Planning for action: Bridging the gap between systematic conservation planning and conservation action

Thesis submitted by
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Adams V.M., **Mills M.**, Jupiter S.D., Pressey R.L. Improving social acceptability of marine protected area networks: a method for estimating opportunity costs to multiple gear types (oral presentation).

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Abstract

To halt the decline of marine biodiversity, networks of interacting marine protected areas (MPAs) – intertidal and subtidal areas "reserved by law or other effective means to protect part or all of the enclosed environment" (Kelleher 1999) – need to be expanded. Systematic conservation planning (hereafter 'systematic planning') offers a way forward with its explicit methods for locating and designing resource management (hereafter 'management') in time and space to promote the conservation of biodiversity (Margules and Pressey 2000). The implementation of systematically planned MPA networks has been demonstrated in some regions. However, numerous challenges (e.g. understanding the willingness of people to engage in conservation) impede translations of many spatial prioritisations into management. Spatial prioritisations are the technical activities within systematic planning that identify the configuration of priority areas for conservation action. Conservation actions are interventions that contribute to conservation goals (e.g. establishing education programs or management) (Salafsky et al. 2008). The failure of many spatial prioritisations to motivate conservation action is referred to as the knowing-doing gap.

The conservation biology literature contains a heated discussion about the best investment of conservation resources, leading to a polarization between systematic planning and opportunistic conservation – conservation that takes advantage of opportunities without considering spatial context or regional conservation goals. Although it can be useful to polarize these perspectives to better understand their respective strengths and limitations, academics and resource managers are now exploring how they can be made complementary. Opportunistic conservation actions can be 'scaled up' to better achieve fisheries and conservation objectives that require perspectives broader than individual local governance units. At the same time, spatial prioritisations must be 'scaled down' or adapted to better inform implementation of conservation actions by incorporating local objectives, unforeseen constraints on conservation actions, and errors in data. The goal of this thesis is to better

understand options for integrating systematic planning with local management. With this goal in mind, my thesis has two main objectives:

1. To investigate methods for scaling down systematic planning to inform conservation actions, focusing on opportunities for implementing multiple forms of management with different contributions to conservation goals; and
2. To explore considerations for scaling up conservation actions to achieve regional conservation goals.

To achieve these objectives, first I examine the mismatch of spatial scales between systematic planning and conservation actions. I review key decisions about spatial scale in systematic planning, and the considerations and implications of these key decisions for informing conservation actions (Chapter 2). In Chapter 2, I develop a framework in which decisions about spatial scale can be made explicit, investigated further, and potentially addressed during systematic planning. In this framework, I identify five decisions about spatial scale: extent and delineation of the planning region, resolution of data, size and delineation of planning units, MPA network design, and applying conservation actions. Each of these decisions involves several considerations, including the extent of available data, extent of bioregions, and social, economic and ecological characteristics of study areas. My framework helps to link theory and application in systematic planning, facilitates learning, and promotes the application of conservation actions that are both regionally and locally significant.

To scale up conservation actions or scale down systematic plans, the differential contributions of several forms of management (e.g. permanent and temporary closures to resource extraction) to conservation goals must be understood, so I develop a method to do so (Chapter 3). Using Fiji as a case study, I gather expert knowledge through dialectic inquiry to obtain perceived effectiveness scores for four forms of management, and use these in a national gap analysis. Permanent closures were the benchmark with an ecological effectiveness score of 1.0. Temporary closures with controlled harvesting had relatively high scores and temporary closures with

uncontrolled harvesting and ‘other management’ had relatively low scores. Understanding the relative contribution of different forms of management to conservation goals facilitates scaling up and down in three ways: (1) forms of management that complement each other in terms of the level of protection they offer and their social acceptability can be identified; (2) conservation achievements in countries where multiple forms of management will be needed to achieve national conservation goals can be assessed; and (3) spatial prioritisations can be tailored to management that is relevant within the ecological, social, economic and political context of the selected planning regions.

To contribute to existing knowledge on opportunities for implementing multiple forms of management, I develop a method to model conservation opportunity at fine resolution for different forms of management (Chapter 4). I also develop an approach to investigate the social characteristics of villages with different forms of management, thereby providing insights into conservation opportunity (Chapter 5).

In Chapter 4, I use key informant interviews and remotely collected data, and model conservation opportunity for different forms of management at regional scales using Maxent. This model provides information on the relative suitability of one area for a particular form of management. I find that two of the most important predictors of suitability for the different forms of management are distance from the nearest road and proportion of inshore fishing ground already closed. This approach is promising, because it produces good fits to the existing data (cross-validated AUC at least 0.98). It also provides insight into the factors influencing the presence and characteristics of different forms of management, and matches accounts in the literature on factors important to establishing closures.

