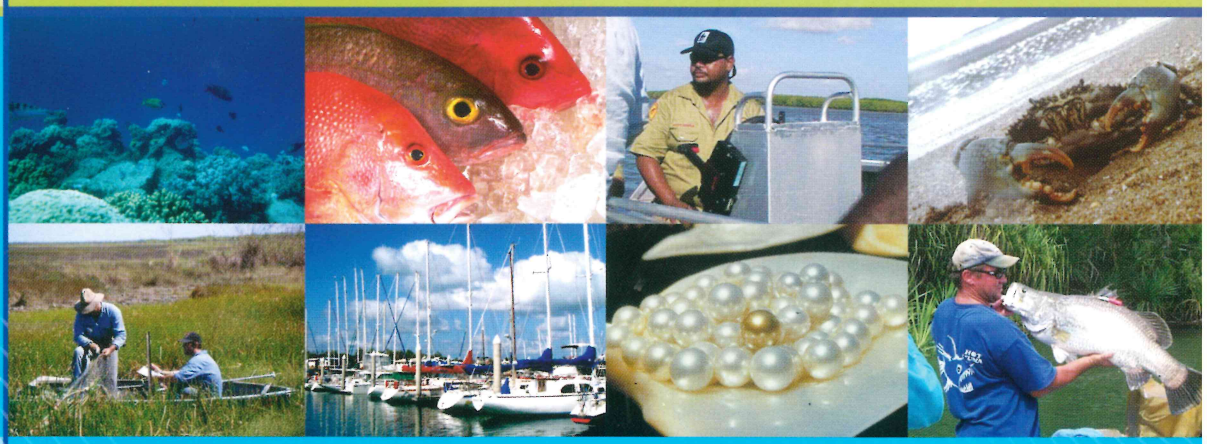
# INVESTIGATING SOURCES OF BROODSTOCK AND GROWOUT SITES FOR THE FARMING OF SPONGES IN REGIONAL NORTHERN TERRITORY

Project No. 2003/248



Northern Territory Government
Department of Business, Industry and Resource Development

Australian Government
Fisheries Research and Development Corporation

Australian Government

Australian Institute of Marine Science

ISBN 0 7245 4712 6 $8.80 Fishery Report No. 75

# INVESTIGATING SOURCES OF BROODSTOCK AND GROWOUT SITES FOR THE FARMING OF SPONGES IN REGIONAL NORTHERN TERRITORY

**Fishery Report No. 75**
**July 2004**

**R. Sellers, C. Wolff, A. Duckworth and I. Ruscoe**

**Project No. 2003/248**

**ISBN: 0 7245 4712 6**

**Investigating sources of broodstock and growout sites for the farming of sponges in regional Northern Territory**

Richard Sellers[1], Carsten Wolff[2], Alan Duckworth[2] and Ian Ruscoe[1].

[1]Northern Territory Department of Business, Industry and Resource Development. Darwin, Australia.
[2]Australian Institute of Marine Science. Townsville, Australia.

**Principal Investigator:** Richard Sellers
**Address:** PO Box 3000
Darwin NT 0801
**Ph:** 08 8999 2144
**Fax:** 08 8999 2065
**E-mail:** richard.sellers@nt.gov.au

**ISBN: 0 7245 4712 6**

**Published by:** Northern Territory Government, Department of Business, Industry and Resource Development. Darwin, Australia.



This publication should be referenced as:

Sellers, R., Wolff, C., Duckworth, A and Ruscoe, I. 2004. Investigating sources of broodstock and growout sites for the farming of sponges in regional Northern Territory. Final report. Fisheries Research and Development Corporation project No. 2003/248. Department of Business, Industry and Resource Development. Darwin, Australia. 35 p.

# TABLE OF CONTENTS

# 1 NON-TECHNICAL SUMMARY

| 2003/248 | **Investigating sources of broodstock and growout sites for the farming of sponges in regional Northern Territory** |
|---|---|


**PRINCIPAL INVESTIGATOR:** Richard Sellers
**ADDRESS:** Fisheries Group
Department of Business, Industry and Resource Development
PO Box 3000
Darwin, NT 0801
Telephone: 08 8999 2144 Fax: 08 8999 2065
E-mail: richard.sellers@nt.gov.au


**OBJECTIVES:**

1. Survey the area surrounding participating communities to determine sponge broodstock abundance.
2. Select possible sites on which to establish sponge farms.

**NON TECHNICAL SUMMARY:**


The value of world production of sponges from harvests and aquaculture is worth up to A$80 million per annum (SPC website, 2004). However, severe over-fishing and mortalities caused by pollution and disease have significantly reduced production. Concurrently, demand for this natural product in domestic, industrial and even medical industries has increased. This has in part led to interest in farming of sponges by coastal Aboriginal communities. In addition, there is an emerging demand for sponge derived metabolites in the pharmaceutical industry (Duckworth et al., 1999).

Prior to this project only three sponge species with economic potential had been identified (Dobson, 2003) in Northern Territory waters. This project was conducted by scientists from the Australian Institute of Marine Science, in collaboration with a commercial partner (Lo Tech Aquaculture) and traditional owners from several coastal communities. They conducted a survey of sponge diversity and abundance in waters adjacent to the communities. The expected outcome would be the identification of several more sponges of economic importance and suitable sites for experimental growout farms.

With backing from homeland associations, several traditional owners have expressed a strong desire to pursue sponge farming as a practical enterprise. However, cultural constraints, such as long absences to fulfil cultural obligations and resistance to significantly alter the environment often hinder the development and operation of aquaculture projects.

The seabed survey around Aboriginal communities identified 37 sponges suitable for bath sponge aquaculture. In addition, suitable sites for pilot farms were identified for four communities (extreme weather conditions and wildlife risks prevent diving at the remaining two communities).

After the completion of this project, pilot stage research farms for sponge aquaculture were established at Warruwi on Goulburn Island and at Maningrida.

Apart from providing employment and income to communities, sponge farming has a very good potential as a producer of a valuable new export product for northern Australia. Once established, low technology farms such as those for sponges, will join a diversified aquaculture industry in northern Australia that includes both indigenous and non-indigenous groups, enabling participants to generate income from a comparatively low investment.

The development of sponge aquaculture in remote Aboriginal communities was identified as having a high priority in the 2003 Northern Territory Department of Business, Industry and Resource Development strategic plan for fisheries R&D. This project sought to promote development of a viable Aboriginal industry in Arnhem Land communities.

**OUTCOMES ACHIEVED TO DATE:**

As a result of consultation with traditional owners in several Aboriginal communities broad support was obtained for the project in areas close to the communities.

The seabed survey conducted by the Australian Institute of Marine Science researchers, Lo Tech Aquaculture and the traditional owners, resulted in the identification of several sponges of economic importance close to several coastal Aboriginal communities in regional Northern Territory, particularly in the communities of Warruwi, Maningrida, Wigram and Galiwin ku.

Sites of excellent potential for sponge growout were identified close to the broodstock sources and the communities. Specific sites have subsequently been defined and pilot sponge farms have been established with labour provided by the communities Sea Rangers.

**KEYWORDS:** Bath sponges, aquaculture, indigenous, Northern Territory, regional.

# 2 ACKNOWLEDGMENTS

This study was part of a large sponge aquaculture development project conducted by several collaborating institutions. The Department of Business, Industry and Resource Development (DBIRD) would like to thank the following organisations for significant financial and in-kind contributions –

- the Australian Institute of Marine Science (AIMS)
- the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF)
- the Fisheries Research and Development Corporation (FRDC)
- the Aboriginal and Torres Strait Islander Commission (ATSIC)
- the Indigenous Land Council (ILC)
- the Northern Land Council (NLC)
- Lo Tech Aquaculture Pty. Ltd.
- the Sea Rangers and Communities at
  - Maningrida
  - Warruwi
  - Barrkira
  - Galiwin ku
  - Mata Mata
  - Bawaka

# 3 BACKGROUND

Studies were conducted in the Northern Territory over the last few years to stimulate interest in growing sponges by indigenous coastal communities. Progress was slow due to poor coordination. However, through this project, significant collaboration between DBIRD, AIMS, ATSIC, DAFF, NLC, ILC and Lo Tech Aquaculture, as well as several Aboriginal communities across the top end, has resulted in the establishment of long term sponge aquaculture projects in some communities. This project has tested the potential for accessing sponge broodstock adjacent to Aboriginal communities and the ability of the fledgling industry to provide employment to these communities.

