

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.

How could sediment carbon sampling be incorporated into routine monitoring work to build the baseline evidence for blue carbon in Welsh marine habitats?

There is growing recognition that benthic habitats play a significant role in carbon sequestration and storage, alongside other vital ecosystem services. The UK Blue Carbon Evidence Partnership, and UK Blue Carbon Forum, have identified a number of evidence

gaps relating to the fundamental understanding of carbon fluxes, sequestration and storage by marine habitats, and there is an increasing need to develop policy on the status and / or protection of blue carbon stores. This project would test the feasibility (logistics, cost and analytical capability) of including carbon sampling in NRW's routine sediment monitoring programmes, perhaps initially as a pilot for one field season. Depending on the outcome, there would then be potential to roll a routine sampling programme out to other sites and water bodies.

Next steps and progress: NRW have initiated an in house project to assess the feasibility of this.

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 feasible and/or effective would it be to remove or modify existing structures in estuarine and coastal Heavily Modified Water Bodies?

The project would investigate the feasibility of removal or modification of existing structures in Heavily Modified Water Bodies. This would include: removal of obsolete structures linked to flood protection, coast protection, navigation ports and harbours; removal of hard bank reinforcement or replacement with soft engineering solutions; modification of existing structures.

This includes consideration of measures which may address hydromorphological pressures in Heavily Modified Water Bodies, measures which would support coastal adaptation or implementation of nature-based solutions, and importantly consider the costs and benefits of those measures to help inform business cases/cost-benefit analysis to determine what can be delivered.

Next steps and progress: NRW in house work to scope out the project and consider mitigation measures.

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: NRW are currently collaborating on a JNCC-led project "Cumulative Effects Assessments to support marine plan development". This contract will be completed by Summer 2024 and be used to inform development of next steps.

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: This has been discussed by various groups working on offshore wind evidence. Work could include an evidence review, analysis of monitoring data from industry and research.

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

Work is required to investigate 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.

Next steps and progress: Collaborative research work underway and awaiting the outcome of a PhD proposal.

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. However, some progress is being made notably for shad in the Bristol Channel through working with research partners. Large gaps remain for other species and regions of Wales.

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 ideally should include lab studies (testing resonant bubbles), field studies (bubble curtains for UXOs) and a desk review.

Next steps and progress: This topic is currently being investigated in a Defra project which NRW is on the steering group for. Once outputs are complete, NRW may seek funding for a project that will address potential gaps and / or build on these outputs.

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 in our advice should be reviewed to ensure the best available evidence/techniques are being used, and are 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 wave and tidal renewable energy devices on mobile species behaviour and collision?

There is a need to undertake monitoring of tidal and wave devices beyond that required for licence conditions, to improve understanding of the frequency, nature and consequences of near-field interactions between mobile species and tidal turbines through monitoring of deployed devices. To address this evidence gap monitoring should 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 evidence to inform impact assessments and predictions of collision risk for wave and tidal stream development.

Next steps and progress: Discussions currently underway with Government and Industry regarding post consent monitoring.

What is the value of Good Ecological Status (GES) under the Water Framework Directive (WFD)?

We need to determine the monetary value on GES for the cost-benefit analysis which is part of the WFD derogations. This would include developing methods to carry out this analysis.

Next steps and progress: Likely to be contracted out.

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

We need to understand how wave and tidal stream devices will impact on the natural environment, and how that manifests itself in terms of impact on natural variability. While the reduction in wave height or tidal current (and subsequently morphodynamics) by individual devices is likely to be small, it is crucial to learn from these demonstration devices to gain confidence in model estimates of energy extraction and changes to the physical environment. This will enhance confidence in model predictions of array scale impacts which are likely to be more substantial.

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.

How do sub-sea cabling practices affect sand wave and sand bank morphodynamics, and the wider sedimentary system?

