ICES WKMARBIO REPORT 2011

ICES SCIENCE COMMITTEE/ ICES ADVISORY COMMITTEE

ICES CM 2011/SSGHIE:02

REF. SIBAS, SCICOM, ACOM

Report of the Workshop on Marine Biodiversity (WKMARBIO): furthering ICES engagement in biodiversity issues

9–11 February 2011

Copenhagen, Denmark

ICES International Council for the Exploration of the Sea

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Recommended format for purposes of citation:

ICES. 2011. Report of the Workshop on Marine Biodiversity (WKMARBIO): furthering ICES engagement in biodiversity issues, 9-11 February 2011, Copenhagen, Denmark. ICES CM 2011/SSGHIE:02. 28 pp.

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Participants at the ICES Workshop on Marine Biodiversity 2011.

1 Executive Summary

In order to ensure that ICES work remains current and correctly focussed in a changing policy environment, ICES has established a Strategic Initiative on Biodiversity Advice and Science. This initiative seeks to build on ICES existing capacity to further develop the profile, relevance, influence and use of biodiversity science and advice. The 2011 ICES Workshop on Marine Biodiversity was a contribution to the Strategic Initiative.

From 9–11 February 2011, 38 participants from 14 countries met at ICES, Copenhagen. The participants included representatives of global, regional and national organisations with responsibility for the development and/or implementation of biodiversity policy met as well as biodiversity scientists and scientific advisors. They were tasked to identify policy drivers, scope issues and solutions relating to biodiversity science and advice and to suggest a future work plan to develop biodiversity science and advice in ICES. The workshop was informed by answers to a questionnaire distributed to ICES customer organisations and all ICES Member Countries in advance of the meeting.

The meeting consisted of 12 plenary talks introducing biodiversity policy drivers and the science, data and assessments that are available to support them. The plenary talks were followed by subgroup meetings on 'data and assessment', 'indicators and reference points' and 'science priorities'. Subgroups presented the outcome of their deliberations during a final plenary session.

This report is not a record of the proceedings of the workshop but instead highlights the key conclusions from the workshop and actions that ICES might take to make a more influential contribution to marine biodiversity science and advice. Particular foci of the report are actions to improve accessibility and quality control of biodiversity data, the selection and application of a more comprehensive suite of indicators and reference points, the understanding of activity-pressure-state relationships and the development of a strategic science programme that ensures ICES can influence and respond to future policy directions.

2 Introduction

In its broadest sense, biodiversity is the variety, quantity and distribution of life. Biodiversity is fundamental to the function and resilience of ecosystems and the goods and services that they provide.

The conservation and sustainable use of marine biodiversity has emerged as the major marine policy issue in recent years and existing and emerging responses to this issue need support at national, regional and global scales. Further, new efforts to describe marine biodiversity; its patterns, linkages, and trends; and the role of biodiversity in supporting the provision of goods and services in a changing environment are recurrent themes of many national and international science programmes.

ICES is already well positioned to support marine biodiversity science and advice. With a network of more than 1600 scientists from 200 institutes linked by an intergovernmental agreement and meeting in over 100 expert groups, it can add significant value to national and international research efforts, co-ordinate data collection and analysis, provide a forum for sharing expertise and offer impartial and consensual scientific advice. ICES also acts as a major custodian and provider of marine biodiversity data.

Existing ICES science addresses the biodiversity of many components of marine ecosystems, the measurement and assessment of biodiversity, and human and environmental impacts on biodiversity. However, the science is distributed throughout ICES and it would be more visible and influential if brigaded and viewed as a thematic package.

Existing ICES advice already addresses a range of biodiversity and ecosystem issues, such as the conservation of marine mammals, protection of cold water corals, species that meet scientific criteria for threatened status, marine protected areas, the development of biodiversity indicators, and integrated assessments of biodiversity and the impacts of human activities on it. Nevertheless, most ICES advice is in response to requests regarding sustainable exploitation of fish populations. To increase the relevance of advice to the broader range of existing and emerging policies ICES must develop additional science and advisory capacity.

The objective of the workshop was to catalyse and then formalise a process to help ICES meet these aims:

- To understand and support the biodiversity data, information and advisory needs of organisations with national, regional and global remits;
- To steer the scientific work of expert groups in ICES to contribute to a wider biodiversity agenda, with an emphasis on the conduct of science that meets tactical and strategic needs;
- To support marine assessment, indicator development, and target setting;
- To help ICES develop and provide advice that makes any tradeoffs between conservation and sustainable use visible and explicit.

Progress towards meeting these aims was supported by talks from plenary speakers representing a broad range of policy and science interests, plenary discussions, a review of responses to questionnaires submitted in advance of the meeting and discussions in three subgroups that focused on: 'data and assessment', 'indicators and reference points' and 'science priorities'.

3 Policy drivers related to marine biodiversity issues

Marine biodiversity conservation and its sustainable use has become an important driver of the management of human activity. Books could be written on the policy obligations and commitments that now apply to ICES member countries, so this introduction is necessarily an overview of the key issues relevant to this workshop.

The 1992 Earth Summit in Rio de Janeiro was, for many, the first time that the concept and phrasing of biological diversity (biodiversity) arrived in public consciousness and was used in international policy. The Convention on Biological Diversity (CBD) derived from this meeting and entered into force in December 1993 as the main global framework. This Convention has three main objectives

- conservation of biological diversity
- sustainable use of biodiversity components
- fair and equitable sharing of benefits arising from the use of genetic resources

Subsequent processes under CBD elaborated goals for the marine environment designed:

- to halt the loss of marine and coastal biological diversity nationally, regionally, and globally;
- to secure its capacity to provide goods and services.

Actions to achieve these goals were to be based on the ecosystem and the precautionary approaches.

A set of targets was agreed at the most recent (2010) meeting of the CBD (www.cbd.int), the most relevant of these to the conservation of marine biodiversity were:

- by 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits; and
- by 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

This protected area target is supported by multiple processes and by criteria agreed upon in 2008 (Box 1) for the selection of Ecologically and Biologically Significant Areas (EBSAs) that may be candidates for protection.

