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MARINE BIODIVERSITY AND FISHERIES IN MADAGASCAR

A BIODIVERSITY AND EXTRACTIVES POLITICAL ECONOMY
ASSESSMENT

September 2016

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ECONOMY ASSESSMENT

SEPTEMBER 2016

DISCLAIMER

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LIST OF ABBREVIATIONS

APGL	<i>Aire de Pêche Gérée Localement</i>
AMPA	<i>Agence Malgache de la Pêche et de l'Aquaculture</i>
COAP	<i>Code des Aires Protégées</i>
CIRPRH	<i>Circonscription de la Pêche et des Ressources Halieutiques</i>
CITES	Convention on International Trade of Endangered Species
CRGIZC	<i>Comité Régional de Gestion Intégrée des Zones Côtières</i>
CPR	Common Pool Resources
CSP	<i>Centre de Surveillance des Pêches</i>
DREF	<i>Direction Régionale des Eaux et Forêts</i>
DRRHP	<i>Direction Régionale des Ressources Halieutiques et la Pêche</i>
EU	European Union
FAMARI	CSO platform in Madagascar working on combatting wildlife trafficking
FIMIMANO	<i>Fikambanana Miaro sy Mampradoso an'i Nosy Ve Association</i>
GAPCM	<i>Groupement des Aquaculteurs et Pêcheurs de Crevette de Madagascar</i>
GELOSE	<i>Gestion Locale Sécurisée (Management Transfer Arrangements)</i>
IHSM	<i>Institut Halieutique et des Sciences Marines</i>
IUCN	International Union for the Conservation of Nature
IOT	Indian Ocean Trepang
LMMA	Locally Managed Marine Area

MIHARI	Madagascar Locally Managed Marine Area Network
MNP	Madagascar National Parks
MRHP	<i>Ministère des Ressources Halieutiques et la Pêche</i>
PACP	<i>Projet d'Appui aux Communautés des</i>
PCDDBA	<i>Plateforme de Concertation pour le Développement Durable de la Baie d'Antongil</i>
PIC	World Bank's Project for Information Coordination
SAGE	<i>Société d'Appui de la Gestion de l'Environnement</i>
SPSM	<i>Société de Pêche de Sainte Marie</i>
SWIOFISH2	Southwest Indian Ocean Fisheries Governance and Shared Growth Project II
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

GLOSSARY

Dina	Customary law subject to government approval and enforcement
Fokontany	Smallest administrative unit; village
Fokolonana	Strong cultural norms
Fokonolona	Traditional council of elder
SMARTFISH	European Union-supported marine resource management project

1.0 EXECUTIVE SUMMARY

1.1 OVERVIEW

Supporting conservation efforts of Madagascar's biodiversity is a high priority for USAID. Madagascar went through significant political and economic turmoil in recent decades, which resulted in a sudden stop of funding for development assistance from the United States and many other donors in 2009. As stability has returned, USAID has worked closely with the government of Madagascar, donor partners, and conservation groups, to identify areas where assistance is most needed from USAID. The protection of marine biodiversity has been identified both as an environmental priority, and equally as a food security priority. This island nation is threatened by overfishing and illegal, unreported, and unregulated (IUU) fishing. Accordingly, this report is based on a rapid field-level political economy assessment (PEA) conducted to support programmatic design in relation to USAID's biodiversity funding. It outlines findings and an analysis of effective approaches in support of areas where USAID can provide the most value.

In 2014 at the IUCN World Parks Congress, Madagascar's newly elected president pledged to triple Marine Protected Areas in the country, with explicit inclusion of a community-based management model for marine areas. Since 2004, important marine areas were already operating under these Locally Managed Marine Areas (LMMAs), and some of these were already associated with Marine Protected Areas though they were operating in relative isolation. In 2012, Madagascar's first national forum of LMMAs came together to form a network called MIHARI. The government welcomed this network given its limited financial resources to oversee large-scale marine conservation. Capitalizing on the Government's momentum on marine conservation, the USAID/Madagascar Mission began exploring ways to support the marine sector, a new programming area.

USAID/Madagascar's Program Office (PO) and Environment and Climate Change Office (ECCO) took the lead in identifying opportunities for USAID address needs in marine conservation. A multidisciplinary research team was deployed to two distinct geographical locations to collect information. Marine biodiversity in both locations is threatened despite the existence of Marine Protected Areas. In both areas the concept of *dina*, or customary law, used by communities to govern resources at the local level was highlighted as an important feature upon which to build stronger local resource management regimes.

1.1.1 OVERVIEW OF NORTHEAST MADAGASCAR

In Antongil Bay, in Northeast Madagascar, a Marine Protected Area project managed by Wildlife Conservation Society (WCS) has involved LMMAs in marine biodiversity conservation efforts since 2008. This area was the site of one of Madagascar's first Marine Protected Areas, formed in 1997 to protect the rich numbers of crustaceans, finfish, sharks, humpback whales as well as extensive coral reefs stretching up to 100 kilometers in length. In addition, it is the first region in the country to have a marine resources management plan. The vast majority of local fishers fish for subsistence, but some of the catch reaches local markets. While fishing is an important source of protein in the local diet, it is far from sufficient. Malnutrition is widespread. By all

accounts the fishery has collapsed, with multiple informants reporting far lower yields in recent years, when compared to historic levels. The involvement of LMMAs is more recent and coincides with increased Government conservation legislation in the area, including the creation of new marine reserves, parks and sanctuaries within the bay and its environs. In 2015, the Government established the bay as a shark sanctuary, defining exclusive local fishing rights and barring entry of international vessels to the bay. Enforcement of traditional zones against Malagasy commercial operators remains problematic. Although there has been progress delimiting boundaries and establishing local jurisdictions there is as yet no agreement on limits to access for commercial prawn fishers. Consequently, local fishers are in frequent conflict with commercial shrimp trawlers. Antongil Bay's management plan and steering committee however could provide a mechanism for addressing those disputes and proposing the conditions required for improved management.

1.1.2 OVERVIEW OF SOUTHWEST MADAGASCAR

Southwest Madagascar is a much larger geographical area than the Northeast research site and is not isolated. It is also the most important commercial fishing area in the country despite dwindling fish stocks. The Southwest has a longer history of LMMAs, with numerous donor interventions that have tried to address depleted fisheries, high levels of poverty, malnutrition, pressures from drought-affected inland populations, and wildlife trafficking. Many local and international non-governmental organizations (NGOs) are working with coastal communities in the Southwest under an array of different types of management regimes allowing the research teams to see how community resource governance and management effectiveness overlay with different levels of government commitment. In the Southwest, management regimes include: formal Marine Protected Areas, co-management arrangements (called Management Transfers), and community-managed reserves. Although all three involve communities, the first two options provide some government oversight and establish permanent or temporary reserves managed by communities with formalized plans with the involvement of NGOs including international organizations like WWF and WCS, and Reef Doctor, a national network known by the acronym SAGE, and a local organization known as Honko which means mangrove in Malagasy. There is also a regional civil society network on combatting wildlife trafficking. The network is part of a national civil society platform.

The NGOs in the Southwest coordinate their work informally through regular meetings with the Regional Directorate of Fisheries. These NGOs are primarily supported by private international foundations, European donors, and other international assistance agencies. They work closely with the Regional Directorate of Fisheries through support from the EU and the World Bank's PIC II Project (*Pôle-Intégré Coordination or PIC*). The Regional Directorate of Fisheries told the team that they are in the process of coordinating research findings and information from all the different projects of NGOs through PIC II to be housed at the Regional Directorate of Fisheries in Tuléar. This coordination is particularly important as a means of providing better information locally about the regional variation of livelihood opportunities and fisheries pressures. The Directorate acknowledges that because it is under-resourced, it works closely with and relies heavily on the work of NGOs and Institute of Fisheries and Marine Sciences (*Institut Halieutique et des Sciences Marines—IHSM*) to monitor changes in fisheries.

1.2 DISCUSSION

IHSM is one of the nation's premier research institutes; it has been working for over two decades on developing and scaling up alternative livelihood options for coastal communities. In addition to improving harvests of shrimp, crab, and octopus through annual closures of temporary reserves, the IHSM has encouraged private sector/parastatal investment in two common near-shore products with high export value, seaweed and sea cucumbers. These can be harvested for sale by fishers. The investment costs, which might otherwise be prohibitive, are typically covered by the NGOs or the company. Copefrito, the largest marine product company in the Southwest has been active in the area for 20 years. It sources 70 to 75 percent of its marine products from the Southwest. Copefrito and Murex both work in the area and have storehouses or resident agents in some villages. Both companies work closely with NGOs and LMMA associations.

The seaweed, which fetches a modest supplementary income, is fared mostly by women, harvested every 45 days and sold to company agents. Sea cucumber (*trepang in French*) farming requires a larger up-front investment in materials to construct netted pens to hold in the tiny juveniles. They also have to purchase the juveniles, which are bred by the Indian Ocean Trepang (IOT) company based in Tuléar. These juveniles are placed in pens in the near-shore waters for 9 months, until they are mature. A pen will hold thousands of sea cucumbers. The farmers can sell sea cucumbers for export at US\$2.50 a piece, contrasted with daily incomes from fishing, which averages around US\$1.50. Unfortunately, not all communities are suitably located for these livelihood options. Currents and nutrient flows in the water dictate the quality of the seaweed, and the relative protection of the sea cucumbers. However, the largest challenge for sea cucumbers is guarding against theft. Communities that produce sea cucumbers have reported that the entire stock had been stolen by armed bandits. Crime has caused many smaller companies that had been working with IOT to pull out of these vulnerable communities. As a result, active sea cucumber farming was not apparent in any of the communities the research teams visited. Asian demand for sea cucumbers is high and many communities in the Southwest reported being offered substantial sums to assist Asian vessels to hunt for wild sea cucumber which is illegal, unreported, and unregulated. Other illicit products such as turtle shells are also sought by these unspecified Asian vessels. Seaweed has a low-value but an almost limitless demand exists for industrial uses as carrageenan.

