Sandfish production and development of sea ranching in northern Australia

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Abstract

Sea cucumber harvesting has been carried out in the Northern Territory (NT) since 1700 when Macassans regularly visited the area. Tasmanian Seafoods Pty Ltd currently holds all licences for sea cucumber in the NT, with the main target species being sandfish (*Holothuria scabra*). Tasmanian Seafoods has successfully trialled propagation and juvenile production for wild fishery stock enhancement and land-based grow-out in ponds. Lease of an ex-prawn farm and hatchery facilities at Darwin Aquaculture Centre has progressed its efforts. Tasmanians Seafoods has established working relationships with remote Indigenous communities situated nearby on recognised fishing grounds on Groote Eylandt, to develop the sea-ranching component of the project and establish joint ventures for the harvesting of the 'released' sea cucumbers. Appropriate policies and management arrangements are also being negotiated with the NT Government Department of Resources Fisheries Group.

Introduction

Sea cucumber harvesting has been carried out in the Northern Territory (NT) since 1700, when Macassans from Celeb (Sulawesi island group, Indonesia) visited annually and set up processing sites adjacent to the fishing grounds (Macknight 1976). The industry has evolved and now consists of a series of regulatory controls to manage the fishery, predominantly through input controls. Entry to the fishery is limited to six licences that are restricted by area, species, minimum size and the number of divers on each vessel (Shelley and Puig 2003).

Tasmanian Seafoods Pty Ltd is currently the sole licence owner for sea cucumber fishing in the NT. The fishery's principle target species is the sandfish (*Holothuria scabra*). Since 2004 Tasmanian Seafoods has been investigating the potential of propagation and juvenile production of sandfish, with a view to enhancing the existing wild fishery through sea ranching and exploring land-based grow-out.

During 2006–08, repeated trials were carried out to assess the potential of land-based grow-out and develop pond-management techniques for *H. scabra.* Promising results led to the expansion of the project by leasing a farm that had previously been used to cultivate prawns. Subsequently, a 'farming' component was added to the sea-ranching project, enabling greater access to, and utilisation of, necessary facilities (e.g. earthen ponds) for the project.

In developing the sea-ranching component of the project, Tasmanians Seafoods has sought to create effective working relationships with remote Indigenous communities situated nearby on recognised fishing grounds, and establish joint ventures for the harvesting of the 'released' sandfish. The development of sea ranching has also required ongoing negotiations with the NT Government Department of Resources Fisheries Group to develop appropriate policies and management arrangements to conform with the NT's *Fisheries Act 1998*.

The fishery

The fishing grounds occur along the Arnhem Land coast, with the major harvest areas being the

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Cobourg Peninsula and Groote Eylandt (Figure 1) (Handley 2010). All commercial harvesting of sea cucumber in the NT is conducted by hand, either by walking the shallows, snorkelling or hookah. The fishery operates in waters up to 3 nautical miles seaward of the NT and surrounding islands coast.

The hatchery

In 2004 Tasmanian Seafoods set up a pilot hatchery at the NT Government's Darwin Aquaculture Centre (DAC). Initially, the hatchery was dependent on wild caught broodstock, which proved restrictive due to the logistics of acquiring broodstock from the fishing grounds, with the nearest grounds being on the Cobourg Peninsula about 200 km away with no road access (Figure 1). This led to the development of transport techniques using vessels and aircraft to collect and transfer broodstock to the hatchery with minimal stress, and the lease of ponds at a local aquaculture farm to hold breeding stock.

Successful larval culture of *H. scabra* led to expansion of the hatchery at the DAC. The larval rearing infrastructure is now a recirculating system comprising a 25,000-L sump, 40,000-L larval rearing volume, 36,000-L conditioning system and two 1,500-L experimental larval rearing systems.

