

The Role of Industrial and Traditional Fishing in
Sustainable Resource Management

MAKAMBA KOBABIA RIHA TSY RITRY
UNIMA/PNB

Aime Schwartz

Advisor: Ghislain Gaspard

Academic Director: Jim Hansen

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I. INTRODUCTION

For decades, the notion of ‘sustainable development’ has been a source of international contention and debate. While the meanings and implications of sustainable development are widely disputed, it is interpreted by many as an ideal that encompasses social, environmental and economic spheres while promoting the value of human rights in development.

Theoretically, this approach allows for the quality of life of current and future generations to be considered in environmental decision-making and formally recognized by national and international standards, dictated primarily by wealthy industrialized governments (Adebowale et al 138). Policy-makers in developing nations continuously face the struggle to balance the pressures of trade liberalization and globalization with sustainable resource use and environmental moderation.

Despite the controversial nature of sustainable development and its economic implications, the underlying principles and impacts are becoming an important asset to developing nations, allowing policy-makers, industries, NGO’s and other stakeholders to consider development programs that incorporate both social and environmental needs in a mutually supportive manner. However, many environmental standards and ‘sustainability initiatives’ result in cost increases which may erode existing market access conditions and reduce export competitiveness (Shahin 207, 222). While these principles play an important role in helping to define policies at the international level, I wanted to learn more about the realities and constraints which drive development at a local level in Madagascar. Too often, the notion of development and the policies which shape it become detached from the communities which suffer most from poverty, isolation, and general underdevelopment the most. In many ways, ‘development’ has become an abstract ideal, overburdened by macro policy structures which fail to address socio-cultural obstacles to progress. For my

independent study, I chose to look at the relevance of local and regional development initiatives which influence sustainable resource use in Madagascar.

The objective of my independent study was to evaluate the role of the private sector in sustainable resource management and development programs in Madagascar. I spent the month with UNIMA, one of Madagascar's largest shrimp export companies, to study the impacts of industrial shrimp exploitation in relation to development efforts, economic stability, social issues, policy structures and natural resource management. I worked with UNIMA's fishing division, Pêcheries de Nosy-Be (PNB), to learn about the relationship between industrial and traditional fishing and their collaborative approach to managing common fish stocks in the region. While sustainable resource management was the basis of the study, I placed an emphasis on relevant local structures and issues which influence resource use in the area.

I chose to work with UNIMA, as opposed to the government or an NGO, to learn about the various dimensions of business practices which influence the private sector's relationship with the environment and development in developing countries. Trade is playing an increasingly important role in defining the connection between industrial economic interests and the environment. Population growth and the expansion of international markets have resulted in significant increases in industrial production in most sectors, including fishing. While industrial development has increased the rate of resource depletion in many cases, the private sector has also revealed vested interests in responsible resource exploitation and development initiatives in developing nations. I was able to study the origin of "sustainable practices" and how and why they are applied in a specific context. Working with PNB, I learned about international market pressures, national policies, local resource issues and the self-defined notion of corporate responsibility that influence the company's role Madagascar's fishing sector.

II. METHODS

During my time with PNB, I tried to gain an understanding of industrial shrimping from a variety of perspectives. In order for my study to be as objective and well-rounded as possible, I spent time on-board PNB's shrimping boats as well as in traditional fishing villages situated along the coast of the fishing zone. My goal was to understand how specific measures serve to minimize negative environmental impacts, stabilize exploitation, and maintain the relationship between industrial and traditional fishing to ensure the long-term viability of the region's fishing sector.

I spent the first portion of my study at PNB to gain an understanding of administrative aspects of the industry as well as processing procedures for all UNIMA export products. In the factory itself, the "Responsable de l'Usine" explained the measures taken by UNIMA to monitor and maintain sanitation in order to meet European Union (EU) health requirements for export. I was also introduced to basic environmental standards set by the MECIE and the European code of responsible and sustainable fishing practices which influence PNB's fishing and processing practices. While these policies did not play a major role in my study, they gave me an interesting first impression of the general nature of environmental standards and how they are perceived, designed, and applied.

I spent three days onboard one of PNB's 6 shrimping boats which operate in Zone A to learn about technical aspects of industrial fishing. I was able to observe how technical measures, such as the use of Turtle Exclusion Devices (TED) and By-catch Reduction Devices (BRD) are applied to reduce impacts on ecosystems and minimize by-catch levels. Spending time on the boat, I was able to appreciate how scarcity issues in the area influence fishing practices and industrial output. I spent time with the onboard inspector from Centre Serveillance de Pêche (CSP) to gain a better understanding of government involvement in fishing and CSP's approach to monitoring fishing activities in Zone A. I was able to look at

CSP documents concerning environmental regulation and catch figures. I helped with assortment of catch and helped analyze catch samples for CSP records.

I spent the following two weeks working with PNB's traditional fishing representative to learn about resource management issues in relation to traditional fishing on "la grande terre." During this field study, we visited fishing villages to attend fishing cooperative meetings and discuss issues with community members regarding closure, local authorities, management of resources, reforestation, and various local issues. While PNB works with fishing villages throughout Zone A, I spent the majority of my time in the village of Ampampamena located in the Baie d'Ambaro. I was able to work with the president of the traditional fishing union to learn about the role of local management efforts in controlling the impacts of traditional fishing practices. During this portion of my study, I spent one week in Diego Suarez attending regional development meetings with representatives from NGO's, the Office of Regional Development, and other stakeholders.

Finally, I participated in PNB's annual mangrove reforestation project during the Labor Day festivities on May 1st in Nosy-Be. PNB employees were joined by students and community members to help plant over 15,000 trees which were transferred from PNB's nursery into the mangrove itself. This was an exciting project and a fun way to experience the company's commitment to the environment and social involvement.

My project incorporated a variety of sources but placed a major emphasis on field study and information collected from meetings and interviews. I had a number of resources at my disposal through UNIMA, including administrative, technical and scientific documents. Most of my information was gathered from the wide spectrum of stakeholders that I worked with and my advisor, who offered an incredible amount of knowledge and guidance.

III. MADAGASCAR: FISHING SECTOR

Private sector capital plays an important role in the Madagascar Action Plan (MAP) which identifies the government's intentions to open trade and financing systems, to enhance market access and reinforce the business community. Madagascar hopes to promote investment and economic growth by improving the business environment and increasing the role of international trade in development (Source: MAP). While this neo-liberal approach is being pursued by many developing nations, it is important to consider how governments are able to hold the private sector accountable for environmental impacts through institutional structures, policies, standards and regulations. Unfortunately, development initiatives in some areas of Madagascar have increased the rate of resource depletion and environmental degradation to the extent to which ecosystems can no longer regenerate and sustain biological functions and equilibriums.

Open-access to fishing grounds has placed serious strains on fishing capacities as well as regulatory measures introduced to manage them (Stone 290). Restraints on entry, technological requirements, zoning, and seasons are extremely difficult to enforce and have been largely inadequate. In Madagascar, poor management tactics, limited scientific knowledge, restricted surveillance capacities, and low incentives for sustainable use of resources are important factors which can lead to the rapid overexploitation and extinction of targeted species. Despite these regulatory disadvantages, meeting criteria set by international quality standards and trade requirements help in the expansion of exports and Madagascar's ability to compete with foreign producers (MAP). Global consumer demands and commercial interests are pushing the boundaries of existing systems of governance, driving a paradigm shift away from traditional governance and resource management through market-led globalization and increasing the role of the private sector (Najam and Robins 171).

This trend is made evident by PNB's involvement in development programs and co-management efforts with traditional fishermen.

Liberalization and industrialization of the fishing sector has had overwhelming effects on marine resources and food security in developing nations by limiting the availability of seafood in local markets and increasing prices (Stone). As fishing export industries expand, local markets are often neglected in an effort to concentrate resources and capital in export sectors. Industry is therefore torn between high potential revenues generated in export markets and high local demand for fish, which constitutes a primary source of protein for coastal populations. While the local demand for industrial shrimp catch is low, the distribution of industrial by-catch has become important for local markets in Madagascar.

In Madagascar's fishing sector, environmental regulation of industry is limited to the MECIE, *Mise en Conformité des Investissements par rapport à l'Environnement*, which identifies "required" environmental standards but does not strictly enforce sanctions for non-compliance for industries which do not respect environmental responsibilities. The only major law regarding fishing and aquaculture (Law N° 93-022) was established in 1993 and does not provide an extensive means of regulation for the industry. UNIMA has autonomously adopted the 'Guide de Bonnes Pratiques pour une Pêche Responsable et Durable,' which was published by the European Economic Commission to provide social and environmental guidelines for responsible fishing practices. While these measures are significant for the general regulation of the fishing industry, I chose to focus my study on voluntary actions taken by UNIMA to go beyond baseline compliance with Malagasy laws and international standards concerning resource use. I focused my project on PNB's role in regional development programs, NGO projects, and local management efforts to control traditional fishing practices and protect common interests in the health of the fishery.

