

# **Integrated Assessment of Trade-related Policies and Biological Diversity in the Agricultural Sector in Madagascar**

## **Transition strategies for the shrimp farming industry Summary**

### **1 Introduction**

Madagascar's shrimp aquaculture sector was selected as the focus of the integrated assessment (IA) because of its economic importance, the important social impacts that could come about as a result of trade liberalization and the sector's close connection to the country's environment and biodiversity. The IA examines future options for the sector to address challenges posed by the evolving nature of export markets and, in particular, trade liberalization under the Economic Partnership Agreements (EPAs) negotiated between the European Union (EU) and the Africa, Caribbean and Pacific (ACP) group of countries. The EPAs will be non-discriminatory and reciprocal. They involve the phased removal of trade preferences established between the EU and the ACP countries and the progressive removal of trade barriers between the trading partners (although adjustment can occur at different rates).

This IA focuses on the EPA and its potential impacts on the future of Madagascar's already globally uncompetitive shrimp aquaculture sector. It was prepared with a view to identifying prospects for the future. It examines the impact of a baseline scenario (representing the *status quo*) and two additional scenarios for the industry: the first examines the effect of fully implementing the EPA; the second examines the combined effect of liberalization under the EPA and the development of eco-certification for shrimp from Madagascar. In the IA, liberalization is discussed primarily in terms of access to the important market in the EU. Ultimately, the IA seeks to influence the policy-making process associated with the shrimp aquaculture sector. It employs a holistic approach, examining how anticipated outcomes of the three scenarios will affect specific economic, social and environmental variables.

Biodiversity is an important consideration in the policy-making process for a country such as Madagascar. It is an island country with unique wealth in terms of its flora and fauna. In economic terms, some of its most important economic sectors, including fisheries, agriculture and tourism, are supported by, and rely on, these natural resources. Biodiversity also contributes to social well-being and environmental health by providing critical ecosystem services. The country has very high levels of endemism for many animal and plant species, including those that live in the mangrove forests along its coastal areas where the shrimp farms are located. The high levels and the health of biodiversity in Madagascar face challenges, especially due to deforestation and the loss of forest cover and habitats. Some species of both animals and plants are threatened with extinction.

### **2 The context of the integrated assessment**

#### **2.1 The state of commercial shrimp aquaculture in Madagascar**

Commercial shrimp farming was introduced to Madagascar in the early 1990s. From the beginning, international organisations and foreign investors have dominated the sector through their contributions in terms of financing, technical support and infrastructure development. To date, the private sector, backed by international investors, continues to dominate the industry. The shrimp aquaculture sector in Madagascar has grown in importance over the years and is responsible for the direct and indirect employment of over 3 000 people on the island.

Despite its initial promise, the future of shrimp aquaculture in Madagascar is uncertain. The sector is confronting various structural problems which have led to the closing of several commercial operations and the widespread loss of employment. Price has been a significant factor in the industry's decline over the past decade. Shrimp farmed in Madagascar are of a high quality but also sell at relatively high prices. They cannot compete with less costly shrimp from Asian producers in the principal export markets, such as the EU.

One of the species of shrimp endemic to Madagascar and prized by shrimp farmers is *Penaeus monodon*. It is renowned for its size and quality and sells for up to three times as much in the European market as shrimp from other countries. *Penaeus monodon* is valued by consumers for its taste and texture but is considered too expensive by those whose purchasing decisions are based primarily on price. Therefore, on price alone, shrimp products from Madagascar cannot compete in export markets. Whether they can perform successfully in high-end niche markets has yet to be established or substantiated but represents a marketing opportunity that might be a viable solution to the crisis now confronting the industry.

In conjunction with the Government of Madagascar, the *Groupement des Aquaculteurs et Pêcheurs de Crevettes de Madagascar* (GAPCM) is examining ways to overcome these challenges and to re-launch the industry. Government and industry representatives believe that the industry has a future and can continue to generate valuable foreign exchange; they project an increase in the value of all aquaculture products for export from DTS 97 million in 2006 to DTS 177 million in 2012.

