

REPORT/RAPPORT: SF-FAO/2016/xx

Phase two project for community lobster
fishery management in the village of Sainte
Luce (Project Oratsimba)

Final report

Tôlanaro (Fort Dauphin)
Madagascar
August 2016

GCP/RAF/466/EC SmartFish Project

Skinner, F., Burtenshaw-deVries, A., Long, S., Randrianantenaina, S. and Ellis, E. 2016. Phase two project for community lobster fishery management in the village of Sainte Luce (Project Oratsimba).
Report/Rapport: SF-FAO/2016/xx. July 2016. FAO-SmartFish Programme of the Indian Ocean Commission, Ebene, Mauritius.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

The contents of this publication are the sole responsibility of the author(s) and can in no way be taken to reflect the views of the European Union

© FAO 2016

FAO encourages the use, reproduction and dissemination of material in this information product. Except where otherwise indicated, material may be copied, downloaded and printed for private study, research and teaching purposes, or for use in non-commercial products or services, provided that appropriate acknowledgement of FAO as the source and copyright holder is given and that FAO's endorsement of users' views, products or services is not implied in any way.

All requests for translation and adaptation rights, and for resale and other commercial use rights should be made via www.fao.org/contact-us/licence-request or addressed to copyright@fao.org.

FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org.

For more information, please contact smartfish@fao.org

Acknowledgements

SEED Madagascar is grateful for funding received from FAO-SmartFish for the implementation of Project Oratsimba. This project could not have taken place without the support of Malagasy institutions and authorities, including: DRRHP, URL, IHSM, Chefs Fokontany (Sainte Luce, Ebakika, Itapera), Chefs ZAP (Mandromodromotra and Mahatalaky), Chefs Commune (Mahatalaky and Mandromodromotra) and the Mahatalaky Gendarmerie. Cooperation of the private sector, operators (Madapêche and Martin Pêcheur), middlemen and *rabbateurs*, has been of critical importance. Valuable guidance was provided by M. Rabenevanana throughout. Taxonomic assistance was given by P. Clark of the Natural History Museum, London. Manafiafy Beach and Rainforest Lodge generously provided access to their vehicles to support project activities. The research would not have been possible without C. Andry (participatory community data collector) who was assisted by international volunteers from the SEED Madagascar Conservation and Pioneer programmes. Finally thanks go to fishers and management committees of the target communities for all their ongoing efforts.

Executive Summary

In response to declining catches in the Fort Dauphin regional lobster fishery over previous decades – a trend seen in small-scale fisheries across the country – Project Oratsimba Phase II aimed to develop a replicable model for sustainable, community based lobster fishery management in south-east Madagascar.

During the pilot phase of Project Oratsimba (June 2013 – March 2014)¹, SEED Madagascar² supported the community of Sainte Luce to establish a fishery management committee (the Riaky³ Committee). Management measures, devised by the community and recognised by a *dina* (customary local law), included: a No-Take Zone (NTZ) closed to lobster fishing for the majority of the year, a Minimum Landing Size (MLS) of 200 mm and the prohibition of landing females with eggs. As a result of encouraging results from Phase I and high levels of community motivation, SEED and FAO-SmartFish decided to implement a second, 18-month phase of Project Oratsimba.

During Phase II, the emphasis has been on developing the Sainte Luce fishery as a sustainable, locally-managed marine area (LMMA), building the capacity of the Riaky Committee to manage their fishery. Regular training sessions have focused on committee roles and responsibilities, financial management, and enforcement of the *dina* (fishery regulations). Throughout Phase II, SEED has supported the community to adopt adaptive, evidence-based decision making balancing community needs with the long-term interests of the fishery. Key to the success of Project Oratsimba has been obtaining the wider support of private sector actors and estate authorities, to support the long-term viability of bottom-up fishery management.

Robust, scientific data collection and analysis has been an integral part of Phase II. Participatory data collection has confirmed fisher perceptions that NTZ openings resulted in significantly higher CPUE and thus catch for limited periods. This was found to have significant economic effects, resulting in a >33% increase in price at the bottom of the value chain – a key step in making it economically feasible for impoverished fishers to adopt sustainable behaviours.

The initial successes in Sainte Luce, including impacts of NTZ opening on catch and the value chain, resulted in an increased appetite for fishery management in the neighbouring communities of Elodrato and Itapera. Following the establishment of a trial NTZ by the fishers of Elodrato in 2015, project support was extended to both communities. There are now Riaky Committees operating in all three communities overseeing the management of

¹ Azafady (2014) A final report on Project Oratsimba [Phase I]: Prepared for SmartFish/FAO.

² Formerly Azafady UK

³ From the Malagasy word *riaky*, meaning sea.

their respective fisheries including the operation of three separate NTZs. The early stages of replication in adjacent communities demonstrate the scope for regional adoption of community-based management, supported by the state and private sector, with the potential to reverse the trends in the regional fishery.

Résumé exécutif

En réponse sur la baisse des captures de la pêche régionale à langouste à Fort Dauphin au cours des décennies précédentes, une tendance observée dans les pêcheries à petite échelle à travers le pays, – le Projet Oratsimba Phase II a visé à développer un modèle reproductible pour la gestion durable, à base communautaire de la pêche à langouste dans le sud-est de Madagascar.

Au cours de la phase pilote du Projet Oratsimba (Juin 2013 au Mars 2014), SEED Madagascar a appuyé la communauté de Sainte Luce à créer un comité de gestion des pêches à langouste (Comité Riaky). Des mesures de gestion, mis au point par la communauté et régie par le dina (loi locale coutumier), inclus une No-Take Zone (Zone non prise volontaire) fermée à la pêche à langouste pour la majorité de l'année, une taille minimale de capture (TMC) de 200 mm et l'interdiction de débarquer des femelles œuvées. À la suite des résultats encourageants de la phase I et des niveaux élevés de motivation communautaire, SEED et FAO-SmartFish ont décidé de mettre en œuvre une seconde phase de 18 mois du Projet Oratsimba.

Pendant la phase II, l'accent a été mis sur le développement de la pêche durable à Sainte Luce comme une zone marine à gestion locale (LMMA), renforcer les capacités du Comité Riaky pour mieux gérer leur pêche. Des sessions régulières de formation ont été renforcées sur les rôles des comités et leur responsabilités, la gestion financière et de l'application des dina. Tout au long de la phase II, SEED a soutenu la communauté à adopter la prise de décision adaptative fondée sur les faits ainsi que l'équilibre entre les besoins communautaires avec les intérêts à long terme de la pêche. La clé du succès du Projet Oratsimba a été l'obtention de l'appui plus large des acteurs du secteur privé et les autorités publics, pour soutenir la viabilité à long terme de gestion des pêches de bas en haut.

Une collecte scientifique robuste et analyse des données a été une partie intégrante de la phase II. La collecte de données participative a confirmé la perception des pêcheurs lors de l'ouvertures de la zone non prise ont abouti que la capture par unité d'effort (CPUE) est significativement plus élevé ainsi capture une durées limitées. Cela a été aperçu d'avoir des effets économiques importants, ce qui entraîne une augmentation de > 33% du prix au bas de la chaîne de valeur une étape clé pour rendre économiquement possible pour les pêcheurs pauvres à adopter des comportements durables.

Les premiers succès à Sainte Luce, y compris les résultats de l'ouverture de la zone non prise sur les captures et la chaîne de valeur ont entraîné une augmentation des souhaits pour la gestion des pêches dans les communautés voisines de Elodrato et Itapera. Suite à la mise en place d'une zone de gestion par les pêcheurs de Elodrato en 2015, le soutien du projet a été étendu aux deux communautés. Il y a maintenant des comités Riaky opérant dans les trois communautés qui supervisent la gestion de leurs pêcheries respectives, y

compris le fonctionnement de trois zones distinctes. Les premières étapes de la réplication dans les communautés adjacentes démontre les possibilités d'adoption régionale de gestion communautaire, soutenue par le secteur public et privé, avec le potentiel d'inverser les tendances de la pêche régionale.

Acronyms and abbreviations

CPUE	Catch Per Unit Effort
DRRHP	Les Directions Régionales des Ressources Halieutiques et de la Pêche
EU	European Union
FAO	Food and Agriculture Organisation of the UN
GOLDS	Groupement des Opérateurs Langoustiers Du Sud
GPS	Global Positioning System
IEC	Information, Education, and Communication
IHSM	Institut Halieutique et des Sciences Marines at the University of Tulear
LMMA	Locally-Managed Marine Area
LoA	Letter of Agreement
MLS	Minimum Landing Size
MoU	Memorandum of Understanding
MRHP	Ministère des Ressources Halieutiques et de la Pêche
NTZ	No-Take Zone
ONG/NGO	Non-Governmental Organisation
SEED	SEED Madagascar
SSF	Small-Scale Fisheries
URL	Unité de Recherche Langoustière
ZAP	Zones d'animations pédagogique

1. Introduction

Project Oratsimba Phase II was launched in October 2014, thanks to a grant of 36,988 USD from FAO-SmartFish and was originally scheduled to be implemented over 18 months, ending in April 2016. This was then extended to July 2016 to encompass NTZ openings and to allow time for additional activities. FAO-SmartFish granted an additional 3,500 USD to the project for the associated increase in cost. The following report outlines activities, progress and lessons learnt during the project, from October 2014 to July 2016.

2. Background

Small-scale fisheries (SSF) play a significant role in food security and poverty alleviation in Madagascar, however recent decades have seen a dramatic decline in spiny lobster catch. National lobster landings fell from 550 tonnes in 2006, to just 240 tonnes in 2012; a situation mirrored across the Fort Dauphin regional fishery, which accounts for the majority of the annual catch and export (fig. 1). As a high-value commodity, lobster are significant contributors to the regional economy, thus declining catch and the potential for fishery collapse pose a serious threat to economic stability. This is a major concern for livelihoods in the Anosy region, one of the poorest regions in a country where 87.7% of the population live below the international poverty line (1.25 USD day⁻¹)⁴.

