

## CO-MANAGEMENT OF THE SHRIMP FISHERY IN MADAGASCAR

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### ABSTRACT

The shrimp fishery is a major export sector for Madagascar, yielding 10,000 tons per year and providing US\$75 million in foreign exchange earnings. From the 1960s, it was managed through annual licenses allowing access to either exclusive or common fishing zones. In the mid-1990s, irregular and discretionary licensing, exacerbated competition amongst fishing companies and loss of confidence between the State and the private sector resulted in overfishing and serious threats to the future of the fishery. In 1994, on the joint initiative of the shrimp industry and government, the GAPCM was set up as a professional organization designed to represent its members' interests and develop a fair policy dialogue. With French cooperation support, a bioeconomic model was developed under a National Shrimp Research Program to provide relevant information to the increasingly dynamic partnership between the government and the GAPCM. In 2000, a decree introduced new fishing rights, raised fees and made licenses longer-lasting, transparent, competitive, transferable and dependent on annual economic performance reviews. The GAPCM also dealt with compliance to EC sanitary regulations, monitoring and surveillance of the fishery, conflict resolution with traditional fishermen and eco-labeling. It now advocates an institutional approach to public management of the shrimp fishery through a mechanism balancing biological and economic sustainability. Although some challenges remain, considerable progress has been made in building up working institutions, which are not only based on a rationale that draws on some of the best recent theoretical work in economics, but which also show empirical evidence of a successful co-management approach.

**Keywords:** Co-management; Bioeconomics; Institutional economics; Shrimp fishery; Madagascar.

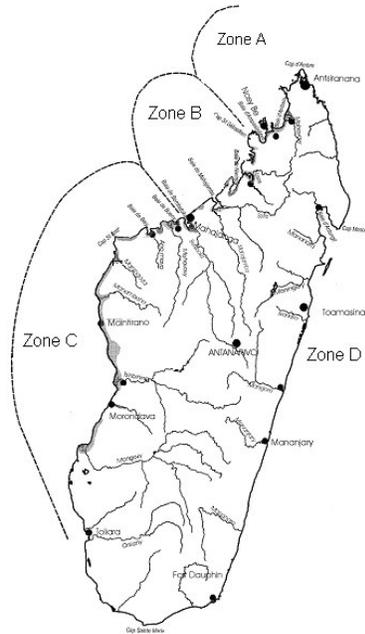
### BACKGROUND AND OVERVIEW OF THE SHRIMP SECTOR

The shrimp industry, including fisheries and aquaculture, is both a primary export earner for the Malagasy economy and a major employment provider in this developing country with a per capita GDP of US\$260. The sector is therefore considered to be strategic at national level.

The fishery started up in 1967. Given the government priority of enhancing employment, The first two fishing companies, *Pêcheries de Nosy Be (PNB)* and *Somapêche*<sup>1</sup>, of which the State was a minority shareowner, were required to invest in on-shore processing plants and also granted exclusive licenses for their north-west coast fishing grounds. This government-driven initiative was typical of the development patterns prevailing at that time in many developing countries, especially in Africa.

In the 1980s, new fishing companies entered the fishery, which expanded to new, non-exclusive fishing zones on the south-west and east coasts. *PNB* and *Somapêche* took part in this expansion, while retaining exclusive rights in their historical zones. Management of the fishery included fishing gear regulations and closed seasons, with issuance of annual fishing licenses for all vessels involved in the fishery.

As the fishery developed, the fishing grounds were divided into 14 fishing areas. In 2000, Decree No. 2000-415 (see below) introduced a new partition: the zones on the west coast were merged into 3 zones (A, B and C) and the eastern zone became zone D (see map below).



**Figure 1. Map of the shrimp fishing areas of Madagascar.**

The fishery has been relatively stable over the last decade, with annual catches ranging from 10,000 to 12,000 tons. The industrial sector, where 10 companies are now operating 70 licensed trawlers (27 m and 480 hp on average), and the artisanal sector with 7 companies operating 36 licensed trawlers less than 50 hp, respectively caught 9,000 and 1,000 tons in 2003. This generated EUR52 million in foreign currency and 5,000 direct jobs. Traditional sector annual catches are estimated at 1,000 to 1,500 tons, using non-motorized canoes (source: Economic Observatory). On the other hand, shrimp farming, backed by investments mainly from already established industrial fishing companies, has undergone steady growth. Production increased from less than 500 tons in 1994 to more than 7,000 tons in 2003, which is now close to wild-caught shrimp, and the number of jobs created by the farming industry stood at 4,000. In 2003, according to World Bank staff estimates, the shrimp industry as a whole provided US\$155 million in foreign income (fishery and farming accounting for half each). This positions it as second export earner behind manufacturing, alongside the vanilla sector. Shrimp export outlets are France (60%), Japan (30%) and neighboring Mauritius and La Réunion (10%). It is noteworthy that the sector is not subsidized.

