

Communications

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Potential breakthrough in hatchery culture of sandfish *Holothuria scabra* by using algal concentrate as food

This note reports on a potentially important advance in larval feeding strategies of the commercially valuable sea cucumber *Holothuria scabra* (sandfish). Reliable and routine methods for sandfish hatchery production have been developed (James et al. 1994; Agudo 2006; Duy 2010) and are based on the provision of live microalgae as the larval food source. Although a mixed-species diet composed of two to three species is generally considered preferable (Agudo 2006; Duy 2010), *Chaetoceros muelleri* can be effectively used alone throughout the larval culture period (Duy 2010). Duy (2010) also reported that Tahitian *Isochrysis* (*T. iso*) is a suitable diet for the first few days of larval rearing, but this species is inadequate as a complete diet (Knauer in prep.). Following settlement, sandfish pentactula and early juveniles are fed live uni-celled algae or diatoms (e.g. *Nitzschia*, *Chaetoceros*, *Skeletonema* species), as well as commercially available dried algae such as “Algamac 2000” and *Spirulina* (Agudo 2006; Duy 2010).

Culturing live microalgae can be unreliable and is expensive and technically demanding. Lack of appropriate resources and technical skills is a major constraint to hatchery-based mariculture development in many tropical countries. This is particularly the case in Pacific Island countries. While a variety of materials have been investigated as potential replacements for live microalgae as a food source for invertebrate larvae (Knauer and Southgate 1999), dried microalgae and concentrated microalgae in paste form have shown particularly promising results (Southgate 2003). Commercially available microalgae concentrates manufactured in the USA (Instant Algae®, Reed Mariculture) have been used as a sole food source for successful hatchery production of the winged pearl oyster in Tonga for the past three years as part of an Australian Centre for International Agricultural Research (ACIAR)-funded project (Teitelbaum and Fale 2008). Clearly, these products may have potential as a food source for the larvae of other marine invertebrates, including sea cucumbers.

A recent technology transfer project in Fiji (funded by ACIAR), attempted hatchery production of sandfish at the Department of Fisheries marine hatchery at Galoa, Viti Levu. Attempts to rear larvae were threatened by a low volume of available live microalgae and its relatively poor quality. But this provided a serendipitous opportunity to assess the nutritional value of the Instant Algae® product called Shellfish Diet 1800® for sandfish larvae. Shellfish Diet® is composed of a mixture of *Isochrysis* (30%), *Tetraselmis* (20%), *Pavlova* (20%) and *Thalassiosira weissflogii* (30%) (see manufacturer’s information: <http://www.reed-mariculture.com>). It is available in a one-quart bottle and has a cell concentration of around 2 billion cells mL⁻¹. It does not contain preservatives.

This trial was unplanned and feeding began in the normal way with the assumption that sufficient live algae would be available. From two 1,000 L larval culture tanks, tank 1 was provided with live algae (20 K cells mL⁻¹ of *T. iso*) on day 2 (first day of feeding) and a small amount on day 5 (10 K cells mL⁻¹ of *T. iso*). The bulk of the diet for the other 10 days of feeding (approximately 90% of that received by the larvae) was Shellfish Diet® (up to 45 K cells mL⁻¹). In tank 2, approximately 60% of the feed was provided by Shellfish Diet® over the same period. Larvae in two 500 L tanks (tanks 3 and 4) were fed predominantly live microalgae (*T. iso* and *Chaetoceros*) (approximately 60% over the culture period) supplemented with Shellfish Diet® as necessary. The larvae reared mainly on Shellfish Diet® (tanks 1 and 2) were present in reasonable densities at late auricularia stage (approximately 30% survival at day 9). They progressed to doliolaria stage (day 11) and settled as pentactula by day 15. The late auricularia and doliolaria had well-developed hyaline spheres, reached maximum sizes (as indicated in the literature), and appeared normal.

This is the first report of successful hatchery culturing of sandfish on a diet composed not exclusively of live microalgae. Indeed, our results, although preliminary, indicate that the majority of a live microalgae diet can be replaced by Shellfish Diet® without compromising growth and survival of sandfish larvae. This finding has major implications for further developments in hatchery culture technology for sandfish and tropical sea cucumber generally. Broad use of Instant Algae® as a food for sea cucumber larvae would be a cheaper, easier

and more efficient option for hatchery culture in Pacific Island countries and would allow diversification of low technology hatchery facilities within the region; a development that would be unfeasible if reliant on live microalgae production. Instant Algae® products have a shelf life of several months when refrigerated, and last up to two years frozen for selected species. Although relatively expensive to purchase per container, when compared to the running cost of a microalgae culture unit, there are significant cost benefits.

