

Farming bath sponges in tropical Australia

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Why farm bath sponges?

Global demand for bath sponges for cosmetic, bathroom and industrial use, far exceeds supply. Commercial bath sponges, species from the order Dictyoceratida that have a high quality spongin skeleton, have traditionally been harvested from natural populations in the Mediterranean Sea and around Florida, USA. Overharvesting and periodic disease outbreaks have decimated these natural populations and severely limited the yield of bath sponges. Because current harvest levels from natural populations cannot meet demand, there is an opportunity to develop alternative supply methods. In-sea aquaculture is one option that could supply sufficient and sustainable quantities of bath sponges to meet the market shortfall. Studies from Australia, New Zealand, Micronesia and the Mediterranean Sea have shown that sponges can be experimentally farmed using simple methods and cheap equipment, thus suggesting that bath sponge farming could be a cost efficient commercial industry. In addition, bath sponges can be processed or cleaned for sale using simple techniques, are non-perishable, need minimal storage requirements and can be transported easily. These factors suggest that bath sponge farming maybe an appropriate industry for development in remote coastal indigenous communities in Australia.

The potential for bath sponge farming in tropical Australia has been explored at two northern Queensland locations (Figure 1), the Palm Islands, situated 70 km north of Townsville, where the Australian Institute of Marine Science (AIMS) is located, and Torres Strait, situated between Cape Yorke and Papua New Guinea. Two bath sponge species, both possessing soft, durable fibers, were experimentally farmed: *Coscinoderma* sp. and *Rhopaloides odorabile* (Figure 2). Both species were farmed at the Palm Islands, while only *Coscinoderma* sp. was farmed in Torres Strait (*R. odorabile* is not present in Torres Strait). Indigenous Australians have been engaged in every stage of the research, including helping out with experimental work. In Torres Strait, sponge divers from the local community were able to SCUBA dive and participate in all underwater work with AIMS scientists. This approach has promoted the transfer of skills and technology from each study to the local indigenous community.

At both locations, sponges were obtained for farming experiments by partially harvesting a small number of wild sponges from the local populations. Similar to most sponge

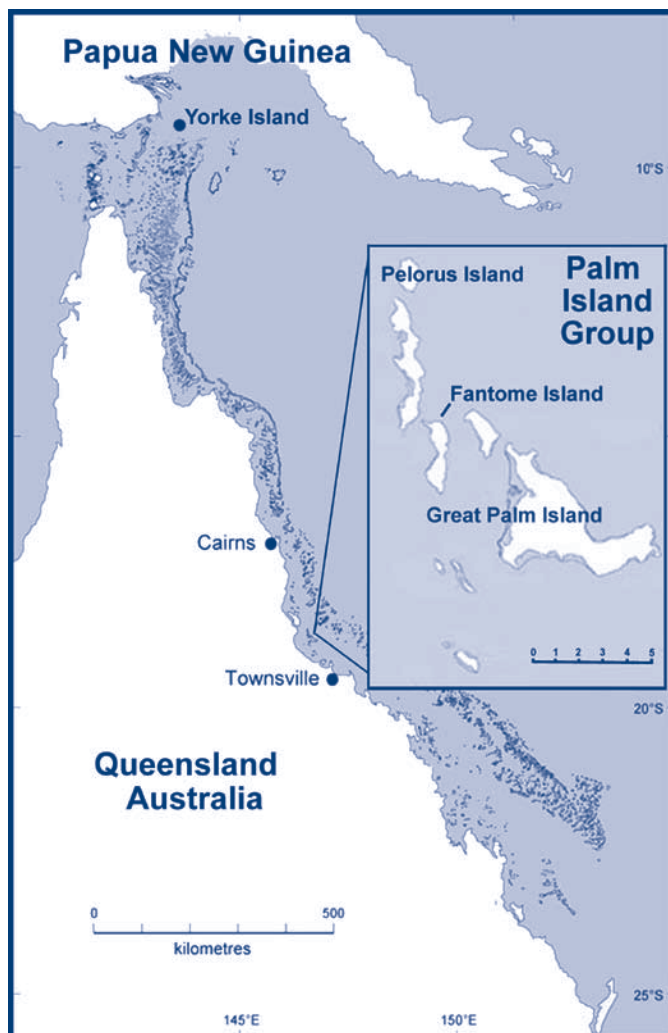


Fig. 1. Map of Queensland showing Torres Strait and the Palm Islands, including the three islands used for experimental sponge farming.

