



Regional Conference on food security and income generation through the reduction of losses and waste in fisheries

Nouakchott, Mauritania,
15–17 December 2013



Cover photograph:

Bony fish harvest and mishandling in the Caspian Sea © FAO

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Preparation of this document

This document summarizes the proceedings of the Regional Conference on food security and income generation through the reduction of losses and waste in fisheries, which was held in Nouakchott, Mauritania, from 15 to 17 December 2013. The document was prepared by Lori Curtis, Yvette Diei Ouadi, Piero Mannini, Ansen Ward and Paula Anton. Support for the conference was provided from regular programme funds of the FAO Regional Office for the Near East and North Africa. The translation of the Arabic document was provided by Issam Krouma.

Abstract

The Regional Conference on food security and income generation through reduction of losses and waste in fisheries was held from 15 to 17 December 2013 at the Wissal Hotel, Nouakchott, Islamic Republic of Mauritania. It was jointly convened by the Food and Agriculture Organization of the United Nations (FAO), the Center for Marketing Information and Advisory Services for Fishery Products in the Arab Region (InfoSamak) and the Ministry for Fisheries and Maritime Economy. The 78 participants included representatives from 14 countries, civil society organizations, fishers' associations and research institutes. The objectives were to: i) review current fisheries practices in the Near East and North Africa region; ii) examine case studies of best practices to identify suitable options for the region; and iii) identify policy-level and operational-level interventions to improve food security and income generation by reducing losses and waste. The conference identified various tools and practices that would reduce fishery losses and waste through the generation of accurate baseline data and loss-reduction initiatives. Case studies of best practices in five countries were considered, after which group discussions focused on: i) best practices for minimizing post-harvest losses and waste; ii) improved utilization of fishery by-products to minimize waste; iii) approaches based on value chains for minimizing fishery losses and waste; and iv) best practices for managing fish bycatches and discards.

The conference drafted and adopted the Nouakchott Declaration, which includes a call to implement policies and legislative frameworks supporting a participatory approach to fisheries management and to create an enabling environment for value-chain actors in small-scale fisheries. The Declaration calls on countries in the region to build the capacities of resource users, managers and post-harvest stakeholders and service providers with a view to reducing losses and waste in the fish supply chain.

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Foreword

Fish as a food and livelihood source for the millions of people across the Near East and North Africa must be valued and appreciated. While there are many ways to ensure that fish is maintained as an important source of animal protein, reduction of losses and waste in the fisheries sector must be a priority before seeking methods to increase production, given that the capture fisheries sector, and the resources on which it relies, is often heavily exploited and at risk of overfishing.

The importance of this topic was highlighted at the 41st Session of the Committee on Food Security held in Rome, Italy (13-18 October) where both the contribution of fisheries and aquaculture to food security and nutrition, as a primary source of protein and essential nutrients, and as a provider of income and livelihoods, and the sustainability of fisheries and aquaculture is a fundamental condition for food security and nutrition were recognized. Additionally, the CFS recommended that initiatives to minimize fish discard and post-harvest losses and waste at all steps of the fish value chain be supported and implemented.

The Near East and North Africa region is relatively unique in that it is spread across two continents, contains some of the poorest and wealthiest nations in the world, and is fortuitous enough to contain such water bodies as the Atlantic Ocean, the Mediterranean, the Red Sea and Gulf of Aden, the Persian Gulf, as well as the Nile, Euphrates and Tigris Rivers. While this diversity means that a regional approach to important issues like fisheries losses and waste is an extremely challenging undertaking, this diversity also allows for a regional approach to a problem which is comprehensive, wide-ranging and inclusive of a multitude of factors.

Given the large areas of land throughout the region which are uncultivable, the importance of the food products derived from the resources of these water bodies is all the more important and relevant.

It is well known that globally there is a need for an increase in the food available to meet a quickly growing population in a sustainable manner; this must be achieved in the face of the challenges of harmful fishing practices, limited and often degraded natural resources, and climate change. The Near East and North Africa region is no exception to these; in fact the evidence of many of these challenges is already being witnessed.

The large majority of fishers in this region are small-scale, many of whom have an income which is only just sufficient to provide for their families. Even small reductions in losses and waste can make a significant difference in the lives of these fishers and their families. The approach for reducing the losses and waste must consider the entire fishery value chain, and innovative and regionally relevant approaches must be formulated and implemented to ensure this sustained reduction in losses and waste.

This consultation represents an important and first ever meeting on the issues of addressing losses and waste in the fisheries sector focusing on the Near East and North Africa. The discussion and outcomes of this consultation are valuable for formulating programming and strategies for the region.

The approach of the workshop is comprehensive in that it encompasses waste and losses from when the fish are caught and follows throughout the stages of the value chain, incorporating dimensions of nutrition, food security, income, markets, regional and cultural traditions and habits, gear selection and impacts on ecosystems.

The outcomes of this consultation, with particular reference to the Nouakchott Declaration, mark an important foundation from which a strategy particular to the Near East and North Africa fisheries dimensions should be formulated implemented. That these outcomes represent the voices, commitment and agreement of country representatives, CSOs, fisher associations and research institutes from the across the region make it all the more important that they are put into action.

