Evaluating the Role of Site Selection Criteria for Marine Protected Areas in the Gulf of Maine

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Executive Summary

Selection criteria play an important role in the process of identifying, valuing, and designating marine protected area (MPAs). This report examines the role of site selection criteria in establishing a network of marine protected areas in the Gulf of Maine. The importance of criteria in providing a rational basis for site selection is first examined. Criteria are identified as guidelines that add consistency to the decision-making process and enable the clarification and achievement of program goals. The application of criteria for ranking candidate sites in order of preference is also briefly discussed and exemplified by the U.S. National Marine Sanctuary Program.

A set of selection criteria specifically for the Gulf of Maine is proposed and defined. The use or nonuse of these criteria by six existing marine protected area (MPA) programs are compared and analyzed to understand commonalties and differences in the process of selecting sites in the Gulf of Maine. Evaluating the manner in which major MPA programs rely on selection criteria identifies overlap in management objectives and reveals opportunities for future coordination in establishing a network of sites. The use of Gulf of Maine selection criteria is further illustrated by matching them with several management objectives based on categories created by the World Conservation Union (IUCN). A comparative analysis demonstrates how the use of selection criteria for the Gulf of Maine depends on the type of management objectives for MPAs. A few criteria that are most relevant to establishing a network of sites are emphasized and described in detail. The report concludes with a series of guidelines for developing and using selection criteria in the Gulf of Maine and elsewhere.

The purpose of this study is **not** to replace existing criteria with an entirely new set, but to understand existing frameworks for site selection and provide direction for establishing a network of MPAs in the Gulf of Maine.

1. Introduction and Background

The selection of sites is an important component in the process of establishing marine protected areas (MPAs). In most instances, a marine protected area is designated through an *ad hoc* process driven by ecological crisis rather than a careful analysis of conservation needs. A well-planned approach to site selection that includes clearly defined goals is far preferable to one in which decision-makers take action on an opportunistic basis (Agardy, 1997). Selection criteria or guidelines for establishing MPAs provide a framework for the decision-making process, allowing a more systematic approach to site identification and designation. By establishing a set of variables from which candidate sites are selected for evaluation, criteria help to prioritize areas for protection and encourage consistency throughout the planning process. Most important, they act as a guide for MPA programs by enabling them to focus upon and meet their management goals.

Because of the openness of marine ecosystems, it is extremely difficult to protect small areas in isolation from their surroundings, especially where currents and species movements ensure linkages over vast distances. For this reason, local protected areas need to be selected and managed as part of a larger system or network of MPAs. Considering marine protected areas in the Gulf of Maine therefore calls for an examination of the role of selection criteria.

This report seeks to identify some of the major issues in using criteria for selecting MPAs. Its purpose is **not** to create an entirely new set of official selection criteria for the Gulf of Maine, nor to lay out a process for their application. Instead, this report is meant to assess existing criteria frameworks and provide direction for future marine protected area designations. Evaluating selection criteria will help to define common protection goals in the Gulf of Maine more clearly and better determine the type of area that may be selected under a collaborative approach to marine protection.

1.1 Definition

Selection criteria may be defined as a set of conditions or characteristics according to which candidate protected areas are assessed. Lists of criteria lay out attributes that an area should possess to be considered for protection. The specific criteria employed depend on the goals and objectives of a MPAs program. Criteria are often broken down into categories associated with protected areas whose goals are ecological, social, economic, and pragmatic (Salm and Clark, 1984). For example, ecological criteria include different characteristics such as diversity, naturalness, or representativeness. Social criteria may involve conditions related to the opportunity for research and education, cultural value, or aesthetic importance. The potential of an area to receive protective status is measured by the number and degree of pre-defined criteria it possesses that meet

a specific protection goal. Criteria are usually compatible across different goal categories and are considered in combination when selecting a particular area.

1.2 Importance of Selection Criteria

The use of selection criteria helps to ensure objectivity in choosing sites for protection. By providing a set of conditions to establish protected areas, criteria help an agency to carry out its protection mandate in a systematic fashion. In this respect, selection criteria can be an invaluable aid in identifying opportunities for protection, assessing the progress of a program, and clarifying and reaching specific protection objectives. They can be used retrospectively to assess proposed or interesting sites, or prospectively to identify candidate sites within a broader systems plan.

Criteria for identifying and selecting MPAs often depend on the overall objective or direction of the program. If, for example, the objective is to safeguard ecological processes, the criteria might emphasize naturalness, habitat diversity, and uniqueness. If the main objective is economic, such as the maintenance of commercial fisheries, the criteria might stress the intensity of resource exploitation, the potential economic value of the resource, and the degree of threat to the resource in question. If the program objective were to protect areas for tourism and recreation, criteria might stress safety factors, accessibility, scenic value, cultural resources, etc. (Salm and Price, 1995).

In many cases there is either no specific objective or several related objectives for a single MPAs initiative. In the first type of situation, the process of developing a set of criteria can help to clarify protection goals as well as identify opportunities for protection. In conservation programs where goals are articulated but protected areas have been successfully identified, selected, and established without the use of criteria, developing criteria may still prove to be useful. Thinking about the use of criteria after the fact can strengthen arguments made for protected areas and be useful for assessing whether the program in question is reaching its intended goals (Salm & Clark, 1984).

2. Application of Selection Criteria

Initially, selection criteria serve to identify and value areas that may be considered for protected area status (evaluation criteria), which is the main focus of this report. When applied, they can be used to order candidate sites according to priority in the selection process (criteria for determination of priorities) (Nilsson, 1998). There are many selection approaches for MPAs, from using criteria as general guidelines to complex methods of scoring and ranking each potential site. The use of criteria often helps decision-makers or panels make judgments as to which candidate site is most deserving of protection (since limited time and resources usually mandate that only a few candidate sites can be designated out of a longer list). This approach to site selection is embodied in the *Delphic* method of analysis, where a group of experts in the field reach consensus on the priority ranking of potential MPAs (Croom and Crosby, 1998). In this approach, criteria are used as guidelines for protection in a setting that fosters discussion and debate among peers. The *Delphic* method entails a purely qualitative assessment of a site as compared to all others.

