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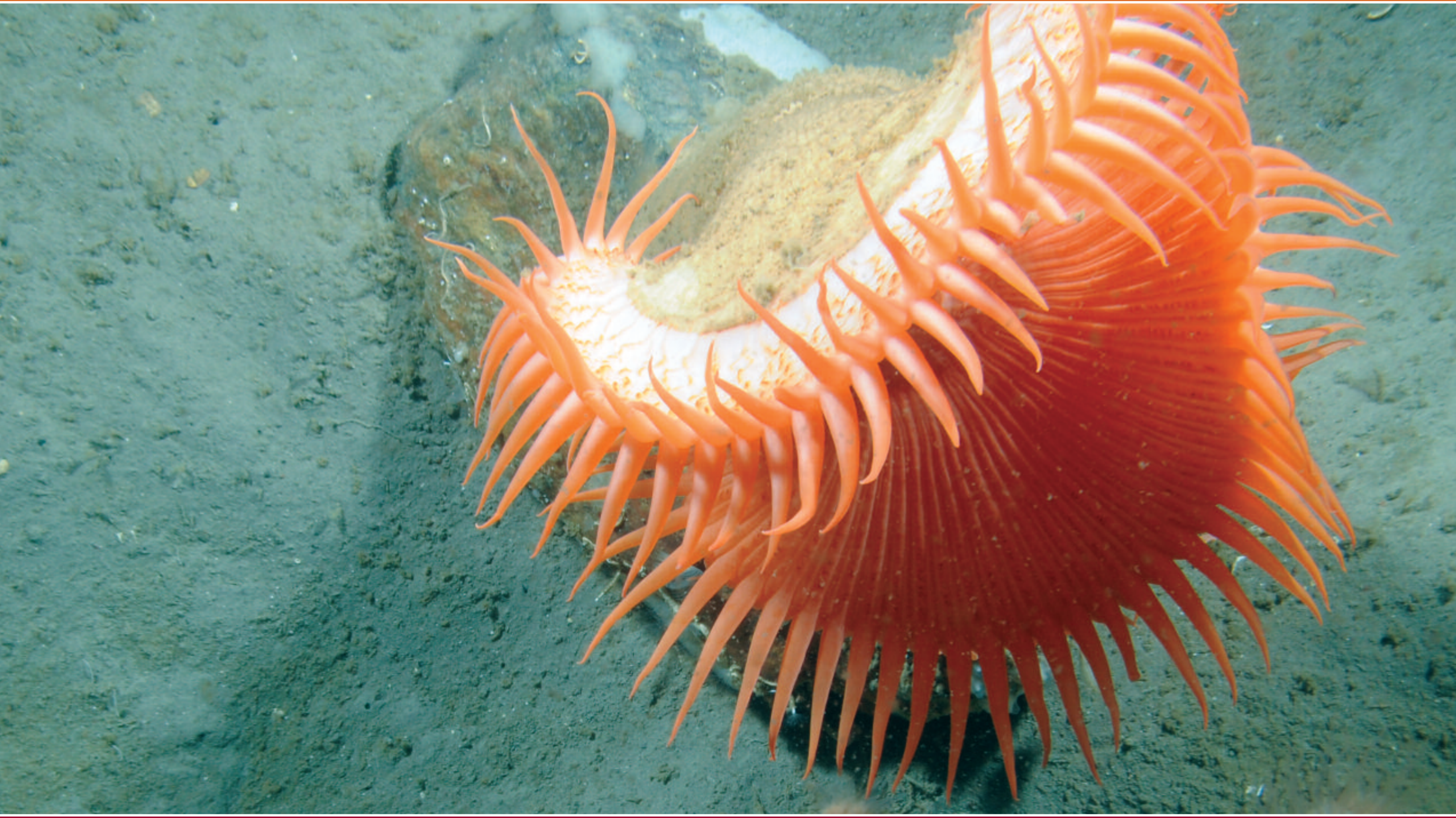
Criteria and Tools for Designing Ecologically Sound Marine Protected Area Networks in Canada's Marine Regions



Suggested citation:
Smith, J., M. Patterson, H.M. Alidina and J. Ardron. 2009. Criteria and Tools for Desigining Ecologically Sound Marine Protected Area Networks in Canada's Marine Regions. WWF-Canada.

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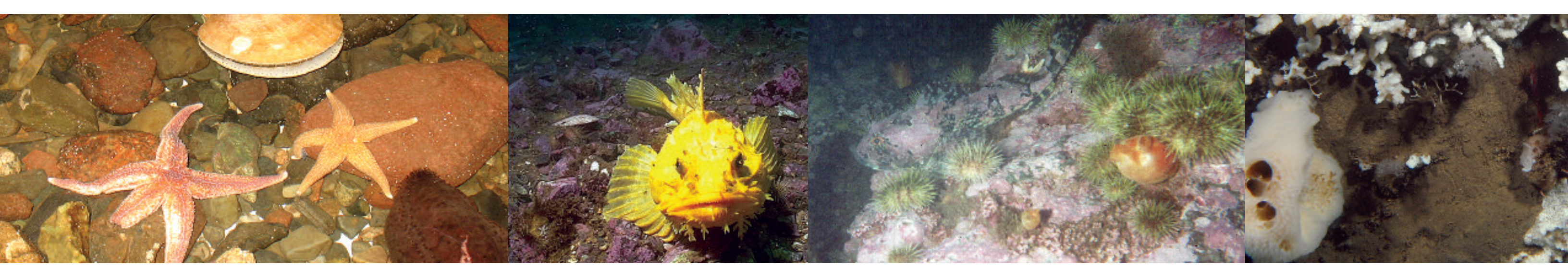


Purpose of this document

This document presents a set of criteria and associated guidance that can be used to help answer the following questions:

- How can we *design* an ecologically sound marine protected area (MPA) network?
- How can we *measure* whether an MPA network is ecologically sound?

As such, it provides a benchmark that will permit WWF-Canada and others to rigorously and consistently measure progress toward sound MPA networks, and to assess the soundness of draft network designs that may emerge from planning processes. We also hope that this document will be of use in formulating ecological network design principles at the outset of the design process.

The criteria are most relevant to regional-scale networks such as those under development in Canada's five priority Large Ocean Management Areas (LOMAs) and other large marine regions. Our focus in this document is on the design of sound, effective MPA networks that can function within broader marine planning approaches, such as marine spatial planning and integrated management.

The first part of this document sets out these criteria, drawing on scientific guidance developed by experts in the field and agreed upon through international bodies, in particular the Convention on Biological Diversity (CBD). It reflects up-to-date scientific advice, global best practice, and commitments under international customary law. For each criterion, additional suggestions are made with regard to implementation in the Canadian context.

Well-thought-out scientific criteria will be moot without a plan to put MPA networks in place on the water. The second part of this document makes suggestions for the policy and operational aspects of implementing sound networks of MPAs that embody these criteria in Canada.

The document has three appendices, intended as tools to support application of the criteria: Appendix I is an example of a set of ecological design principles that can be used at the outset of an MPA network planning process to guide design of an ecologically sound (also referred to in the international literature as "ecologically coherent") MPA network. These design principles can be adapted to each region. Appendix II is a tool, in the form of a checklist, to facilitate evaluation of existing or evolving MPA networks. Appendix III contains the guidance on criteria for ecological coherence as adopted by the CBD in early 2008.