Abdessalam Ould Ahmed

Regional Representative to the Near East and North Africa
Food and Agriculture Organization of the United Nations

Opening

The Regional Conference on food security and income generation through reduction of losses and waste in fisheries took place from 15 to 17 December 2013 at the Wissal Hotel, in Nouakchott, Islamic Republic of Mauritania. It was jointly convened by the Food and Agriculture Organization of the United Nations (FAO), the Center for Marketing Information and Advisory Services for Fishery Products in the Arab Region (InfoSamak) and the Ministry for Fisheries and Maritime Economy. The conference was attended by 78 participants including representatives from 14 countries, civil society organizations, fishers' associations and research institutes, officers from InfoSamak and FAO staff from its Regional Office for the Near East and North Africa, its sub-regional office for North Africa, its country office in Mauritania, and its Headquarters in Rome.

The three objectives of the conference were to: i) review the current practices in the sector in the Near East and North Africa region; ii) examine case studies of best practices to identify suitable options for the region; and iii) identify policy-level and operational-level interventions to improve food security and income generation by reducing fishery losses and waste. The conference prospectus and agenda are attached in Appendix 1; the list of participants is attached in Appendix 2.

The conference was officially opened by His Excellency Hamadi Ould Baba Ould Hamadi, Minister of Fisheries and Maritime in the presence of His Excellency the Food Security Commissioner and the Secretary-General of the Ministry of Rural Development. The delegates were welcomed by Piero Mannini, Senior Fishery Officer at the FAO regional office on behalf of Mr Abdessalam Ould Ahmed, Assistant Director-General and Regional Representative for the Near East and North Africa, and by Abdellatif Belkouch, Managing Director of INFOSAMAK.

Piero Mannini noted that the conference was a follow-up to the last session of the FAO Regional Conference for the Near East and North Africa in Rome on 14 to 18 May 2012, which had requested that FAO assist Members to address the challenges of reducing food waste and losses. He emphasized that issues related to losses and waste in fisheries called for cooperation by all stakeholders to improve assessments and promote involvement in the reduction of waste and losses to ensure food security.

Abdellatif Belkouch stressed that fish is exposed to substantial opportunities for damage throughout the processes of transportation, storage and marketing, especially in developing countries where the cold chain was frequently interrupted, and noted that InfoSamak had implemented regional projects and training sessions to help to upgrade the fisheries sector throughout the supply chain, thereby reducing waste and losses.

The Minister of Fisheries and Maritime Economy HE Hamadi Ould Baba Ould Hamadi noted that the conference would address a major challenge of the millennium – food security – and pointed out that fisheries was one of the routes to meeting the challenge. His Excellency added that implementing the recommendations of the 1996 World Summit on Food Security, Mauritania had established a strategic framework to fight against poverty for the period 2001–2015; this included plans to add value to fish products and to ensure the quality and rational use of fish resources from harvesting to consumption.

Technical session one

THE GLOBAL INITIATIVE ON FOOD LOSS AND WASTE REDUCTION

Ms Yvette Diei Ouadi, FAO Fishery Industry Officer presented on the background and elements of the Global Initiative on Food Loss and Waste Reduction. The evolution of the increasing significance of fish losses and waste was highlighted, from the 1990 Cairo Symposium to its incorporation as a high priority on the global development agenda at Rio +20, and inclusion in the Zero Hunger Challenge. She highlighted the staggering estimate of 1.3 billion tonnes in global food losses and waste, and noted that fish and seafood losses were estimated at 30 percent of initial catch in North Africa and West and Central Asia, the majority of which was lost at the distribution, processing and fisheries capture stages. The rationale for a global initiative promoting food security and nutrition, addressing loss and waste, raising the incomes of value-chain actors, relieving pressure on productive resources and reducing the environmental “food-print” was presented. She also introduced the Save Food initiative, which involved numerous partners and approaches with a view to raising the profile of the issue of losses and waste.

NATIONAL SURVEY QUESTIONNAIRE FINDINGS

Ms Yvette Diei Ouadi presented the results of the survey questionnaire submitted by Egypt, Iran, Iraq, Jordan, Morocco, Palestine, Saudi Arabia, the Sudan, Syria and Tunisia. A few main points extracted from the survey questionnaire analysis include:

Data on losses and statistical methods were not reliable, statistical reliability and methodology were not clear.

- At least one national organization in each country was dealing with post-harvest fish losses, and on average two institutions were dealing with post-capture.
- Two out of five countries appeared to have no specific regulatory mechanisms.
- Five references to legal texts provided by five countries were clearly related to loss management.
- Private-sector actors (socio-professional organizations) were not highlighted in responses, even though they had a central role in preventing and reducing losses.
- Specific measures to address loss and waste ranged from prohibition and penalties to the promotion of good practices or codes of practice with regard to bycatch management, prevention of over-exploitation of resources, endangered species and fish handling on board fishing vessels.
- In terms of quantifying losses, three countries had not assessed losses, and two countries did not have information on physical losses or the quality of losses; the other five countries had information on the extent of losses but not the main causes.
- From the four countries that provided data it emerged that losses were between 5 percent and 15 percent overall and up to 30 percent of the total volume of industrial and semi-industrial fishing, mainly as bycatch; the range of losses for small-scale fishing varied between 1 and 70 percent.
- Of the ten countries, four emphasized the importance of losses related to factors such as market saturation, purchasing power and the economic situation.