None of these options exist in the Northeast. Temporary marine reserve closures, however, have improved size and number of octopus found in both the Northeast and Southwest. The closures are enforced nationwide at least once a year and often twice a year by LMMAs. These earlier restoration efforts played an important role in convincing fishers to join together to manage the fisheries with *dina*, or customary law, through LMMAs. The Northeast's 25 LMMAs are part of the nationwide network of LMMAs called MIHARI and play an important role in the network. The network is supporting fisher communities committed to protection of their marine resources. Community associations have vastly different levels of organizational capacity, something that MIHARI is trying to address. The effective use of *dina* to establish and enforce local management varied across communities as well. Closer study of the communities around Antongil Bay revealed important insights into the nature of *dina*. For example, if *dina* is imposed upon a community, it is not likely to be enforceable. *Dina* emerges from the horizontal accountability of customary institutions and from community recognition of a need for regulation. Yet, *dina* is not always enforceable on outsiders and the majority of conflicts over resources that occur in both North and South are related to outsiders with commercial vessels. The power

imbalances make conflicts difficult to resolve. In the South, fishers reported boats with armed gangs on board could fish with impunity and LMMAs had little recourse. Criminality in the Southwest puts livelihoods at risk. Likewise, in the Northeast, commercial vessels destroy fishing equipment routinely with impunity threatening livelihoods. The inability to resolve these asymmetrical conflicts has implications for food security and nutritional health as well as livelihoods.

1.3 KEY FINDINGS

This PEA provided important first-hand qualitative evidence about the state of fisheries resources and insights into effective management regimes, including the use of *dina*. The PEA also offers a better understanding of research needs for exploring how to strengthen and measure the effectiveness of local marine management in Madagascar. The team found widespread recognition by government institutions and conservation organizations that fisher communities themselves have a critical role to play in marine management. Further, the emergence of MIHARI created huge potential for fundamentally reorienting and strengthening the marine sector in Madagascar.

Our analysis found that any programming in the marine sector must not only consider how to strengthen the LMMA network, but must also seek to address the external systems within which the LMMAs operate. Because many other donors and partners are working to strengthen these broader systems, however, USAID should strategically focus on developing ways to monitor and support the internal dynamics and principles that make LMMAs effective. An important dimension of these internal dynamics for USAID to develop through programming is how *dina* can be used to support LMMAs.

Our field research also highlighted the importance of food security and nutrition, mainly through small-scale fisheries, in coastal areas with few if any livelihood alternatives. In Madagascar over 50% of children under five years of age are suffering from malnutrition, and over 65% of the population is affected by persistent food insecurity.¹ The decline of Madagascar's fisheries resources, as evidenced by the leveling off of total catches, declining commercial landings and declining small-scale fisheries catch rates is an important factor in food insecurity.

The Northeast team met with researchers studying micronutrient deficiencies in Antongil Bay. Recent analyses by Harvard's T.H. Chan School of Public Health and the University of British Columbia-based organization Sea Around Us find that "deficiencies in the micronutrients fish provide including vitamin B12, iron, and zinc, can affect maternal mortality, child mortality, cognitive defects, and immune function. Some 45 percent of mortality in children under five years old is attributable to undernutrition."² In Antongil Bay, studies indicate a 30 percent

¹ Frédéric Le Manach, Charlotte Gough, Alasdair Harris, Frances Humber, Sarah Harper & Dirk Zeller (2012) Unreported fishing, hungry people and political turmoil: the recipe for a food security crisis in Madagascar? *Marine Policy* Volume 36, Issue 1, Pages 218–225

² Powell, A. "Fishing Gaps Called Malnutrition Threat: After peak in global catch, analysis points to health as a growing concern," *Harvard Gazette: Science & Health: Environment & Sustainability*, 15 June 2016. <http://news.harvard.edu/gazette/story/2016/06/fewer-fish-give-rise-to-nutrition-worries/> [Accessed: 2 July 2016]

stunting rate among children also correlated with this undernutrition. Researchers who have worked in Madagascar conclude that better management of fisheries through control of unsustainable fishing practices and commercial fishing fleets could be beneficial not only for the marine environment but also for food security and nutrition.

Although USAID may not, in the near term, be able to directly address the degree to which fisheries decline is affecting food security at the national level, by strengthening the protection and management capacity of sustainable small-scale fisheries, it can help to address the triple threat to marine biodiversity, food security and nutrition problems locally. Essential to addressing food security is enhancing protection of local reserves from commercial fishers, establishing clear guidelines for commercial fishers entering coastal waters, and providing increased monitoring and enforcement of these and all fishing activities within the coastal management zones wherever feasible. Building mechanisms within Locally Managed Marine Areas (LMMAs) to manage resources within communities is important for resolving internal conflicts. Resolving disputes among competing stakeholders, however, (e.g., between commercial and local fishers in the Southwest and between commercial, artisanal and traditional fishers³ in Antongil Bay) particularly where power asymmetry is present will require building the resources and the political clout of regional fisheries directorates to intervene. Further analytical work is needed to determine how to build on existing working relationships between regional fisheries directorates, the private sector, marine science institutes conducting research, and conservation groups engaged in field level implementation. Programming may include addressing the need for legally binding boundaries protecting the coastal fisheries of Locally Managed Marine Areas (LMMAs) and strengthening the ability of LMMAs to enforce community level management rules on outsiders, as well as supporting conflict resolution mechanisms. USAID's should consider building conflict resolution mechanisms and work with donor partners and government to strengthen enforcement of zoning to minimize future conflicts and build enforcement capacity to regulate foreign and domestic fleets that threaten food security.

Criminality from outside a community might also be addressed by uniting private sector actors in the aquaculture sector, with the Tuléar based Institute for Marine Sciences and the Directorate of Fisheries, to consider how to improve security around high value aquaculture products. Copefrito and Murex are both eager to collaborate with communities through NGOs and with MIHARI. These companies recognize the importance of the local level management and of the power of locally defined *dinas*. Donors, MIHARI, and NGOS working with LMMAs may be able to play a supportive role in addressing criminality.

1.4 RECOMMENDATIONS

1. **Support Uptake of Research** – Recognizing that there are a number of donors engaged in research coordination, USAID should focus on supporting MIHARI and others to integrate research finding into better LMMA management

³ Artisanal fishers are defined as having boats (either dugout or fiberglass) with motors of 25-horse power or above. This classification exists in the Northeast with a total of 8 licenses but only 4 or 5 active boats and only 2 fiberglass boats. We did not find any “artisanal” fishers in the Southwest, only traditional fishers with dugouts and sails.

2. **Build LMMA Effectiveness through MIHARI** – Improving marine management will require strengthening not only the existing internal functioning of LMMAs, but also the institutions that support them. USAID should support the coordination efforts of MIHARI, strengthen MIHARI's ability to provide technical training and analysis, and identify incentives mobilizing LMMA effectiveness.
3. **Strengthen Community Based Management Efforts** – USAID should focus efforts on local learning and evidence based conservation approaches associated with *dina*. This would enable the program to coordinate closely with the government, donors and partners to identify gaps and focus on ways that *dina* can be supported and strengthened.
4. **Explore Alternative Livelihoods** –Viable alternatives are needed to deal with declining fisheries and food insecurity as well as poverty and climate change. Developing scalable alternatives is so important that any new biodiversity project should consider incorporating partners with this expertise.
5. **Increase Market Transparency** – Engagement with private sector, NGOs, and key stakeholders would work to improve transparency around aquaculture and fisheries livelihood activities.
6. **Build Conflict Resolution** – Bolster existing structures that effectively and credibly resolve conflicts at the local and regional levels, where they exist. Building capacity for effectively and credibly resolving conflict beyond local level disputes means building enforcement capacity of regional fisheries directorates with increased resources, access to information, and the political clout to pursue offenders.
7. **Explore New Forms of Commercial Licensing** – Support improved transparency in fishing vessel licensing so that information is accessible at the district level. USAID, working with other donors, may consider new approaches for commercial licenses to plan more strategically around food security and long-term support of policies that allow fishers some form of exclusive rights to pelagic waters. This work would be coordinated through LMMAs and in partnership with the Ministry of Fisheries, district and local government and MIHARI to shift away from the reef and toward west coast pelagic waters (*Pêche au large*) in the Southwest while focusing on clear enforceable boundaries for LMMAs in the Northeast.
8. **Increase Monitoring and Enforcement of IUU fishing** – USAID may need further study and collaboration with government and partners of how to best address this issue, but it is the key to ensuring sustainable marine biodiversity resources as well as food security with long-term impacts on human and ecosystem health.

2.0 RESEARCH DESIGN

2.1 OVERVIEW

Madagascar is a high-priority country for marine conservation. The severity of threats facing its resources, including weak governance, corruption, illegal and unregulated extraction, climate change, and poverty, create the need to think beyond traditional conservation approaches. With Madagascar's commitment to tripling marine protected areas in the country, explicitly including locally managed marine areas, USAID/Madagascar wanted to investigate in greater detail how to best support marine biodiversity conservation and local fishing communities by undertaking a political economy analysis of the sector. The Mission selected two very different marine conservation environments with contrasting local management regimes to examine: the Northeast around Antongil Bay and the Southwest around Tuléar. Both teams met with national level actors and/or donors before moving to the field.

Because the marine sector is a new programming area for USAID/Madagascar, a Political Economy Assessment (PEA) was viewed as a useful way to gather important detailed information that could lead to more informed programming around key constraints to marine biodiversity conservation, key openings for effective engagement with government, and a greater understanding of how the high level issues play out for local fisher communities in different parts of coastal Madagascar.

2.2 RESEARCH QUESTIONS

The research was designed to gain detailed information about the political-economic context for marine management options to identify openings for programming biodiversity support. The emergence of locally managed marine areas (LMMAs) in Madagascar in recent years and the network of LMMAs called MIHARI has huge potential for fundamentally reorienting and strengthening the marine sector in Madagascar. However, in order to build more effective programming, more information was needed to contextualize the natural resources governance environment within which the LMMAs operate, and on how well communities are currently able to manage their LMMAs.

- What are the incentives and disincentives and external drivers surrounding community-managed marine resources generally and specifically LMMA associations?
- Why are some LMMAs functioning well while others are not?

2.2.1 SUBQUESTIONS

In order to get a deeper understanding of how these dynamics and principles are working in existing community managed reserves, we applied a modified set of Dr. Elinor Ostrom's (1990:90) eight common pool resource (CPR) design principles. We used these as sub-questions for the PEA:

1. Are the boundaries of the resource clearly defined? How is membership in the group defined? What rights do members have? What responsibilities do members have?

For an LMMA to function the boundaries need to be clearly defined. This allows for individuals to know who has a right to participate and where and what are the physical limits to the resource to be governed.

