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Seventh meeting
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Note verbale dated 19 May 2006 from the Permanent Mission of Canada to the United Nations addressed to the Secretariat

The Permanent Mission of Canada to the United Nations presents its compliments to the Division for Ocean Affairs and the Law of the Sea, and has the honour to forward to the latter, in reply to its communication of 6 April 2006, the attached paper entitled "Report of the Scientific Experts' Workshop on Criteria for Identifying Ecologically or Biologically Significant Areas beyond National Jurisdiction — 6-8 December 2005, Ottawa, Canada".

The Scientific Experts' Workshop on Criteria for Identifying Ecologically or Biologically Significant Areas beyond National Jurisdiction was hosted by Canada and took place in Ottawa, from 6 to 8 December 2005. It was chaired by Jake Rice of Canada and included experts from developed and developing States. The primary objective of the meeting was to gather expert advice on scientific criteria that are appropriate for identifying ecologically or biologically significant areas beyond national jurisdiction and for assisting in their prioritization for management action. The report contains the conclusions of the experts from these discussions.

The Permanent Mission of Canada believes that the information and conclusions in the attached report would provide valuable background to consideration of these issues at the forthcoming meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea.

The Permanent Mission would be grateful for the present note and its annex* to be issued as a document of the forthcoming meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea.

* The annex is being circulated in the languages of submission only.

Annex to the note verbale dated 19 May 2006 from the Permanent Mission of Canada to the United Nations addressed to the Secretariat

[Original: English and French]

Report of the Scientific Experts' Workshop on Criteria for Identifying Ecologically or Biologically Significant Areas beyond National Jurisdiction — 6-8 December 2006, Ottawa, Canada

I. Background and introduction

1.1 History and objectives of the meeting

At the June 2005 meeting of the Convention on Biological Diversity's Ad hoc Open-ended Working Group on Protected Areas held at Montecatini, Italy, Canada offered to "host a workshop of scientific experts to review and assess existing ecological criteria and biogeographical classification systems and to initiate work on the development of a set of scientifically rigorous ecological criteria that could be used to identify potential sites for marine protected areas beyond the limits of national jurisdiction". Discussions at and after the Montecatini meeting identified the UN Food and Agriculture Organization and the International Maritime Organization as also having an interest in science-based criteria for identifying marine areas beyond national jurisdiction in need of enhanced management protection. The term "beyond national jurisdiction" incorporates both the High Seas and the seabed, ocean floor and sub-soil beyond the limits of national jurisdiction as defined in the United Nations Convention on the Law of the Sea. Canada undertook to host a meeting whose products would be of potential use to all three organizations, and thereby contribute to a shared scientific basis for their dialogue and action. This meant that the workshop addressed a narrower range of issues than contained in the Montecatini extract quoted above, but was intended to be of use to a wider range of potential users. Oceans Sector of the Department of Fisheries and Oceans, on behalf of Canada, took responsibility for hosting the meeting, and is the designated client of the expert advice and report from this meeting.

This commonality of interest across these intergovernmental organizations involved in issues on the High Sea led to a focusing of the meeting on ecological and biological criteria for identifying areas that are biologically or ecologically significant, and on those grounds would particularly benefit from more risk-averse than "normal" management and protection. The meeting maintained a focus on providing a basis for science advice to support spatial management policies, plans, and measures.

Experts invited to the meeting were nominated by one or more of the three organisations. A few additional experts were invited to fill disciplinary gaps arising from the absence of nominated experts who were unable to attend the meeting. All attendees participated as independent experts. The meeting report reflects expert scientific advice, but does not imply endorsement by either the organisations or countries of the participants. The meeting operated by consensus, and there was generally excellent convergence of views on most, but not all, the scientific issues.

The workshop was a meeting of science experts. As such, it did not address many governance, policy, and management aspects crucial to the conservation and sustainable use of biodiversity on the areas beyond national jurisdiction. Nonetheless the meeting did have some observations from a science perspective on these aspects; practical considerations and governance features that are necessary for the science input from this workshop report to be used effectively. Following this introduction the report is structured into three Sections. The first presents the recommended science-based criteria for identification of ecologically or biologically significant areas (Ecologically Or Biologically Significant Areas), with supporting information for their application, including definitions, rationales, measurement issues, and considerations in the use of each one. The next Section comprises a brief discussion of other management, governance, and technical issues that should be considered in implementing the scientific criteria. The last Section is a series of Annexes that provide supporting information on the, management and governance considerations relevant to the application of the scientific criteria.

The primary objective of the meeting was to provide expert advice on scientific criteria that are appropriate for identifying ecologically or biologically significant areas beyond national jurisdiction and for assisting in their prioritization for management action. The identification and prioritization aims to call attention to areas where management should be especially risk-averse to avoid serious or lasting harm to biodiversity and marine ecosystems in areas beyond national jurisdiction.

This report does not address biogeographic classification systems or propose biogeographic zones. However, the importance of biogeographic considerations was acknowledged by the meeting participants, and some important aspects are discussed in the section on Representativity as a criterion (2.3). Additional relevant considerations regarding biogeographic classification strategies for marine regions beyond national jurisdiction are presented in Annex 1. Social, economic, and cultural considerations may also justify providing enhanced management protection to some marine areas, but those considerations are not addressed in this report. The meeting also stressed that, , in accordance with relevant international agreements including the FAO Code of Conduct and the WSSD Plan of Implementation, management of human activities in areas beyond national jurisdiction must be sufficiently risk-averse in all places to ensure conservation of biodiversity and long term sustainability of those activities. It further noted that management currently falls short of this basic standard in many marine areas outside national jurisdiction.

The meeting was informed by a review paper (Dearden and Topelko 2005) which summarized previous publications on criteria for evaluating the biological and ecological significance of marine areas. The review paper highlights that the large majority of previous publications proposed criteria specifically in the context of Marine Protected Areas (MPAs) in coastal, territorial and exclusive economic zone (EEZ) areas. Although this meeting of experts did not prejudge what specific management approaches are best suited to provide the enhanced degree of risk-aversion needed to protect biologically and ecologically significant areas, it acknowledged that the biological and ecological criteria for selecting MPAs will have many commonalities with criteria for selecting biologically and ecologically significant areas. The definition of “MPA” used in this paper is consistent with the broad definition of “protected areas” developed by the World Conservation Union (IUCN) which categorizes protected areas by six management objectives ranging from strict nature reserve/wilderness areas to areas managed for sustainable use (see Annex 2).

The review paper also highlights the seminal role of the World Conservation Union’s (IUCN) (criteria for MPAs developed by its World Commission on Protected Areas (Kelleher 1999). These criteria have formed the basis for consideration and refinement by many subsequent groups of experts. The review paper brings out in narrative and tabular form the commonality of criteria across these many expert sources. The meeting acknowledged the substantial foundation that this IUCN work provided for its consideration of criteria for identifying ecologically or biologically significant areas beyond national jurisdiction.

1.2 Ecologically or Biologically Significant Areas

Definition: Ecologically or Biologically Significant Areas are geographically defined areas that have higher significance to one or more species of an ecosystem or to the ecosystem as a whole, compared to other areas of similar bathymetric, latitude, and general ecological characteristics. Management of human activities in Ecologically or Biologically Significant Areas needs to be particularly effective because of the higher potential or more lasting consequences of harm at that location and also the greater potential for long-term benefits obtained by effective management.

Each area of an ecosystem contributes, to a varying degree, to the productivity and/or viability of one or more species, or to the productivity and/or biodiversity of the ecosystem as a whole. Hence there is no absolute threshold for an area's significance. Ecologically Or Biologically Significant Areas are ranked relative to other areas within the ecosystem. Several different ecological and biological criteria can be used to evaluate the relative significance of areas. The body of this report discusses ccriteria that may be used to identify an Ecologically Or Biologically Significant Area among a set of candidate areas.

Identification of a region's Ecologically or Biologically Significant Areas is an early but important step in an ecosystem approach to management because perturbation of such an area by human activities will have a disproportionate effect on aspects of the ecosystem compared to an equal perturbation applied to areas that do not rank as high on these criteria. An ecosystem approach to management will address the spatially unique characteristics of the ecosystem to the extent that they are known and tailor each area's management to its special characteristics, the various human activities seeking to obtain benefits from the ecosystem in that area, and the risks those activities pose for the ecosystem. Each area of an ecosystem can face a variety of types and magnitudes of threats from human activities. The relative ecological or biological significance of an area and the relative level of threats that it faces combine to determine the most appropriate management system for that area, to ensure the conservation of living marine resources in that area while allowing activities that provide sustainable benefits to society. Incorporation of this step in developing approaches to the management of human activities in marine areas beyond national jurisdiction implies there is some knowledge of the biological and ecological features of such areas. The incomplete and often poor knowledge of such features in areas beyond national jurisdiction poses implementation challenges which are discussed in several parts of this report, and underscores the importance of a precautionary approach to management.

The separation of the identification of Ecologically or Biologically Significant Areas from endorsement of any particular approach to ensuring that management is sufficiently risk averse is intended to give the concept utility in a variety of contexts. However, it is yet another term in a field that is already rich with terminology (see for example Annex 3). It is important to distinguish among three types of areas:

1) areas of ecological or biological significance,
2) areas requiring special management consideration,
3) areas that are potential sites for MPAs.

