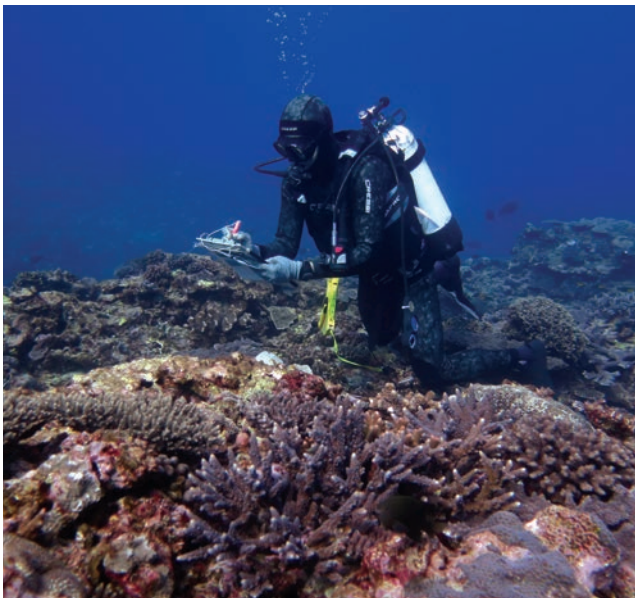
Ningaloo Outlook

A BHP Billiton-CSIRO Research Partnership
Year 2 – Progress Report

Ningaloo Outlook is a five-year strategic marine research partnership between BHP Billiton and CSIRO which is now in its third year. Since 2015 the team has been busy tagging an array of iconic marine wildlife to better understand their movement patterns, developing maps of seafloor habitat for deeper areas of Ningaloo reef, and continuing to apply innovative approaches to understand shallow reefs.

Ningaloo Reef is the largest fringing coral reef in the world, extending over 300 kilometres. The reef is home to many species, and the shallow lagoons and deeper offshore seabed provide a diverse array of habitats.

Research for the Ningaloo Outlook project is grouped into three distinct themes; deep reefs, shallow reefs, and tagging turtles and sharks. Activities commenced in 2015 and will run until 2020.



Researcher completing a transect on the Osprey reef slope (Ningaloo Outlook Shallow Reefs Team, CSIRO)

Expected outcomes from the partnership

Our scientists will deliver the following outcomes as part of the research partnership:

- Status assessments of the core ecological values of the reef.
- New knowledge and a better understanding of the ecology of Ningaloo Reef to inform conservation and management.
- Community engagement to build capacity and understanding within the local community.
- Training opportunities for the next generation of scientists to become world-class researchers.
- Creating science knowledge transfer opportunities through an annual symposium and meeting with the people who are responsible for managing the Ningaloo Marine Park and World Heritage Area.

An update – progress made in Year 2 – what are we finding?

Our researchers have embarked upon numerous field trips to Ningaloo, begun analysis and interpretation of data collected to-date, and led community engagement activities in Exmouth and Perth.

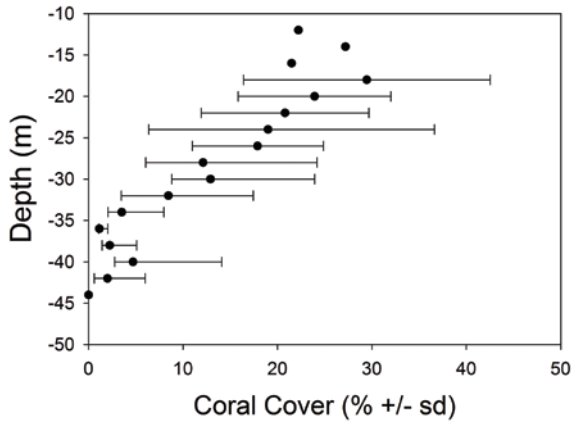
We've also been busy ensuring our three Ningaloo Outlook PhD scholars have access to the best training available.

Deep reefs

Research being led by Dr Russ Babcock is helping to shed new light on the deep reef habitats at Ningaloo. Video and photos have revealed abundant and highly diverse filter-feeding communities (such as sponges and soft corals) in waters between 12 to 25 metres deep; the amount of coral declines consistently beyond 25 metres, and it is scarce to absent at depths greater than 40 metres.

