



Secure Fisheries
Secure Futures



DESK REVIEW : THE PROBLEM OF BYCATCH IN SHRIMP FISHERIES

Hans Bage



INDIAN OCEAN
COMMISSION



Cover photograph courtesy of FAO SmartFish and WWF

REPORT/RAPPORT: SF-FAO/2013/13

Desk review:
The problem of bycatch
in shrimp fisheries

Hans Bage

GCP/RAF/466/EC SmartFish Project

Bage, H. 2013. Desk review: The problem of bycatch in shrimp fisheries. Report/Rapport: SF-FAO/2013/13. January/Janvier 2013. 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 2013

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.

Foreword

The author was contracted to technically contribute to the implementation of activities within the framework of the SmartFish Result 5 under Module 2: *"Improve the regional supply of fish and fish products through post-harvest loss (PHL) reduction"* by identifying key interventions for the reduction and recuperation of the bycatch with a special focus on shrimp trawling in Kenya, Tanzania and Madagascar.

The author specifically contributed to:

Output 5M2.3: Post-harvest losses reduced in the food chain based on assessments from selected countries

Activity 5M2.3.2: Implement interventions to reduce losses in those areas deemed feasible and sustainable

Acknowledgements

The author wishes to thank Davide Signa, SmartFish Fisheries Officer and Key Expert for Result 5, for all the support during the preparation of this study. Many other colleagues gave valuable support during the briefing mission to Rome, in particular John Ryder, SmartFish Lead Technical Officer, Yvette Diei-Ouadi, SmartFish Fishery Industry Officer and Helga Josupeit, Post-Harvest Expert.

Executive summary

The present situation regarding shrimp trawling and bycatch collection in the countries studied can be summarized as follows:

In Kenya, there has been a ban on shrimp trawling for several years due to conflicts with artisanal fishers. This ban was lifted in May 2011 and presently, there are only two shrimp trawlers operating. These trawlers reportedly deliver all their bycatch to the local Beach Management Units (BMUs).

In Tanzania, there was a ban on shrimp trawling in 2008/9 due to resource problems. At this time, there is a new moratorium in place and no shrimp trawling is taking place. However, when the trawlers were operating, there was a system in place to take care of the bycatch, made up of three different options:

- Landed by the trawler at the end of a fishing trip;
- Collected at sea by authorized fish merchants;
- Collected at sea by artisanal bycatch traders.

In Madagascar, a number of activities and projects have been implemented, some with the participation of FAO. At this time, there are systems in place for bycatch collection.

In Mozambique, projects have been implemented to introduce new types of collector vessels, bycatch receiving stations and other more formal arrangements. These activities have failed whilst, at the same time, bycatch collection by artisanal fishermen using traditional canoes and landing on the beaches has increased every year. This has become an important activity for the fishing communities along the Sofala Bank and the bycatch, which is traditionally processed (salted, dried, smoked) and traded, is an important source of income for coastal communities and protein for inland communities.

SmartFish activities should focus on supporting small-scale fishing communities with the organization of their activities to increase bycatch collection:

Legally, by

- Making bycatch collection by small-scale fishers legal at the national level;
- Facilitating agreements between trawler operators and bycatch collectors and their organizations.

At the socio-economic level, by

- Organizing the collectors;
- Providing credit for smaller investments, including safety equipment.

Technically, by

- Introducing improved insulated iceboxes for collector canoes;
- Providing training in safety at sea aspects for bycatch collection operations.

Traditional processing techniques such as salting, drying, smoking and curing should be supported rather than the introduction of new techniques.

In Tanzania and Kenya, where trawler fishing for shrimp has been closed several times, SmartFish activities should also include support for the small-scale fishing sector, including traditional processing and trade of the catch. This could be done by:

- Supporting the Beach Management Units through capacity building activities;
- Organizing cooperatives or associations where necessary;
- Providing training on safety at sea;
- Facilitating access to microcredit.

Résumé exécutif

La situation actuelle concernant la pêche au chalut des crevettes et les prises accessoires dans les pays concernés par l'étude peut être résumée ainsi :

Au Kenya, pendant plusieurs années, la pêche au chalut des crevettes était interdite pour cause de conflits entre pêcheurs artisanaux. Cette interdiction fut levée en mai 2011 et actuellement, il y a seulement deux chalutiers de crevettes qui sont en opération. Il est rapporté que ces chalutiers livrent toutes leurs prises accessoires aux Unités de gestion de plage (BMUs).

En Tanzanie, la pêche au chalut des crevettes était interdite durant la période 2008/9 pour cause de problèmes de ressources. Actuellement, il y a un nouveau moratoire en place et aucune pêche au chalut des crevettes n'est entreprise. Cependant, à l'époque où les chalutiers opéraient, un système était en place pour gérer les prises accessoires. Cela consistait en trois possibilités :

- Le débarquement des prises par le chalutier à la fin d'une journée de pêche ;
- La collecte en mer par des marchands de poissons autorisés ;
- La collecte en mer des prises accessoires par des commerçants artisanaux.

A Madagascar, plusieurs activités et projets ont été mis en œuvre, y compris ceux avec la participation de la FAO. Il y a actuellement des systèmes en place pour la collecte des prises accessoires.

A Mozambique, il y a eu des projets mis en œuvre pour introduire des nouveaux types de navires pour les collecteurs, des stations de réception des prises accessoires et des arrangements plus formels. Ces activités ont échouées alors que la collecte des prises accessoires par des pêcheurs artisanaux utilisant des canoës, ainsi que le débarquement sur les plages ont augmenté d'année en année. Cela est actuellement une activité importante pour les communautés de pêche le long du Banc Sofala et les prises accessoires, qui sont transformées traditionnellement (salaison, séchage, fumage) et commercialisées, sont une source importante de revenu pour les communautés côtières et de protéine pour les communautés intérieures.

Les activités de SmartFish pour augmenter la collecte des prises accessoires devraient se concentrées sur l'appui des communautés de pêche à petite échelle dans l'organisation des activités :

Légalement en

- Légalisant la collecte des prises accessoires par des pêcheurs à petite échelle au niveau national ;
- Facilitant les accords entre les opérateurs de chalutiers et les collecteurs des prises accessoires et leurs organisations.

Au niveau socio-économique en

- Organisant les collecteurs ;
- Accordant des crédits pour des petits investissements, y compris pour les équipements de protection.

Techniquement en

- Introduisant des glacières isolantes pour les canoës des collecteurs ;
- Offrant des formations sur les aspects de la sécurité en mer des opérations de collecte des prises accessoires.

Les transformations traditionnelles comme la salaison, le séchage, le fumage et le traitement de préservation devraient être soutenues au lieu d'essayer d'introduire des nouvelles techniques.

En Tanzanie et au Kenya, où la pêche au chalut des crevettes a été fermée à plusieurs reprises, les activités de SmartFish devraient également inclure le secteur de la pêche à petite échelle, y compris les transformations traditionnelles et le commerce des captures. Cela pourrait être fait en :

- Soutenant les BMUs à travers des activités de renforcement des capacités ;
- Organisant des coopératives ou associations là où c'est pertinent ;
- Offrant des formations sur la sécurité en mer ;
- Facilitant l'accès au micro-crédit.

