery times of associated species and limited geographical extent relative to the natural range of the affected biotopes mean that the overall effects of the proposed development will not adversely affect the distribution of benthic ecology receptors in the region.

| **Impact** | **Sensitivity of Receptor** | **Magnitude of Impact** | **Consequence** | **Significance** |
|---|---|---|---|---|
| Construction (and decommissioning) | | | | |
| Direct physical disturbance and temporary substratum loss | | | | |
| Circalittoral rock and boulder communities | Medium | Minor | Minor | Not significant |

| Impact | Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|---|
| High energy mixed substrate circalittoral communities | Medium | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated subtidal communities | Medium | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | Minor | Minor | Not significant |
| Intertidal rocky communities | Medium | No impact | No impact | Not significant |
| Increased suspended sediment and deposition | | | | |
| Circalittoral rock and boulder communities | Low | Minor | Minor | Not significant |
| High energy mixed substrate circalittoral communities | Low | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated subtidal communities | Low | Minor | Minor | Not significant |
| Intertidal sediment communities | Negligible | Minor | Negligible | Not significant |
| Intertidal rocky communities | Low | Minor | Minor | Not significant |
| Introduction of Marine Non Native Species (MNNS) | | | | |
| All receptor groups | Low | Minor | Minor | Not significant |
| Operational Phase | | | | |
| Long term substratum loss and colonisation of introduced substratum | | | | |
| Circalittoral rock and boulder communities | Medium | Minor | Minor | Not significant |

| Impact | Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|---|
| High energy mixed substrate circalittoral communities | Medium | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Medium | Minor | Minor | Not significant |
| Sublittoral algal dominated subtidal communities | Medium | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | No impact | No impact | Not significant |
| Intertidal rocky communities | Medium | No impact | No Impact | Not significant |
| Electromagnetic fields | | | | |
| Circalittoral rock and boulder communities | Low | Minor | Minor | Not significant |
| High energy mixed substrate circalittoral communities | Low | Minor | Minor | Not significant |
| Circalittoral mixed sediment communities | Low | Minor | Minor | Not significant |
| Sublittoral algal dominated subtidal communities | Low | Minor | Minor | Not significant |
| Intertidal sediment communities | Low | Minor | Minor | Not significant |
| Intertidal rocky communities | Negligible | Minor | Negligible | Not significant |
| Facilitation of the spread of Marine Non Native Species | | | | |
| All receptor groups | Low | Minor | Minor | Not significant |

Table 8.28 Summary of the Impact Assessment of the Western Export Cable Route

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WESTISLAY TIDAL

# ENERGY PARK

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## Contents

# 9. Otters

## 9.1 Introduction

This section describes the baseline conditions and impact assessments for otters (*Lutra lutra*) in the intertidal zone of the West Islay Tidal Energy Project ("the Project") export cable route landfall site at Kintra and 200m Buffer Zone (see Figure 9.1).

Caledonian Conservation Ltd was commissioned to carry out baseline field surveys and an assessment of the potential effects of the proposed development on otters at the export cable landfall site at Kintra on Islay. Field surveys were completed by Stuart Spray (Associate Ecologist), and this assessment was undertaken by Chris Cathrine (Director).

This chapter includes the following sections:

- Assessment Parameters;
- Policy and Guidance;
- Assessment Methodology;
- Intertidal Otter Baseline – a description of the otter ecology of the site based on the results of desk study, consultations and surveys;
- Data Limitations;
- Impact Assessment;
- Cumulative Assessment;
- Summary and Conclusions; and
- References.

This chapter should be read in conjunction with Chapter 5 – Project Description

## 9.2 Assessment Parameters

In line with the Rochdale Envelope approach, this assessment considers the maximum ('worst case') and most likely project parameters, based on the export cable landfall site of proposed project (See Figure 9.1).

As much detail as is feasibly possible needs to be provided in the consent application to allow a robust and informed assessment by regulators and advisors as some parameters require detailed site investigation which can only commence following consent being granted. Thus the detail of some elements may remain unknown at the consent application stage (The Crown Estate, 2012 [*Ref. 9.1*]).

DP Marine Energy Ltd (DPME) proposes to undertake an export cable feasibility study following consent of the proposed Project. This study will assess the environmental implications, practical limitations and financial feasibility of various export cable design parameters to determine the final design envelope. To inform the environmental impact assessment infrastructure used in current marine renewable projects has been reviewed and the most likely technology appropriate for the proposed project identified. Based on this review the environmental impact assessment process has identified a design envelope that represents the realistic worst case scenario in accordance with the Rochdale Envelope approach (Table 9.1).

| Design Parameter | Rochdale Parameter | Pressures on Otters | Impact |
|---|---|---|---|
| Installation | | | |
| Laying of Export Cable in the intertidal zone at landfall at Kintra, Islay. | 56.4 m of multiple 33 kV double armoured cable or a single 132 kV double armoured cable, undergrounded (using temporary trench) in the intertidal zone at the landfall site at Kintra, Islay. | Direct and indirect disturbance. | Temporary disturbance in vicinity of intertidal zone during installation. |

Table 9.1 Rochdale Envelope Parameters related to intertidal otter impacts

## 9.3 Policy and Guidance

The relevant legislative frameworks covering marine ecology are common to all environmental receptors considered within the Environmental Impact Assessment (EIA) process (Chapter 2). In addition, the following guidance documents have been considered in assessing the ecological effects associated with the Project on the otters:

- Guidelines for Ecological Impact Assessment (EcIA) in Britain and Ireland (Marine and Coastal) (IEEM, 2010 *(Ref. 9.2)*);
- Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006 *(Ref. 9.3)*);
- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland (EMEC and Xodus AURORA, 2010 *(Ref. 9.4)*);
- Pentland Firth and Orkney waters; Enabling Actions report. Rochdale Envelope Workshop – Wave and Tidal, 2012 (Ref. 9.1); and
- Argyll and Bute Biodiversity Action Plan 2010-2015 *(Ref. 9.5)*.
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (*Habitats Directive*)
- The Conservation (Natural Habitats, &c.) Regulations 1994
- Electricity works (EIA) (Scotland) regulations 2000
- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000,

- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008.
- Wildlife and Countryside Act 1981 (as amended)
- Nature conservation (Scotland) Act 2004
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007
- Wildlife and Natural Environment (Scotland) Act 2011
- Scottish Executive Planning Advice Note 58: Environmental Impact Assessment
- Scottish Executive Planning Advice Note 45 (revised 2002): Renewable Energy Technologies
- Scottish Executive National Planning Policy Guideline 6 (revised 2000): Renewable Energy Development
- Scottish Planning Policy 6: Renewable Energy

## 9.4 Assessment Methodology

9.4.1 Stakeholder Engagement

DPME first met with the regulator and key statutory consultees in 2008. Consultation on various aspects of the project has continued as more information on the design parameters has become available. Advice received from consultees has been incorporated into all stages of the EIA process to minimise consenting risk associated with the Project. A summary of the stakeholder responses relevant to the intertidal otter assessment of the site and how these points have been resolved or incorporated into the final EIA are provided in Table 9.2 (Full details are provided in Scoping Opinion.

| Key Concerns | EIA Actions |
|---|---|
| Scottish Natural Heritage | |
| The environmental assessment must be EIA and HRA compliant. | The EIA and HRA were conducted in compliance with all statutory legislative frameworks and with reference to relevant guidance documents (Chapter 2). |
| Include details of the proposed subsea cable installation methods | Details of subsea cable installation methods are described in Chapter 5: Project Description. |
| Use the cable route surveys to determine installation options and methodologies along both cable routes | Full details of the subsea cable design parameters are presented in Chapter 5: Project Description. |
| Present justification in the ES for the cable installation methodology | The justification of the final export cable design parameters are presented in Chapter 5: Project Description. |
| Advised against the use of matrix assessments for both EIA and HRA issues. | The EIA process was developed with reference to a number of guidance documents and is based on published scientific research and expert judgement. |
| Consider European Protected Species and specifically disturbance to otters. | Otters are considered in this Chapter. |

| Key Concerns | EIA Actions |
| --- | --- |
| Advised that otters are a European Protected Species, and further information on distribution and usage of the shore is required. An otter survey should therefore be undertaken and impacts assessed. | An otter survey was completed following standard methodology, and impacts assessed as described in this Chapter. The otter survey described in this Chapter included the intertidal zone of the export cable landfall site at Kintra on Islay. |
| Include Environmental mitigation measures. | Mitigation measures to reduce residual impacts have been incorporated into the project design. |

Table 9.2: Summary of stakeholder responses relevant to intertidal otter assessment

9.4.2 Area of Assessment

The otter survey included the intertidal zone at the export cable landfall site at Kintra on Islay, and included a 200m Buffer Zone (See Figure 9.1).

9.4.3 Desk-based Review

Data requests for information concerning otters within 1km of the export cable landfall site at Kintra were made with SNH, Argyll and Bute Council Biodiversity Officer and Islay Natural History Trust. No otter data was supplied by any of these organisations.

9.4.4 Field Survey

A full otter survey was conducted on 15th and 16th September 2012, following standard methodology and using an appropriate field guide (Bang and Dahlstrøm 2006 *(Ref. 9.6)*; Chanin, P. 2003a *(Ref. 9.7)*; Chanin, P. 2003b *(Ref. 9.8)*). Field signs include:

- Holts – below ground resting places;
- Couches – above ground resting places;
- Prints; and
- Spraints – faeces used as territorial markers, with a characteristic sweet odour.

Any sightings or signs of otters were to be noted on 1:10,000 scale maps and recorded using a handheld GPS unit.

9.4.5 Impact Assessment Methodology

The EIA process and methodology are described in detail in Chapter 4, however, each assessment is required to develop its own criteria for sensitivity of receptor and magnitude of impact, since the definition of these will vary between different topics. For otters the significance criteria in this section is based on the methodology described in Chapter 4 but the sensitivity of receptor and magnitude of impact are described in Table 9.3 and 9.4 respectively. In addition, reversibility of effects is also considered (See Table 9.5).

The approach taken to the assessment of ecological impacts follows the guidance produced by the Institute of Ecology and Environmental Management (Ref. 9.2; Ref. 9.3). These guidelines set out the process for assessment through the following stages:

- Identification of Valued Ecological Receptors (VERs) (the ecological components of highest value present at a site.);
- Determining the nature conservation value (sensitivity) of the VERs present within the zone of influence that may be affected by the development;
- Identifying the potential effects based on the nature of the construction, operation and decommissioning of the proposed development;
- Determining the magnitude of the impacts including consideration of the sensitivity of the receptor and the duration and reversibility of the effect;
- Determining the significance of the impacts based on the interaction between the effect magnitude/duration, and the nature conservation value and the likelihood of the effect occurring;
- Identifying mitigation measures required to address significant adverse effects;
- Determining the residual impact significance after the effects of mitigation have been considered, including a description of any legal and policy consequences; and
- Identification of any monitoring requirements.

The assessment process involves identifying VERs. These ecological receptors and their 'Sensitivity' are determined by the criteria defined in Table 9.3. It should be noted that these criteria are intended as a guide and are not definitive. Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example a site designated as a Special Area of Conservation under the Habitats Directive is implicitly of European (i.e. international) importance – and so classified as of 'Very high' sensitivity. Professional judgement is important when attributing a value level to a particular species or individual habitat. In these cases, reference has also been made to national guidelines for the selection of Sites of Special Scientific Interest (SSSI) in order to determine which level of significance should be applied (Nature Conservancy Council, 1989 *(Ref. 9.9)*). Social and economic factors are also considered when valuing receptors, if appropriate.

| Sensitivity Level | Examples |
|---|---|
| Very high | An internationally designated site, candidate site, or an area meeting the criteria for an international designation (e.g. Special Area of Conservation [SAC]).<br>Large areas of priority habitat listed under Annex I of the Habitats Directive, and smaller areas of such a habitat that are essential to maintain the viability of that ecological resource.<br>A regularly occurring, nationally significant population of any internationally |

| Sensitivity Level | Examples |
|---|---|
| | important species, listed under Annex II of the Habitats Directive. |
| High | A nationally designated site, or area meeting criteria for national level designations (e.g. Site of Special Scientific Interest [SSSI]).<br>Significant extents of a priority habitat identified in the UKBAP, or smaller areas which are essential to maintain the viability of that ecological resource.<br>A regularly occurring, regionally significant population of any nationally important species listed as a UK BAP priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act or Annex II of the Habitats Directive. |
| Medium | Viable areas of key semi-natural habitat identified in the UKBAP.<br>A regularly occurring, locally significant population of any nationally important species listed as a UK BAP priority species and Species listed under Schedule 5 of the Wildlife and Countryside Act or Annex II of the Habitats Directive.<br>Sites which exceed the local authority-level designations but fall short of SSSI selection guidelines, including areas of semi-natural woodland exceeding 0.25ha. |
| Low | Areas of semi-natural ancient woodland smaller than 0.25ha.<br>Sites of Importance for Nature Conservation or equivalent sites selected on local authority criteria.<br>Local Nature Reserves.<br>Other species of conservation concern, including species listed under the Local BAP (LBAP).<br>Areas of habitat or species considered to appreciably enrich the ecological resource within the local context e.g. species-rich flushes or hedgerows. |
| Negligible | All other species and habitats that are widespread and common and which are not present in locally, regionally or nationally important numbers or habitats which are considered to be of poor ecological value (e.g. arable farmland). |

Table 9.3: Approach to Identifying Sensitivity for Ecological Receptors.

Effects on VERs are judged in terms of magnitude and duration (Regini, 2000 *(Ref. 9.10)*).

Magnitude is determined on a quantitative basis where possible. This may relate to the area of habitat lost to the development footprint in the case of a habitat receptor, or predicted loss of individuals in the case of a population of a particular species of animal. Magnitude is assessed using the five categories detailed in Table 9.4.

| Magnitude | Description |
|---|---|
| Severe | Total loss or very major alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes would be fundamentally changed and may be lost from the site altogether.<br><br>Guide: <20% of population/habitat remains |

| Magnitude | Description |
|---|---|
| Major | Major loss or major alteration to key elements / features of the baseline conditions such that the post development character / composition/attributes would be fundamentally changed.<br><br>Guide: 20-80% of population/habitat lost |
| Moderate | Loss or alteration to one or more key elements / features of the baseline conditions such that post development character / composition / attributes would be partially changed.<br><br>Guide: 5-20% of population/habitat lost |
| Minor | Minor shift away from baseline conditions. Change arising from the loss / alteration would be discernible but the underlying character/composition/attributes would be similar to pre-development circumstances/patterns.<br><br>Guide: 1-5% of population/habitat lost |
| Negligible | Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation.<br><br>Guide: < 1% population/habitat lost |

Table 9.4: Criteria for Describing Magnitude (adapted from Percival 2007 *(Ref. 9.11)*)

In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, spatial magnitude is assessed in respect of an appropriate scale depending on the value of the receptor.

Reversibility is defined by considering the duration of the impact. This is the time for which the impact is expected to last before recovery – i.e. return to pre-construction baseline conditions (see Table 9.5).

| Reversibility | Definition |
|---|---|
| Irreversible | Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need >25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions can be termed very long term effects) |
| Reversible | Effects that recover over the lifetime of the development, either naturally or as a result of mitigation or compensation. Duration of revisable effects can be categorised as below:<br>Long term (15 - 25 years)<br>Medium term (5 – 15 years)<br>Short term (up to 5 years) |

Table 9.5: Criteria for Describing Reversibility of Effects

Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is used to assess duration, where such information is available.

Magnitude, reversibility and sensitivity are then considered alongside proposed mitigation, and the consequence of the effect determined. The consequence and significance of any effect on a VER is assessed using the criteria in Table 9.6, which is based upon Institute for Ecological and Environmental Management (IEEM) guidelines (Ref. 9.12). The concept of 'integrity' in this context refers to sustained coherence of ecological structure and function of a VER, and includes consideration of both temporal and spatial factors. The 2006 IEEM guidelines use only two categories: "significant" or "not significant". In assessing whether an impact is significant, the concept of "ecological integrity" is a guiding principle. This concept can be applied to both designated sites (for example a SSSI) and to defined populations (for example a local red squirrel population). This concept underpins much of the European legislation in relation to nature conservation. It is to be noted that there may be positive effects on VERs as a result of development and mitigation, as well as negative.

| Consequence of Effect | Criteria |
|---|---|
| Major Negative | The change is likely to cause an adverse effect on the integrity of a VER. |
| Moderate Negative | The change is likely to cause an adverse effect which may affect the integrity of a VER in the short-term. |
| Minor Negative | The change adversely affects the VER, but there will probably be no effect on its integrity. |
| Negligible | No effect on the VER, or one so small it certainly will not affect the integrity. |
| Positive | The change is likely to benefit the VER. |

Table 9.6: Consequence of Ecological Effects.

## 9.5 Intertidal Otter Baseline

No evidence of an otter holt was recorded during the course of the survey. However, an otter spraint was recorded outside a rabbit burrow on the bank of Cornabus Burn just after it passed through a culvert next to the grave yard at grid reference NR 3440 4555 (3.8km south east of the Kintra landfall site), during surveys in the wider area. This confirms that otters are present in the area.

It should also be noted that the Hebrides offer a stronghold for otters and the coastal waters of Islay represented excellent foraging habitat for the species (Strachan, 2007 (Ref. 9.12)). Therefore, otters may use the intertidal zone for foraging on occasion even if they are not resident.

## 9.6 Data Limitations

The field survey was timed to take place after it had been dry for over two days to ensure that field signs had not been washed away by heavy rain or high water levels prior or during the visit. These optimal weather requirements were met for this survey, and therefore no specific data limitations have been identified as part of this assessment.

## 9.7 Impact Assessment

9.7.1 Introduction

Otters are listed under Annex II of the Habitats Directive, Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), and are included as a priority species in both the UK Biodiversity Action Plan and Argyll and Bute Local Biodiversity Action Plan. The site offers foraging habitat for a regionally important population of this species [Ref. 9.13]. Therefore, otters are considered to be a VER of **High sensitivity**.

This section provides an assessment of the potential effects of the development with specific reference to how they may affect otters. Effects are assessed for the construction, operation and decommissioning phases of the development.

9.7.2 Construction Phase Impacts

Although no signs of otter were found during surveys, the coast around Islay offers excellent foraging habitat for this species. Therefore, although otters were not found to be resident within the survey area, they may still make use of this area on occasion.

Increased noise, increased ground vibrations, vehicle traffic and presence of vessels in nearshore waters may result in disturbance to otters, if they forage in this area during construction activities.

Otters may also be displaced from foraging areas during offshore construction activities if prey species are affected. As otters generally forage in coastal waters of 2m depth, and are known to forage at depths of up to 15m on occasion, they may be indirectly affected by disturbance to prey distribution during construction activities in the intertidal zone (McCafferty, 2005 [*Ref. 9.14*]; Twelves, 1983 [*Ref. 9.15*]).

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to otters.

Therefore, there is a small possibility of disturbance during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover naturally.

9.7.2.1 Impact significance

As there is a risk of an impact on the local otter population through mortality, there is therefore a small possibility of an effect of **minor magnitude**, which is **reversible** in the short to medium term. In the absence of mitigation, this potential impact is assessed as being of **moderate consequence** and so is considered to be **significant**.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|
| High | Minor | Moderate | Significant |

9.7.2.2 Mitigation

As a potentially significant impact has been identified, mitigation is required to reduce this impact to an acceptable level.

Preconstruction surveys will be undertaken to ascertain current local status and use of the development footprint within the intertidal zone. Should any holts or couches be identified, and disturbance considered likely, an application for a European Protected Species (EPS) licence will be made. If a license is required, implementation of an otter management plan may be necessary. Where there is a potential risk of fatality through collision with construction traffic, specific mitigation measures will be considered including otter fencing and wildlife reflectors. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid otter, or other mammals, becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works should be appointed to oversee construction activities.

9.7.2.3 Residual Impact

Following implementation of mitigation measures outlined above, the level of the impact will be considered to have been reduced to a **negligible magnitude**. The residual impact is of **minor consequence** therefore considered to be **not significant**.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|
| High | Negligible | Minor | Not Significant |

9.7.3 Operation and Maintenance Impacts

There will be a small increase in the level of human activity during maintenance of the export cable during the operational life of the Project. This may potentially result in disturbance to otters, discouraging them from foraging in the area during maintenance activities. Although generally crepuscular and nocturnal in their habits, coastal otters are known to favour diurnal habits, meaning they will be more likely to be susceptible to disturbance during maintenance activities than contemporaries in other habitats (Kruuk, 1995 *(Ref. 9.16)*; Chanin, 2013 *(Ref. 9.17)*). However, the intertidal stretch of the export cable is comparatively short (56.4m in length), and maintenance activities in this area will be brief and uncommon.

9.7.3.1 Impact Significance

The possible effect of disturbance to otters during maintenance activities is considered to be of **negligible magnitude** and **reversible** in the short term. Therefore, the impact is considered to be of **minor consequence** and so **not significant**.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|
| High | Negligible | Minor | Not Significant |

9.7.3.2 Mitigation

As no significant impact was identified, mitigation measures are not required. However, should preconstruction surveys identify otter holts or couches, best practice will be followed when undertaking maintenance in close proximity to these features. Where disturbance impacts cannot be avoided, it will be necessary to apply for an EPS licence.

9.7.3.3 Decommissioning

The life span of the project will be 25 years. Decommissioning techniques will be agreed with the regulator at the time of decommissioning and will consider the best environmental practice and technologies available at the time. It is assumed that in accordance with current legislation and guidance (Energy Act 2004 and OSPAR Decision 98/3) that decommissioning will involve complete removal of all structures that protrude above the seabed. Surface laid cables will be removed. Cables that are buried in the seabed or under rock armouring will be left *in-situ*. Leaving cables *in-situ* will reduce disturbance during decommissioning, and avoid impacts to otters in the intertidal zone. However, should it be necessary to remove intertidal cable, the impacts resulting from decommissioning activities are expected to be equivalent (or less) than impacts arising during construction.

9.7.3.4 Impact Significance

If the export cable is left *in-situ* in the intertidal zone, there will be **no effect** on otters.

However, if it is deemed necessary to remove the cable, in the worst case decommissioning activities are expected to have an impact equivalent to the construction phase. The risk of an impact through increased mortality of otters would present a potential effect of **minor magnitude**, which is **reversible** in the short to medium term. In the absence of mitigation, this potential impact is assessed as being of **moderate consequence** and so is considered to be **significant**.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|
| High | Minor | Moderate | Significant |

9.7.3.5 Mitigation

No mitigation will be required if the cable is left *in-situ* as there would be no impact in this scenario. However, if the cable it is deemed necessary to remove the cable from the intertidal zone during decommissioning, this may result in a significant impact and mitigation is required to reduce this impact to an acceptable level. In this event, we would recommend the same mitigation is employed as detailed for the construction phase.