Box 1. CBD scientific criteria for identifying ecologically and biologically significant areas (EBSAs)

- Uniqueness or rarity
- Special importance for life history stages of species
- Importance for threatened, endangered or declining species and/or habitats
- Vulnerability, fragility, sensitivity, or slow recovery
- Biological productivity
- Biological diversity
- Naturalness

At a global scale, the United Nations Food and Agriculture Organization (FAO) responded to the 1992 CBD with the Code of Conduct for Responsible Fisheries (1995). This code advises fisheries managers to:

- assess and maintain ecosystem integrity,
- maintain, rebuild and protect biodiversity,
- rebuild and protect threatened species,
- minimise adverse ecological change,
- reduce waste and bycatch.

This code is underpinned by a series of further guidelines, strategies and action plans, including some still under development (www.fao.org/fishery/ccrf/en).

In parallel with the CBD EBSA process, criteria for the identification of Vulnerable Marine Ecosystems (VMEs) were drawn up by FAO and published as part of international guidelines for deep-sea fisheries in 2009 (Box 2). VMEs are designated in order to protect the biodiversity that they contain from significant adverse impact from fishing activities. The Deep-Sea Fishery Guidelines, including the identification of VMEs, were developed for application in areas beyond national jurisdiction, but States have been invited to apply them, as appropriate, within national jurisdiction.

Box 2. FAO criteria for Vulnerable Marine Ecosystems (VMEs)

- Uniqueness or rarity
- Functional significance of the habitat
- Fragility
- Life-history traits of component species
- Structural complexity

The International Maritime Organization (IMO) has also responded to the threats to biodiversity that occur as a consequence of activities that fall under its remit for the management of international shipping. Traditionally IMO has worked to minimise pollution, but following a 14-year process, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was

adopted in 2004 to reduce the risks to biodiversity from shipping-based transfer of harmful aquatic organisms and pathogens.

The International Seabed Authority is an autonomous international organisation established under the 1982 United Nations Convention on the Law of the Sea and the 1994 Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea. A principal function of the Authority is to regulate deep seabed mining and to give special emphasis to ensuring that the marine environment is protected from any harmful effects which may arise during mining activities, including exploration beyond the limits of national jurisdiction. The 'Regulations for Prospecting and Exploration for Polymetallic Nodules in the Sea' (2000) include requirements to ensure environmentally sustainable development of seabed mineral resources and to notify the authority of any prospecting activity that causes serious harm to the marine environment.

The Convention on Migratory Species (CMS, www.cms.int) is a global Convention that aims to conserve marine migratory species. The Convention acts as a framework for concluding more specialised agreements or memoranda of understanding on particular groups or single species. Of relevance in the ICES area are Agreements on small cetaceans, on seals (in the Wadden Sea) and on waterbirds. These agreements all have requirements to take management actions to conserve biodiversity and frequently have reporting requirements that overlap with those of other legislative requirements.

At a regional scale, the Regional Seas Conventions have responded to biodiversity conservation needs. In the ICES Area, the HELCOM (www.helcom.fi) and OSPAR (www.ospar.org) Conventions both have relevant wording in their main texts and have established agreed strategies and actions for Parties to the Conventions to meet these needs. Both Conventions have monitoring and assessment strategies that include biodiversity.

In 2007, the North East Atlantic Fisheries Commission (NEAFC) published the 'Declaration on the Interpretation and Implementation of the Convention on the Future Multilateral Cooperation in North-East Atlantic Fisheries'. This stated that NEAFC should, when making recommendations relating to Articles 5 and 6 of the Convention (relating to conservation and management measures) "take due account of the impact of fisheries on other species and marine ecosystems, and in doing so adopt, where necessary, conservation and management measures that address the need to minimise harmful impacts on living marine resources and marine ecosystems" and "take due account of the need to conserve marine biological diversity."

In the northwest Atlantic, NAFO has also expanded its consideration of ecosystem issues in its management of fisheries, consistent with UNGA Resolution 61/105.

The Directives and Regulations of the European Union are the main drivers of marine biodiversity conservation and its sustainable use for Member States. The Habitats (92/43/EEC) and the Birds (2009/147/EC) Directives are the primary legislation for conservation and apply strict obligations for identification of protected areas for certain species and habitats and for protection against the effects of particular activities. The Marine Strategy Framework Directive (2008/56/EC) (MSFD) is in the early stages of implementation. In addition to further requirements for the establishment of a network of marine protected areas, its main novel feature is a requirement and timetable for European Seas to be moved to 'Good Environmental Status'. Such a status will be defined by a series of descriptors many of which address conservation and sustainable use of biodiversity (Box 3), underpinned by a set of indicators. MSFD is

complemented in nearshore waters by the EU's Water Framework Directive (2000/60/EC).

The Common Fisheries Policy (currently Regulation 2371/2002) has multiple articles directly applicable to biodiversity conservation needs including "taking measures....to minimise the impact of fishing activities on marine eco-systems" (article 2). Priority areas for biodiversity conservation at present are:

- to reduce the overall fishing pressure to sustainable levels,
- protect sensitive marine habitats and sensitive species,
- avoid food web distortions,
- eliminate unwanted by-catches.

Box 3 Qualitative descriptors for determining good environmental status under the Marine Strategy Framework Directive (those directly relevant to biodiversity are italicised)

1) *Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.*

2) *Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.*

3) *Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.*

4) *All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity*.

5) Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.

6) *Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.*

7) Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

8) Concentrations of contaminants are at levels not giving rise to pollution effects.

9) Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.

10) Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

11) Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

In the Western Atlantic, Canada passed the Oceans Act in 1997, with implementation supported by Canada's Oceans Strategy (2002). This strategy outlines how Canada's international commitments and domestic mandates for marine conservation would be met. The Act includes provisions for the establishment of a system of marine protected areas. In addition the Department of Fisheries and Oceans has developed and implemented a Sustainable Fisheries Framework, intended to place all fisheries management in an ecosystem context, with specific policies for protection of special benthic habitats, for management of bycatches, and for fisheries on forage species. In the USA, the Magnuson-Stevens Fishery Conservation and Management Act, commonly referred to as the Magnuson-Stevens Act, is the primary law governing marine fisheries management. It includes provisions for protecting essential fish habitat as well as conserving and rebuilding fish stocks. Marine protected areas can be created by Presidential decree, and under a variety of Federal and State Laws.

