FRDC sponge project – Final Report

Development of sponge farming as a viable commercial enterprise for remote Aboriginal communities.

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FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Charles Darwin UNIVERSITY Australia

PROJECT NUMBER: 2001/225

Project Title:	**Development of sponge farming as a viable commercial enterprise for remote Aboriginal communities.**
Project Number:	**2001/225**
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ISBN / ISSN: 1 876248 85 8

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1. NON TECHNICAL SUMMARY

2001/225	**Development of sponge farming as a viable commercial enterprise for remote Aboriginal communities.**

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Objectives

1. Identify potential markets for bath and cosmetic sponges.
2. Determine commercially viable sponges in Northern Territory waters.
3. Complete an economic evaluation of potential sponge farming systems in the Northern Territory.

Non-Technical Summary

Sponges have been employed for thousands of years for a wide variety of purposes, most commonly for basic hygiene (bath/toilet sponges), padding (historically under armour and saddles) and in certain manufacturing processes. World production from the wild harvest has, however, declined significantly this century due to over fishing, pollution and disease in the traditional fisheries (Mediterranean and Caribbean). Concurrently with this decline the demand for natural sponges for domestic (many people prefer to use a natural product), industrial and medical purposes has risen.

Three commercially viable species of sponge have been identified in this report from Northern Territory waters. All three are found adjacent to indigenous homelands in Arnhem Land and are known to some of the inhabitants of the area. With the backing of Homeland Associations, several Traditional Owners have expressed a strong desire to pursue sponge farming as soon as practicable. The adoption of sponge farming would directly benefit the homelands by providing 'real' employment, financial return for effort and a reduction in dependence on government funding. Sponge farming also has very good potential to provide a valuable new export product for Northern Australia.

Sponge farming is environmentally friendly. Apart from the initial collection of parent stock, there is no appreciable impact on the environment from sponge farming. Once the farm is established all stock replacement is produced on the farm and there is no need for further wild collection. Sponges are non-polluting—they are nett users, rather than producers, of nutrients and also feed on bacteria from the water column. Sponges process hundreds of litres of water per hour and remove up 95% of nutrients and bacteria—this has created interest in using sponges to reduce the effluent being discharged into the sea by both humans and aquaculture farms.

Farmed sponges are propagated asexually. A mature sponge is cut into pieces approximately 2–3 cm square on each side, the pieces threaded onto a piece of thin

rope, wire or bamboo and hung in the water to grow. Once the sponge is placed in the water it needs no further direct care until it is harvested. Sponges are self-cleaning and have few predators (except turtles in some places). Growth rates of sponges placed in the right environment are good, in Townsville the sponges grow to market size in 18 months – 2 years.

Identified markets for 'bath' and 'cosmetic' sponges are extremely buoyant. Over-fishing and disease have caused a severe downturn in production of sponges from traditional sponge fishing regions (the Mediterranean and Caribbean seas). This has left gaps in the market which have not been filled and are open to new producers. Sponges produced from pristine waters, such as those off North Australia, are likely to have a general marketing advantage over those from 'polluted' areas. In addition, sponges that can be labeled as being produced from aquaculture that is carried out by indigenous homeland communities will have a strong advantage in extensive niche markets, especially the tourist market.

Economically sponge farming appears to be well suited to remote areas. Sponge farms are inexpensive to set up ($13,500 including purchasing a suitable dinghy and motor) and operate ($3,000 per year). Experience in Micronesia shows that establishing and maintaining a farm of 30,000 sponges requires approximately 20–30 man hours per week. A farmer can expect a minimum return from a farm this size of $45,000 per year after four years. Niche markets available in Australia could mean that this return is at least double for Australian indigenous producers.

Outcomes achieved.

As a direct outcome of this report interest in establishing sponge culture as a cottage industry on indigenous homelands has increased considerably in both indigenous communities and research organisations. This interest is manifested in a two-year joint pilot project between five Indigenous communities from Arnhemland, the Australian Institute of Marine Science and Lo Tech Aquaculture. This project, to commence in September 2003, is funded jointly by the Indigenous Land Corporation; Agriculture, Fisheries and Forestry Australia; and the Australian Institute of Marine Science.

Drawing on this report, the pilot project will test the viability of sponge cultivation in North Australian waters by:

- Locating suitable sources of commercially viable sponges
- Trialing aquaculture structures for suitability to local conditions
- Develop processing and value adding methods and strategies suitable for Indigenous homelands
- Develop markets for North Australian sponges

KEYWORDS: Sponge, aquaculture, parent stock, cuttings.