Recently demand for sponges in the natural bath, cosmetic and medicinal industries has risen and markets are extremely buoyant. In addition, there is an emerging market for sponge derived metabolites in the pharmaceutical industry (Duckworth et al., 1999; Battershill and Paige, 2000). Concurrently due to high demand, natural sources have declined significantly due to over fishing, pollution and disease in the traditional fisheries of the Mediterranean and the Caribbean.

In the meantime, several commercially valuable species of sponges have been identified in Northern Territory waters (Dobson, 2003). All are located adjacent to indigenous homelands in Arnhem Land and are known to some of the indigenous inhabitants of the area, However, there was no data on the abundance or distribution of these sponges. With backing from homeland associations, several traditional owners expressed a strong desire to pursue sponge farming as a practical enterprise. However, cultural constraints, such as long absences to fulfil cultural obligations, and unwillingness to significantly alter the environment, have often hindered development and operation of such projects. Farming of sponges may overcome these constraints because it involves flexible farming practices, allowing operators to be away from the farm for extended periods without causing problems, and environmental disturbance is usually minimal. In addition, aquaculture is seen as an industry that may interest young people in indigenous communities and has the potential to provide employment in homelands and traditional country.

Sponge farming is seen as an excellent candidate for remote or regional aquaculture for another important reason. The harvested product can be easily processed at the point of harvest with little infrastructure requirements. The product only needs to be washed and dried, and can be stored for extended periods if required. Aquaculture products for human consumption would normally require rapid transport and marketing which will need associated infrastructure. Sponge shipments can be organised around market opportunities or with other activities of the community.

Apart from providing employment and income opportunities to communities, sponge farming may potentially provide a valuable new export product for northern Australia. Once proven successful, low technology farms for sponges, will join a diversified aquaculture industry in northern Australia for both indigenous and non-indigenous groups. It will generate income from a relatively low investment.

The development of sponge aquaculture in remote Aboriginal communities was identified as a high priority in the 2003 DBIRD strategic plan for fisheries R&D. This project sought to promote development of a viable Aboriginal seafood industry in Arnhem Land communities.

# 4 NEED

Although at least three species of sponge with commercial potential have been identified in Territory waters (Dobson, 2003), there is no information on the abundance of these species to act as broodstock, nor is there detailed information on site suitability of marine areas near several communities that were eager to participate in sponge aquaculture. There was a strong need to conduct baseline surveys for sponge broodstock in areas adjacent to interested Aboriginal communities, and to identify specific areas of sea country that could be utilised for pilot sponge growout farms.

This project built on work by the pilot study (FRDC 2001/225) which indicated that sponge farming appeared to be technologically, economically and culturally suitable for remote indigenous communities.

Commonwealth and State Governments increasingly recognise the need to foster economic activity that increases the participation of indigenous people in the fishing industry. This is particularly relevant in the Northern Territory where 28% of the population is Aboriginal and some 85% of the coastline is Aboriginal owned.

# 5 OBJECTIVES

## *5.1. Survey the area surrounding participating communities to determine broodstock abundance.*

This objective has been achieved through a survey of the marine resources, particularly sponges, carried out by AIMS researchers, Lo Tech Aquaculture Pty. Ltd. and the traditional owners of six interested communities (Figure 1.) in December 2003.

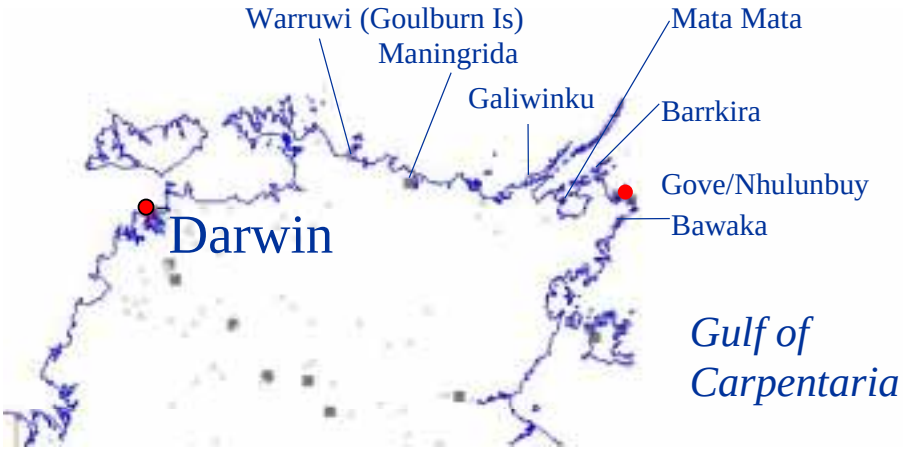



**Figure 1.** Map of the Northern Territory showing the location of Aboriginal communities interested in participating in sponge aquaculture (supplied by C. Wolff, AIMS researcher)

### *5.2. Select possible sites to establish farms.*

This objective has been achieved in consultation with AIMS researchers, Traditional Owners, Lo Tech Aquaculture Pty. Ltd. and DBIRD. Suitable sites were found at Warruwi, Maningrida, Galiwinku and Mata Mata.

Moreover, although it was not an objective of this project, in March 2004 pilot sponge farms have been established adjacent to the communities of Warruwi (Goulburn Island) and Maningrida.

## 6 METHODS

### *6.1. Collation of existing knowledge on tropical sponges.*

Knowledge of tropical sponges was collated by literature and Internet reviews.

### *6.2. Identify traditional and non-traditional knowledge.*

Informal interviews and discussions were held between Mr Graeme Dobson of Lo Tech Aquaculture and traditional owners in the communities of Warruwi, Maningrida, Galiwinku, Mata Mata, Barrkira and Bawaka.

### *6.3. Chart results of sponge biodiversity surveys.*

Results of the sponge biodiversity survey were tabulated for easy reference.

### *6.4. Determine highly prospective sites by diving.*

Sites of high sponge abundance were determined through diving a second time, including areas close to the communities to identify suitable sponge farming sites.

### *6.5. Prioritise sites of most potential.*

Sites were prioritised on the basis of favourable characteristics in terms of ease of access and prospects for sponge growout. Limitations due to budgets and inherent difficulties of travelling throughout Arnhem Land were also considered in the prioritisation.

### *6.6. Select sites after consultation.*

After prioritisation of the sites, Lo Tech Aquaculture consulted with the two communities that ranked highest in terms of ease of access and site suitability. These two communities were at Maningrida, and Warruwi on Goulburn Island.

# 7 RESULTS AND DISCUSSION

## *7.1. Collation of existing knowledge of tropical sponges.*

Literature reviews and Internet searches were highly successful for gathering knowledge on a range of issues relating to tropical sponges. The most significant discovery was a 'Book of Abstracts' from an international sponge conference held at Genoa University in Italy, in 2002. This booklet contained abstracts of over 220 scientific papers that were presented at that conference. An electronic version of this booklet can be found at www.spongeconference2002.com.

Of particular benefit were the 10 or so papers on sponges of Australian waters and the attempts at aquaculturing tropical species from the Mediterranean, Indonesia, the tropical Americas and Australia.

Recently scientists from around the globe collaborated to produce the '*Systema Porifera'* which is a taxonomic guide to the phylum. The guide recognises about 680 genera of living sponges and estimates there are between 5,000 to 15,000 species (Hooper and van Soest, 2002). Research is continuing in a number of countries to create inventories that will aid in bio-geographic zoning and biodiversity and conservation planning. Indonesia alone hosts up to 830 species of sponge (Flori et al., 2002).

Researchers have found that open oceans and reef systems, as well as lagoons with a wide communication with the sea, generally host a rich diversified sponge fauna compared with more enclosed systems (Corriero et al., 2002).

Sponge studies in Australian waters have been few and far between. Recently however, the distribution and abundances of sponges have been assessed in several regions including the Dampier Archipelago of north Western Australia (Fromont et al., 2002), the waters of the Northern Territory (Alvarez et al., 2002), and Northern Queensland (Wolff et al., 2002). The distribution of a *Chondrilla* species from around Australia has also been assessed, and has been found in temperate and tropical waters (Usher et al., 2002).