3.1 Reporting and assessment processes

Most policy development and implementation is underpinned by data gathering, reporting, and assessment processes. Most of the policy drivers listed above require these processes. In Europe it is normal for the responsibility for data gathering and reporting to be at the national level. Standards for (and co-ordination of) data collection are often agreed informally through international collaboration, for instance through the Group on Earth Observations Biodiversity Observation Network (GEO BON). The European Environment Agency (along with the European Topic Centre on Biodiversity) has a formal role in collating, quality checking, and reporting data on some aspects of biodiversity in EU seas. ICES conducts similar processes for certain fisheries and ecosystem data.

Assessments are often conducted both at the national level and at the supra-national level. In the ICES area, regional assessments are carried out by the two regional seas conventions. At a global scale, The World Summit on Sustainable Development in 2002 agreed to establish "a Regular Process … for global reporting and assessment of the state of the marine environment … building on existing regional assessments". This process runs on a 5-year cycle with the first fully integrated assessment scheduled for completion in 2014.

4 Improving capacity to deliver biodiversity science and advice

The subgroups, presentations, representatives of other organisations and contributions to plenary discussions all identified issues that should be addressed to help ICES further develop the profile, relevance, influence and use of biodiversity science and advice. This section summarises those issues by topic and provides links to the recommended actions to be taken by ICES secretariat, committees and expert groups.

The current scientific capacity available in the ICES community to support implementation of biodiversity policy is uneven and evolving. In the short-term, existing knowledge and information needs to be marshalled and applied for implementation of existing policies, including the selection of indicators and reference points. In the longer term there is also a strategic need for knowledge, tools and mechanisms to ensure that assessments, indicators and reference points for biodiversity account for the role of biodiversity in supporting ecosystem services, and take adequate account of natural forcing. The development of science to support policy is complicated by natural variability in marine ecosystems, which changes state in space and time.

4.1 Short to medium term priorities

These are primarily the science and advisory actions needed to support the implementation of existing policy. The actions are brigaded together by lead part of ICES in Section 5 of this report.

4.1.1 Data

A comprehensive gap analysis relating to data on all biodiversity issues was not feasible during the workshop, but numerous gaps in the data needed to support some of the policy drivers listed in Section 3 were identified. Recognised priorities were the need to assess habitat distribution and quality at fine scales (relevant to spatial planning, assessing impacts, and some aspects of MSFD descriptor 6 for seabed integrity) (**Action a**), to conserve and make accessible historical data on biodiversity including habitat distribution (to inform the setting of reference points and targets (by others) for the MSFD) (**Action b**), to describe the spatial and temporal distribution of activities and the resulting pressures in the ICES area (to underpin analyses of the links between pressure and state, Section 3) (**Action c**) and to describe the spatial and temporal distribution of ecosystem services, once methods for achieving this objective have been defined.

The absence of comprehensive metadata to accompany biodiversity data increases the risk of misuse and misinterpretation. The ICES Data Centre is acquiring such metadata where they are not currently available. It is also necessary to increase awareness of the limitations of data in relation to the reporting of specific indicators, and data limitations should be accounted for during indicator development. This would include efforts to develop indicators that are robust to expected uncertainties in data and/ or a quantitative analysis of the potential effects of data limitations on indicator performance (**Action d**). It is also desirable to define quality assurance standards for data used to support policy drivers, ICES could revisit this need as indicators are developed and reference points defined. ICES should also continue to ensure continuity in capability to support reliable data collection (e.g. taxonomy and co-ordination of surveys) and identify and evaluate new technologies as they become available (**Action e**).

Data collection is usually carried out within a specific sampling design that is suited to the initial primary purpose for which the data will be used. This strategy may make the data less useful or even inappropriate for other purposes. Even when data collection has been conducted within a design that can be used for multiple purposes, its use and its reporting often has to be undertaken within different boundaries. The governance boundaries that are relevant to different policies do not consistently match with each other or with ecological boundaries. The former needs careful consideration because many biodiversity reporting obligations, for example to the CBD and MSFD, are at national scales but fisheries and environmental management through the CFP and MSFD seek to meet targets that are set at transnational scales. The latter is an issue because ecological responses to management actions are likely to be influenced by processes reflecting ecological boundaries, such that outcomes may be different from those intended when the management actions were taken.

Data should ideally be collected and stored at the finest scale possible, thus allowing for reporting on different scales. This strategy requires both careful survey design and preserving the details of specific sampling locations rather than only storing and managing aggregate statistics (e.g. on the scale of ICES rectangles or other manage-

ment units) (**Action f**), For flexibility in aggregation it would also be desirable to harmonise data collection and reporting processes across scales in space and time.

4.1.2 Indicators and reference points

Much of the work for evaluating environmental status and contrasting it with policy and management benchmarks will be done independently by various groups, in the case of the MSFD at national scales. To promote consistency and soundness of practices of these groups, ICES, through appropriate Expert Groups (particularly WGECO) and ACOM should develop a number of proactive guidance documents in 2011 and 2012 to provide expert guidance on defining reference points or reference conditions that correspond to sustainable use (**Action g**). These documents include:

- Best practices for setting reference points in changing conditions (to ensure sound science and avoid shifting baselines) (2011);
- Clarifying the issues to be considered and the consequences of using pressure based indicators (e.g. importance of understanding and documenting causality in pressure-state relationships, design of efficient follow-up sampling, how to deal with impacts of multiple pressures) (2012);
- Best practices for developing indicators and setting reference levels in data poor regions (2012);
- Best practices for setting reference levels that reflect sustainable use (2011);
- Guidance on if and how expert judgment should be combined with supporting indicators to produce the best possible information and advice on ecosystem status and management options (2011);
- Implications for role and necessary properties of indicators and reference levels to support application of spatial management measures; the significance of source-sink dynamics in application of those measures (2012);
- Best practices for setting reference points for non-indigenous species (2012).

In some reporting and assessment frameworks there have been attempts to summarise indicators and provide aggregate measures of ecosystem status and trends. ICES could advise on the choice and application of analytical methods to consolidate indicators and interpret the policy and management implications of these aggregate indicators, including disaggregation of such indicators to correctly communicate the information needed to guide management and policy responses (**Action h**).

