**Annexe 2. Certificate in Sciences of Artisanal Maricultures and Village Farming. Long Training**

**Introduction**

The United Nations General Assembly has declared 2022 the “International Year of Artisanal Fisheries and Aquaculture”. Artisanal fishing (also called traditional, rural or small-scale fisheries) is that carried out by fishermen individually or in association, using different types of boats or practicing fishing on foot in a limited range of action. Fishing techniques are very varied, from fishing with various nets to longline fishing, placing traps at sea, harvesting with bare hands and spearing while snorkeling.

Artisanal maricultures (“artisanal maricultures or small-scale maricultures”), for their part, are aquacultures carried out in a marine environment where the organisms of interest are produced by families or coastal village communities. They generally involve extensive or semi-intensive production technologies, low cost and adapted to local economic resources. Sixty million people, including 14% women, were employed in the primary capture fishing and aquaculture sector in 2018 with 40 million people in the artisanal fishing sector alone. Around 100 million additional people are added in associated activities such as processing and marketing of fish products, boat building and net making.

Artisanal fisheries and maricultures are strongly rooted in the heritage of local communities and bear witness to the historical links which unite them with traditions and which strengthen social cohesion. This sector thus contains a diversity and cultural richness of global importance. Along with small-scale agricultural workers, however, artisanal fishermen/aquaculturists continue to be among the most disadvantaged populations in the world. Availability and access to social services in fishing communities is often below average, leading to low educational attainment and poor health conditions. Added to this is a reduction in the quantities and quality of fishery products captured due to excessive anthropogenic pressure and global ecological problems leading to the degradation of certain ecosystems such as coral reefs.

In Madagascar, our consortium has supported the development of artisanal maricultures and village farming for more than 20 years. The first mariculture developed was sea cucumber, i.e., the breeding of holothuroids or sea cucumbers. The species produced in Madagascar is *Holothuria scabra* and is exported to China for food purposes. Today, sea cucumber farming is practiced on company farms (70% of production) and village farming (30%). Seaweed farming, which emerged after sea cucumber farming in Madagascar, consists of the cultivation of a red macroalgae, *Kappaphycus alvarezii*, which is exported to industrialized countries to extract carrageenans which are used in food and cosmetics. It is entirely practiced in “village farming”. Spiruliculture is the cultivation of spirulina, a cyanobacteria of the *Arthrospira* genus, exported for its nutritional benefits. Coral farming is an artisanal mariculture in the making. It concerns the production of corals most often for aquarium purposes. It started in Madagascar 5 years ago and is currently developing under the “village farming” model.

**The problems that the proposed training addresses**

1. Marine fisheries resources cannot indefinitely meet the growing demand exerted by humans. From 1950 to 1988, the production of capture fisheries increased from 20 to 90 million tons per year then, despite an intensified fishing effort, this production stagnated at 90 million tons/year reflecting the maximum limit reached of what can be provided by our oceans.
2. At the same time, the overexploitation of natural fish stocks increased from 10% to 34% between 1974 and 2017. Coastal fish stocks are decreasing drastically and impacting the standard of living of artisanal fishing communities. Artisanal fishermen represent 2/3 of fishermen in the world. The reduction in fish resources caught by artisanal fishermen is a global problem and can be highlighted by the drastic reduction in the volume of products caught daily. This decrease affects both fished invertebrates and fish.
3. Maricultures and in particular artisanal maricultures constitute a sustainable alternative to fishing. Marine aquaculture production has increased fivefold since 1980 and represents approximately a third of the tonnage caught by fishing. The development of artisanal maricultures around the world is quite recent. In Madagascar, village farming was developed in the early 2000s. It is practiced by both women and men. In the area targeted by this project (Toliara region, southwest of Madagascar), sea cucumber village farming today represents 226 farms involving 307 families of village fishermen on more than 300 km of coastline and village seaweed farming is practiced by 1,700 fishing families (around 3,500 villagers). Spiruliculture, for its part, has given rise to some 30 private Malagasy companies and emerging coral farming is being implemented on a trial basis in a few villages.
4. The success of the Malagasy model is internationally recognized and the demand to transpose this model to other countries is significant. To respond to this request, various actions were carried out. As non-exhaustive examples, consultations in sea cucumber farming and village farming were carried out in Nosy Ankao and Nosy Ve (Madagascar), in the Seychelles, in the Sultanate of Oman, in Rodrigues and St Brandon (Mauritius), in Colombia, in Mayotte and New Caledonia (France). In these countries, this work has sometimes led to the consolidation of research into these maricultures but none has led to the development of financially independent private firms or to obvious positive impacts on coastal villagers. The reasons for the lack of effectiveness of the transfer of skills are varied: they can be due to biological problems (for example poor practice in the growth of the aquacultured organism), agronomic (poor "scaling-up" of the technique), economic (for example poor calculation of profitability or bad business plan) and/or sociological (for example poor understanding of the structure of the targeted communities, poor supervision of mariculturists).
5. After discussing it with several requesting countries, the idea of training in Madagascar for representatives of foreign entities interested in good practices of these maricultures and village farming is unanimously perceived as an essential step that is part of the solution to these problems. Training relating to certain specific artisanal maricultures (such as, for example, shellfish farming) already exists in the world, but there is no training relating to generalities relating to artisanal maricultures, nor any training covering the specificities of village farming and four maricultures developed in Madagascar.