It was emphasized that although only ten questionnaires had been returned, some of them incomplete, the results were a sound basis for preliminary thinking about losses and waste in fisheries at the regional level. In the Near East and North Africa, waste and losses were a complex issue that affected small-scale and industrial enterprises throughout the value chain. A major issue was the availability of reliable data and assessments of the quantity and types of loss, and where they occur. It was highlighted that this information would be required for the development of sustainable and effective interventions for reduction.

CASE STUDIES OF BEST PRACTICES FROM THE REGION

Case studies of best practices from Egypt, the Islamic Republic of Iran, Mauritania, Morocco and Yemen. A summary of each is included below; the full reports are available in the Appendixes.

Arab Republic of Egypt

Ms. Azza El Ganainy, Professor of Fisheries Biology, National Institute of Oceanography and Fisheries presented “Post-Harvest Fish Losses in the Gulf of Suez Fisheries, Egypt” (see Appendix 3), highlighting the importance of fisheries in terms of employment and livelihoods in that 1 million people were involved in the sector. She also highlighted the work in Egypt on the post-harvest sector, highlighting the efficiency of the value chain with regards to preserving the quantity and quality of fish until it reaches the central market in Cairo. It is after fish reaches the central market where more significant losses occur (estimated at 18 percent), due to high temperatures and insufficient preservation infrastructure. The high bycatch rates of finfish and invertebrates in the shrimp trawling industry were emphasized; discard rates varied according to fishing season, and the bulk of post-harvest losses occurred shrimp trawling by the semi-industrial fleet. Recommendations included closures of particular areas, regulations on mesh size, enhanced technologies for discard reduction and improved processing factories for additional fisheries products.

Islamic Republic of Iran

Shahram Safiyary, Senior Quality and Processing Officer of the Iran Fisheries Organization presented “An Overview of Post-Harvest Fish Losses in the Islamic Republic of Iran” (see Appendix 4). The increasing trend of aquaculture production in I.R. Iran was highlighted, and it was noted that capture fisheries production was increasing at a much lower rate, with fluctuations from year to year. The importance of fisheries in terms of employment and livelihoods and the number of fishers engaged in the sector, particularly in the Gulf and the Caspian Sea, were highlighted. Losses in terms of fish quality were more common than physical loss as a result of poor post-harvest practices and lack of cold-chain conditions. Overall losses in Iran were estimated at between 2 percent and 15 percent, and higher in capture fisheries than in aquaculture. Tuna was a highly significant species for Iran, where there were 130 tuna canneries; but some of the largest post-harvest losses affected tuna as a result of catching methods, large distances between fishing grounds and landing points, lack of shipboard freezing facilities and insufficient knowledge and training in quality and preservation. Interventions to reduce losses included on-board storage and freezing systems, insulation of vessels, mechanization of fish unloading and handling, the use of slurry ice for chilling and full implementation of the national seafood safety plan. Modifications of catching methods had not been successful, however. The other interventions had been attempted with varying levels of success.

Kingdom of Morocco

Youssef Ouati, *Chef de la Division de la Coopération, Département de la Pêche Maritime* presented “Strategic Approach to the Management of Bycatch and Reduction of Discards in the Kingdom of Morocco” (see Appendix 5). Morocco had always considered bycatch and discards as a priority problem. Artisanal fisheries had adopted selective fishing gear, and waste and loss were minimal at the time of the catch. Examples of seafood processing were presented. Exports from Morocco went mainly to Europe. A roadmap for sustainable development considering the ecological, social and economic implications was discussed.

Islamic Republic of Mauritania

Mohamed Lemine Abdel Hamid, Consultant, presented ‘National Review of Post-Harvest Fish Losses in Mauritania’ (see Appendix 6), who noted that fish were sent to factories to be processed into fishmeal, which was almost entirely for export. Industrial fishing did not contribute to national fisheries production because the fish were not landed in Mauritania. Artisanal fishers were significant in terms of employment and livelihoods, but losses were high, especially in terms of bycatch, and there was a lack of processing infrastructure.

Bycatch and discards were difficult to evaluate, but were estimated at US\$21 million. Policies and actions to reduce post-harvest losses included enhancement of ports and construction of new ports, and the provision of better equipment. The agreement with the European Union for fish to be landed in Mauritania had not yet been implemented, but the fisheries ministry had been empowered to take additional measures to reduce bycatch. There was no industrial fish processing in Mauritania, but one way to improve the social situation in the country would be to establish such an industry. In the artisanal fishing sector, capacity building and training were required for national actors: this could include awareness raising as to diversification into products such as fish meal and fish oil. A lack of infrastructure also constrain the sector. Estimates of the related needs in terms of skills and infrastructure and of the expected benefits would be needed to establish the business case.