IV. ROLE OF THE FISHING INDUSTRY

Since the 1970's, Madagascar's growing shrimping industry has been an important revenue source and a significant component of national development initiatives. Over the past several decades, shrimping efforts have expanded in response to growing international demands, attracting thousands of people to coastal areas to participate in the exploitation of the "pink gold" which thrives off of Madagascar's coasts. The rapid emergence of the shrimping industry in Madagascar has had profound impacts on the national and local economy, social structures, cultural norms, lifestyles, resource management efforts, and the relationship between Malagasy people and the environment (UNIMA).

Fishing, tourism, and mining are Madagascar's three principal sectors for economic development and revenue. Shrimp exports are the largest and most valuable component of Madagascar's fishing export sector, representing 77% in volume of seafood exports and 88% in value (Ramanoelina). Madagascar exports approximately 15 tons of shrimp per year, including 7,300 tons produced from aquaculture, representing 15% of the country's total exports. France imports 68% of Malagasy shrimp products, establishing Madagascar as the second largest contributor to the French shrimp market with the highest value of imports (Fecana).

In 2005, Madagascar's shrimp export volume decreased by 36% in comparison to 2004 levels (La Gazette). The rapid decline in catch levels revealed the urgent need to better manage pressures on marine resources and to address overexploitation of fisheries. While the decline in output has been attributed to poor management of fisheries and chronic deterioration of coastal and marine habitats, the economic impact of the crisis was amplified by a decrease in the value of shrimp on the international market and a simultaneous increase in intermediate costs such as fuel for fishing and transport. In response to the shrimp crisis, the government, industry, NGO's, and traditional fishermen cooperatives have collaborated to

identify ways to restore Madagascar's coastal fisheries through moderation, impact awareness, and an improvement in the structural regulation of the fishing sector.

V. FISHING ZONES

Industrial shrimping in Madagascar is divided into four zones which cover Madagascar's 4,500 km coastline (MAEP). The following table shows the distribution of industrial fishing licenses and the general location of each fishing zone.

	Location	Number of Licenses
Zone A	N: Cap St. Sébastien S: Pointe d'Angadoka	6 UNIMA/PNB 1 Refrigepêche Ouest
Zone B	N: Pointe d'Angadoka S: Katsepy	5 Malgache des Pecheries 1 Refrigepêche Ouest
Zone C	N: Katsepy S: Morombe	15 Malgache des pecheries 6 Pêchexport 6 UNIMA/PNB 4 Aquamen Pêche (Unima Subsidiary) 3 Kaleta Pêche (Unima Subsidiary) 3 Refrigepêche Ouest 3 Les Pecheries du Melaky 2 Crustapêche 2 Hasikin
Zone D	East coast of M/car	6 Refrigepêche Toamasina

(GAPCM)

I carried out my study in Zone A, located in the northwest of Madagascar, which consists of the bays of Ambaro, Tsimipaika, and Ampasindava. This zone is considered to be the most important shrimping zone in Madagascar for both industrial and traditional fishing. Zone B, located just south of Zone A, is the second most productive area for shrimp exploitation. On the following map, Zone A correlates with Zone I, Zone B is comprised of Zones II and III and Zone C extends from Zone IV to Morombe in the South of Madagascar.

VI. BIOLOGICAL ASPECTS

The five principal species of shrimp exploited in Madagascar belong to the family “Penaeidae” and are distinguished by color, size, and other physical attributes.

Common Name	Species
White	<i>Penaeus indicus</i>
Pink	<i>Metapenaeus monoceros</i>
Flower/Tiger	<i>Penaeus semisulcatus</i>
Kuruma/Tiger	<i>Penaeus japonicus</i>
Giant Tiger Prawn	<i>Penaeus monodon</i>

(Richmond)

While the white is the most abundant among these species, all shrimp species follow similar biological cycles and share the littoral and marine habitat. The shrimp biological cycle is 18 months long and takes place between coastal ecosystems and open ocean. Females lay between 500,000 - 1,000,000 eggs at sea, only a small percentage of which survive the larval migration towards the littoral ecosystem to mature (Projet ZAC). While migrating toward their coastal habitat, shrimp transition from a protozoan stage to a post-larval state. Upon reaching the estuary, juveniles spend a 3 month gestation period feeding on plankton and sediments in the mangroves. During this critical stage of development, shrimp are extremely vulnerable to climatic factors, changes in environment, and predation in the mangroves. Growth rates and the size of populations are influenced by environmental factors such as winds, temperature, tidal cycles, salinity of water and general ecosystem health (La Gazette 30/1/2007). Low salinity and a high concentration of nutrients in the warm and shallow waters of the mangroves allow shrimp to mature properly and reach a healthy state of development (Remanevy). These factors are exacerbated by human pressures on both the shrimp stocks and other resources located in the estuary. Shrimp complete their growth period during transition back out to deeper waters to spawn. While this basic lifecycle is shared by the five species, each differs in the time of reproduction and migration, explaining why certain species are more abundant at different times of year (UNIMA).

Mangroves play an extremely important role in maintaining the health and natural equilibrium of coastal ecosystems and provide an important refuge for a number of species. Madagascar has the largest concentrated area of mangroves in the Occidental Indian Ocean, amounting to over 320,000 km² (UNIMA). Mangroves are instrumental in protecting against coastal erosion and provide innumerable resources for fishing villages and coastal populations (Remanevy). Local uses for resources found in mangroves vary widely and constitute an important economic asset in Malagasy fishing villages. Apart from being a rich and accessible fishing zone, mangroves provide firewood, construction materials, medicinal plants, and a productive environment for aquaculture.

Recent population growth in coastal areas and constant increases in fishing efforts limits the capacity of shrimp stocks, and other marine species to regenerate. While traditional fishing practices take place primarily in estuaries and within mangroves themselves, juveniles are often caught by traditional fishing gear before they are able to mature and reproduce in the open ocean. Use of destructive gear, lack of respect for seasonal closures, deforestation of littoral ecosystems and general environmental degradation are important factors contributing to declining output in both traditional and industrial fishing sectors (Remanevy).

The shrimping season closes along the west coast of Madagascar to allow for shrimp stocks to regenerate during December, January and February. In Zone A, industrial fishing efforts are stopped between October 31 and March 1, while traditional fishing is authorized to continue through November. The season closes during the shrimp gestation period in the mangrove and helps to optimize ultimate output and the size of the population available for capture when the season reopens. Lack of respect for closure penalizes all stakeholders in fisheries by inhibiting the development of shrimp stocks and threatening the long-term viability of the resource.

VII. DIANA

In order to understand the complexity of resource management issues in the region, it is important to take into account the series of events which led to the inevitable overexploitation of shrimp stocks. Zone A is located in the Region of DIANA which covers the coastline of the fishing zone and includes Diego Suarez, Ambilobe, Nosy-Be, and Ambanja (Tribune).

UNIMA established Pêcheries de Nosy Be (PNB) in 1973, in response to a global increase in the demand for shrimp and the opening of new markets, such as Eastern Europe. While the establishment of industrial fishing operations in Madagascar drew a significant amount of attention from authorities, the simultaneous expansion of traditional fishing practices went largely unnoticed. In response to the same economic pressures, immigrants from the east coast of Madagascar came to the area to capitalize on the growing market. Due to limited market access and capital restraints, the emergence of 'Sociétés de Collecte' was instrumental in the commercialization of catch caught by traditional fishermen and their participation in the blooming export market. The invasion of immigrants with limited fishing experience destabilized the social fabric among fishing communities and heightened pressures on already scarce resources (Gaspard). Shrimp populations were thus being exploited in both the littoral and at sea by simultaneous increases in uncoordinated and unregulated fishing efforts.

In 2005, catch levels dropped to an unprecedented low, revealing the need to address overexploitation of fisheries and reinforce environmental protection to restore natural processes. In response to this crisis, both PNB and traditional fishermen have worked in a cooperative manner to address over-fishing issues in Zone A. While PNB has already limited fishing efforts in the area, they have also played an active role in helping to create alternatives for traditional fishermen to help alleviate pressures on shrimp stocks and ensure respect for closure.

