

**Implementing the Ecosystem Approach in
Wales: Current status of the maritime
environment and recommendations for
management**

**Dernie, K.M, Ramsay, K., Jones, R.E, Wyn,
G.C., Hill, A.S., & Hamer, J.P.**

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GWEITHREDU'R DULL ECOSYSTEM YNG NGHYMRU: SEFYLLFA BRESENNOL YR AMGYLCHEDD MOROL AC ARGYMHELLIADAU RHEOLAETH

CRYNODEB GWEITHREDOL

Mae'r Dull Ecosystem wedi ei ddiffinio fel '**strategaeth ar gyfer rheoli tir, dŵr ac adnoddau byw sy'n hyrwyddo cadwraeth a defnydd cynaliadwy mewn ffordd gyfiawn, a hynny mewn modd integredig**', a chafodd ei fabwysiadu gan Lywodraeth y DU fel rhan o'r Cytundeb ar Amrywiaeth Biolegol yn y flwyddyn 2000. Mae'n cydnabod bod ecosystemau iach a gweithredol yn hollbwysig i'n hanghenion economaidd a chymdeithasol, ac y gall gweithgareddau dyn gael effaith andwyol ar ecosystemau, gan arwain at golli gwasanaethau. Mecanwaith sy'n sail i Ddatblygu Cynaliadwy yw'r Dull Ecosystem.

Yn yr amgylchedd arforol, fe fydd gweithredu dull ecosystem yn golygu adeiladu ar y fframwaith rheoli cadwraeth natur gyfredol sy'n bennaf seiliedig ar ddiogelu rhywogaethau a chynefinoedd a datblygu dull mwy cyfannol sy'n ystyried ecosystemau a gweithredu ecolegol. Nid yw hyn yn golygu bod angen disodli'r camau diogelu a geir eisoes, er enghraifft rhai'n ymwneud â rhywogaethau prin sydd dan fygythiad; yn hytrach, bydd yn sicrhau bod yr ecosystem ehangach sy'n cefnogi'r holl rywogaethau a'r holl gynefinoedd, ac sy'n cynnig nwyddau a gwasanaethau gwerthfawr, yn iach ac yn wydn, a'i bod yn cael ei rheoli o fewn terfynau ei maes gweithredu.

Nid yw deall y ffordd o weithredu'r Dull Ecosystem yn ymarferol wedi ei datblygu'n ddigonol hyd yn hyn, gan fod y ffordd y mae ecosystem amgylchedd y môr yn gweithredu yn gymhleth. Mae angen ymdrin â bylchau mewn gwybodaeth trwy gynnal gwaith ymchwil penodol a thrwy ddylanwadu ar flaenoriaethau eraill, sef cymuned ymchwilio'r DU yn bennaf.

CYSYNIADAU ECOSYSTEMAU

Gellir disgrifio ecosystem fel **cymhlethfa ddynamig o blanhigion, anifeiliaid a micro-organeddau a'u hamgylchedd, sy'n rhyngweithio fel uned weithredol**. Ceir ecosystemau ar raddfeydd gofodol amrywiol (er enghraifft, pwll glan môr neu Fôr Iwerddon), ond maent i gyd wedi'u cysylltu â'i gilydd.

Gellir ystyried ecosystemau yn ôl y priodweddau **strwythurol** a **gweithredol** sydd ganddynt, a gallant fod naill ai'n fnotig (biolegol) neu'n anfiotig (anfiologol). Fe allai elfennau strwythurol ecosystem forol gynnwys, er enghraifft, wely'r môr, neu helïedd y golofn ddŵr, neu bresenoldeb rhywogaethau/grwpiau o rywogaethau penodol. Mae gweithredu o fewn ecosystemau yn cyfeirio at brosesau, neu grwpiau o brosesau, sy'n cysylltu gwahanol elfennau strwythurol ynghyd, er enghraifft trosglwyddo egni i fyny drwy'r gadwyn fwyd neu lif y dŵr gyda'r llanw.

Ym marn y Cyngor Cefn Gwlad, amgylchedd morol **iach** yw un sy'n cynnig – ac a fydd yn parhau i gynnig – yr holl wasanaethau y mae ar gymdeithas eu hangen o du'r ecosystem. Mae hyn yn cynnwys gwerth esthetig a bioamrywiaeth fel elfennau llai diriaethol – ond elfennau sydd, er hynny, yn nwyddau pwysig a ddisgwyliwn gan ecosystemau.

Mae gan ecosystemau allu cynhenid i ymdopi â rhywfaint o newid a straen. Caiff gallu ecosystem i gynnal ei elfennau strwythurol a gweithredol yn eu cyfanrwydd yn wyneb straen ei ddisgrifio'n arferol fel ei **wytnwch**. Yn ymarferol, fe fydd ecosystem yn parhau i weithredu dan bwysau cynyddol, ond fe fydd ei wytnwch yn lleihau. Rywdro, fe fydd ei wytnwch yn lleihau i'r fath raddau nes arwain, o bosibl, at newidiadau sylweddol – ac, efallai, at newidiadau anghildroadwy – yn y system. Mae dulliau rheoli sy'n seiliedig ar y Dull Ecosystem yn ceisio osgoi newidiadau o'r fath.

CYFLWR ECOSYSTEM ARFOROL CYMRU

Mae pobl wedi bod yn effeithio ar amgylchedd y môr a'r arfordir o amgylch y DU ers miloedd o flynyddoedd, ac o'r herwydd ni wyddom – ac ni allwn ddarganfod – sut amgylchedd fyddai amgylchedd morol cwbl 'ddilychwin'. Serch hynny, ceir tystiolaeth fod gweithgareddau dyn wedi effeithio'n negyddol – ac yn parhau i wneud hynny – ar ecosystemau arforol Cymru.

- Yn hanesyddol, arferai dyfroedd arfordirol Cymru gynnal gwelyau wystrys mawr nad ydynt, erbyn heddiw, i'w cael. Mae cyfyngiadau sylweddol yn effeithio ar yr arfordir, mae tir arfordirol wedi ei adennill, ac yn ôl pob tebyg mae'r arfer o bysgota wedi tarfu ar gyfran helaeth o wely'r môr yng Nghymru (os nad ar holl welyau môr y wlad).
- Mae tueddiadau amgylcheddol negyddol i'w gweld yn safleoedd gwarchoddedig Cymru, er enghraifft mae sawl Safle o Ddiddordeb Gwyddonol Arbennig mewn cyflwr anffafriol, a gwelir bod nodweddion ein Hardaloedd Cadwraeth Arbennig â Statws Cadwraethol Anffafriol. Hefyd, mae rhywogaethau a chynefinoedd a nodir mewn Cynlluniau Gweithredu Bioamrywiaeth Lleol yn dirywio.
- O safbwynt ecosystemau Cymru, mae effeithiau pellgyrhaeddol pysgota, yr arfer o gyflwyno rhywogaethau anfrodorol a chyfyngiadau'r arfordir, yn bwysig.

Mae'n ofynnol i ecosystemau arforol Cymru gael eu rheoli o safbwynt y newidiadau sydd eisoes wedi digwydd, neu'r newidiadau na ellir eu hatal rhag digwydd, er enghraifft newid yn yr hinsawdd a rhywogaethau anfrodorol sy'n dal i ymledu.

ADFER ECOSYSTEMAU ARFOROL

Mae hi'n bwysig gweithredu mewn ffordd a fydd yn hwyluso ecosystemau arforol Cymru i'w hadfer eu hunain, er mwyn sicrhau eu bod yn ddigon gwydn i ymdopi â phwysau a all ddod yn y dyfodol – er enghraifft o ganlyniad i newid yn yr hinsawdd – fel y gallant barhau i ddarparu'r nwyddau a'r gwasanaethau y mae pobl yn eu disgwyl.

Gellir defnyddio technegau ail-greu, adfer ac ailsefydlu cynefinoedd mewn llecynnau arfordirol a rhynglanwol (e.e. ar forfeydd heli, ar systemau twyni tywod ac ar welyau morwellt), a gall y rhain arwain at ganlyniadau cadarnhaol. Serch hynny, pur anaml y gwelir bod y rhain yn ailosod neu'n adfer yn llwyr y cynefin naturiol dan sylw. Yn amgylchedd y môr, y cam gorau yw cael gwared â'r hyn sy'n diraddio'r amgylchedd, gan adael i'r llecyn adfer yn naturiol heb ymyrryd ymhellach.

RHEOLI ECOSYSTEMAU ARFOROL YNG NGHYMRU

Eisoes, ceir sawl fframwaith rheoli ar gyfer diogelu'r amgylchedd arforol sydd â'r potensial i gyfrannu at weithredu'r Dull Ecosystem yn nyfroedd Cymru. Cred y Cyngor Cefn Gwlad fod angen gweithredu'n benodol yn y pum maes canlynol, yn ogystal, er mwyn diogelu'r ecosystem a'i hadfer yn ddigonol yng Nghymru:

- Rhoi system Cynllunio Gofodol Morol ar waith
- Datblygu cyfres o Amcanion Ecosystemau Morol
- Rheoli ein Hardaloedd Morol Europeaidd yn well
- Datblygu Ardaloedd Morol a Ddiogelir i'r Eithaf
- Aildrefniad Rheoledig o'r arfordir

Yn ecosystemau arforol Cymru, awgrymir bod tueddiadau amgylcheddol negyddol i'w cael. Er mwyn gwneud yn iawn am hyn, ac er mwyn dechrau adfer yr ecosystemau, mae angen cael dulliau rheoli gwell, yn seiliedig ar y dull ecosystem. Er gwaethaf y pwysau a gafwyd yn y gorffennol a'r pwysau a geir yn awr, mae gwerth ecolegol gwirioneddol yn perthyn i ddyfroedd Cymru o hyd; a thrwy weithredu'n gyflym ac yn effeithiol, fe allai Cymru fod yn wirioneddol falch o amrywiaeth a bywyd cyfoethog ei moroedd.

IMPLEMENTING THE ECOSYSTEM APPROACH IN WALES: CURRENT STATUS OF THE MARITIME ENVIRONMENT AND RECOMMENDATIONS FOR MANAGEMENT

EXECUTIVE SUMMARY

The Ecosystem Approach has been defined as ‘**a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way**’ and was adopted by the UK Government as part of the Convention on Biological Diversity (CBD) in 2000. It recognises that healthy and functioning ecosystems are fundamental to our economic and social needs, and that human activities can and have negatively impacted ecosystem functioning with resultant loss of services to humans. The Ecosystem Approach is a mechanism that will deliver Sustainable Development.

In the maritime environment, implementing an Ecosystem Approach will mean building on the current nature conservation management framework based largely upon the protection of species and habitats and developing a more holistic approach that takes account of ecosystems and ecological functioning. This does not mean the replacement of existing protection measures, for example of rare and threatened species, but ensuring that the wider ecosystem that supports all of our species and habitats and provides valuable goods and services is healthy and resilient and managed within the limits of its functioning.

Understanding of how to practically implement the Ecosystem Approach is not yet well developed, since ecosystem functioning in the maritime environment is complex. There is a need to address gaps in knowledge by undertaking focussed research and influencing the priorities of others, primarily the research community in the UK.

ECOSYSTEM CONCEPTS

An ecosystem can be described as a **dynamic complex of plants, animals and micro-organisms and their environment interacting as a functional unit**. Ecosystems occur over varying spatial scales, (for example, an individual rock pool or the Irish Sea), but are interconnected.

Ecosystems can be considered in terms of both **structural** and **functional** attributes, each of which can be either biotic (biological) or abiotic (non-biological). Structural elements of a marine ecosystem could include for example the seabed type or salinity of the water column or the presence of certain species or groups of species. Functioning within ecosystems refers to processes, or groups of processes, that link different structural elements together, for example the transfer of energy up the food chain or the flow of water with the tide.

CCW considers that a **healthy** marine environment is one that provides and will demonstrably continue to provide all the ecosystem services required by society. This includes aesthetic value and biodiversity as less tangible but still important goods that we expect from ecosystems.

