Project Manta

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Overview

Manta rays (*Manta birostris* and *Manta alfredi)* are the largest rays in the world. Reaching a disc width of seven meters for *M. birostris* (the average height of a two-story house) and five meters for *M. alfredi*, these rays are one of the few large marine animals that are safe for divers to interact with. They are a major draw for the thriving eco-tourism industry around Australia's Great Barrier Reef.

Both *M.birostris* and *M.alfredi* are listed as globally *Vulnerable* on the IUCN Red List. Scientists only recently discovered that *M. alfredi* is a second separate species, so its biology and population status is poorly understood. Mantas are under threat from fisheries around the world, often caught for their meat, fins, liver, and branchial filaments. Mantas are particularly susceptible to threats because they live long, mature late in life, and have low reproduction rates.

Mantas eat by "filter feeding" on zooplankton. As such, they are likely to be one of the first vertebrates on the Great Barrier Reef to be directly impacted by changes in ocean currents that may result from climate change. Why? The currents affect the population of the zooplankton, its main food source. For example, a warming ocean would alter the abundance and distribution of zooplankton—which could impact the manta ray's feeding habits and overall behavior. Changes in manta ray behavior will impact eco-tourism industries that rely on the predictable occurrence of these animals within this region.

Although manta rays are commonly observed, scientists knew very little about the east Australian population prior to the establishment of an Earthwatch research project taking place on Lady Elliot Island. Scientists working from

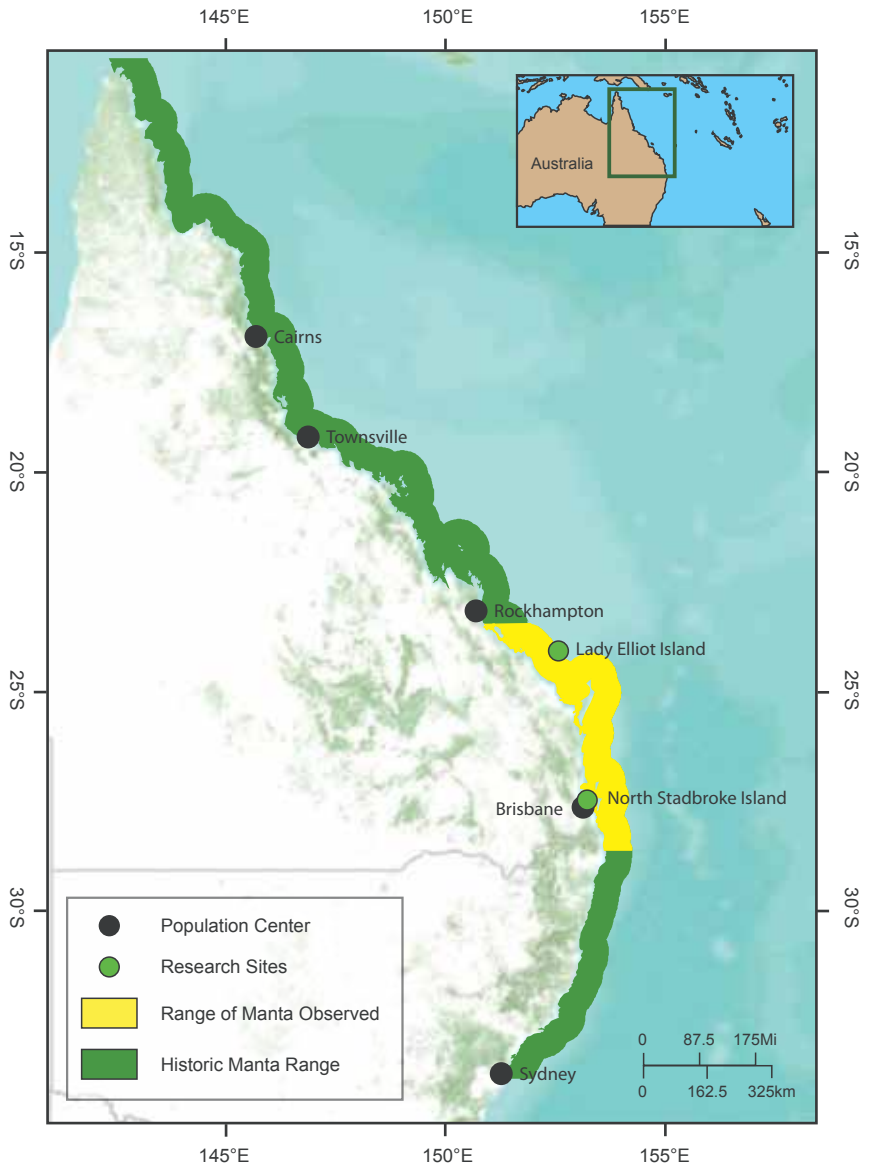

Figure 1: Map of eastern Australia indicating research sites and the range of the observed manta rays.

the island are collecting baseline data on the abundance and feeding habits of *M.alfredi*, relative to oceanic conditions to be able to inform conservation management strategies. Established in 2007 and led by Earthwatch scientist Dr. Kathy Townsend, *Project Manta* is improving our scientific understanding of this iconic marine species.