VIII. INDUSTRIAL FISHING

At an international level, various market instruments have been introduced to help the fishing industry integrate an environmental dimension into their business practices. Environmental certification schemes, industry initiatives, technical requirements, and corporate standards for production and marketing are becoming increasingly influential in helping to determine the fate of resource use in developing countries. At the most basic level, sustainable business models are a viable means of ensuring long-term profitability and creating low-risk investment opportunities. UNIMA is a good example of how social and environmental initiatives are being pursued by producers out of self-interest in anticipation of higher standards and chronic resource depletion, which could permanently dampen productivity of the industry (Najam and Robins 175).

The large-scale and impact of trawlers used by industrial shrimp boats are one of the primary concerns regarding resource exploitation for industrial fishing. Currently, a major emphasis has been placed on reducing by-catch and industrial impacts on non-target species through technical requirements and zone restrictions for the shrimping industry. Regulations and requirements have been enforced through national standards and trade conditions in order to ensure that uniform measures are taken to address problems associated with by-catch. For instance, US law forbids the import of sea products which “compromise” sea turtles. The National Marine Fisheries Service and the Department of State ensure that the government of the nation of origin has implemented specific measures to limit the catch of turtles, or that the fishing environment does not constitute a threat to turtles. Estimates show that if turtle protection measures are 97% effective, sea turtle populations could experience an 11% annual growth in population size (Le Quotidien 17/1/2007). The US is one of the largest markets for shrimp in the world, along with Asia and Europe. Madagascar received American certification for export in October 2006, along with 16 other countries, after the successful implementation

of TED and BRD requirements for all shrimp exporters which began in 2003. Despite the significance of US approval, Europe will most likely remain Madagascar's primary importer due to high transportation costs and other market variables (L'Express 30/1/2007).

Madagascar's shrimping industry has grown significantly since its emergence in the 1960's. In 2005, the industry had a total of 80 boats in Madagascar, seven shrimp farms (Arilala). The following table shows total catch levels for industrial shrimping in Madagascar and UNIMA's contribution to production for the past six years.

Year	PNB	UNIMA Subsidiaries	Total UNIMA	Total Catch for Shrimp Industry	UNIMA contribution
2001	1,833	481	2,314	7,889	29%
2002	2,240	741	2,981	9,102	33%
2003	2,062	773	2,835	8,532	33%
2004	1,770	672	2,450	7,218	34%
2005	957	579	1,496	5,251	28%
2006	1,272	651	1,923	5,752	33%

(UNIMA)

While UNIMA's contribution to Madagascar shrimp production has remained relatively constant over the past six years, the table shows the decline in output beginning in 2004 which has affected all industrial producers. The crisis in 2005 resulted in a significant reduction in output for Madagascar's shrimp sector.

Despite the decline in output in 2005, the shrimp sector has remained an important source of employment and state revenue in Madagascar. The following table shows the employment levels and taxes for 2004 and 2005.

	2004	2005
Total employment	9,189	9,119
Number of Malagasy citizens employed	9,034	8,985
Number of Foreigners	155	134
Taxes paid to the State	15 billion Ariary	11 billion Ariary

(Arilala)

a. RELATIONSHIP WITH TRADITIONAL FISHING

It is difficult to define the role of a private enterprise in sustainable development, as a number of factors can influence a company's responsibilities and independent initiatives to support development. Despite the lack of mandated obligations to cooperate with the traditional fishing sector, PNB has a vested interest in resource management and the health of coastal ecosystems throughout the fishing zone. In recognizing universal interests and their shared fate with traditional fishermen, PNB has adopted a holistic approach to managing resources by integrating a social dimension into their practices. In 1999, PNB initiated collaborative efforts with traditional fishermen in response to inadequate government oversight and a general lack of resources available to manage traditional fishing efforts (Gaspard). PNB's approach in establishing a partnership with traditional fishermen has placed an emphasis on the following components:

- Improving communication and assistance in coordinating meetings
- Elimination of destructive gear by helping to distribute approved fishing nets
- Monthly meetings in villages throughout the fishing zone
- Meetings between industrial boat captains, traditional fishermen, and factory workers
- Providing solutions and alternatives to traditional overexploitation by commercializing by-catch and working directly with fishing cooperatives
- Involvement in regional development projects and advocacy for local issues in traditional fishing villages

PNB's presence in the area and their ability to invest resources and engage in localized development issues distinguished their efforts from government oversight (Gaspard). Even today, government sponsored efforts to control traditional fishing lack proper enforcement and fail to reflect the realities faced by traditional fishermen and their relationship with the environment.

PNB has established a formidable presence throughout the network of fishing villages in Zone A. Steps taken by the company have helped to bridge the gap between traditional and industrial fishing through the recognition of common needs and objectives. PNB is able to

effectively communicate with a wide range of stakeholders while ensuring that specific resource management issues are addressed through development projects. The success of this approach lies in accepting a common purpose among fishermen, and uniting through mutual respect to protect the future of the fishery. As Ghislain Gaspard often said, the industry is fishing “the same resources, at the same time, in the same place” as traditional fishermen, and should thus ensure the protection of both.

IX. TRADITIONAL FISHING

Use of destructive traditional fishing gear, lack of respect for seasonal closures, deforestation of littoral ecosystems, and general environmental degradation in traditional fishing villages have a significant influence on declining output for both traditional and industrial fishing. A considerable amount of blame is placed on traditional fishing for the decline in fish stocks and the debilitation the coastal resources. Government efforts to manage traditional fishing have placed an emphasis on limiting the number of fishermen through the distribution of licenses and CSP surveillance over the commercialization of catch in fishing villages. Unfortunately the sociological dimension of traditional fishing practices in Madagascar is poorly understood and often overlooked by authorities operating at national and regional levels. The neglect of social implications of policies and practices has limited the recognition of local perceptions, attitudes, patterns and understandings which drive resource exploitation in Madagascar at a local level. Despite the contemporary nature of the shrimp market and the predominance of the industry, traditional fishing plays an extremely important role in the shrimp sector. Shrimp was only recently introduced into Malagasy diets and is still perceived largely as an export product for ‘vazaha’ or foreigners. Shrimp occupy a unique market niche among traditional fish products and are not generally intended for local markets and subsistence. Therefore, traditional fishermen have focused on increasing shrimp catches

in response to growing international demands which far exceed those of the local market (Gaspard).

The emergence of 'sustainability' as a policy instrument is a fairly recent phenomenon which, for the most part, has been defined and developed by the industrialized world. Despite the mainstream integration of concepts and terminology associated with sustainable development at an international level, it is important to recognize that they are still foreign to many in the developing world. Therefore, when sustainable use models are applied locally, one must take into consideration perceptions of target populations concerning resource quantity, availability, and the impacts of human practices. This process involves defining the local population's stake in the resource, values associated with resource use, their objectives for future uses, and their influence over management practices. While current programs and management efforts have attempted to address these issues with information campaigns in traditional fishing villages, cultural barriers continue to be a problem. Promoting sustainable fishing practices with traditional fishermen have therefore been complicated by a lack of consensus and understanding between the fishermen and other stakeholders.

a. EMERGENCE AND RECOGNITION

While traditional fishing practices have persisted for centuries along the coastline of Madagascar, fishing methods and the role of traditional fishermen were not officially recognized by the government until recently. Before the 1980's, the impacts of traditional fishing were regarded as relatively benign and insignificant in comparison to the development of industrial fishing. The isolation of rural fishing villages, the modest nature of traditional fishing gear, and seclusion of the local markets caused the local level of exploitation to seem innocuous and thus unworthy of regulation. The rapid emergence of the shrimping industry triggered a surge in traditional fishing, increasing coastal populations and the number of fishermen competing for the resource. Between 1988 and 1999, catch from the traditional

sector increased from 230 tons to 2,150 tons, intensifying exploitation of littoral ecosystems by nearly ten times (UNIMA). In the late 1990's, local associations, cooperatives, NGO's began to emerge in fishing villages in response to the uncontrollable growth and the anarchic state of the region's coastal fisheries. As pressures continued to escalate, coastal populations began to experience a drop in living standards and decreases in resource availability due to overcapitalization and overexploitation of local resources. The rapid disappearance of resources revealed the need to establish universal regulations regarding the number of licensed fishermen and authorized gear (Gaspard, La Gazette).

b. TECHNIQUES

Traditional fishermen use various forms of fishing gear which are designed to be used in estuaries, mangroves, and along the coast. Fishing is done primarily in small wooden boats called 'pirogues'. While some fishing techniques have remained unchanged for centuries, people have only recently taken into account the environmental impacts of various methods. The following table explains the most common techniques and differentiations in catch.