Contents

Foreword	3
Acknowledgements	3
Executive summary	4
Résumé exécutif	6
Contents	8
List of figures	9
Acronyms and abbreviations	10
1. Introduction	11
1.1 Background	11
1.2 Mission details	11
2. Presentation of desk review findings	12
2.1 General	12
2.2 Kenya	12
2.2.1 Shrimp trawling	12
2.2.2 Bycatch	13
2.2.3 Bycatch utilization	13
2.2.4 Policy issues	14
2.3 Tanzania	15
2.3.1 Shrimp trawling	15
2.3.2 Bycatch	16
2.3.3 Artisanal shrimp fishing	17
2.3.4 Bycatch utilization	18
2.3.5 Requirements for increased bycatch utilization	19
2.4 Madagascar	21
2.4.1 Shrimp trawling	21
2.4.2 Bycatch utilization	22
2.5 Mozambique	24
2.5.1 Shrimp trawling	24
2.5.2 Bycatch	24
2.5.3 Bycatch collection	24
3. Conclusion and recommendations	28
3.1 Summary of findings	28
3.2 Recommendations	28

References	30
Annex 1. Terms of Reference, Consultant	32
Annex 2. List of persons met and outcomes	34

List of tables

Table 1. Bycatch ratio from Jan. – Feb. 2011 trawl survey in Malindi-Ungwana Bay, with and without the use of a Turtle Excluder Device (TED)	13
Table 2. Catch composition and bycatch ratio in Tanzanian 2011 trawl surveys using the Turtle Excluder Device	18

List of figures

Figure 1: Shrimp fishing zones in Tanzania	15
--	----

Acronyms and abbreviations

BCS	Bycatch Collection Station
BMU	Beach Management Unit
BRD	Bycatch Reduction Devices
CP	<i>Combinado Pesqueiro</i> – Support station for small-scale fisheries
DANIDA	Danish International Development Agency
DOF	Directorate of Fisheries (Tanzania)
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
IDPPE	Small Scale Fisheries Institute (Mozambique)
IIP	Fisheries Research Institute (Mozambique)
KMFRI	Kenya Marine and Fisheries Research Institute
MCS	Monitoring, Control and Surveillance
ODA	UK Overseas Development Administration
OFCF	Overseas Fisheries Cooperation Foundation
PNB	Pêcherie de Nosy Be
REBYC	Reduction of Bycatch
TAFICO	Tanzania Fisheries Corporation
TED	Turtle Excluder Device
UDIP	Directorate of Industrial Fishery (Mozambique)
UDPPE	Government's Directorate of Small-Scale Fishery (Mozambique)

1. Introduction

Bycatch has become a global fisheries management problem. It is estimated that bycatch accounts for 27 percent of fish caught worldwide. A substantial amount of bycatch is discarded at sea, as fishers concentrate on target species. The use of bycatch reduction devices (BRD) and other selective methods have rendered mixed results so far. In temperate areas, where there are fewer species with wider size variations, such methods have proved effective. It would not be wrong to suggest that it will be a long time before effective selective techniques for tropical multispecies fisheries are available. The multitude of species in tropical populations with size and behaviour similarities makes it very difficult to use the BRDs in temperate regions. Under these circumstances, the utilization of bycatch is at the moment the best proposition. In this regard, the FAO Code of Conduct for Responsible Fisheries calls for states to “encourage those involved in fish processing, distribution and marketing to improve the use of bycatch to the extent that this is consistent with responsible fisheries management practices” (FAO 1995:28-29).

1.1 Background

The author was contracted to carry out a desk review on the issue of bycatch in shrimp fisheries including:

- An appraisal of the magnitude of the bycatch problem, highlighting specificities and similarities among the focus countries;
- A review of all past and ongoing similar interventions, including trade of bycatch and bycatch products, in the region and more specifically in Tanzania, Kenya and Madagascar;
- A review of legal frameworks and policy documents and any other relevant documents, studies, reports/information;
- An analysis of the national contexts and comparison with the case in Mozambique.

1.2 Mission details

The assignment was carried out from 15 October to 2 November 2012 and included a home-based desk review and a two-day briefing mission in Rome to meet the relevant people and collect documents not available on the Internet.

2. Presentation of desk review findings

2.1 General

Bycatch and discards are highest in shrimp fisheries. In 1995, the total bycatch in shrimp fisheries was estimated at 11.2 million tonnes, of which 9.5 million tonnes were discarded, representing 30 percent of the total discards in marine fisheries.

Investigations have been made into the ways to unburden vessels of the bycatch and associated costs. Solutions have involved the possibility of using mother ships and carrier vessels to collect fish directly from the trawlers. However, the costs involved in setting up and running such formalized, often government-run systems, often out-weigh the value of the bycatch itself.

More success has been found in involving smaller vessels with lower capital and running costs and with owners and operators that take advantage of cheaper raw materials. In some instances, this activity has become an addition to fishing. Small-scale fishermen finding it difficult to make a living from capture fisheries, have turned to collecting bycatch from shrimp trawlers in coastal waters, using their existing tools and skills (boats and seamanship).

The following sections provide an overview of the situation of shrimp trawling, discards and the utilization of bycatch in Kenya, Tanzania and Madagascar. The situation in Mozambique, where bycatch collection is an important and growing activity, is also presented. Finally, the conclusion and recommendations of this review are presented.

2.2 Kenya

2.2.1 Shrimp trawling

Initial fishery surveys, conducted by the Government of Kenya with support from the Food and Agriculture Organization of the United Nations (FAO) in the 1960s, showed the existence of shallow water shrimp stocks that could be profitably harvested by a few medium-sized semi-industrial trawlers. Since then, between four and ten medium-sized, semi-industrial trawlers have landed between 400 and 600 tonnes of shallow water shrimp, which is sent predominantly to the export market.

The Malindi-Ungwana Bay complex is one of the most important fishing grounds along the Kenyan Coast. The bay is shallow with a wide continental shelf, extending between 15 and 60km offshore. The bay supports a significant part of the artisanal fishery, as well as the only commercial trawl fishery within Kenyan territorial waters.

Under the fishery regulations, the trawl fishery is open annually from April to October. However, shrimp trawling was stopped by the Fishery Department in September 2006, mainly due to fishery resource user conflicts and contravention of existing regulations by trawlers.

In May 2011, shrimp trawling opened again and currently two licensed trawlers are operating. These trawlers retain the shrimp and the most valuable fish, whilst the rest of the bycatch is sold/given to local Beach Management Units (BMUs).

2.2.2 Bycatch

Since 2007, the Kenya Marine and Fisheries Research Institute (KMFRI) has undertaken environmental, fishery and socio-economic surveys in the bay aimed at assessing the environment of the bay, and monitoring the fishery and the socio-economic status of fishers and other resource users.

A trawl survey was carried out during January - February 2011 using a medium-sized shrimp trawler. The area was stratified into four depth zones: 0 - 10m (Zone 1), 10 - 20m (Zone 2), 20 - 40m (Zone 3) and 40 - 100m (Zone 4). The study found that between 86 and 100 percent of the catch is composed of fish (bycatch).

Table 1: Bycatch ratio from Jan. – Feb. 2011 trawl survey in Malindi-Ungwana Bay, with and without the use of a Turtle Excluder Device (TED)

Zone	Catch kg/hr shrimp with TED	Catch kg/hr fish with TED	% bycatch	Catch kg/hr shrimp no TED	Catch kg/hr fish no TED	% bycatch
1	2.5	47.9	95	3.9	120.9	97
2	1.4	8.6	86	1.0	21.4	96
3	0.8	24.1	95	0	30.4	100
4	0	5.5	100	0	31.0	100

In a similar survey carried out in May 2011, 556kg of shrimp and 4,119kg of fish were caught giving a bycatch ratio of 88 percent.

2.2.3 Bycatch utilization

Part of the bycatch is retained and sold by the trawl companies in the local market, particularly those fish of high commercial value. However, most of the fish is discarded and comprises species that are only of value to artisanal fishing units and consumers.

