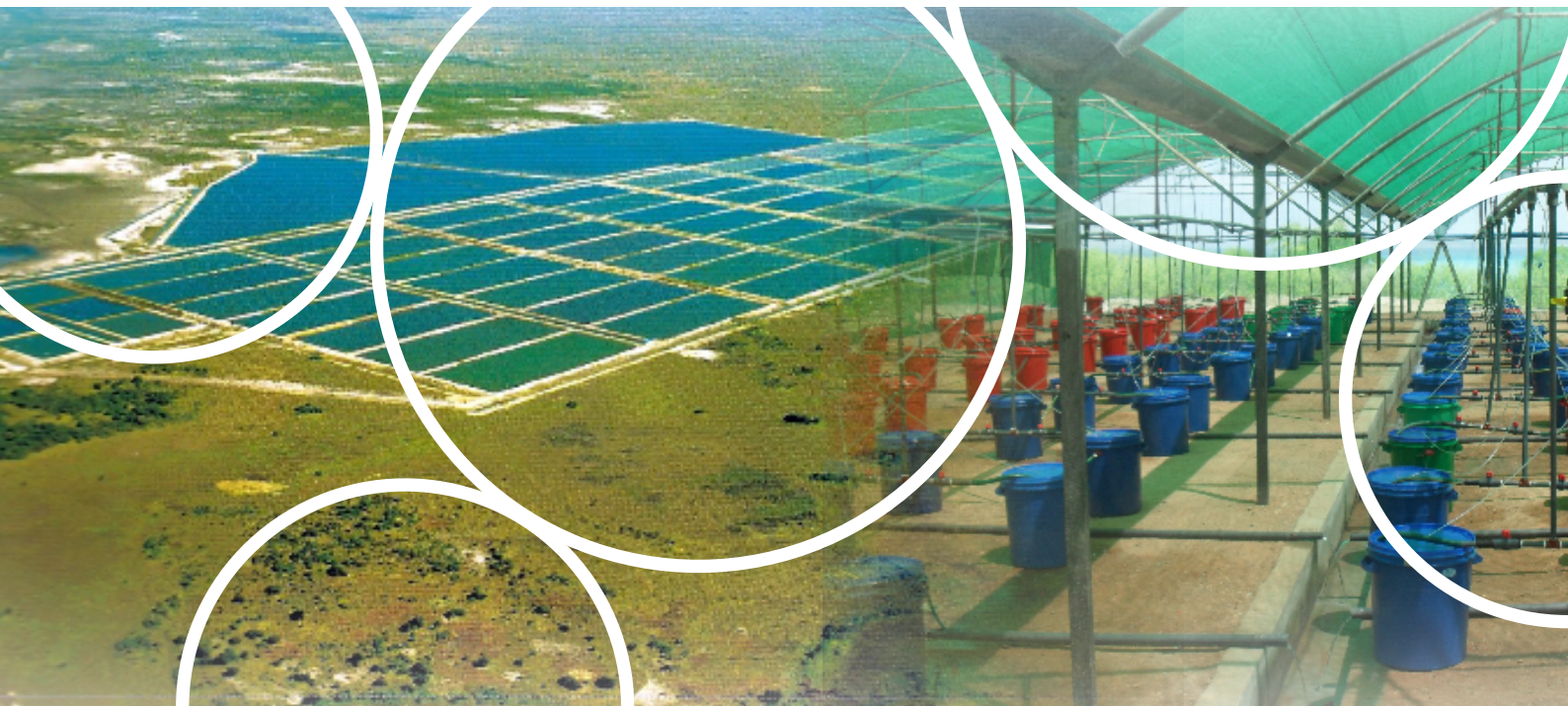




AFRICAN UNION
**INTERAFRICAN BUREAU
FOR ANIMAL RESOURCES**

SUSTAINABLE AQUACULTURE DEVELOPMENT IN AFRICA

SHRIMP AQUACULTURE INDUSTRY IN MOZAMBIQUE



December 2013

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SUMMARY

This document presents the findings from a review and analysis of the shrimp aquaculture industry in Mozambique. The review covers factors that are integral to sustainable commercial aquaculture development including assessment of current practices and institutional settings such as production technology, evaluation of existing policy and legislative frameworks for the sector development, institutions support (e.g. hatcheries, feed supplies etc.) disease control, pollution abatement mechanism and consideration for environmental sustainability or maintenance of ecosystems integrity, public and private sector roles.

The shrimp aquaculture industry in Mozambique is small, with only two industrial shrimp farms currently in operation. The total production in these two farms dropped from around 600 ton in 2010 to 41.4 MT, in 2013 after the white spot virus syndrome hit in 2011. The giant tiger shrimp (*Penaeus monodon*) and Indian white shrimp (*Fenneropenaeus indicus*) are the main farmed species using semi-intensive system culture in earthen ponds.

Mozambique has a comprehensive legal, policy framework and institutional capacity developed. The sector's development policy is based on a set of policy and strategy documents that support many of the country's efforts to develop aquaculture in general and with emphases on commercial shrimp aquaculture.

INTRODUCTION

Mozambique is located (Figure 1) in Southeastern Africa between the parallels of 10o27' and 26o52' South, with a coastline of approximately 2,700 km. The coast is very diverse from coral in the north, swamp and wetlands in the center-north to parabolic dunes alternated with wetlands along the south coast. Mozambique benefits from diversity of tropical and sub-tropical environments and availability of suitable native species for aquaculture.



IOA – Indian Ocean Aquaculture

Figure 1: Mapa of Mozambique with the three shrimp aquaculture farms

Demand for fisheries products in Mozambique is expected to grow substantially over the next ten years, given a population increase of 3.5% (Ministério das Pescas, 2010, increasing incomes (particularly in urban areas) and increased foreign direct investment, mainly in the extractive industry and its associated workforce. Fisheries provide an important source of protein to the population. Per capita fish consumption is currently at 10.4 kg/person/year, little above the Sub-Saharan average of 9 kg/person/year (Ministry of Fisheries, 2012), below the recommended 18 kg/person/year by the World Health Organization.

Despite capture fish production increases over the last decade (Table 1), the country still depends on fish imports to reduce the deficit in local supply. Imports of fish have more than doubled over the last years and are now estimated at approximately 35,000 to 40,000 tonnes per annum, imported from regional markets, mainly horse mackerel from Namibia (Ministry of Fisheries, 2012).