Valakira	A V-shaped fixed trap set at the mouth of the estuary and in the mangroves in tidal zones using thin wooden poles. Low selectivity of this technique results primarily in the capture of juveniles. Rebuilt annually.
Kaokobe	Monofilament 12mm nets operated by four people to catch shrimp using a circular movement. This type of fishing is done at the mouth of the estuary at 4-5 meters of depth. Used to catch
Periky	Mono-filament nets placed on the sea floor during transitions between low to high tide on the coast and further out at sea. This technique uses selective 15 to 20mm nets and targets large shrimp. Periky nets are operated by two fishermen and last approximately 3 years.
Vonosaha	Barriers set up at the exit of estuaries and along the border of mangroves often using mosquito nets with mesh sizes between 1-2mm to catch juveniles. This type of fishing has been prohibited by regional law due to its negative impacts on fish stocks.
Poto	Fixed multi filament nets used strictly during transition from low to high tied. Several traps are placed at the mouth of the estuary, and typically catch juveniles leaving the mangroves. Regional law prohibits the use of this technique because it creates a barrier for marine species living in the estuary.

(Rokotomanana, Projet ZAC)

The MAEP Observatoire Economique (OE) performed a survey in 2004 in the village Ambavanankarana (located in the Bay of Ambaro) to take an inventory traditional fishing gear.

	Valakira	Kaokobe	Periky	Total
Total count in Ambavanankarana	30	40	60	130
Total count in Bay of Ambaro	184	266	711	1,161

(Rakotomanana 138)

The predominance of Periky could be attributed to distribution programs sponsored by ZAC and PNB to help traditional fishermen transition from harmful, prohibited gear. Unfortunately these results do not reflect the number of unauthorized and unregistered fishing materials in the area, as many fishermen in the Bay of Ambaro are unlicensed and are difficult to monitor.

c. LOCAL VARIABLES

Local variables play a major role in defining the relationship between industrial and traditional fishermen in Zone A. The Bay of Ambaro is considered to be the most important area for traditional shrimping in Madagascar, and thus has experienced a significant amount of growth in recent years. A significant problem with current efforts to manage fisheries and resolve resource conflicts is the application of macro-managing models which fail to reflect local realities. Managing schemes are often imposed without considering socio-economic variables which determine the relationship between local populations and their environment, and therefore fail to address key factors which are driving overexploitation.

Results from a UNIMA's recent information campaign in the three bays of Zone A demonstrate the wide range of problems faced by fishing communities. The objective of the project, which covered 43 villages between October 2006 and January 2007, was to exchange information and identify the concerns of traditional fishermen regarding fishing practices, management efforts, environmental issues, and general development efforts. The project revealed the wide range of problems faced by traditional fishing villages and the importance

of considering local variables when defining solutions to resource exploitation. The following table summarizes issues identified by villagers and gives an indication of the wide range of issues faced by fishing communities.

Industrial Fishing	<ul style="list-style-type: none"> ▪ Lack of respect for local customs (Fishing fady* Wednesdays/Sundays) ▪ Waste of by-catch ▪ Lack of respect for the guide of good conduct for responsible fishing ▪ Destruction of traditional fishing gear by industrial fishing boats ▪ Night fishing ▪ Withdrawal of PNB after arrival of ZAC
Traditional Fishing	<ul style="list-style-type: none"> ▪ Lack of control and surveillance over immigrant fishermen using prohibited fishing gear and motorized equipment ▪ Lack of communication, control, and surveillance during closure ▪ Lack of respect for local customs and DINA by immigrant fishermen (Fishing fady Wednesdays/Sundays) ▪ Mesh size and type of fishing nets do not respect DINA ▪ Unregulated night fishing ▪ Fishermen not paid fairly by collectors ▪ Lack of respect for sacred areas ▪ Lack of universal recognition of DINA by resident fishermen ▪ Inefficiency of administrative process for distribution of fishing licenses ▪ Improvement of techniques and fishing gear to increase revenue
Local Authorities	<ul style="list-style-type: none"> ▪ Lack of control and surveillance over areas in need of local management ▪ Failure of local authorities to issue infractions for mangrove deforestation ▪ Conflicts between communes over mangroves ▪ Lack of cohesion between CLB, local government, and villagers ▪ Laxity of court, police, and environmental authorities concerning mangrove destruction and law enforcement ▪ No collaboration between CLB and CSP
Villagers	<ul style="list-style-type: none"> ▪ Villages recently settled by immigrant fishermen lack control and surveillance ▪ Lack of cohesion between CLB's and local population ▪ Personal conflicts between villagers and CLB members ▪ Difficulties obtaining permits to cut for construction needs ▪ Accusations of CLB members profiting from mangrove exploitation for charcoal, construction materials, and firewood ▪ Lack of individual responsibility and commitment
Other Problems	<ul style="list-style-type: none"> ▪ Problems with communication and changes in customs ▪ Difficulties understanding environmental issues related to fishing ▪ Isolation during rainy season ▪ Lack of alternatives to earn revenue ▪ Lack of fertile agricultural land and financing to grow crops ▪ Development projects are not fully completed, lack of follow-through ▪ Lack of framework, tools, and financing to carry out projects: crab farming, reforestation, shrimp farming ▪ Projet ZAC = ineffective ▪ Deforestation of mangroves ▪ Lack of financing, training, and structure for reforestation of mangroves ▪ Men do not participate in mangrove reforesting

	<ul style="list-style-type: none"> ▪ Insufficient control over mangrove exploitation for charcoal, construction materials, and firewood ▪ Lack of plumbing, toilets, potable water ▪ No accessible health care ▪ Insufficient class room space ▪ Coastal erosion in estuary
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*Fady = taboo

As demonstrated by the specific problems listed in the table, gender issues, ethnic tensions, cultural issues, lack of authority, infrastructure scarcity, limited revenue options, lack of financing, and environmental degradation have a significant influence on industrial fishing efforts and may vary widely among different communities. These issues play an important role in helping to define development programs and PNB's efforts in traditional fishing villages in Zone A.

For development projects in the region, a major emphasis has been placed on controlling fishing efforts and deforestation pressures in fishing villages during closure. This focus has been established in an effort to protect juvenile shrimp stocks from depleting and to protect the general health of the littoral ecosystem. As demonstrated by the results of PNB's survey, limited alternatives for income and employment have forced traditional fishermen to exploit shrimp and fish stocks during closure for survival. While alternative sources of revenue are in fact limited, social hierarchies and unwillingness to engage in alternative employment opportunities play an important role in limiting the impact of information campaigns and aquaculture schemes aimed at limiting fishing efforts. Social hierarchies and distinctions between traditional fishermen are defined by the type of fishing they practice and what they catch. Within the community, shrimp fishermen rank highest while fishermen that catch fish and crabs tend to be of lesser status. This has an important influence over efforts to promote crab farming as an alternative to fishing, as fishermen are culturally and socially averse to changing the nature of their profession.

The isolation of rural fishing villages throughout Zone A and the archaic nature of fishing practices and processing methods impose major limitations on efforts to regulate and better manage the traditional fishing sector. A lack of communication and cooperation between fishing villages and cooperatives inhibits collective efforts to manage fisheries and improve environmental conditions. Traditional fishermen throughout Zone A face extensive challenges regarding the commercialization and distribution of their catch. The predominance of informal market structures and restricted market access limit options for the commercialization of products within fishing villages. Shrimp sold by traditional fishermen are often unable to be used for export due to low levels of sanitation which reduce the value of traditional shrimp catch. Due to the lack of refrigeration and storage options in the villages, a significant amount of catch is dried and salted and sold on local markets.

X. STRUCTURE: NATIONAL

At a national level, the fishing industry is regulated by the Ministère de l'Agriculture, de l'Elevage et de la Pêche which is based in Antananarivo. In addition to general oversight of the fishing sector, MAEP helps to facilitate public-private partnerships for development. MAEP programs have placed an emphasis on “sensibilization,” information campaigns, communication improvements, and improved market access for traditional fishing (MAEP). The Centre de Surveillance des Pêches (CSP) was established in April 1999 with the mission of ensuring the rational and sustainable exploitation of Madagascar's fish stocks. CSP regulates the fishing sector through surveillance to help eliminate unauthorized fishing efforts and enforce fishing restrictions during closure. CSP monitors the appropriate use of gear and ensure the respect of government legislation and regulations for both industrial and traditional fishing (Tribune).