ICES should review the scientific "merit" / reliability of use of indicator species in various applications. The practice of using the presence, abundance or distribution of indicator species is well-established and supported with evidence for pressures such as contaminants and nutrients. In other cases, particularly with regard to communicating overall ecosystem or habitat status, the scientific case for using indicator species is less secure for marine ecosystems. Where the practice is considered to be sound, ICES should prepare guidance on best practices for selecting such species (**Action i**).

There are regional and global commitments to the effect that management decisions cannot knowingly inflict serious or irreversible harm to ecosystems. Although the language can vary slightly among policies, ICES should develop the capacity to advise on the limits beyond which policy options pose risk of such harm. ICES is well positioned to look at the various biodiversity properties that may be seriously affected by pressures or must be in a particular state to achieve a 'healthy' ecosystem

and to advise on how these biologically based limits should be set for different classes of indicators (**Action j**).

Table 4.1.2.1 summarises the types of indicators that might be developed to support the needs of policy and management agencies and applied to the various components (e.g. plankton, benthic invertebrates, fish, birds, marine mammals) and pressures (e.g. aggregate extraction, fishing) in marine ecosystems. This table can be used as a starting point for ICES expert groups that focus on specific ecosystem components to report on (i) the strengths and weaknesses of these classes of indicators, (ii) to identify those that are most suited to supporting the policy drivers identified in Section 1 of this report, (iii) to recommend modifications to these indicators if appropriate, and (iv) to describe the process that would be used for data acquisition, analysis and reporting of the indicators (**Action k**). For the indicators that are selected, the ICES expert groups will then comment on any tradeoffs that need to be understood when targets are set (by others) for these indicators, the information, data and tools that are available to assess and quantify these tradeoffs and how the indicators, targets, and tradeoffs might be presented as advice. If there are additional data, information and science needs to quantify tradeoffs the groups will also seek to identify and report on these. Table 4.1.2.1 is intentionally comprehensive as the classes of indicators will be considered for many components and pressures. However, it is expected that only a few of these indicators will be relevant and applicable for any given ecosystem component.

Table 4.1.2.1. Classes of indicators that would be of short term or medium use to policy and management agencies.[1]

Type	Class	Level / scale	Specification / type of property	Relevance – type of users
State/ structure	Diversity	Community	Structure	All
	Diversity	Community	Functional diversity	All
	Population	Species or stock	Size, Range, Composition	All
	Population	Protected, Endangered and Treatened species Invasive species Charismatic Highly migratory Bioengineers Forage	Size, Range, Composition	All
	Genetic Diversity	Species (other levels in specific cases)	Structure	Fisheries Management, Conservation
	Habitat	Multiple scales	Size, Range, Composition	All

[1] **The column headings were developed for convenience at the workshop and are to be interpreted colloquially. In some cases the terms in the table and heading do not match more precise uses of the terms in formal ICES advice.**

Type	Class	Level / scale	Specification / type of property	Relevance – type of users
	Habitat	Multiple scales	Usage – population / community use of available habitat	Conservation & recovery; (All)
	Habitat	Multiple scales	Proportion of suitable conditions where habitat is present	Conservation & recovery, (All)
	Habitat	Species/ Community	Patchiness and connectivity	Conservation, Fisheries
State/ Function	Strategic	Community/ Ecosystem	Marine trophic index (MTI), other trophic indicators from models or community data	Conservation, biodiversity (reporting on state of system - SOS)
	Strategic	Community/ Ecosystem	Ratios of functional groups	Specific to pressure; Reporting SOS
	Strategic	Community/ Ecosystem	Flow/length of food chain, etc	Biodiversity & conservation; Reporting SOS
	Strategic	Community, ecosystem (Population)	Resilience	Reporting on SOS. Indirect back to All
Pressure	Magnitude/ extent of activity; trend	Multiple scales/ Ecosystem	Inherently pressure-specific	Fishing, Shipping, Tourism, mining, oil extraction, etc. All
	Accumulated effects	Species/ Community	Pollution, contamination	All
	Environmental forcing	Community/ Ecosystem	Physical and chemical variables; community abundance of characteristic species / groups (southern, calcifiers)	All (accommodate but not manageable)

4.1.3 Activity– pressure–state relationships

Understanding of activity-pressure-state relationships is essential if management actions to meet defined targets for biodiversity are to be identified and applied. Many of the regional users of biodiversity advice saw the elucidation of the pressure-state link as one of the most important issues to support policy implementation. At present the activity data needed to underpin such analyses are not consistently available (see Action m below), nor is the understanding of the pressure-state links and the influence of the environment on these.

In conjunction with the development of indicators and reference points for biodiversity, it will be necessary to establish the changes in pressure (and hence in the human activity causing that pressure) that are needed to meet the reference points (**Action l**). The highest priority should be given to establishing pressure-state links for indicators that are being used or proposed to support policy needs.

The investigation of pressure-state links also raises questions about how best to determine and report on the relative contributions of different activities to total pressure and hence their relative contributions to changes in biodiversity. For some activities, pressures have yet to be quantified on spatial and temporal scales that are appropri-

ate for research on pressure-state relationships. ICES should describe the spatial and temporal distribution of activities and the resulting pressures in the ICES area (**Action m**). It will also be necessary to assess whether the effects of multiple pressures are additive or synergistic and how any interactions should be accounted for in management (**Action n**).

Pressure-state relationships can be influenced by the environment, as has been long-established when attempting to link changes in fishing mortality to changes in abundance. ICES should evaluate the ways that policy and management might make practical use of indicators of environmental conditions, many of which are already available (e.g. upwelling indices off Iberia, the ratio of the abundance of two copepod-species in the Baltic or North Sea) in strategic policy and management. A guidance document on best practices for how such indicators of changes in ecosystem condition could be taken into account by policy makers and managers would be of great value, once the science has matured (**Action o**).

A better understanding of relationships between management actions (taken within management boundaries) and changes in biodiversity (within ecological boundaries) would be a help in better defining pressure-state relationships (see Section 4.1.1). Where possible, ICES should identify options or possibilities for harmonising boundaries in order to improve the consistency of biodiversity and pressure reporting (see Action f).