9.7.3.6 Residual Impact

Following implementation of mitigation measures outlined in the construction phase section, the level of the impact will be considered to have been reduced to a **negligible magnitude**. The residual impact is of **minor consequence** therefore considered to be **not significant**.

| Sensitivity of Receptor | Magnitude of Impact | Consequence | Significance |
|---|---|---|---|
| High | Negligible | Minor | Not Significant |

## 9.8 Cumulative Impact Assessment

The need to consider cumulative impacts is a requirement of the EIA process. Projects to be incorporated in such an assessment must include those in the past, present, and foreseeable future. Guidance on assessing the potential for cumulative impacts of offshore wind developments is provided in the Guidance Note for EIA in respect of FEPA and CPA requirements (CEFAS, 2004 *(Ref. 9.18)*). The guidance was developed for offshore wind but is relevant to this project, it states that any assessment of cumulative impacts must investigate the project:

- On its own (as done in previous sections);
- Cumulatively with all adjacent renewable energy consented and proposed sites;
- Cumulatively with any combination of the consented and proposed renewable energy sites within the same SEA area (in this case SEA 7); and
- Cumulatively with any combination of all the above with other existing or proposed offshore developments.

DPME has in consultation with Marine Scotland identified a list of other projects which together with the Project may result in potential cumulative impacts. The list of these projects including details of their status at the time of the EIA and a map showing their location is provided in Section 4, Table 4.6 and Figure 4.2 respectively.

Having considered the information presently available in the public domain on the projects for which there is a potential for cumulative impacts, Table 9.7 indicates those with the potential to result in cumulative impacts from a benthic habitats and ecology perspective. The consideration of which projects could result in potential cumulative impacts is based on the results of the project specific impact assessment together with expert judgement of the specialist consultant.

| Project Title | Potential for cumulative impact |
|---|---|
| Islay offshore wind farm | Disturbance during construction, maintenance and decommissioning. Increased risk of mortality to otters during construction. |
| Argyll Array wind farm | Disturbance during construction, maintenance and decommissioning. Increased risk of mortality to otters during construction. |
| Sound of Islay Tidal Energy | Disturbance during construction, maintenance and decommissioning. Increased risk of mortality to otters during construction. |
| Argyll Tidal | Disturbance during construction, maintenance and decommissioning. Increased risk of mortality to otters during construction. |

Table 9.7: Projects with Potential for Cumulative Impacts

9.8.1 Construction Phase

Any offshore development that is constructed concurrently may result in disturbance to coastal otters during the construction phase. This disturbance may be direct or indirect via displacement of prey species during construction. There may also be a cumulative increased risk of mortality through collision with construction traffic and, depending on intertidal zone construction methods, also through becoming trapped in trenches. However, these impacts will be temporary and highly localised – affecting only a very small development footprint in the intertidal zones. Standard mitigation measures further reduce the minimal increased mortality risk to a negligible level.

9.8.2 Operation and Maintenance

Any offshore development that is operational concurrently may result in a cumulative disturbance impact on otters during maintenance activities. However, intertidal zone development footprints are small and maintenance is likely to be brief and infrequent. Therefore, any maintenance activity is likely to result in a negligible increase to baseline disturbance levels.

9.8.3 Decommissioning

If export cables are left *in-situ* there will be no pathway for effect on otters during decommissioning. However, should it be necessary to remove intertidal cable, the impacts resulting from decommissioning activities are expected to be equivalent (or less) than impacts arising during construction. A full EIA will be carried out in line with legislation current at the time of decommissioning.

## 9.9 Summary and Conclusions

The intertidal field survey was completed under optimal weather conditions, and no evidence of otters was found at the export cable landfall site at Kintra. However, the Hebrides are a stronghold for this species and the coastal waters around Islay offer excellent foraging habitat. Therefore, although otters are not resident at the export cable landfall site, it is possible that they will at least forage in the area on occasion.

An assessment of potential effects on otters at the export cable landfall site at Kintra was carried out for the construction and installation, operation and maintenance, and decommissioning phases of the Project. This assessment identified the potential for a significant effect during the construction and installation phase, which may be repeated during the decommissioning phase if the cable cannot be left *in-situ*. However, measures are detailed to mitigate this potential impact. After mitigation is employed, no significant effects are predicted for otters in the intertidal zone. Table 9.8 provides a summary of potential effects.

| VER | Sensitivity | Potential Effect | Mitigation | Reversibility | Magnitude | Consequence | Significance | Level of Certainty |
|---|---|---|---|---|---|---|---|---|
| ***Construction (and Decommissioning) Impacts*** | | | | | | | | |
| Otter | High | Displacement and loss of individuals through construction noise, vibration, increased traffic or becoming trapped in excavations. | Preconstruction surveys to ascertain current local status and use of development footprint.<br><br>Ecological Clerk of Works (ECoW) to ensure best practice is followed during construction, including covering excavations, otter fencing and wildlife reflectors as appropriate. | Short to medium term | Negligible | Minor | Not significant | Disturbance could lead to an increase in stress for some individual otters, if present, but no detectable effect is predicted at the population level. |
| ***Operational Effects*** | | | | | | | | |
| Otter | High | Displacement through disturbance caused by increased human activity during maintenance activities. | Best practice will be followed. | Short term | Negligible | Minor | Not significant | Disturbance could lead to an increase in stress for some individual otters, if present, but no detectable effect is predicted at the population level. |

Table 9.8. Summary of Potential Effects on Otters

## 9.10 References

9.1 The Crown Estate 2012. 2012. *Pentland Firth and Orkney Waters Enabling Actions Report: Rochdale Envelope Workshop – Wave and Tidal.* The Crown Estate.

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9.17 Chanin, P. 2013. *The British Natural History Collection Volume 2: Otters.* Whittet Books Ltd, Stansted.

9.18 CEFAS. 2004. *Offshore Wind Farms: Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2 – June 2004.* Marine Consents and Environment Unit (MCEU).

WESTISLAY TIDAL

# ENERGY PARK

**volume 2 // chapter 10 // birds**

# 10. Birds

## 10.1 Introduction

This chapter describes the existing bird interests within the marine element of the West Islay Tidal Energy Project ("the Project") and the surrounding area and presents an assessment of the predicted impacts of the project on bird populations. This chapter has been completed by Natural Research Projects Limited (NRP) and compliments the separate evaluation of potential ecological effects in Chapter 7: Mammals, and Chapter 11: Natural Fish. Technical appendices referenced by the chapter are listed in Table 10.1.

| Appendix | Title |
|---|---|
| 10.1 | Summary of Bird Surveys Technical Report. |
| 10.2 | HRA Ornithology Screening Report |

Table 10.1: Technical Appendices Referenced by Ornithology Chapter.

The project proposal is to install and operate a 30MW array of up to 15-30 tidal energy converters (TEC) on the seabed to the south-west of Islay. The Rochdale criteria (i.e., the maximum design envelope) pertinent to the ornithological assessment are summarised in Table 10.2, the project is fully described in Chapter 5: Project Description. The Rochdale criteria consider two turbine designs (MCT and TGL) and the array may consist of a mix of the two types plus other turbines with a configuration which sits within the Rochdale envelope defined.

| **Turbine Specification** | **MCT** | **TGL** |
|---|---|---|
| Installed Capacity | 2MW | 1.5MW |
| Number of Rotors | 2 | 1 |
| Number of rotor arms per rotor | 3 | 3 |
| Width (across stream) | 50m | 22m |
| Rotor Diameter | 20m | 22m |
| Rotational Speed | 11.5rpm | 14rpm |
| Swept Area | 628m$^2$ (both rotors) | 380m$^2$ |
| Cut in speed | 1m/s | 1m/s |
| Rated Speed | 2.4m/s | 2.7m/s |
| Seabed Clearance | 3m | 6m |
| Surface Clearance (LAT) | 3.5m | 7m |
| Protrusion Height (LAT) | 21m | Not applicable |
| Area of Pod Platform | 7x9m | Not applicable |
| Turbine Foundation | MCT | TGL |
| Materials | S355 Steel | S355 Steel |
| Maximum area covered (per TEC) | 260m$^2$ | 154m$^2$ |
| Footprint of piles (3 off) | 4m | 4m |
| Height | 12m | 16m |
| Array Design and Spacing | MCT | TGL |
| No. of turbines | 15 | 30 |
| Minimum crossflow spacing | 61m | 66m |
| Maximum crossflow spacing | 300m | 240m |

| Turbine Specification | MCT | TGL |
|---|---|---|
| Minimum separation tip to tip | 10m | 44m |
| Maximum downflow spacing | 400m | 440m |
| Minimum downflow spacing | 200m | 220m |
| Minimum water depth of device at project site | 29m | 35m |
| Maximum water depth of device at project site | 40m | 50m |
| Floating Platform | | |
| Materials | Standard offshore Marine Steel | |
| Platform dimensions | 60m x 35m x 7m | |
| Vessels | MCT | TGL |
| Installation Vessel (See vessel details section 5.26) | Self-elevating vessel with DP2 | Vessel capable of lifting & handling a 120 tonne |
| Operation and maintenance vessel (See vessel details section 5.26) | Suitable workboat greater than 30m length capable of towing the floating turbine & of the deck transportation & lifting of the 4 tonne floating winch unit of dimensions 2.5m x 2.5m x 2.5m | |
| Decommissioning vessel | Similar vessels as those used for installation | |

Table 10.2: Summary of Rochdale Criteria Pertinent to Ornithological Assessment

The potential effects on the bird population by the installation, operation, maintenance and decommissioning of the proposed project are explained. The methods used to undertake the environmental assessment and determine the significance of impacts are described. This includes the process used to determine the Nature Conservation Importance and the priority for EIA of the birds that use in the area potentially affected by the project. No bird species was categorised as high priority for EIA. Two species, common guillemot and razorbill were categorised as medium priority due to a combination of their relatively high vulnerability to the effects of tidal arrays and the moderate numbers sometime occurring in the development area, particularly in winter.

The potential effect of the proposed project on sites designated for birds is also summarised. This subject is covered in detail in a standalone HRA screening report (Appendix 10.2). This report concludes that that there is no realistic potential for the development to have a likely significant effect (LSE) on any Natura site ornithological qualifying feature. Although this conclusion was endorsed by Department of Environment, Northern Ireland-(DOENI) Marine Division, SNH has commented that they consider a more precautionary approach to HRA screening and advised that it should be assumed that there was potential for LSE involving breeding guillemot, razorbill and puffing at six SPAs. The implications of this advice are that these qualifying features at these SPAs require to undergo Appropriate Assessment by the regulator.

The chapter summarises baseline survey work undertaken over two years to inform the environmental impact assessment, presenting the results for each species in the context of regional population estimates so that the importance of the area potentially affected can be established. Eleven seabird species were regularly recorded using the development area during the 20 baseline bird surveys visits undertaken between October 2009 and August 2011. During the breeding season the numbers of individuals of each seabird species that use the development area (and surrounding nominal 1km buffer) are small or very small in the context of the size of regional breeding populations. It is concluded that the development area is of low or very low importance for regional populations of seabirds during the breeding season. The marine element of the project is too far offshore (approximately 6 km at its closest from the nearest land on Islay) to cause effects on terrestrial bird species.

The chapter then presents the findings of an assessment of the potential impacts arising from the installation, operation and maintenance and decommissioning phases of the proposed development. The magnitude and the significance of potential impacts is assessed. The potential impacts of the project on birds together with proposed mitigation to define residual impacts are summarised in Table 10.3.

All anticipated impacts are considered to be of negligible or minor magnitude to seabird species and in all cases are judged to be either of negligible or minor significance under the terms of the EIA Regulations.

| **Impact description** | **Receptor populations** | **Initial impact** | **Mitigation** | **Residual impact** |
|---|---|---|---|---|
| Construction phase | | | | |
| 1: Vessel disturbance of seabirds | All seabird species | Negligible significance | Not required, but good practice will be for project vessels to stick to the defined routes and adopt a voluntary speed limit of 15km/hr. | Negligible significance |
| 2: Direct habitat loss | All seabird species | Negligible significance | None. | Negligible significance |
| Operational phase | | | | |
| 3: Vessel disturbance of seabirds | All seabird species | Negligible significance | See Impact 1. | Negligible significance |
| 4: Seabird displacement from, and attraction to, marine habitats | All seabird species | Negligible significance | Ensure that all potential perching locations are safe for birds. | Negligible significance |
| 5: Collision risk to diving seabirds. | Guillemot, razorbill, puffin | Negligible significance | Should there be evidence of collision mortality, measures will be considered that aim to prevent it occurring. | Negligible significance |
| 6: Marine pollution and contamination | All seabird species | Negligible significance | Ensure that all potential perching locations are safe for birds. | Negligible significance |
| Decommissioning phase | | | | |
| 7: Vessel disturbance of seabirds | All seabird species | Negligible significance | See Impact 1. | Negligible significance |
| 8: Habitat | All seabird | Negligible | Good practice guidance on | Negligible |

| | | | | |
|---|---|---|---|---|
| reinstatement | species | significance | habitat reinstatement prevailing at the time will be followed. | significance |

Table 10.3: Summary of Predicted Impacts, Mitigation and Residual Impacts

## 10.2 Study Area

The area considered for baseline characterisation studies of birds (Technical Appendix 10.1) is the original project search area considered for deployment of TECs and a surrounding 4km buffer (Figure 10.1). The original search area was an area of 8.5 $km^2$ located about 7 km to the south-west of Islay (Figure 1 in Technical Appendix 10.1). After the completion of baseline bird surveys and in response to updated information on tidal resource and substrate the location of the proposed site for the initial 30MW project was reduced in size to 2.3$km^2$ and shifted south-east by approximately 2km (see Figure 10.1), nevertheless the site remains comfortably within the 4km buffer of the original bird survey design.

## 10.3 Overview of Potential Impacts

The development will comprise between 15 to 30 TECs with an 18-20m diameter rotor. A detailed project description, including TEC device layout, installation and operational procedures is presented in Chapter 5: Project Description and figure 5.1, 5.13a and 5.13b.

Ornithological interests have the potential to be affected by the following elements of the development:

- Installation activities;
- Operational activities, including TEC device function and maintenance works;
- Decommissioning; and,
- Cumulative effects in conjunction with other marine renewable projects in the region whether operational or in application.

Potential effects of the development on birds evaluated include:

- Disturbance of seabirds from project vessels;
- Direct sea-bed habitat loss due to the placement of TECs;
- Displacement of seabirds (indirect habitat loss) from the vicinity of project infrastructure and vessels;
- Attraction of seabirds (indirect habitat gain) to the vicinity of project infrastructure, especially emergent infrastructure;

- Collision with TEC rotors; and
- Pollution and contamination, in particular from vessel discharges and accidental leakage of contaminants;

The potential for collision with TEC rotors during operation is poorly understood as this technology has not yet been deployed in large scale field situations. Therefore at present this effect cannot be fully assessed quantitatively.

It is apparent that not all of the potential effects are relevant to all types of bird potentially affected by the development. Notably, seabirds that restrict their activities to sea surface and the air will not be at risk of collision from TEC rotors.

There is a paucity of studies on how seabirds will respond to the presence of operational devices of the design proposed. Studies of birds in the vicinity of the SeaGen S device installed in Strangford Lough, Northern Ireland, found that seabirds showed only small or indiscernible displacement effects, and there was no evidence of collisions occurring (Marine Current Turbines 2011).

## 10.4 Methodology

The following guidance and legislation was taken into account to inform the methodology undertaken during this assessment:

### 10.4.1 Legislation

- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000;
- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive on Conservation of Natural Habitats and of Wild Flora and Fauna 92/43/EEC (Habitats Directive);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended); (The Habitats Regulations);
- The Nature Conservation (Scotland) Act 2004 (as amended) ;
- Marine Scotland Act 2010; and
- Wildlife and Natural Environment (Scotland) Act 2011.

### 10.4.2 Guidance

- Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. Part 3 - EIA & HRA guidance;

- Jackson and Whitfield (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 4. Birds. Unpublished draft report to Scottish Natural Heritage and Marine Scotland;
- COWRIE (Camphuysen *et al*. 2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K; and
- COWRIE (Maclean *et al*. 2009) A review of assessment methodologies for offshore windfarms.

10.4.3 Conservation listings

- UK Biodiversity Action Plan (BAP);
- Birds of Conservation Concern (BoCC3) 'Red List' (Eaton *et al*. 2009); and
- IUCN threatened species list.

10.4.4 Scoping study

An ornithological scoping study was undertaken by NRP in 2009 before survey work started. This identified that year-round monthly boat-based transect surveys were required to assess the use of the sea and a surrounding buffer by seabirds. The field survey work proposed had two broad aims:

- To determine baseline conditions required for assessing the likely effects of the proposed development; and
- To establish baseline conditions against which any future changes can be compared.

Specific objectives were:

- To determine the year-round distribution and abundance of birds using the Development Search Area and a 4-km wide surrounding buffer. This is referred to as the 'main survey area'
- To determine how the summer densities of common guillemot, razorbill, puffin and kittiwake vary between the proposed Development Search Area and the two closest SPA seabird colonies, namely North Colonsay and Western Cliffs SPA and Rathlin Island SPA.

The scoping study also identified that the development site is not part of, or immediately adjacent to, any international or national designated site. However, because of the large distances (10s-100s of km) travelled by some seabird species to forage it is possible that there is connectivity between the development area and some designated sites in the region (see Appendix 10.2).

10.4.5 Designated sites

No part of the development site lies within a site designated as a SPA, a SSSI or Ramsar site. However, there are several Natura sites (SPAs), SSSIs and Ramsar sites in the wider region designated for their breeding seabird populations. Generic and colony specific information on breeding seabird foraging movements (e.g., Thaxter *et al*. 2012) gives a good indication of whether there is likely to be connectivity between a designated site and the anticipated impact footprint of the development, and if so approximately how strong it may be (see Appendix 10.2).

Evidence for estimating the likely extent of connectivity between the anticipated impact footprint and SPAs seabird colonies is examined in detail in Appendix 10.2: HRA Ornithology Screening Report. The closest breeding seabird SPAs to the Project are Rathlin Island (Northern Ireland), located approximately 50 km south-east, and the North Colonsay and Western Cliffs SPA on Colonsay, approximately 60 km to the north-east. Both these SPAs are sufficiently close for it to be possible that, for several qualifying species, some individuals may use the development area for foraging, for example auk species and kittiwake. The large or very large foraging ranges of some species (e.g., commonly >100 km for puffin and commonly >200 km for gannet, Manx shearwater and fulmar) means there is also potential for individuals of these species breeding at designated sites further afield to use the anticipated impact footprint (Appendix 10.2). In particular, it is possible that gannets from Ailsa Craig SPA and Manx shearwaters from Rum SPA and Copeland Island SPA in could use the site.

The HRA screening report (Appendix 10.2) also considers the potential for the Project to adversely affect SPA qualifying features by applying screening criteria to identify potential Likely Significant Effects (LSE). The screening criteria used were: theoretical and actual connectivity (SPA populations rated as having moderate and high connectivity were screened in); a species' likely vulnerability to tidal arrays (Furness *et al*. 2012), and; the abundance of the species in the anticipated impact footprint as measured by the two-year program of baseline surveys (threshold set at 0.1% of population).

The HRA screening report (Appendix 10.2) concluded that there is no potential for the development to have a likely significant effect (LSE) on any qualifying ornithological feature at a Natura site. DOENI Marine Division accepted the conclusions of the HRA screening report (DOENI letter 21/3/2013). SNH advised that it would be preferable to use a much more cautious connectivity threshold (they advised that qualifying features rated as having low theoretical connectivity should be screened in) and advised that using a minimum baseline threshold abundance criterion for screening was not appropriate (letter from SNH, 14 April 2013). SNH further advised that, through applying their screening criteria, there is potential for LSEs on breeding auk qualifying features (guillemot, razorbill and puffin) at six Natura sites. These potential LSEs will require to be examined in more detail through the process of Appropriate Assessment by the regulator. In the case of guillemot SNH advised that potential for LSE should be concluded for Ailsa Craig SPA, Canna and

Sanday SPA, Mingulay and Berneray SPA, Rum SPA (all rated as low theoretical connectivity), North Colonsay and Western Cliffs SPA and Rathlin Island SPA (both rated as moderate theoretical connectivity). In the case of razorbill SNH advised that potential for LSE should be concluded for Rathlin Island SPA (rated as low/moderate theoretical connectivity). In the case of puffin SNH advised that potential for LSE should be concluded for Canna and Sanday SPA, Mingulay and Berneray SPA (both rated as low theoretical connectivity) and Rathlin Island SPA (rated as moderate theoretical connectivity).

This ES chapter and technical appendices provide SNH and MSS with information on the seasonal abundance, behaviour of these species in the anticipated impact footprint together with information on the likely strength of connectivity with these SPAs and SPA population sizes. This information will enable SNH and MSS to undertake Appropriate Assessment of the potential LSEs identified by SNH. The potential for the Project to affect the conservation objectives of Natura site ornithological qualifying features is not considered further in this chapter.

There are several small seabird colonies along the west coast of Islay containing approximately 3000 pairs each common guillemot and razorbill and small numbers of kittiwake, fulmar, shag and black guillemot. One of these colonies lies within the Rinns of Islay Ramsar site and breeding razorbill is listed as a qualifying interest at this site on the grounds that they are a nationally important population. This colony also lies within the boundary of the Rinns or Islay SPA and within the boundary of Glac na Criche Site of Special Scientific Interest (SSSI), however, no seabird species are qualifying features of these designated sites.

