FAO SmartFish
Publication 11

Secure Fisheries
Secure Futures

HANDLING OF MUD CRAB

Illustrated Operators`Manual

INDIAN OCEAN
COMMISSION

CREDITS

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Thanks also to the FAO colleagues Yvette Diei Ouadi; Alessandro Lovatelli and Davide Signa for the technical revision and to Shirley Chan for the support on the graphic layout.

The success of this project would not have been possible without the strong willpower of operators in the mud crab value chain, too numerous to mention here, it would be impossible to find effective, innovative and simple solutions to reduce post-harvest losses, which are still very high in the mangrove crab industry in Madagascar.

Introduction

SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in twenty countries throughout the Indian Ocean Region, Southern and Eastern Africa, focuses on fisheries governance, management, monitoring control and surveillance, trade, and food security.

Under the activities related to the reduction of post harvest losses to improve the food security of small scale fish operators, the project has been supported over the past year, a series of interventions aimed at improving the value chain efficiency of the crab industry in Madagascar.

The brochure serves as an extension tool for technical solutions and sharing of day-to-day code of practices to popularize technical solutions and share some everyday rules of good practices for the different actors in the value chain, aimed at reducing post-harvest losses of crabs. To maximize its impact, the distribution of this booklet shall be accompained by other outreach and awareness initiatives such as video screening, radio broadcasts and dissemination of various specially designed products among others.

This guide is intended for all operators in the mud crab value chain, but also technicians and and fisheries administration, development practitioners and NGOs interested with the promotion of traditional fisheries and environment sustainability. It is designed for ease of use by low literate or illiterate operators, as the drawings provide a better understanding.

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Guidelines for operators in the value chain

Rationale

- Though the crab resources are not generally overfished (Annual catch estimated at 3500 tonnes for a potential of 7500 tonnes / year), fishing areas exploited for several years and those located nearby cities show signs of overfishing, through a reduction.
- A recent study conducted in the beginning of 2012, in Madagascar, for example, confirms high mortality rate at all stages in the supply chain, with total figure of 22% annually which can exceed 50% in the rainy season.
- Small crabs (mainly discarded after sorting by export companies) are often sold in local markets and bazaars despite the existence of legislation prohibiting fishing and marketing crab carapace width less than 10 cm.
- Some fishing techniques (hook) used damage the crab or are less selective.

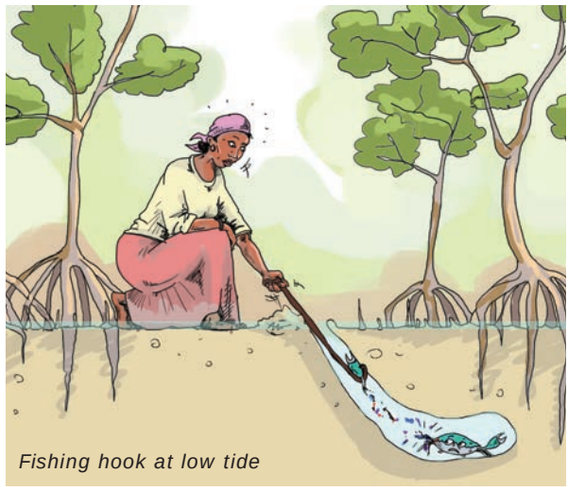
Objectives

- The overall objective of the guide is to provide a framework for a code of practices for all operators in the mud crab value chain to protect the mangroves and ensure sustainable development of the value chain.
- The specific short-and medium-term objectives are:
  - Improve the income of operators at each stage of the supply chain by reducing post-harvest losses and not only through an increase in fishing;
  - Contribute to reduce the high percentage of mortality of crabs along the entire value chain - by one third within 2-3 years the crab mortality which was assessed at 22% in 2012.

1. Fishing

1.1. Beware of the hook!

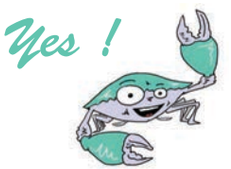
Limit the use of hook tools that can often hurts crabs (Clip torn) and damage burrows.

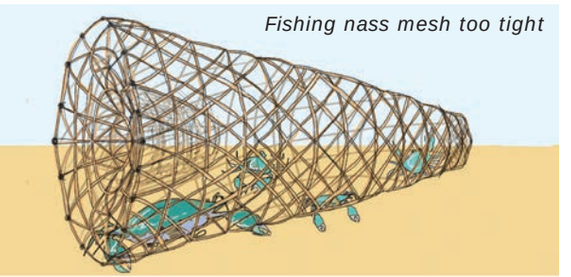


Fishing hook at low tide

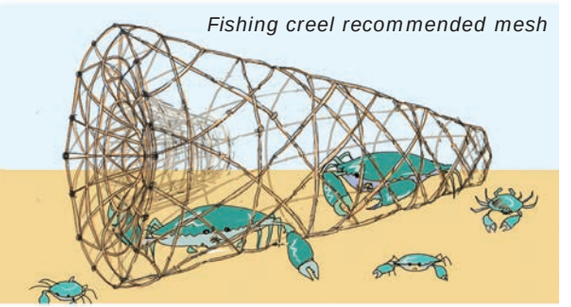
1.2. Respect recommended mesh size of crab traps

The mesh size used should prevent the fishing of small crabs. (carapace width below 10 cm).