It is also possible to evaluate how management implementation in one area (or time) affects another area (or time), while recognizing that connectivity of systems and source-sink dynamics are often poorly known. Connectivity studies of representative species (contrasting life histories) and ecosystems (circulation) can contribute to advice on management and policy actions to help conserve genetic diversity and population structure (SCICOM and Science Plan)

4.1.4 Assessing management trade-offs and tools

Trade-offs among multiple objectives (for different sectors or for ecological, economic, and social outcomes of a single sector) are inevitable at national, regional and global scales. Science has an important role in informing choices about the consequences of different management actions and in making decisions transparent. Questions that need to be addressed by ICES (**Action p**) include:

i) Articulating and quantifying the implications of different policy objectives, and how particular choices for one objective might constrain or create opportunities for other objectives, thus informing societal decisions before they are taken;

ii) providing guidance on the relationships between pressures and impacts, and between the scales of activities and the magnitude of the pressures they create, thus informing how allocation of opportunities among sectors changes the aggregate pressures on biodiversity;

iii) providing guidance on how to incorporate externalities such as natural variability in (ii), so they are considered in sustainable allocation of sectoral opportunities;

iv) Conducting periodic high-level integrated assessments to evaluate if the allocation scheme adopted has achieved a sustainable balance among pressures.

Science can also provide advice on potential incompatibilities of targets amongst policies/sectors and therefore help to avoid them (**Action q**). Aspects of the role include needs for coherence in scientific advice/ information provided at different scales and the need to include experts trusted by each relevant sector/ agency being asked to act on science advice and information. Coherent science advice could be developed further at the sectoral level.

Several biodiversity-related policies call for the establishment of Marine Protected Areas. There is a need for science advice on fulfilling global and regional targets for the ecological coherence and other properties of MPA networks and for the types of management measures needed to meet particular MPA objectives (**Action r**).

4.1.5 Co-ordination and sharing expertise

ICES is one of several scientific and/ or advisory bodies that are conducting biodiversity science and/or collating and analysing data to give advice on status and trends in biodiversity and their links to human activities. Recognising the range of adopted approaches and their different strengths and weaknesses, it would be helpful for these bodies to share their experiences, in particular to develop best-practice that may support a move towards greater consistency and rigour in national, regional and global biodiversity reporting. Further, feedback processes that encourage nations and regions to contribute to global marine assessments are not consistently formalised. In the case of the CBD, national focus points generally concentrate on terrestrial issues, but would receive more marine data and advice if there were a process to support this. Nothing precludes the national focal points from receiving and passing on more and better marine data and information. However national governments have generally placed the focal points in Ministries with terrestrial mandates, and provided few incentives for those Ministries to reach out to marine Ministries. There is a potential role for ICES to use its existing capacity for regional review and assessment to support member countries in delivering consistent and compatible advice to CBD focal points in member countries. There is a parallel need for a process to capture and share regional experiences that have worked well (e.g. the NEAFC-OSPAR cooperation in the NE Atlantic), in contrast to those that hit barriers in policy development or implementation, in ways that highlight lessons learned. It would be desirable to scope how the sharing of experience and best practice might be achieved, for example by working with other regional and/or scientific advisory bodies to establish a forum for sharing information on biodiversity assessment and target setting (**Action s**). Such a forum would add value to existing national, regional and global efforts.

4.2 Strategic science priorities

Strategic scientific initiatives should be developed over the coming decade in anticipation of their potential use in future decisions. They support needs that are considered to be urgent, but for which inadequate solutions can be provided with available data and knowledge. Particularly in the context of the ecosystem approach, efforts to sustain individual species or reference points for biodiversity may become overshadowed by efforts to sustain function and service. Biodiversity and ecosystem functions contribute to the emergent properties of resilience and habitat integrity. The capacity of ICES to address the strategic science priorities identified below should be assessed by ICES in 2011 (**Action t**)

In a broad sense, methods to value final ecosystem services (goods of direct value in commerce to humans such as fish production) are more likely to influence management and policy decisions than intermediate services (processes that support final

services). Policy widely recognizes the need to preserve function, but considerable effort is needed to: (1) develop a better capacity to evaluate how biodiversity contributes to function (2) develop effective metrics of ecosystem function; (3) evaluate roles of species and/or functional groups in ecosystem functions; (4) understand how different pressures, single and cumulative, affect function.

A better understanding of biodiversity patterns is necessary to identify diversity hotspots including the development of methods to integrate biological data from disparate sources (e.g. trawls, grabs, photographs), and the development of diversity metrics (genetic, species, functional) so that approaches can be applied regionally and holistically (**Action u**). Integration of existing and emerging methodologies (e.g. genetic barcoding) can produce better data on biodiversity patterns in poorly known groups and geographic region.

Better metrics are needed to evaluate changes in functions with changes in biodiversity. Though production is comparatively easy to measure, capturing indicators of nutrient cycling, carbon sequestration/cycling and other functions are far more difficult (**Action v**).

A better understanding is needed of the specific functional role of species in delivering ecosystem services, and the degree to which these services depend on particular species or functional groups. Services of particular interest include fishery production, climate regulation, critical habitat for commercial species, clean water, and essential fish habitat, that are facilitated by major functions that include productivity, nutrient cycling, carbon sequestration, resistance to disease, pollution remediation, and habitat complexity. Owing to the challenges of quantifying function overall, and assigning functional roles for individual species in complex communities, there would be great value in identifying surrogates for function that can be widely applied, if such exist. Such an effort should include a strategy to specify the functions served that made the species a 'keystone' and look for (and report) these function (**Action w**). Better understanding of the functional role of species in delivering ecosystem services would support the analysis of relationships between biodiversity and service provision.

A better understanding is needed of how cumulative pressures may affect ecosystem function. This effort would expand on exploratory studies that compare distributions of biodiversity and functions to determine whether multiple functions that operate simultaneously within a location respond differently to a change in state. Multivariate analyses of biodiversity-function relations using manipulative laboratory experiments and field "manipulations" such as closed areas may be a step forward, if they are designed in ways that allow results to be extrapolated natural systems. Once a link between a pressure and a state has been established, it may be possible to develop new state indicators to support assessment.

In order to understand how future environmental variation and change affects pressure-state relationships, it would be useful to further develop methods to downscale climate models, but at the same time upscale ecological and fisheries models so both are useful at national/regional scales (**Action x**).