This document was precipitated in part by, and draws upon, a workshop hosted jointly by WWF-Canada and Fisheries and Oceans Canada (DFO) in January 2008. The workshop report will be available at **www.wwf.ca/MPAworkshop**

A note about terminology

In this document, the term **marine protected area (MPA)** is used in a generic sense – not to refer to any one specific legislative or regulatory mechanism – unless otherwise noted. We use the IUCN definition of an MPA, which focuses on intent and result:

> *A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.*

The term **Ecologically and Biologically Significant Area (EBSA)** is defined differently in the CBD guidance than it is by DFO Science. The CBD definition, and accompanying criteria for consideration of a site as an EBSA, can be found in Appendix III. In this document, we use the term EBSA in the CBD sense unless specifically referring to the DFO approach. See section 1.1 for more detail.

1 Science-based criteria for sound MPA networks

In May 2008 the 9th Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) adopted a package of guidance commissioned from an experts' working group (contained in Appendix III). The CBD criteria represent a consolidation of guidance from other sources and a consensus of expert advice. Canada, through Fisheries and Oceans Canada, was closely involved in the drafting and adoption of this guidance.

The CBD commitment is to establish comprehensive, effectively managed, and ecologically representative national and regional networks of protected areas. An MPA network can be defined as:

> *A collection of individual marine protected areas operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfill ecological aims more effectively and comprehensively than individual sites could alone*[1]*.*

Behind this definition is the concept that a network is more than simply a set of sites, but rather that the constituent MPAs maintain a relationship to one another and to the surrounding environment. This core concept has been labeled "ecological coherence." In Europe, the OSPAR (Northeast Atlantic) and HELCOM (Baltic) Commissions have both agreed that an ecologically coherent network should:

- Interact with and support the wider environment;
- Maintain the processes, functions, and structures of the intended protected features across their natural range; and
- Function synergistically as a whole, such that the individual protected sites benefit from each other to achieve the two objectives above.
- Additionally, it may also be designed to be resilient to changing conditions[2].

The above concept of ecological coherence fed into the development a five-point package of scientific guidance for selecting areas to establish a representative network of MPAs, including in open ocean waters and deep-sea habitats, adopted at CBD COP 9 in May 2008. There it was agreed that MPA networks should possess the following five properties:

- Ecologically or biologically significant areas
- Representativity
- Connectivity
- Replicated ecological features
- Adequate and viable sites

This document has been structured around these five properties. For each, the CBD definition is provided, followed by additional scientific guidance with special relevance in the Canadian context.

1.1 Ecologically or biologically significant areas[3]

Scientific guidance

> *Geographically or oceanographically discrete areas that provide important services to one or more species/ populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar*

[1] WCPA/IUCN. 2007. Establishing networks of marine protected areas: A guide for developing national and regional capacity for building MPA networks. Non-technical summary report.

[2] OSPAR. 2007. Background Document to Support the Assessment of Whether the OSPAR Network of Marine Protected Areas is Ecologically Coherent. OSPAR Biodiversity Series, 319. This definition is based on previous guidance from OSPAR and on Laffoley, D. d'A., S. Brockington, and P.M. Gilliland. 2006. Developing the concepts of Good Environmental Status and Marine Ecosystem Objectives: some important considerations. English Nature Research Report, Peterborough. 29 pp.

[3] The development of the CBD EBSA criteria was led by Canada and based on earlier work by DFO. However, the detail of what emerged from the CBD is somewhat different from the criteria developed earlier in Canada. To avoid confusion, we use the acronym EBSA here in the broader sense, as per the CBD guidance, unless expressly referring to the specific DFO methodology.

ecological characteristics, or otherwise meet the criteria as identified in annex II.[4]

- "Significant," "distinctive" or "special" areas have traditionally been the focus of conservation efforts. While representation of the full range of biodiversity has become the foundation for a comprehensive protected areas network, there will always be outstanding sites which serve a special function in a regional ecosystem and merit protection.
- The CBD guidance provides a list of seven criteria for the selection of EBSAs:
  - Uniqueness or rarity
  - Special importance for life history stages
  - Importance for threatened, endangered or declining species and/or habitats
  - Vulnerability, fragility, sensitivity or slow recovery
  - Biological productivity
  - Biological diversity
  - Naturalness

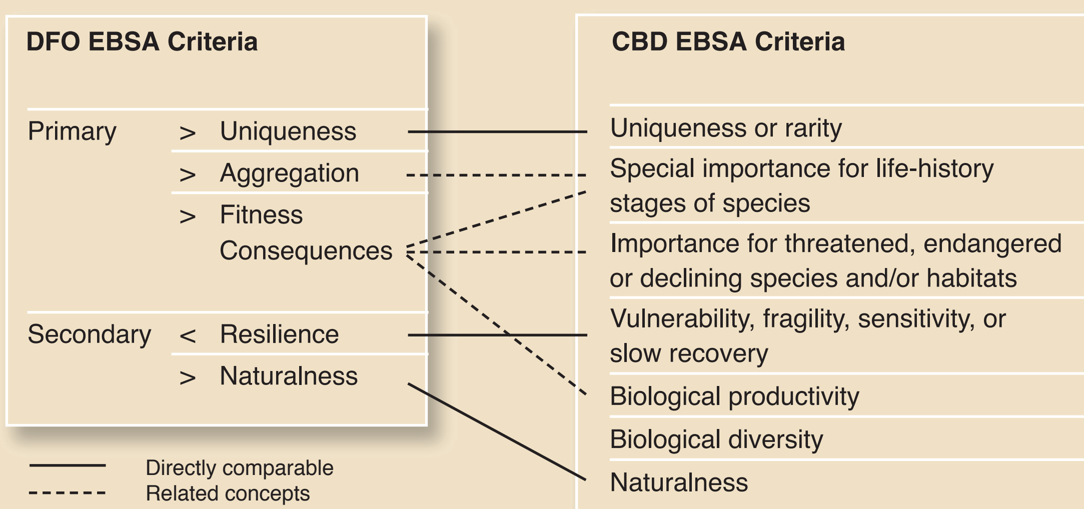
  The presence of any one of these seven criteria is considered sufficient to warrant an area's consideration for protection. Full descriptions can be found in Appendix III

EBSAs in Canada

- Canada, led by DFO, has already made much progress with a federal approach to identifying EBSAs in the form of scientific guidance and draft maps for each of the five priority LOMAs.
- The notion of EBSAs is of course not a new one, and some provincial, territorial and First Nations governments have independently made efforts to identify equivalent sets of areas. For instance in BC there has been a provincial effort to identify Valued Marine Environments and Features (VMEFs).[5]
- As outlined below, there may be areas of significance, according to the CBD guidance, which would not be identified via the Canadian approach – such areas should be considered to supplement existing inventories of EBSAs and other areas of conservation value.
- To ensure that the inventory of EBSAs used for MPA network planning is comprehensive, the planning process will need to be informed by both the formalized DFO EBSAs and by other sites that may be of particular ecological significance but do not meet the highly specific approach outlined in the DFO status report[6].