These are not the same although they overlap, sometimes considerably. Areas of ecological or biological significance necessarily require highly risk-averse management, and therefore need for special management measures for activities that may harm the properties which make the areas significant. All areas of ecological or biological significance require special management consideration, but areas can require special management consideration for other reasons as well, such as cultural or historical significance. Finally, designation as an MPA is one approach to ensure an Ecologically or Biologically Significant Area receives highly risk-averse management from a broad range of human activities. However, depending on the features of the area and the human activities to be managed, sometimes sufficiently risk-averse management may be achieved using other approaches as well, as described briefly in Annex 4.

II. Scientific criteria

2.1 Introduction

This meeting took the synthesis of previously published criteria from the Dearden and Topelko review paper as a starting point for its deliberations. Table 1 is taken from their paper, as illustrative of how various criteria are viewed by different authors. The overall pattern in the table provided the necessary information for the subsequent work, even though there were some differences of opinion among experts about the proper entry for a small number of cells in the table.

Scientific criteria recommended by the meeting follow, in each case with a definition of how the term or phrase given as a criterion is to be used in the context of this report, a scientific rationale for the criterion, information on how the criterion can be measured directly or indirectly in an area, and special considerations for its use. The subsequent sections contain information on how these science-based criteria may be used in the process of developing policies and management practices for the areas beyond national jurisdiction. These criteria should considered general and flexible guidelines, and as explained in Section 3 and the Annexes may need to be adapted to specific contexts in which they are used. Their relationship to the criteria adopted by the IUCN for designation of MPAs is illustrated in Annex 4.

2.2 Specific Criteria for Ecological or Biological Significance

2.2.1 Uniqueness or Rarity

Definition: Areas whose characteristics are unique, rare, distinct, or for which there are very few or no alternatives. Areas may contain uniquely occurring species (endemics, relicts, etc.), populations, communities or geographic features; or be specific habitat for species that are considered themselves as inherently rare, endangered, or especially threatened. Uniqueness may be considered in national, regional, and global contexts, with increased importance at each scale.

Rationale: Unique areas are typically irreplaceable and their loss would mean the probable permanent disappearance of species or a feature. Rare habitats, or habitats associated with rare species, are by definition few in number and loss of even one would be a substantial reduction in biodiversity.

Measurement and proxies

Pelagic: Because of the more cosmopolitan distributions of many pelagic marine species, unique pelagic marine areas may be relatively few, and may most likely focus around avian or pinniped species that typically utilise isolated islands for breeding, molting, etc. In such situations, associated feeding grounds may be relatively large, and the Ecologically Or Biologically Significant Area delineation needs to be considered carefully. Because such islands typically have EEZs, delineation and management of High Sea Ecologically Or Biologically Significant Areas under such circumstances can gain substantial benefit when linked with national Ecologically Or Biologically Significant Areas. Complementary protection adjacent to areas beyond national jurisdiction and national Ecologically Or Biologically Significant Areas may be necessary for conservation measures in either to be effective.

Benthic: Endemic communities around thermal vents, isolated sea mounts or sea mount chains would be the most obvious examples of areas which meet this criterion. Given that much of the abyssal deep remains unexplored, there are probably many areas which may meet this criterion but cannot be identified with existing knowledge.

Considerations in use

Those conducting evaluations using this criterion should be aware that information sources may be clustered in geographical space, and may thus provide a biased view of the perceived uniqueness of well-sampled areas. In regions that are very poorly studied, areas where some sampling has occurred may appear unique or support species that appear rare just because something is known about these areas or the species has been recorded at all. If there are imminent threats from human activities, it is consistent with both the precautionary approach and the use of the best science information available to consider such areas as Ecologically Or Biologically Significant Areas until such time as more is known about the surrounding region. For the remaining poorly studied parts of the region, uncertainty necessarily is high and according to the Precautionary Approach management should be highly risk averse throughout. Application of the Representativity criterion (Section 2.3) would also result in some portion of the poorly studied region being considered as Ecologically Or Biologically Significant Areas as well.

The examples listed under Measurement and Proxies for pelagic systems are all cases where the “unique” property also is tied to performance of a life history function, and the areas may be picked up on that criterion as well. It could be argued that such situations are double-counting of a single trait under two criteria. However it could also be argued that an area which is one of very few sites where a critical life history function is achieved by a species (i.e. “unique”) is, in fact, comparatively more ecologically significant than areas which meet either but not both criteria, and the apparent “double-counting” is an accurate assessment of its significance.

Rarity at the present time may sometimes be a consequence of serious depletion from earlier human activities. The area used by the remnants of a severely depleted population may stand out on the Uniqueness/Rarity criterion, but biodiversity concerns should extend to management of the habitat needed for the population’s recovery as well.

2.2.2 Critical life-history functions/habitats

Definition: Critical life-history functions are required for a population to survive and thrive (e.g. breeding, larval/juvenile nursery periods, growth). Critical habitat is a specific area required to ensure these functions can be achieved by a species or population, such that the species or population can pass through that life stage and persist (e.g. cetacean calving grounds, spawning and egg-laying beaches, larval retention gyres in coastal currents, migration routes and over-wintering areas). When the same area is critical habitat for many species in a community, its overall ecological significance is even greater.

Some species aggregate to perform all or some of their critical life-history functions. An aggregation is an extremely high density of individuals compared to the mean density of these individuals within the population’s range as a whole. Sites used for breeding, nursery grounds, oceanic fronts, and areas of high primary/secondary productivity are examples of possible areas of significant aggregation. For some sedentary species, areas of aggregation may persist throughout their lives thus rendering these sites important for multiple life history functions. For mobile forms, aggregations may be seasonal or even shorter term, and ephemeral in both space and time.

Rationale: Marine species are not distributed evenly within their geographic ranges. Various biotic and abiotic conditions coupled with species-specific physiological constraints and preferences tend to make some parts of marine regions more suitable to particular life-stages and functions than other parts. Correspondingly some portions of the oceans will be more significant than other portions to specific species or communities of species.

Most organisms develop through two or more life-stages. In many instances, each life-stage relies on specific, and often different, aspects of the environment for achievement of particular critical life-history functions. Moreover, individual life-history stages often have to fulfil several critical life history functions, and each may require different environmental features. The more that the dynamics of a population or a community are constrained by the life-history function requiring a particular habitat that is rare or limiting, the more ecologically or biologically significant such a habitat is.

Measurement and Proxies: Measurements or proxies should be related to the ecology of the animal to the extent possible. For sedentary forms (e.g., corals, many molluscs), “currencies” for measurements may be relatively easy to identify as the spatial distribution and density of the species (present or historical) may form a sufficient basis for measurement of the environmental features to which it responds. In mobile forms, indirect measurement proxies must often be considered especially if the various life functions are fulfilled in different geographic areas, as may be the case in many pelagic species in areas beyond national jurisdiction.

Among the most universally accepted measurements of areas that are associated with critical life-history functions are the extent or features of the spawning or breeding grounds, which are often relatively small compared to the geographic range of individuals of the species. When the spatial extent of such areas is known, a given area’s relative importance to that aspect of the species life-history becomes comparatively easy to measure. Similarly, migration routes, nursery areas, and feeding areas may also constitute specific and measurable areas which are crucial to the life-history of the species or marine communities in question.

Considerations in use: All life-history stages must be functional in order for a species to thrive and fulfil its role in the ecosystem. Thus it is important to consider linkages between areas and transport, rather than consider each area in isolation of other areas. Commonly linkages would be achieved either through trophic interactions or physical transport (passive transport or active migration) carrying productivity from a comparatively restricted but significant area to other trophic levels and geographic areas of the ecosystem. Spawning areas of schooling pelagic forage species are good examples of trophic export from small areas to the wider ecosystem.

Connectivity between life-history stages and among adjacent areas is a key concept when considering export functions and delineating an Ecologically Or Biologically Significant Area. Proxies for connectivity or the strengths of the ecological linkages within habitat areas of a population and among populations remain ill-defined, and direct measurement is often challenging, particularly in areas beyond national jurisdiction. Recent efforts to study population genetics and ecological habitat use with otolith microchemistry have provided tools to determine such linkages for coastal areas. The approaches should be comparably useful in areas beyond national jurisdiction, but demand large science investments. Until such information becomes available for areas beyond national jurisdiction areas, it may be necessary to infer connectivity from knowledge of the physical oceanography (particularly transport mechanisms) of a region, and the general life histories of the species.

In cases where an area necessary for a critical function is no longer in use because of low population abundance, it may still be important to identify such areas as Ecologically Or Biologically Significant Areas due to their significance in supporting recovery of the population.

2.2.3 Vulnerability

Definition: Vulnerable species, habitats or ecosystems are those which are susceptible to degradation in either or both of two ways. Vulnerable individuals or features may be physically or functionally fragile and therefore easily degraded and/or they may be slow to recover once degraded.

The term ‘resilience’ may be useful in considering vulnerability. The ecological meaning of “resilience” has been debated widely in the literature. The usage here refers to an emergent or holistic system property consistent with the following definitions: ‘... the extent to which ecosystems can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly flipping into alternate states’ (Hughes et al. 2005); and ‘... the capacity of a system to absorb disturbance, undergo change and still retain essentially the same function, structure, identity, and feedbacks’ (http://www.resalliance.org). In regard to Ecologically Or Biologically Significant Areas, low resilience of a population, community, or ecosystem in an area usually corresponds to high vulnerability. However vulnerability may also apply more narrowly than resilience, to easily damaged characteristics of individual species or system components which are significant in their own right, but the loss of which may not affect overall system resilience, for example, rare species. In this sense, the term ‘fragile’ may be more appropriate.