All sea water entering the system has a salinity of 30‰ and is filtered to 1 µm. Once in the loop, the water is repeatedly treated with UV sterilisation and foam fractionation. The hatchery is located in a covered outdoor area, and water temperature in the larval rearing tanks is in the range 27–31 °C.

During the larval run, the larval tanks are static with a daily partial water exchange. The larvae are predominantly fed *Chaetoceros muelleri*, beginning at densities of 15,000 cells/mL and increasing to 35,000 cells/mL by the end of the run. Once the larvae have settled, the tanks are put on flow-through at 100% water exchange per day.

The conditioning tanks are used to cover settlement substrates with diatoms, with a good coverage of periphytic diatoms on our settlement substrates generally taking around 5–7 days. Settlement substrates are then put into the larval tanks at the time of settlement, to help induce the larvae to settle and provide food for the post-settlement and early juvenile stages. While larval settlement is consistently achieved, the settlement rate is highly variable between tanks, often ranging from 0.4% to over 20%. The larval tanks are harvested and graded soon after settlement, generally at around day 30.

The ponds

Tasmanian Seafoods secured the lease on a prawn farm in 2009. The facility comprises eight 1-ha ponds, six 0.1-ha ponds, and one 2-ha reservoir. The

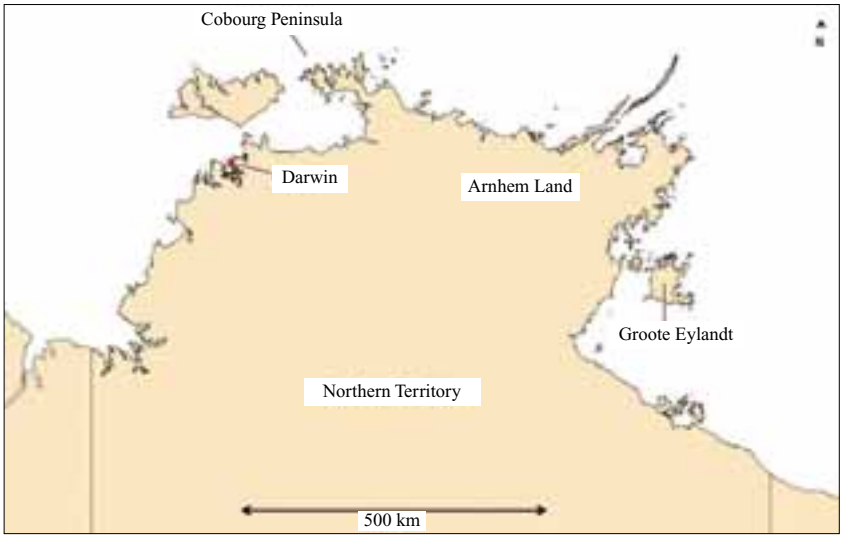

Figure 1. Major harvest areas of the Northern Territory (Australia) sea cucumber fishery

1-ha ponds are used for production, currently yielding 2.0–2.5 tonnes wet weight per hectare. The 0.1-ha ponds are more versatile and easily managed, and are used for broodstock holding and conditioning, and nursery production.

Water is pumped from Darwin Harbour into the reservoir, which then gravity-feeds the rest of the farm. The ponds are on flow-through, and water quality is regularly monitored. Between February 2010 and January 2011, the salinity in the reservoir ranged from 24.6‰ to 38.6‰, and the temperature ranged from 24.7 °C to 35.2 °C. Optimal dissolved oxygen levels are maintained by using air diffusers mounted on the bottom of the ponds connected to air blowers. The diffusers also vertically mix the water column, preventing stratification.

The pond nursery system currently consists of 30 hapa nets (2.5 × 2.5 m, 1-mm mesh), which are stocked with newly settled juveniles (>1 mm). The grow-out ponds are stocked when juveniles reach 25 mm (Figure 2). The growth rates in ponds increase with animal size, and with suitable conditions can exceed 2.5 g/day when animals are nearing harvest (i.e. around 350 g). Freshwater influx into the ponds through the monsoon season is managed by adjusting flow-through rates; and pond depth is maintained using boards or internal standpipes, giving the ability to skim the fresh water off the top.

