Nodweddion Morol Natura 2000 yn Agored i Effeithiau Newid yn yr Hinsawdd

Climate Change Vulnerability of Marine Natura 2000 Features

Rhaglen Natura 2000 LIFE yng Nghymru
LIFE Natura 2000 Programme for Wales

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1.1 Asesiad o effaith newid yn yr hinsawdd ar nodweddion morol Natura 2000

Mae cryn dipyn o waith wedi cael ei wneud yn flaenorol i gynnal asesiad o effaith newid ar yr hinsawdd ar nodweddion Natura 2000 a safleoedd yng Nghymru. Ceir disgrifiad yn *Climate Vulnerability Assessment of Designated Sites in Wales* (Wilson et al., 2011). Fodd bynnag, nid yw'r gwaith hwn yn cynnwys nodweddion morol felly mae yna hyd heddiw fwlch mewn tystiolaeth allweddol yn y maes hwn.

Mae ystod o adroddiadau wedi cael eu cynhyrchu sydd wedi archwilio pa mor fregus yw cynefinoedd a rhywogaethau morol (Jones et al 2011; Jolley et al. 2012; Mieszkowska, 2013, 2014) ond nid yw'r rhain wedi canolbwyntio ar nodweddion Natura 2000 yn benodol neu wedi canolbwyntio ar raddfeydd amser sy'n wahanol i ofynion y gwaith hwn.

1.2 Assessment of the vulnerability of marine Natura 2000 features to climate change

A significant amount of work has been undertaken previously to develop a vulnerability assessment of Natura 2000 features and sites in Wales to climate change. This is described in *Climate Vulnerability Assessment of Designated Sites in Wales* (Wilson et al., 2011). However, this work did not include marine features so there remained a key evidence gap in this area.

A range of reports have been produced which have examined the vulnerability of marine habitats and species to climate change (Jones et al. 2011; Jolley et al. 2012; Mieszkowska, 2013, 2014) but these have not focused on Natura 2000 features specifically and have considered time-scales which are not appropriate for current needs.

2. Aim

To resolve this evidence gap the LIFE Natura 2000 Programme convened a workshop of Natural Resources Wales species and habitat experts to consider the inherent vulnerability of marine Natura 2000 features to climate change. The aim was to use the best available knowledge and expert opinion to rank the features as either high, medium or low vulnerability. This assessment will provide a broad vulnerability score for the features on a Wales-wide level, and will allow the relative risk of climate change to key Natura 2000 features to be evaluated.

3. Special Area of Conservation Annex I habitat and Annex II species features

3.1 Method

The workshop was held on 9 February 2015. The features were assessed using rationale that was developed by the MarLIN team in consultation with the MarLIN Technical Management Group (MARLIN, 2015). The intolerance and recoverability of the features to the main impacts of climate change (sub-issues) were considered in order to evaluate their inherent vulnerability. The sub-issues are shown in Table 1.

Full definitions of intolerance and recoverability are shown in Appendix I. Table 2 shows how these two factors are combined to establish the vulnerability level.

The likelihood of exposure to the mechanisms of climate change within the first epoch was considered (up to 2030). The participants and features of focus are shown in Table 3.

Table 1. Climate change sub-issues

Category	Climate change: sub-issue
Physical	Substratum loss
	Smothering
	Changes in suspended sediments
	Changes in turbidity
	Changes in emergence regime
	Changes in water flow rate
	Changes in wave exposure
	Physical disturbance or abrasion
	Temperature change
	Changes in freshwater input
Chemical	Changes in PH (e.g. Decalcification or metabolic stress)
Anthropogenic factors and management implications	The effect of management mechanisms on a feature's ability to adapt to climate change (e.g. impacts resulting from the implementation of the Shoreline Management Plan).
	Potential future scenarios, that may exist as a result of climate change, that will indirectly impact the features condition or extent and policy towards their conservation. E.g. renewable energy policy, changing fisheries policy, changing land use.
Strategic management actions	Strategic actions required, at a national or regional level, to mitigate against the potential effects of climate change (human interventions that can be made to reduce effect on a region or at a national scale).
Evidence Gaps	Key evidence gaps where further information and research will give us a greater ability to understand the vulnerability of features to climate to aid in more effective management.

