



## **FCFS-R5-067: Management of Knowledge Transfer Programme on Good Aquaculture Practices to Seabass Cage Culture Farmers in Tumpat, Kelantan**

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### **Abstract**

*Seabass brackish water cage culture is a very profitable and challenging enterprise. However, the main problem of the culture is high mortality of fish due to factors such as improper management, water quality, environmental and diseases. The fish farming community in Laguna Sri Tujuh, Tumpat, Kelantan, has been continuously facing poor production of seabass due to high mortality of fish (fish kill) and poor aquaculture practices among fish farmers since the start of the cage culture in 2003. Knowledge transfer programme on good aquaculture practices (GAP) was initiated and undertaken by a group of researchers from Universiti Malaysia Kelantan (UMK) in January, 2016. Knowledge on GAP was transferred to the community through onsite training by using the Department of Fisheries (DOF) Malaysia seabass cage culture cluster project site as a model for this community. Guidance on water quality monitoring and methods on improving water quality were demonstrated. Important records such as daily mortality rate, feed consumption, fish stocks, and water physical properties were established. The farmers were taught on proper way of grading fish, feed and feeding management, proper waste disposal, prudent use of drugs, and use of immune enhancers as preventive medicine. In addition, Faculty of Veterinary Medicine, UMK also provides fish disease diagnostic services to the fish farmers. It is envisaged that the seabass cage culture farmers who participated in this programme will be able to improve their production and raised their income by reducing fish mortality. The programme also aims to strengthen collaboration among fish farming community, DOF's authority and researchers of UMK in promoting GAP*

*for sustainable and profitable aquaculture. The programme will also produce a competent graduate intern with knowledge and technical skills in the brackish water cage culture, enhancing her employability in the aquaculture sector.*

**Keywords:** *Good Aquaculture Practices, Seabass Farming Community, Knowledge Transfer Programme, Malaysia*

### **1. Introduction**

As most of the captive fisheries are already at or beyond its production limits, aquaculture has become the fastest growing food producing sector in the world (World Fish, 2015). Malaysia national food fish production in 2014 was 1.98 million tonnes valued at RM 11.97 billion, contributing to National GDP 1.1%, and 14.4% agriculture GDP. Marine and brackish water culture contributed to about 30.3% of the total aquaculture production by commodity (DOF, 2014). Among the marine and brackish water fish species cultured in Malaysia, seabass (*Lates calcarifer*), constituted over 80% of the production in Malaysia (DOF, 2014). Seabass is one of the most popular cultured fish species because of its ability to breed in captivity; relatively easy to rear with fast growth rate, and has a delicately flavour flesh which fetch a high market price. In Kelantan, seabass brackish water cage culture is a very profitable and challenging enterprise contributing to significant social economic growth of fish farming communities. However, the main problem of the culture is high mortality of fish due to many factors such as improper management, water quality, environment and diseases (Idris, et al., 2013).

A fish farming community in Laguna Sri Tujuh, Tumpat, is one of the active areas of marine cage culture in Kelantan. However, the community has been continuously facing poor production of seabass due to high mortality of fish and poor aquaculture practices among the fish farmers since the start of the cage culture in 2003. Estimation of losses due to fish kill by DOF is about RM 0.1 million in 2003, RM 2 million in 2007, RM 0.5 million in 2009, RM 0.02 million in 2012 and RM 0.02 million in 2014 respectively according to the records of DOF in Kelantan. Thus, a knowledge transfer programme on good aquaculture practices was initiated and undertaken by a group of researchers from Faculty of Veterinary Medicine in Universiti Malaysia Kelantan in January 2016. The aim of the programme is to improve fish production and raised the income of fish farmers by reducing mortality through good aquaculture practices (GAP). The programme also aims to strengthen collaboration among fish farming community, DOF's authority, and researchers of UMK in promoting GAP for sustainable and profitable aquaculture. The programme will also produce a competent graduate intern with knowledge and technical skills in the brackish water cage culture, enhancing her employability in the aquaculture sector.

## 2. Methodology

Through the KTP, the Department of Higher Learning, Ministry of Education has transferred a fund to UMK to support the knowledge transfer programme on GAP to the seabass cage culture community in Laguna Sri Tujuh, Tumpat, Kelantan for two years starting on 1st December 2015 till 30 November, 2017.