Table 1: Total fisheries capture and culture, including marine fisheries & aquaculture (MT/year)

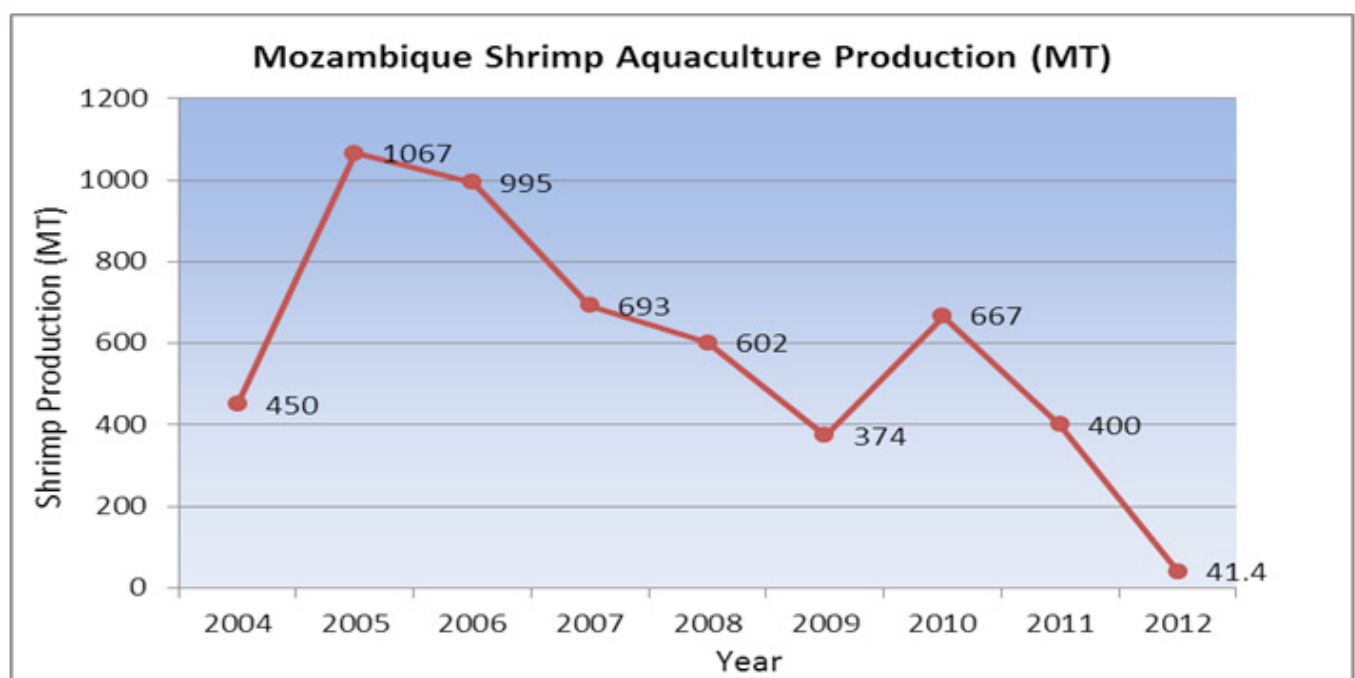
Year	Total Capture	Aquaculture
2000	37,729	0
2001	30,074	70
2002	36,462	855
2003	43,933	855
2004	91,191	609
2005	85,063	1,090
2006	92,962	1063
2007	93,178	907
2008	130,460	760
2009	150,128	561
2010	165,512	844
2011	188,830	796
2012	213,436	603

Source: Ministry of Fisheries, 2012

The natural stocks of shrimp sustain an annual production from capture fisheries of about 5,877 tonnes (Ministry of Fisheries, 2013) including artisanal and industrial fisheries, that are processed and frozen on board and in most cases exported, mainly to Europe with an annual value of around 50-60 million USD.

The Aquaculture sub-sector is still in its infancy in the country as it is shown from historical production figures (Table 1) despite the great potential that the country has for developing this activity.

The first industrial shrimp farm in Mozambique was approved in 1994. By 2004 there were three large shrimp farms operating in the country. Production from these farms (Figure 2) peaked in 2006 at 1,067 MT/year (Blanc, 2012). In 2007 the largest farm, shut down due to financial difficulties in addition to low market price, and limited production output between 2008 and 2009. In 2010, one of the two remaining shrimp farm suspended production and later sold. Productivity was beginning to increase when white spot syndrome virus (WSSV) hit one of the farms in August, 2011. Aquaculture shrimp production in Mozambique dropped to 41.4 MT, in 2012.

**Figure 2:** Mozambique Shrimp Aquaculture Production, 2004 – 2012 (Omar & Pereira, 2013)

This document presents the findings from a review and analysis of the shrimp aquaculture industry in Mozambique. The review covers factors that are integral to sustainable commercial aquaculture development including assessment of current practices and institutional settings such as production technology, evaluation of existing policy and legislative frameworks for the sector development, institutions support (e.g. hatcheries, feed supplies etc.) disease control, pollution abatement mechanism and consideration for environmental sustainability or maintenance of ecosystems integrity, public and private sector roles.

Objectives

This consultancy was commissioned by AU-IBAR. The general objective of this review was to set realistic benchmarks for sustainable commercial aquaculture development in Mozambique. The culture systems were reviewed and examined based on farm visits, interviews with those involved in the production side of the value chain. The assessment was undertaken with the view of elaborating, packaging and disseminating best practices for expeditious development of the African aquaculture industry.