species, *Coscinoderma* sp. and *R. odorabile* have remarkable regenerative abilities and can survive two-thirds of their biomass being harvested as long as the harvested portion is removed cleanly with a sharp knife and the basal area remains attached to the substrate. These sponges will re-grow the harvested portion in one to three years. The harvested portion can be further cut into smaller pieces or explants for farming. It is important that at least one side of each

explant has intact pinacoderm or sponge skin. Using this method, a dozen partially harvested sponges can produce a hundred explants for farming. However, this process would only be used to supply farm seed stock for the first few years of a commercial sponge farm. Subsequently, new explants would be created from sponges produced on the farm.

Farming Method

An important step in developing a successful bath sponge aquaculture industry is identifying the optimal farming procedures and methods for local species and conditions. Sponges have been experimentally farmed in the sea for over 100 years, with early culture attempts involving threading sponges onto thin wire line so they hung in mid-water. This method has also been tested successfully using modern materials (plastics) for several Mediterranean species and is employed in Micronesia for small-scale commercial farming. Some sponges, however, become dislodged from a threaded line, possibly because of damage incurred when the line is threaded or unfavorable line material is used, promoting an avoidance response. Farming sponges in mesh bags or panels eliminates these problems for some species.

Experiments were conducted at both Queensland locations to identify a method for growing bath sponges successfully under local conditions. Novel and existing methods were tried, such as threaded-line, mesh panels and spikes, each varying in material composition or mesh size. The experimental results from the Palm Islands and Torres Strait were unambiguous. *Coscinoderma* sp. and *R. odorabile* grew best when farmed in mesh panels (Figure 3). After one year, mean sponge growth rates were up to three times faster in mesh panels than when other farming methods were used. Sponges farmed in mesh panels also had a good shape, being generally oval or round in appearance. In contrast, sponges farmed on threaded line in these two locations often grew into “doughnut” shapes (Figure 4) which is unlikely to be commercially valued. Survival of *Coscinoderma* sp. and *R. odorabile* was also highest in mesh panels, probably because tissue damage was minimal compared to other farming methods so the sponges were less stressed. However, mesh panels were susceptible to biofouling, from algae for example, but regular cleaning and the feeding actions of herbivorous fishes prevented biofouling from becoming a major problem. Another disadvantage of the mesh panels used to date was that they caused surface deformation when sponges grew through the mesh. That issue was being addressed by changing the panel design.

Farming Site

Farm site selection and identifying favorable environmental conditions that promote growth and survival are also important to promote the commercial success of a bath sponge farm. Sponges are filter feeders and rely greatly on the flow of water to provide food, predominantly bacteria and microalgae. Although sponge growth rates generally increase as water flow rates increase, high water flow from storms or strong currents can damage farmed sponges and reduce survival. A good farming site must, therefore, be situated in a sheltered



Fig. 2. *Coscinoderma* sp. (grey) and *R. odorabile* (brown) will soon be commercially farmed for their soft, durable fibres. Individuals of both species commonly grow to over 50 cm in size.