Species estimates for the NT are varied. The Department of Environment and Heritage lists a total of 126 sponge species, while other inventories indicate up to 274 species for the Darwin and Cobourg Peninsula regions alone (Alvarez et al., 2002). Also, the NT Museum undertook an intensive collection program for Darwin Harbour in 2002 and found 230 species of sponges.

Culture of sponges is not new and can be undertaken for a number of reasons. Sponges reportedly hold many bioactive compounds with antibacterial, antiviral and even anti-cancer compounds (Duarte et al., 2002). Much of the production technology however, was refined in the commercial production of bath sponges, as is currently under investigation in Queensland and the Northern Territory.

In most cases it is not feasible to harvest wild sponges due to small and patchy distributions. Also, sponges tend to be slow growing, and an intensive fishery can quickly decimate numbers. Sponge farming in both temperate and tropical waters seems to have been successful in terms of growth and survival (as well as yield of the active compounds, although their concentrations vary seasonally) (Alcolado et al., 2002) although commercially sustainable ventures are few and far between (Evans-Illidge et al., 2002). The inexpensive requirements and potential yields are expected to benefit regional communities that are undertaking culture of sponges in Indonesia (de Voogd et al., 2002).

Wolff et al., (2002) presented results from an initial feasibility study of sponge aquaculture in the Palm Island group in the Great Barrier Reef. That study showed that none of the donor sponges died and

survival of the explants ranged from 0% to 75% depending on the experimental treatment. Volumetric growth of up to 1,200% (to commercial market size) was achieved over 21 months.

## *7.2. Identify traditional and non-traditional knowledge.*

Discussions with Arnhem Land traditional owners and community members showed that some traditional knowledge of sponges did exist. It was found that some people knew of sponges for washing, others for cleaning but not for the skin, and interestingly sponges that 'make you very sick' (Dobson, 2003). This last type of sponge is, in some areas, cut up and used as a fish poison, and may have pharmaceutical benefits.

## *7.3. Sponge survey to determine abundance and diversity.*

The survey trip was undertaken by AIMS, Lo Tech Aquaculture, and the various traditional owners in November and December 2003.

The complete report entitled "NT Sponge Aquaculture Project - Arnhem Land bath-sponges: Candidates and Locations, Survey Report, Trip 3499", by Dr Carsten Wolff of AIMS is presented in Appendix 3.

Table 1 provides descriptions of the various sample sites where sponge abundance and diversity were surveyed (from Wolff, 2004).

**Table 1.** Site descriptors of the various sample sites

| Date | Site | Locality | Samples taken | Notes |
|---|---|---|---|---|
| 27/11/2003 | 1 | OFFSHORE IS OFF BAWAKA, ARNHEM LAND | 4 | OFF SMALL BEACH IN MIDDLE OF ISLAND, ROCKY HEADLAND |
| 27/11/2003 | 2 | OFFSHORE IS OFF BAWAKA, ARNHEM LAND | 1 | S OF ROCKS ~500M SSE OF SITE 1 |
| 28/11/2003 | 1 | ISLET 500M NW OFF PT. WILLIAM | 2 | SMALL LOW ISLET NW OFF PT. WILLIAM, SLOPING, GOOD BIODIVERSTIY |
| 29/11/2003 | 2 | NW ASTELL IS | 3 | OFF ROCKS W OF CHANNEL BETWEEN TWO ISLANDS, LOW VISIBILTY |
| 30/11/2003 | 1 | MATA MATA | n/a | VIDEO TRANSECT ONLY |
| 1/12/2003 | 1 | MATA MATA | n/a | SCUBA SURVEY |
| 3/12/2003 | 1 | HAUL ROUND IS (W-SIDE), MANINGRIDA | 6 | GOOD SPONGE SITE? (+ CORAL SURVEY) |
| 3/12/2003 | 2 | HAUL ROUND IS (E-SIDE), MANINGRIDA | 4 | MAINLY LARGE IRCINIA |
| 3/12/2003 | 3 | ROLLING BAY, MANINGRIDA | 0 | EXPOSED SITE, NOT MUCH DIVERSITY, INTERESTING HOLOTHURIANS |
| 4/12/2003 | 1 | NORTH GOULBURN ISLAND (W-SIDE) | 1 | TRASHED BY CYCLONE, WAS ONCE GOOD FRINGING REEF. |
| 4/12/2003 | 2 | NORTH GOULBURN ISLAND (SE-CORNER) | 5 | |
| 4/12/2003 | 3 | SOUTH GOULBURN ISLAND (NEAR NE-CORNER) | 3 | GOOD PALE DICTYOCERATIDS, CRYPTIC IN CREVICES |
| 5/12/2003 | 1 | SOUTH GOULBURN ISLAND, SW REC BOAT-RAMP | 3 | EXCELLENT LARGE SPONGE SITE |
| 5/12/2003 | 2 | SOUTH GOULBURN ISLAND (OFF BOTTLE ROCKS) | 1 | OFF ROCKY ISLETS; AVERAGE DIVERSITY |
| 5/12/2003 | 3 | SIMS ISLAND (E-SIDE) | 4 | DROP-OFF TO 30M+, BEST SPONGE/CORAL SITE ON THIS TRIP |

Table 2 shows the diversity of sponges encountered that may be suitable for bath sponge application (From Wolff, 2004).

**Table 2.** Taxonomy of sponges encountered in the November-December 2003 survey of Northern Territory waters

| sample number | site number | depth min (m) | max (m) | demosponge field identifications: | | | |
|---|---|---|---|---|---|---|---|
| | ymmdd## | | | ORDER | FAMILY | GENUS | SPECIES |
| 26146 | 3112701 | 12 | 14 | POECILOSCLERIDA | AXINELLIDAE | ACANTHELLA | |
| 26147 | 3112701 | 13 | 14 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26148 | 3112701 | 3 | 14 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | RAMOSA? |
| 26149 | 3112701 | 13 | 15 | VERONGIDA | DRUINELLIDAE? | | |
| 26150 | 3112702 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA? |
| 26151 | 3112902 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA? |
| 26152 | 3112801 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA? |
| 26153 | 3112801 | 3 | 6 | VERONGIDA | IANTHELLIDAE | IANTHELLA | N.SP.? |
| 26154 | 3112902 | 3 | 6 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26155 | 3112902 | 3 | 6 | DICTYOCERATIDA | SPONGIIDAE | PHYLLOSPONGIA | SP |
| 26156 | 3120301 | 2 | 5 | DICTYOCERATIDA | THORECTIDAE | | |
| 26157 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA? |
| 26158 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | |
| 26159 | 3120301 | 2 | 5 | DICTYOCERATIDA | | | |
| 26160 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | |
| 26161 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26162 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26163 | 3120302 | 2 | 5 | DICTYOCERATIDA | THORECTIDAE | | |
| 26164 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26165 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26166 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26167 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26168 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26169 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26170 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26171 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26172 | 3120403 | 2 | 5 | DICTYOCERATIDA | SPONGIIDAE | | |
| 26173 | 3120403 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26174 | 3120403 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26175 | 3120501 | 2 | 9 | DICTYOCERATIDA | SPONGIIDAE | COSCINODERMA? | |
| 26176 | 3120501 | 2 | 9 | DENDROCERATIDA? | | | |
| 26177 | 3120501 | 2 | 9 | DENDROCERATIDA? | | | |
| 26178 | 3120502 | 4 | 7 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26179 | 3120503 | 8 | 13 | DICTYOCERATIDA | SPONGIIDAE | COSCINODERMA? | |
| 26180 | 3120503 | 8 | 13 | DICTYOCERATIDA | | | |
| 26181 | 3120503 | 8 | 13 | DICTYOCERATIDA | | | |
| 26182 | 3120503 | 8 | 13 | DICTYOCERATIDA | SPONGIIDAE | | |

The following is the summary and conclusions section of the above report.

"The initial dive and towed video-transect surveys at all sites can by no means be termed exhaustive, but nonetheless gave an indication for the regional species richness. One of the notable factors affecting the diving was the shallowness of the coastal habitats especially in Eastern Arnhem Land and the number of areas windwardly exposed which would severely affect non-encrusting benthic lifeforms in cyclone/storm situations. The richness at sites sheltered by topography was therefore deemed to be generally higher than that in not sheltered areas. (See "*surveyed sites*" section and Table 2).