Fishing nass mesh too tight

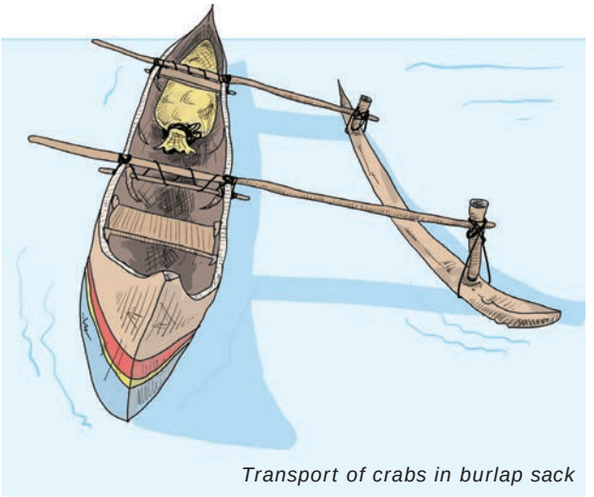


Fishing creel recommended mesh

1.3. Burlap Bags

Transport the crabs in burlap bags, which do not easily heat up and do keep more moisture than polyethylene bags (Bags of rice).

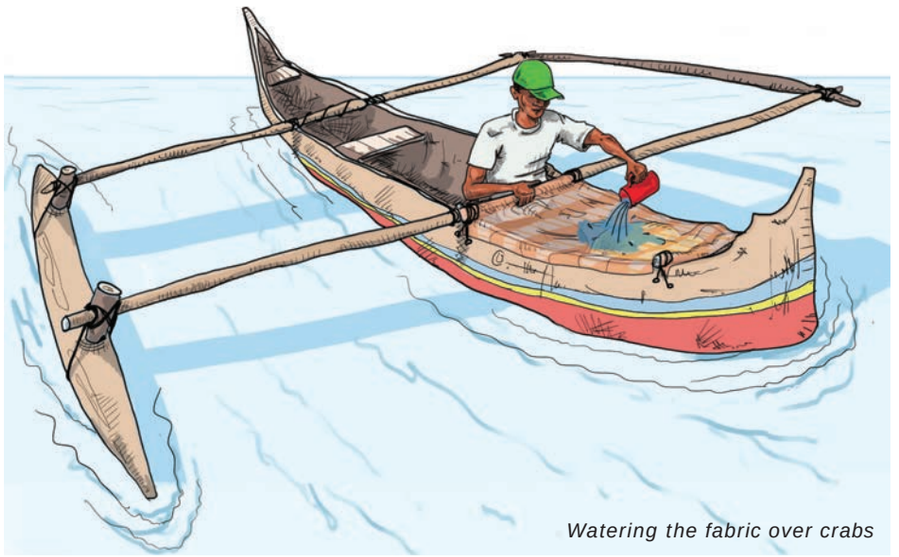
If possible, coat the crabs with clean mud in the fishing canoe.



Transport of crabs in burlap sack

1.4. When transporting in dugout canoe

- Protect the crabs by covering them with fabric, grass or mangrove leaves, placed above crabs
- Keep the crab wet sprinkling them regularly with sea water

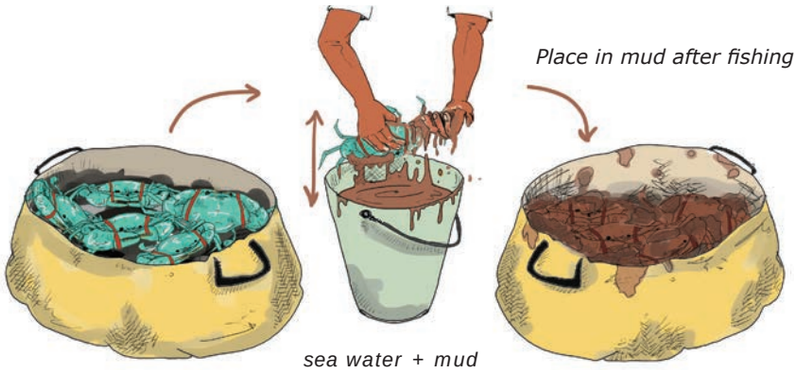


Watering the fabric over crabs

2. Storage

2.1. Place in mud before or just after landing

- Bind the crabs (page 21) and put them immediately into the mud.
- To protect and to ensure there is sufficient moisture
- Prepare the mud with clean and fresh sea water drawn from the rising tide and fine mud without grains of sand from the channel or the bottom of the bay.