FIGURE 1.

Relationship between the Canadian and CBD EBSA criteria



[4] Passages in italics are drawn from the CBD guidance. For context and further detail on each property, see Appendix III

[5] Dale, N.G. 1997. An overview and strategic assessment of key conservation, recreation and cultural heritage values in British Columbia's marine environment. Prepared by ESSA Technologies Ltd., Vancouver, BC for BC Corporate Information Services, Victoria, BC.

[6] DFO. Identification of Ecologically and Biologically Significant Areas. Ecosystem Status Report 2004/06. http://www.dfo-mpo.gc.ca/csas/Csas/status/2004/ ESR2004_006_E.pdf

DFO's approach to identifying EBSAs is founded on placing areas or features on a continuum for each of three primary dimensions and two secondary dimensions. The placement of a site on these continua, taken individually and collectively, is a guide to its significance. The CBD approach is more direct, simply listing a number of criteria which, if present, indicate significance. Both approaches provide a helpful framework for thinking about the significance of a given site or feature, and both are likely to be useful for MPA network planning. We suggest that the CBD guidance be used to check for gaps in the existing EBSA inventories early in any regional network planning process.

Based on figure 1, some particular kinds of significant areas that may not be identified through the Canadian federal approach, but which should be considered, include areas of *Special importance for life-history stages of species, Importance for threatened, endangered or declining species and/or habitats, Biological productivity,* and *Biological diversity.* Some of these may be addressed through other processes, such as the identification of critical habitat under SARA, the identification of "degraded sites," and/or other initiatives carried out by implementing agencies of other levels of government (e.g. BC VMEFs). However a comprehensive inventory of likely EBSAs as a single information product would be most valuable as a starting point for MPA network planning, as per the first step recommended by the CBD (see appendix III).

Suggestions for implementation

- Once a comprehensive regional inventory of EBSAs has been created at the outset of a planning process, the course of action for implementing protection for EBSAS will be influenced by:
  - The degree to which it meets the EBSA criteria
  - The characteristics of the EBSA, such as sensitivity or risk, that may indicate a higher level of protection
  - The importance of the particular EBSA to the comprehensiveness and coherence of the network.
- As discrete places in the marine environment, EBSAs will usually require a place-based management response. This may be an MPA or an other form of spatial management.
- Regardless of the management response chosen, the onus rests with the competent authority to demonstrate that the chosen tool and/or regulation will adequately protect the characteristics that led to the identification of the site as an EBSA. DFO's EBSA framework suggests that EBSAs are areas where management should be more risk-adverse than in surrounding waters: explicit steps should be detailed toward putting these management measures in place or integrating heightened precaution directly into ongoing decision making, such as the expansion of new fisheries or granting of exploration licenses.
- Alternatively, if it is decided that an EBSA will not be protected, the competent authority should be transparent and accountable for the reasoning behind that decision
- If an EBSA is chosen as a part of an MPA network, the mandates, policies and capacities of different levels of government and individual agencies will necessarily act as a guide to the appropriate MPA designation tool.
- There should be no new or significantly expanded development or extractive activities in EBSAs before the selection process is complete and MPA network plans are established, and interim protection measures will often be an appropriate precautionary response.

The scope of management measures for EBSAs should extend beyond just MPA networks. For example, an EBSA chosen for its importance to an at-risk cetacean species may be adequately conserved by restrictions on forage species and entanglement-causing gear, and/or by appropriate shipping lanes and speed restrictions. An EBSA chosen for its unique and sensitive ecosystem might be best served by an MPA with a no-take core. Other factors might include expected seasonal or long-term changes in the presence of the species or process that makes it an EBSA.

The second factor in whether an EBSA should be designated an MPA (and what level of protection is warranted) is the role it would play in the network. An EBSA with a significant influence on the regional ecosystem, or that acts as a critical link in the network spatially or from a connectivity perspective, may be vital to the functioning of the network in the long-term.

Once the decision has been made to include an EBSA in an MPA network, the question becomes which legislative tool is most appropriate from the perspective of mandates, program priorities, and regulatory powers. It should, however, be kept in mind that one MPA may encompass more than one EBSA, and may also contribute toward representativity, so this will rarely be a one-to-one relationship.

Although the DFO method for identifying EBSAs has been applied in the five priority LOMAs, decisions continue to be made that influence their management and expose them to impacts – and large areas of Canada's oceans fall outside the priority LOMAs. A systematic MPA network planning process, particularly if nested within a larger marine spatial planning process, will take time and there is potential for ongoing or new activities to erode the ecological values of an EBSA before conservation decisions are made. It is therefore important that EBSAs be integrated into the range of oceans management decisions immediately, including fisheries management, and be addressed through Integrated Management and other marine use plans. *There should be no new or significantly expanded development or extractive activities in EBSAs* before the selection process is complete and MPA network plans are established. In some EBSAs, interim measures restricting existing activities may need to be put in place.

[7] Annexes to CBD Decision IX/20: recommendations as adopted at COP 9. See appendix III

1.2 Representativity

Scientific guidance

> *Representativity is captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems[7].*

- The CBD guidance is built on the scientific consensus that representative areas are a critical compliment to EBSAs, and are necessary for a truly comprehensive network that will provide a foundation for sustainable development.
- In order to plan for and report on representativity, it is necessary to develop or choose a biogeographic, habitat, and/or community classification system that matches the scale of the planning process (as prescribed in the CBD guidance on initial steps toward MPA network planning).
- Classifications will vary from one region to another, but some key ecosystem gradients across which regional-scale representation should be sought include: Benthic and pelagic habitat types (physical characteristics), cross-shelf (from inshore to offshore), and along-shelf (in cases where different conditions and ecosystems are found along the coast).
- A large body of literature on biogeographic classification exists, however the key lesson learned from many successful MPA network initiatives has been the importance of pragmatism in selecting a workable, intuitive and widely-accepted classification for which data are readily available.
- While representativity targets offer can often be achieved with many different network designs – allowing significant scope for trade-offs – site

selection should be guided by a preference for relatively intact examples that exhibit a higher degree of naturalness.
- In the case of rare or widely degraded habitats, the selection strategy will instead have to focus on what areas remain and/or their potential for restoration.

Representativity in Canada

- Canada has a framework for achieving representativity of 29 large Natural Regions through the Parks Canada mandate. However, it is currently unclear how representativity will be achieved below this coarse national scale. Although approaches to regional-scale representation are being explored by different entities in different regions (eg. The NMCA program in the Pacific), a clear statement of policy intent has yet to be made by any government or agency with regard to achieving representativity at the regional scale.

While representation of biogeographical subdivisions can be considered at scales ranging from global to site-level, the scientifically-accepted definition of a representative protected area network implies that all of these scales are taken into account. In Canada, the Parks Canada Agency leads a well-defined program to achieve representation of 29 large "Natural Regions" that reflect the diversity of oceans and Great Lakes at a national scale. The Natural Regions are large, however, and a single NMCA will likely still not represent the "full range of ecosystems" within each region. In addition, Parks Canada has expressed their intent to choose only areas adjacent to land, in keeping with their mandate to provide for public enjoyment. Representativity must therefore also be adopted as a design principle for regional network plans to ensure that the full range of diversity is captured *within* LOMAs, Parks Canada Natural Regions, and other planning regions of generally similar scale.