**THE BIRTH OF GAPCM AS A RESPONSE TO THE CRITICAL SITUATION OF THE 1990s**

In the early 1990s, with total catches reaching the estimated MSY of 8,000 to 10,000 tons for the industrial and artisanal sector (not counting traditional fishing), the status and performance of the fishery raised major concerns for the operators, the State and external donors.

**Fishing Companies**

Government licensing policy during this phase of development was globally discretionary. Fishing companies faced an uncertain future as each political change brought threats of new licenses being issued.

In 1993, for instance, several licenses were given to new local and foreign companies, some of whom owned no trawlers. The situation was made even more precarious, as licenses were issued on an annual basis, which naturally represented a permanent risk to investment.

At the same time, the situation remained inequitable. On the one hand, the two firms that had historically started the fishery still held exclusive rights in the now-called zones A and B respectively. On the other hand, some of the smaller and more recent companies operating in the common zone C<sup>2</sup>, claimed equitable access to the resource in all of the areas in order to reach a competitive level and introduce full competitiveness across the entire sector.

### **The Government of Madagascar**

The government was facing a serious lack of information in terms of biological and economic data. The sole management benchmark, if any, was the MSY, which took no account of financial or economic returns. License fees, in fact, were not introduced until 1994. As a result of its discretionary policy, the government also came up against opportunistic and fraudulent behavior from the firms, while remaining unable to effectively monitor and control the fishery due to severe budget constraints. In this context, bribery was obviously a tempting option.

With no policy dialogue, no clear or shared vision for the future, a lack of transparency in fishing rights allocation and monopoly situations, the fishery was both unstable and economically unsuccessful from a national viewpoint. Equity issues also led to exacerbated competition and sometime serious conflicts between operators.

### **The French Development Agency**

From 1982 to 1991, the French Development Agency (AFD) set up a loan portfolio of nearly EUR10 million for the Malagasy shrimp fishery under public aid conditions. The International Finance Corporation, a subsidiary of the World Bank, also sponsored the sector.

In the 1990s, the situation was an issue of concern for AFD from the point of view of sustainability as well as the economic impact of the fishery at national level. In 1992, AFD commissioned a sector review and the shrimp fishery thus became a subject of discussion between the government of Madagascar and an external donor partner.

### **Birth of the GAPCM**

There was evidence that the fishery needed reforming and two key objectives were to gain better knowledge of the resource and establish a responsible dialogue between the operators, the State Fisheries Department and the research institutions. In late 1994, the Minister of Agriculture and Fisheries of Madagascar sent all fishing companies a letter that clearly called for the creation of a professional shrimp industry association and for proposals from the private sector to improve shrimp fishery management.

The GAPCM (*Groupement des Armateurs à la Pêche de Madagascar / Madagascar Prawn Fishing Industry Association*) was launched in 1995. It aimed 'to enhance knowledge about the fishery and to dispose of up-to-date and accurate data as a basis for fair discussion in order to achieve better management.'<sup>3</sup> The GAPCM, now mainly funded by its members, is a well organized and professionally run group and the major player in managing the shrimp fishing and aquaculture industries in Madagascar. The greatest strength of the GAPCM is its role as a spokesman for the entire commercial shrimp industry. This has endowed it with credibility and authority at both national and international level and helped to lay the ground for successful co-management of the fishery.

## FISHERY CO-MANAGEMENT: REFORMS AND ACHIEVEMENTS

### GAPCM Activities with External Support

In 1996, a 3-year, EUR0.46-million project funded by AFD accompanied GAPCM's first steps in view of fuelling the policy dialogue with the government of Madagascar. The French Ministry of Foreign Affairs funded a senior adviser who acted as GAPCM General Secretary until 2004<sup>4</sup>. This first project supported several studies on the economic situation of the fishery, traditional fishing, compliance with EC food sanitary regulations, VMS and dredging the Morondava (west coast) and Toamasina (east coast) harbors. With IRD as co-sponsor (EUR0.8 million) and scientific partner, a National Shrimp Research Program (NSRP) was established and a national workshop was held in 2000. The GAPCM has made optimal use of the external funding granted and put forward sound proposals on major issues regarding the overall management of the fishery sector.