Ecosystems have an intrinsic ability to cope with a certain amount of change or stress. The ability of an ecosystem to maintain its structural and functional integrity when subject to stress is typically described as its **resilience**. In practical terms, an ecosystem will continue to function under increasing pressure, whilst resilience deteriorates. At some point resilience will be reduced to such a level that significant, and possibly irreversible, change occurs to the system. Management based on the Ecosystem Approach seeks to avoid such change.

STATE OF WELSH MARITIME ECOSYSTEM

Humans have been impacting the marine and coastal environment around the UK for thousands of years and as a result we do not and cannot know what a ‘pristine’ maritime environment would look like. Welsh waters do support a rich variety of habitats and species. Nevertheless, there is evidence that Welsh maritime ecosystems have been, and continue to be, negatively impacted by human activity.

- Historically, Welsh coastal waters used to support large oyster beds that no longer exist, the common skate has become commercially extinct, the coastline has been significantly constrained and coastal land re-claimed, and fishing activity is likely to have disturbed a significant proportion, if not all, of the sea bed around Wales.
- Wales’ protected sites exhibit negative environmental trends, such as significant proportions of Sites of Special Scientific Interest in unfavourable condition, and features of our SACs in Unfavourable Conservation Status, as well as declines in BAP species and habitats.
- The widespread impacts of fishing activity and the physical restraint of the coastline are important at the ecosystem level in Wales.

Welsh maritime ecosystems must be managed for ‘locked-in’ changes – those changes that have already occurred, or that cannot be prevented from occurring - such as climate change and the existence and continued spread of non-native species.=

RECOVERING MARITIME ECOSYSTEMS

It is important that action is taken to facilitate the recovery of Welsh maritime ecosystems to ensure that they are resilient enough to cope with future pressures, for example as a result of climate change, so that they continue to provide the goods and services that humans expect from them.

Habitat recreation, restoration and rehabilitation techniques can be used in coastal and intertidal areas (e.g. salt marshes, sand dune systems and seagrass beds) with positive results. Nevertheless, these rarely replace or fully restore the natural habitat they aim to recreate. In the marine environment, the best course of action is to remove the source of degradation and allow an area to recover naturally without further intervention.

MANAGING MARITIME ECOSYSTEMS FOR WALES

A number of management frameworks already exist for the protection of the maritime environment that have the potential to contribute to the implementation of the Ecosystem Approach in Welsh waters. CCW believes that focussed action is also required in the following five areas in order to achieve adequate ecosystem protection and recovery around Wales:

- Implementation of a Marine Spatial Planning system
- Development of a suite of Marine Ecosystem Objectives
- Improved Management of our European Marine Sites
- Development of Highly Protected Marine Areas
- Managed Realignment of the coast

There are indications of negative environmental trends within Welsh maritime ecosystems. Improved management, underpinned by the Ecosystem Approach, is needed to reverse this and start a trend towards recovery. Despite past and current pressures, there remains much of real ecological value in Welsh waters and with prompt and effective action Wales could be truly proud of the wealth of life and diversity of its seas.

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1. INTRODUCTION

1.1 The Countryside Council for Wales (CCW) has been asked by the Welsh Assembly Government (WAG) to help develop the concept of the Ecosystem Approach, providing advice on the functioning and health of maritime¹ ecosystems in and around the seas and coasts of Wales as well as providing practical suggestions for their protection and recovery.

1.2 The ecosystem approach is underpinned by the consideration and protection of ecosystem functioning. For CCW and others, moving towards an ecosystem approach will require building on the species and habitat focused protection of wildlife that has been undertaken to date. This represents a more holistic and robust approach to the protection of natural systems, but is a complex concept that needs careful implementation.

1.3 The advice set out in this report is based on CCW's practical experience of the management of the marine and coastal environment and its current condition, and informed by current scientific understanding of the subject. The report provides;

- CCW's broad understanding of the Ecosystem Approach concept as it relates to the maritime environment
- A summary of relevant terminology and concepts regarding maritime ecosystems and their functioning
- Our current understanding of the health of key maritime ecosystems and their components in Welsh waters
- Some practical suggestions to ensure the protection and recovery of Welsh maritime ecosystems

2. THE ECOSYSTEM APPROACH

2.1 The Ecosystem Approach has been defined as '**a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way**' and was adopted by the UK Government as part of the Convention on Biological Diversity (CBD) in 2000 and endorsed by the World Summit on Sustainable Development in 2002 (CBD, 2002). Box 1 sets out the 12 principles of the

¹ The term 'maritime' is used in this report to include fully marine areas, intertidal areas and other coastal areas closely associated with the marine environment, such as sand dunes, seacliffs, salt marshes and estuaries.

Box 1: The Ecosystem Approach: Drivers and Principles

There are clear commitments by the UK to implement the Ecosystem Approach stemming from the World Summit on Sustainable Development (WSSD) and the Convention for Biological Diversity (CBD). In the UK, the principles of the Ecosystem Approach (see right) proposed by the CBD have been accepted as a cornerstone for delivering UK Government's Marine Stewardship Process (Defra, 2002) and Marine Bill (Defra, 2006). In addition, the Ecosystem Approach is central to the recently proposed Marine Strategy Directive (European Commission, 2005).

In the Welsh Assembly Government's Environment Strategy (WAG, 2006):

'The marine environment around Wales will be valued by all, understood and respected for what it contains and provides. Our seas will be clean, support vibrant economies, and healthy and functioning ecosystems that are biologically diverse, productive and resilient, while being sensitively used and responsibly managed'.

The Ecosystem Approach is the mechanism that will deliver this vision, in line with the Assembly's duty for Sustainable Development (WAG, 2004) and the overarching UK Strategy for Sustainable Development (HM Government, 2005).

The CBD sets out 12 principles that characterise the Ecosystem Approach representing a framework for delivering sustainable use or development:

1. The objectives of management of land, water and living resources are a matter of societal choice
2. Management should be decentralised to the lowest appropriate level
3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems
4. Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: reduce those market distortions that adversely affect biological diversity; align incentives to promote biodiversity conservation and sustainable use and internalise costs and benefits in the given ecosystem to the extent feasible
5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the Ecosystem Approach
6. Ecosystems must be managed within the limits of their functioning
7. The Ecosystem Approach should be undertaken at the appropriate spatial and temporal scales
8. Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term
9. Management must recognise that change is inevitable
10. The Ecosystem Approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity
11. The Ecosystem Approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices
12. The Ecosystem Approach should involve all relevant sectors of society and scientific disciplines

approach as outlined by the CBD and the policy context for the Ecosystem Approach in the UK and Wales.

2.2 The Ecosystem Approach recognises that healthy and functioning ecosystems are fundamental to our economic and social needs, and that human activities can, and have, negatively impacted ecosystem functioning with resultant loss of goods and services to humans (Box 2). It requires us to better understand the way that ecosystems function, and ensure that human activities do not significantly affect the system's natural ability to cope with stress or change so that in the long-term they will continue to provide us with the goods and services that we expect from them.

2.3 The Ecosystem Approach is not solely environment or biodiversity-based. Reconciling social and economic goals with environmental considerations is an integral part of the holistic management framework defined by the Ecosystem Approach, which can be thought of as a mechanism to underpin Sustainable Development (Laffoley *et al*, 2004). Development and delivery of the Ecosystem Approach for the maritime environment therefore needs to be an inclusive process requiring the engagement of all those with a stake in the Welsh maritime environment - at local, regional, national and international levels. Raising awareness and understanding of the value and sensitivity of maritime ecosystems must be a part of this process. Whilst recognising the importance of the range of stakeholders and interests that must be engaged and accommodated in order to deliver the Ecosystem Approach, this report focuses on the scientific basis and conservation implications of the approach.

2.4 In the maritime environment, implementing an Ecosystem Approach will mean building on the current nature conservation management framework that is currently based largely upon the protection of species and habitats by developing a more holistic approach that takes account of ecosystems and ecological functioning. This does not mean the replacement of existing protection measures, for example for rare and threatened species. However, it is also necessary to ensure that the wider ecosystem, which supports our species and habitats as well as providing valuable goods and services to humans, is managed within the limits of its functioning.

2.5 Understanding of how to practically implement the Ecosystem Approach is not yet well developed. Ecosystem functioning is not well understood, particularly in the maritime environment, where knowledge is limited and data is sparse in comparison to terrestrial systems. Gaps in knowledge need to be addressed by undertaking focussed research. This can

Box 2: Ecosystem Goods and Services

Ecosystem goods and services are the earth's natural capital; the resources and functions that ecosystems provide to sustain life on earth (Eftec, 2005). Coastal seas and the oceans, covering 70% of the planet, play a major role in providing ecosystem goods and services.

Maritime ecosystems provide goods, for example fish and raw materials, and many services, some of which are of direct use to human beings, for example recreation and tourism, whilst others, such as climate regulation, cycling of nutrients and disturbance regulation, benefit us indirectly (Costanza *et al*, 1997). Ecosystem goods and services give other, less tangible but nevertheless important cultural and aesthetic benefits such as those that people gain from knowing a resource



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Maritime ecosystems provide numerous goods and services to Wales

exists for enjoyment, "existence value"; the benefit of having the option to use particular goods or services in the future, "option value"; and the benefit of being able to leave functioning ecosystems to future generations, "bequest value".

In Wales, a wide range of goods and services provided by maritime ecosystems include: food such as fish and shellfish; a source of renewable energy; raw materials, such as aggregates; recreation and tourism; coastal protection provided by coastal habitats such as mudflats, salt marsh and sand dunes; refugia for various animals; the cultural and aesthetic value of landscape and biodiversity; and cultural value in supporting a "way of life" for coastal communities.

Recent unpublished research for CCW indicates that the maritime environment contributes around £2.46 million (GDP) to the Welsh economy, supporting over 52,000 jobs (6% of jobs in Wales).

be achieved by influencing the priorities of others, primarily the research community in the UK. Wales is well placed to build on an already strong maritime science base.

2.6 The precautionary principle² and adaptive management³ are cornerstones of the Ecosystem Approach. Limited knowledge should not prevent us from taking steps towards better ecosystem management, which can be refined over time as our knowledge increases and our understanding evolves.

Recommendations

Taking forward the Ecosystem Approach for the maritime environment in Wales will require a significant shift in thinking by CCW and other bodies. It will be necessary to:

- Influence UK research priorities to better inform policy and management decisions about the Ecosystem Approach, including developing our understanding of ecosystem functioning in Welsh waters and how it is (and can be) impacted by human activity
- Take forward demonstration projects that allow us to gain experience in the practical implementation of the Ecosystem Approach
- Expand current surveillance programmes to better allow changes in the health and functioning of ecosystems to be detected
- Establish, work towards and keep under review, aims and objectives describing the desired state of components of maritime ecosystems
- Better understand and promote awareness of the goods and services provided by maritime ecosystems in Wales and the need to protect ecosystems to ensure the provision of these services into the future
- Fill gaps and weaknesses in existing management measures, as well as looking for opportunities to develop, implement and strengthen ecosystem management to incorporate a more holistic, ecosystem approach

² The precautionary principle states that where the consequences of an activity are unknown, but are judged to have potential for major negative environmental consequences, then the activity should be avoided until better understanding is established.

³ Adaptive management recognises scientific uncertainty and promotes a flexible approach that allows management to be reviewed and refined as understanding improves and experience is gained.

Key Messages

- The Ecosystem Approach provides an integrated, holistic approach to managing the environment. It specifically recognises the important goods and services that ecosystems provide to humans and provides a means of achieving Sustainable Development
- The Ecosystem Approach requires us to protect ecosystems and their functioning. This must compliment, but not replace, existing protection of rare and threatened species and habitats
- A lack of understanding of ecosystem functioning, particularly in the maritime environment, does not prevent the Ecosystem Approach from being taken forward
- Management of Wales' maritime environment needs to be driven by clear environmental, social and economic policies

3. ECOSYSTEM CONCEPTS

3.1 Ecosystems, processes and functioning

3.1.1 An ecosystem can be described as a *dynamic complex of plants, animals and micro-organisms and their environment interacting as a functional unit*.