2. ACKNOWLEDGMENTS

I would like to thank the following organizations for their support and collaboration in this project:

Australian Institute of Marine Science, Townsville
Northern Land Council, Darwin
Marthakal Homelands Resource Centre, Galiwin ku
Yirrkala Business Enterprises, Gove
Bawinanga Aboriginal Corporation, Maningrida
Laynhapuy Homelands Association
The Key Centre for Tropical Wildlife Management, NTU, Darwin

I would also like to thank the following for their advise and assistance:

Dr John Hooper. Queensland Museum
Mr Simon Ellis, COM Land Grant, Pohnpei, Federated States of Micronesia
Mr Peter Murphy, Original Oceanz, Townsville
Mediterranean Natural Sponges, Sydney

3. BACKGROUND

This project has been conducted to determine if sponge farming is potentially a viable industry for remote communities and relevant to 'Aboriginal Fisheries Development' as set out in the Northern Territory Strategic Program for the next 5 years and to the 'NT Foundations for Our Future' documents, specifically item No.4 of the 6 foundation areas, 'to foster partnerships in Aboriginal development'.

The combination of low technology and low capital requirements, ease of storage, handling and transport, and good markets make sponge farming potentially an ideal industry for indigenous groups in remote areas. Sponge farming has the potential to make a significant contribution to the aquaculture industry and to the export earnings of the Northern Territory.

Sponge farming is environmentally friendly. Apart from the initial collection of parent stock, there is no appreciable impact on the environment from sponge farming. Once the farm is established all stock replacement is produced on the farm and there is no need for further wild collection. Sponges are non-polluting—they are nett users, rather than producers of nutrients and feed on bacteria from the water column.

World production from the wild harvest has declined significantly due to over fishing and disease. Concurrently demand for natural sponge for domestic, industrial and medical purposes has risen. In addition to existing markets, there may be a large and untapped market available to cultured sponges—some large retail chains do not sell natural sponges because of the perceived damage to the environment caused by wild harvesting. This market may be available to communities provided that a good quality endemic sponge is found and farmed.

This report is limited to the production of bath and cosmetic sponges (ie whole sponges), however it must be mentioned that there is a large potential market for

farmed sponges to produce a range of pharmaceutical products such as antibiotics and anti-cancer drugs.

4. NEED

There is an urgent need for employment and income generating projects within remote communities of northern Australia. Aquaculture may form the basis for some such projects.

Despite there being several excellent sites for aquaculture near indigenous communities, there is currently no significant indigenous involvement in aquaculture in Northern Australia. This is partially the result of cultural norms in the communities not being compatible with the intensive and high technology farming systems now in common use. There is a need to develop projects at a level of technology that will allow the participation of remote indigenous groups.

Such projects will form the basis for a diversified aquaculture industry in the Northern Territory that will be inclusive of both indigenous and non-indigenous groups in remote areas, they will have the capacity to generate income from a comparatively low investment and collectively will form a significant export for the Northern Territory.

5. OBJECTIVES

1. Identify markets for bath and cosmetic sponges.
2. Determine commercially viable sponge species in Northern Territory waters.
3. Complete an economic evaluation of potential sponge farming systems in the Northern Territory.

6. METHODS

6.1 Desktop study: Literature reviews and web searches were carried out to ascertain if:

1) There were any known commercially significant bath or cosmetic sponges from Northern Territory waters.
2) There were sponge farming systems in use interstate or overseas that may be adaptable to Northern Territory conditions.
3) Available markets for sponges, quality and grading systems and prices being fetched.

6.2 Consultation:

Visits were made to:

- Dr John Hooper at the Queensland Museum to determine the extent of knowledge about sponges in the Northern Territory—Dr Hooper spent several years as curator of *Porifera* at the Northern Territory Museum and is an accepted authority on the region.
- Australian Institute of Marine Science (AIMS) facility at Townsville to gain some familiarity with commercial sponges and the methods used at AIMS to propagate them.

- Community organizations that support the project to discuss traditional knowledge of sponges and to instruct some members of the communities in the collection and preservation of specimens for identification.

Remote consultation was with:
- Mr Simon Ellis, COM Land Grant, Pohnpei, was consulted via e-mail on sponge farming techniques.
- Mr Peter Murphy, Original Oceanz, Townsville was consulted on marketing issues. Mr Murphy is a private marketing consultant with expertise in aquaculture products.
- Mediterranean Natural Sponges, Sydney, on the specific marketability of sponges found in the Northern Territory. Mediterranean Natural Sponges are an Australian based sponge import/export wholesale company.

6.3 Field trip:
A short field trip was made to areas of Arnhem Land where possible commercial sponges had been reported and samples collected. These samples were submitted to Dr Belinda Alverez de Glasby at the Northern Territory Museum for identification and assessment of their commercial potential.

7. RESULTS AND DISCUSSION

7.1 Desktop study and Consultation

7.1.1 Suitable commercial species known in Northern Territory waters
Literature reviews, web searches and consultation did not reveal any recorded commercial sponges from Northern Territory waters. Discussion with Arnhem Land community members, however, demonstrated some indigenous knowledge of sponges—some people knew of sponges that were used for washing, sponges that could be used for scrubbing pots but not skin, and sponges that can 'make you very sick', although the nature of the sickness (rash, illness, etc.) was not explained. This last group included a sponge that, in some areas, is cut up and used as a fish poison and may prove of interest for pharmaceutical uses.