2. How are limits set on fishing (time, place, fishing modality, quantity, etc...)?

Communities must set the limits on how the resource is extracted (what nets and techniques are allowed) and where and when extraction is allowed. When possible, the quantity of extraction might also be limited. Establishing rules on the time and place that fishing is allowed, how fish are caught, and quantity of fish taken are all rules that allow the resource to be managed in a way that can protect fish stocks, creating a means to match extraction to local needs and conditions of the resource.

3. How are rules made? How are rules changed? How often are they changed? Who can change them?

Procedures for rules matter but so does the enfranchisement of those using the resources to make the rules that govern it. Are most of those fishing in the community members? Can members of the LMMA take part in making, changing, or amending the rules that govern the LMMA? This matters because participation and inclusion are key pieces to giving legitimacy to the rules and are likely to lead to their success.

4. Who monitors compliance with the rules? Are monitors primarily accountable to the LMMA?

Since the rules are developed by the LMMA it is important to have a subset of members taking part in monitoring compliance and that these monitors are accountable to the LMMA and its members.

5. What happens when members break the rules? Are sanctions graduated based on the severity of the offense?

Penalties for rule breaking need to be severe enough for deterrence, but should also be graduated depending on degree of the offense. Since LMMAs are also nested within the boundaries of fisheries management plans, as well as *fokontany* and local communal boundaries, these levels of government and personnel can be called on as well to help enforce and provide sanctions depending on the severity of the offense.

6. How are conflicts resolved?

Having a means to manage and decide disputes is important. A means to handle disputes needs to exist internally to the LMMA as well as external to it such as a means to resolve conflicts with commercial fishers and allow for the redress of the destruction of equipment.

7. Are the rights of the LMMA to set their own rules respected by government officials and outsiders or are they challenged?

Throughout the world we frequently see common property rights undermined by local, regional and national officials. Common property regimes are frequently been seen as a challenge to central government, or simply viewed as backwards. At the same time, governments frequently do not have the capacity to establish the rules governing appropriation and means of harvesting, as well as to monitor the resource, enforce laws, and resolve conflict. LMMAs are much more likely to function well if they are understood, respected, legitimated, and supported by government officials.

8. Are other forms of government nested above the LMMA providing support in terms of provisioning, monitoring, enforcement, and conflict resolution?

LMMAs do not exist in a vacuum, but are a form of micro-governance⁴ to ensure horizontal accountability⁵ amongst the members. It is vital that other layers of government support the functioning of the LMMA and provide a means to ensure its legitimacy as well as resolve disputes particularly with outside entities.

2.3 METHODOLOGY

The methods used for the research are detailed in the USAID Framework for Applied Political Economy Analysis.⁶ The team scoped and honed the PEA research question prior to the start of field research activities. To prepare for the field research, the international PEA team members reviewed background documents and then worked in-country with the two USAID/Madagascar team members and two Malagasy research assistants to develop questions that could be used in key informant interviews to collect qualitative data using unstructured and semi-structured interviews with small groups and individuals with expertise on the topics. Because research was carried out in two different part of the country, the team was divided into two sub-teams.

Coding frameworks were employed to facilitate information exchange and synthesis of findings across groups. Sub-teams used a simple coding framework after every interview to categorize key findings that fall into one of four categories: Foundational Factors, Rules of the Game, Here and Now, and Dynamics. This helped with the daily synthesis of the findings.

⁴ Microgovernance refers to the creation of institutions in a community that can enable collective action to address problems being faced. The concept views governance as substantially different from government in the sense that it is outside the formal government institutions but can be applied in this case to govern resources more effectively than, or in the absence of, government.

⁵ Horizontal accountability refers to the ways in which members of an association can be held accountable to each other and hence follow rules that they set as a group. This is particularly important in locally managed resource management and proves to be more effective than vertical accountability, when rules are imposed and sanctioned from above, by those in authority.

⁶ Brown, A. "What is This Thing Called 'Theory of Change'?", USAID's Learning Lab, 18 March 2016. <https://usaidlearninglab.org/library/applied-political-economy-analysis-field-guide> [Accessed: 24 August 2016]

The Southwest team also used field-notes. Information from field notes was entered daily into a summary template of field-based notes that identified the stakeholder and bullet-pointed findings from each interview for easy reference (attached in annex).

2.4 TEAM COMPOSITION

One of the team members was a trainer for USAID's PEA Framework and four additional team members were trained on the Framework. Two of the team members are Foreign Service Nationals with USAID/Madagascar based in Antananarivo; they will build local USAID PEA capacity. The sub-teams were evenly divided in terms of multidisciplinary backgrounds and PEA experience.

Although the team initially intended to include representatives from the Fisheries and Environment Ministries of the Government of Madagascar, this was not possible to achieve due to the fact that the fieldwork coincided with a period of government restructuring.⁷

2.5 FIELD SITES AND TIMING

The fieldwork occurred from May 9 to 20, 2016. Two sites with very different characteristics were identified by the mission to enable a study of the range of coastal management options in operation at the present time in Madagascar. Before heading out to the field sites, teams met with donors, private sector, and NGOs in Antananarivo.

The **Southwest team** confronted an array of different management regimes in that region where a variety of local and international conservation partners are actively engaged with communities. The **Southwest team** met with these communities and with conservation partners. The Southwest team learned about the degree to which these partners coordinate efforts and share information among one another and with donors and local government. They noted an abundance of potential resources for strengthening marine conservation efforts, such as the Tuléar-based Fish and Marine Sciences Institute (IHSM) and as many as five private sector actors involved in aquaculture. They also identified some key stakeholders such as the civil society platform on combatting wildlife trafficking, FAMARI, and the national coordinator for the network of locally managed marine areas (LMMAs) mentioned above, MIHARI, both champions of biodiversity conservation. At the community level, the team noted constraints such as drought and climate change as well as high levels of criminality, a lack of access to information and markets, and resource depletion among the key factors affecting the lives of fishing communities.

The **Northeast team** had the opportunity to focus more intensively on the management structures of the LMMAs supporting fisheries management in Antongil Bay. The team interviewed stakeholders around sites where Wildlife Conservation Society (WCS) has been working with the Government and local communities to protect important terrestrial and marine biodiversity under a set of protected areas, parks and reserves. Antongil Bay, in northeastern

⁷ The change of government resulted in a shift of the Ocean portfolio from the Environment Ministry to a *Secretariat d'Etat* in charge of the Ocean under the Ministry of Aquatic Resources and Fishing.

Madagascar is a biologically significant marine biodiversity area and forms a key part of a larger landscape/seascape that includes threatened moist tropical lowland rainforests in Masoala National Park and critically endangered coastal forests in Makira Protected Area possessing some of the country's most important terrestrial biodiversity. WCS manages the Masoala National Park, declared in 1989 to protect 1,583 square miles of critical coastal watershed for the Antongil Bay.⁸ Since 2008 WCS has supported marine conservation efforts in 24 of Antongil Bay's 104 communities. In 2010, the entire bay and its outer reaches were put under temporary full protection by an interministerial decree (no.52005/2010) and since that time Antongil Bay's management plan explicitly works with 25 LMMAs around the bay and includes marine protected areas or no-take zones as well as exclusive community fishing use and management rights. The 1,438 square mile Makira Park, was declared in May 2015 by the Government of Madagascar for its astounding levels of biodiversity and lemur populations.⁹ Together the Bay and the two terrestrial parks are now referred to as MaMaBay.¹⁰ In 2015, the Government of Madagascar established the country's first marine sanctuary for sharks in Antongil Bay as part of an effort to safeguard marine resources and the communities who rely on them. The new law also restricts international fishing boats from entering Antongil Bay, a 1,446 square mile body of water.¹¹ In the absence of agreement on limits to access for commercial prawn fishers, local fishers are in frequent conflict with commercial trawlers. Despite existing legal guidelines, enforcement is weak and current power asymmetries between traditional and commercial fishers in Antongil Bay do not favor local community managers.

The Northeast team traveled to Maroantsetra by air. The area is only reachable by air or sea as the only road, Route 5, is little more than a forest track and is frequently impassable. The communities are largely isolated, with little access to markets. The team learned about the conflicts over depleted resources among commercial shrimp trawlers, artisanal fishers and local fishers; they identified constraints on livelihood alternatives to fishing, and they evaluated some of the key principles behind what enables local marine management associations to function well.

⁸ Rübel, A. Hatchwell, M., MacKinnon, J., and P. Ketterer (2003) *Masoala: Eye of the Forest: A New Strategy for Rainforest Conservation in Madagascar*, Zoo Zurich. <http://www.nhbs.com/title/131845/masoala-the-eye-of-the-forest?bkfno=143243> [accessed 13 September 2016]

⁹ Wildlife Conservation Society, News Release, "Government of Madagascar Inaugurates Makira Natural Park," WCS, 29 May 2015 <https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/6770/Government-of-Madagascar-Inaugurates-Makira-Natural-Park.aspx> [accessed September 13, 2016]

¹⁰ Wildlife Conservation Society, News Release, "MaMaBay environmental campus will help implement conservation programs in the epicenter of Madagascar's biodiversity," WCS, 11 December 2013. <https://newsroom.wcs.org/News-Releases/articleType/ArticleView/articleId/5256/Madagascars-Masoala-National-Park-Interpretive-Center-Inaugurated.aspx> [Accessed September 13, 2016]

¹¹ Wildlife Conservation Society News Release "Government of Madagascar Creates Country's First Shark Sanctuary," WCS, 4 February 2015. See <https://press.wcs.org/News-Releases/articleType/ArticleView/articleId/6563/Government-of-Madagascar-Creates-Countrys-First-Shark-Sanctuary.aspx> [accessed 13 September 2016]

3.0 COUNTRY BACKGROUND

This section lays out foundational factors for understanding the institutions and dynamics shaping marine policy in Madagascar.

With an area of less than half a percent of the earth's landmass, Madagascar is known as a mega-diversity country, with high levels of terrestrial and marine endemism. Madagascar's biodiversity has come under intense threat due to overexploitation, illicit trafficking, and rent-seeking behavior of the elite political class, particularly with regard to natural resource exploitation. Recent analyses point to a systemic lack of political accountability as a driver of these behaviors.