Due to the somewhat cursory nature of this survey, in Eastern Arnhem Land we were so far only able to identify limited habitats for sponge aquaculture. This was in part due to the lack of deeper water and opportunities to find hotspots of high sponge density in these areas. It is therefore suggested, in order to show proof of concept that, initially, only Maningrida and Warruwi in Western Arnhem Land be used as sites for pilot experiments, as we found high biomass of potential donor sponges and deeper water for the pilot experiments planned in 2004."

### *7.4. Select site for pilot sponge growout.*

Upon arriving at each community Lo Tech Aquaculture Pty Ltd, and AIMS researchers, met with the Sea Rangers and discussed the sponge culture project. The general design of the farming system was demonstrated on a white-board, while the Sea Rangers suggested possible farming sites in their respective locations.

At Maningrida, two farming sites (70 to 200 m apart) were chosen. At Warruwi, two sites were chosen off South Goulburn Island and a further two sites off Sims Island. The position of each farming system was decided after consulting with the Sea Rangers at each location. Factors we considered important for site selection included substratum depth and composition (on sand to minimise environmental impact), away from river mouths to ensure high salinity, relatively sheltered water/areas to reduce storm effects and tidal currents, accessibility for each community, and away from popular fishing areas.

AIMS and Lo Tech Aquaculture, together with the Sea Rangers, will monitor the farmed sponges at Maningrida and Warruwi each month, subject to weather conditions and Sea Ranger availability.

In July/August, 2004 smaller trials will be set at Mata Mata and Barrkira in association with homeland residents, depending on the location of suitable stocks of commercially viable sponges in the area. The size and extent of these trials has yet to be determined and will depend in part on the success of the Maningrida/Goulburn trials and in part on ideas of the homeland people.

*Other sites*

Many people have expressed interest in this project. As suitable sponges are located very small test-ropes (three single vertical ropes with anchors and floats, sponges placed along the rope) will be placed at nearby homelands. The purpose of this is twofold:

- Gather as much data on growth and suitable farm sites as possible in a short time
- Be seen to be inclusive and maintain and foster as broad a support base for the project as possible.

# 8 BENEFITS

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

- the income that will be generated from an eventual commercial operation will reduce or replace the current dependence on Government funding; and
- the employment will provide a reason for young people to remain on the homelands, and in the remote communities, and will ultimately lead to stronger communities with reinforced traditional and cultural values.

The regional Aboriginal communities of the Northern Territory are the beneficiaries as identified in the original application.

Secondary beneficiaries may result when the sponge farming ventures become commercial.

*Training*

Lo Tech Aquaculture has an agreement with the Department of Employment, Education and Training to provide basic aquaculture training for 25 indigenous people associated with this project. The training will give a solid grounding in mariculture while developing training methods and materials to train other indigenous groups in sponge cultivation. The methods and materials will be developed with the advice of the trainees to ensure that they are relevant and effective for indigenous groups.

A member of Lo Tech staff will be travelling to Greece (the centre of the sponge trade) to learn correct methods of grading, processing and marketing sponges. On this trip sponges from Arnhem Land will be shown to the market for an informed assessment of their quality and value. This knowledge will be passed on to communities through workshops to enable the communities themselves to value-add their product by processing and packing. It is envisioned that this will lead to family based cottage industries that will provide real employment and generate income for homelands.

# 9 FURTHER DEVELOPMENT

Based on the findings of this project, including the results of the sponge survey and the identification of sponge farming sites, new developments have already taken place. In March 2004 pilot sponge farms were developed in collaboration between the two Aboriginal communities - Bawinanga Aboriginal Corporation at Maningrida, and the Warruwi Community Incorporated at Goulburn Island – and AIMS and Lo Tech Aquaculture. These experimental farms are trialling several species of sponge at various locations and depths, with different farming techniques to determine the best husbandry methods for pilot or commercial ventures. The Northern Territory Community Sea Rangers were involved in the construction and stocking of the experimental farms and will continue with monthly monitoring with Lo Tech Aquaculture and AIMS.

Other experimental farms are expected to be established later in 2004 at other communities in Arnhem Land.

# 10 PLANNED OUTCOMES

The planned outcomes were:

1. Determining availability of broodstock, and
2. Identification of and selection of four appropriate sites.

The outputs of this project, namely the sponge survey of waters adjacent to interested Aboriginal communities, has completely satisfied planned Outcome 1. In all, 37 field identified species have been acknowledged as potential bath sponges.

Outcome 2 has been satisfied by the identification of six potential sites for the farming of bath sponges. Now two of these sites are being utilised as trial farms.

# 11 CONCLUSION

This small project has contributed to the knowledge base of sponge resources of the Northern Territory. The survey that was carried out by AIMS, Lo Tech Aquaculture and the traditional owners, has shown that commercially appropriate sponge species do exist in waters adjacent to regional Aboriginal communities. The project has also shown that there are areas close to Aboriginal homelands that are suitable for sponge aquaculture.

Sponge farming appears to be an appropriate activity for Aboriginal communities in terms of social, cultural and environmental practices. Through appropriate marketing and careful business planning the economic benefits may become evident in time. At this stage however, the project aims have been met, and surpassed, with the development of pilot sponge farms in Warruwi and Maningrida.

# 12 REFERENCES


Alcolado, P.M., Grovas-Hernandez, A. and Marcos, Z. (2002). General comments on species inventory, fisheries, culture and some community features of the *Porifera* in Cuba. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 8.

Alvarez, B., Browne, M.F. and Horner, S. (2002). Sponge biodiversity in Darwin Harbour, Northern Territory, Australia. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 10.

Corriero, G., Longo, C., Mercurio, M., Nonnis Marzano, C. and Scalera Liaci, L. (2002). Taxonomy and distribution of the demosponges from coastal basins of the western Mediterranean sea. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 47.

Dobson, G. (2003). Development of sponge farming as a viable commercial enterprise for remote Aboriginal communities. Final project report 2001/225. Fisheries Research and Development Corporation. Canberra, Australia.

Duarte, C., Goncalves, J. and Humanes, M. (2002). Bioassay guided fractionation of the crude extract of a marine sponge: HIV-I inhibition. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 57.

Duckworth A.R., Battershill C.N., Schiel D.R., Bergquist P.R. (1999). Farming sponges for the production of bioactive metabolites. Memoirs of the Queensland Museum Vol 44: 155-160.

Evans-illidge, E.A., Battershill, C.N. and Wolff, C.W.W. (2002). From experiment to enterprise – sponge aquaculture ventures for regional Australian communities. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 66.

Flori, M., Calcinai, B., Cerrano, C., Boyer, M., Pratasik, B., Lalamentik, O. and Bavestrello, G. (2002). The boring spongofauna of the marine park of Bunaken (North Sulawesi, Indonesia). *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 68.

Fromont, J., Vanderklift, M. and Kendrick, G. (2002). Marine sponges of the Dampier Archipelago: Their distribution and abundance. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 70.

Hooper, J.N.A. and van Soest, R.W.M. (2002). *Systema Porifera*. A guide to the classification of sponges. The end of a beginning. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 94.

SPC Website 2004. www.spc.org.nc/aquaculture/site/commodities/sponge.asp.

Usher, K.M., Sutton, D.C., Toze, S. and Fromont, J. (2002). The distribution of *Chondrilla* species (*Demospongiae*) in Australia. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 200.

de Voogd, N.J., van Soest, R.W.M., Noor, A. and Hoeksema, B.W. (2002). An assessment of sponge mariculture in the Spermonde Archipelago, Indonesia. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 205.

Wolff, C.W.W., Battershil, C.N. and Evans-Illidge, E.A. (2002). New species aquaculture of tropical dictyoceratids for production of commercial sponges in the Great Barrier Reef region. *Boll. Mus. Ist. biol. Univ. Genova*, 66-67. p. 220.

Wolff, C.W.W. (2004). NT sponge aquaculture project - Arnhem Land bath-sponges: Candidates and locations, Survey Report, Trip 3499. Australian Institute of Marine Science. Townsville, Australia.

