

Certificate in the Science of Artisanal Mariculture and Village Farming

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Introduction

In Madagascar, our consortium, made up of universities (Universities of Toliara, Mons and Liège) and private partners (Indian Ocean Trepang, Ocean Farmers, Spirusud), has been supporting the development of artisanal mariculture and village farming for more than 20 years. Four types of mariculture were particularly developed: holothuriculture, algoculture, spiruliculture and coralliculture. The first one to be developed was holothuriculture. Today, sea cucumber farming is practiced on company farms (70% of production) and in village farming (30%) throughout Madagascar. Seaweed farming, which emerged after sea cucumber farming in Madagascar, consists of the cultivation of red macroalga, *Kappaphycus alvarezii*, which is exported to industrialised countries to extract carrageenan which is used in foods and cosmetics. It is totally practiced in a village farming situation. Spiruliculture is the cultivation of *Spirulina*, a cyanobacterium of the genus *Arthrospira*, exported for its nutritional benefits. It is carried out entirely on a company farm. Coral farming is an artisanal mariculture in the making, and involves the production of corals – most often for the aquarium trade.

The success of artisanal mariculture and village farming developed in Madagascar is internationally recognised (Eeckhaut 2022), and the demand to transfer these techniques to other countries is real and significant. To meet this demand, several actions have been carried out: 1) meetings and discussions during colloquium and conferences; 2) exhibitions of research work through publications; 3) occasional visits to Madagascar; and 4) consultancies carried out by the Malagasy-Belgian team to interested foreign entities. These actions have only had mixed impacts in developing countries. To date, they have not led to the development of autonomous private firms such as those in Madagascar, nor has there been any obvious positive effects on coastal villagers. This issue was addressed in focus group discussions and, after discussions with several countries requesting training techniques, the idea of providing training for best practices for mariculture and village farming is unanimously seen as an essential step in the solution to these problems.

As a result, our consortium is setting up a Certificate in the Science of Artisanal Mariculture and Village Farming, financed by Académie de Recherche et d'enseignement supérieur – Coopération au développement (Belgium). There

are four main problems with transferring mariculture and village farming to other countries: biological, agronomic (fisheries engineering), economic and sociological. The training will, therefore, include these four themes. Instructors will provide expertise in biology, fisheries engineering, economics and the sociology of village farming. The Malagasy universities involved will be Tulear (Haliéutic Institute and Marine Sciences) and Tamatave, and the Belgian universities will be the University of Mons and University of Liège. Because the private sector is important in the development of village farming, people from the private sector will be actively involved in teaching. Training will take place at the Institute of Fisheries and Marine Sciences at the University of Tulear (southwest Madagascar).

The Certificate

The Certificate in the Science of Artisanal Mariculture and Village Farming will welcome 20 candidates annually, with the first year of courses beginning in September 2024. Some of the participants will be scholarship holders from developing countries supported by ARES-CCD (28 countries supported), while the others will be candidates (from developing and developed countries) who will be self-financing. The scholarship application should be submitted by January 2024 to the Academic Committee (a website is under construction for applications). Candidates who successfully complete the training will have triple certification (i.e. a university certificate) from the University of Tulear, the University of Mons and the University of Liège.

The course will accept candidates with a Master's or Engineering degree. In special cases, if the Academic Committee considers that the application of a candidate who has neither a Master's nor Engineer degree is interesting, the activities of the candidate relating to training may give weight to their application. All applicants will be asked for a letter of support from an interested entity within their country.

All training will be conducted in English. The course will last one academic year, and consist of 60 credits. It will include four modules: 1) one concerning general information about aquaculture, 2) another focusing on the biology and engineering of the four artisanal maricultures, 3) a third relating to the sociology and economy of village farming, and the final module devoted to an end-of-study work. If some students are only interested in one type of mariculture

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(e.g. sea cucumber farming), the modules will be organised in such a way that the student can follow a practical course of two to three months that focuses on their chosen mariculture.

Students can view the theoretical courses remotely. To do this, video capsules will be produced by the instructors for all the theoretical courses and integrated into a flipped classroom system that also offers exercises and tests. Students will thus have the possibility of viewing these courses from Madagascar or abroad (mainly because of covid). Training will include as many practice sessions as possible. Practical training will take place in hatcheries, nurseries, pens at sea, and in target villages for the study of village farming. All necessary infrastructure will be accessible and usable at the Marine Station of Belaza⁷ and in the neighbouring villages. To enable the acquisition of this knowledge and skills, theoretical courses will be highlighted during the practical work carried out and during field visits. During this practical work, instruction will be totally interactive, with students handling the organisms of interest and being in some cases in contact with Malagasy mariculturists.

Modules, courses and expected skills

The four modules of the Certificate cover the following courses:

Module A “General courses”: 1) Biology of Aquacultured Organisms; 2) Mariculture: generalities; 3) Diseases of organisms in the marine environment

Module B “Sociology and economy of mariculture and village farming”: 4) Sociology of village farming; 5) Gender in artisanal mariculture; 6) Management and entrepreneurship related to artisanal mariculture; 7) Legislation relating to village farming

Module C “Biology and engineering of mariculture and village farming”: 8) Aquaculture of integrated and multitrophic systems; 9) Sea cucumber farming; 10) Seaweed farming; 11) Coral farming; 12) Spiruliculture farming.

Module D “Certificate thesis”: A research work at the end of the study will be required to estimate the level of competence reached by the students. Examples of possible certificate theses include: “Is the transposition of sea cucumber farming profitable in the Ouidah region in Benin? “What is the degree of acceptance of Haitian fishermen to becoming seaweed farmers? “How does the growth of *Seriatopora hystrix* (Scleractinia) vary with temperature conditions identical to those encountered in Vietnam?

The skills targeted at the end of the training will be:

1. Possess, in the field of artisanal mariculture sciences and village farming, highly specialised knowledge.
2. Be able to mobilise, articulate and enhance the knowledge and skills acquired in order to contribute to the conduct and implementation of a large-scale development in connection with artisanal mariculture and village farming.
3. Be able to organise and carry out research, development or innovation in order to address an unprecedented problem relating to artisanal mariculture and village farming.
4. Be able to communicate clearly, in a structured and reasoned manner, both orally and in writing, to an informed public, the principles underlying artisanal mariculture and village farming.
5. Be aware of and understand the biological, agronomic, social and economic problems inherent to these maricultures and to react accordingly if these problems arise in the countries or regions where the methods are transposed.

Sea cucumber aquaculture and farming: the targeted skills

People only interested in sea cucumber aquaculture and village farming will be able to follow a special module of approximately six weeks focused on these practices only. The expected skills acquired will be to know:

1. the biology of sea cucumbers and the stages of their production in aquaculture;
2. how to analyse the reproductive cycle of sea cucumbers;
3. the methods to increase the efficiency of breeders, including the maintenance of breeders, thermal shocks and *in vitro* fertilisation;
4. to raise embryos and larvae to post-metamorphic individuals in a hatchery;
5. to raise juveniles in a nursery, and adults at sea; and
6. the right steps in the formation of trepang (dried exported product).

⁷ <http://www.polyaquaculture.mg/>



Figure 1. Signature of the agreement concerning the Certificate in the Science of Artisanal Mariculture and Village Farming. The president of the University of Tulear, Razafiharison Manantena (left), and the rector of the University of Mons, Philippe Dubois (right).



Figure 2. Inauguration, with personalities from the University of Mons, University of Tulear and the Indian Ocean Trepang company, of the Belaza Marine Station (Madagascar), which has become a Belgian-Malagasy university campus and where some of the Certificate courses will take place.