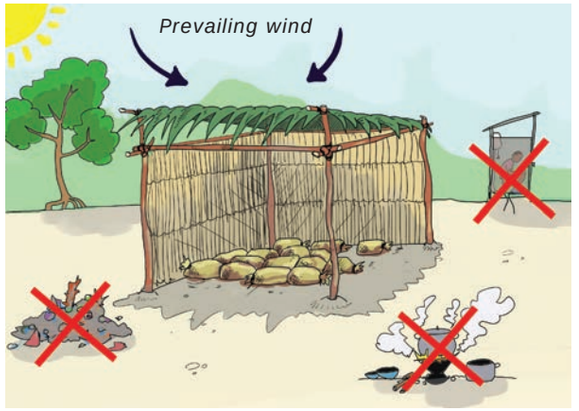
- The amount of mud should be around 10% of the weight of crabs.

2.2. Do not smoke

Avoid smoking cigarettes while handling crabs because their ashes are poisonous to the crabs.

2.3. Simple shelter

This is a simple shelter built with local materials useful for fishermen and/or wholesalers to store crabs coated with mud and put in bags or baskets. The shelter must be constructed in a well aerated and clean place (no garbage, no toilet in the vicinity).



2.4. Storage shed

This is a closer shelter of a bigger capacity for wholesalers and sub collectors, who handle larger amounts of large crabs

It is recommended to place shelves inside to optimize space utilization and avoid stacking the bags or baskets.

Protection against wind, sun and rain

2.5. Actions during the storage in a shed

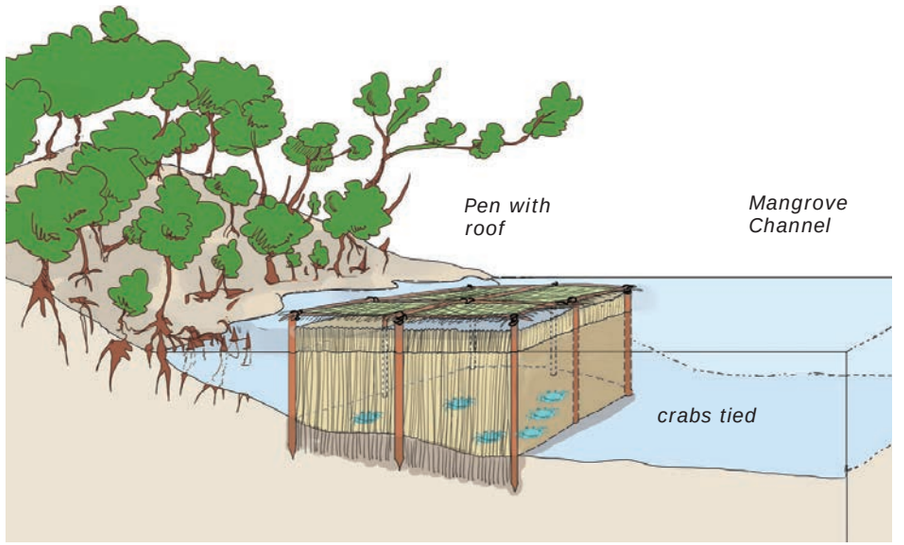
The storage time between fishing and shipping by boat or cart, should not exceed 4-5 days, if crabs are kept in baskets or bags.

- After 2-3 days of storage do an initial sorting and put them back into the fresh mud, then on the day of transportation to town, do a second round of sorting and put them back in the mud.
- At least do a light watering after 2-3 days of storage (1/4 litre of fresh seawater by basket or bag).

Water after 2-3 days in storage

2.6. Pens and tanks

If the storage period exceeds 4-5 days (due to rain or delay of the collectors), bound crabs should be stored in tanks or pens along the channel.

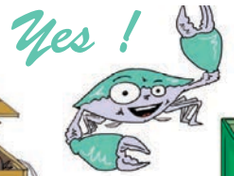


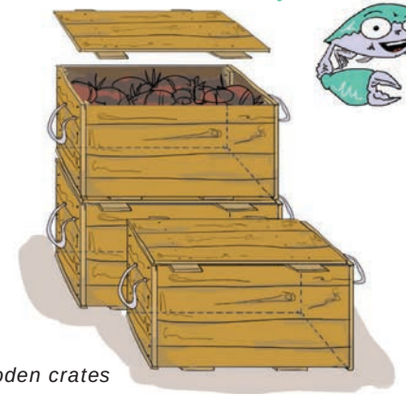
3. Transport

3.1. Transport in crates rather than in baskets

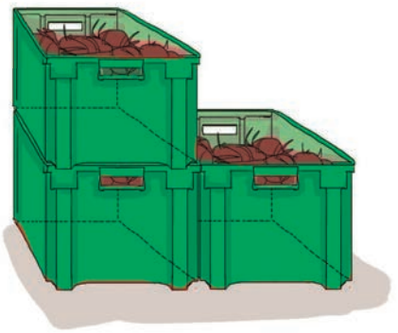
- In baskets, crabs are easily crushed and significant losses occur, especially with large baskets.
- In wooden or plastic crates crabs are better protected and they do not crash when crates are stacked on top of the other or during transport.