## **2.2 Trade-related policies affecting the shrimp sector**

When the IA was undertaken, Madagascar, along with the other countries in the negotiating configuration of Eastern and Southern African countries, had signed an interim EPA. It is expected that a final EPA will follow.

The EPA negotiations have highlighted several challenges facing Madagascar with respect to the export of fishery products to the EU. These include the erosion of ACP trade preferences, given the ongoing liberalisation of trade at the multilateral level. They also include specific trade-related measures such as complying with rules of origin and often complex sanitary and phytosanitary (SPS) and other standards applied to exports to the EU. Some measures in the interim EPA are relevant to the shrimp aquaculture sector. For example, Article 33 indicates that EU support is focused primarily on reinforcing the development of export markets, capacity building, technology transfer, SPS standards, investment, financing, environmental protection and building appropriate legal and regulatory frameworks.

Realizing that further trade liberalization will make its shrimp exports increasingly uncompetitive, the shrimp industry in Madagascar has worked hard to establish its products as high quality alternatives to lower priced options through a labelling or certification process. This could enable shrimp farmed in Madagascar to gain and maintain key market access, especially in the French market where Malagasy shrimp are certified under both the *Label rouge* and *Agriculture biologique* labels. But this effort alone may be insufficient to guarantee the long-term competitiveness of the industry.

### **3 The integrated assessment**

#### **3.1 The process**

The IA in Madagascar was led by the Ministry of Agriculture and Fishery (MAEP), represented by its environmental division. The MAEP designated the *Ecole Supérieure des Sciences Agronomiques (ESSA)*, Department of Water and Forests, as the principal research institution to undertake the IA.

The project steering committee, called le *Comité National Directeur (CND)*, coordinated the project at the national level and included representatives from MAEP and the research institution, representatives from Ministry of Economy, Trade and Industry (MECI), Ministry of the Environment, Water, Forests and Tourism (MEEFT), Ministry of Education and Scientific Research (MENRS), and a representative from the GADCM.

The study was undertaken by a national team and included input from several national and international stakeholders including representatives from the industry and industry associations, government officials, international organizations (such as the EU) and non-governmental organizations. The key actors involved in the IA included local communities, the operators in the shrimp aquaculture sector (under the umbrella of the GAPCM), policy makers, research centres and the Universities of Antananarivo and Mahajanga, different ministries, the Authority for Fishing Health, the National Programme for Shrimp Research of Mahajanga, the Economic Observatory for the Shrimp Sector, and the World Wide Fund for Nature.

Several meetings were held during the course of the project. The project was launched at the first national workshop, which was held in Antananarivo from the 9-11 May 2007. This meeting also included working group sessions to build capacity with respect to IA among the relevant actors. A regional workshop was held in Mahajanga on 12-13 September 2007, to present and discuss the project at the regional level. A mid-term national review workshop was held on 12 June 2008. The objective of this workshop was to achieve consensus with respect to the principal avenues of research, notably with respect to the policies chosen, the indicators, the scenarios and the impacts. Another national workshop was held on 26 September 2008 to discuss the findings and to adopt the report. Five meetings of the CND were organized during the first year of the project in 2007 and three in 2008. Above all, these meetings contributed to the general organization of activities and on the validation of the results. Over the course of the IA, the project team participated in three International Review Meetings that were organized by UNEP and held in Geneva.

## 3.2 Methodology

The methodology employed in the IA involved the development of a conceptual framework, the definition of relevant indicators and the use of scenarios. The conceptual framework identified the links between shrimp aquaculture and sustainability, which include links between trade liberalization under the EPA, prices, production systems and environmental and social impacts. To analyze these linkages, the project team employed a range of tools starting with an environmental impact assessment of the potential impacts on the environment of industrial shrimp aquaculture. The team also employed a cost-benefit analysis to assess the economic impacts associated with shrimp aquaculture for each production site. This allowed the team, *inter alia*, to simulate the potential economic impacts of applying eco-certification measures on costs of production. The team also employed a multi-criteria analysis which examined the differences between the goals of conservation, economic development and social well-being. This analysis identified the preferences of the actors concerned and examined how resources were managed.