The first challenge that the GAPCM had to face was the EC embargo on Malagasy livestock and fishery products in August 1997 following a veterinary inspection. Thanks to GAPCM's prompt mobilization, funds raised through matching grants from the AFD subsidized 20-50% of the corporate investment needed to meet European sanitary standards. At the same time, the European Commission supported upgrading the national Veterinary Service. As a result, the European embargo was limited to three months. Furthermore, AFD financed 80% of the dredging of Morondava and Toamasina harbors, with the GAPCM providing the remainder. The AFD grant contribution for sanitary improvements and dredging totaled EUR1.9 million.

A third EUR7.6-million project was then funded by AFD and the French GEF in 2001, with additional contributions of EUR1 million each from the GAPCM and the national Aquaculture and Fisheries Development Fund<sup>5</sup>. This more ambitious project, which is still under way, comprises seven components:

- Economic Observatory for the shrimp industry;
- National Shrimp Research Program;
- Concerted Management Zones (ZACs - *Zones d'Aménagement Concerté*): this component aims at resolving conflicts between industrial companies and traditional fishers, who have recently adopted new techniques to increase their fishing capacity and become more market-oriented. It also aims to establish commercial partnerships between the two sub-sectors of the fishery in order to encourage traditional fishers to catch larger-sized shrimps and improve preservation techniques so as to obtain better market value for potential export by industrial operators;
- Environmental protection through limitation of turtle and finfish by-catch;
- VMS, within the framework of a larger project funded by the EC as a counterpart of tuna fishing agreements;
- Harbor infrastructures in the ports of Majunga and Toamasina where the bulk of the shrimp fishing fleet is based;
- Support to GAPCM by providing cofinancing for specific studies or consultancy services on a 30% GAPCM - 70% AFD basis.

Achievements of particular significance to the fishery management are dealt with in more detail below.

### Economic Observatory

At national level, especially in the context of developing countries, economic performance of the fishing industry cannot be limited to financial rent (i.e. corporate profit plus state budget earnings from license fees). Net contribution to the current account balance and employment are also important considerations, together with social equity and regional development issues (Bailey and Jentoft, 1990). This is why

Madagascar, like other coastal states, encouraged fishing companies to make on-shore investments at the risk of lower returns compared to those obtained through on-board vessel processing—thus balancing added value with employment.

The Economic Observatory (EO) was created in 1998 following an initial economic analysis conducted by the GAPCM and is jointly run by the State Fisheries Department and the GAPCM. It uses a specific method (Chervel and Legall, 1976) to comprehensively assess the value added (VA) created by the fishery from catch to export, the net contribution to budget earnings and the current account balance, as well as wealth-sharing. Not only is the direct VA generated by fishing, processing and export assessed, but also the indirect VA created upstream by the many suppliers of the fishing industry, which means that included (i.e. direct plus indirect) VA representing the actual contribution of the sector to GDP can be accurately determined. Imported input value is fully assessed on the same basis, which makes it possible to calculate the net contribution of the fishery to the trade balance. Finally, calculation is made of VA-sharing amongst the economic agents (profits for firms, taxes and fees for the State and wages for households). This method, which has been progressively extended to the three sub-sectors of the fishing industry and to shrimp farming, is thus well-suited to monitoring and balancing the contribution of the fishery to macroeconomic objectives. The information supplied by the EO (aggregate data for confidentiality purposes) enables license fees to be annually adjusted to the economic performance of the fishery. For instance, license fees were lowered in 2003 in view of decreasing world shrimp prices. Furthermore, the EO's aggregate data include minimum and maximum indicator values and are used by fishing companies for rating their individual performance. Finally, these data provide a basis for monitoring the international competitiveness of Madagascar shrimp products.

### **National Shrimp Research Program and Bioeconomic Modeling**

Under the NSRP, data on catch, effort and recruitment have been refined and more extensive knowledge about the traditional sector has been gained. A comprehensive bioeconomic model that links management scenarios with economic results has been designed in collaboration with the IRD using data from the EO and other sources (Chaboud, in Ranaivoson (ed), 2000). The model, of which the final version will be available late 2004, takes into account the interactions between the different sub-sectors of the fishery and enables multi-criteria decision-making in line with biological and economic objectives. It already appears to have made a positive contribution to the decisions made by the A-zone fishing companies in 2004 on specific seasonal closures and prohibition of night fishing in certain areas.