Republic of Yemen

Abdullah Saeed Al Kasadi, Marketing and Exports of the Ministry of Fisheries Wealth presented the “National Review of Post-Harvest Fish Losses in the Republic of Yemen” (see Appendix 7), emphasizing that problems in Yemen started with fish handling and continued through the distribution chain. Bycatch had a negative impact on fisheries, and discards constituted a serious loss; post-harvest losses were much higher in capture fisheries than in aquaculture for a given species. Yemen was implementing a strategy to minimize losses and waste in terms of bycatch, but the Government had yet to recognize the need to address the effects of shrimp trawling and bycatch on biodiversity.

A more immediate issue, however, was non-declaration of catches by international vessels: this had to be addressed, particularly in the interests of countries that produced fish products but lacked the infrastructure for effective enforcement. It was recognized that improved understanding of the sector, the actors involved and their needs and skills were essential for designing effective interventions.

BEST PRACTICES AND STRATEGIES FOR MINIMIZING POST-HARVEST LOSSES AND WASTE

Ansen Ward, Fisheries Development Specialist, presented “Best Practices and Strategies for Minimizing Post-Harvest Losses and Waste” (see Appendix 8), emphasizing that the country overviews provided a good entry point for the collection of more detailed

primary data identifying hot-spots and unexplained losses, and also provided an opportunity for applying recognized loss-assessment methods. He emphasized that the reduction of post-harvest fish losses required a broad approach that considers the factors affecting national capacities in loss prevention and that included supportive policies and legislation as well as skills, knowledge, services, infrastructure and technology. Best practice principles are given in Box 1.

BOX 1

Best practice principles for reducing post-harvest losses and waste

High-priority areas, or “hotspots”, for the region were identified with a view to improved targeting of interventions. These focused on elements such as gill nets and static gear, trawl fisheries, small pelagic fish, artisanal fleets, larger harvests, remote locations, lack of ice or cold chains, lack of landing sites or infrastructure, and high ambient temperatures.

Generic examples were used to illustrate how best practices could be applied in the region, specifically for artisanal fisheries catching small pelagic fish, the use of fish for food rather than fishmeal, and the high level of bycatch in shrimp trawling. The unique aspects of artisanal fisheries as opposed to industrial enterprises were emphasized in terms of their importance as livelihoods. It was also stressed that any intervention to reduce bycatch needed to be carried out in a well-informed and holistic manner.

WORKING GROUPS: TECHNICAL SESSION 1

Participants were divided into groups and were tasked to identify types, causes and locations of losses and then to identify interventions to address these problems and the associated challenges or successes. The aim was to develop a clearer picture of best practices in the region (see Table 1 and Table 2).

The subsequent discussion raised a number of issues. Problems varied from one country to another, and guidelines and strategies should be specific to the region. Disparities among countries in terms of capacity, experience and knowledge was significant, and could be addressed through regional cooperation and information sharing, regional commissions and networks and regional fishery-management organizations. A need was identified for FAO to develop actions with member countries, or groups of countries, where there were common issues. The issue of illegal, unreported and unregulated fishing (IUU) in the region was common to many countries, and it was emphasized that this should be a priority. Additionally, there exist critical environmental problems, particularly in relation to discharges of petroleum. The importance of not only discussing the problems but also coming up with solutions was emphasized, with regards to both on-board and post-harvest losses.

TABLE 1
Existing context for losses and waste in the post-harvest sector

Types of losses	Where losses occur	Main causes		Priority Issue for Countries
Discards	On board vessels (shrimp, octopus, demersal fishery)	Bottom trawling method Unmodified fishing gear Undersized fish Non marketable species: low value, consumer preference	Capacity for freezing Lack of monitoring Fishing zones Illegal species e.g. Shark fins	Egypt, Iran, Mauritania, Morocco, Libya, Lebanon, Tunisia, KSA, Yemen These are fleet and landing sites specific issues but have an impact throughout the region
	Landing sites	Lack/improper facilities and services No ice in markets No cold chain Improper display of fish Poor handling	High supply High postharvest cost relatively to value of product Market access (physical access and market information)	
	Consumer/ Household	Consumer behaviour and cultural & social traditions Buying high quantity Methods of storing & processing Excess (ceremonies,..) Poor awareness of product, its quality and method of cooking Poor awareness of nutritional values (ovaries)		
Fish losses in habitat	Small-scale fisheries (inland and marine)	Leaving nets in water for long periods of time (high fuel cost) Fishing gears Fishing zones	Poor fishing practices Lack of awareness Ghost fishing Interaction with agriculture (inland)	Egypt, Jordan, Lebanon
Quality loss/ deterioration due to spoilage	On board (inc small-scale fisheries)	Storage and handling Unsustainable fishing method		Iran Mauritania Morocco, Sudan, Libya, Egypt and Yemen
	Landing site	Deficiency of ice Poor handling		
	Small pelagic fishery	Storage and handling Gill net fishing		
Processing and cooking losses	Processing plants (smoking, salting, canning etc.	Improper processing facilities and technologies Fish species and size		Yemen, Egypt, Morocco, and Mauritania
	Household (consumer) level	Food habits and consumption patterns (cultural issues)		
Loss of food nutritional value	At market place and during retailing processes	Lack of proper logistics and infrastructure		More of an issue for weaker economies in the region

