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Wales

Marine Biodiversity Collaborative Research Priorities

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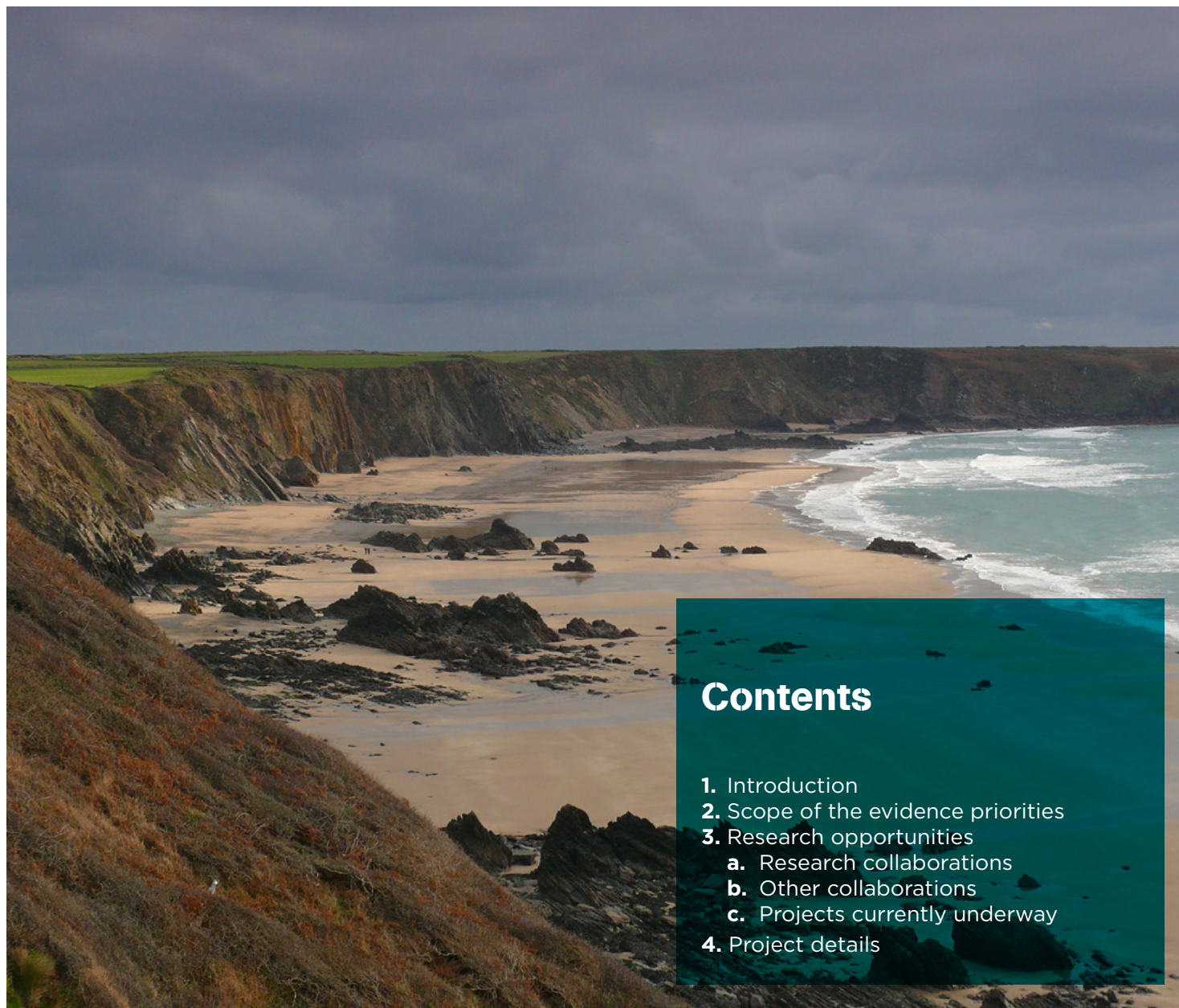


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Yn ddiweddar mae Cyfoeth Naturiol Cymru wedi nodi anghenion tystiolaeth pwysig sy'n ymwneud â'n gwaith bioamrywiaeth forol. Mae'r ddogfen hon yn amlinellu'r prosiectau a ystyriwn i fod yn flaenoriaeth uchel le hoffem ymchwilio cyfleoedd ar gyfer gweithio ar y cyd.