Dr John Hooper from the Queensland Museum provided considerable information on known sponge species from Northern Territory waters. He was, however, unable to confirm the presence of any commercial species except a possible industrial grade sponge (*Hyattella intestinalis*).

7.1.2 Culturing methods
First references to sponge 'husbandry' date back to Aristotle in 5th C BC (Storr, 1957) who noted the sponge's ability to regrow when the base is left on the sea floor. Whether this knowledge was used to conserve or actively husband stocks is not known, however given that sponges were a very important industry in ancient times (Debrenne, 1999) it is quite possible.

Sponges reproduce naturally by both sexual and asexual means. Farmed sponges are propagated asexually—a parent sponge is cut into pieces about 3–4 centimetres square and threaded onto a short length of rope or wire, which is then tied to a long line or frame and suspended in the water. Reports of growth rates vary, however

drawing on Queensland experience sponges in the Northern Territory could reach market size in 18 months—2 years.

7.1.3 Sponge farming systems that may be suitable for Northern Territory conditions

Dr Chris Battershill from AIMS provided information on sponge culturing methods developed by AIMS and the current stage of development of a potential sponge farming industry in Queensland.

There are several sponge farming systems that have been, or are being employed both experimentally and in full commercial production in sponge producing areas of the world.

The Japanese made significant and relevant experiments on sponge cultivation in their Pacific Territories from 1927 until 1943. In 1946 the American Robert Smith recorded brief observations of the Japanese trials and these observations were later expanded on by Cahn (1948), who incorporated information from former researchers Mr Kiyoshi Okajima and Mr Kiichi Kozuka. Unless otherwise stated, the following information (including drawings) on the Japanese trials (methods 1–6) is drawn from Cahn's leaflet.

The Japanese researchers experimented with several culture methods:

1) Attaching individual sponges to concrete discs (Figure 1). A sponge was selected from the wild as parent stock and cut into pieces approximately 6 cm square. These pieces were each threaded onto No.24 aluminium wire attached to a round concrete block 30 centimetres in diameter by 5 centimetres thick. The discs were then placed on the reef at depths of 3–5 metres.

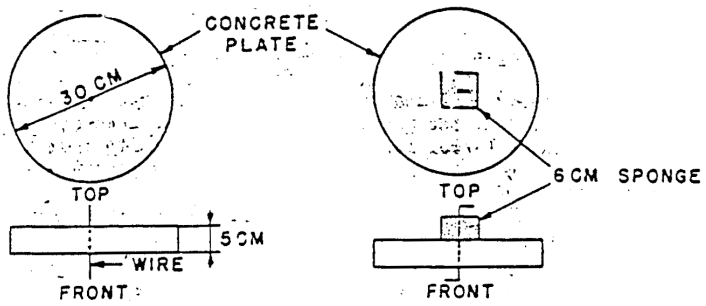

Figure 1: The concrete disc method of growing sponges.

2) Suspending several sponges from wire frames set in concrete blocks (Figure 2). A parent sponge was cut into pieces 4 cm square and the pieces threaded on an aluminium wire and suspended from frames made from No.8 aluminium wire set in concrete blocks. The blocks were set in water depths similar to those used for concrete discs

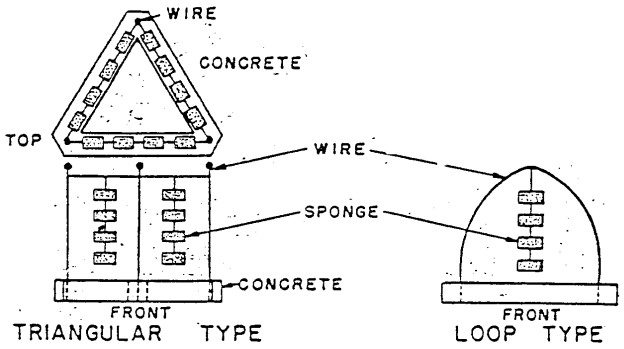

Figure 2: Suspending sponges from wire frames.

3) Hanging sponges from a raft or rack (Figure 3). A raft was made from a grid of bamboo. About 10 pieces of sponge were threaded on about two metres of thin rope and suspended from each intersection of bamboo on the raft. A weight was hung on the end of each line to prevent sideways drift and entanglement. A water depth of 5–10 metres gave the best results. In shallow water the grid was attached to posts driven into the sea bed, however tidal currents and storms appear to have taken a heavy toll on these structures.

