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**Secretariat of the Pacific Community
and The WorlFish Center**



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Use of hatcheries to increase production of sea cucumbers

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High demand for sea cucumbers in Hong Kong, Singapore and mainland China has resulted in widespread overfishing of these valuable resources throughout the Pacific.

As stocks dwindle, investors and traders from Asia are looking for other ways to maintain supply. Based on the success of culturing one species of sea cucumber in the cooler waters of China, private companies are approaching countries and territories in the Pacific with proposals to construct hatcheries for sea cucumbers. Although this may appear to be a practical way of restoring and maintaining productivity, much caution is needed in assessing these proposals. Hatcheries can only be used to produce one species of tropical sea cucumber reliably at the present time and therefore have potential for very few locations.

Poorly planned hatchery operations run the severe risk of raising expectations that cannot be met, leaving participating communities disillusioned.

The purpose of this short briefing paper is to inform policy-makers in the Pacific about:

1. The main objectives and potential benefits of producing sea cucumbers in hatcheries.
2. The normal management measures that should be used to restore and maintain sustainable harvests of sea cucumbers.
3. The limits of technology for restocking and sea ranching tropical sea cucumbers.
4. Conditions that need to be met by sea cucumber aquaculture investors to protect wild sea cucumber stocks.

The main objectives and potential benefits of producing sea cucumbers in hatcheries

Before managers consider whether investment in a sea cucumber hatchery may provide a benefit to their country, they need to have a clear understanding of the status of their sea cucumber fishery. They should apply the approach outlined in the recently published sea cucumber fisheries manager's toolbox [1] to determine this status.

In theory, hatcheries provide managers with: 1) an option for restoring severely depleted fisheries for sea cucumbers through 'restocking' programmes, and 2) a way of increasing production through 'sea ranching' projects.

'Restocking' is defined as the release of cultured juveniles into wild population(s) to restore severely depleted spawning biomass to a level where it can once again provide regular, substantial yields.

'Sea ranching' is defined as the release of cultured juveniles into unenclosed marine environments for harvest at a larger size in 'put, grow and take' operations.

However, restocking represents just one of many options available to managers for rebuilding an over-exploited fishery (see below). Sea ranching is a possible way of producing more sea cucumbers, but many conditions need to be fulfilled for it to be successful (see below).

Other management measures to restore and maintain sustainable harvests of sea cucumbers

The sea cucumber manager's toolbox [1] provides an easy guide to help managers identify the status of their sea cucumber fishery, and the various measures that should be used to restore production and then maintain sustainable harvests. These management measures include:

- **Declare no-take zones** in areas where sea cucumbers are known to spawn to protect adequate numbers of adults. If permanent no-take zones are difficult to establish, use temporary or rotational fishing closures for periods of 5-10 years instead. The larvae produced in no-take zones will replenish nearby fishing grounds.
- **Apply minimum size limits** to sea cucumbers outside no-take zones so that they can reproduce before they are harvested. Size limits also help fishers earn more for each sea cucumber they catch. Size limits should be applied to processed (dried) sea cucumbers (bêche-de-mer) at export gateways but fishers should also be provided with corresponding size limits for live animals so that they know which ones to retain.
- **Inspect all exports of bêche-de-mer** to check that they comply with size limits. Impose heavy penalties (including loss of export licence) on exporters who break the rules. Limit the number of enterprises licensed to export to make it easier to inspect all bêche-de-mer leaving the country.
- **Restrict fishing methods** for sea cucumbers. Ban the use of compressed air (SCUBA and hookah), weighted spears ('bombs'), small dredge nets and the use of lights at night. These gear restrictions will help maintain the natural 'refuges' of species created by their distribution and behaviour. Permit only a mask and snorkel to be used for collecting sea cucumbers

(NB. See the sea cucumber manager's toolbox for a more complete list of the management actions needed)

Only when a sea cucumber species has been fished so heavily that the animals are too far apart to reproduce, should restocking be considered. Even then, it will usually be a lot easier and less expensive to place enough of the remaining individuals in 'no take zones' to create effective spawning aggregations, and to manage those remaining outside the no take zones using the measures outlined above. After all, creating effective spawning aggregations is the ultimate aim of a restocking program.

More details about how to use the remaining wild sea cucumbers to form effective spawning aggregations to help rebuild depleted sea cucumber fisheries are available in a recent publication called 'Restoring small-scale fisheries for tropical sea cucumbers [2].

