



Connectivity and Resilience of Marine Protected Area in Bird's Head Seascape

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Motivation

Coral reef ecosystems are under severe threat from local to global stressors (e.g., fishing, decreasing water quality, over-tourism, and climate change). In response to the increasing threat, Marine Protected Area (MPA) is a common management tool used for conserving and managing coral reef ecosystems. However, a major challenge is to maximize the effectiveness of conservation areas and to ensure the resilience of the MPA with increasing stressors. Lack of fundamental and integrated insights into ecology, connectivity, hydrology, and human threats poses severe limitations to implementing effective management plans and zonation. In the proposed project, we set out to identify and elaborate on the conceptual and methodological tools for analyzing connectivity and resilience of MPAs in Bird's Head Seascape (BHS) (Fig. 2).

Aims and Objectives

- Assess resilience characteristics and identify primary drivers, feedback, or potential thresholds in the BHS MPAs.
- Map the connectivity within and among BHS MPAs based on population genetic diversity within species and species diversity within communities.
- Reveal biodiversity dynamics over the spatial-temporal scale within and among BHS MPAs.
- Produce a dynamic system model that predicts how coral reefs may respond to multiple stressors or changes in the ocean.

Method

A multi-faceted approach with population genomics, photo-analyses, and modeling will be used. Several MPAs in Bird's Head Seascape will be selected as priority MPAs in Indonesia. Resilience indicators and environmental characteristics will be measured, tissue sampling of coral (*Acropora* table), sponge (*Xestospongia testudinaria*), and grouper (*Plectropomus leopardus*) will be sampled to study population connectivity. Environmental DNA will be employed to reveal biodiversity. Finally, responses of coral reefs to multiple stressors and resilience of MPAs will be modeled.

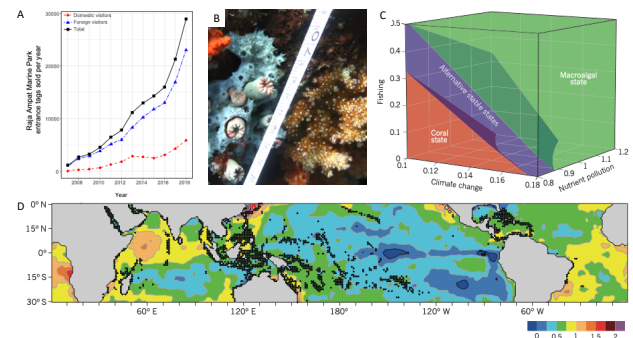


Figure 1. A. Tourism increase in Raja Ampat (Maas et al., 2020), B. Benthic community (competition between coral and sponge) (photo: Agustin Capriati), C. The modelled responses of coral reefs to multiple stressors i.e. fishing, climate change, and nutrient pollutions (Hughes, et al., 2017), and D. Global trend in tropical Sea Surface Temperature (SST) (Hughes et al., 2017)

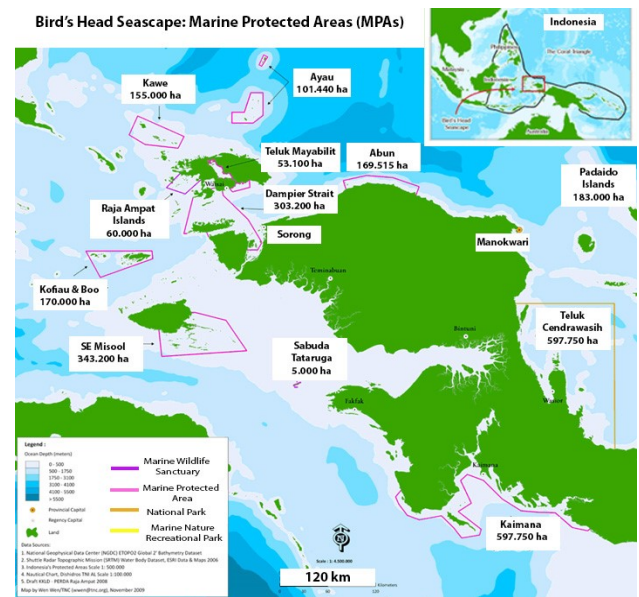


Figure 2. Map of Marine Protected Areas in Bird's Head Seascape (Source: The Nature Conservancy)



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