3.1.2 Ecosystems occur over varying spatial scales (from the biosphere itself, through large scale global ecosystems right down to small scale systems such as an individual rock pool). Critically, although for the purpose of the Ecosystem Approach it is useful to define ‘ecosystems’ at scales that correspond to the various scales at which management of human interaction with the environment is organised, all of these systems are interconnected. Due to the scales at which maritime ecosystems function, the management of Welsh coasts and seas must be nested within a wider regional seas context (i.e. greater than Welsh Territorial Seas).



3.1.3 Ecosystems can be considered in terms of both **structural** and **functional** attributes, each of which can be either biotic (biological) or abiotic (non-biological) (Table 1). Structural elements of a marine ecosystem could include for example the seabed type or salinity of the water column (abiotic) or the presence of certain species or groups of species (biotic). Functioning within ecosystems refers to processes, or groups of processes that link different structural elements together, for example the transfer of energy up the food chain (a biotic process) or the flow of water with the tide (an abiotic process).

Table 1. Examples of ecosystem structure and function.

STRUCTURE		FUNCTION	
Abiotic	Biotic	Abiotic	Biotic
<i>Examples:</i> Temperature Sediment type Salinity Oxygen level	<i>Examples:</i> Biodiversity Abundance Biomass Community structure	<i>Examples:</i> Tidal flow Erosion-deposition cycles of sediment Freshwater input Abiotic habitat provision	<i>Examples:</i> Annual change in diversity Growth Productivity Nutrient regeneration Biotic habitat provision

Adapted from Elliott *et al*, (2006)

3.1.4 There are countless processes occurring in the maritime environment that make up a healthy and functioning ecosystem. The way that these processes work and are interlinked is complex and not fully understood. However, it is possible to highlight a few groups of processes occurring in ecosystems that are fundamental to their health:

i) Physical and chemical environmental processes: These include those primary physical and chemical processes that structure the maritime environment, for example

wave exposure, salinity and pH, ocean currents, stratification of water bodies, and the erosion and deposition of sediments. Such processes are fundamental in determining the distribution of different species through the environment, yet human activities are capable of disrupting them. For example, ocean circulation and stratification may be vulnerable to impacts such as those resulting from climate change, and it is now known that the pH of oceanic surface waters has decreased (becoming more acidic) by 0.1 pH units as a result of increased atmospheric carbon dioxide concentrations (Caldeira and Wickett, 2003). Nearer shore, coastal developments and sea defences constrain natural coastal processes, preventing the coastline from reacting dynamically to changes in wave exposure and rising sea levels.



ii) Biologically-mediated processes: These include the dynamic interactions that occur between organisms and between organisms and their environment that are an integral part of a functioning ecosystem, such as predation, competition, propagation and colonisation. Biodiversity itself is important since links between diversity and ecosystem functioning have now been demonstrated (Vandermeer and Wardle, 2005). Organisms also interact and alter the physical environment they inhabit. For example, certain organisms such as tubeworms and seagrasses act to stabilise the sediment in which they live, whilst others (such as lug worms or bivalves) churn up and loosen the sediment through their burrowing behaviour. These interactions affect both the biological communities that exist in an area and the way that other physical processes (e.g. sediment transport) occur. Anthropogenic activities can have impacts that disrupt these processes, for example by reducing biodiversity, impairing the ability of species to reproduce successfully due to pollution (e.g. by Tributyltin (TBT) and hormone mimics), physically disturbing the relationship between organisms and their habitat (e.g. bottom fishing activity) or introducing non-native species which then out-compete native species.

iii) Marine food webs, productivity and nutrient cycling: The transfer of energy and nutrients through the food chain is also a biologically-mediated process and is of considerable importance in terms of ecosystem functioning as well as being sensitive to disruption by human activities. Marine food webs are extremely complex but are the mechanism by which energy and nutrients flow through the biological elements of the system, from the capture of the sun's energy by phytoplankton and algae at the lowest trophic level, through grazers (herbivores) and filter feeders, scavengers and detrital feeders, through to organisms at the top of the food chain such as sea birds and marine mammals. Fisheries can disrupt the food chain by removing large numbers of target and by-catch species with knock-on effects on their prey and predators. In addition, by selecting for the largest individuals, fisheries can affect the size structure and potentially the reproductive capacity of target species populations.

3.2 Marine Ecosystem resilience and health

3.2.1 Fluctuations and variability are natural characteristics of ecosystems. Maritime ecosystems are inherently dynamic and subject to a range of natural stresses and perturbations. As a result they have an intrinsic ability to cope with a certain amount of change or stress. The ability of an ecosystem to maintain its structural and functional integrity when subject to such stressors is typically described as its **resilience**.

3.2.2 In practical terms, an ecosystem will continue to function under increasing pressure, whilst resilience (and health) deteriorates. At some point resilience will be reduced to such a level that significant, and possibly irreversible, change occurs to the system. The result of this may be a ‘regime shift’ where the resultant ecosystem, although functioning in some way, has changed and therefore fails to produce the goods and services that people have come to expect from it. There are numerous examples of such changes in maritime ecosystems that have occurred as a result of human activity (Box 3).

3.2.3 Assessing the ‘health’ of an ecosystem brings an element of subjectivity since what exactly defines ‘health’ is open to debate. Health may be partly defined in terms of naturalness, but a lack of data confounded by the history of human impacts upon marine and

Health of features in protected sites

CCW already has experience in the assessment of health in the context of Welsh protected sites. The need to protect the health and functioning of site features is recognised in site management plans for all designated intertidal SSSI.

For example, in the case of a honeycomb worm reef (*Sabellaria spp*) it is understood that to optimise the conditions for a healthy and bio diverse reef there must be a range of reef types from newly settled worms through vigorous fast growing reef to older, more biologically diverse hummocks. We are now also building this broader consideration of feature health into SACs via the Regulation 33 and Regulation 34 process of the Conservation Regulations (1994).

coastal environments means that we do not know what a ‘natural’ maritime environment would be. A more useful definition is provided in a report to Defra (Raffaelli *et al*, 2005), where a healthy ecosystem is described as one that has the capability to resist, or recover from, disturbance. CCW considers that a healthy maritime environment is one that provides and will demonstrably continue to provide all the ecosystem goods and services required by society (see Box 2). This includes aesthetic value and biodiversity as less tangible but still important goods that humans expect from ecosystems.

3.3 Managing ecosystems

3.3.1 Since an ecosystem may continue to function despite being impacted, we need robust yet sensitive indicators of ecosystem degradation and a consensus on what we consider healthy. Undertaking research and gathering evidence about the nature of the marine environment and how it functions is expensive, time-consuming and technically challenging. Because of this, we will always have incomplete information. We don't know what our seas used to be like before human influence and we don't have comprehensive information on what they are like now. Nevertheless, we need to have a clear vision of what we are aiming for in

Box 3: Human impacts on ecosystem health and function

Overfishing of the Grand Banks

The major cod fishery of the North East USA and Canada collapsed in the 1980's due to over-fishing. The extent of the decline was not apparent in catch data for a number of years since fishermen were able to keep following the declining stocks using sonar and satellite technology. The fishery was



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Cod stocks at the Grand Banks collapsed due to over fishing

eventually closed in 1992, but by this time cod stocks had declined to just 1% of what they were in the 1960's. Twenty years after closure of the fishery the cod population has not recovered and the fish stocks in the area are now dominated by dogfish and other species of low commercial value. It appears that the marine ecosystem has been pushed beyond the point of recovery into a new, and in this case, less desirable state.

Introduction of a non-native into the Black Sea

In the 1970's the Black Sea was a highly productive ecosystem with a thriving anchovy fishery, but over a period of less than 20 years it was subject to severe degradation and trophic change. This was largely as a result of accidental introduction of a non-native species, the Ctenophore *Mnemiopsis leidyi*, probably *via* ship ballast water. A carnivorous predator on zooplankton, including pelagic fish eggs and larvae, it proliferated and caused negative impacts throughout the foodchain, most notably resulting in a crash in the pelagic fishery (GESAMP, 1997). The population explosion was eventually controlled by the accidental introduction of another Ctenophore, *Beroe ovata*, which preys almost exclusively on *M. leidyi*, and the system has begun to recover. In the last two decades of the twentieth century *M. leidyi* invaded the Azov, Marmara and Aegean Seas and most recently it was introduced into the Caspian Sea probably *via* the ballast water of oil tankers.

Seabird breeding failure in the North Sea

A large-scale change is occurring in the North Sea ecosystem that appears to be largely due to climate change. Scientists have identified a regime shift in plankton communities with knock-on effects on other elements of the system. The most dramatic indication of this was the large-scale breeding failure of sea birds witnessed in 2004 in the Northern Isles of Scotland. Birds starved to death or were unable to reproduce successfully as a result of a widespread food shortage, of sandeels in particular. The reason for this reduction in sand eels is thought to be due to a change in sea temperatures and plankton communities as a result of climate change, possibly confounded by fishery pressure.



Mike Hammett / CCW / © Mike Hammett

Kittiwakes suffered breeding failures in 2004 in Scotland

order to ensure co-ordinated action and to maximise our chance of success. In some ways, knowing what we don't want to happen to our ecosystems is more important and easier to communicate than specifying exactly how we do want Welsh maritime ecosystems to look (Box 4).

**Box 4: Implementing the Ecosystem Approach in Wales:
Direction of travel**

Human activities have had impacts on global, regional and local ecosystem health and functioning worldwide. Although it is not possible to know exactly what an unimpacted marine ecosystem would look like, it is easy to define those things that are not desirable in Welsh waters. These include:

- Declines in biodiversity resulting from poor management and over exploitation
- Ecosystems dominated by opportunistic species that are responding to anthropogenic pressures
- Collapse of commercially exploited fisheries species
- Shifts in trophic structure within marine food webs
- Native species being out-competed by non-native species
- A reduction in resilience and ability of the ecosystem to cope with stress and change

CCW believes that that there needs to be a change in the current direction of travel so that certain current negative trends indicative of poor ecosystem health (section 4) are reversed. In order to have robust and resilient ecosystems, that are secure for the long term, action is needed now to ensure that:

- Populations of species of conservation importance are stable or increasing
- Biodiversity increases where it is currently declining
- Average size of commercially important fish species is increasing
- The distribution and abundance of slow growing, late-maturing species is increasing
- There are fewer introductions of non-native species
- Maritime ecosystems retain or regain their resilience and health

3.3.2 Critically for management purposes, it is primarily habitats and species that deliver ecological processes (Bremner *et al*, 2006). Whilst in some cases it is possible to measure ecosystem health directly, in most cases it is not and instead we rely on modelling them based on measurements of structural elements such as organism abundance. So, for ecological and practical reasons, consideration of the protection of ecological function and health must be based on an understanding of the identities and roles of the organisms that exist within a given ecosystem.

3.3.3 The effects of growing pressures on our ecosystems may not easily be detected, especially at an early stage. However, the knowledge of the way in which pressures are

growing can give us advanced warning of more serious ecosystem-scale effects that could follow. A stronger precautionary approach must be adopted where our understanding of the way that human activities may impact on the environment is not complete.

3.3.4 It will be necessary to set some specific targets that will define the limits to the way maritime ecosystems are used. It is likely that these will focus on critical species or habitats that are known to be indicators of wider ecosystem health or change. Maritime ecosystems do not respect administrative boundaries and taking forward the management of our seas must be taken forward within the context of the wider UK seas and further afield. As part of the developing UK Marine Bill, a suite of Marine Ecosystem Objectives is being considered as a means of protecting marine ecosystem health (see 6.4).