CSP has 29 ‘observateurs’ which monitor the activities of industrial fishing boats and report on information regarding activities and captures to the center in Antananarivo. Officers are assigned to individual ships for two months at a time to observe the technical and regulatory compliance of the industry. This program has placed a significant amount of CSP resources and personnel within the industry, decreasing the availability of officers and funds available to effectively monitor issues in traditional fishing villages. CSP officers on-board industrial ships monitor environmental variables such as waste management, by-catch treatment, by-catch composition, and biological characteristics of shrimp catch. APPENDIX I and II are sample documents being used by the officer on board UNIMA II to regulate environmental Impacts of the boat.

The Groupement des Armateurs à la Pêche Crevetrière de Madagascar (GAPCM) was created in 1994 to help facilitate cooperative management between the government and the private shrimp sector with the objective of optimizing output and limiting depletion of the resource. GAPCM has helped to improve communication between the Agence Francaise de Developpement (AFD), CSP, the Observatoire Economique, shrimping companies, and the government. In prioritizing the co-management of the fishing sector, GAPCM helped to improve market conditions for export companies through improved transparency, regulation, licensing, and resource management. GAPCM focused on initiating changes in both fishing gear and tactics to help the private sector address resource management issues (GAPCM).

Changes in fishing gear

- Increase in mesh size
- Prohibit use of destructive chains on nets
- Limit use of twin trawlers
- Reduce by-catch, particularly of large organisms

Changes in fishing tactics

- Increase length of closure
- Alternation between night/day fishing depending on season and shrimp species
- Reduction in the length of industrial hauls

GAPCM was instrumental in the establishment of economic cooperation and means of compliance for both the industry and traditional fishermen. The organization was also involved in local development projects to help control resource exploitation in traditional fishing villages.

XI. STRUCTURE: REGIONAL DIANA

There are several actors which regulate the fishing sector at a regional level in DIANA. Unfortunately, the centralization of power has limited the capacity of regional bodies to effectively govern the fishing practices. Regional bodies are pushing for a shift in control to exercise national authority at a regional level by adapting legal texts to allow for regional actors to apply national laws. While there are several important actors at the regional level, I focused on the roles of the Regional Director of Development (DDR), SAGE, and Projet ZAC during my time in Diego to study the political aspects of fishery management and regional development efforts. The Regional Director of Development, Kleoni Mandimbisoa, has become involved in efforts to coordinate and improve regional initiatives which promote the development of the fishing sector in rural communities. Despite the importance and symbolic significance of Mr. Mandimbisoa's position, the Office of Regional Development lacks resources and the administrative capacity to act as an authority in the region and to sponsor initiatives. Due to regional under-financing, regional efforts to manage fish stocks in Zone A have been driven by the private sector (PNB), NGO's, and foreign aid projects. PNB has played an extremely important role by working directly with cooperatives villages and demonstrating a clear commitment to resolving resource issues in the area. PNB serves as an important means of communication, collaboration, and support between regional initiatives and local communities.

The Service d'Appui à la Gestion de l'Environnement (SAGE) is an active NGO in the

area which focuses on local development and sustainable resource use. SAGE receives funding from UNDP and operates at the national, regional, and local level. The national environmental program focuses on decentralization and the integration of the environmental dimension in Madagascar's development efforts (Source: SAGE). One of SAGE's primary objectives is to help facilitate a transfer in the management of resources from national authorities to local communities. In DIANA, SAGE has helped to carry out local initiatives and build institutional capacities to improve social and environmental conditions in rural areas. SAGE was instrumental in establishing 'Comités Locaux de Base' (CLB) in fishing villages to control resource use and monitor environmental issues. CLB's help to promote communication and consensus between community members by placing an emphasis on shared interests and local governance (SAGE). While the creation of CLB's both symbolically and practically significant, CLB's lack authority, organization, financing, means of control, and influence within local communities. Despite these shortcomings, the degree of local initiative and progress has been an important motivation for fishermen and a key means of progress.

Projet ZAC is a program financed by the EU and the Agence Française de Développement that supports the rational management of marine resources in DIANA. Under the aegis of MAEP and the regional government, ZAC has helped to facilitate communication between public and private stakeholders to help uphold respect of closure in local fishing communities. ZAC, which stands for 'Zone d'Amenagement Concerté,' works directly with local surveillance committees, fishing cooperatives, private sector representatives and the government (Tribune). The project was allocated six million euros to be distributed between the 3 pilot sites located in the Bay of Ambaro, Morondava, and the bay of Antengile. In Ambaro, ZAC established a platform for communication and consultation to improve the management of shrimp stocks in traditional fishing villages.

The project identified five pilot villages in the area to help improve local awareness of environmental issues associated with fishing pressures and communication with other stakeholders. In the villages, ZAC expanded on existing efforts by SAGE and PNB by helping to establish *Comités Locaux de Surveillance* (CLS) to reinforce local surveillance efforts. Unfortunately, CLS are not officially recognized by the CSP and therefore play a very limited role in overseeing fishing efforts. ZAC plays a restricted role in the implementation of projects and development proposals and has not pursued concrete actions or investment strategies in local communities. Instead, ZAC promotes collaboration and consensus between stakeholders and relies on stakeholder initiatives to identify solutions to resource management problems.

The project will be ending this summer and has thus far provided no capital or long-term investments in local villages to help sustain management efforts. During a meeting at the ZAC office, project administrators identified lack of staff as a major obstacle to the program's capacity and influence in the region. Difficulties rallying local actors and inciting participation in communal efforts were also mentioned as significant limitations. ZAC identified problems with financing during closure and product commercialization as major obstacles to traditional fishermen but pursued no tangible means of ameliorating the situation. ZAC administrators recognized the need to stabilize prices and improve market access in order to strengthen fishing communities and improve leverage of local cooperatives. While ZAC did not directly invest in local communities during closure, the program helped to finance the following projects to help promote the respect of seasonal closure:

- Informative radio programming
- Visual aids such as signs and posters
- Awareness of fishing impacts and gear use
- *Comités Locaux de Surveillance* to monitor local violations

After nearly two and a half years, pilot villages have demonstrated no tangible improvements in relation to other villages in the area which were included in general information campaigns.

ZAC administrators claim that “positive dynamics” dynamics in pilot villages between different stakeholders can be attributed to the involvement of the project. However, this assumption is not backed by quantitative results or discernible improvements in the structure of the fishing sector and management efforts. Despite the restricted role assumed by ZAC, the project is still perceived as a major actor in regional resource management initiatives due to its financial resources and ‘expertise’ in development.

(Source: ZAC)

XII. STRUCTURE: LOCAL

Local laws and fady’s are an important and effective means of controlling resource use in a local setting. For instance, the local government collaborated with fishermen in Nosy Faly, an island near the Bay of Ambaro, to establish a local closure for Indian Mackerel fishing. The closure has been formalized by local law and is respected as a result of the mutual recognition of the need for regulation and action which led to its establishment. In many fishing villages, local fady’s for certain fishing gear have been successful in reducing the use of destructive gear and facilitating changes in customs and attitudes (Gaspard, Projet ZAC). The success of these two examples can be attributed to the high degree of local consensus, cultural relevance, and the mutual agreement and respect between parties which play an extremely important role in local governance.

Comités Locaux de Base (CLB’s) were established with the help of SAGE and other actors in 74 villages near the Bay of Ambaro to integrate environmental objectives into communal development initiatives (Source: SAGE). The objective of CLB is to strengthen the capacity of local actors and stakeholders to specifically manage coastal resources, protect the environment promote sustainable uses. The committees were established to help facilitate the transfer of management from national and regional bodies to local authorities. CLB’s use

DINA, local laws, as a means of establishing and reinforcing an environmental ethic in traditional fishing practices and general resource use. Unfortunately, limited recognition and lack of resources dampens the capacity of communal organizations and thus dampens their ability to control resource use.

As indicated by the results of the UNIMA sponsored information campaign, CLB's are not fully respected by community members and often are an ineffective means of controlling resource use. As a relatively new means of local governance, CLB's have a poorly defined role and are not always respected as an 'authority' within local communities. Committee members are intended to assume the role of local police, but do not necessarily exercise their rights in patrolling resource use (Etienne). CLB's are also a controversial means of controlling fishing practices, as their authority is only relevant to land issues and does not extend into tidal areas.