### **A Major Step Forward: Decree No. 2000-415 on Shrimp Fishing License Allocation**

A study funded by the World Bank led to the issuance of Decree No. 2000-415 in June 2000. This Decree, prepared jointly with the GAPCM, addressed the issues of the sustainability and economic returns of the fishery, as well as transparency and equity in the licensing system. Provisions were made to:

- Secure the resource base by freezing the fishing effort and making the VMS compulsory;
- Secure investments while enhancing competition: issuance of 20-year licenses, automatic renewal on payment of license fees, right of transfer, license auctions for free licenses<sup>6</sup>;
- Secure information by making it compulsory for fishing companies to deliver statistical and economic data to the NSRP, the EO and the State Fisheries Department, and by publicly disclosing information on license allocation;
- Ensure equity by canceling exclusive rights in zones A and B, and avoid monopoly situations by limiting the number of licenses held by an individual company/group to 40% of the total;
- Implement rent-sharing by increasing fiscal income to 8% of catch value in 2002;
- Provide incentives for improved economic performance through penalties or license withdrawal for the less economically efficient companies, according to EO-defined criteria: export value, contribution to

budget earnings, employment, finfish supply to domestic market and cooperation with traditional fishers.

The threat of license withdrawal provided for in Decree No. 2000-415, together with the transparency resulting from EO-supplied data in terms of general information and corporate ratings, brought about significant improvements in the economic performance of the fishery. So far, therefore, no penalties or withdrawals have needed to be applied.

It has been objected that this freezing encouraged a 'local cartel' and offered no opportunity for competitive outsiders to enter the fishery. It has to be remembered that the outstanding issue at the time the Decree was passed was to stabilize the fishing effort, which was successfully achieved. The Decree does, moreover, make provisions against monopolies and for open auctions of free licenses. Yet, in the Malagasy context, it is highly debatable that issuing licenses to new entrants rather than operators already present could have improved economic returns without jeopardizing sustainability. There is evidence in developing countries that an auction-licensing scheme alone often opens the way for opportunistic players who have little consideration for responsible fishing and who are very difficult to control. Certainly, the most appropriate response to these objections is to point to the improved economic performance of the Malagasy shrimp fishery (see below).

### **External Donor Awareness**

The GAPCM is successfully keeping donor and government focus on the shrimp fishery within the framework of the IMF and World Bank structural adjustment loans, which entail macroeconomic policy reforms and sound management of major export sectors in order to maximize foreign earnings.

### **Further Achievements: Reduced Fishing Effort, By-Catch Limitation and Sanitary Management**

Other measures beside the new license allocation scheme implemented under Decree No. 2000-415 were effective in reducing the overall fishing effort. Vessel power was limited to 500 hp and, in 2003, the GAPCM extended the official opening and closing fishing dates on its own initiative in a drive for better financial results. The association also increased mesh size from the legal 40 mm to 50 mm for the cod-end and 60 mm for the rest of the trawl. Then, in 2004, the State Fisheries Department introduced a 10% reduction in trawl head-rope length, bringing it down to 69 m at the request of the GAPCM.

On GAPCM initiative, turtle-excluding devices and by-catch reduction devices were made compulsory in 2004. These are now being adapted to the entire fishing fleet and a turtle-tagging program is under way. As for by-catch<sup>7</sup>, the GAPCM's policy is to reasonably reduce both by-catch and discard of unavoidable by-catch, while continuing to ensure the much-needed domestic supply of high-protein food. Following an urgent request from the authorities, the GAPCM has agreed to nearly double by-catch landings in 2004, from 3,000 to 5,500 tons. Finally, on the food safety side, the GAPCM effectively managed to prevent the 1999 cholera outbreak from impacting shrimp exports.

### **Current Issues and Challenges: Traditional Fishing, Eco-Certification, Improved Management Tools and Institutions**

ZACs: along with the by-catch issue, cooperation with traditional fishers is of major importance for the Malagasy shrimp fishery and setting up the ZACs is a challenge for the future. The traditional sector is having a negative impact on the commercial sector, as the 1,500 tons of shrimp harvested by around 8,000 canoes include undersized shrimps and fishing is also carried out during the closed season. There are further concerns that the lack of quality control in the traditional sector may jeopardize the whole Madagascar shrimp industry, since half of this sub-sector's products are exported (Goedefroit *et al.*,

2002). Yet, the importance of traditional fishing for thousands of poor fishers cannot be ignored in terms of poverty reduction and regional development. The dialogue established between industrial and traditional fishers has already made steps toward a better mutual understanding, even though effective cooperation is still to be achieved. This needs to take full account of the various and complex socio-economic issues of migratory flows, subsistence and revenues during the closed season, mangrove and forest management, and gender. It is planned to set up three AFD-funded pilot ZACs in zones that characterize the socio-economic diversity of traditional fishing. This component represents half the cost of the ongoing AFD project.

Toward certification: Madagascar shrimp already enjoys a good reputation on world markets (Lawrence, 2003) but there is potential for implementing a certification scheme based on quality, sustainability and environmental criteria. In 2003, the GAPCM carried out a pre-assessment study for certification of the Madagascar shrimp fishery under the Marine Stewardship Council and is currently conducting a similar study for certification of shrimp farming with the collaboration of the WWF.