To help scientists map out its distribution in time and space, they need to first understand the ecology of *M. alfredi*, which includes how its abundance relates to oceanic variables and the abundance of zooplankton. This research will be valuable to stakeholders, including divers, ecotourism and island resort operators, and the Great Barrier Reef Marine Park Authority (and other Marine Park and Protected Area management agencies).

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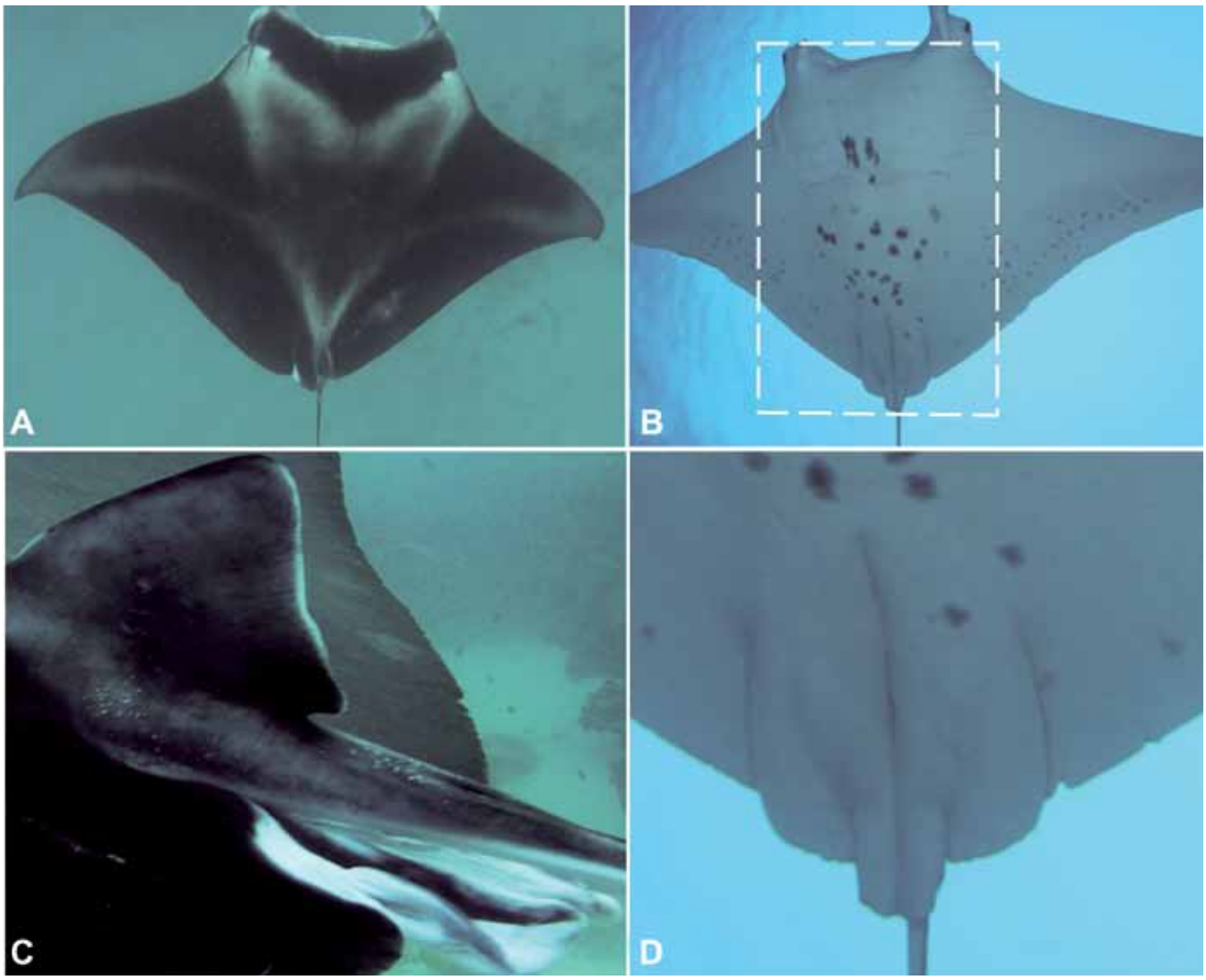

Figure 2: Key features used to identify and sex *M. Alfredi:* (a) dorsal surface coloration, (b) ventral surface spot distribution, (c) absence of caudal spine, and (d) presence of reproductive organs known as "claspers".

