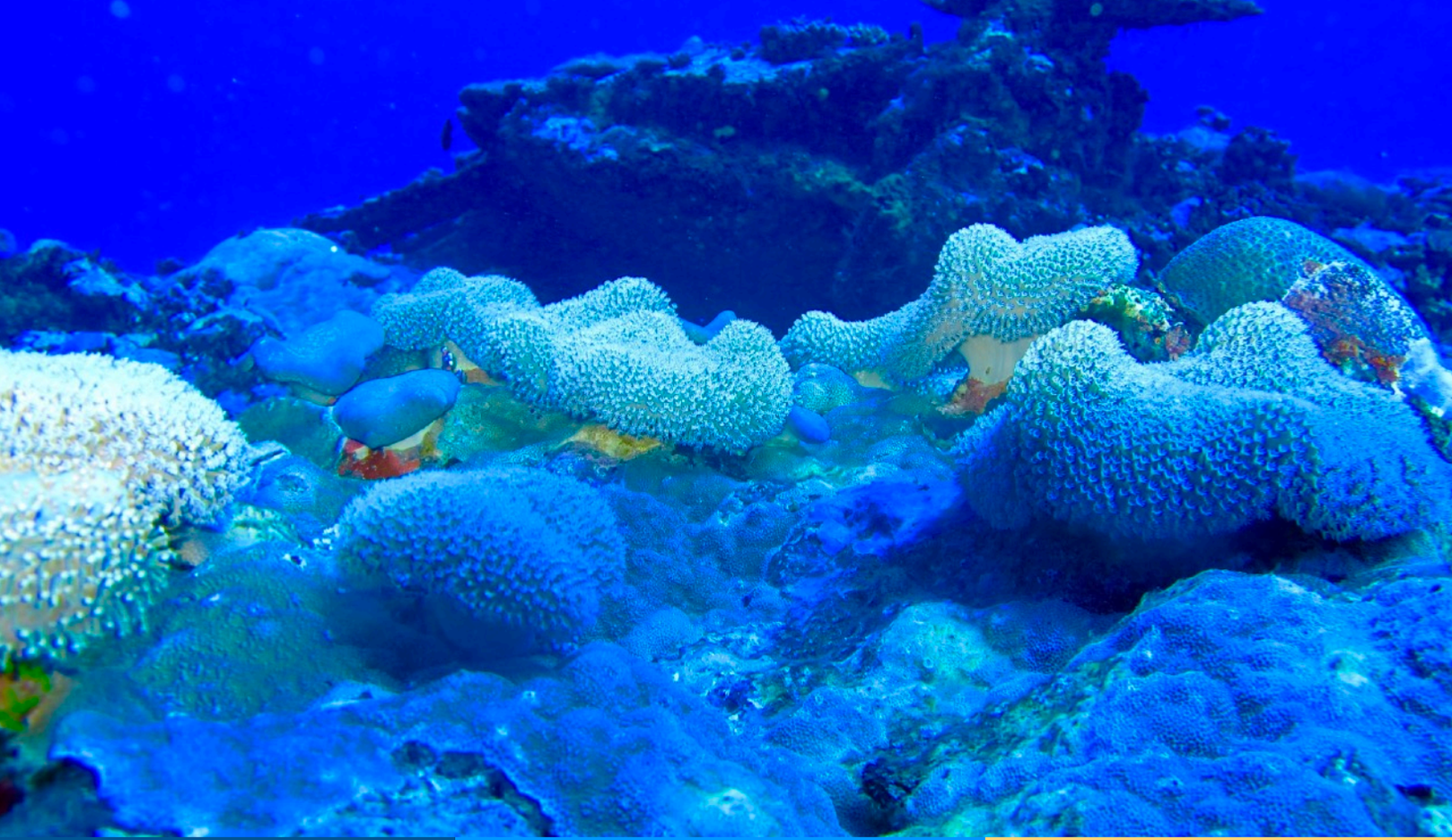
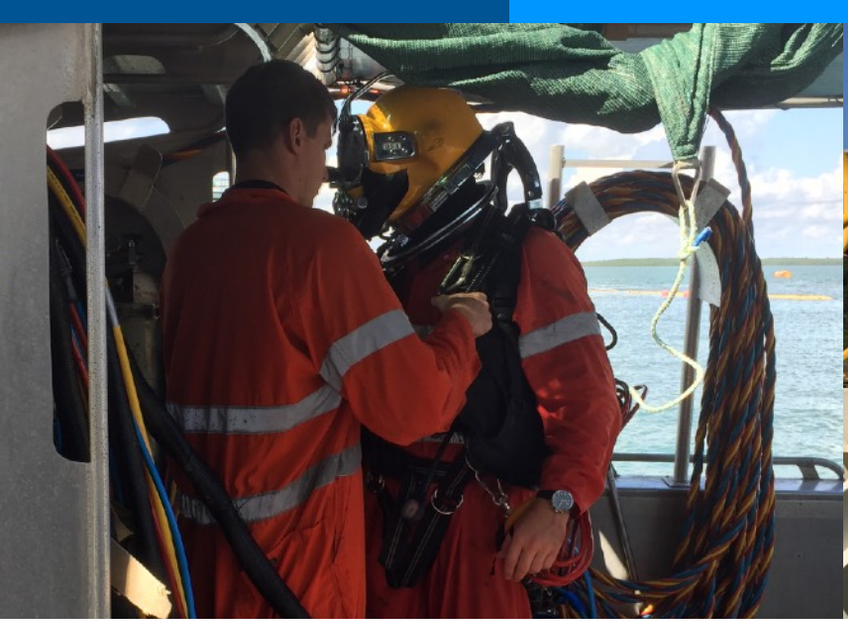


Artificial Reef Capability Statement



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Artificial reefs are deployed globally to create and enhance marine biodiversity and to attract fish for recreational fishers. The success of an artificial reef requires an intricate knowledge of marine science and ecology, physical factors, including local bathymetry and hydrodynamics and marine/maritime infrastructure development.