Baskets packed





Wooden crates



Plastic crates

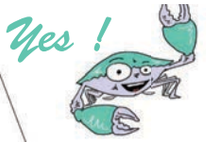
• Boxes of wood or plastic are easily stackable without affecting the crabs.

They can be transported in different types of transportation vehichles: canoes, carts, minibuses, truck, etc..

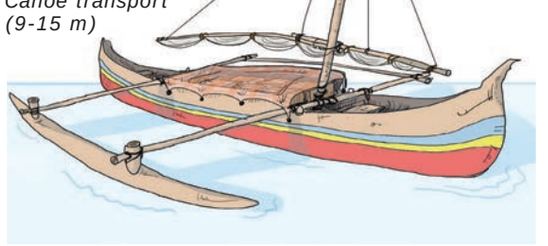
3.2. Transporting by sea

3.2.1. Protect the crabs from the sun, wind and rain:

- In the rainy season, use a cloth or synthetic tissue (bag of rice);
- In the dry season, use cotton fabric and water regularly with seawater



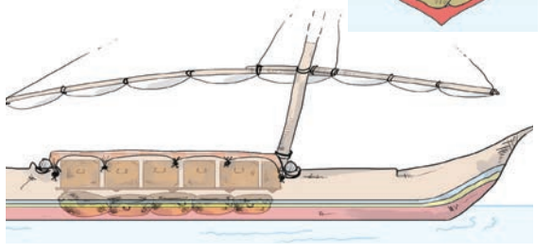
Canoe transport (9-15 m)



3.2.2. Install mobile shelves in the canoe being used for transportation

For canoes transporting small amounts (less 10 m long) in order to better use the space in the hull we can place the baskets / bags at the bottom of the canoe and put the crates on shelves.

Interior view: baskets and boxes protected by tissue

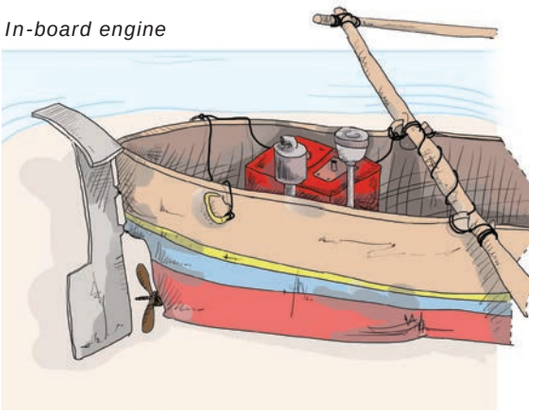


3.2.3. collection Motorisation

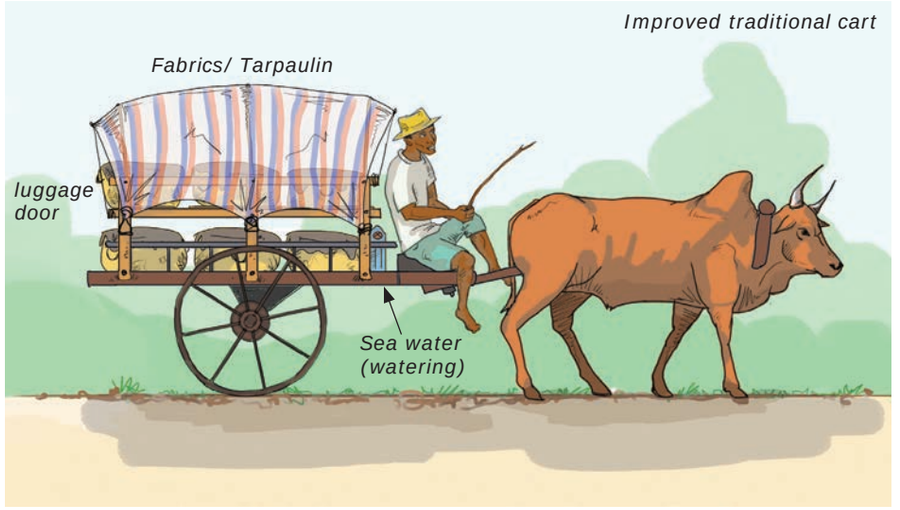
Motorisation of canoes reduces significantly travel time, which therefore reduces crab mortality during transport.

The use of “inboard” engines on transport canoes should be encouraged.

In-board engine



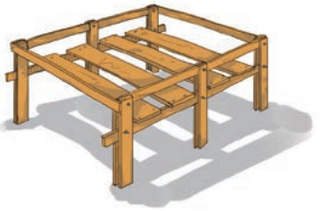
3.3. Transport in cart



3.3.1. Adapting the cart

- Construction of a removable luggage rack (edges higher, shelves);
- Installation of a cover / roof for protection against the sun, wind and rain.