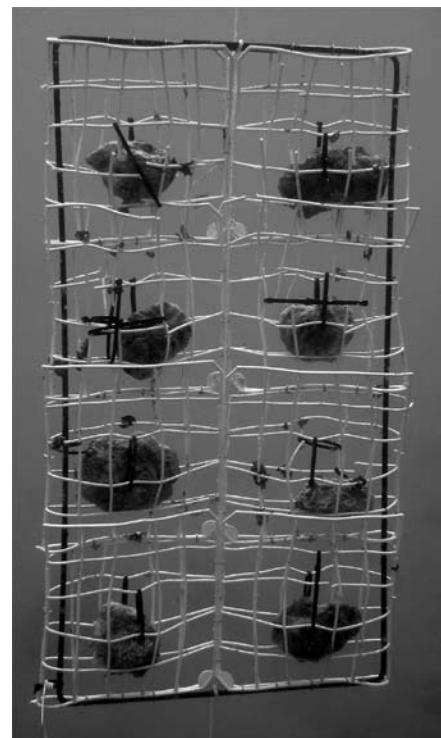


Fig. 3. Explants of *R. odorabile* being farmed in a mesh panel. After 1 year, many explants had grown to market-size.

area, which receives sufficient water flow and food availability to promote high sponge growth.

Identification of a suitable farming site was done at the Palm Islands and in Torres Strait, though only the results from the former location are discussed here. Sponges of *Coscinoderma* sp. and *R. odorabile* were farmed at six sites around three of the nine islands in the Palm Island group: Great Palm (1 site), Fantome (3 sites) and Pelorus Island (2 sites; Figure 1). At each site, about 50 sponges of each species were farmed in mesh panels. Farming started in August or October 2005 (winter in Queensland) and will continue for three years to investigate intra- and inter-annual variation in farming response. Sponges were monitored *in situ* every few months, with the last monitoring time occurred in January 2007.

Mean sponge growth varied greatly among the six farming sites. For both species, farmed sponges grew best at the two Pelorus Island sites (Figure 5). After 15 months of farming, *Coscinoderma* sp. sponges were on average approximately four times their initial size at Pelorus 1, while *R. odorabile* sponges were almost six times their original size at both Pelorus sites. These growth rates were some of the highest recorded for farmed sponges and clearly showed the potential of farming bath sponges at the Palm Islands. Although not as spectacular, growth rates of bath sponges at some other farming sites were also good. By January 2007, for example, *R. odorabile* farmed at Great Palm 1 had almost tripled in size. The experiment also showed that some farming sites in the Palms Islands were



Fig. 4. An explant of *Coscinoderma* sp. growing away from the threaded line. This shape is not marketable.

simply unsuitable for commercially farming sponges, such as Fantome 1 for *Coscinoderma* sp. and Fantome 3 for *R. odorabile*. Notably, both sponges were reasonably common on reefs adjacent to these two sites, indicating that the presence of a species at a site does not necessarily mean that the site will be suitable for commercial farming.

Farmed sponges of *Coscinoderma* sp. and *R. odorabile* generally had similar growth patterns among the six farming sites, suggesting they had similar environmental requirements. Growth of both sponges also varied over time, with most growth occurring in the warmer summer months (December to May). Our farming study in Torres Strait also found

that farmed *Coscinoderma* sp. grew best over the summer. Seasonal variations in environmental conditions such as food abundance and water temperature have been suggested to explain the seasonal variation in growth of temperate sponges. In tropical waters, environmental conditions fluctuate less over the seasons, but slight differences in food abundance over time, for example, may be sufficient to cause seasonal variations in growth. Our Palm Island study also showed that growth of farmed sponges could vary greatly between years (Figure 5). This finding indicated that production of bath sponges from a commercial farm would fluctuate from year to year, with lower production in years of poor growth. A good business plan that stockpiled bath sponges produced in good farming years and released them for sale during poor