**The goals**

The specific objective we are pursuing is to increase the number of professionals (men and women) capable of supporting the development of artisanal maricultures for the benefit of village communities in various developing countries. This objective should contribute to the well-being of coastal communities and the preservation of their natural resources (general objective).

**Target audience**

Any Master or Engineer in one of the fields relating to Natural Sciences or Social Sciences showing an interest in the sustainable development of the Oceans. Any other person (non-Master or Engineer) who can demonstrate and thus promote their work in an area of artisanal mariculture for more than three years.

**Access conditions**

1) Be a Master or Engineer in one of the fields relating to Natural Sciences or Social Sciences. Failing this, have a Bac +3 level diploma in one of the fields relating to Natural Sciences or Social Sciences and be able to demonstrate work in a field of artisanal maricultures for more than three years

2) Complete the admission file including (i) personal data, (ii) academic background, (iii) professional background

3) Send a cover letter

4) Send a letter of support from a university or any other institution interested in the development of artisanal maricultures

**Calendar**

Classes will take place between September 15 and August 31. In particular, the theoretical courses will all be supported by videos that can be viewed at any time of the year and taught in “flipped classes. Practical work concerning the four artisanal maricultures will be provided, for sea cucumber farming, from September 15 to December 23, for spiruliculture from January 10 to the end of February, for seaweed farming, from March 1 to April 30 and for coral farming from 1 May to June 30.

**The modules and courses of the certificate in “Sciences of Artisanal Maricultures and Village Farming” are listed in the table below**

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| --- | --- | --- | --- |
| Teaching unit | Theoretical hours | Practical hours | Credits |
| Module A: General courses | | | |
| Biology of aquacultured organisms | 10 | 0 | 2 |
| 2. Maricultures: generals | 10 | 0 | 2 |
| 3. Diseases of organisms in the marine environment | 10 | 20 | 3 |
| Module B: Sociology and economics of maricultures and village farming | | | |
| 4. Sociology of village farming | 10 | 30 | 4 |
| 5. Gender in artisanal maricultures | 10 | 20 | 3 |
| 6. Management and entrepreneurship relating to artisanal maricultures | 10 | 30 | 4 |
| 7. Legislation relating to village farming | 10 | 0 | 2 |
| Module C: Biology and engineering of maricultures and village farming | | | |
| 8. Aquaculture of integrated and multitrophic systems | 10 | 40 | 5 |
| 9. Holothuriculture | 10 | 40 | 5 |
| 10. Algoculture | 10 | 40 | 5 |
| 11. Coralliculture | 10 | 40 | 5 |
| 12. Spiruliculture | 10 | 40 | 5 |
| Module D: End-of-study work | | | |
| 13. Thesis |  |  | 15 |
| **TOTAL** | **120** | **300** | **60** |

**The skills targeted at the end of the training**

1. Possess, in the field of the Sciences of Artisanal Mariculture and Village Farming, highly specialized knowledge;

2. Be able to mobilize, articulate and promote the knowledge and skills acquired in order to contribute to the management and implementation of a large-scale development project linked to Artisanal Maricultures and Village Farming;

3. Be able to organize and carry out research, development or innovation work to address a new problem relating to Artisanal Mariculture and Village Farming;

4. Know how to communicate clearly, in a structured and argued manner, orally and in writing, to an informed or uninformed public, the principles underlying Artisanal Mariculture and Village Farming;

5. Be able to critically reflect on the impact of the discipline and the implications of the projects to which they will contribute;

6. Know the biological, agronomic, social and economic problems inherent to these maricultures and be able to react accordingly if these problems arise in the countries/regions where the methods are transposed.