3.1 POLITICAL INSTABILITY

Madagascar has struggled with chronic levels of political instability and dysfunction since the 1960s. The recent five-year long political crisis (2009-2013) has had devastating economic, social, and humanitarian impacts on a country that is already one of the poorest in the world. Despite its abundance of natural resource wealth, some 92% of households live in poverty, the highest rate in Africa (World Bank, 2011). The election of President Hery Rajaonarimampianina in 2014 has afforded some political and economic stability, but the economy remains fragile and is highly dependent on official aid.

3.2 CHANGING CLIMATE

Since 2013, one of the most prolonged and deepening droughts ever observed has gripped southern Madagascar, where over one million people cannot get enough food to eat. Due in part to an exceptionally strong El Niño event, the coming year is expected to be the driest in 35 years. International relief workers are already pre-positioning food aid; 80 percent of rain-fed crops in the south are expected to fail this year. The southern part of Madagascar is already the poorest part of the country, with 90 percent of the population earning less than \$2 per day. Informants told the research team that people are eating clay and rice husks to fill their stomachs. Farmers in search of food and livelihood are migrating from the dry interior to the coasts to take up fishing and frequently engaging in unsustainable fishing practices.

By contrast the Northeast is not suffering from drought, and is one of the wettest places in the country with an average of 3-4 meters of rain per year. The region has recorded up to 7 meters in a single calendar year. The Antongil Bay is situated in this moist tropical rainforest zone where agriculture is supported along with fisheries; although fishing still plays an important role in local diets, average catch has declined in recent years without a real alternative source of protein for many of the region's population. Health researchers are recording a level of thirty percent stunting among children as a result of declining nutrition levels, particularly of micronutrients. These researchers, associated with Harvard, are measuring and recording everything the family members are eating in an effort to get better details on the micronutrients in the diet and their effects. Communities living around Antongil Bay have little access to markets with no functioning roads. They also have high levels of conflict with commercial

trawlers, which fish in near-shore waters, competing with local fishers and destroying their fishing equipment in the process.

3.3 FISHERIES DECLINE

Of concern for this PEA are the decreasing fisheries stocks in coastal Madagascar where poverty rates are high and implications for fisher communities are severe. Fish is a major source of food security that has rapidly declined in recent years. IUU fishing, including by commercial and artisanal longlines, illegal use of fish aggregating devices (FADs), trawlers, and inappropriate nets, have depleted fishing stocks. Increased sedimentation and climate change effects have a role in the changing fisheries as well. Program responses must grapple with a number of difficult issues that span the political and economic terrain. They will also need to support the existing momentum of ongoing marine biodiversity conservation work in Madagascar.

3.4 FISHERIES RESTORATION EFFORTS

Recent studies of community-based marine management efforts indicate that fisheries can be restored through improved management. The removal of fishing pressure has been shown to increase average size, diversity, abundance and biomass of invertebrates and fish within protected areas. There is also evidence that these benefits may have positive consequences for fisheries outside protected areas. In particular, a combination of new management approaches to simultaneously allow restoration of fisheries and the development of alternative incomes for fisher communities is shown to be effective and, therefore, of critical importance for sustainable development in coastal Madagascar. Specifically, from 2004-2010, octopus closures are said to have improved fisher incomes by 461% in median recorded catches per closure, resulting in an enhancement of catch per unit of effort (CPUE) of up to 120% following the resumption of fishing.¹²

Introduction of temporary octopus reserves in Southwestern Madagascar, since 2004, have demonstrated the effectiveness of annual closures of even 3 months duration. The temporary “reserves,” with locations determined by the local communities, has increased both the size and number of octopus harvests following the closures. These measures have been adopted by the national government and have improved incomes along the west coast of Madagascar. This PEA verified that these closures are widespread and well understood by fisher communities in the Southwest. Recent changes in the administration of oceans and fisheries management appear to favor a strengthened relationship between research institutes, conservation NGOs, practitioners in the field, and local fisher communities. USAID and other donors will want to build on these kinds of concrete steps towards greater involvement of communities in the management of their resources with the support of the government.

¹² LeManch, F. (2015) op cit.

4.0 MARINE MANAGEMENT IN MADAGASCAR

4.1 MARINE MANAGEMENT REGIMES

Three forms of management of marine resources are found in Madagascar:

- Marine Protected Areas (*Aire Marine Protégée* or AMP)
- Management Transfers (*Gestion Locale Sécurisée* or GELOSE)
- Community-Managed Marine Areas (*Aire de Pêche Gérée Localement* or APGL)

Marine Protected Areas (MPAs) can consist of temporary or permanent closures. For the purposes of this study, MPAs will typically consist of a “no-take” area(s)¹³ with some type of buffer or other nearby zones within which extractive and non-extractive uses are regulated. Management Transfers closely reflect this same level of regulation, which is established by the management committee or community association through short-term leases from the government; an initial 3-year contract which can be renewed. After renewing twice, the community can apply for a 10-year contract. Community-Managed Marine Areas can take many forms. In general, more discretion is left to communities when they are managing outside of the MPA or Management Transfer arrangements.

4.2 LEGAL FRAMEWORK

Following the president’s first pledge to triple protected areas at the World Parks Congress in Durban in 2003, at the time a new decree (*Décret d’Application* No 848-05) for the existing protected area policy (COAP) was issued. The COAP is now a law. The last approved version of the law 2015-005, dates to February 26, 2015. (See USAID/Madagascar’s 2014 Environmental Threats and Opportunities Assessment for a complete list of regulations and legislation relating to environmental policy). The law set up a System of Protected Areas of Madagascar, or SAPM, which simplified and redefined the legal process used in protected area creation. Under this more flexible model, organizations other than Madagascar National Parks, the state protected areas agency, are allowed to manage protected areas. This includes NGOs, community organizations, and the private sector. This policy change enabled international and local conservation NGOs to engage directly with communities to support them in managing their resources. At the World Parks Congress, in Sydney Australia in November 2014, the pledge was made by the government of Madagascar to expand marine protected areas with the involvement of communities. This set the stage for innovation in Locally Managed Marine Areas

¹³ For MPAs, the no-take zone is the core zone or conservation zone. Sustainable use of resources is allowed/regulated within the buffer zone and peripheral zone.

(LMMAs). Already actively lobbying on behalf of traditional fishers at the Congress, MIHARI pushed to allow LMMA representatives discuss the challenges they face in local management and identify opportunities for improved government support.

4.3 LEGAL PLURALISM

Government support for LMMAs is an important part of the legal pluralism that defines functioning common property resource management regimes. Legal pluralism and the policies that support it are concerned primarily with regulation and a focus on the institutions, like *dina*, for governance. Legal pluralism also provides a framework for people to deal with more than one system of rules at a time, and the relationship between these rules can explain people's behavior. For example, how rules are established might influence people's compliance. We found that a rule that the government imposed on communities regarding the use of certain fishing nets was less effective than a rule that communities established themselves. The challenge for *dina* in the case of resource management is to what extent broader policies can balance the interests of the state against society, in ways that can allow flexible and adaptive management under *dina* for diverse and changing contexts. For resource management, the context and local power relations may influence which laws take precedence and to what extent *dina* is enforced.

Dina can operate in both formal and informal ways. Madagascar's GELOSE (Management Transfer) contracts with communities require both a formal legal component—communities must be legally declared—and a common law component—referring to ordinary agreements that regulate rights and responsibilities in society and the use of *dina* in the event of disputes and enforcement.¹⁴ Within the legal framework of the state, legal pluralism falls along a spectrum from a hierarchical, nested scheme that aims to give each group legitimacy and scope to act, to policies that allow institutions of different groups to coexist.¹⁵ Federations of organizations, like MIHARI and its members, may fall somewhere in the middle of this spectrum. *Dina*, like most customary law, is more flexible and adaptive than formal government regulations.

National policies are not able to address the wide range of diverse management contexts in Madagascar. Government policies can quickly become outdated and are hard to change, whereas *dinas'* local level rules can be enforced immediately at the local level or changed upon agreement of the community. To be enforceable beyond the community-level, and to have the legitimacy of the state, *dina* must be approved by the *fokontany* (village), the *kaomina* (commune), the *fivondronana* (the district) the *faritra* (the regional government) to ensure consistency with national legislation; it is then enforceable by law. That process takes time, but has advantages in strengthening local rule setting and enforcement, which is particularly critical in managing natural resources. Despite what some may see as government efforts to codify customary law, *dina* remains a robust and flexible customary institution forming a basis for horizontal accountability at the village level. We found some cases where *dinabe* (big *dina*) was applied on a wider basis, and was invoked in an effort to control rampant cattle theft in the entire district of Tuléar. Local government officials talked about it as a practical and socially acceptable

¹⁴ Wollenberg, E. et al (2012) *Though All Things Differ: Pluralism as a Basis for Cooperation in Forests*. CIFOR (Center for International Forest Research). P. 36-8

¹⁵ *ibid.* p. 37

way to enforce rules. It will be important to probe this further to understand how government is perceiving constraints to law enforcement. *Dlnabe* is also considered a powerful means of enforcement in the Northeast where sanctions for violation were very high. The understanding and use of *dina* nationwide may vary, but its validity is remarkably accepted.

4.4 COMMUNITY MANAGED MARINE AREAS

Even before the President's 2014 commitment to expand marine protection, community management of marine resources was already underway. The law gave communities a formal role in marine management, making community-managed marine areas part of the commune development plans that are overseen by the *Direction de Pêche* at the District Level. NGOs have been involved in almost every effective community managed marine area since as early as 1997. NGO involvement in Madagascar over the past decades has led to a deeper look at local needs and the approaches that might help communities alleviate poverty while restoring marine resources. Different NGOs have established long-term commitments to particular geographic areas and communities where marine resources are in critical need of protection. The Locally Managed Marine Area (LMMA) terminology was borrowed from marine management regimes that evolved in the Indo-Pacific where peer-to-peer exchanges have strengthened understanding of the conditions under which these LMMAs can improve marine resource stocks and livelihoods.

4.5 DESIGN PRINCIPLES FOR COMMONS

The research team identified a need to design a way to evaluate the existing LMMAs to determine what might help to strengthen their management. Marine researchers have been working with communities managing LMMAs across the South Pacific, and have accumulated a sizeable body of evidence, discussed briefly below. However, for the purposes of this PEA research, we applied a preliminary analysis of the principles defining robust governance of common-pool resources, including well-defined resource boundaries, and collective-choice arrangements based on Ostrom (1990) laid out above. We found this to be a useful way to give a rapid measure of the effectiveness of the community management regimes of marine resources that we encountered. We also found these questions to be more appropriate than many marine protected area assessments. Those assessments tend to favor a Western conservation model, making conservation the primary goal and relying on organized law enforcement for monitoring and sanctions. This is in contrast to the LMMAs where community empowerment and self-management of the resource is the primary goal and conservation is a desired outcome of that approach. Though the difference might seem subtle, it matters a great deal and influences how one evaluates and supports the success of LMMAs.