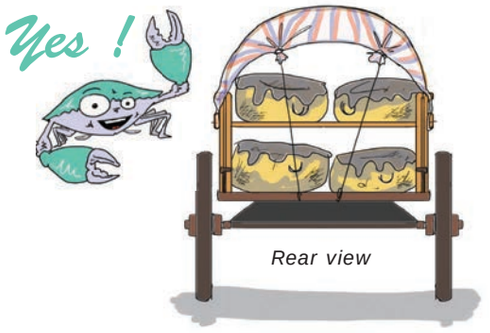
Removable luggage rack



3.3.2. Reduce the size of baskets

30-35 kg instead of 80-120 kg.

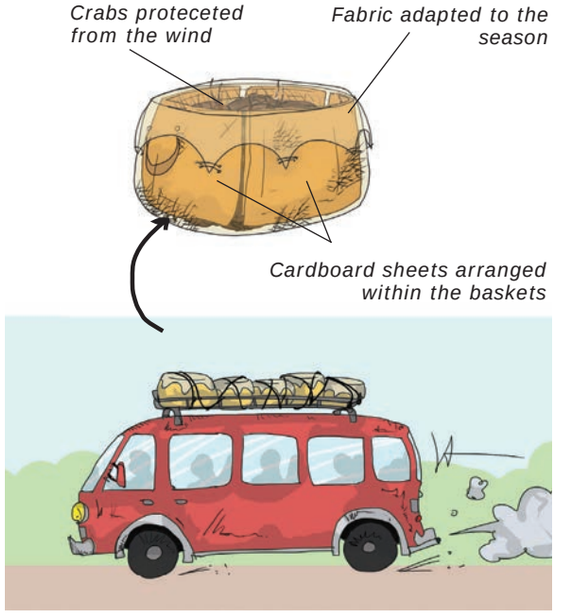
They can also be replaced by wooden or plastic crates.



3.4. Transporting by bush-taxis or trucks

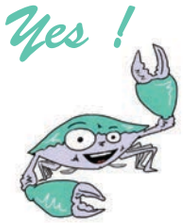
3.4.1. Bush-taxi

- Put cardboard in baskets transported by bush-taxis, to protect crabs against the wind.
- The cover fabric of the baskets must be changed depending on the season:
  - Rainy season: fabric or polyethylene;
  - Dry season: fabric or material



3.4.2. Truck

- Use shelves in the truck if the crabs are transported in baskets / bags.
- With the plastic or wodden crates, they will reduce significantly your losses during tranport.



4. Sensitization and Management

4.1. Awareness raising

Sensitize the crab value chain actors on the regulation, new fishing techniques, storage, transport and handling of crabs to reduce losses and maximize profits.

4.2. Legislation and enforcement

- The extension services or any relevant institution should ensure and monitor the effective compliance of the regulation by the crab collectors and mongers/ sellers.
- Advise sellers on how to reduce their losses by using any shelter or roof or shadow to protect against the sun and the rain.
- Consider the need for:
  - Establishing or revised the current legislation on minimun sizes.
  - The size vary by large geographical area
    (for ex: province, village, country...)

Storage shed

Action to be taken	Store crab in a spacious shed
Storage link	Store in the village, camp site or collection site
Main actors concerned	Wholesalers, sub-collectors, collectors
Objectives	● Protection against the sun and rain. ● Protection against wind and dry air currents due to the walls that keep moisture and avoid desiccation. ● Limiting crushing crabs (space, shelves). ● Maintain moisture by covering the soil with grass/ wet leaves (watering)

Storage under roof of the house

Shed made of raffia (baobao) and satrana

Shed entirely made up with satrana.

Reception and storage shed in vondro

The crabs stored in a shed are either bound in the mud in baskets / bag or left loosely on wet grass or mangrove leaves

Location	Accessible by cart/car. Far away from fire and smoke from cooking, as well as garbage and toilets
Type of shed	Two types of shed : - Shed intended only for storage ; - Shed intended for reception and storage (mixed). This one is made of two parts, with two doors (entrance and exit): a) reception (sorting, weighing, storage in the mud and in the baskets/sacs); b) storage (in the mud baskets / bag).
Dimensions	Vary depending on the amount of crabs handled per week / shipping, its functions and the use or lack of shelves. Minimum shed size : length - 5m, width - 4m height - 2,5 m. Mixed hangar length can exceed 10 m.
Construction material	Locally available materials, such as: satrana or vondro, for the rods, raffia (baobao) for the posts Honko, and wooden door frame.
Construction timeframe	1 to 3 weeks (depending on availability of materials and technical capacity of the worker)
Construction cost	150 000 to 300 000 Ariary (750 000 to1 500 000 FMG)
Life span, maintenance	3 to 5 years, depending on weather conditions (abundance of rain, wind and cyclones) and its regular maintenance (with periodic replacement of some of the damaged parts)
Reduction of losses and its economic impact	Mortality rate according to the type of storage: - Usual storage terrace: 11.5% (11 out of 100 dead crabs) - Storage shed 7.2% (7 out of 100 dead crabs) Additional income: 160 000 Ar per shipment Return on investment
Other observations, suggestions	● Bind and sort crab before storage; ● Avoid excessive handling of crabs; ● Observe proper load baskets / bag; ● Sort crabs regularly (every 2-3 days);

Shed with shelves; crabs in baskets or in bags.