Natural Resources Wales have recently identified priority evidence needs relating to our marine biodiversity work. This document outlines projects that we consider to be high priority where we would like to explore opportunities for collaborative working.

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1. Introduction

The purpose of this document is to outline projects where we have identified high priority marine biodiversity evidence needs and opportunities for collaborative working.

Natural Resources Wales' purpose is to pursue sustainable management of natural resources in all of its work. This means looking after air, land, water, wildlife, plants and soil to improve Wales' well-being, and provide a better future for everyone. Since its creation NRW has made a strong commitment to being an evidence based organisation. We seek to ensure that our strategy, decisions, operations and advice to Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment. While we have limited funds available for research, we recognise that there are many opportunities to work with others to gather the evidence fundamental to our work.

This document is based on the results of an exercise NRW has recently completed to identify high priority evidence needs relating to our marine biodiversity work. This is a living document; some evidence needs will remain relevant for many years, some evidence gaps may be filled and new evidence needs will emerge over time. We intend to update this document on a yearly basis and are also considering extending the scope of the work. NRW's high priority evidence needs relating to marine renewable energy are not detailed in this leaflet¹.

If you are interested in carrying out research on any of the projects listed overleaf, please contact marinebiodiversityevidence@naturalresourceswales.gov.uk

2. Scope

This document has a specific focus and does not cover all NRW's evidence needs within the marine environment.

In scope

- Subtidal, intertidal and saltmarsh habitats and species.
- Physical processes where these can affect marine biodiversity.
- Social and economic information (including activity mapping) only where it affects our ability to manage sites / make management decisions etc. relating to marine biodiversity.

Out of scope

- Coastal habitats other than saltmarsh (e.g. sand dunes, sea cliffs etc.).
- Monitoring & surveillance (i.e. repeat collection of information to inform reporting against targets/objectives).
- Evidence specific to the Water Framework Directive.
- Ecosystem goods and services.
- Marine Renewable Energy¹.

¹ We are a partner in the UK Offshore Renewable Energy Joint Industry Programme (ORJIP) for Ocean Energy and the ORJIP OE Forward Look (<http://www.orjip.org.uk/documents>) identifies the key environmental evidence gaps for the wave and tidal sectors and a prioritised list of strategic research projects to address these gaps.

3. Research Opportunities

The list of high priority projects has been divided into the following groups:

- Possible research collaborations.
- Other possible collaborations that may be less suited to the work of Universities and Research Institutions but may nevertheless offer opportunities to collaborate; for example, with part, but not all, of the project. Some are focussed on data collation or survey work, rather than research. Some of these may also require the involvement of other organisations.
- Projects that are currently underway but may still have some scope for further collaboration

Click on each project to view a more detailed description.

Research collaborations

- [Use of marine habitat for nursery, shelter and foraging for diadromous fish](#)
- [Impacts of forestry management and tree felling on estuarine habitats](#)
- [Localised impacts on *Modiolus modiolus* \(horse mussel\) beds](#)
- [Diet of marine mammals, especially bottlenose dolphin, harbour porpoise, grey seal](#)
- [Development of appropriate modelling tools to more accurately model fish behaviour](#)
- [Survival of *Crepidula fornicata* \(slipper limpet\) deposited onto the seabed in different environmental conditions](#)
- [Developing methods to assess the behaviour of birds underwater](#)
- [How to create new habitat \(other than saltmarsh\) e.g. mudflats, sandflats, mixed shores, seagrass beds](#)
- [Understanding vulnerability of Sites of Special Scientific Interest to climate change \(especially marine habitats\)](#)