Suggestions for implementation

- In line with Canada's CBD commitments, representativity should be seen as an overarching objective for MPA networks in Canada, and can be accomplished without overstepping or detracting from the individual mandates of MPA-legislated authorities. It should be seen as a collective responsibility to which each agency contributes.
- Coordination and a systematic approach to planning are the most important mechanisms for achieving representation. Representative MPA networks in the Canadian context can be achieved by:
  - Setting representativity as a design criterion in regional MPA network planning
  - Developing or choosing a biogeographic habitat and/or community classification system appropriate to the region.
  - Iteratively identifying sites to include in a network, seeking to achieve conservation of EBSAs, representativity, connectivity and replication. In many cases, representativity targets will be achieved in the course of protecting EBSAs, particularly when decision-support tools are used to help identify efficient design options.
  - Developing an implementation plan that makes the most of individual agency mandates and the legislative scope of each MPA tool.
- Representative areas should include significant highly-protected ("no-take") core zones.

Since representativity is a well-recognised best practice and a Canadian commitment through the CBD, it should be seen as a fundamental consideration for achieving ecosystem-based management (EBM) and a legitimate outcome of Integrated Management planning. However, it is currently unclear whether DFO is willing to oversee and ensure implementation of *representative* networks. Given its stated role to lead and coordinate integrated management and MPA networks, we would argue that DFO, on behalf of the Government of Canada, should be charged with this responsibility, but that all MPA-responsible agencies and levels of government should consider representative networks a collective commitment and work in a coordinated fashion to plan and implement them.

The selection of the appropriate MPA tool for protection of specific representative areas is a separate question. Parks Canada is the agency with the most explicit mandate to protect areas for their value in contributing to representation, however the one NMCA planned for each Natural Region is unlikely to achieve representation targets at all scales alone, and other aspects of the Parks mandate, such as accessibility for public enjoyment, may restrict the contributions of the Agency to representation of offshore ecosystems. The Oceans Act specifies that, in addition to places and species considered threatened, unique, biodiversity or highly productive, the Minister may designate MPAs for "the conservation and protection of any other marine resource or habitat as is necessary to fulfill the mandate of the Minister." This clause would appear to provide for the use of an Oceans Act MPA in the event that a site must be selected and justified solely for its role in contributing to representativity, and cannot be addressed by Parks Canada. Other agencies and levels of government, including the Provinces, may also have this latitude.

In order to ensure their intactness and integrity, representative areas will often require a high level of protection, the regulation of fishing activities. In this light, DFO will often need to be involved no matter which authority the MPA designation falls under.

1.3 Connectivity

Scientific guidance

> *Connectivity in the design of a network allows for linkages whereby protected sites benefit from larval and/or species exchanges, and functional linkages from other network sites. In a connected network individual sites benefit one another.*[8]

- While connectivity is an important characteristic for MPA networks, there is not yet a single definitive approach or model for assessing the connectivity of an MPA network (although many are in development)[9].
- There are, however, a number of practical guidelines that can be used to incorporate connectivity into the design of MPA networks. These include "rules of thumb" about areas of importance to connectivity and about the spacing and distribution of sites.
- A network that embodies representativity and replication will inherently bring us much of the way toward achieving connectivity.

Suggestions for implementation

- A systematic planning approach and a view of the network as a system are needed to make best choices and realize benefits regarding connectivity.
- Achieving the connectivity criterion should be seen as a collective responsibility to which each agency and level of government contributes.
- Sites important to connectivity will frequently also be identified as EBSAs, i.e. if they are areas of high aggregation in bottlenecks, high-productivity sites that act as source areas, etc.
- In other cases, connectivity could be a driving factor within network layout. Agencies should be aware of the "big picture" when considering their selection of candidate areas and of how these could link to other areas, including areas that have been designated by another authority.

[8] Annexes to CBD Decision IX/20: recommendations as adopted at COP 9. See Appendix III.

[9] For example, see Robinson, C.L., J. Morrison and M.G.G. Foreman. 2005. Oceanographic connectivity among marine protected areas on the north coast of British Columbia, Canada. Canadian Journal of Fisheries and Aquatic Sciences. 62(6):1350-1362(13) and Laurel, B.J. and I.R. Bradbury. 2006. "Big" concerns with high latitude marine protected areas (MPAs): trends in connectivity and MPA size. Canadian Journal of Fisheries and Aquatic Sciences. 63(12): 2603-2607

BOX 1

Practical "rules of thumb" for maximizing connectivity

While complete models of connectivity in marine ecosystems are rarely available, scientific guidance has been developed to maximize connectivity of MPA networks based on best available information and practical 'rules of thumb.' Some readily-adopted guidelines that have relevance in Canada's temperate and arctic marine ecosystems include:

- Capturing areas of known importance to regional flow of biota, including source areas, and migration bottlenecks. Some of these sites may already be considered EBSAs, as they are also likely to feature aggregations of individuals and have fitness consequences and/or high productivity.
- Designing sites to accommodate movement of maturing individuals from nursery or spawning grounds to adult habitats, for instance, by designing continuous sites or complexes of sites that extend from the intertidal zone to deep waters offshore.
- Designing networks such that sites are well distributed across the region and including a range of site sizes and distances between sites. In some ecosystems, specific distances have been suggested for both long-shelf and cross-shelf distances. For example, 50-100 kms between long-shelf sites was suggested by the science advisory team for the California Marine Life Protection Act initiative. For cross-shelf sites, the advisory team recommended spacing of between 10 and 20 kms. The following have been proposed in the OSPAR region as maximum between-site distances above which the MPA network is clearly not ecologically coherent: nearshore ~250 km (shoreline-distance); offshore ~ 200 000 km2 (~500km diameter circle); high seas ~ 1 000 000 km2 (square with ~1000 km sides).

1.4 Replicated ecological features

Scientific guidance

Replication of ecological features means that more than one site shall contain examples of a given feature in the given biogeographic area. The term "features" means "species, habitats and ecological processes" that naturally occur in the given biogeographic area[10].

- Unless they are unique, all conservation features (habitat types, EBSAs and other features targeted for conservation) within a region should be captured more than once in discrete locations throughout the network. This provides a degree of insurance against the loss of that feature sample via human or natural impacts and helps to ensure that natural variation in the feature (such as genetic variation) is captured.
- Replication is also being recognized as a measure to build resilience and adaptive capacity for the persistence of features represented within MPA networks in the face of uncertain conditions, such as those resulting from climate change (see Box 2 at the end of this section).
- Replication is particularly important for representative features and for those habitats that are most vulnerable such as seamounts or low-resilience ecosystems.
- Some types of EBSAs are inherently unique and replication will not be possible, while some (eg. spawning areas for wide-spread species) may occur several times in a region, but merit replication due to their significance and vulnerability.

