



Securing sustainable small-scale fisheries

Showcasing applied practices in value chains,
post-harvest operations and trade



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Edited by

Joseph Zelasney

Fishery Officer

FAO Fisheries and Aquaculture Department

Rome, Italy

Alexander Ford

Small-scale Fisheries Consultant

FAO Fisheries and Aquaculture Department

Rome, Italy

Lena Westlund

International Fisheries Analyst

FAO Fisheries and Aquaculture Department

Rome, Italy

Ansen Ward

Post-harvest loss and fish value specialist

FAO Fisheries and Aquaculture Department

Rome, Italy

and

Omar Riego Peñarubia

Fishery Officer

FAO Fisheries and Aquaculture Department

Rome, Italy

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Preparation of this document

This FAO technical paper on *Securing sustainable small-scale fisheries: showcasing applied practices in value chains, post-harvest operations and trade* was prepared under the auspices of the FAO Umbrella Programme for the Promotion and Application of the SSF Guidelines – Enhancing the Contribution of Small-Scale Fisheries to Food Security and Sustainable Livelihoods (SSF Umbrella Programme), which was established following endorsement of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) by the FAO Committee on Fisheries (COFI) in 2014.

The SSF Umbrella Programme supports the development of policies to achieve implementation of the SSF Guidelines by promoting knowledge sharing and exchange of experiences. This technical paper supports that objective by showcasing a diverse selection (both topically and geographically) of initiatives designed to promote and improve market access by enhancing value chains, post-harvest operations and trade in small-scale fisheries, based on the recommendations contained in Chapter 7 of the SSF Guidelines.

Further impetus for this technical paper comes from recommendations of FAO governing bodies, including COFI, the COFI Sub-Committee on Fish Trade (COFI:FT) and the Committee on World Food Security. COFI and COFI:FT have requested guidance on how to overcome challenges in complying with public and private requirements in small-scale fisheries, including certification and traceability. Likewise, they have recommended that FAO provide guidance for achieving equitable market access and distribution of benefits for small-scale fishers, including for products from inland fisheries. In addition, the two governing bodies have called for further work to strengthen capacity of post-harvest operators and their organizations in order to reduce post-harvest losses and improve processing techniques.

In June 2015, the Committee on World Food Security held a High-Level Forum on Connecting Smallholders to Markets¹ to discuss challenges and consider lessons learned from examples of smallholders that have built sustainable linkages to markets. This meeting led to the endorsement of a set of policy recommendations, *Connecting Smallholders to Markets*,² at the Committee's 43rd Session in 2016. The recommendations focus on the reduction of inequalities by addressing the challenges behind unequal access to markets, land and other natural resources. This document seeks to reinforce those recommendations by providing examples from a fisheries-specific context.

Finally, the technical paper seeks to support achievement of the 2030 Agenda for Sustainable Development – specifically SDG Target 14.b: “Provide access for small-scale artisanal fishers to marine resources and markets”; and SDG Target 2.3: “By 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment”.

¹ <http://www.fao.org/3/a-mo212e.pdf>.

² <http://www.fao.org/3/a-bq853e.pdf>.

Abstract

The Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) recognize the rights of fishers and fishworkers, acting both individually and collectively, to improve their livelihoods through enhanced value chains, post-harvest operations and trade. To achieve this, Chapter 7 of the SSF Guidelines recommends building capacity of individuals, strengthening organizations and empowering women; reducing post-harvest losses and adding value to small-scale fisheries production; and facilitating sustainable trade and equitable market access. This document includes nine case studies that showcase applied practices and successful initiatives to enhance small-scale fisheries value chains, post-harvest operations and trade, illustrating the recommendations contained in the SSF Guidelines. The case studies constitute a rich selection of experiences that are diverse, not only with regard to their geographical setting, but also in the topics covered and approaches employed. Each case study presents critical analysis of the relevant enabling conditions and discusses the challenges and opportunities in relation to replicating the respective initiative in other fisheries and development contexts. The studies were chosen for their potential to inform an international audience of development and fisheries professionals and stakeholders, with the intention of supporting national and international policies and policy processes to enhance small-scale fisheries value chains, post-harvest operations and trade.

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7. Madagascar's mud crab fishery: How fishers can earn more while catching less

Zbigniew Kasprzyk

Independent fisheries consultant

Antananarivo, Madagascar

Adrian Levrel

Blue Ventures

London, UK

ABSTRACT

Madagascar, one of the poorest countries in the world, has large coastal communities who rely heavily on various small-scale fisheries, such as mangrove mud crab (*Scylla serrata*), for income. There has been a marked increase in mangrove mud crab fishing due to high international demand, and it is now the country's third most valuable seafood export. This has led to overfishing, with documented decreases in quantity and average size of catches. Additionally, post-harvest losses along the value chain lead to lost value, due to poor handling, transport and storage. This lost value further reduces the earnings and food security of the coastal communities who depend on this fishery. The Smartfish Programme, jointly implemented by the Indian Ocean Commission and the Food and Agriculture Organization of the United Nations and funded by the European Union, worked with the Government of Madagascar's ministry responsible for fisheries resources and locally-based NGOs including Blue Ventures and WWF, to assess methods of reducing exploitation of the fishery and increasing benefits to fishers and the wider supply chain. This case study reviews practical approaches to recover lost value in the mangrove mud crab fishery, highlighting low cost interventions that can increase yields even in the face of falling catches. The value of catches were augmented by obtaining higher prices for export crabs (around half of the annual harvest) and reducing post-harvest losses, providing a practical example of how low-cost changes in behaviour, logistics and technique can reduce post-harvest losses, helping fishers to earn more while catching less.