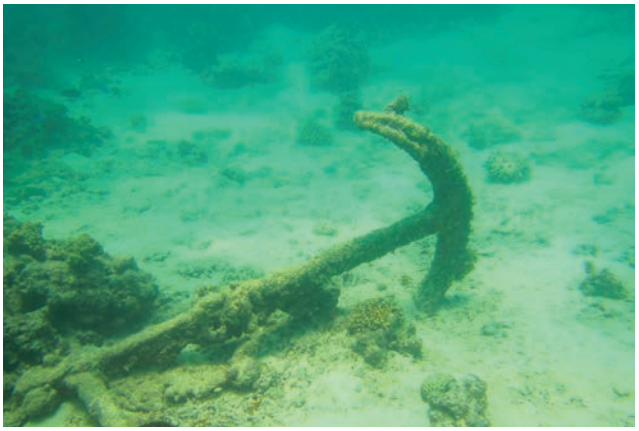
In all, more than 4 kilometres of photographic transects were completed by the Starbug-X Autonomous Underwater Vehicle (AUV) as part of the 2016 field surveys, at depths ranging from 12 to 49 metres. Comparison of seabed habitat maps from the four areas revealed striking differences between the reef and the adjacent seabed. Helby Bank was characterised by a large area of submerged high-relief reef, with extensive areas of shallow sand, and low profile reef further offshore. The most extensive areas of high-relief reef were found at Osprey, and were separated from the main reef by an extensive area of sand-covered rock. This submerged secondary line of high-relief reef (which are submerged relict beach dunes) was also evident at other locations, albeit smaller and closer to the main reef line.

Maps of deep-water habitats, extending from the main reef line to depths of up to 60 metres are now available for Helby Bank, Tantabiddi, Mangrove, Mandu and Osprey. By exploiting the characteristic signals produced by the sonar over different habitat, the team continues to garner more detailed insights into the habitats of the deeper seabed of Ningaloo.



Percentage cover of reef building corals as a function of depth at Ningaloo (2016). Cover declines rapidly below depths of approximately 25 metres, and averages less than 5% at depths greater than 35 metres, where suitable substrata are available

In an exciting twist, during a test mission in the Ningaloo lagoon with the Starbug-X a large, old admiralty-type anchor was seen on video. The WA Maritime Museum confirmed that the anchor was likely from a small coastal vessel, and up to 150 years old. What a find!



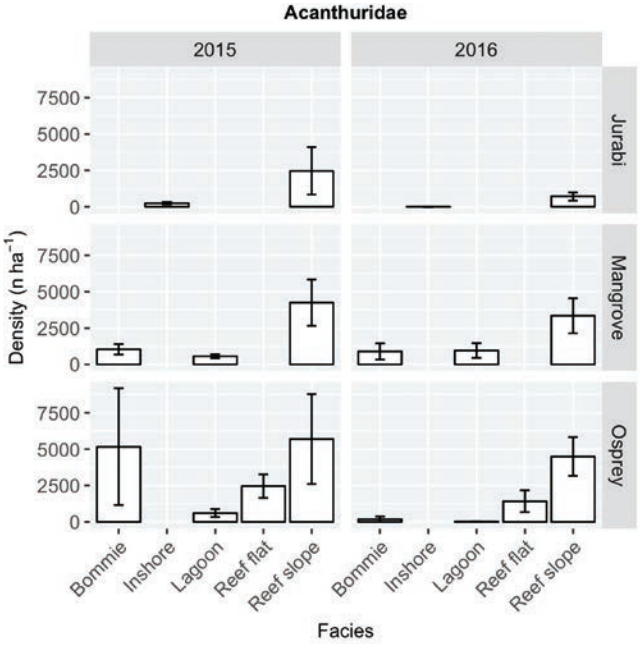
StarBug-X anchor discovery at Ningaloo (Russ Babcock, CSIRO)

Shallow reefs

The shallow reefs of Ningaloo are home to over 200 species of coral and 500 species of fish, provide food and shelter to turtles and sharks and provide physical protection from waves and storms to over 200 kilometres of coastline.

