

UK Marine Biodiversity Indicators

*A Report from the
Second Meeting of the UK
Biodiversity Indicators Forum*

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1. Background and purpose

Indicators provide the Government, other organisations and the general public with an excellent means of monitoring the status of elements of UK biodiversity, tracking pressures and impacts, monitoring response actions and the effectiveness of responses through changes in biodiversity state. Many sets of biodiversity indicators have so far been developed, with key sets for the UK Government including the:

- (a) Quality of Life Counts (QOLC) indicators²
- (b) England Biodiversity Strategy (EBS) indicators³, and equivalents being developed for other parts of the UK.

Biodiversity indicators have also been developed internationally (*e.g.* European Environment Agency indicators), sectorally (*e.g.* Indicators of sustainable agriculture⁴, Indicators of sustainable forestry⁵ *etc.*) and also at local levels (*e.g.* Local Authority Best Value Indicators, Local Biodiversity Action Plans *etc.*) and so there is much expertise and experience in both the development and interpretation of indicator sets at many different levels, expertise which could beneficially be shared.

It was mainly for this reason that Defra initiated the UK Biodiversity Indicators Forum, the first meeting of which was held in March 2002 (see: www.ukbap.org.uk/library/library_2.htm). This meeting focused predominantly on terrestrial ecosystems, with little reference to marine biodiversity. Subsequently, the Government gave a commitment within the EBS to the development of a marine biodiversity indicator and so a Forum meeting dedicated to marine biodiversity indicators was seen to be both timely and worthwhile. The purpose of the meeting was to:

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² *Quality of Life Counts*, DETR, London, 1999

³ *Working with the grain of nature: A biodiversity strategy for England*, Defra, 2002

⁴ *Towards Sustainable Agriculture*, MAFF, 2000

⁵ www.forestry.gov.uk/sfindicators

- (a) Exchange information and experience about the development of marine biodiversity indicators in the UK.
- (b) Identify opportunities for co-ordination and co-operation between initiatives.
- (c) Discuss and recommend a process for the delivery of “an indicator of marine biodiversity” as an addition to the EBS and QOLC indicator sets.

2. Forum meeting details

The Forum meeting took place on 16th June 2003 and was hosted by Defra. The programme for the day is reproduced as Annex 1, whilst Annex 2 provides a list of attendees and the organisations they represent. Thirty people attended the Forum, representing sixteen organisations, an indication of the widespread interest in the topic of the day.

Twelve presentations were made, with intervening and concluding discussion sessions. The individual presentations are not reproduced or documented in full here. Instead, this document provides a brief summary of the key outcomes of the day, particularly in relation to ideas for the development of an indicator or indicators of marine biodiversity for the EBS and QOLC indicator sets.

One obvious gap in the programme related to the potential relevance of developmental work for implementation of the Water Framework Directive (2000/60/EC) (WFD) in the UK. This was researched after the meeting and is outlined in brief in Section 3.2 below.

3. Key specific outcomes

From the presentations and discussions of the day, four main areas of potential development activity were recognised, as follows.

3.1 Potential to adopt/influence existing frameworks

Presentations were made about the EEA’s and OSPAR’s indicator frameworks but it was noted the biodiversity elements were one of the less developed parts. However, as these indicator sets included components relating to species, habitats, designated areas and ecosystems, there seemed to be some considerable merit in exploring in detail the suitability of both the frameworks these initiatives provide, and the suitability of the individual indicators themselves, for our purposes.

Some expressed concerns, however, that these international sets needed to be rationalised, required very large amounts of data and were potentially open to mis-interpretation. The OSPAR EcoQOs are already agreed in principle and work is ongoing towards implementation – however they relate to quite specific and selective management targets and do not attempt to make a more comprehensive assessment of marine biodiversity state – which is the gap in the EBS/QOLC indicators. There was currently potential to influence the EEA and OSPAR indicator programmes since developmental and implementation work is programmed for the next few years. There was also the potential to influence reporting exercises, such ‘State of the Seas’ assessments, which might be important in promoting any new or amended sets of marine biodiversity indicators.