# APPENDIX 1. INTELLECTUAL PROPERTY

Valuable information arising from this research includes:

- The knowledge that commercially suitable sponges are found close to Aboriginal communities.
- The knowledge that sea country areas adjacent to homelands are in some cases suitable for sponge culture.

# APPENDIX 2. STAFF LIST

| | |
|---|---|
| Mr Graeme Dobson | Lo Tech Aquaculture |
| Mr David Steinberg | |
| | |
| Dr Carsten Wolff | Australian Institute of Marine Science |
| Dr Alan Duckworth | |
| Dr John Veron | |
| MrTerry Mahney | |
| Ms Jane Gioffre | |

**Community representatives**

Djawa Yunupingu
Milkayngu Mununggurr
Nalkuma Burrarrwanga
Timmy (Djawa) Burrarrwanga
Kevin (Garrurru) Burrarrwanga
Daymbawi Burrarrwanga
Milkayngu Mununggurr
Djawa Yunupingu
Kevin (Garrurru) Burrarrwanga
Johnny (Gurrumgurrum) Burrarrwanga
Lirrwa (Bruce) Gamambarr
Jamie Yunupingu
Lirrwa Ganambarr
Kevin Gurrurrur
Robert Rratj
Ray Hall
Jonas Klein
Stewart Ankin
Colin Dudanga
Roy Wununguj
Brendan Marrngan
Peter Minkulk
Albert Nururaidj
'Darryl'
Abraham Gunmalar.

# APPENDIX 3. BIODIVERSITY SURVEY REPORT

See attached report.

Wolff, C.W.W. 2004. Arnhem Land Bath Sponge Aquaculture Project: Candidates and Locations. Dictyoceratid Sponge Survey, AIMS Trip 3499, R/V Cape Ferguson, December 2003. Australian Institute of Marine Science, Townsville, Australia.

# ARNHEM LAND BATH SPONGE AQUACULTURE PROJECT: CANDIDATES AND LOCATIONS

## DICTYOCERATID SPONGE SURVEY
## AIMS TRIP 3499, R/V CAPE FERGUSON

Carsten Wolff, Australian Institute of Marine Science
December 2003

# NT SPONGE AQUACULTURE PROJECT

# ARNHEM LAND BATH-SPONGES: CANDIDATES AND LOCATIONS

## SURVEY REPORT, TRIP 3499

Carsten Wolff, December 2003

This is a summary of the initial survey of bath-sponge candidate species for an indigenous sponge aquaculture industry in Arnhem Land. AIMS in partnership with Arnhem Land communities and homelands of Bawaka, Barrkira, Mata Mata, Galiwinku, Maningrida and Warruwi, has begun a sponge aquaculture project that builds on existing research results and business plan/market analysis and will provide the foundation for the establishment and development of a new, indigenous owned and operated, sponge aquaculture industry in tropical Australia. Pilot experiments will be deployed in 2004. Preliminary funding and support is currently committed from AIMS, ILC and DAFF.

AIMS trip 3499 aboard 24m AIMS research vessel “Cape Ferguson” left Nhulunbuy on 26 November 2003 and arrived in Darwin on 6 December 2003.

Scientific personnel consisted of:

| | |
|---|---|
| **Carsten Wolff**, | cruise leader and dive-supervisor |
| **John Veron**, | scientist and diver |
| **Graeme Dobson**, | Lo-tech Aquaculture, consultant |
| **Terry Mahney**, | liaison officer (NLC), diver |
| **Jane Gioffre**, | aquaculture technician and diver |

## ITINERARY:

***Summary of visiting locals hosted aboard R/V Cape Ferguson:***

**26/11 - Nhulunbuy to Bawaka**

Djawa Yunupingu and Milkayngu Mununggurr stayed on board overnight

**26/11-27/11**

Nalkuma Burrarrwanga 26/11, day visit only

**27/11 - Bawaka**

zodiac am: Timmy (Djawa) Burrarrwanga, Kevin (Garrurru) Burrarrwanga.
zodiac pm: Daymbawi Burrarrwanga, Milkayngu Mununggurr

**28/11 - Nhulunbuy to Barrkira**

Djawa Yunupingu

**30/11- Mata Mata**

zodiac first trip: Kevin (Garrurru) Burrarrwanga, Johnny Gurrumgurrum Burrarrwanga
zodiac second trip: Lirrwa (Bruce) Gamambarr, Jamie Yunupingu

**30/11 - Overnight on Cape Ferguson**

Lirrwa Ganambarr, Jamie Yunupingu, Kevin Gurrurrur and Robert Rratj

**1/12 - Zodiac - am at Mata Mata**

Robert Rratj

**1/12 - Mata Mata to Galiwinku**

Lirrwa Ganambarr, Jamie Yunupingu, Kevin Gurrurrur and Rober Rratj

**3/12 - Maningrida area -**

people on board for lunch: Ray Hall, Jonas Klein, Stewart Ankin, Colin Dudanga
zodiac: Jonas Klein, Colin Dudanga

**4/12 - Goulburn Island**

On boat for lunch and zodiac: Roy Wununguj, Brendan Marrngan, Peter Minkulk, Albert Nururaidj

**5/12 - Goulburn Island -On zodiac:** "Darryl" and Abraham Gunmalar.

# SURVEYED SITES:

**Bawaka:**

Site 1: 300 m transect; offshore side of middle island. Sloping from 3-14 m; medium inshore-type biodiversity with about 15 spp. of soft corals, many ascidians, 5-30% live cover; ancient limestone rocky reefs and patchy sand opening at 13-14 m depth to sandy plain. Shallower bottom somewhat scoured.

Sponges: mainly *Pseudoceratina* and Plakinidae; some Axinellids and interspersed encrusting *Ircinia (cf ramosa*) common and occasional *Ircinia gigantea**.

Site 2: 300 m south of first site; between two rocky islets. More scoured; lower biodoversity, but occasional bigger *I. gigantea*; also Astrophorida two spp.; higher *Diadema* urchin occurrence; rich fishlife. 250 m transect.

**Pt. William (Elisabeth Bay) (*in-lieu of Barrkira having been omitted due to weather*):**

NW, very sparse; NW Islet v. good diversity though; sloping from intertidal to about 8-9 m; higher coral cover w. occasional *Acropora* thickets. Larger specimens of *I. gigantea* quite common. Good softcoral cover, many ascidians (about 20+ spp. and about 30 spp. of sponges; high abundance of Verongida and common two spp. of Plakinidae (?). (black, inside white, easy to cut. Very large *Pseudoceratina* (2+ spp). orange, tough, massive. High current (1 kn). 500 m transect.

**W-Wigram Is:**

Sparse rock platform (probably intertidal), stepping to deeper water down to 10 m. muddy/sandy bottom with patchy coral, medium biodiversity. seven spp of sponges, 12 spp of ascidians. Urchins, good scleractinian cover. 300 m transect.

**NW-Astell Is:**

More inshore community: first finding of *Ceratodictyon spongiosum* in shallows. High biodiversity, both porifera, ascidacea (colonial/encrusting forms) and cnidaria. 30+spp of softcorals and dominant Ellisellidae-types, short video transect (low visibility). Large *Pseudoceratina* and abundant *I. gigantea*. Scattered bommies on sand and broken reef with undistinct slope. 300m transect.

**Mata Mata:**

Two largely intertidal rubble-reefs; one extensive (1/12/03) one coming off the point east of Mata Mata airstrip; about 1 km long and of similar width; reasonable live coaral coer around the edges to a depth of about 1.5 m at low tide. High biodiversity of encrusting organisms; about 20+ spp of ascidians (*Polycarpa* two spp, *Lissoclinum*, botryllidae two spp, Didemnum three spp) Sponges limited largely to encrusting forms in shallows( about 12-17 spp.) with *Dysidium herbacea* being the dominant species. A 5-minute spot dive under the boat revealed muddy/sandy bottom. Low biodiversity (small patches of assemblages): *Clathria, Jaspis stellifera*, pink Poecilosclerida; sea-whips, small fans, *Sargassum*, ascidians. 300 m transect.