Keywords: Mud crab, *Scylla serrata*, Madagascar, mangroves, mangrove fisheries, value chain improvement, post-capture losses, small-scale fisheries, traditional fisheries.

7.1 INTRODUCTION

Approximately 30 000 traditional fishers work in Madagascar's mangrove mud crab fishery, mostly in areas of the West coast exhibiting mangrove forests in proximity to seafood buyers. Fishers fish on foot or from non-motorised wooden pirogues (sailing or paddled outrigger canoes) using simple equipment. Market demand has increased significantly since the late 2000s, particularly for live crabs, leading to overexploitation in all but the remotest regions, with a marked trend of reductions in fishing yields and the average size of crabs harvested. At the same time, population growth and economic

migration to the coast have led to more people exploiting mangroves, in particular for charcoal production and construction timber, as well as harvesting fish and crustaceans for local and foreign markets. Small-scale fishers who live in the mangroves typically have no farmland and rely heavily on mud crab fisheries for their livelihoods.

In the early 2000s, it became clear that mangrove forests and crab stocks were being overexploited. Subsequently, Madagascar's government ministry responsible for fisheries resources (*Ministère des Ressources Halieutiques et de la Pêche* - MRHP, merged into the *Ministère de l'Agriculture de l'Élevage et de la Pêche* in 2019) decided to develop a new policy for the sector. The SmartFish Programme¹, jointly implemented by FAO and the Indian Ocean Commission, began working with MRHP in 2011 with the aim of making the mud crab fishery more sustainable by:

- Enhancing the value of the crab sector by reorienting exports to live crabs, which are more lucrative than frozen crabs and can be sold for twice the price;
- Reducing post-harvest mortality to under 20 percent by the end of 2015, compared to 32 percent in 2013 (with peak losses of 50 percent in the rainy season).

The challenge for fishers could be summed up as: “Can you earn more while catching less?” Ten improved practices for catching and handling crabs were developed with the aim of improving the quality of live crabs handled across all links in the value chain. These good practices were tested and disseminated directly to fishers, wholesalers and collectors. The result has been that the crabs are now healthier and more robust, with a better meat yield, and are more able to survive both domestic transport and export.

These good practices align with the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines; FAO, 2015), particularly: reducing post-harvest losses throughout the sector (paragraph 7.5), facilitating access to the international market through the export of live crabs (paragraph 7.6), and increasing the quantity of crabs sold on the local market and thereby contributing to food security (paragraph 7.7). Identifying simple innovations together with fishers and collectors, and involving them in development, testing and skills transfer to spread the good practices, has been at the heart of the intervention strategy (paragraph 12.3).

The MRHP achieved widespread adoption of post-harvest handling practices by using a participatory process linking decentralized departments, actors in the sector, and fisheries experts. This case study details the process the SmartFish Programme followed for identifying, testing and disseminating good practices on the ground in all five of the coastal regions of Western Madagascar that contain mangroves. It also provides recommendations on how to replicate this positive experience in other mangrove areas of Madagascar, as well as other African countries with mangroves and mangrove crab fisheries.

7.1.1 The mangrove crab sector in Madagascar

The mangrove crab, *Scylla serrata* (Forsk., 1755), also known as the mud crab, is one of the largest and most sought-after crab species in the *Portunidae* family. It is found in the intertidal zones of estuaries and mangroves in the Indian and Pacific Oceans. It is adapted to subtidal (constantly submerged) zones and can tolerate significant variations in salinity – from 1 to 30 percent (Ali *et al.*, 2004).

According to remote sensing carried out in 2010, Madagascar has around 2 000 km² of mangroves (Jones *et al.*, 2016). In 1997, this represented 20 percent and 2 percent

¹ The SmartFish Programme is a European Commission funded initiative to develop and support the implementation of the Eastern and Southern Africa and Indian Ocean (ESA-IO) fisheries strategy for sustainable management of the fisheries sector.

of the total in Africa and the world, respectively (ONE and ANGAP, 1997). The vast majority of Madagascar's mangroves are located on the country's West coast (Figure 7.1).

Official figures from MRHP state that the national maximum sustainable yield (MSY) for mangrove crab is 7 500 tonnes a year (Ralison, 1987). This estimate is based on a hypothetical production level of 2.5 tonnes/km² for 3 000 km² of mangroves.

Sustainable exploitation of both mangrove fisheries and forests has become critical, and not just for the sake of crab fisheries. The mangrove forests provide a habitat for many other crustaceans and fish, as well as a host of other valuable ecosystem benefits, such as protection against storm surges and sequestration of carbon dioxide.

Mangrove crab fishing in Madagascar is exclusively traditional: it is carried out in inaccessible mangrove areas on foot or in small non-motorized pirogues, using very simple and inexpensive fishing techniques (e.g. hooks, crab hoop nets, keepnets and lines). A national survey carried out in 2013 showed there are about 30 000 mangrove crab fishers in Madagascar, of which 21 percent are women (MRHP and PASP, 2014). Women processors generally handle storage and sale, often assisted by their children.

Crabs are generally handled live, covered in mud. Collectors, wholesalers and local market vendors have collection permits and wholesaler or vendor cards. The proportion of informal actors in the sector is shrinking and both formal and informal operators use few employees and little capital. With almost no access to credit, they have little funds of their own to invest in collection resources. In stark contrast, export companies have processing plants that typically meet international standards (Kasprzyk, 2014).

