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Evaluation of the DOF marine research station in Myeik, Myanmar

Visit to Myeik April 25-28 2017

IMR Project no. .....

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Scope of work

1. Visit the DOF marine research station in Myeik
2. Issues regarding maintaining and running a marine research station.
3. Make an assessment of the needs and costs of upgrading the Myeik research station, including ongrowing facilities, to a higher standard.
4. Outline pros and cons for e.g. moving the station to the main land.

1. Visit the DOF marine research station in Myeik

This report is based on a three day visit to the area of Myeik in the region Thaninthary, Southwest in Myanmar. Two days were spent at the DOF research station at the Kadan Island for inspection and discussions with the key staff from DOF Myeik involved in local marine aquaculture (mariculture) development.

The DOF marine research station at Kadan island (Myeik).

Myeik is a fishing town located by the Adaman Sea. The population is 115 000, to a large extent depending on fishing and mariculture activites in the region. DOF has a District office in Myeik and the DOF marine research station is located on Kadan island.

I was briefed by Assistant Director Mr Kyaw Sone Tun (M.sc) and his two key hatchery biologist's Mrs Nyunt Htay and Ms Tin Tin Ye, holding B.sc in Zoology, about the operational aspects and conditions at the DOF research station. In addition, I met with the DOF District Director in Myeik and a local owner of a fish and aquaculture business in Myeik.

Mr Kyaw explaines about the Kadan Island locations and the DOF research station

The research station can only be accessed by boat, a journey that takes about 30 minutes with speedboat from Myeik (about 30 knots).

The station consists of several small buildings functioning as hatchery facilities for production of Asian sea bass fry. The target of the station is delivery of fry and fingerlings to the local fish farmers. DOF has selected Asian sea bass (Lates calcifer) as a target species. The Asian sea bass is appreciated in most markets in South East Asia as well as in the US and Australia. It is a species well adapted to the environmental conditions in the region. The local farmers ongrow the fingerlings in wooden cages (3mx3m) until the fish reach a market size of 0.5-0.8 kg (<1 year cycle). The delivery of farmed fish from farmers in the region has been estimated near 150 metric tons annually (ref. DOF in Myeik).

Schematic overview of the DOF marine research station on Kada Island

The DOF research station can only supply part of the local demand for fingerlings. DOF is the only public supplier of fingerlings in the region and the station on Kadan island has rather low capacity for delivery of the correct size fingerlings (2, 5-3 inch) to the ongrowers. Today the research station is delivering mainly small seabass fry (<0.2 gram) that are 20-25 days post hatch. The fry are first delivered to a pond system on the main land, where they are grown 1-2 months in earth ponds, until they are large enough to be stocked in the cages. The fingerlings are then shipped back to the farms located around the Kadan Island. The logistics is not good for obtaining optimal fish health and welfare conditions, but is currently an adaption to cope with the restriction in holding capacity at the research station.

The fingerling production cycle depends on the natural spawning season of the region (January to May). DOF keep brood fish in a small cage farm by the Kadan Island. During the spawning season mature fish are moved to the DOF hatchery to spawn. Since fingerling production depends on the seasonal spawning cycle, the fingerlings can only be delivered to farmers 2-3 times annually.

A few private farmers in the region are also involved in some of the upstream activities (hatchery cycle of grouper), and some farmers import grouper and cobia fingerlings from Thailand and Taiwan. The status of aquaculture in the Myeik region is similar to the development seen in Thailand a few decades ago. The farm technology applied in Myeik requires low investment, and due to the smaller scale farms, it can be operated by manual labor. The operational model has several limitations when it comes to biological performance and predictable outcome, and the model depend on choosing species with known biological performance and market price. The cycle from egg to market needs to be as short as possible, and the growth rate and survival rate must support an expected market price. To lower biological and economical risks, the farmers prefer to grow several different species within the same cage farm.

I visited a fish farm in the vicinity to the DOF research station. These fish farms have local ownership and employees from the island village.

Local cage farm, holding several species (seabass, grouper, cobia)

2. Issues regarding maintenance and running a marine research station

To be able to master the hatchery stage and development of a marine fish species, the following areas needs to be in focus for development and research activities:

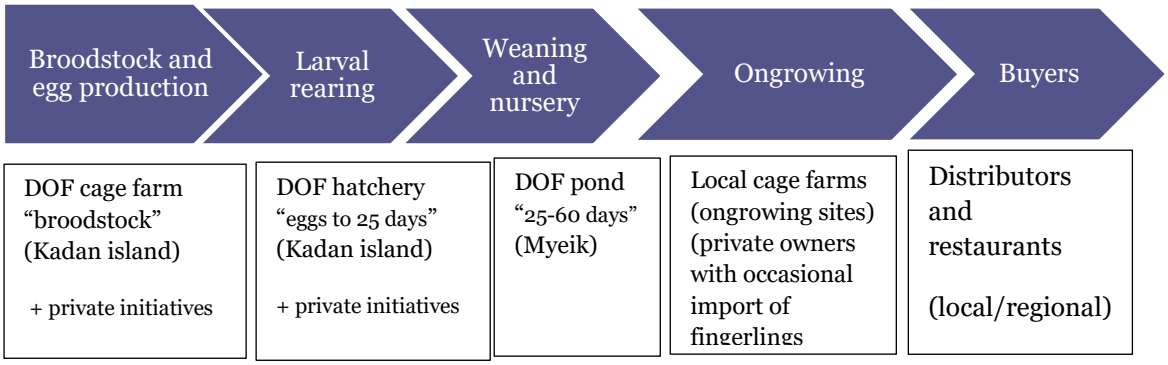
1) brood fish maturation and egg production
2) live feed production (rotifers/artemia/zooplankton)
3) fish larvae production techniques (both biological and technical aspects)
4) weaning of fry onto artificial diets (dry feed adaptation and nutrition)
5) nursery production to grow and grade out fingerlings of the correct size and quality to the customers (ongrowers) cage farms (biological and technical aspects)

