NRW’s Marine and Coastal High Priority Evidence Needs

As part of NRW’s Marine and Coastal Evidence Programme we produce a list of high priority evidence needs, which is updated on an annual basis. Many of these are being progressed internally and completed evidence reports will be published on our website. This document describes the high priority evidence needs and the progress we have currently made with them. If you think you may be able to help us deliver any of these evidence needs, please get in touch.

We also have a longer list of other marine and coastal evidence needs and have identified projects from this list that might be particularly suitable for delivery by partners, especially through academic research projects.

High Priority List

How do human activities and changes in habitat condition affect carbon sequestration and storage in the marine environment?

There is a growing focus on the ability of the marine environment to store and sequester carbon, and a requirement to both maintain and enhance blue carbon stores to help achieve net zero. Particular focus at present is on blue carbon habitats such as saltmarsh and seagrass, with a view to include them in the UK's Greenhouse Gas Inventory. Existing studies show that marine habitats play an important role in carbon storage and sequestration, but we have little current knowledge on how impacts on them, and / or changes to habitat condition, may affect their ability to provide this ecosystem service.

Next steps and progress: Partnership working with other Government Bodies and Academia.

What are the flood-risk benefits provided by coastal habitats?

This work would comprise a technical assessment to bring together recent evidence and research relating to the flood risk benefits of different marine and coastal habitats in Wales. It would explore the wider well-being outcomes and produce a summary report and visual materials to share with wider stakeholders such as Welsh Government.

Next steps and progress: Likely to be contracted out.

How can we assess cumulative effects at the plan level?

We would like to develop a method for understanding cumulative effects across sectors (to include both existing activities and consideration of potential future activities scenarios). This would inform NRW advice and support Welsh Government's spatial approach to marine planning.

Next steps and progress: Literature review potentially included in NRW's spatial approach work programme.

What are the impacts of wave and tidal renewable energy devices on mobile species behaviour and collision?

Improvement of knowledge on the frequency, nature, and consequences of near-field interactions between mobile species and tidal turbines through monitoring of deployed devices. To include: near-field avoidance and evasion behaviour, quantification of number of collisions and near misses, consequences of collisions (e.g. injury/damage to animal) and identification of object/species types (to inform behaviour and impact studies). This information will provide contextual and empirical evidence to inform impact assessments and predictions of collision risk for tidal stream development.

Next steps and progress: This evidence gap requires deployment of tidal turbine devices before monitoring can be undertaken. Discussions currently underway with Government and Industry regarding post consent monitoring.

What methods can be developed for monitoring wave and tidal devices for mobile species behaviour and collision?

Development of instrumentation to monitor mobile species behaviour around tidal stream turbines (including near-field responses). This includes methodologies to detect avoidance of tidal stream turbines, collision events and consequences of collisions. Due to the reliability and survivability of instruments in high energy waters there are a number of operational challenges that need to be addressed including: hydrodynamic forcing, corrosion and biofouling, pressure and sealing and development of solutions to reduce electronic interference between instruments on platforms. In addition, advancements are required to improve efficiencies in storing, processing, and analysing large amounts of data generated by monitoring.

Next steps and progress: Collaboration with Welsh Government, Industry and Academia.

What impact does introduced hard substrate (turbines, mattresses, rock dump) have on the biological and ecological structure and functioning of designated sediment habitats in Marine Protected Areas (MPAs)?

The introduction of hard substrate to sedimentary benthic habitats has the potential to change their ecological characteristics and biological composition. A better understanding is needed of the tipping points that lead to changes to community structure and function.

Next steps and progress: May be taken forward as part of a collaborative project.

What are the densities of seabirds and cetaceans in resource areas for tidal turbines?

Seabirds at sea and marine mammal surveys are needed in areas that may be developed for tidal stream energy. These data would inform the planning process and could be used to input into a range of environmental assessments to inform consenting of tidal turbine projects.

Next steps and progress: Strategic evidence which needs large scale funding.

What models are appropriate to predict fish encounter and collision rates for tidal range renewable energy developments?

Several types of modelling are likely to be required to predict impacts to fish from marine renewable energy tidal range devices. This would include models to predict encounter rates, avoidance rates and collision rates. Currently, the modelling tools to do this are limited and do not allow different modelling approaches to be compared or contrasted to further understand the range of impacts and provide confidence in the overall assessment. This desk top project would research how to adequately develop new, or improve existing modelling tools, including how to incorporate uncertainties within the statistical analysis of the models.

Next steps and progress: Contract has been awarded.

Can marine habitat creation (e.g. managed realignment, seagrass restoration) deliver effective mitigation for loss of marine and estuarine fish?