TABLE 2
Best practices and strategies for minimizing post-harvest losses and waste

Issue	Intervention attempted	Level of Intervention (policy, operational, etc)	Challenges faced/Successes experienced
Shrimp bycatch	Bycatch reduction devices	Policy and operational	Reduction of shrimp catch
Demersal fishery	Banning of bottom trawling	National regulation	IUU fishing increased
Fisheries regulations	Closed season, minimum landing sizes	National regulation	IUU fishing increased (Egypt)
Quality deterioration	Development of infrastructure in landing sites and markets Capacity building in value chain Specialized quality control labs Cold chain upgrade	Policy and operational	Sudan (policy level) Egypt (operational) Palestine Morocco
Discarded fish	Zoning (banning) of bottom trawlers Implementation of closing seasons Awareness raising in Nile Fish for All: provide market facilities for fish selling so that bycatch is sold in markets (Mauritania) Mauritanie 2000 project: Promote value-added for women (eg. Salting, drying, fermentation, 15 boutiques selling fish in Nouakchott and Nouadhibou) Training and capacity building to fishermen to other fisheries (Morocco)	Operational (Qatar) Operational in Libya, Egypt, Sudan and Yemen	Fishers fully complying with legislation Successful in Libya, Sudan, and Yemen but not in Egypt since 2011 Egypt: Nile fisheries (improved practices) Fish is available in some rural areas where not previously available (Mauritania) Mauritania 2000: provide dried and fermented fish in far areas despite not having cold chain/ice facilities
Overfishing	Promoting aquaculture Marketing project to enhance fish quality in the market, better equipment in the markets including ice facilities and administration control of fisheries (Libya)	Operational	Reduce pressure on juvenile resources, more locally produced fish (Jordan, KSA) Better quality and variety of fish on the market More control of the quality (Libya)
Processing losses (cooking losses)	Adoption of proper and efficient processing technologies for manufacturing of products like fish meal, fish oil extraction and accessories production	Implementation level	Poor quality of end products (e.g. fish meal)

Technical session two

Technical session two focused on: i) fishery by-products and co-products for minimizing waste; ii) a value-chain approach for minimizing fish losses and waste; and iii) best practices in fish bycatch and discard management.

FISHERY BY-PRODUCTS AND CO-PRODUCTS FOR MINIMIZING WASTE

Jogeir Toppe, Fishery Industry Officer of the FAO Fisheries and Aquaculture Department, delivered a presentation entitled 'Fishery by-products and co-products for minimizing waste', highlighting that generally, it was fish processing that created opportunities to use by-products. He noted that fish and shellfish were often processed before reaching the consumer, for example by gutting, filleting, skinning and removing shells, especially in industrial fisheries and with larger species; such processing was less common in small-scale fisheries and with smaller species. The canning of small pelagic fish generated a smaller percentage of waste and by-products, but overall volumes of waste could be large. He noted the different ways in which by-products could be utilized by being processed into: i) feed ingredients such as fishmeal, fish oil and silage; ii) products for human consumption such as Omega-3 oils, minced fish, peptides and minerals; iii) fertilizer and biofuels; and iv) high-value products such as chitosan, gelatine, enzymes, bioactive peptides and pigments. It was emphasized that product development had to be market-driven and profitable to sustain the utilization of by-products.

Mr Toppe informed participants that at the industrial level, approximately 50 percent of the fish ends up as a by-product which is often not considered optimal for human consumption, despite the fact that it may be highly nutritious. Tuna is an example of how press cake meal can be a use of by-products, as traditionally 70 percent of tuna being processed in canning factories are by-products, which include viscera, head, backbones, skin, belly flaps and dark muscle. In the Philippines dark muscle, heads and belly flaps were increasingly sold for human consumption. By-products such as fish bones and oils yielded vitamin A, iodine, iron and zinc that could be used to address micronutrient deficiencies, for example in school programmes that provided meals to address food security and nutrition challenges.

Participants in this working group (results in Tables 3 and 4) had the objective to identify the main challenges and opportunities in the region for minimising waste through better utilization of by-products. Questions to facilitate this discussion were:

- What are the main sources of fishery by-products in the region?
- What are the main fish by-products processed, and what are the final products?
- What are the main challenges related to the utilization of by-products?
- Suggest potential products that can be produced from existing by-products?
- How can improved use of fishery by-products contribute to improved health and food security?
- What would be the needs, challenges and opportunities in improving the use of fish by-products for food security?