The specific objectives were to:

1. Evaluate the current practices, production systems, supporting facilities (e.g. hatcheries), consideration for available technologies and environmental practices, including disease control mechanisms, genetic engineering, environmental sustainability and lessons to be drawn from these practices
2. Assess the role of relevant collaborating institutions in the country, policy and institutional frameworks involved in aquaculture sector. This included evaluation of institutional capacities (including human) to support sustainable aquaculture development
3. Review existing strategies, policy and legislative frameworks in place that underpin aquaculture development noting regulations covering movement of genetic materials, disease controls, use of additives, EIA, etc. etc and implementation of international instruments or guidelines for sector development.
4. Evaluate the role of private and public sector in sector development and lessons to be drawn in the sector development in the country. This review indicate levels of public and private sector investments in the sector, prevailing enabling environment, incentives and any factor stimulating or impeding investments in the sector
5. Review harvesting, processing, marketing and distribution systems and their effectiveness
6. Review data collection and record keeping at farm level and across the reporting hierarchy [optimizing data resources] to advise on improvements;

CURRENT PRACTICES, PRODUCTION SYSTEMS, SUPPORTING FACILITIES

The giant tiger shrimp (*Penaeus monodon*) and Indian white shrimp (*Fenneropenaeus indicus*) are the main farmed species using semi-intensive system culture in earthen ponds. Farms are located in area of coastal plain. Ponds use brackish to full strength marine water, according to the rain and hot (30°C) or dry and cool season (20°C). Shrimp are fed with imported (feeds are imported Reunion Island and Mauritius) formulated extruded feed containing 38% protein at up to 2.5% of body weight. There is no aquatic animal feed produced in Mozambique. Ponds are managed in open system (flow-through) with very little aeration. In all farms activities are fully vertically integrated, ranging from hatchery (50 million PL₂₀/year each) operations, nursery activities, grow-out, processing, packaging, to marketing. Each farm area has a standard operation procedures manual including a contingency plan such as broodstock management, hatchery and nursery management, water quality management, and general pond management, feed management, shrimp health management, therapeutic agents and other chemicals, effluent and solid waste management. Prior to disease outbreak in August 2011, larvae were reared (from nauplii to zoea to mysis stages) in 10 to 15 days. Larvae are stocked into nursery tanks at an average stocking density of 150/m² and reared for about 20 to 30 days. The average survival rates in nursery tanks were about 75%. The majority of the broodstock are wild-caught. Grow-out ponds, which range from 1 to 10 ha in size are designed and constructed with water depth averaging 1.5 m, are stocked at densities of 7 up to 14 post larvae or PLs/m² (stocking size is PL₁₂-PL₂₀ with an average of PL₁₅ (0.2 to 1 g/PL)). Productivity ranges from 1.5 to 2 tonnes/ha/year and farms operates in 1 to 1.5 crops a year. There are no chemicals (antibiotics) products used in nursery or grow-out ponds. One of the existing farms has organic product certification. According to environmental legislation, each farm must have settlement ponds for effluent discharge and an issued environmental impact license.



Source: APCM

Figure 3: General layout of Sol & Mar shrimp farm

Fertilizers, tea-seed-cake (only at beginning) and lime are applied at beginning of the farming cycle at different rates and frequency during the cycle, varying according to water quality, animal health and other parameters. For instance, the amount (kg) of fertilizer required is calculated dividing the amount of nutrient desired by the % of nutrients in the fertilizer. Lime is applied according with soil and quality parameters. The organic farm does not use fertilizer. In the hatchery some chemical products are used such as Treflan (Trefluraline) to inhibits the growth of spores in larvae (600 g/million larvae); chlorine (calcium hypochlorite) used in water treatment and disinfection of the premises; thiosulphate of sodium to neutralize residual chlorine; formol (Formaldehyde at 40%) used in animals disinfection as well in premises disinfection during the ; Na₂ EDTA, used in water to agglutinate metals; phytoplankton nutrients (boric acid, sodium potassium nitrate, metasilicate of sodium, iron chloride, phosphate of sodium, manganese) and vitamins (H, B₁, B₁₂).

ROLE OF RELEVANT COLLABORATING INSTITUTIONS IN THE COUNTRY, POLICY AND INSTITUTIONAL FRAMEWORKS INVOLVED IN AQUACULTURE SECTOR

Institutional framework of the fisheries and aquaculture sector administration

In Mozambique, the public administration of the fisheries sector focuses on three components: the policy component formed by the Ministry of Fisheries (MF) and its provincial directorates, the component of development promotion and the component of fisheries management. The Ministry of Fisheries is the political body, coordinator of the fishery administration system. The main responsibilities of Ministry of Fisheries concerns the establishment of fisheries and aquaculture development policies, their translation into development plans, as well as the coordination of its implementation through a performance control of the system components.

The fisheries management subsystem consists of the National Institute of Fisheries Research (IIP) whose function is the research and management of fishing and aquaculture resources; the National Fisheries Administration (ADNAP) who defines the conditions access to the fishing resources and monitors and manages the fisheries and of the National Institute of Fish Inspection (INIP) which is responsible for ensuring the quality of fishery and aquaculture products.

The subsystem of development promotion consists of the National Institute of Development of Small Scale Fisheries (IDPPE) that has the mission to promote and assist the development of small-scale fisheries, focusing on poverty reduction and improving the living standard of fishing communities; of the National Institute of Aquaculture (INAQUA) responsible for the promotion and management of aquaculture activities, with emphasis on small scale aquatic animals farming promotions, administration and monitoring of commercial farms, disease monitoring and surveillance; of the Fisheries Development Fund (FFP), a financial institution with the function of providing credits for the development of fisheries and aquaculture; and of the School of Fisheries (EP) which provides basic and medium training in various fishing and aquaculture areas.

The Fisheries Administration has a local presence in the provinces, through the delegations of central institutions. In the district, the jurisdiction for fisheries and aquaculture administrations is at the District Service for Economics Activities (SDAE).

Recent efforts for the development of the sector

Government's Five Year Programme (PQG) 2010-14. The Government Programme for 2010-2014 is focused on actions to reduce poverty, to improve living conditions of Mozambicans, in an atmosphere of peace, harmony and tranquillity. To achieve these goals, the Government proposes to promote a rapid socio-economic growth, which is comprehensive and sustainable, with an incidence of actions in the area of rural development, basic social services and infrastructure, creating employment opportunities, as well as the creation of a favourable environment for private investment and the development of national entrepreneurship.