Catches at a national, regional and local level are below historic peaks (fig. 1), supported by perceptions of local fishers, the regional industry and state authorities⁵. Data presented by Sabatini et al.⁶ support the conclusion that there has been a long-term decline in catch. It is unlikely declines can be attributed to decreased fishing effort, indeed it is more likely that fishing effort has increased in recent decades. Madagascar has a population growth rate of 2.8% per year⁷, which is thought to be higher in coastal regions⁸. Given that lobsters are a comparatively high-value commodity, and there are few entry barriers to lobster fishing, it is predicted that there are now increased numbers of lobster fishers in south-east Madagascar where extreme poverty is most pronounced⁹. The combined effect of these factors is likely to have resulted in increased pressure on regional stock, though no effort time-series are available to confirm this. Prevailing fishing practices, over-exploitation and a climate of non-compliance with national legislation pose significant threats to the regional lobster stock, the long-term viability of the fishery and the livelihoods of fishers in impoverished coastal communities.

The rural village of Sainte Luce has historically been recognised as one of the most important lobster fishing villages on Madagascar's southeast coastline^{10,11}. Fishing is a significant contributor to the community's economy, with 79% of households identifying it as their primary source of income¹². Whilst Sainte Luce has exhibited a less precipitous decline in total catch (fig. 1), this trend is likely to have been masked by population

⁴ UNDP. Human Development Report 2015: Work for Human Development. New York, USA: United Nations Development Programme (UNDP), 2015.

⁵ Long, S. (2016, in review) Short-term impacts and value of a periodic No Take Zone (NTZ) in a community-managed small-scale lobster fishery, Madagascar. *PLoS ONE*

⁶ Sabatini G. et al. (2008) A review of the spiny lobster fishery in the Tolagnaro (Fort-Dauphin) region. In: Ganzhorn JU, Goodman SM, Vincelette M (Eds.) *Biodiversity, ecology and conservation of littoral ecosystems in southeastern Madagascar, Tolagnaro*. Washington DC, USA: Smithsonian Institution p. 299-308.

⁷ The World Bank Group (2015) Madagascar - Systematic country diagnostic. Washington, D.C., USA.

⁸ Le Manach F. et al. (2012) Unreported fishing, hungry people and political turmoil: the recipe for a food security crisis in Madagascar? *Marine policy*. **36**(1):218-25.

⁹ The World Bank Group (2015) Madagascar - Systematic country diagnostic. Washington, D.C., USA.

¹⁰ Charbonnier, D. and Crosner A. (1961) Quelques données sur la pêche des langoustes à Madagascar. *La Pêche Maritime*, pp1-3.

¹¹ Sabatini G. et al. (2008) A review of the spiny lobster fishery in the Tolagnaro (Fort-Dauphin) region. In: Ganzhorn JU, Goodman SM, Vincelette M (Eds.) *Biodiversity, ecology and conservation of littoral ecosystems in southeastern Madagascar, Tolagnaro*. Washington DC, USA: Smithsonian Institution p. 299-308

¹² Holloway G. and Short S. (2014) Towards a more adaptive co-management of natural resources-increasing social-ecological resilience in southeast Madagascar. *Madagascar Conservation & Development*. **9**(1): 36-48.

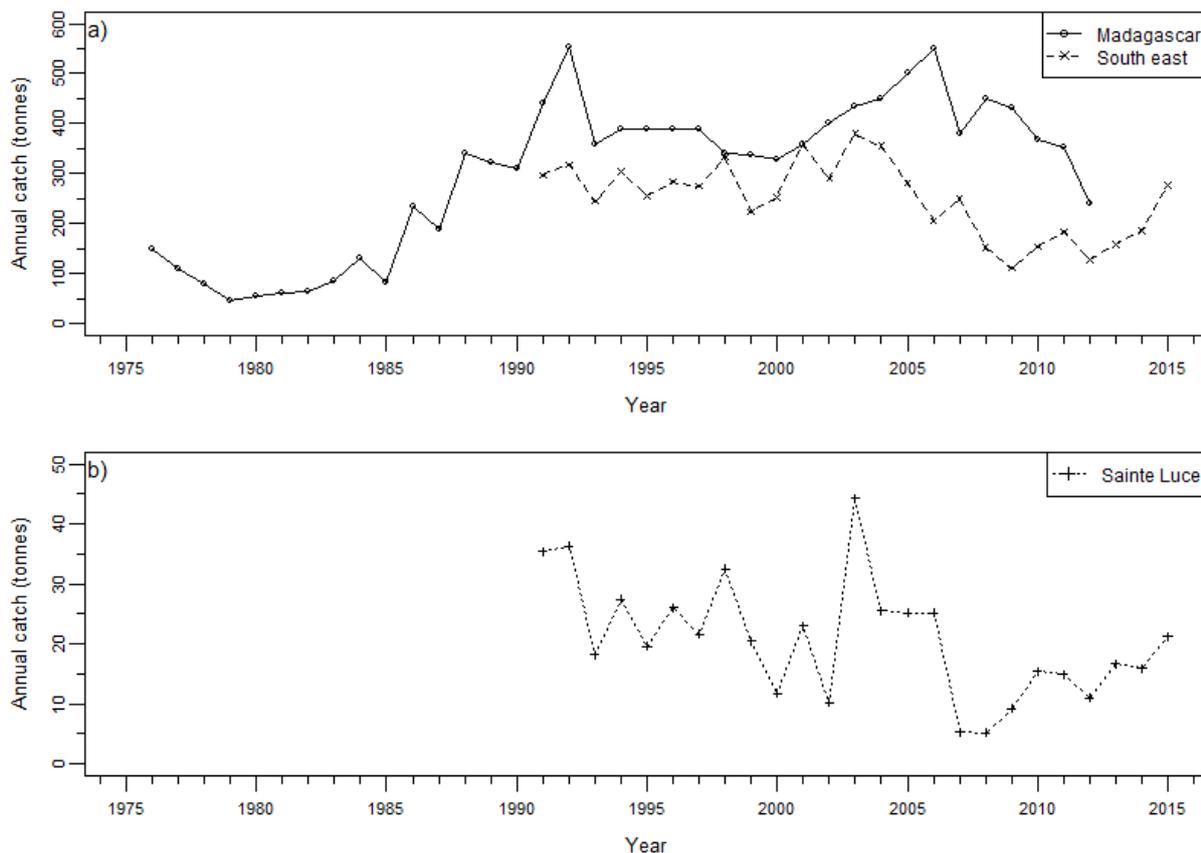


Figure 1: Long-term trends in annual lobster catch. Annual catch of lobster (tonnes) at a) a national (Madagascar), regional (south east) scale, and b) a local (Sainte Luce) scale. Data: national, FIGIS (2015); regional and local, DRRHP/URL. From: Long, in review.

growth and migration to the village, leading to an ever greater number of fishers and increased levels of effort concentrated in the fishery. The perception among local stakeholders is that Catch Per Unit Effort (CPUE) has decreased significantly over the past decade.

In response to this worsening situation, and based on perceived success seen in octopus fishery closures in southwest Madagascar^{13,14}, FAO-SmartFish consulted with the two principal lobster merchants/exporters (hereafter operators)¹⁵ in Fort Dauphin and approached SEED Madagascar (SEED). SEED has worked in Sainte Luce for over 15 years, with a track record in terrestrial conservation of the threatened southern littoral forests and sustainable livelihood programming.

In June 2013 SEED initiated a project to pilot bottom-up lobster fishery management, supported by FAO-SmartFish. The pilot phase of Project Oratsimba worked with the

¹³ Benbow S, et al. (2014) Lessons learnt from experimental temporary octopus fishing closures in south-west Madagascar: benefits of concurrent closures. *African Journal of Marine Science*. **36**(1):31-7.

¹⁴ Oliver T.A. et al. (2015) Positive Catch & Economic Benefits of Periodic Octopus Fishery Closures: Do Effective, Narrowly Targeted Actions Catalyze 'Broader Management? *PLoS ONE*, **10**(6).

¹⁵ Madapêche and Martin Pêcheur.

community of Sainte Luce to establish sustainable, community-based fishery management. This included forming the Riaky Committee, a body of 15 elected local fishers responsible for fishery management. Local management measures were developed by community consensus and prescribed by a *dina* (customary local law) and were designed to complement existing national law (table 1). This included the implementation of a short (< 1 year) time-area closures or periodic No Take Zone (NTZ), similar to those employed in octopus fisheries on the west coast.

Table 1: Management measures in the Sainte Luce lobster fishery, Madagascar. As dictated by *dina* (customary local law) and *lalana* (national legislation). An 'X' indicates the measure is specified by this form of legislation.

Measure	Detail	<i>Dina</i>	<i>Lalana</i>
No Take Zone (NTZ)	13 km ² area (fig. 2) closed to lobster fishing for the majority of the year	X	
Minimum Landing Size (MLS)	200 mm	X	X
Landing restriction	Landing or sale of berried females	X	X
Gear restrictions	Snorkelling/diving equipment prohibited	X	
National closed season	1 st October to 31 st December inclusive		X

The NTZ was first opened to fishing on 01 August 2014. The perception of the community was that lobster catches were greatly increased during this two-month period, which was supported by increased landings reported by Unité de Recherche Langoustière (URL). A key objective of Phase II was therefore to conduct a statistically robust participatory fishery monitoring programme to assess this prevailing perception. The NTZ opening during this pilot phase had significant impacts on the neighbouring communities of Elodrato and Itapera, increasing the appetite for fishery management and resulting in the establishment of a trial NTZ in Elodrato for a portion of the 2015 lobster fishing season.

3. Purpose

Significant enthusiasm for the project from Sainte Luce and neighbouring communities and promising results from the pilot phase encouraged SEED and FAO-SmartFish to initiate a second phase of Project Oratsimba in October 2014.