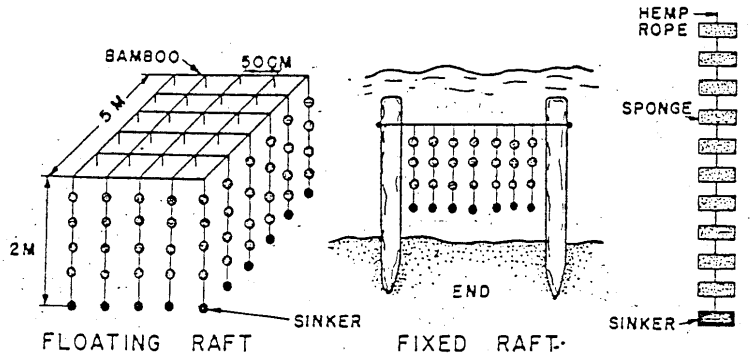

Figure 3: Hanging sponges from rafts or racks.

4) Fixing sponges to anchored vertical rafts (Figure 5). Rafts were bound into a square or triangular formation and sponges threaded onto a series of thin ropes strung across them. One end of the rafts is fixed firmly to weights to anchor them in place on the sea bed. As with the racks in 4), currents and storms appear to have taken a toll of this method.

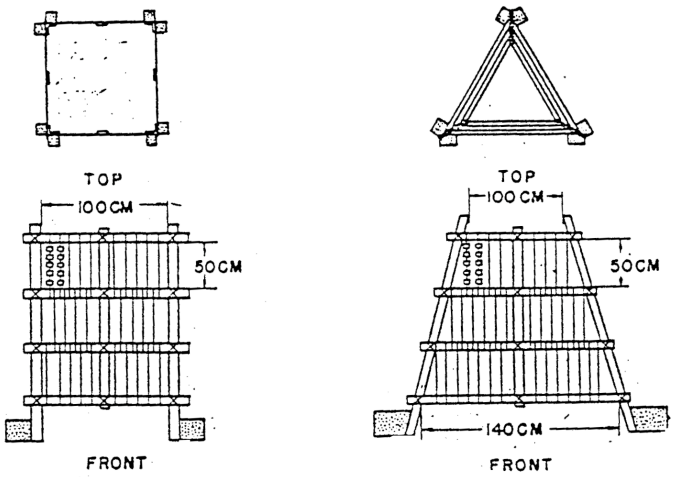

Figure 4: Attaching sponges to fixed vertical rafts

5) Fixing sponges to floating vertical rafts (Figure 5). This method employed rafts bound into squares or triangles as in 4), but instead of fixing the raft to the sea bed it was anchored and allowed to float vertically just below the surface.

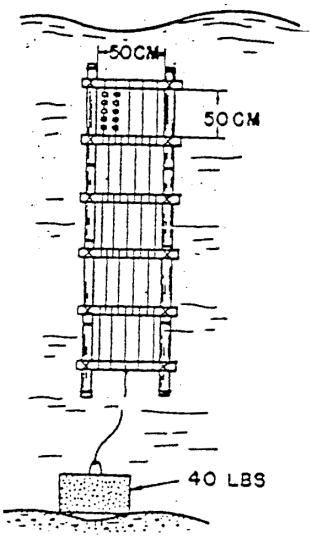

Figure 5: Attaching sponges to floating vertical rafts

6) Fixing sponges on a line suspended between a float and an anchor (Figure 6). Four or five sponges were threaded onto a length of aluminium wire at about 10 centimetre intervals. The pieces of wire were linked together (the number of links depending on the water depth) and attached at one end to a concrete block and the other to a float —the Japanese used beer bottles as floats.

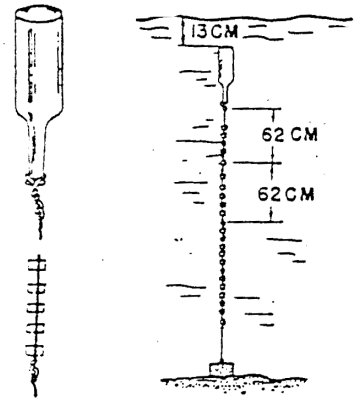

Figure 6: Growing sponges on anchor and float

Since 1985 there have been new attempts by Mr Richard Croft of Pohnpei Natural Products, the Centre for Tropical and Subtropical Aquaculture (Hawaii) and the University of Hawaii Sea Grants Extension Service to establish sponge farms in Micronesia. The cultivation method they recommend (MacMillan et al., 2000) is the suspension of sponges from thin ropes strung horizontally between two heavy ropes which are, in turn, attached to rocks or coral bombes (Figure 7). The sponges are individually threaded onto lengths of rope that are then looped onto the support line.