TABLE 3
Existing context and issues for by-products and co-products

Source of by products	Main fish by products processed	Final products	Main challenges associated	Market for products
Sardinella	Heads and guts	Fish meal and oil	Conservation: done onboard, preserving it until landed	
Yellow mullet	Roe	Roe (Poutargue)	Export challenges for artisanal products: no certification or standards to export in an environment that supports this Artisans need agreements // allowances for traditional by products to be exported Need for capacity building Improved technology and equipment	Local (Potential) International (Potential) Expatriate market
	Head and bones	Oil for humans and animals		
	Bones	Animal feed (chickens) Compost		
	Skin	Leather		
Tuna	Head, bones, skin, inedible parts	Fish meal	Technology, batch issues	
Rainbow Trout	Roe	Roe	Branding/marketing	Local International

TABLE 4
Potential opportunities for utilization of additional by-products and co-products

Potential by-products and co-products	Contribution to food security/nutrition	Requirements for utilization (infrastructure, training, capacity)	Potential market (local, national, export)
Fish meal, silage from Tilapia (Sudan)	Animal feed, compost Livelihoods, income generation	Silage processing facilities Training in processing techniques Marketing	Local
Ornamental goods from Sardinella Omega 3 from Sardinella	Beneficial for health	Infrastructure Capacity Technology	Local International
Fish protein concentrate Omega 3	Food enrichment	Infrastructure technology Raw material quality	Local International
By-product processing from yellow mullet be used for other species, such as black mullet	Livelihoods, income generation	Awareness raising Technology Market access support for artisanal processors	Local (Potential) international

VALUE-CHAIN BASED APPROACH FOR MINIMIZING FISH LOSS AND WASTE

Mohamed Naji, Institut Agronomique et Vétérinaire Hassan II, gave a presentation entitled, 'Value chain based approach for minimizing fish loss and waste'. He explained the elements of a value chain and the ways in which it dealt with the flow of products and services along the chain, the relationships between enterprises and the coordination of production chains, noting how the value chain approach can be useful in that they are driven by end markets. The choice of point of entry was essential for defining the links and the activities in the chain that were to be the subject of special enquiry. In specific reference to fisheries, he highlighted the need to look at each stage where value was increased – for example capture, landing, processing and marketing.

In Morocco this approach was utilized within the framework of a project to promote economic development and reduce poverty among value-chain actors in artisanal fisheries: it identified points of intervention such as the establishment of managed landing sites, organization and equipment of fish merchants, the creation of marine protected areas and the sensitization of fishers.

Participants in this working group were tasked to identify the main challenges and opportunities throughout value chain for minimizing fish loss and waste (see Table 5 and Table 6). The facilitating questions were:

- What are the different markets for different fish products?
- Which are the key stages for which fish increases in price/value, and where/what type of losses occur from capture to consumer?
- What are the main challenges faced at each stage in terms of loss reduction?
- What are the solutions to minimizing losses at each stage include actions to enhance conditions, capacity, management?

TABLE 5:
Existing value chains and challenges

Fish product type	Market	Main stages for value addition	Challenges (and at which stage)
Tuna	Local Regional Export	Processing (canning) Cage farming Fresh products	Good handling practices onboard and at landing sites
Pelagic fish/sardines	Local Regional Export	Processing (Canning) Salting Drying Fishmeal processing	Onboard: handling and preservation at landing sites Transportation: to processing plants and local markets
Crustaceans and shrimp	Export National Regional	Processing Deheading and peeling	Non selective fishing gears Overfishing and exploitation Fishery management
Cuttle fish /octopus	Export Regional Local	Processing Onboard grinding	Threatened species due to overfishing
Demersal fish	Export Regional Local		
Sharks	Export Local Regional	Salting and drying	Stock depletion(endangered species)

TABLE 6:
Potential solutions to challenges in value chain

Solutions to minimize losses	Value chain actors involved	Actions required (infrastructure, training, capacity, etc)	Potential market (local, national, export)
Onboard: Use of appropriate selective fishing gears and suitable mesh size	Fishers Policy makers	Legislation Law enforcement	Export Regional Local
Application of good handling practices onboard	Fishers Local government National government Donors	Infrastructure Vocational training/ capacity building	Export Regional Local
Stock assessment (role of research)	Research authorities Government Donors Regional communities (RFMOs)	Acquisition of appropriate data Data base creation Dissemination Strengthen research capacities	Export Regional Local
Awareness raising and capacity building for all value chain actors	Government Donors Fisheries communities/ organizations stakeholders value chain and project implementation	Training Promotional campaigns	Export Regional Local
Infrastructure development at landing sites	Local and national government Agencies, Donors Fishers	Building new facilities Supporting services/facilities (ice machines...)	Export Regional Local

Solutions to minimize losses	Value chain actors involved	Actions required (infrastructure, training, capacity, etc)	Potential market (local, national, export)
Legislation development and enforcement	Policy makers (legislators) Law enforcement authorities	Capacity to observe and implement the laws Use of advanced technologies for monitoring	Export Regional Local
Improved fish transportation facilities from landing sites to markets and processing plants	Fish traders Fish processors	Good infrastructure transportation including good roads and services (power, water, fuel.) and transportation vehicles	Export Regional Local
Diversification of fish product outlets for the consumer	Government Processing plants Investors	Construction of well equipped fish outlets/ markets	Local
Awareness campaigns with regard to fish consumption (health) and waste reduction/ elimination	Government (Ministry of Health) Local and social media Donors NGOs-CSOs	Initiate series of awareness campaigns promoting benefits of fish consumption and waste reduction	Local