3.2 Potential for joint working with the Water Framework Directive

Several participants emphasised the potential value of recent work being undertaken in relation to implementation of the WFD. This is relevant to estuaries and coastal waters because it is based on a whole river basin system approach, though any monitoring and indicators sets would have to be extended further out to sea to be of relevance to marine biodiversity.

The Directive introduces new broader ecological objectives for the aquatic environment, designed to protect and, where necessary, restore the structure and function of aquatic ecosystems. The principal environmental objectives are to:

- Prevent deterioration in status;
- Restore to good status by 2015; and
- Protect and restore, where applicable, to achieve the objectives for Protected Areas established under Community legislation.

Determining the degree of success in meeting these environmental objectives will require a means of judging the state of the environment and thus status classification schemes are being introduced for chemical status and ecological status. The Directive requires UK responsible organisations to develop appropriate monitoring and classification systems by December 2006.

Ecological status categories are defined by the Directive: five classes are used (from 'bad' to 'high') to represent a different level of disturbance from a reference state. High ecological status is equivalent to meeting reference conditions. The classification system will be underpinned by a range of biological quality elements, supported by measurements of physico-chemistry, hydrology and morphology.

Classification of a water body will require, among other things, the condition of its aquatic plants and animals to be estimated from monitoring information and then compared with their predicted reference conditions. The required monitoring will embrace phytoplankton, other aquatic plants, invertebrates and fish, with factors such as composition, abundance, biomass and age structure assessed. For protected areas, it is anticipated that the 'condition monitoring' being put in place for the *Natura 2000* site series will be used. The Directive requires the use of indicators to measure the condition of the most sensitive quality elements (*e.g.* a sensitive species or group of species or a factor such as photosynthetic pigment levels in the water body's phytoplankton) and also a wider series of quality elements of the ecosystem.

One potential problem is that most monitoring effort will be targeted at water bodies or groups of water bodies identified as being at risk from specific pressures, instead of a wider and more generic monitoring effort. However, the approach could be extended in order to represent marine biodiversity more holistically and could probably produce various indicators relating to marine ecological quality and the condition of marine protected areas.

3.3 Adoption of the 'Taxonomic Distinctness' approach

This approach is being further developed and tested in the RAMBLERS research programme⁶. It was developed because of worries about the limitations of species measures (*e.g.* comprehensive survey impractical) or traditional diversity indices (*e.g.* heavily dependent on sample size or sampling effort) with regards to providing a simple measurement of biodiversity.

⁶ Rapid Assessment of Marine Biodiversity Linked to Environmental Degradation and Remediation Studies

The index is a measure of the taxonomic spread of species present, and may be based on quantitative (abundance) or qualitative (presence/absence of species) data. The latter may be used as a rapid assessment method that involves considering how diverse an assemblage is, based on simple recording of species present.

The method provides some important advantages over other methods, *e.g.* it can be calculated retrospectively from quite low grade information, is independent of sampling effort, has a good statistical framework, can be used predictively *etc.* It is also been shown to reflect well important changes in biodiversity in case study situations. The approach would appear to have considerable merit with regards to the development of a marine biodiversity indicator but exploratory research, testing and validation would be needed.

As part of RAMBLERS, the Taxonomic Distinctness method has been applied using the data from the National Marine Monitoring Programme (NMMP) to identify sites falling above and below their theoretical average index level, a good example of a useful spatial application. In the context of this method, it was noted that the NMMP has much to offer, providing data that is consistently and accurately collected, held centrally and has good statistical validation. It was quoted to be “probably the most consistent data available” and is collected at 72 estuary/offshore stations. Problems exist, however, such as some of the indicators that could be provided from this source need further development, taxonomic representation may need to be expanded and, more fundamentally perhaps, that the selection of recording sites is neither necessarily geographically representative nor configured optimally for biodiversity.