Previously, crab fishing was considered by fishers, collectors and fishery authorities to be of lower importance than fishing for shrimp and fish. Indeed, catches from 1985 to 2008 were well below MRHP's hypothesised MSY of 7 500 tonnes. However, in 2009, crab fishing increased significantly when shrimp companies adapted some of their processing infrastructure to crab to compensate for falling shrimp production. Traditional fisher production has increased from 4 052 tonnes in 2012 to 6 018 tonnes in 2017 (Figure 7.2), with its value increasing in parallel.



The mangrove crab, *Scylla serrata* (Forskål, 1755).



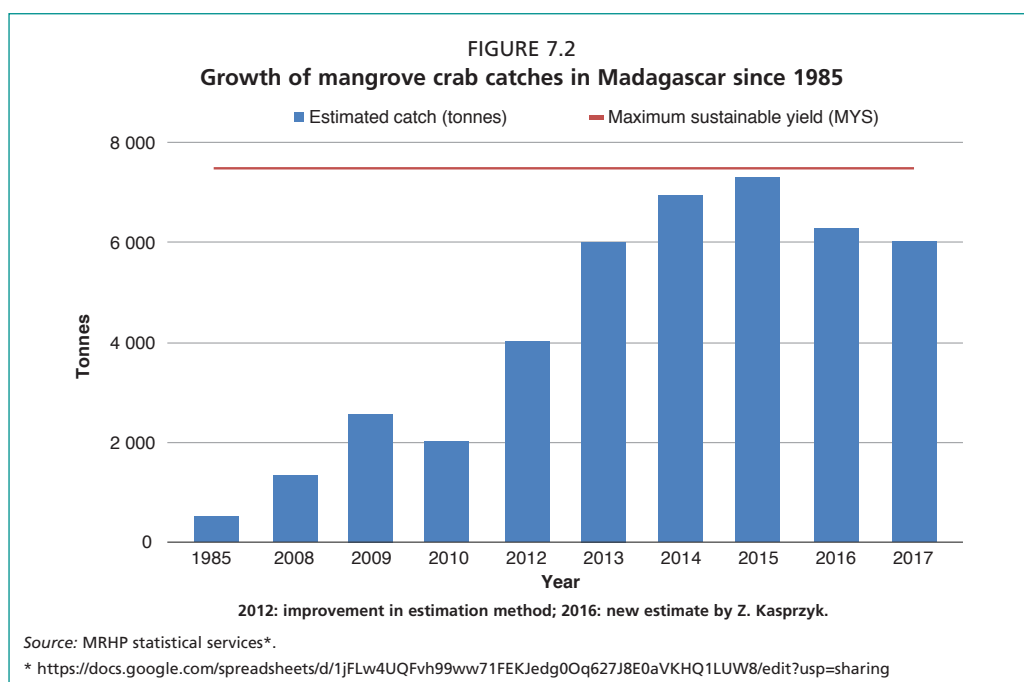
Female mud crab fishers launching pirogue among mangroves.

FIGURE 7.1
Simplified map of the mangrove zones in Madagascar



Source: Kasprzyk and Levrel, 2018.

Map conforms to: Map No. 4170 Rev. 18.1 United Nations, February 2020.



7.2 REDUCING POST-HARVEST MORTALITY

This part of the study is directly linked to paragraph 7.5 of the SSF Guidelines.

Methods

The SmartFish Programme implemented the “crab project”, which actively engaged actors from each step in the supply chain with the aim of addressing post-harvest mortality and identifying good practices to reduce post-harvest losses (Table 7.1). The project began by mobilizing dynamic and innovative local supply chain actors and identifying a range of technical solutions with them. These were then tested, optimized and presented to actors and partners for their approval. These same actors and partners were also involved in the awareness-raising and dissemination stages.

TABLE 7.1
Process of identifying post-harvest good practices

Phase	Mobilizing actors and resources	Outputs
1. Introduction on the ground, baseline survey and preliminary analysis	In-depth study and analysis of the situation on the ground Engagement and awareness raising of technical services and local authorities Recruiting local agents that know the terrain well to act as facilitators Identifying dynamic individual actors	Estimation of post-harvest losses and causes at each link in the chain Identification of innovative local practices that could be optimized or improved A range of technical solutions proposed for each link in the sectoral chain
2. Testing a range of technical solutions	Setting up a testing mechanism for technical solutions with the actors identified Training of operators with follow up by facilitators Broad geographical coverage and sufficient duration to observe clear results	Evaluation of the technical solutions using survey data and opinions gathered in workshops List of good practices for approval
3. Approval of good practices	All the identified sector actors engaged to approve the selected good practices	List of approved good practices to disseminate List of actors and facilitators to mobilize for demonstration and training on the ground
4. Dissemination of good practices	Producing a teaching toolkit for training and communication Organizing awareness-raising and dissemination campaigns	Follow-up evaluation of adoption of good practice and the impact on post-harvest losses

Post-harvest mortality diagnostics

To reduce cold-chain investments, mangrove crabs are handled live at each link in the supply chain. Mortality rates are significant between the moment of capture and the arrival at final destination (i.e. factory/market).

The SmartFish crab project conducted numerous field surveys in 2012 and 2013 assessing mortality at each link in the supply chain (Table 7.2).

TABLE 7.2
Post-harvest mortality in the crab sector in Madagascar

Link	Mortality rate*
Fishing and storage in villages (with fishers)	7%
Storage in villages and transport to collectors (with wholesalers)	7%
Storage at collection points including transport and delivery to the factory/market located on the coast (with collectors)	16%
Transport between coastal villages and Antananarivo for crabs exported live by air or sold in the capital (with collectors)	5%
Sale at local market/bazaar (with vendors)	6%

* Outside of cyclone season.

