

# Artificial Reefs in Australia – An Overview

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## Authors

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Reef Balls in Botany Bay 12 months after deployment

## This presentation

Today I will provide an overview of artificial reefs in Australia. I will detail the history of artificial reefs constructed for fishing, current developments and the direction to be taken in the future.



Materials of Opportunity

## First Some History - Materials of opportunity

### Sydney

Artificial reefs are a relatively new idea in Australia, and have only been constructed for fishing since the early 1970s. Early reefs were made of discarded materials and ships. These are what we call “materials of opportunity”. Off Sydney a number of ships and barges were sunk in 100 m in ocean waters to create an excellent reef for commercial and recreational fishing. Although the program was discontinued through lack of funding, these reefs continue to provide good fishing.



Tyres and car bodies were once acceptable

In several NSW estuaries reefs of car tyres were deployed. These eventually broke up, sank into soft sediments and were lost.

### Darwin

In Darwin in the Northern Territory, ships have been sunk in the harbour for decades to enhance recreational fishing. This program continues, utilising fishing boats detained for illegally fishing in Australia's northern waters.



Hulks sunk in Darwin Harbour

### Brisbane

In Queensland waters south of the Great Barrier Reef natural reef is scarce, particularly in the large sandy bays. Cocharine Reef was constructed from industrial and building waste, sunken ships and barges.



Ships and building materials at Cocharine Reef

Roy Rufus Reef was constructed from old car bodies, tyres and scrap material.



More rubbish dumped at Roy Rufus Reef

At Tangalooma on Moreton Island ships and dredges were sunk for fishing and to provide an anchorage.



Tangalooma Ship Reef

At a number of other sites in southern Queensland ships have been sunk to construct fishing reefs. The Queensland government plans to spend \$1 million on

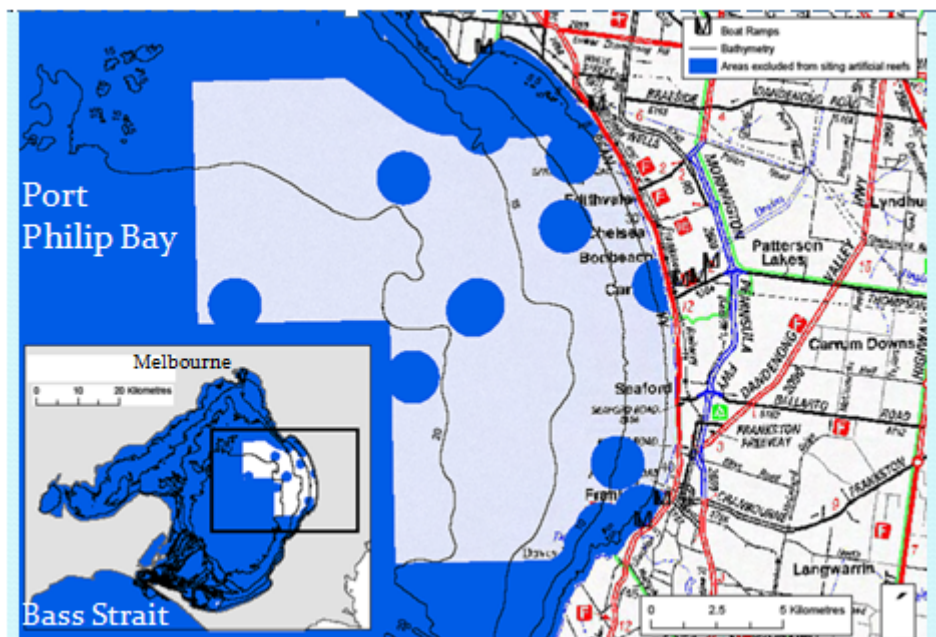
artificial reefs in Moreton Bay off Brisbane to offset loss of access within the rezoned Moreton Bay Marine Park. No design has yet been selected.