**The targeted learning outcomes for each of the courses included in the different modules.**

**For courses included in Module A “General Courses”:**

(1) Biology of aquacultured organisms (Bruno Frédérich, Gilles Lepoint and Richard Rasolofonirina). Know the basic principles governing marine environments and in particular the tidal zones of tropical zones; Know the biology of fish (for multitrophic systems), sea cucumbers, aquacultured macroalgae, aquacultured corals, spirulina and fish (for multitrophic systems)

(2) Maricultures: generalities (Bruno Frédérich and Richard Rasolofonirina). Know the generalities about industrial and artisanal fisheries; Understanding the environmental impacts of maricultures

(3) Diseases of organisms in the marine environment (Guillaume Caulier, Igor Eeckhaut and Gildas Todinanahary) Know and identify diseases of organisms of interest; Understand the parasite cycle and the ethiology of diseases; Know preventive methods in the marine environment; Know how to use the most common microbiology methods

**For the courses included in Module B “Sociology and economics of maricultures and village farming”**

(4) Sociology of village farming (Benjamin Pascal, Marc Poncelet and Gédice Fernand). Understand social structures, land issues and their dynamics within coastal communities; Understand production systems, the social organization of work and household economic strategies to adapt approaches; Understand and master the concepts and mechanisms used for supervision and advice to village aquaculturists (company farming vs. contractual village farming, importance of contracts, incentive mechanisms, pilot farmers, advice to family farms, community mobilization and socio-organizational structuring ...); Anticipate and manage risks and conflicts linked to village aquaculture

(5) Gender in artisanal maricultures (Gédice Fernand). Be able to understand the integration of the gender approach into development projects and programs; Become aware of the unequal relationships and dominations existing in our societies; Know how to determine the contexts and motivation of the groups who will implement the program or project; Understanding gender integration issues: case study of Vezo fishermen; Know the benefits generated by women in the context of village farming

(6) Management et entreprenariat relatifs aux maricultures artisanales (Frédéric Pascal,Thomas Picart, Thierry Lavitra). Know how to identify the regulatory framework for interventions in village farming: operating authorizations, environmental authorizations, and commercial risks (theft, parallel sales, etc.); Know the specific financial mechanisms open to models with a positive social and environmental impact (grants) and their issues (accountability, advantages, disadvantages); Understand the issues of technical supervision and training (human resources)

(7) Legislation relating to village farming (Thierry Lavitra; Gaëtan Tsiresy) Understand a government’s aquaculture policy; Know the objectives as well as the expectations of the State on aquaculture in general and village farming in particular; Know the national strategy as well as the village aquaculture development plan; Identify and understand the regulatory texts governing village aquaculture in coastal villages (case study in Madagascar)

**For the courses included in Module C “Biology and engineering of maricultures and village farming”**

(8) Aquaculture of integrated and multitrophic systems (Carole Rougeot, Richard Rasolofonirina). Know the basic functioning of different fish farming systems (extensive, semi-intensive, intensive and integrated); Know the production cycle of species of interest for aquaculture in developing countries (tilapia, clarias): reproduction, larval rearing and growth; Know the concepts of well-being and know how to put them into practice for farmed animals

(9) Holothuriculture (Richard Rasolofonirina and Igor Eeckhaut). Know the biology of sea cucumbers and the stages of their production in aquaculture; Know how to analyze the reproduction cycle of sea cucumbers; Practice the thermal shock method to obtain viable embryos; Be able to raise embryos and larvae to postmetamorphic individuals; Raising juveniles in a nursery; Raising adults at sea; Understand the stages in the formation of trepang (exported dried product)

(10) Algoculture (Gaëtan Tsiresy et Gilles Lepoint). Know the biology of algae and the stages of their production in aquaculture; Know how to implement “off-bottom” systems and understand “long-line” methods; Know how to cut algae in situ and maintain cultivation plots; Know how to identify and manage infestations by epiphytes and algal diseases

(11) Coralliculture (Gildas Todinanahary and Igor Eeckhaut). Know the biology of scleractinian corals and the stages of their production in aquaculture; Know how to take coral cuttings; Recognize areas of optimal growth Know how to maintain coral culture tables

(12) Spiruliculture (Vola Ravelo) Know the biology of *Arthrospira* and the stages of their production in aquaculture; Understand optimal growing conditions; Know how to cultivate spirulina strains; Knowing how to produce spirulina after two months of production