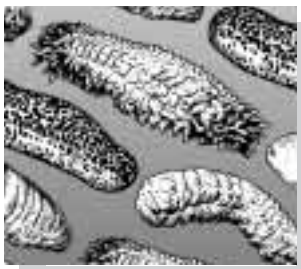

new info
beche-de-mer

Developing optimal strategies for restocking sandfish: a collaborative project in New Caledonia

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Background

Sea cucumbers, processed into beche-de-mer, are a valuable resource for coastal communities in the Pacific. In the case of New Caledonia, there is a long history of fishing for sea cucumbers, dating back to the 1840s (Conand 1990). The fishery is currently composed of mainly indigenous and artisanal fishers. The price offered to fishers for sea cucumbers varies from about USD 0.60 to 2.20 per kilo for whole, fresh animals.

The increased fishing pressure for sea cucumbers in the Pacific is fuelled by the increasing wholesale price of first-grade product, such as well-prepared sandfish, *Holothuria scabra* (Fig. 1). In the year 2000, a total of 62 metric tonnes of dried beche-de-mer was exported from New Caledonia (Observatoire Economique, New Caledonia), where sea cucumbers are still abundant. However, in other places in the Pacific and South-East Asia there has been severe over-fishing of high-value species, such as *H. scabra*, and it is now apparent that depleted stocks can take decades to recover.

It is encouraging to see that many Pacific Island countries are now embracing the idea of marine reserves or Marine Protected Areas (MPAs) to protect some parent stock as a source of egg production for depleted inshore areas. However, numbers of sea cucumbers may be too low in some areas to constitute viable breeding populations. Recent advances in aquaculture now allow the culture of sea cucumbers to a small size in hatcheries, and this process offers a way to restock inshore habitats with valuable species. ICLARM – The World Fish Center recently completed a three-year project in Solomon Islands, which found that *H. scabra* is the species most suited to restocking in the tropical Pacific and South Asia. The project established the methods for rearing juvenile sandfish en masse in simple, land-based nursery systems.

Figure 1. Dried sandfish from New Caledonia, for export.

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Figure 2. Broodstock of both colour morphs of *H. scabra* collected near Noumea.

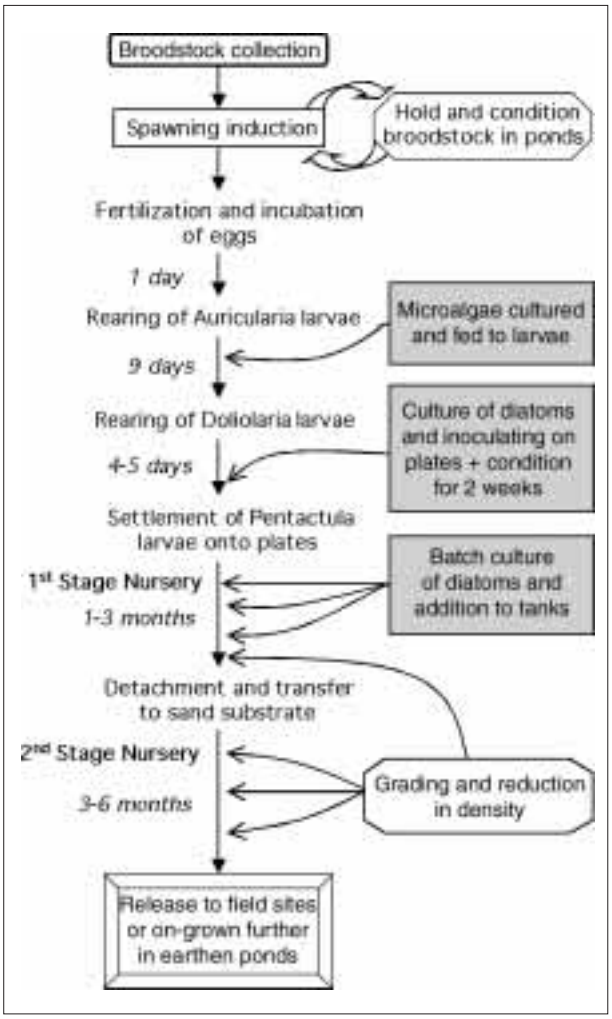

Figure 3. Flow chart of stages of sandfish hatchery culture.

Project overview

The second phase of the research program will use New Caledonia as the study location. It aims to find the most effective ways to release hatchery-produced juvenile sandfish into shallow reef/inshore habitats so that a high proportion of them survive to repopulate depleted areas. Broodstock are available from local waters and large adults can be found in both colour morphs at some sites (Fig. 2).

