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Development of Offshore Renewable Energy in Scotland's Seas

Research Implementation Strategy

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1. INTRODUCTION

1.1 Purpose of Document

This document sets out the proposed Marine Scotland research programme to inform and support the further development of offshore renewable energy in Scotland's seas. It identifies potential delivery routes for projects, timescales, costs and supporting partners. Details of when and how supporting partners will be involved in each of the research programmes is also set out.

The Strategy is intended to be an iterative document that will reviewed and updated as the knowledge base develops and new requirements and opportunities emerge.

1.2 Strategy Information

The Strategy establishes the various gaps in current knowledge that have been identified through the ongoing programme of work that Marine Scotland is delivering to support the development of offshore renewable energy in Scotland's seas.

The Research Implementation Strategy has been informed by:

- The SEA Post Adoption Statement for 'Blue Seas, Green Energy', a Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters;
- The 2007 Marine Renewables Strategic Environmental Assessment;
- The offshore renewable energy demonstration projects in Scottish waters;
- The Pentland Firth & Orkney Waters marine spatial plan pilot project and framework document;
- Advice from Marine Scotland Science on potential gaps.
- Approaches from Industry on particular issues in relation to development applications.

2. POLICY DRIVERS

2.1 Introduction

The Scottish Government has a target for 100% of Scottish demand for electricity to be met from renewables by 2020 by creating a balanced portfolio of both onshore and offshore technologies.

Marine Scotland must ensure that the development of wave, tidal and offshore wind energy sectors is achieved in a sustainable manner in the seas around Scotland. To address the various issues and challenges of developing offshore renewables, a number of projects have been initiated to provide solutions and support to partner organisations and Industry.

The potential for interactions between offshore renewable energy deployments and sites and species of European importance means that a significant programme of research is required to facilitate developers marine licence applications and to inform Marine Scotland's licensing decisions in the context of uncertain environmental effects and strengthen compliance with the requirements of European and national legislation.

2.2 Sectoral Marine Planning

Sectoral Marine Plans are being developed to ensure that Offshore Renewable Energy sources, wave, tidal and offshore wind, will make a full contribution to meeting our ambitious targets. Sectoral marine plans will be adopted into the statutory National and Regional Marine Plans and set out the Scottish Government's policies for developing offshore renewable energy. Sectoral Marine Plans are developed using Strategic Environmental Assessment (SEA), Habitats Regulations Appraisal (HRA) and consultation and informed by socio-economic assessment at the strategic level, using The Crown Estate's MaRS system for scoping and initial mapping, supplemented by information from Scotland's Marine Atlas and other sources. Through this process, gaps in environmental knowledge relating to the deployment of offshore renewable energy are being identified and will inform the prioritisation of research to facilitate the sectoral marine planning process and the wider marine planning system in Scotland. Please see http://www.scotland.gov.uk/Topics/marine/marineenergy for further details on the Sectoral Marine Planning process and the Plans published to date.

2.3 Planning and Licensing Research Policy

To underpin the research programme and to ensure that the research programme is contributing towards the Scottish Government's aim of facilitating sustainable development of offshore renewable energy, Marine Scotland have developed a planning and licensing research policy. The policy is set into 6 distinct phases into which specific research projects can fit:

- Phase 1 – Survey to identify species and habitats characterisations
- Phase 2 – Prediction of impact
- Phase 3 – Methodology to assess significance of effect
- Phase 4 – Effectiveness of Mitigation and changes to impact significance

- Phase 5 – Ability to advise on granting / refusing licence / consent
- Phase 6 – Monitoring requirements (post consent)

2.4 Survey, Deploy and Monitor Policy

The Survey, Deploy and Monitor Policy aims to provide a risk-based approach to help address uncertainties in licensing for offshore renewables development, taking into consideration environmental sensitivity, device type and scale of development. A draft version of the policy is available on the Scottish Government website[1], this will be shortly finalised following consultation.

2.5 Demonstration Strategy

The renewables demonstration strategy is a component of the Marine Scotland approach to reducing the environmental uncertainty currently inherent in the licensing of renewables developments in Scottish waters. Information, beyond the monitoring which would be required of the developer as consent conditions, will be obtained and used to inform the licensing/consenting of future developments.

Marine Scotland will, in agreement with developers taking forward initial array developments, use consented projects to gather strategic information into how marine devices interact with the wider ecosystem. Priority for demonstration strategy investigations will be given to those interactions which are relevant to features of the environment that may be designated under EU (or national) legislation, i.e. seabed habitats, seabirds, marine mammals (seals and cetaceans), and migratory fish (primarily salmonids), but not confined to these features.

2.6 Short life Energy Planning and Consenting Task Force

This Task Force reported on 9 February 2012 with a number of recommendations. The recommendations focus on further improving Scotland's planning and consenting landscape by requiring wide ranging pre-application engagement, co-ordinating the collation of, and access to, relevant data as well as resourcing the regulators sufficiently to deal with the peak of project applications expected in the near future.

The online marine data system "Marine Scotland interactive (MSi)[2]" is being expanded and used to make a wide range of data and information available to the renewables industries and other stakeholders. The system has traditionally held map-based information from MSS research projects related to renewables. It now has the capacity to hold and display information from MS externally-commissioned work, for example strategic level seabird surveys, and reviews of populations trends at designated seabird colonies. It will also provide access to information on the locations and state of progress with marine renewables developments, and provide access to important documents in the consenting process, such as Scoping responses, Environmental Statements, and Appropriate Assessments.

[1] http://www.scotland.gov.uk/Topics/marine/Licensing/marine
[2] http://www.scotland.gov.uk/Topics/marine/science/MSInteractive

3. RESEARCH IMPLEMENTATION STRATEGY

3.1 Strategy Description

This Strategy sets out the research priorities identified to assist in the development of offshore renewable energy in Scottish waters. Research reports will be made available for viewing and download via http://www.scotland.gov.uk/Topics/marine/marineenergy/Research .

The Marine Scotland Offshore Renewables Research Implementation Strategy addresses a range of key issues in the development of sustainable offshore renewable energy industries. It takes accounts of the needs of the licensing and sectoral planning processes, concentrating on priority issues, such as the interactions between renewable energy developments and habitats and species protected under Natura 2000 regulations.

The Government's Economic Strategy envisages 'a single environmental and rural service for businesses in pursuit of a greener and wealthier Scotland'. With this in mind, Marine Scotland Offshore Renewables Research Implementation Strategy takes account of the responsibilities of other public bodies that will play a significant role in delivering offshore renewable energy. This includes marine roles of the Scottish Environment Protection Agency (SEPA) and Scottish Natural Heritage (SNH) and is relevant to other bodies contributing to the Co-ordinated Agenda for Marine, Environment and Rural Affairs Science (CAMERAS).

3.2 Links to Marine Scotland Offshore Renewable Energy Projects

To support the sustainable development of offshore renewable energy Marine Scotland is taking forward a number of projects to facilitate sectoral marine planning for offshore renewable energy deployments. The research that is outlined in this Strategy will inform and support the various projects that could be developed in Scottish waters.

3.3 Planning and Licensing Research

Marine Scotland Planning and Policy Division provides the policy support and procurement management with scientific support, advice and input from Marine Scotland Science. Once a project outline has been prepared, MS Planning & Policy and Science undertake consultation with the statutory nature conservation advisors and stakeholders prior to commissioning to ensure that each research project is focused on the right issues and knowledge gaps.