Source: Surveys conducted by the SmartFish Programme crab project in 11 of the 17 administrative districts in the country that contain mangroves. FANOITRA NGO & Kasprzyk, 2016

The mortality rate varies significantly depending on the remoteness and accessibility of the fishing villages or camps, the way that collection is organized, and the final destination of the crabs. Mortality also increases significantly in cyclone season (values presented in Table 7.2 are for outside of cyclone season only).

Annual losses in 2013 were estimated at 1 300 tonnes – a commercial loss of USD 4.5 million (Kasprzyk, 2016). These are total losses, as the dead crabs are not fit for human consumption or use in animal feed, due to toxins that quickly develop after death.

The main causes of this elevated mortality, some of which are illustrated in Figure 7.3, are:

- The way the collection is organized and the extended period of time during which crabs are handled, from when they are caught to final delivery (up to a week or more for remote villages);
- Use of inadequate storage and transport, leading to crabs being crushed;
- Crab suffocation due to the inadequate quantity and quality of mud and the lack of watering;
- Late tying of crabs' claws, which encourages injuries (as they are carnivorous and cannibalistic);
- Sale of crabs without claws in certain regions of Madagascar (if claws are removed, crabs are injured and therefore more vulnerable).

Phases 1–3: Identification, testing and approval of good practices

Once the losses had been quantified, the MRHP set a goal of reducing the estimated mortality of 32 percent by a third. With the support of SmartFish, it implemented a programme with sector stakeholders based on two principles:

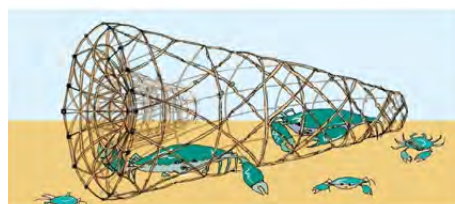
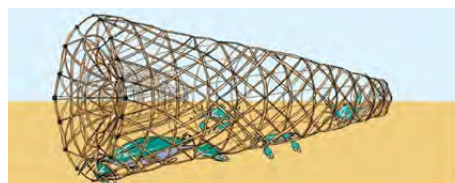
- Identifying simple, low-cost technical solutions using locally available skills and materials, and promoting local good practices;
- Achieving broad geographical coverage, with numerous pilot sites for demonstration.

Between November 2012 and January 2014, practices were identified, tested and approved. Consultants carried out several visits to villages, allowing them to identify the actors (fishers, wholesalers and collectors) who reported lower mortality than

FIGURE 7.3
Practices associated with a high level of post-harvest mortality



Hook fishing at low tide (injured crabs)



Too fine a mesh in keepnets
(catching undersized crabs)



Unloading baskets that people carry on their heads



Outdoor storage



Transport in large overloaded baskets



Transport without protection against the sun and rain



Transport in lorries without shelves



Placing crabs for sale on the ground

others. After analysing techniques, these methods were individually tested over several months by the leaders of other villages.

In collaboration with the World Wildlife Fund, SmartFish carried out 716 tests and demonstrations in 33 villages in four of Madagascar's six mangrove regions. This involved providing fishing materials as well as training to 205 fishers while approximately 2 500 fishers had access to the demonstrations in their villages.

At each demonstration site, the project monitored and evaluated post-harvest losses in comparison with the baseline established during the initial surveys. This made it possible to quantify the reduction in mortality, and to also analyse the adaptability of the innovations as well as their profitability (i.e. additional revenue and amortization period). Importantly, a fisheries expert regularly supported the local consultants, spending more than 75 days working in coastal villages and towns between November 2011 and September 2015.

This work was ultimately used to produce SmartFish Manual No. 35, entitled "Enhancing the value of mangrove crab through reduction of post-harvest losses", which was published in French and Malagasy by SmartFish, the European Union and FAO in 2014, detailed in the next section - dissemination.

TABLE 7.3
Brief description of the ten good practices published by SmartFish

Point in sector value chain	Good practice	Principles
Fishing	1. Crab hoop net	Catching larger specimens, in deeper water
Storage (fisher)	2. Storage hut	Sheltering crabs awaiting collection
	3. Live-crab storage cage	Keeping the crabs in their natural environment (no losses)
Storage (collector)	4. Storage hangar	Limiting losses through appropriate storage
	5. Live-crab storage enclosure	Keeping the crabs in their natural environment (no losses)
Transport (collector)	6. Adapted carts (shelves)	Reducing crab crushing, protecting them against the sun and rain
Transport (collector/wholesaler)	7. Wooden box for transport	Reducing crab crushing, maintaining favourable transport conditions
Transport (collector/wholesaler)	8. Improved shelves for transport by pirogue	Reducing crab crushing, maintaining favourable transport conditions
Transport (collector/wholesaler)	9. Improved shelves for transport by lorry	Reducing crab crushing, maintaining favourable transport conditions
Transport (collector/wholesaler)	10. On-board motor for transport by pirogue	Reducing transport time

Phase 4: Dissemination of good practices

The second phase of the project involved broader awareness raising and dissemination activities, consisting of the following elements:

- Producing a detailed technical manual in French and Malagasy for all actors in the sector;
- Producing an awareness-raising/dissemination toolkit (again in French and Malagasy) based on the manual, presenting the various tools to different target audiences;
- Broadcasting on local radio stations in local dialects, so as to reach as wide an audience as possible;
- Organizing regional and interregional workshops for training and demonstration;
- Setting up three mobile demonstration units in the villages to show training videos, make practical demonstrations, and distribute the different tools or dissemination kits.