Much more research is required before such development could be considered, however. For example, there are questions about the physical behaviour of Instant Algae® in the water column (i.e. cells do not swim and are negatively buoyant) and whether the feeding regimes and culture systems (e.g. aeration) developed for use with live microalgae need to be modified to account for this. Purposely designed nutritional studies should be undertaken to determine if Instant Algae® provides the required nutrients for all development stages of *H. scabra* larvae (i.e. live microalgae may be required at some critical developmental stages), and to assess the relative nutritional value of the five products within the Instant Algae® range for sandfish larvae. These and other aspects relating to the use of these products with sandfish larvae will be addressed in ongoing research at James Cook University.

References

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Presentations at the 7th European Conference on Echinoderms: Echinoderm Research 2010. University of Göttingen, Germany, 2–9 October 2010

Caballero-Ochoa and Laguarda-Figueras: Zoogeography of holothurians (Echinodermata: Holothuroidea) of the Mexican Pacific Ocean [oral presentation].

Caulier, Flammang, Gerbaux, Rakotoarisoa and Eeckhaut: When a repellent becomes an attractant: Harmful saponins are kairomones that maintain the symbiosis between the Arlequin crab and their sea cucumber hosts [oral presentation].

Hennebert and Flammang: Echinoderms don't suck: Evidence against the involvement of suction in tube foot attachment [oral presentation].

Mezali and Paulay: About the taxonomic status of aspidochirotid holothurians inhabiting the *Posidonia oceanica* meadow in the Algerian area [oral presentation].

Navarro, Tuya and González: Population density and size distribution of *Holothuria sanctori*, *Holothuria dakarensis* and *Holothuria arguinensis* (Holothuroidea: Aspidochirotida) on Gran Canaria, Canary Islands (Central–Eastern Atlantic) [oral presentation].

Palazón-Fernández: Casual hermaphroditism in a population of the gonochoric sea cucumber, *Isostichopus badiotus* Selenka (Echinodermata: Holothuroidea) of north eastern Venezuela [poster presentation].

Reich and O'Loughlin: Modern holothurian calcareous ring anatomy and stereom structure — the need for more detailed studies and research [poster presentation].

Reich and Stöhr: Hard-part morphology of the sea cucumber *Eupyrgus scaber* (Holothuroidea: Molpadiida: Eupyrgidae) [poster presentation].

Rogacheva, Gebruk and Alt: Swimming in deep-sea holothurians: An adaptation to the mid-ocean ridge environment? [oral presentation].

Thandar and Arumugam: A new family within the holothuroid order Dactylochirotida [oral presentation].

From: Sharon Ng, Irwin Wong and Poh Sze Choo

WWF – Malaysia, 49, Jalan SS23/15, Taman SEA, 47400 Petaling Jaya, Selangor, Malaysia

Report on WWF – Malaysia Regional Workshop on “Feasibility of sea cucumber and abalone farming as an alternative livelihood in Semporna, Sabah”

A regional workshop that was organized and sponsored by WWF – Malaysia on the “Feasibility of sea cucumber and abalone farming as an alternative livelihood in Semporna, Sabah” was held from 14–16 April 2010 in Semporna. The workshop was attended by about 40 participants from Malaysia, Singapore and the Philippines, who included scientists, government officials, fishers, traders and representatives from non-governmental organisations (NGOs) and local coastal communities. This report focuses on the agenda and recommendations made specifically for sea cucumbers by workshop participants.

The objectives of the workshop were to:

- discuss the feasibility of sea cucumber and abalone farming as a supplementary livelihood in Semporna;
- review lessons learned and best practices in sea cucumber and abalone farming locally and overseas;
- identify the potential for a pilot project and partners for the project.

Papers presented at the workshop that are relevant to sea cucumber farming included:

- Introduction to Sulu-Sulawesi Marine Ecoregion (SSME), Semporna and objectives of the workshop: Kenneth Kassem;
- A review of sea cucumber and abalone fisheries in Malaysia: Choo Poh Sze;
- Sea cucumber ranching and lessons learnt in the Philippines: Ruth Gamboa; and
- Commercial sea cucumber farming proposal: Teng Seng Keh.