### 10.4.6 Consultation

Following pre-scoping meetings with SNH and RSPB a Request for a Scoping Opinion was issued in May 2009. Table 4.2 in Chapter 4: EIA, ES and Consultation summarises the main responses and references where those responses have been addressed in this ES. In relation to birds, a summary of pertinent issues raised during the consultation process and subsequent engagement is presented in Table 10.4 below.

| **Consultation** | **Summary of Response** | **Where addressed** |
|---|---|---|
| Islay Tidal Scoping Opinion (10th September, 2009) | Concerns for possible effects on SPA bird populations, in particular common guillemots, kittiwakes and razorbills breeding at North Colonsay and Western Cliffs SPA and Rathlin Island SPA. (SNH and RSPB) | Additional survey work was undertaken along corridors orientated towards Colonsay and Rathlin Island. The potential connectivity to all SPAs was determined using a combination of foraging range metadata, tagging results from regional colonies and abundance in the development area. Presented in Appendix 10.2 and summarised in Section 10.4.5. |
| | Recommended using meta-data | The metadata from the most recent |

| Consultation | Summary of Response | Where addressed |
|---|---|---|
| | on seabird foraging ranges to determine (theoretical) connectivity with SPAs. (SNH) | published reviews (Birdlife database and Thaxter *et al*. 2012) on the foraging ranges of breeding seabirds are used to quantify theoretical potential connectivity. Presented in Appendix 10.4 and summarised in Section 10.4.5. |
| | Recommended that the scoping proposal be submitted to The Northern Ireland Environment Agency (NIEA – Now submissions to DOENI Marine Division and forward to NIEA for Birds) (SNH and RSPB) | The EIA scoping report and methodology were sent to NIEA. Acknowledgement was received but no formal opinion was provided. |
| | Established whether the seabed habitat is suitable to support the seabird prey fish for birds such as sandeels (SNH). | Chapter 8, describes the sea bed habitats, at the array site and shows that they comprise bed rock and loose stones, habitats unsuitable for sand eels. |
| | Advised that a minimum of 2 full years of survey work is required for birds (SNH) | Surveys were undertaken over a two-year period. Periods of persistent poor sea-state conditions prevented four of the 24 scheduled surveys going ahead, but these gaps are all outside the breeding season. |
| | Advised that potential disturbance during installation, operation and maintenance and decommissioning should be assessed (SNH). | Disturbance is assessed for each phase of the development and presented in Sections 10.7, 10.9 and 10.13. |
| | Advised that the potential for lighting to affect birds be considered. (SNH) | The impact of lighting is address in Section 10.10 |
| | Recommendation that surveys are undertaken to quantify to dive distance and duration of diving seabirds. (RSPB) | This proved to be impractical. Generic data on these parameters are available from tagging studies. |
| | Requested that contamination via leakage and anti-foulants is considered. (RSPB) | Pollution and contamination effects are considered in Section 10.12. |
| | Requested that mitigation measures to be included in the ES. (RSPB) | Mitigation measures are proposed for all impacts where appropriate in Sections 10.7 to 10.14 |
| | Recommend that an appropriate monitoring programme is agreed with SNH (SNH).<br><br>Recommendation for sub-surface monitoring such as video and sonar to collect data the response of diving birds and marine mammals. (RSPB) | The survey programme was designed to give data that would form a suitable baseline against which to compare future monitoring. A range of possible bird monitoring measures are discussed in Section 10.16 and these will form a starting point for discussion should consent be granted. |
| Comments on Year 2 Bird report, (30/8/2012 SNH) | Recommendation that the bias of surveys to neap tidal cycles should be addressed (SNH) | The bias has been examined in detail and is not as great as was stated in the Year 2 report. Over a third of |

| Consultation | Summary of Response | Where addressed |
|---|---|---|
| | | surveys were conducted on dates with tides intermediate between springs and neaps. This is presented in Appendix 10.1. For operational and safety reasons we were advised by the boat operator against surveying in peak spring tides. |
| | Request that the reduced autumn survey coverage and the implications of this should be discussed. (SNH do not advocate that further survey work is required.) (SNH) | This is discussed in Appendix 10.1. The autumn gap in Year 2 coverage is not considered likely to undermine the ES conclusions because it falls out with the breeding season and this period was well covered (3 surveys) in Year 1. |
| | Concern expressed over using NHZs to define regional populations of seabirds. SNH hope to provide further guidance on this issue in the future (SNH) | In the absence of receiving further detailed guidance the preferred boundaries for regional populations, regions are defined that broadly reflect natural geography and the ranging ecology of the species as presented in Section 10.4.8. The ES conclusions are not highly sensitive to choice of regional boundary for a species. |
| Meeting Note (21 June, 2012) | Query over whether diving species seen on the sea surface would be considered to be feeding and hence potentially at risk of collision. (SNH) | ESAS surveys collect bird behaviour data as apparent in the short period a bird is under observation. In the absence of other information it is assumed in the assessment of impacts (Section 10.11) that surface diving species recorded on the sea are likely to be feeding, as this would lead to more cautious assessment conclusions. |
| 23 January Meeting Note (20th March, 2013) | Query over whether *Distance* analysis was used to estimate bird densities from survey data. (MSS) | Since this meeting, bird density has been estimated using *Distance*. These results were sent to SNH and MSS in April 2013 are presented in full in Appendix 10.1. They are the basis of the estimated abundances states in Section 10.5 |
| | Request to submit a HRA screening report before submission to identify potential for Likely Significant Effects on SPAs. (SNH) | HRA screening report for birds sent out to SNH, MSS and DOENI in February 2013. The screening report was revised in March 2013 in light of comments from SNH. HRA screening is presented in Appendix 10.4 and discussed in Section 10.4.5. |

Table 10.4 Key consultation comments relevant to birds.

10.4.7 Baseline Surveys

The field survey design, methods and analysis and are fully described in Appendices 10.1 (Bird Surveys Summary Technical Report). The main points are summarised below.

The main survey area comprised the original Development Search Area (covering 8.5 km$^2$) plus a 4-km wide surrounding buffer area (covering 98 km$^2$) (see Figure 1 in Appendix 10.1). The layout of the survey comprised seven parallel transects spaced 2 km apart and orientated WSW – ENE, approximately perpendicular to the major environmental gradients of tidal current and bathymetry. The European Seabird at Sea (ESAS) survey method (Camphuysen *et al*. 2004) was used as this is the most appropriate method for surveying relatively large areas offshore. This is the standard method used to survey seabirds at sea and is commonly used in surveys to characterise and monitor offshore renewable energy developments such as windfarms (Camphuysen *et al* 2004). It was planned to undertake surveys at approximately monthly intervals over a two year period commencing in October 2009. To achieve high detection rates and safe conditions for surveyors, survey work was only undertaken when sea conditions at the time of survey were below Sea State 5, and ideally below Sea State 3.

In the summer months (April to August) additional survey work was carried out along two corridors stretching from the main survey area to the North Colonsay and Rathlin Island SPAs respectively.

Surveyors recorded all birds seen within 300m of the transect line (to one side of the survey vessel). The species, number, plumage, activity, flight direction, distance-band from the boat (0-50m; 50-100m; 100–200m; 200-300m), and whether flying birds were 'in transect' at the time flying-bird snapshot were taken. The survey conditions prevailing at the time survey work were recorded in terms of sea state, swell height, wind force and direction, precipitation and sun glare.

10.4.8 Regional Population Context

There is no guidance or accepted division of the seas around Scotland into regional units that can be used to provide consistent context for evaluating results, a subject that SNH is currently developing guidance on. Providing context by comparing survey results with the numbers of birds in the relevant SNH Natural Heritage Zone (NHZ), in line with convention for on-shore renewable development, is not considered appropriate for two reasons. First, although the Project is located approximately centrally within NHZ 14 (Argyll West and Islands), it is approximately equally as close to seabird colonies in Northern Ireland as it is to Scottish colonies in NHZ 14. Second, for species with particularly large foraging ranges (i.e., mean maximum foraging ranges in excess of 150 km, such as gannet, fulmar and Manx shearwater), it is obvious that NHZs (including NHZ 14) are inappropriately small as individual of these species are likely to range well beyond the boundaries of an individual zone during their day-to-day activities.

Although putting the results into a regional context is valuable, it is apparent that the conclusions of the environmental impact assessment that follow are in no case sensitive to the regional boundary used. For all species with mean maximum foraging range of less than 150km, the regional breeding population is defined as the sum of the population in Argyll and Bute and County Antrim as reported in the Seabird 2000 census (Mitchell *et al.* 2004). Argyll and Bute approximately corresponds to NHZ 14. County Antrim corresponds to the closest section of coastline in Northern Ireland and includes Rathlin Island, the largest seabird colony in Northern Ireland.

For the three species with mean maximum foraging ranges in excess of 150km (gannet, fulmar and Manx shearwater) the number breeding in the southern half of western Scotland (South of a line between the Sound of Harris and Skye) and all of Northern Ireland is considered to be a more appropriate regional breeding population. Specifically in the case of gannet, the only colonies within this area are Ailsa Craig and Scare Rocks and these are also the only colonies within the mean maximum foraging distance (229km) from the project site. Specifically in the case of Manx Shearwater, the defined region includes colonies on Rum, Canna, Treshnish Islands, Sanday and the Copeland Islands.

The size of regional populations present in the winter is not known. Winter distributions and density of seabird species around the UK are relatively well understood (e.g., Kober *et al.*, 2009) but regional populations sizes have not been calculated. The marine extent of NHZ 14 effectively reaches as far as the Irish coast and is approximately 11,000km$^2$. This area multiplied by the approximate average density gives an indication of the total numbers likely to be present in the region in winter. Arguably a larger area than the marine extent of NHZ 14 should be used for the wintering population regional context. However, this is academic as the conclusions of the environmental impact assessment would not be affected (defining a larger winter region would inevitably dilute any regional impact arising from the development over a wider area and a larger number of birds).

Where the available data allow, the conservation status of potentially affected bird species is evaluated within the appropriate regional unit (as defined above). For these purposes conservation status is taken to mean the sum of the influences acting on a population which may affect its long-term distribution and abundance. Where information on regional conservation status is unavailable, information on conservation status at a wider geographic scale is used, e.g., Forrester and Andrews *et al*. 2007, Eaton *et al*. 2011, SNH 2012.

10.4.9 Vulnerability to TECs

The term vulnerability as used here is a characteristic of a species, and is a measure of how likely a species is to experience a given impact or a collection of impacts. The question of how vulnerable seabird species are to impacts caused by tidal devices has recently been reviewed by Furness *et al*. 2012. As part of this review species were rated on a number of criteria and the scores combined to give an overall vulnerability score, with a higher score indicating a greater level of vulnerability. These scores were then used as the basis for categorising each species into one of five generic vulnerability categories ranging from very low to very high. The criteria used included the potential for collision with TEC rotors, response to vessel disturbance and flexibility of their foraging behaviour.

The methods used by Furness *et al.* (2012) and their resulting generic vulnerability scores are considered to be entirely appropriate with respect to the project and are therefore adopted. However, it should be noted that these are scores of generic vulnerability to TEC devices and the actual vulnerability of a species to the array may be lower. For example, if a species has a high generic vulnerability score but does not use the anticipated impact footprint, then its vulnerability to the TECs will be negligible.The generic vulnerability scores and categories are presented for relevant species in Table 10.6.

| **Species** | **Vulnerability score** | **Vulnerability category** |
|---|---|---|
| Black guillemot | 9.9 | High |
| Razorbill | 9.6 | High |
| Shag | 9.6 | High |
| Common guillemot | 9.0 | High |
| Puffin | 3.8 | Moderate |
| Arctic tern | 1.9 | Low |
| Manx shearwater | 1.5 | Low |
| Gannet | 1.4 | Low |
| Great black-backed gull | 1.0 | Very low |
| Kittiwake | 0.9 | Very low |
| Herring gull | 0.8 | Very low |
| Fulmar | 0.5 | Very low |
| Storm petrel | 0.5 | Very low |

Table 10.5: Species Vulnerability to Tidal Energy Converter Impacts Ordered by Vulnerability Score. Based on Furness et al. 2012.

10.4.10 Assessment of Significance

The evaluation follows the process set out in the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 ("the EIA Regulations") and guidance on the implementation of the Birds and Habitats Directives (SERAD 2000).

Judgement is made against the general expectation that the project would not have a significant adverse effect on the receptor populations under consideration, their range or distribution. In assessing the effects, consideration is given to the relevant populations of the species. Trivial or inconsequential effects are excluded.

The significance of potential effects is determined by integrating the assessments of Nature Conservation Importance, magnitude and sensitivity to effects in a reasoned way (Institute of Ecology and Environmental Management, 2010). In judging significance, consideration is given to the population status and trend of the potentially affected species. If a potential effect is determined to be significant, mitigation measures to avoid, reduce or remedy the effect are suggested wherever possible.

10.4.11 Methods Used to Evaluate Nature Conservation Importance (NCI)

The Nature Conservation Importance (NCI) of the bird species potentially affected by the development is defined according to Table 10.7

Species listed in Local Biodiversity Action Plans (LBAPs) would be considered moderately important only if the Project supported at least 1% of the regional population.

| Importance | Definition |
|---|---|
| High NCI | Species listed in Annex 1 of the EU Birds Directive. Breeding species listed on Schedule 1 of the Wildlife and Countryside Act (WCA).<br><br>Species present (and in the case of seabird species making use of the area) in nationally important numbers (>1% national population). |
| Moderate NCI | Other species listed in the UK Biodiversity Action Plan (BAP).<br><br>Other species listed on the Birds of Conservation Concern (BOCC) 'Red' list.<br><br>Other species listed on the IUCN threatened list.<br><br>Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed Development.<br><br>Species present (and in the case of seabird species making use of the area) in regionally important numbers (>1% regional population). |
| Low NCI | All other species not covered above. |

Table 10.6: Determining Factors for Nature Conservation Importance (NCI).

Of the 11 seabird species that were regularly recorded only Arctic tern was rated as high NCI (due to it being on Annex 1), and only herring gull was rated as moderate NCI (due to it being BOCC red listed). Storm petrel, as species that was recorded irregularly in small numbers, is also rated as high NCI (due to it being on Annex 1). All other species are rated as Low NCI.

10.4.12 Methods Used to Evaluate Species Priority

So that the EIA can focus on relevant species and issues, each species was rated as high, medium or low priority for the EIA according to the criteria in Table 10.7. If there was uncertainty as to which category was best for a species the higher category for chosen.

High priority species are those that merit the greatest level of scrutiny because the effects on these could potentially lead to significant impacts on a regional receptor population.

Medium priority species for EIA also merit detailed consideration nevertheless it is clear that any effects are unlikely to have potential to lead to significant impacts of regional populations even under pessimistic scenarios because the numbers using the site are too low. Nevertheless, effects on these species should be assessed and it will be best practice where possible to reduce any adverse effects through mitigation.

Low priority species are all species that do not merit categorisation as either high or low priority.

| Category | Criteria |
|---|---|
| High | Species for which >1% of the assumed regional population uses the development site in at least one season of the year.<br><br>And at least one of the following:<br>High NCI (as defined in Table 10.7)<br>Species with have a at least moderate vulnerability effects of tidal arrays (Table 10.6)<br>Species with at least Moderate theoretical connectivity to one or more SPA and that at times use the development area in reasonable numbers in the context of the population size (Appendix 10.4). |
| Medium | Species for which >0.1% of the assumed regional population uses the development site in at least one season.<br><br>And at least one of the following:<br><br>Species rated as Moderate NCI (as defined in Table 10.7<br>Species with have at least moderate vulnerability effects of tidal arrays (Table 10.6)<br>Species with low theoretical connectivity to one or more SPA and at times use the development area in reasonable numbers (>0.1%) in the context of the population size (Appendix 10.4).<br>Species with High or Medium theoretical connectivity to one or more Ramsar site or SSSI that is not otherwise designated SPA for the species, and at times use the development area in reasonable numbers (>0.1%) in the context of the population size (Appendix 10.4). |
| Low | All other species |

Table 10.7 Criteria Used to Categorise Species Priority for EIA.

On this basis no species were categorised as high priority and only two species were categorised as medium priority, namely common guillemot and razorbill. All other species were categorised as low priority, including gannet, shag, fulmar, Manx Shearwater, herring gull, great black-backed gull, Arctic tern, kittiwake and puffin. The reasons why a species was assigned a particular priority category are explained in the species summaries (section 10.5: Existing environment)

All high and medium priority species are considered in the assessment of predicted effects of arising from the Project (i.e., the EIA). Low priority species are not thought to be plausibly affected by the development thus obviating any further consideration under the subsequent EIA assessment process.

10.4.13 Methods Used to Evaluate the Magnitude of Impacts

Impact is defined as a change in the population of bird species present as a result of the Project, with change occurring either during or beyond the life of the Project. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note that impacts can be adverse, neutral or favourable.

Magnitude of impact is assessed in respect of an appropriate regional population (as defined earlier under 'Regional population context'). Impacts are categorised in terms of their temporal magnitude (four categories) as detailed in Table 10.8.

| Magnitude | Definition |
|---|---|
| Permanent | Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period. |
| Long term | Approximately 15 - 25 years or longer (refer to above). |
| Medium term | Approximately 5 - 15 years. |
| Short term | Up to approximately 5 years. |

Table 10.8: Scales of Temporal Magnitude

Effects are also categorised in terms of their predicted magnitude on the bird population under consideration (five categories, Table 10.9).

| Magnitude | Definition |
|---|---|
| Very High | Total/near total loss of a bird population or productivity, due to mortality or displacement or disturbance.<br>Guide: >80% of population affected, >80% change in mortality or productivity rate. |
| High | Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance.<br>Guide: 21-80% of population affected, 21-80% change in mortality or productivity rate. |
| Moderate | Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. |

| Magnitude | Definition |
|---|---|
| | Guide: 6-20% of population affected, 6-20% change in mortality or productivity rate. |
| Low | Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance.<br>Guide: 1-5% of population affected, 1-5% change in mortality or productivity rate |
| Negligible | Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation.<br>Guide: <1% population affected, <1% change in mortality or productivity rate. |

Table 10.9: Criteria for Assessing the Magnitude of Effects on Bird Populations.

10.4.14 Sensitivity to impacts

Sensitivity as used here (Table 10.10) is a characteristic of a receptor population under consideration and is a measure of how sensitive it is to an impact (this is different to the measure of generic vulnerability to impacts discussed earlier). Sensitivity is a measure of how likely a population would be affected, in terms of changes to its size, reproductive output or geographical range, as a consequence of that population experiencing a given impact. It can also be thought of as a measure of the capacity of a population to absorb an impact and its ability to recover from temporary adverse conditions.

In determining the significance of impacts, sensitivity is considered in respect of each potentially affected population. Sensitivity is determined according to each species population's' ecological function and behaviour, using the broad criteria set out in Table 10.9. The assessment takes account of information available on the responses of birds to various stimuli (e.g. existing marine developments such as wind farms, noise and disturbance by humans). Note, however, that behavioural sensitivity can differ even between similar species (Garthe and Hüppop, 2004) and that, within a particular species, some populations and individuals may be more sensitive than others, and that sensitivity may change over time, for example due to habituation. Thus the behavioural responses of birds are likely to vary with both the nature and context of the stimulus and the experience and 'personality' of the bird. Sensitivity also depends on the type of activity of the bird, with, for example, a species likely to be less tolerant of disturbance whilst breeding than at other times in its life. Seabirds at sea are likely to be more vulnerable to the impacts of disturbance, displacement and barriers when they are subject to particular time and energy stresses, such as when provisioning young and during moulting. Some species, notably auk and duck species, are particularly vulnerable to disturbance during the period of annual wing moult when they are temporally flightless.

| Receptor Sensitivity | **Definition** |
|---|---|
| High | No capacity to accommodate the proposed form of change. |
| Medium | Low capacity to accommodate the proposed form of change. |

| Receptor Sensitivity | **Definition** |
|---|---|
| Low | Some capacity to accommodate the proposed form of change. |
| Negligible | Receptor is likely to have tolerance to accommodate the proposed change. |

Table 10.10: Criteria for Assessment of Sensitivity of Bird Populations

The significance of an effect on a receptor population is judged by combining the category of magnitude (Table 10.10) with the category for sensitivity (Table 10.11).

| Sensitivity | Magnitude | | | |
|---|---|---|---|---|
| | High | Medium | Low | Negligible |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Minor |
| Low | Moderate | Minor | Minor | Negligible |
| Negligible | Minor | Minor | Negligible | Negligible |

Table 10.11: The Level of Significance of an Impact Resulting from each Combination of Sensitivity and Magnitude.

Magnitude of effect is assessed in respect of an appropriate ecological unit, in most cases the regional population (see 'Regional population context').

Potential effects are evaluated in respect of all species of high or medium priority species (Table 10.7) that regularly use the study site and could be plausibly affected by the proposed development.

## 10.5 Existing Environment

10.5.1 Physical Environment

The development site is located approximately 5km west of the south-west tip of the island of Islay off the west coast of Scotland. The site is centred on latitude $55^0$ 40.20′ 'N and longitude $06^0$ 38.50W. The final project site (i.e., the area where TECs are proposed) covers 2.3 $km^2$ (Appendix 10.1, Fig 1).

Water depths across the survey area vary from 25 to 50m LAT. The seabed is characterised by a rock outcrop extending south-west from the Rinns of Islay and gravely sand with superficial sediment. The sea bed in the vicinity of the project site is mostly unsuitable for lesser sandeel (*Ammodytes marinus*), a species that is a major food source for seabirds, including auk species, and which requires soft sediments for burrowing (see Chapter 11: Natural Fish).

10.5.2 Summary of Ornithological Interest

The following summary of the ornithological interest of the survey area is based on the results of baseline studies. Full details of survey results are given in Appendices 10.1 and 10.2 together with relevant contextual information, for example on regional population sizes and conservation status.

10.5.2.1 Baseline Survey Effort

Surveys were conducted at approximately monthly intervals over a two-year period starting in October 2009. The survey area is exposed and experiences strong tidal currents. As a consequence it was common for sea conditions to be unsuitable for survey work, sometime for periods of several weeks. On occasions when adverse sea conditions prevented a planned survey visit being undertaken it was usually possible to compensate by undertaking two surveys the following month.

During the two-year period 20 out of the planned 24 survey visits were achieved, 11 in Year 1 and nine in Year 2 (Appendix 10.1). The four 'missed' surveys were all during the autumn and winter (September to March). One survey visit (December 2009) was curtailed part way through due to deteriorating sea conditions.

The shortfall of around 30% in survey results achieved in the autumn and winter is not considered to result a serious information gap, a view endorsed by SNH (Table 10.4 Comments on Year 2 Bird Report 30/8/2012 SNH). This is because the surveys that were satisfactorily completed were well distributed through the autumn and winter, and the results from the surveys that were undertaken showed there were generally low numbers of birds present in these seasons. Furthermore, the autumn and winter is a time when, for most species at least, birds from SPA colonies in the region are likely to be wintering elsewhere.

The Colonsay SPA corridor was surveyed seven times, three times in 2010 and four times in 2011. The Rathlin Island SPA corridor was also surveyed seven times, four times in 2010 and three times in 2011.

10.5.2.2 Ornithological Overview

Individual species summaries are provided below for all seabird species that were regularly recorded during baseline surveys. Species rated as having either high or medium priority for EIA of the project are covered in greater detail as these have greatest relevance to the EIA. Regularly occurring species rated as low priority are only given brief summaries as these are of low relevance for the project and therefore do not merit consideration in the assessment. Summary statistics of the estimated abundance of species in the anticipated impact footprint together with regional population estimates are presented for the breeding season and the autumn/winter period in Tables 10.12 and 10.13 respectively. Full details of baseline surveys results for all species, including irregularly occurring low priority species, are presented in Appendix 10.1. Appendix 10.1 also include maps for most species showing the distribution of records across the survey area. The NCI, generic vulnerability to TECs and species priority categorisation for the breeding season and the autumn/winter period are summarised in Tables 10.14 and 10.15 respectively.

In the species summaries below (Tables 10.12 and 10.13, Appendix 10.1) values for estimated bird abundances are given for the 2.3km$^2$ development area (DA) and this area with surrounding buffer of 1km (DA+1km), these areas corresponding to maximum anticipated impact footprint (depending on the impact being considered). The development area buffered to 1km covers 13.1 km$^2$, over five times the development area alone. In the species summaries the estimated numbers present in the DA or DA+1km are rounded to the nearest integer except for values less than one which are rounded to 1 decimal place.

A total of 11 seabirds species were regularly recorded (defined as at least two records) using the development area and 1km buffer during the two years of baseline surveys. Of these, fulmar, gannet, and Manx shearwater were commonly seen but the great majority of individuals were in flight apparently transiting through the area. Common guillemot and razorbill were both reasonably common through the year and at times in the winter occurred in relatively large numbers. All other regularly occurring species, namely shag, herring gull, great-black-backed gull, kittiwake, Arctic tern and puffin were uncommon, each with just a few records.