In this regard, Marine Scotland has been developed a programme of research to inform project licence applications and potential interactions with species of European importance, notably, seabirds, marine mammals and migratory fish.

A number of socio-economic assessment projects are being taken forward to inform development of the Pentland Firth Marine Spatial Plan pilot project, implementation of the Sectoral Marine Plan for offshore wind and development of the Sectoral Marine Plan for Marine Renewables. Project Plans have been developed for each of

these streams of work and contain further information on the specific assessment projects that are being taken forward for – Shipping and Navigation; Tourism and Recreation; Fishing.

3.4 Policy Reviews

Policy reviews have been undertaken for completed and published research. The reviews assist in the assessment of report outputs by showing how the reports align with the licensing / consenting policy outlined in section 1.4 above. Policy reviews will be published alongside completed reports on the Marine Scotland Offshore Energy Research web pages - http://www.scotland.gov.uk/Topics/marine/marineenergy/Research

3.5 Associated Research Programmes

Scottish Marine Renewable Research Group

A significant research programme for marine renewables (wave and tidal) has been established through the Scottish Marine Renewable Research Group (formerly MESPG Environmental Research sub-group). This body of research is specifically looking at the uncertainties and unknowns relating to the interactions between wave and tidal energy and the environment. The research is specifically investigating potential impacts between seabirds, marine mammals, habitats and marine renewables, as well as generic research into the potential effects on the marine environment as a whole.

Information on the current research being taken forward by Marine Scotland and partners and overseen by the Scottish Marine Renewable Research Group can be found at http://www.scotland.gov.uk/Topics/marine/marine-environment/mespgresearch.

Marine Mammal Scientific Support Research Programme

Marine Scotland have appointed the Sea Mammal Research Unit (SMRU) to manage this programme. The programme is of strategic relevance to Scottish Government Ministers under a wide range of key marine policy areas. Three specific research Themes (marine renewables, unexplained seal deaths and the common seal decline) have been prioritised because information, reactions and resolutions are urgently needed so that Scottish marine policy and its links to marine mammal management and conservation can develop across a number of critical work areas. These relate not only to the protection of marine mammals in Scottish waters but also to the relationship between the development of the offshore renewable energy sector across Scotland and its bearing on the maintenance and conservation status of these top predators.

In particular, the following research streams have been commissioned:

- Map out the current offshore renewables research landscape with respect to marine mammals and other relevant issues;
- Assessment of the data gaps with regard to marine mammals and offshore renewables;

- Methods for tracking the fine scale underwater movements of marine mammals around marine tidal devices ;
- Provision of an advice function to support regulators and appropriate regulatory bodies on matters concerning marine mammals;
- Characterisation of seal and cetacean population distribution and abundance;
- Quantify the risk to marine mammal populations from different types of interaction with renewable devices in areas identified as having potential for renewable development;
- Identify and test management and mitigation measures with respect to marine renewable energy.

Scottish Marine Science Strategy

The Offshore Renewables Research Implementation Strategy has been developed to ensure that it is fully coherent with the Scottish Marine Science Strategy 2010-2015. The high level SMS Strategy builds upon Scotland's Marine Vision for 'Clean, healthy, safe, productive, biologically diverse marine and coastal environments, managed to meet the long term needs of people and nature'. It sets out the priorities and objectives needed to ensure that marine science in Scotland supports the Government's single purpose of "creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth". The vision will be delivered through a co-ordinated approach to the management of the marine environment, underpinned by high quality marine science directed towards policy issues. The Government's Economic Strategy gives particular attention to Energy (with a particular focus on renewable energy) as being especially important in relation to energy security and reducing emissions such as carbon dioxide. The Scottish Marine Science Strategy describes the framework for the delivery of this marine science.

Co-ordinated Agenda for Marine, Environment and Rural Affairs Science (CAMERAS)

An overall framework for marine science in Scotland developed by CAMERAS has five main elements:

1) Understanding the functioning of marine and freshwater ecosystems
2) Environmental change
3) Assigning economic and societal value to our natural assets to inform policy and planning decisions
4) Protecting Scotland's natural assets (e.g. land, water, biodiversity etc.) for future generations in the face of competing pressures and threats
5) Improving Scotland's economic and environmental performance.

A series of the science priorities are identified within this framework, and the formulation of projects within the Marine Scotland Offshore Renewables Research Implementation Strategy has taken account of the scopes of relevant priorities, such as (using the numbering as above):

1) The most important natural physical and chemical properties of aquatic ecosystems that are sensitive to climate change; The role of biodiversity and key

species (including humans, marine mammals, seabirds, and fish) in the functioning of the aquatic ecosystem; The causes of change, ecological requirements and management needs of priority habitats and species.

2) Undertake surveys including remote sensing required to identify, monitor and map habitats in Scottish waters on a scale related to spatial planning and to assess the status and condition of habitats and species;

3) Develop decision-making tools to appraise the economic, social and environmental costs and benefits of different uses of resources such as fisheries, aquaculture, recreation, conservation, renewable energy, and carbon capture and storage so as to inform marine spatial planning; Estimate the value people place on the services they derive from Scotland's aquatic ecosystem including recreation and enjoyment of the marine environment.

4) Environmental, economic and social impacts of management measures that aim to change human activity for conservation purposes such as Marine Protected Areas (MPAs), modified fishing gears or fishing effort restrictions; The costs, benefits and other effects of contaminants, acidification, eutrophication, engineering operations, litter, disturbance and noise upon aquatic ecosystems and natural or cultural heritage. Cumulative effects, in particular, need to be considered; Assess the extent to which losses of ecosystem services due to human activity are reversible, investigate the time taken for ecosystems to recover after damage, and identify management measures required.

5) Investigate sustainable options for the further development of renewable energy in the marine environment;

4. RESEARCH PRIORITIES

Seabird Research

No	Research Project	Project Description	Project Manager	Supporting Partners	Contractor	Estimated Start Date	Estimated Completion Date	Project Funding (£)
SB 1	Assistance with assessment of survey methods, data assessment and analyses for renewable energy developments (Work Package A Seabird Research)	Accessing CREEM staff to assist in assessing protocols and subsequent environmental statements. Provision of a peer review process for regulators to offer opinions regarding statistical validity of site characterisation and impact monitoring studies associated with consent applications for offshore renewables.	Phil Alcock Ian Davies	• MS LOT	CREEM	Feb 2012	Mar 2014	n/a
SB 2	Collision Risk Modelling - Assessment of the sensitivity of Scottish Seabirds to interactions with renewable developments (Work Package B Seabird Research)	The project will investigate Scottish seabird populations interactions with offshore renewable developments, in particular recording particularly sensitive species and devices.	Phil Alcock Ian Davies	• TCE • OW Developer Groups • SNH • JNCC	McArthur Green Consultants	Dec 2011	Mar 2012 – completed available online Policy Review available online Web-link provided in section 3.6	10k
SB 3	Population dynamics of Forth & Tay breeding seabirds:	Review of the currently available population models	Phil Alcock Ian Davies	• SNH • JNCC	Specialist Contractor	Oct 2012	Mar 2013	tbc

