

## Assessing the relative importance of economic valuation, ecological and socio-economic ecosystem indicators: a multi-criteria application to Australian coastal development

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**Summary:** Ecosystem based management requires the integration of various types of assessment indicators. Eliciting and comparing stakeholders' preferences for these indicators is insightful for management and decision-making. In particular, preferences and expectations of both decision-makers and the general public matter in democratic participatory management institutions. We present in this paper a multi-criteria analysis that aims to quantify the relative importance to these populations of economic, ecological and socio-economic indicators usually conveyed when managing ecosystem services in the coastal development context. The Analytic Hierarchy Process is applied within two nationwide surveys in Australia, and preferences of both the general public and decision-makers for these indicators are elicited and compared. We show that, on average, for both samples, the priority in terms of assessing the consequences of a generic coastal development project goes predominantly to the ecological assessment of marine biodiversity, and that ecological assessment indicators are globally preferred to economic values or socio-economic indicators. This result is observed for a significantly larger proportion of decision-makers. Our findings question the representation of general public's preferences by decision-makers.

### Introduction

The need for developing participatory framework in policy development and ecosystem assessment processes, and the importance of articulating and integrating the different dimension of Ecosystem Services (ES) (Martín-López et al., 2014), raise the issue of how economic, ecological and social criteria are weighted and balanced by both decision-makers and the general public when assessing the consequences of changes in ES.

The general objective of this work is to examine and compare through an Analytic Hierarchy Process (AHP) (Saaty, 1977) the weights attached by decision-makers and the general public to three main categories of indicators to assess changes in ES values in a coastal development context. These indicators – namely (1) economic valuation indicators; (2) ecological indicators; and (3) socio-economic (socio-eco) indicators – are the most commonly encountered “in the field” in ES management. Our AHP model represents a generic coastal development scenario where these indicators can be used to assess the consequences of coastal development on marine commercial activities, on marine recreational activities and on marine biodiversity.

### Materials and Methods

Figure 1 shows the structure of the AHP model, based on the hypothetical scenario. In effect, the AHP aimed to elicit: (1) the relative weights attached by stakeholders to the various types of consequences to be assessed; (2) the preference regarding the different assessment of ES changes (economic, ecological and socio-economic) described here as changes in marine activities and marine biodiversity. Based on this hierarchical tree, 12 pair-wise comparisons are developed using the nine points judgement scale. The relative weights are derived from a consistent reciprocal matrix (A) of judgements from these pairwise comparisons, using the right eigenvalue method (Saaty, 1977).

The model is applied to the context of Australian coastal management, and the AHP is implemented in nation-wide online surveys. Two samples are targeted: a representative sample of the general public with 250 individuals, and a sample of decision-makers. The later is based on a list including around 456 individuals identified as being directly involved in Australian coastal and marine management (Marre, 2014).