Action Plan for the Reduction of Poverty (PARP) 2011-2014. The PARP is a medium-term strategy of the Government to operationalize the Government's Five Year Programme (2010-2014), focused on the objective of combating poverty in order to achieve inclusive economic growth and the reduction of poverty and vulnerability of the most disadvantaged groups of the population. Thus, PARP has as main goal to reduce the rate of incidence of poverty from 54.7% to 42% in 2014. Its general objectives are: (i) the increase in production and productivity in agriculture and fisheries (including aquaculture), (ii) the promotion of employment, (iii) human and social development, (iv) good governance, and (v) the macroeconomic and public finances balance. According to PARP, the main challenges of the fisheries sector are: (i) increasing

access to inputs (production factors), in particular for women, (ii) the availability of appropriate technologies, (iii) quality inputs for aquaculture (fingerlings and feed), and (iv) improving the capacity for surveillance and control of diseases in plants and animals.

Agenda 2025. The Agenda 2025 presents a strategic reflection on the future of Mozambique, with the objective to create, through a participatory process, a Long-Term National Vision and prepare, through a participatory process, a National Strategy for Development that sets policies and programmes needed to respond to the identified development objectives. Achieving these goals will enable the increase of the capacity of government institutions and civil society to design and implement policies, programmes and national economic projects, ensure consistency between economic and social policies of short, medium and long term and increase the capacity of the government to take a leading role in the coordination and management of cooperation for development.

Millennium Development Goals: Mozambique is a signatory of the Millennium Declaration, and has adopted the Millennium Development Goals (MDG). The adoption by the international community of quantified targets and deadlines set for the poverty reduction aims at facilitating its reduction through the orientation of development of policies in favour of the poorest sectors of the society, greater equity, inclusive growth and better social conditions. Five of the MDG are geared towards the social sector, three of which relate to health (HIV/AIDS, maternal and child mortality). The Government and its partners, including civil society and donors, support these objectives. In its sequel, the Government has established clear links and synergies between these objectives and the PQG, PARP and Agenda 2025.

Sector instruments relevant for aquaculture development

Fisheries Master Plan (2010-2019). The development objective of the FMP (2010-2019) corresponds to the immediate objective of PARP (Action Plan for Poverty Reduction 2010-2014). This instrument directs efforts in the fisheries and aquaculture sector towards the goal of poverty reduction in Mozambique. The FMP (2010-2019) aims at increasing food security, improving living conditions of communities living on fishing and small-scale aquaculture base, greater fund raising from commercial fisheries and aquaculture or poverty alleviation and a growing contribution to the balance of the Payments Scales. This is in a context of a public sector administration better able to pursue these ends and of sustainable fishery and aquaculture resources in particular and aquatic ecosystems in general. All these objectives contribute to the national goal of poverty reduction.

Strategy for the Development of Aquaculture in Mozambique. Taking into account the political objectives set, the Strategy for the Development of Aquaculture in Mozambique aims at ensuring the exploitation of the potential of aquaculture in a sustainable manner, respecting the environment, promoting economic and social development. There have been identified three major strategic objectives within the development strategy: (1) To step up the sustainable development of aquaculture; (2) To increase the current levels of annual production of marine shrimp and other aquatic species (animal and vegetable) intended for export, and to guarantee community food security; (3) Establish a legal, normative and institutional framework for appropriate and effective management of aquaculture.

Strategic Plan for Fishery Inspection (PEIP). The development objective of the PEIP corresponds to the immediate objective of the Fisheries Master Plan (2010-2019). Thus the first objective of PEIP is established in the following terms: "The inspection function of fish contributing fully for the Fisheries Sector to achieve the objectives expressed in the Fisheries Master Plan (2010-2019): (i) the national competent authority considered equivalent to give official guarantees, with no restrictions, to access to food of aquatic

origin (wild and farmed) for its availability in the international markets; (ii) supporting actions aimed at improving the quality of hygiene and health in food products of artisanal fishing and small-scale aquaculture origin; (iii) support activities along the supply chain in order to improve the quality of hygiene and health of aquatic food products, and (iv) gradually create conditions for all industrial processing plants and commercial fishing vessels to sell products to the domestic market in the possession of a sanitary certificate”.

Institutional Capacity

The National Institute for Aquaculture Development (INAQUA) of the Ministry of Fisheries has a leading role to play for the development of aquaculture in Mozambique. It has autonomous provincial delegations.

Shrimp culture research is recognized as constraints in Mozambique aquaculture strategy. In the early 1980s the Government of Mozambique and French Aquaculture evaluated and selected three main areas for shrimp culture development—Maputo, Beira and Quelimane. This study was later, in 2007 to 2011, updated and covered all coastal areas. The FAO set up a 10-ha demonstration shrimp project in Maputo (80's). The main problem was the lack of wild shrimp PL to stock the pond. There were no hatcheries. There were four different shrimp species in the area and it proved to be difficult to sort them out. Each had different growth characteristics, and they could not be cultured together (Rafael & Ribeiro, 2002).

Environmental management and monitoring is primarily a government function for which the INAQUA has a primary responsibility in respect of aquaculture. The Ministry of the Environment has management functions, which affect aquaculture, such as land use and environmental impact assessment. INAQUA has made progress to carry out the environmental management functions required for marine aquaculture, and is tasked with liaising with other Government Departments, which have legislated environmental management functions. The two main environmental considerations are site selection and site assessment.

Aquaculture Strategy identifies education and training as essential for the growth of aquaculture. Despite most of the Government staff trained at post-graduate level has completed their degrees with a specialization in aquaculture in other countries (United Kingdom, Canada, Iceland, and Brasil, South Africa), there are presently opportunities for aquaculture training and education in Mozambique and there are currently few experienced nationals who are capable of training others. Currently, some public Universities and Polytechnics in Mozambique offer aquaculture subjects at undergraduate and post-graduate level and in collaboration with European Universities (e.g. Brazil, Norway, Sweden). The Fisheries School has a three year aquaculture course and students graduate as technician.

Shrimp culture producers in Mozambique are organized in association. The Shrimp Producers Association of Mozambique (APCM – Associação de Produtores de camarão de Moçambique) is an association without profit aims, with legal personality, constituted for an indefinite period and representing 100% of the aquaculture industry in Mozambique. Despite being a very new industry, APCM members jointly represent, so far, a total private investment of more than 100 million U.S. dollars invested in Cabo Delgado, Sofala and Zambézia, generating approximately 2,000 direct jobs and a potential income of approximately \$ 25 million per year. APCM comprises the following three incumbents: AQUAPESCA, LDA; Indian Ocean Aquaculture and Sol & Mar (APCM, 2013).