[10] Annexes to CBD Decision IX/20: recommendations as adopted at COP 9. See Appendix III

BOX 2

Practical guidance for replication

- During the process of setting network design targets, each conservation feature should be examined to see if it is one that can/should be replicated. If so, the target should ideally be to include multiple samples of the feature in spatially separate MPAs or zones within a large MPA. The California Marine Life Protection Act Science Advisory Committee called for the following: "Ideally at least five replicates (but a minimum of three) containing sufficient representation of each habitat type should be placed in the MPA network within each biogeographical region…"
- Replicates should ideally be selected to span gradients, such as cross-shelf or along-shore.

Replication in Canada

Replication, particularly for representative and/or vulnerable features, is an important design element for ensuring that the network will remain comprehensive into the future. In addition to natural disturbance events and direct damage by humans (such as accidental or illegal discharges, Illegal, Unregulated or Unreported (IUU) fishing activity, or management failures), marine ecosystems are increasingly facing stresses and change induced by macro-scale impacts like climate change, depleted oxygen 'dead zones' and ocean acidification.

Suggestions for implementation

- Multiple agencies and levels of government can contribute to achieving replication by employing their respective designations for protection of features in a coordinated way.
- Decision-support tools such as Marxan that help to quickly generate and explore efficient options will be helpful in achieving replication in a practical and pragmatic way. Like representativity, replication will in many cases be an automatic byproduct of the other design criteria.
- Replication can also be achieved within larger MPAs, such as National Marine Conservation Areas (NMCAs) which contain multiple high-protection zones. The NMCA Science advisory committee in BC recommended a minimum of two geographically separated replicates for each habitat type within each NMCA.

1.5 Adequate and viable sites

Scientific guidance

Adequate and viable sites indicate that all sites within a network should have size and protection sufficient to ensure the ecological viability and integrity of the feature(s) for which they were selected[11]*.*

- Adequacy and viability of sites within a network hinges on two design elements: size/shape and protection level.
- Size/shape is a factor of the feature, the conservation target and ecological integrity considerations:
  - Features should generally not be bisected.
  - For representativity, conservation targets of 20-30% of the total area of each habitat are recommended.
  - Additional ecological information can inform what constitutes an adequate and viable size, and zoning can help to minimize edge effects.
- Protection levels are informed by the purpose and conservation goals of the site and of the network as a whole:
  - For representative areas, the conservation goal is recovery and/or preservation of integrity, structure and function: protection levels should therefore be high.
- Adequacy can also be considered a property of the network as a whole: the set of MPAs is

[11] Annexes to CBD Decision IX/20: Recommendations as adopted at COP 9. See Appendix III.

adequate when it collectively achieves the goals of the entire network and contributes significantly to the health of the regional ecosystem.

Size/shape

Ecological considerations for optimal size will include a) the scale and extent of the feature to be protected, b) the overall target proportion of the feature to be protected, c) other considerations to ensure ecological integrity and long-term persistence of the conservation features.

a] For distinct physical or ecological features, often EBSAs, the MPA should usually be designed to encompass, not bisect the feature. For example, protecting only one slope of a canyon and allowing intensive use on another may mean that conservation goals are undermined for species that range between both areas.

b] The conservation target, or proportion of each feature or habitat type to be protected, will also influence the size of sites in the network. Science advice and global experience with regard to MPA planning suggests that 10-50% (unweighted mean recommendation: 30%)[12] of a region should be contained in protected areas, and in representative networks that proportion translates into a similar conservation target for each biogeographic subdivision. For some habitat types, such as those that are particularly sensitive or smaller, a higher minimum conservation target may be warranted.

c] There may be other factors, based on ecological theory or knowledge of the feature and biota, that will influence decisions about how to maximize the integrity of a site. In general, guidance indicates that it is best to tend toward fewer but larger sites rather than several smaller ones, particularly for representative areas, though a variety of sizes throughout a given network will be inevitable and necessary. In some cases, information may be available to indicate a certain size required to achieve conservation goals, such as allowing for recovery of a population or encompassing the range of an endangered species. Tools such as population viability analysis and models such as *Ecopath with Ecosim* can help further define these design considerations by defining size requirements for recovery and conservation goals. Adequate zoning, including significant buffer zones, is likely to help ensure the viability of smaller, vulnerable core zones from edge effects and user infractions.

Because of variation in these three factors, there is no specific minimum size or required optimum shape in all cases. However, a bias in the size distribution or absence of a certain size class may be a sign that the network is not fully adequate[13].

Protection levels

The technical guidance adopted by COP 9 flowed from an earlier decision (VII/5)[14], which specifies that the integrated networks of marine and coastal protected areas to which CBD signatories committed should consist of protected areas where, at minimum,

> *"threats are managed for the purpose of biodiversity conservation and/or sustainable use and where extractive uses may be allowed."*

This management intent and level of protection is a starting point for MPAs in an ecologically coherent network. The IUCN protected area management categories[15] are a global framework, recognized by the CBD, for describing and categorizing the full spectrum of protected area management types, and the new Guidelines for applying these categories provides specific guidance on their use in marine environments. However, sites chosen for their role in achieving representativity should be highly protected, and

[12] Ardron 2008. Based on: Ballantine, 1991, 1997; Carr and Reed, 1993; Roberts and Hawkins, 2000; Rodwell and Roberts, 2004; GACGC, 2006; OSPAR, 2008c, Annex II

[13] For more on size/shape considerations, see Andersson, A. and A-S. Liman. 2008. Towards an Assessment of Ecological Coherence of the Marine Protected Areas Network in the Baltic Sea Region. BALANCE Interim Report No.1.

[14] Decision VII/5, Marine and coastal biological diversity (Paragraph 21) http://www.cbd.int/decisions/?m=COP-07&id=7742&lg=0

[15] Dudley, N. (Editor). 2008. Guidelines for Applying the IUCN System of Protected Areas Management Categories. Gland, Switzerland: IUCN. 86 pp. http://www.iucn.org/about/union/commissions/wcpa/index.cfm?uNewsID=1794

include a significant no-take zone. Their role is to conserve the integrity of intact, functioning and relatively natural examples of each ecosystem: According to the CBD, integrated networks of Marine and Coastal Protected Areas (MCPAs) should include

> *"representative MCPAs where extractive uses are excluded and other significant human pressures are removed or minimized to enable the integrity, structure, and functioning of ecosystems to be maintained or recovered."*

There is a strong scientific consensus on the need for – and effectiveness of – highly protected MPAs[16].