Rationale: Although it is an ecological or biological property, vulnerability [or resilience] per se or the presence of vulnerable components does not necessarily indicate ecological or biological significance. Rather, it can indicate the degree of risk that will be incurred if human activities in the area or component cannot be managed effectively, or are pursued at an unsustainable rate. As such, it may lead managers to give priority to protecting highly vulnerable systems although they may be less ecologically or biologically significant than other areas which may receive lesser protection.

Measurement and Proxies: Vulnerability in the context of not being resilient usually cannot be measured directly, but can be inferred from the history of how species or populations in other similar areas responded to perturbations. At the species or population level, resilience is likely to be closely linked to life-history characteristics. The response of populations with particular life-history characteristics to perturbations is sufficiently well understood that reasonable predictions about resilience can be made from models or from other populations with similar characteristics. For example, body size, fecundity, and time to maturity are useful, if imperfect, predictors of vulnerability to fishing, including for the 95% of marine fish species whose status has yet to be assessed. At the community or ecosystem level, best scientific practice usually requires first assessing the similarity of areas of concern to areas whose histories are known. One then assumes that the area of concern will exhibit similar resilience to specific perturbations as observed in similar areas elsewhere. Ecosystem models can be used to explore the resilience of specific model configurations to specific perturbations. However, reviews by groups such as ICES have found such approaches to be very sensitive to model structure and parameterizations. For most applications in areas beyond national jurisdiction information on specific areas will not be adequate to build and parameterize ecosystem models that provide robust quantifications of resilience.

Vulnerability in the context of fragility of individuals and habitat features can be measured directly as the likelihood of breakage and rate of repair. Local information will often not be necessary, as fragility usually can be extrapolated robustly from information on how readily individuals or habitat features elsewhere have been damaged by a human activity, and on their corresponding rates of recovery. Individual longevity can be a proxy for rate of recovery. Deepwater corals that live for decades or centuries will recover from disturbance much more slowly than a nearshore eelgrass bed.

Considerations in use: Ecological systems may be vulnerable to impacts of both human activities and natural events. The purpose of identifying Ecologically Or Biologically Significant Areas is to guide management of human activities, so it may seem that vulnerability to human activities should be given greatest attention in applying this criterion. However, impacts of human activities may stress ecological systems in a variety of ways that increase their vulnerability to natural events. Therefore the interaction of these two categories of impacts needs to be considered in assessments of system vulnerability.

2.2.4 Productivity

Definition: The rate of growth of marine organisms and their populations, either through the fixation of inorganic carbon by photosynthesis or chemosynthesis, or through the ingestion of prey, dissolved organic matter or particulate organic matter.

Rationale: Some areas of the ocean support high production relative to surrounding areas due to patterns of light availability and nutrient transport, or through the natural aggregation or enhanced concentration of prey. These areas play a disproportionately important role in fuelling ecosystems and increasing the growth rates of organisms and their capacity for reproduction. Productive areas often supply adjacent areas through the export of surplus production by way of the drift, diffusion, sinking or migration of organisms, their reproductive products and breakdown products. When considering the impact of anthropogenic activities, threats or risks to highly productive areas, and particularly to the mechanisms of production, should be managed in a manner that will not reduce or compromise their ecological role. Examples of ocean features that are often highly productive include upwelling cells, oceanic fronts, Taylor columns and hydrothermal vents.

Measurement and Proxies: The direct measurement of productivity has to be matched to the organism, population or community, and will involve the measurement of the rate of change of mass (macrofauna) or the rate of uptake of nutrients (plants, microbes). Units are typically mass per unit time, but mass-specific growth, increments in length, or rates of change of population size, either relative or absolute, are also commonly used.

Proxies are typically used in measuring production at sea. The most common means of carbon fixation is by photosynthesis, for which the concentration of photosynthetically active pigments (e.g. chlorophyll-a) is a reliable basis for estimation of production. Surface pigment concentrations can be measured remotely by satellite. Production can also be approximated by measuring inputs (e.g. rate of flux of marine snow, stomach content examination) or outputs (e.g. egg production in copepods or birds).

A reliable time-series of catch rates in a fishery and, in the absence of other information, just catches by species or community can provide information on productivity of the harvested populations. For many areas beyond national jurisdiction catch data may be the only quantitative information available on productivity, and therefore comprise the “best scientific information available”, although catch data must be used with substantial caution.

Considerations in use: Especially for the “ingestion of prey” aspects of productivity, care needs to be taken to apply this criterion in ways that are complementary to, but not redundant with, feeding as a critical life history function.

2.2.5 Biological Diversity

Definition: “Biological diversity” means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (CBD Article 2 Use of Terms. http://www.biodiv.org/convention/articles.asp?lg=0&a=cbd-02).

Biological diversity, as defined above, includes genetic diversity. A further component of diversity, not explicitly included in this definition but relevant to diversity of ecosystems, is habitat diversity which will also need to be considered within the context of criteria for identification of ecologically or biologically significant areas beyond national jurisdiction. Habitat diversity is not explicitly included in the definition above, but is indirectly included as part of the diversity of ecosystems.

Rationale: The overarching goals of management are sustainable use of marine resources and conservation of biodiversity in order to ensure that existing and potential ecosystem goods and services are maintained and available for the present and future generations. For example, Paragraph 31 of the WSSD Plan of Implementation includes the requirement to, “In accordance with chapter 17 of Agenda 21, promote the conservation and management of the oceans through actions at all levels, giving due regard to the relevant international instruments to: (a) Maintain the productivity and biodiversity of important and vulnerable marine and coastal areas, including in areas within and beyond national jurisdiction”.

Following from the WSSD Plan of Implementation, areas of relatively high diversity are specifically emphasised as ecologically or biologically significant, and likely to warrant elevated attention in management of human use and impacts.

Measurement and proxies: Of the many indices of diversity, the most relevant ones are measures of richness such as the number of species in a system. Measurements on this criterion should give highest value to areas that have a naturally high variety of species (in comparison to similar habitat/biotope features elsewhere) or include a wide variety of habitats/biotopes (in comparison to similar habitat/biotope complexes elsewhere). This can be expanded to include high genetic diversity or highly varied ecosystems, habitats, and communities, when such information is available. Although the concept is to protect biodiversity at all taxonomic levels, care must be taken in the measurement of relative biodiversity to include comparable components of the complete taxonomic spectrum.

In areas beyond national jurisdiction even the species richness of delineated areas is not fully sampled, and in most areas is unknown and likely to remain so for the next few decades. However ecological theory supports the use of habitat heterogeneity or diversity as a surrogate for species diversity in areas where biodiversity has not been sampled intensively, and in particularly information poor areas topographical complexity may serve as a surrogate for habitat diversity.

1. Many common measures of diversity are often unhelpful in guiding management actions to protect diversity within a given ecosystem. For example, severe overfishing may cause increases in diversity indices affected by the evenness with which species occur, suggesting incorrectly that the overfishing has been good for biodiversity. Similarly the natural occurrence of a very strong year-class of perhaps a forage species may cause diversity indices affected by evenness to decrease, suggesting an increase in abundance of species at middle trophic levels is bad for biodiversity.

2. Diversity will sometimes be particularly high at ecotones, where two or more ecosystem or habitat boundaries overlap. Such zones may represent the edge of their ranges for many of the species in the overlapping systems and may therefore not be ideal sites for strengthened management aimed at conserving biodiversity. In such cases it may be necessary to give lesser consideration to the diversity criterion and greater consideration to some of the other criteria described in this report.

3. Diversity indices are indifferent to species substitutions which may, however, reflect ecosystem stresses (such as those due to high fishing intensity).

4. Diversity indices are indifferent to which species may be contributing to the value of the index, and hence would not pick up areas important to species of special concern, such as endangered species.

2.2.6 Naturalness

Definition: Naturalness is the degree to which an area is impacted and changed due to human activities. An area with high naturalness has no or a low level of human-induced disturbance or degradation. This corresponds to a pristine or near pristine state.

Rationale: Naturalness is a property that adds value to the biological and ecological significance that an area would have on other criteria. Among areas comparable in other aspects of their biology and ecology, an area with no or low disturbance and degradation will as a general rule provide more "goods and services" to the marine ecosystems themselves, and hence be of great value in the conservation of biodiversity. Compared to disturbed areas, highly natural areas are also more likely to support ecosystems with structural and functional properties whose ecological significance we may not yet understand or appreciate, but which are essential for the long term viability of those systems, and human uses of them.

Measurement and proxies: The naturalness of an area needs to be assessed in a holistic manner taking into account the overall ecological quality (or conditions or state) of the area and the degree of disturbance and degradation resulting from human activities. These activities may occur outside the area (e.g. pollution) and need to be assessed at the appropriate ecological scale. Sites that periodically experience extreme natural events (hurricanes) need to be evaluated in the context of constant ecological succession, rather than an equilibrium paradigm.

Considerations in use: Natural areas include pristine areas, but may also include areas that have experienced successful recovery from earlier anthropogenic effects. In areas with a long history of exploitation, the degree of naturalness will be a relative one. For example, with regard to fisheries, some areas have been fished for centuries, but it is only recently that certain methods have come into use. These methods should be judged against the historical baseline to determine if they have had a greater or lesser impact, and thus effect on "naturalness," where they have been applied.