The indicators that were employed to undertake the evaluation covered economic, environmental and social parameters and were defined in the framework of the national and international workshops. Three scenarios were employed during the IA. These included a baseline scenario, a scenario involving the EPA, and a scenario that included the application of eco-certification.

- **Baseline scenario.** The baseline scenario reflects the existing trade regime, which includes an interim EPA, with no new policies or standards. Under the interim EPA the export of shrimp still benefit from EU preferences including duty-free and quota-free access. Also important under the baseline scenario is the application of the labelling regimes that apply to shrimp from Madagascar under the *Label rouge* and *Agriculture biologique* standards. It is important to note, however, that these two labelling regimes only relate to quality standards in the French market and, as such, are narrower than the regime proposed under the eco-certification scenario of the IA. Developing the baseline scenario required an understanding of the policies and their interactions at both the national and international levels including policies that directly or indirectly affected the production, trade and export of shrimp aquaculture products.
- **EPA Scenario.** The EPA scenario analyzed the impacts associated with conclusion of a full EPA with the EU, which would make the trading relationship between the ACP countries and the EU compatible with the WTO rules on regional trade agreements. The WTO requires that the EPA covers essentially all trade. This is typically interpreted to mean that the EPA will cover roughly 90 per cent of trade with some asymmetry permitted between the EU and the ACP countries. For example, the EU could liberalise 100 per cent of its market, while the ACP countries might liberalise 80 per cent, excluding certain “sensitive” or nationally-significant products from full liberalisation, which can also occur progressively over time. The EPA negotiations have focused on questions of development, market access, fisheries, services, and liberalization of agricultural trade. Madagascar has proposed a list of sensitive products that represent 19.5 per cent of its trade with the EU.

- **Eco-certification in the context of an EPA.** The eco-certification in the context of an EPA scenario involves liberalization under the EPA, in conjunction with eco-certification of shrimp aquaculture products. Eco-certification in this context is seen as an internationally recognized, albeit evolving, tool that promotes environmentally sustainable practices and biodiversity conservation. Eco-certification of shrimp from Madagascar is an initiative that has been championed by WWF France in conjunction with GAPCM. The process includes different actors in the sector and has been pursued through a series of dialogues organized in different regions to develop a global standard. The dialogue on shrimp aquaculture seeks to establish performance-based standards and criteria with the aim of certifying the shrimp aquaculture production. Standards are based on principles that include, for example, site selection, water use, feed management, social responsibility. At present, a pilot committee, which includes representatives of major stakeholder groups, is working with WWF France to develop the criteria for eco-certification.

### 3.3 Findings

The IA identified economic, social and environmental impacts associated with the baseline and each of the two other scenarios. Economic impacts include those affecting revenues as well as levels of employment. Social impacts include the effect shrimp aquaculture operations have on the provision of health and educational services, recreational facilities and other community infrastructure. Environmental impacts pertain to the conservation of land, air and water resources and animal, plant and marine life.

#### 3.3.1 Baseline scenario

The IA defines the *status quo* as continuation of existing industry policies under the interim EPA. Under the interim EPA shrimp exported from Madagascar will continue to enjoy preferential access the European market, and most shrimp produced in Madagascar will be exported to the EU. Moreover, the labels – *Label rouge* and *Agriculture biologique* – which are favourably recognized by consumers will continue to help secure access to the French market.

Despite these relative advantages, the industry continues to lose market share. Production costs, particularly the cost of inputs such as fuel and fish meal or flour, continue to rise. The costs of shrimp feed per kilogramme of shrimp rose from €1.69 in 2004 to €2.61 in 2006. In 2006, production costs rose from €8.32 per kilogramme to €9.83 per kilogramme. This puts the industry in Madagascar at a relative disadvantage because its production costs are higher than those of its main competitors and its products already sell at the high end of the price spectrum, making them even less attractive to price-sensitive consumers. The market price for shrimp from Madagascar is €15 per kilogramme while shrimp from other countries sells for between €7 per kilogramme and €10 per kilogramme. Revenues generated by the shrimp aquaculture industry in Madagascar are falling.