Main points of workshop discussion and recommendations

- It was felt that pen culture of sea cucumber is more suitable in Semporna because of soil conditions. The bedrock there is very near to the surface and building ponds in these places is a problem.
- A sea cucumber hatchery is necessary and there are two options to acquire broodstock: 1) buy from fishers or others in Sabah, or 2) import from neighbouring countries such as Indonesia and the Philippines.
- The Sabah Parks hatchery in Bohey Dulang is considered to be a suitable site to locate a sea cucumber hatchery.
- The state government should take the lead in setting up the sea cucumber hatchery.
- The state government should designate an area for sea cucumber farming. Locating farms in one particular area may also help aggregate broodstock and facilitate natural sea cucumber recruitment.
- It is felt that financing — in the form of micro-credit or interest-free loans for farmers — is necessary and should be provided by the government or NGOs. Rearing individuals to the minimum marketable size of 250 g may take up to 1½ years of culturing, and farmers may need financial support during the grow-out period.
- Government aid through the Projek Rakyat Termiskin project, which is directed at the very poor) and Projek Luar Bandar (Rural Development Project) should be explored for financing farmers.
- Integrated farming such as sea cucumbers with fish, or sea cucumbers with seaweed could be considered, especially in existing fish or seaweed farms.
- Field trips conducted on 16 and 17 April identified Nusa Tengah and Omadal as suitable sites for sea cucumber farming.



Participants of the regional workshop on “Feasibility of sea cucumber and abalone farming as an alternative livelihood in Semporna, Sabah” held in Semporna from 14–16 April 2010.



Participants were taken to several locations to observe the sea cucumber fishery in Semporna.

From: Choo Poh Sze

Sulu-Sulawesi Marine Ecoregion (SSME) consultancy for “A study on the feasibility of sea cucumber and abalone farming as a supplementary livelihood in Semporna, Sabah”: Project-5000-MY025611 and 5140-MY025641-INTL).

As the title suggests, this report explores the feasibility of farming abalone and sea cucumber in Semporna, Sabah. The report begins with a short review on the declining status of the abalone and sea cucumber fishery in Sabah, and suggests why farming these two species is important.

A literature review of sea cucumber and abalone fisheries in Sabah shows that natural populations of both resources are declining. Average annual sea cucumber landings from 2000–2005 was 137 tonnes while that for abalone from 2003–2005 was 39 tonnes. The high-value sandfish and teatfish fisheries appear to be very threatened and the sea cucumber fishery in Sabah comprises mainly lower-value species such as tigerfish, blackfish, curryfish, elephant trunkfish and lollyfish. The main abalone species exploited commercially is the donkey-ear abalone.

Presently, there are no fishing regulations specific to sea cucumber and abalone fisheries. As a result, overfishing of both abalone and sea cucumber has occurred. In the present study, 74% of the fishers surveyed indicated that abalone and sea cucumber resources have declined, and suggested that the fisheries should be regulated by imposing a minimum size at harvest.

There is an urgent need to stop the decline of both fisheries through aquaculture and sea ranching efforts. Fishing for sea cucumber and abalone provides livelihood options for many who are poor and landless; sustaining the fisheries will ensure that the poor are not deprived of a source of much needed income. Only 10% of respondents interviewed in this study reported monthly earnings of above RM1000 (RMD 1.00 = USD 0.30) — an amount exceeding the monthly poverty line household income of RM960 for Sabah.

Although culturing sea cucumbers has been conducted since the early 2000s, no sustained large-scale seed and grow-out production has been realized. Trials on grow-out in sea pens are restricted by an insufficient wild seed supply, and hatchery-produced seed are not available locally. Abalone farming has attracted participation from the private sector where species from temperate waters (*Haliotis iris* and *H. discus*) have been farmed successfully on a small scale. Farming of tropical and subtropical species (*H. asinina* and *H. diversicolor supertexta*) has also been successfully carried out on a commercial scale by a company in Labuan in East Malaysia. About 90% of fishers interviewed indicated their interest in farming abalone and sea cucumber.

A draft pilot project proposal to initiate the farming of abalone and sea cucumber (involving various government agencies and NGOs in Semporna) is also included in this report.

From: Martin Brogger

Dear friends,

The first Latin American Echinoderm Congress will be held from 13–18 November 2011 at Centro Nacional Patagónico, Puerto Madryn, Argentina. The second circular is available on the webpage of the meeting (in Spanish) at: www.cle2011.com.ar

The planned schedule includes: Sunday, 13 November, arrival and evening reception; Monday, Tuesday, Thursday and Friday half day, oral and poster sessions; Wednesday, field trips and evening banquet. Presentations in Spanish, Portuguese and English are welcomed.