The programme specifically targeted each of the actors in the sector (fishers, wholesalers and collectors) as well as those around them – i.e. their spouses and children (who participate in crab handling) and the broader public that uses mangrove resources. Children attending school are often the only literate members of the household, and are thus more inclined than adults to take on the good practices and innovate. Technical services, local authorities and development partners in coastal zones were involved at each stage.

TABLE 7.4
Description of the awareness-raising toolkit

Tools	Content	Target audience and use
Technical manual, format 17x25 cm (80 pages)	Code of conduct for operators and detailed description (photos, drawings) of ten good practices for strengthening crabs and reducing post-harvest losses	Actors in the sector (collection businesses, individual collectors), fishing and coastal environment authorities, Non-governmental Organizations (NGOs) and projects
Information posters (five) in A2 format, coated	Instructions for assembling and using the tools for fishing, transporting and storing crabs recommended in the technical manual	All actors in the sector. Display: village billboards, markets, village and community schools, administration offices, local offices of NGOs and projects.
Fact sheets (ten) in A4 format, double-sided and laminated	Concise fact sheets on the ten good practices described in the technical manual	All actors in the sector. Distributed by mobile demonstrations units to people interested in a particular technique.
Radio programmes (three)	Code of conduct and good practices, in the form of a sketch or a short play in different coastal dialects	General public (radio is the only media accessible for the majority of remote villages)
Training video (43 minutes)	Manufacture and use of the tools recommended in the good practices	All actors in the sector and the general public. Disseminated in the villages by mobile demonstration units.
Comic, format 21x30 cm (15 pages), bilingual, in Malagasy and French	Raising awareness among the young about the benefits of mangroves, the importance of protecting them, and the existence of post-harvest good practices.	Children aged 10–14 years and their families in mangrove areas. Distributed in village schools.
Illustrated cloth wrap (lambahoany), format 170x112 cm, fabric with four-colour screen printing	Illustrations showing the good practices and reminding people of the minimum catch size	Women. Distributed by the mobile demonstration units and during regional workshops.
Illustrated mats in A3 format, double-sided and laminated	Illustrations showing the good practices and reminding people of the minimum catch size	Local restaurants (<i>gargotes</i>), fishers' families. Distributed by the mobile demonstration units and during regional workshops.

Key elements of training and dissemination

Regional and interregional workshops in the coastal towns of West Madagascar were key to the success of the project. From 2014, these brought together a total of 270 people, of which 52 were fishers and 140 were actors elsewhere in the value chain. During the workshops:

- The MRHP services demonstrated their engagement and raised awareness about new legislation being prepared.
- The operators and partners had the opportunity to approve the good practices selected for dissemination, and so were fully involved in the dissemination.
- The participants had the opportunity to engage in debate and exchange opinions on sustainable use of crabs and mangroves, while gaining technical training and expertise.
- An innovation contest was launched to identify new practices or improvements to those that had already been disseminated.

What set these workshops apart was that they included practical training and demonstrations, in addition to the presentations and debates. This was important in that it allowed the operators to participate and demonstrate their expertise. The

fishers and wholesalers, who were generally quite passive during the presentations and debates, were very active during the sessions on assembling and optimizing better gear, such as crab hoop nets, live-crab cages or other wooden boxes.

The main challenge for the dissemination campaign was the remoteness of the mangrove areas. Reaching the fishing villages is difficult and time-consuming, as they are accessible only by sea. For this reason, SmartFish set up three mobile demonstration campaigns in April and May 2015, each lasting six weeks and travelling around in motorized boats. Each mobile unit consisted of three or four people, including at least one practitioner capable of demonstrating how to make and use the different innovations. The mobile unit was equipped to show training videos and had a dissemination kit. It adapted to the life and work schedule of the fishers and their families in order to reach as many people as possible.

Importantly, the people demonstrating the good practices in the villages were the best fishers, intermediaries and collectors. After they themselves had been trained, their new knowledge and evident professionalism enabled them to train other village actors (Box 7.1 and Figure 7.4).

BOX 7.1

A typical day for a mobile demonstration unit

In the morning, while the fishers were at sea, the demonstration unit met the younger pupils (10–14 years) at school and gave them the comic with explanations and discussions. At the same time, a member of the unit did a brief survey with the local operators on fishing and post-harvest losses, to understand the local context before the afternoon session.

In the afternoon, a meeting was held with the fishers and other supply chain actors. The fishers were first given the floor to express their opinions. Then the discussion broadened to the causes of crab mortality and how the villagers themselves could reduce their losses.

Next, the unit showed the training video on good practices (43 minutes), and then demonstrated specific good practices (crab hoop nets, live-crab cages, etc.). The fishers, wholesalers and collectors were invited to participate and the most active and interested people received laminated fact sheets, the technical manual and other items from the dissemination kit.

At the end of the day, the unit put up displays in public places (offices, markets and schools) and the headquarters of local groups, NGOs and projects active on the ground.

The results of the mobile demonstration units were as follows:

- 46 *fokontany* (village-level administrative unit) visited involving nearly 9 800 fishers, of whom 4 000 were specialized in crab fishing;
- 2 060 fishers trained, 1 090 children received a comic;
- 140 technical manuals, 1 430 laminated sheets, 225 posters, 90 placemats and illustrated cloth wraps;
- Participation of mayors, village chiefs, knowledgeable elders, presidents of grassroots community organisations, head teachers and teachers.