Southern Queensland ship reefs

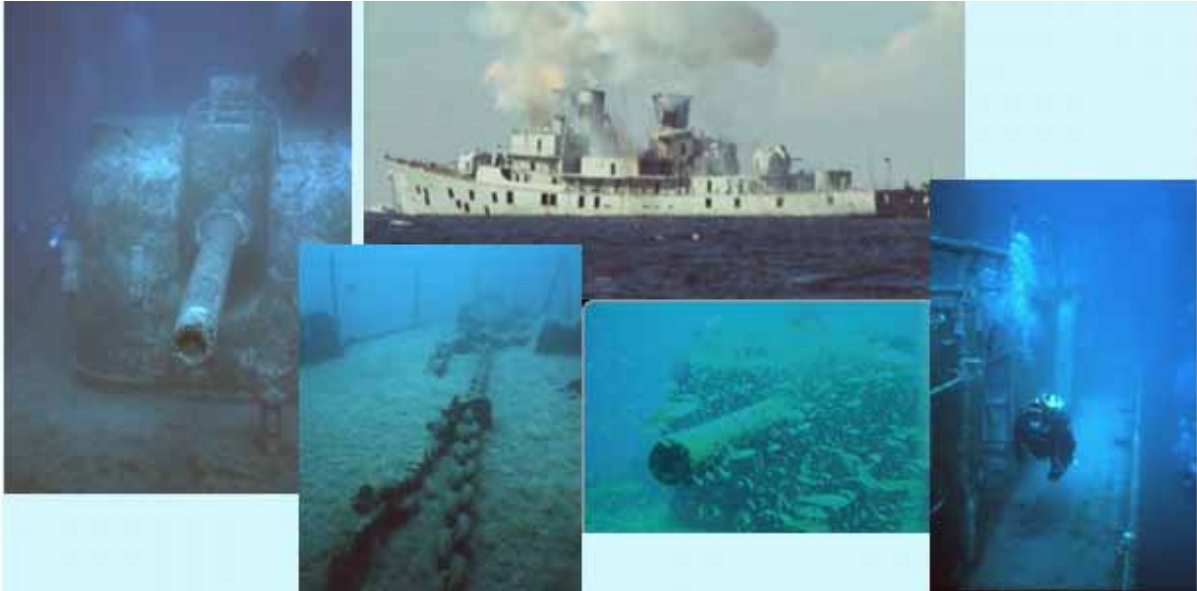
## Victoria

Melbourne, Australia's second largest city is located on Port Phillip Bay. A number of small reefs have been constructed over the years by recreational fishers without approval. This year the Victorian government has decided to construct a number of small experimental reefs using concrete reef balls in the location shown.



Port Phillip Bay experimental reef sites

There are also a number of warships sunk as dive sites off Victoria, Tasmania and Western Australia. A destroyer will be sunk off New South Wales next year. Unfortunately these reefs are closed to recreational fishing.



