

SHORT SUMMARY

5.21.002

Identifying the Potential of Artificial Floating Benthic Ecosystems to Underpin Offshore Development.

KEY POINTS

- » Reefs are common benthic systems throughout Australia's extensive coastline and provide significant ecosystem services, many of which can be provided by artificial reef systems.
- » Floating of artificial reefs to maintain them within the photic zone is a way to extend these ecosystem services beyond inshore waters and throughout Australia's Exclusive Economic Zone.
- » Floating of artificial reefs is a novel and blue skies concept and current knowledge is reliant on artificial reefs position on the seabed in coastal environments.
- » As a novel concept, significant advantages in leading developments in his area, including patents and first mover advantages can be achieved. Disadvantages include the unproven design, untested economic viability and lack of regulatory frameworks.
- » A research roadmap is presented to address these disadvantages and develop the substantial opportunities which floating artificial offshore reefs can provide to the Australian economy.

THE CHALLENGE

To-date artificial reefs have been confined to coastal systems where they are placed on the seabed. Floating artificial reefs so that they can be suspended in the photic zone and anchored in all water depths has never been attempted. This scoping study brought together the existing

knowledge and expertise on existing artificial reef construction and designs to develop a roadmap for the development of floating artificial reefs.

THE OPPORTUNITY

Australia's most valuable seafood exports are reef based species and floating artificial reefs provide an opportunity to build on these products. They also provide opportunities to recycle nutrients from their own and other food production systems, to produce products for carbon sequestration, to provide buffering of oceanic sea conditions and assist in restoration of coastal systems. By being based on ecosystem principles, floating artificial reefs are likely to be more socially accepted than other traditional aquaculture systems.

OUR RESEARCH

This scoping study aimed to provide a summary of the existing knowledge on floating artificial reefs and develop a roadmap for development of floating artificial reef systems.

Floating artificial reefs are defined as artificial reef systems that are suspended from the surface to depths that maintain the reefs within the photic zone so that primary production is maintained. This is considered to be in depths from 5m to 40m.

As floating artificial reefs are a new approach to aquaculture systems, there was no literature

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available and information regarding their design and construction was reliant on literature pertaining to artificial reefs used in the coastal zone and positioned on the seafloor.

Natural reef systems are one of the most dominant coastal ecosystems in Australia and provide substantial ecosystem services including provisioning of food and other marine products, cycling of nutrients, carbon sequestration, buffering of coastal foreshores and cultural services for traditional first nations peoples. Artificial reefs can supply many of these ecosystem services as well as providing restoration opportunities for degraded reef systems.

Artificial reefs that more closely replicate natural systems in rugosity of surface material, three dimensional shape including different sized voids and crevices have proven to be provide more diverse biological communities.

Concrete has been the major building material to-date and advances in improving the ecological footprint of concrete are encouraging. Other products including ceramics and recycled HDPE plastic are also worthy of consideration.

As a novel concept, design considerations in the structures for support of floating artificial reefs, containment of culture products and moorings need to be developed although some information can be obtained from the oil and gas industry and offshore fish aggregation devices. A schematic of a conceptual design identifying some of the key

considerations is provided in Figure 1.

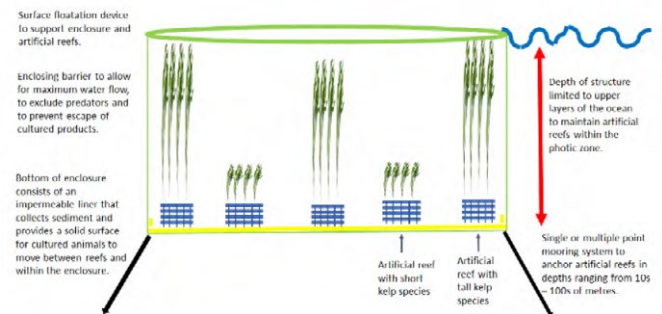


Figure 1. Schematic of a hypothetical floating artificial reef design highlighting design considerations

As an innovative concept, floating artificial reefs will require engineering and technology research into materials, mooring and anchoring systems, stability, structural analysis, monitoring technologies and installation techniques. Ecological design will focus on complexity for both commercial species, nutrient recycling species and carbon sequestration and ocean dampening species. Biological considerations include the species mix, their stocking densities to minimise external food inputs and maintain high growth rates. Key Australian species for temperate regions included rock lobsters, abalone, bull and giant kelps and urchins.

Although there is current legislation and international agreements on offshore structures and dumping at sea, new or adapted regulations are likely to be needed for the development of floating offshore artificial reefs. These are likely to also encompass other offshore infrastructure such as platforms. Societal understanding and expectations of what floating artificial reefs are,

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how they work and the benefits and impacts of their use need to be transparently accessed throughout their development.

OUTCOMES

A roadmap, identifying the research needs from the BECRC's Offshore Engineering and Technology, Seafood and Marine Products; Environment and Ecosystems; and Sustainable Offshore Developments programs, was developed that would culminate in a floating offshore artificial reef prototype for industry consideration and adoption.

NEXT STEPS

The next step is the development of an integrated project that addresses the research outlined in the roadmap. This will provide greater certainty in the structural integrity and biological productivity of the system to determine economic viability, including market and non-market values.

PROJECT TEAM

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PROJECT REPORTS/PUBLICATIONS

- » Komyakova, V. Wright, B. Frusher, S. Mohajernasab, S. Shakourloo, A. Abdussamie, N. Haward, M. (2022) Identifying the Potential of Artificial Floating Benthic Ecosystems to Underpin Offshore Development. 5.21.002 – Final Project Report. Hobart: Blue Economy Cooperative Research Centre.

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