The other rubble slope runs along the east-west line parallel to the shore from about 500 m west of Mata Mata to about 2,500 m west (to the nearest point), also v. shallow. Tow-video transects were taken (30/11/03):

- 06.089 S, 136 14.238 E to 12 06.029 S, 136 14.220 E;
- 12 05.976 S, 136 14.253 E to 12 05.972 S, 136 14.238 E;
- 12 05.966 S, 136 14.277 E to 12 05.966 S, 136 14.254 E;
- 12 05.972 S, 136 14.334 E to 12 05.951 S, 136 14.282 E;

Bottom covered largely by softcorals such as *Sarcophyton* and massive-form scleractinia, interspersed with *Sargassum* and *Caulerpa*. Live cover about 30-50% *in toto*.

There is also a small patch-reef out from that point in the middle of the Strait, possibly a sacred site.

**Galiwinku:**

Tow-video transects only, due to perceived crocodile presence. 5 transects, 08.30 to 09.30 am:

- 12 03.116 S, 135 32.988 E to 12 03.150 S, 135 32.961 E depth 6.6 m, good sponge diversity, zooanthids, *Sargassum*, some *Halimeda,* massive coral.
- 12 03.853 S, 135 32.472 E to 12 03.870 S, 135 32.444 E depth 5.3 m, some sponges, lower biodiversity
- 12 03.404 S, 135 31.312 E to 12 03.408 S, 135 31.307 E depth 4.6 m, no macrofauna
- 12 03.338 S, 135 30.848 E to 12 03.341 S, 135 30.825 E depth 2 m, low biodoversity, sparse
- 12 01.671 S, 135 33.620 E to 12 01.677 S, 135 33.592 E depth 2.7 m, good scleractinian cover, some sponges and *Sargassum.*

**Maningrida:**

*Haul Round Island:* Western-side: dive off cay 3-5 m depth; clear water, quite sheltered; good biodiversity; rocky/coral rubble and small bommies; four dictyoceratid species; multitude of ascidian spp., urchins, softcoral cover 1-5%. 500m transect on scuba. Eastern-side: transect off small mangrove patch. Coral bommies and rubble; more sandy patches, very high abundance of cf. *I. gigantea* sponges.

*Rolling Bay:* shallow patch reefs ~2 km off the bay: terracotta-like pavement; rubble; sandy plain with low cover at a depth of 3-4 m onwards; abundant sea cucmbers, in particular *Holothuria sp* and *Stichopus sp*. Mostly encrusting benthos due to exposed environment.

**Warruwi:**

*North Goulburn Island:* fringing reef off sandy bay with intertidal rock patch and rocky/rubble headlands. Shallow. Old cyclone damage had apparent strong impact of this reef, possibly resulting in low biodiversity; encrusting forms dominating. Good ascidian cover (20+ spp). two dictyoceratid sponge spp. and about 15+ other sponge spp.

*South Goulburn Island:*
Quite shallow on NE side. Very good slope, with very big biomass and diversity of sponge spp.; to about 10 m+ on SW corner (rec. boat-ramp, two bays S of barge landing).
*Bottle rocks*:
Solid rock; massive. Determining underwater landscape; relative sparse for area.
*Sims Island:*
On eastern side masive reef wall *Galaxea* colony wall to 12 m then rubble slope, then shelving steps to 30 m+. Excellent site for massive dictyoceratids; few spp. but v. large.

***Note: So far, all sponge identifications are tentative field identifications only**

**Table 1.** 37 sponge samples were retained and are being analysed for bathsponge suitability

| sample number | site number ymmdd# # | depth min (m) | max (m) | demosponge field identifications: ORDER | FAMILY | GENUS | SPECIES |
|---|---|---|---|---|---|---|---|
| 26146 | 3112701 | 12 | 14 | POECILOSCLERIDA | AXINELLIDAE | ACANTHELLA | |
| 26147 | 3112701 | 13 | 14 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26148 | 3112701 | 3 | 14 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | RAMOSA? |
| 26149 | 3112701 | 13 | 15 | VERONGIDA | DRUINELLIDAE ? | | |
| 26150 | 3112702 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA ? |
| 26151 | 3112902 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA ? |
| 26152 | 3112801 | 3 | 6 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA ? |
| 26153 | 3112801 | 3 | 6 | VERONGIDA | IANTHELLIDAE | IANTHELLA | N.SP.? |
| 26154 | 3112902 | 3 | 6 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26155 | 3112902 | 3 | 6 | DICTYOCERATIDA | SPONGIIDAE | PHYLLOSPONGIA | SP |
| 26156 | 3120301 | 2 | 5 | DICTYOCERATIDA | THORECTIDAE | | |
| 26157 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | GIGANTEA ? |
| 26158 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | |
| 26159 | 3120301 | 2 | 5 | DICTYOCERATIDA | | | |
| 26160 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | IRCINA | |
| 26161 | 3120301 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26162 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26163 | 3120302 | 2 | 5 | DICTYOCERATIDA | THORECTIDAE | | |
| 26164 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26165 | 3120302 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26166 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26167 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26168 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26169 | 3120401 | 2 | 3 | DENDROCERATIDA | DYSIDEIDAE | DYSIDEA? | |
| 26170 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26171 | 3120402 | 2 | 3 | DICTYOCERATIDA | | | |
| 26172 | 3120403 | 2 | 5 | DICTYOCERATIDA | SPONGIIDAE | | |
| 26173 | 3120403 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26174 | 3120403 | 2 | 5 | DICTYOCERATIDA | IRCINIIDAE | | |
| 26175 | 3120501 | 2 | 9 | DICTYOCERATIDA | SPONGIIDAE | COSCINODERMA? | |
| 26176 | 3120501 | 2 | 9 | DENDROCERATIDA ? | | | |
| 26177 | 3120501 | 2 | 9 | DENDROCERATIDA ? | | | |
| 26178 | 3120502 | 4 | 7 | DICTYOCERATIDA | THORECTIDAE | HYRTIOS/LUFFARIELLA | |
| 26179 | 3120503 | 8 | 13 | DICTYOCERATIDA | SPONGIIDAE | COSCINODERMA? | |
| 26180 | 3120503 | 8 | 13 | DICTYOCERATIDA | | | |
| 26181 | 3120503 | 8 | 13 | DICTYOCERATIDA | | | |
| 26182 | 3120503 | 8 | 13 | DICTYOCERATIDA | SPONGIIDAE | | |

*Ad-hoc*, the following sponges have been earmarked as very good candidates: 26149 (same species as 26167 and 26180), 26173 (same as 26174) and 26175.

Other good sponge candidates include at this stage: 26172 and 26179.

Graeme Dobson is currently processing the specimens in Darwing and will provide AIMS with material for further studies.

**Figure 1.** 26149

**Figure 2.** 26173

**Figure 3.** 26172

**Figure 4.** 26179

**Figure 5.** 26175

**Table 2.** Site descriptors of sample sites

| Date | Site | Locality | Samples taken | Notes |
|---|---|---|---|---|
| 27/11/2003 | 1 | OFFSHORE IS OFF BAWAKA, ARNHEM LAND | 4 | OFF SMALL BEACH IN MIDDLE OF ISLAND, ROCKY HEADLAND |
| 27/11/2003 | 2 | OFFSHORE IS OFF BAWAKA, ARNHEM LAND | 1 | S OF ROCKS ~500M SSE OF SITE 1 |
| 28/11/2003 | 1 | ISLET 500M NW OFF PT. WILLIAM | 2 | SMALL LOW ISLET NW OFF PT. WILLIAM, SLOPING, GOOD BIODIVERSTIY |
| 29/11/2003 | 2 | NW ASTELL IS | 3 | OFF ROCKS W OF CHANNEL BETWEEN TWO ISLANDS, LOW VISIBILTY |
| 30/11/2003 | 1 | MATA MATA | n/a | VIDEO TRANSECT ONLY |
| 1/12/2003 | 1 | MATA MATA | n/a | SCUBA SURVEY |
| 3/12/2003 | 1 | HAUL ROUND IS (W-SIDE), MANINGRIDA | 6 | GOOD SPONGE SITE? (+ CORAL SURVEY) |
| 3/12/2003 | 2 | HAUL ROUND IS (E-SIDE), MANINGRIDA | 4 | MAINLY LARGE IRCINIA |
| 3/12/2003 | 3 | ROLLING BAY, MANINGRIDA | 0 | EXPOSED SITE, NOT MUCH DIVERSITY, INTERESTING HOLOTHURIANS |
| 4/12/2003 | 1 | NORTH GOULBURN ISLAND (W-SIDE) | 1 | TRASHED BY CYCLONE, WAS ONCE GOOD FRINGING REEF. |
| 4/12/2003 | 2 | NORTH GOULBURN ISLAND (SE-CORNER) | 5 | |
| 4/12/2003 | 3 | SOUTH GOULBURN ISLAND (NEAR NE-CORNER) | 3 | GOOD PALE DICTYOCERATIDS, CRYPTIC IN CREVICES |
| 5/12/2003 | 1 | SOUTH GOULBURN ISLAND, SW REC BOAT-RAMP | 3 | EXCELLENT LARGE SPONGE SITE |
| 5/12/2003 | 2 | SOUTH GOULBURN ISLAND (OFF BOTTLE ROCKS) | 1 | OFF ROCKY ISLETS; AVERAGE DIVERSITY |
| 5/12/2003 | 3 | SIMS ISLAND (E-SIDE) | 4 | DROP-OFF TO 30M+, BEST SPONGE/CORAL SITE ON THIS TRIP |

