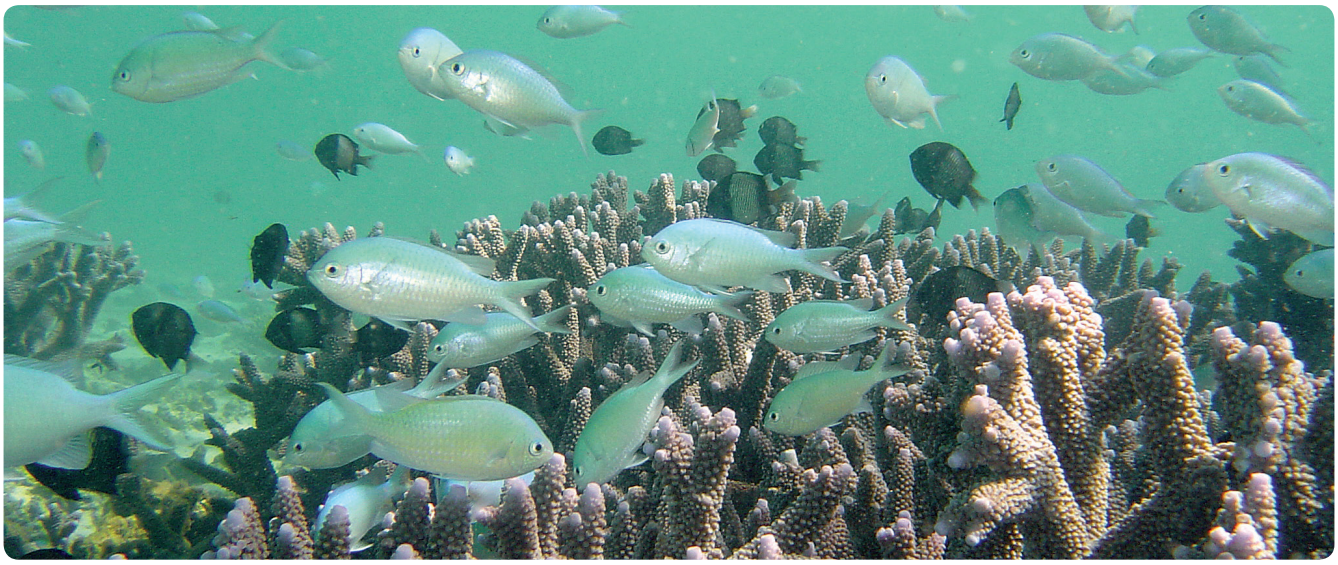
Ningaloo

Collaboration Cluster

Exploring the depths of the ocean to improve reef management

This project is working to produce data about the depth of the Ningaloo Reef in shallow waters as well as understand what is on the ocean floor. It is one of the largest remote sensing projects using airborne hyperspectral data (measurements of "colour" intensity and brightness collected at many wavelengths of light) for a coral reef system in the world.



Why knowing about the sea-floor is important

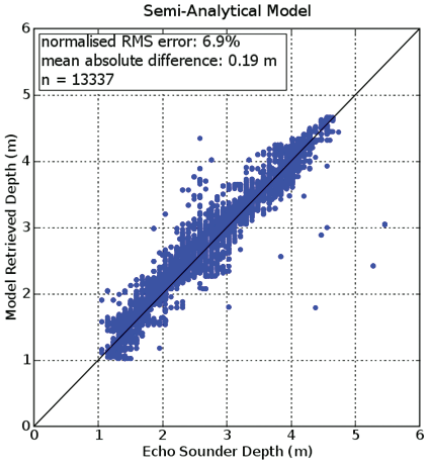
Data about what covers the bottom of the ocean can provide whole-of-reef information which is important to the management of a coastal system. Management of coastal systems requires accurate and extensive information about the physical shape and biological resources not only for effective management but also for the development of hydrological and ecosystem models.

Detailed information about the ocean depth is crucially important for developing numerical models of current flow through the Ningaloo Reef system, because they provide an understanding of flow regimes, system flushing times, nutrient cycling, sediment transport and tidal forcing.

How the science works

The products were determined from measurements of visible light collected with an airborne sensor called a hyperspectral spectrometer. The raw data firstly had to be processed to remove the effects of atmospheric haze and sun glint from the ocean surface. The ocean-depth product was directly validated using equipment fitted on a small boat that sampled and measured depth at the same time as aircraft over flights. Additionally, water column samples were taken from the small craft at locations under the flight paths. These samples were filtered on site and subsequently analysed for pigment concentrations.

The ocean-depth data derived from airborne remote sensing is able to describe depth, slope and aspect in the shallow regions of the reef (0 to 20 metres) with very good accuracy. Such quality data is difficult to obtain by any other means due to difficulties in accessing parts of the reef and the large area of the Reef.



The findings

The project research found that:

1. Airborne remote sensing has the ability to deliver shallow water (<20 m) ocean-depth information over extensive coastal marine systems, particularly in regions where access is difficult. The accuracy of the measurements is good and suitable for use in numerical, hydrodynamic models. In such shallow water coral reef systems, the accuracy achieved using the airborne technology is close to the vertical scale of the ocean surface roughness.
2. Key broad ocean floor cover types (biological, physical, coral etc.) were identified by comparing the airborne hyperspectral measurements to a library of spectra (colours) of the major species covering the ocean floor cover on the reef. A classification of cover types was achieved at a resolution of 3.5 square metres.

Typically, large-scale ocean-depth data is not available for shallow water coastal systems because of technical and / or logistical difficulties. Airborne assessment of the physical and biological resources of coastal systems, including coral reefs, has significant benefits with respect to reduced cost and the extent of spatial sampling possible.

Why it is important

With respect to management of the Ningaloo Marine Park, the level of detailed physical and biological information available is extremely beneficial to operational management, particularly with respect to adding to the understanding of how a particular reef system functions.

In the longer term, airborne surveys of this type can aid in the detection of changes that occur in the marine park, for example sediment deposition or erosion and, very importantly, changes in ocean-floor cover and the mix of key ocean-floor species.

The Council of Australian Governments has identified ocean-depth as a key missing area of knowledge for Australian, its territories and neighbouring Pacific Island States threatened by sea level rise. The approach of using airborne hyperspectral measurements to measure ocean-depth fills this gap for the Ningaloo Reef System.

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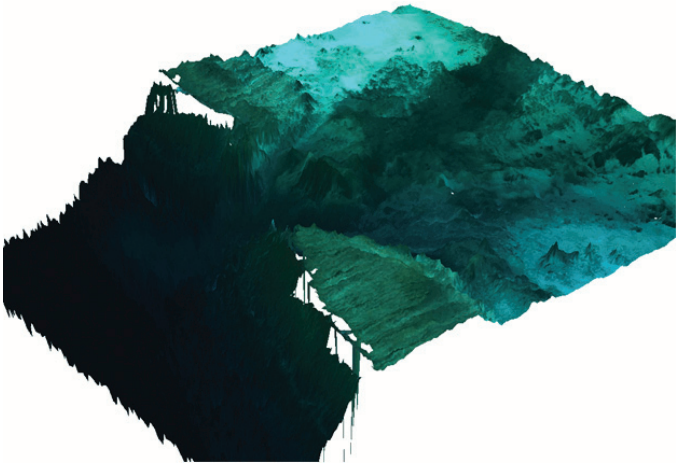

Ningaloo research is an initiative of the Western Australian Marine Science Institution, CSIRO's Ningaloo Collaboration Cluster and the Australian Institute of Marine Science, working in partnership with government, local communities and enterprises.

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