Possibility for restoration of degraded areas may be an ancillary consideration in comparing different areas on this criterion.

2.3 Representativity

Representativity functions somewhat differently from the criteria listed in Section 2.2, in that it points to a class of areas which are all "representative". As long as an acceptable proportion of "representative" areas receive enhanced management, choices can be made from this class about which ones to manage in particularly risk-averse ways, and which to manage in ways that are still sustainable, but less restrictive. All the criteria in Section 2.2 would identify specific areas, which for the criterion of interest are especially significant. Each of these areas would require management enhanced in ways that give a high degree of protection to the feature(s) that made it significant.

Definition: Representativity is the measure of whether a given area contains habitat / biotope types, species assemblages, ecological processes or other natural features that are characteristic of the larger marine region.

The demarcation of ecological regions in areas beyond national jurisdiction is most commonly achieved using biogeographic classification systems, which generally result in groupings of pelagic and/or benthic components on large geographic scales. Thus, representativity can be established at two nested levels: first relative to broad fairly homogeneous biogeographic regions; and, within each biogeographic region, relative to typical and characteristic features.

Rationale: Selecting "representative" areas for enhanced management will help management protect a wide range of biodiversity and ecosystem processes and components that characterise an ecological region. This is necessary because the relationships and processes which give ecosystems their intrinsic properties are still incompletely known, and the areas beyond national jurisdiction are generally data-poor. Other criteria may guide protection of areas that are known to be special in some ways, but do not necessarily ensure protection of important but poorly understood ecological processes, or any areas in eco-regions which are poorly studied. By giving enhanced protection to some representative areas, in it intended that all the relationships and processes, including ones not yet understood, also receive protection. Such areas provide reference benchmarks against which to evaluate the impacts of human activities in areas beyond national jurisdiction, and may contribute to recovery of adjacent areas from human-induced perturbations, and provide insurance against irreversible biodiversity loss or damage in poorly understood areas. Representativity can be used as a stand-alone criterion. It can also be used in conjunction with the other criteria for identifying ecologically or biologically significant areas noted below. Both uses are consistent with the precautionary approach and ecosystem-based management approach called for at the World Summit on Sustainable Development as well as the FAO Code of Conduct for Responsible Fisheries and the reasoning behind the call at the WSSD for developing representative networks of MPAs by 2012.

Measurement and Proxies: The level of detail of representativity is to some degree determined by the size of the area and the areal extent of the human activities under consideration. However, the scale of any given representative ecological feature is ultimately a reflection of the scale of its ecological associations. At the broadest scales, representativity is most commonly evaluated using physical parameters, with biological components generally being incorporated at somewhat finer scales; though for the areas beyond national jurisdiction distributions of certain pelagic taxa, such as seabirds, can also indicate particular broad-scale pelagic regions.

In the selection of Ecologically Or Biologically Significant Areas, representativity can be refined by also using fine-scale or ancillary criteria such as species-specific distributions or habitats, as appropriate to the management issues at hand. When such fine-scale detailed data are not available, however, best scientific practice dictates the use of broad-scale proxies that give some assurance that the fine-scale features are being addressed. As such, representativity will be particularly influential in the selection of Ecologically Or Biologically Significant Areas in information-poor regions, in accordance with the precautionary approach (see section 3.6).

Considerations in Use: When a large area is being considered as an Ecologically Or Biologically Significant Area, it would be expected to contain a representative mix of features in addition to special considerations as appropriate. Alternatively, when a relatively homogenous smaller area is in consideration, it should be representative of other such areas within that biogeographic region, should they exist.

Biogeography provides the foundation for assessing the scale at which species are distributed and identifying representative habitats requiring special protection. For abyssal depths, the benthic realm is sufficiently decoupled from the pelagic realm to justify separate assessments of representativity. For the seabed and ocean floor in areas beyond national jurisdiction (known legally as The Area), measures of benthic representativity often rely on sea-bottom oceanographic, superficial, and topological data, because of the scarcity of biological data. For the pelagic realm(s) the large-scale features of the ocean circulation and water mass distributions are known for all ocean basins. In addition, remote sensing can aid in the identification of sea surface features, which can include variables such as ocean colour (indicative of concentrations of phytoplankton), temperature, and sea height. Such features, in turn, can serve guides to likely aggregation sites and/or migration routes for some species fish, seabirds, and marine mammals. New tracking technologies can provide substantial information about migration routes as well.

The biogeography of open ocean and seabed environments remains an active area of investigation, with substantial gaps in our knowledge of many habitats, such as seamounts, and some faunal groups, such as the abyssal macrofauna, as well as of large areas of the oceans remain poorly sampled. However pelagic ecosystems, hydrothermal vent, seamount and cold-seep communities, and deep-sea fish and the invertebrate megafauna in areas beyond national jurisdiction have all been subjects of major reviews. These reviews provide the basis for a provisional assessment of the spatial scale of distribution of major oceanic and seabed faunas in areas beyond national jurisdiction, and of the scale on which representative habitats may be identified for special protection.

Authors sometimes differ in detail in their application of biogeographic criteria, and thus it is possible to use more than one classification system for a given area. If these systems appear to be equally applicable to the management issues under consideration, it is recommended that they be used side by side, as complementary proxies. Areas that are “representative” in multiple classification systems would be of particular interest under this criterion.

The identification of particular areas as “representative” depends critically on the biogeography of an area, which in turn depends on the nature of the data available. To date, much of the High Seas remains poorly sampled, with some notable exceptions (see Annex 1). Use of the Representativity criterion also is affected by the system used to partition the areas beyond national jurisdiction into ecological Regions and sub-regions. Aspects of these considerations are developed in Annex 1.

III. Considerations in the use of the scientific criteria

3.1 Introduction

For the criteria to be helpful and effective in ensuring that adequate levels of protection are provided to areas beyond national jurisdiction, it is necessary that they be applied effectively. Effective application involves technical aspects of both scoring areas on the criteria and combining information on an area related to multiple criteria. A full review of the technical issues was too time-consuming for the meeting and hence is beyond the scope of this report, but the important considerations are highlighted in Section 3.2, with further background in Annex 5.

In making spatial management approaches operational in coastal and EEZ areas, experience has shown that in addition to biological and ecological criteria, many governance, administrative, and management considerations are relevant for selection of areas for various types of management and protection. Many of these additional considerations have been developed into formal criteria in the context of MPAs inside EEZs. In the view of this Expert Group, similar criteria also would relevant for spatially based approaches to management of human activities in areas beyond national jurisdiction. This report does not develop these considerations into specific criteria comparable to the scientific criteria in Section 2, the consistent with the mandate of this Expert Group. However, Sections 3.3, 3.4, and 3.5 provide brief discussions of some relevant non-scientific considerations to encourage future deliberation, and provide supporting information in Annex 6. These sections highlight that scientific criteria by themselves contribute little to conservation and sustainable use of biodiversity, and have to be supported and enacted by effective administrative, management, and governance systems. To improve conservation and sustainable use of living resources beyond national jurisdictions, it would be valuable to have appropriate experts in management and governance develop these criteria more fully for those areas.

3.2 Technical Considerations in Using the Scientific Criteria

3.2.1 Approaches that Weight and Combine the Scores across Criteria

There are several steps in going from the stage of applying the criteria individually to a host of areas beyond national jurisdiction to that of recommending a pattern of spatially-based management measures. The first phase starts with the compilation of data necessary for mapping habitats and species distributions within a particular region. Completion of this phase results in maps of areas which meet each of the criteria individually; being representative, unique, important for a critical life history function of one or more species, etc. Much of the oceans beyond national jurisdiction are data poor, and this mapping phase will also illustrate the parts of the region about which little is known. With little information on these areas, uncertainty about the consequences of human activities on the ecosystems is necessarily high, and the Precautionary Approach should guide management in such areas (See section 3.6).

The second part of phase one involves integrating the information in the separate criterion-specific maps, and requires judgments on the relative priority (weighting) of the criteria, even if the judgment is that they all have equal priority. There are numerous algorithms by which the scores on individual criteria can be combined, and they generally provide similar results given a set of weightings specified for the individual criteria. However, there are many social and cultural components to determining what would constitute appropriate weights of a criterion triggered by, say the spawning grounds of an endangered species versus a criterion triggered by a rare physical structure on the sea floor. Differences in weighting of the importance of the various criteria can provide very different prioritizations of areas. Hence, great attention must be given to the process of assigning the weightings to the criteria. Some aspects of appropriate processes are discussed in Annex 5.

Although it is important to consider all criteria when evaluating the significance of each potential area, a summing of weighted scores across all criteria is not the only way to use the information. In some circumstances, it may be prudent to identify an Ecologically Or Biologically Significant Area on the basis of a very high score on a single criterion even though the area scores low on other criteria. Thus, the weighting of criteria needs to take into account the management context and the potential risks facing the areas.