3.4 Adoption of a ‘Trophic Rank Score’ for fish assemblage

There was a general consensus at the Forum, that relatively simple marine biodiversity indicators were required, with high public resonance. This would perhaps be akin to the headline indicator for farmland birds, itself a useful outcome-orientated indicator (and one of the Public Service Agreement – PSA- targets being delivered by Defra). This group of birds had been selected because farmland itself makes up so much of the terrestrial landscape, because good data exist and because birds have considerable appeal to members of the public.

English Nature reminded us of the PSA target for the marine environment – “the maintenance of wider marine ecosystem health” and asked us what a suitable outcome-orientated indicator would be? It would seem that a good equivalent to the use of birds would be fish in the marine environment and so one could adopt a similarly simple approach for the development of a ‘popular’ marine biodiversity indicator (*e.g.* cod from the ‘fish and chip’ shop). For this, English Nature suggested the use of a score for the mean trophic level of landed fish, perhaps with regionalised versions and a separation between pelagic and benthic species. Such an indicator could easily be calculated from existing and historical data-sets.

In discussing this, it was noted that this would not be the same as the already available indicators of fish stock. The approach has merit because it could be built from information for lots of different fish groups, is politically very relevant and would provide one simple ‘overview’ indicator (albeit a fish one). Whilst it was agreed that this could be devised to have popular appeal, there were reservations about how this one, fish-based, indicator would relate to the whole of marine biodiversity. Some linkages could be inferred from existing understanding of the role of fish within marine ecosystems, but the approach would adopt the philosophy of the farmland bird indicator, which is also probably unlikely to be representative of farmland biodiversity as a whole.

A second, complementary, PSA target was suggested by English Nature for the marine environment – the maintenance of marine ecosystem quality. This would be a composite index

consisting of the proportion of marine waters considered to be in good ecological status (see 3.2 above, Water Framework Directive) plus % of Marine Protected Areas in unfavourable recovering through to favourable condition.

4. Generic thoughts, conclusions and recommendations

Throughout the day, significant generic challenges were noted to exist, amongst the most important of which were:

- Keeping in step nationally with international initiatives.

This was a major challenge for any one person, but as a group the forum has an important role to play in maximising opportunities for information exchange, coordination and cooperation.

- Ensuring we work at a scale or scales appropriate to everyone's reporting needs.

In this respect, thorough consultation with all stakeholder groups will be needed about any proposed marine biodiversity indicators.

- Being able to distinguish between natural and anthropogenic changes.

This was recognised as the most difficult challenge faced with monitoring and indicators generally, with only experiments affording an opportunity to disentangle the drivers of change adequately.

- Making the most use of existing data sources (e.g. NMMP, MarLIN, MarCLIM, JNCC condition monitoring) and Gateways for data access (e.g. NBN).

One recommendation in this respect was to ensure that developers, through regulatory bodies, are obliged to make their data-sets available. Work on making existing data-sets more available might also be more cost-effective than initiating programmes to collect a whole new data series. Strong links with the Environment Agency and the Dti will be important if this is happen in the future.

Another was to encourage the involvement of the British Geological Society/NERC in the Forum for the have useful data-sets and experience to inject. Similarly, the Marine Conservation Society has an important role to play in continuing to optimise data quality and utility from their affiliation of recreational divers.

- Making the most of all data collection opportunities

Better coordination and cooperation was seen to be important on a practical level, making sure, for example, that all reasonable opportunities are taken to share boats for the purposes of marine data collection.

- Resourcing the potentially expensive research needed to underpin and routinely produce marine biodiversity indicators.

Potential funding organizations will need to plan for the scope and scale of marine biodiversity indicators work to match likely available resources. Partnerships and sharing of work and outcomes are likely to be needed.

- Using best practice in the derivation of indicators.

Enough best practice now exists to know the characteristics of good indicators. The challenge is to ensure that best practice is implemented.

- Taking care to ensure that indicators are interpreted appropriately.

Indicator information is open to challenge and cases of mis-interpretation are likely to degrade the overall value of indicators as a monitoring and reporting tool. Care should therefore be taken, controls should be put in the place and guidance should be provided with all future indicators to make sure that such problems are avoided.