BEST PRACTICES IN FISH BYCATCH AND DISCARD MANAGEMENT

Mr Petri Suuronen, Fishery Industry Officer, FAO, presented ‘Best practices in bycatch management and reduction of discards’ explaining that while there is no single definition of bycatch it can be understood in terms of its effects on lost yield and income, wasteful usage of natural resources, livelihoods and food security. Bycatch and discards increased pressure on fish stocks and reduced the quantity and quality of fish resources. The main challenges in managing bycatch were highlighted, including that the amount of bycatch/discards as well as the impacts on nutrition, livelihoods and fisheries resources are not well known, and that there is no acceptable level of bycatch. Additionally, the adoption of mitigation measures are constrained by poor awareness, inadequate political will, economic incentives, and inadequate financial and human resources. The reduction in bycatch over the last 20 years was largely a result of increased utilization of bycatch species, more selective fishing, improved management and enforcement actions and the decline of some fisheries with high bycatch rates, as well as lack of data. Box 2 shows the tools for managing bycatch and discards, and the benefits and challenges.

BOX 2

Tools and benefits for managing bycatch and reducing discards**Tools to manage bycatch and reduce discards**

- Fishing capacity and effort controls
- Spatial and temporal closures:
 - closed areas and seasons, zoning
 - real-time closures,
 - fishing gear bans, etc.
- Better design and use of fishing gear:
 - mesh size, hook type, BRD^{*}, TEDs^{**}, SMPs^{***}, rigging
 - technologies to reduce encounters
 - alternative fishing gears and practices
- Limits on bycatch:
 - bycatch quotas, no-discard regimes, etc.
- Economic incentives:
 - facilitating the uptake
 - market-based tools
 - value adding to discards to (increase) motivation

Benefits from reduced bycatch and discards

- Improved productive potential of fish stocks:
 - Higher catch per unit effort CPUE
 - larger size of fish
 - improved catch value
- Positive public attitude (image):
 - better business opportunities
 - new markets
- Reduction of operating costs:
 - reduced sorting time of catch
 - improved catch quality and value
 - reduced fuel cost

* Bycatch reduction devices

** Trawl efficiency devices

*** Square mesh panels

The group was tasked to identify main challenges, needs and opportunities in managing fish bycatch and discards (see Table 7 and Table 8). The facilitating questions were:

- In which fisheries do excessive bycatch and discards exist?
- The main factors leading to bycatch and discards?
- How have these issues been addressed?
- How well are fishermen aware of the consequences of not acting?
- What are the data and information gaps?
- What challenges are there and how should we sustainably manage bycatch and reduce discards?
- If not already discussed, how can we improve fishing technology and gear selectivity?
- What are the main challenges related to the utilization of the discarded species?
- What are the potential products that could be created from existing discards?

TABLE 7
Existing conditions for bycatch and discards

Fisheries with high bycatch	Factors contributing to bycatch	Attempts to address issues? (how/where)	Challenges in addressing bycatch issues
Demersal trawl fishery (often targeting shrimp) bycatch discards	Too much fishing effort/capacity. Poor gear selectivity. Operating in high biodiversity fishing grounds: difficult to avoid with trawl gears. Operating in too shallow fishing grounds, often in nursery grounds (juveniles). Operating in bycatch hot-spots. Operating in critical seasons. Long trawl hauls. Limited space for catch. Lack of markets. Some bycatch species have some value and are landed if there is space.	Closed seasons areas the most common measure implemented but efficiency not adequately evaluated (e.g. Libya, Tunisia) Some attempts to use BRD and selective trawls gear (e.g. Tunisia) but very weak adoption by the fishing sector. General attempt to increase trawl codend mesh size to 40-50 mm in the Mediterranean countries (heavily resisted but not adequate). Reduction the size of trawler fleet. Banning the bottom trawling (e.g. Oman, Qatar, Iran). Increasing the utilization of sustainable bycatch and discards.	Ineffective Enforcement. Lack of compliance. Foreign fleet intruding fishing grounds and not following the ulerules (IUU). Open access (in some areas) Lack of incentives. Inadequate technology transfer capacity.
Small-scale gill-net fisheries Bycatch Quality losses Trammel net for lobster and shrimp (e.g. Tunisia) Fish bycatch	Too much fishing effort/capacity in wrong places at the wrong times. Too long soaking times. Fishing in warm water seasons. Extensive use of monofilament nets (highly contributing to bycatch).	Closed season and area. Improved net selectivity.	Ineffective enforcement of ulerules. Lack of compliance. Poor awareness. Inadequate capacity/ infrastructure (e.g. lack of ice, roads, etc) Poor gear design and operation.
Beach seine Bycatch	The ssize of seine nets is increasing, use of mechanical devices common – more effort	Not much.	Lack of clear rules. Enforcement and compliance.
Small pelagic fish (trawl) Bycatch of juveniles	Poor selectivity of gear.	Not known.	