5 Recommendations for actions to support the capacity of ICES to engage further in marine biodiversity issues

This section summarises the recommendations from WKMARBIO and links them to those parts of ICES that we consider to be most appropriate for leading the response to the recommendations. Please refer to Section 4 of this report for supporting and background information. Further possible actions were derived from the responses to the questionnaire and are listed in Annex 4.

5.1 ICES Secretariat/ Bureau

(s) ICES Secretariat (2011). Establish a forum for sharing information on biodiversity assessment and target setting, to add value to existing national, regional and global efforts.

5.2 ACOM initial lead

(f) ACOM (for biodiversity related requests from 2011). Ensure that the ICES Data Centre, and any expert groups that are responsible for developing or co-ordinating survey design and using survey data for biodiversity assessment, are aware of the range of management areas for which indicators should be reported and any spatial incompatibilities between them. This is to encourage data collection processes that most effectively support multiple reporting processes.

(g) ACOM. Ask WGECO and other relevant expert groups to address additional Terms of Reference in 2011 and 2012 (with review in 2012) to provide guidance documents (see Section 4) that will help to promote consistency and soundness of practices when evaluating environmental status (for Marine Strategy Framework Directive).

(h) ACOM (2011 ASC). To establish and manage a process for developing guidance on the choice and application of analytical methods to consolidate indicators and to interpret the policy and management implications of these aggregate indicators, including disaggregation of such indicators to correctly reflect the information needed to guide management and policy responses.

m) ACOM-SCICOM-SIASM (2011 ASC) To develop a process to describe in a consistent and accessible form, and at a scale relevant to management needs, the spatial and temporal distribution of human activities and the resulting pressures in the ICES area. This should involve the creation of a new expert group that draws on data provided by SGVMS, WGEXT, WGDEC, WGDEEP and others and compiles data on activities and pressures.

(p) ACOM (2011 ASC) To develop a process that explicitly describes the trade-offs that will need to be made in management meet specified objectives for biodiversity conservation and sustainable use. While some of this process is already in place within fisheries advice, the contrasts between the often data-rich area of fisheries management and the data-poor area of biodiversity conservation will pose particular challenges. Section 4.4 of this report provides further areas for consideration.

(l) ACOM-SCICOM (ongoing from 2012). A rolling request to ask relevant expert groups to define and test for the existence of activity-pressure-state links for indicators of marine biodiversity that are being proposed, developed, or tested for management. The request is not relevant to biodiversity indicators that are solely used to

report changes in ecosystem state but are not linked to a defined management process

(q) ACOM-SCICOM (ongoing as biodiversity targets are being established) Establish a programme to develop methods for assessing compatibilities and incompatibilities between targets.

(r) ACOM-SCICOM (ongoing). Develop advice on the ecological coherence and other properties of MPA networks and on management measures needed to meet MPA related objectives.

5.3 SCICOM initial lead

(i) SCICOM-SSGEF (2011). To establish and manage a process to review the use of indicator species in marine environmental management and to prepare guidance on best practice for selecting such species.

(a) SCICOM-SSGSUE ToR WGMHM (2012). Review policy drivers relating to the management of seabed habitat and define scales for describing the distribution and types of habitat that would be needed to support these drivers. Initiate a process for describing habitat in the relevant categories at the relevant scale.

(b) SCICOM-SSGSUE ToR SGHIST (2011, recognising that they meet after the 2011 ASC). Describe the availability of historic biodiversity and habitat data for each of the regions covered by the Marine Strategy Framework Directive and assess the utility of such data for assessing historic states and informing target setting (by others) for the Directive. (If not regarded as sufficiently fishery focused by SGHIST then consider this as a ToR for WGMHM in 2012)

(c) SCICOM- SSGEF (2012). Assess capacity of expert groups to contribute to mapping the spatial and temporal distribution of ecosystem services in the ICES region and work with them to develop a scientific plan to achieve this, possibly including the establishment of a group specifically to work on the science and assessment of ecosystem services.

(u) SCICOM (2012) Request WGBIODIV to consider methods to integrate biological data from disparate sources and using various metrics in order to better describe biodiversity hotspots.

(v) SCICOM (2012). Task relevant expert groups to develop metrics for assessing changes in ecosystem function with changes in biodiversity, taking account of the 2011 WGBIODIV review of ICES science capacity in this area.

(w) SCICOM-SSGEF (2012). Task-relevant expert groups to identify functional characteristics that would lead to the classification of 'keystone' species, taking account of the 2011 WGBIODIV review of ICES science capacity in this area.

(x) SCICOM-ACOM (2012). Task-relevant expert groups to assess how future environmental variation and change is expected to affect pressure-state relationships for biodiversity

(d) SCICOM-ACOM (ongoing from 2012). For any expert groups tasked with developing biodiversity indicators in support of policy drivers there should be a standing request to develop indicators that are robust to expected uncertainties in data and/ or to provide a quantitative analysis of the potential effects of data limitations on indicator performance.

(e) SCICOM-SSGEF request WGBIODIV (ongoing from 2012) to conduct a regular assessment of new technologies that can support improved biodiversity monitoring and assessment.

(o) SCICOM-ACOM (ongoing from 2012). To manage a process to develop a guidance document outlining best practices to assess how indicators of changes in ecosystem condition could be taken into account by policy makers and managers.

(n) SCICOM- SSGEF (on delivery of compiled data on activities and pressures). To establish a new expert group on cumulative effects to assess whether the effects of multiple pressures on biodiversity are cumulative or synergistic and how any interactions should be accounted for in management.

5.4 Expert Groups

(t) WGBIODIV (2011) Assess ICES capacity to address the strategic science priorities identified in the Report of the 2011 ICES Workshop on Marine Biodiversity Science and Advice.

(j) WGECO with ACOM review (new ToR 2011). To assess when components of biodiversity are subject to serious or irreversible harm in order to guide the setting of limits for biodiversity indicators.

(k) WGDEC, WGEF, WGFE, WGMHM (with SGVMS and BEWG), WGMME (2011). To review Table 1 in this report consistent with the Terms of Reference set for 2011.