Selection criteria can also be quantified or scored to minimize the influence of personal bias. In the most simple of applications, each site is scored (e.g. on a scale of one to five) for a set of selected criteria. The scores for each site are summed and the priority areas are identified on the basis of the highest scores. The *Dimensionless Analysis* method relies on this type of scoring and ranking to select MPAs. In this approach, scores are assigned to criteria for each site based on the Semantic Differentiation Scale (Low Value=1, Moderate Value=2, High Value=3, Unknown Value =X). Chosen criteria are then weighted through a statistical process so that final scores reflect the relative importance of the qualities a site possesses as well as the degree to which it possesses them (Croom and Crosby, 1998). This quantitative method is meant to ensure objectivity throughout the selection process. In reality, the application of selection criteria does not always fit neatly into different academic approaches. Some processes involve combining statistical analyses with decisions based on discussion and public input.

While extremely complicated scoring and summing techniques may seem the most objective and defensible way to choose a priority site, these methods are not always utilized the most. Because selecting MPAs is a subjective process involving assumptions by individuals, it is impossible to remove personal bias from even the most rigorous quantitative analyses (Salm and Clark, 1984; Ray and Legates, 1998). A simple assessment system is easier to use, requires fewer resources, and can often achieve program goals as effectively as a more complex approach. Simple and clearly understood applications for selection criteria are also advantageous when sites are being evaluated by a diverse group of individuals with varying levels of expertise. The degree of complexity for the selection system, however, depends on the requirements and objectives of a particular program.

2.1 Example - National Marine Sanctuary Program

The US National Marine Sanctuary Program has developed a site selection process involving the application of specific criteria. Although the technique is not presently in use (since new sites are not currently being selected), it provides a good example of how criteria can be used to select priority sites. The process uses a ranking system to distinguish among candidate sites, but it relies on the judgment of experts (a *Delphic* approach) and comments from the public to make final site selection decisions. Sanctuary site identification criteria are initially developed to provide standards for assessing the value of potential marine sanctuary sites and to ensure that only high-quality sites are recommended. Each site preliminarily identified by a resource evaluation team (members are selected for their knowledge of regional coastal resources and processes in their region) is examined to determine which of the criteria are met. The degree to which each site satisfies each criterion is then assessed through a rating system of *Low Value* (L), *Moderate Value* (M), *High Value* (H) *and Unknown Value* (X). Rather than calculating a total score for each site, the rating scheme is used primarily for sorting purposes. Sites that consistently have relatively low values for the criteria receive an overall "low priority" rating and are eliminated. In contrast, sites that satisfy the majority of the criteria or consistently have high values receive a "high priority" assessment and are recommended for further consideration (Sanctuary Programs Office, 1982).

A Site Evaluation Matrix (Figure 1) is used to tabulate this information, after which a narrative is prepared to support the evaluation and the priority rankings. The resource evaluation team then compiles a list of the most highly qualified sites, and initial regional lists are sent out for regional public review. Comments on each list and information about the sites are requested. Information is gathered on present or potential user conflicts, activity levels, and management options. Based on this initial analysis, each regional team compiles a final list of sites that include the most significant marine areas in the region. Regional lists are then submitted to NOAA which makes the final decision as to which sites will be placed on the Site Evaluation List (SEL). From this list, active candidates are chosen, which are the most highly qualified marine sites identified in accordance with the Program's mission, goals, and selection criteria. Final site selection is based on additional public comment, a description of each site, feasibility considerations, and the political climate at the time (Sanctuary Programs Office, 1982). The SEL is not expected to expand in the near future[1].

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[1] In 1995, site selection and identification criteria were removed because the SEL was no longer active or expanding and the National Marine Sanctuary program intended to issue revised, updated criteria prior to its reactivation. This rule making does not affect the status of sites currently on the SEL (*Federal Register* 60, no. 248, 27 December 1995). These sites, which have already been identified through the use of site selection criteria, can still be formally designated. The NMS program has yet to develop a revised criteria and has no immediate plans to select more sites to the SEL.

Figure 1: National Marine Sanctuary Site Evaluation Matrix

CRITERIA	Low Value	Medium Value	High Value	Comments

Natural Resource Values:
   A. Regional Representation
   B. Subregional Representation
   C. Community Representation
   D. Biological Productivity
   E. Biotic character/Species representation
   F. Species Maintenance
   G. Ecosystem structure/habitat features

Human Use Values:
   A. Recreational fisheries importance
   B. Commercial fisheries importance
   C. Ecological/aesthetic importance
   D. Research importance
   E. Interpretative importance
   F. Historical/archaeological/
       palaeontological importance

Potential Activity Impacts (list relevant activities):
  A.
  B.
  C.
  D.

Administrative Concerns:
   A. Relationships to other programs
   B. Managing a conservation unit
   C. Accessibility
   D. Surveillance and enforcement
   E. Economic considerations
   F. Others (list)

SOURCE: Adapted from Sanctuary Programs Office (1982).

3. Selection Criteria for MPAs in the Gulf of Maine

When considering a network or systems approach to the establishment of MPAs in the Gulf of Maine, it is important to examine the role of selection criteria. The use of criteria focuses management objectives, assists programs in meeting their intended goals, and provides an objective basis for selecting one area over another. Evaluating a range of potential variables used in the decision-making process will provide direction for a MPAs network and help determine what types of areas should receive protection within the larger ecosystem. Several different selection criteria already exist for MPA programs in the Gulf of Maine. A collaborative approach to using site selection criteria will be more successful if it builds upon existing frameworks, rather than duplicates or replaces them.