A marine research station needs to focus on the species that are most attractive to target customers (farmers, traders, researchers etc.). To master a complete hatchery cycle of various marine species requires biological knowledge within the different development stages of the specie's life cycle (ref. 1-5). This will also require a certain standard of the facilities and application of suitable and sustainable technology. Several types of technology can be applied to a fish species, but the technology needs to be adapted to the market and market value as well as the expected operational cost.

Currently, the DOF hatchery in Myeik do not have sufficient resources (it is small facilities lacking operational funding) to improve outcome and revenues from fry/fingerlings of Asian sea bass and some improvements (investments) will be necessary to improve the capacity and to complete the life cycle of a fingerling size that is required by local cage farmers. Further, the operational budgets need to be increased in order to operate the hatchery with a production line of sea bass combined with a training and development program (see Chapter 3).

Regarding artificial diets (4. and 5); many feed qualities are available in the international market, depending on location and known adaptations towards various species. In the Myeik region, the farmers use "scrap" fish (local catch) combined with pelleted feed imported from Thailand. Control of the feed supply (both live and artificial feed) is among the key control points in a marine hatchery. The "green house" techniques applied in most marine hatcheries, the so called "extensive" technique (typical to South East Asia), has limitations when it comes to predictability and development of scale, but usually this technology will provides high quality fry/fingerlings of good health status that can be transferred to the ongrowing farms.

A marine research station needs to have facilities that can support studies and research programs etc. Most studies will need confirmation from duplicate or triplicate tank setups with options for control groups. In Asian sea bass and the high valued fish species of groupers, the early life stages are similar to sea bass but require different protocols for feed and water quality. This is particularly valid for bloodstock maturation and larval rearing. The groupers will require environmental stability and a higher quality of live feed items then the sea bass. The type of investments allocated to a marine research station should also keep in mind that the facilities are able to culture several species as well as being campus for training/research programs. Logistics and access to a hatchery will need to hold a minimum standard in order to support a 24/7 work schedule for staff and researchers.



The current aquaculture "value chain"for the mariculture activities in the Myeik region

The most commonly farmed species in the region; Asian sea bass(left) and Tiger grouper (right)

3. Make an assessment of the needs and costs of upgrading the Myeik research station, including ongrowing facilities, to a higher standard

Marine fish and hatchery models

The main operational costs in a research station that works with the cultivation of marine species are labor, feed ingredients and energy. Modern large scale hatcheries, which are built for the "intensive" targets of mass production (often a single species), require investments in biosecurity facilities and very high standards of automation, security and operational stability (often through implementation of modern RAS technology). This model enables the farms and/or research stations to operate at a maximum capacity level, independent of seasonal fluctuations. In general, this model is progressing in Norway and other countries that are industrializing aquaculture and fish farming.

It will be an advantage to build a integrated hatchery at the same location, including a holding and spawning facility for brood stock recruits and spawning. However, such a program will require a long-term plan of sufficient funding and investments in both biosecurity and breeding programs. To describe and implement a breeding program organized by DOF Myeik is not a part of this evaluation, but a breeding program should be considered in a longer-term development plan for the region. It will typically need to be a part of a species selection program.

Aquaculture of marine fish species, such as Asian sea bass and groupers, are well developed in many countries in South East Asia (SEA), and the biologists from the DOF research station have previously also visited research stations operated by DOF Thailand, to participate in short term training courses. The "green house" technology used in Myeik is common to SEA, and the key staff master this technology at the present level. However, the hatchery on the island has several restrictions ("bottle necks") related to both capacity and operating budgets, hence the potential for improving the production of marine fingerlings at the existing research station is good.