Annex 1: Agenda for ICES Workshop on Marine Biodiversity 2011

9 February

12.00 Welcome to ICES (*Adi Kellerman, Vivian Piil*)

12.15 Tour de Table

12.30 Workshop objectives and organisation (*Simon Jennings, Mark Tasker*)

13.00 Lunch (provided in ICES Secretariat)

SESSION 1. DRIVERS FOR BIODIVERSITY ASSESSMENT

14.00 Session introduction (*Paul Snelgrove, Session Chair*)

14.05 CBD COP 10 outcomes on marine biodiversity and implications for biodiversity assessment (*Jihyun Lee, Secretariat of the Convention on Biological Diversity*)

14.20 Biodiversity information needs of the FAO (*Gabriella Bianchi, Food and Agriculture Organisation of the UN*)

14.35 Marine biodiversity information needs for the Marine Strategy Framework Directive and related European policies (*David Connor, European Commission)*

14.50 Marine biodiversity information needs for the Common Fisheries Policy (*Ken Patterson, European Commission*)

15.05 Session discussion

15.30 Tea/coffee

SESSION 2. DATA AND ASSESSMENT

16.00 Session introduction (*Mark Tasker, Session Chair*)

16.05 Measuring progress towards global biodiversity targets (*Damon Stanwell-Smith, Biodiversity Indicators Partnership/ UNEP*)

16.20 Biodiversity data requirements for international marine assessment (*Louisa Wood, United Nations Environment Programme*)

16.35 EEA role in supporting marine biodiversity reporting (*Trine Christiansen, European Environment Agency*)

16.50 Session discussion

17.15 Close

10 February

SESSION 3. BIODIVERSITY PRIORITIES FOR THE REGIONAL COMMISSIONS

09.00 Session introduction (*Jake Rice, Session Chair*)

09.05 Biodiversity information needs of the Oslo and Paris Commission (*Emily Corcoran, OSPAR Secretariat*)

09.25 Biodiversity information needs of the Helsinki Commission (*Samuli Korpinen, HELCOM Secretariat*)

09.45 Session Discussion

10.30 Tea/coffee

SESSION 4. BIODIVERSITY SCIENCE AND INDICATOR DEVELOPMENT

11.00 Session introduction (*Simon Jennings, Session Chair*)

11.05 DIVERSITAS, marine biodiversity and plankton indicators (*Peter Burkill, DIVERSITAS*)

11.20 'Living planet index': scalability and marine data needs (*Louise McRae, Zoological Society of London, Institute of Zoology*)

11.35 The ICES Data Centre: providing data on marine biodiversity (*Neil Holdsworth, ICES*)

11.50 Session Discussion

SESSION 5. SUBGROUPS

12.20 Introduction to subgroups (*Simon Jennings, Mark Tasker*)

1. Data and assessment (*Louisa Wood, Chair; Steven Degraer, Rapporteur*)

2. Indicators and reference points (*Jake Rice, Chair; Emily Corcoran, Rapporteur*)

3. Science priorities (*Paul Snelgrove, Chair; Martin Solan, Rapporteur*)

13.00 Lunch (provided in ICES Secretariat)

14.00 Subgroups convene

15.30 Tea/coffee

16.00 Preliminary subgroup reports (*Steven Degraer*, *Jake Rice, Martin Solan*)

16.20 Subgroups (continued)

17.00 Close

11 February

09.00 Introduction to day

09.10 Subgroups (continued)

10.30 Tea/ coffee

11.00 Subgroups (continued)

13.00 Lunch (provided in ICES Secretariat)

14.00 Subgroup 1 report to plenary (*Steven Degraer*)

14.10 Subgroup 2 report to plenary (*Jake Rice*)

14.20 Subgroup 3 report to plenary (*Martin Solan*)

14.30 Plenary discussion of subgroup outputs (*Mark Tasker, Chair*)

15.15 Next steps and reporting (*Simon Jennings, Mark Tasker*)

15.30 Close

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Annex 3. Further possible actions for ICES identified in the questionnaires directly relevant to biodiversity needs

Question 12 of the questionnaire sent to Member Countries and invited participants ahead of the meeting of WKMARBIO asked "Give three questions that the marine science community would best answer to better support your needs for advice, data and information on biodiversity?" The following is a summary of whether or not these questions are covered in the actions described in Sections 4 and 5 of this report. Coverage was essentially determined by whether the question was addressed by one of the subgroups. As some of the actions not covered in Sections 4 and 5 are relatively tractable, they are provided here for further consideration. This annex demonstrates a considerable unmet demand for further work.

SOURCE	QUESTION	RESPONSE
CBD	What are the effective ways of measuring progress in achieving 2011-2020 Aichi Biodiversity Targets, in particular Target 6 and Target 11 (see footnote)	Not yet responded to
	2. What are the effective ways to provide scientific support to countries in identifying ecologically or biologically significant marine areas in need of protection that meet the scientific criteria adopted by the Conference of the Parties to the CBD in its decision IX/20, Annex I?	Not yet responded to
	What are the effective ways to synthesise scientific information on the impacts of climate change on marine and coastal biodiversity as well as the role of marine and coastal biodiversity in climate change adaptation and mitigation?	Partly addressed action o
European Environment Agency	Can you develop coherent broad scale marine habitat maps (benthic and pelagic) incl. a biological characterisation, relevant for informing both human use as well as environmental concerns?	Not yet responded to
	Can you show the linkage between targets set for individual species (e.g. population or stock) and how these affect other species? This is not only between commercial exploited fish, but also e.g. how a target set for a commercial fish species interacts with the conservation targets set for dependent Natura 2000 species.	Action n
	Any coherent approach for presenting high resolution pressure information would be highly desirable – can this be done incl. a methodology for assessing multiple pressure on individual biodiversity components?	Action m
Black Sea Commission	Provision of: Check Lists (for all taxa) Red Data List for taxa (IUCN criteria specified) Status of habitats, MPAs networking Climate change, Mediterranisation System of alerts for toxic blooms and jellies proliferation Biological manuals/guidelines climate change and biodiversity, valuation of goods and services in the field of biodiversity, spatial planning to avoid conflicts of interest and protect biodiversity, better control on ballast waters and improved knowledge on invasions, regime shifts leading to changes in biodiversity	Partly addressed in review of strategic science priorities