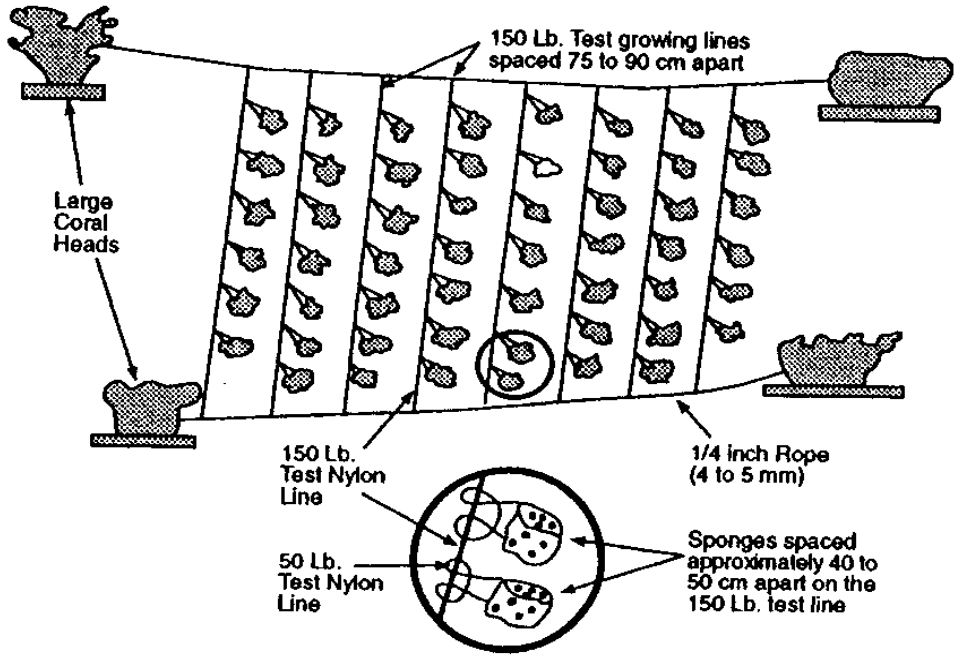

Figure 7: Current sponge cultivation system recommended in Micronesia

This method is similar to that used near sea cages in Greece where sponge farms are being trialed for use in absorbing nutrients and other pollutants from large, intensive finfish culture (Pronzato, et al., 1999). If proven, this could open a new field of polyculture. At this stage, however, there are few intensive aquaculture systems in use adjacent to Aboriginal land so it's relevance to this report is confined to the physical sponge growing structure being used in the Greek systems (Figure 8), which are somewhat higher technology than those employed in Micronesia.

Figure 8: Sponge cultivating systems off the Greek Islands. (From Pronzato et al.)

7.1.4 Cleaning sponges

There are several traditional methods used for cleaning sponges prior to marketing.

- In Micronesia sponges are removed from the water and buried in sand in the intertidal area and left for three days. They are then washed thoroughly, first in sea water and then in fresh, before use.
- The method advocated by the Centre for Tropical and Subtropical Aquaculture is to expose the sponge to air and sunlight for several hours then to return it to the sea for four or five weeks, it is then rinsed with fresh water and washed twice in a washing machine using a detergent on the first wash.
- The methods from the Mediterranean are all variations of the same theme—the sponge is squeezed, trodden or beaten to remove as much of the living tissue (called 'milk' or 'gurry') as possible, soaked overnight in fresh water, squeezed again and returned to the sea for two days, it is then washed in fresh water. This method is advocated by the AIMS researchers (C. Battershill, personal communication).

Each of the above cleaning methods removes the living matter from the sponge and leaves a clean, soft skeleton. The sponges can now be stored on the homelands until it is convenient or economic to send them to market.

The sponge is usable at this stage (in fact it is stronger, more durable than a bleached sponge and may contain a natural antibiotic which is destroyed by further treatment), but is an unattractive grey/brown colour that is a marketing drawback. Wholesalers normally treat the sponges with weak acids to remove foreign shell grit, then bleach and dye them for on-selling.

7.1.5 Production

The Centre for Tropical and Subtropical Aquaculture estimate that two people can 'plant' 200 sponge cuttings in 4–6 hours, this equals about 30,000 sponges per year. After about two years (based on growth rates obtained by AIMS in Queensland) there will be 10,000–12,000 sponges ready for market.

7.1.6 Available markets, quality and grading systems and prices

Dr Battershill (AIMS) provided information on the current state of the sponge market and also an introduction to Mr Peter Murphy from Original Oceanz, who provided further information and the address of Mediterranean Natural Sponges in Sydney for practical assessments.

There appears to be a very buoyant world market for sponges. World production from the wild harvest of sponges (1,412,448 Kg for the period 1990–1998: Appendix III) has declined significantly this century due to over fishing, pollution and disease in the traditional fisheries of the Mediterranean and Caribbean and these areas cannot meet demand. Concurrently with this decline the demand for natural sponges for domestic use (many people prefer to use a natural product), industrial and medical purposes has risen. Today, the uses of sponge skeletons include:

- Bathing
- Cosmetic application
- General cleaning (cars, windows)
- Industrial (very good for soaking up oil)
- Paint application (faux painting)
- Manufacture of pottery, leather and glass
- General arts and crafts
- Surgery
- Promotion of bone growth (sponge can be placed where bone is missing, the bone grows through the sponge)
- Natural tampons

In addition there appears to be a market for ground sponge in the manufacture of cosmetics and a large developing demand for sponges to produce a range of pharmaceutical products such as antibiotics and anti-cancer drugs (Battershill and Page, 2000; Duckworth et al., 1999). Many of these drugs have been isolated and apparently cannot be synthesised in the laboratory. Pharmaceutical companies are already looking for suppliers of the natural product—communities that can demonstrate a capacity to grow the required species of sponges will be in a very good position to negotiate with these companies.