Watering after 2-3 days in storage

Cage / Pen - Storage pool

Action to be taken	Store crabs in spacious tanks/pens
Storage link	Store in the village, camp site or collection site
Main actors concerned	Wholesalers, sub-collectors, collectors
Objectives	• Store under natural conditions (water and mangrove channels) • Optimization of storage conditions through the environment's physical and chemical conditions (temperature, dissolved oxygen, salinity) and the availability of feed (plankton, eggs, post-larvae, etc..) • Increases the length of storage

Storing on the terrace of the fisherman's house

No !

Individual cages (in ponds)

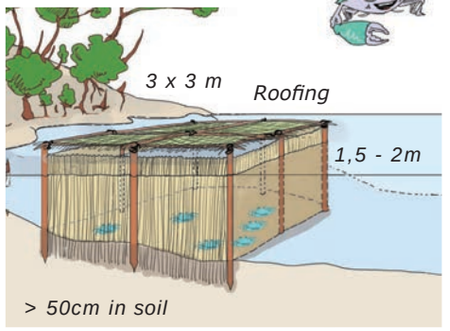
Yes !

Pour the crabs ` into a pen

Yes !

Collective pen in a mangrove channel

Yes !



Crabs in the pools must be tied up

Type of storage	Tanks	Pens
Location	Small arms mangrove channels or small bays, with relatively clean water and renewed by the tides	
Uses	Tank stored individually, used by fisherman or fishing family.	Collective pool of storage used by several fishermen or a fishmonger / sub-collector to keep the product purchased with several fishermen
Dimensions	Length – 1m, width – 1m and height – 1m($1m^3$)	• Vary depending on the amount of crabs handled per week / shipping. For operators who collect 1-2 tons / week the dimensions are: length - 3m, width - 3m, height - 1.5 to 2m (Depending on the tide) • The upper part is covered by a net / satrana roof to protect the pen against the sun at low tide. • The lower part is pressed at least 50 cm into the ground, and crabs are bound to prevent them escaping by digging
Construction Materials	Crates made from local wood (honko) covered by a second hand-fishing net. The upper part is closed with with a rope	Locally available materials; cover made from second hand-fishing net and satrana.
Construction timeframe	Tank : 1 day	Pen : 1 to 2 weeks
Construction Cost	Tank of $1m^3$: 35 000 Ar/piece, or 175 000 FMG/piece	Pen of $9m^2$ (estimation): 100 000 – 150 000 Ar/piece, or 500 000 – 750 000 FMG/piece
Life span, maintenance	1 year, depending on the need for regular maintenance of the wooden structure and the net	For the pen, lack of experience (Remains to be seen).
Reduction of losses and its economic impact	Mortality rate: - Normal storage in baskets or bags: 3.5% (3-4 dead crabs out of 100) - Storage cage-pool: 1.0% (1 dead crab out of 100) and storing several days possible. Additional income: 3000 MGA week. Return on investment	
Other observations, suggestions	• Bind the crabs before pouring them into the tank. • Regularly check the condition of the net and the cover of the enclosure to prevent the crabs from escaping. • Testing a module of the collective pen	

Bound crabs

Improved cart

Action to be taken	Modification of the cart (planks placed higher up, shelves, cover/protective roof
Transportation links	Transport track
Main actors concerned	Sub-collectors, collectors, transporters
Objectives	• Reduction of crushed crabs (injured and dead) by the shelves and the small size of baskets. • Maintain moisture, lower the temperature and protection against rain, wind and sun using a cover / roof.

No !

Transportation of baskets in a traditional cart

Yes !

Modified cart and removable luggage rack

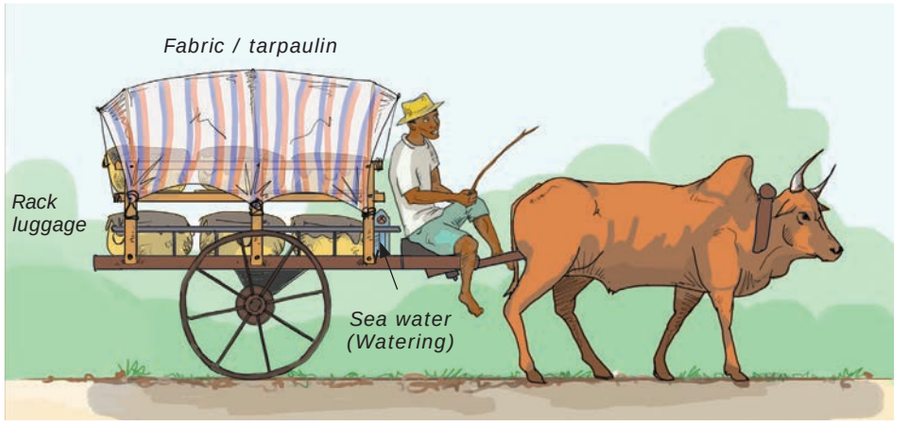
Yes !