	Review of available models and modelling of key breeding populations (Work Package D Seabird Research)	and recommendation on population model to apply to key species for key species in the Forth & Tay		• TCE • OW Developer Groups				
SB 4	Review of breeding seabird population sizes (Work Package E Seabird Research)	Review of breeding seabird SPA population sizes for those populations around the whole of Scotland to provide good solid baseline data.	Phil Alcock Ian Davies	• SNH • JNCC • TCE • OW Developer Groups	Natural Power Consultants	Dec 2011	Mar 2012 – completed and available online Policy Review available on-line Web-link provided in section 3.6	10k
SB 5	Effects of displacement from marine renewable developments on seabirds breeding at SPAs (Work Package G Seabird Research)	A proof of concept project on the development of a displacement model to estimate potential effects on adult breeding Common Guillemots on the Isle of May	Phil Alcock Ian Davies	• SNH • JNCC • TCE • OW Developer Groups	CEH	Feb 2012	June 2012 – completed and available online Policy Review available online Web-link provided in section 3.6	10k
SB 6	Population Trends of breeding seabird colonies in Scottish SPAs (Work	Continuation of Work Package E to allocate population trend data collected at the national	Phil Alcock Ian Davies	• JNCC • SNH • TCE	Natural Power Consultants	Mar 2012	July 2012 – completed and available	10k

	Package H Seabird Research)	level to specific locations in Scottish waters.		• OW Developer Groups			on line Policy Review available online Web-link provided in section 3.6	
SB 7	Population Consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs (CR/2012/03)	Application of a model of the population consequences of displacement from proposed offshore wind energy developments for all species of seabirds breeding at Scottish SPAs and to apply it to the specific offshore wind farm development areas.	Phil Alcock Ian Davies	• TCE • SNH • JNCC	Specialist contractor	Nov 2012	May 2013	tbc
SB 8	Cumulative assessment of collision risk of wind farms to migrating birds (CR/2012/04)	Development of a series of assessments of the cumulative collision risks to migrating bird species that are designated features of UK SPAs, and of the component of that risk arsing from wind farms in Scotland. The work will build on the outputs from the SOSS-05 project commissioned by The Crown Estate through the SOSS group.	Phil Alcock Ian Davies	• MSS • TCE • SNH • JNCC	Specialist contractor	Nov 2012	May 2013	tbc
				•				
SB 9	Methodological guidance on the modelling of bird (and abundant cetacean)	A study to test and validate a standardised approach to Density Surface Modelling of	Phil Alcock Ian Davies	• TCE • SNH • JNCC	Specialist Contractor	Nov 12	May 13	tbc

	distributions in offshore renewables development areas (CR/2012/05)	the distributions of vulnerable wildlife (primarily seabirds, but potentially also cetaceans in areas where they are sufficiently abundant) at marine renewable energy (wind, wave and tide) development areas and preparation of methodological guidance.						

Marine Mammals

No.	Research Project	Project Description	Project Manager	Supporting Partners	Contractor	Estimated Start Date	Estimated Completion Date	Project Funding (£)
MM 1	Methods for monitoring marine mammals	This Project will provide Marine Scotland with an evidence base on which to ascertain the best survey approach to count marine mammal populations in sea areas.	Elaine Tait Ian Davies	• SMRU • SNH • JNCC • University of Aberdeen	University of Aberdeen	January 2012	October 2012	150k
MM 2	Validation of noise dissipation models – Work Package A1 Marine Mammals	Proposed project to investigate which noise dissipation models have been validated and are applicable for use in Scotland	Ian Davies Phil Alcock	• Uni of Aberdeen	In House	Nov 2012	Dec 2012	n/a
MM 3	Displacement of marine mammals during installation - strategic placement of c-pods - joint project with EDPR / Repsol (Work Package A2 Marine Mammals)	Joint project with EDPR / Repsol to place MS PAM devices in strategic locations on the east coast of Scotland	Ian Davies Phil Alcock	• Uni of Aberdeen • Developers	In House	Spring 2013	Autumn 2013	n/a
MM 4	Displacement of marine mammals around operational OWFs - SMRU literature review (Work Package A3 Marine Mammals)	Literature review of existing data and research on effect of offshore wind farms on marine mammals	Phil Alcock Ian Davies	• SMRU	Within Call off contract	April 2012	July 2012	n/a
MM 5	Modelling of noise effects of operational offshore wind turbines, including noise	Proposed project to model the noise fields and potential effects from existing offshore	Ian Davies Phil Alcock	• Uni of Abd • SNH	Specialist contractor	Oct 2012	Mar 2013	tbc

	transmission through various foundation types (Work Package A4 Marine Mammals)	wind turbines – using known operation offshore wind developments. Will also include modelling of noise through foundation types i.e. concrete, piled, jackets						
MM 6	Preparation of Guidance on use of passive acoustic devices in impact monitoring (Work Package A5 Marine Mammals)	Proposed project taken forward within 2 distinct stages - stage 1 literature review - stage 2 production of a best practice guidance document.	Phil Alcock Ian Davies	• SNH • JNCC	Specialist contractor	Dec 2012	Mar 2013	tbc
MM 7	Information on distribution of key marine mammal species in East Scotland (Work Package B1 Marine Mammals)	Proposed project to identify, collect and assemble currently available data on distribution of key species such as bottlenose dolphin, common dolphin and harbour porpoise.	Ian Davies Phil Alcock	• SMRU	Specialist Contractor	Oct 2012	Dec 2012	tbc
MM 8	Noise tolerance of bottlenose dolphins, seals and harbour porpoise – Work Package B2 Marine Mammals	Proposed project to include plan for placement of PAMs in Aberdeen harbour, Mouth of the Tay and the Sutors to measure background noise that current populations of species can live with	Phil Alcock Ian Davies	• SNH • JNCC	Specialist contractor	Dec 2012	Mar 2013	tbc
MM 9	Advice on populations of cetaceans that might be involved in significant interactions with offshore energy development - SMRU literature review (Work Package C2 Marine Mammals)	Literature review of existing data and research on cetacean populations in Scottish waters	Phil Alcock Ian Davies	• SMRU	SMRU	Apr 2012	August 2012	n/a

MM 10	Sound of Islay Demonstration Pilot – Seal Disturbance Monitoring	The Sound of Islay demonstration (tidal) project presents an opportunity to study the disturbance of seals (e.g. pup abandonment, disuse of haul out sites) caused by vessel movements and construction activity during the installation of tidal turbines.	Mark Christie Ian Davies	• MSS • SNH • SPR	Specialist Contractor	Est. 2013	unknown	tbc
MM 11	Sound of Islay Demonstration Pilot – development of methods for direct observations of seal collisions	Approaches being considered include the development of sophisticated tags to track the underwater movement of seals in greater detail or imaging equipment being placed on the turbines which can detect the movement of seals around them.	Mark Christie Elaine Tait	• MSS • SNH • SPR	Specialist Contractor	Est 2013	Unknown	tbc
MM 12	Methods for tracking the fine scale underwater movements of marine mammals (in the vicinity of tidal turbines) – undertaken through the SMRU call off contract, work package MR3	A review of current (and developing) technologies for tracking the fine scale underwater movement of marine mammals which are applicable to high energy tidal sites. This will include a prediction of the feasibility of these technologies for direct observation of possible collisions in high energy tidal environments (e.g. Sound of Islay)	Mark Christie Elaine Tait	• MSS • SNH	SMRU	June 2012	Oct 2012	n/a