Since 2000, shrimp trawlers have started to retain more of the bycatch, which in turn has landed on the consumer's table, hereby augmenting protein requirements.

When the trawlers in Kenya operate, the owners are reluctant to make the bycatch freely available to fishermen. Firstly, the trawler operators feel that their crew might also sell shrimp and high quality fish to artisanal fishermen, leading to catch losses. Secondly, the trawlers are concerned about safety if such operations take place in the open sea.

Market destinations also vary from one species to the other. Tourist hotels in Malindi and Mombasa, and a seafood processing company, Sea Harvest, were the main market destinations for lobsters and shrimp at the time of the surveys. For the rest of the species, Malindi and Gongoni were the main market destinations. Mixed fish, which normally consists of fish that do not command high price in the market, are consumed by the local population.

Bycatch caught by the two trawlers presently operating in Kenya is sold or given to the local BMUs.

2.2.4 Policy issues

In Kenya, the Department of Fisheries is responsible for managing fisheries resources (Godfrey Monor). The strategy of the Fisheries Department is to maximize the production, exploitation and utilization of the country's fisheries resources on a sustainable basis for the social and economic benefit of the Kenyan people. The Fisheries Department is mandated to formulate and issue national fisheries policies and guidelines for the sustainable management and exploitation of national fisheries resources.

There is no formal policy in Kenya regarding bycatch, however, the Fisheries Department is in the process of developing a national fisheries policy. In the absence of a national policy on bycatch, the Government encourages the utilization of fish bycatch as food to meet national food requirements. In Kenya, the following legislation relate to bycatch:

- Trawling is only allowed beyond five nautical miles from the shore (Fisheries Act cap 378, Regulation 43). This regulation was meant to minimize conflicts between semi-industrial shrimp trawlers and local/artisanal fishermen. However, this legislation was not backed by any scientific information. Stocks of shrimp are relatively poor beyond the five nautical miles limit and consequently shrimp trawlers commonly trawl within the five nautical miles band, resulting in many conflicts. Compliance with this legislation is therefore very low. The government is reviewing this legislation and more detailed research is being undertaken to determine the distribution of shrimp stocks within the Malindi-Ungwana Bay area. Information gathered from this research will help guide the formulation of a new legislative regime.
- The Kenyan Government issued a notice in the Kenya Gazette (Gazette Notice No. 7565 of 31/10/2001) which requires all shrimp trawlers to use Turtle Excluder Devices at all times while trawling in Kenyan territorial waters. To date, however, compliance is very poor due to the inadequate performance of the TEDs available and weak enforcement mechanisms.

- In the Kenya Gazette (Gazette Notice No. 7565 of 31/10/2001), the government also publicised a closed season for trawling from November to March. This period has been identified as the shrimp breeding season and this legislation intends to safeguard this. Implementation has been enforced and compliance is expected to improve.

Utilization of the fish as food and encouraging the creation of fishmeal factories are other potential means to reduce the large amount of discarded bycatch.

2.3 Tanzania

2.3.1 Shrimp trawling

The Tanzanian coast has been divided into three areas for shrimp fishery trawler licensing purposes known as Fishing Zones 1, 2 and 3. These are categorized according to their resource potential as follows:

- Zone 1: Pangani to Bagamoyo stretch, commonly called the Sadani to Pangani area; it is ranked third in terms of production volume, contributing to approx. 25 percent of annual output;
- Zone 2: The central area is in the Rufiji delta, commonly known as the Kisiju area; this area has the most potential and contributes to approx. 45 percent of the total annual shrimp production;
- Zone 3: To the south is Jaja, Kilwa and further south, an area commonly known as the Jaja and Kilwa area; this area is ranked second in terms of production volume, contributing to approx. 30 percent of annual production.

Figure 1: Shrimp fishing zones in Tanzania



In the mid-1980s and more specifically, 1987, licensing of foreign trawlers started. A few trawlers were licensed in 1987 and the number of applicants has been increasing every year. In 2001, the number of shrimp trawlers was 20.

The industrial trawlers are licensed by the Directorate of Fisheries to fish in the territorial waters. Some of the areas in which they fish are also potential areas for artisanal fishers.

For the 2002 fishing season, 26 vessels were licensed and out of these vessels, 24 actively participated in the shrimp fishery. In 2003, 25 vessels were licensed.

The total production of shrimp is estimated to have been over 2,200 tonnes/year on average between 1991 and 2001, with 800 tonnes produced by industrial fisheries and 1,400 tonnes by the artisanal sector. Thereafter, the shrimp production trend shows a decline from 1,320 tonnes in 2003 to 202 tonnes in 2007, regardless of the reduction in fishing effort. Studies of shrimp catch trends and population dynamic indices over the past ten years justified a closure of the fishery to allow for the recovery of the overexploited stock. For this reason, the shrimp fishery was closed in 2008 and 2009 in the three fishing zones along the coast of Tanzania and more recently there has been a new moratorium imposed on shrimp trawling.

2.3.2 Bycatch

A survey carried out between March and July 2009 showed that 9, 4.5 and 29.2 kg of finfish was caught in the three fishing zones for every kilogram of shrimp, giving a bycatch ratio of 90, 81 and 97 percent for the different zones. The bycatch for shrimp trawling included different species of finfish, crabs, squids and sea urchins.

Surveys carried out in February and June 2011 show that a substantial part of the bycatch caught during the surveys is retained by the research vessel while a smaller amount is discarded.

Table 2. Catch composition and bycatch ratio in Tanzanian 2011 trawl surveys using the Turtle Excluder Device

	1 st survey	1 st survey	2 nd survey	2 nd survey
	TED catch (kg)	TED catch (kg)	TED catch (kg)	TED catch (kg)
Total catch	2812	2808	4528	5037
Total retained catch	2565	2762	3957	4453
Retained fish	2076	2173	2658	3105
Shrimp catch	450	509	648	741
Discarded catch	247	46	154	120
% retained bycatch	73	77	59	63
% discarded bycatch	3	3	1	1
% total bycatch	76	80	60	64

Bycatch occurs in both marine and inland fisheries. Shrimp trawling is the single largest bycatch producer in the country and most of the bycatch produced in the marine industrial fisheries is discarded, which is in fact illegal.

In 1992, it was estimated that the average percentage of bycatch discarded from the Bagamoyo and Kisiju grounds (Zones 1 and 2) was 74 and 82 percent respectively.

2.3.3 Artisanal shrimp fishing

Artisanal shrimp fishers are either permanent villagers or migrants who set up seasonal camps in potential areas, following the onset of the annual long and short rains. Some camps have developed from semi-permanent to permanent villages. Fishing camps are set up in different, remote areas where accessibility and frequent communication is not so easy. Such areas are reachable by dugout canoes, sail boats, outrigger canoes and motorized boats.

There have been conflicts between the artisanal and industrial subsectors of the Tanzanian shrimp fishing industry over a number of issues. Although the conflicts have been settled amicably, as and when they occurred, there has been no permanent solution to ensure long-term harmony. The artisanal fishers feel very strongly that the industrial trawlers have been the cause of decreased catches and cash earnings. They also claim that substantial amounts of fish that would have been useful for human consumption is being thrown overboard by the captains to create room for sorting and the preservation of export shrimp. There have been quite a number of allegations, including the destruction of fishers' nets, destruction of the environment and biodiversity and violation of government instructions, such that a general analysis suggests establishment of co-management arrangements.