Warships make interesting dive sites but poor artificial reefs

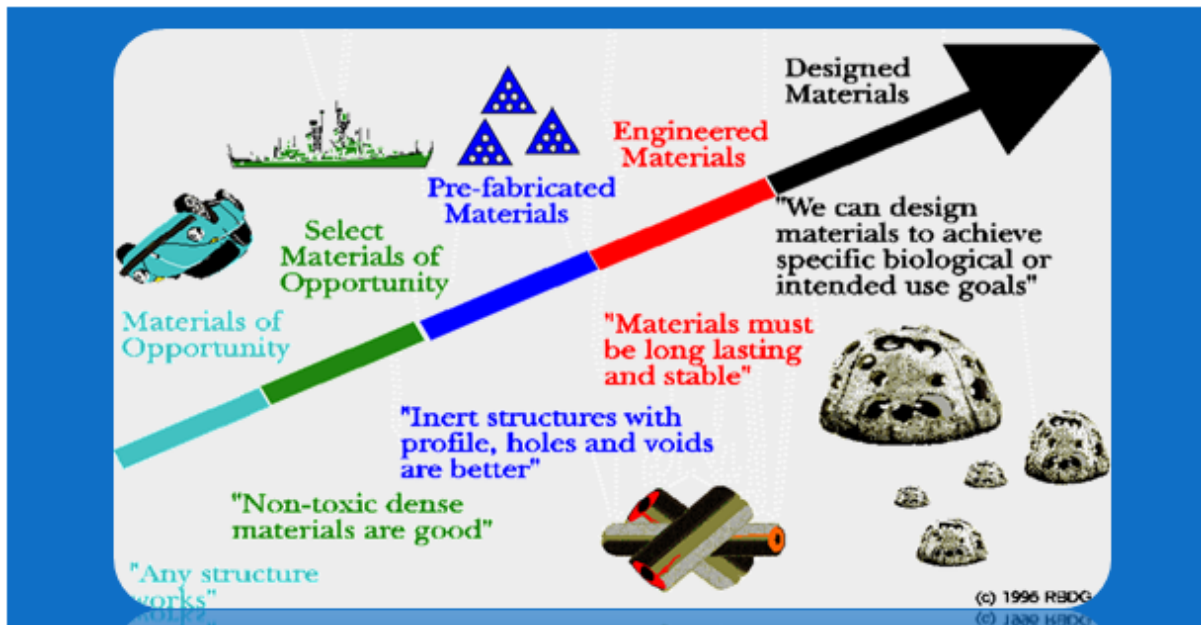
### Environmental Impact

More recently “materials of opportunity” for over have fallen from favour. There are three basic reasons for this. Firstly, there have been some very poor environmental outcomes. Tyres, in particular, have been troublesome with leaching, breakup and poor fishing. Secondly, new environmental laws have banned the dumping of junk and made the preparation of vessels for sinking increasingly expensive. And thirdly research has shown that well-designed, purpose-built reefs produce better fisheries.



Dumping tyres can be a costly mistake

There has been an increasing trend away from "materials of opportunity" to reef module designs based on good engineering and sound biological research.