In the past, the industry has reacted to these market pressures by closing some commercial operations. Other operations continue to be at risk of temporary, or permanent, closure. GAPCM

estimates that the number of employees working in the industry decreased by 40 per cent over the five year period between 2002 and 2007.

If this trend continues, this may have negative impacts in terms of resource exploitation and positive impacts in terms of pollution. The shrimp farms help shield the mangrove forests from being exploited for wood and charcoal produced by burning wood. Despite their relative importance to the local economy, the farms occupy very little space. But their existence often impedes access to the surrounding mangrove forests. Closure of the shrimp farms will enable individuals to exploit areas for wood that were hitherto off limits and could lead to the over exploitation of mangrove forests. For example, experience shows that when one large shrimp farm was closed, the local population began to cut down the mangrove swamps in order to produce charcoal. This problem would be exacerbated if the farms that cease operations are located near populous areas. However, one positive impact of the farm closures may be the potentially lower level of water pollution in the areas surrounding existing operations, including a lower risk of possible infections transmitted from the commercial shrimp to endemic marine species.

From a social perspective, increasing levels of unemployment as a result of farm closures could lead to out-migration from affected areas, particularly of skilled workers. Those remaining may have difficulty making a transition into other sectors, and crime rates could increase. In addition, the struggle for control of the mangrove forests and other revenue-generating lands could increase social tensions between indigenous populations and newly unemployed migrant workers. On the other hand, conflicts over land would probably diminish as a result of migration, taking pressure off existing land, except in certain areas where agricultural potential is high. Closure of the shrimp farms will also result in the loss of the social benefits and supports provided by the industry. Commercial shrimp aquaculture operations designate up to two per cent of their revenues to the economic and social development of local populations. When they close, the quality of health, educational and other social services may suffer. These impacts could be alleviated to the extent that there is migration out of the affected areas.

This IA suggests that the risks of continuing with the *status quo* are unacceptable to most industry stakeholders, including the private companies and foreign investors involved in most commercial operations, the industry associations, the government, and the employees and their families.

### **3.3.2 The EPA scenario**

From a trade perspective, the EPA could open shrimp from Madagascar to an even more unfavourable trading environment, resulting from the erosion of tariffs and trade preferences, and the further loss of market access and competitiveness of shrimp from Madagascar. This could result in the closure of additional shrimp aquaculture operations. It is likely that the most important economic impact would result from changes in price structures. Shrimp from Madagascar are already the most expensive shrimp in the EU market and must increasingly compete for market share in Europe with shrimp from India, China and other Asian countries, despite the fact that those countries face import duties on shrimp entering the EU. The EPA could make shrimp from Madagascar even less competitive in the EU market, if they also

become subject to import duties, which are typically much higher for agricultural products than for industrial goods. Most European consumption (with the exception of the Spain and Portugal) is driven by price rather than by quality.

Any upward pressure on production costs in the shrimp aquaculture sector in Madagascar poses an additional threat to the viability of the industry. This could accelerate the impacts that were identified in the baseline scenario with respect to the permanent or temporary closure of additional shrimp aquaculture operations and increasing levels of unemployment. Given the increasing pressure on the competitiveness under a full EPA, it is likely that even more shrimp aquaculture operations would close than under the baseline scenario, leading to proportionally more severe negative social impacts related to increasing unemployment, declining social benefits, and potential conflicts over land resources. As in the baseline scenario, from an environmental perspective, there is a risk of increased access to mangrove forests, deforestation and exploitation of biodiversity although levels of contamination of areas adjacent to the shrimp aquaculture operations that have been closed would improve.

It is worth noting, that the EPAs allow a proportion of specific goods that are considered nationally important or economically sensitive, to be excluded from full liberalization. Therefore it is possible that under a final EPA shrimp from Madagascar could be classified as a sensitive product and could continue to enjoy the trade preferences that it has enjoyed in the past. The impact on the industry would then be similar to the impacts identified in the baseline scenario.