The following factors are critical to create an artificial reef:

- Understanding of the endemic marine flora and fauna species likely to colonise the artificial reef structure;
- Mimicking the natural surrounding environment by installing structure/s which have the greatest capacity to provide suitable habitat for pioneering species (i.e. encrusting and autotrophic species) which ultimately attract and encourages visitation by local fish species;
- Optimising the available surface area for the artificial reef;
- Orientation of the structures, including provision of both horizontal and vertical services at different depths in the water column, to allow for different species to colonise different parts of the structure; and
- Materials used in the creation of the structure should optimise longevity and encourage settlement;
- The method of deployment should allow for accurate positioning on the seabed, with little disturbance of the surrounding environment.

Understanding the Host Environment

Having a sound understanding of the marine environment and the flora and fauna communities that the artificial structure is being deployed into is critical. Tropical reefs are different to temperate reefs, which are also different to cold water environments. Each environment will influence the types of flora and fauna species likely to colonise the structure.

It is important to understand species habitat preferences, species life cycle and colonisation processes and their likely growth rates. For example, the large kelps and encrusting algae are likely to grow in shallower depths on flat surfaces, whereas sponges, ascidians and hydrozoans are more likely to colonise the deeper parts of the structure. It is also expected that in warmer waters colonisation of the structure will be faster than in cold water environments. Knowing this provides for more informed decision making when selecting the type of structure/s to be deployed.

Surface Area of the Artificial Reef

Surface area is of critical importance because it provides a larger area for recruitment, and a greater probability to attract more fish. Providing a more substantial habitat in turn results in a larger artificial reef.

Orientation of the Reef Structures

Orientation, vertical versus horizontal alignment of an artificial reef structure influences the establishment of marine organisms and ultimately the biological diversity. Studies have found that surface orientation in rocky reef communities significantly influences species richness and abundance. Furthermore, the orientation of the artificial reef structure must take into consideration the natural tidal currents. Seabed material can accumulate and impact on the function of the reef module if orientation is not correctly achieved (i.e. modules should be placed to encourage flushing of material, with large openings facing the prevailing currents).

Mimicking the Natural Environment

From a long-term standpoint, an artificial reef will only mimic its adjacent natural reef communities if it possesses structural features similar to those of the natural surroundings. AMA takes a species-centric approach that ensures that the new artificial reef best mimics the surrounding communities with a large surface area of different orientations to promote biological diversity, which has the best chance of establishing a diverse autotrophic, primary producer and primary consumer community. We believe that once this is established the artificial reef modules have the greatest potential to regularly attract the target species for the recreational sector, where applicable.

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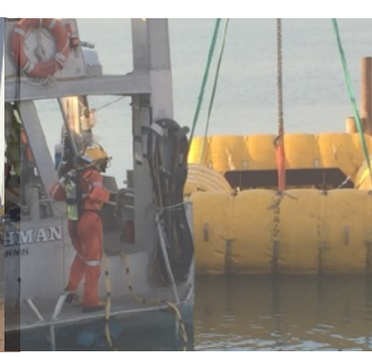
The Australasian Marine Associates Team

The AMA team are skilled Principal Marine Scientists, with significant experience in marine infrastructure development, fisheries science and marine coastal system processes. It is the blending of these critical skills that provides a team that understands the biology and environmental processes, alongside the design and fabrication works and methods of instillation to maximise the long-term success of the artificial reef.

Relevant Artificial Reef Projects Undertaken by AMA Directors

- Diver Debris Clearance/ 500 tonne in Artificial Reef Creation and Diver Surveys, Provision of habitat for Blue Groper *Achoerodus viridis* and temperate reef communities, Twofold Bay Woodchip Wharf, ANWE 2016/2017;
- Palm Beach Reef Shoreline Project, Artificial Reef Stability Assessment and Marine Environmental Surveys, Royal HaskoningDHV, 2019;
- Palm Beach Submerged Control Structure, Geotechnical, Geophysical and Environmental Surveys, Gold Coast City Council, 2016;
- Project Director, Fisheries Science, facilitating Group Leader – Chemistry & Benthic Ecology 2010 – 2012 at the Queenscliff Fisheries Research Branch;
- Principal Marine and Dive Officer, Marine Ecology and Bioaccumulation Studies, Artificial Reef Surveys, John Brewer Reef, Great Barrier Reef, Client confidential, Queensland, 2013;
- Offshore Artificial Reef Structure Feasibility Design Study, South Head, NSW Department of Industry and Investment, NSW, 2011;
- Team member, Sinking of ex-HMAS Adelaide, Terrigal, NSW, 2009. Including Baseline Technical Studies, Department of Lands, NSW;
- Co-Author, Long Term Monitoring and Management Program, ex-HMAS Adelaide, Department of Lands, NSW,2008;
- Team member, Sinking of HMAS Brisbane, QPWS, Queensland, 2008. Including Wreck Stability Assessment, post sinking.



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