Suggestions for implementation

- Canada must be clear with agencies, stakeholders and the public: an ecologically coherent network plan will yield a number of significantly-sized sites with highly-protected zones. A concerted policy commitment and public communication strategy will be needed to achieve this criterion. Sound, specific rationale for the selection of each site, based on the criteria described in this document, will support this communications effort.
- Questions are likely to be raised about what designations and management options constitute adequate protection within an MPA network. The re-worked IUCN definition of an MPA may be a useful guide:

  A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

  Breaking down this definition[17], sites should meet the following tests:
  - Be clearly *defined* in space (coordinates and/or GIS files available)
  - Be *recognized* on charts, in legislation, in management plans, and by users of the marine environment
  - Be *dedicated* to conservation as their primary purpose
  - Be *managed* (i.e. have management plans or active management with the goal of conservation foremost)
  - Meet the above requirements through *legal or other effective means*, indicating that regulatory and voluntary measures may meet the standard
  - Be seen as *long-term*, if not permanent
  - Have achievement of the *conservation of nature* (with associated ecosystem services and cultural values) as their primary purpose
- The IUCN protected area management categories are likely to be a useful tool for differentiating between MPAs that meet this minimum definition. Being able to place Canada's different MPAs within the IUCN categories will also be important for reporting on international commitments. The new Guidelines for their application include a characterization of the types of MPAs to be found within each category.
- It is WWF-Canada's position that, for a network to be considered 'adequate and viable,' it should capture at least 20-30% of the total area of the planning region in MPAs (or zones within MPAs) that fall within IUCN Protected Area Categories I-III. A comprehensive network will include a range of protection levels, and should work in concert with broader marine spatial planning. Sites and zones of categories IV-VI (for example, sustainable use zones within Oceans Act MPAs or NMCAs, or, in some cases, fisheries closures that meet the above IUCN definition of a protected area), will often be appropriate and beneficial, and may also be useful as tools for interim protection. However, it is our view that to 'count' toward Canada's MPA network commitments, sites/zones must a) meet the IUCN definition of a protected area,

[16] http://www.nceas.ucsb.edu/Consensus/consensus.pdf, http://www.piscoweb.org/outreach/pubs/reserves

[17] For a more detailed deconstruction of this definition, see the IUCN guidelines referred to on the previous page

and b) fall within categories I-III. This is consistent with terrestrial reporting standards adopted by the Canadian Council for Ecological Areas (CCEA) and the Federal-Provincial-Territorial Canadian Parks Council (CPC).

- Zoning will be important to achieving adequacy and viability for many sites – at least two of the tools (NMCAs, Oceans Act MPAs) have the flexibility to implement sophisticated and responsive zoning approaches. Tools may also be used in combination in some cases to achieve the benefits of zoned management.[18]

BOX 3

Cross-cutting consideration: "Climate-smart" MPA networks[18]

Comprehensive, ecologically coherent protected area networks are the foundational tool helping build resilience in ecosystems, particularly in the face of climate change. Representative habitats and replication provide refugia for the range of biodiversity, even as ecosystems change and shift; connectivity allows for migration; and adequate and viable sites buffer against impacts. Networks consistent with the criteria discussed above will inherently provide this function, however it is also possible to consider additional cross-cutting design principles that will maximize the degree to which a network is "climate-smart," i.e. to develop a network that enhances ecosystem resiliency to environmental change/climate change. Some such principles include:

- Achieving adequate representation in transition zones between and across regions
- Replication of habitats across environmental and climatic gradients
- Selecting areas that show resistance to environmental and climate change
- Including temperature refugia in the selection of EBSAs and placement of sites
- Reducing non-climate stressors around protected sites

[18] From Hoffman, J., 2003. Designing Reserves to Sustain Temperate Marine Ecosystems in the Face of Global Climate Change. In Hansen, L.J., J. Biringer and J.R. Hoffman (eds). 2003. Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems. WWF, Gland. Posted online at http://www.panda.org/news_facts/publications/index.cfm?uNewsID=8678

2 Implementing sound networks

This section sets out three overarching considerations for achieving ecologically coherent MPA networks in the Canadian context. Recalling the properties of an ecologically coherent network discussed in section 1, the following are suggestions for key ingredients to overall implementation:

2.1 A systematic approach

An ecologically coherent network is unlikely to emerge from an ad hoc or site-by-site implementation process. A systematic approach allows for setting and realizing up-front commitments to the criteria that will lead to an ecologically coherent network that is greater than the sum of its parts. The CBD guidance suggests four initial steps to be considered in the development of MPA networks:

1. *Scientific identification of an initial set of ecologically or biologically significant areas*
2. *Develop/choose a biogeographic, habitat, and/or community classification system*
3. *Drawing upon steps 1 and 2 above, iteratively use qualitative and/or quantitative techniques to identify sites to include in a network.*
4. *Assess the adequacy and viability of the selected sites.*

These steps provide a general framework for a systematic approach. More detailed guidance on systematic protected area network planning was elucidated by Margulies and Pressey 2000[19], and adapted for application in planning MPA networks in Canada by Smith et al. 2006[20].

BOX 4

Steps in systematic conservation planning[21]

1. **Identify and involve stakeholders.** Effective conservation planning requires the involvement of stakeholders from the onset of the planning process. Engaging stakeholders encourages information exchange, enables collaborative decision-making, fosters buy-in by increasing stakeholders' understanding of decisions made, and increases the accountability of those leading the planning process. Potential stakeholders include departments and different levels of government, industry, traditional owners, land holders and concerned community members.

2. **Identify goals and objectives.** The definition of clear goals and objectives for a comprehensive network distinguishes systematic conservation planning from other approaches. Conservation goals articulate priorities for the protection and restoration of biodiversity, whereas socio-economic goals seek to protect and enhance the social and economic interests of the region and the people living in it. For example, the establishment of the Great Barrier Reef Marine Park, Australia involved a balance between protecting the ecological integrity of the park while minimising the cost to industries, such as fisheries and tourism, which are dependant on the reef.

[19] Margules, C.R., and R.L. Pressey. 2000. Systematic conservation planning. Nature 405:243-253.

[20] Smith, J.L., K. Lewis and J. Laughren. 2006. A Policy and Planning Framework for Marine Protected Area Networks in Canada's Oceans. WWF-Canada: Halifax.105 pp.

[21] Excerpted from Ardron, J.A., Possingham, H.P., and Klein, C.J. (eds) 2008. Marxan Good Practices Handbook. External review version; 17 May, 2008. Pacific Marine Analysis and Research Association, Vancouver, BC, Canada. 155 pages. www.pacmara.org.

3. **Compile Data.** In order to design a network that embodies these goals and objectives it is necessary to understand and map the *conservation features* (features to be conserved in the network). In addition it may be useful to map human uses, threats and land tenure. Assembling the best available ecological, socio-economic and cultural data will require evaluating existing data, identifying gaps, and may involve the collection of new data to fill these gaps. Conservation features may be areas of importance to certain species, classifications that describe the different habitat types of a region, or physical proxies for the distribution of biodiversity; maps of human uses may depict places of high value for fishing, mining or forestry; threats may include highly developed areas or point sources of pollution; and tenure could include lands held in fee-simple (free-hold), licenses (leasehold) and claims for resource extraction, and traditional ownership or stewardship by indigenous people.

4. **Establish conservation targets and design principles.** Conservation targets specify how much of each conservation feature (such as species and habitat types) to protect within the network. Design principles exert influence over the geographic configuration of the network, addressing factors such as size, shape, number and connectivity of sites, with the goal of ensuring persistence and ecological integrity in a truly cohesive network. Conservation targets may be statements such as "protect 20% of each bioregion" or "at least 10 turtle nesting sites;" design principles may include "design a network with sites no smaller than 20 km^2," "select between 7 and 12 sites," or "keep the edge to area ration of the network low."

5. **Review existing protected areas and identify network gaps.** Most protected area networks do not begin with a "blank slate:" typically, there will be existing protected areas to build on. Once features are mapped and targets set, it becomes possible to review existing protected areas to determine the extent to which they already encompass conservation features, meet conservation targets, and provide meaningful protection toward network goals. In some cases, existing protected areas can contribute to goals and targets with enhanced management.