Key Messages

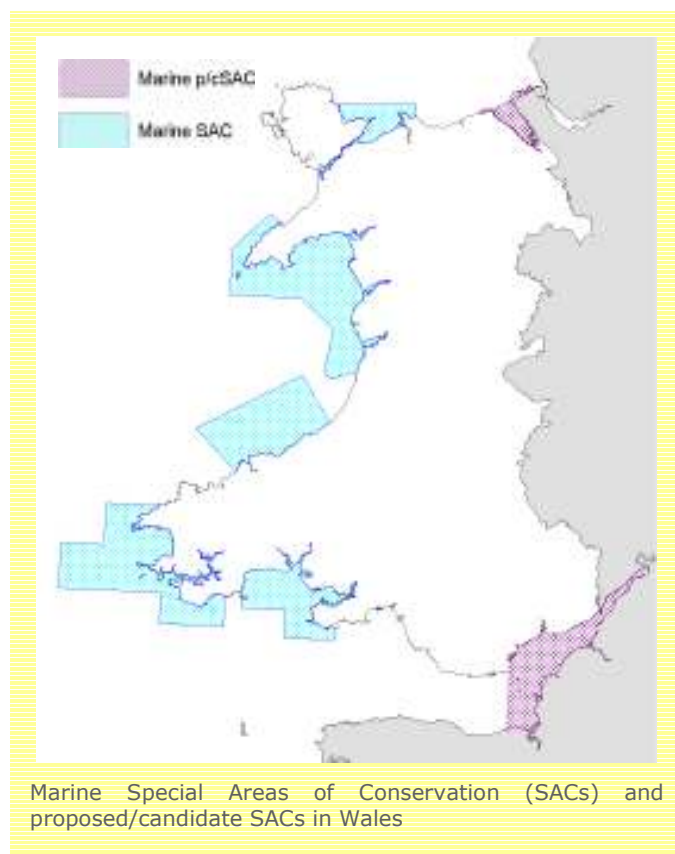
- Ecosystems are complex and spatially and temporally dynamic. Such characteristics create practical and conceptual difficulties when trying to monitor and assess ecosystems
- Defining “ecosystem health” and “ecosystem degradation” in ways that acknowledge that some types and levels of human impact on marine ecosystems is both inevitable and acceptable presents a considerable challenge to policymakers
- We know that human activities can, and continue to have an impact on maritime ecosystems in Wales and globally. We need to ensure that further declines in biodiversity and the reductions in the resilience of ecosystems do not happen and, where degradation has occurred, promote recovery if we can
- There is a need to introduce targets related to ecosystem health and functioning into the management framework of our seas that are relevant in the Welsh, UK and wider seas context

4. STATE OF WELSH MARITIME ECOSYSTEMS

4.1 Background

4.1.1 The UK Government and devolved administrations published its State of UK Seas Report entitled *Charting Progress - An Integrated Assessment of the State of the UK Seas* at the beginning of 2005 (Defra, 2005). This represented the first comprehensive, integrated assessment of the state of the seas across the UK Continental Shelf and forms the basis upon which Government will plan for delivery of its vision for UK Seas, underpinned by the Ecosystem Approach, set out in *Safeguarding Our Seas* (Defra, 2002). The *Charting Progress* report produced regional assessments of progress towards UK Governments vision for the seas including assessments that covered Celtic and Irish Seas. These assessments do not focus specifically on Welsh maritime environment but provide useful background information and summarise the anthropogenic impacts that are currently considered important.

4.1.2 Charting Progress (Defra, 2005), and other reports considering environmental trends in UK seas (Box 5) focus on habitats, species and water and sediment quality, largely because this is the basis of existing monitoring and surveillance effort in the maritime environment. In the conservation sector most of that monitoring has been concentrated on protected sites and species. Nevertheless, the trends that we see in protected sites and species broadly reflect the



health of the ecological processes that support them. In addition, the marine Natura 2000 network (Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)) in Wales cover about 30% of Welsh Territorial Seas (to the 12 NM limit) and, as such, the condition of these goes some way to describing the condition of the whole of the Welsh maritime ecosystem.

4.1.3 Less attention has been paid to research and monitoring focussed specifically at the ecosystem level, mainly because



this is a complex and relatively recent area of science. As a result, knowledge of the state of ecosystem processes and functions in the Welsh maritime ecosystem is substantially less complete than the relatively basic knowledge that exists for habitats, species and water quality. It is likely that certain species and habitats will be good indicators of wider ecosystem health (as opposed to measuring the ecosystem functions or processes themselves), however a suite of species and habitats that indicate health of the ecosystem would not necessarily be the same as the suite of species and habitats that are currently protected and monitored for conservation purposes.

4.1.4 There is a need to work with the scientific community to develop methodologies for monitoring and assessment of ecosystem function and process to underpin management. Nevertheless, due to the difficulties in collecting data about ecosystem functioning and processes, expert scientific judgement will remain an important element in advising on ecosystems and their functioning in the short to medium term. In the following sections, CCW draws some conclusions regarding the health of Welsh maritime ecosystems from known large-scale trends and from our knowledge of the ecology of Welsh coasts and seas.

Box 5: The current status of UK seas

Over recent years a number of reports that focus on the state of the UK maritime environment have been published. These include the first comprehensive integrated assessment of the state of the seas across the UK continental shelf, - Defra's *Charting Progress* (Defra, 2005). In addition, English Nature's *Maritime State of Nature Report* (English Nature, 2002), the Environment Agency's *The State of the Marine Environment in England and Wales* (Environment Agency, 2005) and WWF's *Marine Health Check 2005* (WWF, 2004) all present evidence for positive and negative environmental trends that have been detected in UK seas.

Key findings from these reports:

- 
- There has been a significant change in plankton communities populations across the UK sea linked to climate change^a
 - Food chains and size class distributions of fish populations have been altered as a result of over-fishing^b
 - The native oyster, which used to be a staple diet for many in Britain, is now very rare in UK waters and found in only a handful of estuaries^d
 - Sea surface layers have become more acidic by 0.1 pH units^c
- 
- Pollution from metals, lindane and polyaromatic compounds (PAHs) from point and diffuse sources are declining^a
 - Discharges of sewage, hazardous chemicals and radioactive materials have been greatly reduced^c
 - Seal populations are increasing or stable^a

4.2 Historical changes in Welsh maritime ecosystems

4.2.1 Humans have been impacting the marine and coastal environment around the UK for thousands of years and as a result it is not possible to know what a ‘pristine’ maritime environment would look like. This is reflected in the Charting Progress report (Defra, 2005), which states ‘there are likely to be few areas of marine habitats in the UK which remain unchanged by human activities’ (Defra, 2005). Nevertheless, there is historical and anecdotal evidence that can help to build a picture of what the system may have been like in the past.

4.2.2 For example, large beds of native oysters used to be found around Wales up until around 100 years ago but no longer exist. The presence of oysters created an important fishery in the 1800s that was exploited more intensively after the arrival of rail transport at the end of the 19th century. By the early 1900s these large beds had disappeared and native oysters are no longer found in such large numbers around the coast. Filter feeders such as oysters play an



Native oysters no longer exist in large beds in Welsh waters

important role in maintaining water quality in coastal waters as well as providing structural complexity to the seabed habitat that facilitates the development of diverse communities. The effect of the loss of large oyster populations upon the wider ecosystem in Welsh waters is not well understood.

4.2.3 Over time, the coastline of Wales has been significantly altered and constrained. For example, in the Glaslyn/Dwryd estuary the construction of the Cob at Porthmadog involved the reclamation of almost all of the Glaslyn estuary in the early nineteenth century. This has resulted in ongoing sediment accretion in the estuary and the expansion of the Morfa Harlech sand dune system into the estuary mouth. Similarly, approximately 6,000 ha of the Dee Estuary (principally mud flat and salt marsh) have been lost to land claim in the past. In the last 20 years over 700 hectares of intertidal sand and mudflat have been transformed to saltmarsh as a result of sediment accretion in the Dee Estuary. This change in habitat type will have had an effect on the wider maritime ecosystem by changing the pathways of food and nutrients. For example, loss of mudflat will reduce feeding areas for many wetland birds; but increased saltmarsh is likely to increase export of primary productivity (breakdown products



There is now good evidence that fishing activity can damage wildlife, for example seabirds and mammals

of the plants) to adjacent maritime habitats. In general, coastal developments have resulted in the loss of large areas of intertidal (and some subtidal) habitats; particularly in marine inlets. Unfortunately, while the importance of the pathway and services that these habitats provide is known the full implications of such changes is not.

4.2.4 The historic long term impacts of fishing activity are difficult to measure since fishing occurred in UK waters for hundreds of years before scientific measurement of the environment were made. Concerns regarding the impacts of towed bottom fishing gears were raised as early as 1376, where the Commons petitioned the King of England to complain that “the great and long iron of the

wondyrchoun runs so heavily and hardly over the ground when fishing that it destroys the flowers of the land below water there”.

Fishing activities occur over a vast proportion of the Welsh maritime environment in the water column and on the seabed. We know that some fish and shellfish stocks have been severely reduced in the past, such as the crayfish population around Bardsey Island and the Llŷn Peninsula that was decimated by over-collection by divers in the 1970’s-80’s. Populations of these species have still not recovered. There is now good scientific evidence that fishing activity has negative impacts on a variety of ecosystem components including seabed habitats, marine mammals and sea birds (CCW, 2003; RCEP, 2004).



Before and after: the effects of scallop dredging on a boulder and cobble reef

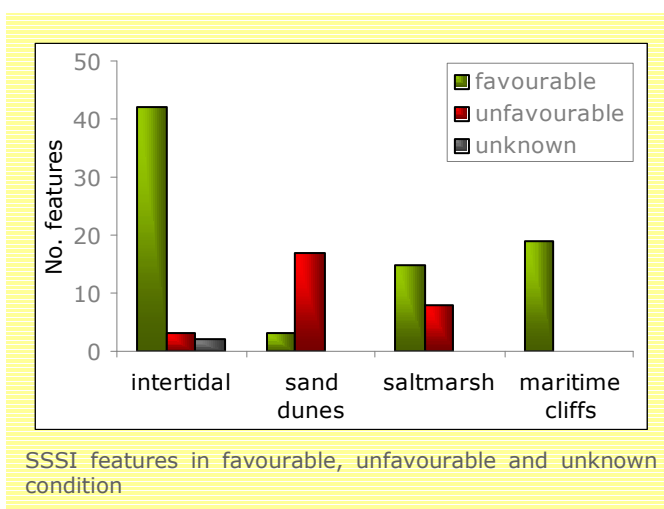
4.2.5 The decline in migratory species of fish from those described historically, when people talked of ‘surfeits of lampreys’ and eels being ‘ubiquitous’ has been caused by habitat loss and degradation across marine and freshwater ecosystems. Most of these species are now highly protected but numbers have not returned to historical levels. At the same time, there is little doubt that the harvest of hundreds of thousands of seals, whales, sea turtles and flightless birds during the commercial whaling era altered marine ecosystems in ways that are now impossible to measure.

4.3 Protected sites and species

4.3.1 Due to the extent of protected marine and coastal sites (SACs, SPAs and SSSIs) in Welsh waters, the condition of these goes some way to describing the condition of the wider Welsh maritime ecosystem. This section briefly outlines our current knowledge of the condition of marine and coastal SSSIs, SACs, SPAs and BAP habitats and species.

4.3.2 SSSI

- In 2004 CCW carried out a rapid review of the status of designated habitats in a number of Sites of Special Scientific Interest (SSSIs). The rapid review showed that 25 out of 55 coastal sites and 58 out of the 63 intertidal sites assessed were thought to be in favourable condition (Allen, 2004).



- In the case of sand dunes, 17 of the 20 sites assessed were classed as unfavourable. The main factors include lack of sufficient grazing and the impact of invasive species (scrub and bracken). Other factors include the impact of forestry, coastal defence works, nutrient enrichment, disruption of hydrology and recreation.
- The review found that 8 of the 23 salt marsh sites assessed were regarded as unfavourable. The problems include inappropriate grazing, water quality and the dumping of dredged material.
- Intertidal SSSIs were reported as being in a better state with 93% considered to be in favourable condition. However, some large sites were described as being in

unfavourable condition (e.g. Milford Haven), or the condition was unknown (e.g. the Severn Estuary). The problems here are largely cumulative, relating to a number of activities occurring in these areas concurrently, including flood defence, piecemeal coastal development, bait digging and discharges resulting in poor water quality.