**Summary and conclusion:**

The initial dive and towed video-transect surveys at all sites can by no means be termed exhaustive, but nonetheless gave an indication for the regional species richness. One of the notable factors affecting the diving were the shallowness of the coastal habitats especially in Eastern Arnhem Land and the number of areas windwardly exposed which would severely affect non-encrusting benthic lifeforms in cyclone/storm situations. The richness at sites sheltered by topography was therefore deemed to be generally higher than that in not sheltered areas. (See "*surveyed sites*" section and Table 2).

Due to the somewhat cursory nature of this survey, in Eastern Arnhem Land we were so far only able to identify limited habitats for sponge aquaculture. This was in part due to the lack of deeper water and opportunities to find hotspots of high sponge density in these areas. It is therefore suggested, in order to show proof of concept that, initially, only Maningrida and Warruwi in Western Arnhem Land be used as sites for pilot experiments, as we found high biomass of potential donor sponges and deeper water for the pilot experiments planned in 2004.

# APPENDIX 4. SITE SELECTION AND FARM ESTABLISHMENT REPORT

See attached report.

Duckworth, A. 2004. Bath sponge culture in Arnhem Land. First deployment of experimental farms. Australian Institute of Marine Science and Lo Tech Aquaculture. March, 2004. Australian Institute of Marine Science, Townsville, Australia.

**Bath sponge culture in Arnhem Land**

**Australian Institute of Marine Science and Lo Tech Aquaculture**

**March, 2004. First deployment of experimental farms**

**Alan Duckworth and Carsten Wolff (AIMS)**

**David Steinberg and Graeme Dobson (Lo Tech Aquaculture)**

**Funding from the Indigenous Land Corporation and the Department of Agriculture Fisheries and Forestry**

The first stage of the two year project was to deploy experimental bath sponge farms at Maningrida and Warruwi (South Goulburn Is), Arnhem Land. Upon arriving at each community we met with the Sea Rangers and discussed the sponge culture project. AIMS and Lo Tech aquaculture demonstrated on a white-board the general design of the farming system (Figure 1), while the Sea Rangers suggested possible farming sites in their respective locations. Each farming system was approximately 30 m long and situated on sand at a depth of 6-8 m. It consisted of two sets of 40 kg anchors, each with a subsurface buoy at a depth of ~2 m MLW. Stretching between the two buoys was a horizontal line, used for attaching the sponge dropper lines so that they sat in mid-water and off the sandy bottom. To mark the position of each farming system, a surface buoy was attached using rope to the horizontal line. Each sponge dropper line contained explants of only one sponge species. A 0.5 kg weight, made of half a soda bottle filled with concrete, and attached to the bottom of each dropper line kept the line taut and eliminated tangling. Apart from the rope, all farming equipment used was recycled material such as old buoys and 10 kg flour containers filled with concrete to act as the main anchors. Using recycled materials reduced costs, maximised participation of the Sea Rangers, and kept with the theme of "low technology aquaculture". The farming system, designed by AIMS and Lo Tech Aquaculture, is inexpensive and easy to construct, has minimal environmental impact, and allows for deployment and monitoring from a boat, thus reducing the risk from predatory attack from wildlife such as crocodiles. Although okay for the initial work, AIMS and Lo Tech Aquaculture will develop more suitable farming systems as the study progresses and as we better understand the farming environment and limitations in Arnhem Land, such as strong currents coupled with exposed waters.

At Maningrida, six farming systems were deployed at three sites on the southern side of Round Haul Island (Table 1). Each site was at least 1 km apart, and contained two farming systems (70 to 200 m apart) to examine intra-site variability in culture response. At Warruwi, two farming systems were deployed off South Goulburn Island and a further two systems off Sims Island (Table 2). The position of each farming system was decided after consulting with the Sea Rangers at each location. Factors we considered important for site selection were substratum depth and composition (on sand to minimise environmental impact), away from river mouths to ensure high salinity, relatively sheltered water/areas to reduce storm effects and tidal currents, accessibility from each community, and away from popular fishing areas.

After deployment of the farming systems, Dictyoceratida species were collected using scuba from each location and cut into explants (Table 3). To minimise harvesting impact, at least 1/3 of each sponge was left behind and still attached to the substratum. These cut sponges will heal quickly and regrow. We collected species that were locally abundant and appeared to have spongin skeletons suitable for commercial application. Species names are tentative at this stage, but in time will be fully classified. After collection, the sponges were cut into ~ 27 $cm^3$ explants and then threaded onto nylon or polyester lines (sponge dropper lines). In addition, some explants were placed into mesh bags to act as a damage control, and thus determine the effect of threading. Three farming methods were trialled at both locations, with each dropper line containing five explants approximately 20 cm apart to reduce inter-explant competition. The farming methods tested and replicate number per site for *Coscinoderma* sp. *Ircinia gigantea* and *Ircinia* sp. are shown in Tables 4, 5 and 6. At Warruwi, one dropper line of five Dictyoceratida sp. explants was also deployed at site 3. At Maningrida, four dropper lines each containing five *Ircinia* sp. explants from Warruwi were deployed at site 1, area B. This will examine the potential of translocating *Ircinia* sp. between locations (permission obtained from DBIRD).

AIMS and Lo Tech Aquaculture, along with the Sea Rangers, plan to monitor the farmed sponges at Maningrida and Warruwi each month, but this is subject to weather conditions and Sea Ranger availability. Apart from collecting the sponges when SCUBA qualifications were required, the Sea

Rangers at Maningrida and Warruwi were involved during all stages of the project such as setting-up and deployment of the farming systems, and cutting and threading sponges (Figures 2-4). Table 7 lists the names of the Sea Rangers of Maningrida and Warruwi that were involved in the first stage of this study.

A mid-term report was to be submitted by AIMS and Lo Tech Aquaculture by 10 June 2004.

**Table 1.** Coordinates of the six farming systems deployed at Round Haul Island, Maningrida. The waypoints were taken at the midway point of each system.

| Site | Area | Latitude | Longitude |
|---|---|---|---|
| 1 | A | S11.53.269 | E134.12.359 |
| | B | S11.53.328 | E134.12.334 |
| 2 | A | S11.53.724 | E134.12.780 |
| | B | S11.53.757 | E134.12.791 |
| 3 | A | S11.53.690 | E134.13.092 |
| | B | S11.53.723 | E134.13.079 |

**Table 2.** Coordinates of the four farming systems deployed at Warruwi. The waypoints were taken from each end of the system.

| Site | Latitude | Longitude |
|---|---|---|
| 1, South Goulburn Is | S11.40.404 | E133.24.240 |
| | S11.40.416 | E133.24.237 |
| 2, South Goulburn Is | S11.40.864 | E133.23.529 |
| | S11.40.877 | E133.23.513 |
| 3, Sims Is | S11.40.075 | E133.19.162 |
| | S11.40.081 | E133.19.165 |
| 4, Sims Is | S11.40.074 | E133.19.035 |
| | S11.40.069 | E133.19.015 |

**Table 3.** The number of harvested sponges and explants cut from the Dictyoceratida species collected at Maningrida and Warruwi.