Materials of opportunity have been replaced by more effective designs

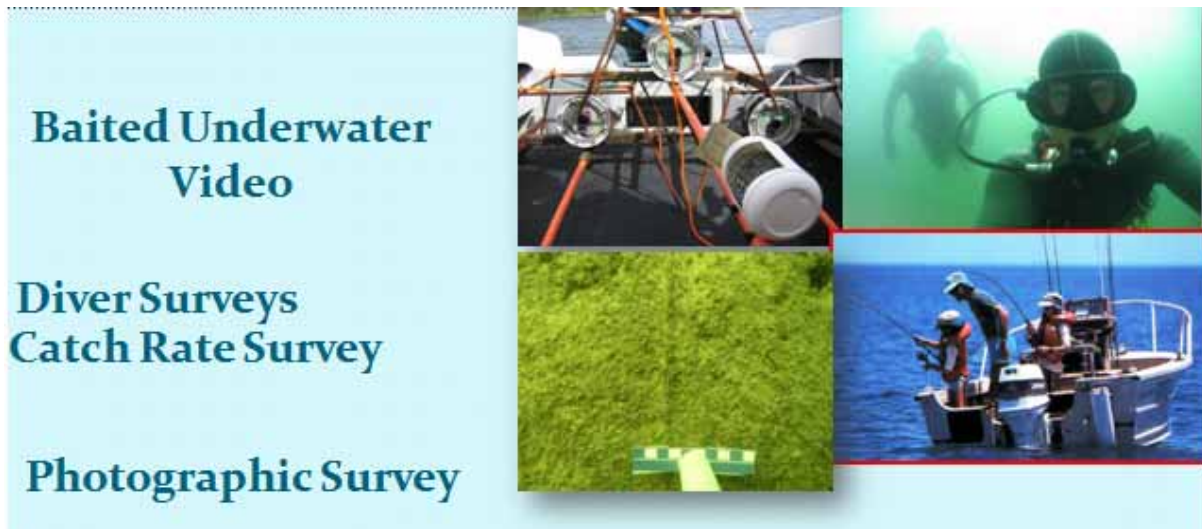
## Estuary Experience in NSW

The estuarine artificial reef program in NSW commenced in 2005 as a research project. We chose to use reef balls to capitalise on the extensive research conducted on these modules in other places. By doing this we were able to obtain the necessary environmental approvals. Pilot artificial reefs have so far been placed in 4 estuaries and will be expanded to another one early next year.



Deploying experimental reef balls in Lake Macquarie NSW

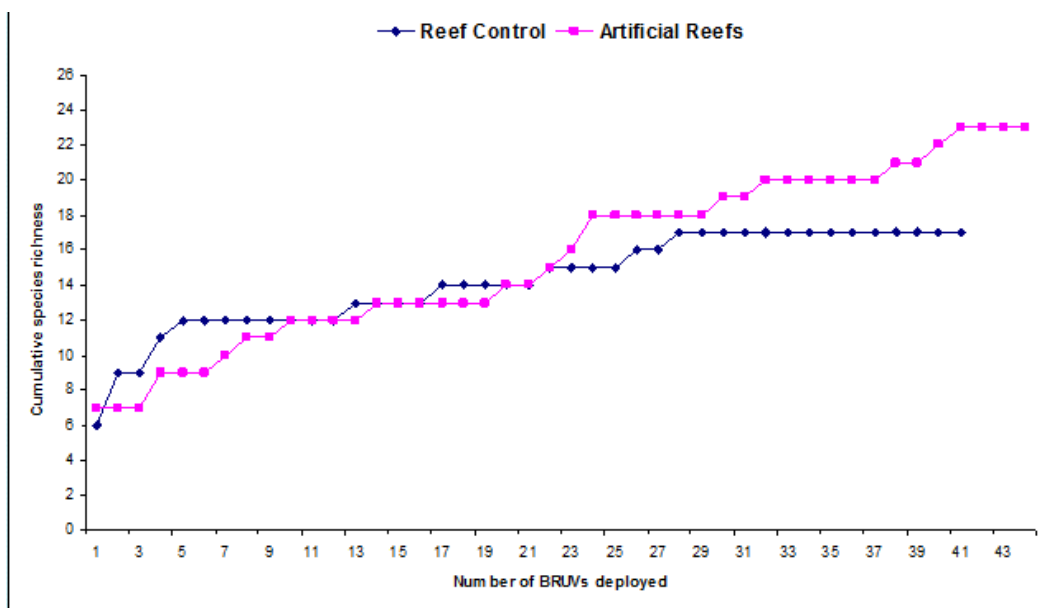
Over the past 2 1/2 years the estuarine reefs have been extensively studied using baited underwater video, diver surveys, catch rate surveys and a photographic survey.



### Research techniques

These studies are examining the Species Richness (S), Species Diversity (Hs), Species Evenness (J) and Relative Abundance.

While there are many interesting results from these studies I draw your attention to this graph. After a little over 2 years the artificial reef has exceeded the natural reef control site in species richness. This is probably due to the increased physical complexity of the reef balls compared to the relatively low profile natural reef.



Cumulative species richness Lake Macquarie NSW

The research has shown that Baited Remote Underwater Video is effective in monitoring artificial reefs, and when combined with diver census can give a more accurate indication of the reef communities.

In summary, over the study period the artificial reefs show large numbers of a diverse range of species. There appears to be significant differences in species richness, diversity and relative abundance between the artificial and natural reefs. There are possibly structural differences between the natural and artificial reefs that may give rise to different climax communities. And of course, as all scientists always say “More work is needed”.