A review is required of the effectiveness of creating or restoring coastal or intertidal habitats to deliver mitigation (and/or compensation) for loss of marine/estuarine and freshwater diadromous fish in relation to marine renewable energy developments, e.g. tidal range projects. Measures to mitigate impacts on key fish species and populations are likely to play key roles in consenting processes for tidal lagoon developments and need to be better understood.

Next steps and progress: To be contracted out.

What are the critical inshore and coastal migration routes and marine habitats used by diadromous fish in Wales?

Based on recommendations in NRW Evidence reports; 'Feasibility Study of Methods to Collect Data on the Spatial and Temporal Distribution of Diadromous Fish in Welsh Waters' and 'Acoustic tracking in Wales – designing a programme to evaluate Marine Renewable Energy impacts on Diadromous fish'. The project would hydroacoustically tag and track diadromous fish from a selection of Welsh rivers, to collect data on their distribution, particularly in marine energy resource areas. The evidence would be used to inform modelling tools to establish risk to salmon, sea trout, eel and shad populations from tidal range and tidal stream developments in Wales.

Next steps and progress: Strategic evidence which needs large scale funding.

How effective are noise abatement methods in Welsh waters?

It is likely that noisy activities such as piling for offshore wind, and detonation of unexploded ordnance, may cause adverse effects, especially for marine mammals and fish. Noise abatement methods, such as bubble curtains, to reduce noise at source or reduce how far the noise is able to propagate, have been demonstrated to reduce the noise impact. However, there is no information on how these techniques might perform under the hydrographical conditions in Welsh waters, such as deep water or strong tidal areas. This project has been scoped out to include lab studies (testing resonant bubbles), field studies (bubble curtains for UXOs) and a desk review.

Next steps and progress: Seeking funding from OWEC (Offshore Wind Evidence for Change programme) for a project which will cover some aspects of this project. Field studies would need collaboration with developers.

How much marine mammal bycatch is there in the Welsh Zone (and the relevant marine mammal management units)?

It is thought that there is negligeable bycatch of marine mammals in Welsh waters but there is no analysis currently available that demonstrates this. There is also no bycatch estimate at the scale of the relevant Marine Mammal Management Units (MMMUs); although estimates for OSPAR and ICES regions exist, they do not represent the same spatial area of the MMMUs. This project would estimate the fishing effort and bycatch rates of marine mammals potentially bycaught in Welsh waters (the Welsh zone) and the MMMUs.

Next steps and progress: Likely to be contracted out.

What are the best Collision Risk Models and parameters to assess impacts on marine mammals?

Existing collision risk models and encounter rate models and their input parameters used for our advice would be reviewed to ensure the best available evidence/techniques are used, and made more applicable to Wales. Other collision risk models have been/are being developed, especially to accommodate different/unusual tidal turbine designs, and a review (with recommendations) of available models/techniques would be valuable.

Next steps and progress: Likely to be contracted out.

What is the efficacy and potential longer-term impacts of acoustic deterrent devices for marine mammals, birds, and fish?

There remains a gap in knowledge of how some marine mammal, fish and bird species respond to acoustic deterrent devices (ADDs). They are routinely advised as potential mitigation techniques for tidal energy and other industries/activities but while there is some information for seals around aquaculture sites, and for fish at power stations, our understanding of how effective these are for some species remains limited or unknown. The need is for experimental research observing reactions to ADDs at sea. There is also a need to explore how ADDs optimised for one receptor (species) could affect other receptors, particularly given differences in hearing range, auditory sensitivity, and behaviour in reaction to underwater noise. Finally, research is needed to evaluate longer term ADD deployments, and whether these could have lasting displacement or disturbance effects on different receptors.

Next steps and progress: May be taken forward as part of a collaborative project.

What are the impacts of renewable energy devices on physical processes?

We need to understand how embryonic renewables technologies (e.g. wave & tidal) will impact on changes to energy, and how that manifests itself in terms of impact on natural variability. There is a need to differentiate between natural processes and anthropogenic impacts, and to understand regional scale and medium to long-term effects of energy extraction on morphodynamics and sediment transport regime on other receptors such as habitats, flood risk etc.

Next steps and progress: This evidence gap requires deployment of renewable energy devices before monitoring can be undertaken. Needs discussion with Government and Industry regarding post consent monitoring.

What are the types, distribution, frequency and intensity of fishing activities from commercial fishing vessels in Welsh waters?