5.0 FINDINGS: ANSWERING THE PEA QUESTIONS

What are the incentives and disincentives and external drivers supporting community-managed marine resources generally, and specifically locally managed marine areas associations? Why are some locally managed marine areas (LMMAs) functioning well while others are not?

The team observed that certain management arrangements appear to provide a more effective framework for communities to manage and protect marine resources. Well-understood boundaries, clearly defined membership, and readily perceived benefits, particularly economic benefits, draw communities together to support community-managed resources. Cultural and family ties are also strong incentives for cooperation. External drivers supporting community-managed marine reserves include the role of the private sector and/or NGOs who can provide or leverage economic benefits, but also the existence of the commercial port of Tuléar (Toliara) supports trade in the region. The road system in the Southwest is also supportive, allowing some communities access to markets, particularly Saint Augustine and Saroadrano, but even where the road is not paved further north and south of Tuléar, there is bush taxi access. While not necessarily frequent or speedy, bush taxis provide some market access, allowing private sector middlemen to reach these areas.

Recognition from government is also an important external driver, but not the only determinant. IHSM provides technical expertise throughout the region that benefits communities and the private sector. Where there is recognition, in the form of some level of formal management arrangement including a detailed management plan for the marine area, either as part of a Management Transfer Arrangement, in the case of Honko's community association, or as part of a Marine Protected Area, as in the case of Soariake, active involvement in LMMA associations is more robust. However, WWF's work in the Southwest with coastal communities was also clearly well managed and supported by the Mayor and local government.

Different management contexts may require different approaches, but some key aspects or principles held true. Community managed reserves rely on clear management rules. Recognition in both formal (legal) and informal management arrangements has been negotiated by NGOs and strong community leaders. The legal recognition seemed more important for protecting the community from outsiders than for strengthening the internal functioning of the LMMA. For example, the formal recognition of the Management Transfer at Honko was important, but their contract was lapsed due to bureaucratic lethargy. They have been managing the reserve for eight years and have only had a legal contract for 3 of those years. Nonetheless they maintained their commitment and waited for the next contract to be renewed; it had been two years since they requested the renewal but the government official died and the replacement has not gotten around to it. They have little interaction with the government. Madagascar National Parks has made clear that there is no way forward that doesn't involve working through LMMAs and local communities. The MPA at Soariake is managed by WCS, and here the boundaries are clearly defined in a detailed management plan; formalized rights and responsibilities are clear to all, rules are known and enforced, and community associations have committees to manage different aspects of the LMMA. Yet, fishers can continue to engage in their individual fishing activities, allowing each to benefit according to their efforts, which is

culturally for the *Vezo* (as the fishers of western Madagascar are known) communities is important. The NGO engagement has been the key to successful management of these marine protected areas.

We felt that the following sub-questions answer both PEA Research Questions.

Sub-question 1: Are the boundaries of the resource clearly defined? How is membership defined? What rights and responsibilities do members have?

Clearly defined boundaries and clearly defined access are two key principles that this study found correlate with sound management. One of the clear findings that emerged from the field research in the Southwest was that management of the marine resources is stronger where some formalized rights and responsibilities have been given to the communities. Where communities are co-managing MPAs or Management Transfers with clearly defined rules and geographical boundaries, it seemed that the communities were better organized and could more clearly articulate the benefits of the reserve both economically and socially.

In conservation, there is often conflict with local communities over government-imposed boundaries. We did not find conflicts over boundaries with government in our field visits. Communities in coastal Madagascar want to set their own boundaries and want to protect them against outsiders because they see their value. However, boundaries are difficult to enforce in a marine context without the involvement of both communities and the government. The challenge of community-based reserves is that the community cannot rely on *dina* alone to keep outsiders from entering their reserves. Yet the government entities that do not have competing interests lack the resources to back the communities. In one case, the commune was called to come and help talk to outsiders fishing in the reserve (the case is described below), but because the encroachers were armed, the commune representative and community members were afraid. In another case, the community association apprehended people illegally harvesting wild sea cucumbers, but the mayor was complicit in the illegal harvesting. In general, there is a desire for more cooperation from the government to protect marine areas from outsiders, but little effective government enforcement seems to be taking place beyond confiscation of fishing nets. The Directorate of Fisheries in Tuléar told the research team that he knows that this is not effective, but he doesn't have resources to patrol. Other means of enforcement are needed.

In the case of the marine protected areas, the reserve boundaries were determined together with the communities. This is also the case with the mangrove restoration areas. The involvement of NGOs ensured that communities were able to get access to information they needed to make decisions about their resources. However, throughout the fieldwork the team in the Northeast noted that each of the four communities talked about their struggles in trying to delimit and communicate the boundaries of the locally managed marine area, particularly in relation to industrial and commercial fishers.

Communities in the Northeast also demonstrated substantial social cohesion, perhaps due to greater isolation, community organizing, or more resources being invested in ensuring that the community is benefitting from the reserve. It is equally possible that the stronger cohesion is due to having clear rules about the restrictions, enforcement of the rules, and committees and procedures in place to handle infractions. The involvement, and even leadership, of communities in the process helped to ensure that the reserves would be accepted. One of the

key determinants is the ability of a community to define its membership. Both men and women are members, and they often form sub-groups around economic activities in which they engage. For example, women were more involved in near-shore octopus hunting and seaweed farming; men were more involved in offshore octopus hunting and fishing.

Sub-question 2: How do you set limits on fishing (time, place, fishing modality, quantity)?

One of the important aspects of local management of marine resources in Madagascar present in both areas visited by the PEA research teams is the concept of *dina*, local laws based on traditional social code. Although *dina* are customary rules created and enforced by communities, they can be recognized by regional courts, enabling them to have legal weight. *Dinas* have been used with different levels of effectiveness to address problems of resource management, as well as other issues. Local *dina* is validated by a community and put into force at the local level to control against misuse of resources. Establishing temporary or permanent reserves involves the use of *dina*.

Dina is developed through a consensus-based process involving all the members of the community and fishers associations. It is used to establish both the timing and location of closures, and in establishing rules about limits on equipment or techniques. The members also determine the levels of fines, or sanctions, to be paid for infractions and the rules around enforcement of the *dina*. In one community in the Southwest, the fishers told us, "If my relatives are visiting, and I fail to inform them of the rules, and they violate them, I am held responsible."

Sub-question 3: How are rules made? How are rules changed? How often are they changed?

We did not find high levels of compliance everywhere that LMMAs have been established. Most communities were engaged in the process of rule setting in the Southwest, but we could not find hard evidence of *dina* being enforced. On the one hand, they told us that most people follow the rules. Though they admitted that there is a degree of leniency toward family, especially poor relations that have come from the drought-stricken inland areas.

While *dina* are usually focused on local issues, certain rules on use of particular types of fishing gear or equipment like beach-seine nets are common across all LMMAs in MIHARI's network. Despite this widespread agreement, the declaration of a national *dina* on these nets was deemed impractical by government representatives present. However, the government officials did feel that if LMMAs could widely enforce the ban, it might form the basis for an official nationwide ban. This would expand on subregional bans in existence like the *Arrêté 18680/2006*, which bans the use of mosquito nets.

Rules are made with all members of the LMMA association present. We did not learn how rules are changed, but the communities meet regularly through different committees that are formed around economic activities or *dina* enforcement, and other interests. The more formal the management arrangements, the more regular the meetings.

We found that associations involved in formal management arrangements appeared better informed and organized. There appears to be a recognition of the perceived benefits of the marine reserves and mangrove restoration even in sites where there are not formal management roles given to the community (i.e. community reserves). Communities we met told us that they have larger catches and they are aware of the importance of protecting some areas for juveniles of important species to grow bigger. The communities who have made agreements and commitments to protect the reserves have clearer rules, clearer membership, clearer enforcement of rules, and, in general, meet all of Ostrom's eight CPR design principles. Those communities involved in more informal arrangements appeared to be better organized where there were clear benefits in organizing. For example, of two communities visited that were organized by one NGO, the community that had an installation providing clean drinking water more clearly met the CPR design principles by which we were measuring the LMMAs. In another set of two communities where one NGO was involved, the community with greater incomes from seaweed farming appeared to be more organized than the other.

Box 1. Conflicts between Traditional and Commercial Fishers

Throughout our discussions, various actors in the Northeast noted the on-going conflicts with commercial shrimp boats. Many key informants noted that commercial shrimp fishers frequently come close to the shore. Government and community informants reported that there is no formal agreement or regulation on the boundaries between where traditional and commercial fishers can fish. At the same time they explained that commercial fishers are supposed to remain 3,800 meters from the coast. The commercial fishers do not respect this limitation. Those communities located near coastal geographic features such as sizable fresh water river outlets tend to come into high levels of conflict with commercial fishing boats. These nearshore waters have higher shrimp density due to the nutrient-rich river waters. Local fishers frequently have their nets destroyed by the large nets of the commercial vessels fishing close to the coast. Though communities have tried to report these incidents to the local gendarme, mayor's office and others, no fisher has been compensated for loss of equipment or catch. The informal rules are not enforced and there is no formal and established process to manage these disputes or a means to seek compensation by local fishers for loss of equipment.

Sub-question 4: Who monitors compliance with the rules? Are monitors primarily accountable to LMMA?

Communities that were engaged in more formal management arrangements had less difficulty with enforcement. Yet, even there, no one could cite any recent violations. However, where LMMAs were more formalized, *dina* committees explained to us that they propose and enforce *dina* that is agreed to by the whole community and later approved by the different levels of government. Monitors are primarily accountable to the LMMA. When the community cannot handle matters, it is very difficult to get any assistance from the government or other outsiders. The communities along the Southwest coast are largely cut-off from government support and resources.

Interestingly, in the Southwest, the government introduced a *dinabe* (or big *dina*) in 2009 to deal with cattle theft and other banditry because local law enforcement was not up to the task. This

dinabe was especially welcome in communities where LMMAs were not strong because it gave them the force of the law to impose fines of up to 1000 cups of rice, and gave the communities the authority to defend their cattle from outsiders in a time of rampant lawlessness.