Removable luggage rack

Yes !

Modified cart with baskets and protective cover

Removable Luggage rack	The newly built luggage rack is removable and can be added to the traditional cart.
Modification of the size of the baskets	Weight reduction of baskets from 100 kg to 30-40 kg / piece and increase in the amount per trip from 3 to 8-12 (4 to 6 baskets on the floor of the cart and 4-6 on the Removable luggage rack). Basket dimensions: diameter - 50 cm height - 35 cm.
Dimensions of luggage rack	Length – 1.60 m, width – 1.10 m (like the traditional cart) and height – 0.60 m (compared to 0.15 m for the traditional cart). The shelf is placed 0.40 m from the floor.
Construction material	Locally available wood. To ease the burden and cost the removable luggage rack is limited to having a wooden frame without boards.
Construction timeframe	1 week (depending on the availability of local materials).
Construction cost	250 000 to 300 000 Ar/piece, or 1 250 000 to 1 500 000 FMG/ piece (construction costs from villagers who are specialized carpenters).
Life span, maintenance	2-3 years, depending on the working conditions (road conditions, density of travel) and and the quality of maintenance (wood preservation, repair / replacement of damaged components)
Reduction of losses and its economic impact	Mortality rate: - Traditional cart: 14.0% (14 out of 100 dead crabs) - Improved cart: 8.5% (8-9 crabs died in 100) - Additional income: 24, 000 Ariary per trip Return on investment
Other observations, suggestions	If the trips are done during night time and rainy days it is advised to use a protection tarpaulin fabric (second-hand rice bags or tarpaulin sheets). On the other hand, on sunny days, it is recommended to use natural fabrics.



Wooden crates for transport

Action to be taken	Replacing the baskets made from satrana with wooden crates
Transportation links	Transported by boat, cart and truck
Main actors concerned	Sub-collecters, collecters, transporters, export companies
Objectives	• Reduction of crushed crabs (injured and dead) by the shelves and the small size of baskets.
	• Maintain moisture and temperature due to sealing the crates and properties of the wood (wood absorbs the remainder of the water and is a poor conductor of heat).

Transportation of crabs in baskets

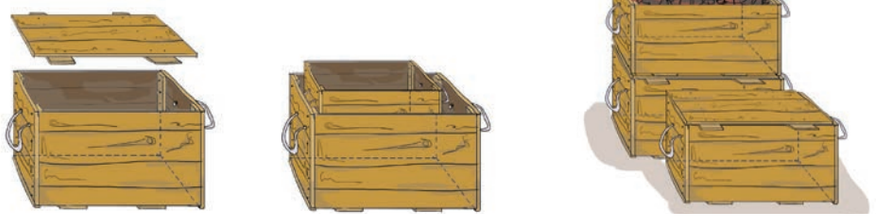
Used wooden crates (recycled /reused from agricultural products such as tomatoes.)

Empty crates of different size are stackable

Wooden crates in a transport canoe

Use of crates with lids	Transport use in modified carts, by trucks and big canoes, where the shape of the hull makes better use of the space available. For canoes smaller transport matches the two types of packaging: baskets and crates are separated by a shelf
Advantages and disadvantages of the crates as compared to the baskets	• Advantages: reduction in number of crabs crushed; maintains humidity and a lower temperature • Disadvantages: Heavier per unit, more costly for initial designs; the use of the available space in the canoe is limited due to the rigidness of the crates
Dimensions and weight	Having crates of two different sizes makes better use of the available space in the canoe or cart and in the empty crate, by placing one crate inside another • Small crate: length - 50 cm, width - 40 cm, height- 40 cm, weight- 9 kg • Large crate: length - 70 cm, width - 50 cm, height - 50 cm, weight- 15 kg
Construction material	Fir wooden planks of 13 cm wide and 1.2 cm thick. To reduce the initial costs, crates used to transport tomatoes, vegetables and fruits can be used
Construction timeframe	3 days for 15 crates made from the new planks
Construction cost	Small crates, new planks: 13 000 Ar/piece (65 000 FMG). Large crates, new planks : 22 000 Ar/piece, (110 000 FMG). Small crates, old planks: 6 000 Ar/piece (30 000 FMG)
Life span	Crates made from new planks: 6 – 9 months (to be confirmed) Crate made from old planks: 1 – 2 months
Reduction of losses and its economic impact	Mortality in transport canoe: - Transport in baskets: 25.0% (25 out of 100 dead crabs) - Transportation in crates: 9.4% (9-10 of 100 dead crabs) Additional income 120 000 Ariary per trip Return on investment
Other observations, suggestions	The local light wood (harofy, mainaty) can be used to reduce costs (the pine trees from the high lands)