Sea ranching

In 2006 Tasmanian Seafoods began searching for suitable sites to conduct sea-ranching trials. Little Lagoon on Groote Eylandt (Figure 3) was chosen due to the presence of suitable release habitat for hatchery-produced juveniles. In addition, the local community of Umbakumba expressed an interest in being involved in the project.

Little Lagoon is a shallow basin approximately 2,000 ha in area comprising patches of seagrass, shifting sand bars and mud substrate. The area has long been recognised as a productive fishery and natural nursery area for sandfish (R. Hone, pers. comm., 2009). The lagoon also has favourable geographical characteristics for monitoring the released sandfish, including protection from the weather due to its semi-enclosed nature and a low tidal range, which helps to maintain good water visibility.

Building a successful relationship with the Umbakumba community has been critical for the

Figure 2. Nursery production of sandfish

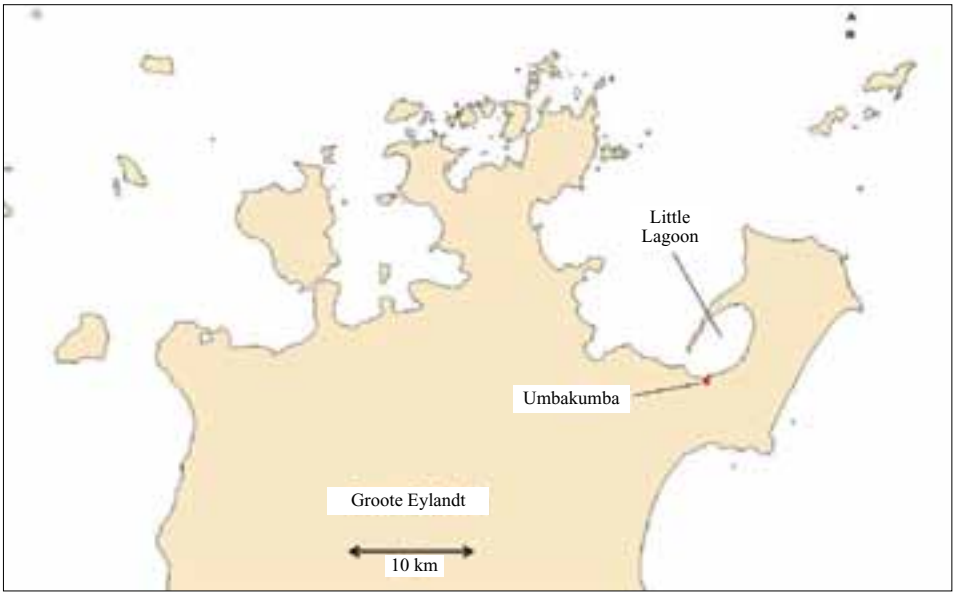

Figure 3. Location of sea-ranching site, Little Lagoon, Groote Eylandt

developmental stage of the sea-ranching project. There are obvious logistical difficulties associated with this site, which is approximately 700 km from the hatchery. However, local community involvement allows for relatively simple management of the project, while regular barge and plane services facilitate transport of equipment to and from the site.

Future direction

The future direction for Tasmanian Seafoods in sea cucumber propagation and sea-ranching research is to increase hatchery and nursery efficiency through improved hatchery protocols and system design; improve pond management to reduce variation and increase yields; and accurately assess the viability of sea-based grow-out of sandfish.

Tasmanian Seafoods aims to promote Indigenous community involvement in sea ranching in the NT, creating opportunities and economic activity in remote areas. Information generated in the research will assist in determining the potential of stock enhancement as a management tool for the future development and sustainable use of the NT's sea cucumber fishery.

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