3.1 Considering Selection Criteria for the Gulf of Maine

When establishing a network of MPAs in the Gulf of Maine, it is important to consider possible criteria for selecting candidate sites. The criteria listed and defined below are based on those used by existing programs in the Gulf of Maine. The objective is **not** to develop a new set of official criteria for the region, thereby further complicating the institutional landscape, but to examine the range of characteristics that may be useful in thinking about and planning for a network of interconnected sites. Focusing on selection criteria in this way will enable decision-makers to utilize and build upon existing frameworks rather than create new ones. Furthermore, developing selection criteria geared specifically for the Gulf of Maine will help identify commonalties and differences among existing MPA-related programs and provide direction for choosing a network of related sites in the future.

The following criteria may be considered when selecting areas contributing to a network of MPAs in the Gulf of Maine. While in many instances, the criteria are closely related to each other in their definition, satisfying all criteria is not necessary for an area to be selected. In addition, criteria may be used and weighted differently, depending on the specific objectives for selecting a particular site. One of the challenges in defining selection criteria for the Gulf of Maine and in general is that it is extremely difficult to define a threshold for each attribute. For example, how much diversity or representativeness is enough to warrant using a criterion in site selection? For this reason, selection criteria in this report should be considered as general guidelines that focus management objectives and provide some level of rationality for choosing among specific sites. The definitions below are, in many cases, theoretical constructs that are difficult to measure precisely or even determine with scientific certainty.

3.1.1 Ecological Characteristics

Candidate MPA sites can be measured by the ecological value of species and ecosystems through the following terms:

Representativeness - the degree to which an area is representative of a habitat type, ecological process, biological community, physiographic feature, or other natural characteristics. The area under consideration is often characteristic of the biogeographic or physiographic region in which it is located.

Diversity - the extent to which an area under consideration is significant for the variety and number of life forms and communities that occur within the specified habitat type or within the biogeographic region. The area will contain a diversity of habitats, communities, and species, populations, and gene pools found within the designated region or habitat. This criterion can refer to genetic, biological, or physical diversity.

Ecological Importance - the degree to which an area contributes to maintenance of particular species, species groups, and essential ecological processes. These areas include critical habitats, such as breeding or juvenile areas, feeding, and rest areas.

Ecological Sensitivity - the degree to which an area contains habitats for endangered, threatened, rare, or sensitive species or biological assemblages.

Uniqueness - the degree to which an area contains rare or unique species, habitats, or features. The area is considered 'one of a kind' and characteristics are found only in that area.

Naturalness - the extent to which an area has been protected from, or has not been subjected to, human-induced change. Degraded systems have little value for fisheries or tourism and do not make strong biological contributions.

Integrity - the extent to which an area encompasses a complete system or is an effective self-sustaining ecological entity. Integrity often relates to the size of the candidate MPA. Because an MPA would have to be extremely large to encompass a complete system, this criterion may be difficult to apply when selecting individual sites for a network. The goal of multiple sites, however, could be to protect integrity as a whole.

Biological Productivity - the degree of primary and/or secondary production within an area that benefits species or humans. It should be noted that high productivity may not always be a benefit. Increased productivity through human influence may lead to eutrophication, adversely impacting the natural environment.

3.1.2 Economic Importance

The economic value resulting from protection in both the near term and long-term. Economic benefits can be measured in terms of an area's:

Importance to Fisheries - the number of dependent fisherman and the size of the fishery yield, or the area's importance as a source for recruits to a fishery elsewhere. The greater the dependence of fisherman on an area and the greater its yield of fish, the more important it becomes to manage an area to ensure a sustainable harvest.

Importance to Species - the degree to which commercially valuable species depend on the area (especially for settlement and nursery) and form the basis of a fishery resource.

Importance for Tourism and Recreation - the potential of an area to be appreciated by tourists and others. Areas that lend themselves to types of tourism compatible with conservation (by containing exceptional natural resources) have a higher tourism or recreational value. The value of tourism and recreation can be assessed through market and nonmarket measures of benefits and costs. Market-observable benefits may include revenues produced by tourism and are relatively straight forward to measure. Nonmarket benefits can be broken down into use and nonuse values. Use benefits are calculated from the actual contact that tourists have with marine resources from visits. Nonuse benefits are intangible and are derived from the satisfaction that individuals experience knowing that a marine resource is protected without any actual physical use. Nonuse values can be further divided into option, bequest, and existence values (Hoagland et.al, 1995).

3.1.3 Social Importance

The existing or potential social value resulting from protection. Social benefits can be measured in terms of an area's:

Value to Research and Monitoring - the degree to which an area exhibits significant opportunities for implementing long term research and monitoring programs. Such activities are meant to define baseline characteristics and to detect and measure changes in the status of biota or environmental conditions.

Value to Education On and Interpretation of the Marine Environment - the degree to which an area under consideration provides an opportunity to demonstrate and interpret the importance of marine resources to enhance understanding, appreciation, and sustainable use of the marine environment.

Historical, Archaeological, or Cultural Value - the area under consideration contains features that are of special historical, cultural, archaeological significance. The area could also be important for the traditional subsistence or cultural uses of indigenous human communities.

Importance to Conflict Resolution- the degree to which an area may help to resolve conflicts between natural resource values and human activities. A designation that can be used to exemplify the resolution of conflicts in the region should receive higher rating.

3.1.4 Pragmatic/Feasibility

The feasibility of and appropriate timing for protection can be measured in terms of:

Degree of Threat/Urgency - the present and potential threats from direct exploitation and development projects. Sites should be evaluated for the immediacy of the need to implement a program of comprehensive and coordinated conservation and management. Urgency of need for protection is judged according to the degree to which immediate action must be taken before values within the area are lost.

Availability for Protection - the degree to which an area of sea and adjoining watershed area is available for acquisition or can be managed by agreement with the owners. The issue of tenure rarely applies to the sea, although adjacent lands and islands may have to be acquired before a site can be designated. Future aquaculture, oil, and gas development may cause this criterion to increase in importance over time.