3.1. Project Aim

Phase II, initially 18 months and extended to 22 months, aimed to develop a replicable model for sustainable community fishery management. This entailed establishing Sainte Luce as a Locally Managed Marine Area (LMMA) through building the capacity of governance structures for community management, informed and assessed by a participatory fishery monitoring programme.

3.1.1. Specific objectives

Specific objectives and responsibilities are outlined here and can be found in detail in Annex B:

- Recruit and train project staff
- Build the capacity of the Sainte Luce Riaky committee to lead community-based fishery management.
- Support replication in neighbouring communities
- Development of the Sainte Luce *dina*, including community awareness and compliance, legal status and enforcement
- Regular stakeholder meetings to develop engagement and promote cooperation between community, private sector and state authorities
- Conduct scientific research to inform and assess community management
- Support community to hold events to promote the project and community-based fishery management
- Ensure longevity of the action and enable scale up through; production and distribution of IEC (information, Education and Communication) materials, identifying mechanisms for financial sustainability of the Riaky Committee and supporting initiatives and partnership with the private sector
- Replace buoys demarking the NTZ(s)

4. Project Description

4.1. Outputs and Activities

4.1.1. Project initiation

Despite a funding hiatus prior to the start of Phase II, the community of Sainte Luce remained enthusiastic for the project and responded well to meetings re-introducing Project Oratsimba, its goals and approaches. After signing the Letter of Agreement (LoA) with FAO-SmartFish on 21 October 2014, efforts were primarily focused on recruiting the necessary staff to implement and manage the project. The Research Coordinator joined SEED at the beginning of January 2015 and received training appropriate to the role. A decision was also taken to recruit a local staff member in Sainte Luce, whose primary role was to undertake participatory data collection under the guidance of the Research Coordinator, as well as providing translation and community liaison. This appointment has been an extremely valuable opportunity for SEED to build the capacity of a non-fisher community member, and significant progression has been seen in terms of English language capability and understanding of scientific research methodologies. It has been determined that in a future phase this staff member would have the skills and knowledge to lead the training of additional community data collectors in Elodrato and Itapera.

Outputs:

- ✓ Core project staff members recruited and trained;
- ✓ Successful re-introduction of the project to the community of Sainte Luce

4.1.2. Capacity building of the Sainte Luce Riaky Committee: Development of Community Governance Structures

Phase II has worked to build the capacity of the Sainte Luce Riaky Committee as the primary body responsible for governing and overseeing community-based fishery management in Sainte Luce. A series of training sessions held at the start of Phase II focused on effective management of the Sainte Luce NTZ, ensuring the cooperation of local fishers and enforcing the *dina*. Initial meetings were held to confirm the rules of the Riaky Committee, as outlined in their terms of reference, and establish a memorandum of understanding between SEED and the Riaky Committee (including discussion of management compensation payments to the Riaky Committee). SEED also provided training on community meeting facilitation, patrol procedures, *dina* requirements, enforcing the *dina* and administering fines when appropriate. The Riaky Committee were encouraged to disseminate information to their fellow fishers so they could understand the importance of sustainably managing their natural resources and respect the *dina*.



Riaky Committee member holding locked box for *dina* penalties

During 2015, financial training sessions took place to ensure transparent management of management compensation payments and their equitable distribution by the Riaky Committee. In November 2016, a triple lock box system was introduced to the Riaky Committee, to increase financial transparency in the collection and storage of fines for *dina* infractions. The system, which requires three key holders to be present to open the treasury box, is also designed to increase community trust and promote accountability for the use of monies recovered from penalties. Further training was delivered to ensure the support and understanding of Committee members of the new system.

The Riaky Committee has demonstrated improved capacity in evidence-based decision making at the community level, despite a series of challenges related to fishery governance during the second year of the project. In October 2015, sea cucumber buyers arrived in the community approaching the Riaky Committee for permission to buy sea cucumbers from the Sainte Luce LMMA. The Riaky Committee made a community needs-centred decision that sea cucumbers could only be purchased during the three-month national closed season for lobster. This decision, supported by the local community, allowed fishers to supplement their income during periods of greater economic hardship. The Riaky Committee also determined that buyers should cease operations in January to prevent over-exploitation of the sea cucumber stock. While representing an important effort for sustainable diversification of marine livelihoods, national legislation has banned the capture of wild sea cucumbers as of April 2016¹⁶. Despite this, the interaction shows the responsiveness of the Riaky Committee to community needs, and its commitment to sustainable fishery management.

Successful enforcement of the NTZ by the Riaky Committee was seen at the start the start of the 2016 lobster fishing season in January. A small number of fishers set pots in the NTZ, in contravention of the *dina*, and ignored the Riaky Committee's initial requests to remove them. The Riaky Committee responded by contacting the Director of *Direction Régionale des Ressources Halieutiques et de la Pêche* (DRRHP) who visited Sainte Luce and reprimanded the individuals, resulting in the removal of the pots from the NTZ. Fines were subsequently recovered; in one case it was necessary to expedite this by resorting to the Gendarmerie, who, at the request of the Riaky Committee and Chef

¹⁶ MRHP (2016) Arrêté No. 10772/16 Portant suspension de toutes activités sur l'exploitation des tréphants (holothurie, concombre de mer, bêche de mer).

Fokontany, incarcerated the offending individual until a fine payment schedule was agreed. The event showed the willingness and capability of the Riaky Committee to escalate issues where necessary to ensure effective enforcement, whilst also highlighting that the community management model has the active support of government authorities. While the enforcement of fines remains challenging, community knowledge of the *dina* is now strong. Through support from the Gendarmerie and DRRHP, the few infringements of the NTZ are now increasingly successfully penalised in a timely manner (see 4.1.4 for more detail).

Adaptive, evidence-based fishery management was evident through the fishers' decision to increase the area of NTZ from approximately 10km² to 13km² in November 2014 in order to capitalise on the perceived benefits from the first phase. In March 2016, the Riaky Committee responded to community requests to open the NTZ twice per year, April-May and August-September. There were a number of ecological and socio-economic reasons for this, including:

- The period April-May is recognised as the optimum time for lobster fishing, as the two key lobster species are less likely to be bearing eggs (as determined by SEED and URL data); this affords maximum protection to breeding females in the NTZ during the spawning peaks
- August and September are the windiest months, with the roughest sea conditions making fishing far from shore risky, the NTZ thus offers comparatively safe fishing
- School fees have to be paid at the beginning of October



Sea cucumber catch being dried

A community meeting was held, attended by fishers, middlemen, the Riaky Committee, a representative from DRRHP, Chef de Poste of the Mahatalaky Gendarmerie, Chef Fokontany and a representative from URL. The meeting resulted in agreement of two NTZ opening periods, April-May and August-September, with the remaining eight months each year as closed periods. The outcome represented a true achievement in adaptive community-based fishery management, balancing immediate community need with long-term objectives, utilising participatory fishery monitoring data. The involvement and support of state representatives and local stakeholders also served to strengthen acceptance and enforcement of the change. The NTZ opened as planned on 01 April and successfully closed on 01 June. In July, the Riaky Committee was also seen to effectively respond to community rumours of an earlier second opening. Committee members

visited fishers using a door-to-door approach to ensure all fishers were aware of the 01 August opening.

Outputs:

- ✓ Capacity building sessions conducted with the 15 member Sainte Luce Riaky Committee
- ✓ Riaky Committee utilising triple lock box system for secure, transparent management of monies
- ✓ Riaky Committee overseeing fisheries management, including information sharing with community and liaising with private sector and regulatory stakeholders
- ✓ NTZ in Sainte Luce revised to two openings per year, in line with community need and fishery data

4.1.3. Integration of the neighbouring community of Elodrato and Itapera into Project Oratsimba

The spiny lobsters which account for the vast majority of annual catch, have a long (>6 month) pelagic, planktonic stage of their lifecycle, resulting in dispersal on large spatial scales. Consequently, the lobsters exploited in Sainte Luce, Elodrato and Itapera should be regarded as part of, and reproductive contributors to, the regional population. This means effective and replicable regional scale up is crucial to sustaining depleted populations and ensuring the long-term sustainability of the lobster fishery. The commitment to sustainable fishery management seen in the two communities neighbouring Sainte Luce, and the demonstrated ease of informal replication, show significant promise for regional replication of community fishery management.

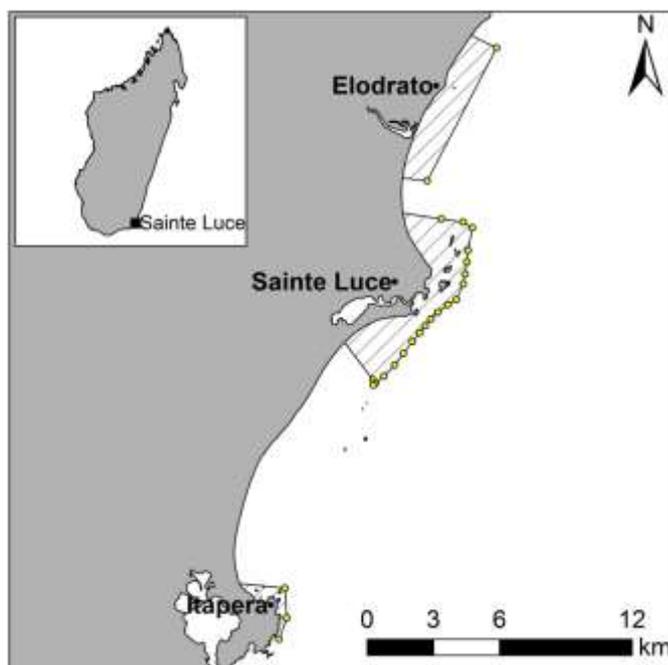


Figure 2: Map of NTZs of Elodrato, Sainte Luce and Itapera. NTZs are shown (hashed areas), as determined by buoys (yellow dots) dropped in 2015 and 2016.