Mozambique Investment Centre (CPI) is an institution of the Ministry of Planning and Development that identify viable, bankable projects and find suitable investors locally and regionally, as well as internationally. Provides institutional assistance to investors in approval and implementation of investment projects; ensure investors to get access to fiscal incentives provided by law for establishment of their projects; promote business linkages between domestic and foreign companies, small and medium enterprises and large companies.

LEGISLATIVE FRAMEWORKS IN PLACE THAT UNDERPIN AQUACULTURE DEVELOPMENT

Legal and Policy Framework

There legislative framework for aquaculture comprises several legal instruments that have been developed and approved to provide support for aquaculture development in Mozambique, these include:

- Law 19/1197 of September: Land Law
- Law 20/1997 of 1st of October: Environment Law
- Law 16/1191 of 3 of August: Water Law
- Law no 4/2009 of 12 January. Fiscal Benefits Code
- Law 22/2013 of 1st of November: Fisheries Law
- Decree 35/2001, of 13 November: General Regulation of Aquaculture;
- Decree 43/2003, 10 of December, Regulation of Maritime Fisheries (REPMAR);
- Decree 57/2008, 30 of December, Regulation of Fisheries in Inland Waters
- Decree 42/2008 of 4 of October, Regulation concerning Environmental Impact
- Decree 76/2009, 15 of December, General regulation for hygiene control on foodstuffs of aquatic origin
general regulation for hygiene control on foodstuffs of aquatic origin
- Decree 71/2011. Aquaculture Marine Reserve
- Regulation of Aquatic Health Animals (in Press)

Law 22/2013 of 1st of November: Fisheries Law

The Law 22/2013 of 1st of November: Fisheries Law is now covering many issues of aquaculture, as the need to develop this sub-sector has been clearly identified by the government. It defines clearly the role and responsibilities of the fisheries authorities and principles guiding aquaculture activities. It empowers the Fisheries Authorities with responsible for regulating all the aquaculture issues such as the definition of species allowed to be grown in aquaculture facilities, the aquaculture production systems, the standards and principles to be observed in species introduction and control of diseases, standards on the use of chemicals, feedstuff and veterinary drugs.

Decree 35/2001, of 13 November: General Regulation of Aquaculture

The object of this Regulation was to put into effect the Law 22/2013 of 1st of November, related to provision for aquaculture activities. It is a Regulation that applies to all individuals or organizations, nationals or foreigners who exercise any aquaculture activity in the territory and / or jurisdictional waters of Mozambique. It serves as the basic legal framework regulating the development of aquaculture. It is a valuable tool as it addresses a considerable range of aquaculture related issues, however, certain clauses of the decree such as those relating to the environmental issues, import of exotic species and disease control needs to be addressed properly and harmonized with the other legislative frameworks and roles defined. The Decree No 35 of 2001 is lack of standards in some of the issues addressed, with direct effect on its enforcement. The Fisheries Sector in Mozambique is now considering revising the General Regulation of Aquaculture currently in place.

Article I, Section I, Chapter II in the regulation, states that “the Ministry of Fisheries will promote the preparation of development plans concerning Aquaculture, whenever necessary.” The inventory and reserve of potential areas for marine and inland water aquaculture is part of development plans conducted by the sector in order to promote aquaculture in the country.

The use of land and water that is part of the public ownership of water resources for aquaculture purposes, are subjected to a respectively defined regime in the land and water legislation (Article 6). Related to production systems, there are three identified production systems in the exercise of an aquaculture activity, namely,

extensive system, semi-intensive system and the intensive system. Shrimp aquaculture activity is restricted to the application of extensive and semi-intensive systems.

The import of aquatic species requires an authorization from the Ministry of Fisheries, following consultation with the Fisheries Research Institute (IIP), where applicable quarantine norms should be specified (Number I, Article 9).

Regarding the authorization for the establishment of an aquaculture project, the application of authorization for the establishment project of industrial, experimental and research aquaculture has to be filled according to the form attached in Annex I of the Regulation and the application must be delivered to the local provincial representation of the Ministry of Fisheries together with indispensable elements for its appreciation (Article 12, Section II).

The starting of aquaculture activity and the issuing of a license are conditioned to the realization of an inspection to check the appropriateness of the installation for aquaculture with the terms of authorization (Article 15, Section III).

Market and Consumer (Article 20, Section I, Chapter IV): The handling and processing, as defined in the General Regulation for Aquaculture, as well as the storage, commercialization and exporting of aquaculture produce should comply to hygiene, sanitation and quality management norms, as well as, the authorization to install such establishments and sanitation license, as stated in decree number 17/2001, of the 12th June, and its complementary legislation.

Genetic manipulations (Article 21): According to the applicant's request, the Ministers of Fisheries and Health, following consultation with the Fisheries Research Institute, may authorize, through a joint dispatch, the performing of genetic manipulations. The application to carry out genetic manipulations should be addressed to the Minister of Fisheries and delivered to the appropriate central body at the Ministry of Fisheries with concise and necessary elements for analysis.

It is important to refer that in the present mandate (2010-2014) the Fisheries Sector has indicated the Aquaculture Sub-sector as the top priority for development within the Sector. The availability of aquatic resources and the existence of excellent environmental conditions offer opportunities to develop marine aquaculture of prawns, fish, bivalves, seaweed and other aquatic organisms; given the high commercial value of prawns, and the great pressure on stocks of wild prawns, the government's priority is to develop and expand the marine aquaculture of prawns.

The government of Mozambique in recognition of the importance of aquaculture for the socio-economic development of the country and poverty alleviation has defined aquaculture as one of the top priority activities to be carried out from now onward. Plans for the country include, amongst others, increase of both local and foreign investment, increase in public investment of the provisional and local Government for aquaculture. In this regard, the Government organized the first ever Business Conference in November 2010 at an international level, to attract international investors to Mozambique for the purpose of boosting its Aquaculture industry. The Conference served as a platform where investors and aquaculture business companies were informed on Mozambique's resources, investment potential and business opportunities in the aquaculture sector.