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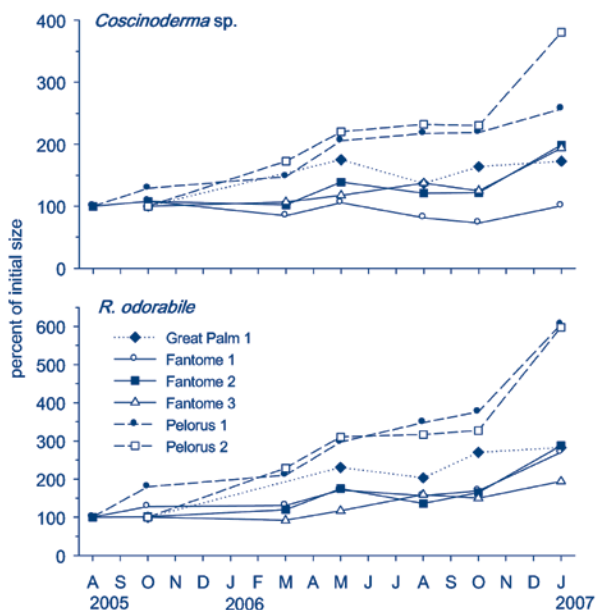


Fig. 5. Growth of *Coscinoderma* sp. and *R. odorabile* over time at the six Palm Islands farming sites.

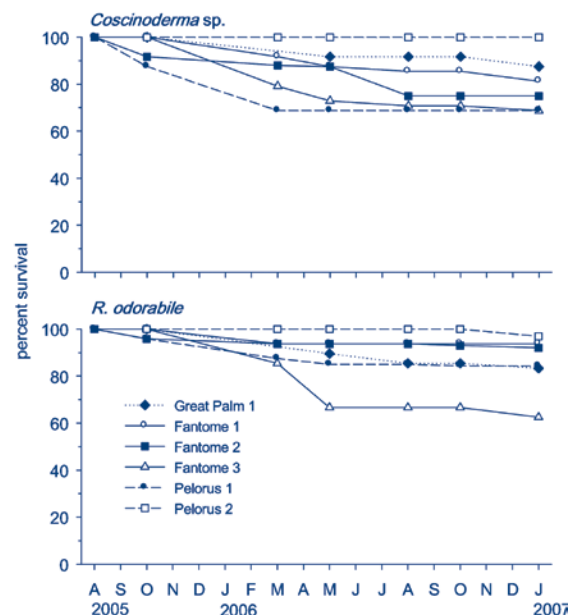


Fig. 6. Survival of *Coscinoderma* sp. and *R. odorabile* over time at the six Palm Islands farming sites.

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years of growth would guarantee a reliable and sufficient source of sponges to the market.

Survival of farmed *Coscinoderma* sp. and *R. odorabile* varied among the six farming sites (Figure 6), being highest at Pelorus 2 with 100 percent and 97 percent alive after 15 months. These survival results are outstanding and again highlight the potential of commercially farming bath sponges at the Palm Islands. At the remaining five sites, most sponge mortality occurred during the first few months. During that period, sponges are healing their cut surfaces so some mortality may result from pathogens infecting their exposed tissues.

Indigenous Australians

Besides developing the best farming method and selecting good farming sites, current research is addressing a range of other issues critical to underpinning the establishment of commercial sponge farms in Torres Strait and the Palm Islands. These include determining the optimal explant size for best farm production, investigating the abundance and size frequency patterns of wild populations to establish seed-stock harvest regimes, determining the genetic structure of sponge populations and connectedness for setting appropriate translocation protocols and establishing exactly what sponges are removing from the water column for food. Thus, as a complete package, research will support the establishment and regulation of sponge farming with a knowledge base for best practice farm production, as well as sustainable environmen-

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Fig. 7. A Torres Strait Islander sponge diver, monitoring the farming experiments.

tal management.

While regulatory approvals from environmental managers are yet to be granted for either location, the data look positive. The farming response in both locations has been great, with sponges growing quickly and showing high survival in the best treatments. Indigenous Australians at the Palm Islands have ground truthed the experimental data with market analysis and development of a business plan. They have also developed a commercially viable model that will provide employment for 32 people in a community that currently endures over 90 percent unemployment. In Torres Strait the community has begun a similar process to arrive at a commercial production model that will work for them. Sponge farming has the potential to become more than a new sustainable marine industry for Australia. It could also present a platform for training, employment and economic development in communities that have limited opportunities for commerce and enterprise (Figure 7).

Notes

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