In 2016, the team revisited 55 shallow reef sites to measure the abundance and diversity of fish, sharks, corals and macroalgae. In doing so, they extended one of the longest continuous datasets on abundance of fish and corals for northern Ningaloo.

The surveys of reef fish revealed significant differences in composition between habitats and regions. On the reef slope, the most abundant families were Acanthuridae and Scaridae, while in the lagoon and inshore, the most abundant families were Lethrinidae and Labridae. These large differences in the abundance of different fish families often occur when gradients in physical conditions such as wave energy, light and temperature are steep.

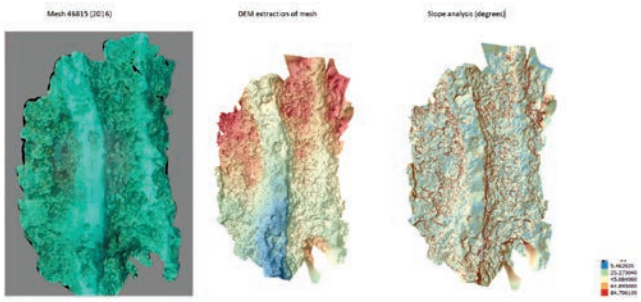


Mean density (±1 SE) of Acanthuridae (n ha^{-1}) observed on Underwater Visual Census transects (25 and 100m combined) at reef habitats at Jurabi, Mangrove and Osprey during May 2015 and May 2016

The surveys of corals and algae suggested the relative abundances were reasonably similar between 2015 and 2016. In both surveys, the four major benthic groups were hard corals, macroalgae, turf algae and crustose coralline algae (CCA). Like the fish, the surveys also revealed large differences in composition between habitats. Reef slope locations consisted of moderate to high cover of corals, turf algae and CCA, while lagoon and inshore habitats featured low cover of hard coral, high cover of macroalgae and variable cover of turf algae.

The shallow reef research team is continuing to apply innovative approaches to understand how shallow reefs function, such as the use of 3-dimensional structural complexity measures to understand patterns in the composition and abundance of fish and coral among habitats.

"The turtle tagging excursion was a great opportunity to see scientists at work and learning about the different types of tags - acoustic and satellite. Thanks to BHP, CSIRO and our teacher Mrs Bedford."
- Emma Talbot, Year 9 Student



An example of a benthic habitat photo mesh obtained from the Mangrove reef slope in 2016 (left), the digital elevation map (middle) and the QGIS slope analysis of the digital elevation map showing the fine scale changes in reef complexity (right). Scale bar on the right-hand side shows slope in degrees

In-water and land-based debris assessments suggest northern Ningaloo generally contains a very low density of floating and sinking debris. Common items include plastic bottles, plastic bottle tops, monofilament fishing-line, rope and plastic bags.

Tagging turtles and sharks

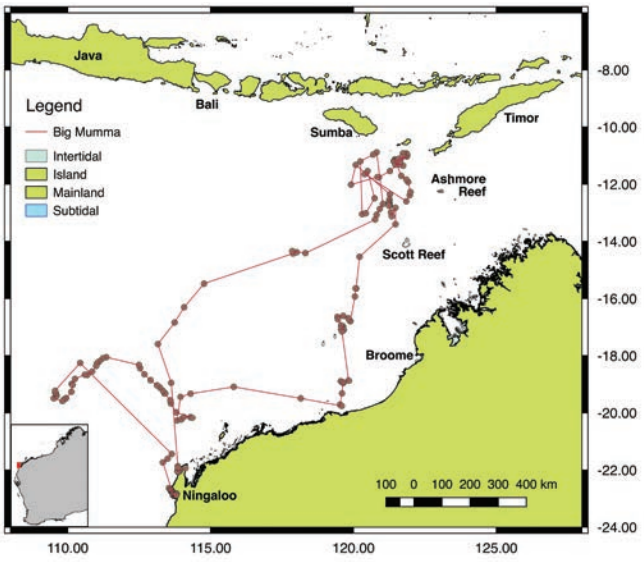
Turtles, whale sharks and reef sharks are iconic species that capture the attention of the community, both locally and more broadly. These species are also listed as important ecological assets of Ningaloo Coast World Heritage Area.