The limits of technology for restocking and sea ranching tropical sea cucumbers

In recent years, China has developed a large industry based on pond farming and 'sea ranching' of one species of sea cucumber, *Apostichopus japonicus*. Indeed, China now produces more sea cucumbers from hatchery-based operations than the rest of the world harvests from the wild. However, this technology cannot simply be transferred to the species of sea cucumbers that live in the tropical Pacific.

Such transfer takes a long time and much investment to accomplish successfully. So far, the transfer of technology to the Pacific has been limited to just one species of tropical sea cucumber, the ‘sandfish’ (*Holothuria scabra*). The WorldFish Center has spent almost 10 years developing the basic technology to produce this species in hatcheries at modest scales [3].

Therefore, *hatcheries for sea cucumbers in the Pacific can only be expected to produce one species* in large numbers and at suitable sizes for release in the wild until further research and development is undertaken.

Astute and responsible investors will understand that a hatchery for sea cucumbers in the Pacific has potential mainly for sea ranching, and only for sandfish.

Conditions to be met by investors when construction of a hatchery is deemed to be in the national interest

If and when an investor proposes to construct a hatchery for the purposes of sea ranching sandfish, and careful analysis by independent experts shows that this may have net benefits for the country, managers need to be sure that the following conditions will be fulfilled.

1. *Under no circumstances should investors in a hatchery for sea cucumbers be permitted to engage in fishing for sea cucumbers in the wild.* There have been proposals in the region by private companies to negotiate access to wild stocks on the promise that the overall abundance of the resource will be increased through the release of hatchery-reared juveniles. However, the juveniles were not reared to a size large enough to survive well in the wild, and no evidence was provided that they contributed to the wild stock. A grave concern is that a proposal to release hatchery-reared juveniles in the wild is simply a façade to gain access to sea cucumber resources.

Therefore, sea cucumber hatchery investors, their staff and associates should have no access to, or other connection with, the wild sea cucumber fishery or stocks. Their activities should be limited to sea ranching projects in limited areas. Hatcheries used for restocking programmes (in the rare event that they are absolutely necessary) should be operated by traditional owners of sea cucumber resources and the independent NGOs and regional agencies prepared to support such interventions.

2. For sea ranching projects, there must be a robust partnership with local resource owners, who agree to provide access to suitable habitat for the grow-out of sandfish to market size, in return for acceptable and agreed benefits. The partner community needs to have sole authority to grant access to the area, and the risk of illegal or unauthorised harvest (poaching) needs to be very low.
3. The investor must have sufficient capital, and must employ qualified hatchery staff, to produce the numbers of juvenile sandfish needed to make sea ranching operations profitable. Note that the juveniles need to be grown to a size of about 3-5 g before they are released. Even then, high levels of mortality (>80%) can be expected before the animals reach market size.

4. Hatchery-reared animals must be released into limited designated areas belonging to communities, and harvesting operations for the sea ranching project must not involve collection of any animals from outside these designated areas. For sandfish, the area of suitable habitat required for the number of released animals estimated to survive to market size (5-20% of the number of juveniles released) can be estimated approximately as 5 m² per surviving animal.
5. Harvest size should well exceed the minimum size at first maturity so that the released animals also contribute to the replenishment of the wild stock both within and outside the designated sea ranching area. (The extent of these benefits will depend on the nature of the local currents for dispersing larvae).
6. Hatchery operations should be environmentally responsible, viz.
 - a. Broodstock for use in the hatchery should be collected from the area where the juveniles are to be released to prevent 'genetic pollution' of stocks.
 - b. Broodstock or juvenile sea cucumbers must not be imported from overseas. This will also prevent genetic pollution and minimize the risk of introducing diseases to hatcheries, which can later spread to infect wild stocks.
 - c. The hatchery should be located where effluents will not contaminate the environment.
7. Investors should bear the cost of demonstrating that their proposal to construct a hatchery and operate a sea ranching project for sandfish is socially and commercially viable, and environmentally responsible. The proposal should be assessed by independent experts.
8. In the event that an investor proposes to construct a hatchery for other species of sea cucumbers, they should provide evidence that they have the capital and commitment to do the research and development required to produce commercially viable technology for the mass production of juveniles that are large enough to survive at high rates when released in the wild. Any such proposal should be limited to species of sea cucumber that occur naturally in the country. The conditions outlined under (6) above should also be applied.

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References

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