4.3.3 Marine and Coastal Natura 2000 Sites

- CCW has a statutory duty to report in 2007 to Europe (through JNCC) on the status of its SACs. CCW is currently undertaking work to assess marine sites, which include coastal, intertidal and subtidal habitats and species. Preliminary indications are that roughly 60% of features in marine sites are likely to be considered as in unfavourable conservation status. This is largely due to the insufficient level of control over damaging human activities (see 6.5).
- At present only one marine Special Protection Area (SPA) has been designated in Welsh waters (in Carmarthen Bay for its scoter population) and this is considered to be at Favourable Conservation Status. There are three coastal SPAs in Wales, and another two on the Wales-England border, notified for wintering populations of wildfowl and waders. Only one of the Welsh coastal SPAs (Traeth Lafan) is considered to be in favourable condition. The condition of the two cross-border SPAs, the Dee Estuary and Severn Estuary, has not yet been assessed.

Horse Mussel reefs (*Modiolus modiolus*)

Horse mussel reefs are a marine BAP habitat that are becoming increasingly rare throughout the UK, largely due to the effects of bottom fishing. They perform important functions within the ecosystem, being highly productive and thus providing an important energy source for other ecosystem components. They also increase the structural complexity of the seabed and as a result support a high diversity of organisms.

- There are indications that there used to be horse mussel beds off the north coast of Anglesey, but these have disappeared, probably as a result of bottom fishing. It is not known whether recovery is possible or how long recovery would take for this habitat following physical disturbance but it is likely to be decades.
- A large horse mussel bed off the north side of the Llŷn Peninsula that occurs within a SAC and is protected from fishing disturbance by scallop dredgers through a byelaw of the North Western and North Wales Sea Fisheries Committee. This bed appears to be thriving.



Bill Sanderson / CCW / © Bill Sanderson

4.3.4 Marine and Coastal Biodiversity Action Plan habitats and species

- In December 2005 a review was carried out of the status of Biodiversity Action Plan (BAP) habitats and species in the UK. Results showed that the status of many of these marine and coastal habitats and species is unknown, whilst a few are stable or increasing.

4.4 Ecosystem processes and function

The conceptual difficulties of investigating complex ecosystems, combined with the practical issues associated with the definition and assessment of ‘health’ means that CCW does not currently have comprehensive information about the current status of, or trends in, the ecological functioning of our maritime ecosystems. The scientific community has not yet developed a definitive list of key components that contribute to ecosystem functioning. However, as set out in section 2, physical and chemical processes, biologically-mediated processes and in particular food webs, productivity and nutrient cycling are key elements, with evidence that human activities are currently influencing each of these.

4.4.1 Physical and chemical processes

Energy is the driver of physical processes and the tidal and wave energy environment varies significantly around the Welsh coast. It is of key importance in controlling erosion, sediment transport and sediment deposition. The interplay of these forces over the Millennia has produced the rich tapestry of coastal habitats and landscapes that characterise Wales today. However, this template has been substantially modified in some areas by human activity such as the construction of defences to safeguard capital assets or reclaim land from the sea or by

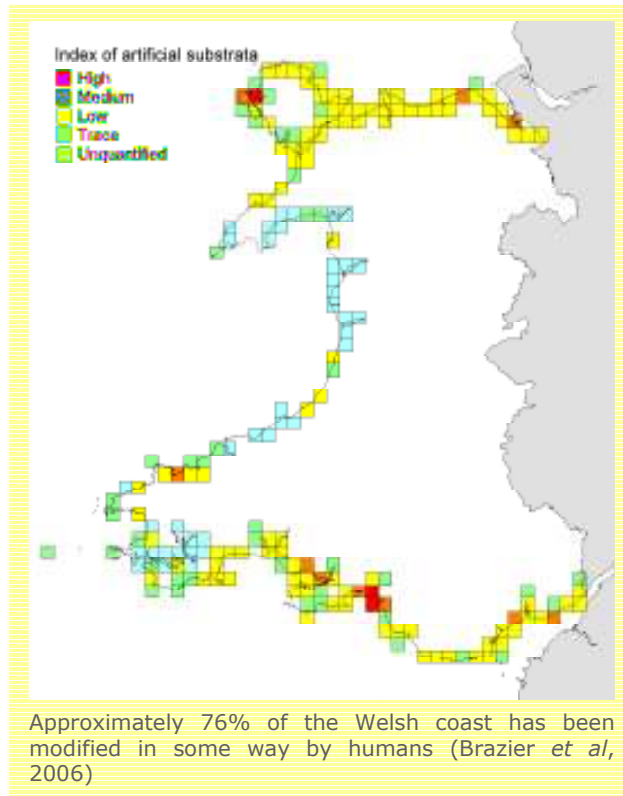
the construction of road and rail infrastructure.



Key railway construction exists close to the coast, acting as a constraint on coastal evolution.

The main anthropogenic influence on physical processes in the Welsh maritime environment is probably through coastal development and sea defence. Coastal and intertidal systems have been heavily modified by sea defence systems and coastal development around Wales. Maintained hard sea defences constrain 29% of the

Welsh coastline; in Newport there is no natural coastline left. If, as predicted, sea level rise continues, this will inevitably cause major coastal squeeze and further loss of coastal and intertidal habitat. CCW's recent intertidal phase 1 survey found that up to 76% of the coast has been modified by humans in some way (Brazier *et al*, 2006). Because of the mountainous interior of Wales the coast has provided a key location for railway construction with approximately 200 km of railway lying on or adjacent to the coast. This acts as a major physical constraint on its ability to



evolve in response to change and a major social and economic constraint on the opportunities for re-enabling natural coastal processes.

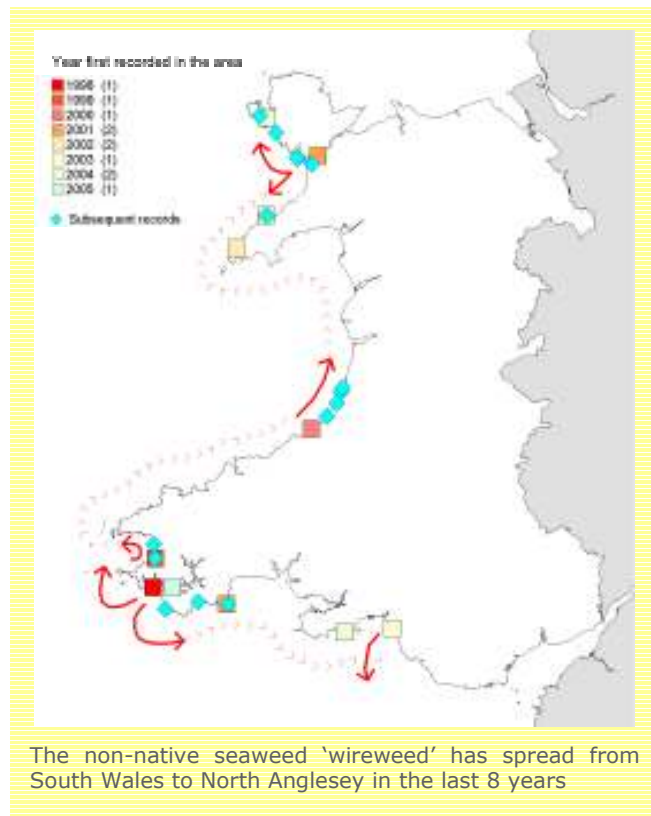
In terms of chemical processes, oxygenation, pH and salinity are important aspects of water quality and can be influenced by human activity. The most obvious anthropogenic impact on water quality is the direct disposal of contaminants into the water column or on to the seabed. However, the disposal of harmful substances has come under strict control over the last 10-20 years and therefore poses less of a threat to maritime ecosystems currently than in the past. Nevertheless, there is a legacy of pollutants such as heavy metals and TBT locked in marine sediments (particularly adjacent to ports and harbours) that can be resuspended through physical disturbance, such as during maintenance dredging. Nutrient inputs from diffuse sources (in particular from agricultural use of fertilisers within riverine catchments) can result in hyper-nutrication and eutrophication in coastal waters whilst water abstraction in rivers and estuaries can have locally significant effects on salinity.

4.4.2 Biologically-mediated processes

There are many anthropogenic pressures that impact on biological processes. Fishing activity by its nature selectively removes certain species and size classes from a population, changing natural predator-prey relationships and resulting in shifts in trophic structure. Aggregate extraction and bottom fishing disrupts the delicate relationship between organisms and the sediment environment they inhabit, de-stabilising the seabed and affecting community

assemblage structure. The anti-fouling chemical TBT, although now banned, had well documented effects on dog whelk populations throughout the UK since it prevented this species reproducing effectively in some areas. The introduction of non-native species (e.g. through ballast water or on ship hulls) can also have negative impacts on native species and communities. Some non-native species now found in Welsh waters are invasive. One example is the seaweed *Sargassum muticum* (also known as wireweed). Originally from

Asia, this seaweed became established in West Angle Bay in 1998 and has spread from South Wales up to North Anglesey (see map). It threatens native algae and seagrass beds by overgrowing them and shading them out, and does not support the same associated communities as native seaweeds. Attempts to remove this species, normally by hand, are largely unsuccessful and therefore once established there is little that can be done to prevent further colonisation and potential effects on other benthic species.



4.4.3 Marine food webs, productivity and nutrient cycling

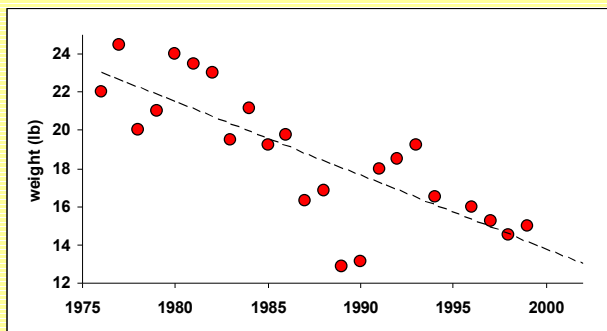
In the marine environment, the use of towed fishing gears (e.g. beam trawls and scallop dredges) damage and kill many animals that live on or within the seabed. The effects of towed gears upon naturally stable habitats are particularly severe, impacting on the species composition of animal communities, reducing species richness, and altering the biomass and the flow of energy production within the system. The repeated disturbance of some sea bed areas by towed gears is thought to be responsible for effects at the ecosystem level by causing the loss of long-lived and slow growing sedentary species. Whilst some localised areas of seabed probably remain untouched, either because they are inaccessible or likely to cause the loss of expensive fishing gear (for example if covered in rocks and boulders), most of the seabed around Wales is likely to have been disturbed by towed gear, and regularly in some areas. Nevertheless, fishing in inshore waters of Wales is less intense than in some other areas of the UK, for example parts of the North Sea.

Commercial fisheries (and probably some recreational fisheries) disrupt the food chain by removing large numbers of target and by-catch species with knock-on effects on their prey and predators. The spur dog (a small type of shark) has virtually disappeared from Welsh waters since the 1980's, when there used to be a thriving fishery for this species, whilst the common skate is now commercially extinct. The wider impacts of this loss is



Skates and rays have declined in Welsh waters as a result of commercial and recreational fishing activity

unknown. By selecting for the largest individuals, fisheries can affect the size structure and potentially the reproductive capacity of target species populations. For example, a recent study has shown that the size of the biggest Welsh-caught thornback ray reported to the



In Welsh waters, the heaviest thornback ray caught by recreational anglers each year and reported to the NFSA has decreased steadily over the past 30 years (Richardson *et al*, 2006)

National Federation for Sea Anglers (NFSA) each year has decreased from a maximum of 24 lb 7 oz in 1977 to an average of about 15 lb more recently. (Richardson *et al*, 2006). The knock-on impact of fishing on sea birds and marine mammals is of particular concern around Wales and the UK.

4.5 'Locked-in' changes

'Locked-in' change refers to irreversible impacts that have already occurred or are likely to occur to maritime ecosystems. Whilst we cannot prevent or control these, future management needs to take into account of impacts that will continue to exert a pressure on maritime ecosystems into the future to a greater (e.g. climate change) or lesser (e.g. persistent pollutants) extent.