ROLE OF PRIVATE AND PUBLIC SECTOR IN SECTOR DEVELOPMENT AND LESSONS TO BE DRAWN IN THE SECTOR DEVELOPMENT IN THE COUNTRY

Industrial Aquaculture Development Requirements

The General requirements for any investors who would like to invest in Mozambique, including all the processors and different stakeholders within the Government to acquire are:

- land use right under the Ministry of Agriculture,
- water use right with the Ministry of Public Works and housing,
- investment applications, with commercial banks
- aquaculture project application with the Ministry of fisheries, and
- Environment Impact Assessment (EIA) with the Ministry of Environment.

Some challenges that are still being faced by investors, include gas and tourism conflict, the need for vertical integration with financing and that there is no service industry in the country, thus individual companies need to be completely self sufficient. The shrimp aquaculture industry in Mozambique has been hit in 2010 by the white spot virus, which caused high mortality and practically closed off the shrimp operations in all the different farms across the country. It was a negative situation for the investors, and most importantly, to be able to survive the companies are considering entering into Public Private Partnership, and also considering to divert to other aquaculture species, such as tilapia in order to use their facilities and retain part of the many lost jobs.

There is an increase in conflict between the different industries, and on this account the Government of Mozambique has become proactive in zoning land and water areas for aquaculture purposes, to enable growth in all sectors and motivate the investors. The Marine Reserve Aquaculture established under a presidential Decree is the main instrument recently produced to minimize conflicts with different industries and protect potential areas for aquaculture development. A similar work is also being developed to identify and reserve potential areas for inland aquaculture.

Other issues that are still important challenges for aquaculture development in Mozambique, where there is already some work going on, are:

1. Unavailability of feed: At the present some experiments for feed production locally are taking place in chicken feed factory. The major constrain is to get the pellets extruded as it requires an additional important investment for the factory and take the risk of diversifying their orientation in feed production.
2. Inadequate support infrastructures such as research, reference laboratories for aquatic animals diseases, environmental contaminants according with international requirements;
3. Lack of human and financial resources to monitor the impacts of aquaculture on the environment.

Despite all problems that have been hampering the development of aquaculture in Mozambique in this particular case the marine aquaculture, some progress has been made in the development of a strategy for white spot disease control on shrimp industry, inventory of potential areas for marine and inland water aquaculture, appearance of new industries of marine aquaculture farming marine fish and also exploiting possibilities of farming crabs and mussels, interaction with other projects where there is an overlap and an apparent conflict of activities

Investment strategy to attract foreign investors into aquaculture

Mozambique has established an investment strategy to attract private sector investment primarily set up for shrimp aquaculture investment (National Directorate of Fisheries, 1994) and later extended to all aquaculture

activities as part of the overall country investment strategy. There are specific legislation on investments with objectives to: define the powers, intervene with time limits for deciding investment projects; determine the minimum and forms of foreign direct investment; establish the procedures, establish the rules for determining the real value of the investment, define the rules of the authorizations, establish mechanisms for integration and coordination, planning, implementation and monitoring of the functioning of Special Economic Zones or Areas (SEAs) and Industrial Free Trade Zones (IFTZs) and define the rules of communication and correspondence and resolution of complaints. Two government agencies, CPI (Center for Investment Promotion) and GAZEDA (The Office of Accelerated Development Economic Areas) assist investors during approval and investment implementation phase and act as “one stop shop” connecting investor to other government agencies (GLM, 2010 & Waty, 2011). In general the investment incentives system in Mozambique comprises of four major components, namely (i) tax incentives, (ii) customs incentives, (iii) incentives related to the repatriation of invested capital and profits, and (iv) the security and protection guarantee provided by the Mozambican state for private property and investment. Specific tax and non-tax benefits were approved for SEAs and IFTZs. Certain sectors, projects and territories are eligible for specific incentives, as is the case with agriculture, aquaculture and fisheries (which is eligible for a substantial reduction in the income tax rate), hotel and tourism activities, mining, oil, Rapid Development Areas and Industrial Duty-Free Areas and, finally, large projects (that is to say, projects with a value of over 500 million USD) (Law 4/2009 of 12th January). The two shrimp farms that are still operating were approved under Zambezi Valley Development Zone fiscal benefits (a SEA). The shrimp farm that closed operations in 2007 was approved under IFTZ.

HARVESTING, PROCESSING, MARKETING AND DISTRIBUTING SYSTEMS OF THE SHRIMP INDUSTRY IN MOZAMBIQUE AND THEIR EFFECTIVENESS

Worldwide, the growth of aquaculture has led to significant changes in how its products are perceived and marketed. In becoming an important contributor to the markets for seafood, aquaculture is increasingly subject to safety mechanisms and controls, such as the statutory hazard analysis critical control point (HACCP) methodology. In order to review the harvesting, processing, marketing and distribution systems on the status of aquaculture in Mozambique and their effectiveness, this document based on a structured interview and the Standard Operating Procedure (SOP) review.

The review of harvesting, processing, marketing and distributing systems of the Shrimp Industry in Mozambique and their effectiveness, as well as data collection and record keeping is centered in one shrimp aquaculture company (AQUAPESCA), as is the existing company currently operating in Mozambique. The shrimp industry in Mozambique is small, with only two industrial shrimp farms currently in operation. The total production area in these two farms is only 534 Ha. However, there is significant potential for further development (Omar & Hecht, 2011).

According to the interview and Standard Operation Procedures review, below is the status of the shrimp aquaculture sector in Mozambique:

Harvesting, Icing and transport

Before beginning shrimp harvest, the farmer has proper containers and adequate quantities of clean water for the tank and adequate quantities of ice. Besides that, sufficient numbers of people on site are recruited for the estimated harvest quantity. During shrimp harvest the shrimp is handled quickly and gently to avoid damage, strictly following the HACCP. The shrimp is rinsed clean and transferred to an ice bath and weighed. The ice bath consists of 50% ice and 50% saltwater. Shrimp is kept in this ice bath for a minimum of 15 minutes and a maximum of two hours before transported to the processing plant.

During the transportation, the temperature of the shrimp is lowered to 0 degrees Celsius (32 degrees Fahrenheit) after harvest and the cool temperature is maintained in order to avoid the product from developing black gills, shell discoloration, a red head or to deteriorate in any other way.

Processing

The handling, processing, and marketing of shrimp products are essential complementary functions of all food production systems. However, the product quality and integrity issues are addressed through a specific action plan, Sanitation Standard Operating Procedures (SSOPs) created and implemented to establish and maintain control of the processing environment.