A longer-term goal of the study is to use manta rays as an indicator species to help monitor environmental change and global oceanic health.

Research objectives are:

- To develop a manta identification database through photographic identification
- To record and interpret manta behavior
- To investigate environmental conditions and the availability of food resources

Outcomes

Earthwatch volunteers help with photo identification, assist with plankton sampling and take part in filming mantas for ongoing behavioral studies.

Using images of the unique pattern of spots on the underside (ventral surface) of individual manta rays, Dr. Kathy Townsend and her team have created an identification database of over 500 mantas to date—all *M.alfredi*. The fully searchable database, which includes photographs and sketches plus data on each individual's behavior, locations and general biological information, will provide invaluable to decisions on species and habitat management plans.

Changes in manta ray behavior will impact ecotourism industries.

Acoustic and satellite tags help scientists track broad-scale (for example, ocean-wide) and small-scale (for example, reef) movement patterns of the mantas. Twenty individual animals were tagged using specialized acoustic tags, each of which has a unique identification code that allows the tags to be logged if the animals travel within about 500 meters of an underwater listening station.

Six listening stations were deployed around Lady Elliot Island in April 2009, and six were set up around North Stadbroke Island. These continue to provide valuable data on the presence of animals in the area, and their movements over months and years. Existing deployments of listening stations by other research groups will also be able to record the tag's presence, greatly expanding the research area and offering a breadth of coverage that had not been available before. These listening stations form part of the Australian Acoustic Tagging and Monitoring System—an Australia-wide network shared by marine researchers on all coasts. Over the course

Volunteers help study manta feeding habits and assist with plankton sampling and analysis.

Figure 3: Volunteers take images of the unique pattern of spots on the ventral surface of individual manta rays, contributing to an identification database of over 500 mantas.

of the project, Earthwatch researchers have confirmed the movement of animals between Lady Elliot Island and North Stradbroke Island (380 kilometers apart) and even further to Byron Bay (506 kilometers from Lady Elliot Island) in New South Wales. This is the first time seasonal migrations have been confirmed for these animals; understanding their distribution is crucial information for conservation management strategies.

Project Manta has also started to understand the relationship between site use and food availability. Manta rays need plankton as a food source to survive, but there is relatively little information on the abundance, composition, and nutritional quality of plankton within seasonal aggregation sites such as North Stradbroke Island. Mantas are usually observed here between October and April, which could relate to the abundance and nutritional quality of zooplankton during these months. In one study, scientists examined the abundance, biomass, and nutritional qualities of zooplankton between October 2007 and March 2008 at four sampling stations around North Stradbroke Island. They found the greatest biomass in November 2007, and the abundance was highest in November and February at a popular fishing area called "The Group"—where manta rays are known to congregate.

Based on these results, the researchers feel the need for more research, involving a whole year of monthly or weekly zooplankton samples so they can compare zooplankton productivity with both the presence and absence of manta rays. They also need data on actual foraging requirements and behavior at known manta ray feeding grounds.

Following on from this study, *Project Manta* scientists investigated the seasonal variation in nutritional quality of zooplankton at North Stradbroke Island. It was hypothesized that the nutritional quality of zooplankton would be highest when manta rays were present. To test this, the team analyzed the biochemical composition of zooplankton in the area, including protein, carbohydrate, lipid and fatty acid content, and energetic value. The researchers took samples every month from March 2008 to April 2010, and as suspected, they found that in the spring months, there was an increase in both the nutritional quality of the zooplankton at North Stradbroke Island and the number of manta rays.

Also in 2010, the team captured on film the late stage courtship behavior of manta rays at Lady Elliot Island. This has only been filmed a handful of times before.

Recent Publications

Couturier, L.I.E., Jaine, F.R.A., Townsend, K.A., Weeks, S.J., Richardson, A.J. and Bennett, M.B. (2011) Distribution, site affinity and regional movements of the manta ray, *Manta alfredi* (Krefft, 1968) along the east coast of Australia. *Journal of Marine and Freshwater Research* **62:** 628 - 637

Couturier, L.I.E. (2009) "Zooplankton community, remote sensing and seasonal migration of manta rays at North Stradbroke Island" Honours thesis for the University of Queensland

Townsend, K.A. and Kyne, P.M. (2010). New records of the Japanese devilray *Mobula japanica* (Muller & Henie 1841) for Australian waters. *Memoirs of the Queensland Museum—Nature* **55:**225-230

Verlinden, N (2010) "Seasonal variation of zooplankton nutritional quality in manta ray (*Manta alfredi*) aggregation areas", Honours thesis for the University of Queensland