Migratory Fish

No.	Research Project	Project Description	Project Manager	Supporting Partners	Contractor	Estimated Start Date	Estimated Completion Date	Project Funding (£)
MF 1	Measurements of audiograms for key fish species - salmon, sea trout, eels, herring, cod and Sandeels (Work Package A1 Migratory Fish)		Ian Davies Phil Alcock	• MSS Freshwater Lab	Specialist Contractor	Oct 2012	Jan 2013	30k
MF 2	Modelling the consequences for Salmon of exposure to piling and operational noise (Work Package A2 Migratory Fish)	Proposed project to model effects and potential impacts of construction methods and operational noise to Salmon in Scottish waters	Ian Davies Phil Alcock	• MSS Freshwater lab	Specialist contractor	Oct 2012	Mar 2013	tbc
MF 3	Modelling exercise of potential offshore wind farms to investigate audibility to migrating salmon and sea trout (Work Package A3 Migratory Fish)	Proposed project to model potential audibility of operating offshore wind farms to migrating Salmonids	Ian Davies Phil Alcock	• MSS Freshwater Lab	Specialist Contractor	Dec 2012	Mar 2013	tbc
MF 4	Investigation into Sandeel interactions with offshore renewable energy construction methods (Work Package A4 – Migratory Fish)	Proposed project looking at Sandeel behaviour during various construction methods of offshore wind farms	Ian Davies Phil Alcock	• MSS Freshwater Lab	Specialist contractor / In House	Nov 2012	Mar 2013	tbc
MF 5	Field investigation of effects of installation noise on fish	Potential project to locate fish cages containing species,	Ian Davies Phil Alcock	• MSS Freshwater	Specialist contractor /	Not known at this		tbc

	hearing Work Package A5 – Migratory Fish)	notably, salmon and sea trout, and monitor effects on behaviour		Lab	in-house (tbc)	stage		
MF 6	Study of Sandeel habitat (Work Package Additional Project 1)	Proposed project to investigate % of habitat available, % of that available allocated to development;	Phil Alcock Ian Davies	• MSS	In-house?	Oct 2012	Jan 2013	tbc
MF 7	Review of COWRIE reports on skates and rays (Work Package Additional Project 3)	Proposed project to review and inform whether additional work required to inform licensing	Phil Alcock Ian Davies	• MSS	In-house?	Nov 2012	Jan 2013	tbc
MF 8	Study on population numbers of Basking Sharks (Work Package Additional Project 4)	Proposed study to identify population and distribution in Scottish waters; potential to expand to include sensitivity to EMF, disturbance and noise and identify mitigation;	Ian Davies Phil Alcock	•	Specialist contractor	Nov 2012	Mar 2013	tbc
MF 9	Collation of data on Salmonid populations in the Solway region to assess the potential influence of the Robin Rigg offshore wind farm development (Work Package Additional Project 5)	Project to collect all available data on species within the Solway Firth	Iain Malcolm Phil Alcock	• MSS	Specialist Contractor	July 2012	Nov 2012	10k
MF 10	Analysis of fish and fisheries data to assess the potential impact of offshore wind development on Solway rivers (Work Package Additional Project 6)	Analysis of the fish and fisheries data to assess potential impact of offshore wind development on the Solway rivers, building on the data collected through WP AP 5	Iain Malcolm Phil Alcock	• MSS	Specialist Contractor	Nov 2012	Jan 2013	10k

MF 11	Migratory Fish Research	Phase 1 – Construction of a coil system to investigate electro-magnetic force impacts on Salmonids	John Armstrong		In-house (MSS)	November 2011	March 2012 – installed	n/a
MF 12	Migratory Fish Research	Phase 2 – Evaluation of genetic methods for assigning fish caught in coastal zones to river of origin	John Gilbey		In-house (MSS)		August 2012	n/a
MF 13	Migratory Fish Research	Phase 3 – Evaluation of options for establishing the migration routes of Atlantic Salmon in coastal areas	Jason Godfrey / Stuart Middlemas		In-house (MSS)	February 2012	August 2012	n/a
MF 14	Migratory Fish Research	Potential for marine renewable power developments to affect diadromous fishes in Scottish waters: informing EIAs	Iain Malcolm		In-house (MSS)	April 2012	April 2015	n/a

Generic

No.	Research Project	Project Description	Project Manager	Supporting Partners	Contractor	Estimated Start Date	Estimated Completion Date	Project Funding (£)
G 1	Scottish Shelf modelling (MROW 1)	The project will provide a quantitative description of marine currents and water properties for the whole of Scottish waters on a full range of spatial scales. It will initially focus on modelling tidal and non-tidal currents, but once produced will allow modelling of other coastal processes.	Tracy McCollin Alejandro Gallego	• MSS • RERAD • MS Aquaculture	Specialist Contractor	August 2012	Spring 2014	530k
G 2	Concrete Base Research work	Investigation in to the potential effects of concrete bases in the marine environment. Initially focusing on an industry workshop.	Pippa Goldschmidt	• MSS	In-house	May 2012	Completed – workshop held	n/a
G 3	Review of the Scottish Marine Monitoring Network (MROW 8)	Project to investigate the monitoring network and the OW SEA and HRA requirements for strategic monitoring	Phil Alcock Ian Davies	• SNH • JNCC • SEPA	Halcrow	December 2011	Aug 2012	40k
G 4	Offshore Wind Build out Programme	To establish lessons learnt from previous offshore wind projects and identify any interventions necessary to secure the economic benefits associated with 5 STW and Scotland's 2 Round 3 sites	David Stevenson	• MS P&P • SE • HIE • SRF • TCE • National Grid	In House (Energy Directorate / Marine Scotland)	June 2011	August 2012	n/a

G 5	Mapping Sea Fishing Activity in Scottish waters: ScotMap Project (MROW 2)	Roll out of the ScotMap project to the remainder of Scottish waters. Project to collect fishing data on vessels of 15m length and below	Phil Alcock Anne McLay	• SFF • MSC	Specialist Contractor	July 2012	Mar 2013	40k
G 6	Inshore Surveys - Phase 1: West of Lewis bathymetry survey	survey work required by Marine Scotland in support shallow water renewables development. The sites of interest for shallow water work are to the west of the outer Hebrides.	Peter Hayes	• NLB • MCA • BGS	Specialist Contractor		September 2011 Data available via Marine Scotland interactive	117k
G 7	Inshore Surveys - Phase 2:	second tranche of geo-survey (sub-bottom profiling) work in areas of prime importance for marine renewables. The aim of the work would be to undertake sub bottom profiling from the wave sites associated with the Round 1 leases and the southwest Shetland lease area.	Peter Hayes	• NLB • MCA • BGS	Specialist Contractor	Feb 2012	Mar 2012 Data available via Marine Scotland interactive	117k
G 8	Inshore Surveys - Phase 3:	Focus on collection of bathymetric data for the south west of Shetland, building on the limited data collected by FRV Scotia during 2011.	Peter Hayes	• NLB • BGS	Specialist Contractor	Feb 2012	Mar 2012 Data available via Marine Scotland interactive	20k
G 9	Inshore Surveys – Phase 4 (MROW 3)	Focus on collection of bathymetric data for West of Scotland – Argyll, Islay and mull of Kintyre	Peter Hayes	• NLB • BGS	Specialist contractor	June 2012	Mar 2013	150k