### **3.3.3 Eco-certification in the context of the EPA**

Eco-certification and the related sustainability standards are currently a topic of discussion within the industry. Several producers are convinced that eco-certification is the only way that they can maintain their position in the niche market for high-quality products. They reason eco-certification is necessary to justify the higher price for conscientious consumers and, ultimately, to brand their product for its superior qualities, and maintain their own commitment to the ideal of sustainable development. Producers also recognize that existing quality standards, such as the labels used to gain access to the French market, could be used to penetrate other national markets.

However, for farms to adopt eco-certification standards, the process of obtaining certification can require an overall investment of €15 000 to €200 000, including for the construction of new tanks and other infrastructure improvements, as well as for inputs such as fish food or meal. This would be in addition to the actual costs associated with the certification process. As a result of achieving eco-certification, producers could maintain the market prices for their shrimp and access niche markets and conscientious consumers willing to pay the price premium associated with Malagasy shrimp. In some cases, the higher production costs may not always be fully compensated for by increases in price and it is possible that some companies may have to reduce staff levels to mitigate the higher costs associated with the eco-certification process. Nevertheless, in conjunction with increased promotion of the benefits of eco-certification and increasing consumer awareness, and given the high quality and high cost of Malagasy shrimp, this scenario presents the most viable future for shrimp aquaculture in Madagascar from an economic perspective.

There are also several environmental benefits associated with the eco-certification scenario. The principles associated with eco-certification address issues related to the use of the shoreline (obligation to construct farms on shores that no longer have vegetation), mangroves and water, the emission of hydrocarbons, the treatment of waste and wastewater, and the use of forest products and forest management related to the mangroves.

Eco-certification could lead to the improved protection of, and perhaps, an increase in, the area of land occupied by mangrove forests. Only small areas of mangrove forest are deforested to accommodate commercial shrimp farms and, as long as operations remain semi-extensive these farms have minimal impact on surrounding areas. Thus the existence of semi-intensive shrimp aquaculture farming would have few negative impacts on the mangroves given the limit of 10 per cent for authorised cuts relative to the size of the production area, which is contained in the principles related to eco-certification.

A move towards eco-certification could also promote the improved conservation of biodiversity. A major service provided by the installation of the shrimp aquaculture farms is the conservation of specific important wild species. Without the farms that reproduce shrimp and limit illegal fishing in the immediate area, the reproduction of wild shrimp could be severely compromised to the extent that the species might disappear.

From a social perspective, given the predicted downsizing of shrimp aquaculture operations and employee layoffs, eco-certification promises to help maintain levels of employment and the social services that help maintain strong communities. The IA suggests that the social impact of a scenario that includes eco-certification are more positive than the social impacts that are likely to come about as a result of the baseline or EPA scenarios.

### **3.3 Conclusions**

There is a very limited local market for shrimp in Madagascar, and so exports must be maintained to ensure a future of the industry. At present, exports depend on a niche clientele prepared to pay a price premium based on the French labels, the *Label rouge* and *Agriculture biologique*, and on consumers who are motivated primarily by the high quality of the species, *Penaeus monodon*. Under the EPA scenario, the prospect appears to be negative for the shrimp industry in Madagascar, unless it can be classified as a sensitive sector and continue to benefit from existing preferences.

The IA suggests that the scenario that includes eco-certification is the most viable for the industry's future. Liberalization in conjunction with eco-certification is identified in the IA as a potential solution to the economic crisis affecting Madagascar's shrimp farming industry and as a means to promote sustainable development practices to maintain the industry over the long term. Shrimp produced in Madagascar will remain among the more expensive shrimp on the market. However, eco-certification will reinforce the ability of Madagascar shrimp to penetrate high-end niche markets, achieve a price premium, and stimulate development in a way that supports economic growth and social well-being, and, ultimately, sustainable development. The

IA notes that under this scenario, the most beneficial social and environmental impacts would be realized at the local and national levels.