While CLB's have been given authority over land use issues, fishing cooperatives influence fishing activities and resource issues in the water. Fishing cooperatives have been established to provide structure and support for fishing efforts. Villages can have multiple cooperatives, such as Ampampamena (a village of nearly 700 inhabitants) which has three fishing cooperatives. There are five fishing unions in Zone A, which have been established to collectively represent groups of fishing cooperatives in different areas. Cooperatives are an important means of monitoring fishing efforts and organizing fishermen at a local level. Cooperative representatives and unions are critical in helping to convey environmental issues to fishermen and other community members (Gaspard, Etienne). The establishment of fishing cooperatives has created a network between fishermen that is an important means of communication and organization for other stakeholders. Projects, such as Projet ZAC, are able to use unions and cooperatives to communicate issues, establish agendas, and identify solutions concerning fishing practices and resource management.

Cooperatives are often used to help communicate issues concerning closure with local fishermen and coordinate efforts to reduce non-compliance. Increased participation in cooperatives has resulted in a decline in illicit fishing due to increased control over fishing efforts and improved dynamics between fishermen. Cooperatives promote the recognition of mutual interests and use social pressures to ensure compliance. Therefore, respect for closure can become a kind of shared social contract, as opposed to a technical constraint imposed on individual fishing efforts. Although illicit fishing persists throughout the fishing zone, cooperatives feel as though they are not responsible for the lack of respect for closure. Instead, cooperative members argue that unaffiliated 'outsiders' are to blame for exploitation of shrimp stocks and other species during closure (Etienne).

Unaffiliated fishermen are also blamed for using unauthorized fishing gear, while techniques used by cooperative members tend to be better regulated. The distribution of 15mm nets through cooperatives has helped to standardize techniques while also acting as an incentive for fishermen to join. Nets are often distributed to cooperatives by aid projects as new fishing gear are poorly commercialized at a local level and relatively inaccessible to many traditional fishermen (Projet ZAC).

Although the establishment of cooperatives and union has helped to promote and facilitate progress with traditional fishermen, the lack of available resources has limited capacity and impact. Membership dues, which are supposedly 200 Ariary per month, are rarely collected and cooperatives have very limited access to direct funding outside of the community (Etienne). While representatives are often prominent members within fishing communities, educational levels are relatively low. Legal texts and development agendas typically written in French and are often not even distributed to fishing cooperatives. Therefore, when texts are in fact distributed, cooperative members are often unable to understand and evaluate the policy structures which impact them (Gaspard). Many villages

have experienced conflicts between CLB members and cooperatives due to personal issues, conflicting agendas, and disagreements over jurisdiction and responsibilities (Etienne). The frequent lack of collaboration between these two key local actors is a clear hindrance to progress and the general impact of their activities.

Finally, Projet ZAC helped establish Comités Locaux de Surveillance (CLS) which are intended to collaborate with CSP during closure to help regulate fishing efforts. While CLS may cooperate with local CSP officers at a community level, the committees lack official recognition by CSP at a national level. With no official mandate, CLS representatives have almost no authority and cannot enforce sanctions for local infractions. Due to a lack of financing, committees are not sustained while the shrimp season is open (Source: ZAC). This clearly inhibits CLS from sustaining efforts and makes it difficult for representatives to gain local recognition and respect. Although these committees are currently the least effective means of local governance, I believe that they could potentially play a valuable role in helping to ensure local compliance and sustainable management.

XIII. CURRENT ISSUES

Currently, there are three major projects being pursued in DIANA to help improve both regional and national abilities to manage traditional fishing efforts and control resource use. At a national level, the notion of 'fishing rights' is being redefined in an effort to reduce pressures on the fishing zone by restricting the number of traditional fishermen, which is similar to the approach for controlling industrial fishing. While this is a classic approach to managing fisheries, narrowing the definition of fishing rights contradicts the right of access to the sea for all Malagasy citizens which is granted in the current constitution. This could be a significant shift away from culturally established norms by altering the fundamental right to marine resources in Madagascar. Despite the controversial impacts of such a change, defining

entitlement and ownership of fish stocks could help to clarify roles, rights and responsibilities concerning the governance of these resources which are currently unclear.

Pursuing a strategy of decentralization could force the government to give up control over resources by allowing regional and local authorities to define uses and identify management strategies. Currently, different notions of ownership exist at the national, regional, and local level. The Malagasy government considers marine resources to be a strategic national asset which requires control at the national level. The former Chef de Region in DIANA claimed marine resources to be the “patrimoine de la region” and demonstrated a determination to exercise regional control over fishery management (Gaspard). At the local level, villagers have developed their own perception of ownership through direct dependence on the resources and inheritance.

I had the opportunity to attend a village meeting with traditional fishermen in Ampampamena which was held to discuss issues concerning the potential change. While fishing cooperatives agree that the government needs a better means of managing traditional fishing and controlling exploitation, there is a significant amount of local concern regarding government involvement in license distribution and the identification of professional fishermen. During the meeting, the local fishermen emphasized the importance of the involvement of local cooperatives and authorities in the licensing process to make sure that there are fair distinctions between professional fishermen, gear owners and collectors which commercialize the products.

Two regional committees are in the early stages of development in DIANA which could potentially improve the dynamics between stakeholders in the fishing sector. These committees have emerged in response to the need to organize projects and enhance communication efforts in the region. The Comité Regional de la Concertation Pêche (CRCP) is a committee that has been proposed and pursued by Projet ZAC to help increase the

involvement of regional stakeholders within the program's general framework. I attended a 'preparatory meeting' for the first official reunion with the five union presidents at the ZAC office in Ambilobe on April 23rd. The following objectives were identified and introduced to union presidents during the meeting:

1. Pursue the Federation of fishing unions to reinforce the structure and recognition of unions as well as individual cooperatives.
2. Improve local availability of authorized fishing gear through local commercialization.
3. Collective commercialization of products to bypass collectors and provide fishermen with direct access to the market. This objective would need to address various infrastructure limitations.
4. Improvements in product sanitation to meet health standards and improve the commercialization options for traditional shrimp catch. This would be accomplished through access to improved equipment, materials, and processing procedures.
5. Make the region responsible for informative radio programming during closure.

(Source: Projet ZAC)

A second regional committee is being pursued by the Director of Regional Development and has been named the Comité Regional Environnement Pêche (CREP). Various tensions have arisen between CREP and CRCP, as both are in the early stages of development and competing for regional authority and support. A major criticism for CRCP is that it only represents 1/6 of the region and therefore does not involve *all* regional fishermen (Source: Projet ZAC). CREP has made a concerted effort to create an opportunity for all regional actors to be involved in the committee's framework. The following "missions" were identified by the committee's board at a meeting I attended in Diego:

1. Ensure the integration of an environmental awareness.
2. Ensure the integration of an environmental consciousness in fishing practices.
3. Ensure the integration and harmonization of different actors and stakeholders.
4. Prioritize good governance and transparency in the conservation of coastal resources.
5. Identify needs and establish specific solutions.
6. Ensure better circulation and management of information.