G 9	Wave and Tidal Plan Development - Habitats Regulations Appraisal (MROW 9)	HRA of the Initial Plan Framework for wave and tidal energy in Scottish seas	Phil Alcock	• SNH • JNCC • SE Link • TCE • SEPA	ABPMer	Sep 2011	Aug 2012	41k
G 10	Wave and Tidal Plan Development - Strategic Environmental Assessment (MROW 4)	Strategic Environmental Assessment of the Initial Plan Framework for wave and tidal energy in Scottish seas	David Pratt Fiona Simpson	• SNH • JNCC • SEPA • His Scotland • TCE	SG EA Team	June 2011	Mar 2013	92k
G 11	Wave and Tidal Plan Development - Socio-Economic Assessment (MROW 4)	Socio-economic assessment of the Initial Plan Framework for wave and tidal energy in Scottish seas	David Pratt Kevin Brady	• TCE • MS E •	ABPMer	Sep 2011	July 2012	60k
G 12	Offshore Wind, Wave and Tidal Plan Development - Scoping Report of the potential of Scottish Waters for W, W & T Energy	Marine Scotland Scoping Studies to identify additional potential resource areas for wind, wave and tidal energy generation.	David Pratt Ian Davies	• TCE	In-house	Jan 2012	July 2012 completed and available on line Web-link provided in section 3.6	n/a
G 13	Offshore Wind, Wave and Tidal Plan Development – Regional Locational Guidance	Marine Scotland Regional Locational Guidance documents identifying areas for potential w, w & t development	David Pratt Ian Davies	• TCE	In-house	Jan 2012	Aug 2012 completed and available on line Web-link provided in section 3.6	n/a

G 14	Seascape – Pentland Firth & Orkney Waters	Project to model impact upon seascape of planned renewable activities and to determine economic value of seascape and any change in this as a result of renewable activities	Pippa Goldschmidt	• MSS • TCE • SNH • MS / DG Energy Economists	Specialist contractor			tbc
G 15	Wave and Tidal Developments – Pentland Firth & Orkney Waters	Project to determine the timescales and resources for construction of planned developments in the geographic area	Pippa Goldschmidt	• TCE • DG Energy	Specialist Contractor			tbc
G 16	Shipping and Navigation – Pentland Firth & Orkney Waters	Project to determine the volume and routes of different types of shipping in order to identify the need for setting priority areas for shipping and renewables	Pippa Goldschmidt	• TCE • DG Energy • NLB • MCA	Specialist Contractor			tbc
G 17	Commercial Fishing – ScotMap – Pentland Firth & Orkney Waters	Project to determine the areas fished and the economic value of fishing	Pippa Goldschmidt	• MS Fishing • MS Compliance • MSS	In-house	June 2010	April 2012 – [draft] report published July 2012 Web-link provided in section 3.6	25k
G 18	Tourism and Recreation – Pentland Firth & Orkney Waters	Project to determine the spatial extent and economic activity or relevant tourist activities (including sea angling and water sports)	Pippa Goldschmidt	• SACN • VisitScotland • RYA	Specialist Contractor			tbc

4.1 Description of the Research Priorities

Please find below brief descriptions of the research projects identified by Marine Scotland and listed in the table above. Further details of the projects will emerge as they are commissioned and taken forward.

Final reports for the projects and the associated Policy Reviews can be found at http://www.scotland.gov.uk/Topics/marine/marineenergy/Research.

SB 1. Project: Assistance with assessment of survey methods, data assessment and analyses for renewable energy developments (Work Package A Seabird Research)

Marine Scotland have established a call-off contract arrangement with CREEM whereby CREEM will provide comments, opinions and assessment of survey proposals and interpretations as and when they are required by Marine Scotland in support of renewables licensing.

SB 2. Project: Collision Risk Modelling: Assessment of the sensitivity of Scottish seabirds to interactions with renewable developments (Work Package B Seabird Research)

Previous work, carried out by Garthe & Huppop (or King et al 2009), was applied to the southern North Sea. This work does not apply to Scotland's marine environment very well, as we have more and larger breeding seabird colonies. The project will investigate Scottish seabird populations interactions with offshore renewable developments, in particular recording particularly sensitive species and devices. This scoring would be very helpful to regulators and developers to clarify which are species of particular concern and which are not an issue. Approach would involve asking a group of experts to review scores to adjust these on the basis of expert consensus, so a final version would take a few weeks to complete.

SB 3. Project: Population dynamics of Forth & Tay breeding seabirds: Review of available models and modelling of key breeding populations (Work Package D Seabird Research)

The project will develop an approach to population modelling which can be applied strategically across the Forth and Tay region in respect of the proposed offshore wind developments.

The project will be split into two distinct phases:

- Phase one will review the existing literature and population models relevant to the Forth and Tay wind farm developments and develop an appropriate ('proof of concept') model for kittiwake breeding populations.

- Phase two will apply the agreed model used for kittiwake populations to the remaining breeding seabird species (with appropriate modifications as may be necessary) identified for the Forth and Tay Offshore Wind Developer Group

The key breeding seabird species and relevant SPAs being considered within the study are:

- **Kittiwake** at Forth Islands SPA, Fowlsheugh SPA and St Abbs to Fast Castle SPA.
- **Herring Gull** at Forth Islands SPA, Fowlsheugh SPA and St Abbs to Fast Castle SPA.
- **Guillemot** at Forth Islands SPA, Fowlsheugh SPA and St Abbs to Fast Castle SPA.
- **Razorbill** at Forth Islands SPA, Fowlsheugh SPA and St Abbs to Fast Castle SPA.
- **Puffin** at Forth Islands SPA.

Gannet at the Forth Islands SPA. This species needs to be considered in Appropriate Assessment. However, further population modelling is not required due to the work already undertaken by the Strategic Ornithological Support Services (SOSS) group – The available modelling for gannet will be reviewed under Phase 1 of this project.

SB 4. Project: Review of breeding seabird population sizes (Work Package E Seabird Research)

A solid review of breeding seabird SPA population sizes and trends for those populations around the whole of Scotland to provide good solid baseline data. The project would apply the results from Seabirds 2000 and the SMP to SPAs and takes account of regional population trends that will fill the gap until the next big seabird 2000 type project.

SB 5. Project: Effects of displacement from marine renewable developments on seabirds breeding at SPAs – Proof of concept model for Guillemots on the Isle of May (Work Package G Seabird Research)

The project has produced a model which estimates the consequences of displacement and barrier effects on the time/energy budget of breeding seabirds. For the purposes of this “proof and concept” report, common guillemot breeding on the Isle of May were used in order to demonstrate the feasibility of this approach to modelling consequences of displacement and barrier effects from offshore wind farm development.

SB 6. Project: Population trends of breeding seabird colonies in Scottish SPAs (Work Package H Seabird Research)

The project has built upon the outputs of the Work Package E report ‘Population sizes of breeding seabirds in Scottish SPAs’ and presents trends in the data using the most complete time series data available for each designated SPA species. The project utilised data from JNCC, SNH, RSPB and other sources. The purpose of the project was to provide a collated source of information for renewable developers, regulators and advisers in support of EIA and HRA considerations at the marine licensing level. It did not act as a specific review of SPAs.