To deal with these issues it has been suggested that:

- The number of shrimp trawlers is reduced, from the 26 licensed in 2002, to 8. This suggestion was merely based on the number of trawlers operated by the Tanzania Fisheries Corporation (TAFICO) before the licensing of foreign trawlers;
- Licensed vessels fish further offshore in order to allow for a no-trawling zone for artisanal fishers. The suggested distance offshore was 8km and a depth of 7m; presently, they are confined to a depth of 5m;
- Arrangements are made for the captains of the trawlers to sell the marketable bycatch and rejected shrimp to the local communities;
- The 'closed season' for trawlers should be extended from 3 to 6 months.

2.3.4 Bycatch utilization

With regard to the utilization of bycatch from shrimp trawling, there are indications that there has been a positive trend over the years. This could be attributed mainly to increased demand for fish in the country.

Sometimes shrimp trawlers would avoid periodically offloading the catch in Dar es Salaam for fear of losing time and the advantage of a good fishing zone. If a trawler needs to move further afield it would rather discard its fish catch instead of offloading it in the harbour.

Official data seems to be composed of bycatch that is landed by respective trawlers at the end of fishing trips and, to a certain extent, the amount of fish that is collected at sea by authorized fish merchants. The data hardly includes the amount informally collected at sea by artisanal fish traders. It is estimated that the latter group lands 700–750 tonnes of bycatch per annum. Based on assumed 1:5 shrimp to bycatch estimates, it could be suggested that the bycatch volume from both artisanal and industrial shrimp fisheries ranges between 8,000 and 10,000 tonnes. Landed bycatch constitutes 25–30 percent of the total amount thus leaving 70–75 percent discarded at sea.

Three options are used to land bycatch from shrimp trawlers in Tanzania, these are:

- Landing by the trawler at the end of a fishing trip;
- Collection at sea by authorized fish merchants;
- Collection at sea by artisanal bycatch traders.

Preservation of bycatch on board a trawler until the end of a fishing trip is the most acceptable mode of landing in terms of the existing legal framework.

Landing by authorized fish merchants is undertaken by rich fish merchants residing in big towns, particularly Dar es Salaam, who purchase bycatch from shrimp companies. The fish is collected either at sea or in the harbour when a trawler docks at the end of a fishing trip. Payment is either on a cash or credit basis. Prior to embarking on a collection trip at sea, the merchant and trawler owner have to obtain a permit from the Department of Fisheries to allow them tranship the bycatch. In this manner, transactions are relatively straightforward since the merchants are well organized and there is good communication between the captain on board and the onshore office. However, this type of trading is very sporadic as merchants only go to sea when the price of fish in the market is high.

Artisanal fish traders, living adjacent to shrimp fishing grounds, have been engaged in bycatch collection since commercial shrimp trawling began in the 1960s. Initially, transactions were primarily based on barter arrangements, whereby villagers would supply provisions such as vegetables, fruits and drinks in exchange for the bycatch. More often than not, the fish was processed and sold or shared within the village.

Sometimes cured bycatch was sold to nearby hinterland villages. Over time, however, the demand for bycatch increased, changing the barter system to cash transactions.

Nowadays, the supply of provisions, especially in Zone 1, is regarded as the equivalent to cash with the issuance of receipts. Transactions are made before a trader is provided with the equivalent amount of fish, based on a standing price. In most cases the price is harmonized amongst the different trawlers operating in a particular zone. In the southernmost zone (Zone 3), however, artisanal bycatch traders may assist in processing fish on board in order to obtain bycatch.

The number of bycatch collectors has been increasing over time, particularly in Bagamoyo area. For instance, in 1995, there were ten artisanal bycatch traders in this area; by 1998 the number had increased to 45. These artisanal fish traders hire motorized canoes to collect the bycatch at sea.

The bycatch market also varies from place to place. In Dar es Salaam, open market fresh/frozen fish is sold. Away from the coast, salted and smoked products are highly rated, whilst along the coast, salted fermented fish, locally known as nguru and ng'onda, is more appreciated. Fishing communities usually prefer fresh fish.

2.3.5 Requirements for increased bycatch utilization

Legal requirements

The fishing industry in Tanzania is regulated by the Fisheries Act of 1970 (No. 6 of 1970), which provides the legal framework for the development and management of the sector. The main regulations in force are the Fisheries Principal Regulations 1989, which lay down different controls such as the licensing rules for fishing vessels, fishermen and fish dealers.

Basically, the regulations tend to favour bycatch utilization. The main problem is that the legal framework relies on vessels landing bycatch at the end of a fishing trip. Although this may sound ideal and orderly theoretically, landing a complete bycatch at the end of each fishing trip in practice is not easy due to the aforementioned factors.

Based on experience in-country and from other countries, collecting the bycatch at sea appears to be a practical solution. In this case, current regulations, particularly regarding transshipment, should be re-considered to integrate prevailing realities. There is no doubt that issuing permits to fish merchants to allow them to collect the bycatch at sea is an important step towards increased bycatch utilization.

It should be remembered, however, that these merchants only make up a small proportion of the traders involved in bycatch collection. The majority of traders are made up of artisanal fish traders living in villages adjacent to shrimp fishing grounds.

These traders should be assisted in organizing themselves before they can be expected to comply with legal requirements. Unfortunately, the present legal framework does not enable extension services to be given to artisanal bycatch traders because their operations are illegal. This is actually one of the setbacks that needs to be addressed if their trade is to be regularized for the promotion of bycatch utilization.

Involvement of the fisheries stakeholders in the co-management of the resource is outlined in the National Fisheries Policy of 1997. One of the objectives of decentralization in Tanzania is to extend services and provisions closer to the people and in practice, this was meant to devolve resource management responsibilities to the District Councils. Although resource development and management plans are prepared annually, the District Councils have failed to implement them effectively due to financial constraints.

Formation and registration of fisher associations or cooperatives can be done under the Societies Ordinance 1954 or the Co-operative Societies Act, 1991.

Institutional requirements

As mentioned above, three institutions are directly linked to the promotion of bycatch utilization in Tanzania: the Directorate of Fisheries (DOF), trawler owners (together with the crew at sea) and bycatch traders. Each of the institutions has specific objectives and different interests in bycatch utilization.

The DOF has an obligation to ensure increased food fish availability alongside employment opportunities in the fisheries sector. In this case, it is obliged, according to its policy, to ensure rational utilization of what is being caught, including incidental catches. The policy and legal framework are consistent with the political will; however, it has been very difficult to enforce the regulations.

Given the present enforcement capabilities, discarding of bycatch at sea, as well as informal collection by artisanal fish traders, will continue. Promotion of institutional capacity building in villages adjacent to shrimp fishing grounds would be one way of organizing the trade for the mutual benefit of both parties. Once organized, adherence to rules could be enforced by social pressure of peer groups rather than relying on more costly and less effective conventional methods of Monitoring, Control and Surveillance (MCS).

Following a decline in catch per unit effort, shrimp companies are increasingly in need of bycatch traders in order to offset production costs. Although it is obvious that trawler owners would like to receive more revenue from sales of bycatch, they tend to resent collection at sea by artisanal fish traders. There are many reasons behind this negative and non-cooperative attitude including: the pilfering of shrimp, the contamination of export products on board and failure, by trawler owners, to receive expected revenues due to collusion between untrustworthy crews at sea and traders.

In this regard, attractive incentive packages could help enhance collaboration between crews at sea and owners on shore. Such incentives would evidently, in turn, promote the utilization of bycatch.