<u>Fulmar</u>

Fulmar is categorised as a low priority for this EIA. Fulmar is considered to have a very low vulnerability to tidal arrays because they do not dive to any appreciable depth and have a high tolerance to human disturbance (Furness *et al.* 2012). Although the development lies within the Mean Maximum Foraging Range (400km) of several breeding colonies designated as SPAs in west Scotland where this species is a qualifying feature (Appendix 10.2), the numbers recorded using the development area during baseline surveys was very small in the context of the numbers breeding in western Scotland in general and at these SPA sites in particular. The great majority (approximately 75%) of fulmars recorded were in flight and showed no signs of using the development area, i.e., they were likely to been simply transiting through.

Fulmars were scarce year round; the estimated average number present in the breeding season was 0.6 bird in the DA and 3 birds in the DA+1km, and in the autumn/winter it was 0.8 birds in the DA and 5 birds in the DA+1km (Tables 10.12 and 10.13). To put these results in context, 21,704 pairs of fulmars breed in the region (Mitchell *et al*. 2004) and approximately 12,000 birds are present in the region in autumn and winter (Tables 10.13 and 10.14). It is concluded that the numbers present in the DA and DA+1km in the breeding season and autumn/winter are negligible (well below 0.1%) in the context of the assumed regional populations.

Manx shearwater

Manx shearwater is categorised as a low priority for this EIA. Manx shearwater is considered to have a very low vulnerability to tidal arrays because they do not dive to any appreciable depth and have a relatively high tolerance to human disturbance (Furness *et al.* 2012). Small numbers of Manx shearwater were recorded during the breeding season; on average there were estimated to be 2 birds in the DA and 13 in the DA+1km (Tables 10.13). The great majority (approximately 75%) of Manx shearwater recorded were in flight and showed no signs of using the development area, i.e., they were likely to been simply transiting through. The peak number of Manx shearwater estimated to be inside the DA was 7 birds in June 2011. To put these results in context the numbers of Manx shearwater breeding in the region is estimated at 126,366 pairs (Tables 10.12), suggesting a population of at least 300,000 individuals including immatures. It is concluded that the numbers present in the DA and DA+1km in the breeding season are negligible (well below 0.01%) in the context of the assumed regional population. Manx shearwater is a summer visitor and was not recorded during the autumn and winter months.

Gannet

Gannet is categorised as a low priority for this EIA. Gannet is considered to have a very low vulnerability to tidal arrays because they are not likely to dive to the depths occupied by TECs (typically >10m below the surface) and they have a high tolerance to human disturbance (Furness *et al.* 2012). The development site lies within the Mean Maximum Foraging Range (approximately 229km) of one breeding colony, namely St Ailsa Craig lying 120km to the SE). The great majority (88%) of gannet recorded were in flight and showed no signs of using the development area, i.e., they were likely to been simply transiting through; only approximately 12% of records were of birds recorded as using the area (i.e., on the sea or actively searching for food).

The baseline surveys recorded small numbers of gannet. On average there were estimated to be 2 birds in the DA and 9 in the DA+1km during the breeding season, and 0.3 bird in the DA and 2 birds in the DA+1km during the autumn/winter (Tables 10.12 and 10.13, map in Appendix 10.1). To put these results in context the numbers of gannet breeding in the region is 34,408 pairs (Mitchell *et al.* 2004) suggesting a population of approximately 100,000 individuals over-summering in the region if immatures are included. The regional winter population is approximately 6,000 birds (Table 10.12) It is concluded that the numbers present in the DA and DA+1km in the breeding season and autumn/winter are negligible (well below 0.1%) in the context of the assumed regional populations.

Shag

Shag is categorised as low priority for EIA because they occurred in very low numbers in the DA+1km with none recorded in the DA (Table 10.13). The majority of shags seen during the baseline surveys were in the relatively shallow water within a few kilometres of the Islay coast (see maps in Appendix 10.1). Based on the average density across the survey area, the estimated mean number in the D.A. and DA+1km during the breeding season was 0.3 and 2 birds respectively (Tables 10.13). On the same basis the estimated mean numbers present in autumn/winter were 0.7 in the D.A. and 4 in the DA+1km (Table 10.13). The regional breeding shag population is 3,622 pairs (Mitchell *et al*. 2004), and as this species is fairly sedentary the population present in autumn and winter is assumed to be the same. It is concluded that the numbers present in the DA and DA+1km in the breeding season and autumn/winter are negligible (well below 0.1%) in the context of the regional population.

Herring gull

Herring gull is categorised as low priority at all times of year because it occurred only in very small numbers (Table 10.12) and because it is considered to have a very low vulnerability to tidal arrays (Furness *et al.* 2012). Herring gull was seen only during the autumn and winter months, most were in flight transiting through (Appendix 10.1). Only four individuals were recorded on the sea, all in January of Year 2. The estimated average number in present in autumn and winter was 0.3 birds in the DA and 2 in the DA+1km. The regional autumn/winter population is approximately 36,000 birds (Table 10.13). It is concluded that the numbers present in the DA and DA+1km are negligible (well below 0.1%) in the context of the regional population.

Great black-backed gull

Great black-backed gull is categorised as low priority at all times of year because it occurred only in very small numbers (Table 10.12) and because it is considered to have a very low vulnerability to tidal arrays (Furness *et al.* 2012). Most birds seen were in flight transiting through the survey area during the winter. Only two individuals were recorded on the sea in the DA+1km during the two years of baseline survey work, both in January of Year 2. The estimated average number in present in autumn and winter was 0.2 birds in the DA and 1 in the DA+1km, and they were virtually absent in the breeding season (Tables 10.12 and 10.13). The regional autumn/winter population is approximately 3,000 birds (Table 10.13).

Kittiwake

Kittiwake is categorised as low priority at all times of year because it occurred only in small numbers (Table 10.12) and because it is considered to have a very low vulnerability to tidal arrays (Furness *et al.* 2012). All but a single bird seen in baseline surveys were in flight, apparently transiting through (Appendices 10.1

and 10.3). The estimated average number present in the breeding season in the DA was 0.8 birds and in the DA+1km 5 birds, well below 0.1% of the regional breeding population (Table 10.12), even allowing for recent declines (SNH 2012). The estimated average number present in the autumn/winter in the DA was 2 birds and in the DA+1km 13 birds, the latter representing approximately 0.2% of the assumed regional autumn/winter population (Table 10.13).

Arctic Tern

Arctic tern is categorised as low priority at all times of year because it occurred irregularly and in in very small numbers (Table 10.12) and because it is considered to have a very low vulnerability to tidal arrays (Furness *et al.* 2012). The only records were two flock small flocks (of 6 and 10 birds) flying through the site in June of Year 2. These may have been breeding birds on foraging trips. This species was not recorded in Year 1. The estimated average number present in the breeding season in the DA was 0.2 birds and in the DA+1km 1 birds, well below 0.1% of the regional breeding population (Table 10.12).

Common guillemot

Common guillemot is categorised medium priority for EIA in the winter and low priority in the breeding season. It merits medium priority in winter because the numbers present in the development area on average are approach 0.1% of the assumed regional population (Table 10.12) and because it is considered to have a high vulnerability to TECs on account of the apparent potential for collision risk (Furness *et al*. 2012).

The estimated average number present on the sea in the autumn/winter was 25 birds in the DA was and 140 birds in the DA+1km, representing approximately 0.1% and 0.6% of the assumed regional autumn/winter population (Table 10.13). In the breeding season the numbers present were much lower (see below) and hence the species is categorised as low priority at this time of year. The estimated average number present on the sea in the breeding season was 4 birds in the DA and 21 birds in the DA+1km, well below 0.1% of the regional breeding population (Table 10.12). Immature common guillemots typically return from wintering areas to spend their summer relatively close to their natal area (Wernham *et al.* 2002), but they do not breed until around four years of age. It is therefore likely that a significant minority, perhaps around a third, of the birds present in the breeding season comprise non-breeding immature birds that have yet to settle at a particular breeding colony.

The likely origin of the common guillemots in winter is relevant because this is the only time of year when relatively large numbers are sometimes present within or close to the development area, and thus when there is the greatest potential for adverse effects. Ringing recoveries show that common guillemots breeding in Scotland disperse widely outside the breeding season. They typically overwinter several hundred kilometres from their breeding site but there is considerable individual variation with some individuals moving only short distances (Wernham *et al*. 2002). In mid-winter (December and January) ringing recoveries of British adult common guillemot are on average approximately three degrees of latitude (approximately 330km) of their breeding site, and about one quarter are up to six degrees (approximately 660km) of their breeding colony. Most Scottish birds head south (especially to the Bay of Biscay) or south east (to the southern North Sea), but others go north (to the Faeroes) or east (to the northern North Sea). Recoveries also show that some birds breeding overseas overwinter around Scotland, in particular those from the Faeroes and Norway.

It is concluded that the common guillemots present in the development area in winter are likely to originate from a wide range of breeding sites, mostly likely are sites in west Scotland and the Faeroes. The Faeroes bird potentially could make up a large proportion of birds overwintering in west Scotland as they number in the region of half a million individuals, roughly the same as size of the west Scotland breeding population. Common guillemots are the most numerous seabird wintering around the coast of the UK with a population of several million individuals (Kober *et al*. 2009).

<u>Razorbill</u>
Razorbill is categorised as medium priority for EIA in the winter and low priority in the breeding season. It merits medium priority in winter because the average numbers present in the development area approach 0.1% of the assumed regional population (Table 10.12) and because it is considered to have a high vulnerability to TEC arrays (Furness *et al*. 2012). The estimated average number present on the sea in the autumn/winter was 6 birds in the DA was and 32 birds in the DA+1km, representing approximately 0.1% and 0.5% of the assumed regional autumn/winter population (Table 10.13).

In the breeding season the numbers present were much lower and hence the species is categorised as low priority at this time of year. The estimated average number present on the sea in the breeding season was 2 birds in the DA and 9 birds in the DA+1km, well below 0.1% of the regional breeding population (Table 10.12).

The most likely origin of the razorbill present in the breeding season are small colonies on the west coast of Islay, the closest breeding colonies to the development area. These include the colony of approximately 330 pairs in the Rinns of Islay Ramsar site approximately 24km to the north-east of the development area. Razorbill is included in the designation interest of this Ramsar site because it is considered to be a 'nationally important population' (however this appears to be untrue as the size of the colony is well below the '1% population threshold' used by convention to define sites of national importance). The Islay west coast colonies also included a small breeding colony at Glac na Criche SSSI.

The likely origin of the razorbill occurring in autumn/winter is relevant because relatively large numbers are sometimes present within or close to the development area at this time. Recoveries of razorbill ringed at breeding sites in western Scotland show that they typically overwinter several hundred kilometres away in areas to the south and east, such as the North Sea and western Norway

(Wernham *et al.* 2002). Indeed, the median distance for winter recoveries of British adults is nearly 700 km from the breeding site, and nearly a 1000km for immature birds (Wernham *et al.* 2002). Recoveries also show razorbills from breeding sites in Iceland and Scandinavia overwinter in the seas around the UK including Scotland (Wernham *et al*. 2002). On the basis of measurements off dead birds washed ashore, it is also inferred that large numbers of birds of the nominate race overwinter in western Britain, most likely from breeding sites in Greenland. It is concluded that the birds present in winter mostly or entirely originate from overseas breeding areas, and probably comprise a mix of birds from Greenland, Iceland, Scandinavia and perhaps the Faeroes also. Icelandic birds in particular are likely to account for a high proportion because Iceland has a very large breeding population, approaching a million individuals (i.e., about three times the number that breed in the Great Britain and Ireland).

<u>Puffin</u>
Puffin is categorised as low priority for EIA because it occurred only in small numbers at all times of year. The estimated average number present on the sea in the breeding season in the DA was 2 birds and in the DA+1km 11 birds, 0.02% and 0.1% of the regional breeding population respectively (Table 10.12). The estimated average number present in the autumn/winter in the DA was 0.2 birds and in the DA+1km 1 birds, the latter representing approximately 0.1% of the assumed regional autumn/winter population (Table 10.13).

<u>Black guillemot</u>
Black guillemot is categorised as low priority for EIA because it occurred only in very small numbers at all times of year (Table 10.12 and 10.13). The majority of black guillemots seen during the baseline surveys were in the relatively shallow water within a few kilometres of the Islay coast (see map in Appendix 10.1). Based on the average density across the survey area, the estimated mean number in the D.A. and DA+1km during the breeding season was 0.1 and 0.5 birds respectively Tables 10.13. On the same basis the estimated average number present in the autumn/winter in the DA was 0.1 birds and in the DA+1km 0.4 birds, well below 0.1% of the assumed regional autumn/winter population (Table 10.13).

**Table 10.12. The estimated mean number of birds present in the development area (DA) and development area buffered to 1 km (DA+1km) during the breeding season (see Appendix 3) compared to the assumed regional population. For fulmar, Manx shearwater and gannet the regional population is defined as south-west Scotland (Skye southwards) and Northern Ireland. For all other species the region is defined as Argyll & Bute and County Antrim. Population sizes are from Seabird 2000 census (Mitchell *et al.* 2004)**

| Species | Scotland regional colonies popltn. (pairs/AOBs) | N. Ireland regional colonies popltn. (pairs/AOBs) | Regional population total (pairs) | Estimated abundance DA (birds, 2.3km$^2$) | Estimated abundance DA+1km (birds, 13.1 km$^2$) | Mean % of regional popltn. in DA | Mean % of regional popltn. in DA+1km |
|---|---|---|---|---|---|---|---|
| Fulmar | 15,712 | 5,992 | 21,704 | 0.8 | 4.8 | <0.01% | 0.01% |
| Manx Shearwater | 121,733 | 4,633 | 126,366 | 2.2 | 12.6 | <0.01% | <0.01% |
| Gannet | 34,408 | 0 | 34,408 | 1.6 | 9.4 | <0.01% | 0.01% |
| Shag | 3,341 | 281 | 3,622 | 0.3 | 1.7 | <0.01% | 0.02% |
| Great Black-backed Gull | 1,736 | 16 | 1,752 | 0.01 | 0.1 | <0.01% | <0.01% |
| Kittiwake | 8,976 | 12,109 | 21,085 | 0.8 | 4.5 | <0.01% | 0.01% |
| Arctic tern | 1,823 | 4 | 1,827 | 0.2 | 1.3 | 0.01% | 0.04% |
| Guillemots on sea (incl. share of 'large auks') | 42,697 | 98,546 | 141,243 | 3.6 | 20.8 | <0.01% | 0.01% |
| Guillemot, flying (incl. share of 'large auks') | | | | 0.6 | 3.4 | <0.01% | <0.01% |
| Razorbill, on sea (incl. share of 'large auks') | 9,056 | 24,084 | 33,140 | 1.6 | 9.2 | <0.01% | 0.01% |
| Razorbill, flying (incl. share of 'large auks') | | | | 0.8 | 4.8 | <0.01% | 0.01% |
| Puffin, on sea | 2,597 | 1,610 | 4,207 | 1.9 | 10.7 | 0.02% | 0.13% |
| Puffin, flying | | | | 0.2 | 1.0 | <0.01% | 0.01% |
| Black guillemot | 3,046 | 865 | 3,911 | 0.1 | 0.5 | <0.01% | 0.01% |

**Table 10.13. The estimated mean number of birds present in the development area (DA) and development area buffered to 1 km (DA+1km) during the autumn and winter compared to the assumed regional population. In the case of shag and black guillemot the regional population is assumed to be the same as the regional breeding population. For all other species the approximate regional autumn/winter population is derived from densities in Kober *et al*. 2010 multiplied by an area of 12,000 km$^2$, the approximate seaward extent of NHZ14 and the coast of Northern Ireland.**

| Species | Approx. mean regional density (birds/km$^2$) | Approx. regional total | Mean density in Survey Area | DA (2.3km$^2$) | DA+1km (13.1 km$^2$) | Mean % of regional popltn. in DA | Mean % of regional popltn. in DA+1km |
|---|---|---|---|---|---|---|---|
| Fulmar | 1 | 12000 | 0.26 | 0.6 | 3.4 | <0.01% | 0.03% |
| Gannet | 0.5 | 6000 | 0.14 | 0.3 | 1.8 | 0.01% | 0.03% |
| Shag | 1 | 12000 | 0.33 | 0.7 | 4.3 | 0.01% | 0.04% |
| Great Black-backed Gull | 0.25 | 3000 | 0.08 | 0.2 | 1.1 | 0.01% | 0.04% |
| Herring Gull | 3 | 36000 | 0.13 | 0.3 | 1.7 | <0.01% | 0.00% |
| Kittiwake | 0.6 | 7200 | 0.97 | 2.2 | 12.8 | 0.03% | 0.18% |
| Guillemot, on sea (incl. share of 'large auks') | 2 | 24000 | 10.68 | 24.3 | 140.3 | 0.10% | 0.58% |
| Guillemot, flying (incl. share of 'large auks') | | | 0.53 | 1.2 | 7.0 | <0.01% | 0.03% |
| Razorbill, on sea (incl. share of 'large auks') | 0.6 | 7200 | 2.45 | 5.6 | 32.2 | 0.08% | 0.45% |
| Razorbill, flying (incl. share of 'large auks') | | | 0.87 | 2.0 | 11.4 | 0.03% | 0.16% |
| Puffin | 0.1 | 1200 | 0.10 | 0.2 | 1.3 | 0.02% | 0.11% |
| Black guillemot | 1 | 12000 | 0.03 | 0.1 | 0.4 | <0.01% | <0.01% |

**Table 10.14: Summary of EIA priority, Nature Conservation Importance (NCI) and status of bird species recorded in the development area during the breeding season. *** Importance to foraging birds in the regional population is based on the mean proportion of assumed regional population present in the development area, as follows: Very low, <0.01%; Low, 0.01% to 0.1%; Moderate, 0.1% to 1%, High, >1%.

| Species | NCI category | Importance of site for foraging * | Vulnerability to effect of tidal arrays (Furness *et al*. 2012) | EIA priority |
|---|---|---|---|---|
| Fulmar | Low | Very low | Very low | Low |
| Manx shearwater | Low | Very low | Very low | Low |
| Gannet | Low | Very low | Low | Low |
| Shag | Low | Very low | Low | Low |
| Great black-backed gull | Low | Very low | Very low | Low |
| Kittiwake | Low | Very low | Very low | Low |
| Arctic tern | High, (Annex 1) | Very low | Low | Low |
| Common guillemot | Low | Very low | High | Low |
| Razorbill | Low | Very low | High | Low |
| Puffin | Low | Low | Moderate | Low |
| Black guillemot | Low | Very low | High | Low |

**Table 10.15: Summary of EIA priority, Nature Conservation Importance (NCI) and status of bird species recorded in the development area during the autumn and winter.** *Importance to foraging birds in the regional population is based on the mean proportion of assumed regional population present in the development area, as follows: Very low, <0.01%; Low, 0.01% to 0.1%; Moderate, 0.1% to 1%, High, >1%.

| Species | NCI category | Importance of site for foraging * | Vulnerability to effect of tidal arrays (Furness *et al*. 2012) | EIA priority |
|---|---|---|---|---|
| Fulmar | Low | Very low | Very low | Low |
| Gannet | Low | Very low | Low | Low |
| Shag | Low | Very low | Low | Low |
| Herring gull | Moderate (BOCC Red List) | Very low | Very low | Low |
| Great black-backed gull | Low | Very low | Very low | Low |
| Kittiwake | Low | Low | Very low | Low |
| Common guillemot | Low | Low | High | Medium |
| Razorbill | Low | Low | High | Medium |
| Puffin | Low | Very low | Moderate | Low |
| Black guillemot | Low | Very low | High | Low |

## 10.6 Impact Assessment: Do nothing scenario

In a 'do nothing' scenario the range of bird species and their abundance occurring in the areas potentially affected by the development would not be expected to remain constant over the next 20 years for a number of reasons. However, the range of bird species and their abundance are expected to remain broadly similar to that recorded in baseline surveys. There is a wealth of long term monitoring data on bird populations in the UK and these show populations can fluctuate markedly and ranges change in their extent. For example, the JNCC program of monitoring breeding seabird colonies (Mitchell *et al*. 2004). The distribution of where seabirds choose to feed is also influenced by prey availability, and this will vary, on occasions markedly so, from year-to-year and season-to-season in response to natural changes in the marine environment such as sea temperature, currents, and plankton density. Similarly, on land, the areas chosen by birds for breeding and feeding will vary from year-to-year and season-to-season in response to vegetation structure and food availability (amongst other factors), which in turn reflect natural and man induced changes to the environment.

## 10.7 Impact Assessment: Installation Phase

10.7.1 Impact 1: Disturbance of seabirds

It is likely that noise and disturbance from vessels associated with installation activities would temporarily displace some foraging or resting seabirds from marine habitats.

Disturbance effects on seabirds during installation would be confined to routes travelled by installation and survey vessels, the marine development site and its immediate vicinity. Installation is anticipated to last 6 months, as described in Chapter 5: Project Description. Observations made from seabird surveys in vicinity of the development and elsewhere around Scotland show that the species encountered in the development area have a moderate to high tolerance to slow moving (approximately <10 knots) vessels at all times of year. The species encountered typically only show a behavioural escape response to such vessels if it approaches closer than 100m. There is no on-site experience to inform how seabirds in the vicinity of the development will respond to faster moving vessels, but experience from elsewhere indicates that faster moving vessels would cause greater disturbance because seabirds are likely to show escape behaviour at greater distances, particularly to vessels exceeding 20 knots.

No seabird species breed in or close to the areas that will be potentially affected by installation disturbance. Therefore the disturbance effects at seabird breeding sites due to vessels during the installation phase are likely to be nil and, therefore, not significant under the terms of the EIA Regulations.

Vessel disturbance would be limited to the disturbance of birds at sea. A review paper of vulnerability to effects of windfarms by Garthe and Hüppop (2004) rated seabird species for sensitivity to disturbance by vessels. Most of the species occurring in the development area were scored as either 1/5 or 2/5, equating to very low or low sensitivity. Common guillemot and razorbill were scored as 3/5, equating to moderate sensitivity. These scores are in line with the experience of surveyors' watching how these species responded to the survey vessel during baseline surveys. Based on this, the likely effect of any disturbance from project vessels would be for some individuals that are approached too closely (e.g., typically less than 100 m away) to be temporarily inconvenienced as they relocate to a nearby location, typically no more than a few hundred or so metres away. Given the relatively high tolerance to vessel disturbance by the seabird species that use the development area and its immediate surrounds, only a small minority of individuals present within the development area are likely be affected by disturbance at any one times, even were there to be several vessels operating in the development area.

It is concluded that provided vessels are travelling relatively slowly, disturbance would be an impact of negligible magnitude and short term duration on regional populations of seabirds. Therefore, for all species the predicted impacts are of **negligible significance** under the terms of the EIA Regulations.

10.7.1.1 Mitigation in Relation to Impact 1

No mitigation is required for any species.