Improved management tools and institutions: although the Decree No. 2000-415 is a major step in improving the shrimp fishery management, further measures need to be envisaged for introducing market-based mechanisms of effort transfer within the existing allocation so as to optimize the overall efficiency of the fishery. One possible measure, as advised by the Mentor Committee (Goodlad *et al.*, 2003), would be the move towards a system of flexible, transferable, individual fishing rights, such as boat-days. This issue is currently being examined in collaboration with an expert from the Australian Northern Prawn Fishery. Additionally, in view of the recurrent weaknesses of the State Fisheries Department, the creation of an autonomous management agency is beginning to be seen as a realistic option.

## ECONOMIC IMPACT OF THE REFORMS

### Increased Value Added compared to World Trends

For economic analysis purposes, a relevant indicator is the net contribution to growth, that is, the included VA per ton of shrimp caught. As the Malagasy shrimp fishery has been stabilized at an acceptably sustainable level of around 10,000 tons since the mid-1990s, and the fishing effort and CPUE have also remained steady (Andrianaivojaona *et al.*, 2003), any eventual changes in VA per ton are assumed to have no volume or yield origin and to stem only from price changes or intrinsic performance. In fact, the main economic effect brought about by the new management system introduced in 2000 is the average Malagasy shrimp export price trend, which shows a 10% increase in 2000/2001 and a 3% increase in 2001/2002 against a decline in world prices as reflected by the Urner Barry index for white shrimp (see Figure 2).

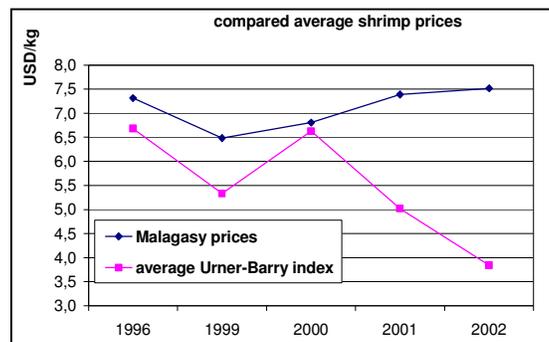
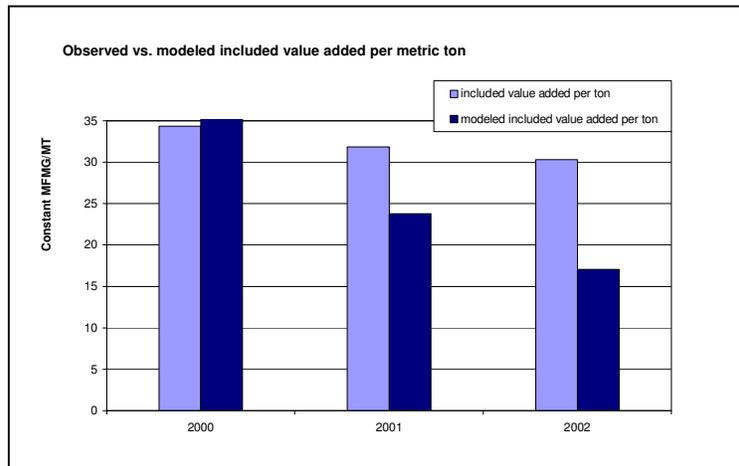


Figure 2. Average shrimp export prices in US\$ per Kg, Malagasy vs. Urner Barry's white shrimp, from 1996 to 2002, current value (Sources: EO, Urner Barry Publications, Inc.); Malagasy price in HO equivalent.

Two driving factors have been identified for this trend: on the one hand, a better shrimp size as a result of fishing effort control, and on the other hand, better export prices<sup>8</sup> due to the transparency insured by the EO and the threat provided by the Decree No. 2000-415 as to economic results (see above). Both of these factors are closely linked to the co-management approach to the fishery.

In order to assess the gain resulting from the Malagasy price advantage in terms of included VA, the actual included VA per ton observed in the Malagasy shrimp fishery has been compared to a simulated VA-per-ton trend reflecting the world market price based on Urner Barry's index (Figure 3). On these grounds, the total VA gain of the fishery has been estimated at EUR27.2 million over the 2000-2002 period<sup>9</sup>.