The project is being conducted in partnership with the Secretariat of the Pacific Community (SPC) and is funded by the Australian Centre for Agricultural Research (ACIAR), the Provinces of New Caledonia, and the French Government.

Culture methodology

The project will culture sandfish at the hatchery at St Vincent, north of Noumea, and later at Foue in the Northern Province. We will apply methods of larval rearing, settlement and grow-out established previously and described by Pitt (2001). Figure 3 shows the culture steps and duration that will be employed in New Caledonia. On arrival at the hatchery, broodstock are weighed (Fig. 4), then sexed via biopsy to determine the sex ratio of the sample group. Groups of 30–60 animals will be induced to spawn using temperature shock.

The fertilised eggs will be collected, rinsed and transferred to 60- or 250-l plastic incubators with filtered seawater. After hatching (~12–24 hrs), the auricularia larvae will be placed into 1000-l conical tanks. High turbidity of intake water at the hatchery is a potential problem, addressed by using storage water, possibly treated with antibiotics and/or EDTA (5 ppm).

Figure 4. Large broodstock *H. scabra* being weighed at St Vincent hatchery.

The auricularia larvae will be fed a variety of microalgae including *Rhodomonas salina*, *Chaetoceros muelleri*, *C. gracilis*, *C. calictrans*, and *Platymonas* sp. The pentactula larvae should be competent to settle after 14 days, at which time stacks of diatom-coated PVC plates (600 mm x 300 mm) will be introduced to induce metamorphosis and provide settlement substrata. Alternatively, competent larvae may be transferred directly into raceways containing the diatom-coated plates.

Juveniles can be grown in these tanks for about three months, when they are expected to reach 10–20 mm in length, or 1 g. Stocking density is then reduced from 400 to around 130 juveniles m^{-2}, through successive grading. Control of copepods via the use of insecticide is also a likely requirement.

At 20 mm in length, juveniles will be placed onto a sand substrate in canvas raceways, ponds or pens in the inshore waters and grown for a further 2–3 months until they reach 60 mm or 20 g. Density at this stage is further reduced to 10 juveniles m^{-2}. Additionally, the aquaculture component will examine broodstock conditioning and tagging, validating gonad biopsy methods, simplification of the larval feeding regime, and intensification of the first and second nursery stages.

Research programme

Tens of thousands of hatchery-produced juvenile *H. scabra* will be released in successive field experiments to identify the best transportation methods, size and density for release, release habitat, release time, and release season. The partnership with SPC will greatly facilitate dissemination of the findings through SPC's international fishery meetings, regional aquaculture strategy, and links with the University of the South Pacific.

Stock assessments of sandfish in New Caledonia will be conducted and linked to existing GIS data on habitat types in the lagoon from ZoNéCo (Zone économique de Nouvelle Calédonie), a local multidisciplinary programme for marine resources.

Short-term experiments will test different methods for transporting juveniles to release sites and fence enclosures will be trialled as a method for improving recaptures and survival of juveniles. Survival of released juveniles will be tested in potential release habitats, including deep and shallow sandy areas with and without seagrass.

The subsequent experiment will determine the optimum size and density of juveniles for release, allowing a cost-benefit analysis of the best trade-off between production costs and survival. A further experiment will examine the survival of juveniles released at different times of the day and year.

We plan to conduct tank- and pond-based experiments to examine conditions for scaling-up the production of juveniles and for culturing sandfish with shrimp, which forms an aquaculture industry in New Caledonia. The experiments will complement current work by Rayner Pitt in Vietnam through ICLARM – The World Fish Center.

Collaborative work with the Australian Institute of Marine Science (AIMS), in Australia, will determine the genetic structure of sandfish stocks from the Provinces of New Caledonia and perhaps develop a genetic tag for restocked animals. Juveniles will be tested for disease by scientists from IFREMER and quarantined if necessary.

Project vision

In many countries, over-fishing of sandfish has caused a loss of income and a switch to fishing for species of sea cucumber of lower value. This project aims to supply a comprehensive outline of the methods for restocking sandfish in areas that have been, or may become, over-fished. In addition, there is ample scope for local communities to become involved in 'ranching' sandfish in fence enclosures at low cost and with little maintenance.

By examining the co-culture of sandfish with shrimp, the project will reveal strategies for producing by-crop species for shrimp aquaculture industries. Once definitive results of the methods and viability of co-culture are obtained, the technology can be progressively transferred to shrimp growers for large-scale culture. Co-culture may ultimately improve yields of shrimp to the industry because the digestion of organic waste products by sandfish has the capacity to improve pond conditions.

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