During development of Project Oratsimba Phase II, SEED staff learned that the village of Elodrato – situated about 6 km north of Sainte Luce – was interested in being involved in the project and establishing an NTZ. Between initial project development (August 2014) and the first meeting with SEED (November 2014), the approximately 250 fishermen of Elodrato had elected their own Riaky Committee of 20 people and created their own NTZ, which they planned to close from January to April 2015. The community estimated that this pilot NTZ was 30km². Community members in Elodrato were initially mistrustful of outside help and eager to self-manage their NTZ

pilot, at least until the first opening in April 2015.

SEED project staff therefore took the decision to provide support to Elodrato only to the extent requested by the community. After several further meetings, it was agreed that SEED would assist Elodrato in mapping out the NTZ, both physically with buoys and with a Global Positioning System (GPS). After an independent trial in 2015, Elodrato requested more formal support for operating the NTZ in 2016. The mapping and demarcation of the NTZ was completed in April 2016, determining the area to be 11km², and the NTZ opened as planned on 01 April 2016. Project staff visited the community following the opening, and whilst no formal catch data is available, community perception indicated that catches had increased significantly during the opening period.

The team also assessed the possibility of extending the project south of Sainte Luce, to the village of Itapera. A village-wide meeting was held in November 2015, during which Itapera demonstrated significant interest in creating an NTZ. The community had had a past negative experiences with a fishery management intervention¹⁷ but were enthused by the successes achieved they had seen in Sainte Luce and were keen to replicate this model.

The community of Itapera was motivated to operate an NTZ from January 2016, and SEED assisted with mapping this, both physically with buoys and using GPS. However, the NTZ originally mapped by the community was later felt to be too small an area by some community members. The community hopes to meet to discuss this within the coming months and open a universally agreed NTZ for the 2017 fishing season. The community reported that the current NTZ remained closed from January to April 2016 (opening to fishing in May 2016) and is adhered to by the community.



Presidents of the Sainte Luce and Elodrato Riaky Committees shake hands at meeting of two communities

In November of 2016, SmartFish Consultant Michel de San conducted a site visit, during which time a meeting was held in Sainte Luce, with community members of both Elodrato and Itapera in attendance. Through this meeting key collective objectives were determined, including the potential for increased collective bargaining power to strengthen price negotiations with the private sector, and a long-term commitment to

¹⁷ Part of the Project Pôles Intégrés de Croissance (PIC).

the sharing of learning best practice through cross visits. Representatives of all three communities have subsequently been invited to and attended stakeholder meetings held in Fort Dauphin.

Outputs:

- ✓ Four meetings held between the community of Elodrato and the Project Oratsimba team (including two meetings with SmartFish consultant Michel de San and one with consultant Man Wai Rabenevanana)
- ✓ Demarcation of NTZ in Elodrato and Itapera, including both buoys and GPS mapping
- ✓ One meeting held with key members of all three communities
- ✓ Integration of Elodrato and Itapera Riaky Committees into stakeholder meetings

4.1.4. Development and implementation of the Sainte Luce *dina*

Since the initiation of Phase II, SEED project staff and the Riaky Committee have been working towards the ratification of the Sainte Luce *dina* by the regional Tribunal in Fort Dauphin. A series of issues – including wage disputes and other grievances, culminating in the Tribunal striking during March 2015 and for three months during 2016 – has meant that the *dina* has yet to be formally ratified. The Head of Environment of implementing partner ONG Azafady is in regular contact with the President of the Tribunal, in order to follow the developments of these issues. Following the end of the strike in 2016, the Sainte Luce *dina* application was resubmitted to the Tribunal. However, in addition to the documents already submitted, the Tribunal requested submission of the decree numbers for all relevant legislation pertaining to lobster fishing. Mr C. Razafimandimby, the former Director of DRRHP, now Director General of the Ministère des Ressources Halieutiques et de la Pêche (MRHP) in Antananarivo – with whom SEED collaborated for much of Phase II – is preparing these documents at the time of writing. It is anticipated that these will facilitate swift ratification.

Whilst formal ratification is a necessary step to giving the *dina de jure* legal status, ensuring that fines can be legally enforced above community-level, the community of Sainte Luce continues to exhibit strong acceptance of the NTZ measure. Monitoring data from project staff and feedback from Riaky Committee indicates that almost all fishers are respecting the NTZ in Sainte Luce, with infractions becoming increasingly infrequent over time. In the few instances of NTZ infringement, the issue has been resolved at the community level, or the Riaky Committee has effectively escalated concerns to either DRRHP or the Gendarmerie. Both state bodies have become increasingly responsive to requests for assistance from the Riaky Committee, providing a further external enforcement mechanism to reduce community conflict and promote increased compliance of *dina* measures. A series of radio messages were broadcast twice daily for one week in February 2015 to promote increased awareness of the regulations outlined in the *dina*. Signboards were also placed in each of the three target *fokontany* to inform community of *dina* measures.

Despite high compliance with the NTZ, compliance with the Minimum Landing Size (MLS) of >200 mm and the prohibition on landing berried (egg bearing) females, as prescribed

by the *dina*, remains low. Research conducted by the Project Oratsimba Research Coordinator (see activity 4.1.5), indicated as much as 42.8% of the lobster catch in 2015 was undersized, with lobsters smaller than 120 mm being sold on the beach. Lower compliance predominantly results from economic necessity. Fishers living in chronic poverty are under significant economic pressure to land berried females or undersized lobsters. Rigorous enforcement of the *dina* would have significant impacts on fishers' incomes, financially punishing those in an already impoverished community. This underlines the importance of increasing prices at the bottom of the value chain as a necessary precondition to the adoption of sustainable behaviours. The NTZ has now been shown to be a successful mechanism for achieving this, paving the way for further work.

Fishers living a hand-to-mouth existence, below the national poverty line, are far less able to adopt sustainable practices, such as returning undersized lobsters. While national law dictates an MLS of 200 mm this is infrequently adhered to, in particular as the private sector continues to purchase lobsters of this size. Therefore a focus of activities during the second project has been enforcing and gradually increasing a *de facto* MLS at the local level. This started at 160 mm in 2016 and is intended to reach 180-200 mm by 2017. During a visit to Sainte Luce during the NTZ opening in April 2016, a DRRHP representative affirmed acceptance of the *de facto* MLS, stating that the DRRHP would no longer allow the sale of lobsters below 160 mm.

Whilst this represents a significant achievement, subsequent monitoring data has revealed the ruling has not been enforced. Fishers have continued to land lobsters below 160 mm, both for local consumption and for sale to *rabbateurs*¹⁸. The creation of a two-tiered price system, whereby non-berried lobsters above the MLS return a significantly higher price per kilogram, may represent a socio-economically viable approach to increasing *dina* compliance and ensuring the long-term sustainability of the fishery.

Phase II has also made significant efforts towards engaging the private sector to make sustainable behaviours economically feasible, increasing adherence to the *dina*. The private sector acknowledges the need for sustainable management of lobster populations to protect their profits long term, and as such, private sector actors have been active participants to date. Discussions on value chain transformation have occurred at stakeholder meetings including no longer purchasing lobsters smaller than 160 mm, and increasing price for catch to compensate for sustainable behaviours. These conversations have been met with some resistance, however this is generally acknowledged by all private sector parties as a crucial step towards sustainability.

Outputs:

- ✓ Twice daily radio messages broadcast regionally for one week, and one meeting held with the fishermen of Elodrato to enforce the Sainte Luce *dina*
- ✓ Increased enforcement of *dina* by external regulatory bodies, including support from the Gendarmerie and DRRHP at the community level

¹⁸ *Rabbateurs* work for middlemen buying lobsters from fishers on the beach. This is the first point of sale in the value chain.

- ✓ Gradual introduction of tolerated MLS >160 mm, creating a two-tier price system for lobster
- ✓ Documents prepared to support application for *dina* ratification

4.1.5. Participatory Fishery Monitoring

To inform and assess Project Oratsimba an ongoing participatory monitoring programme was developed and implemented by the Research Coordinator. Data collection will continue until the end of September 2016, beyond the life of Project Oratsimba, to ensure two full years of fishery data. The results of this work have enabled SEED and the community of Sainte Luce to verify the impacts of the NTZ closure and other initiatives under Project Oratsimba.

Methodology

January 2015 was used for methodological development after which monitoring was undertaken throughout the national lobster fishing seasons of 2015 and 2016 (January to September, inclusive). Data was collected by a member of the Sainte Luce community (assisted by international volunteers) following training and initial supervision.

Monitoring consists of two survey types. The catch/effort survey elucidates trends in catch and Catch Per Unit Effort (CPUE), the methodology was adapted from Stamatopoulos^{19,20} and summarised in Annex D. The catch composition survey provides details of species and size class composition of catch.

Results

A full analysis of the data collected from the 2015 lobster fishing season is given by Long²¹. Data from the 2015 season will be freely available to the public via an online data repository (DRYAD) upon acceptance. A summary of those findings, supplemented by additional data from January to May 2016 inclusive, is given here.

There was statistically significant variation in CPUE between months, with periods of NTZ opening yielding the highest CPUE (fig. 3). In the 2015 season, the observed variation in CPUE (fig. 3 and table 2) and effort accounts for the differences in estimated catch between months, with July 2015 (the opening month of the NTZ) having the highest estimated catch of 4,593 kg (table 2).

¹⁹ Stamatopoulos, C. (2002) Sample-based fishery surveys: A technical handbook. FAO Fisheries Technical Paper. No. 425. Rome, FAO.

²⁰ Stamatopoulos, C (2004) Safety in Sampling: Methodological Notes. FAO Fisheries Technical Paper. No454. Rome FAO.