Processing is limited to grading and freezing. Sometimes when the prevalence of molten animals is high, heads are removed before freezing. Foreign workers are employed at several steps of production (broodstock and ponds) and process.

At the processing plant, the size and quality of the shrimp is checked and sorted accordingly to meet a variety of consumer and customer needs. Depending on the client specific product specification, the product is processed according to the Mozambican regulation as well as according to local regulation in the country of export. Each facility has lines designed specifically to process shrimp according to these product formats. Shrimp are generally processed by hand. For added convenience, some frozen shrimp are sold pre-cooked.

Shrimp are steamed cooked to specific temperatures and cook times and are then cooled quickly to maintain quality.

Product Quality

Samples of each finished production code receive qualitative and quantitative evaluations prior to being released for shipment. Specific attributes that are evaluated include color, flavor, smell, texture and workmanship.

Marketing and distribution system

Finished product is shipped to the customers. For the market and distribution system, the shrimp industry in Mozambique uses marketing mix channel (Needham, 1996), defined by two categories namely: selective and exclusive distribution, where the industry relies on few to very few intermediaries. The product is mainly exported overseas, specifically Japan, Asia and European Union.

Data Collection and Record Keeping

Monitoring is well documented in term of procedures and operating manuals and a review of the manual has been made recently. All records (ponds parameters and production measures as well as plant monitoring) are processed in a database conceived by the company, which allows efficient use of the information for analysis, following production and reporting.

AREAS WHERE IMPROVEMENTS CAN BE MADE OR GAPS REQUIRING RESEARCH ALONG THE PRODUCTION SIDE OF THE VALUE CHAIN AND RECOMMENDATIONS FOR BEST PRACTICES INCLUDING IMPLEMENTATION OF INTERNATIONAL GUIDELINES OR INSTRUMENTS FOR SUSTAINABLE AQUACULTURE DEVELOPMENT

There are a considerable number of documents, policy papers and legislation are available to support and regulate aquaculture operations in Mozambique. Most of them can be considered satisfactory as they are based on relevant international legal framework, and they meet required standards but some still need to be adjusted to meet those standards.

The General Regulations in Aquaculture (Decree No 35 of 2001) It is a valuable tool as it addresses a considerable range of aquaculture related issues, however, certain clauses of the decree such as those relating to the environmental issues, import of exotic species and disease control needs to be addressed properly and harmonized with the other legislative frameworks and roles defined.

The Fisheries Law (Act No. 22/2013) recently approved revision of the complementary legislation. Therefore, the authorities should consider revising, in 2014, the current regulatory framework on aquaculture.

There is lack of legislation regarding aquatic animal health where the role of each stakeholder is clearly defined. INAQUA, the government agency responsible for overseeing the aquaculture industry is taking the lead on drafting the aquatic animal health legislation. On the other hand, INIP is the designated Competent Authority for aquatic animal health, but lacks a reference laboratory or personnel with training in aquatic animal disease diagnostics (Responsible Aquaculture Foundation, 2013).

Environmental issues

It is widely known that the aquaculture industry can impact on the environment if appropriate measures are not taken. Some of the environmental impacts attributed to aquaculture are (Boyd, et al, 2008):

- Destruction of mangrove, and other sensitive aquatic habitat.
- Conversion of agricultural/grazing land to ponds.
- Water pollution resulting from pond effluents.
- Use of drugs, antibiotics, and other chemicals for aquatic animal disease control.
- Inefficient utilization of fish meal and other natural resources for shrimp production.
- Salinization of land and water by effluents, seepage, and sediment from brackish water ponds.
- Spread of aquatic animal diseases from culture of organisms to native populations.
- Conflicts with other resource users and disruption of nearby communities.

The Environment Act empowers the Ministry for Coordination of Environment Affairs (MICOA) the authority for approval of a project based on the Environment Impact Assessment. In Mozambique, the Environmental Impact Assessment (EIA) in aquaculture is only mandatory if the project size is over 5 ha or if the production is over 100 tonnes/year. The small-scale farmers do not require EIA or any other authorization from the Ministry of Fisheries to setup their farms. This procedure can jeopardize the environment.

Some reasons can be advanced for including the small-scale farmer to some degree in environmental assessment processes:

- There is always a potential for an aggregation of small farmers to collectively create unexpected environmental impact. For instance, the Mozambique Government in its effort to introduce aquaculture in inland areas has been encouraging the rural communities to work collectively in building their ponds. As a result, aggregates of ponds belonging to the communities are emerging massively in some parts of the country.

- This category of farmer would benefit from some formal protection from negative impacts on their resources as a result of other external activities.
- Environmental issues are often a key part of the message working towards best aquaculture practice (for example in sustaining good water quality). Some support to small-scale farmers can be provided as part of institutional outreach activities, possibly in the form of a simple checklist approach, which informs the farmer/extension personnel of the best management options for aquaculture and draws attention to acceptable or unacceptable practices.

Local people with inadequate technical knowledge and capital have developed small shrimp aquaculture projects in coastal areas (e.g. in Angoche area) without formal permission from the government. Such projects may do tremendous environmental damage, and they often are abandoned within a few years.

Sanitary issues

The most important destinations of Mozambican exports of shrimps from aquaculture are the EU, South Africa and the Middle and Far East (Mendiate, 2013), whose importing requirements for standards are high for access to their markets. In order to export, Mozambique has to comply with the standards demanded by the importing market, which are basically related to sanitary and environmental contaminants issues.

The processing of shrimps made by the aquaculture companies and processing plants in Mozambique is modest, consisting basically of removing objectionable materials, cleaning and control for specific parameters required for health and sanitary standards, done at the processing plants. Typically the final products are block frozen head-on or headless shrimps (Mendiate, 2013).

Mozambique is presently listed in the EU Annex II to Decision 2006/766/EC establishing the list of third countries and territories from which imports to EU are permitted of fishery products for human consumption. And is also in the Annex to Decision 2011/163/EU, indicating that the residue monitoring plan (RMP) is approved in accordance with the EU Directive 96/23/EC for aquaculture and therefore can export aquaculture fishery products to the EU (Food and Veterinary Office, 2013).