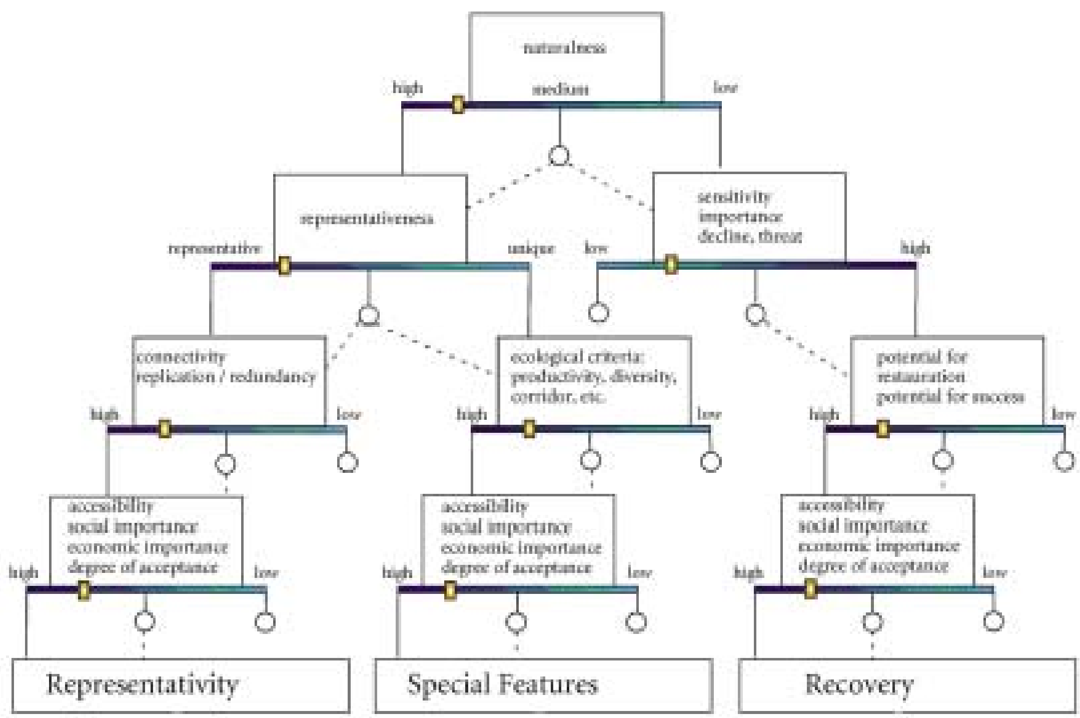
The second phase focuses on identifying connectivity requirements among Ecologically Or Biologically Significant Areas and other Areas of Interest (AOIs), so the management of the areas ensures that the features of significance or interest are protected. This phase makes uses all available information on the ecosystem and on the human activities possible in the area, to develop a pattern of spatial management that ensures conservation of marine biodiversity while allowing social, cultural, and economic activities to the greatest extent compatible with the conservation goal.

The third planning phase is then concerned with moving from a set of Ecologically Or Biologically Significant Areas and other AOI's to determining a logical and defensible spatial management system, which may include an MPA network. The goal is a network of spatially based management measures that meet identified ecological goals whilst minimising disruption to socio-economic and cultural needs. Here again, the process of making the social and economic goals explicit, and integrating them with the ecological ones, is crucial to success. Formal spatial optimisation algorithms offer a powerful tool for MPA network design, improving rigour, transparency and efficiency. Other decision support tools (such as GIS and Delphic approaches) are often needed when fine-tuning boundaries, developing zoning plans, or when choosing among candidates that are of interest to several stakeholder groups.

3.2.2 Approaches that Use the Criteria Hierarchically

One method for using the information contained in the suite of criteria presented in Sections 2 and 3 is to apply each criterion sequentially to the area in question. For each criterion there would be an evaluation of the area, leading to a judgment that might only be an interval scoring of perhaps low, moderate, or high. Depending on the category chosen, different choices would be available in subsequent steps. This would result in a branching network of possibilities, and end with assignment of the area to a category of biological or ecological significance or MPA type. The outcome of such a process could be sensitive to the rank ordering of the criteria in the branching tree, but with even a modest amount of reticulatness, consistent outcomes could be achieved from different views on which criteria should have precedence over others. Likewise the number and naming of the final categories could be presented in different ways, to match the detailed needs of different users.

One illustration of this approach is presented below. It is slightly modified after Sabine Christiansen, WWF, 2000 [WWF, 2000. Developing a framework for marine protected areas in the North-East Atlantic. Report of the Workshop held 13-14 November 1999 in Brest, France]. Although the particular ranking and branching of criteria in this example were not specifically endorsed by the expert group, it was considered to be a reasonable one, and an interesting illustration of the hierarchical use of these criteria.



3.3 Considerations of Management Feasibility

Although there are likely some commonalities between the management of areas in near shore/continental shelf and High Sea areas, there also are important differences that warrant consideration. These include:

- lack of a single national jurisdiction over any part of areas beyond national jurisdiction;
- existence of multiple national jurisdictions over activities carried out beyond national jurisdiction (i.e., flag state jurisdiction; jurisdiction over citizens and national corporations);
- correspondingly, where there is not a mandated institution already in place, the need to agree on an organization, agency, or other mechanism to "manage" the areas beyond national jurisdiction, including the development of its rules and procedures and,
- potential higher variability in the size of the areas beyond national jurisdictions that are to be managed.

Marine management experience generally has been by individual nation-states within their jurisdiction or over their flag vessels, although there are increasing numbers of nation state compacts attempting to cooperatively manage adjacent coastal and nearshore areas or species of common conservation concern (see Annex 6).

In areas under the jurisdiction of such agencies and organisations, effectiveness of spatially-based management measures are often tied to effectiveness of the breadth of their mandate/legal competence as well as the commitment of member states. Hence criteria regarding the presence, effectiveness, and mandates of management authorities, as well as the ability of member States to provide effective surveillance and enforcement are relevant to evaluating areas as candidates for targeted efforts at spatially-based management.

For the most part management efforts in areas beyond national jurisdiction presently are sectoral-based mechanisms for management of shared fisheries (generally RFMOs) and for areas potentially impacted by navigation. There are a few notable exceptions such as Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), which has a broad remit beyond fisheries and includes conservation of living marine resources and the North-East Atlantic OSPAR Commission, but there are few such non-sectoral management institutions for areas beyond national jurisdiction. Therefore, two primary management challenges are to:

- develop appropriate institutional mechanisms to protect and manage ecologically or biologically significant areas in areas beyond national jurisdiction;
- integrate ecosystem-based management of these areas with sectoral-based management, where it exists.

Generally, there also is a lack of organisations or agencies which can actually implement non-sectoral management plans for areas beyond national jurisdiction. Areas to be protected within the EEZ usually are identified, designed, and managed day-to-day by a government agency or consortium of government agencies. With the exceptions noted above, such operational management agencies do not exist for areas beyond national jurisdiction. Even nearshore considerations such as land ownership and ancestral rights will rarely or never apply in areas beyond national jurisdiction.

There is potentially a wider range of sizes and scales of areas beyond national jurisdiction to be managed than for the near-shore, depending importantly upon the resource(s) or system to be conserved. Sizes could range from quite small vents or seeps to large submarine canyons or collections of seamounts, and even very large to protect open-ocean ecosystems and pelagic or highly migratory species, such as whales. One broad spatial scale option would be an approach that includes spatial protection of areas important for critical life history functions of the resource(s) of concern (see Section 2.3) linked by migration corridors. Dynamic area management, where the protection moves with the resource, also is an option.

For these reasons, when developing spatial management approaches for areas beyond national jurisdiction, criteria should be developed that take into account the feasibility of managing on the spatial scale needed to give the ecosystem attributes of concern adequate protection. These criteria would have to address both physical and institutional considerations, and take due account of potential conflicts among uses and opportunities for synergies in management.

3.4 Anthropogenic Value

Some sites in areas beyond national jurisdiction may also require enhanced protection because of their anthropogenic value. Ecosystems beyond national jurisdiction provide many valuable ecosystem goods and services, including fisheries production, as a sink for greenhouse gasses, as a critical part of global biogeochemical cycles, and as a regulator of global climate through the role of the ocean in planetary heat and salt fluxes. Although the ecosystem processes underlying these services are mostly diffuse, they may provide further criteria for selection of areas requiring enhanced management protection.

Consideration needs to be given to the protection of sites in areas beyond national jurisdiction because of their value for scientific research. Several sites in areas beyond national jurisdiction have now been the subject of relatively intensive scientific study and monitoring for more than a decade. As the localities for the very few long-term deep-ocean time-series, they provide a unique perspective for understanding natural variability and long-term processes in the deep sea. Protection of these sites from anthropogenic disturbance including in the execution of the science itself, should be a high priority. Deep ocean sites may also require protection for the study of long-term recovery from anthropogenic disturbance, such as from mining, fishery impacts, navigation, oil and gas extraction and so on.

Sites in areas beyond national jurisdiction may also require enhanced protection for their cultural or historical significance, for example sites of historic shipwrecks or other cultural or archaeological artefacts.

3.5 Implementation Considerations

The scientific criteria for identifying areas according to their biological and ecological significance are proposed to be used for conservation and sustainable use of living aquatic resources in areas beyond national jurisdiction, and not just as a scientific exercise. “Sustainable use” requires that administrative and governance processes be in place to seek scientific advice, use the advice in developing policies and management plans, and implement the policies and plans. Many non-science considerations are important in determining the preferred administration and governance models for areas beyond national jurisdiction. Nonetheless, the experience of participants in this meeting of science experts supports several observations about properties that administrative and governance processes must have, for these (or any other) criteria to be used in effectively in conservation, management, and policy.