To fish traders, bycatch collection is a source of employment, income and food. There are differences between the rich traders living in Dar es Salaam and the artisanal fish traders living in villages adjacent to fishing grounds. The former group is small, well organized and their trading operations are relatively smooth. On the other hand, the latter group comprises several disorganized traders. Despite their disorganization, the artisanal traders are more likely to facilitate increased bycatch utilization due to their cost-effective modes of operation. In addition, the experiences from other developing countries confirm that systems involving small-scale traders are more efficient in terms of the collection of bycatch compared to other systems.

According to experience in Mozambique, it is important to base strategies for the sustainable maintenance of bycatch enterprises at the local level. An FAO project in Madagascar came out with similar observations (Rakotondrasoana, 1995). In the case of Tanzania, the artisanal fish traders need institutional support to enable them to be formally recognized and thus, allowed to operate under the same conditions as the rich merchants.

Technological requirements

Regarding technological constraints, the problem of bycatch utilization starts with the limited amount of space on board the trawlers. Artisanal bycatch traders prefer to collect frozen fish that has not stayed long in cold rooms. In this way, they are able to command high market prices. Sometimes, they are obliged to purchase fish from evening hauls, which is often not frozen compelling increased use of ice.

Artisanal bycatch traders prefer to minimize the use of ice. The lack of insulated containers on board artisanal canoes and in the villages forces the artisanal fish traders to send the fish to market as quickly as possible, even if the market price has dropped.

The number of operating days is highly affected by fluctuation of fish prices in the open market and lack of storage facilities. The use of locally made containers such as the 'Senegalese type container' in the canoes could no doubt improve the current situation.

2.4 Madagascar

2.4.1 Shrimp trawling

The marine fisheries in Madagascar comprise industrial and artisanal practices. The majority of fisheries are artisanal. The industrial fleet trawls off the central, northwest, and east coasts up to 2 miles from shore and exploits a 1–10 mile-wide coastal area on the west coast. The artisanal fisheries also exploit the same coastal areas.

Most of the industrial fishing fleets around Madagascar are international, primarily from the European Union or Japan. Native fishermen are generally artisanal, whereas the international fleets are industrial.

The majority of fishers are local artisanal fishers that catch shrimp with beach-seine and trawl nets. The primary industrial fisheries are the shrimp and tuna fisheries including a small, local industrial fleet that trawls for shrimp. Between 1990 and 2001 artisanal shrimp catches were between 20,000 and 40,000 tonnes/year whilst shrimp catches from trawling were approximately 15,000 tonnes/year between 2001 and 2004.

For shrimp trawling, the following zones have been defined:

Zone I	Nosy Bé, Ambaro and Tsimipaika Bay. The permissible catch is 1,560 tonnes/year.
Zone II	Natendry Bay The permissible catch is 760 tonnes/year. Only eight trawlers are allowed.
Zone III	Mahajamba Bay The permissible catch is 320 tonnes/year. Only three trawlers are allowed.
Zone IV	Mahajanga The permissible catch is 310 tonnes/year. Only three trawlers are allowed.
Zone V	Cap Tanjona The permissible catch is 930 tonnes/year. Only 10 trawlers are allowed.
Zone VI	Cap San Andres
Zone VII and VIII	Area between Voalavo and south of Morondave The permissible catch is 1,000 tonnes/year.

2.4.2 Bycatch utilization

In 1990, Raveloson and the FAO conducted a shrimp trawler bycatch study. They collected information on the constraints of rational exploitation, the technical and economic situations and drew up a proposition for bycatch development.

From 1993 to 1994, Roullot and Rakotondrasoa worked with the FAO to assess the utilization of bycatch. They collected information on: the situation of bycatch globally and in Madagascar; the species composition of bycatch; categories of bycatch fish; quantities unloaded in each zone; variation of catch (day/night); the collection of bycatch at sea by different types of boats; and subsequent processing and marketing procedures. This study found that 18,000 – 20,000 tonnes of bycatch per year were discarded in Madagascar and 10,500 tonnes of bycatch was used for animal feed.

In 1995, the FAO, UNDP, and the Malagasy Government teamed together to assess the utilization of bycatch from shrimp trawlers at an international workshop in Nosy Be, Madagascar. Information was shared on: bycatch utilization in different countries; conclusions and recommendations concerning government policies on bycatch; and collaboration between governments and fleet owners in coastal countries. Participants came from: Benin, Cameroon, Cuba, Gambia, Guinea, Nigeria, Madagascar, Mozambique, Suriname, Tanzania, Thailand, the United Kingdom (with information from India), and Vietnam.

From 1997 to 2000, the Overseas Fisheries Cooperation Foundation (OFCF) of Japan, in collaboration with the Malagasy Government, implemented another project on the best use of bycatch. The OFCF conducted surveys on fishing ground development within the Exclusive Economic Zone (EEZ) in coastal countries concerned, providing related advice and guidance. Studies were carried out and technical guidance was provided for coastal fisheries development, fish processing and improvements for distribution. Bycatch marketing was enhanced through the provision of materials for storage and transport, the training of fishermen and sellers, the promotion of bycatch consumption (testing a new process) and different processing methods (smoked, dried, etc.). The Japanese project developed fishing grounds, promoted fisheries, fish processing and distribution, and conducted surveys on living marine resources.

In 1998, Andriamizara participated in a national shrimp workshop to determine bycatch in Mahajanga. Information was collected from three fishing companies working in Mahajanga on species composition, the ratio of shrimp/fish and bycatch marketing prices and destination.

In 2002, the Japan International Cooperation Agency (JICA) and the Malagasy Government conducted a project on developing bycatch storage. They conducted feasibility studies (collecting information about society and bycatch in Mahajanga), and provided a cold storage unit (900m³, 300 tonnes, -20 °C) and transportation. The study determined that storage on land was one way of improving the quality and quantity of bycatch and that there needs to be collaboration between the administration and fleet owners. Local fishers use six to seven metre vessels (with small inboard motors) that transfer bycatch from vessels at sea to shore side markets. This transfer permits the retention and use of bycatch that would have previously been discarded.

Fresh bycatch is available to coastal communities in remote areas and frozen bycatch is marketed in urban areas. In other remote areas, people in small canoes scoop up discarded bycatch from the surface of the water. Such fish enter the traditional food chain as salted, dried, or smoked fish and is sold in rural and urban markets. The company, Pêcherie de Nosy Be, which collaborated with an FAO project on bycatch utilization in 1994, had an active community bycatch programme. However, it appears that the company closed down 2 years ago.

2.5 Mozambique

2.5.1 Shrimp trawling

Shrimp is the most valuable commercial fishery in Mozambique and commercial shrimp fishing takes place mainly on the Sofala Bank. Most of the shrimp is caught inside the 12-mile limit. Deep water shrimp are found further out, inside the 200 mile EEZ. The total fleet registered in 1997 was 109 vessels, of which 82 are ascribed to the industrial fishery (64 for shrimp and 18 for deep water shrimp), and 27 to the semi-industrial fishery.

2.5.2 Bycatch

The industrial trawlers only land a small portion of bycatch; normal practice is to retain the shrimp and some of the more valuable fish from the last few hauls.

The Fisheries Research Institute (IIP) of Mozambique publishes reports and studies on aquatic science and fisheries research on a regular basis. From biological studies and national statistics, it has been found that there is a wide variation in bycatch yields. Research cruises have given indications that bycatch to shrimp ratios (by weight) varies from 2.6:1 to 10.5:1 depending on the area fished. In addition, a study conducted by the IDPPE (1994), estimated rates of 5:1 for fish bycatch and shrimp, based on samples collected by extension workers on board trawlers.