SB 7. Project: Population consequences of displacement from proposed offshore wind energy developments for seabirds breeding at Scottish SPAs (CR/2012/03)

The aim of this research project is to develop a model of the population consequences of displacement from proposed offshore wind energy developments for all species of seabirds breeding at Scottish SPAs and to apply it to the Forth/Tay offshore wind farm development area.

SB 8. Project: Cumulative assessment of collision risk of wind farms to migrating birds (CR/2012/04)

The research aim of this research project is to develop a series of assessments of the cumulative collision risks to migrating bird species that are designated features of UK SPAs, and of the component of that risk arsing from wind farms in Scotland

SB 9. Project: Methodological Guidance on the modelling of bird (and abundant cetacean) distributions in offshore renewables development areas (CR/2012/05)

The project will consider the potential to improve the quality of wildlife surveys making use of modern statistical modelling methods, particularly Density Surface Modelling and provide methodological guidance for use in environmental assessments of proposed offshore energy projects.

MM 1. Project: Methods for monitoring marine mammals at marine renewable energy developments

The study will provide Marine Scotland with an evidence base on which to identify the most suitable and cost effective methods for collecting strategic level information on marine mammal distributions. The risk of interactions between the species and offshore renewable devices (for example collision with tidal turbines or response to noise generated during the installation of wind turbines) is a key aspect of the Appropriate Assessment process for offshore renewables development. The denser the populations, the greater the potential for interactions.

The project is taking advantage of the considerable monitoring information available for the Moray Firth, partly due to research and monitoring funded by DECC and Marine Scotland for offshore oil and gas and considers a number of survey techniques which have been deployed in the Moray Firth. The techniques involve:

- Aerial Survey – using observers within aircrafts;
- Digital aerial survey – using still or video cameras mounted in aircraft;
- Boat based survey – observers based on raised platforms;
- Passive Acoustic Monitoring – using acoustic devices at strategic locations.

The study will compare the techniques and combinations of techniques to identify which are most effective in providing information on seals, dolphins, porpoises and whales. The outputs of this study will provide Marine Scotland with an evidence base on which to ascertain the best approach to survey methodologies, on a cost

and quality basis, which should be applied in marine areas with potential for offshore energy development.

MM 2. Project: Validation of noise dissipation models (Work Package A1 Marine Mammals)

Proposed project to investigate which noise dissipation models have been validated and are applicable for use in Scottish waters. Likely to involve a literature review of existing knowledge and information and a subsequent analysis with UK experts to identify which models could have practicable application in Scottish waters. Further detail will be added when available.

MM 3. Project: Displacement of marine mammals during installation – strategic placement of Passive Acoustic Monitoring devices – joint project with EDPR / Repsol (Work Package A2 Marine Mammals

Working with industry Marine Scotland will design the siting of Marine Scotland PAM devices (c-pods and S2M devices) at locations in the Moray Firth, Tay and Forth in late spring / early summer 2013.

MM 4. Project: Advice about the displacement of marine mammals around operational offshore windfarms (Work Package A3 Marine Mammals)

Provision of an authoritative review of what is known about the behaviour of marine mammals (seals and cetaceans) around operational offshore wind farms and, particularly, any degree of displacement that persists after completion of the most disruptive construction phase. To provide an initial assessment of the significance of any displacement risk, and proposals for practical research activity, if necessary.

- a review of information on degree of displacement of marine mammals by operational wind farms using published and preliminary information from wind farms in European waters, and elsewhere as may be available.
- advice on the potential significance of any risk of displacement found.
- advice on feasible research activities to improve the characterisation of any displacement risk and, if possible, the potential consequences for individual marine mammals and larger populations.

MM 5. Project: Modelling of noise effects of operational offshore wind turbines, including noise transmission through various foundation types (Work Package A4 Marine Mammals)

The aim of this research project is to develop models of the acoustic fields produced by offshore wind farms, taking account of the range of foundation types being considered for Scottish offshore wind farms.

MM 6. Project: Preparation of Guidance on use of passive acoustic devices in impact monitoring (Work Package A5 Marine Mammals)

Proposed project to be taken forward in two distinct stages – stage 1 will be comprise of a literature review of available and current knowledge and information,

stage 2 will be the production of a best practice guidance document for use by industry, regulators and advisors. Further detail will be added when available.

MM 7. Project: Information on distribution of key marine mammal species in East Scotland (Work Package B1 Marine Mammals)

Proposed project to identify, collect and assemble currently available data on the distribution of key species such as bottlenose dolphin, common dolphin and harbour porpoise. Further detail will be added when available.

MM 8. Project: Noise tolerance of bottlenose dolphins, seals and harbour porpoise (Work Package B2 Marine Mammals)

Proposed project to plan for placement of Passive Acoustic Monitoring devices in Aberdeen harbour, Mouth of the Tay and the Sutors to measure the existing background marine noise that current populations of species can live with. Further detail will be added when available.

MM 9. Project: Advice on populations of cetaceans that might be involved in significant interactions with offshore energy development (Work Package C2 Marine Mammals)

To provide advice on appropriate biological population units to be used in environmental impact assessments of the potential impacts on cetacean populations of marine renewable energy developments in Scottish waters. The advice should, where appropriate, be consistent with population units already established in related contexts, including Moray Firth SAC population of bottlenose dolphins, population units used for the assessment of the significance of by-catch of harbour porpoise in the ICES area, and population units for minke whale and other cetaceans used by the IWC, ASCOBANS etc. The project should focus on the most regularly present and significant cetacean species in Scottish waters - i.e. bottlenose dolphins, harbour porpoise, minke whales, risso's dolphins, white-beaked dolphins, common dolphins, white-sided dolphins and killer whales - and provide scientific support, as appropriate, for the populations selected.

- information on the structure of populations of regularly present and significant cetacean species (see above) in Scottish waters (out to 200 nm) and the geographical scale of biologically meaningful population units of the relevant species where these units extend beyond Scottish waters.

- advice on the relevant population units of these regularly present and significant cetacean species, which can be found in areas of search for renewable developments identified in Marine Scotland Scoping Studies for wind (2011), wave (2012) and tidal stream (2012) energy, and which therefore should be used in SEAs and project EIAs

MM 10. Project: Sound of Islay Demonstration Pilot – Seal Disturbance Monitoring

The Sound of Islay demonstration (tidal) project presents an opportunity to study the disturbance of seals (e.g. pup abandonment, disuse of haul out sites) caused by vessel movements and construction activity during the installation of tidal turbines.

MM 11. Project: Sound of Islay Demonstration Pilot – Development of methods for direct observations of seal collisions

The Sound of Islay demonstration (tidal) project presents an opportunity to develop methods for direct observations of collisions between seals and tidal turbines. Approaches being considered include the development of sophisticated tags to track the underwater movement of seals in greater detail or imaging equipment being placed on the turbines which can detect the movement of seals around them. Investigations would begin when the devices are installed (2013 onwards).

MM 12. Project: Methods for tracking the fine scale underwater movements of marine mammals (in the vicinity of tidal turbines)

This project will review current (and developing) technologies for tracking the fine scale underwater movement of marine mammals, which are applicable to high energy tidal sites. This will include a prediction of the feasibility of these technologies for direct observation of possible collisions in high energy tidal environments. A case study for marine mammals at the Sound of Islay will be developed.