Since the project commenced, tags have been deployed on 57 green turtles (17 satellite tags and 40 acoustic tags), 28 whale sharks (with acoustic or satellite tags) and 29 reef sharks (acoustic tags). Analysis and interpretation of movement data is ongoing, but preliminary findings suggest that the movement ranges of nesting turtles are substantially larger than those of turtles tagged outside nesting season, even females at nesting size.

One of the highlights of the 2016 tagging was the data obtained from Big Mumma, an 8 - 9 metre female whale shark tagged with a towed SPLASH tag in early July. Big Mumma covered more than 7,500 kilometres over seven months moving nearly 1,600 kilometres away from Ningaloo Reef up to Sawu and Roti Island in Indonesia. She remained in this region from August to October before returning to Ningaloo Reef in January 2017. To our knowledge, this is only the second record of a tagged whale shark moving away from Ningaloo and then returning while the tag was still attached and recording. It is also one of the longest tracks of a whale shark tagged at Ningaloo Reef.

The program will continue deployment of satellite and acoustic tags on green turtles, reef sharks and whale sharks in 2017.

Whale shark with a clamp tag attached, which can now be tracked at seaturtle.org/tracking (Richard Pillans, CSIRO)



The movement of the whale shark 'Big Mumma' tagged at Ningaloo, showing her journey over 6 months to Indonesia then back again to Ningaloo

Community Engagement

Volunteers from the Cape Conservation Group have continued to play an important role in the tagging of green turtles and participated in taking biological measurements prior to their release. Web-based platforms continue to be an important outreach tool, where members of the public can view the tracks of animals captured in near real-time (www.seaturtle.org/tracking).

Community participation is a key component of the tagging work, so to encourage greater involvement, the research team ran a turtle naming competition which attracted over 665 votes for the top 10 names chosen by the general public. The top three names were given to nesting turtles satellite tagged in January 2017: Jurabi, Budgial and Ningles!

Volunteers play an important role in tagging activities completed as part of the Ningaloo Outlook partnership (Richard Pillans & Sue Pillans, CSIRO)

The Ningaloo Outlook team have also embarked on inspiring future scientists at Exmouth School.

During 2016 each of the research themes engaged school students in science activities which ranged from a day on the beach with researchers taking measurements of green turtles being fitted with tags, to driving CSIRO's AUV StarBug-X in the local swimming pool!

In addition to the hands on activities outside, the team also brought creative science direct to the classroom. Students were engaged in 'Shark Art' and visual story telling activities related to whale sharks and the tagging being undertaken.

"We thought it was really interesting how scientists research the reef with an AUV, collect the data, check the health of the system and discover new things. Thanks BHP and CSIRO."
- Chelsea Davies Yr 10

PhD scholars Jessica Stubbs and Anna Cresswell on a field trip with CSIRO researchers at Ningaloo reef (Sue Pillans, CSIRO)

The Deep Reefs Research Team with the StarBug-X and Exmouth School science students (Jo Myers, CSIRO)

Training our future scientists

A key element of the Ningaloo Outlook partnership is to provide training opportunities for future scientists. This is in part being achieved through co-supervision of three PhD scholars (Anna Cresswell, Joe Turner and Jessica Stubbs), all based at the University of Western Australia (UWA). All of our scholars had their research proposals accepted in 2016 and all have had an exciting year participating in field activities at Ningaloo and attending national conferences related to their area of research.

Did you know?

Science generated from the Ningaloo Outlook research partnership will inform future management of the Ningaloo reef area through the development of knowledge, monitoring techniques and input into key environmental baselines.

Key users of this information include government departments responsible for managing and monitoring the Ningaloo reef area and industries operating in the vicinity of the Ningaloo reef (e.g. resource extraction activities, fisheries, tourism).

Like to know more and keep up-to-date?

Visit our webpages:

https://research.csiro.au/ningaloo/

Or email:

- CSIRO Team: Ningaloo.outlook@csiro.au
- BHP Billiton: bhppetexternalaffairs@bhpbilliton.com