Radio broadcasts were translated into official Malagasy and the two coastal dialects, and broadcasted 74 times by eight local radio stations in five large coastal towns. Radio was also used to inform the public of the aims of the mobile demonstration units. Radio broadcasting was a low-cost way of spreading the key messages to fishers, wholesalers and collectors who had had no direct contact with the government or project trainers. Even where collectors had easier access to the authorities or the project, radio still served to advise and update them.

FIGURE 7.4
Demonstration in the village and distribution of the comic



Reduction in post-harvest losses

TABLE 7.5
Mortality rates: progression between 2013 and 2015

Stage in the value chain (actor)	Mortality rate (%)	
	2013	2015
Fishing and storage in villages (fishers)	7.0	2.5
Storage in villages and transport to collectors (wholesalers)	7.0	2.5
Storage at collection points including delivery to factory/market located on the coast (collectors)	16.0	6.5
Transport between coastal towns and Antananarivo (collectors)	5.0	5.5
Sale at local market/bazaar (vendors)	6.0	6.5
Cumulative mortality:		
• Coastal town delivery	23.0–36.0	11.5–18.0
• Antananarivo delivery	28.0–41.0	17.0–23.5

Source: Fanoitra and Kasprzyk, 2016.

Over the duration of the project, the results obtained were satisfactory:

- In two years, the mortality rate dropped from 32 percent to 17.5 percent.
- This represents a gain of 600 tonnes of crabs with a market value of USD 2.1 million.
- The objective of reducing the mortality rate by a third was exceeded.
- Each kg of crab “saved” translates into an additional USD 1 for the fisher.

Mortality was successfully reduced in the supply chain mainly where the fishers, village intermediaries and collectors were active. This was achieved thanks to the improved practices being broadly disseminated and taken up with the strong involvement of local supply chain actors. Collectors and traders working together in the fishing areas were able to reduce the length of time the crabs were stored. In 2012, collection happened once a week or less; in 2015, storage did not last longer than three days, and collection took place two or three times a week.

However, mortality did not drop among the collectors that transport live crabs to Antananarivo. This is explained by the increase in distance between the coastal towns where collection takes place and the capital: in 2013, crabs sent to Antananarivo came from Mahajanga and Morombe (a distance of 570–700 km), but now an increasing number come from Antsohihy, Ambanja and even Toliara (a distance of 750–1 000 km). Longer routes cause higher crab mortality.

7.3 ENHANCING MARKET ACCESS

This part of the study relates to paragraph 7.6 of the SSF Guidelines.

7.3.1 Increasing the sale price

Reorientation and growth of exports

TABLE 7.6
Production and exports of crabs between 2012 and 2017

Description	2012		2013		2014		2015		2016*		2017	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Catches	4 052	-	6 014	-	6 946	-	7 306	-	6 300	-	6 018	-
Exports (in live weight)	2 454	-	3 221	-	4 465	-	3 594	-	3 156	-	3 008	-
Exports (in finished products)	1 100	4.92	1 966	12.19	3 401	20.80	2 836	16.61	2 345	11.85	2 317	10.73
Live	29	0.16	881	8.07	2 476	17.17	2 205	14.49	1 668	9.27	1 715	8.13
Frozen	1 040	3.82	1 084	4.06	925	3.63	632	2.12	677	2.58	602	2.60
Semi-preserved	31	0.94	1.4	0.06	-	-	-	-	-	-	-	-

Q – quantity (tonnes); V – value (USD millions); *2016: new estimate by consultant;
Conversion coefficient in live weight: live crab (1.0), frozen whole crab (1.1), frozen crab in pieces (2.2), raw crab meat (6.1), pasteurized crab meat (10.0).

Source: MRHP statistics service.

Until 2012, crabs frozen in pieces made up 93 percent of the tonnage and 73 percent of the value of exports; small amounts of live crab were sold to neighbouring Mauritius and Réunion. Frozen crab was primarily sold to Europe, in particular to France (Kasprzyk, 2014). Then in 2013 the MRHP began granting various permits for collection and export of live crabs, which was quickly reflected in exports (Table 7.6). There was a 49 percent increase in total crab production in 2017 compared to 2012 (Figure 7.2); over the same period, the tonnage of live weight exports increased by only 23 percent, while the value of exports increased by a multiple of 2.2.

This large increase in export value is essentially explained by the significant increase in the proportion of live crabs exported (3 percent in 2012, more than 70 percent from 2014 onwards) and their higher value: the average live weight price per kilogram is 1.7 times higher than that of frozen crabs. Europe, the main importers of frozen crab before 2012, has now been overtaken by Asia (in particular China).

Impact on sale price and fishers' income

Surveys were carried out to quantify the reduction of losses and improvement in incomes achieved by the crab project, 191 people – fishers, intermediaries and collectors were surveyed in September and October 2015 in 38 villages and 8 Western coastal towns (Ambanja, Antsohihy, Mahajanga, Namakia, Soalala, Belo-sur-Tsiribihina, Morondava and Morombe) in 11 districts. The results showed that the price went from a national average of less than USD 0.5 per kg at the start of 2012 to over USD 1.1 per kg at the end of 2015. For pirogue fishers in Boeny region, their income increased by 26 percent between 2011 and 2015, despite their catch decreasing by 33 percent over the same period (Table 7.7). This is mainly attributable to the increase in sales price. Reduction in post-harvest losses also contributed, but to a lesser extent.