6. **Select new protected areas.** This step addresses the task of filling in the gaps identified in the previous step. Alternate designs are generated for complete network configurations, laying out options for a cohesive network that meets conservation targets and the design criteria. From the range of possible network configurations, new sites will be selected for protection. It is in this step that decision-support tools like Marxan are most helpful.

7. **Implement conservation action.** The implementation of conservation measures involves decisions on fine-scale boundaries, appropriate management measures, and other site-specific considerations. In cases where all sites in the network cannot be protected at once it may be necessary to implement interim protection and set priorities for sequencing of implementation.

8. **Maintain and monitor the protected area network.** Once a network is in place, the original goals and objectives will inform management and monitoring necessary to evaluate whether management is effectively preserving ecological integrity, and whether the site makes a meaningful contribution to the network.

2.2 Coordinated planning and implementation

Achieving an ecologically coherent network and undertaking a systematic approach in the Canadian context will require coordinated planning and implementation amongst MPA-legislated authorities and, in some cases, other agencies, organizations and levels of government. Achieving the ecological coherence criteria described in part 1 should be seen as a collective responsibility – and a Canadian commitment – to which all agencies and levels of government contribute. At the regional level, this means:

1. establishing mechanisms for planning together, adapted to the particular circumstances of the region;
2. jointly agreeing to overarching network goals, objectives, and design criteria, and protection standards (and recognizing these as a collective responsibility, even if individual agencies may be directly responsible only for certain elements of it);
3. jointly agreeing to a single overall regional network plan;
4. putting in place interim protection measures;
5. creating a joint strategy for advancing and designating sites using the most appropriate legislative tool; and
6. periodically assessing progress toward achieving a network that embodies the goals and design criteria.

Such a collaborative and coordinated approach should be seen as one that simplifies and enables individual agencies and governments to better meet their own specific MPA mandates while contributing to the overarching goal toward developing ecologically sound MPA networks.

2.3 MPA networks in context:
Ecosystem-based management, integrated management, and marine spatial planning

More than simply modifying existing plans, the adoption of EBM signifies a paradigm shift. MPA networks are a powerful tool for realizing ecosystem-based management. There are, however, other tools that must be employed. The long-term contributions of MPAs will also depend on forward-looking management throughout each region. This is consistent with the recommendations of the CBD Expert Working Group that:

- *effective protection of biological diversity…will require enhanced management throughout the marine environment; and*
- *marine protected areas are a necessary component of such enhanced management, but the implementation of other management measures is also required.*

MPA networks in Canada will proceed in a context of established and emerging management regimes for target species, species at risk, habitats, and other aspects of the marine environment. MPAs and MPA networks should be understood as an element of marine spatial planning or zoning, albeit a foundational one. Networks should therefore be nested in a larger, more strategic spatial approach to marine use and conservation. This will require coordination with other, non-MPA-legislated governments, agencies and sections, notably the Fisheries and Aquaculture Management division of DFO, the shipping governance agencies including Transport Canada, regional energy boards and others.

By undertaking MPA networks in the context of broader ocean use planning, we have an opportunity to create plans that reflect social, economic and cultural aspirations compatible with, and complimentary to, the ecological ones outlined in this document. Such planning is the basis for truly sustainable development.

Appendix I

Sample ecological design principles for regional MPA network planning

These design principles, drawn from the CBD guidance and building on previous work by OSPAR, HELCOM and WCPA-Marine, may be adapted and used as a starting point for regional MPA network planning. They are intended to ensure that all five ecological coherence criteria are considered at the outset of network planning. These principles address only ecological considerations – parallel principles addressing socioeconomic, cultural, or practical design considerations will lead to better, more feasible MPA network designs.

Ecologically or Biologically Significant Areas

1. Protect areas of ecological or biological significance, in spatially separate replicates where appropriate.

Representativity

2. Protect at least two significant examples (e.g. at least 20-30%) of each habitat or community type in the region in highly protected zones.

Connectivity

3. Protect areas of known or suspected importance to connectivity.
4. Ensure that selected sites are well-distributed across the region, with a range of distances between sites.

Replicated ecological features

Addressed in 1 and 2.

Adequate and viable sites

5. Protect entire features where possible.
6. Choose a mix of site sizes and shapes, but tend toward larger and more compact sites.

Appendix II

A checklist for evaluating ecological coherence in regional MPA networks

Gap analysis is a telling and rapidly-deployed tool for assessing comprehensiveness in protected area networks. However, a simple gap analysis may not convey the degree to which an evolving network achieves each of the five criteria for ecological coherence. The following questions can form a starting point for an "enhanced gap analysis." They are questions that can feasibly be answered given the data and resources available in the Canadian context.[22]

Ecologically or biologically significant areas

Yes/no question	Scale/per cent question
Are all areas that meet the CBD EBSA criteria sufficiently protected to conserve their ecological values?	What proportion of each EBSA is protected?

Representativity

Does the network capture a significant example of each major habitat or community type in the region?	What proportion of each habitat or community type is protected: In highly-protected areas? • In areas meeting the IUCN definition of an MPA? Or: How many habitat classes or community types fall into each category. For example, Anderson and Liman (2008) suggest the following categories: • <10% protection of a habitat or community type = badly represented • 10-20% = poor • 20-30% = moderate • 30-60% = good • >60% = high

[22] These questions were developed through a synthesis of the work of the WCPA-Marine, Ardron 2008, Andersson and Liman 2008, and others. See also Korpinen, S. and H. Piekäinen. 2006. Literatiure review on ecological coherence of a network of marine protected areas (MPAs) – Suggestions for practical criteria to evaluate ecological coherence of the Baltic Sea MPA Network. http://sea.helcom.fi:15037/dps/docs/documents/Nature%20Protection%20and%20Biodiversity%20Group%20 (HABITAT)/BALANCE-HELCOM%20Workshop%20on%20Ecological%20Coherence%202006/Literature%20review.pdf

Connectivity

Are areas of known or suspected importance to connectivity protected?	What proportion of each area of known importance to connectivity is protected?
Are sites well-distributed across the region/ are there any major gaps between sites?	How many gaps exist that exceed the scientifically recommended maximum. For example, the following minimum guidelines were suggested for the OSPAR region (NE Atlantic) as indicators of ecological coherence: <~250km (shoreline distance) between nearshore sites? <~200 000 km2 (500 km diameter circle) between offshore sites? <~1 000 000 km2 (square with 1000 km sides) on the high seas?

Replicated ecological features

Are all representative features replicated in spatially separated sites of at least x hectares?	What proportion of habitat or community types are protected in two or more spatially separated sites of at least x hectares?
Are all EBSAs (for which more than one example exists) replicated in spatially separated sites?	What proportion of EBSAs (for which more than one example exists) are replicated in spatially separated sites? Is the number of replicates for each habitat and the spatial separation adequate for the size of the bio-geographic region

Adequate and viable sites

Do all sites meet the aspects of adequacy and viability?

- Are any features bisected by boundaries between protected/unprotected areas?
- Is at least 20-30% of the planning region captured in IUCN Category I-III protection?
- Is at least 20-30% of each representative feature protected?
- Are edge effects minimized through site design and zoning?
- Are significant examples of representative features captured in highly-protected zones?
- Are there obvious biases in the network toward larger or smaller sites?