Cable laying activities include sand wave clearance, cable burial via trenching and cable protection measures. The morphological impacts on sand waves and sand bank systems caused by these activities are poorly understood. Equally, the implications of any change on the wider sediment budget, especially links to the coast, requires investigation. Key questions include: does cable protection block bedload transport pathways? Do sand waves recover after clearance and what are the timescales? Does sand wave clearance affect the form and function of the sandbank system? Will the impact of cabling practices alter the natural coastal protection that sand banks provide? It is particularly important to understand this for areas of Wales where cable routing and landfall is expected; for example, the North Wales coast and the Pembrokeshire coast.

Next steps and progress: Collaboration on a knowledge exchange project underway, but further research, including bathymetric surveys, will be required.

How will tidal lagoons impact water quality?

Identify the approach and techniques that may be used to quantify the impacts of tidal lagoons on water quality receptors. Some questions to consider include:

- How will lagoons impact turbidity, salinity, temperature, nutrients, dissolved oxygen, bacterial concentrations and phytoplankton communities both inside and outside the lagoon?
- How will lagoons impact the dispersion of discharges from 3rd party assets such as trade effluents and sewage discharges?

Next steps and progress: Contract and/or research.

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

The majority of Welsh commercial fishing vessels are under 12m in length. However, currently we know very little about where, when, with what gear, how much gear, and how often these boats go fishing. This information would have multiple uses, including helping us to understand possible impacts on the marine environment. Data from Welsh Government's inshore vessel monitoring systems, Catch app and logsheets could be combined and analysed to indicate the type, distribution, frequency and intensity of <12m commercial fishing vessels' activity in Welsh waters.

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

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 (PLAS) SAC, sandbank infaunal diversity across the MPA Network, pink sea fan *Eunicella verrucosa* in the Skomer Marine Conservation Zone. 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: Being progressed as part of a Nature Networks project with current collaborations with Universities. However, further research work is needed into sensitivities and reasons for decline of these species and habitats that cannot be addressed within current programme (ideally PhDs but also shorter term research projects).

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 could 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.

How do we assess impacts on fish communities in Welsh estuaries and coastal waters?

This relates mainly to Marine Protected Areas where fish communities are included in the site Conservation Objectives. Qualitative and quantitative methods could be explored, including the application of ecosystem modelling. This project proposal will initially need to be scoped out to determine a small number of more specific projects.

Next steps and progress: Needs further development and scoping through in-house working group.

What is the source apportionment of nutrients to Welsh estuarine and coastal waters?

We need to investigate the sources and apportionment of nutrients coming into our estuaries and causing water quality failures there. 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 (SACs) and their features are in unfavourable condition due to DIN. Any modelling would need to be able to represent diffuse and point sources, including continuous and intermittent discharges, entering these systems both direct and from the catchment. An additional part of the project would be to add aerial deposition of Nitrogen to the project to look at apportionment in the estuarine and coastal environment.

Next steps and progress: Some water body failures and SAC feature failures to be taken forward by the National Environment Programme; further investigation needed for other water bodies.

What are the impacts of intermittent sewage discharges into Marine Protected Areas and their catchments?

Intermittent sewage discharges enter the catchment and their effluent is carried to our Marine Protected Areas (MPAs); the discharges also enter directly to our MPAs. An analysis of data on intermittent discharges is required, including determining the volume and concentration (loading) from discharges from the wider catchment and determining if the assets are spilling only during wet weather. An assessment of the impacts of the discharges on MPA feature condition is required.

Next steps and progress: To be undertaken as part of the National Environment Programme.

Where are the most suitable locations for marine and coastal restoration (saltmarsh, native oysters and seagrass) in Wales?

We need to build on 2021 work that mapped opportunities for restoration of native oysters, seagrass, *Sabellaria*, *Modiolus modiolus*, saltmarsh and mudflats (NRW Evidence Report No 554). This next phase should refine previous mapping to identify the most suitable locations for restoration of saltmarsh, native oysters and seagrass and take account of the opportunities to deliver wider benefits (e.g. flood defence, improved water quality, blue carbon etc.). This work could include engagement with local communities and should consider biodiversity implications on existing features in those locations.

Next steps and progress: Likely to be contracted out.

This document was last updated in January 2024.

Next update due December 2024.

For more information please contact Dr Kirsten Ramsay

kirsten.ramsay@cyfoethnaturiolcymru.gov.uk