MF 1. Project: Measurements of audiograms for key fish species – salmon, sea trout, eels, herring, cod and Sandeels (Work Package A1 Migratory Fish)

Proposed project to identify the levels of audibility that certain species of fish react to, in order to identify levels of noise that could potentially affect species in the marine environment. Further detail will be added when available.

MF 2. Project: Modelling the consequences for Salmon of exposure to piling and operational noise (Work Package A2 Migratory Fish)

Proposed project to model potential effects and impacts of construction methods and operational noise on Salmon in Scottish waters. Further detail will be added when available.

MF 3. Project: Modelling exercise of potential offshore wind farms to investigate audibility to migrating salmon and sea trout (Work Package A3 Migratory Fish)

Proposed project to model the potential audibility of operating offshore wind farms to migrating salmonids. Further detail will be added when available.

MF 4. Project: Investigation into Sandeel interactions with offshore renewable energy construction methods (Work Package A4 Migratory Fish)

Proposed project to investigate Sandeel behaviour during various construction methods of offshore wind farms. Further detail will be added when available.

MF 5. Project: Field investigation of effects of installation noise on fish hearing (Work Package A5 Migratory Fish)

Proposed project to locate fish cages containing species such as salmon and sea trout and monitor effects of behaviour during construction methods. Further detail will be added when available.

MF 6. Project: Study of Sandeel habitat (Work Package Additional Project 1)

Proposed project to investigate % of habitat available, % of that habitat available which has been identified for potential offshore renewable energy development. Further detail will be added when available.

MF 7. Project: Review of COWRIE reports on skates and rays (Work Package Additional Project 3)

Proposed project to review and inform whether additional work required to inform licensing of offshore renewable energy developments. Further detail will be added when available.

MF 8. Project: Study on population numbers of Basking Sharks (Work Package Additional Project 4)

Proposed study to identify population and distribution in Scottish waters; potential to expand to include sensitivity to EMF, disturbance and noise and identify mitigation options. Further detail will be added when available.

MF 9. Project: Collation of data on Salmonid populations in the Solway region (Work Package Additional Project 5)

The project will identify and compile (in agreed formats), available data gathered before, during and after installation of the Robin Rigg offshore wind farm.

MF 10. Project: Analysis of fish and fisheries data to assess the potential impact of offshore wind development on Solway rivers (Work Package Additional Project 6)

The project will build upon the data collected and formatted under project WP AP 5 and undertake an analysis on the data to assess potential impacts of offshore wind on species of migratory fish. The project will also carry out power analysis on the available data to determine its ability to have detected any change and thereby inform the design of future monitoring programmes.

MF 11 - 13. Project: Migratory Fish Research (Phases 1 – 3)

Salmon, sea trout and eels are species of high economic and / or conservation value. In recognition of the potential impacts from offshore renewable developments on these species a pair of reviews were commissioned on (1) migratory routes and behaviour and (2) sensitivity to electromagnetic fields and noise by Marine Scotland and Scottish Natural Heritage respectively. Both reviews identified substantial gaps

in our knowledge for these species, which the 3 projects, lead by Marine Scotland Freshwater Science, will begin to identify.

MF 14. Project: Migratory Fish Research: Potential for marine renewable power developments to affect diadromous fishes in Scottish waters: informing EIAs

A review by Malcolm et al (2010) identified that knowledge of the migration routes and swimming depths of diadromous species (salmon, sea trout, eel) were currently inadequate to determine the potential for the spatial overlap of these species and proposed marine renewable energy developments. Similarly an SNH commissioned review (Gill and Bartlett, 2010) identified a paucity of reliable information on diadromous fish responses to EMF.

This project aims to provide information on the migratory routes and swimming depths of returning adult salmon. Salmon will be captured on the north coast of Scotland and their continuing migratory movements and swimming depths will be monitored using pop-off satellite tags equipped with depth sensors. An EMF generator will be used to examine potential impacts on salmon smolt behaviour under experimental conditions, and to identify the minimum strength of EMFs at which effects on behaviour may be expected.

G 1. Project: Scottish Shelf modelling (MROW 1)

Marine renewable and offshore wind developments have the potential to alter local and regional Hydrographic processes, including wave climate and consequently to affect sediment movement and deposition patterns offshore and a range of erosion and deposition processes at the coast.

Strategic Environmental Assessment undertaken on ‘Blue Seas – Green Energy: A Sectoral Marine Plan for Scottish territorial waters’ identified a need and a key knowledge gap that in order to fully inform the licensing and consenting process of these developments and to aid future sectoral planning for offshore renewables there is a requirement to develop a hydrodynamic model of Scotland’s seas. The modelling will provide a quantitative description of marine currents and water properties for the whole of Scottish waters on a full range of spatial scales. It will initially focus on modelling tidal and non-tidal currents, but once produced will allow modelling of other coastal processes. The project will provide a piece of software for use and application by Marine Scotland Science.

G 2. Project: Concrete Base Research work

Investigation in to the potential effects of concrete bases in the marine environment. Current understanding is that bases are generally approximately 100m2 in size, purpose of the project would be to investigate potential footprint and beneficial biodiversity effects through appropriate base design i.e. colonisation by reef forming habitats, potential nursery grounds. Marine Scotland hosted a workshop for the concrete manufacturers and offshore energy industry to initiate early investigations.

G 3. Project: Review of the Scottish Marine Monitoring network (MROW 8)

Identified as a key gap in the SEA of 'Blue Seas, Green Energy', the aim of this project is to review the existing Scottish marine monitoring network, identify its capabilities and identify gaps in marine environmental data being collected that is required to inform offshore wind and wave and tidal energy SEA and HRA strategic assessment and monitoring requirements.

The project will cover the existing network operated by SNH, SEPA, JNCC, Marine Scotland Science (in the first instance) and other agencies operating in Scottish waters.

The Review will be an assessment of whether the existing system is fit for purpose and is capable of meeting offshore energy development potential, through advice available to regulators and developers on localised, regional and national marine environmental conditions and interactions. The Review will also investigate whether the existing monitoring network is sufficient to establish potential impacts on marine species that co-exist in proposed developmental areas.

G 4. Project: Offshore Wind Build Out Programme

Proposed project to establish the lessons learnt from previous offshore wind projects and identify any interventions necessary to secure the economic benefits associated with the 5 Scottish territorial water sites and Scotland's 2 round 3 sites.

G 5. Project: Mapping Sea Fishing Activity in Scottish waters: Roll out of ScotMap Project (MROW 2)

A study of fishing activity, which will collect data on the spatial distribution and economic importance of fishing activity in Scotland's seas. There is currently limited information on the spatial distribution of fishing activity and the relative importance of different fishing grounds, especially for fishing vessels of less than 15m in length. For vessels greater than 15m in length, there are VMS data, however there are limitations in its usage. Although focused primarily on fishing activity within 12 nautical miles, data collection will be undertaken, where possible, for activity in the extent of the Scottish Fisheries Zone. The provision of this data will provide a more detailed understanding of fishing activity and locations, including the economic and environmental importance of particular areas or grounds.