The national average however hid significant price disparities between regions: USD 1.88 per kg for the regions of Sofia and Diana, USD 0.74 per kg for Boeny and Menabe, and just USD 0.38 per kg for Atsimo-Andrefana. These disparities are explained by the differences in quality of crabs collected and the higher costs of

TABLE 7.7

Average catches and earnings of pirogue fishers in 2011 and 2015 – Boeny region

Description	2011	2015
Monthly catch (kg)	261	196
Sale price (USD/kg)	0.47	0.74
Gross monthly income (USD)	114	144

Sources: Kasprzyk, 2012; Fanoitra et al., 2016.

transport in more remote regions. Moreover, the average price increase across all these regions has since incentivized all actors in the sector to adopt the new practices.

The additional income gained by reducing losses is substantial among collectors and wholesalers (Table 7.8). Fierce competition has pushed these actors to take up the techniques disseminated by the project. Income generated then sometimes helps to finance the materials needed to make further improvements in fishing and storage equipment. The collectors and wholesalers are currently continuing the work of the project by applying and disseminating the good practices, and stand to earn more by doing so.

TABLE 7.8

Additional monthly income earned thanks to the reduction in mortality (national average)

Actor	Monthly production (kg)	Unit sale price (USD/kg)	Reduction in losses		Additional monthly income due to the reduction in losses (USD)
			%	kg	
Fisher	194	1.00	4.5 (7.0–2.5 = 4.5)	9	9.54
Intermediary	2 221	1.40	4.5 (7.0–2.5 = 4.5)	100	140
Collector	3 939	2.20	9.5 (16.0–6.5 = 9.5)	374	823

Source: Fanoitra et al., 2016.

Impact on local market

Opening the market for exports of live crabs led to fears that it might decrease the amount available for local consumption. In fact, the opposite has been observed: local consumption and sales have more than tripled, from 628 tonnes in 2012 to 1 964 tonnes in 2017 (Table 7.9).

TABLE 7.9

Distribution of crab catches in 2012 and 2017 (in tonnes)

Description	2012	2017
Total catches	4 052	6 018
Distribution		
• post-harvest losses	970	1 050
• exports	2 454	3 008
• local consumption	628	1 964

Source: Kasprzyk and Levrel, 2018a.

The relatively weak growth in quantity of crab exports may be because of the significant tonnage rejected by collectors/exporters of live crabs, due to the crabs being weak, injured, low meat yield and, above all, below the standard size. On average, exporters reject between 40 and 45 percent of the crabs supplied to them. These are sold immediately to local traders and, to a lesser extent, to frozen crab exporters. Some of the crabs that are not sold are eaten by the fishers themselves. The estimated amount of catch eaten by fishworkers has increased from 5 percent to 9 percent in Mahajamba Bay (Kasprzyk, 2012; Kasprzyk and Levrel, 2018b).

Management measures

In 2006 an initial attempt to put in place a management plan was met with resistance among actors in the sector. The only rules accepted were a minimum carapace size of 100 mm, which only protected 10 percent of mature females (Rafalimanana, 2006), and a ban on catching egg-bearing females and soft-shell crabs.

Subsequently the increase in fisher income made it more feasible to introduce new management measures in the sector. In addition, catches increased significantly, exceeding 90 percent of the MSY in 2014–2015. From 2015 on, the MRHP took several important decisions to better regulate crab harvesting:

- Capping the annual catch at 5 000 tonnes;
- Fixing the total authorized export quota to 4 250 tonnes a year (in 2015, the export quota had been set to 3 600 tonnes and was distributed between nine operators located in five regions);
- Increasing the minimum carapace size for crabs caught from 100 to 110 mm;
- Closing the fishery for four months each year (the closure law also prohibited the collection, sale, purchase, transportation, storing and export of live and processed crabs). As the majority of fishers target multiple species, they are able to continue earning from fish, shrimp or other catch during the closure;
- Banning the harvest of soft-shell crabs or egg-bearing females, and of fishers and wholesalers handling crabs without legs or claws before sale;
- Banning the cutting, collection, transport and sale of mangrove wood.

7.3 CONCLUSIONS

7.3.1 Lessons from the SmartFish Programme crab project

The fishers of Madagascar's West Coast are already among the poorest and most marginalized people in the country. Rapid population growth and coastal migration are causing pressures on nearshore fisheries and mangroves. In this context, work to reduce post-capture losses and so enhance the value of crab harvests both reduces poverty and facilitates better natural resource management.

The Madagascar experience shows that even when catching less crab, the fishers, wholesalers and individual collectors were able to maintain or even increase their income. This became possible thanks to a) the higher price of high-quality crab (healthy, with a higher meat yield) suitable for live export, and b) the reduction in post-harvest losses through broad uptake of good practices. The price incentive, along with the involvement of all the actors in the sector in co-designing improvements and promoting their adoption, helped the MRHP to enhance the value of the crab sector and encourage sustainable management.

Alongside the development and implementation of fisheries or ecosystem management measures, maintaining or improving the income of fishers should have a positive impact on fisheries resources, and also protection of the mangrove forests. When fishers earn a better living thanks to the mangroves, we expect them to be less inclined to cut and sell mangrove wood, and also show greater interest in fighting timber trafficking and cutting mangroves for charcoal.

The success of this project has been possible due to certain conditions:

- The strong international demand for wild crab, at a higher price, has facilitated improvements in fishing and post-harvest practices.
- The MRHP has been willing to collaborate actively with the SmartFish Programme and to quickly enact the recommendations of inclusive national and regional workshops.
- Actors in the sector co-designed improvements and tested them out in actual operations. This meant that the good practices used technical innovations that were inexpensive and could be readily made with local materials.