Compatibility With Other Programs, Management Plans, and Uses - the potential contribution of a site to enhance existing regulations, management activities or MPA networks is an important factor in site selection. A candidate site should be compatible with the current management framework and programs, or fill gaps in a fragmented system of MPAs.

Accessibility - the ease of access by humans for the purposes of education, tourism, and recreation. Areas to be used by visitors, researchers, and fisherman must be readily accessible. The greater the level of accessibility, the higher the value of a site along this dimension, but the area may be subject to a higher level of use as well. Consequently, accessibility is heavily weighed for MPAs with social objectives but is not necessarily desirable for those meeting solely ecological criteria.

Opportunity for Cooperative Management or Regional/International Cooperation - a site that offers the opportunity for different countries, jurisdictions, and organizations to work together on common protection and management goals will receive a higher rating. The Gulf of Maine ecosystem encompasses multiple jurisdictions and organizations whose goals are to manage what are often the same marine resources. The opportunity to collaborate on the protection of common resources is therefore of greater value than it would be for marine ecosystems involving less jurisdictional complexity.

Size - how much of the various habitats need to be included for adequate protection. The size of an MPA is determined by the area required to protect the resources of significance.

In the case of biological resources, the site should encompass an area large enough to protect a functioning, self-sustaining ecological community. Because the size criterion is often used to protect an ecological system or functioning component of a system, it is closely related to the integrity criterion. Determining size, however, is derived from feasibility considerations while integrity is measured solely through ecological factors.

Financial Resources - the level of funding required to establish and manage a protected area. Financial resources determine the ability to run a credible protection program within an area. The level of resources is often related to *surveillance and enforcement* of a site to ensure that human activities are conducted in accordance with protection goals and regulations.

Social and Political Acceptability - the degree of public and/or community support for designating an area as protected. An area that is supported by local communities, organizations, and the general public should receive a higher priority because the designation will be more successful in meeting its goals over the long term. While local community support is important, the acceptability criterion should also be considered for interests (state, national, etc.) that are not directly relying on the resource in question. The value of a regionally significant resource should not be measured only by the communities that have the privilege of using them. Acceptability can thus be measured through market-observable and nonmarket benefits and costs (see *importance for tourism and recreation*). Market-observable values are based on direct use or services that can be consumed directly, such as commercial fishery harvests. Nonmarket values are less tangible and can be measured by an individual's satisfaction of simply knowing marine protection exists (Hoagland et. al., 1995).

3.1.5 International Significance

The degree to which a site could be considered internationally significant (e.g. World Heritage Site, Biosphere Reserve) or is the subject of an international agreement.

3.2 Use of Selection Criteria By Existing Programs in the Gulf of Maine

There are several existing programs in the Gulf of Maine that rely on selection criteria when designating sites. Understanding the commonalties and differences among programs with respect to the use of criteria can reveal institutional emphases and help identify those criteria that would lead the greatest coherence to a network of MPAs. The matrix and discussion below evaluates existing MPA-related programs against the selection criteria proposed for the Gulf of Maine in the previous section. The four major federal programs dealing with marine protection in the region are chosen for analysis, as well as a state and international program. Not every MPA-related program in the Gulf of Maine is included in the matrix. In addition, some programs of interest do not have established selection criteria to compare.

The following is a brief summary of each program being examined with respect to their selection criteria. More information about these programs is provided in Brody, Samuel. 1997. *Report #1, Evaluation of Legal and Institutional Mechanisms For Establishing Marine Protected Areas in the Gulf of Maine*.

- The National Marine Conservation Areas (NMCAs) program enables the Department of Canadian Heritage (Parks Canada) to establish a network of representative marine protected areas in each of Canada's 29 marine eco-regions. Although biogeographic representativeness is the overriding selection criterion, a wide range of other ecological, environmental, and social characteristics are also considered in the selection of priority sites. NMCAs are identified and designated in consultation with provincial governments, other federal agencies, non-government organizations, and the general public. There are no NMCAs currently located in the Gulf of Maine.

- As of 1994, Environment Canada (Canadian Wildlife Service) can designate Marine Wildlife Areas (MWAs) between the 12 and 200 mile limits of the Exclusive Economic Zone (EEZ) to protect marine wildlife and their habitats for the purposes of conservation, research, and interpretation. MWAs are meant to emphasize the protection of marine birds. The selection criteria for these designations are currently being developed, and will be based on the selection criteria for National Wildlife Areas (NWAs), which protect areas up to the 12 mile limit of the territorial sea. All NWAs must meet a minimum set of criteria developed as a national standard for selection. It is also recognized that regional applications may require specific guidelines and that regions may choose to elaborate on the national criteria. In any case, the regional criteria must complement the national criteria. MWAs have yet to be designated, but there are three NWAs with a coastal, estuarine, or marine component in the Gulf of Maine.

- The National Marine Sanctuary (NMS) Program enables the U.S. Secretary of Commerce to designate ocean waters as national marine sanctuaries for the purpose of preserving or restoring areas of "national significance." Site identification criteria have been developed to serve as standards for assessing the value of potential marine sanctuary sites. They are grouped into the following categories: 1) natural resource values; 2) human-use values; 3) potential activity values; and 4) management concerns. Resource evaluation teams use the criteria to evaluate each site through a Site Identification Matrix (see Figure 1). The most highly qualified sites are placed on the Site Evaluation List (SEL) and are considered to be active candidates for selection as national marine sanctuaries (Sanctuary Programs Office, 1982; Croom, 1992). Because the NMS is not currently selecting new sites, the selection criteria and the SEL are presently inactive, but they indicate the emphasis and goals of the NMS Program to date (see Section 2.1). Stellwagen Bank NMS, designated in 1992, lies within the Gulf of Maine.