"Green house" technology applied at the research station

Description of the proposed upgrading of the research station at Kadan

1. A main “bottle neck” at the research station is the current capacity of seawater available to the hatchery activities. The water intake should be extended farther out from shore to enable pumping of more water over a longer period. Moving the intake will help to reduce the level of silt and sand with the intake water. The old pump should be replaced by electrical pumps operated by generator.
2. It is recommended to look into a borehole option (wells) drilled near the shoreline. This option will stabilize and improve water quality to the hatchery and provide stable holding and spawning conditions for brood stock on a year around basis. In order to work with the higher valued species (mainly groupers), stable salinity will be of importance. A geological evaluation of the shoreline and the water quality should be performed as a separate project. The borehole alternative should be investigated based for instance on solutions applied at marine hatchery sites in South America (shrimp).
3. A second header tank (reservoir) for seawater should be constructed adjacent to the existing reservoir, thus more then doubling the capacity for holding seawater.
4. Seawater from the pump station should be sand filtered prior to the reservoirs, and water from the reservoirs should be pumped in separate pipe lines, through cartridge and UV-filtration, prior to being used to the live feed and fish rearing sections.
5. The second main bottleneck today is capacity and proper design of fish tanks for ongrowing of fry and fingerlings after 20-25 days of the cycle, thus avoiding the shipment of small fry to external ponds in Myeik with later return to the Kadan area. It is recommended to invest in a new fish tank facility that will complete the fingerling cycle at the Kadan Island (50-70m 3 of tank volume). Seawater will be supplied through installations as proposed under the 1-4.
6. The new installations require a higher energy consumption, which currently needs to be supplied from new diesel generators. It is suggested that the higher energy demand to the live feed and fish areas are fully covered by diesel generators. A solar panel system (including batteries) should cover the extra demand for electricity that will be related to acitivities at the administration and laboratory facilities. It is a future plan for extending the power line from the village at Kadan to the DOF research station. When this occure, the generators will function as permanent back up solution during unexpected power cuts.

7. It is suggested to improve the access to Island, to enter close to the research station. It is proposed to build a wooden quay of sufficient length in order to get closer with the landing point for boats and equipment.

The seawater pump needs to be replaced

The water intake should be moved further out from the shoreline

A new reservoir tank should be constructed adjacent to the existing reservoir (picture)

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Some of the buildings need to be repaired

Investment budget (technical equipment – by Norwegian projections)

New items	**USD** **estimates**	
New intake pump	6 250	
Booster pumps	1 875	
Sandfilter	2 500	
Bagfilters	2 000	
Diesel generators	25 000	
Air blowers	7 500	
Fish tanks (ongrowing of fingerlings)	37 500	
Solar energy panels (incl battery)	5 000	
Grading and counting equipment (manual)	2 500	
Total	**90 125**	

Investments in new infrastructure (materials and equipment that needs to be arranged through DOF)

There will be additional investments needed to support installations of the technical equipment. This is related to purchase of pipe materials (PEH and PVC), plumbing installations, electrical wiring, shade cloth structures, wood and metal supports and roofing materials to repair the most worn out buildings. These investments will depend strongly on local resources and prices. Roughly, I estimate these cost items to be within a range of USD 15-20 000.

A new water reservoir, pumphouse for booster pumps, construction of a quay (wood) and a new concrete platform to support ongrowing tanks for fingerlings, are estimated at USD 40-45 000 (needs to be confirmed by DOF).

It is reasonable to believe that an upgrading of the infrastructure at the research station can be expected to cost USD 55 000–65 000.

The proposed investments will lead to higher running cost (operational cost). The direct running cost consists of mainly energy and feed items that need to be covered over the DOF operational budgets. The fixed running cost will as well increase due to the higher demand for maintenance of new equipment and buildings. The total operational budget for the station will depend on the detailed plan concerning fingerling production and additional costs for starting research and development programs.

Installations of the proposed technical equipment should be based on more detailed engineering projections before starting an order process. This will require some minor resources over the IMR budget.

4. Outline pros and cons for e.g. moving the station to the mainland.

Due to the early state of marine aquaculture activities in Myanmar and the limited resources currently allocated to the DOF research station in Myeik, it is recommended an upgrading of the existing facilities at Kadan Island. The location has some benefits in relation to water quality aspects, and also the fact that the staff working at the station today have some operational experience with the "green house" technology for culturing marine species. Because of the upgrading, it is required higher budgets to support research, labor, energy, feed purchase/storage and a maintenance program to rise the standard of both equipment and infrastructure.

The pros of moving the research station to the main land means that a new station should be designed and constructed from scratch in accordance with a long term strategic development program, making it possible to build a fully integrated station in accordance with the "industrialized model" described in chapter 3.

The cons in relation to moving the station to the mainland would be the fact that a new station will require an area with the correct conditions for access to clean and high quality seawater, controlled conditions and permits for discharge of fresh and seawater, and general low risks concerning possible impact from other activities in the vicinity.

A pro but also a con will be the fact that a research station, being relocated to the mainland, should be based on modern RAS technology to control all aspects of water quality and operational procedures in the hatchery sections, thus being independent of seasonal variations. A modern hatchery concept will, however, require higher capacity and output of fingerlings towards a broader type of market. This is to enable an operation of a research station that are both biological and economical sustainable. In other words, the timing for a research station to support the current growth and industrialization of mariculture activities in the Myeik region may not be correct for today, but maybe over a 5-10 year period.

The longer time period to perform site selection programs, permit processing, new employment with gradual competence building as well as demand for proper engineering and construction of the station, will require investments 8-10 times of what has been proposed for upgrading the existing station at Kadan Island.