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Title:	Increased effectiveness of mariculture hatchery systems in the Pacific
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Summary/short description/key points:

- Mariculture hatcheries in the Pacific, produce the following commodities: giant clams, shrimp/prawns, pearl oysters, sea cucumbers, marine finfish, and some propagation of seaweed.
- The mariculture of larvae of marine animals requires the maintenance of broodstock, filtered seawater, the production of live feed, until the settlement of larvae in the case of bivalves and holothurians, or the weaning onto feed pellets for finfish and shrimp.
- The operation of mariculture hatcheries requires expertise in biological management and biosecurity, aquaculture engineering, but also personnel and financial management.
- In the Pacific, marine hatchery operations must also manage risks to production exacerbated by supply chain issues and the impacts of tropical climates on their infrastructure.

Recommendations:

a) Members update SPC on their public and private sector marine hatchery development and production bottlenecks, risks, or problems that they have experienced.

b) Members are asked to consider their capability for categories of mariculture hatchery operation including biological, engineering, personnel and financial management, and advise SPC on areas of preferred capacity development.

Increased effectiveness of mariculture hatchery systems in the Pacific

1. Mariculture hatcheries are needed for 'full cycle mariculture', where the whole of a marine species' life cycle is under culture.

2. Full cycle mariculture allows a more efficient expansion of genetic improvements (domestication), which can improve the efficiency of mariculture production systems rapidly.

3. Marine hatcheries are land-based mariculture systems, principally flow through systems.

4. Marine hatcheries may have the following operational components:

    - Broodstock quarantine maintenance and gamete collection.
    - Live feed production.
    - Larval rearing.
    - Settlement (of shellfish) or weaning (first feeding of finfish).
    - Juveniles growing in land-based nurseries.
    - Size grading.

5. Marine hatcheries can be 'small scale' with a lower capital investment selling seedstock into a wider industry, such as milkfish hatcheries in southeast Asia, or they can be very large-scale capital investments of tens of millions US dollars.

6. The following groups are produced by marine hatcheries in the Pacific Island countries and territories (PICTs):

    - Giant clams
    - Shrimp or prawns
    - Pearl oysters
    - Sea cucumbers
    - Marine finfish

7. Most widespread marine hatchery-based mariculture in the Pacific are endemic species with relatively simple and short larval cycles, and low marine farm investment (giant clams).

8. Groups, excepting seaweed, require the production of live feed (a progression of microalgae, rotifers, copepods and *Artemia*, depending on the group) or the use of preserved live feed. The use of preserved microalgae feed (microalgae pastes or freeze-dried powder) currently reduces productivity from that obtained from live feed.

9. Mini (very small scale) hatchery development is only currently feasible for species that have larval cycles amenable to preserved feed, presently in the PICTs giant clams and sea cucumbers.

10. Mini hatchery development may reduce investment to a level accessible by communities, that have traditional marine tenure to develop marine farms in appropriate coastal areas.

11. Operation of a mariculture hatchery includes the management of the following workflows or systems:

    - *Biological management*
      (Water quality, species physical characteristics, behaviour, growth, nutrition, disease susceptibility).
    - *Aquaculture engineering*
      (Design standards, quantity surveying, construction methods, mechanical/electrical/plumbing systems (MEP), materials, energy efficiencies, mass balance (inputs = outputs), wastewater treatment).
    - *Personnel management*
      (Communication, empowerment and trust, fairness and equity, standard operating procedures, team building, after hours work).
    - *Financial management*
      (Budgeting, planning, accounting, production planning, risk management)

12. The control of people and equipment entering hatchery areas is important to preserve biosecurity. It is important to providing staffing and facilities to enable the maintenance of a reasonable level of hygiene in marine hatcheries.

13. Communication is of importance in a marine hatchery, to ensure clarity and understanding of complex information required, to manage biological and engineering systems. Engagement of both staff and management is necessary to enable productivity.

14. The establishment and use of standard operating procedures (SOPs) allows for the site-specific amalgamation of biological and engineering information, that encourages a standardisation of decision making, and a replication of effort and improves communication.

15. Production planning, the determination and prediction of the number or quantity (biomass) of the 'biological assets' (animals or plants) that may be produced by a marine hatchery, is an important component of its biological management and financial planning. Production planning also allows the determination of the unit cost of the species produced, to evaluate the sustainability of a marine hatchery operation, either through full cost recoveries or the acquisition of development funding.

Conclusions

16. Marine hatcheries are essential for mariculture industry development in the Pacific Island countries and territories (PICTs).

17. Operating a marine hatchery demands proficiency in biological management, aquaculture engineering, personnel management, and financial management.

18. PICTs' goal of developing marine hatchery-based mariculture requires substantial and long-term funding. Regional agreements and biosecurity capacity development can enhance the effectiveness of this funding, allowing for regional stock movement.

19. For community investments and traditional marine tenure rights, 'mini mariculture hatcheries' with suitable live feed alternatives may be suitable.

Breakout group questions

1. What marine commodities are produced by mariculture hatcheries in your country/territory that you know of? Are the mariculture hatcheries private or public sector?

2. What marine commodities are coastal communities interested in from your experience? Are commodities for food security or economic development?

3. Does successful community-based fisheries management provide a pathway to community aquaculture? Should efforts for community-based fisheries management be recognised by the formal and developmental financial sector to enable pathways for community mariculture hatcheries of small investment?

4. Would regional mariculture hatcheries of significant investment and complexity be of interest to supply marine seedstock to several countries/territories? Can biosecurity and genetic risks be managed for the importation of non-endemic marine seedstock?