Table 1 presents a summary of the impacts of the three scenarios on the economic, environmental and social indicators that were assessed in the IA.

**Table 1: Summary of impacts of the three scenarios**

Indicator	Baseline: status quo	Liberalization under the EPA	Liberalization under the EPA + eco-certification
<b>Economic Impacts</b>			
<b>Production costs</b>	Increase from 8.32 €/kg to 9.83 €/kg in 2006. Contributing factors: oil, fish meal (flour).		Higher production costs: <ul style="list-style-type: none"> <li>• production standards increase inputs by €0.2 /m<sup>2</sup></li> <li>• full certification costs between €250 and €2 000.</li> </ul>
<b>Market price</b>	Production exported to Europe. High price: €15.	Prices increase as trade preferences are removed and taxes rise to 5.1% of value.	Maintain market prices. Support niche market for high quality Malagasy shrimp.
<b>Consumer behaviour</b>	Preference for ‘bio’ products; some consumers pay more for high quality Malagasy shrimp.	Risk that consumers become more price conscious.	Promote ‘bio’ products and build consumer awareness.
<b>Human resources</b>	Layoffs at some shrimp aquaculture operations.	Layoffs due to temporary halts in production and/or permanent closures.	Layoffs as companies adjust to higher cost structures.
<b>Environmental impacts</b>			
<b>Mangrove forest surface areas</b>	Little overall impact. Deforestation offset by growth elsewhere (16% at Mahajanga).	Increased risk of deforestation.	Increased protection of mangroves (installation of farms brings positive external factors).
<b>State of biodiversity</b>	Vegetation: exploitation of most species proportional to in-migration of workers.	Increase in exploitation, often illegal.	Increase in taxes and duties linked to growth in production and more manageable than under trade deregulation.
	No significant change in production of shellfish and other fishery resources.	Increase in taxes and duties.	Id.
<b>Contamination of adjacent areas</b>	Desalination: introduction of fresh water adversely affects salinity; mass extinctions of mangrove species in tidal areas.	Disappearance.	Low risk if environmental guidelines are respected.
<b>Existence of disease</b>	No disease in the areas surrounding shrimp basins.	None.	Id.
<b>Services provided by the mangroves and proximate plant species</b>	Ecological disturbances will affect both wild and farmed species (including mammals, birds, reptiles, molluscs, and shellfish).	Increase in disturbances linked to deforestation (but not to chemical or organic products).	Acceptable and verifiable disturbances.
<b>Social impacts</b>			
<b>Social tensions</b>	Immigrants outnumber native-born residents in farming areas.	Disappearance.	Id., status quo or decrease.
	Lack of respect for <i>fady</i>	Id.	Id.

	(local customs).		
	Lack of respect for traditional social hierarchies.	Id.	Id.
	Conflicts over land as production grows.	Id.	Id.
	Conflicts over land between farms and other community needs.	Disappearance but conflicts grow over access to resources in/around abandoned farms.	Id.
	Intergenerational tensions and conflicts.	Decrease in tensions. Increase in economic insecurity, delinquency and breakdown of traditional social structures.	Id.
	Widening income gaps between rich and poor.	Reduction in income gaps.	Id., status quo or its accentuation.
<b>Social benefits</b>	Strengthening and community engagement.	Decrease or decline.	Accentuation of status quo.
	Search for development partners.	Id.	Id.
	Creation of education and health care infrastructure.	Id.	Id.
	Improvement in education and health care services.	Id.	Id.
<b>Migration</b>	Fluctuations in employment levels.	Economic insecurity, unemployment, delinquency.	Id., status quo or a decrease.
<b>Labour rights</b>	Right to time off: workers allowed 10 days of rest for 20 days of work.		Id., status quo or improvement.

## 4 Recommendations

The recommendations presented in the IA should be used to guide policy making seeking to reverse the crisis in the shrimp aquaculture sector. Shrimp aquaculture makes an important contribution to the economy in Madagascar, but must be developed in a way that is economically sustainable, socially acceptable, and respectful of the environment. The IA suggests that development in this sector can be used to combat poverty while at the same time protecting the environment and conserving biodiversity. The policy recommendations that have been developed should be the basis of policy reforms moving towards the sustainable production of shrimp in Madagascar.