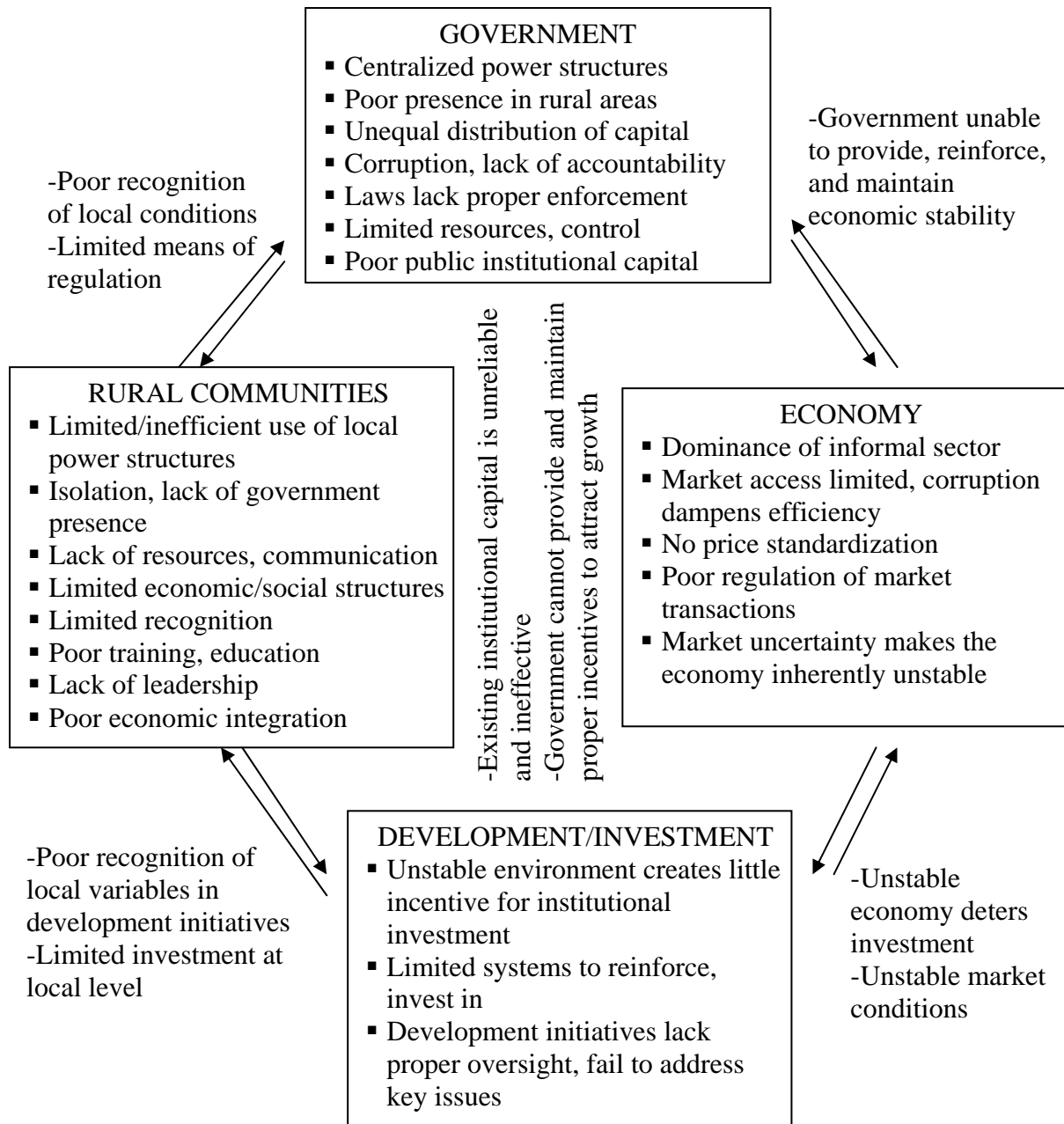
(Source: CREP meeting)

While these are preliminary aims, the ultimate objective of CREP is to help concentrate efforts and improve the administrative capacity of the region to manage fishing practices. These goals are a good foundation for the project, but it is critical that CREP integrates the oversight for concrete development efforts into its agenda. It will be interesting to see how these two committees evolve and resolve issues over the regional roles and the general influence of each committee. Hopefully the establishment of regional committees of this nature will draw attention to problems concerning the fishing sector and help to optimize the impact of development efforts. What is most important is that the two committees establish a productive, cooperative relationship and do not compete for resources to serve as yet another encumbrance for regional development efforts.

PNB has been active in both of these initiatives and has served as an advocate for all fishermen in ensuring that development efforts address specific issues facing the fishing community. At meetings that I attended, PNB ensured that committees were making efforts to communicate with the traditional fishing community and that they were being included in the process (PNB even took the initiative to translate French CRCP documents into Malagasy for distribution within fishing cooperatives). While their role in these initiatives is purely voluntary, I believe that their involvement and the resources they are able to provide are indispensable to development efforts in the region.

XIV. ANALYSIS

I believe that the major barriers to development and improved management of fish stocks in the DIANA region are the lack of institutional and economic infrastructure to help facilitate and support progress at the local level. There are clearly many factors which influence this lack of structure and the general lack of organization and effectiveness that results. While conducting my study, I established this basic diagram of issues which served as the general framework for my analysis of resource management restraints in Madagascar.



This chart looks at the dynamics between, what I perceive to be, four essential factors in development. While each element has its own inadequacies, it is important to consider the relationship between various factors and how they ultimately impact development.

Addressing these key issues and recognizing their connections is crucial to the success of development initiatives as well as the social, political, environmental, and economic security of Madagascar. I believe that reinforcing one level, such as rural communities, could have

positive repercussions for the whole cycle and therefore help to further development efforts in Madagascar.

Pilot projects and current programs have generated awareness for fishery management issues and demonstrated varying degrees of commitment from all stakeholders. Existing efforts have established a wide base of participation, ranging from international to local actors. After spending a month studying the dynamics between various stakeholders in the region, I believe that the role of local communities is the most critical aspect of sustainable development and resource management. The fact that local committees have been established and are recognized by fishing communities is already a significant accomplishment. Now, it is important to focus regional efforts and enhance the role of local bodies in managing resources and controlling local uses.

There is a problem with competition between regional actors and the lack of consistency between various projects and representatives. The 'monopolization' of aid by specific actors has become an issue as some international actors are able to use financial status to exert more control than others. In order to resolve this issue, I think that there needs to be a better general consensus over development initiatives in the region and an emphasis placed on the sustainability of those efforts as opposed to short term gain. PNB's role in these projects is critical, as the industry is able to lobby for all fishermen and ensure that projects address specific issues facing the fishery.

While PNB's efforts have thus far been successful, it is important to recognize limitations associated with this approach in Zone A. PNB's initiative has been critical in establishing the unique relationship with traditional fishermen and other regional stakeholders which is not necessarily characteristic of most industrial fishing companies. Traditional fishermen, regional authorities, and even NGO's have become dependent upon PNB's involvement in the area to varying degrees. The knowledge and resources that PNB is able to

provide have become critical to the success of development initiatives in DIANA, and particularly for those which focus on specific management needs for the shrimp sector. Also, the cooperation, partnership, and sustainable outcomes of PNB's efforts are limited to localized impacts in Zone A. There is no mandate for the involvement of the private sector, and thus it is impossible to assume that other industries will take the initiative to cooperate with other stakeholders to the same degree. If the industry is not willing to assume these responsibilities, the government cannot be relied on to protect local populations and ensure proper management of the resource.

I observed various issues with development efforts, projects, and management which dampen efforts to control fishing practices and ultimately protect the resource. This basic trend in development efforts can be used to illustrate problems with many of the initiatives which have been pursued in the area and thus explain limited success of previous management efforts:

NO FOLLOW-UP → NO EVALUATION → NO RESULTS

These are general problems which characterize the current situation in DIANA and should be addressed to ultimately improve the management of shrimp stocks:

1. The stagnant nature of development projects

Pilot projects and current programs have generated awareness for fishery management issues and demonstrated varying degrees of commitment from all stakeholders in the region. I believe that existing efforts have been successful in establishing a wide base of participation and awareness in the area. However, it is critical that efforts move beyond the stage of "sensibilisation" and begin to identify a more concrete means of improvement. For instance, the lack of discernible progress after over two years of Projet ZAC demonstrates the need to directly invest in local communities and reinforce market structures to improve control over the fishing sector.

2. Barriers to commercialization

The archaic and inefficient commercialization systems in traditional fishing villages have impeded development and capital accumulation in the area. Poor market regulation during closure is a major contributor to continued fishing pressures and the over-fishing of juvenile shrimp stocks. Even while the shrimp season is open, improved market regulation could help to reduce the exploitation of juvenile shrimp and can be used as a tool to influence traditional fishing practices. Limited commercialization options restrict the revenue potential for traditional fishermen and thus impede their ability to invest and improve production efficiency.

3. Lack of training and institutional reinforcement at local level

Actors at the local level suffer from various forms of neglect which limit their effectiveness and their ultimate impact on community resource management issues. The national government is removed from realities faced by traditional fishermen and thus fails to integrate significant local variables within general policy framework. Despite these issues, the establishment of local committees is already a major accomplishment. However, low education levels are still prevalent among community members and committee representatives. The lack of formal training for local committees has dampened their effectiveness because members lack the ability to fully interpret and enforce management responsibilities. Training and oversight can reinforce the role of local committees and give members a better understanding of their role within the community.

4. Competition and overburdening of local capacities

As previously mentioned, competition between various actors can be an impediment to progress and the success of projects. Instead, project should aim to collaborate through mutual strategic support to accomplish goals. Project sponsors should not rely too heavily on local actors without establishing a positive, working relationship. Demanding too much, too

fast from local committees could limit progress and limit the effectiveness of local actors. I think that it is critical that projects recognize the barriers and limitations facing local committees and help to address those issues in order to expand capacities and increase effectiveness.