With these ratios and a shrimp catch of about 10,000 tonnes per year, the estimated bycatch is between 30,000 and 50,000 tonnes per year, assuming the minimum ratios of 3:1 and 5:1. Despite these variations, it is apparent that the bycatch accounts for a large percentage of the catch.

2.5.3 Bycatch collection

Some progress towards retention of increased amounts of bycatch by the semi-industrial trawlers and fishermen with collector crafts is currently being made. The system of transferring the bycatch from the trawlers to the small collector craft at sea is of particular interest.

The utilization of bycatch from shrimp trawlers is part of a general development goal of the Mozambique fisheries, aimed at overcoming fish shortages. Many factors (technical, economic, marketing and social) inhibit the utilization of bycatch.

The retention of bycatch on board trawlers is hampered by two factors: labour and space. Labour is confined to the sorting, grading and packing of the shrimp catch between hauls. This factor affects the handling and disposing of the bycatch. The amount of storage space available on board also imposes limitations. Occasionally, the bycatch can be transferred at sea from the trawler to small-scale fishermen operating in the same area, who then sell it to processors or send it directly to wholesale markets.

A system, known as the Moma method, was the basis of an experiment sponsored by the Government's Directorate of Small-scale Fisheries (UDPPE). It was based in Moma harbour and commenced in 1982. The support station for the small-scale fisheries (Combinado Pesqueiro – CP) in Moma was the shore base, hence the name for this method.

Moma transfers have progressed from an experimental phase to full-scale production. However, the operation presented a number of issues:

- the quality of the fish could suffer due to delays between catch and collection as the bycatch was not preserved on the trawler;
- the economy of the collection system is dependent on the distance of trawler operations at the fishing ground to the nearby shore base, and other related costs such as fuel and maintenance;
- the system is only feasible/operational in good weather conditions;
- the communication between trawler and collector boat was difficult, as the collector crafts did not have radios (nowadays mobile phones are widely used);
- fish handling and preservation was poor, partly due to the limitations imposed by the vessels.

Despite the fact that the fishing trawlers operate throughout all periods of the day, almost all the bycatch is collected during daylight hours only and the peak time for collection is between 04:00 – 12:00 hours. The fishermen claim that they collect the bycatch more frequently during this period, as sea conditions are usually more favourable. At night time, the main problem expressed by the fishermen is the difficulty in navigation. During the evenings, the main problem is the incidence of large waves as a result of the northerly breeze thus making the bycatch collection difficult. Under these conditions, bycatch caught at night, during bad weather is likely to be discarded at sea. However, some fishermen in the region of Moma and Pebane districts state that they accompany shrimp trawlers at night.

In order to maximize the utilization of wasted resources, the government, through the IDPPE, has strengthened its efforts to improve the system. A project for the retention of shrimp bycatch for human consumption was identified in 1983. The project aimed to improve the already known Moma method for bycatch transfer at sea, by introducing a new type of collector vessel. The project planned to construct ten new, better-designed vessels for bycatch collection, three vessels for transport, and upgrade small boats used for bycatch collection at sea, and at the same time organize five bycatch collection stations. All boats were to be designed in Denmark but built in Mozambique.

The Government, in cooperation with the Danish International Development Agency (DANIDA) and the UK Overseas Development Administration (ODA), provided the funding and necessary expertise for the project.

Short-term objectives of the project included:

- The establishment of a system for the administration, operation and supply of bycatch collection stations (BCS). These stations were to be fully operational with functioning boats and radios and regular transport to the major cities.

Medium term objectives were:

- To ensure that the five BCSs selected for the project were functioning at full capacity, each bringing in 635 tonnes of fish per year or a combined 3,175 tonnes of bycatch to be used for salting, drying or for fresh consumption.

Long-term development objectives of the project were:

- To have a minimum of 50 percent of the 40,000 tonnes of estimated shrimp bycatch brought in by the Moma method when the system was fully expanded.

However, these objectives were not achieved in the timeframe planned as the project was severely delayed. Several project review reports identified various issues that can be summarized as follows:

When the project was designed, the administrative structure to support fisheries activities was divided into two Directorates, a Directorate of Industrial Fisheries (UDIP) and a Directorate of Small-scale Fisheries (UDPPE). The UDIP was responsible for the three state-owned shrimp trawling companies (EMOPESCA-Beira, EMOPESCA-Quelimane and EMOPESCA-Angoche) and had a formal influence on foreign companies trawling for shrimp, as part of joint ventures with the government: PESCAMAR (Spanish), EFRIPEL (Japanese) and MOSOPESCA (the Soviet Union). The CPs were controlled by the UDPPE. The sale of bycatch therefore appeared to be a practical arrangement between two government institutions under the same management.

With the introduction of the adjustment programme (PRE), the shrimp trawler companies were privatized. The state-owned EMOPESCA was transformed into three separate companies required to operate on commercial terms. During the same period, which was when the new economic policy was introduced, government institutions were also changed. The Small Scale Fisheries Institute (IDPPE) was created and became responsible for research, development and extension activities.

When the project was conceived, the institutional set-up appeared to be quite simple, involving only two state agencies. However, with the partial decentralization of the fisheries sector, the set-up became fairly complex and involved more than five agents: the three trawler companies, the collector crews (IDPPE), the CP's (IDPPE/SFP), DANIDA/IDPPE/ODA, the shipyard (SFP), as well as the Fundo Fomento Pesqueiro (FFP, the Fisheries Support Fund) for payment of the boats.

At the same time, the new motorized collector crafts landed very low quantities of bycatch and the total amount of bycatch brought ashore was only 6 percent of planned production.

IDPPE (1994) pointed out that with a more market-oriented approach than trawler crews, the canoe fishermen were bringing in an increasing part of the bycatch.

The project finally concluded that the local crafts were more suitable for bycatch collection. As a result, the project's original aim was abandoned in favour of the smaller crafts and artisanal canoes. This situation showed that it is important that projects base their strategies on the sustainable maintenance of bycatch enterprises at the local level. Strategies should also involve the promotion and capacity building of community groups as the managers and benefactors of bycatch operations.

At this time, bycatch activities are being carried out by local fishermen in direct cooperation with fishing companies and/or trawler crews. Future programmes or projects should include research to identify and help organize fishing communities.

The Master Plan for the Fishery Sector advocates that one option to improve the rational exploitation of shrimp is to restructure trawlers to allow for more available space. The other alternative is to reduce the length of fishing trips to land more bycatch. The former option, with implications of relatively high capital investment, is not likely to be attractive to the fishing companies. The second option implies increased operational costs against lower values of fish sales. For instance, most fishing companies claimed that the profitability of bycatch activity was low – hence why they do not make business out of the bycatch.

On the other hand, the local fishermen, despite limitations of the size of collector craft and the technical problems of transferring bycatch at sea, find the bycatch to be a viable alternative source of income.

The overall weakness in development assistance programmes has been too much investment in 'hardware', which requires increased inputs to ensure sustainability. For example, local boat builders already have a tradition of building improved crafts (e.g. the Moma canoe and NP-750), which local fishermen are able to buy. The local craftsmen make use of the local carpenters' machinery for improved techniques, which they learned through an exchange capacity building experience before the start of the project.

Throughout the entire project development process there was a prevailing perception that the local crafts and their technology were inferior and that only small quantities of bycatch were being caught. Indeed, it is this perception that appears to have influenced the decision to introduce new crafts (EP-900) with little regard for local initiatives and no material support. This in turn may result in the beneficiaries' rejection of useful innovations in the future.