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Other collaborations

- [Data collation and survey for distribution of fish assemblages](#)
- [Targeted survey to improve maps of Annex I subtidal habitat \(primarily Reef and Sandbank\)](#)
- [Targeted survey to improve maps of Environment \(Wales\) Act Section 7 and OSPAR threatened and declining habitats](#)
- [Measuring ambient marine noise and vibration](#)
- [Recording distribution, frequency and intensity of recreational activities](#)
- [Developing acceptable limits \(stock levels etc\) for living marine resources that are not subject to fishery assessments](#)
- [Quantifying and safeguarding regional and sub-regional sediment budgets.](#)
- [Predicting and recording loss of habitat through climate change, including recording of coastal casework that leads to coastal squeeze](#)
- [Collation of information on use of habitat for spawning, nursery, shelter and foraging for marine fish](#)
- [Bathymetry and topographic data to be collected within coastal and estuarine environments where there is no present baseline data.](#)
- [Improving wave data availability for Wales](#)
- [Recording distribution, frequency and intensity of commercial fishing](#)
- [Targeted survey of distribution of specific invasive non-native species in Welsh waters](#)
- [Understand pathways and vectors of spread for invasive non-native species](#)
- [Update old National Vegetation Classification \(NVC\) maps for saltmarsh](#)

Projects where work is currently underway but may still have scope for further collaboration (project description not provided, please contact NRW for further information)

- Collate information on extent, abundance & distribution of invertebrate Section 7 & OSPAR species.
- Collate data on distribution of invasive non-native species in Welsh waters.
- Distribution of non-native species at existing dredge disposal sites.
- Improve maps of Annex I subtidal habitat (primarily Reef and Sandbank), using data currently available.
- Improve maps of Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats.
- Improving confidence in sea-level rise estimates for Wales.
- Impacts of artificial structures on spread of invasive non-native species.



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4. Project Details

Use of marine habitat for nursery, shelter and foraging for diadromous fish

The knowledge base of the habitat use and requirements for diadromous fish when in the marine environment is very poor. While some diadromous fish are known to undertake long range migration and may only be transient in our waters, others use the inshore and coastal habitats extensively. Research is needed to establish the marine habitat preferences and migration routes for diadromous fish in order to link existing and on-going habitat mapping to possible impacts.

Impacts of forestry management and tree felling on estuarine habitats

Forestry plantation occupies a significant proportion of the catchments of many of our estuaries. Understanding of the impacts of this land use on estuarine habitats and species is limited. Large scale cultivation of non-native coniferous trees and forestry operations such as clear-felling and track construction and maintenance could lead to pressures on the protected estuary features within Marine Protected Areas, for example increased sediment input, increased nutrients, acidification and remobilised pollutants arising from erosion. The project needs to:

- Identify potential pressures and assess the scale of these pressures.
- Identify to what extent Water Framework Directive (WFD) targets are suitable and whether these potential pressures are being assessed.
- Assess whether impacts from these pressures on estuarine habitats and species are significant

- Identify critical thresholds for acidification, pollutants and nutrients enabling performance indicators to be set for protected estuarine habitats and species that can be used for both feature condition assessment and Habitat Regulations Assessments.

Localised impacts on *Modiolus modiolus* (horse mussel) beds

Modiolus modiolus (horse mussel) beds are an extremely sensitive habitat and there have been indications recently that even infrequent and relatively low level activity may have the capacity to degrade the habitat. Therefore, there is a need to investigate the possible impacts of any activity that could take place that involves physical contact with a *Modiolus* beds, e.g. towed video, potting, anchoring. This study could be carried out in several ways, including direct observations of an activity, or an experimental study.