In the Northeast there was an attempt to establish a *dinabe* for the whole Antongil Bay. This effort was blocked in the courts. We did not establish who challenged the *dinabe* and what their interests were. Further clarity on this point is needed. Ongoing conflict between local fishers and commercial trawlers continues in Antongil Bay (See Box 1.)

We found the value of local knowledge in terms of monitoring and managing the marine areas is high. The fishers know the species based on the current and the flow of the water and the season. They know where to find the species. They also know when illegal fishing is occurring, but they are not always able to address it (See Box 2.).

Box 2. Community Enforcement Efforts

One community leader in the Southwest described how they went to one of their traditional fishing zones expecting to find plenty of fish. He described how they could find this zone in the dark by measuring depths at ordinal points, because they are accustomed to going out to fish at 3 AM. They did not pull up any fish. They realized a big boat had come and taken everything. So they went in search of the boat. They found it and tried to report it. The people on the larger vessel destroyed their fishing equipment and threatened them. They tried to pursue this to the district level in Tuléar and discovered there is allegedly no record of fishing licenses kept at the district level. They did eventually pressure the captain of the ship to provide them with compensation for the destroyed property but not for the fish they took (presumably with an illegal Fish Aggregating Device). Other fisher communities had similar stories, but said that vessels had brandished guns to make the fishers back off, had gotten away because the vessel was larger and motorized or in some cases the vessel was manned by people hired by a prominent local. The Regional office in Tuléar is inadequately resourced for enforcement. It was unclear whether they had any staff or boats to patrol.

Issues of transparency and record keeping related to licensing and permitting at local level for programming to explore include:

- Assessment of how enforcement of fishing licensing and permitting could be improved.
- How best to support the Regional Directorate of Fisheries.
- How to support communities trying to enforce fishing local rights.

Sub-questions 5&6: What happens when members break the rules? Non-members? Are sanctions graduated based on the severity of the offense? How are conflicts resolved?

In the Northeast, the sanctions for violating the *dina* in one community were set very high. In another neighboring community, the local government had set the sanctions at a very low rate

and no one was following it. The fishers told the research team, “We want to try again but we need to set our own *dina*, otherwise it will not work. No one will follow it unless we decide together” (see Box 3).

Box 3. Comparing *Dina* & Compliance

In Northeast region of Madagascar, Rantohely and Ambodipaka, there are two communities with contrasting experiences in compliance. Rantohely has a relatively strong, functioning LMMA. In Ambodipaka, the LMMA no longer functions. Comparison of the made clear the role that community ownership of a *Dina* plays. The people of Rantohely developed their own *dina*, and they set the fines very high. The penalty for using a beach seine stated in the *dina* was 1 Zebu, 5 kg of salt, and 100 kg of rice. In contrast, Ambodipaka association members noted that they were given *dina* by Ministry of Fisheries and did not develop their own. In addition they set their fines very low, assessing only 5,000 Ariary for the illegal use of a beach seine. The members said this was far too low and did not function as a deterrent. The lack of a *dina* where the members felt ownership and had help developed rules, along with light penalties led to a classic collective action problem where individuals felt more and more compelled to use illegal equipment since many other were also doing so.

In many communities in the Southwest, there is leniency on community members and a preference to resolve things locally to avoid the weight of the *dina*. Community leaders told us that they prefer to educate people rather than to punish them because ultimately, they are trying to strengthen marine management. When non-members break the rules, they typically comply with the *dina* payments, according to informants. However, there were a number of cases we heard about in which the fishers were unable, even with the involvement of the administrative authorities to enforce the *dina*, particularly in regard to industrial or commercial fishers, traffickers, or corrupt government officials. Interviewees discussed one case where a local-level politician released individuals accused of illegally harvesting wild sea cucumbers. When a civil society organization pursued the case, district level officials dissolved the organization and the local politician replaced it with his own organization. Although national-level pressure from civil society ultimately spurred the national government to pressure the district to bring charges against the local politician, he ultimately did not stand trial and simply stepped down at the end of his term.

Sub-questions 7 and 8: Are the rights of the LMMA to set their own rules respected by government officials and outsiders or are they challenged? Are other forms of government nested above the LMMA providing support in terms of provisioning, monitoring, enforcement, and conflict resolution?

Presently, local governments are supportive of LMMAs and of the MIHARI network. Legally, this support could help enable more effective and integrated management. Although there are high levels of engagement of various marine science institutes, the private sector, NGOs, donors, and academics in supporting national networks like MIHARI to strengthen LMMAs, local government officials lack sufficient capacity and resources to support LMMAs in monitoring and enforcing the *dina*. Communities that try to bring transgressors to court find their cases thrown out on technical grounds, or because parts of law enforcement are complicit in the violation; this was especially true in the Southwest with regard to trafficking of illegal marine products. Cases

that we heard about had mostly been rejected by the court for lack of evidence, *i.e.*, written evidence that semi-literate fishers do not generally have, or the seized take, which is not particularly practical to bring to court. With regard to the Northeast, one informant noted that Ministry of Fisheries received over 50% of its revenue from commercial fishers. While there may be a political commitment at some level of government to empowering the role of local communities in marine resource management, there are real economic interests within the governance system opposed to community management. For example, hunting of wild marine life such as turtles, which has important cultural and traditional roots in Vezo society is still tolerated, and informants reported that turtle meat and products are sold on the streets of Tuléar.

In addition, while the Regional Directorate of Fisheries at the district level is supportive of LMMAs, questions about the legal status of LMMAs remain potentially problematic if they are to be self-sustaining. LMMAs are classified as non-profit community associations (Malagasy Law 60:133). In order to become independent of NGOs, they need to be able to generate incomes, but government officials have interpreted their legal fundraising authority as limited to charging membership fees. A transition of management support will need to take place over time. Consequently, these issues will need to be further explored in order to identify what steps are needed to more fully support LMMAs.

6.0 PROGRAMMING WITH PEA FINDINGS

6.1 APPLYING FINDINGS

Commonalities and nuances among sites may help to extrapolate findings more broadly. We began with the assumption that community managed marine areas would have higher marine conservation feasibility where the characteristics of the governance system met the criteria of the CPR design principles. For example in the Northeast, it is interesting that irrespective of the strength of the LMMA, enforcement of the boundary against illegal and unregulated fishing vessels, especially those with political connections is extremely limited. As a result, the enforcement context for LMMAs remains fragile and LMMAs will not succeed without building enforcement capacity at multiple levels.

Despite the rich local traditional knowledge of the resource as well as the ability of these communities to manage themselves and their resources, weak governance structures are a threat to marine biodiversity. Despite all the differences in culture, levels of market access, nutrition, access to clean water, education, health, and of criminality and conflict across the sites, communities with different forms of management may have been more similar to each other socially than to villages with resource management that was not working effectively. Geographical location also has a role in determining levels of external threat which drive behaviors among the community and leave some communities more vulnerable and prone to conflict or criminality.

We lacked the ability in our quick analysis to collect social data at the household level, but other research, and common sense, suggest that household level interviews would have resulted in much higher levels of variation in the form and presence of management compared to data at the level of village meetings conducted.

6.2 SUMMARY OF KEY FACTORS THAT ARE DRIVING THE ACTION/ACTORS UNDER STUDY:

It seemed clear to us that other factors outside of Ostrom's model are also at play and must be considered in determining the functioning of the LMMAs in coastal Madagascar, and these factors should be considered in designing programmatic responses around threats to marine biodiversity.

Strong traditional self-governance--The role of cultural lineage, clans, and family connections was seen as of critical importance in Southwest. Some clans are understood as the spiritual leaders and carry more weight than the administrative leaders. *Vezo* are considered fiercely individualistic, and tend toward skepticism of what the government can offer them.

Perceived resource decline, and a link between perceived decline and resource use--this was consistently a key motivator for associations to come together. The communities who had made that connection had begun to change behavior.

Social capital--those with resources to redistribute such as the women's microfinance arrangements among family lineage groups can more readily benefit from new economic opportunities that might arise around new management.

Leadership--where good leaders are bringing communities together, resources are better protected; closely linked to social capital is the concept of leadership: traditional leaders, strong leaders, good leaders are critical to making these associations and marine management work well. Some communities have them, some do not.

Box 4. Nutrition Impacts of Declining Fisheries

Through our conversations with a wide variety of stakeholders in Antongil Bay there was strong consensus that the fishery has largely collapsed. Most fishers in Antongil Bay are traditional fishers using dug out canoes and nets. They have no real access to external markets and fish almost exclusively for subsistence. What they do catch often goes to local markets or to brokers on the beach. Through our conversations with a Harvard postdoctoral fellow looking at the impact of declining fisheries on the diets of local communities within Masoala National Park, we learned that despite access to fish, their diet is protein poor and lacking in important micronutrients. The Harvard study in progress now has documented stunting of around 30% amongst children. The consequence of more effective LMMAs might be a short-term reduction of protein in communities whose food needs are currently far from met. If the Mission hopes to support the management efforts in the Bay of Antongil, and assist in the rebound of fishery populations, then providing alternative protein and livelihoods is

absolutely imperative. Moving demand away from the fishery will only be possible with viable alternatives. The Mission, with implementers and researchers in the area need to explore viable alternative livelihoods and support their implementation and uptake by the local communities. One of the political economic realities faced by communities in the Northeast is the lack of market penetration which reduces alternative livelihood options. An important finding in the Northeast was that poor road access is not a result of a lack of government resources or attention but rather the intentional interference of the “vanilla baron” in the region who does not want any competition with his company in harvesting and shipping Madagascar vanilla beans from the area. A new and improved road could bring new private sector interests in vanilla. So, it is common knowledge that he uses his influence to sabotage any efforts at road rehabilitation to keep the area remote. Exploration of livelihood options will need to carefully consider the context of any initiatives.

Resource dependence--According to research linking incentives to management of a marine area, LMMAs are most feasible where resource dependence for commercial purposes is high. Where compliance with management of the marine reserve results in tangible benefits, there is more incentive to cooperate.