| Location | Species | Harvested no. | Explant no. |
|---|---|---|---|
| Maningrida | *Ircinia gigantea* | 8 | 120 |
| Warruwi | *Cosconoderma* sp. | 4 | 90 |
| Warruwi | *Ircinia* sp. | 6 | 150 |
| Warruwi | Dictyoceratida sp. | 1 | 5 |

**Table 4.** Summary of the experimental design testing importance of farming method and site for culture of *Ircinia gigantea* at Maningrida. The numbers refer to the number of replicate dropper lines deployed at each site/area.

| Site | Area | Nylon | Polyester | Mesh bags |
|---|---|---|---|---|
| 1 | A | 3 | 3 | 3 |
| | B | | 3 | |
| 2 | A | | 3 | |
| | B | | 3 | |
| 3 | A | | 3 | |
| | B | | 3 | |

**Table 5.** Summary of experimental design testing importance of farming method and site for culture of *Coscinoderma* sp. at Warruwi. The numbers refer to the number of replicate dropper lines deployed at each site.

| Site | Nylon | Polyester | Mesh bags |
|---|---|---|---|
| 1 | 3 | | |
| 2 | 3 | | |
| 3 | 3 | | 3 |
| 4 | 3 | | |

**Table 6.** Summary of the experimental design testing importance of farming method and site for culture of *Ircinia* sp. at Warruwi. The numbers refer to the number of replicate dropper lines deployed at each site.

| Site | Nylon | Polyester | Mesh bags |
|---|---|---|---|
| 1 | 3 | | |
| 2 | 3 | | |
| 3 | 3 | 3 | 3 |
| 4 | 3 | | |

**Table 7.** Names of the Sea Rangers at Maningrida and Warruwi who participated in the first stage of this study.

| Maningrida | Warruwi |
|---|---|
| Alistair | Brandon |
| Dennis | Robert |
| Dean | Lance |
| Alexander | Abraham |
| Samson | Henry |
| Benjamin | Roy |
| Bob | |
| Tim | |
| Fabian | |
| John | |
| Victor | |
| Stuart | |

**Timeline**

15/3/04, Monday. Alan Duckworth, David Steinberg and Graeme Dobson flew into Maningrida, met with Sea Rangers and discussed sponge farming project. Organised and partially set-up farming equipment.

16/3/04, Tuesday. Deployed three farming systems at Round Haul Island (Second Island) using Sea Ranger boat.

17/3/04, Wednesday. Deployed another three farming systems at Round Haul Island.

18/3/04, Thursday. Steamed from Maningrida to Warruwi, using Maningrida Sea Rangers' boat.

19/3/04, Friday. Met with Sea Rangers at Warruwi and discussed sponge farming project. Organised and partially set-up farming equipment.

20/3/04, Saturday. Carsten Wolff arrives. Set-up remaining farming equipment.

21/3/04, Sunday. Stormy conditions making it unsafe to be out on water. Day spent doing paperwork.

22/3/04, Monday. Graeme Dobson leaves. Deployed four farming systems: two systems off South Goulburn Island and two off Sims Island. One scuba dive collecting sponges.

23/3/04, Tuesday. One dive collecting sponges, *Coscinoderma* sp. and *Ircinia* sp.. Sponges cut into explants, threaded onto ropes and transplanted onto farming systems.

24/3/04, Wednesday. Steamed from Warruwi to Maningrida. Twenty *Ircinia* sp. explants collected from Warruwi were stored overnight in "crab pot" temporally deployed off Entrance Island, Maningrida.

25/3/04, Thursday. Transplanted *Ircinia* sp. explants. Three dives collecting sponges, probably *Ircinia gigantea* specimens. Sponges stored overnight in "crab pot" off Round Haul Island.

26/3/04, Friday. One dive collecting sponges. *Ircinia gigantea* sponges cut into explants, threaded onto ropes and transplanted onto farming systems.

27/3/04, Saturday. Alan Duckworth, David Steinberg and Carsten Wolff depart Maningrida for Darwin.

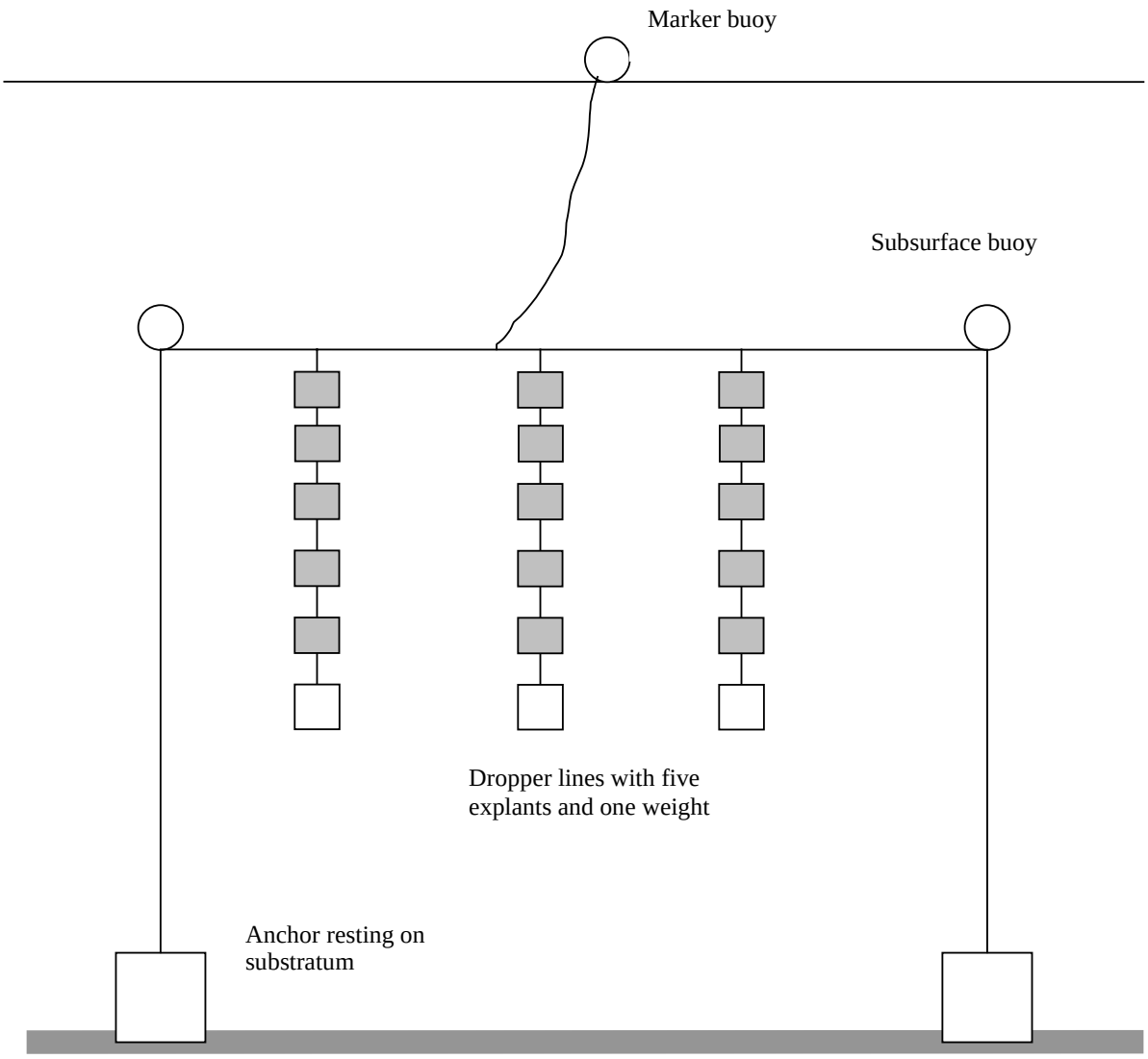



**Figure 1.** Schematic presentation of the sponge farming system used in Arnhem Land

**Figure 2.** Roy and Henry of the Warruwi Sea Rangers recycling old material to use in the sponge farming experiment. Also shown are the 20 kg anchor weights, made from flour containers filled with concrete.

**Figure 3.** Samson, Dean, William and Alistair from the Maningrida Sea Rangers deploying the farming systems.

**Figure 4.** Maningrida Sea Rangers cutting the harvested sponges and threading the explants onto lines. Gloves are worn to prevent contamination.