4.5.1 Climate Change appears almost certain to result in significant long term changes in marine and coastal environments including increased sea temperatures, sea level rise and ocean acidification, and as such probably poses the biggest single threat to maritime ecosystems (Defra, 2005). The precise effects on maritime biodiversity are difficult to predict

but in general terms we are likely to see widespread changes to the distribution of species and habitats. For example, we may see an advance of southern species into Welsh waters and the retreat of northern species. Recently, the MarClim project (<http://www.mba.ac.uk/marclim>) showed that the toothed topshell, *Osilinus lineatus*, previously eradicated from parts of the North Wales coast by the cold winter of 1962/3, has re-established on the Llŷn Peninsula in response to warming climate. Sea level rise will lead to more pressure on coastal space and, although sea levels are unlikely to change as much around Wales as more eastern UK coasts, these effects will need to be managed in a manner that is sensitive to coastal habitats that are already under pressure. The impacts of ocean acidification are not yet well understood, but preliminary studies indicate the potential for very significant effects on biodiversity at the ecosystem level.

Ocean acidification

It has recently been discovered that surface seawater has increased in acidity by 0.1 pH units. This is because in the last 200 years, the oceans have absorbed about half of the CO₂ produced by human activity. If global emissions continue as predicted, then the pH in the oceans could drop by 0.5 units by 2100. This is lower than has been experienced for hundreds of millennia and would occur at a rate of change much greater than at any time over this period.



Understanding the exact impacts of these changes on maritime ecosystems is difficult but it is likely to be widespread and very significant. Evidence suggests that, amongst other impacts, it will affect the process of calcification, which is widely used across marine groups including plankton, molluscs, crustaceans (crabs, lobsters etc), echinoderms (e.g. starfish and urchins) and corals to make calcium carbonate shells and plates. It is unclear exactly how this will manifest itself in terms of the long term future of these groups but has potentially large implications for the long term sustainability of maritime ecosystems (Royal Society, 2005).

4.5.2 A number of non-native species are already present in Welsh waters (Eno *et al*, 1997). Many of these can be expected to continue to extend their ranges over time. It is unlikely that

we will be able to eliminate them and therefore they will continue to exert a pressure on native assemblages of organisms.

4.5.3 Whilst point-source pollution discharges have now come under very strict control, certain chemicals such as PCBs and some heavy metals are persistent in the environment, and can have ecotoxicological effects many decades after they were originally released. Many of these compounds can bioaccumulate through the food chain over time such that top predators, for example marine mammals, can accumulate high levels in their bodies that can be passed on to their young during gestation and weaning. At high levels, these pollutants can reduce the health of populations making them less resistant to disease and affect their reproductive success. Little is known about the effects of these pollutants in Welsh waters, especially at the ecosystem level, but there are likely to be implications for the resilience of those ecosystem components especially at higher trophic levels. For example, it is likely that organochlorine concentrations affected the immunity of common seals to the recent Phocine Distemper Virus in the UK. Whilst the impacts of these may not be as long term as climate change and non-natives, over the short to medium term they may have significant effects on certain populations.

4.5.4 There is probably only a limited amount we can do to manage the long-term impacts of climate change, established non-native species or persistent pollutants. Any future management will need to take into account the implications of the changes expected to occur as a result of these existing ‘locked-in’ pressures.

Key messages

- Over hundreds of years, the Welsh maritime ecosystem has changed significantly as a result of human activities. There is no baseline against which to measure the extent of this change
- Many of Wales’ protected sites and species are in unfavourable condition and improved management is needed to reverse this and start a trend towards recovery. However, there remains much of real ecological value in Welsh waters and with prompt and effective action Wales can be truly proud of the wealth of life and diversity in its seas
- The pressures that appear to be having a particularly wide-ranging effect and/or effects at the ecosystem level in Welsh waters are fisheries and coastal development, including coast protection and flood defences

- Other pressures are having more localised effects, or effects at the habitats and species level. These include land management (for coastal habitats), bait digging, aggregate extraction and water quality issues
- Due to the difficulties in collecting data about ecosystem functioning and processes, expert scientific judgement is likely to remain an important element in advising on these issues in the short to medium term. Expert value judgement will always be central to the policy-making process
- There are a number of 'locked-in' changes in the maritime environment that we have little control over. These include climate change, which is likely to have the most significant impact of any on the maritime environment in the long term, as well as the existence and spread of non-natives and persistent pollutants. There is a need to ensure that maritime ecosystems, and as such the habitats and species they support, are resilient enough to cope with these inevitable pressures and changes

5. RECOVERING WELSH MARITIME ECOSYSTEMS

5.1 Welsh maritime ecosystems have been altered through historical impacts including land reclamation and long term fishing activity and are under continued pressure from diverse human activities and their associated impacts, as outlined in the previous section. It is important that action is taken to reverse negative trends by facilitating the recovery of our ecosystems to ensure that they are resilient enough to cope with future pressures and are able to continue to provide the goods and services that are expected from them.

5.2 The Ecosystem Approach seeks to encourage the ‘restoration of ecosystem interactions and processes’ (under Principle 5). There are also numerous other drivers for restoration and recovery of the Welsh maritime environment in existing legislation (Box 6).

Box 6: Existing commitments for recovery of maritime ecosystems

Numerous legislative and policy drivers exist at international and national levels that are aimed at promoting recovery of the marine environment:

- Principle 5 of the Ecosystem Approach encourages ‘restoration of ecosystem interactions and processes’
- Under the Habitats Directive member states have a requirement to maintain, restore and avoid deterioration of natural habitats. The Directive allows for compensatory measures, such as habitat enhancement or creation, to offset any negative effects of activities permitted in N2k sites
- Defra state in ‘Safeguarding our Seas’ (2002) there is a need to, ‘where practicable, restore marine areas that have been adversely impacted’
- One of the strategic goals put forward by the Review on Marine Nature Conservation (Defra, 2004) is ‘to halt the deterioration in the state of the UK’s marine biodiversity and promote recovery where practical’
- The Water Framework Directive introduces ecological objectives, and measures, designed to protect and, where necessary, restore the structure and function of aquatic, including inshore marine, ecosystems
- The Countryside Rights of Way 2000 Act places a duty upon the relevant authorities to further the conservation of the living organisms and types of habitat including ‘the restoration or enhancement of a population or habitat’
- The draft Marine Strategy Directive currently includes Programmes of Measures that provide for ‘management tools which guide human activities to restore damaged components of marine ecosystems’
- Objectives of the UK Biodiversity Action Plan include preservation and, where possible, enhancement of native and internationally important species, habitats and ecosystems

5.3 Scientific understanding of the recovery of degraded maritime ecosystems is largely in its infancy. Whilst habitat recreation, restoration and rehabilitation techniques have been used around the UK in coastal and intertidal areas and habitats (e.g. salt marshes, sand dune systems and seagrass beds) with positive results, it is generally accepted that such measures rarely replace or fully restore the natural habitat they aim to recreate (Atkinson *et al*, 2001). As a result, where practical it is better to avoid negative impacts than to attempt to facilitate recovery following unnecessary environmental damage.

5.3 Clearly, there are fewer practical intervention options for securing the recovery of the subtidal marine environment. Here, the best course of action is to remove the source of degradation and allow an area to recover naturally.

Key messages

- Prevention is better than cure, and the need to address recovery in the future may be avoided through effective management of potentially damaging activities
- Numerous drivers for recovery exist, but there is a lack of practical experience of how to secure recovery most effectively
- For coastal and intertidal environments, there are techniques available for restoration and re-creation, however, experience to date indicates that such initiatives rarely result in the successful replication of the ecosystem features they aimed to re-create
- For marine systems, removal of a stressor followed by natural recovery is likely to be the only mechanism to effect recovery

6. MANAGEMENT FOR WALES' MARITIME ECOSYSTEMS

6.1 Management frameworks that already exist for the protection of the maritime environment have the potential to contribute significantly to the implementation of the Ecosystem Approach in Welsh waters:

- European marine sites cover around 30% of Welsh Territorial Seas, and the maintenance of their structural and functional integrity is a key objective of the Habitats Directive.
- The Water Framework Directive delivers a holistic approach to the management of water bodies and offers protection for ecosystems and ecosystem functioning out to 1 nautical mile from the terrestrial baseline.
- A suite of other management mechanisms, including Shoreline Management Planning, Strategic Environmental Assessment, Environmental Impact Assessment and the Environmental Liability Directive are also tools that can underpin the application of the Ecosystem Approach.

6.2 In order to achieve adequate protection and recovery of Welsh maritime ecosystems CCW believes that focussed action is required in the following five areas:

- Marine Spatial Planning
- Marine Ecosystem Objectives
- Improved management of European Marine Sites
- Highly Protected Marine Areas
- Managed Realignment

The forthcoming Marine Bill offers the opportunity to take forward some of these, whereas some are practical issues that can be implemented specifically at the Wales level without the need for new legislation.

6.3 Marine Spatial Planning

6.3.1 There is currently no mechanism for strategically planning and managing the use and exploitation of the maritime environment. Current arrangements for managing the seas have developed in a piecemeal fashion, such that the regulation of individual maritime sectors is the responsibility of a range of Government Departments and other statutory bodies. In addition, the growth in use and multi-dimensional nature of the marine environment means that there may be multiple activities at the same location (either simultaneously or through

time), increasing the likelihood of significant cumulative environmental impacts. A more strategic, holistic and streamlined plan-led approach is needed to ensure that the interests of all legitimate users of the sea (now and in the future) can be accommodated. CCW agrees with Government that a system of spatial planning is an essential part of delivering better protection for, and sustainable use of, the marine environment and should form the overarching framework for improving the management of UK seas.

6.3.2 Any system of planning adopted will need to have sustainable development of the maritime environment at its core. CCW believes that better protection and sustainable use of the maritime environment and its natural heritage can be best achieved with the introduction of a Marine Spatial Planning (MSP) framework, underpinned by the Ecosystem Approach, that delivers integrated management and decision-making. Such a planning system will, by its nature, deliver multiple objectives, only some of which will relate to conservation. However, an underlying principle of any MSP must be the need to safeguard the capacity of the sea to supply essential ecosystem goods and services now and into the future. CCWs' view is that a MSP system should take full account of a carefully developed suite of Marine Ecosystem Objectives, as well as other existing targets and commitments, in order to safeguard the wider maritime ecosystem.

6.3.3 The way that spatial planning might be implemented in the maritime environment is currently under consideration by UK Government as part of the Marine Bill. The precise nature of any MSP system that may be adopted is yet to become clear but it is important that the specific needs of Wales are considered at an early stage. For example, it will be necessary to consider the relationship between MSP and the Wales Spatial plan, and the degree to which marine spatial planning would provide for a prescriptive process including the allocation of space to individual activities. A marine spatial planning system based upon current administrative boundaries would have implications for holistic management at a regional seas level and the delivery of an ecosystem approach. In taking forward MSP for Welsh waters and for the Irish Sea, it will be necessary to work closely with adjacent UK countries and with Ireland.

Recommendations

CCW believes that a MSP system should:

- take account of all existing and future uses of the maritime environment
- have a statutory basis with plans that are legally binding upon decision making authorities
- be formulated, implemented and enforced by a clearly defined body or group of bodies
- ensure that the regulation and management of developments and activities safeguards ecological processes and ecosystem resilience
- provide a framework that translates international and European targets, through UK and devolved level targets, to regional and local spatial plan targets
- integrate with existing governance tools and measures, including the Wales Spatial Plan, land use planning, sectoral management regimes, Strategic Environmental Assessment, Water Framework Directive and Marine Protected Areas
- be informed by evidence-based policy and decision-making processes that take full account of scientific advice and give a strategic focus to the gathering, collation, management, presentation and accessing of data marine environment
- promote participation by being transparent, open, and inclusive and should actively seek involvement of all relevant stakeholders (including local communities)
- be flexible to adapt to future changes in use of the sea as well as better understanding of the way human activity can impact it

6.4 Marine Ecosystem Objectives (MEOs)

6.4.1 Marine Ecosystem Objectives are a concept being explored by Defra that may be taken forward as part of the Marine Bill. The Marine Bill consultation (Defra, 2006) states that Ecosystem objectives would help to:

- Clarify the environmental limits within which sustainable development needs to operate
- Set measurable objectives for key components of ecosystem health

6.4.2 CCW considers that a suite of operational MEOs is required to underpin the delivery of the Ecosystem Approach in the maritime environment. Currently however, more work is required to consolidate the concept of ecosystem objectives and in particular the practicalities of applying them in the context of managing our seas.