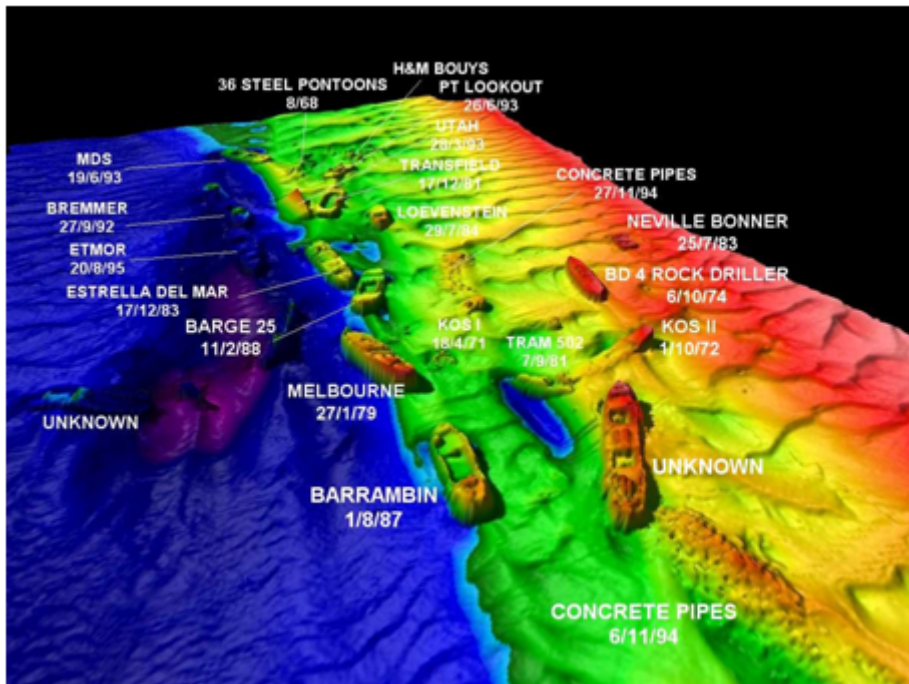
### **Ocean Dominated Bays and Ocean Waters**

In NSW the artificial reefs program is expanding into ocean dominated bays and inlets, with constraints mapping and site selection complete for Sydney Harbour, Port Hacking and Pittwater close to Sydney. Ocean sites have been selected off Sydney, Newcastle and Wollongong.



Concrete artificial reef Japan

Constraints mapping identifies undersea cables, historic ship wrecks, commercial fishing grounds, soft sediments, existing reefs or other constraints that would preclude reef installation. This is the essential first step in site selection.



Site survey southern Queensland – bottom contours and existing wrecks

Before embarking on these new projects we decided to investigate developments in other places and visited Korea and Japan last year. We were excited to discover the excellent research and development work carried out on artificial reefs over many years.



Traditional Korean reef module designs.



Steel reef modules from Korea

We were particularly intrigued by the steel reef modules we saw in Korea. These provide exceptional complexity with sophisticated design features including current deflection and turbulence baffles. This design, weighing about 36 mt has been selected for our ocean waters reefs and may be constructed in Australia under agreement with the Woochang Corporation of Korea.



Woochang steel reef Korea

In Australia the approvals process is very complicated. Firstly, if the reef is deemed to be a “major development” then an Environmental Assessment is required under the State *Environmental Planning and Assessment Act 1979*. The Environmental Assessment for our offshore reefs will probably cost about A\$500,000. Approvals are also required under the *Threatened Species Conservation Act 1995*, the *Fisheries Management Act 1994*, the *Coastal Protection Act 1979* and the *Crown Lands Act 1989*.

Approvals are also required under National government laws including the *Environmental Protection and Biodiversity Conservation Act 1999*, the *Environmental Protection (Sea Dumping) Act 1981* and the *Historic Shipwrecks Act 1976*

Despite these requirements the Environmental Assessment for ocean artificial reefs will commence this year, and hopefully the first reef modules will be deployed in mid 2009.

## **Acknowledgements**

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