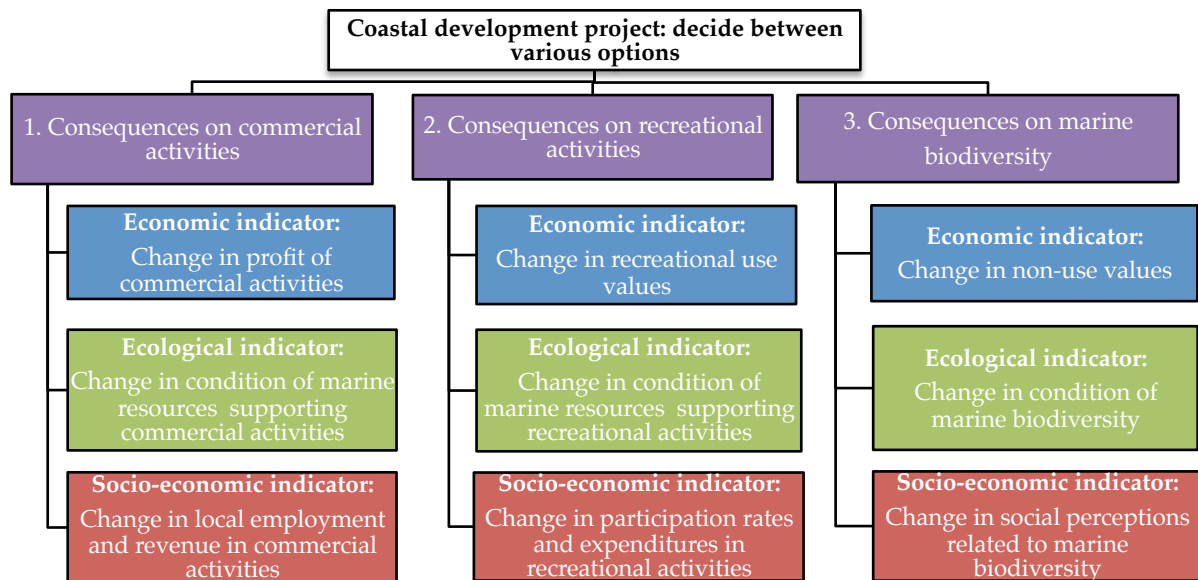


Figure 1 AHP Hierarchical structure

## Results and Discussion

In total, 256 respondents from the general public and 64 decision-makers completed the AHP. The proportions of respondents from the general public and decision-makers retained for our analysis, accounting for both consistency and protest answers, are respectively 50% and 75% (Marre, 2014). Figure 2 represents graphically the final weights for these respondents, derived from the AHP.

On average, ecological assessment indicators are generally preferred, even when looking at commercial and recreational impacts. In comparison to the general public, decision-makers consider the assessment of marine biodiversity as more important, and the commercial dimension as less important. They also place higher weights on the various ecological assessment indicators, and lower ones on the economic and socio-economic indicators. This raises the question of the representation of groups in the general public with interest in commercial and socio-economic dimensions in our decision-makers sample, and potentially in decision-making processes. The issue of respondents' preference heterogeneity is studied in further details through cluster analysis (Marre, 2014).

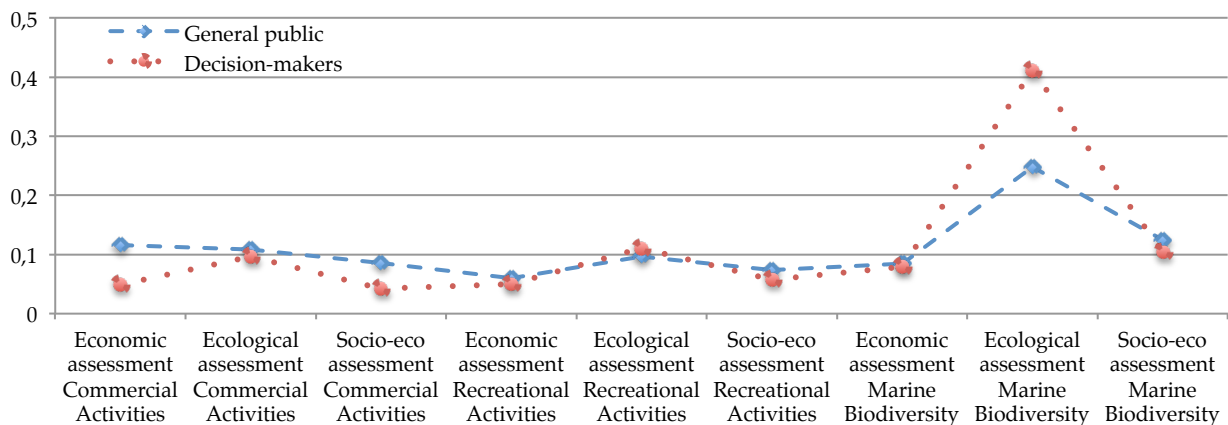


Figure 2 General public and decision-makers final weights for the various assessments of the consequences on commercial activities, recreational activities, and marine biodiversity

## References

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