G 6. Project: Inshore Surveys Phase 1: West of Lewis

The project will utilise vessels owned and operated by British Geological Survey and Northern Lighthouse Board to undertake survey work required by Marine Scotland in support shallow water renewables development. The sites of interest for shallow water work are to the west of the outer Hebrides. Shallow water survey work would marry in with the work already completed by Marine Scotland and Maritime Coastguard Agency in deeper waters.

G 7. Project: Inshore Surveys Phase 2

Following a successful survey programme off the West Coast of Lewis 2011, there is now a possibility of appointing British Geological Survey (BGS) to undertake a second tranche of geo-survey (sub-bottom profiling) work in areas of prime importance for marine renewables. Specification for the work is currently being drawn up by Peter Hayes, incorporating Industry requirements and advice. The aim of the work would be to undertake sub bottom profiling from the wave sites associated with the Round 1 leases and the southwest Shetland lease area. The purpose of the work would be to determine the depth of surface sediment from the wave lease sites which in turn would guide the mooring/anchoring requirements for the proposed devices being deployed. Marine Scotland Science has an FRV Alba Na Mara cruise already in place for renewables work from 28th of February to 12th of March 2012 that could be modified to incorporate this work. Using the Scottish Government (SG) memorandum of understanding (MoU) with the BGS, would enable the BGS to provide equipment and personnel to collect sub bottom profiling data using FRV Alba Na Mara.

G 8. Project: Inshore Surveys Phase 3

The success of the survey work undertaken off the west of Lewis during 2011 implemented through the MoU between the SG and the Northern Lighthouse Board and BGS has lead to further survey work being considered for the end of this financial year. The NLB has a gap in its cruise schedule for the NLB Polestar from 15th to 29th of March. The original project was to undertake bathymetric work off the north coast of Scotland that coincided with the Farr Point wave site. However, this site was surveyed by FRV Scotia during the 2011 cruise (15th of October – 3rd of November) due to the poor south-westerly weather experienced off the southwest of Shetland. Consequently, the site requiring bathymetric data as a matter of priority would be the south west of Shetland, building on the limited data collected by FRV Scotia during 2011. To date this has proven to be a difficult site to survey due to its exposed nature and the frequency and intensity of poor weather originating from the west. Contingency shallow water bathymetry renewables work could be indentified for the Magnus Bay area for periods of poor weather from the south/south west. Additionally, MPA work on the east side of Shetland, guided by Scottish Natural Heritage, could be considered during periods of poor weather encountered on the west side of Shetland.

G 9. Project Inshore Surveys Phase 4

Building on the success of Phases -3, this phase of work will initially concentrate on areas in the West of Scotland, notably the Argyll region, Sound of Islay and Mull of Kintyre. Further detail will be added when available.

G 10. Project: Wave and Tidal Plan – Habitats Regulations Appraisal (MROW 9)

The HRA will consider the possible effects from potential development proposals outlined in the IPF for marine renewables and will need to consider the following issues: effects of development, including in-combination effects; possible effects of strategic marine grid and grid connections through cable landfall (if known); hydro-dynamics; and the conclusions of the HRA undertaken by the Crown Estate for the Pentland Firth Strategic Leasing Area.

G 11. Project: Wave and Tidal Plan – Strategic Environmental Assessment (MROW 4)

Building upon the conclusions of the 2007 Marine Renewables SEA, a review exercise is required under Environmental Assessment Regulations to take account of policy and other developments relating to the Scottish marine renewables sector. The SEA review process will start with a Screening and Scoping exercise which will identify early on in the process the potential for impacts on Scotland's environment and set out the scope and level of detail of the environmental assessment

G 12. Project: Wave and Tidal Plan – Socio-Economic Assessment (MROW 4)

The socio-economics study will assess potential impacts on key sectors and industries operating in Scottish waters, most notably, fishing, shipping and navigation, ports and harbours, recreation and tourism, crofting, aviation, offshore wind energy and offshore aquaculture. The impact assessment (IA) will identify the likely effects on social indicators including environment, health and education.

G 13. Project: Wave and Tidal Plan – Scoping Report of the potential for Scottish waters for Wave and Tidal Energy

In house exercise to be undertaken by Marine Scotland Science. Will build upon the Scoping and RLG studies done in support of the Saltire Prize Programme to identify additional potential resource areas for wave and tidal energy generation. The project will incorporate consideration of the East Coast for potential energy generation and potentially identify further areas in the Northern Isles, West Coast and North Scotland for wave and tidal energy generation.

G 14. Project: Pentland Firth - Seascape

The Stage 1 Framework document for the Pentland Firth Marine Spatial Plan pilot showed where National Scenic Areas and other regional designated landscapes were situated in the area. It stated that ‘the marine spatial plan will set policies for the protection of the seascape’. In order to do this, an estimate of the likely visual impact is the planned renewable activities is required. This project will include a study of the existing seascape and the impact upon it of renewable activities. The output of this study will be a computer simulation of how the seascape will look from key points on the coast after renewable devices (and their required onshore infrastructure) have been installed. In tandem, a study will be commissioned to estimate the economic value of the seascape to the tourism industry in this area, and an estimate of how this may be impacted by the development of renewables.

G 15. Project: Pentland Firth – Wave and Tidal Developments

Wave and tidal developers are working towards an overall deadline of 2020 to achieve fully operational devices. However, there is still a lack of detailed understanding of planned renewable activities in the eleven lease areas, namely how they will be developed, operation and maintenance requirements and decommissioning. This project will include studies of an estimate of the timescales

for construction, including key milestones, for each lease area; the associated resources required for construction to meet milestones and the resources required for operation and maintenance and decommissioning.

G 16. Project: Pentland Firth – Shipping and Navigation

This study will determine the volume of shipping in the area and will be informed by the MCA Guidance sheet MGN 371[3]. The study will concentrate on the types of shipping not included in stage 1 of the Pentland Firth project, namely – commercial vessels smaller than 300 tonnes, naval vessels, yachts, small fishing vessels. It will also monitor ferry routes in more detail to determine actual routes and their variation with tide and season. The study will monitor the following aspects of these vessels – numbers, types, sizes and routes (transitory and non-transitory). The outputs of the study will be considered alongside the wave and tidal device specifications to determine if and how these devices can be co-located in areas of shipping traffic.

G 17. Project: Pentland Firth – Commercial Fishing (ScotMap Pilot)

A study has been concluded that piloted the ScotMap approach to collecting fishery data in order to assess the spatial distribution of inshore fishing activity, on smaller geographical scales than currently available information. The study identified the areas used, species fished, gear used and economic value of each area. The data collected – via questionnaire and GiS plotting – will be used to determine where and how fishing and renewables can be co-located and identify priority areas for each sector. The study is a pilot for a more general national inshore fishing study, to cover all of the inshore fishing waters around Scotland.

G 18. Project: Pentland Firth – Tourism and Recreation

This study aims to understand the potential impact upon tourism and recreational activities of planned renewable activities. The study will assess the number of people involved in recreational activities in the marine environment, the number of people involved in activities situated near to the marine environment, where activities happen and the socio-economic value, the views of those undertaking recreational activities to planned renewable activities, the views of other people i.e. locals and tourists, and what is the economic impact of those reactions.

[3] 'Offshore renewable energy installations (OREIs) – guidance on UK navigational practice, safety and emergency response issues'.