Good practice would aim to minimise vessel disturbance to seabirds by avoiding where possible preferred feeding and resting areas and adopting voluntary speed restrictions. Studies elsewhere indicate the severity of disturbance by boats is related to speed (Ronconi and Cassady St. Clair, 2002). Vessel speed limits are commonly used to limit disturbance to seabirds in the vicinity of colonies and feeding sites; however there is no accepted maximum permissible speed. A maximum vessel speed of 15km/hr (approximately 8 knots) is likely to give most seabird species time to move away from an approaching vessel without resorting to flight.

Good practice will be for project vessels to stick to the defined routes, as far as possible, between ports and the development area as a means of reducing disturbance of seabirds. Studies have shown that disturbance is reduced if birds can predict where the disturbance will occur (Schwemmer *et al.* 2010). Baseline surveys identified no marine areas of particular ornithological sensitivity between the development site and Islay.

10.7.1.2 Residual Effect of Impact 1

The good practice mitigation measures will reduce vessel disturbance, the residual impact will, as initially, remain of negligible significance for all species.

10.7.2 Impact 2: Direct habitat loss

The loss of seabed habitat caused by the installation of devices is considered in detail in Chapter 8: Benthic (Table 8.6 The maximum area of seabed occupied by the TEC device foundation footprints is 496 $m^2$ This represents approximately 0.02% of seabed in the development area (2.3 $km^2$) and is a tiny fraction of the area of seabed in the region as defined for seabird populations (approximately 12,000 $km^2$). Although sea bed habitat loss will be long term temporally it will be of negligible spatial magnitude. Therefore the effects of direct sea-bed habitat loss are deemed not significant for all seabird species under the terms of the EIA Regulations

10.7.2.1 Mitigation in relation to Impact 2

No mitigation is required for any bird species.

10.7.2.2 Residual effect of Impact 2

Effects of habitat loss will remain not significant for all species.

## 10.8 Impact Assessment: Operational Phase

10.8.1 Impact 3: Vessel disturbance of seabirds

During the operational phase of the proposed development, which is schedule to last 25 years, there is potential for displacement of seabirds from foraging areas, principally by disturbance caused by maintenance and survey vessels. Although similar in nature to vessel disturbance caused during the installation phase (see Impact 1), the frequency and duration of any vessel disturbance during the operational phase is likely to be much less. For example, it is anticipated that each TEC will require a only a single 2-day maintenance check over each year. Therefore, following the reasoning presented for vessel disturbance for the installation phase (Impact 1), it is predicted that the likely effects of vessel disturbance on seabird species during the operational phase will be negligible and not significant under the terms of the EIA Regulations.

10.8.1.1 Mitigation of Impact 3

Although no mitigation the same good practice measures described for Impact 1 will be adopted to minimise disturbance by vessels.

10.8.1.2 Residual effect of Impact 3

The good practice mitigation measures will reduce vessel disturbance, the residual impact will, as initially, remain not significant for all species.

10.8.2 Impact 4: Displacement of Seabirds from Marine Habitats

There is a paucity of studies on how seabirds will respond to the presence of operational TEC devices. Studies of birds in the vicinity of the SeaGen device installed in Strangford Lough, Northern Ireland, found that seabird there showed only small or indiscernible displacement effects (Marine Current Turbines 2011).

There is, of course, a wealth of experience on how seabirds respond to static man-made marine structures such as fixed lights, buoys, fish cages and moored vessels. The SeaGen-MkII TEC devices (one of the two possible TEC designs proposed) would have a surface piercing tower extending to approximately 21m above LAT that supporting a 7x9m pod. The emergent part of the SeaGen TEC devices will be highly visible to birds when on the water and flying. The SeaGen devices will also create a wake when there is a current running.

The visual presence of the SeaGen device towers and pods could potentially cause some bird species to avoid their immediate vicinity. However seabirds of the species encountered in the development areas are commonly observations foraging very close to various man-made structures in the marine environment, such as lighthouses, oil rigs and vessels. Were the SeaGen device towers to cause displacement at most this is likely to be a weak effect, limited to their immediate vicinity. Even if all sea birds were displaced from a 100m radius around the 15 (maximum) SeaGen towers, which is highly unlikely, this would amount to an effective loss of less than 0.5 $km^2$, a negligible proportion of the foraging areas available to regional populations (approximately 10,000 $km^2$).

The SeaGen towers would be fitted with lighting to comply with rules for marking navigation hazards. The specifications for this lighting have not been finalised. Although some forms of lighting can potentially cause displacement or disorientation of nocturnally active birds there is no evidence that the type or intensity of lighting that is likely to be used on SeaGen devices would have any impacts on seabirds. Indeed, the seabird populations in the region already commonly experience night time lighting from many source without any noticeable adverse impacts, e.g. from vessels, lighthouses and navigation buoys. Indeed lighting could help reduce other risks such as collision risk posed to birds flying at night. For the purposes of assessment it is assumed that the choice of lighting for SeaGen devices and other marine infrastructure will be commensurate with existing marine lighting in the region in terms of its brightness and colour, and therefore within the limits of what seabirds in the region currently experience. Even if lighting were to displace some species from the vicinity of TECs at night, it is unlikely that the displacement effect would extend more than a few hundred metres and thus to total area so effected would be negligible compared to the area of sea in the region.

It is concluded that the predicted impact of displacement (including that caused by lighting) on seabirds in the operational phase are of negligible magnitude and long term. Therefore the impact of disturbance is of **negligible significance** under the terms of the EIA Regulations.

The emergent superstructure of SeaGen devices could attract some seabird species, either because the wake provides new foraging opportunities or because the towers and pods provide elevated perches. Gull species are likely to perch on superstructure, but any benefits this may bring to regional species populations are likely to be negligible. Although it is possible that shags (a species that was seldom recorded in the development area in baseline surveys) may find emergent superstructure attractive for perching and lead to them making greater use of the development area, this is considered to be relatively unlikely because the area is deeper and further offshore than those typically used by this species (Wanless *et al*. 1991).

10.8.2.1 Mitigation of Impact 4

No mitigation is required for any species. It is inevitable that birds will perch on emergent superstructure, therefore, good practice measures will be taken to ensure that all potential perching locations are safe for birds. The potential adverse effects of lighting on birds will be taken into consideration in the design and final choice of lighting used on towers and other infrastructure. The relevant authorities, including SNH, MSS and NLB, will be consulted over the choice, positioning and operational regime of marine lighting.

10.8.2.2 Residual effect of Impact 4

The residual impact will remain of negligible significance for all species.

10.8.3 Impact 5: Collision Risk to Diving Seabirds

TEC devices pose a theoretical collision risk to actively diving seabirds and this could lead to death or injury. However, there is currently no empirical evidence to indicate if TEC devices pose a real collision risk to diving seabirds. This information gap requires investigation (Shields, 2009).

Experience of operating open rotor device at Strangford Lough in Northern Ireland have provided no evidence of collision effects on diving birds.

The baseline survey results show that the area where the TECs will be deployed is relatively little used by diving seabirds (Tables 10.12 and 10.13) and so the potential for collision is likely to be low. The only diving species potentially affected by collision seen feeding (or suspected to be feeding) within the footprint of the development were guillemot, razorbill and puffin. These three species commonly undertake dives to depths of at least 30m and are therefore likely to reach the depths of TECs and so could potentially be exposed to a collision risk. The development area appears to have no or negligible importance to black guillemot and shag (Appendix 10.1) and for this reason these species are unlikely to be affected by collision.

During the breeding season small numbers of three auk species (common guillemot, razorbill and puffin) were present on the sea (and therefore potentially feeding) in the development area: on average there were <4 common guillemots, <2 razorbills and <2 puffins present (Table 10.13). In all cases, these numbers are a tiny proportion of their regional populations of many thousands of individuals (0.001% in the case of guillemot, 0.002% for razorbill and 0.02% for puffin, Table 10.13). For this reason the magnitude of the potential for collision effects on these auk species during the breeding season is considered to be negligible.

The average abundance of common guillemot and razorbill (but not puffin) recorded during the autumn/winter period was much greater than in the breeding season and so there is greater potential for collision risk at this time of year. Nevertheless, the average estimated numbers present in the development area at this time were very low in the context of the assumed regional wintering population sizes (Table 10.14); the average number of common guillemot was approximately 25 birds representing around 0.1% of the regional wintering population and the average number of razorbill present was approximately 6 birds representing around 0.08% of the regional wintering population.

As shown above, because the abundance of auks on the sea (and therefore presumed to be feeding) in the development area was very low it is concluded that the potential magnitude of any collision risk is also likely to be very low. This is the main reason why collision rate modelling (CRM) has not been undertaken. There is currently no approved method, or an adequate understanding on avoidance or the consequences for birds of collision (e.g., injury rate when a bird comes into contact with a rotor) therefore attempting to undertake CRM is unlikely to change the initial conclusion. The combination of the relatively small size of the rotor swept area of devices (up to 380m$^2$ per rotor, Table 10.3) and the relatively wide spacing distance between rotors (see Table 10.3) it is clear that only a very small proportion (well below 1%) of dive paths of auks feeding in the development area would be likely to pass through the rotor swept area of a device. It is also clear that only a minority (approximately 20%, estimated using Band model, Band *et al*. 2007) depending on TEC design and rotation period) of birds that swim through a TEC rotor swept area would be struck even if they showed no avoidance. It is also likely that a high proportion of birds (e.g., in line the proportion assumed likely for seals by Davies and Thompson (2011)) will make effective avoidance manoeuvres and that many collisions will not cause any injury (e.g., those that occur when rotors are turning at slow speed or make contact near the hub). During periods of low current speed (<1m/s) and TEC maintenance there will be no collision risk as rotors will not be rotating; rotors are estimated to be inoperative for approximately 25%-30%. Given all the above, it is clear that injurious collisions will at most be rare events.

To further justify the conclusion of an impact of negligible magnitude, it is worth considering how much additional mortality would be required to cause a significant impact on the regional populations of wintering common guillemot or razorbill. In the case of guillemot, out of a regional wintering population of approximately 24,000 birds, approximately 2760 of these would be expected to die annually due to baseline mortality (assuming an adult mortality rate 11.5% del (Hoyo, Elliot and Sargatal, 1996)). For collision mortality to merit classification as an effect of low magnitude (as defined in Table 10.9) there would need to be between 28 and 140 additional deaths per year. Similarly for razorbill, out of a regional wintering population of approximately 7200 birds, approximately 684 of these would be expected to die annually due to baseline mortality (assuming an adult mortality rate 9.5% (del Hoyo, Elliot and Sargatal, 1996)). For collision mortality to merit classification as an effect of low magnitude (as defined in Table 10.9) there would need to be between 7 and 35 additional deaths per year. Given the low numbers of individuals using the development area and it is considered very unlikely that that these levels of additional mortality would occur.

It is concluded that there is a theoretical collision risk to diving auk species, in particular common guillemot and razorbill during the autumn/winter. It is further concluded that, due to the combination of low diving bird densities in the development area and the likely low risk of injurious collision events, the magnitude of any collision mortality is unlikely to merit a categorisation as being of greater than negligible magnitude for any species.

In summary, the collision risk posed by operational TEC rotors to diving birds is assessed as an effect of negligible magnitude and temporally long term. It is judged this effect is of **negligible significance** under the terms of the EIA Regulations.

10.8.3.1 Mitigation in Relation to Impact 5

Results of research and monitoring on this subject will be followed and, should there be evidence of mortality, measures will be considered that aim to prevent it occurring. The operators of the development will share any relevant data it may collect on this subject with other stakeholders in the spirit of promoting as wide an understanding as possible of collision risks to diving birds.

10.8.3.2 Residual Effect

Impacts of collision will likely remain unchanged at **negligible significance** at least in the short term.

10.8.4 Impact 6: Marine Pollution and Contamination

The release of oil and other marine pollutants and the toxic effects of anti-fouling chemicals could have lethal and sub-lethal effects on seabirds and their prey. For example it is well known that oil slicks can kill seabirds. As the various regulations and codes of practice covering the safe use of oil, lubricants, chemicals and antifouling paints in the marine environment will be fully complied with, the risks of such contamination occurring would be limited to accidental release. The development will also adopt an explicit policy to deal rapidly and effectively with any accidental release of pollutants.

When combining the contingency policy, with the following factors:

- that the potential quantities of any oil or chemicals accidentally released are relatively small;
- that the wave and tide action would quickly disperse and dilute any contaminants; and
- that the numbers of all seabird species using the development area are small in a regional context.

The impact of the likely effects on regional seabird populations is assessed as being of negligible spatial magnitude and long term temporally. It is judged that this impact is **negligible significance** under the terms of the EIA Regulations.

10.8.4.1 Mitigation in Relation to Impact 6

No mitigation is required.

The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally, any chemicals used during installation will require prior approval through the licensing process and any lubricants will be non-toxic, biodegradable and capable of dispersal in seawater.

10.8.4.2 Residual Effect of Impact 6

Provided good practice guidelines are adhered the impacts of pollution and contamination on marine birds populations will remain not significant for all species.

## 10.9 Impact Assessment: Decommissioning Phase

10.9.1 Impact 7: Vessel Disturbance

For all seabird species a potential effect during the decommissioning phase is disturbance from foraging areas by project vessels. Although similar in nature to vessel disturbance caused during the installation phase (see Impact 1), the frequency and duration of any vessel disturbance during the decommissioning phase is likely to be much less. Following the reasoning presented for vessel disturbance in the installation phase (Impact 1), it is predicted that the likely effects of vessel disturbance on seabird species during the operational phase will be negligible and not significant under the terms of the EIA Regulations.

10.9.1.1 Mitigation of Impact 7

Although no mitigation is required, the same good practice measures described for Impact 1 will be adopted to minimise disturbance by vessels.

10.9.1.2 Residual Effect of Impact 7

The good practice mitigation measures will reduce vessel disturbance, the residual impact will, as initially, remain not significant for all species.

10.9.2 Impact 8: Habitat Reinstatement

Definition of the marine habitat reinstatement requirements would be agreed in consultation with the statutory authorities as part of the decommissioning proposal. It is anticipated that devices would be removed at the end of the operational phase (likely to be 25 years). The magnitude of the impacts on reinstatement of habitats during decommissioning on all species is considered likely to be an impact of negligible magnitude and medium term temporally. Any impacts are judged likely to be of **negligible significance** for all species under the terms of the EIA Regulations.

10.9.2.1 Mitigation in Relation to Impact 8

No mitigation is required for any species.

Good practice guidance on habitat reinstatement prevailing at the time will be followed.

10.9.2.2 Residual Effect of Impact 8

The residual impact is likely to remain not significant for all species.

## 10.10 Cumulative Effects

The EIA Regulations require that the development be assessed cumulatively along with other projects or plans. In doing so, guidance on assessing cumulative effects (King *et al.* 2009) has been followed. In considering cumulative effects it is necessary to identify any effects that are minor in isolation but which may be major additively.

Following the guidance in King *et al.* (2009), species requiring CIA were taken to be species of high or moderate Nature Conservation Importance (as defined in Table 7.3.6 and presented in Table 10.15) or species categorised as high or medium priority for EIA (as defined in Table 10.8 and presented in Tables 10.15 and 10.16) and for which there was some indication of a potential impact as a result of the development which may be exacerbated cumulatively. On this basis, four species were identified as possibly meriting assessment for cumulative effects, namely Arctic tern (high NCI, breeding season only), herring gull (moderate NCI, winter only), common guillemot (medium priority, winter only) and razorbill (medium priority, winter only). However, the impacts of the development on these species are categorised as zero or negligible magnitude, and so no species would be identified as requiring assessment for cumulative effects.

However, to account for the possibility that even negligible impacts could act together to produce an overall cumulative effect on a population that may be of concern, the two medium priority species (common guillemot and razorbill) are further considered. Arctic tern and herring gull are not considered further because they had very low baseline abundance in the development area (Tables 10.13 and 10.14) are considered to have low or very low vulnerability to impacts from TECs (Furness *et al*. 2012). For common guillemot and razorbill it is shown that there is potential for collision mortality, particularly in the autumn/winter when densities using the development area are greatest. Although there is some uncertainty about the likely magnitude of the collision mortality that could be caused by the development, for a number of reasons it is concluded that it is very unlikely to be of greater than negligible magnitude for all the species mentioned (as defined in Table 10.9). The development is also shown to potentially lead to negligible displacement and habitat loss impacts on regional wintering populations of guillemot and razorbill, but the predicted magnitude of these impacts are so small (due to the small size of the area affected and the low density of birds using it) that it is not plausible that the contribution made by the development to a regional CIA could make a material difference to the conclusions. Therefore, these effects are not considered further.

Following advice given by SNH, projects that are operational, consented, or that are otherwise reasonably foreseeable are considered in the cumulative assessment. A 35kW prototype tidal stream device is currently proposed in Sanda Sound off the South Kintyre coast. Impacts from this development are anticipated to be of a very low level and would not contribute to cumulative effects of the Project. Also proposed, but unconsented, is the 3MW Argyll Tidal project off the western coast of the Mull of Kintyre, and similarly, due to the small scale of potential effects and the distance to the project, no risk of cumulative effects are identified. These demonstration projects are not considered further in this CIA.

It is appropriate to consider CIA at the relevant population management level, which is taken to be either the regional breeding or regional wintering population (as defined in 'Regional population context'). The potential for cumulative impacts on common guillemots, razorbill and puffin are summarised in Table 10.7 and discussed below.

The environmental statement for the consented Sound of Islay Demonstration project showed that in the spring and summer months razorbill occurred in the Sound of Islay development area at a similar density to that recorded in the project survey area (approximately 0.7 birds $km^2$), but were much more scarce in winter. The Sound of Islay Demonstration project could potentially cause collision impacts on the regional razorbill breeding population of negligible magnitude, and this could have a cumulative effect with the negligible impact identified for the Project. Nevertheless it is judged that the cumulative impacts on razorbill would be negligible in magnitude and it is therefore judged not significant. Common guillemots and puffin were both very scarce in the Sound of Islay baseline studies and thus no impacts are expected to be caused by the Sound of Islay Demonstration Project on these species.

Common guillemots, razorbills and puffins habitually fly low above the sea (typically well below wind turbine rotor height) and therefore the collision risk posed to flying auks by the two proposed offshore windfarms (the Islay Offshore Wind Farm and the Argyll Array Offshore Windfarm) in the region is likely to be close to zero, and therefore these projects are not likely to contribute to a cumulative impact with the Project on these species.

A 35 kW prototype tidal stream device is currently proposed in Sanda Sound off the South Kintyre coast. Impacts from this development are anticipated to be of a very low level and would not contribute to cumulative effects with the West Islay Tidal Energy Park. Also proposed, but unconsented, is the 3MW Argyll Tidal project off the western coast of the Mull of Kintyre, and similarly, due to the small scale of potential effects and the distance to the project, no risk of cumulative effects are identified.

Two exclusivity leases have been granted for the development of tidal energy off Northern Ireland in the Rathlin Island and Torr head Strategic Area; Fair Head (DP Marine Energy / DBE) and Torr Head (Tidal Ventures). These projects have not yet reached the scoping phase and insufficient information exists to support an assessment of cumulative effects. These projects are therefore screened out of the CIA.

| Project name | Potential for causing mortality | Potential for significant |
| --- | --- | --- |

| / type | to common guillemot, razorbill and puffin. | cumulative impact with the project |
|---|---|---|
| Sound of Islay Tidal Demonstration Project (tide) | Razorbill, small potential for collision as this species occurs in low density in the Sound of Islay.<br>Guillemot and puffin occur at very low density in Sound of Islay so negligible potential to cause collision impacts. | Razorbill, negligible<br>Guillemot and puffin, none |
| Islay Offshore Wind Farm (wind) | Effectively none, these species fly too low to be at significant risk of collision with wind rotors. | None |
| Argyll Array Offshore Wind Farm | Effectively none, these species fly too low to be at significant risk of collision with wind rotors. | None |
| Argyll Tidal project (3MW) | These projects are very small scale and therefore it is very unlikely that they would pose a significant collision risk to these species. | Unlikely. Although there is no assessment information, these projects are small in scale and not close to breeding colonies so any impacts are likely to be of negligible magnitude. |
| Sanda Sound (35 kW tidal demonstration project) | | |

Table 10.16. The potential for cumulative mortality impacts on regional populations of common guillemot and razorbill.

There appears to be no reasonable potential for significant cumulative impacts to arise from the developments considered, either because the risk is known to be negligible, or it is assumed to be negligible because of the very small scale of the project.

In conclusion, the cumulative combined effects of the development and other projects are likely to be negligible in magnitude and long term temporally and so deemed to be of negligible significance under the terms of the EIA Regulations.

## 10.11 Future Monitoring

None of the Project's potential effects on birds are deemed to be of more than minor significance, however, current good practice suggests that an appropriately detailed monitoring programme be agreed and implemented.

The two-year bird survey programme was designed to give data that would form a suitable baseline against which to compare future monitoring data. Collection of boat-based survey data using the same method during the installation and operational phases would potentially provide a means to measure the extent of any seabird displacement response to the development. Future monitoring should focus on the species rated as having or medium EIA priority (guillemot and razorbill, no species merited a rating of high priority) and SPA qualifying species for which potential LSE has been identified (guillemot, razorbill and puffin). Nevertheless, monitoring should only be embarked upon if it can be shown (for example by a statistical power analysis) that there is a realistic possibility of showing a significant displacement effect, something that may be unlikely given the generally low encounter rates of auk species during the baseline surveys. The surveys noted above should be conducted during installation and in years 1 to 3, 5 and 10 of the Project's 25 year operation period. However, flexibility will be retained to cancel this monitoring programme if it is clear that useful information is not being collected.

Monitoring the response of diving auks to turbine rotors and provide data on collision risk would also be desirable, however this is likely to be practically difficult to achieve due to the problems of undertaking direct visual observations. However, technologies such as sonar and underwater video may be suitable for such studies. The exposed offshore location of the Project means that compared to some other tidal energy developments (e.g., Sound of Islay Demonstration project and MCT Strangford Lough project) this development is a naturally poor candidate for research aimed at better understanding the collision risks posed to diving birds by TECs.

## 10.12 Conclusions

The likely impacts of the development were evaluated in accordance with Section 10.5 and the magnitude and significance of each potential impact stated.

It is concluded that the likely impacts of the development on regional populations of all bird species are not significant under the terms of the EIA Regulations.

It is also concluded that the likely cumulative effects of the proposed development together with the other proposed renewable energy developments in the region on bird populations of all species are not significant under the terms of the EIA Regulations.

The potential for the Project to impact on the qualifying ornithological features of Natura sites (SPAs) is presented in Appendix 10.2. SNH have advised that there is potential for Likely Significant Effects on breeding auk qualifying features at six SPAs. This chapter and its appendices provide the information required by the SNH to undertake Appropriate Assessment of these features as set out in HRA guidance.

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WESTISLAY TIDAL

# ENERGY PARK

**volume 2 // chapter 11 // natural fish**

# 11. Natural Fish

## 11.1 Introduction

This chapter presents a summary of the baseline for natural fish and shellfish resources found present around the West Islay Tidal Energy Project ("the Project") and along the proposed Western Export Cable Route to landfall at Kintra on Islay. An assessment of the potential effects that could impact upon those species is subsequently presented, along with proposed management and mitigation measures.