Table 2. Matrix showing how intolerance and recoverability was used to determine vulnerability (Adapted from Marlin 2015)

NS = not sensitive, NR = not relevant

		Recoverability						
		None	Very low (>25 yr.)	Low (>10/25 yr.)	Moderate (>5 -10 yr.)	High (1 - 5 yr.)	Very high (<1 yr.)	Immediate (< 1 week)
Intolerance	High	Very high	Very high	High	Moderate	Moderate	Low	Very low
	Intermediate	Very high	High	High	Moderate	Low	Low	Very Low
	Low	High	Moderate	Moderate	Low	Low	Very Low	NS
	Tolerant	NS	NS	NS	NS	NS	NS	NS
	Tolerant*	NS	NS	NS	NS	NS	NS	NS
	Not relevant	NR	NR	NR	NR	NR	NR	NR

Table 3. Participants in the marine Natura 2000 feature workshop

All participants are Natural Resources Wales species or habitat specialists or members of the LIFE Natura 2000 Programme team.

Group	Names	SAC features
1	• Paul Brazier (Intertidal ecologist) • Clive Walmsley (Climate specialist) • Gabe Wyn (Intertidal and coastal ecosystems) • Natasha Lough (Subtidal ecologist) • Heather Lewis (Coastal ecologist) • Emmer Litt (Marine and coastal physical scientist) • Helen Bloomfield (LIFE Natura 2000 Programme) • Andrew Jeffery (LIFE Natura 2000 Programme)	• Atlantic salt meadows *(Glauco-Puccinellietalia maritimae) Salicornia* and other annuals colonising mud and sand • Mudflats and sandflats not covered by seawater at low tide (Intertidal mudflats and sandflats) • Coastal lagoons
2	• Karen Robinson (Subtidal ecologist) • Rob McCall (Climate specialist) • Ben Wray (Marine biodiversity ecologist) • Kirsten Ramsay (Marine ecosystems specialist) • Rowland Sharp (Marine conservation officer) • Nicola Rimington (Marine and coastal physical scientist) • James Moon (Marine conservation officer) • Jan Verbeek (LIFE Natura 2000 Programme)	• Reefs • Sandbanks which are slightly covered by sea water all the time • Submerged or partially submerged sea caves • Large shallow inlets and bays • Estuaries

3.2 Results

Table 3 below shows the overall inherent vulnerability of the marine Natura 2000 features to climate change as determined in the workshop. The reasoning and analysis behind the vulnerability score can found in the spreadsheet*: LIFE Natura 2000 Programme for Wales: Climate Change Vulnerability Marine SAC Features Analysis, 2015, Natural Resources Wales*.

Table 4. Inherent vulnerability of marine Special Area of Conservation features in Wales to climate change

Marine SAC feature	Vulnerability
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	High
Coastal lagoons	High
Mudflats and sandflats not covered by seawater at low tide (Intertidal mudflats and sandflats)	High
Estuaries	Medium
Reefs	Medium
Salicornia and other annuals colonising mud and sand	Medium
Large shallow inlets and bays	Low
Sandbanks which are slightly covered by sea water all the time	Low
Submerged or partially submerged sea caves	Low

3.3 Considerations

- The frequency of occurrence of the sub-issues will affect the ability of the features and their associated communities to recover in the longer term.

- The overall assessment of the feature was based on the worst case scenario from the climate change sub-issues which are likely to impact the feature within the first epoch.

- The workshop considered the overall inherent vulnerability of the feature on a Wales-wide level, but there is likely to be local variation depending on biological, chemical and physical factors.