Above all, the governance processes have to be inclusive not just of the full diversity of states with an interest in conservation and sustainable use of marine resources in areas beyond national jurisdiction, but also of the potential resource users, conservation organisations, and other stakeholders. "Inclusiveness" goes beyond just consultation with interested parties. It requires full sharing of information, and decision-making that is open, transparent, and participatory.

Appropriately inclusive governance processes could take a variety of forms, and how these criteria would be used in practice could be affected by many details of how those processes are structured and operate. Again, however, there are some general properties that the operating procedures of the governance processes must have, to use the criteria effectively in ensuring conservation of biodiversity and sustainability of use of marine resources in areas beyond national jurisdiction. The criteria are a science basis for prioritising areas according to their biological and ecological significance, and require that the governance processes make priority setting an early and influential step in their operating procedures, whether the priorities are expressed as ecosystem objectives, goal determination, or in some other way. There are many biodiversity conservation issues in areas beyond national jurisdiction, and the processes of prioritisation should be viewed in the context of triage. Highest priorities may need most urgent and decisive action, but lower priorities cannot be ignored. This is particularly a concern in areas where absence of information makes application of the science criteria for biological and ecological significance difficult. Moreover, a comprehensive strategy for conservation of biodiversity in areas beyond national jurisdiction will require an ability to react swiftly and apply appropriate measures. In some cases, where available information is limited but indicates both the presence (or likely presence) of biologically of ecologically significant features and imminent threats of serious or lasting harm, interim measures may be necessary until sufficient information has been accumulated to determine long-term objectives and measures.

Even the prioritisation and planning procedures will achieve little unless there is effective implementation and enforcement of the plans for enhanced management in areas beyond national jurisdiction and the ability to quickly adapt plans and actions to changing conditions. For example, despite major efforts by many states and international agencies to ensure compliance with single species fisheries quotas, illegal, unreported or unregulated (IUU) fishing remains a threat to a number of stocks in areas beyond national jurisdiction. The lessons learned from the successes and failures in dealing with IUU fishing have important messages for spatial management plans and measures intended to achieve conservation and sustainable use of living resources in areas beyond national jurisdiction.

The paucity of information on biodiversity in areas beyond national jurisdiction, and incomplete knowledge of the consequences of both different human activities in areas beyond national jurisdiction and different measures intended to mitigate undesired consequences, also have implications for any governance system and management processes using these criteria. First of all the processes have to use the best scientific information available (including "traditional" and "experiential" knowledge) when applying the criteria, but, consistent with the Precautionary Approach, not let the incompleteness of scientific information be a reason to delay action. As discussed in Section 2.2.1 on Representativity, action will be needed to protect representative areas when there is a lack of scientific information to demonstrate additional ecological or biological significance.

Secondly, the processes need to be iterative in application, so the science based step and human-values based steps in setting priorities and objectives for conservation and use of biodiversity in areas beyond national jurisdiction can interact constructively while each part maintains its integrity. Thirdly, the entire process has to be adaptive, containing regular reviews of progress towards objectives, and applying new knowledge as it is acquired. For the system to be adaptive and learn from experience, it is necessary that monitoring of effects as well as compliance accompany any management plans to which these criteria are an input.

3.6 The application of Precaution

In the identification of Ecologically Or Biologically Significant Areas in areas and deep oceans beyond national jurisdiction, the best scientific information available should be used in concert with the precautionary approach, commensurate with the level of uncertainty associated with what is not yet known about these areas. Considering that many aspects of seas beyond national jurisdiction remain poorly studied, this is consistent with the definition of the precautionary approach provided in the FAO Code of Conduct for Responsible Fisheries, which specifically calls for wide application of this approach to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the marine environment (para. 6.5), and provides that "the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target species and their environment."

Given what is known about the deep oceans beyond national jurisdiction (as well as within), it is acknowledged that while they remain poorly explored and understood, current information indicates that deep sea ecosystems and species are vulnerable to human impacts (e.g. seamounts, deep sea coral reefs and sponge beds), and many species inhabiting such areas are long-lived, slow growing, fragile, and when damaged take a long time to recover. In keeping with a precautionary approach, the criteria in this document can be used to identify immediate priorities for special management. In addition, as noted above, in cases where available information is limited but indicates both the presence (or likely presence) of biologically or ecologically significant features and imminent threats of serious or lasting harm, implementation of effective protection should not be delayed until sufficient information has been accumulated to determine long-term objectives and measures.

Table 1. Summary of criteria developed for identifying candidate sites for MPAs.

Source	Biogeographic representation	Habitat representation/ heterogeneity	High diversity (habitat, sp.)	Genetic diversity	Degree/Nature of Threats	Productivity	Spawning/Breeding grounds	Size/shape/ connectivity	Export functions	Viability	Disturbance	Management/ Feasibility	Aggregations	Vulnerable habitats	Vulnerable life stages	Species or populations of special concern	Exploitable species	Ecosystem linkages	Ecological services for humans	Naturalness	Uniqueness/Rare habitats	Rare/ endemic species	Scientific value	Critical habitat	Comprehensiveness	Site integrity	Int'l/nat'l importance
Gubbay, 2003		✓	✓		✓				✓		✓	✓									✓	✓				✓	
IMO, 2001	✓	✓	✓			✓	✓							✓				✓		✓	✓	✓	✓	✓		✓	
IUCN, 1996	✓	✓	✓					✓				✓	✓			✓		✓	✓	✓	✓			✓		✓	✓
Kelleher, 1999	✓	✓		✓			✓									✓		✓		✓	✓	✓				✓	
Salm & Clark, 2000	✓	✓	✓			✓								✓				✓		✓	✓					✓	
Roberts, *et al.*, 2003a	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
Hockey & Branch, 1997	✓		✓						✓					✓	✓	✓	✓									✓	
Gladstone *et al.*, 2003	✓	✓					✓								✓												
Mills & Carleton, 1998	✓				✓																						
OSPAR Commission, 2003	✓	✓	✓		✓		✓	✓				✓		✓	✓	✓				✓							
Conner *et al.*, 200			✓		✓			✓							✓	✓				✓	✓	✓					✓
McLeod *et al.*, 2005; Johnston *et al.*, 2000		✓														✓					✓				✓		✓
UNEP, 1994		✓					✓								✓	✓		✓			✓	✓	✓				
DFO, 2005																				✓	✓						
Levings & Jamieson, 1999		✓	✓			✓	✓		✓	✓		✓		✓						✓	✓	✓		✓			
Parks Canada, 2003	✓	✓											✓			✓							✓	✓	✓		
ANZECC, 1998	✓	✓		✓		✓								✓	✓			✓		✓	✓	✓			✓		✓
Environment Australia, 2003	✓	✓	✓		✓		✓	✓									✓			✓							
NSW, 2000	✓	✓		✓		✓	✓							✓	✓	✓			✓	✓	✓	✓			✓		✓
Brody, 1998	✓	✓	✓		✓	✓		✓								✓				✓	✓	✓		✓		✓	
Total	**14**	**16**	**10**	**3**	**6**	**6**	**8**	**6**	**4**	**2**	**2**	**5**	**3**	**8**	**8**	**11**	**3**	**7**	**3**	**12**	**13**	**9**	**3**	**5**	**4**	**7**	**5**

Annex I

BIOGEOGRAPHY in areas beyond national jurisdiction

Although there are substantial gaps in our knowledge of large areas beyond national jurisdiction (the Southern, Indian, South Atlantic, and sectors of the South Pacific Oceans are particularly poorly sampled) considerable progress has been made in laying the foundations for the biogeography of major habitats in areas beyond national jurisdiction. The pelagic biogeography of the world's oceans is comparatively well studied, based upon reviews of the distribution of various groups of planktonic organisms (e.g. McGowan 1971, Gibbons 1997, Pierrot-Bults and van der Spoel 1998) and more recently, through the use of remote sensing data to define global ocean productivity regimes (Longhurst 1998). Despite gaps in our knowledge, the biogeography of several key deep-sea environments has also been reviewed: hydrothermal vents (Tunnicliffe et al 1996, 1998, van Dover et al 2001, 2002), cold seeps (Sibuet and Olu 1998, van Dover et al 2002), trenches and the abyssal plain (Ekman, 1967, Gebruk et al 1997, Vinogradova 1997). The biogeography of chemosynthetic, vent and seamount faunas is currently an active area of oceanographic research through both national and international research programmes (e.g. the Census of Marine Life CHESS, CenSeam, and MarEco projects, and the European Union Oasis and Hermes projects). The development of comprehensive international databases is a key output of such projects, and advances in hitherto neglected areas, such as seamount biogeography are anticipated in the near future.

Although the biogeography of high-seas environments is still in its infancy, there appears to be significant variation in the species diversity and patterns of endemism and some coherence of distribution among sets of species. These emerging patterns should provide the basis to assess the spatial scale for selection of representative habitats for protection.

Pierrot-Bults AC and van der Spoel S (1998) Pelagic Biogeography. IOC Workshop Report 142.

Ekman S (1953) Zoogeography of the Sea.

Gebruk AV, Southward EC, Tyler PA (1997) The biogeography of the oceans. Advances in Marine Biology 32.

Gibbons MJ (1997) Pelagic biogeography of the South Atlantic Ocean. Marine Biology 129:757-768.