Diet of marine mammals, especially bottlenose dolphin, harbour porpoise, grey seal

Knowledge of diet in marine mammals in Wales is minimal and/or dated. We have no stomach content samples from bottlenose dolphins in Wales, although a proposed project to biopsy dolphins could allow forensic techniques to examine diet (stable isotope analysis). We have stomach content information from stranded and bycaught harbour porpoise but data is not analysed. Grey seal diet work in Wales is from a single report from 1996 in Pembrokeshire (Strong 1996) and requires updating. Diet is an important descriptor of prey changes in the ecosystem. As diet is intricately linked to habitat, knowledge of diet will inform our assessments of the condition of marine mammal habitats.

Development of appropriate modelling tools to more accurately model fish behaviour

Modelling is likely to be required to predict impacts to fish from marine renewable energy and other devices in several stages; to predict encounter rates, avoidance rates and injury 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. In addition to the development of appropriate modelling tools, further research (as described in other evidence needs) is required to parameterise the models adequately.

Survival of *Crepidula fornicata* (slipper limpet) deposited onto the seabed in different environmental conditions (linked to dredge deposition licensing)

There is a lack of evidence on the environmental conditions suitable for slipper limpet (*Crepidula fornicata*) survival. If *C. fornicata* is able to survive at depths/environmental conditions found at dredge disposal sites around Wales then depositing them there (as part of dredge waste) alive would be contributing to the spread of the species around the Welsh Coast. If however it can be ascertained that *C. fornicata* cannot survive these conditions then the activity would be of lower risk in spreading marine non-native species.

Developing methods to assess the behaviour of birds underwater

This project would develop methods to track and record the behaviour of birds underwater, e.g. around tidal turbines. Once methods have been developed we could gain a better understanding of bird behaviour whilst underwater, thus enabling better predictions of avoidance etc of tidal turbines and other developments.

How to create new habitat (other than saltmarsh) e.g. mudflats, sandflats, mixed shores, seagrass beds

There is a need to develop methods to create new intertidal and subtidal habitat. At present there are reliable methods available only for creation of saltmarsh habitat. Projects are needed at a variety of different scales, from small scale developments of techniques like propagation of seagrass and algae to larger scale habitat creation trials.

Understanding vulnerability of Sites of Special Scientific Interest to climate change (especially marine habitats)

Assess likely vulnerabilities and impacts from climate change on both a Site of Special Scientific Interest site and feature level. This should identify those habitats and species that are most vulnerable to climate change and also look at the level of likely changes along the coast of Wales.

Data collation and survey for distribution of fish assemblages

A number of fish species may be important sources of food for other marine species including mammals, birds and other fish species. Understanding the distribution of these species will improve our ability to manage Marine Protected Areas and to advise on potential developments in the marine environment.

The project would review available scientific literature relating to fish assemblages and species, making use of grey literature and other monitoring data sources such as Water Framework Directive work, tagging studies, fisheries bycatch, fish survey reports etc. Additional survey work could also be carried out.

Targeted survey to improve maps of Annex I subtidal habitat (primarily Reef and Sandbank)

Carry out subtidal survey work to identify Habitats Directive Annex I habitat. This would be likely to consist of multibeam and/or sidescan survey in combination with either drop down video and/or grab sampling. Areas to be targeted could be those where there is a risk of damage (especially from activities that do not require survey as part of an Environmental Impact Assessment) and where there is sparse or no data within Special Areas of Conservation (SACs). These would then be incorporated into NRW's maps of Annex I Reef and Sandbank habitat used for Habitats Directive Article 17 reporting and Regulation 35 advice.

Targeted survey to improve maps of Environment (Wales) Act Section 7 and OSPAR threatened and declining habitats in areas where these habitats have been recorded but NRW does not hold any data

Carry out subtidal survey work to identify Section 7 and OSPAR habitats. This would be likely to consist of multibeam and/or sidescan survey in combination with either drop down video and/or grab sampling. This would target areas where we have reason to believe these habitats may be present (e.g. from anecdotal records, third party data that we cannot access or proximity to recorded habitat). These would then be incorporated into NRW's maps showing the distribution of Section 7 and OSPAR habitats.

