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Population genetics and social network analysis: implications for the conservation of manta rays in Raja Ampat

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Abstract

The Raja Ampat archipelago is one of the few places in the world where populations of both reef (*Manta alfredi*) and giant (*M. birostris*) manta rays can be found. It is a globally important habitat for manta rays and provides an excellent opportunity to gain further insight into the biology and ecology of these threatened species. Accurate information on population size and structure is necessary in order to understand the conservation requirements of a species, develop effective management strategies, assess and monitor population health over time. A collaborative research project between the Marine Megafauna Foundation (MMF), the University of Papua (UNIPA) and Bogor Agricultural University (IPB) has been launched in 2016 with the aim of conducting long-term, focused research into Raja Ampat's manta ray populations.

With the help of citizen science data, long-term photo identification (photo-ID) catalogues are being developed for both species of Manta. The Raja Ampat *M. alfredi* Catalogue already consists of over 500 unique individuals and 120 *M. birostris* individuals have been identified to date. Continued photo-ID data collection will expand these catalogues, forming the backbone of further population studies.

Photographic documentation and behavioral observations will be used to record and analyze social structure in the *M. alfredi* population. Sociality in manta rays is yet to be studied and may be a crucial factor linking individual behavior, group information and aggregations within populations. Population genetic techniques will also be employed to estimate population size and investigate the structure and spatial connectivity of the *M. alfredi* population. The genetic component is the first assessment of fine-scale spatial connectivity within a *M. alfredi* population. This research represents the continuation of a long-term database and contributes to global knowledge of Manta species as well as aid in the development and refinement of efficient management and conservation strategies for manta rays in the Bird's Head seascape.

Keywords: manta ray ecology, photo identification, population genetics, social network analysis

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