Wooden crates that fit together and overlap easily. Rope handles can be easily handled

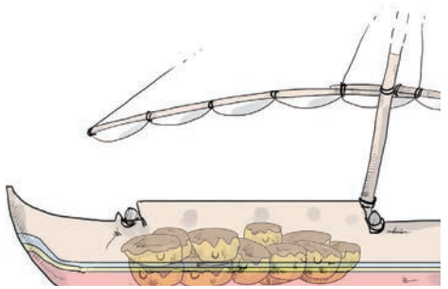


Removable shelves / canoe transport

Action to be taken	*Installation of removable shelves in the sailing and wooden canoe*
Transportation links	*Transport by canoe*
Main actors concerned	*Sub-collecters and collecters.*
Goals and justifications	*Reduction of crabs crushed / dead (carried baskets or in bags) through the use ofshelves, which avoid crowding of baskets and bags.*

No !

Transporting crabs in baskets without shelves.



Yes !

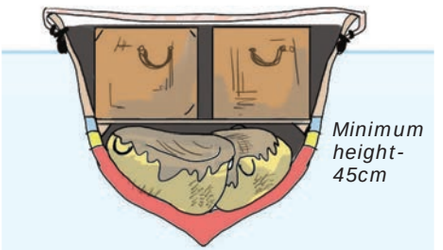
Construction of shelves

Yes !

Installation of the shelves in the center of the canoe

Yes !

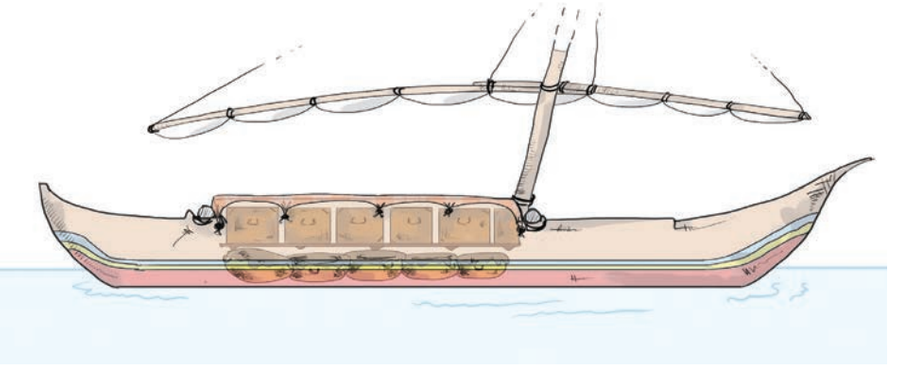
Interior view of a canoe with shelves, crates and baskets.



Minimum height- 45cm

Installing a floor for the bottom of a canoe	A floor needs to be installed at the bottom of the canoe for two reasons: ● separation of the goods from stagnating water and filth in the canoe. ● possibility of loading crates / boxes.
Removable shelves	The removable shelves consist of several numbered planks. They can be removed as needed (using the canoe when it is empty or when being used for transporting other products)
Dimensions	Measured in m², depending on the length and width of the transport canoe. Space between the floor and the shelves – minimum 45 cm; (height of the model of the small crate – 40 cm)
Construction material	Hardwood planks, width- 15 cm and thickness- 2.5 cm. Support plank for shelf made from herringbone wood, dimensions: 10 cm x 10 cm.
Construction timeframe	1 week, if the timber and support plates are available in the area.
Construction cost	Varies depending on the size of the transport canoe. For a canoe of 12 m long and 2.5 m wide, the cost is 480 000 Ar, or 2 400 000 FMG.
Life span	2-3 years depending on the tonnage of goods transported and the frequency of maintenance of the planks and support planks (if the damaged/broken planks can be replaced by new ones)
Other observation, suggestions	The layout of shelves increases the weight of the canoe when empty (about 0.5 ton more for a big canoe (12 m)

Transport canoe with shelves and protection fabric/tarpaulin.
Transport of basket (below) and crates (on the shelves)



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SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in twenty countries throughout the Indian Ocean Region, Southern and Eastern Africa, focuses on fisheries governance, management, monitoring control and surveillance, trade, and food security.

As part of activities to reduce the post-harvest loss, FAO, in partnership with the Ministry of Fishing of the Government of Madagascar, has produced this booklet to help operators in the crab value chain to improve their management and quality of their products.

This brochure provides valuable information, solutions and basic techniques using illustrated instructions that are easy to follow and easy to apply in practice.

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