Longhurst A (1998) Ecological geography of the seas. Academic Press, San Diego

McGowan JA (1971) Oceanic biogeography of the Pacific. In: Funnell B, Riedel W (eds) The Micropaleontology of the Oceans. Cambridge University Press, Cambridge, pp 3-74

Sibuet M, Olu K (1998) Biogeography, biodiversity and fluid dependence of deep-sea cold-seep communities at active and passive margins. Deep-Sea Research II 45:517-567

Further Information: A good overview of how a biogeographic classification system was created from a variety of other pre-existing systems, and the myriad of issues involved, is described in:

Dinter, W.P. (2001) Biogeography of the OSPAR Maritime Area: a synopsis of biogeographical distribution patterns described for the north-east Atlantic. Federal Agency for Nature Conservation, Bonn, Germany.

Annex II

Definition of "Protected Area"

IUCN - the World Conservation Union, defines a protected area as: "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means."

The IUCN categorizes protected areas by management objective and has identified six distinct categories of protected areas:

(a) Strict Nature Reserve/Wilderness Area: protected area managed mainly for science of wilderness protection

(b) National Park: protected area managed mainly for ecosystem protection and recreation

(c) Natural Monument: protected area managed mainly for conservation of specific natural features

(d) Habitat/Species Management Area: protected area managed mainly for conservation through management intervention

(e) Protected Landscape/Seascape: protected area managed mainly for landscape/seascape protection and recreation.

(f) Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems.

(Source: IUCN/World Commission on Protected Areas' website, December 2005)

Annex III

Comparable concepts from the United States of America (U.S.A.)

The concept of Ecologically and Biologically Significant Areas has many similarities to two concepts defined in the U.S.A. to identify areas in need of additional protection. Habitat Areas of Particular Concern are identified in the context of protecting sustainable fisheries, and Critical Habitats are identified in the context of aiding species listed as endangered or threatened.

Habitat Areas of Particular Concern

The term ‘essential fish habitat’ (EFH) as defined in the U.S.A> Magnuson-Stevens Fishery Conservation and Management Act (1996) means those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. Habitat Areas of Particular Concern (HAPCs) are discrete areas within EFH that either play especially important ecological roles in the life cycles of federally managed fish species or are especially vulnerable to degradation from fishing or other human activities. The designation of HAPCs acknowledges cases where detailed information exists on ecological function and/or habitat vulnerability to highlight certain habitats as priority areas for conservation and management. The EFH regulations encourage the fishery management councils to identify HAPCs based on one or more of the following considerations:

(a) Importance of ecological function provided by the habitat;
(b) Extent to which the habitat is sensitive to human-induced environmental degradation;
(c) Whether and to what extent development activities are, or will be, stressing the habitat type;
(d) Rarity of the habitat.

Critical Habitat

The U.S.A. Endangered Species Act (ESA) (1973) requires the federal government to designate “critical habitat” for any species it lists under the ESA. “Critical habitat” is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

Critical habitat designations must be based on the best scientific information available, in an open public process, within specific timeframes. Before designating critical habitat, careful consideration must be given to the economic impacts, impacts on national security, and other relevant impacts of specifying any particular area as critical habitat. The Secretary of Commerce may exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless excluding the area will result in the extinction of the species concerned.

Annex IV

A summary of the criteria recommended by this expert group and the IUCN criteria (Kelleher 1999)

Recommended criteria for identifying areas potentially requiring special management consideration	**IUCN criteria for selecting MPAs**
Representativity - habitat/biotope types - species assemblages - ecological processes - other natural features	- Representative of a biogeographic "type" or types
Uniqueness or rarity - areas with unique, rare or distinct characteristics - areas with unique species, populations, communities or geographic features - specific habitats for rare, endangered or threatened species	- Presence of rare biogeographic qualities - Existence of unique or unusual geological features - Existence of rare or unique habitat for any species - Presence of habitat for rare or endangered species
Critical life-history functions / habitats - spawning areas, calving grounds, larval retention areas, etc. - areas of aggregation of organisms	- Presence of nursery or juvenile areas - Presence of feeding, breeding or rest areas
	Integrity – the degree to which the area, either alone or in association with other protected areas, encompass a complete ecosystem
Vulnerability - species, habitats or ecosystems which are susceptible to degradation - physically or functionally fragile - slow to recover once degraded	
Productivity - areas with high production - areas with export to adjacent areas	Ecological processes or life support systems (e.g. as a source of larvae for downstream areas)
Diversity - within species - species - habitats - ecosystems	- Degree of genetic diversity within species - The variety of habitats
Naturalness – the degree to which an area is not impacted or changed due to human activities	Naturalness – extent to which the area has been protected from, or has not been subject to, human-induced change

Annex V

Technical considerations in combining information from different criteria

There are several steps in going from the stage of applying the criteria individually to a host of areas beyond national jurisdiction to that of recommending a pattern of spatially-based management measures. These steps can be summarized in three phases (Fig. 1). The first phase starts with the compilation of data necessary for mapping habitats and species distributions within a particular region. Completion of this phase results in maps of areas which meet each of the criteria individually; being representative, unique, important for a critical life history function of one or more species, etc. Even at this unintegrated level systematic habitat classification is important to the success of protecting marine biodiversity, as it allows identification of the variety of marine habitats requiring appropriate levels of protection, and the reasons why that protection is needed.

The second part of phase one is the selection of a set of Ecologically Or Biologically Significant Areas and other areas of interest (AOIs), which comprise a potential system of protected areas, and form the basis for spatial management overall. This requires integrating the information in the separate criterion-specific maps. The integration, in turn, requires judgments on the relative priority of the criteria, even if the judgment is that they all have equal priority. Particularly when scorings of an area on the individual criteria are quantitative, but even when it is qualitative or binary (present/absent), there are numerous algorithms by which the scores can be combined. All require weightings of the criteria, and the weightings are affected by many social and cultural considerations, which can vary widely among stakeholders and even expert advisors. A number of investigations have shown that given a specific set of weightings, many of the best studied analytical methods of combining scores provide very comparable rankings of a set of marine areas. However, differences in weighting of the importance of the various criteria can provide very different prioritizations of areas, regardless of what algorithm may have been used. Hence, great attention must be given to the process of assigning the weightings to the criteria.

The rest of the second phase focuses on identifying connectivity requirements among Ecologically Or Biologically Significant Areas and other Areas of Interest (AOIs), so the management of the areas ensures that the features of significance or interest are protected. This phase makes the best use possible of the available information on the ecosystem and on the human activities possible in the area. The goal is to ensure conservation of marine biodiversity while allowing social, cultural, and economic activities to the greatest extent compatible with the conservation goal.

The third planning phase is then concerned with moving from a set of Ecologically Or Biologically Significant Areas (or AOI's) to determining a logical and defensible spatial management system, which may include an MPA network. This phase considers the weighting of socio-economic and cultural objectives and associated criteria to choose among areas warranting enhanced management measures to create a network of MPAs and a general spatial approach to management of human activities. The goal is a network of spatially based management measures that meet identified ecological goals whilst minimising disruption to socio-economic and cultural needs. Here again, the process of making the social and economic goals explicit, and integrating them with the ecological ones, is crucial to overall success.

Formal spatial optimisation algorithms offer a powerful tool for MPA network design. These programs improve rigour, transparency and efficiency, but they only contribute to part of the overall AOI-MPA network selection process. Other decision support tools (such as GIS and Delphic approaches) are often needed when fine-tuning boundaries, developing zoning plans, or when choosing among candidates that are of interest to several stakeholder groups.