Measuring ambient marine noise and vibration (including levels of noise caused by different developments not covered by noise registry)

Measuring ambient and anthropogenic noise in the marine environment is of key importance to understanding impacts from marine industry and marine activities to protected species. No national (Welsh) scheme exists to properly record and measure sound levels underwater in Welsh waters. Essentially, this would map the soundscape of representative sea areas and measure noise (frequency, sound exposure level, sound pressure level) from marine activities.

Recording distribution, frequency and intensity of recreational activities (e.g. update Wales Activity Mapping Database)

There is a need to develop mechanisms to better record the distribution, frequency and intensity of recreational activities in the marine environment in Wales. This work should look to the Wales Activity Mapping work led by the Pembrokeshire Coastal Forum which includes information on sailing, motor boating, kayaking, coastering, surfing, beach activities, etc. in Pembrokeshire. Good information on spatial extent and intensity of activity is important to understand the management needs of protected sites, and the wider marine environment. Data could also be analysed to investigate potential recreational carrying capacity of different locations which can be used to inform management and marine planning processes.

Developing acceptable limits (stock levels etc) for living marine resources that are not subject to fishery assessments, e.g. seaweed gathering, razor shell fisheries

Currently little is known about sustainable catch/ collection levels for several living marine resources that are not covered by Total Allowable Catch / quota. Work could take the form of a stock assessment as well as investigating ecosystem impacts as a result of removal of these species, although other options could also be explored.

Key species / species groups to assess would be:

- Seaweed (kelp, *Porphyra sp.*, dulce etc.)
- Razor shells (*Ensis sp.*)
- Shore crab (*Carcinus maenas*)
- Winkles (*Littorina sp.*)
- Bait worms
- *Salicornia sp.*

Quantifying and safeguarding regional and sub-regional sediment budgets.

Sediment budgets describe the inputs (sources), outputs (sinks) and fluxes (vectors - indicating the direction and amount of sediment transport) within a coastal system. This project aims to improve the evidence base by undertaking a number of steps which could be separated into smaller projects. Key tasks include:

- Reviewing existing regional sediment budgets established for Wales, including documenting what has been established, the quality of the data and information sources and associated confidence levels, assumptions, limitations with the data and the approach.
- Identifying any evidence gaps within present understanding including areas that need to be updated, and determine how these gaps can be best filled

- Review and determine a sediment budget analysis approach which is fit for purpose, this will also look to develop a consistent approach/ data which is comparable on a national basis (and will require input from other UK projects).
- Collect any new data required, analyse and perform an agreed sediment budget analysis methodology if necessary.

These tasks could be undertaken on a national basis or all the tasks undertaken for one region at a time in relation to the Shoreline Management Plan 2 areas.

Predicting and recording loss of habitat through climate change, including recording of coastal casework that leads to coastal squeeze

The most significant mechanism for adverse effects from climate change is due to coastal squeeze where habitat extent is squeezed between rising sea-levels and a fixed shoreline. Monitoring is required to measure changes in extent and distribution of Natura 2000 habitats that could be affected by coastal squeeze, and there is potential to develop collaborative approaches to monitoring, or undertake research to develop an approach which is pragmatic but also scientifically robust. It will also be necessary to develop casework recording (Marine Licencing/Planning) to record the implementation of "Hold the Line" policies and as such a record of the anticipated coastal squeeze and compensation needs via the National Habitat Creation Programme (NHCP). It is expected that this element of recording should be developed by NRW and coastal planning authorities.