Investing in existing technology at the grassroots level is a policy decision that is needed to increase the bycatch collection. Recent information shows that the development of bycatch collection by coastal communities using traditional craft (canoes with outboard engines) has increased yearly and is now an important activity in coastal communities along the Sofala Bank; the bycatch is also an important source of food for inland communities.

3. Conclusion and recommendations

3.1 Summary of findings

The current situation regarding shrimp trawling and bycatch collection in the countries studied can be summarized as follows:

In Kenya, there has been a ban on shrimp trawling for several years due to conflicts with artisanal fishers. This ban was lifted in May 2011 and at this time only two shrimp trawlers are in operation. These trawlers reportedly deliver all their bycatch to the local BMUs (Beach Management Units).

In Tanzania, there was a ban on shrimp trawling in 2008/9 due to resource problems. At this time, there is a new moratorium in place and no shrimp trawling is being undertaken. However, when the trawlers were operating, there was a system in place to land the bycatch consisting of three options:

- Landing by the trawler at the end of a fishing trip;
- Collection at sea by authorized fish merchants;
- Collection at sea by artisanal bycatch traders.

In Madagascar, a number of activities and projects have been implemented, some with the participation of FAO. Currently there are systems in place for bycatch collection.

In Mozambique, projects have been implemented to introduce new types of collector vessels, bycatch receiving stations and more formal arrangements. Whilst these activities have failed, bycatch collection by artisanal fishermen, using traditional canoes and landing on the beaches, has increased each year. This is now an important activity for the fishing communities along the Sofala Bank and the bycatch, which is traditionally processed (salted, dried, smoked) and traded, is an important source of income for coastal communities and protein for inland communities.

3.2 Recommendations

The lesson learned from Mozambique is that formal projects to create new arrangements for bycatch collection with collector vessels, receiving stations, and organized processing and trade have failed. However, small-scale fishermen have gradually increased their bycatch collection.

From starting out informally through the bartering of fruit, food, etc. for bycatch from the trawlers operating in coastal waters, bycatch collection has gradually developed into a more organized trade.

In this respect, SmartFish activities, to increase bycatch collection, should concentrate on supporting small-scale fishing communities with the organisation of their activities:

Legally, by

- Making bycatch collection by small-scale fishers legal at the national level;
- Facilitating agreements between trawler operators and bycatch collectors and their organizations.

At the socio-economic level, by

- Organizing the collectors;
- Providing credit for smaller investments, including safety equipment.

Technically, by

- Introducing improved insulated iceboxes for collector canoes;
- Providing training in safety at sea aspects for bycatch collection operations.

Traditional processing such as salting, drying, smoking and curing should also be supported rather than trying to introduce new techniques.

In Madagascar, many projects and initiatives to organize bycatch collection and treatment have been carried out, including the installation of a bycatch cold storage facility (900 m³, 200 tonnes, -20 °C) in 2002. However, the Pêcherie de Nosy Bé, the company that collaborated in an FAO bycatch project in 1994, closed down two years ago. Small, six to seven metre vessels are used by local fishers to transfer bycatch from trawlers to shore side markets. Future SmartFish activities should aim to support small-scale activities as described above.

In Tanzania, where there is a resource problem, and in Kenya, where there are conflicts between trawlers and small-scale fishers, trawl fishing for shrimp has been closed several times and so for the time being SmartFish should not carry out any activities to support bycatch collection. However, more general support for small-scale fishing should be given in terms of traditional processing and trade of the catches. This could be done by:

- supporting the BMUs through capacity building activities;
- organizing cooperatives or associations where necessary;
- providing training on safety at sea;
- facilitating access to microcredit.

References

FAO, 2004. Report of the Regional Workshop on Approaches to Reducing Shrimp Trawl Bycatch in the Western Indian Ocean. Mombasa, Kenya, 13–15 April 2003. FAO Fisheries Report. No. 734. Rome, FAO. 49 pp.

Papers presented:

- National fisheries policy and bycatch legislation in Kenya. Godfrey Monor, Fisheries Department, Mombasa.
- Utilization of shrimp bycatch. Frans Teutscher.
- Utilization and the socio-economic impacts of bycatch in Kenya. Jacob Ochiewo, KMFRI, Mombasa.
- Improved utilization of some low value fish in Kenya. Peter Odour, KMFRI, Mombasa.
- The Kenyan trawling sector's perspective on bycatch utilization. Basta Paolo, Basta & Sons, Mombasa.
- Utilization of bycatch in Madagascar. Guy Rabarison (CNRE) & Olga Andriamiseza (Ministry of Fisheries), Antananarivo.
- Utilization of bycatch in Mozambique. Francisco Bomba, Ministry of Fisheries Maputo.

FAO, 2005. Seventh FAO Expert Consultation on Fish Technology in Africa. Saly-Mbour, Republic of Senegal, 10–13 December 2001. FAO Fisheries Report. No. 712. Rome, FAO. 170 pp.

Bycatch papers presented:

- Bycatch utilization in Tanzania: legal, institutional and technological requirements. Mgawe, Y.I.
- Technical feasibility and moral aspects of bycatch utilization in sub-Saharan Africa. Mgawe, Y.I.

FAO, 2011. International guidelines on bycatch management and reduction of discards. Rome, FAO. 73 pp.

Clucas, I. 1997. A study of the options for utilization of bycatch and discards from marine capture fisheries. FAO Fisheries Circular. No. 928. Rome, FAO. 59 pp.

Gillett, R. 2008. Global study of shrimp fisheries. FAO Fisheries Technical Paper. No. 475. Rome, FAO. 331 pp.

Njifonjou, O. 2009. FAO – REBYC Project. Trading the shrimp trawling bycatch in the Central Gulf of Guinea: a dilemma for its negative/positive impact. Report and papers presented at the second Workshop on Fish Technology, Utilization and Quality Assurance in Africa. Agadir, Morocco, 24–28 November 2008. FAO Fisheries and Aquaculture Report. No. 904. Rome, FAO. 2009. 201 pp.

Teutscher, F. 1995. Bycatch in tropical shrimp fisheries. Report and proceedings of workshop on the utilization of bycatch from shrimp trawlers. Nosy Bé, Madagascar. Rome, FAO.

Kenya Marine and Fisheries Research Institute. SWIOFP Survey Technical Report. Shallow-water prawn trawl survey in Kenya, January - February 2011.

Kenya Marine and Fisheries Research Institute. SWIOFP Trip Report. Shallow-water prawn trawl survey in Kenya. May – June 2011.

Kangwe S.J., Mwakosya, C. A., Kuguru, B., et al. 2009. Report on the assessment of the effectiveness of closure of commercial prawn trawling in Tanzania's coastal waters. Report submitted to MACEMP offices and World Bank supervision mission. Tanzania Fisheries Research Institute (TAFIRI). 99pp.

Tanzania Fisheries Research Institute. SWIOFP Survey Report. Shallow-water prawn trawl survey in Tanzania. February 2011.

Tanzania Fisheries Research Institute. SWIOFP Survey Report. Shallow-water prawn trawl survey in Tanzania. June 2011.

Lema, R. 2004. Community participation in the Tanzanian Prawn Fishery Management Plan. Paper presented at the Second Workshop of the Capacity Building in Planning and Co-Management of the Tanzania Prawn Fishery Project. FAO TCP/URT/0168 (A).

Suluda, S.L. 1998. Utilization of shrimp bycatch from the Sofala Bank - Mozambique: current practices and trends. Clucas, I. and Teutscher, F. (eds.) Report and proceedings of FAO/DFID Expert Consultation on Bycatch Utilisation in Tropical Fisheries. Beijing, China, September 1998. Chatham, UK, Natural Resources Institute.