The following technical studies have been used to support this chapter:

| Technical Study | Relevance |
|---|---|
| The Natural Fish baseline report (SRSL, report number 00623_P0357, Nov 2012, Volume 4 Technical Reports) (1) | Baseline report of conditions of the site and surrounding area. |
| The Islay Benthic Video Survey Report (Envision Mapping Ltd, Sept 2012, Volume 4 Technical Reports) (2) | Presents the detail from video surveys conducted in the area thereby providing habitat information. |
| Technical appendix 5 (which lists turbine fluids along with supporting data sheets) | This information has been used in the assessment of potential contamination releases (sections 11.6.1 and 11.6.5) and anti-fouling compounds (section 11.6.9) in relation to impacts on natural fish resources. |

Table 11.1: Technical Studies Referenced within the Natural Fish Chapter

The chapter should be read in conjunction with following chapters:

| Chapter | Relevance |
|---|---|
| 4 – EIA/ES and Consultation | Sets out the process applied in undertaking the environmental impact assessment. |
| 5 – Project Description | Presents the detail on the project installation, devices and cabling. |
| 6 – Physical Environment | Presents the detail on the environment at the Tidal Site and along the western Export Cable Route. |
| 7 - Mammals | Although basking shark are a fish species, because of the similarities in the mechanism of potential impact they have been assessed along with marine mammals, and not within this natural fish chapter. |
| 8 - Benthic | Presents the detail from benthic surveys and hence fish habitat information for the area. |
| 12 – Commercial Fisheries | Provides an assessment of species fished commercially and local commercial fisheries. |
| 14 - Shipping and Navigation | Presents the detail on navigation lighting which is relevant to the assessment of operational light pollution on natural fish resources (section 11.6.15). |
| 19 - Noise | Presents the noise background for the tidal site which is relevant to the assessments of noise on natural fish resources (sections 11.6.3 and 11.6.12). |

| Chapter | Relevance |
|---|---|
| 20 - EMF | Presents additional detail on Electromagnetic Fields (EMF) which is relevant to the assessment of EMF on natural fish resources (section 11.6.13). |

Table 11.2: EIA Chapters Relevant to the Natural Fish Chapter

Rochdale envelope parameters pertinent to this chapter include:

| Rochdale Envelope Parameter | Where it is addressed |
|---|---|
| Turbine rotors in respect of collision risk | Section 11.6.11 Collision risk |
| Turbine anti-fouling paint | Section 11.6.9 Anti-fouling compounds |
| Turbine oils and lubricants | Section 11.6.5 Fluid/contamination released from devices during installation, operation and/or decommissioning |
| Foundation Footprint | Sections 11.6.6 loss of spawning grounds, 11.6.7 loss of nursery grounds, 11.6.8 removal/alteration of habitats |
| Foundation piling | Section 11.6.3 noise and vibration (during installation) |
| Drill cuttings and foundation grout | Section 11.6.1 Fluid/contamination release from construction activities |
| Turbine Noise | Section 11.6.12 operational noise and vibration |

Table 11.3: Rochdale Envelope Parameters Relevant to the Natural Fish Chapter

## 11.2 Relevant Legislation and Guidance

11.2.1 Legislation

Instruments of particular relevance to the assessment of fish ecology impacts for the Pproject include:

- EU Habitats Directive (Directive 92/43/EEC) (3);
- The Habitats Regulations 1994 (as amended in Scotland) (4) implements species protection requirements of the Habitats Directive in Scotland, on land and inshore waters;
- UK Biodiversity Action Plan (UK BAP) (5);
- Scottish Priority Marine Features (PMF, SNH 2012) (6);
- Conservation of European Wildlife and Natural Habitats Convention (Bern convention) (7);
- European Union management plans (8) (relevant to commercial species, see Chapter 12 Commercial Fisheries); and
- Wildlife and Countryside Act 1981 (9) (specific to basking sharks only, see Chapter 7 Mammals).

The following sections provide further details on the specific aspects of the above conservation and management legislation relevant to fish ecology.

### 11.2.2 Guidance

The European Marine Energy Centre (EMEC) has developed EIA guidance (EMEC 2005 [10]) for wave and tidal energy developers seeking consent within the EMEC test site in Orkney. These guidelines give an overview of the potential impacts of marine energy development on fish and shellfish resources, but do not discuss detailed EIA reporting requirements. However, the guidance suggests that the following potential effects on fish resources should be considered:

- Behavioural changes and altered well-being associated with noise, light and other disturbances;
- Changes in fish health resulting from release of contaminants; and
- Entrapment / collision with underwater devices.

There are no other specific EIA guidelines developed for tidal turbines. However, the guidelines developed for undertaking EIA in support of licensing of offshore wind farm developments under the Food and Environment Protection Act 1985 (FEPA) [11] and the Coast Protection Act 1949 (CPA) [12] by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS 2004 [13]) are largely applicable. The draft consenting guidance being developed by Marine Scotland (Marine Scotland Act 2010 [14]), has also been followed, noting that this doesn't yet address specific receptors.

CEFAS guidance [13] advises that there is potential for the construction, development and use of offshore wind farms to adversely affect fish and shellfish resources, and details what an EIA should take into account when assessing impacts on those resources. This has been considered as certain principles are common to the development of tidal energy projects. The EIA should present baseline information that describes fish resources within the project site and in the wider area. The presence and relative importance of fish resources should be described and assessed. Important fish resources include those species:

- Of significant importance in commercial and recreational fisheries;
- Of conservation importance;
- Susceptible to the effects of electromagnetic fields (EMF); and
- Restricted geographical distribution and/or locally abundant in the area.

For those fish resources identified as important the following aspects of their ecology should be considered:

- Spawning grounds;
- Nursery grounds;
- Migration routes; and
- Feeding grounds.

The EU Habitats Directive 92/43/EEC (as amended) [3] lists eight fish species in Annex II. To meet the requirements outlined in Article 3 of the Habitats Directive, Special Areas of Conservation (SACs) have been designated in UK waters to contribute to the European network of important high-quality conservation sites that will make a significant contribution to conserving these species.

11.2.3 Biodiversity Action Plans (UKBAP) and Priority Marine Features (PMF)

The UKBAP [5] identifies a list of species of conservation concern in response to the Convention on Biological Diversity [15]. There are a number of fish species listed on the above BAPs that may be present in the waters around Islay and these are picked up under the PMF listing presented in Table 11.4 and in section 11.4 which notes any additional species potentially relevant to the Tidal Site and Western Export Cable Route which are not listed as a PMF.

As a result of devolution, and new country-level and international drivers and requirements, much of the work previously carried out by the UK BAP [5] is now focussed at a country-level rather than a UK-level. In Scotland, work is on-going to define a list of PMFs [6], which although will not replace the listing of species and habitats in other legislation, will provide a new focus for marine conservation activities across the three pillar approach of the Nature Conservation Strategy (i.e. (i) species measures (ii) site protection measures (iii) wider seas policies and measures).

A separate list of Marine Protected Areas (MPA) search features, comprising mostly of Priority Marine Features which will benefit from spatial protection measures, has been produced (SNH 2012 [16]) and will be used to guide the selection of search locations for Nature Conservation MPAs.

11.2.4 The Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR)

OSPAR [17] is the mechanism by which 15 governments of Western Europe work together to protect the marine environment of the north-east Atlantic. In 2003, the UK government committed to establishing a well-managed, ecologically coherent network of Marine Protected Areas (known as the OSPAR MPA commitment). Marine SACs designated under the Habitats Directive [3] have been submitted as the UKs initial contribution to the OSPAR network.

11.2.5 International Union for Conservation of Nature (IUCN)

IUCN has compiled a list of threatened species that are facing a high risk. The list (IUCN, 2011 [18]) includes fish species that may be present around Islay, noting that these are picked up by the PMF listing presented in Table 11.4 and in section 11.4 which notes any additional species potentially relevant to the Tidal Site and Western Export Cable Route which are not listed as a PMF.

11.2.6 The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

The Bern Convention [19] principle aims are to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to regulate the exploitation of those species (including migratory species). To implement the Bern Convention in Europe the European community adopted amongst others, the EU Habitats Directive [3]. In the UK the Bern Convention was implemented into UK law by the Wildlife and Countryside Act (1981 as amended) [9]. Seventeen fish species are listed on Appendix II of the Bern Convention and are strictly protected against disturbance, capture, killing or trade. Approximately 120 fish species are listed on Appendix III of the Convention, and although these species are afforded protection, exploitation is permitted (in exceptional circumstances), with prohibitions on particular hunting methods and equipment.

## 11.3 Data Gathering Methodology

The data for the baseline was compiled from various sources. Where data was available in areas adjacent to the Tidal Site and Western Export Cable Route, this has also been used in order to increase the overall data set used in producing the baseline. The methods used to gather data were:

- Literature relevant to the Tidal Site and Western Export Cable Route was sourced using internet searches (Google scholar, Marine Scotland website and Web of Science). Additional data was downloaded from the Scottish west coast trawl surveys conducted in adjacent areas by Marine Scotland and lodged with ICES. Data were processed to reveal the range of species caught in the vicinity of the proposed development and temporal patterns in dominant and species of conservation concern;
- Beam trawl surveys were conducted using a 2m beam trawl fitted with an iron tickler chain and 24mm mesh net. A total of 8 tows were undertaken lasting from 5 to 13 minutes in length, at a speed over ground of between 2 and 3 knots. Total swept areas thus ranged from 802m$^2$ to 1845m$^2$. One tow failed due to a ripped net resulting in a total of seven valid hauls. The trawls were undertaken along the Western and Eastern Export Cable Routes. None were undertaken at the Tidal Site due to the risk of net snaring on the seabed surface. This is reflected locally in that, there is no commercial fish trawling undertaken at the Tidal Site due to its rocky nature;

- Video surveys undertaken at the Tidal Site and across the Western Export Cable Route to Islay, taken via a drop down video frame with tows lasting from 2-5 minutes each; and
- Organised discussions with local fishermen, through fisheries liaison on Islay and also on Kintyre.

## 11.4 Baseline Description

### 11.4.1 Tidal Site Characteristics

Chapter 5 Project Description: sections 5.3 and 5.4 provide detail on the location and characteristics of the Tidal Site. To summarise, the area is 2.28 $km^2$ in size and lies around 6km off the south-western tip of Islay. The Tidal Site is characterised by water depths of between 25 and 50 m and high tidal flow.

The Islay Benthic Video Survey Report [(2)] describes the physical habitat as follows;

"The Tidal Array search area habitat was tide-swept bedrock, bedrock and boulders or boulders with very little finer sediment. A marked drop-off (from approximately 30 m to 90 m) lay along the south eastern boundary of the search area and the substratum was of rugged bedrock. The bedrock extended north of the drop-off but with an increasing proportion of boulders. The northern and north-western areas were extensive level areas of boulders with very little bedrock."

Further information on the local environment at the Tidal Site is provided within Chapter 6, Physical Environment, and Chapter 8, Benthic.

### 11.4.2 Characteristics of the Western Export Cable Route to Islay

The Western Export Cable Route runs for approximately 21km east from the centre of the Tidal Site, passing just South of the Rinns of Islay and on to Laggan Bay for landfall at Kintra. Chapter 5 Project Description: sections 5.3 and 5.4 provide detail on the location and characteristics.

The Islay Benthic Video Survey Report [(2)] describes the physical habitat as follows;

"The cable route from the array to Laggan Bay crossed the drop-off into deep water and the substrate here was of pebbles and shelly gravel. The sea floor gradually rose eastwards along the proposed cable route and was largely of boulders, pebbles and sand. Some predominantly sandy sites were located along the route, but with scattered boulders. The eastern end of the cable route rose into Laggan Bay and, at a depth of about 23m (2.5km from the shoreline), the substrate became predominantly of boulders."

Further information on the local environment across the Western Export Cable Route is provided within Chapter 6, Physical Environment, and Chapter 8, Benthic.

### 11.4.3 Fish Species Present

The top ten species caught in the Scottish ground fish surveys adjacent to the Tidal Site and Western Export Cable Route, in terms of numbers per hour, were whiting; grey gurnard; sprat; Norway pout; dab; poor cod; haddock; herring; plaice and common squid [1]. All these species are common to the west of Scotland.

There is considerable variability in average catches by year across the time-series (1985 – 2012) which is to be expected when data from a limited number of hauls per year (1-3) are averaged [1]. However, some trends are apparent e.g. catches of poor cod appear to have increased in recent years. Other species have fluctuated without any obvious pattern. Several species have had single year peaks which dominate the overall average catches e.g. haddock and common squid. Whiting were particularly abundant between 1998 and 2005 but since then have been caught at much lower levels.

The Islay Benthic Video Survey Report [2] recorded only a few fish at the Tidal Site and along the Western Export Cable Route. These included butterfish (*Pholis gunnellus*) and Ballan wrasse (*Labrus bergylta*). Again these species are common around rocky habitats at shallow to moderate depth.

### 11.4.4 Elasmobranches

Rays (spotted, blonde, cuckoo and roker) and common skate were caught in relatively low abundances but noting that some species (cuckoo and spotted) were caught on more than one third of the hauls [1]. Spurdog were caught in relatively low abundance although average catch increased since 2010 and spurdog were present on more than one third of the hauls [1].

Basking sharks are known to occur in the area and are of conservation interest. Although these are a fish species, they have been assessed along with marine mammals, see Chapter 7 Mammals.

### 11.4.5 Shellfish Species

Video surveys undertaken at the Tidal Site and across the Western Export Cable Route [2] found hermit crabs and scallops in limited numbers. Brown crab, velvet crab, lobsters and queen scallops are fished in areas adjacent to the Tidal Site and Western Export Cable Route, and are widely distributed around the coast of Islay and between Islay and Kintyre (DP Energy, Fisheries Liaison, Kintyre [20]). Crayfish (European Spiny Lobster), a priority marine feature (PMF) species, is known to occur around the coast of Islay, based on discussions with local fishermen [20], although currently not fished due to restrictions.

### 11.4.6 Spawning Areas

The closest spawning ground for whiting to the Tidal Site and Western Export Cable Route is in the North Channel of the Irish Sea [1]. Given prevailing south to north current flow, whiting eggs and larvae might be transported to the west of Islay. A spawning ground for plaice is noted to the west of Islay (within approximately 20 nautical miles) [1]. Nephrops and sprat are also reported to spawn to the west of Islay (within approximately 20 nautical miles) [1].

For species known to occur in the waters adjacent to the Tidal Site and Western Export Cable Route (based on analysis of IBTS data in the Natural Fish Baseline report [1]), Ellis *et al.*, (2010) [21] suggests that spurdog, common skate, spotted ray, herring, cod, whiting, blue whiting, ling, hake, anglerfish, sandeels and mackerel may use the area (within approximately 20 nautical miles) as nurseries. The abundance of juveniles of these species to the west of Islay was however classified as low intensity, except for spurdog, whiting and blue whiting, where it was classified as high intensity.

For species known to occur in the waters adjacent (within approximately 20 nautical miles) to the Tidal Site (based on analysis of IBTS data in the Natural Fish Baseline report [1]), Ellis *et al.*, (2010) [21] also identified specific data gaps (i.e. high uncertainty in the data) for spawning sites for common skate and for spawning and nursery grounds for spotted ray.

Noting that the Tidal Site is nearly all bedrock/boulder habitat it would not be expected that it will be important for spawning for Sandeel or Nephrops. The Western Export Cable Route running from the Tidal Site to Islay contains areas of sand along with the presence of scattered boulders and pebbles, so could present spawning areas for Sandeel. Mud was not encountered along the Western Export cable route and as such it is expected that it is not important for Nephrops spawning.

### 11.4.7 Migration Routes

Malcolm *et al.*, (2010) [22] summarised the current state of knowledge on migration pathways for salmon, sea trout and eel as follows: "Broad scale patterns of migration are identified for adult Atlantic salmon, although the resolution of available data is unlikely to be sufficient to inform site specific risk assessment. Less extensive information is available on juvenile migratory routes and no information is available on juvenile migration from important east coast rivers. The limited information available on sea trout migration suggests predominantly inshore and local use of the marine environment, although wider ranging migrations have been observed from some rivers. No specific migratory routes can be discerned for either juvenile or adult sea trout. European eels in Scotland are part of a single European population for which there is considerable uncertainty regarding migratory routes. The limited evidence which is available suggests that eels from a number of European countries may migrate through Scottish waters. For all the species considered, there is only very limited information on behaviour and swimming depths. Most of this information has been generated out with Scotland and it is uncertain whether it can be reliably transferred to the Scottish context given differences in the life stages observed and local geography".

According to the Argyll Fisheries Trust (AFT) [23], Islay has historically supported fisheries for salmon and sea trout. In line with the decline in salmonid species elsewhere these fisheries are now not as productive as they once were. The AFT has undertaken a limited sampling programme on two river catchments on the Island. Little is currently known of the status of fish populations in most of the other rivers on the island.

The Isle of Jura supports limited fisheries for salmon and sea trout and in line with the decline in salmonid species elsewhere, these fisheries are not now as productive as they once were [23]. AFT has undertaken a limited sampling programme on one river catchment. Little is currently known of the status of fish populations in most of the other rivers on the island.

Literature searches revealed no information on the migration routes of salmon or trout from these rivers.

### 11.4.8 Priority Marine Features (PMFs) and Other Sensitive Species

PMFs found at or close to the Tidal Site and Western Export Cable Route during the baseline investigations and surveys, against the relevant entries in the recommended list of PMFs in Scottish Territorial Waters are presented in Table 11.4 below.

| Priority Marine Feature (PMF) | Taxon Group | Species | Found During Investigations/Surveys |
|---|---|---|---|
| European spiny lobster | Lobsters and sand hoppers | Palinurus elephas | Habitat subtidal rocky, exposed coasts in circalittoral zone, 5-70 m depth – noted as present via fisheries liaison discussions around the area of the tidal site [20]. |
| Eel (marine part of life cycle) | Bony fish (catadromous) | Anguilla anguilla | Not recorded during surveys |
| Atlantic salmon (marine part of life cycle) | Bony fish (anadromous) | Salmo salar | Not recorded during surveys |
| European river lamprey (marine part of life cycle) | Bony fish (anadromous) | Lampetra fluviatilis | Islay is at edge of northern range in UK - not recorded during surveys |
| Sea lamprey (marine part of life cycle) | Bony fish (anadromous) | Petromyzon marinus | Occurs offshore throughout the UK and Ireland, migrates into freshwater to spawn – not recorded during surveys |
| Sea Trout (marine part of life cycle) | Bony fish (anadromous) | Salmo trutta | Not recorded during surveys |
| Sparling (marine part of life cycle) | Bony fish (anadromous) | Osmerus eperlanus | Does not occur in west of Scotland |
| Anglerfish (juveniles) | Bony fish | Lophius piscatorius | Caught during Scottish groundfish surveys adjacent to tidal site and cable route |
| Atlantic herring (juveniles and spawning adults) | Bony fish | Clupea harengus | Caught during Scottish groundfish surveys adjacent to tidal site and cable route |
| Atlantic mackerel | Bony fish | Scomber scombrus | Not recorded during surveys |
| Cod | Bony fish | Gadus morhua | Caught during Scottish groundfish surveys adjacent to tidal site and cable route. Area to west of Islay is indicated as a nursery area for young cod |
| Ling | Bony fish | Molva molva | Caught during Scottish groundfish surveys adjacent to tidal site and cable route |
| Norway Pout | Bony fish | Trisopterus esmarkii | Caught during Scottish groundfish surveys adjacent to tidal site and cable route |
| Saithe (juveniles) | Bony fish | Pollachius virens | Caught during Scottish groundfish surveys adjacent to tidal site and cable route. Area to west of Islay is indicated as a nursery area for young saithe |
| Sandeels | Bony fish | *Ammodytes marinus and Ammodytes tobianus* | Corbin's sandeel Caught during Scottish groundfish surveys, but lack of suitable habitat at the Tidal Site. |
| Sand Goby | Bony fish | Pomatoschistus minutus | Caught during Scottish groundfish surveys adjacent to tidal site and cable route |

| Priority Marine Feature (PMF) | Taxon Group | Species | Found During Investigations/Surveys |
|---|---|---|---|
| Whiting (juveniles) | Bony fish | Merlangius merlangus | Caught during Scottish groundfish surveys adjacent to tidal site and cable. Closest spawning ground shown is in the North Channel of the Irish Sea; given prevailing south to north current flow, whiting eggs and larvae might be transported to the west of Islay |
| Basking Shark | Sharks, skates and rays | Cetorhinus maximus | Sitings reported adjacent to tidal site. |
| Common Skate | Sharks, skates and rays | *Formerly Dipturus batis now split provisionally into D. cf. flossada and D. cf. intermedia* | Caught during Scottish groundfish surveys adjacent to tidal site and cable route. |
| Spiny Dogfish (spurdog) | Sharks, skates and rays | Squalus acanthias | Caught during Scottish groundfish surveys adjacent to tidal site and cable route. |

Table 11.4: PMFs Found Relative to the Tidal Site and Western Export Cable Route During the Baseline Investigations and Surveys [1]

Other sensitive species potentially relevant to the Tidal Site and Western Export Cable Route not listed as PMFs, but within the habitats directive [1], UK BAP [5], OSPAR [17], IUCN [18] and Bern Conventions [19] include:

- Twaite shad;
- Allis shad; and
- Acipenser sturio.

Of the three additional species noted, no evidence of their presence at the Tidal Site or along the Western Export Cable Route was found during the baseline studies.

11.4.9 Baseline Description Summary

To summarise, the investigation results indicate that the fish and shellfish communities at the Tidal Site and along the Western Export Cable Route to Islay are characterised by relatively low abundances of largely common and widespread species suited to a coarse rock/boulder strewn substratum, with strong water movement.

There is no evidence that the Tidal Site or Western Export Cable Route to Islay are important nursery or spawning grounds, although spawning and nursery grounds for some species are reported within approximately 20 nautical miles of the Tidal Site.

Although some PMF species have been recorded in and adjacent to the Tidal Site and Western Export Cable Route, there is no evidence to suggest that the Tidal

Site and/or Western Export Cable Route act as significant habitats for these species.

## 11.5 Natural Fish EIA Assessment Process

The process defined in Chapter 4 EIA/ES and Consultation: section 4.4 has been applied in order to assess the potential environmental impacts that the development may place on natural fish and shellfish resources.

This section presents the specific descriptions of the proposed categories used for assessment of receptor sensitivity and impact magnitude, with consequence of impact and impact significance being used as currently presented within Chapter 4 EIA/ES and Consultation: section 4.4.