- These same actors promoted the use of good practices and helped their widespread uptake. Above all, action on the ground was key to the project's success.

7.3.2 Sustaining the achievements of the project in Madagascar

The challenges of joint management

The national workshop held on 21 March 2006 recommended a participatory approach to possible changes to the crab fishery management plan and its effective application on the ground (MAEP, JICA and Océan Consultant, 2006). For administrative and political reasons, the next workshop did not take place until March 2012. This national workshop initiated the shift of exports to the live-crab market and committed to reduce post-harvest mortality by a third. Following this, the MRHP used five regional workshops between November and December 2014 to publicize the proposed management measures that would be introduced in 2015. The SmartFish technical manual on enhancing the value of mangrove crab by reducing post-harvest losses was disseminated during these workshops.

In November 2015, the national workshop on the results of the SmartFish crab project concluded that the 2012 objective of reducing estimated losses of 32 percent by a third had been achieved (losses dropped to 17.5 percent of catch). The workshop's recommendations included:

- Further reducing post-harvest mortality to 12.5 percent;
- Extending awareness raising and demonstrations to new areas, including the Melaky region and the Mangoky delta;
- Mobilizing the resources necessary for effective implementation of the management measures specified in the regulations.

However, when the project ended in June 2016, the question of continuity arose, particularly of how to inclusively bring together all fishery actors to maintain dialogue and improve the fishery. Following this, in 2017, the MRHP called off the seasonal closure for crab fishing which caused concern amongst many stakeholders that this would place the resource in danger, given the real risks of overfishing. Closed seasons are often applied in other countries; they are easy to control, and effective at restoring stocks (Razafindrainibe, 2006).

Regulation enforcement challenges

In a study carried out by Blue Ventures entitled "Summary of recent events that have influenced the crab sector and its management", it was shown that fishers, wholesalers and vendors on local markets often do not respect the minimum catch size or the protection of egg-bearing females and soft-shell crabs. The limited number of inspectors in the national fisheries monitoring service, the Centre de Surveillance des Pêches, makes it difficult to monitor on the ground. The annual catch quota has also been exceeded. Furthermore, a ban on cutting mangrove wood encountered many challenges due to overlapping jurisdictions; use of mangrove wood is governed by the ministry responsible for environment and forests.

Based on these events and on field observation, the MIHARI network (a national small-scale fisheries platform) prepared and organized two interregional workshops, as well as a national feedback workshop entitled "Enhancing the value of production and responsible management of the mangrove crab" (*Meilleure valorisation de la production et gestion responsable du crabe de mangrove*) in the second half of 2018. During the workshop, the participants prioritized the following actions:

- Restoring a national closed season lasting three months (September to November) beginning in 2019;
- Modifying the maximum authorized quantity of crabs exported to match the current production quota;

- Strengthening communication of all crab sector regulations using innovative, adaptable approaches;
- Training fishers and distributing the good practice guide to all other actors in the crab value chain.

In the presence of MRHP officials, the participants formulated and approved 15 recommendations for 2019/2020. These concerned re-evaluating crab stocks; preserving and restoring mangroves; enhancing the value of crab production; and improving and promoting systems (particularly community-based) for follow-up, control and monitoring. These recommendations will be implemented by the fishery authorities and various projects, NGOs and fishers' organizations.

Ensuring the continuity of the technical innovation process

It is crucial that the MRHP maintain the process of working with the crab sector to identify, co-design and disseminate new good practices that will enhance the value of crab catches. Such an approach has been at the heart of the project's success to date. The MIHARI network could play a key role in engaging fishing communities and facilitating dialogue. In 2018 Blue Ventures published a new guide for good practices in the crab sector. The 16 solutions it proposed, together with the 10 proposals in Technical Manual No. 35 published by SmartFish in 2014, should enable operators to learn how to earn more while catching less (Figure 7.5).

The 2018 Blue Ventures guide details innovative ways to keep crabs alive and support the management of the fishery. It was produced as part of a competition launched by SmartFish in 2015. Two years later, in December 2017 and January 2018, experts met with 35 competition participants to observe and test on site how viable their proposed technical solutions were. Ultimately, 16 innovations were judged effective and worth including in the guide. The 50-page guide, in French and in two local Malagasy dialects, was given to MRHP staff, exporters, collectors, wholesalers and fishers in 2018 during workshops organized by MRHP with MIHARI and Blue Ventures.

7.3.3 Replicability in other Indian Ocean nations

Madagascar's experience could be shared with many countries in the Western Indian Ocean that have mangroves. Specific experience in managing the crab fishery and its supply chains has been developed in these countries alongside this, making exchanges of experience potentially very fruitful.

Regional collaboration could be accelerated by organizing an international forum in Madagascar to exchange experiences, involving the economic operators and fishery authorities of the countries concerned. Irrespective of the technical solutions that are ultimately applied, the Madagascar experience tells us that their success depends on certain preconditions, including: i) a firm resolve on the part of the national government to develop the crab sector in the interests of small-scale operators (fishers, wholesalers, collectors); and ii) the existence already of a relatively well-developed crab fishery, with experienced collectors and exporters, particularly of live seafood.

FIGURE 7.5
Examples of good practices



Crab hoop net with bait bags



Double crab hoop net



Live-crab storage cage



Storage hut



Improved storage hangar



Transporting crabs by bicycle



Adapted cart



Removable shelves/transportation pirogue



Rapid transportation van



Covered market for live crabs (Ambanja)

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