²¹ Long, S. (2016, in review) Short-term impacts and value of a periodic No Take Zone (NTZ) in a community-managed small-scale lobster fishery, Madagascar. *PLoS ONE*

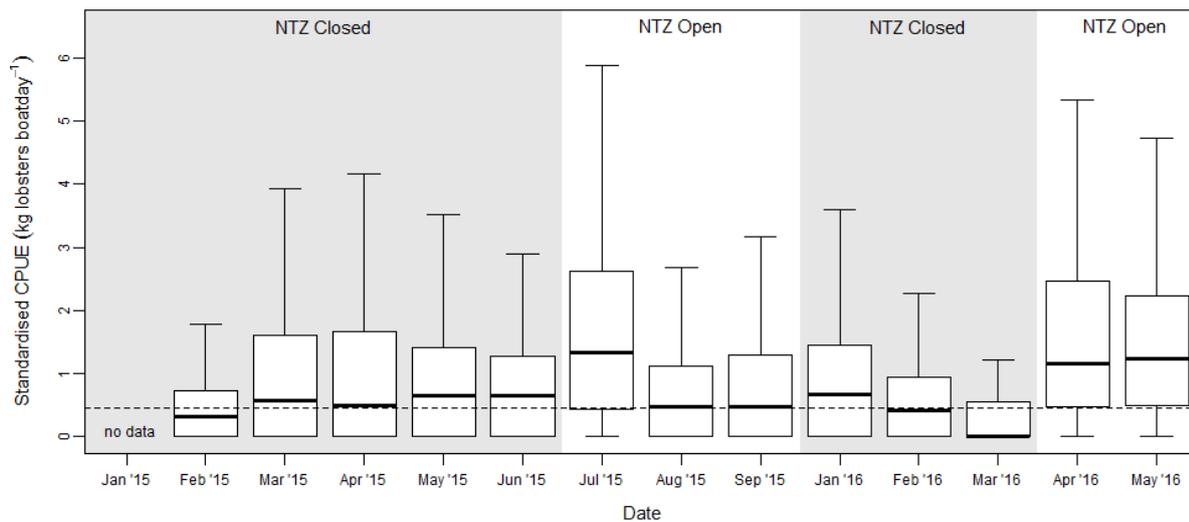


Figure 3: Variation in CPUE. Box plot showing standardised Catch Per Unit Effort (CPUE) (kg lobster boatday⁻¹) in relation to the No Take Zone (NTZ). Data was collected throughout the 2015 season and from January to May 2016, inclusive. No data was gathered during January 2015 or the national closed season (October to December, inclusive). CPUE was standardised to the mean number of pots used per boat for the entire survey period, 20.1 pots (sd = 11.9, n = 3470). Periods of NTZ closure (grey background) and NTZ opening (white background) are indicated. For clarity outliers are not shown. For reference the median standardised CPUE for periods of NTZ closure 0.46 kg lobsters boatday⁻¹ (IQR = 0 – 1.13, n = 1329) is shown. (dashed line). Adapted from: Long, in review. Additional data from January to May 2016 has been included.

Table 2: Landings in 2015. Estimated total landings for 2015 disaggregated by month for the Sainte Luce lobster fishery, Madagascar. Calculated from catch/effort survey occasions in 2015 (n=120). Estimated value for each month was determined by multiplying the estimated catch by the price received at the point of first sale, when fishers sell catch to *rabbateurs/collecteurs*. Adapted from: Long, in review.

Month	CPUE (kg boatday ⁻¹)	Estimated catch (kg)	Price (MGA kg ⁻¹)	Estimated value (MGA)
January	-	1,015*	15,000	15,230,654
February	0.86	1,255	15,000	18,830,197
March	0.77	775	15,000	11,631,111
April	1.07	1,580	15,000	23,696,567
May	1.02	536	15,000	8,039,411
June	0.58	149	15,000	2,240,704
July	2.24	4,593	20,000	91,865,265
August	0.78	1,531	20,000	30,629,189
September	0.53	554	20,000	11,081,059
2015 season		11,990	-	213,245,089

*No data was collected in January; the estimate is the mean of the estimated landings for February and March.

The size class composition of the catch indicates that 42.8% of lobsters sampled (n=1915) were below the MLS (Annex D, Fig. AI).

A total of seven lobster species were identified, composed of four spiny lobster species (*Panulirus homarus*, *P. longipes*, *P. ornatus*, *P. penicillatus*) and three slipper lobster species (*Scyllarides squammosus*, *Parribus antarcticus* and *Arctides regalis*). The identification of *A. regalis* of which only three individuals were encountered, is provisional. Additionally, *P. versicolor* was observed on one occasion, though not as part of a formal survey.

P. longipes and *P. homarus* dominate the catch with *P. longipes* more prevalent during NTZ closures, and *P. homarus* more prevalent July to September, the period of NTZ opening (Appendix II, Fig. A2). The observed sex ratio of *P. homarus* and *P. longipes* in catch during the 2015 season was close to 1:1 (*P. homarus*, 53.1% female) and (*P. longipes*, 52.4% female). The proportion of females (*P. homarus* and *P. longipes*) in the catch which were carrying eggs varied between months (Appendix II, Fig. A3).

Discussion

In the 2015 season the largest estimated catch for any month was in July following NTZ opening with an estimated 4,593 kg landed (table 2). This is a 435% increase on the mean for the preceding 5 months, resulting from the combined effects of higher CPUE effort and effort. There was a 260% increase in CPUE on the mean for the preceding 5 months and a 118% increase in the number of boatdays. This latter increase occurs as fishers anticipate higher catches and thus expend a greater level of effort. In 2015 the effect was short lived with effort, CPUE and landings returning to typical levels in August and September (fig. 3 and table 2). In the April-May NTZ opening of 2016, the CPUE was again higher than the median for the periods of NTZ closure in 2015 and 2016 (fig. 3). It remains to be seen whether the August-September 2016 NTZ yields higher CPUE than closure periods.

The duration of NTZ closures is relatively short compared with the lifecycle of the target lobster species. Therefore, it seems highly unlikely that the closures have resulted in local lobster population increases, especially given the Sainte Luce NTZ is only in its third year of operation. The increased CPUE (compared with fishing outside the NTZ) was observed in both the number and weight of lobster, thus cannot be accounted for by an increase in the size of lobsters²². It would appear that higher CPUE is simply the result of concentration of effort (in time and space) in a productive area of the fishery. It is important to recognise that whilst ecological benefits on management measures may take several years to accrue, and may be spread over a wider area, there were significant value chain impacts of NTZ closures. Specifically, concentrating catch in short periods of the year promoted inter-merchant competition, resulting in a >33% increase in the price fishers receive for their catch. This is a crucial step in making it economically

²² Long, S. (2016, in review) Short-term impacts and value of a periodic No Take Zone (NTZ) in a community-managed small-scale lobster fishery, Madagascar. *PLoS ONE*

feasible for fishers to adopt other sustainable behaviours (e.g. returning berried females and undersize individuals).

Dominance of *P. homarus* during NTZ openings is accounted for by its preference for shallow inshore water. This highlights how NTZ design may preferentially favour one species over another, in this case affording greater protection to *P. homarus*. This should be considered by communities and NGOs in the future when designing NTZs for lobsters.

Outputs:

- ✓ Eight months of participatory fishery data collected in 2015
- ✓ Seven months of participatory fishery data collected in 2016, with 2 more to be completed before end of fishing season
- ✓ One paper disseminating findings in peer-review

4.1.6. Stakeholder liaison: Meet with relevant stakeholders on a quarterly basis to establish collaborations and share lessons learned

Stakeholder meetings have been crucial to the success of Phase II, bringing together key actors from the community (Riaky Committees of all three villages), the state (DRRHP, the Gendarmerie and URL) and the private sector (GOLDS, Madapêche, Martin Pêcheur). Four stakeholder meetings were conducted during Phase II; each was perceived to be extremely productive, providing a platform for stakeholders to share concerns, identify common objectives and plan coordinated action towards sustainable fishery management. Unfortunately, it was not possible to hold meetings on a quarterly basis as originally proposed due to logistical difficulties in finding a date and time to suit all parties. This was particularly challenging as stakeholder meetings without all parties in attendance, or without the authoritative leaders of stakeholder groups, were observed to have less impact.



Information sharing at a stakeholder meeting in 2016

Stakeholder collaboration led to increased awareness amongst private sector actors of the role of pricing mechanisms in securing the sustainability of the fishery. The ability of fishers to negotiate and secure a fair price for lobster is critical to making it economically viable for fishers to adhere to fishery management measures prescribed by the *dina* and national law. Data presented and discussions held at stakeholder meetings were instrumental in enabling fishers to obtain a 33% price increase per kilogram.

Ongoing stakeholder engagement has also proven crucial in securing in-kind donations from local eco-hotel Manafiafy Beach and Rainforest Lodge. This has included the sharing of 4x4 transport for staff travelling to and from the field and the use of a motorboat to support the dropping of buoys in Elodrato, Itapera and Sainte Luce.

Beyond collaboration with stakeholders at a local level, a key development in Phase II has been the participation of Sainte Luce in *MItantana HAreNA and Ranomasina avy eny Ifotony* (MIHARI), Madagascar's national LMMA network. The MIHARI network provides a platform for sharing information, learning and best practice on sustainable fishery management across Madagascar. SEED has attended, and presented at MIHARI regional and national forums, and assisted in coordination meetings for the southern region.

Through participation in MIHARI during Phase II, fishers from Saint Luce developed links and a sense of solidarity with other LMMAs, which is crucial given the remote and isolated nature of many fishing communities. Fishers also took away best-practice learning, such as the separation of enforcement from other management activities, and developed increased motivation for sustainable marine resource management. Members of the Sainte Luce Riaky Committee also became more aware of the underrepresentation of the Anosy region in MIHARI platforms. This inspired them to increase awareness of marine management amongst other communities, and played a direct role in Sainte Luce's desire to work in a collaborative capacity with Eldorato and Itapera during Phase II.