- Marine Natura 2000 features have very broad definitions and are comprised of different component communities which have varying vulnerabilities to climate change (e.g. overall reefs are of medium vulnerability but *Sabellaria* reefs components are thought to be highly vulnerable).

- 'Large shallow inlets and bays' and 'Estuaries' contain other Natura 2000 features within them, which are considered of higher vulnerability. As the components of the feature will be considered under the other features assessments, the 'Large shallow inlets and bays' and 'Estuary' features were considered irrespective of these components.

- In all cases it has been assumed that the foundations are there to rebuild communities (e.g. suitable substrate) following an extreme event such as a catastrophic storm event.

4. Special Protection Area Annex I and regularly occurring migratory bird species

4.1 Method

The Climate Vulnerability Index for features not previously considered was determined using the model outputs from Pearce-Higgins et al (2011). The models were converted into a Climate Vulnerability Index score of high, medium or low as per the table below.

CHAINSPAN output	CVI index given
High magnitude increase	Low
Moderate magnitude increase	
Low magnitude increase	Medium
Low magnitude decline	
Moderate magnitude decline	High
High magnitude decline	

For the bird assemblage features the average Climate Vulnerability Index score for the assemblage component species was used.

4.2 Results

The Climate Vulnerability Index for the bird features were determine as below.

English name	Latin Name	Climate Vulnerability Index
Bar-tailed godwit	*Limosa lapponica*	Medium
Seabird assemblage		Medium
Waterfowl assemblage		Medium
Black (common) scoter	*Melanitta nigra*	Low
Red-breasted merganser	*Mergus serrator*	Low
Red-throated diver	*Gavia stellata*	Low

5. References

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- Wilson, L., R. McCall, S. Astbury, A. Bhogal and C. Walmsley. 2011. Climate Vulnerability Assessment of Designated Sites in Wales. CCW Contract Science Report No. 1017, CCW, Bangor. (NRW-13-039075)

Appendix 1: Definitions of intolerance and recoverability adapted from MARLIN (2015)

Factor	Factor definition	Scale	Scale definition
Intolerance	The susceptibility of a habitat, community or species (i.e. the components of a biotope) to damage, or death, from an external factor/ mechanism. Intolerance must be assessed relative to change in a specific factor.	High	Species important for the structure and/or function of the biotope, or its identification ("important characterising" species), are likely to be killed and/or the habitat is likely to be destroyed by the factor under consideration.
		Inter-mediate	The population(s) of species important for the structure and/or function of the biotope, or its identification ("important characterising" species), may be reduced or degraded by the factor under consideration, the habitat may be partially destroyed, or the viability of a species population, diversity and function of a community may be reduced.
		Low	Species important for the structure and/or function of the biotope, or its identification ("important characterising" species), will not be killed or destroyed by the factor under consideration and the habitat is unlikely to be damaged. The viability of a species population or the diversity/functionality in a community will be reduced.
		Tolerant	The factor does not have a detectable effect on the structure and/or function of a biotope or the survival or viability of species important for the structure and/or function of the biotope or its identification. The extent or species richness of a biotope may be increased or enhanced by the factor.
		Tolerant*	The extent or species richness of a biotope may be increased or enhanced by the factor.
		Not relevant	Intolerance may be assessed as not relevant where communities and species are protected or physically removed from the factor (e.g. circa littoral communities are unlikely to be affected by increased emergence regime).
Recoverability	The ability of a habitat, community, or species (i.e. the components of a biotope) to return to a state close to that which existed before the activity or event caused change.	None	Recovery is not possible.
		Very Low	Partial recovery is only likely to occur after about 10 years and full recovery may take over 25 years or never occur.
		Low	Only partial recovery is likely within 10 years and full recovery is likely to take up to 25 years.
		Moderate	Only partial recovery is likely within 5 years and full recovery is likely to take up to 10 years.
		High	Full recovery will occur but will take many months (or more likely years). Should be complete within about 5 years.
		Very high	Full recovery is likely within a few weeks or at most 6 months.
		Immediate	Recovery immediate or within a few days.