- The National Estuarine Research Reserve System (NERRS) seeks to establish and manage a national system of estuarine reserves representing different biogeographic regions and estuarine types in the US. The system is administered by the Sanctuaries

and Reserves Division of NOAA's Office of Ocean and Coastal Resources Management (OCRM). Site selection criteria for reserves fall into the following categories: 1) environmental representativeness; 2) value of the site for research, monitoring, and resource protection; 3) suitability of the site for education and interpretation; and 4) acquisition and management considerations. Prior to the application of the full set of criteria, a state may use a simplified set of criteria (when appropriate) to screen candidate sites and eliminate those areas that are clearly not suitable for protective status. In addition, NERRS criteria and the relative values placed upon them can be modified (in consultation with the Sanctuaries and Reserves Division) to reflect regional differences in the ecological characteristics of the habitats to be considered for protection. Gulf of Maine NERR sites include Waquoit Bay, Massachusetts; Great Bay, New Hamphsire; and Wells, Maine.

- Areas of Critical Environmental Concern (ACECs) contain concentrations of highly significant environmental resources that have been formally designated by the Massachusetts Secretary of Environmental Affairs following a public nomination and review process. The designation directs state environmental agencies to take actions to preserve, restore, and enhance the resources of an ACEC. While ACECs also focus on land management, there are 13 coastal designations (8 in the Gulf of Maine) covering important estuarine wetlands and fishery habitats. The ACEC program has established a set of criteria that the Secretary shall consider in selecting areas. The criteria can be weighted differently and all factors need not be present for an area to be designated. While an area that meets several criteria is more likely to be nominated, the strong presence of even a single criterion may be sufficient for designation (302 CMR 12.09).

- Ramsar Sites are wetlands of international importance designated under the 1971 Convention on Wetlands of International Importance (Ramsar Convention). Naming of a Ramsar site implies a moral obligation on the part of participating agencies to pursue further measures for the protection of key site features. However, an area can be designated but not have protected status. A wetland is identified as being of international importance if it meets at least one criterion set out in the following categories: 1) representative or unique wetlands; 2) plants and animals; and 3) waterfowl. There are several Ramsar sites in the Bay of Fundy where the protection of bird habitats is stressed.

Table 1: Comparative Analysis of Existing Selection Criteria in the Gulf of Maine

Criteria	NMCAs	MWAs/ NWAs	NMS	NERR	ACECs	Ramsar Site
Representativeness	■	■	■	■		■
Diversity	■	■		■		■
Ecological Importance	■	■	■	■		■
Ecological Sensitivity	■	■	■		■	
Uniqueness		■	■	■	■	■
Naturalness	■				■	■
Integrity				■		
Biological Productivity			■		■	
Economic Importance			■		■	
Tourism/ Recreation	■		■			
Research/Monitoring	■	■	■	■		
Education/Interpretation	■		■	■		
Historical/Archeol./Cultural	■		■			
Conflict Resolution	■					
Degree of Threat/Urgency	■	■	■		■	
Availability				■	■	
Compatibility	■		■	■		
Accessibility			■	■		
Cooperative Management	■			■		
Size			■			
Financial Resources		■				
Social/Political Acceptability					■	
International Significance						■

Table 1 shows the commonalties and differences in selection criteria for six MPA-related programs. It is important to understand where there is overlap in the use of criteria if a collaborative approach to selecting MPAs is to succeed. It should be noted, however, that this table can be used only as a general indicator of program focus. Specific criteria may be weighted or applied differently in each program depending on the specific objectives. For example, the NMCAs and the NMS program both list representativeness as a criterion, but it may be emphasized more strongly by Parks Canada than by NOAA. Also, two programs might use slightly different interpretations of a criterion, such as integrity. Finally, even though a criterion is not officially listed for a program, it may still be considered informally during the nomination and designation process. Despite these distinctions, comparing criteria is an effective way to reveal commonalties in objectives for protection and help determine the most appropriate types of areas to emphasize in a Gulf of Maine MPAs initiative.

Ecological characteristics are clearly the criteria most heavily emphasized by each of the six programs. Among federal initiatives, *naturalness* is recognized only for NMCAs, but

representativeness and *ecological importance* are both commonly listed criteria. Every program identifies *uniqueness* as an important factor except for NMCAs, while only NERRs considers *integrity* in the selection process. *Research and monitoring* is another criterion that is stressed by all four federal programs, with the NERR system weighting this criterion most heavily.

Social values, such as *education*, *recreation*, and *culture*, seem to be the least used criteria among the identified programs. Only the MNCAs and NMS programs pay attention to a broad array of social site selection criteria. The NERR system, however, considers *education and interpretation* to be one of its most important criterion for making site selection decisions. Of the pragmatic/feasibility criteria listed, *compatibility* with existing uses and management regimes and the *degree of threat* to an area are the most commonly relied upon criteria. It should be noted that an emphasis on *degree of threat* may reduce the ability of a program to protect areas that are extremely important but do not happen to be under intense pressure from human activities. This criterion could be inappropriate, at least for broad application, when a systems planning approach to MPAs in the Gulf of Maine is contemplated. Another important criterion to consider in establishing a network of MPAs is the opportunity for *cooperative management*. This variable is listed by only two of the programs in the table. *Acceptability* is listed only by the ACEC program. Despite the fact that this criterion is considered essential to the success of an MPA, it is not formally acknowledged by any of the federal programs listed. Also receiving little attention is *economic importance*. The idea that an area can contribute economic value by virtue of its protection has yet to become a commonly used reason for selecting a site.

There are other important MPA-related initiatives in the Gulf of Maine not listed in Table 1. For example, the National Marine Fisheries Service (NMFS) and the New England Fishery Management Council (NEFMC) have no clearly defined set of criteria for fish closures under Amendment #7 or the emerging Essential Fish Habitat Program. Similarly, fisheries management in Canada under the *Fisheries Act* designates areas for closures, but has no official selection criteria in effect. While MPAs can successfully be developed without the use of established criteria, this represents a more opportunistic or reactive approach to marine protection.