There are three main grades of sponge on the market, all of which belong to the class *Demospongia*, order *Keratosida*, genus *Spongia* or *Hippiospongia*. There are several species within these genera that are of value. These are known in the market as ‘silk’, ‘sheep’s wool’, ‘yellow’ and ‘grass’. Silk sponges are generally the higher priced grade, however sheep’s wool sponges are of almost equal value and are more commonly used for bath sponges. Grass and yellow sponges are lower quality and are generally for industrial use.

The prices that can be expected depend very heavily on the marketing strategy employed. An approximate minimum return of about $US1 per 800 gram sponge (MacMillan et al., 2000.) can be expected from selling to a wholesaler, but this figure will fluctuate according to the wholesaler and current market conditions. Higher returns will be obtained by selling direct to stores or chains, but exact returns cannot be quoted until commercial samples are available. Higher returns again (US $5–17 each) may be gained by selling direct through the internet (see Appendix IV). For

both of these options, however, the sponges would need to be trimmed, bleached and dyed.

The highest return would be obtained from selling into the tourist market. If the sponge is correctly packaged and presented as a product of an Aboriginal homeland or community it will make an attractive and useful souvenir. This market also presents the possibility of value adding by packaging in locally made containers such as woven baskets and including other locally available products such as pumice stone. Sponges sold in this way may not need bleaching and dying.

7.1.7 Costs of establishing a farm

According to figures from Micronesia (MacMillan et al., 2000.), a viable farm can be set up for a material cost of US$995 (~A$2,000). Even allowing for modifications, a farm in Arnhem land should cost no more than A$3,000 in materials.

This does not include the purchase and running cost of a small work boat and outboard motor. A suitable 4.75 meter dinghy with 40 HP 2 stroke out board delivered to a community will cost approximately $8,500 (Spot On Marine, Darwin).

Labour costs will vary according to the amount of outside assistance that is needed. Until an income is derived from the farm, local labour will be paid from the Community Development Employment Program (the majority of local people are now on this program on a semi-permanent basis). Given that the farm is simple and easy to set up, the requirement for employment of outside expertise should be minimal. I estimate two days @ $1,000 per day. Collection, cutting and stringing of sponges can all be done by the farmer.

Northern Territory Aquaculture Licence fees are currently $758 per anum.

7.1.8 Training

As with any new venture, there is considerable training required. The Northern Territory University has a Certificate II in aquaculture available which is specifically written for delivery to indigenous people on their homelands. The course revolves around training in low technology techniques and will suit all aspects of sponge farming very well. Training is currently funded by the Northern Territory Employment and Training Authority.

7.1.9 Economic summary

Based on the CTSA figures and with allowance for modification to north Australian conditions, the approximate costs associated with establishing a sponge farm are:

Fixed (capital items)	$2,500
Equipment (knives, masks, snorkels, protective clothing)	$ 500
Hire of assistance in setting up (two days @ $1,000 per day)	$2,000
Dinghy and motor (if required)	$8,500
Total	**$13,500**

Annual maintenance costs are estimated at:	
Equipment replacement	$ 500
Fuel and repairs @ $100/month	$1,200
Licence fees	$ 758
Marketing costs (transport to wholesaler)	$ 500
Total	**$2,958**

Assuming that 30,000 sponges are planted per year with 80% survival, growth to harvest time of 18 months and a minimum return of A$2.00 per sponge, nett returns from the farm, will be a minimum of $16,000 at the end of two years rising to $45,000 after 4 years (table 1).

Table 1: Summary of cash flow for a hypothetical homeland sponge farm.

Year	Year class harvested	Sponges harvested	Cost ($)	Gross return ($)	Nett return ($)
1	0	0	16,500	0	-16,500
2	1	8,000	3,000	16,000	-3,500
3	1-2	24,000	3,000	48,000	+41,500
4	2-3	24,000	3,000	48,000	+45,000

7.2 Field trip

A short field trip was made to areas of Arnhem Land to collect samples of sponges—because of sea conditions at the time of the trip these were collected from beaches. The samples were submitted to Dr Belinda Alverez de Glasby at the Northern Territory Museum for identification and assessment. Those that Dr Alverez de Glasby indicated may have commercial potential were sent to the Mediterranean Natural Sponges in Sydney who confirmed that the samples contained commercial ‘sheep’s wool’ and ‘silk’ grade sponges, but they were unable to place a value on them due to the sample size and condition (this was also a problem for Dr Alverez de Glasby in identifying them beyond family). Subsequent efforts to obtain fresh samples from the area have been frustrated due to problems in transporting samples to Darwin in a suitable condition for either accurate identification or correct treatment for commercial evaluation. These problems would be unlikely to arise with farmed product as the treatment of all sponges would take place *in situ* (see 7.1.4).