The programme has started in January, 2016 by a consensus among the DOF's Authority, the fish farming community association of in Laguna Sri Tujuh, also known as "Persatuan Penternakan Ikan Siakap Laguna Sri Tujuh (PPILS7) and UMK researchers. It was agreed the programme will use the DOF seabass cage culture cluster project site for GAP knowledge transfer programme. In the cluster project, the government through DOF provides the infrastructure, cages, nets, feed and fish for the project while the community farmers provides the manpower through the PPILS 7. Daily operation is run by a few staff paid by PPILS 7.

Information on the culture site and demography profiles of the fish farming community was obtained from the DOF's authority and the secretary of PPILS7.

A graduate intern was employed under the KTP fund and stationed full time on site to monitor the daily operation of the culture activities and assist in record keeping. Knowledge on GAP was gradually transferred to the community by the UMK team through on-site training and demonstration of technics in DOF cage culture cluster project site as a model to

this community. Training on how to handle fish during grading including fish anaesthesia, proper feed and feeding management, proper disposal of death fish to prevent contamination of water and environment including waste management, prudent use of drugs and use of immune-enhancers were demonstrated on site in the cluster cage culture. Guidance on how to monitor water quality and methods on improving dissolved oxygen were demonstrated. The graduate intern also established proper records system for data collection and record keeping.

There is an Aquatic Animal Health Lab in the Faculty Veterinary Medicine, UMK. The researchers in UMK also provide fish disease investigation and diagnostic services whenever there is fish mortality. UMK researchers work closely with the Fisheries Research Institute (FRI) in Tg. Demong, Terengganu during disease investigation of fish kill.

All the process of knowledge transfer and the GAP will be published as a GAP Manual for the farmers at the end of the programme. Appropriate findings or case studies will be sent to scientific journal for publication.

## 3. Results and Discussions

The seabass fish farming community that is involved in the KTP programme is located in Laguna Sri Tujuh, Tumpat, Kelantan. It is about 30 km from Kota Bharu, Kelantan. The site has been in operation since 2003, i.e. about 13 years ago. The area is about 24 hectares and  $\frac{3}{4}$  of the 24 hectares has been used for cage culture (Figure 1). The lagoon has a potential of producing 622 tonnes/year or about 30-40 tonnes / month, valued at RM 6.7 million. Majority of the fish species farmed in this area are seabass (92%) while the rest are tilapias (8%) and groupers (8%). There are about 2,527 cages for 98 farmers and the average annual production is about 120 to 180 tonnes. Eighty percent (80%) of the production are mainly exported to Singapore and Thailand while 20% are sold locally. The farming of seabass cage culture here is very promising and has already been seen to generate a steady source of income to the fish farming communities in Laguna Sri Tujuh, Tumpat, Kelantan.

The fish farming community in Lagunan Sri Tujuh has set up an association known as PPILS7 to facilitate the operation of seabass culture in the Lagoon. There are 98 members PPILS7 and the members consisted mainly of local Malays (90.8%); Chinese (2.1 %) and Thais (2.1 %). Majority of them are male (88%) and female (12%). The age group ranges from less than 40 year-old (30.6%); between 40-49 year-old (15.3%); and more than 50 year-old (54%). Though majority of the fish farmers are more than 50 year-old, a good proportion i.e. 30.6% are less than 40-year old. They are good assets for future seabass culture development and expansion in this culture site. Most of the fish farmers here are owners of small business such as

vegetable farmers or retailers in addition to fish farming. Ninety-five % (95%) of the PPILS7 members have two occupations.

The Seabass cage culture cluster project is DOF project under the national key economic area (NKEA) for aquaculture to increase the national protein supply (food security) and to raise the income of fish farming community. It is part of the development strategies to improve fish production by restructuring existing projects. In this cluster project the government built two seabass cage culture facilities which housed about 40 cages each and provided fish feed and fingerlings for culture. The full operation is run by the community under PPILS7. The project is operated through a profit sharing scheme (30% government, 30% small boat fisherman, 40% rolling). There are 25 small boat fishermen in the cluster project. The 30% profit of the small boat fishermen will further split into 1/3 each among the small boat fishermen, PPILS 7 and rolling fund).

It was good timing that the KTP programme started in January, 2016, which coincided with the start of the DOF's cluster project in January, 2016 too. On-site training on stocking of fish fingerling, fish grading, water quality monitoring and establishing various records for collecting data were conducted smoothly. The farmers were taught on proper way of handling and grading fish to reduce mortality, feed and feeding management, proper waste disposal, prudent use of drugs, and the use of immune enhancers as preventive medicine. The use of herbal medicine has been planned to boost immunity of fish as well as to reduce bacterial infection.