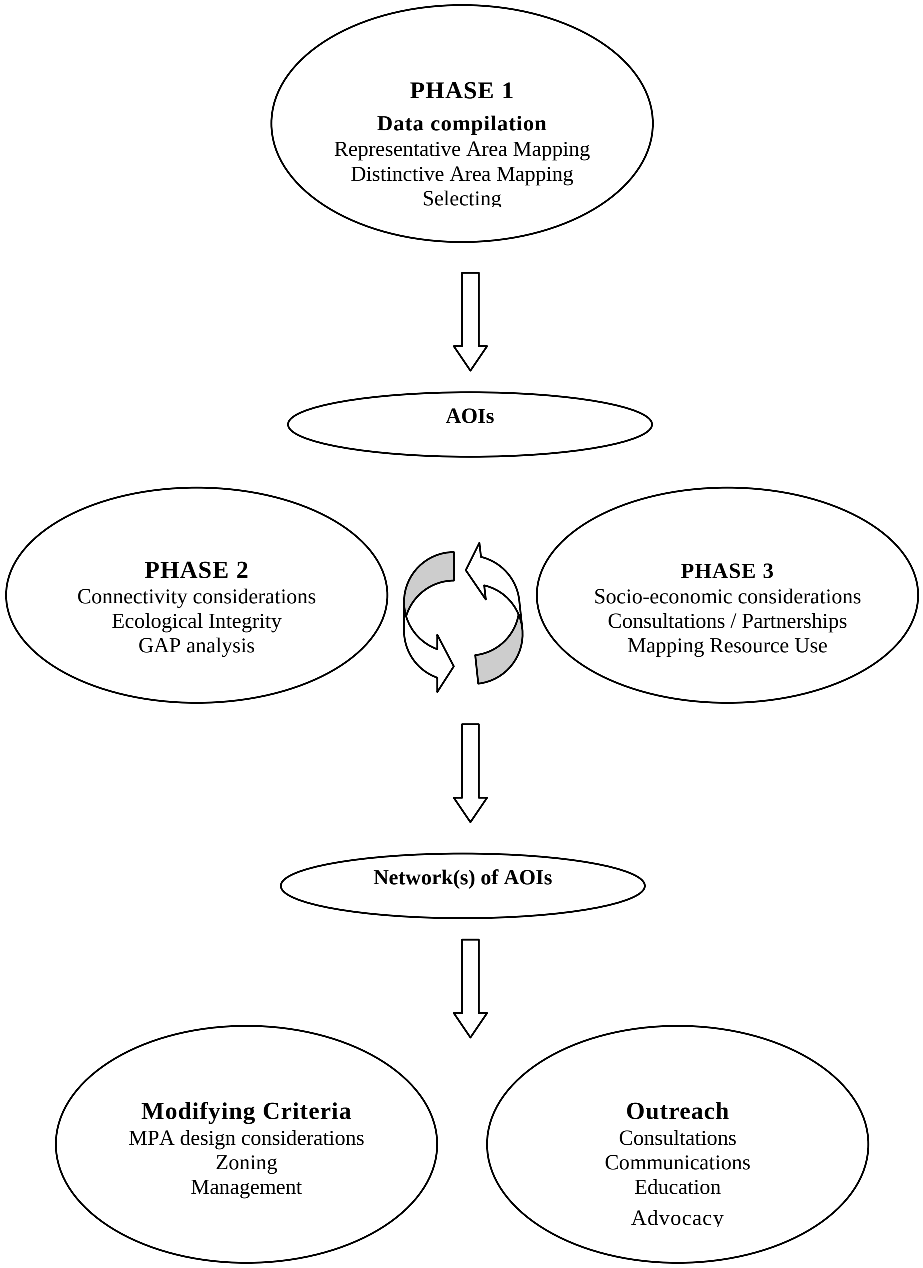


Fig. 1. Steps involved in the development of a network of marine protected areas (based on WWF/CLF 2004).

Overall any approach towards establishing Ecologically Or Biologically Significant Areas, including networks of MPAs within the larger spatial management system should be systematic, ecologically-based and scientifically defensible using the best available data, and be designed to meet multiple objectives for the diverse set of MPAs that can be designated in the overall area. The advantage of a systematic approach is that it maximises the chance that decisions on spatial management will address the full suite of objectives, it ensures a transparent and defensible process and it makes efficient use of available resources.

Annex VI

Consideration regarding Management Feasibility

As noted in Section 3.3 there also are important differences between management within and outside national jurisdictions. These include:

- lack of a single national jurisdiction over any part of areas beyond national jurisdiction;
- existence of multiple national jurisdictions over activities carried out beyond national jurisdiction (i.e., flag state jurisdiction; jurisdiction over citizens and national corporations);
- correspondingly, where there is not a mandated institution already in place, the need to agree on an organization, agency, or other mechanism to "manage" the areas beyond national jurisdiction, including the development of its rules and procedures and,
- potential higher variability in the size of the areas beyond national jurisdictions that are to be managed.

Marine management experience generally has been by individual nation-states within their jurisdiction or over their flag vessels, although there are increasing numbers of nation state compacts attempting to cooperatively manage adjacent coastal and nearshore areas or species of common conservation concern (e.g., West Africa, North America, the Mediterranean). These may include organisations established for sectoral management and conservation purposes in specified areas which may include portions of areas beyond national jurisdiction (e.g., Regional Fisheries Management Organisations [RFMOs] such as NAFO IOTC, CCSBT, and NEAFC) as well as agreements and agencies established for broader purposes such as ecosystem or biodiversity conservation of specified areas such as Northeast Atlantic OSPAR Commission, the Antarctic Treaty Consultative Mechanism and its Committee for Environmental Protection, and the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

In areas under the jurisdiction of such agencies and organisations, effectiveness of spatially-based management measures are often tied to effectiveness of the breadth of their mandate/legal competence as well as the commitment of member states. Hence criteria regarding the presence, effectiveness, and mandates of management authorities, as well as the ability of member States to provide effective surveillance and enforcement are relevant to evaluating areas as candidates for targeted efforts at spatially-based management.

For the most part management efforts in areas beyond national jurisdiction presently are sectoral-based mechanisms for management of shared fisheries (generally RFMOs) and for areas potentially impacted by navigation. There are a few notable exceptions such as Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), which has a broad remit beyond fisheries and includes conservation of living marine resources and the North-East Atlantic OSPAR Commission, but there are few such non-sectoral management institutions for areas beyond national jurisdiction. Therefore, two primary management challenges are to:

- develop appropriate institutional mechanisms to protect and manage ecologically or biologically significant areas in areas beyond national jurisdiction;
- integrate ecosystem-based management of these areas with sectoral-based management, where it exists.

Generally, there also is a lack of organisations or agencies which can actually implement non-sectoral management plans for areas beyond national jurisdiction. Areas to be protected within the EEZ usually are identified, designed, and managed day-to-day by a government agency or consortium of government agencies. With the exceptions noted above, such operational management agencies do not exist for areas beyond national jurisdiction. Even nearshore considerations such as land ownership and ancestral rights will rarely or never apply in areas beyond national jurisdiction.

There is potentially a wider range of sizes and scales of areas beyond national jurisdiction to be managed than for the near-shore, depending importantly upon the resource(s) or system to be conserved. For example, vents or seeps are relatively small in area, and seamounts also may be relatively small. Submarine canyons or collections of seamounts, such as those of south Tasmania may be larger. Very large areas might be necessary to protect open-ocean ecosystems and pelagic or highly migratory species, such as whales. One broad spatial scale option would be an approach that includes spatial protection of areas important for critical life history functions of the resource(s) of concern (See Section 2.3.3) linked by migration corridors. Dynamic area management, where the protection moves with the resource, also is an option. For these reasons, when developing spatial management approaches for areas beyond national jurisdiction, criteria should be developed that take into account the feasibility of managing on the spatial scale needed to give the ecosystem attributes of concern adequate protection.

These considerations of management feasibility will interact with the considerations from the scientific criteria in Section 2. The identification of areas and corresponding spatial management approaches may be facilitated by “feasibility criteria” addressing features such as:

Physical Considerations

- What spatial challenges will be faced in achieving the desired level of conservation and spatial management?
- How is the size of an area determined? Is it limited by costs or other considerations?
- Level of isolation and accessibility – can it be managed?
- Configuration – what practical considerations must be made for site design (such as plotting efficient navigation routes)?
- How long does the site stay in place? What are the unique management challenges to managing ephemeral sites such hydrothermal vents or seeps?
- How do we address persistent hydrographic features such as current systems or fronts which have general geographic locations, but which vary over time? Would it be sufficient to design spatial management approaches based around their average position?
- Are there sufficient data to make an informed decision? Are available data possibly anomalous or otherwise not representative?

Institutional Considerations –

- Where a mandated institution does not already exist, what institutions are available and which ones are needed to achieve the desired level of conservation and spatial management?
- In considering the potential role of existing institutions or the need to establish new ones:
  - How is a management plan developed and who develops it?
  - What is the operational entity? Who takes responsibility for the area for management purposes? To whom do they report?
  - What is the source of funding for management? What are the staff requirements, facilities, and equipment requirements?
  - What are the points of access or entry to an area? Or, are they accessed by global users in transit, such as passing ships, that have no dependency on nearby land bases?
  - How could surveillance and enforcement conducted for what are likely to be distant, remote areas?
  - How can monitoring of the effectiveness of management be conducted?
  - Is timely adaptive management feasible for the governance system? Can operational management agencies in areas beyond national jurisdiction respond in a timely manner to address

immediate threats or changing conditions for an area established by multi-national agreement? Can a process to modify management be built into the design process?

Potential Conflicts and Opportunities – Potential economic uses of resources can be viewed as potential threats to them, but when implemented in a responsible manner respecting relevant national and international instruments, they also provide the potential for cooperation.

- What are the economic interests in the area? Are there existing or potential environmental impacts from pursuing those interests? Are there ways to pursue the economic interests which do not impact the resources or areas being proposed for enhanced protection?
- How will areas be affected by shipping? Should shipping avoid or transit the area? Should there be special restrictions on discharges? Would answers depend upon the resource involved or the level of protection desired, and if so, how? Could such shipping be used as part of a surveillance program?
- Would deep-sea mining or oil and gas exploration and development (either inside or outside EEZs) present threats to these areas? Could such activities provide opportunities for increased observation, monitoring, and surveillance of an area?
- Would submarine cables, archaeological sites, marine scientific research or bioprospecting likewise present threats and/or opportunities?
- How will areas be affected by alternative energy production installations (e.g., wind, hydrothermal, methane, vent or Ocean Thermal Energy Conversion) inside or outside EEZs, or by other new uses of the ocean?
- How are new or emerging uses incorporated into the planning and adaptive management process?

This short and incomplete discussion highlights that the management of human activities in the areas beyond national jurisdiction will require an unusually broad spectrum of expertise, well beyond that provided by natural sciences. Most importantly, success of management in areas beyond national jurisdiction will depend on a universal appreciation of the threats and the value of resources beyond national jurisdictions for humanity, and a strong willingness among parties to cooperate in finding and implementing solutions.

Annex VII

List of participants

The International Marine Ecological Experts Workshop, December 6-8, 2005

NAME	COUNTRY	AFFILIATION
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