Anecdotal evidence from several indigenous sources in Arnhem land indicating extensive beds of commercial sponges in several inshore areas of the region is supported by observation of a large numbers of sponges washed up on some beaches. The condition of the beached samples did not allow for identification to species and further investigation of these beds was not possible within the time frame of this report.

8. BENEFITS

The direct beneficiaries of this project are the remote indigenous communities where commercial sponges have been identified. Farming sponges will provide a form of employment both within the communities and on associated homelands that does not interfere with traditional values and mores and will provide two direct benefits:

- The income that will be generated will ultimately reduce or replace the current dependence on Government funding.

- The work will reduce levels of boredom and provide a reason for people to remain on homelands rather than gravitate to the communities.

Indigenous communities are beneficiaries identified in the original proposal.

Secondary beneficiaries will be the Northern Territory, Queensland and Western Australia which will benefit by the creation of a new, albeit small, export industry.

9. FURTHER DEVELOPMENT

Based on the findings of this study the following recommendations are made for further development:

1. A survey of commercial sponges be conducted in waters near indigenous homelands in northern Australia to establish the quantity and quality of the available resource. This resource will provide the initial parent stock for farms, once established all parent stock will be grown on the farm and there will be no further need for wild harvest. Correctly harvested (see 7.1.2) wild stocks will not suffer any permanent impact.
2. Samples of sponges be collected from the wild and assessed for suitability for commercialisation. If proven to be suitable, further samples be collected, processed and marketed to obtain a precise range of prices that may be obtained for each species.
3. An experimental farm be established in at least one location in Arnhem Land. Such a farm could be used to develop an appropriate farm design for north Australian conditions, provide training for prospective farmers and supply seed stock for farms. It is also recommended, however, that small farms be established in several locations in the region to maximise the opportunity for participation by local people and to minimise the risk of translocation of sponges.

10. PLANNED OUTCOMES

The planned outcomes stated in the project proposal were:

1. Commercially viable sponges are identified.
2. Potential markets for Northern Territory sponges are identified.
3. An economic evaluation of sponge farming in the Northern Territory is completed.

The outputs of this project have located at least three commercially viable sponges in Northern Territory waters and thus satisfied planned outcome 1. Although these sponges have not been identified to species, they have been assessed as commercial species by their structure (ie texture and lack of sand or spicules in the skeletal matrix).
Similarly, a range of potential markets for Northern Territory sponges have been identified to satisfy planned outcome 2.

Planned outcome 3, the economic evaluation of sponge farming in the Northern Territory, is harder to satisfy. There is ample economic evaluation of sponge farming available from other parts of the world, virtually all of it positive. In addition, there is an evaluation of the economics of sponge farming on the aboriginal community on Palm Island off the coast of Queensland. Because this evaluation has been commercially contracted and therefore has a certain degree of confidentiality, the information I have received from it is anecdotal and non specific, however it appears to be very positive.

Evaluation of sponge farming in the Northern Territory is made difficult by two factors

1. There is no existing farming system known to be wholly suitable for Northern Territory conditions. Existing systems in use overseas may prove suitable, but it is likely that they will require some adaptation.
2. Without actual samples to put into the market, it is difficult to ascertain the real returns that can be expected. This will require special permits from the Northern Territory fisheries (possibly the issue of a 'Developmental Licence') and more time than available in the scope of this project.

Never-the-less, the sponges that have been identified appear to be of good quality 'Silk' and 'Wool' grades, both of which fetch good prices in the markets. In addition, any farming system is unlikely to be much more expensive than any of those it may be adapted from (~ A$ 3,000). Consequently, while the economic evaluation is not as complete as I would like, it is very positive.

11. CONCLUSION

There are commercially viable sponges in Northern Territory waters that have the potential to be farmed economically by indigenous communities and homelands. There are adequate farming models to draw on to create a farming system appropriate to the people and the region. The chief modification that needs to be made to existing systems is to reduce or eliminate the need for diving after the initial set up. This is important from a safety and 'duty of care' aspect as the areas proposed for these farms harbour many dangerous marine animals from crocodiles and sharks to box jellyfish.

A farm can be set up for about $13,500, including the cost of a workboat and motor, and operated for about $2,500 per year excluding labour costs, which can be met by the Community Development Employment Program. These costs are set against a return of $43,000 after three years rising to $45,000 after four years. An income of this size would be valuable to the homeland not only for its monetary value, but also in breaking the dependence on government money and providing a tangible incentive for work, especially among the young people.