Accessibility to markets with alternative income generation was seen as a critical factor for motivating changes in behavior and also for taking pressure off the reefs, particularly in the Southwest. We noted few other viable alternatives for income generation. Experts we spoke with indicated that fishing pressures must be removed to allow reef restoration, which will take decades. Ideally, incomes need to be diversified and generated in aquaculture or off the water entirely. Inaccessibility of private seafood sector collectors and the need for assistance from NGOs in identifying and evaluating the potential for alternative livelihood activities, providing training, capacity building and connecting communities to international markets is a huge hurdle and the single largest challenge facing marine management (See Box 4).

7.0 THEORY OF CHANGE

The Mission's current theory of change is that the improved management of marine resources, both within and beyond formally declared protected areas, will reduce the unsustainable use of marine resources and curb alarming rates of biodiversity loss. This theory of change requires multiple simultaneous initiatives: improved community management capacity; strong management plans, clear zoning and enforcement of plans, improved value chains for alternative livelihoods, and improved understanding of communities of their rights and responsibilities with regard to natural resource ownership, access, and use rights.

The political economy analysis findings are consistent with this approach. Effective community management, supported by better research and analysis and external accountability systems, and combined with meaningful and scalable livelihood alternatives, will reduce the unsustainable use of marine resources and curb biodiversity loss.

First, effective community management of marine resources can only be achieved through the eight principles of CPR management. These are:

- Clearly defined boundaries
- Congruence between appropriation and provision rules and local conditions
- Collective-choice arrangements allowing for the participation of most of the appropriators in the decision making process
- Effective monitoring and enforcement by credible parties who are part of or accountable to the appropriators
- Graduated sanctions for appropriators who do not respect community rules
- Conflict-resolution mechanisms, which are cheap and easy of access
- Minimal recognition of rights to organize (e.g., by the government)
- Multiple layers of nested enterprises supporting commons management

Second, the extreme levels of environmental degradation and the complete dependence of coastal communities on marine resources due to climate shocks will require significant economically beneficial livelihood alternatives that can be scaled up. Given the differences in climates and market penetration in the Southwest and Northeast coastal regions, livelihood alternatives will differ in each region. Differences notwithstanding, they are critical to deterring further pressure on marine biodiversity.

Third, the effective local management of marine resources can only function through effective reinforcement of the rights of local communities. This requires that communities be aware of their rights and responsibilities, and have the ability to access and analyze information. However, it also requires that the external governance systems - local government, law enforcement, zoning, and licensing, among others--respect the integrity of local institutions and provide appropriate support for their management practices.

The PEA findings recommend a fourth complementary intervention around capitalizing on existing and current research, data collection and analysis, and linking these efforts with local community knowledge about the marine resources. The efforts of PIC II to improve data and analysis will provide more accurate information about biodiversity and fishing stock levels. This in turn will inform better laws, policies, regulations, and community-enforced *dina* that can be linked to metrics that will increase biodiversity and support sustainable levels of extraction. Technical assistance based on these applied research findings is a role played by IHSM, which is making technical assistance available to train the local associations.

8.0 KEY PROGRAMMING RECOMMENDATIONS

1. Supporting uptake of research finding:

The Tuléar-based *Institut Halieutique et des Sciences Marines* (IHSM) has been conducting research on marine degradation for many years, and has strong international and local credibility. Currently, the EU is working closely with the government's Regional Directorate of Fisheries, supporting NGOs and IHSM in efforts to coordinate research. The World Bank's information coordination program, PIC II, also aims to support better coordination of the ongoing data collection efforts to give greater visibility to government officials and to assist more effectively in the management of marine resources. In the Southwest, multiple NGOs and independent researchers have various data collection efforts to track the types and quantities of fish extracted and to monitor a number of data points including the size and locations where fishers are fishing different species. USAID may want to focus on ways that research findings can be made accessible and applicable within the MIHARI network.

Integrating research findings into *dina* and other resource management: USAID may be in a position to create feedback loops in collaboration with other donors to ensure that research is leading to more informed national policies, legislation, and regulations, and also that communities have access to the information generated from the research to inform their local management measures and *dina*. Research is an area donors are already supporting, so it will be important to work together to help the IHSM and government to support management of the data in ways that improve access.

Integrating research through MIHARI: The MIHARI Network links local leaders, civil society, and policy makers in Madagascar in promoting LMMAs. MIHARI is already integrating research that has been done within the LMMA network in Madagascar and with support can continue to identify the factors of success in LMMAs in Madagascar. It will be critical to consider evidence from a wide body of research from outside the country as well as through peer-to-peer exchanges used by the network

2. Building LMMA effectiveness through MIHARI

Improving marine management will require strengthening not only the existing internal functioning of LMMAs, but also the institutions that support them. USAID should support the coordination efforts of MIHARI and identify incentives mobilizing LMMA effectiveness.

Supporting MIHARI: Supporting MIHARI in engagement with participatory action research could strengthen work in Madagascar. Already, the MIHARI network has been in the process of establishing peer-to-peer exchanges across the LMMA network. Research in Fiji and other Small Island Developing Countries where coastal

communities have established LMMAs can help inform USAID programming in Madagascar.¹⁶

Engaging with private sector: USAID should consider entry points for facilitating MIHARI and other NGOs working with private sector to improve information flows and develop projects that might be more advantageous to both the private sector and the fisher communities by increasing transparency and trust as well as incomes and scaling up of existing operations. This collaboration could take many forms.

Support Internal Functioning of LMMAs: The design principles outlined in this report will guide activities to support the internal functioning of LMMAs. Good leaders are key to the sound functioning of LMMAs. Questions to explore include: How can LMMA leadership skills be fostered? What geographical factors might be at play? For example, location may inform the motivation of some LMMA members to work together. Location might also make some communities more vulnerable, for example from to criminal activity. What internal and cultural factors support the LMMA? Family ties might allow better marketing of products for some members of the community. Social networks could be mapped. What small interventions might help? For example, one small intervention could be providing LMMAs in the Northeast with inexpensive buoys to denote the boundaries of their fishing zones.

3. Strengthening Community Based Management Efforts

There may be opportunities for USAID to support government, civil society, and community stakeholders to learn from the improved accountability of marine resource management systems through LMMAs. For example, USAID could help develop consensus between LMMA federations, artisanal and commercial fisheries, and government actors such as the *Centre de Surveillance des Pêches* around zoning and boundaries for different fishing activities, and help institutionalize grievance processes for communities to seek remedy for violations. In addition, engaging civil society networks such as FAMARI around monitoring and oversight over marine resources will be a key activity USAID can support, in providing communities with access to information on their rights and remedy options, and in engaging with government institutions to conduct appropriate oversight and enforcement.

4. Exploring Alternative Livelihoods

In the Southwest, a variety of international and local conservation NGOs including WCS, WWF, Reef Doctor, Honko, and SAGE are engaged in experimentation around small-scale livelihood alternatives. There are important lessons that should be captured around these efforts; at the same time much more analysis is required about market opportunities that can provide a true alternatives to dependence on fishing. USAID can help to facilitate collaboration between the conservation organizations and those experienced in market analysis and supporting scalable alternative livelihoods, including through requiring that any new biodiversity project incorporate partners with this expertise. In addition, there are at least three private companies or parastatals with market penetration in the Southwest; this provides a real opportunity for further dialogue

¹⁶ Representatives from FIJI participated in the last year (Oct 2015) MIHARI network forum.

about opportunities to expand non-fishing livelihoods as well as for communities to negotiate fairer terms for their products that can help mitigate some of the economic imperatives of unsustainable fishing practices. The Mission may work with the private sector on medium-to-high value industries to define what measures are needed to guard against the inevitable vulnerability to theft that successful livelihood alternatives may garner. USAID could look holistically at opportunities in agriculture and nutrition that can provide alternative sustenance for areas where there is limited to no market penetration, including through cross-sectoral programming.

5. Engaging with the Private Sector to increase Market Transparency

The private sector has a central role to play in developing viable livelihood alternatives including continuing to build on existing models that have been developed in aquaculture and helping to ensure that fishers can receive an economically feasible income from activities. We were able to meet with one private sector company, GAPCM, which works with shrimp farmers, as well as with COPEFRITO and MUREX, which work closely with IOT in the Southwest. Refrigépêche in the Northeast was not available. All these actors are involved in the production of aquaculture products including contracting for production as well as the collection of fish products. Partners and donors already have existing relationships with these companies in the Southwest. Copefrito and Murex work closely with NGOs. Murex specifically mentioned their collaboration with WWF, WCS, Blue Ventures, and SAGE as well as with the Madagascar National Parks. USAID should support communities in their engagement with the private sector to identify ways that investments could strengthen market values for the fishers' products.

Taxation might be a leverage point for LMMA associations to demand more from local government. Taxes paid by the private sector at the district level for products collected at the local level are not well documented, and communities are not documenting whether the amounts received (the 3 percent *ristourne*) from the district are correct, nor are they documenting how these funds are spent at the commune level. This could be an opening for strengthening civic demand for accountability. Working with private sector may be an important way forward as the companies expressed interest in ensuring their percentage reaches the communities they work with.

Supporting CSOs to engage on these and other improved accountability issues is a key activity USAID will support.

6. Building Conflict Resolution

This research points to the need for strengthening existing structures that can effectively and credibly resolve conflicts at the local and regional levels where they exist. USAID should work with communities and regional actors to develop improved accountability and conflict resolution principles at selected sites with the long-term goal of building a body of best practices to share with donor partners and the ministry to improve conflict resolution. USAID should support conflict resolution processes through the support of MIHARI network and collaboration with technical and financial partners.

Skills around conflict resolution need to be strengthened, and it will be important for USAID to further investigate how best to complement existing mechanisms and arrangements, and existing donor and NGO activities and engagements. On the other hand, there are active power imbalances between traditional/local fishers and

commercial fishers, especially with half of the ministry's revenues coming from commercial licensing. Together with the ministry and donors, USAID could consider how to initiate a forum for conflict resolution, bringing together commercial and other fishers into discussions with LMMAs. However, the conflicts between fishers and distant water fleets or locally unlicensed vessels should be of high concern to government, in terms of conservation, sustainability, and in terms of revenues. So, it will be important to address these issues as well possibly through USAID's collaboration with donor partners working on fisheries and marine areas. USAID can keep these forums most relevant by focusing at the local level.