The NEFMC closes areas to meet fish mortality reduction goals. Areas are chosen as needed through the best available scientific information, committee recommendations, and a public negotiation process. However, when developing a network of MPAs or initiating a systems planning approach to management, the use of some type of selection criteria can be more effective in designating candidate sites. Consistently applied criteria not only help to assess candidate sites as they are proposed, but create a planning framework for identifying and selecting areas at an ecosystem or regional level.

It should also be noted that the Department of Fisheries and Oceans in Canada is in the process of developing selection criteria for its MPAs program. The selection criteria will be based on the following objectives: a) the conservation and protection of commercial and non-commercial fishery resources, including marine mammals and their habitats; b) the conservation and protection of endangered or threatened marine species, and their

habitats; c) the conservation and protection of unique habitats; d) the conservation and protection of marine areas of high biodiversity or biological productivity; and e) the conservation and protection of any other marine resource or habitat as is necessary to fulfill the mandate of the Minister (of Fisheries and Oceans).

3.3 Choosing Selection Criteria for MPAs in the Gulf of Maine

The choice of selection criteria is dependent on the specific goals and objectives for selecting MPAs. There is no clearly defined and agreed upon goal for a comprehensive MPA initiative in the Gulf of Maine. When thinking about the establishment of a network of sites, however, selecting areas that have regional significance or that help to support the larger ecosystem would most likely become a priority. Whatever the overarching goal, it would incorporate multiple objectives based on different programs participating in the development of a network. The application of selection criteria depends on the nature of the program, its specific objectives, and the type of area being considered for protection.

The selection criteria proposed for the Gulf of Maine in Section 3.1 contains a wide range of attributes. The actual use of specific criteria will depend largely on the objective for protection or the reasons behind choosing a particular site. To illustrate this relationship, the Gulf of Maine selection criteria are matched against a range of objectives based on the IUCN management categories for protecting marine areas. These categories were accepted at the Marine Protected Areas Workshop (see Brody, Sam. 1997. *Marine Protected Areas in the Gulf of Maine: A Report on the Results of a Workshop, April 24-25, 1997, Freeport, Maine*) and are used worldwide to assist managers in designating MPAs. Evaluating criteria against various management objectives demonstrates under which circumstances the criteria proposed in this report should be applied. The management objectives are based on the following IUCN categories:

I. Strict protection (i.e. Strict Nature Reserve/Wilderness Area)

Management objective: Strict protection of natural processes, habitat, and fauna/flora (no extractive uses) in their natural conditions to serve as reference sites (scientific research and/or environmental monitoring only).

Examples: none known

II. Ecosystem conservation and recreation (i.e. National Park)

Management objective: Protect natural processes, habitat, and fauna/flora for passive human uses (i.e. sport diving, bird watching, whale watching).

Examples: Acadia National Park, Stellwagen Bank National Marine Sanctuary, Petite Manan National Wildlife Refuge.

III. Conservation of natural features (i.e. National Monument)

Management Objective: Protect or preserve specific natural/cultural features which are of unique value because of their inherent rarity, aesthetic qualities or cultural significance (i.e. submarine canyon, shipwreck).

Examples: St. Croix International Historic Site, Salem Maritime National Historic Site.

IV. Conservation through active management (i.e. Habitat/Species Management Area)

Management Objective: Maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities, or physical features of the environment where these require human manipulation for optimal management (i.e. management of harvesting techniques and amounts taken).

Examples: NEFMC Western Gulf of Maine Fishing Closure, Grand Manan Migratory Bird Sanctuary, Chignecto National Wildlife Area.

V. Landscape/seascape conservation and recreation (i.e. Protected Landscape/Seascape)

Management Objective: Maintain the interaction of nature and culture through the protection of landscape and/or seascape and the continuation of traditional commercial and recreational uses.

Examples: Massachusetts Ocean Sanctuaries, Massachusetts Areas of Critical Environmental Concern (ACEC).

VI. Sustainable use of natural ecosystems (i.e. Managed Resource Protected Area)

Management Objective: Protect and maintain the biological diversity of natural systems while providing at the same time a sustainable flow of natural products and services to meet community needs.

Examples: none known

Table 2: Matrix of GOM Criteria and IUCN Management Objectives

Criterion	Objective I	Objective II	Objective III	Objective IV	Objective V	Objective VI
Representativeness	X	X				
Diversity	X	X			X	X
Ecological importance	X			X	X	X
Ecological sensitivity	X	X	X			
Uniqueness		X	X		X	
Naturalness	X	X				X
Integrity	X	X			X	X
Biological productivity				X	X	
Importance to fisheries				X	X	
Importance to species				X	X	
Tourism/recreation		X			X	
Research/monitoring	X					
Education/ interpretation		X	X		X	
Historical/archaeological/cultural			X			
Conflict resolution				X	X	
Degree of threat/urgency	X	X		X		
Availability			X		X	X
Compatibility		X	X	X	X	X
Accessibility		X	X		X	
Cooperative manage./ international cooperation				X	X	X
Size	X	X		X	X	X
Financial resources		X	X	X		
Acceptability	X	X	X	X		
International significance		X	X			

Table 2 demonstrates the relationship between the use of selection criteria for the Gulf of Maine and the type of management objective for MPAs. The reason for designating a

MPA influences which criteria are used to select sites. This matrix will help managers think about which criteria are more applicable when they select areas based on specific objectives. A single criterion will, in many instances, apply to several different management categories. Also, some criteria may be weighted more heavily than others used for the same management category. The difference in the weight of criteria used is not reflected in Table 2.

Overall, management objectives that involve a high level of protection or prohibit human activity (i.e. IUCN category I and II) tend to emphasize ecological criteria, such as *representativeness*, *naturalness*, *diversity*, and *ecological sensitivity*. The focus of these MPAs is to protect natural processes or threatened species, placing a high priority on criteria which value ecological components of the marine environment. *Public support* is also a criterion commonly used when selecting MPAs whose objectives relate to strict protection. Sites that regulate human activities more heavily than others are more likely to be opposed by local communities and the general public. The level of *public support* will thus become more of a factor in site selection.