**Figure 3. Observed versus modeled included VA per metric ton in constant 2002 Malagasy Francs million (Sources: EO, Urner Barry Publications, Inc., calculations M. Carli and D. Rojat).**

It must be acknowledged that this comparison may not be fully relevant to the Malagasy shrimp fishery for three reasons. First, the Malagasy *Penaeus indicus* has higher market value than the American white shrimp, which is supplied from farmed stocks and has a different calibre distribution. This bias has been corrected for the purposes of the calculations by weighting the Malagasy price by the 1996 advantage. Second, Euro appreciation against the US\$ and marketing strategies have played a definite, although not determining role in the price advantage observed. Third, consumer behavior on the Central and South American market covered by the Urner Barry index differs from that of the European and Japanese markets to which the Malagasy shrimp is exported. Our comparison, however, is basically intended to build a figure-based reference, bearing in mind that given the unstable situation of the fishery before the reforms, a ‘worst-case’ scenario could well have resulted in considerably higher economic losses and consequently much higher advantages related to co-management. Our EUR27.2 million estimate can thus be considered as conservative.

### Rent-Sharing

Since the rent-sharing mechanism through adjusted license fees was brought in under the new co-management system, the public share has been growing steadily: only 11% of total direct fishery VA accrued to the State in 1996 compared with 16% in 1999, 21% in 2000 and 26% in 2001. License fees are closely related to export earnings (see Figure 4) and rose to 8% of catch value in 2003 (Figure 5), which the GAPCM reports as being one of the best rates in the world.

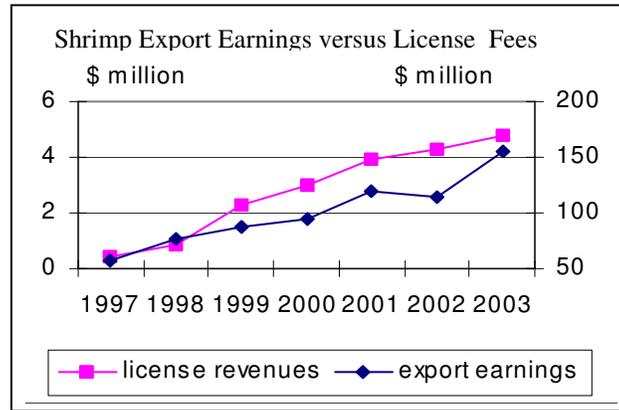


Figure 4. Shrimp export earnings versus license fees from 1997 to 2003 in US\$ millions, current value (Source: statistical data compilation, World Bank staff, 2004).

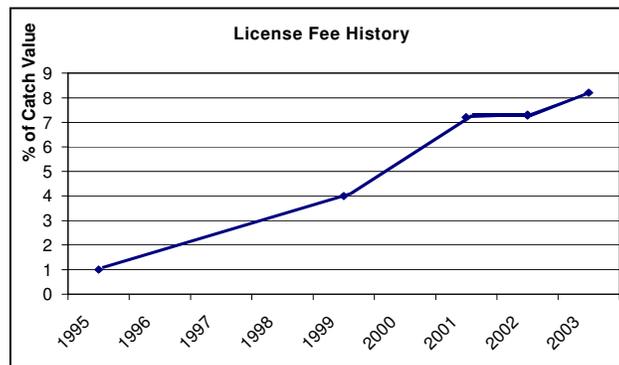


Figure 5. License fee history in percentage of the catch value from 1995 to 2003 (Source: EO).

### CO-MANAGEMENT - AN INSTITUTIONAL ECONOMICS PERSPECTIVE

From the GAPCM experience, it may be seen that one dimension of co-management is a public-private partnership designed to manage an economically significant fishery at national level. Institutional economics provides both tools for a better understanding of key players’ strategies and a strong rationale for investing in capacity-building.

#### The State’s Role

Fish stocks are a public good and fisheries are subject to externalities, hence they cannot be managed through open market forces (Hardin, 1968). State intervention, through enforcement of selectivity instruments, taxes and fishing rights allocation, is necessary to avoid resource depletion and rent dissipation and to ensure that collective, long-term interests are taken into account regarding sustainability and equitable economic returns of the fishery.

#### The State and the Private Sector: a Prisoner’s Dilemma

However, especially in developing countries, the government often lacks the skills and financial resources needed to fulfil this role. Furthermore, in all cases, the fishery is subject to high transaction costs (TCs)<sup>10</sup>

(Coase, 1937) due to information asymmetry and uncertainty between the state and the private sector. According to O. Williamson (1985), TCs can be divided into:

- *ex ante* TCs: due to asymmetry of information on fishing operations, the state may have to carry out expensive work to obtain the basic scientific, commercial and economic data needed for management decisions, especially if fishing companies have a feeling of uncertainty and are reluctant to share information;
- *ex post* TCs: the state will have to bear heavy costs for designing and enforcing management decisions and measures (including surveillance and control), particularly if these are poorly accepted due to lack of stakeholder involvement and/or confidence.

