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## II. Description of Dimensionless Analyses and Delphic Priority Ranking Methodologies for Selecting Marine and Coastal Protected Areas

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After a "short list" of potential Marine and Coastal Protected Area (MACPA) sites had been developed based on the special significance of sites to the mythical country's MACPA Program, and their resource values described, the next step (for which this workshop focused) was to determine the priority ranking of sites relative to each other. This is especially important in times of restricted fiscal budgets, when new MACPA sites may be added to the existing networks at a very slow pace.

For the first part of the priority ranking exercise, determination was accomplished using the Dimensionless Analysis model described below (adapted from Mondor, C. 1991. "Application of the Dimensionless Analysis model technique for selecting new National Parks and National Marine Parks". Canadian Parks Service, National Parks Systems Branch, Ottawa). The model compares the resource values of each site to the resource values of the biogeographic province which that site represents, followed by a comparison among the sites themselves in order to determine priority ranking of sites. Some strengths that have been given for this model are that (1) all criteria influencing the site selection decision, as well as the weight placed on each criterion, must be specified; (2) subjective and objective criteria can be combined; and (3) the analysis is mathematically rigorous. The steps in applying the analysis are described below.

### DIMENSIONLESS ANALYSES

#### Descriptions of potential MACPA sites

Site descriptions have been developed documenting the significant natural and human use resources of the potential MACPA sites and provided to workshop participants. Brief descriptions of the impacts of human activities and management concerns were also included. The descriptions were developed drawing on regional expertise and previous external review by the mythical MACPA program.

#### Establish Weighting Factors

Weighting factors were used so that scores reflect the relative importance of the values and qualities of the sites in the ranking process in order for the mythical MACPA Programmatic objectives and goals to be met.

#### Scoring potential MACPA sites

Scores for the critical criteria were assigned for each site based on the Semantic Differentiation Scale. Scores for each site were then compared with each of the other potential sites to result in a ranking of each site relative to all others.

#### General Definition of Semantic Differentiation Scale (Scores)

Low Value (Numerical score = 1) - Low quality; not significant from a national perspective but still a viable concern; low potential for contributing to the MACPA

network; of minor importance; other equally good representative sites are available; the site duplicates, in significant measure, another recommended area or designated MACPA.

**Moderate Value (Numerical score = 2)** - Moderately good quality; significant but not the most important concern; helps to support species or preserve biodiversity, but not critical; supports the regional ecology, but only in a small measure or in a general way; a few other good representatives are available; of moderate potential to contribute to the MACPA network.

**High Value (Numerical score = 3)** - Very high value; high quality; a major reason for MACPA consideration; extremely important to regionally significant species; of great importance in terms of ecological functions and processes; regional ecology would likely suffer significant alteration if the value or attributes were not protected; no significant duplication of other recommended areas; absolutely unique; best available representative of the biogeographic province or region; extremely high potential for contribution to the national system.

**Unknown Value (X)** - Value or consequences unknown; more study needed to determine value or consequence; factor does not apply; or factor is not an issue, does not need to be considered.

### Compare Sites to Each Other:

Sites were compared to each other in pairs by computing weighted ratios according to Equation 1:

$$R_i = ((A/B)^W)_i$$

where

$R_i$  = weighted ratio for the  $i^{\text{th}}$  criterion;

A = Site A score for the  $i^{\text{th}}$  criterion;

B = Site B score for the  $i^{\text{th}}$  criterion;

W = weighting factor for the  $i^{\text{th}}$  criterion;

i = one criterion in a list of criteria numbered  $i = 1, 2, \dots, n$ .

The preferred site of each site pair was selected by generating a preference number which was based on the scores and weights assigned to the Site Identification Criteria. This preference number, P, was computed by multiplying together the weighted ratios of the site pair, as shown in Equation 2. Because P is the product of weighted ratios, the preference number tests the numerator with respect to the denominator. The preferred selection is the site whose preference number is greater than 1. The magnitude of the preference number does not confer a "degree of preference"; preference is established solely by whether the value of P is greater than or less than 1. If  $P = 1$ , the two sites are equivalent. The formula for computing P is:

$$P = \prod (R_i)$$

Equation 2

where

$P_n$  = the preference number

$\prod$  = the product of weighted ratios for criteria  $i = 1, 2, \dots, n$

$R_i$  = the weighted ratio for the  $i^{\text{th}}$  criterion (see Equation 1)

Pairs of sites were compared iteratively using this process of preference selection. The final result was a list of potential MACPA sites ordered by priority for selection as active candidates for further consideration as additions to the mythical MACPA network.

### DELPHIC ANALYSES

For the purpose of this workshop exercise, the "Delphic" method consisted of each breakout group (consisting of wise and learned men and women who are viewed as national and international experts in the field of MACPAs due to their years of training and experience) reaching a consensus on the priority ranking of the potential MACPA sites based on their purely qualitative assessment of each site compared with all the others.