What proportion of sites meet the aspects of adequacy and viability? AND/OR taken individually:

- What proportion of features are bisected by boundaries between protected/unprotected areas?
- What proportion of the planning region is captured within IUCN Category I-III protection?
- What proportion of each representative feature protected? (this is addressed through the gap analysis).
- In what proportion of sites are edge effects minimized through site design and zoning?
- What proportion of each representative feature is captured in highly-protected zones? (this is addressed through the gap analysis)
- What is the size distribution of sites in the network?

Appendix III

Annexes to CBD Decision IX/20: Recommendations as adopted at COP 9

Annex I

SCIENTIFIC CRITERIA FOR IDENTIFYING ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS IN NEED OF PROTECTION IN OPEN-OCEAN WATERS AND DEEP-SEA HABITATS 41/

Criteria	Definition	Rationale	Examples	Consideration in application
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features	• Irreplaceable • Loss would mean the probable permanent disappearance of diversity or a feature, or reduction of the diversity at any level.	*Open ocean waters* Sargasso Sea, Taylor column, persistent polynyas. *Deep-sea habitats* endemic communities around submerged atolls; hydrothermal vents; sea mounts; pseudo-abyssal depression	• Risk of biased-view of the perceived uniqueness depending on the information availability • Scale dependency of features such that unique features at one scale may be typical at another, thus a global and regional perspective must be taken
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.	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.	Area containing: (i) breeding grounds, spawning areas, nursery areas, juvenile habitat or other areas important for life history stages of species; or (ii) habitats of migratory species (feeding, wintering or resting areas, breeding, moulting, migratory routes).	• Connectivity between life-history stages and linkages between areas: trophic interactions, physical transport, physical oceanography, life history of species • Sources for information include: e.g. remote sensing, satellite tracking, historical catch and by-catch data, vessel monitoring system (VMS) data. • Spatial and temporal distribution and/or aggregation of the species.

41/ Referred to in paragraph 1 of annex II to decision VIII/24.

Criteria	Definition	Rationale	Examples	Consideration in application
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.	To ensure the restoration and recovery of such species and habitats.	Areas critical for threatened, endangered or declining species and/or habitats, containing (i) breeding grounds, spawning areas, nursery areas, juvenile habitat or other areas important for life history stages of species; or (ii) habitats of migratory species (feeding, wintering or resting areas, breeding, moulting, migratory routes).	• Includes species with very large geographic ranges. • In many cases recovery will require reestablishment of the species in areas of its historic range. • Sources for information include: e.g. remote sensing, satellite tracking, historical catch and by-catch data, vessel monitoring system (VMS) data.
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.	The criteria indicate the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively, or are pursued at an unsustainable rate.	*Vulnerability of species* • Inferred from the history of how species or populations in other similar areas responded to perturbations. • Species of low fecundity, slow growth, long time to sexual maturity, longevity (e.g. sharks, etc). • Species with structures providing biogenic habitats, such as deepwater corals,	• Interactions between vulnerability to human impacts and natural events • Existing definition emphasizes site specific ideas and requires consideration for highly mobile species • Criteria can be used both in its own right and in conjunction with other criteria.

Criteria	Definition	Rationale	Examples	Consideration in application
			sponges and bryozoans; deep-water species. *Vulnerability of habitats* • Ice-covered areas susceptible to ship-based pollution. • Ocean acidification can make deep-sea habitats more vulnerable to others, and increase susceptibility to human-induced changes.	
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.	Important role in fuelling ecosystems and increasing the growth rates of organisms and their capacity for reproduction	• Frontal areas • Upwellings • Hydrothermal vents • Seamounts polynyas	• Can be measured as the rate of growth of marine organisms and their populations, either through the fixation of inorganic carbon by photosynthesis, chemosynthesis, or through the ingestion of prey, dissolved organic matter or particulate organic matter • Can be inferred from remote-sensed products, e.g., ocean colour or process-based models • Time-series fisheries data can be used, but caution is required

Annex II

SCIENTIFIC GUIDANCE FOR SELECTING AREAS TO ESTABLISH A REPRESENTATIVE NETWORK OF MARINE PROTECTED AREAS, INCLUDING IN OPEN OCEAN WATERS AND DEEP-SEA HABITATS 42/

Required network properties and components	Definition	Applicable site specific considerations (*inter alia*)
Ecologically and biologically significant areas	Ecologically and biologically significant areas are geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics, or otherwise meet the criteria as identified in annex I to decision IX/20.	• Uniqueness or rarity • Special importance for life history stages of species • Importance for threatened, endangered or declining species and/or habitats • Vulnerability, fragility, sensitivity or slow recovery • Biological productivity • Biological diversity • Naturalness
Representativity	Representativity is captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems.	A full range of examples across a biogeographic habitat, or community classification; relative health of species and communities; relative intactness of habitat(s); naturalness
Connectivity	Connectivity in the design of a network allows for linkages whereby protected sites benefit from larval and/or species exchanges, and functional linkages from other network sites. In a connected network individual sites benefit one another.	Currents; gyres; physical bottlenecks; migration routes; species dispersal; detritus; functional linkages. Isolated sites, such as isolated seamount communities, may also be included.
Replicated ecological features	Replication of ecological features means that more than one site shall contain examples of a given feature in the given biogeographic area. The term "features" means "species, habitats and ecological processes" that naturally occur in the given biogeographic area.	Accounting for uncertainty, natural variation and the possibility of catastrophic events. Features that exhibit less natural variation or are precisely defined may require less replication than features that are inherently highly variable or are only very generally defined.
Adequate and viable sites	Adequate and viable sites indicate that all sites within a network should have size and protection sufficient to ensure the ecological viability and integrity of the feature(s) for which they were selected.	Adequacy and viability will depend on size; shape; buffers; persistence of features; threats; surrounding environment (context); physical constraints; scale of features/processes; spillover/compactness.

42/ Referred to in paragraph 3 of annex II of decision VIII/24

Annex III

FOUR INITIAL STEPS TO BE CONSIDERED IN THE DEVELOPMENT OF REPRESENTATIVE NETWORKS OF MARINE PROTECTED AREAS:

1. *Scientific identification of an initial set of ecologically or biologically significant areas.* The criteria in annex I to decision IX/20 should be used, considering the best scientific information available, and applying the precautionary approach. This identification should focus on developing an initial set of sites already recognized for their ecological values, with the understanding that other sites could be added as more information becomes available.

2. *Develop/choose a biogeographic, habitat, and/or community classification system.* This system should reflect the scale of the application and address the key ecological features within the area. This step will entail a separation of at least two realms–pelagic and benthic.

3. *Drawing upon steps 1 and 2 above, iteratively use qualitative and/or quantitative techniques to identify sites to include in a network.* Their selection for consideration of enhanced management should reflect their recognised ecological importance or vulnerability, and address the requirements of ecological coherence through representativity, connectivity, and replication.

4. *Assess the adequacy and viability of the selected sites.* Consideration should be given to their size, shape, boundaries, buffering, and appropriateness of the site-management regime.

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- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption

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