One example from the research of a local level existing conflict resolution institution involving LMMAs is that of the Bay of Antongil Management Council. Using the park's management plan and the council as a space to discuss and resolve the issue of identifying limits to commercial fishers might be a reasonable goal to define ways forward at the local level. One key informant thought that the Ministry of Fisheries might be open to denoting a boundary for commercial fishers in particular areas. Supporting a local level focus, on dispute resolution might under these types of efforts could enable local fishers to be compensated for their losses due to the destruction of their nets by commercial fishers. Reducing conflict between local and commercial fishers is an important piece of the puzzle and will be most effective through local level mediation. It should be noted, however, that neither team was able to talk with commercial fishers in the course of their field interviews. It is imperative that programming fills this gap in understanding the interests and perspectives of commercial fishers as the specific issues of potential field sites emerge.

7. Exploring New Forms of Commercial Licensing

Because the Ministry receives half of its resources from commercial fishery licensing, several informants felt that commercial fisherman had disproportionate influence on the Ministry's decisions versus traditional fishermen. Improving transparency would be to support the management plans of marine protected areas and marine reserves and thus would be contributing to improved biodiversity as well as improved food security. This work will be coordinated through LMMAs and in partnership with the Ministry of Fisheries, district and local government and MIHARI to shift away from the reef and toward west coast pelagic waters (*Pêche au large*) in the Southwest while focusing on clear enforceable boundaries for LMMAs in the Northeast.

8. Increased Monitoring and Enforcement of IUU fishing

With the extent of publicly available data on the decline of fisheries in Madagascar, it is exceedingly clear that IUU fishing is depleting stocks and efforts at national and international levels are needed to shift orientation toward local small-scale fishing rights. With the expansion of coastal populations, the decrease in fish stocks and the associated increasing levels of food insecurity and malnutrition indicate that local fishing rights are a human rights issue. In our zones of intervention we want to monitor this issue and be able to contribute knowledgeably to the problem. USAID will work in partnership with the ministry and donor partners to determine how best to address this issue.

9.0 KEY ACTORS

Active engagement of private sector actors working in the marine sector will be critical. There is a need to examine existing value chains and identify how roadblocks can be removed. In the Southwest, fishers have been cultivating seaweed and harvesting sea cucumbers and octopus in recent years. This has improved incomes, but the livelihood arrangements in their current form face structural obstacles and disincentives, including threats of criminality, that have constrained communities in their ability to fulfill the role in production envisaged by the IOT, IHSM, and private sector operators. Improvements in efficiency, competition and the terms of contracts for aquaculture could increase profits both for communities and for the private sector. The future of the reef depends on fishers making an adequate income from aquaculture to make the closures enforceable, and provide room and income for expanding livelihood opportunities into new areas.

The project should consider the introduction of new or enhance existing economic development options for people who are currently dependent on the use of natural resources, through diversification into other value chains and/or strengthening of existing value chains, resulting in reduced pressures on biodiversity. In addition, the project should reach out to other USAID health and food security programs or programs of other partners to ensure that water and sanitation, health, nutrition, food security, family planning, and education support can be provided to communities in the target implementation sites.

10.0 MONITORING AND EVALUATION

The PEA research noted that within the field of marine management there is a trend towards developing new quantitative indices, models, and technical spatial tools to bring better information about resources uses to the management arena. The effort to better map, quantify, and describe human cultures, livelihoods, and governance in relation to marine space has benefits in terms of ensuring that these aspects of the marine environment are given due consideration during management decision-making. This is an important development but it will be necessary to also ensure that information on local perceptions of resources and benefits from marine reserves are captured. Good indicators must motivate practitioners to measure and evaluate the causal linkages between human behavior and marine resources.

It is critical in designing marine programs that fishers are not lumped into homogeneous categories. For example, the culture of the Vezo is fluid and malleable but also individualistic. It is important to recognize decision-making and behavior as that of the individual fisher without assuming that all fishers will behave in the same manner. A focus on understanding social networks is a strategy that may help avoid oversimplification, while also helping to situate individuals in a context that better explains behavior and indicates possible incentives for changing behaviors across a wide range of coastal contexts. Indicators should be well developed and baseline data collection should be a priority for good indicator development

(see Box6.)Box 6. Empirical questions and applications for baseline data collection for indicator development

Establishment of Enabling conditions:

- Identifying levels and types of social capital, legislative frameworks necessary for effective conservation outcomes through community managed reserves.

Stakeholders:

- Identifying relevant stakeholders and actors in diverse positions within social networks helps to address issues of marginalization and avoids potential conflict (Prell et al. 2009; Prell et al. 2011).

Location/ boundary setting:

- Coastal-marine seascapes are spatially heterogeneous with regards to use (e.g., different gear types often target different habitats, species and/or depths) as found in our two research teams. Similar to stakeholder analysis above, the identification of different users contributes to their inclusion in deliberative decision-making regarding the location and boundaries associated with a new or existing marine management area, as they may be differentially impacted. Randomized collection of household level information is recommended.
- Identifying the location and distribution of local knowledge related to key ecological processes and patterns (e.g., spawning patterns and larval dispersal) among social networks contributes to establishing appropriate ecological boundaries (Frank et al. 2011). Different subgroups have different information. Trust is a huge issue here for getting good information. Household level verification recommended.

Decision making/ Advisory councils

- Similar to stakeholder analysis it contributes to the identification of key individuals (e.g., actors with particular types of ties and/or numerous ties) for decision-making entities and advisory committees (e.g., board members for an MPA, cultural leaders, important clan members).

Participation & engagement

- How might social relational ties within and between social network subgroups, youth and gender in particular, influence participation in MPA planning meetings, and how are these roles changing over time?
- Using network analysis offers one way to consider how an actor's location or position within the network is impacted by membership in fisherfolk cooperatives, tourism associations, etc. (Frank 2011).

Governance Adaptive management

- How might relational patterns between MPA managers enhance or inhibit to the diffusion of innovative practices?
- What structural and/or social relational features of networks foster collective learning for adaptive management of MPAs? (e.g., Newig et al. 2010).
- How do social networks contribute to the monitoring and evaluation of MPA goals, targets and management plans?
- Similar to stakeholder analysis it helps to identify key individuals for network intervention to facilitate social learning among a given set of actors (e.g., Prell et al. 2011).
- How does the structure of social networks (formal and informal) enhance or inhibit the integration and application of different types of knowledge?
- How do relational patterns within MPAs and MPA networks contribute (i.e., facilitating or constraining) to the capacity of governance systems to adapt to climate change?

Collaborative management

- How does composition and connectivity of subgroups facilitate or constrain collective action related to community-based MPAs?
- The examination of network structures and patterns of influence provides insights into power asymmetries, which may constrain collaboration among relevant actors (e.g., Weiss et al. 2012).
- How might relational patterns in one network facilitate or constrain the relational patterns of another?

Formal and informal institutions

- Examining the role of relational ties regarding the flow and diffusion of community norms associated with MPAs for insights concerning compliance (Frank 2011).
- Identifying institutional entrepreneurs and understanding the structural/social relational factors that enhance or inhibit such individuals (Crona et al. 2011).
- How do relational patterns associated with an MPA network contribute to the establishment of new formal institutions (e.g., rules, regulations, legislation)?

11.0 LIMITATIONS

Data access and analytical challenges posed by limited data, as well as time, were major limitations on the PEA research process. There are also important limitations on the proposed solutions. Our findings indicated that it is important to contextualize the local relations of stakeholders involved in marine resource management. However, there are instances when the role of social relational networks in MPA contexts are not as important to the establishment or to governance of the resource at the local level, as other factors, for example, market forces or institutional factors (e.g., lack of state support and/or recognition of local management arrangements, weak sanctions) may contribute more significantly to particular MPA governance arrangements, conservation outcomes, and/or human behavior. Additionally, limitations exist with regard to the application of some theories and concepts to implementation. For example, theories of social embeddedness are based on the premise that actors identify with a given community, which may not always be the case (e.g., mobile fishers, migrant resource users, merchants, buyers) and thus these actors are unlikely to be influenced by community norms.

11.1 PROGRAMMING CONSTRAINTS: LIMITATIONS IN PROGRAMMING THAT MUST BE CAREFULLY WEIGHED:

The PEA research highlighted an ethical concern that increased effectiveness of enforcement of marine protected area management could lead to further reductions in micronutrients and caloric intakes that could have short to medium impacts on the diets of local fisher communities with long term repercussions on children's health. This issue is particularly sensitive in the Northeast where Harvard researchers are tracking these health impacts, but malnutrition appears to be widespread affecting the drought-stricken Southwest and other coastal areas. For that reason, program development should address the nutritional intake through appropriate livelihood support and monitoring of micronutrient intake in coastal communities by focusing efforts on providing protein alternatives to fish in the near to medium term to ensure that increased enforcement of management does not lead to further malnutrition. Enforcement may lead to decreased takes in the short term but should help fisheries rebound. For example, octopuses, which are hunted in the near shore waters can rebound in size and number within two-three months with effective temporary reserve closure.

Programming will also need to assess the potential that increases in income or access to services like markets could undermine the goals of marine management in the long term. There is evidence from LMMA sites in the South Pacific that improved incomes led to changes in practices such as purchase of motor boats or other gear that lead to increases in fishing pressure. The baseline income in coastal Madagascar may be so much lower than Fiji that these concerns are unwarranted. However, integrated programs including health and education, which are desperately needed, should be approached with full consideration of long-term effects and developed with the LMMA associations.

11.2 RESEARCH LIMITATIONS

Due to time/logistical constraints the Bay of Antongil research team had insufficient interviews with key government informants. Should this site be selected for inclusion in the new program we recommend that one to two days be taken during project preparation to have a series of key informant interviews with the Gendarmerie, police, and other stakeholders outside of the marine community.

The team initiated a positive engagement with the private sector, and should continue to reach out to local government, and the IHSM along with other research institutions. For a variety of reasons we were unable to get interviews with all of the stakeholders we would have liked to meet with in these institutions.

12.0 ANNEXES

ANNEX A: SUMMARY TEMPLATE OF FIELD-BASED NOTES

Questions to be asked during interview:

1. How do you see the future of LMMAs in relation to MPAs?
2. How has the expansion of MPAs impacted the livelihoods of marine communities?
3. What makes some LMMAs function better than others
4. What is the broader set of institutional relationships on which LMMAs depend to function?
5. How does overfishing happen?
6. How can Madagascar meet its commitment to triple its MPAs?
7. How is the fisheries sector organized?
8. Why do you think the fisheries portfolio was removed from the Ministry of Environment and placed under the Secretariat d'état?

Individual/Institution	Responses

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