Please do not hesitate to contact us if you want more information about the congress.

We hope see you in Puerto Madryn.

From: Cathy Hair

The “Asia-Pacific tropical sea cucumber aquaculture symposium” will be held from 15–17 February 2011 at the Secretariat of the Pacific Community (SPC) headquarters in Noumea, New Caledonia. Organising agencies for the symposium are the Australian Centre for International Agricultural Research (ACIAR) and SPC.

The symposium is an ACIAR initiative that will focus on the current status of research on tropical sea cucumber aquaculture, covering a range of topics such as recent advances in hatchery production technology; release strategies and farming techniques; management practices; post-harvest technologies for value adding; and supply chains and marketing.

The symposium will identify gaps in current knowledge and generate recommendations for future research to support development of sustainable tropical sea cucumber aquaculture. Symposium proceedings will be published following the meeting. This symposium provides a valuable opportunity to bring together key participants who are actively engaged in progressing tropical sea cucumber culture technology and developing its potential to deliver benefits to coastal communities. Requests for further information about the symposium program should be emailed to: Geneviève Mirc (GenevieveM@spc.int) or Cathy Hair (Cathy.Hair@jcu.edu.au).

From: Christine Mae A. Edullantes and Marie Antonette Juinio-Meñez

Department of Science and Technology through the Philippine Council for Aquatic and Marine Research Development for funding support.

The sea cucumber fishery has been a source of livelihood to many coastal villagers in the Philippines. However, due to its high demand on the international market, the landed catch and production of sea cucumber products have declined. *Stichopus* spp. locally known as *hanginan* is among the many sea cucumber species in the country that has a high economic value. The animal is usually collected in the intertidal zone, and is processed, dried and sold as trepang.

Part of the ongoing efforts of the Sea Cucumber Research Program at the University of the Philippines' Marine Science Institute is to develop management and culture technologies to rebuild depleted populations of commercially important species aside from *Holothuria scabra*. Culture trials for *Stichopus* spp. started in March 2009 in the outdoor hatchery of the Bolinao Marine Laboratory. Three batches of larvae have been produced from a spontaneous spawning in the hatchery, and a few thousand juveniles were successfully reared to >5 cm from the last batch of larvae. Early juveniles (~1 cm) were reared in submerged hapa cages at ~2 m depth. Growth was quite variable, some juveniles grew up to about 7 cm after three months of rearing in hapa cages while some juveniles were clearly smaller (Fig. 1). Further spawning trials and grow-out studies will be conducted to improve our understanding of the biology and ecology of the animal.



Figure 1. *Stichopus* spp. raised at the Bolinao Marine Laboratory.

From: Beth Polidoro, Marcelo Tognelli, Heather Harwell, Cristiane Elfes (IUCN Facilitators), Amancay Cepeda, José F. González-Maya, Diego A. Zárrate-Charry (ProCAT Hosts) and Juan José Alvarado, Milena Benavides, Chantal Conand, Erika Paola Ortiz, Ruth Gamboa, Jean-Francois Hamel, Annie Mercier, Steve Purcell, Veronica Toral-Granda (scientists)

IUCN Red List workshop for sea cucumbers

The International Union for Conservation of Nature (IUCN) Sea Cucumber Red List Workshop was held in Cartagena, Colombia from 17–21 May 2010. The workshop was convened by the Global Marine Species Assessment, an initiative of IUCN and Conservation International, and hosted by local NGO ProCAT Colombia. The primary goal of this five-day workshop was to bring together regional and international scientific experts to assess the conservation status and probability of extinction for approximately 300 species of sea cucumbers (Echinodermata: Holothuroidea: Aspidochirotida) for the first time, by applying the IUCN Red List Criteria. Results, in the form of Red List Assessments from this important workshop, will provide much needed information for marine conservation efforts for these species around the world, and will be made publicly available on the IUCN Red List of Threatened Species (<http://www.iucnredlist.org>).