6.4.3 In taking forward thinking on MEOs the focus to date has been weighted towards existing commitments and objectives in the maritime environment (Rogers and Tasker, 2005). These largely relate to discrete structural components such as water quality or species populations since management and regulation to date has been focussed at this level. Whilst such components are important aspects of ecosystems, the species and habitats on which they focus are not necessarily the best indicators of ecosystem health and functioning. For example, the selection of habitats and species under the Habitats Directive was not based on the need to ensure the delivery of healthy ecosystem functioning. CCW wishes to see a suite of objectives developed that explicitly recognises the importance of ecosystem health and functioning, and will therefore strengthen the value of existing protection to support the health of the wider ecosystem.

6.4.4 An important consideration is the potential link between a suite of MEOs and the need to achieve Good Environmental Status (GES) under the proposed Marine Framework Directive (Laffoley *et al*, in prep). A suite of MEOs should inform any assessment of GES and it will therefore be important to ensure that the two concepts are compatible.

6.4.5. Developing a suite of Marine Ecosystem Objectives

Thinking on the concept of MEOs is currently developing rapidly. There is a need to work closely with the scientific community to answer some of the difficult but important questions regarding broad ecosystem functions and what indicators could underpin monitoring and assessment of these. It is likely that MEOs will need to be developed and adapted over time as understanding of ecosystem functioning increases. A report by Laffoley *et al*, (2006 in prep.) suggests a series of principles to underpin the selection of Marine Ecosystem Objectives, stating they should be:

- **Comprehensive** – representing the full range of ecosystem components
- **Representative** – characterising the ecosystems they are selected to represent
- **Threat relevant** – including ecosystem elements subject to a high risk of loss or damage
- **Precautionary** – not allowing scientific uncertainty to preclude important ecosystem components

- **Temporally relevant** – effectively integrating short, medium and long term changes
- **User-orientated** – accessible to managers and decision makers

CCW considers that these principles set out a useful basis for the development of objectives for the maritime environment. Nevertheless, in our view, there are some key questions that need to be addressed in order to facilitate the development of an appropriate suite of MEOs. This includes how, in practice, they would be used to inform management. Our view is that MEOs should inform a Marine Spatial Planning system (which is integrated with all marine management regimes, including consenting, SEA, EIA and other relevant regulatory controls) operating at the regional sea and marine landscape scale, and that there should be a statutory duty placed upon all relevant bodies to take objectives into account in their work.

It will be necessary to determine which elements of ecosystem health and functioning should be included in a holistic suite of objectives, and what indicators could be used to monitor these (Gubbay, 2004). Although further work is required to develop a comprehensive suite of objectives, in our view, key elements of the three groups of processes set out earlier in the report should be incorporated:

- **Physical environmental processes:** e.g. Ocean acidification; stratification of water bodies; sediment transport
- **Biologically-mediated processes:** e.g. Community structure; size class distributions
- **Marine food webs, productivity and nutrient cycling:** e.g. Trophic health; biomass

Recommendations

- A comprehensive and hierarchical suite of ecosystem objectives, relevant at the UK seas level and complimentary to the Marine Framework Directive concept of 'Good Environmental Status', that incorporates critical aspects of ecosystem process and function, should be developed
- This suite of objectives should inform the development of Marine Spatial Plans, particularly at the regional sea and marine landscape level. Further consideration needs to be given to establish how, in practise, such objectives would be used to support decision-making
- The suite of ecosystem objectives must be underpinned by the best current scientific understanding. There is a need to develop better links between science and policy in the UK to ensure that policy is based on the most up-to-date science and that research being undertaken by the scientific community fulfils current and future policy needs in this area

6.5 Strengthening the management of Marine Natura 2000 sites

6.5.1 Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) cover a significant proportion (approximately 30%) of Welsh territorial waters, and about 70% of the coastline, encompassing a wide variety of habitats and species populations. Conservation objectives for European marine site features include objectives relating to structure and function, including physico-chemical and biological processes, and seek the achievement of favourable conservation status (FCS). Collectively therefore, Wales' European marine natura 2000 sites offer a significant opportunity for the protection of ecosystem functioning in the Welsh maritime environment.

6.5.2 Currently sites are not being managed effectively. Many activities occur within marine SACs and SPAs that may be having a deleterious effect on the conservation status of the habitats and species for which they are designated. The situation could be improved by more effective implementation of existing legislation and by plugging gaps that allow damaging activities to proceed either completely or partially unregulated. Current inadequacies in the protective regime (outlined below) must be addressed as part of the Ecosystem Approach:

Lack of regulation for certain activities and operations

Where species and habitats are notified under the Wildlife and Countryside Act (WCA) 1981, as amended by the Countryside and Rights of Way Act (CROW) 2000 as features of a Site of Special Scientific Interest (SSSI), the degree of protection for them is high, with infringements of the legislation carrying fines of up to £20,000. However, the majority of the protection measures provided by WCA and CROW apply to owner / occupiers within SSSIs and to planning authorities. Whilst the CROW Act provides some measures for protection of



Existing legislation allows damaging activities to proceed either completely or partially unregulated

SSSI features from third party damage, these measures are, in practice, difficult to apply in the foreshore environment, where many public rights exist. SSSIs do not offer a satisfactory means of providing adequate protection of marine SPAs and SACs, since they do not generally include sub-tidal areas and so cover less than 6% of the spatial extent of European marine sites.

Protective management of the subtidal environment within EMS is limited to the regulation of certain human activities and their immediate environmental consequences. Broadly, these cover discharges and deposits to the marine environment, civil engineering projects (coastal development, construction works, cable and pipeline lays, coastal defence, offshore energy structures etc), certain commercial fisheries, mineral and aggregate abstractions. This leaves a number of gaps where potentially damaging activities are not subject to regulations capable of controlling their

Agitation dredging of marinas and harbours

Agitation dredging is a process whereby material lying on the beds of docks, harbours or marinas and presenting a hazard or impedance to navigation is re-suspended by hydraulic or mechanical agitation and then pumped or enabled to flow out of the dock/marina into adjacent marine waters. It appears that this type of operation falls outside any existing regulatory controls covering dredging, disposal or discharge, since material is technically not 'dredged', 'deposited' or 'discharged', merely redistributed. Nevertheless, depending on the location, timing and method of works, and on the volume and nature of the material concerned, this type of operation has the potential to significantly affect the features of marine Natura 2000 sites.

impact on maritime ecosystems. Examples include fisheries for certain species (e.g. shore crabs), bait collection, resuspension and pumping of sediments from marinas/harbours and the use of powered vessels.

Identification of Competent Authorities

The legislative requirements of the Conservation Regulations⁴ state that "...every competent authority, in the exercise of any of their functions, shall have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of those functions." Nevertheless, some activities with the potential to significantly impact habitats and species of nature conservation importance are effectively unregulated when no competent authority can be identified.

Lack of suitable regulatory powers within authorities

The Habitats Regulations do not provide competent authorities⁵ with sufficient additional powers for protecting features of European Marine Sites, requiring only that competent authorities have due regard for the requirements of the Directive when exercising their

⁴ Conservation (Natural Habitats &c.) Regulations 1994

⁵ The term **competent authorities** includes any statutory body or public office exercising legislative powers, whether on land or sea. **Relevant authorities** are those competent authorities that have powers or functions which have, or could have, an impact on the marine area within or adjacent to a European marine site.

existing functions. Most competent authorities are applying management measures that are not intended for use as conservation management tools and as such lack sufficient powers for the appropriate management of European marine sites. Although the Habitats Regulations empower CCW to make byelaws for the protection of European marine sites, this power is constrained such that CCW may not interfere with any function of any other relevant authority or with any right of any person. Such byelaws are also subject to approval by the National Assembly for Wales and 100 percent agreement of all parties potentially affected before byelaw approval is given, making them unworkable in practice.

When competent authorities have used their byelaws for the purposes of protecting features of nature conservation interest, this typically happens in reaction to problems that have already occurred or are occurring, since byelaws must only be adopted to address an existing problem. However, to be most effective, the protection must be implemented proactively, with foresight, to prevent unacceptable damage and deterioration of conservation features. Retrospective implementation, whilst intended to prevent further damage, takes considerable time to come into force such that the feature or features it aims to protect may have been irretrievably damaged or lost.

Multiple consents in the marine environment

Many developments and activities within the marine environment require multiple consents and permissions, usually from two or more different competent authorities. For example, a proposal for a new marina development might require planning permission from the Local Planning Authority, as well as different licences from Defra, DfT, WAG and the Environment Agency (EA). Under existing procedures, each of these consents and licences is applied for and assessed separately in relation to its likely impact on any SAC or SPA features. This is a time consuming and costly process that can take several months or even years to complete. In addition, it becomes very difficult to consider the cumulative effects of the proposal on SAC or SPA features until relatively late in the whole process. It would be far more efficient to consider the proposal and all associated consents and licences within a unified process.

Lack of understanding of the requirements of the Conservation Regulations within Competent Authorities

Although the Habitats Regulations came into force over 10 years ago, awareness and understanding of their legislative requirements is still poor within some key competent authorities. This is understandable since it is a complex piece of legislation that is still in its infancy relative to other regulations. Whilst key personnel within most of the core competent authorities are familiar with the legislation, this understanding is not necessarily passed to all

of the many officers involved in such matters. Frequent staff changes and internal reorganisations within competent authorities, particularly local authorities, hinder efforts to embed the Habitats Regulations into their day-to-day work. Officers and senior managers in some competent authorities not directly involved with European site management, frequently have no knowledge of the existence of the legislation, let alone of its requirements.

At the same time, for several competent authorities the requirements of the Habitats Regulations are perceived as being in conflict with their primary remit or core work. This is particularly an issue where the regulator is responsible for consenting plans or projects that support its own work (e.g. port authorities and other statutory undertakers). Complying with the Habitats Regulations can be resource intensive, requiring staff time, legal fees etc.

Recommendations

European Marine Sites in Wales need to be managed more effectively in order to achieve Favourable Conservation Status, to maximise their contribution to wider ecosystem health and the delivery of the Ecosystem Approach. This could be facilitated through the following actions:

- **Provision of WAG guidance:**

The preparation of generally applicable guidance on the Habitats Directive and Regulations, relevant to competent authorities operating both on land and at sea, should be seen as a priority. CCW welcomes WAG's recently published consultation draft of revised guidance to local planning authorities on their responsibilities towards nature conservation (Technical Advice Note 5). However, no up-to-date guidance is available for competent authorities generally, who instead rely on reading across from planning guidance or on seeking procedural advice from CCW on a case by case basis. In particular, the following is needed:

- A clear steer on Wales' interpretation, understanding and means of compliance and enforcement with the legislation.
- Mechanisms to increase the efficiency in the way plans and projects requiring multiple consents are dealt with, including identifying lead authorities, so that the cumulative effects of multiple activities and developments are assessed alongside one another.
- The way other environmental regulations (e.g. Water Framework Directive, Environmental Liability Directive) can be used to maximum effect in European Marine Sites

- How Wales can focus more on the requirement to restore damaged habitats as outlined in the Habitats Directive
- **The Marine Bill provides an opportunity to:**
 - Provide the necessary legislative powers and tools for competent authorities to effectively manage, for conservation purposes, activities that may damage conservation features within European Marine Sites
 - Strengthen protection of EMS through the Marine Bill, e.g. by bringing in new legislation that would allow them to be underpinned by Nationally Important Sites or by formally extending seaward some of the provisions of the Wildlife and Countryside Act, as amended
 - Establish additional offences for lack of compliance with the requirements of the Habitats Regulations, including inappropriate damage to features through inappropriate authorisation, or non-management, of damaging activities. There is a need to seek clarity on the potential of the Environment Liability Directive to deal with issues of non-compliance or neglect
 - Provide enabling legislation for the implementation of Highly Protected Marine Areas to provide an increased level of protection to important areas in SACs

6.6 Highly Protected Marine Areas

6.6.1 The term ‘Highly Protected Marine Areas’ (HPMAs) is used in this report to describe areas where there is a presumption against human activities, unless it can be demonstrated they will not have a negative impact on an area⁶. There are numerous examples of HPMAs around the world, but none in Welsh waters and only one in the UK, within the Lundy Marine Nature Reserve, which covers 3.3km² (less than 0.01% of the English Territorial Sea). In contrast, at the Great Barrier Reef Marine Park in Australia, a large network of highly protected areas was put into place in 2004 that covers 33% of the Park (more than 116,000km²). CCW considers that it is a fundamental principle of sustainable resource use

⁶ In many cases it would be appropriate to allow certain levels of non-extractive recreational activity to occur in a HPMA, (e.g. diving, sailing, snorkelling) as well as limited scientific research to inform monitoring and management. Such activities can raise awareness and support for such initiatives as well as having positive socio-economic effects locally. However, some of these activities can have negative environmental impacts in their own right and would therefore need to be carefully managed.

and management that a small proportion of the Welsh Territorial Seas should be allowed, as far as possible, to function without being impacted directly by human activities.