MPA management objectives that encourage human use (i.e. IUCN category II-VI) rely more on pragmatic/feasibility criteria, such as *accessibility*, *compatibility*, *financial resources*, and *cooperative management*. These types of MPAs involve managing people and setting regulations which requires thinking about how visitors access the site, if regulations are in agreement with existing frameworks, and if the necessary resources to oversee various activities are available.

Objectives that provide for passive human uses (i.e. IUCN category II and III) seem to emphasize *tourism/recreation* and *education/interpretation* criteria. Selecting sites as national parks or national monuments requires the use of criteria related to sightseeing and learning as opposed to resource extraction. The same types of MPAs also use *uniqueness* as a selection factor because they are usually protecting outstanding resources or features that attract the interest of visitors. On the other hand, management objectives that focus on more intensive human use or aim to protect areas as working land/seascapes (i.e. IUCN category IV and V) rely more on economic criteria, such as *importance to fisheries* or *importance to species*. The main objective of these MPAs is often to maintain a species/habitat for sustainable human use. Potential economic benefits should thus be considered during site selection for these categories of MPAs. *Biological productivity* is another criterion used to select sites whose goals are to facilitate traditional activities (e.g. commercial fishing) since it often relates to the ability of a resource to provide economic or subsistence benefits to humans.

Size or *integrity* tends to play a role in selecting sites whose objectives are to: a) protect a self-sustaining ecological unit, or b) protect an area as a working land/seascape involving multiple human uses. In the latter case, sites are usually larger in size because they focus on human interactions with the natural environment which usually occur over some distance. Larger, more dispersed MPAs, such as biosphere reserves often involve an adjacent land component which requires the application of *availability* as a criterion for

site selection. Finally MPAs that allow for various human activities may use *conflict resolution* as a criterion for site selection because these areas provide an opportunity to balance what are in many cases competing uses.

3.4 Focusing on specific selection criteria in the Gulf of Maine

A wide range of possible site selection criteria have been proposed for MPAs in the Gulf of Maine. However, a few merit special attention when considering the establishment of a network of sites or a systems approach to planning. The following criteria have been identified as among the most useful in forming a network of MPAs in the Gulf of Maine.

Ecological Importance: Protecting ecologically important areas or areas that support ecological functions often lies at the heart of an ecosystem approach to management. Focusing protection measures on areas that "drive" ecological processes is one way to achieve protection of the larger marine ecosystem. Ecological importance is a major concern for many MPA programs in the Gulf of Maine. Spawning areas for commercially valuable fish stocks and breeding areas for migratory birds are given high priority for protection because they support larger ecological processes. While the species focus may differ (fish versus birds), every federal program lists this criterion for site selection. Ecological importance is also incorporated into the Gulf of Maine Council on the Marine Environment's objective *to achieve a 10% increase in the acreage of regionally significant coastal habitats that are protected by public and private organizations*. In terms of protecting ecological value, this criterion may be the lynch pin of a Gulf of Maine MPAs initiative.

Representativeness: Since the level of knowledge on marine environments (how marine ecosystems function, where key species spawn, etc.) in the Gulf of Maine and elsewhere is incomplete, the best surrogate for conserving essential components of the ecosystem is to incorporate representative areas into a network of MPAs. Setting aside representative habitats for the future provides the opportunity to invoke the "precautionary principle" where MPAs act as a buffer against unforeseen events or mismanagement of resources that may create irreversible change to the marine ecosystem (Agardy, 1994). Achieving representation often relies on a clearly defined marine classification system, which has yet to be developed for the Gulf of Maine region (WWF is developing a hierarchical ecological classification framework that could be applied to the Gulf of Maine). However, representativeness is an important site selection criterion for many MPAs programs and initiatives in the Gulf of Maine, such as National Marine Conservation Areas under Parks Canada and the National Estuarine Research Reserve System managed by NOAA's Office of Ocean and Coastal Resources Management. This criterion could act as a key factor in selecting candidate sites for an MPAs network.

Economic Benefits: The net present value (NPV) resulting from protection is a criterion that should be weighted heavily in the site selection process. The application of economic criteria is essential to understanding the value of a MPA designation to society and for attaining a management framework based on sustainable use. MPAs can have negative

economic impacts in the short term by closing commercial fisheries and other economically valuable resources. However, sites which provide positive economic value over the long term (healthy fish stocks, protection of biological diversity) should be considered strongly in the site selection process. Determining economic benefits can be difficult because it involves the evaluation of market, as well as non-market values ("use" and "non-use"). Several methods and examples exist to measure the value of an MPAs designation in economic terms (Hoagland et al., 1995).

In the Gulf of Maine, the economic value of an MPA should be measured by its importance to tourism and recreational and commercial fisheries, the two most important economic resources in the region (Colgan and Plumstead, 1995). Economic value is explicitly listed by only one MPA program examined in this report and, in general, is not given much consideration in marine protection initiatives in the Gulf of Maine. While this criterion does not yet play a major role in site selection, it may be one of the most important in gaining political support and acceptance for the concept of an MPAs network.

Opportunity for Cooperative Management and/or International Cooperation: A site that offers the opportunity for different jurisdictions and organizations to work together on common protection goals should receive a higher rating in a Gulf of Maine MPAs initiative. The Gulf of Maine ecosystem encompasses three states, two provinces, an international boundary, and a multitude of organizations all interested in the protection of what are in many instances common marine resources. As a result, the management of shared resources is fragmented. Due to the fluid nature of the marine ecosystems, sites of mutual interest may extend across jurisdictional boundaries, be biologically linked, or have some other type of regional importance. Collaborating on the protection of certain areas would therefore be of great value when considering the establishment of a MPAs network in the Gulf of Maine. At the federal level, many existing programs foster some level of cooperation with other entities. Internationally, the Gulf of Maine Council on the Marine Environment provides an established forum for transboundary collaboration and management of marine resources.