Sponge farming technology appears to fit well with indigenous values and will not interfere with traditional practices. A farm may be worked as intensively as the farmer wishes—a farmer may wish to plant only a few hundred sponges or he may wish to attempt 100,000—the market appears to be available for any quantity. In fact a farmer who opts to farm a limited number sponges and packages them attractively for the tourist market may do very well.

The technology represented by sponge farming is potentially the best way to engage the isolated indigenous communities in aquaculture and utilise the extensive resources they have available. These resources include aquaculture sites, a potential labour pool with intimate knowledge of the region and traditional knowledge of the owners.

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Appendix I

Intellectual Property

Valuable information arising from this research is:

- The presence of commercially viable sponges in Northern Territory waters.
- Identification of sponge farming methods that can be easily adapted for use in remote indigenous communities.

Appendix II

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Appendix III

FAO records of sponge production from wild harvests from 1990 –1998

19 Records

Sponges (KG)	Year
All fishing areas (KG)	1998
Bahamas	59,517
Colombia	2,000
Cuba	72,100
Egypt	1,000
France	5,000
Greece	10,000
Croatia	5,400
Italy	2,000
Japan	4,000
Libya	10,000
New Zealand	4,100
Philippines	7,000
Spain	800
Tunisia	21,400
Turkey	1,000
USA	1,199,131
China	8,000
Developed	1,230,431
Developing	182,017

Appendix IV

Samples of sponge sale websites

SPONGES, SPONGES, SPONGES. We are your best source for natural sponges of all types including bath sponges, paint/faux sponges and a wide variety of natural sponges used in the trades. If you install commercial wall vinyl, such as 54" goods, a 8-9" sea wool (RIW890) is perfect for washing off excess adhesive. If you want a larger sponge for washing the car, try our top of the line 11-12" sea wool (RIW1112). If you are expecting, have a newborn or a toddler, our wool bath sponges are perfect. So much better than wash cloths. They are very soft to the skin, (like sheepswool). They make tons of lather even with just a little baby or bath wash. The WBS67 are the best value of all the sizes we carry, (more sponge for the money). All of our sea sponges have no shells or sand. They are bright, clean, soft and ready to use. Enjoy what only nature can give.

Specialty Sponge Company
Importers of Fine Natural Sponges

Specialty Sponge Company is your best source for natural sponges. We supply sponges to wallpaper hangers, window washers, wall washers , painting decorators, and faux artists. All of our sponges are no.1, premium quality. You'll find them to be exceptionally clean and free of shells. Minimum orders are only $25.00 and remember our prices **INCLUDE SHIPPING!!!**

(PENNSYLVANIA RESIDENTS ADD 7% SALES TAX)

YOUR SATISFACTION IS GUARANTEED!

Natural Sponges

Natural Sea Wool Sponges
(Excellent for wall washing, wallcovering, window washing, etc.)

OTHER SIZES AVAILABLE

Stock Number	Size Range	Market Price	Our Price
RIW-560	5.0" - 6.0"	$11.49	$6.50
RIW-670	6.0" - 7.0"	$12.99	$8.40
RIW-780	7.0" - 8.0"	$14.49	$9.75
RIW-890	8.0" - 9.0"	$15.49	$11.90
RIW-910	9.0" - 10.0"	$17.49	$13.90
RIW-1011	10.0" - 11.0"	$19.70	$16.90
RIW-1112	11.0" - 12.0"	$23.60	$19.90

Designer Natural Sponges "Yellow"
(Best for decorative sponge painting and texturing. Good for wall covering etc.)

OTHER SIZES AVAILABLE

Stock Number	Size Range	Market Price	Our Price
DNS-670	6.0" - 7.0"	$6.49	$5.60
DNS-780	7.0" - 8.0"	$8.79	$6.50
DNS-890	8.0" - 9.0"	$10.49	$8.90
DNS-910	9.0" - 10.0"	$12.49	$10.45

Luxurious Bath Sponges

All bath sponges are not alike! Ours are Sea Wools, NOT lower grade "grass" sponges

(Spoil yourself with nature's best. Our bath sponges are soft, clean, and hypoallergenic)

Stock Number	Size Range	Market Price	Our Price
WBS-45	4.0" - 5.0"	$6.90	$5.88
WBS-56	5.0" - 6.0"	$9.65	$8.16
WBS-67	6.0" - 7.0"	$11.56	$9.85

Artist Sponges
(Special purpose sponges used for canvas painting and other artistic pursuits.)

Stock Number	Size Range	Description	Our Price
ASF-45	4.0" - 5.0"	Fine Natural Sponge	$3.40
ASM-45	4.0" - 5.0"	Medium Natural Sponge	$3.40
ASC-45	4.0" - 5.0"	Course Natural Sponge	$3.40
ASCMIX-4	4.0" - 5.0"	4 Piece Mixed Artist Sponges	$6.40