5. Inadequate surveillance capacity

Clearly, surveillance is an important issue for industrial and traditional fishing. Surveillance is needed to regulate the use of fishing gear, zoning issues, and to ensure compliance with restrictions during closure. A major issue concerning surveillance issues at the local level is CSP's poor presence in traditional fishing villages. While CSP is active in the area, officers have little to no relationship with fishing cooperatives and a poor rapport within communities. Often, traditional fishermen have complained about unjustified sanctions and corruption among CSP officials and I sensed a significant amount of resentment between fishing cooperatives and CSP officers during my study. While I cannot accuse any actor of corruption or abuse of power, I think that it is important to reinforce local surveillance efforts in order to help bridge the gap between CSP and the community. CSL's have been established but their lack of recognition and continuous funding renders them virtually ineffective. The committees are, for the most part, unable to enforce sanctions for non-compliance and act as local authority. Therefore, recognizing their importance and establishing a more constructive partnership with CSP would be necessary to make CSL's a viable means of local surveillance.

XV. PROPOSAL

1. Need for action and investment

It is important for development projects to continue education and awareness regarding environmental issues and the role of traditional fishermen in environmental

protection. However, efforts must move beyond this stage and provide fishing villages with a more practical means of development. There is a major need for need for development capital at the local level to provide practical assistance for villagers. Programs need to provide local communities with the infrastructure and resources necessary to sustain change and to drive sustainable local development through active participation and involvement. I believe that 'action' and 'participation' should be adopted as general objectives of development projects.

2. Reinforce local infrastructure

I believe that, in order to improve and sustain resource management efforts in the area, the strengthening of local institutional structures should become a priority for development efforts. There are several ways to go about doing this. In general, Madagascar needs to continue the process of decentralization to allow for regional and local actors to exercise control over resource use. Investing in local capital could give local committees a more structured and productive framework and enhance their capacity. It is critical that projects aim to strengthen local human capital to allow for local communities to sustain projects and ensure that committee representatives are qualified and effective. In order to integrate this goal, projects need to pursue an adaptive approach with the willingness and ability to modify strategies in response to local pressures and unforeseen variables.

Projects must ensure the cultural and social relevance of development efforts in order to count on local participation, support, and integration. Because cooperatives, unions, and various local committees have already been set up, I think that efforts should build upon systems of infrastructure already established within the community to improve market structure and efficiency. This would involve the integration of local actors within these groups which have influence over other community members and can help to mobilize a broader base of support. There is a pressing need for leadership, innovation, and initiative at the local level to help drive this change.

I would also argue for an adjustment in structure and financing to enable key local actors to manage resources and perform necessary functions. Recognition by regional and national authorities is an important means of defining the purpose and authority of local actors. It is critical that regional actors are able to ensure stable financing and necessary supplies to enable key local actors such as fishing cooperatives, local surveillance committees, and CLB's to perform necessary functions and sustain their efforts. Of course, making local actors dependent upon exterior financing is risky and could pose problems in maintaining efforts. Therefore, the challenge lies in finding sustainable financing options (preferably at a local level) through structural support and agreements within communities. Enabling local actors through financing schemes and structural support is critical in order to allow for locally driven, continuous processes to uphold development efforts.

3. Provide resources to local communities that can have positive impacts on production, management, and output

Currently, local means of production, processing, and commercialization serve as major limitations to traditional fishing efforts in the area. Of course, one could argue that improving efficiency could increase production and thus exacerbate pressures on the resource. However, providing local communities with necessary sanitary and health infrastructure to improve the health of the population and fish products could stabilize their efforts and make the community less financially vulnerable. This could increase revenue and also free up time to hopefully be invested in other sources of income such as agriculture. In doing so, it is important to build upon systems and infrastructure already established within the community to improve market structure, efficiency, and commercialization options. Although the poor infrastructure is a clear barrier to development, I think that projects can take advantage of the lack of structure to help shape development in a way that supports the long-term viability of the fishing sector.

4. Accumulate resources at the local level

At the local level, the lack of a concrete financing system limits access to financial resources and support outside of the community. During closure, many fishermen are forced to violate regulations and exploit juvenile shrimp stocks, mangroves, and other marine resources due to a lack of income. In order to help resolve this issue, I think that it is important to change the mentality of fishermen towards money by stressing the value of saving and introducing ways to better manage income. Introducing a system of low-interest micro-financing to help fishermen during closure could help to reduce financial insecurity and thus lower pressures on littoral ecosystems by ensuring that fishing villages are able to financially sustain themselves during closure. Access to financing could also enable traditional fishermen to invest in improved processing methods and infrastructure to increase the quality of their products and possibly increase income. While financial aid plays a major role communal development, it is important that the financing systems are locally integrated and help to address the lack of communal investment.

Improving the price structure for fish products is another important means of accumulating capital at the local level. Fishermen should receive fair compensation for their work which can provide them with financial resources to invest in local institutions (such as CLB's and cooperatives) and improved fishing and processing techniques.

5. Streamline regional efforts to manage resources

I think that it is essential to concentrate resources and efforts by establishing a regional authority to coordinate and oversee projects for fisheries management (such as CREP or CRCP). However, I believe that it is less effective to have two regional bodies competing with each other than to keep the system as it is. This issue reveals the need to limit conflicts and competition between stakeholders and development initiatives by building a general consensus for regional development of the fishing sector. By streamlining efforts and

identifying a regional authority, projects can avoid institutional gridlock and the ‘internal politics’ associated with multi-layer authority.

I think it is equally important for regional coordinators to establish criteria for aid distribution to ensure capital investment at the local level. Regional development efforts should acknowledge different development strategies and provide guidelines for investment to ensure that all issues are addressed (commercialization, institutional development, environmental protection, communication improvements, fishing gear, etc.). I think that a time frame should also be designed for development projects in the area which identifies clear standards, expectations, and goals for projects. Stakeholders should evaluate financing strategies and perform a basic cost-benefit analysis to make sure that projects are in fact addressing the wide-range of needs facing the regions fishing sector. A system such as this could be used to establish expectations and hold development projects accountable for actions and expenditures.

6. Increase control over the commercialization of traditional fishing products

It is critical that the region consider price standardization or regulation to limit financial insecurity, stabilize the sector, and ensure fishermen are compensated fairly for their efforts. Including collectors in development initiatives and meetings is a good way to establish a more cooperative relationship and communicate issues associated with the market for fish products. One way to standardize the price structure for shrimp is to pay by size in order to create a disincentive for the capture of juveniles. The market can serve as an important mechanism to limit the capture of juveniles by reducing commercialization options and the demand for small shrimp. Improving market surveillance during closure could also help to reduce fishing violations and improve the ecological stability of the area.

I think that efforts should also be made to improve local market access through integration and the establishment of local commercialization networks. Theoretically, fishing

cooperatives could be given direct access to markets without having to use collectors and other forms of ‘middle-men’. Of course, this would require transportation and processing infrastructure that does not currently exist. However, it could improve efficiency and increase the role of fishing cooperatives in local production.

XV. CONCLUSION

As demonstrated by the issues facing fishermen in DIANA, the socio-cultural obstacles to development have an overwhelming influence on institutional capacities, social organization, development initiatives, and environmental impacts in developing nations. While efforts and projects sponsored PNB, NGO’s, local organizations, and regional authorities ultimately help to improve environmental conditions and protect marine resources, they are often designed to address the social aspects which drive resource exploitation and the role of people in resource management. The UNDP defined this phenomenon as the poverty of potential and capacity, despite relative abundance of natural resources. I have found this definition to be tragically true, in a region with some of the most unique and abundant environmental riches in the world.

The fishing industry demonstrates the importance of compliance through cooperation and private sector initiatives in helping to promote sustainable resource management and development. PNB has become an important advocate for traditional fishermen and an active participant in development efforts. Industries such as this can help to promote and facilitate sustainable development by preserving resources and serving as a long-term source of jobs and income for Malagasy people. PNB’s efforts demonstrate how engagement in development and a holistic approach to resource management can help to ensure the long-term viability of the industry, they also help to limit negative impacts that producers have on local economies,

social structures, traditional livelihoods, and resources and effectively contribute to sustainable development efforts.

Private sector initiative is clearly dependent upon a variety of variables, most importantly the recognition of corporate responsibility and the long-term stake in the resource. However, due to the lack of government support and clear expectations for industry involvement, there is a large degree of trust in private sector. Some may argue that protecting environmental conditions and collaborating with other users is a conflict of interest for the industry. After conducting this study, I firmly believe that the notion of corporate responsibility will continue to play a significant role in defining development and managing the pressures of globalization in a localized context. PNB's efforts to protect its own interest in shrimp stocks and act as an important investment in the social, economic, and environmental well-being of Madagascar's future.

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