As such, Mozambique is periodically subject to audits from the EU. The scope of the audits is focused on the organization and performance of the Competent Authorities at central and regional level, the export certification procedure, the official control system in place covering production, processing and distribution chains applicable to fishery and aquaculture products to be exported to the EU. The scope also covers the legal and administrative measures in place to give effect to the relevant EU requirements and controls with regard to residues and veterinary medicinal products and their operation, and the performance of residue laboratories.

The very last audit was carried out in April and May 2013 by the Food and Veterinary Office of the European Commission (FVO) and the results show that the country is making significant progress with regards to sanitary issues.

The legislation and standards applied to exports are largely in line with the importing country's highly demanding rules (e.g. the EU rules) and provide an adequate basis for the Competent Authorities (CAs) to implement an official control system aimed at providing the necessary guarantees with regard to importing countries requirements.

The National Institute of Fish Inspection (INIP), the CA has been given the mandate, enforcement powers,

resources (facilities, equipment, staff training and a dedicated laboratory network) and have put in place the necessary written procedures to perform the official controls required.

The Residue Monitoring Plan (RMP) is based on the requirements of the EU Directive 96/23/EC and in most respects is in conformity with the requirements set out in that Directive, for example concerning the sampling procedures and substances to be tested for. Overall, the standards set and the operational procedures, provides for a good system of official controls (Food and Veterinary Office, 2013). However, certain deficiencies in the implementation do not allow the CA to fully guarantee that all fishery products exported comply with the norms and are produced in accordance with the sanitary conditions for fishery products (Food and Veterinary Office, 2013).

As regards to the system of residues controls, it can generally be considered satisfactory (Food and Veterinary Office, 2013). However the effectiveness of the residues monitoring plan has few weaknesses in its implementation, laboratory performance and controls on the authorization, distribution and use of veterinary medicines.

Social Issues

The main social issues found related to shrimp aquaculture in Mozambique are conflicts over use of land, water and other natural resources. Disputes over land rights are most common in coastal areas of countries where the right to use coastal land resides in concessions or leases from local or national governmental authorities rather than from land ownership (Boyde et al., 2008). In Mozambique the land is owned by the State. Influential investors obtain the right to use land through financial influence, and considerable extensions of land have been ceded to companies for many years. Local people sometimes have been unable to develop small aquaculture projects in prime areas because the land has been conceded to large companies.

The siting of aquaculture projects has caused much conflict between local communities and the aquaculture industry. The main social problem is related to the installation of the shrimp farms in places that interfere with use of traditional resources. Farms have blocked the routes to fishing sites and farms may be built in mangrove areas (at least the small scale farms) that had been sources of fuel, building materials, and other resources for local communities. Pollution by farms also may result in a decline in fish and other aquatic organisms important as a local food source.

Large aquaculture facilities may be major employers and play an important role in local economies. Therefore, these companies should exhibit civic responsibility by being a good neighbor in local communities. For example, they should have regular meetings with local civic leaders. These meetings could serve as a dialogue in which farm management and local leaders could exchange information and make plans for avoiding conflicts. Aquaculture facilities should hire local workers to the extent possible, and they also should make contributions to community health and educational programs.

Aquaculture companies should also show due responsibilities to their workers. Wages should be equal between the nationals and foreigners doing similar tasks. This does not often happen in Mozambique, where the foreigners, mainly from the investor's country, have much more higher salaries than the nationals regardless their role in the company.

Because the facilities are located in remote areas, workers sometimes are housed on farms when on duty. These workers should have adequate and healthy food, good living conditions, and access to health care including prompt treatment for on-the-job accidents or sudden illnesses.

Sanitation is a major issue where workers live on farms. Sanitary bathrooms and bathing facilities must be maintained, and wastewater from living quarters, offices, and kitchens must be treated before discharge to the environment. Solid wastes must be collected on a regular schedule and not allowed to accumulate.

FINAL CONSIDERATIONS

The long-term viability and sustainability of the shrimp industry development in Mozambique, particularly in respect of commercial aquaculture, will be market driven, taking into account not only the consumer's requirements but also the structure and legislative demands of the target market, be it local or international. Some of the key issues that need to be addressed by both the government and the private sector are mentioned in the following sections.

- There is a growing desire for knowledge of what is being consumed, a position that, in some cases, is accompanied by liability for consumption.
- The collection, analysis and dissemination of relevant information must be facilitated in order to enable producers and industry operators to make informed decisions and to ensure consumer confidence in aquaculture products.
- Increased efforts must be taken to improve the quality of food that is placed in the market taking into account the growing concern about food safety.
- Achieve and maintain consumer confidence requires considerable effort.

LESSONS FROM MOZAMBIQUE AQUACULTURE SHRIMP INDUSTRY

National aquatic animal health policies are critical for national biosecurity

The lack of a national aquatic animal health legal framework and policy proved that the country was vulnerable to epizootic disease outbreaks. The white spot syndrome virus that took the shrimp aquaculture industry into the collapse was found almost over the entire coastal area shortly after the first outbreak, suggesting that it may have been present in the country for long time before the first outbreak. If a national surveillance program was in place, and the sampling of the wild populations was done on a regular basis before the outbreak occurred, it would have allowed the shrimp farmers to take necessary measures to improve biosecurity before the disease affected their farms.



Source: APCM

Figure 4: Broodstock quarantine facility at Aquapesca hatchery

Institutional capacity and management

The fisheries administration is well established in a way that it is represented at national, provincial and district levels. It is proven by the outcomes of the recent efforts of the government to create and strengthen the capacity of the fisheries sector. Regarding capacity building, the government identifies education and training as essential for the growth of the aquaculture by training and specializing national human resources to reduce production costs of hiring international expertise.

Regarding environmental enabling, the government recognizes that it is its primary function and responsibility. The fisheries sector works closely with other sector such as Ministry of Environment Affairs relatively to environment impact assessment and with other relevant sectors in order to guarantee an appropriate and effective growth of the fisheries sector including aquaculture.

Market and Distribution Systems

Market and export driven factors have influenced the development of the sector leading to production reduction and closure of one of the shrimp farm in the country. This can be used as lessons learned as it provided some essential precaution and insights that are relevant to establishment of a strong and sustainable aquaculture industry.

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