SOURCE	QUESTION	RESPONSE
FAO	Guidance on how fisheries should be managed in order to make sure that impacts on biodiversity are such that ecosystems resilience is maintained at an acceptable level, particularly in view of possible impacts of climate change	Addressed in review of strategic science priorities
Helsinki Commission	What would be the key parameters to assess habitat quality, taking into account the existing monitoring programmes?	Partly addressed action a
	What would be the best use of phytoplankton and zooplankton species data in the assessment of status of the Baltic marine ecosystem?	Partly addressed actions d, h
	Which community index would suit best as an indicator for seabirds?	Not yet responded to but WGSE could consider
NEAFC	Detailed mapping of potential fishing areas with respect to VMEs and by-catches	Partly addressed action m
Canada	How can we establish reference points (threshold and healthy) for biodiversity indicators for different ecosystems from tropical to temperate to arctic?	Not yet responded to
	What are the keystones species at the different trophic levels for various ecosystems?	Action w
	What are the best indicators of biodiversity?	Partly addressed action h
Finnish Game and Fisheries Research Institute, Finland	How marine science community could gather information on salmon post-smolts of different origin during the sea migration phase?	Not yet responded to
	Better knowledge on biodiversity of fish species monitored under Marine Strategy Framework Directive and Data Collection Framework (for the Common Fishery Policy of the EU), would facilitate construction of scientific advice on these matters. Here, biodiversity should include both genetic integrity of populations (incl. sub-populations, population complexes) and related life history variation.	Not yet responded to
IFREMER, France	Understanding issues on marine connectivity	Not yet responded to
	Understanding resilience	Not yet responded to
	Modelling functional biodiversity …based upon well develop – interoperable database at the national & international levels	Action v
Johann Heinrich von Thünen-Institute, Germany	How can we select suitable indicator species in light of assessing biodiversity for the Marine Strategy Framework Directive (Descriptor 1)?	Actions d, i, l, o
	How can we determine reference levels for biodiversity for the good environmental status?	Not yet responded to
	How can we combine biodiversity measures across different communities such as benthic invertebrates, zooplankton, macrophytes and fish into a single indicator?	Action h
MRI, Iceland	What is the best approach to map the biodiversity of benthic habitats in data limited areas as is the case for Icelandic waters?	Not yet responded to but WGMHM could consider
	Can we use fisheries data to evaluate trends in biodiversity?	Partly addressed action h
	How do we complement data sources collected at various spatial scales (local to global) to predict e.g. effects of human activities?	Partly addressed action n

SOURCE	QUESTION	RESPONSE
Marine Institute Ireland	How can biodiversity data be used to examine a change or loss in ecological functionality at the community and habitat level?	Action u
IMARES, Netherlands	Are there 'keystone species' the presence and abundance of which strongly alters biodiversity? Which species are these and why?	Action w
	How does complexity (diversity) in the sea affect ecosystem functioning and stability?	Action v
	How dynamic are patterns of biodiversity in space and time in the sea?	Partly addressed action b
Waterdienst, Netherlands	How to reduce the cost of monitoring?	Partly addressed action f
	How to quantify and map pressures resulting from human activities?	Action m
Portugal	Is the European agreed marine trophic index (MTI) appropriate to measure marine biodiversity trends?	Not yet responded to
	If not which other indicators could be used to measure fishing impacts on biodiversity?	Not yet responded to
	Which baselines could be used?	Action b
Instituto Espanol de Oceanografia, Spain	How to provide an operational definition of "biodiversity" (to make it manageable)?	Not yet responded to
	How can we use data from other surveys (e.g. pelagic) to also provide information on biodiversity trends?	Action f
	If we are working with biodiversity trends, how can we join the information from different areas towards getting a general overview of what the biodiversity is doing in a region?	Actions b, p
Sweden	Genetic structure and local adaptation of fish species in the Baltic to North Sea gradient – what are the key things to protect?	Not yet responded to
	The effects of exploitation of fish on biodiversity within and among trophic levels?	Not yet responded to
	How can Marine Protected Areas best be used to protect biodiversity of populations, species and communities?	Partly addressed action r
	How do we include links between trophic levels and links between taxa and abiotic factors to achieve a more holistic assessments?	Not yet responded to
AFBI, UK	Functional(trophic) relations	Not yet responded to
	Environmental drivers	Not yet responded to
	Life history studies	Not yet responded to
CEFAS, UK	How do we make data more accessible?	Not yet responded to
	How do we reduce the cost of monitoring?	Partly addressed action f
	How do we predict the cumulative impact of multiple stressors?	Action n
JNCC, UK	How can we work more closely with and form partnerships with offshore industry organisations in order to improve relationships and access to data?	Not yet responded to

SOURCE	QUESTION	RESPONSE
	Can models of and assumptions about sensitivity and resilience of certain habitats to human impacts be tested and improved?	Not yet responded to
SAHFOS, UK	How is marine biodiversity responding to global change processes?	Implied in Action o
	How can the impacts of global change processes be differentiated?	Action o
	How can marine biodiversity be measured more efficiently?	Not yet responded to
University of Aberdeen, UK	What do species do (functionally)? And which species are most vulnerable?	Action v
	Do species alter their functionality with context?	Not yet responded to
	Can we define certainty?	Not yet responded to
Zoological Society of London, UK	Most appropriate measures of abundance	Generally dealt with already in ICES but on regional rather than global scale
	Species range maps and / or estimates of global abundance	
	Threats and nature of impact on abundance of different species	
US Navy CNO N45 (Energy & Environment)	What are the keystone taxa we need to monitor?	Action v
	What are the best sensor options for obtaining those data?	Action e
	How do we archive, manage and model such data?	Not yet responded to
NOAA - NESDIS – National Oceanographic Data Center, US	How can we better communicate biodiversity needs and priorities from various perspectives, i.e. what do 'you' value about biodiversity (i.e. asking a farmer, fisher, and scientists using surveying techniques)?	Not yet responded to
	What are reasonable functional biodiversity data requirements/standards for national ecosystem monitoring programs?	Action v
	How important are biodiversity data that are not clearly 'baseline' data, for example from measures in an impacted locality (like measurements to quantify the impact from oil well development)?	Not yet responded to

Footnote

Aichi Biodiversity Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits

Aichi Biodiversity Target 11: By 2020, at least 17 per cent of terrestrial and inland water areas, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.