Collation of information on use of habitat for spawning, nursery, shelter and foraging for marine fish

This project seeks to develop a better understanding of habitat use by marine fish at different stages of their life cycle. Initially, there is a need to make a list of fish species to consider, followed by a review of literature on their biology and habitat preference for various life stages, from ichthyoplankton to adult. The project would then need to look at habitat types for relevant Marine Protected Areas, other areas etc. and link habitats and sediment types to fish usage. Some modelling and habitat mapping may be required, in addition to literature review. Evidence gaps are likely to appear once this exercise is finished which may require further work (surveys etc.).

Bathymetry and topographic data to be collected within coastal and estuarine environments where there is no present baseline data.

Topographic data for the intertidal, supratidal and subtidal areas of the coastal and estuarine zone is key to developing and understanding of the baseline environment and how it might evolve in response to natural forcing factors and anthropogenic pressures. This project involves data collation of bathymetric and topographic data in Welsh waters, identification of gaps in the data coverage and assessment of quality of the data available. This should look to build on an initial assessment undertaken by the Wales Coastal Monitoring Centre to establish topographic data collections of Welsh coastal practitioners, if available. Results should be used to make recommendations for high priority areas and a strategy to improve this evidence need. A review of available methodology and instrumentation for collection of topographic data is also required to determine the most appropriate and cost effective means.

Improving wave data availability for Wales

There is limited long term (i.e. over a 2-year period) and nearshore directional wave data available for the Welsh coast. This project should look to:

- Report the available coverage of wave data availability for Wales including long term and present/ historic short-term deployments as a record/ look up table. This report could also include improvements for wave data availability, so that a few common platforms are used.
- Identify data gaps for wave data and make recommendations for high priority areas and a strategy to improve this evidence need (in relation to long term deployments and short term deployments to secure coverage of inshore wave data). This project should build on results of a KESS II partnership project between NRW and Swansea University which includes analysis and consideration of long-term wave data in Wales.

The most important part will be to look for funding and partnership opportunities to deploy directional wave buoys, and determine appropriate mechanisms to collect and store wave data which is publicly available.

Recording distribution, frequency and intensity of commercial fishing

The aim of this project is to understand the distribution, frequency and intensity of commercial fishing vessels' activity in Welsh waters.

Targeted survey of distribution of specific invasive non-native species in Welsh waters

There is a need to collect more accurate and regular data on the distribution of marine Non-Native Species (NNS) in Wales. At present marine NNS data is collected mainly in 'one off' surveys or as part of other surveys and many of the hotspots of introduction are not covered. To include cord grass *Spartina sp.*, slipper limpet *Crepidula fornicata*, carpet sea squirt *Didemnum vexillum*, mitten crab *Eriocheir sinensis* and wireweed *Sargassum muticum*.

Understand pathways and vectors of spread for invasive non-native species

Marine non-native species are introduced into Wales and then spread around Wales via pathways such as shipping (hull fouling, ballast water), aquaculture, recreational boating and marine developments. Mapping these pathways is needed to be able to understand the risk posed to native habitats and species.

Update old National Vegetation Classification (NVC) maps for Saltmarsh habitat

NVC maps exist for much of saltmarsh in Wales including coverage of the vast majority of the extent of the Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs). However, these maps are out of date having been produced largely between 1996 and 2003. Some of these maps were produced without the aid of aerial photographs or GPS and the dynamic nature of saltmarsh means that in many areas they are now inaccurate. Rather than repeating NVC surveys it is proposed that the surveys are updated bringing together existing evidence plus ground truthing. An initial assessment is required to evaluate the scale of the task. This should involve assessing the existing maps against the aerial photographs, identifying where Water Framework Directive (WFD) data can be used, identifying areas where maps are inaccurate or where there has been a lot of change and liaison with NRW staff. The next step is to digitise visual changes in the existing surveys against aerial photographs. Ground truthing of this work will need to be carried out focussing on the identified areas of change and on habitats where boundaries are not visible on aerial photographs. Where alterations to habitat boundaries not visible on the aerial photographs has occurred remapping these boundaries will be necessary.



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