The IUCN Red List assessment approach is based on assessing complete clades of species, in order to better understand the status of complete taxonomic groups and to provide baseline data for all species within a group. The assessment process relies heavily on the expertise and participation of hundreds of scientists and institutions. Sea cucumber workshop participants met at the Hotel Bahia in Cartagena, Colombia for five days to create draft Red List assessments for over 300 species of sea cucumbers. The goals of the workshop were to assess the 66 UN Food and Agriculture Organization recognized commercial species, as well as the remaining 250 species within the order Aspidochirotida. Based on a literature review and expert knowledge, participants provided information on each species' taxonomy, distribution, population status, habitat and ecology, major threats and conservation measures in place or recommended. This information was then used to collectively apply the IUCN Red List Categories and Criteria (IUCN 2001), which uses quantitative thresholds to determine each species' probability of extinction expressed as a Red List Category.

Over the next year, all species accounts and results from the workshop will undergo a thorough post-workshop review and consistency check before being finalized. During the review, additional experts will be consulted to fill in missing information gaps where possible, and all species account information and Red List Category classification will be checked for technical accuracy. In addition, a geo-referenced digital distribution map will be produced for each species to allow for further spatial analyses of results. Final products, including digital distribution maps, comprehensive species information, and final Red List Category for each species, are scheduled to be published on the 2011 IUCN Red List of Threatened Species.

The IUCN Red List Categories and Criteria are the most widely accepted system for classifying extinction risk at the species level. Comprehensive results from this first-ever Red List assessment of commercial and non-commercial sea cucumber species in the order Aspidochirotida will transform conservation priorities for these species across the globe, and will provide the most up-to-date review of each species' current state of knowledge and global population status. Once published, IUCN Red List assessments for a species can be regularly updated, depending on the availability of better or new data, and any subsequent changes in a species' Red List Category will serve as an important indicator of the success or failure of conservation actions.

Reference

IUCN. 2001. IUCN Red List categories and criteria version 3.1. Available: http://www.redlist.org/info/categories_criteria2001.html.



Participants of the IUCN workshop.

From: Chantal Conand

Dear friends, I would like to point you to DORIS, a new website run by the French Federation of Underwater Studies and Sports. Even if this website is in French, I'm sure our English-speaking colleagues will find some useful resources. The following presentation has been translated from their homepage.

DORIS: Underwater biodiversity as seen by divers...

DORIS (*Données d'Observations pour la Reconnaissance et l'Identification de la faune et de la flore Subaquatiques* – Observation data for recognising and identifying underwater flora and fauna) is a participatory site (<http://doris.ffessm.fr>) run by the French Federation of Underwater Studies and Sports (FFESSM). Designed by divers for divers but open to all, the DORIS site uses illustrated factsheets to make it possible to identify and inventory animal and plants species spotted during dives or at the edge of the water in French departments and territories. These species are described in a way that is both precise and comprehensible for the general public. For each one, the species' living conditions and locations are explained along with its most important biological characteristics and distinguishing features. Any need to protect it and any dangers it might present are explained and identified by logos. Each species factsheet is illustrated by a large number of original photos of the plant or animal on site. Here is an example of part of the factsheet on the sea cucumber *Thelenota ananas*.

The DORIS forum has become a meeting place for everyone who is interested in aquatic biology and its primary goal is to share knowledge and make it accessible to the public. The editorial team takes great care in verifying the information published, thanks to the support of informed amateurs or scientists, who review all the sheets. The same care is taken with the factsheets' illustrations through deliberately unusual and varied images.

With the support of some 700 volunteers, DORIS offers a French-language data and image base on aquatic life; a base that is unique in its kind and is constantly expanding: more than 1400 sheets on-line, 12,000 original illustrations, 690 terms explained in the glossary!

Having gained the recognition of the scientific community, DORIS has become a partner site for the French Inventory of Natural Heritage at the French Museum of Natural History in Paris. DORIS received the educational website award at the World Festival of Underwater Pictures in Antibes in 2007.

The DORIS team is open to all offers of assistance, which are, in fact, a basis for our success. We are always looking for people to draft factsheets, specialists to verify them and photos to illustrate them. If you would like to join us, even for a limited time, please do not hesitate to contact us!

The screenshot shows the DORIS website interface. At the top, there is a search bar and navigation links. The main content area displays the factsheet for *Thelenota ananas* (Jaeger 1833), also known as the Indo-Pacific tropical sea slug. The page includes a large photograph of the sea cucumber and several smaller images showing details of its papillae. The text describes the species' characteristics, such as its size (average 45 cm), its color (orange to brown), and its habitat (Indo-Pacific tropical seas, 5 to 30 m depth). It also mentions that the species is found in French territories like Réunion, Guadeloupe, and Martinique.

Figure 1. Part of the DORIS factsheet on *Thelenota ananas*.