### 4.1 Policy and research-related recommendations

**Develop the quality control (AQC) standard beyond eco-certification.** Since it is vital that shrimp farmers can produce shrimp for export (because of the lack of a profitable local market) eco-certification was identified as a key issue to improve the competitiveness of Malagasy shrimp in the international market. A successful eco-certification programme should mitigate the negative environmental and social impacts of aquaculture, while promoting positive economic impacts. The AQC standard was considered to be the most effective at linking economic, social and environmental sustainability and it is directly relevant to the endemic shrimp species in

Madagascar. Eco-certification is an important step, and a combination of the two standards (eco-certification and AQC) would be even more effective for promoting sustainable development.

**Decentralise the planning and development of shrimp aquaculture.** Planning is important for the local development of the industry with respect to its ability to attract public funding earmarked for industries covered by communal development plans. For the industry to recover and to expand in the future, it should undertake the necessary planning at the national and local levels to allow it to access funding available for local development.

**Develop complementary legal incentives.** The legal and political framework governing the shrimp industry should be improved to help increase financial returns and motivate business owners to compete effectively in the international market.

**Conduct complementary research.** The development of the shrimp aquaculture industry should be accompanied by research to identify the optimal conditions for profitability, taking into account risks of environmental degradation. Key points that should be examined were identified during the national workshop. They included promoting the local production of shrimp feed to make it more profitable than imported feed, examining ways to integrate artisanal aquaculture so as not to exclude small producers from the industry, improving the understanding of environmental factors associated with production so as to maintain, if not improve, environmental performance in the industry and to protect the mangroves.

Table 2 summarizes the recommendations associated with policy and research to promote environmental protection and social well-being, while continuing to develop a competitive shrimp aquaculture industry.

**Table 2: Summary of recommendations**

<b>Role of government</b>
• Support of the acceleration of eco-certification.
• Reinforce fiscal policies and incentives.
• Establish the aquaculture and shrimp farming system according to the EPA.
• Put in place a legal framework for local food production that includes sanitary and phytosanitary standards and traceability and is based on EU or international standards.
• Secure existing and future national or foreign investments in aquaculture activities.
<b>Recommended research agenda</b>
• Secure funding for research on local food production.
• Conduct complementary research on local food production.
• Identify the terms required to be met to achieve the standards and norms of food production.
• Identify environmental factors and exploitation conditions of farms to conserve the premium quality of Malagasy shrimp.
• Consider terms of integration for artisanal aquaculture, including technique to recommend to aquaculture farmers.
• Undertake research on the protection of mangroves (particularly with respect to the impact of tanners).
• Undertake research on the dichotomy between development and environmental protection.

## 4.2 Recommendations with respect to the integrated assessment methodology

IA is a tool that is still not well understood by policy makers and decision makers in Madagascar. However, in a country such as Madagascar, which depends on agriculture and where it is vital to properly value natural resources, IA is a useful tool to encourage decision makers to take into account the environmental and social impacts of decisions related to the exploitation of natural resources. The principles and methodology applied in the IA should become a reference for development models in the country.

**Communicate the importance of integrated assessment as a tool to encourage sustainable development.** The methodology and the findings of the IA should be disseminated among decision makers to promote an integrated vision for economic development. While some decision makers are aware of the existence of IA as a tool, it is not widely employed due to lack of experience in applying relevant methodologies. However, there are several sectors in Madagascar that could benefit from the type of IA to promote sustainability and it is worth promoting both as a tool for further planning in the shrimp aquaculture industry, and in other sectors of the economy.

**Incorporate integrated assessment into the strategic assessment of marine resources.** The Government of Madagascar is in the process of elaborating a strategic evaluation of marine resources. In the short term, the IA process and analysis could be applied to marine resources broadly, building on the experience that has been gained during the shrimp aquaculture case study.