A Riaky Committee member in the official T-shirt for the MIHARI platform in 2015

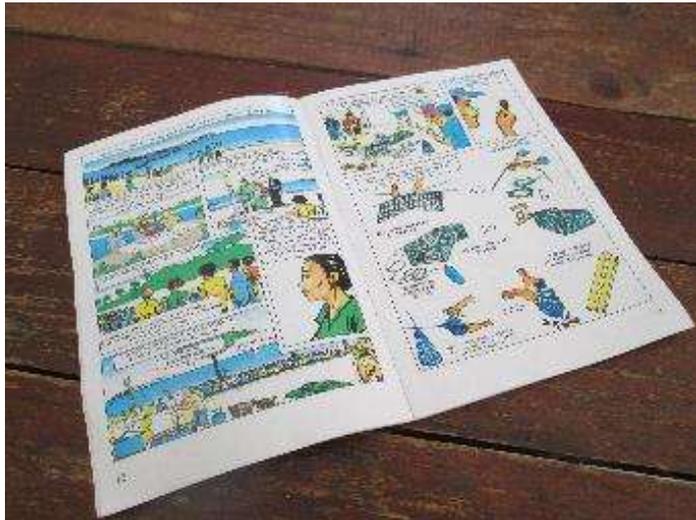
Project Oratsimba's development and implementation has been directly informed by learnings from MIHARI, adapted to fit with the local context. This has included learnings on financial management strategies, technical approaches, and advice on liaison with state authorities.

Outputs:

- ✓ Four Stakeholder meetings held with key stakeholders
- ✓ One regional LMMA network forum attended by two fishers, with a second to be attended in August 2016
- ✓ One national LMMA network forum attended by fishers and project staff
- ✓ One research poster presented at national LMMA network forum

4.1.7. Ensure longevity and scale-up: Develop and produce relevant IEC (Information, Education, and Communication) materials to underpin project activities.

During project development, it was proposed that a lobster nursery could be physically constructed in the bay of Sainte Luce for the release of undersized lobster and berried females. This activity was included in the subsequent LoA and budget however, following project initiation, SEED determined that this was not feasible due to technical challenges and prohibitive costs.



A printed copy of the educational cartoon booklet

After consultation with SmartFish, it was decided to reallocate funding towards the design and production of educational cartoon books for children, based on a model trialled by SmartFish and proven to be particularly effective in northern Madagascar. Funding supported a site visit for a Malagasy educational practitioner, with previous experience compiling educational materials of this nature, who then created a 20-page full colour cartoon booklet for children on sustainable fishery

management. As the next generation of fishers, it is critical for children to understand the rationale and methodology of fishery management to ensure the sustainability of the fishery. Children are also effective disseminators of information at the household level sharing messages with the wider family, including fishers.

Two channels were identified for the distribution of cartoon booklets: Year 4 and 5 classes in public schools in Sainte Luce and in Ebakika, a village adjacent to Elodrato, and Itapera; and Club Atsatsaky, a weekly environmental club held in Sainte Luce which provides regular education on conservation issues relevant to the local environment. Club Atsatsaky is free to attend and is therefore able to reach children unable to attend school. Targeting children both within and outside of schools ensures high visibility of the cartoon booklet and enabled the project to reach young people of all ages and backgrounds.



Children with informational cartoon booklet on sustainable fishery management

Following production of the booklet, meetings were held with Chef ZAPs (Zones d'Animation Pédagogiques) from the Mahatalaky and Mandromodromotra communes.

The key messages of the booklet were outlined and it was agreed Chef ZAPs would train local teachers to deliver the age appropriate lessons to Year 4 and 5 students on the cartoon booklet. Booklets were distributed in six schools. In some communities in Mahatalaky, booklets were distributed directly to students rather than to schools, owing to teacher preferences to only use material directly relevant to national examinations. This was an unfortunate outcome for the project as children did not receive the formal lesson on the key messages of the booklet, however SEED recognises the underlying teacher motivation in wanting to achieve high examination results.



Club Atsatsaky participants learning from the cartoon booklet

Monitoring data indicated the booklets were extremely popular and understanding of fishery management was high, as evidenced by quiz results. See Appendix G for quiz questions, focused on key learning objectives. In Manafiafy EPP (Sainte Luce) 78% Year 5 students passed the quiz on the topics covered, with scores in excess of 50%. In Year 4, 25% of students passed the quiz, suggesting that the material may be more appropriate for a slightly older audience. In Elodrato, 57% of Year 4 and 5 students in passed their quiz with a grade above 50%, a particularly promising result given the relatively early stages of fishery management within the community. SEED project staff faced difficulties in receiving quiz sheets back from schools at the conclusion of the school year due to the focus on end of year exams. In future initiatives, the timing of lessons should be scheduled to avoid this period. The cartoon booklet will be shared digitally with stakeholders via the MIHARI network for dissemination and

use in other LMMAs across Madagascar.

Additional IEC materials were developed to support fishers and the wider community in managing finances during periods of higher income, notably NTZ opening periods. Within Sainte Luce, financial savings mechanisms are largely non-existent, and therefore surplus income is often used immediately to pay off debts or is used on consumables. SEED designed a pictogram to promote financial saving, showing the number of lobsters required to buy items that create further revenue or social capital, such as medicine, pirogues, or *zebu* (cattle). These posters were displayed in key locations such as shops, and were also referenced during the focus groups on pirogue ownership (outlined above).

4.1.7. Events

Following the annual national lobster fishing closed period, from October – December inclusive, 01 January marks the period when the national fishing zone re-opens, but the NTZ remains closed. In 2015, SEED supported the Riaky Committee to organise a celebration, which was attended by local fishers, the Riaky Committee, representatives from SEED, DRRHP, the Chef Fokontany, the Mayor of Mahatalaky Commune and private sector actors. A series of speeches outlined the aims of Project Oratsimba and the challenges that need to be addressed by all stakeholders. This was followed by celebratory drinks and the traditional sacrifice of a *zebu*.

World Environment Day, celebrated annually on 05 June, is an important event in the community, which occurred twice during the project lifetime. Celebrations in Sainte Luce were used as an opportunity to promote and disseminate key project messages to both children and adults in a fun and engaging way, including through a community parade. Preliminary research findings were fed back to the community at the event in 2015. The international focus in 2016 was the prevention of the trade of illegal animals, therefore undersized and egg bearing lobsters were featured during the event, with children wearing lobster masks during the community parade.



Children's parade to celebrate World Environment Day 2016, including lobster costumes

Outputs:

- ✓ A one-day event held to celebrate the closure of the NTZ on January 1st 2015
- ✓ Two World Environment Day events held in 2015 and 2016, with a focus on the lobster

4.2. Communication and Visibility



**Dina informational sign board in
Manafiafy, Sainte Luce**

T-shirts and caps were provided to members of the Riaky Committee and Project Oratsimba team to increase the visibility of the project in Sainte Luce and the surrounding communities. The FAO/SmartFish and EU logo was clearly displayed to promote local awareness of the funding source. Noticeboards detailing the *dina* regulations and aims and activities of the project were erected in each hamlet of Sainte Luce, and a radio message on the *dina* was broadcast throughout the region to increase local understanding of the management measures. Throughout the project the Senior Community Liaison Officer and Research Assistant were primarily based in Sainte Luce and played a key role in disseminating information and

increasing visibility.

Feedback from project stakeholders also indicates that the project also has strong visibility amongst relevant private sector and regulatory actors in Fort Dauphin, with widespread support for the project. All outreach materials produced, including presentations delivered at stakeholder meetings, included the FAO-SmartFish and EU logos to ensure external audiences are aware of the generous support of both bodies.

4.3. Lessons Learned and Recommendations

From the outset, it was clear that project goals would only be achieved by working in close collaboration with communities. SEED has a privileged position of having worked in Sainte Luce for more than 10 years, and has built excellent relationships with the community during this time. Working with other communities, such as Elodrato and Itapera, will require extensive efforts to build strong relationships if similar levels of community support are to be generated and project results maintained in the long-term. Community liaison and engagement across multiple communities will require greater staffing resources and, as such, a larger project team would be integral to the successful scale-up and replication of Project Oratsimba.

Key to developing a replicable model is ensuring that there are limited costs to the community associated with adopting sustainable fishery management. In particular, there is a need to establish long-term financial security of the Riaky Committee. SEED continues to provide compensation for management activities; however the team is actively investigating future strategies for supporting the Riaky Committee in becoming a

financially solvent, permanent institution in Sainte Luce. Strengthening prosecution of *dina* infractions and the collection of fines will provide a long-term revenue stream to cover management costs. SEED has also explored the possibility of establishing an Association of registered fishers to introduce rights-based access to the fishery. Whilst membership would be free initially, in the long-term this has the potential to generate revenue through a small annual membership fee for registered fishers.

Monitoring from the distribution and use of IEC materials for children highlighted the importance of producing resources in local dialect, as opposed to official Malagasy, to facilitate understanding amongst children in rural villages. This is particularly important for children who do not attend school and are not exposed to the official Malagasy language. Work within schools should also be scheduled so that lessons and subsequent monitoring activities do not coincide with or interrupt national examinations.

A key barrier preventing fishers from adopting sustainable fishing behaviours is the low price that fishers receive per kilogram of lobster. Non-compliance with the MLS and prohibition of landing berried females in particular is often driven by economic necessity and the need to feed one's family. At present, exporters own most pirogues in the fishery and loan these to fisher groups on the condition that all catch will be sold back to the pirogue owner at a fixed, depressed price. This prevents fishers from negotiating on price, inhibits competition and depresses price at the bottom of the value chain. Phase II identified that fishers owning pirogues receive prices of up to 15% higher for their catch; this highlights the potential for pirogue ownership to increase both income and sustainable fishing behaviours.

Research conducted during Phase II identified that the optimal unit for the promotion of pirogue ownership is the 'fisher group', comprising four to six fishers who paddle together every day. A trial focus group held with three fisher groups (one from each hamlet in Sainte Luce) resulted in one group purchasing a pirogue with money saved during the NTZ opening. The two groups opting not to purchase a pirogue expressed strong interest, but cited a lack of competition amongst middlemen as another reason for price depression. This suggests that increasing competition among middlemen, for example by removing barriers that prevent a greater number of middlemen operating in Sainte Luce, could in turn improve fisher willingness to purchase pirogues and thus leverage higher prices at the bottom of the value chain.