Guidance on how to measure water physical properties such as Temperature (T), Dissolved Oxygen (DO) and Salinity were demonstrated. The optimum water quality for seabass culture is: T = 22-27<sup>0</sup>C; DO = 4-5 ppm; Salinity = 17-20 ppt. Daily water quality monitoring is important to detect drastic variation in the T, DO and Salinity. Methods on improving water quality such as increasing the DO level by using paddle wheels (Figure 2) or propeller from the motor boat engine. (Figure 3) were demonstrated. Important records such as total fish fry received, daily mortality rate, total feed consumption, usage of net in cages, weight and fish growth, net cleaning schedule, grading schedule, stock and sales, physical water properties (DO, T and salinity) were established for use in the cluster project as examples of data collection and record keeping to the cage culture community. The UMK team has established a record system and Graduate Intern is currently task to assist in record keeping in order to generate monthly records on mortality, fish stock according to cage, size and weight of fish, number of cages and net used, feed received and feed used. During the culture period from January to July 2016, the culture site had encountered numerous events which caused high mortality of fish.

UMK researchers and DOF's authority had assisted the farmers in the investigation of fish kills and many factors have been identified such as poor aquaculture practices, environmental pollution, water quality and diseases due bacterial and protozoan infection at various stages of culture. So far the common marine parasites found in the fish gills and body are the protozoa *Cryptocaryon irritans* and monogenean fluke *Diplectanum spp.* The farmers were taught to be prudent in the use of drugs or chemical to treat the fish. Instead of using chemical to treat the marine parasite, the farmers were taught to dip the fish in freshwater for 30 minutes to rid the fish of the marine parasite.

It was a common practice that farmers were throwing dead fish out of the cages instead of bringing them to the land to be disposed. As a consequence, water was contaminated and pathogens recycling back to the cage culture especially if the dead fish was diseased. In view of that the fish community have been reminded to observed proper disposal of dead fish to prevent re-occurrence of disease due to the above pathogens. Preventive measures by using immune enhancer and stimulants have been planned and will be implemented for the next batch of the fingerling for cluster projects due before end of 2016.

Another challenge that the fishing community faces is the natural disaster arising from climate change. In January, 2016 there was a storm attack on the culture site due to the monsoon rain which resulted in high tide and flood. This has destroyed not only many culture cages but also feed store near the jetty house. As a result, two containers to store fish feed needed to be built at a higher ground near the jetty by DOF's authority. The other environmental challenge was the El. Nino effect on water temperature in March to April 2016, Fish kill has occurred due to high water temperature of 30-34<sup>0</sup>C (Figure 4). The optimum water temperature for seabass is 22-27<sup>0</sup>C.

The other pressing environmental issue the community is facing currently is the dirty lagoon bottom due to silting and poor waste management over a long period of culture since 2003. This has resulted in low DO (< 2 ppm) from time to time as the water is stagnant and the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are high. The condition was worse when there was low tide and the water become very shallow (< 1 m). Normal depth for culture must be at least 3 m deep. It is imperative to dig out the dirty material in the lagoon bottom to prevent depletion of DO as well as ammonia built up which could cause fish kill. Many interventions have been discussed and planned among PPLIS 7, DOF's authority and UNK researchers in the coming months to overcome the environmental issues on water quality. The fish farming community has also been advised to practice good aquaculture practices to ensure sustainability and profitability of the seabass cage culture.

#### 4. Conclusion

As the project started only on January, 2016, we have yet to see the first harvest production which will be due in November, 2016 (approximately 9-10 months per cycle). The next cycle will start again after a full assessment of the environment and applying some technologies to overcome the pollution issue before the next stocking of fingerlings into the cluster project. It is of the advantage to the community to be able to see the impact of applying GAP in at least two cycles of cage culture for comparison in the two-year KTP programme. All the process of applying GAP will be documented and published as guidance manual in the Malay Language for the fish farmers at the end of the KTP programme. Scientific findings and interesting case reports will be selected for publication in high Impact Factor Journal for knowledge sharing.

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Figure 1: Laguna Sri Tujuh, Seabass cage culture site for KTP Transfer Programme in Tumpat, Kelantan



Figure 2: One of the methods of increasing the Dissolved Oxygen level by using paddle wheels



Figure 3: Increasing the Dissolved Oxygen level by using propeller of the motor boat engine



Figure 4: Fish kill due to high water temperature of 30 -34°C because of El Nino effect in March and April 2016