### 11.5.1 Receptor Sensitivity

Table 11.5 below presents the definitions of the receptor sensitivity categories set out in Chapter 4 EIA/ES and Consultation: section 4.4.3 for natural fish and shellfish resources.

| Receptor Sensitivity | Definition |
|---|---|
| Very High | Natural fish and/or shellfish resources of international or national conservation importance, with the assessed effect having lethal consequences. |
| High | Natural fish and/or shellfish resources of national or regional conservation importance, with the assessed effect having potentially lethal consequences. |
| Medium | Natural fish and/or shellfish resources of regional or local conservation importance, with sensitivity, although non-lethal, to the assessed effect. |
| Low | Natural fish and/or shellfish resources of low, little or no conservation importance with minor sensitivity to the assessed effect. |
| Negligible | Natural fish and/or shellfish resources of low, little or no conservation importance, with very little or no sensitivity to the assessed effect. |

Table 11.5: Receptor Sensitivity Definitions used in the Assessment of Natural Fish and Shellfish Resources

11.5.2 Impact Magnitude

Table 11.6 below presents the definitions of the impact magnitude categories set out in Chapter 4 EIA/ES and Consultation: section 4.4.3 for natural fish and shellfish resources.

| Impact Magnitude | Definition |
|---|---|
| Major | A fundamental change to the baseline condition of marine fish and/or shellfish resources. |
| Moderate | A detectible change in the baseline condition resulting in the non-fundamental temporary or permanent condition of marine fish and/or shellfish resources. |
| Minor | A minor change to the baseline condition of marine fish and/or shellfish resources. |
| Negligible | An imperceptible and/or no change to the baseline condition of marine fish and/or shellfish resources. |
| Positive | Has a positive change to the baseline condition of marine fish and/or shellfish resources. |

Table 11.6: Impact Magnitude Definitions used in Assessment of Natural Fish and Shellfish Resources

## 11.6 Assessment of Potential Effects on Natural Fish Resources

Assessed potential effects relative to natural fish and shellfish resources can be categorised along with the main phases of the project lifecycle:

- Construction (and those applicable at decommissioning); Fluid/contaminant release, light pollution during night working, excess noise and vibration and an increase in suspended sediments from construction activities (Sections 11.6.1 through to 11.6.4);
- Installed Life; Fluid/contaminant release, loss of spawning/nursery grounds, removal/alteration of habitats, the presence of anti-fouling compounds and barriers to fish movement (Sections 11.6.5 through to 11.6.10); and
- Operation; Collision risk, excess noise and vibration, electromagnetic fields, changes in tidal flows and operational light pollution and (Sections 11.6.11 through to 11.6.15).

The detail on each potential effect is presented in the following sections.

11.6.1 Fluid/contamination Release from Construction and Decommissioning Activities

Chapter 5 providing the project description should be read in conjunction with this assessment.

Contamination originating from vessels or drilling and grouting operations is considered to be the worst case scenario for potential contamination release during construction activities.

Installing a foundation pile through drilling mainly consists of two steps. First a socket is drilled for the foundation pile. After that the pile is placed inside the socket and cemented in place using grouting hoses.

Drilling operations will be sea water lubricated, i.e. no drilling muds will be used. Typically, the drilled cuttings are removed from the socket by injecting air into the drill pipe, that effectively sucks the cuttings into the drill pipe and then into the sea. The grout is pumped from the mixing/pumping plant on deck to the annulus between the foundation pile and the drilled bore hole. Hence, drill cuttings are the only direct discharges expected to the marine environment during the drilling.

All other spills to the marine environment are considered to be accidental. These could include anti-fouling paint, diesel, grout, lubricants or oil, which are potentially toxic to fish and shellfish if occurring in sufficiently high quantities.

Precise impacts depend on which fluids are used but due to common use in oil and gas industry this has been well researched. Long-term exposure (> few weeks) of juvenile lobster to certain types of drill cuttings has been shown to have deleterious effects (Barshaw and Bryant-Rich 1989) [(24)].

Studies conducted in the North Sea on the effects of hydrocarbons and associated oil industry activity discharges (including drill cuttings) on fish larvae have not clearly shown associated deleterious effects (Stagg and McIntosh 2012) [(25)], even noting the high aromatic hydrocarbon levels present in the North Sea (noted at 10 times the background level).

Toxicity assessments (in juvenile fish) of individual ingredients of synthetic-based drilling muds (Bakytyar and Gagnon 2012) [(26)] demonstrate the importance of selecting fluids with less toxicity in terms of fish health, and selection of low toxicity fluids is planned for the Pproject (see Technical Appendix 5). Accordingly receptor sensitivity is considered as low.

The local hydrodynamic activity would quickly disperse contaminant releases resulting in a low exposure of species to these materials, and would therefore be unlikely to have any adverse effect on the local habitats and species. In addition, many mobile species will likely move away from construction activity, decreasing numbers exposed at the release point. Noting the relatively low abundances of shellfish and benthic fish species at the Tidal Site and along the Western Export Cable Route to Islay, impact magnitude is considered as negligible, with an overall consequence of impact rating of negligible.

Noting that the overall impact is considered negligible, no additional mitigation and management measures would be proposed. However, a Project Environmental Management Plan (PEMP) will put in place to provide controls for avoidance or clean-up of such spills, along with the provision of spill kits. Only certified construction techniques will be used and regular maintenance checks will be carried out to prevent spills. In addition, low toxicity hydraulic oils and lubricants will be used, compliant with national and international standards, which are also biodegradable in most cases.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.1 | Low | Negligible | Negligible | Negligible – not significant |

11.6.2 Light Pollution during Construction and Decommissioning Activities

Light pollution from construction/decommissioning vessels working through the night could have a potential impact upon shellfish and fish species at the Tidal Site and along the Western Export Cable Route. Those particularly sensitive might include the spiny lobster (see below). Baseline surveys indicate relatively low abundances of most shellfish and benthic fish of conservation importance (defined as Scottish PMFs) in the area. For spiny lobster (*Palinurus elephas*) there is limited abundance data although discussions with local fisheries [(20)] and habitat considerations indicate that they are likely to be present.

Some behaviour modification of fish and shellfish by light might occur during works e.g. lights might attract small clupeids to the surface. Shellfish such as nephrops may suffer visual damage from bright lights e.g. when they are sorted on fishing vessel decks (Shelton, *et al.*, 1985), [(27)] noting that nephrops are not likely to be present at the Tidal Site nor along the Western Export Cable Route due to a lack of suitable habitat. However, given that most crustacea will naturally be in cryptic habitats, ship light pollution is not likely to be significant. No data on damage from light pollution of spiny lobster could be found although measurements of their visual acuity have been made (Neil, *et al*., 1983) [(28)]. Settlement behaviour of larvae of other spiny lobster species appears to be controlled by light (Butler, *et al*., 2011) [(29)] so settlement rates of larval stages could be affected. Accordingly, the receptor sensitivity is considered as medium.

The potential impact only exists during construction and decommissioning activity, if undertaken during the hours of darkness. During summer-time when most work is likely to occur, the hours of darkness will be low at this location (8 hours or less per day). Impacts will be very localised to the immediate working area if there are fish and shellfish species present at that precise moment. Accordingly impact magnitude is considered as negligible, for an overall consequence of impact rating of negligible.

Noting that the overall consequence of impact rating is considered as negligible, no additional mitigating and management measures would be proposed. However, where practical it may be possible to limit lighting to the levels required (i.e. not over-light) although noting the need to maintain lighting levels for the safety of the operations being conducted at the time.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.2 | Medium | Negligible | Negligible | Negligible – not significant |

### 11.6.3 Noise and Vibration during Construction and Decommissioning Activities

Chapter 19 on noise should be read in conjunction with this assessment.

Noise and vibration from construction/decommissioning activity, drilling, cable laying/burial and rock placement may potentially affect fish and shellfish species at the Tidal Site and along the Western Export Cable Route. The baseline assessment conducted for the Tidal Site notes the presence of a moderately noisy background with a recorded average level of around 82 dB re 1 $\mu Pa^2/Hz$ (see Chapter 19 Noise). Additional noise would have to be at a level at or above the background level to have an impact.

Most species at the Tidal Site may be exposed to the noise, but not all are sensitive (Vella *et al.*, 2001 [(30)]). The impact on shellfish is expected to be very low due to the absence of swim bladders. A recent study has suggested that fish eggs and larvae are unlikely to be adversely affected by this type of noise (Bolle, *et al.*, 2012 [(31)]).

Noise impacts on fish have been mostly studied in relation to pile-driving into soft sediments [(32)]. Although pilling is not being used, drilling for pin piles and cable trenching is planned, which is likely to result in more constant, lower intensity noise. Dumping of rock armour (if used) will result in a very short lived intense noise. Accordingly, the receptor sensitivity is considered as negligible.

Fish and shellfish would be expected to move away from construction areas due to noise, and would be expected to be able to recolonise areas once work finishes. As such, impact magnitude is considered as minor, for an overall consequence of impact rating of negligible.

Noting that the overall consequence of impact rating is considered as negligible, no additional mitigating and management measures would be proposed.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.3 | Negligible | Minor | Negligible | Negligible – not significant |

11.6.4 An Increase in Suspended Sediments during Construction and Decommissioning Activities

A temporary increase in suspended sediments/turbidity could arise from construction and decommissioning activities including drilling at the Tidal Site, rock placement at the Tidal Site and along the Western Export Cable Route and trenching for the Western Export Cable Route landfall at Islay.

The Tidal Site is mainly comprised of bedrock, with few areas of free sediment that could be put into suspension, although drilling activities will create small solids that could be suspended.

Chapter 5 Project Description: section 5.26.10 notes the potential for a total of 2,500m$^3$ of drill cuttings to be produced at the Tidal Site (based on 4 sockets per device location of 5m depth and 2.3m diameter) with a worst case grout leakage per foundation/device as 0.5m$^3$. Drill cuttings would consist of the underlying material, noting the predominantly bedrock nature of the Tidal Site. Although the grout type has not yet been selected, it is planned that a marine application specific, low/non-toxic grout will be selected, which will not give rise to significant pluming. Finer materials released from the cuttings and/or grout would be dispersed rapidly noting the tidal nature of the Tidal Site (see Chapter 6 Physical Environment).

Mobile species would be likely to move away and so not be affected in the longer-term, with less mobile species, for example scallops, being less able to do so. Significant increases in water turbidity might affect susceptibility of fish to predation as both positive and negative effects have been demonstrated (depending on illumination and turbidity).

Changes in turbidity can affect fish feeding success and predation susceptibility e.g. Engström-Öst J, Mattila J (2008 [(33)]). Long-term increases in sediments have been reported to negatively impact shellfish such as oysters. However, noting the relatively low abundances of shellfish and benthic fish at the Tidal Site, and the temporary nature of the potential for suspended sediments, the receptor sensitivity value is considered as medium.

The hydrodynamic regime at the Tidal Site would rapidly disperse suspended sediments, reducing exposure of individuals to harmful effects. At landfall, it is planned to undertake trenching construction from the shore during low tides, which would give rise to reduced levels of sediment suspension, also noting that surf activity in the intertidal zone would also disperse suspended sediments rapidly. Accordingly the impact magnitude value is considered as negligible, with the overall consequence of impact rating considered as negligible.

Noting that the consequence of impact is considered negligible, no additional mitigating and management measures are proposed.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.4 | Medium | Negligible | Negligible | Negligible – not significant |

11.6.5 Fluid/contamination Released from Devices during Installation, Operation and/or Decommissioning

Chapter 5 Project Description: sections 5.20 and 5.21 provide details of the chemical use, management and potential discharges to sea for the proposed devices. As the devices will contain oils and hydraulic fluid there is a potential for releases affecting shellfish and benthic fish species at the Tidal Site, should the devices be critically damaged or not be maintained and secured correctly. However, bunding and containment measures are designed into the devices, and as an example, operating experience from the MCT SeaGen TEC in Strangford Lough over the past four years demonstrate the effectiveness of such design principles in respect of discharge control. This effect is not applicable to the Western Export Cable Route, as no additional devices or structures are being installed between the Tidal Site and landfall at Islay.

Studies conducted in the North Sea on the effects of hydrocarbons and associated oil industry activity discharges (including drill cuttings) on fish larvae have not clearly shown associated deleterious effects [25], even noting the high aromatic hydrocarbon levels present in the North Sea (noted at 10 times the background level). Accordingly receptor sensitivity is considered as low.

Toxicity assessments (in juvenile fish) of individual ingredients of synthetic-based drilling muds [26] demonstrate the importance of selecting fluids with less toxicity in terms of fish health, noting that selection of low toxicity fluids is planned for the West Islay Tidal Energy Project.

Releases would be in small volumes, with a critical release affecting only one device at any one time (it is unlikely that more than one device would be critically damaged at any time due to the spacing between devices). Due to the unlikely event of a critical failure, and spread across the Tidal Site due to the size and dynamic nature of the local tidal conditions, any release would be low in volume and dispersed quickly. As such, impact magnitude is considered as negligible, for an overall consequence of impact rating of negligible.

Noting that the consequence of impact is considered negligible, no additional mitigating and management measures would be proposed. Although it is noted that the project designers are selecting low toxicity oils and lubricants, compliant with national and international standards, which are also biodegradable in most cases.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 11.6.5 | Low | Negligible | Negligible | Negligible – not significant |

11.6.6 Loss of Spawning Grounds through Installed Life

Where spawning sites exist, the Western Export Cable Route, associated trenching for land fall at Islay and the presence of new devices/structures located at the Tidal Site, could potentially lead to the loss of spawning habitat. Spawning grounds for whiting (juveniles being a PMF species), plaice, nephrops and sprat have been noted approximately 20 nautical miles to the west of the Tidal Site [(1)], however evidence has not been found to indicate spawning within the Tidal Site nor along the Western Export Cable Route to Islay. Whiting juveniles and nephrops are not expected at the Tidal Site or along the Western Export Cable Route to Islay due to a lack of suitable habitat.

To assess the area affected at the Tidal Site, the worst case scenario of 30 devices and a subsea collection station would give a total device footprint of 496m$^2$. In addition, although unlikely, there is the potential that rock placement may be necessary on the inter-array cabling (details from Chapter 5 Project Description: section 5.24). For assessment purposes, the worst case scenario of 100% rock placement of 2 tonne rock bags, containing graded inert rock of median grain size of 65 mm with a 25mm mesh, 4m either side of the inter-array cabling, totalling 20km in length, at the tidal site is considered, giving a rock placement footprint of 0.16km$^2$. The device and rock placement footprint combined represent an area change of 7% at the 2.28km$^2$ Tidal Site, although noting that it is very unlikely that cable ballasting/protection will be used to such a great extent.

To assess the area affected across the Western Export Cable Route, the worst case scenario of 100% rock placement of 2 tonne rock bags, 4m either side of the cables, for 21km to landfall is considered, giving a rock placement footprint of 0.168km$^2$. However, it is noted that rock placement will only be utilised where necessary, with the potential for self-burial of the cable, in sandier areas closer to Islay. Trenching at landfall, will not include the introduction of new structures, but merely inclusion of the cable and then backfill of the trench with the originally excavated material, and as such is also considered to present a negligible alteration.

Due to the small area that the devices and cabling (including trenching) occupy and the lack of evidence suggesting use of the Tidal Site and the Western Export Cable Route as spawning grounds, the receptor sensitivity and impact magnitude is considered negligible for an overall consequence of impact rating of negligible. However, sand gobies *(Pomatoschistus minutus),* a PMF species present in the area*,* have been observed laying eggs in beds of 25mm ceramic beads deployed in exposed current locations, although not enclosed within a mesh/bag (pers com Tom Wilding 28/05/2013). Accordingly, the use of rock bags may present a positive impact for spawning of some species noting that they can provide a higher degree of habitat complexity compared to the surrounding tidally swept rock.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 10.6.6 | Negligible | Negligible | Negligible | Negligible – not significant |

11.6.7 Loss of Nursery Grounds through Installed Life

Where nursery grounds exist, the Western Export Cable Route, associated trenching for land fall at Islay and the presence of new devices/structures located at the Tidal Site, could potentially lead to the loss of nursery grounds Nursery grounds for spurdog, common skate, spotted ray, herring, cod, whiting, blue whiting, ling, hake, anglerfish, and mackerel have been noted in the wider area to the west, south and north of the Tidal Site (1), however no evidence has been found that the Tidal Site and Western Export Cable Route to land fall at Islay, are used as nursery grounds. Spurdog, common skate, herring (juveniles and spawning adults), cod, whiting juveniles, ling and anglerfish juveniles are all PMF species. The others are not considered to be of conservation importance.

To assess the area affected at the Tidal Site, the worst case scenario of 30 devices and a subsea collection station would give a total device footprint of 496m$^2$. In addition, although unlikely, there is the potential that rock placement may be necessary on the inter-array cabling (details from Chapter 5 Project Description: section 5.24). For assessment purposes, the worst case scenario of 100% rock placement of 2 tonne rock bags, 4m either side of the inter-array cabling, totalling 20km in length, at the tidal site is considered, giving a rock placement footprint of 0.16km$^2$. The device and rock placement footprint combined represent an area change of 7% at the 2.28km$^2$ Tidal Site, although noting that it is very unlikely that cable ballasting/protection will be used to such a great extent.

To assess the area affected across the Western Export Cable Route, the worst case scenario of 100% rock placement of 2 tonne rock bags, 4m either side of the cable, for 21km to landfall is considered, giving a rock placement footprint of 0.168km$^2$. However, it is noted that rock placement will only be utilised where necessary, with the potential for self-burial of the cable, in sandier areas closer to Islay. Trenching at landfall, will not include the introduction of new structures, but merely inclusion of the cable and then backfill of the trench with the originally excavated material, and as such is also considered to present a negligible alteration.

Due to the small area that the devices and cabling (including trenching) occupy and the lack of evidence suggesting use of the Tidal Site and the Western Export Cable Route as nursery grounds, the receptor sensitivity and impact magnitude is considered negligible for an overall consequence of impact rating of negligible. However, it is considered that the use of rock bags may present a positive impact for juveniles of some species, particularly shellfish including lobster (Robinson and Tully 2000 (34), Wahle 1992 (35) and Wahle and Steneck 1991 (36)) noting that they can provide a higher degree of habitat complexity compared to the surrounding tidally swept rock.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.7 | Negligible | Negligible | Negligible | Negligible – not significant |

11.6.8 Removal/alteration of Habitats due to the Presence of New Devices and Cables

Chapter 8 on impacts on benthic ecology should be read in conjunction with this assessment.

The presence of new devices and cabling at the Tidal Site, cabling along the Western Export Cable Route to Islay and trenching at landfall could lead to the introduction, removal and/or alteration of existing habitats, where located.

The impact would be greatest on sessile, immobile bottom dwellers including mussels and whelks. It could also impact crustaceans such as crabs and lobsters (European spiny lobster being a PMF species), although noting their greater mobility allowing better avoidance.

11.6.8.1 Tidal Site

To assess the area affected at the Tidal Site, the worst case scenario of 30 devices and a subsea collection station would give a total device footprint of 496m$^2$. In addition, although unlikely, there is the potential that rock placement may be necessary on the inter-array cabling (details from Chapter 5 Project Description: section 5.24). For assessment purposes, the worst case scenario of 100% rock placement of 2 tonne rock bags, 4m either side of the inter-array cabling, totalling 20km in length, at the tidal site is considered, giving a rock placement footprint of 0.16km$^2$. The device and rock placement footprint combined represent an area change of 7% at the 2.28km$^2$ Tidal Site, although noting that it is very unlikely that cable ballasting/protection will be used to such a great extent.

In addition, Chapter 5 Project Description: section 5.26.10 notes the potential for a total of 2,500m$^3$ of drill cuttings to be produced at the Tidal Site (based on 4 sockets per device location of 5m depth and 2.3m diameter) with a worst case grout leakage per foundation/device of 0.5m$^3$. Drill cuttings would consist of the underlying material, noting the predominantly bedrock nature of the Tidal Site. Although the grout type has not yet been selected, it is planned that a marine application specific, low/non-toxic grout will be selected.

In the case of immobile species, they would likely be destroyed during construction in the immediate area of the device footprint with mobile species having the opportunity to avoid the works and colonise adjacent areas. A similar impact would be presented at decommissioning if it is deemed necessary/practical to remove the foundations.

Noting that the Tidal Site consists predominantly of hard substrate, the new devices, drill cuttings, rock placement and grout (marine cement) consists of replacing a small area of hard substrate with an alternative hard substrate which would provide new habitats for benthic species such as crab, urchin, whelk, mussels, lobsters and species that feed on these to re-colonise, localised to the sites of the structures/devices, although with anti-fouling paint to be applied (see section 11.6.9).

11.6.8.2 Western Export Cable Route

To assess the area affected across the Western Export Cable Route, the worst case scenario of 100% rock placement of 2 tonne rock bags, 4m either side of the cables, for 21km to landfall is considered, giving a rock placement footprint of $0.168km^2$. However, it is noted that rock placement will only be utilised where necessary, again replacing an area of hard substrate with an alternative hard substrate, with the potential for self-burial of the cables, in sandier areas closer to Islay. As noted in sections 11.6.6 and 11.6.7, the use of rock bags will present a positive impact for some species by providing a higher degree of habitat complexity compared to the surrounding tidally swept rock.

The planned trenching at the landfall would present a passing alteration which would recover quickly, noting that no new materials would be introduced (save the cables), with the trenches being back-filled with the originally excavated material, allowing subsequent re-colonisation after back-fill, but also noting the potential disturbance again at decommissioning if it is deemed necessary to remove the cable.

11.6.8.3 Summary

Receptor sensitivity is considered as low with impact magnitude being negligible, noting the low abundances, low conservation value of those likely to be impacted, very localised disruption from construction over a very small area and opportunity for re-colonisation, presenting an overall consequence of impact of negligible.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed.

| **Potential Effect** | **Receptor Sensitivity** | **Impact Magnitude** | **Consequence of Impact** | **Residual Impact Post Mitigation** |
|---|---|---|---|---|
| 11.6.8 | Low | Negligible | Negligible | Negligible – not significant |

11.6.9 The Presence of Anti-fouling Compounds through Installed Life

Installed devices and structures at the Tidal Site will be applied with anti-fouling coatings which could affect fish and shellfish species at the Tidal Site. Intersleek teflon based anti-fouling paint or similar will be used, which are non-leaching and work through physical properties as opposed to the presence of biocides.

From experience gained on the SeaFlow and SeaGen systems, there will not be a requirement to apply additional anti-fouling materials to the system while operating. The system will be treated with antifouling paint during the manufacturing phase and further treatments on site will not be necessary.

Due to the application of non-leachable materials, it is considered that species within the water column will not be affected.

Receptor sensitivity is considered as low, due to the few species likely to be affected, with an impact magnitude of minor due to the low abundance and low conservation value of those that may be potentially affected, giving an overall consequence of impact rating of minor.

As a means of management, appropriate low toxicity coatings are being selected where practical, at the design stage.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.9 | Low | Minor | Minor | Minor – not significant |

11.6.10 Barriers to Fish Species Movement through Installed Life

The installation of the new devices and associated infrastructure at the Tidal Site could act as a barrier to the movement of migrating species, and mobile species traversing the Tidal Site frequently. Notable migrating species would include Eel, Atlantic salmon and Sea trout which are all PMF species for the marine part of their lifecycle, although none of these were recorded during the surveys undertaken [(1)].