There is a correlation between understanding of the Riaky Committee and wider community on fishery management theory and practice, and compliance with *dina* management measures. The NTZ is highly visible, both spatially through its location close to the shore and encompassing the landing sites, and temporally through the increase in fisher income during NTZ openings. It is apparent from Phases I and II that to rural communities, there are clear tangible benefits to implementing a NTZ. Indeed, the steep increase in income during the NTZ opening in Sainte Luce is a key reason for the informal, and subsequently supported, replication in Elodrato and Itapera. Compliance with the MLS and ban on landing of berried females remains low, as short-term economic needs often outweigh long-term sustainable goals. For this reason, it has

been suggested that any future initiatives should focus on community education to inform communities of the critical need to return undersized and berried lobsters to increase stocks and prevent fishery collapse in the long-term. This must occur alongside continued value chain transformation to make it economically feasible for fishers to adopt sustainable behaviours and comply with all management regulations.

5. Conclusion and Way Forward

Phase II of Project Oratsimba has made significant progress in developing sustainable fishery management within Sainte Luce, positively impacting on the fisher livelihoods and the regional lobster stock of the southeast coast. Compliance with the NTZ at the community level is now extremely high, and where necessary state authorities are willing to support *dina* enforcement at the community level. Through ongoing engagement with private sector stakeholders, fishers are now receiving a higher price for lobster catch, increasing their ability to adopt sustainable fishing behaviours. Looking forward, fishers are well placed to continue negotiations for more equitable prices through stakeholder meetings and increased pirogue ownership, promoting the sustainability of the fishery for generations to come.

Phase II has worked with the Sainte Luce Riaky Committee to build its capacity in leading adaptive, community-based fishery management, ensuring transparent financial processes, and overseeing *dina* enforcement. The Committee has led evidence-based decision making in the operation of the NTZ, balancing immediate community need with long-term fishery aims and fishery data on breeding. Participatory fishery monitoring in Sainte Luce, continuing to the end of the fishing year, will enable SEED to monitor catch during opening periods of the NTZ and evaluate the wider impact of project activities.

In future phases of Project Oratsimba, SEED will look to develop a regionally replicable model for sustainable fishery management, drawing on the successes and learnings of Phases I and II. This will include continued support to the villages of Elodrato and Itapera and promoting increased coordination and collaboration between the three fishing communities. Ultimately, Project Oratsimba Phase II has contributed to the FAO strategic objective to increase and improve the provision of goods and services from fisheries in a sustainable manner and represent a reform strategy for recovery of an overfished and priority fishery in the region.

4. Annexes

Annex A. Terms of Reference of the LoA

2.1 Definition of Output(s) and/or Outcome(s)

Under the overall FI FAO, general guidance of the SmartFish project Chief Technical Advisor, and in close collaboration with Technical Assistance Project to support the step by step approach for the South Madagascar lobster fishery management through **"Phase two project for community lobster fishery management in the village of Sainte Luce"**.

The Service Provider will produce, achieve or deliver the following outputs or outcomes:

Strengthen the Riaky Committee and its partnerships to develop a robust system of community-based natural resource management of the lobster industry in Sainte Luce, underpinned by scientific research monitoring the catch data, and thus the impact of the NTZ

(i) **Activities.** The Service Provider will undertake the following activities:

- Recruit, induct and train project staff;
- Capacity building of the Riaky Committee established during the pilot stage, including financial training;
- Integration in the Riaky committee members of the North closeby village of Esohihy and the cocomitent NTZ extention;
- Support the Riaky Committee to develop, monitor and evaluate progress of an annual plan for lobster management;
- Establish administration protocol for the Riaky Committee and stakeholders, including MOUs, role descriptions, per diem payments, etc.;
- Support the Riaky Committee to validate and finalise the *Dina* and to implement and enforce this throughout Sainte Luce and into neighbouring villages;
- Establish a series of meetings with the community and wider stakeholders (including private sector) to support this work and disseminate learning and long term collaboration;
- Develop procedures and frameworks for the Riaky Committee to manage and police the NTZ and extend it north to Esohihy;
- Ensure the community validation of the NTZ via robust monitoring and evaluation of lobster catches, so that the results of the second NTZ opening in August-September 2015 can be reliably indicated;
- Promote and enforce the respect of the rules set up by the Administration (LT 200 mm and the release of all gravid females into the NTZ), as far as is possible. The Service Provider will discuss and evaluate the value of having a permanent MCS agent based in Sainte Luce, according to the needs and wishes of the community;
- Investigate financial mechanisms for sustainability of the Riaky Committee;
- Develop and produce relevant IEC materials required to underpin these activities throughout the length of the project;

- Work with the community to organise all relevant celebration days;
- Devise a minimum necessary system of scientific data collection (LT, landing and gravid femelle) and analysis to disseminate the concrete result of the NTZ research, learning and results of the project;
- Identify, research and advocate for further initiatives required to stabilise the lobster industry in Sainte Luce, for example, investigation of a nursery, timing of the closure season and release of gravid females;
- Organise quarterly meetings of the steering committee with the administration, NGO, private sector, URL, and SmartFish representative.

2.2 Description of Services

The final output/products expected by the project are as follows:

The success of the project second phase in Sainte Luce through the village management approach is probably of paramount importance for the survival of the Madagascar lobster fishing industry.

This process of management of the resources by villages for the entire lobster fishery can take 10 years but a failure of Sainte Luce can stop the nascent process.

- a) In order to build up stakeholder participation, SEED has an obligation to have in Fort Dauphin a quarterly steering committee (Administration, Gold (association of industrial actors) and SEED) with a maximum one page report to be sent to SmartFish Antananarivo
- b) All minutes and summaries of reports will be sent to stakeholders in French and full reports will be available in English
- c) The final report should summarize and present a global view of the experience in order to permit the capitalization for new villages and prepare the third phase for Sainte Luce.

Documents will be submitted in English in electronic format, in Microsoft Word. They will include an executive summary, footnotes, a bibliography and a list of all acronyms used. FAO will provide comments and clearance of the documents produced within 15 days of the submission date.

2.3 Workplan and Timeframe

Please see Annex B for an updated workplan and timeframe.

2.4 Monitoring Mechanisms and Reporting Requirements

The Service Provider shall submit the following report:

1. *First Progress Financial and Narrative Report is due 30 of April 2015 (6 month after signature of the contract).*

The narrative report shall describe activities occurred during the period and contain the Products 1 to 5 (see table in the workplan and timeframe).

At this stage due to the constraints of the official extension agreement between FAO and EU the second payment of USD 18,494 (eighteen thousand four hundred and ninety four only) will be made.

2. The Final Report before terminal payment is due the 30 April 2016 (18 months after signature of the contract).

The Final narrative report is to cover all the activities foreseen under this LOA, including the village/stakeholder meeting reports.

At this stage due to the constraint of official extension agreement between FAO and EU the final payment of USD 7,398 (seven thousand three hundred and ninety eight only) will be made.

Annex B. Objectives of the LoA/Contract

The primary responsibilities of SEED under the Letter of Agreement (LoA) are as follows:

- a) Project initiation: Recruitment, induction and training of project staff including a Project Coordinator and Research Assistant.
- b) Capacity building of the Sainte Luce Riaky Committee: Provide a series of training sessions (including financial management and association organisational training), in addition to assisting the Riaky Committee to develop and implement an annual plan for lobster management in Sainte Luce.
- c) Integration of neighbouring communities into Project Oratsimba: Liaise with the northerly community of Elodrato regarding an extension of the Sainte Luce NTZ into their fishing area. In the final months of Phase II it was acknowledged that this should also be extended to the community of Itapera due to high community interest.
- d) Development and implementation of the Sainte Luce *dina*: Facilitate the process for validating the Sainte Luce *dina* and support the Riaky Committee to enforce it in Sainte Luce and neighbouring communities through management and policing of the NTZ and fishing procedures (including prohibited equipment, catch of berried/undersized lobsters etc.).
- e) Stakeholder liaison: Meet with relevant stakeholders on a quarterly basis to establish collaborations and share lessons learnt.
- f) Conduct scientific research: Compile baseline research before the opening of the NTZ and establish a robust methodology to collect data and disseminate results to indicate the impact of closing the NTZ.
- g) Support the community to organise and conduct relevant events and celebration days.
- h) Ensure longevity and scale-up: Develop and produce relevant IEC (Information, Education, and Communication) materials to underpin project activities. Investigate viable mechanisms for financially sustaining the Sainte Luce Riaky Committee, as well as investigating further initiatives for stabilising the lobster industry in Sainte Luce.

The LoA extension added the following responsibilities, as well as reaffirming commitment to the above activities:

- i) Promote the long-term sensitisation of school children through an illustrated booklet on lobster management, delivered in the schools of two villages of Sainte Luce and Elodrato
- j) Replace damaged buoys marking Sainte Luce NTZ and provide buoys to mark the outer corners of the Elodrato NTZ. In the final months of Phase II it was acknowledged that this should also be extended to Itapera due to high community interest.