- Ensuring what we do is understandable to the general public and can be easily communicated.

This is very important and is one of the key characteristics of a good indicator. Some promote the use of surrogate/sign post indicators to portray potentially complex messages from the environment. Others question whether these really do portray the changes we are interested in and warn that surrogates can only be used where these can be shown to be reliable.

- Ensuring what we do is acceptable to Society.

Acceptability from both a resource-spend and methodological point of view is important to the society that we seek to inform.

Overall, it appears inevitable that a suite of marine biodiversity indices might be needed to fully reflect marine biodiversity interests, but several areas of productive research were identified from the Forum meeting (as discussed above). These can be summarised as:

- Examining in detail the relevance of existing frameworks (WFD, EEA, OSPAR) to ensure that UK marine biodiversity indicators can be presented in an international context.
- Monitoring of good ecological condition/favourable condition for designated sites (extended approach based on the WFD).
- Exploring the use of the Taxonomic Distinctness approach for selected taxonomic groups/habitats in coastal and marine waters.
- Exploring the use of Trophic Rank Score' for pelagic and benthic fish assemblages.

It was clear that protected areas monitoring would be needed but wider marine environmental monitoring, from which indicators can be generated, would also be needed to fulfil the requirements for the EBS and QOLC. This was the key gap at present, but there was also need to ensure that appropriate data are, and will be, available through marine monitoring programmes. This will be costly and perhaps logistically difficult but there are many past and current initiatives on which a programme for marine biodiversity indicators can be built.

As is the case for the bird QOLC indicator, which is presented as a headline indicator with separate trends also for farmland and woodland birds, there was suggested to be some merit in

presenting a small number of sub-indicators that relate to different, but critical, parts of the marine ecosystem, *e.g.* hard coasts, soft coasts, benthic, pelagic *etc.*. In this way a headline indicator for marine biodiversity could be built up from its constituent parts, a process akin to that being developed for the Water Framework Directive (and this could be extended for application further out to sea).

In closing the meeting, which had been very productive, it was agreed that a small working group be convened to further consider the various ideas and recommendations formulated and determine the way forward towards the development of indicators for the UK's marine biodiversity.

5. Appendices

Annex 1: Programme

UK MARINE BIODIVERSITY INDICATORS FORUM

Programme

Department for Environment, Food & Rural Affairs

Defra, Page Street, London

Room LG06

16th June 2003

Chairman: John Custance, Defra

10.15	<i>Coffee and registration</i>	
10.45	Welcome	John Custance, Defra
10.50	Purpose of the meeting	Andrew Stott, Defra
Insights into relevant work: Part I		
11.00	European Environment Agency	Richard Emmerson, Defra, standing in for Jacqueline Jones, CEFAS
11.15	OSPAR Ecological Quality Objectives	Stuart Rogers, CEFAS
11.30	Fisheries indicators	Nick Dulvy, CEFAS
11.45	Ecological disturbance of fishing (MAFCONS)	Bill Turrell, FRS
12.00	State of seas assessment	Richard Emmerson, Defra
12.15	Discussion	Paul Leonard, Defra
12.30 Lunch		
Insights into relevant work: Part II		
13.15	Condition monitoring and marine biodiversity work	Jon Davies, JNCC
13.30	National Marine Monitoring Programme	Matt Service, DARDNI
13.45	RAMBLERS research programme	Paul Somerfield, PML
14.00	English Nature initiatives	Dan Laffoley, EN
14.15	MBA work, MarLIN, MarClim	Keith Hiscock, MBA
14.30	Discussion	Richard Emmerson, Defra
14.45 Tea		
Delivery of marine biodiversity indicator		
15.15	Way forward to develop a marine biodiversity indicator	Andrew Stott, Defra
16.00	Chairman's Concluding remarks	John Custance, Defra
16.05	<i>Close</i>	

Annex 2: Participants

UK MARINE BIODIVERSITY INDICATORS FORUM

Department for Environment, Food & Rural Affairs

Defra, Page Street, London

Room LG06

16th June 2003

Participants List

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