In Chapter 5, I use the social-ecological systems diagnostic framework, and compare the performance of data at different resolutions for informing conservation opportunity. Even though conservation opportunity is context-specific, using a well-recognized diagnostic framework allows identification of

characteristics that lead to effective governance within different contexts. I use canonical correspondence analysis to examine the association between the presence and form of management on one hand and, on the other, human and social characteristics of villages. I find that, in the Solomon Islands, human and social characteristics that influence the presence and absence of management can be more easily differentiated than those related to different forms of management. Furthermore, I find that household-scale data are more effective than village-scale data at identifying the human and social characteristics associated with management. Understanding these characteristics and mapping conservation opportunity facilitate the scaling down of systematic plans by informing planners of priorities for feasible forms of management within a social-ecological system.

To further explore considerations for scaling up conservation actions to achieve regional conservation goals (objective 2), the conservation opportunity model developed in Chapter 4 is used as the basis for comparing systematic planning and opportunistic approaches to conservation. I carry out 10-year simulations of additional conservation actions with systematic planning and opportunistic conservation approaches, identifying the difference between the upper and lower bounds of plausible future conservation achievements (Chapter 4). To predict future conservation action, I use data on conservation opportunity (Maxent suitability model), established MPAs, key informant interviews, and Marxan with Zones (systematic planning software). The opportunistic approach achieves quantitative conservation objectives for half the ecosystems, while all objectives are achieved or nearly achieved with the systematic planning approach. Chapter 4 informs policy makers about what incentives and regulations are needed to steer Fiji toward achieving national conservation goals into the future.

My thesis contributes to the theoretical advancement of the field of conservation biology by investigating the results of different approaches to conservation (i.e., systematic planning and opportunistic approaches) and developing methods that help integrate them. Chapter 2 informs both scaling up and scaling down by identifying the considerations needed and the trade-

offs between considerations when making decisions about spatial scale. Chapter 3 provides a method to understand the differential effectiveness of management and integrates this understanding into a national gap analysis, which facilitates scaling down of outputs from systematic plans by tailoring them to specific regions. Understanding differential effectiveness also helps to scale up management by informing decision makers about complementary forms of management. Together, chapters 4 and 5 provide methods to understand opportunity for conservation. This is critical if spatial prioritisations are to identify priority areas that are most likely to be implemented, thereby facilitating the scaling down of systematic plans. Lastly, Chapter 4 also demonstrates a method to understand the benefits of coordinating opportunistic management to facilitate the development of policies and incentives.

Glossary

Term	Definition
Bioregions	Areas with relatively homogeneous biological and physical composition, distinct from adjacent regions and large enough to ecological and evolutionary processes (Spalding et at 2007).
Conservation actions	Interventions that contribute to conservation goals (e.g. establishing education programs or management) (Salafsky et al. 2008).
Conservation objectives	Quantitative interpretations of the broader goals of planning
Ecological effectiveness	The relative contribution of a form of management to realizing conservation objectives.
Implementation strategy	The development of a plan of how spatial prioritisations are going to inform management (Knight et al. 2006b).
Knowing-doing gap	The difference between the number of spatial prioritisations produced and the number that actively informs management. The knowing doing gap is composed of the research-implementation and the planning-implementation gap.
Locally Managed Marine Area (LMMA)	An area of inshore waters governed by local residents and involving a collective understanding of, and commitment to, management interventions in response to threats to marine resources. In terms of management it is equivalent to an MPA.
Management effectiveness	The feasibility of a management approach for a particular biological, social and economic context, and its ability to promote the persistence of all levels of biodiversity (based on Hockings et al 2006).
Martine protected area (MPA)	“Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Kelleher 1999).
Marine protected area networks (MPA networks)	“A collection of individual marine protected areas operating cooperatively and synergistically …to fulfil ecological aims more effectively and comprehensively than individual sites alone could” (WCPA/IUCN 2007).
Opportunistic conservation	Conservation that takes advantage of opportunities without considering spatial context or regional conservation goals.
Permanent closure	Areas where the extraction of resources is prohibited indefinitely (a.k.a. no-take areas, marine reserves).

Planning units	Spatial units of assessment and comparison used in most planning exercises that employ decision-support software and are the building blocks of regional MPA designs.
Planning region	The geographic domain within which areas are evaluated and compared as candidates for conservation action.
Protected areas	Areas “designated or regulated and managed to achieve specific conservation objectives” (CBD 2008).
Resource management (management)	Any action directed at protecting, enhancing or restoring species and ecosystems.
Regional priorities	Areas identified for generic or specific conservation actions during regional scale design.
Regional scale	An area which shares common “patterns and processes of biodiversity and human uses” (Pressey and Bottrill 2009).
Spatial scale (scale)	The extent and resolution of study regions, data, and areas of assessment.
Spatial prioritisation	The “technical activities that identify the location and configuration of priority areas for conservation action” (Knight et al. 2006b).
Systematic conservation planning (systematic planning)	An explicit operational model for locating, designing and implementing conservation actions in time and space to promote the conservation of biodiversity and sustainable use of natural resources (Margules and Pressey 2000).
Temporary closure	Areas where the extraction of resources is prohibited temporarily. These can be ‘controlled’, where harvests are allowed once per year as dictated by a management plan or collective decision at the community level; or, uncontrolled, where areas are harvested without any predefined frequency and duration.