On the firms' side, TCs stem from managing uncertainty on the part of the state and eventual unfair competition from peer operators. The high costs and asset specificity of fishing and processing investment are further causes of high TCs as they act as a 'lock' for entry or exit from the fishing business.

The situation may develop into a kind of blind man's buff, as the state will be tempted to increasingly tighten the rules of the game and firms will, in turn, adopt increasingly opportunistic and/or fraudulent behavior, resulting in general misuse of state power and private-sector information. It is well known, in fact, that centralized management by the state is ultimately ineffective. Basically, the state and the private sector are faced with the 'prisoner's dilemma' (Axelrod, 1984), where separate, non-informed decisions from different players on common interests do not allow them to reach a Pareto optimum (the 'Nash equilibrium' of game theory).

The advantage of information-sharing would be to reduce TCs and gradually improve confidence. The best eventuality would be a 'cooperative equilibrium' where mutual assurance of behavior through mutually agreed and enforced rules would lead to concerted decision-making in a win-win situation. In practice, this would apply both to the cohesion within a producers' organization such as the GAPCM and, at least partially, to the co-management relationship between the state and the operators.

### **Co-management in the Light of the Principal-Agent Model**

In the case of co-management, the appropriate reference is the 'Principal-Agent' model (Laffont *et al.*, 2002), which is designed for situations where non-peer players with only partially common interests act in an asymmetrical information context. The model stages a regulating authority (the Principal) and one or more operators (the Agent(s)), who will conclude a contract under which the Agent agrees to comply with the objectives set by the Principal in exchange for positive sanctions. In this context, such contracts provide efficient organizational alternatives to a dysfunctioning market. They are designed to minimize TCs and create incentives and control mechanisms aimed at conflict resolution and cooperation. In the case of fisheries, they consist in an exchange of secured use rights against information and compliance to rules.

The advantages of co-management are tangible: transparency and partnership provide a shared vision for the future, discourage opportunism and arbitrary events, favor conflict resolution, make management decisions more relevant and acceptable, and public investments easier to design and implement. All kinds of TCs are lowered and the fishery develops into a more sustainable, efficient, equitable, adaptable and self-reinforcing system.

In this perspective, support for co-management consists in bearing *ex ante*, short-term TCs by establishing institutions and rules to reduce long-term TCs and ensure economic returns. An investment analysis conducted along these lines would help to justify investment in public and private institutions from a public or a donor agency standpoint.

## COST-BENEFIT ASSESSMENT FROM A DONOR AGENCY VIEWPOINT

Although TCs and their direct effects can be well defined, their accurate evaluation for the purpose of an empirical economic analysis remains very difficult. Yet a tentative assessment can be made on the basis of the costs incurred in institution-building against those economic improvements that can be clearly linked to co-management. In the case of the Malagasy shrimp fishery, this assessment has been conducted using as benefits the already calculated EUR27.2 million gains in included VA from 2000 to 2002 (see ‘Economic Impact of the Reforms’ above) against the overall costs of support to the co-management process. The latter are the sum of the three AFD and French GEF projects (rounded up to EUR10 million), the IRD participation in the NSRP (EUR0.8 million), the EC support to the surveillance system and the Veterinary Service (estimated at EUR3.5 and EUR0.5 million respectively), the cost of the externally-funded General Secretary of the GAPCM (EUR0.9 million), plus additional public investment through FDHA and the current budget of the GAPCM itself (EUR1 million each), totaling EUR17.7 million<sup>11</sup> as a whole. This rough analysis yields a comfortable 1.5 benefit-cost ratio.

## CONCLUSION

Under co-management, the Malagasy shrimp fishery has achieved sustainability together with a high contribution to the national economy and balanced rent-sharing between the private sector and the State. Cooperation with traditional fishermen and bio-diversity conservation are under way in view of implementing certification in the near future. The fishery can thus be regarded as environmentally, economically and socially ‘responsible’.

As an alternative to either ‘command and control’ or to strictly market-oriented management instruments such as license auctioning, the institutional approach underpinning co-management has proved both successful in terms of empirical cost-effectiveness analysis and theoretically sound in the light of institutional economics. The history of fisheries, and of external support to fisheries in developing countries, suggests that co-management is a prerequisite for ensuring the workability of any intervention in other aspects of fisheries management.

In the context of developing countries, this approach to co-management could help to enrich and renew current debate on poverty reduction, transparency and capacity-building. It gives useful insights into the linkages between good governance and sustainable and equitable development, the respective roles of the state and ‘civil society’, and the effectiveness of public-private partnership. In this sense, it provides a strong business case for donor agencies’ support to institutions.