Research and Monitoring: Areas that could act as scientific "benchmarks" or control sites should be given strong consideration when selecting candidate sites. Scientific understanding of the Gulf of Maine ecosystem, particularly regarding habitats, is lacking. MPAs can be used to generate baseline data, predict responses to impacts from various events, and monitor natural and human-induced changes to marine systems over time. When networked, MPAs can provide a means of understanding complex ecological linkages and permit statistically valid assumptions to be made across a geographic region. This criterion is of great value in selecting sites, but it should be applied along with other complementary criteria, since selecting a site for research opportunities alone may not be a widely supported objective for marine protection. Nevertheless, scientific value is a criterion recognized by almost every major MPA program in the Gulf of Maine. Using it to guide the site selection process could result in a significant increase in the state of

scientific knowledge of the marine ecosystem. Scientific research is already facilitated by the Regional Association for Research on the Gulf of Maine (RARGOM).

Education and Interpretation: Protected areas involving programs that enhance public understanding and appreciation of the marine environment have greater value to the public. Education and interpretation is a goal of several MPA initiatives in the Gulf of Maine, as well as for programs not directly involved in establishing MPAs. This criterion is most effective when the accessibility of the resource is high.

4. Conclusions and Recommendations

Selection criteria are an important part of any marine protected areas program. They help guide the decision making process by focusing management objectives and providing a rational basis for choosing among potential sites. Furthermore, they provide insight into why and where an area is designated for protection. However, there are several complications to using selection criteria that can reduce their effectiveness. First, the terms being considered, such as biological diversity and ecological importance, are often vague or difficult to define. In many cases, the same criterion is interpreted differently by several individuals or programs. Second, once a set of criteria has been identified, there is often a lack of information about each variable. For example, in a Gulf of Maine initiative, ecological importance may be the highest ranking criterion, but it cannot be applied effectively because the state of knowledge about critical areas for certain species or ecological processes is incomplete. In addition to data gaps, it is difficult to establish a "threshold" for the presence of each criterion. For example, it can be impossible to determine how much biological productivity, opportunity for research and monitoring, or accessibility is enough to warrant using such criteria in the selection process. Finally, despite mathematically rigorous models for applying criteria, the selection process is often subjective and, in the end, highly influenced by political factors. To reduce these complexities and allow selection criteria to make a strong contribution to the planning process, the following guidelines are proposed for the Gulf of Maine and elsewhere:

I. *Define a common goal*: The identification and application of site selection criteria is intricately linked to program goals and objectives. It is extremely important to have a clearly defined goal for a system of MPAs, since it determines which criteria are used to help make decisions throughout the site selection process. For example, a goal to establish a system of conservation areas for endangered species would emphasize ecological and regional criteria. If, on the other hand, the goal is to protect localized critical habitats for fish species, the selection criteria may be more inclusive of social and economic criteria. When planning for a system or network of MPAs covering a broad region, such as in the Gulf of Maine, there will most likely be several goals, or an integrated goal, meeting numerous objectives. In this instance, criteria will be more comprehensive and allow for more flexibility in the objectives of selected MPAs (Salm and Price, 1995). Before a network of MPAs can be established in the Gulf of Maine, a common goal must be set that meets the needs of existing programs. An integrated goal should be formed around criteria that are held in common (see section 3.2).

II. *Obtain Sound Information*: The site selection process relies on accurate and up-to-date information about the resource in question. For example, it is difficult use critical areas as a selection criterion if those areas are either not known or are poorly understood. Once criteria are established, an assessment of existing information and future informational needs about each variable must take place. Scientific information on the

Gulf of Maine is scattered and incomplete. Emphasizing specific criteria can help drive an information-gathering process and reveal where future study should be directed. Understanding of criteria will always be lacking or inconsistent, causing decisions to be made under uncertainty. The objective is to obtain as much information as possible under the given time and resource constraints.

III. *Use Selection Criteria As A General Guide to the Planning Process*: Because the process of selecting MPAs is often subjective, criteria should not be used to quantitatively value and choose specific sites. Instead, criteria should act to guide and focus decision makers throughout the planning process. Complex statistical methods are cumbersome, expensive, and not very effective in eliminating bias from the selection process. Selection criteria are meant to help humans make decisions, not take humans out of the decision-making process. More simplified techniques for applying criteria are preferable for an initiative that involves the integration of existing programs and processes, as would be the case in the Gulf of Maine. The application of selection criteria in this case should be used only to focus collaborative efforts and reveal common protection goals.

IV. *Maintain Flexibility*: Every jurisdiction has different social, political, economic, and environmental parameters. In addition, every conservation management program has its own goals, objectives, and set of regulations. For these reasons, there can be no one definitive model for choosing a site for protection. The key for every initiative or project is to maintain flexibility throughout the selection process. To achieve this goal, sets of criteria should be adapted as appropriate for individual cases and specific objectives within an overall program. Flexibility is especially important when establishing a network of MPAs in the Gulf of Maine, since there are so many existing programs and management objectives. Common selection criteria would have to accommodate multiple approaches to marine conservation.

V. *Allow For Diverse Participation*: A site selection process must reflect the opinions of a variety of representatives. In this regard, developing and applying selection criteria for MPAs should involve input from many different interests, as opposed to a few experts in the field. Ultimately, criteria that take account of the needs of many will result in MPAs that are more successful in meeting their goals over the long term.

Selection criteria are vital to the establishment of a network of MPAs in the Gulf of Maine. Established criteria provide a framework for regional collaboration and ensure consistency throughout the site selection process. By creating a standard for selecting multiple sites, selection criteria can help bring different programs together to identify and work on common goals for marine conservation and management. This report can only examine existing use of criteria, suggest a range of variables to emphasize, and provide direction for the future. An agreement between different parties to develop or focus on specific criteria, or chart a course of action for selecting sites, is the responsibility of existing jurisdictions and their programs. The presence of existing selection frameworks and a strong recognition that cooperation is needed will enable parties to work together in establishing MPAs in the Gulf of Maine.

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