The Western Export Cable Route and associated trenching at landfall are not large enough to present barriers to fish species movement.

Both Islay and Jura support salmon and trout fisheries, noting that they are not as productive as they once were in line with a general decline of salmonids elsewhere [(23)]. Migration paths for salmonids have not been defined, but could potentially include the Tidal Site (Gill 2010 [(37)], Gill 2012 [(38)]). European eels may also migrate through Scottish waters, although routes are not certain [(37 & 38)]. European eels and salmon were not recorded as caught in the ground trawls adjacent to the Tidal Site [(1)]. Trout were caught, but in very small numbers (1.6% of hauls, with an average of 0.03 individuals per hour over all hauls) [(1)].

Salmonids and eel are known for their ability to pass considerable barriers during river movement for spawning, for example, travelling up very narrow streams (less than a metre in width) in very shallow water (10cm depth and less), with the ability to get over weirs and small waterfalls. Chapter 5 Project Description: sections 5.6.5 and 5.6.6 present the potential device array spacing, with the minimum noted tip-to-tip spacing between devices being 10m in the case of the SeaGen S or 44m for the TGL turbine, which in comparison would not present a particular obstacle to such species. Noting the very low abundances and minimum spacing presented, the receptor sensitivity value is considered to be negligible.

Although noting the minimum spacing, species will also be able to go around the development and hence impact magnitude value is also considered to be negligible, with the consequence of impact rating also being negligible.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures are proposed necessary.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.10 | Negligible | Negligible | Negligible | Negligible – not significant |

11.6.11 Collision Risk

There is a potential collision risk to all non-benthic fish from rotating underwater blades, noting that even predominantly benthic species may move into the water column periodically and become exposed to the risk. Some species of pelagic fish have been recorded adjacent to the Tidal Site but at relatively low abundances[(1)]. Spawning herring and juvenile whiting (PMFs) have been reported adjacent to the Tidal Site but are unlikely to be present at high abundance within the Tidal Site [(1)].

The ability of fish to evade collision with the blades will depend on a number of factors including manoeuvrability, locomotor performance, developmental stage, size, schooling behaviour, curiosity and sensory (vision and mechanosensory) capabilities (Wilson *et al.*, 2007) [(39)]. Evasion will vary across species. Fish may also avoid the area around a turbine (responding at greater range than evasion responses) and these responses will be dependent on sound stimuli from the device. Fish are sensitive to low frequency infrasound and make avoidance responses triggered by it (see Enger, 1993 [(40)], Sand *et al.*, 2001 [(41)]; Knudsen *et al.*, 1992 [(42)]; Knudsen *et al.*, 1994 [(43)]; Knudsen *et al.*, 1997 [(44)]). Based on the noted studies, and the low abundances at the Tidal Site, the receptor sensitivity value is considered to be low.

The worst case scenario for a 20m diameter turbine is when deployed in 29m water depth, with a minimum of 6m between the swept area and the water surface and 3m between the swept disc and the seabed. At the mean tidal speed in mid-water at the Tidal Site (1.22 m/s over a lunar month) measured using ADCP, the turbine blades would rotate at a mean speed of 3.07 m/s (with a mean tip speed of 4.8m/s and a peak tip speed of 13m/s). Noting the low abundances of fish species present at the Tidal Site, it is possible that a very low number of encounters may occur at velocities below 6 m/s, the velocity that a visual looming stimulus model predicts fish can evade (Batty and Wilson, 2010) [(45)]. Accordingly the impact magnitude value is considered to be negligible, with the consequence of impact also being negligible.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures are proposed necessary.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.11 | Low | Negligible | Negligible | Negligible – not significant |

11.6.12 Operational Noise and Vibration

Chapter 19 on noise should be read in conjunction with this assessment.

Inherent noise and vibration from the operating devices, could potentially affect fish and shellfish species at the Tidal Site. The baseline assessment conducted for the Tidal Site notes the presence of a moderately noisy background with a recorded average level of around 82 dB re 1 $\mu Pa^2/Hz$ (see Chapter 19 Noise), hence additional noise would have to be at a level above the high background to have an impact. The Western Export Cable Route to landfall at Islay does not contain any elements that could give rise to operational noise and vibration.

Most species at the Tidal Site would be exposed, but not all are sensitive [30], with impact on shellfish expected to be very low due to the absence of swim bladders. However, compared with potentially higher noise levels associated with rock drilling there has been less research into sensitivity of fish and shellfish to continuous, low level noise. Taking account of sensitivity and low abundance of species likely to be affected at the Tidal Site, the receptor sensitivity is considered as low.

Noise and vibration from devices would be expected to increase in proportion to tidal flow, however at peak flow background noise will also increase. However, noise levels are still expected to be relatively low and unlikely to exceed background to any great degree. Some noise above background would be beneficial as it will be detected by fish and may trigger an avoidance response, thus reducing collision risk (see section 11.6.11). Accordingly the impact magnitude value is considered to be negligible, with the consequence of impact rating also being negligible.

Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures are proposed necessary.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.12 | Low | Negligible | Negligible | Negligible – not significant |

11.6.13 Electromagnetic Fields (EMF)

Chapter 20 on EMF should be read in conjunction with this assessment.

It has long been known that some fish use electromagnetic signals to search for prey and possibly for navigation (Meyer *et al.*, 2005 [(46)], Kimber *et al.*, 2011 [(47)]). This is particularly true of some of the elasmobranchs who possess specialist organs (the ampullae Lorenzini). Sharks may be particularly sensitive to electric fields, with a threshold of sensitivity as low as 5 nV/cm (5/1,000,000,000 of a volt measured in a centimetre-long ampulla). Some bony fish also possess similar electro-detection organs.

This has led to concerns that EMF signals emanating from underwater power cables might interfere with normal elasmobranch behaviour [(47)]. Recently a major review of EMF effects on marine organisms, including fish, has been released in the US (see Normandeau Associates *et al.*, 2011 [(48)] and Chapter 20 EMF).

For fish potentially sensitive species include elasmobranchs, as already noted, but also lampreys and sturgeons (in UK waters lamprey, *Petromyzon marinus* and sturgeon *Acipenser sturio*, are species of conservation concern, although neither were recorded during the surveys undertaken [(1)]). Little experimental work has been conducted on the effects of underwater power cabling. Gill *et al.*, (2009) [(49)] conducted one of the few semi-natural experiments on the reactions of fish to power cabling. They found that the behaviour of several fish species including dogfish (*Scyliorhinus canicula*) was affected by whether cabling was actively powered or not. However, it was difficult to extrapolate from this limited experimental study to what effects in the natural system might be. They have since shown in the laboratory that dogfish (*Scyliorhinus canicula*) may confuse artificial and naturally emitted electric fields and that artificial fields might thus impact feeding success [(47)].

It is also important to note that few invertebrates have ever been tested for an electric sense, though some recent evidence for this has been reported in decapod crustaceans (crabs, shrimp, and lobsters). Sensitivity to early life stages in both fish and shellfish is largely unknown [(48)].

According to the Normadeau report [(48)], most marine species may not sense very low intensity electric or magnetic fields at AC power transmission frequencies (i.e., 60 Hz in US). AC magnetic fields at intensities below 5 µT may not be sensed by magnetite-based systems (including fish and invertebrates), although this AC threshold is theoretical and remains to be confirmed experimentally. Low intensity AC electric fields induced by power cables may not be sensed directly at distances of more than a few meters by the low-frequency-sensitive ampullary systems of electrosensitive fishes. If these generalities for AC magnetic and electric fields hold across the many taxa and life stages that have not been investigated, then this limits the area around AC cables in which sensitive species would detect and therefore possibly respond to EMFs. However, AC electric fields associated with power cables may still evoke responses of individuals and affect populations most closely associated with the benthic habitat, especially in very close proximity to cables.

Elasmobranchs including common skate, spiny dogfish, spotted ray, blond ray, cuckoo ray and spurdog have been caught in ground survey trawls approximately 20 nautical miles from the Tidal Site, but not in great numbers (e.g., individuals of cuckoo ray to 10's of individuals of spurdog [1]). Of these, common skate and spiny dogfish are PMF species.

Due to field damping effects (extra heavy armoured cable and device insulation) receptor sensitivity is considered to be low based on numbers of individuals present against the likely field effects to be emitted beyond the structures/cables and insulation. Research to date suggests that fish sensitivity to EMF is at rather short-spatial scales i.e. close to cables or sources. The effect declines rapidly with distance [48].

In the case of the proposed turbines, transformer and power conditioning equipment will be integrated internally to the devices. Inter array/device cables will be insulated, armoured and potentially ballasted. The export cables will be larger, and hence the highest field generator, but also noting that it will be insulated and double armoured. Up to three cables will be surface laid and potentially ballasted in places at the Tidal Site and along the proposed Western Export Cable Route to Islay, with trenching in the intertidal zone at landfall. Due to the insulation and double armouring overall field effects will be localised. Accordingly the impact magnitude value is considered to be minor, with an overall consequence of impact rating of minor.

As a means of management, transformer and power conditioning equipment have been designed internally, hence reducing field effects external to the devices. Extra heavy armoured cable is being selected for the export cables, which has higher levels of insulation (compared to less armoured cable).

| **Potential Effect** | **Receptor Sensitivity** | **Impact Magnitude** | **Consequence of Impact** | **Residual Impact Post Mitigation** |
|---|---|---|---|---|
| 11.6.13 | Low | Minor | Minor | Minor – not significant |

11.6.14 Changes in Tidal Flows

The Western Export Cable Route and associated trenching at landfall are not large enough to influence or change tidal flows.

Devices at the Tidal Site, taking energy out of the tidal waters could impact upon Shellfish and fish species present. There may be a potentially larger impact on immobile species (whelks, mussels, barnacles, etc.) compared to mobile species. However, it is also worth noting that such species are generally present in intertidal rocky habitats, which are subject to very changeable tidal flows on a daily basis. As such the receptor sensitivity is considered as negligible.

Noting that the Tidal Site is extremely energetic, with the devices taking out a comparatively minute proportion of energy overall the impact magnitude is considered to be negligible, although noting the potential for some small local variation in tidal flows.

Considering the small total amount of energy taken out of the existing extremely energetic conditions, the consequence of impact value is considered to be negligible. No further management actions are proposed, although noting that the devices are being deliberately spaced (see Chapter 5 Project Description: section 5.6) which takes account of flows and predicted wake effects.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.14 | Negligible | Negligible | Negligible | Negligible – not significant |

11.6.15 Operational Light Pollution

Chapter 14 on Shipping and Navigation presents the detail on navigation lighting to be installed at the Tidal Site and should be read in conjunction with this section.

Lighting will not be installed for the Western Export Cable Route and/or landfall at Islay, although light pollution from navigation lighting installed on devices at the Tidal Site could have a potential impact upon shellfish and fish species present. Those particularly sensitive might include the spiny lobster (see below). Baseline surveys indicate relatively low abundances of most shellfish and benthic fish of conservation importance (defined as Scottish PMFs) in the area [1]. For spiny lobster (*Palinurus elephas*) there is limited abundance data although discussions with local fisheries [20] and habitat considerations indicate that they are likely to be present.

Some behaviour modification of fish and shellfish by light might occur during works e.g. lights might attract small clupeids to the surface. Shellfish such as nephrops may suffer visual damage from bright lights e.g. when they are sorted on fishing vessel decks [27], noting that nephrops are not likely to be present at the Tidal Site nor along the Western Export Cable Route due to a lack of suitable habitat. However, given that most crustacea will naturally be in cryptic habitats, ship light pollution is not likely to be significant. No data on damage from light pollution of spiny lobster could be found although measurements of their visual acuity have been made [28]. Settlement behaviour of larvae of other spiny lobster species appears to be controlled by light [29] so settlement rates of larval stages could be affected. Accordingly, the receptor sensitivity is considered as medium.

Impacts from device lighting will be very localised to the immediate area, noting that navigational lighting is designed for horizontal illumination, with light positioning and support bases reducing downward shine, although with the need to maintain lighting levels for navigational safety. Accordingly impact magnitude is considered as minor, for a consequence of impact rating of minor.

| Potential Effect | Receptor Sensitivity | Impact Magnitude | Consequence of Impact | Residual Impact Post Mitigation |
|---|---|---|---|---|
| 11.6.15 | Medium | Minor | Minor | Minor – not significant |

## 11.6.16 Summary

Table 11.7 provides a summary of the assessed potential effects for the Tidal Site and Western Export Cable Route to Islay. Of the potential effects presented, all have been assessed as having an overall impact rating of negligible or minor effect. This general overall consequence of impact rating reflects the designed approach of the development, the relatively low abundances of shellfish and fish species found, lack of sensitive species and low importance of the area in respect of nursery, spawning and migration activity.

| Section No. | Potential impact | Receptor Sensitivity (Table 11.5) | Impact Magnitude (Table 11.6) | Consequence of Impact Table 4.5* | Potential Mitigation Measures | Residual effect Table 4.6* |
|---|---|---|---|---|---|---|
| **Construction and/or Decommissioning** | | | | | | |
| 11.6.1 | Fluid/contamination release from construction and decommissioning activities. | LOW | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall impact is considered negligible, no additional mitigating and management measures would be proposed. However, a Project Environmental Management Plan (PEMP) will put in place to provide controls for avoidance or clean-up of such spills, along with the provision of spill kits. Only certified construction techniques will be used and regular maintenance checks will be carried out to prevent spills. In addition, low toxicity hydraulic oils and lubricants will be used, compliant with national and international standards, which are also biodegradable in most cases. | NEGLIGIBLE - Not Significant |
| 11.6.2 | Light Pollution during construction and decommissioning activities | MEDIUM | NEGLIGIBLE | NEGLIGIBLE | Where practical it may be possible to limit lighting to the levels required (i.e., not over light) although noting the need to maintain lighting levels for the safety of the operations being conducted at the time. | NEGLIGIBLE - Not Significant |

| Section No. | Potential impact | Receptor Sensitivity (Table 11.5) | Impact Magnitude (Table 11.6) | Consequence of Impact Table 4.5* | Potential Mitigation Measures | Residual effect Table 4.6* |
|---|---|---|---|---|---|---|
| 11.6.3 | Noise and vibration during construction and decommissioning activities | NEGLIGIBLE | MINOR | NEGLIGIBLE | Noting that the consequence of impact rating is considered negligible, no additional mitigating and management measures are proposed. | NEGLIGIBLE - Not Significant |
| 11.6.4 | Increase in suspended sediments during construction and decommissioning activities | MEDIUM | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed. | NEGLIGIBLE - Not Significant |
| **Installed Life (from Construction through to Decommissioning)** | | | | | | |
| 11.6.5 | Fluid/contamination released from devices during installation, operation and/or decommissioning | LOW | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall impact is considered negligible, no additional mitigating and management measures would be proposed. Although it is noted that the designers are selecting low toxicity oils and lubricants to national and international standards, which are also biodegradable in most cases. | NEGLIGIBLE - Not Significant |
| 11.6.6 | Loss of spawning grounds | NEGLIGIBLE | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed. | NEGLIGIBLE - Not Significant |
| 11.6.7 | Loss of nursery grounds | NEGLIGIBLE | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed. | NEGLIGIBLE - Not Significant |
| 11.6.8 | Removal/alteration of habitats due to presence of new devices/cables | LOW | NEGLIGIBLE | NEGLIGIBLE | Noting that the overall consequence of impact is considered as negligible, no additional mitigating and management measures would be proposed. | NEGLIGIBLE - Not Significant |

| Section No. | Potential impact | Receptor Sensitivity (Table 11.5) | Impact Magnitude (Table 11.6) | Consequence of Impact Table 4.5* | Potential Mitigation Measures | Residual effect Table 4.6* |
|---|---|---|---|---|---|---|
| 11.6.9 | Anti-fouling compounds | LOW | MINOR | MINOR | Anti-fouling paints meeting recognised international and national standards that do not require additional treatment during operation are being selected at the design stage. | MINOR - Not Significant |
| 11.6.10 | Barriers to fish species movement | NEGLIGIBLE | NEGLIGIBLE | NEGLIGIBLE | Noting that the consequence of impact is considered as negligible, no additional mitigating and management measures are proposed. | NEGLIGIBLE - Not Significant |
| **Operation** | | | | | | |
| 11.6.11 | Collision Risk | LOW | NEGLIGIBLE | NEGLIGIBLE | Noting that the consequence of impact is considered as negligible, no additional mitigating and management measures are proposed. | NEGLIGIBLE - Not Significant |
| 11.6.12 | Operational noise and vibration | LOW | NEGLIGIBLE | NEGLIGIBLE | Noting that the consequence of impact is considered as negligible, no additional mitigating and management measures are proposed. | NEGLIGIBLE - Not Significant |
| 11.6.13 | New electromagnetic fields introduced to the Tidal Site | LOW | MINOR | MINOR | For the devices, transformer and power conditioning equipment have been designed internally, hence reducing field effects external to the device. Extra heavy armoured cable is being selected for the export cables, which has higher levels of insulation (compared to less armoured cable). | MINOR - Not Significant |

| Section No. | Potential impact | Receptor Sensitivity (Table 11.5) | Impact Magnitude (Table 11.6) | Consequence of Impact Table 4.5* | Potential Mitigation Measures | Residual effect Table 4.6* |
|---|---|---|---|---|---|---|
| 11.6.14 | Changes in tidal flows | NEGLIGIBLE | NEGLIGIBLE | NEGLIGIBLE | Considering the small total amount of energy taken out of the existing extremely energetic conditions, the overall consequence of impact is considered negligible. No further management actions are proposed, noting that the devices are being deliberately spaced (see Chapter 5 Project Description section 5.6) which takes account of flows and predicted wake effects. | NEGLIGIBLE - Not Significant |
| 11.6.15 | Operational light pollution | MEDIUM | MINOR | MINOR | The lighting by nature is designed for horizontal illumination, with the light bases also providing some shielding against downward illumination | MINOR - Not Significant |

Table 11.7: Summary of Assessed Potential Effects on Natural Fish and Shellfish Species at the Tidal Site and Western Export Cable Route to Islay. *From Chapter 4 EIA/ES and Consultation.

## 11.7 Proposed Management and Mitigation

Proposed management and mitigation measures in relation to potential impacts on natural fish and shellfish resources are presented in section 11.6. The proposed actions can be categorised along with the main phases of the project lifecycle as follows:

- **Design considerations;** Secure fluid containment and appropriate bunding, appropriate selection (low toxicity, biodegradable) of fluids, contaminants and anti-fouling paints to international/national standards taking, insulation aspects (cabling and devices);
- **Construction aspects;** Controls for contamination release and response, use of certified construction techniques and use of low toxicity oils and lubricants;
- **Maintenance activities;** Confirm the inventory of fluids/contaminants during maintenance checks to assess for leaks. Checking of seals and containment measures during maintenance;
- **Decommissioning methods;** Repetition of any relevant construction management/mitigation aspects and monitoring that also apply during decommissioning.

Although the overall impact significance values have been assessed as negligible or minor, management and mitigation actions are being undertaken, particularly during the design stage to reduce effects further.

## 11.8 Potential Cumulative and Trans-boundary Effects

For each potential impact identified, an assessment has been made as to whether there are aspects that could lead to cumulative effects (see below). Where aspects with potential for accumulation have been identified, they have been assessed in relation to neighbouring developments and activities in order to identify realistic potential cumulative impacts.

With the Pproject in open waters to the West of Islay, it is considered that many potential impacts are unlikely to pose a cumulative risk, compared to developments in more enclosed conditions. For example, potential barrier effects on migrating species and changes in tidal flow would be more of a concern in narrow straits, or in sea loch inlets, compared to open ocean situations.

In summary, when considering the open water situation in conjunction with the low abundances of species present, the development is not considered to give rise to cumulative effects that could potentially impact upon the fish and shellfish species present. Nor is it expected that the development would give rise to concern in neighbouring areas or developments in relation to cumulative impacts, also noting the distances to other developments (the nearest being the SSER Offshore Wind Farm, which is around 20km to the north, also in open water).

Similarly, the potential for trans-boundary effects is considered to be negligible. The development does not have the capacity to be a major source of pollution, nor does it present major impacts in the immediate area or in the extended adjacent areas. Impacts upon migrating species are also assessed as negligible, again due the nature of the development in open waters.

## 11.9 Indirect Effects

For each potential impact identified, an assessment has been made as to whether there are aspects that could lead to indirect effects (see below).

The accumulation of pollutants within fish species at the Tidal Site, with the potential to affect predators, for example birds and mammals, has been assessed. Potential pollutants could arise from construction/decommissioning activities (see section 11.6.1) and general operation/device presence (e.g., anti-fouling paints, oils and fluids, see section 11.6.5). A number of studies have been undertaken on this subject and it is considered unlikely that pollutants from fluids would accumulate in shellfish or fish to the point where it would affect other organisms predating on them (Stagg, R.M. *et al.*, 1996 [(50)]; E and P Forum Report No. 2.61/202 April 1996 [(51)]; and Neff, J.M. 1988 [(52)]).

The presence of night time lighting during construction, operation and/or decommissioning could attract small fish to the surface which might in turn attract in higher predators. Night time lighting will be monitored during construction and or decommissioning work so as to use appropriate lighting where practical (i.e., not overlight), although noting the need to maintain appropriate lighting levels for safe working. Navigation lighting during operation is designed for horizontal illumination, with lighting mounts/bases reducing downward illumination, however, again noting the need to maintain appropriate levels of lighting for navigational safety aspects.

Noise and vibration during construction, operation, maintenance and decommissioning could potentially scare food sources (fish species) away from the area during construction which could temporarily affect predator distribution patterns. During construction, maintenance and decommissioning, working methods would be selected taking noise and vibration into account, with noise monitoring undertaken during tasks to validate selected methods. Although an engineered level of noise from the devices in operation will be desirable in terms of mitigating collision risk for fish species.

An increase in suspended sediments during construction and/or decommissioning could alter predation susceptibility of fish and shellfish to other predators. To mitigate, machinery and working methods would be selected that reduce the amount of sediment/solids suspended in the water column. Where rock placement is necessary, materials would be selected that do not have a high particulate content.

Removal and/or alteration of habitats due to the presence of the new devices could lead to the potential loss of some food sources for predators, however, the amount of feeding grounds this represents is insignificant compared to overall feeding grounds for predators. Converse to this, the introduction of new habitats could lead to greater food sources localised around the structures/devices. This could attract predators, which in turn might be vulnerable to turbine impacts. However, taking account of the size of the altered habitats compared to the overall feeding grounds available, the expected overall effect would be negligible.

## 11.10 Summary and Conclusions

The Project is considered to present a negligible or minor consequence of impact in relation to shellfish and natural fish species, present at the Tidal Site and along the Western Export Cable Route to Islay. This takes account of the low abundances of species found, lack of sensitive species, low importance of the area in respect of nursery, spawning and migration activity and siting of the development in open waters. For similar reasons, the assessment also considers potential cumulative and trans-boundary effects to be negligible.

Although the overall consequence of impact is negligible or minor for all potential effects considered, a number of good practice management and mitigation actions are proposed during design, construction, maintenance, operational monitoring and decommissioning activities.

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