Project GloBal. Global bycatch assessment of long-lived species. Madagascar Bycatch Country Profile (available at <http://bycatch.nicholas.duke.edu/Countries/Madagascar/MadagascarCP>)

Annex 1. Terms of Reference, Consultant

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



Terms of Reference for Consultant/PSA

Name:	Hans Bage		
Job Title:	International Fisheries Consultant		
Division/Department:	Fisheries and aquaculture policy and economic division, Fisheries and Aquaculture Department		
Programme/Project Number:	GCP/RAF/466/EC	Baby project, Result 5	
Location:	Home station plus visit to Rome and Field mission to Kenya, Tanzania, Madagascar and Mauritius.		
Expected Start Date of Assignment:	15 October 2012	Duration:	50 days from 15 October to 11 December 2012
Reports to:	Name: Davide Signa Mrs Yvette DieiOuadi	Title:	Fisheries officer, SmartFish Fish Industry Officer FIPM- FAO

GENERAL DESCRIPTION OF TASK(S) AND OBJECTIVES TO BE ACHIEVED

Tasks Description

Under the overall supervision of Fisheries and Aquaculture Policy and Economics Division (FIP), in particular of Mr John Ryder Lead Technical Officer (FIPM) and Mrs Yvette DieiOuadi, Fish Industry Officer FIPM, and under the technical supervision of Davide Signa, SmartFish Fisheries Officer, within the framework of the SmartFish Result 5, the consultant will technically contribute to the implementation of the Activities under the *Module 2 – “Improve regional supply of fish and fish product through post-harvest loss (PHL) reduction”* through identifying key intervention for the reduction and recuperation of by catch with a special on shrimp trawling in Kenya Tanzania and Madagascar.

In the specific he will contribute to:

Output 5M2.3 Post harvest losses reduced in the food chain based on assessments from selected countries

Activity 5M2.3.1 Undertake analyses to identify those losses that can be sustainably and feasibly addressed

Specific Task:

Phase 1 Desk review (home based plus briefing in Rome 15 Days from 15 Oct -2 November)

- Carry out a desk review including:
 - Review of all past and ongoing similar interventions, including trade of by-catch and by-catch products, in the region and specifically in Tanzania, Kenya and Madagascar;
 - Review of legal frameworks and policy documents and any other relevant documents, studies, reports/information;
 - Analyses of the national contexts and comparison with the Mozambique case. (5 days from 15 to 19).
- Undertake a two-days briefing mission in Rome for meeting with all relevant people and collect all relevant documents not available on the web (2 days 22-23 October).
- Complete the desk review in line with the results of the briefing and prepare the detailed mission plan including a list of people to meet and contacting the relevant institutions through the FAO country offices (8 days from 24 October to 2 November).

Phase 2 Field mission (Kenya, Tanzania, Madagascar and Mauritius 25 Days from 3 to 27 November)

- Visit the three target countries in order to:
 - Carry out a field assessment on pre-identified sites in the three countries in line with the mission plan;
 - Undertake a feasibility study/stakeholder analysis in the three countries highlighting possible roles and responsibilities of all different actors;

- Identify possible beneficiaries and partners for the by catch recuperation/utilization interventions including trade of the products;
 - Facilitate joint meetings and future arrangements;
 - Elaborate a tentative intervention plan in each of the three countries.
5. Debrief the SmartFish team in Mauritius presenting the results of the mission and discuss the future steps (2 Days 26-27 November).
- Phase 3 Reporting (home based 10 days from 28 November to 11 December)
6. In line with the discussion/debriefing with SmartFish team, finalize the pilot project proposals (Kenya, Tanzania and Madagascar) including design and fine-tuning of the specific intervention activities budgets and work plans. The project proposals should include proposals for national and regional trade development as well as promotion of by-catch products.
7. Produce a 2 pages policy brief summarising main lessons learnt and specific key recommendations for shrimp fishing by-catch discard and utilization in the Eastern-Southern Africa and Indian Ocean Region highlighting sector strengths and weaknesses and opportunities and niches.
8. Consolidate all documents prepared in a detailed end of assignment report which includes detailed list of activities carried out and analyses the present situation and gives advice for SmartFish interventions in the sector addressing the technical and in-kind support needs including marketing systems; submit to M. Davide Signa, SmartFish Fisheries Officer and Mrs Yvette DieiOuadi, Fish Industry Officer FIPM- FAO for technical comments.

Annex 2. List of persons met and outcomes

During the mission to Rome a number of meetings were held to collect information about SmartFish, former projects as well as activities related to bycatch from shrimp trawling and discards: recuperation, processing and trade of bycatch and its products:

SmartFish Video Meeting 09:30 – 11:00, 22 October 2012

Name	Position
Aubrey Harris	SFS Harare
Clotilde Bodiguel	Coordinator, FIPX Mauritius
John Ryder	Lead Technical Officer, SmartFish
Helga Josupeit	FIPI Post-harvest
David Brown	Coordinator, FIPI Somalia Task Force
Alessandro Lovatelli	FIRA Aquaculture
Marc Taconet	FIPS
Patrice Talla	LEGN
Jessica Sanders	FIPI
Florence Poulain	FIPI

The following items were on the agenda:

- Update on Result 1 (4 modules) and Result 5 (3 modules);
- Comments provided by TTF on the draft progress report;
- EU Mid-Term Evaluation and SmartFish Phase II;
- SmartFish Steering Committee meeting and Focal Point meeting in Mauritius.

I presented the content of my consultancy that is part of Result 5, Module 2 “*Improve regional supply of fish and fish products through post-harvest loss (PHL) reduction*” where I will concentrate on identifying key interventions for the reduction and recuperation of bycatch with a special focus on shrimp trawling in Kenya, Tanzania and Madagascar.

Meeting with Somalia Task Force 15:00 – 16:00

Name	Position
David Brown	Coordinator, FIPI Somalia Task Force
John Ryder	Lead Technical Officer, SmartFish
Helga Josupeit	FIPI Regional Value Chain TCP, national projects and post-harvest
Ari Gudmundsson	FIRO vessels and safety at sea, IMO
Alessandro Lovatelli	FIRA aquaculture development
Susana Siar	FIRO landing sites

David gave a description of the situation in Somalia including trawling activities as well as ongoing and future FAO activities in Somalia and a brief on the people working in the FAO office. The possibility of extending bycatch activities in Somalia was also discussed.

23 October 2012

Meeting with Helga Josupeit, FIPI and Yvette DieiOuadi, FIPI (09:00)

I was informed of past and ongoing FAO activities regarding bycatch recuperation, fish processing and trading and was supplied with the relevant documents.

Meeting with Janne Fogelgren, FIDF (11:00)

Janne provided informed about activities related to the REBYC (Reduction of Bycatch) project and supplied documents regarding these activities, in particular those related to the handling of bycatch from shrimp trawling.

Meeting with Frans Teutscher, FAO Retiree (14:00 – 16:00)

Frans provided a lot of information about who to contact and which places to visit as well as links to relevant documents.

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 20 countries throughout the East and Southern Africa - Indian Ocean region, focuses on fisheries governance, management, monitoring, control and surveillance, trade, and food security.

Bycatch and discards are highest in shrimp fisheries. In 1995, the total bycatch in shrimp fisheries was estimated at 11.2 million tonnes, of which 9.5 million tonnes were discarded, representing 30 percent of the total discards in marine fisheries.

This report presents the findings of desk review conducted on the issue of bycatch in shrimp fisheries in Kenya, Tanzania, Madagascar and Mozambique.



Funded by

*European
Union*