Currently we know very little about where, when, with what gear, how much gear, and how often Welsh boats go fishing to help determine impacts on marine receptors. The majority of the Welsh fleet are <12m and until relatively recently were not required to have vessel monitoring systems (VMS) onboard. Vessels >10m submit logsheets detailing catches, however vessels <10m, again until relatively recently, did not have to submit catch data. This has changed with the introduction of *inshore* VMS for all <12m vessels and the Catch App to record species catch and effort data for all <10m vessels. Data from these new sources combined can be analysed to indicate the type, distribution, frequency and intensity of commercial fishing vessels' activity in Welsh waters. This analysis has application for environmental assessment, MPA management, marine planning, fisheries management etc.

Next steps and progress: Continue to liaise with Welsh Government.

What impact does potting have on horse mussel beds?

Horse mussel *Modiolus modiolus* beds are an extremely sensitive habitat and there have been indications that even infrequent activity may have the capacity to degrade the habitat. Therefore there is a need to investigate the possible impacts of any activity that takes place that involves physical contact with a *Modiolus* bed. This study could be carried out in a number of ways, including direct observations of fishing activity, or an experimental potting study.

Next steps and progress: Welsh Government and Bangor University study underway.

What are the reasons for the decline of specific species and benthic habitats across the Marine Protected Area network in Wales?

Monitoring has shown a decline in the health of various habitats and species in Welsh Marine Protected Areas (MPAs). Work is needed to identify the causes of these declines. This will include the following: maerl and herring around Milford Haven in Pembrokeshire Marine Special Area of Conservation (SAC), sponges in the Menai Strait and Conwy Bay SAC, *Modiolus modiolus* (horse mussel) beds in the Pen Llyn a'r Sarnau SAC, sandbank infaunal diversity across the MPA Network. This will allow effective management measures to be identified that will improve our understanding of the ways to improve the condition of MPA features, improving the resilience of marine ecosystems across Wales.

Next steps and progress: To be progressed as part of the Nature Networks project.

Why is the population of pink sea fan around Skomer Marine Conservation Zone in poor condition and not recruiting?

The population of pink sea fan around Skomer Marine Conservation Zone is currently in poor condition and there is a lack of new sea fans being recruited. Work is needed to identify the cause(s) of the decline in numbers and health. Poor condition relates to an increase in necrotic (dead) tissue and increased epibiota and entangled elasmobranch eggs. The population is under pressure from individual losses and there are wider questions about the potential longevity of the population due to the lack of recruitment/connectivity. Elements could include determining whether reproduction is taking place, aging fans, connectivity with other populations, larval supply and also potential links to sea water temperature.

Next steps and progress: Collaboration with Academia (PhD starting at Exeter University).

What are the productivity and survival rates of seabirds at Welsh colonies?

Set up ringing and resighting for seabird species as well as camera traps for productivity and diet at seabird colonies. This should include the following species: Atlantic puffin, black-legged kittiwake, common guillemot, lesser black-backed gull, razorbill, shag cormorant, tern species, gulls.

Next steps and progress: Collaboration with Academia and NGOs.

What upper limit of livestock stocking levels on saltmarsh is required to safeguard water quality?

Grazing of livestock on saltmarsh can lead to water quality problems when the saltmarsh is inundated by the tide and faecal matter is washed into the sea. This is particularly a problem where there are shellfish waters which are susceptible to faecal contamination and can close a fishery until the contamination has cleared. However, actual grazing levels where numbers of livestock will cause issues are not known and there is a need to establish appropriate upper grazing levels to prevent unacceptable levels of bacterial loading in coastal water.

Next steps and progress: Modelling study.

Where do nutrients that impact our estuaries come from?

We need to investigate the sources of nutrients coming into our estuaries and causing water quality failures. Modelling is needed to identify those sources. Many of our transitional and coastal waters fail for Dissolved Inorganic Nitrogen (DIN) and five of our Special Areas of Conservation are in unfavourable condition due to DIN also. Any modelling would need to be able to represent diffuse and point sources, including continuous and intermittent discharges. The model should also be able to identify the portion of the catchment where the diffuse sources are originating and the land use type.

Next steps and progress: May be taken forward in the Natural Environment Programme.

Infrastructure enhancement: what is the optimal design, number and configuration of structures to best enhance biodiversity?

The Ecostructure project has significantly increased our knowledge of the artificial enhancements that could be installed on existing and new structures to increase biodiversity. However, work to complete monitoring of installed structures is still ongoing. When completed, this will build on the current evidence available regarding aspects such as the optimal number of enhancement structures required, preferred citing and configuration for the most effective biodiversity enhancement. Monitoring of any additional newly installed enhancement structures is essential.

Next steps and progress: Collaboration and encourage monitoring of new enhancement structures.

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