Annex C. Workplan/Timeline of Activities

	Oct 14	Nov 14	Dec 14	Jan 15	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15	Dec 15	Jan 16	Feb 16	Mar 16	Apr 16	May 16	June 16	July 16
PR = Progress report; FPR = Final Progress Report							PR															FPR
Activity 1: Capacity building support to the Riaky Committee	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Product 1: Activities documented in PR and FPR							X															X
Activity 2: Agreement and definition of the VNTZ to include Esohihy		X	X	X																		
Product 2: Marking of the extended NTZ to Esohihy			X	X	X																	
Activity 3: Ratification of the <i>dina</i> and later amendment to include the NTZ extension to Esohihy		X	X	X																		
Product 3: Legally recognised <i>dina</i> for the extended VNTZ					X																	
Activity 4: Data collection of lobster landings				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Product 4: Results summary and dissemination to partners							X												X			
Activity 5: Research into release of gravid females into NTZ and enforcement					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Product 5: Results summarised and disseminated to the community								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Activity 6: Develop a methodology for data								X	X	X												

collection during the open season																						
Product 6: Written methodology in collaboration with Smartfish consultant									X	X												
Activity 7: Organising and supervising the opening of the NTZ and monitoring results throughout										X	X	X	X									X
Product 7: Report and data from NTZ opening											X	X	X	X								X
Activity 8: Quarterly stakeholder meetings		X			X			X			X			X			X					
Product 8: Minutes disseminated to stakeholders and Smartfish		X	X		X	X		X	X		X	X		X	X		X	X				
Activity 9: school sensitization in two villages																		X	X			

Legend:

	National closed season
	NTZ closed
	NTZ open

Annex D. Research methodology

The Catch/Effort survey methodology is described in detail in Long (in review), from which this summary is adapted.

Sampling is conducted approximately 15 days per month. A survey consists of visiting both landing sites (Main and Lodge) at dawn and estimating the total number of boats at sea by counting the drag marks left in the sand left from launching boats. The number of inactive boats – seaworthy boats remaining on the beach – is also counted. The data collector(s) are then stationed at one of the two landing sites until >80% of boats had returned. The number of survey days spent at each landing site per month varies to approximately represent the proportion of the fleet operating from each. This varied from month to month with the majority of boats operating from the Main beach in all months.

On days where one or more boats were active, boats were sampled on an opportunistic basis as they returned to the landing site, with the sample size always >50% of the number of estimated to have gone to sea (from the count of drag marks). For each boat sampled that had been engaged in lobster fishing the following was determined: number of fishers, number of pots checked, number of lobster caught and total weight of the catch.

Estimated Total Monthly Catch (Catch) is determined by Equation 1:

$$\text{Catch} = \text{Effort} \times \text{CPUE}$$

Where CPUE and Effort are estimated as per Equations 2 and 3. Equation 2:

$$\text{Effort} = \text{BAC} \times F \times A$$

Where:

BAC = Boat activity coefficient

F = Total number of pirogues in the fishery

A = Number of days in the month

The BAC is the probability that any given pirogue will be active on any day of the month. It can be determined by Equation 3:

$$\text{BAC} = \frac{\text{number of active pirogues}}{\text{active} + \text{inactive pirogues}}$$

Count of active and inactive pirogues is made on every survey and the average BAC is calculated for each month.

Annex E. Catch composition survey results

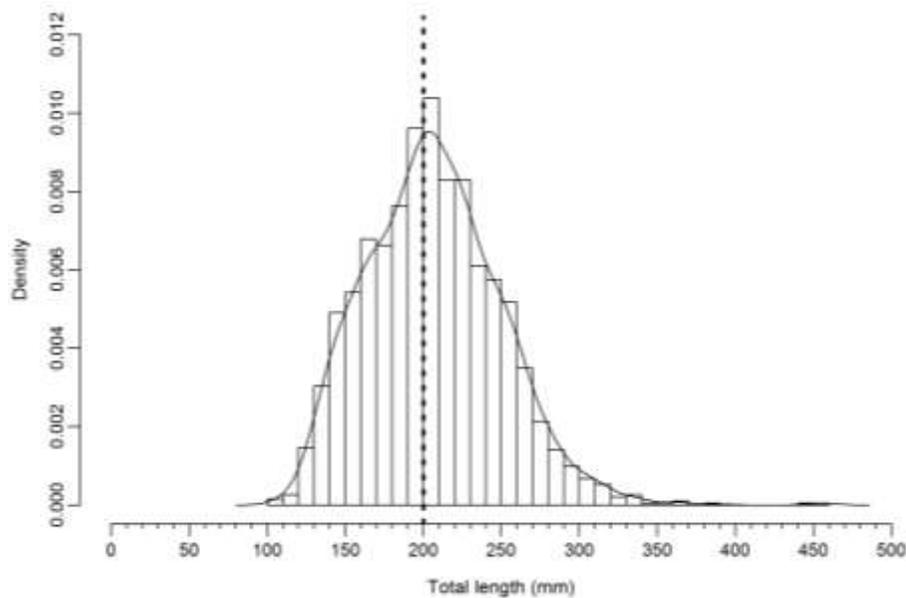


Figure A1: Size classes of lobster. Histogram of total length of lobsters of all species sampled from catch, February to September 2015 inclusive ($n = 1915$). The Minimum Landing Size (200 mm) is shown (thick dashed black line), with kernel density estimate (bandwidth = 8.565) drawn (solid black line), bin widths are 10mm. From: Long, in review.

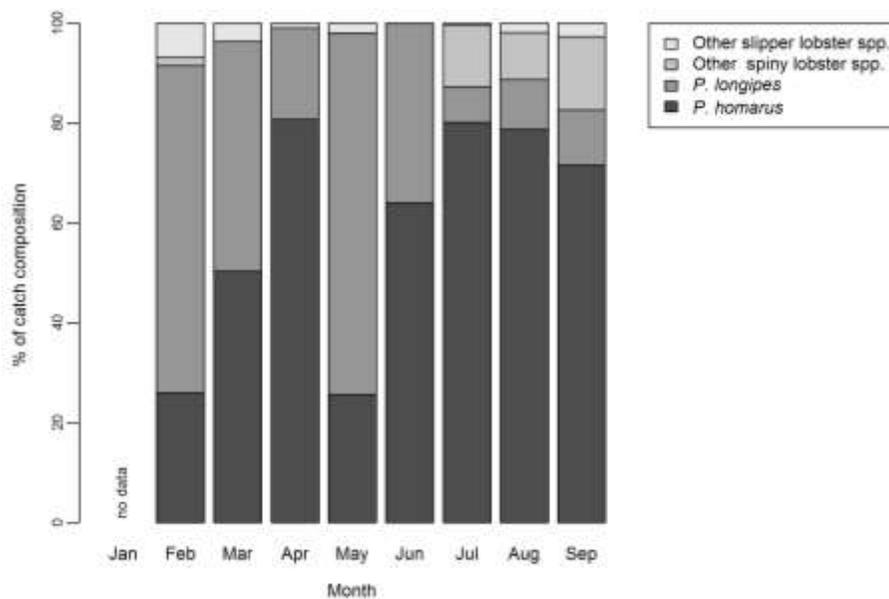


Figure A2: Variation in catch composition between months. Showing the species catch composition by month ($n=1919$). Showing dominant species, *P. homarus* and *P. longipes* with other slipper lobster species (*S. squammosus*, *P. antarcticus* and *A. regalis*) and other spiny lobster species (*P. ornatus* and *P. penicillatus*). Catch sampled February to September 2015 inclusive. From: Long, in review.

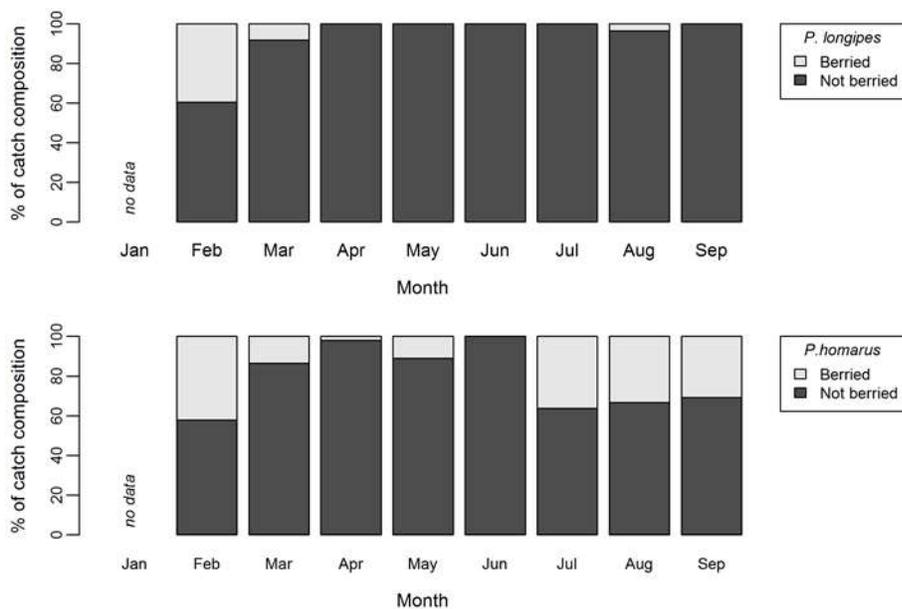


Figure A3: Variation in the proportion of berried females lobster between months. Showing the proportion of female lobsters, *P. longipes* (n = 337) and *P. homarus* (n = 593), which were berried by month. Catch sampled February to September 2015 inclusive. From: Long, in review.

Annex F. Quiz questions

A Malagasy translation of the following quiz was provided to all school students who received the booklet. In the book the Limby character's village had previously engaged in local marine management, and Izahasoa's village had just begun the process of creating an LMMA.

1. Why does Limby's family make more money?
2. In Limby's village, how big do lobster have to be to be caught?
3. In Limby's village, what do they do with lobsters that have eggs on their belly? Why?
4. What days is the no take zone closed in Limby's village?
5. Is there a no take zone in your village? What days is it closed? What day does it open?
6. When are fishermen allowed to fish for lobster in a no take zone?
7. When are they allowed to fish for fish?
8. What happens to the fisherman in the story who breaks the dina when he sets pots in the no take zone?
9. What kinds of fishing are not allowed in Limby's village?
10. What kinds of fishing are not allowed in your village?
11. Why does Limby's father say it's bad to catch a lobster with eggs?
12. What does the *lalana* say about the size of lobsters that you can catch?
13. What do you think of the man who puts lobster pots in the NTZ? Why? (an open ended question to gauge opinions)
14. Why is Izahasoa's father not sad that they only made a little money at first?
15. What do they buy for Izatasoa once they have more money?