6.6.2 Experience from abroad has shown HPMAs can deliver significant environmental and socio-economic benefits (e.g. Keller, 2005). Many of these areas have been set up with a focus on stricter protection for biodiversity, but benefits to biodiversity can result in benefits at the ecosystem level, for example through increased productivity or nutrient cycling. This is because of the key role that some habitats and species play in ecosystem functioning (Gubbay, 2006).

6.6.3 In order to understand and promote recovery of Welsh maritime ecosystems, and to ensure the protection of certain very sensitive habitats and species, CCW believes that it will be necessary and appropriate to establish HPMAs in Welsh waters. Identifying and implementing HPMAs is probably the only mechanism available to facilitate the recovery of certain ecosystem components, particularly in marine areas. The underlying objective for a HPMA would be to enable recovery to its' most natural state. A suitably designed series of such areas would ensure that representative examples of the entire suite of habitats and species that make up Welsh maritime ecosystems are fully protected in the long term.

The functional importance of seagrass beds

Seagrass beds exist in a number of locations around the Welsh coast and are recognised as playing an important functional role within marine ecosystems. They provide physical structure which (in the same way as horse mussel reefs) enhances biodiversity providing shelter for a variety of organisms including the juveniles of commercially important fish species. Seagrass beds are among the most productive ecosystems on earth. They are an important global sink for carbon, accounting for 15% of the uptake of CO₂ by marine organisms globally (Duffy, 2006).



Blaise Bullimore / CCW / © Blaise Bullimore

HPMAs would provide the following:

Protection and recovery of large and long-lived species

Certain species that are large and late maturing (such as large bivalves like the ocean quahog, *Arctica islandica*) are sensitive to disturbance since they must reach a certain age before they can reproduce. They are therefore vulnerable to disturbances that prevent them surviving to

reproductive age, such as bottom fishing. HPMAAs are an effective mechanism for allowing the recovery of such species and ensuring that they can maintain viable populations in the long term.

Protection and recovery of sensitive habitats

There are a number of subtidal habitats found around Wales, including seagrass beds and horse mussel reefs, that are structurally complex and support very diverse assemblages of organisms. However, they are particularly sensitive to physical disturbance and may be irreparably damaged by just a single pass of bottom-towed fishing gear for example (MarLIN, 2005). Experience at Strangford Lough, one of the UK's three Marine Nature Reserves, where horse mussel reefs have been severely damaged through bottom fishing, highlight the need for stringent protection for such areas if they are to be secured in the long term. It is likely that some such areas have already been lost around Wales and therefore it is particularly important that action is taken to protect those areas where important or sensitive habitats still exist.

Increased resilience of European Marine Sites

In Wales, the sensitive areas that are in need of such high levels of protection would be likely to fall within the boundaries of existing SACs. Offering strict protection to smaller areas within SACs would facilitate recovery and strengthen the resilience of these important sites and provide a major contribution to the delivery of site Conservation Objectives and improved site management.

Better understanding of what a 'natural' maritime ecosystem would look like

HPMAAs would restrict all damaging activities within a given area and thus allow recovery to a more 'natural' state. This would provide a critical baseline to inform our understanding of what an undisturbed maritime ecosystem might look like and how it should function.

6.6.4 Establishing HPMAAs in our waters constitutes a significant challenge in terms of gaining support from those with an interest in the marine environment. It is unrealistic to expect to gain a consensus on this issue, particularly amongst those stakeholders whose interests may be negatively impacted by the designation of such areas. There is a need to develop a better understanding of the potential ecosystem benefits of strict protection in temperate marine systems in order to make a better case for taking forward HPMAAs in Wales. CCW will undertake work focussing on existing evidence for the effects of a high level of protection for areas within the North East Atlantic to address this information gap and inform the debate.

Recommendations

- Currently there is no statutory mechanism for the designation of HPMA's within UK waters. The Marine Bill should be used as an opportunity to allow the provision of legislation to underpin HPMA's in Welsh waters
- More research is needed into the specific benefits we could expect from having HPMA's in Welsh waters
- The choice and implementation of HPMA's must be taken forward in a clear and accountable manner, with the positive benefits of this form of management clearly articulated. There will need to be a willingness to designate HPMA's without the full support of all stakeholders

6.7 Managed Realignment

6.7.1 Finally, CCW believes that a stronger emphasis on managed realignment of the Welsh coastline is required to underpin the Ecosystem Approach. Managed realignment is the term used for the deliberate process of altering a flood defence to allow the flooding of a presently defended area and as such is a mechanism for re-creation and recovery of coastal ecosystems as well as facilitating the natural and dynamic functioning of the coastline.

6.7.2 As outlined in section 4, a significant proportion of our coast is constrained by flood defence and coastal protection, in some cases to protect historically reclaimed land. However, the coastline is naturally subject to continuous change and attempts by humans to hold a fixed line through the construction of such defences and coastal protection significantly constrains coastal processes and results in the loss of beaches and coastal habitats, along with the goods and services that these provide (such as the natural buffer capacity of salt marsh and mudflats). Maintenance of such defences- 'holding the line'- is likely to eat up increasing financial resources in the face of sea level rise and climate change, whilst the likelihood of catastrophic failure of such defences, with risk to human life, is increased. Whilst it will be necessary to continue to protect important assets around the Welsh coastline, CCW believes that in order to establish a more resilient and self-sustaining coastal ecosystem, Wales should take forward managed realignment of areas of coast where this practical option exists. The recently revised Shoreline Management Planning guidance will strengthen the value of the second round of SMPs in informing the development of sustainable solutions at the coast.

6.7.3 Managed realignment offers a significant opportunity to restore natural coastal processes as well as offering a mechanism for Wales to reach, or even exceed, important nature conservation targets. Under BAP for example, Wales has a target of delivering a minimum of 10 ha per year of intertidal salt marsh through managed realignment – minimal in the context of the thousands of hectares that have been lost over the past few hundred years. Given the potential that exists in Wales this is easily achievable over the medium to long term. There are also BAP targets relating to sand dune and shingle along with requirements under the Habitat Directive to maintain existing habitats. In this context the Environment Agency are producing a Coastal Habitat action Management Plan (ChaMP) for the Severn Estuary. This will identify likely SAC habitat losses over the next 20, 50 and 100 years in the Severn and set the framework for where habitat recreation (predominantly through managed realignment) should occur.



6.7.4 There are many areas in Wales where there are opportunities for managed realignment, whilst in other places it is not a practical option. The scale of opportunity varies significantly around the Welsh coast with constraints posed by high value capital assets being a particularly significant issue on the North and South Wales coastline. By comparison, opportunities exist within some mid-Wales estuaries such as the Mawddach where managed realignment could restore up to 500ha of estuarine habitat. Opportunities for realignment (e.g. sale of coastal land) often occur without warning and funding and decision-making systems need to be flexible enough to be able to respond to opportunities where they occur.

6.7.5 Managed realignment in Wales has the potential to deliver a higher quality and more resilient ecosystem combined with an improved landscape and the restoration and re-creation of degraded or lost coastal habitat. The implementation of managed realignment in Wales is still in its infancy and while there are opportunities to take this forward, there are a number of issues that need too be addressed if its full potential is to be delivered:

Gaining practical experience

There is a lack of practical experience in undertaking managed realignment projects resulting in an element of nervousness by authorities in relation to the implementation of schemes. However, theoretical and practical knowledge and experience has now been drawn together in design guidance for managed realignment (Leggett *et al*, 2004). In addition, practical experience from initiatives elsewhere in the UK is helping to provide a better understanding of the actual changes that result from the breaching and removal of defences and coastal protection.

Costs of scheme design and implementation.

The cost of construction of new realigned embankments may, in some cases, exceed that of old embankments since the construction of the breach or removal of old flood embankments is not cheap. In addition, the number of consents required and complexity of the consenting process may be a disincentive to adopting re-alignment options whilst the costs of undertaking an environmental assessment of even a small realignment scheme can be substantial (Halcrow Group, 2002). It is therefore important that the significant long term environmental and financial gains of realignment are more fully taken into account in decisions relating to the maintenance of existing defences.

Public acceptability

The task of gaining public acceptability is considerable in terms of taking forward managed realignment in Wales. Convincing landowners of the importance of undertaking such work in the absence of substantial funds for compensating them for any losses is understandably difficult. This issue is even more problematic where there are substantial assets in the form of homes in locations, which, in the longer term,



It will not be possible to secure all coastal assets in the long term

may be impractical to protect against extreme events. It is important that a targeted campaign to raise awareness is put in place that explains why in the longer term the status quo will not always be a realistic option at the coast. This will prepare the way for bodies such as Local Authorities and the Environment Agency to take difficult decisions regarding these issues. There may be socio economic opportunities through realignment and environment restoration

schemes that can encourage tourism through raising the quality and profile of coastal the environment that could help to build support for the concept.

Recommendations

- There is a need to raise the profile of the critical need for managed realignment in Wales, and develop a more strategic approach to capitalise on opportunities that will be delivered by successful managed realignment.
- Short-term political priorities should not distract from the longer-term decisions needed to ensure that future generations are not left to address the adverse consequences of sea-level rise at the coast.
- Financial resources need to be made available to compensate land owners for loss of land through managed realignment.
- There is a need to raise public awareness regarding the issue of sea-level rise and the long term sustainability (both financially and environmentally) of constraining our coastline, in order to make managed realignment a more palatable solution.

7. CONCLUSIONS

7.1 Wales has a rich maritime ecosystem that delivers important goods and services. However, historical and continuing pressures on the maritime environment have resulted in damage to maritime ecosystems exhibited in declines in biodiversity and loss of habitat.

7.2 In order to ensure the continued delivery of the goods and services that are expected from Welsh maritime habitats there is a need to take action now to develop a more holistic framework for management of human activity, that fully incorporates the need for the protection of ecosystem function.

7.3 Because of the way that maritime ecosystems function, the management of the Welsh maritime environment must be seen within the context of the UK seas and taking forward the Ecosystem Approach will necessitate close working with our neighbours.

7.4 The Marine Bill provides an opportunity to address some of the key legislative issues that are currently an obstacle to the holistic management of UK seas. Nevertheless, there are also practical actions that can be taken within Wales, without the need for new legislation, which must be tackled in order to ensure the sustainability of Welsh seas.

7.5 CCW will work with partners in Wales to take forward and deliver the Welsh Assembly Governments vision for a marine environment that is:

‘valued by all, understood and respected for what it contains and provides. Our seas will be clean, support vibrant economies, and healthy and functioning ecosystems that are biologically diverse, productive and resilient, while being sensitively used and responsibly managed’ (WAG, 2006)

This will require concerted effort in the short to medium term, but is essential if we wish to safeguard Welsh seas for future generations.

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