As final recommendations, we would advocate: in-depth economic analysis of a range of co-management experiences to discriminate the impact of co-management from other factors; the design of appropriate indicators and criteria for institutional achievements and support to capacity-building; and further work as to how economic theory could suitably contribute to paving the way for better practices.

## REFERENCES

- Andrianaivojaona, Charles, B. Coûteaux, Z. Kasprzyk and E. Ranaivoson, 2003, Aménagement de la pêche crevette, *Actes de l’atelier*, 383 pp.
- Axelrod, Robert, 1984, The evolution of cooperation, *Basic Books, New York*.
- Bailey, Conner, and S. Jentoft, 1990, Hard Choices in Fisheries Development, *Marine Policy*, July 1990, pp. 333-344.
- Chervel, Marc, and M. Legall, 1976, Manuel d’évaluation économique des projets : la méthode des effets, *Ministère de la Coopération*, 204 pages.
- Coase, Ronald, 1937, The nature of the firm. *Economica* 4(16), pp. 386-405.

- Economic Observatory, 2004, Analyse dynamique et macroéconomique sur l'exercice 2002 de la sous-filière pêche industrielle crevette, *Report n° 9*, 82 pp.
- Goedefroit, Sophie, C. Chaboud and Y. Breton, 2002, La ruée vers l'or rose, regards croisés sur la pêche crevette traditionnelle à Madagascar, *IRD Editions*, 229 pp.
- Goodlad, John, A. Jarrett and J. Wilson, 2003, Report of the Mentor Committee, 23 pp.
- Hardin, Garrett, 1968, The Tragedy of the Commons, *Science*, Vol. 162, pp 1243-48.
- Laffont, Jean-Jacques, and D. Martimort, 2002, The Theory of Incentives, the Principal-Agent Model, *Princeton Paperbacks*.
- Lawrence, Felicity, 2003, Is it OK to eat Tiger Prawns? *The Guardian*, June 19 2003.
- Ranaivoson, Eulalie and Z. Kasprzyk, ed., 2000, Aménagement de la pêche crevette à Madagascar, *Actes de l'atelier*, 453 pp.
- Williamson, O, 1985, The Economic Institutions of capitalism, *Free Press*.

## ACRONYMS

AFD	French Development Agency	IRD	Research Institute for Development
EC	European Commission	NSRC	National Shrimp Research Program
EO	Economic Observatory	TC	Transaction Cost
EUR	Euro	VA	Value Added
GDP	Gross Domestic Product	VMS	Vessel Monitoring System
GEF	Global Environment Facility	ZAC	Concerted Management Zone

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## ENDNOTES

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- <sup>1</sup> Somapêche was mainly funded through direct Japanese investment.
- <sup>2</sup> Zone D being exploited by a single company under specific conditions with lower yields and no competitors.
- <sup>3</sup> The name of GAPCM was later changed to *Groupe des Aquaculteurs et des Pêcheurs de Crevettes de Madagascar* (Madagascar Shrimp Farming and Fishing Industry Association), to include shrimp farming.
- <sup>4</sup> The organization has now appointed a Malagasy General Secretary as of May 2004.
- <sup>5</sup> FDHA (*Fonds de Développement Halieutique et Aquacole*), mainly funded by license fees.
- <sup>6</sup> i.e. expired, withdrawn, or issued following a decision to increase fishing effort.
- <sup>7</sup> The latest studies conducted by the GAPCM indicate that an average of 2 kg of finfish is caught for 1 kg of shrimp, and half of the finfish is processed for human consumption.
- <sup>8</sup> Since several owners of Malagasy fishing companies also hold shares in marketing firms abroad, export prices may represent transfer prices.
- <sup>9</sup> Given a 6,177 FMG/Euro average exchange rate, with exports ranging from 8,500 to 9,000 tons.
- <sup>10</sup> Transaction costs are the costs incurred to obtain information, negotiate and enforce arrangements when market forces do not provide for it, assuming that under perfect competition (i.e. no market distortion), price incorporates all information needed by economic agents for decision-making. In the presence of market imperfections such as transaction costs, price only partially serves this function and non-market-based, 'hierarchical' forms of economic organizations, like firms and institutions, are an efficient solution.
- <sup>11</sup> A methodological point can be raised as to whether the costs of the AFD-funded sanitary investment and dredging project (EUR1.9 million) and the EC-funded surveillance project (EUR3.5 million) should be considered as costs or, on the contrary, at least partially as benefits of the co-management, since these projects would not have been implemented or would have been less efficient in the absence of co-management. In order to obtain a conservative assessment, we counted all these projects as costs.