TABLE 8
Solutions to manage bycatch and reduce discards

Possibilities to improve gear/ technology	Challenges to utilization of discards	Potential products for discards	Data and information needs
Trawl fishing: If well supported and adopted by the fishing sector, selective fishing technology (e.g. BRDs, square mesh panel) can be a useful supporting measure. It requires support, training, capacity building, research and establishment of strong economic incentives. • With improved technology the problems can be mitigated but likely not completely solved – a potential supporting measure. • Effective zoning and closing of bycatch hot-spots from trawling often necessary additional measure.	Lack of adequate storage space onboard. Lack of infrastructure at landing sites. Lack of markets. Poor price.	<ul style="list-style-type: none"> • Fish meal • Fish oil • Raw material in pharmaceutical and medical industry Not much information available on this topic yet.	Research and development on processing is needed Market research needed.
Gillnet fishing: There are many options to improve the gear design and operation. Live-release of some bycatch species is possible with proper handling procedures.	Lack of adequate storage capacity onboard. Lack of infrastructure at landing sites.	Not much information available on this topic	Research and development on processing is needed

Closing

Based on the results of the working groups and presentations, the workshopworkshop participants designated a drafting committee to review a draft declaration. The draft declaration, which was named the 'Nouakchott 'Declaration', was adopted as below on 17 December 2013 at 16:00.

Nouakchott declaration

PREAMBLE

The Food and Agriculture Organization of the United Nations (FAO) held the Regional Conference on Food Security and Income Generation through Reduction of Losses and Waste in Fisheries from 15 to 17 December 2013 in Nouakchott, Islamic Republic of Mauritania. The Conference was convened in partnership between FAO, the Ministry for Fisheries and Maritime Economy, and the Center for Marketing Information and Advisory Services for Fishery Products in the Arab Region (INFOSAMAK). The Conference was attended by 78 participants, including delegates from 14 countries¹, representatives of Civil Society Organizations (CSOs), academia and the private sector from throughout the region.

Considering the dependency of the region on imports to meet its food needs, the difference that fish could make in this regard as a valuable nutritious commodity, yet lost throughout the stages from harvesting to the consumer level, impacting hence on food security, livelihoods and the sustainability of aquatic resources, the conference was convened to: review the current practices in the fisheries sector in the Near East and North Africa Region; examine case studies of best practices globally and discuss the best options for the region; and to identify policy level and operational level interventions to improve food security and income generation through the reduction of losses and waste in fisheries in the region.

Case studies from the region on best practices in five countries were presented and discussed, following which presentations, working groups and discussions focused on four technical topics: a) best practices and strategies for minimizing post-harvest losses and waste; b) improved utilization of fishery by-products for minimizing waste; c) value chain based approach for minimizing fish loss and waste; and d) best practices for fish by-catch and discard management.

THE CONFERENCE NOTED

...the FAO global initiative on food loss and waste reduction, and in particular the role and importance of reducing post-harvest loss and waste in order to improve global food security, take full advantage of the significant benefits of fish, as a provider of essential nutrients and micronutrients, raise the income of value chain actors, relieve pressure on productive resources, and to curb the environment 'food'print.

...that the 31st FAO Regional Conference for the Near East and North Africa (NERC-31) (Rome, Italy, 14-18 May 2012), considered the implications of the high levels of food losses and waste on food security in terms of food availability, health and nutrition in the region and recognized the need for reducing these losses both in terms of quantity and quality.

... that NERC-31 urged member countries to include "reduction of food loss and waste" in national policies, priorities, and strategies to improve food quality and consumer health and safety, also urging Member countries to improve partnership,

¹ The People's Democratic Republic of Algeria, the Arab Republic of Egypt, the Islamic Republic of Iran, the Republic of Iraq, the Lebanese Republic, Libya, the Islamic Republic of Mauritania, the Kingdom of Morocco, Palestine, the State of Qatar, the Kingdom of Saudi Arabia, the Republic of Sudan, the Republic of Tunisia, and the Republic of Yemen.

coordination and collaboration with the public and private sectors as well as CSOs to enhance capacities, education and awareness of all the stakeholders, including producers and consumers, on value chain improvement, value addition, and quality and safety systems.

THE CONFERENCE CONSIDERED

... the importance of fisheries and aquaculture as a source of common wealth and health for the region, and recognized that any actions to reduce loss and waste must take a sustainable development and management approach in order to truly benefit fishing and aquaculture communities as well as the state of natural resources.

... the importance of food traditions and habits in the region, and that there is a need for a critical scrutiny of loss generating practices especially in specific situations, for awareness on best practices and options to reduce fish loss and waste at the household level. This would include post-cooking waste as a focus area to be included in national food security policies. The value of the good use of fish and fishery products for a healthy diet, particularly of young people and including school meals, was highlighted.

... that post-harvest fish losses, including by-catch and particularly discarded fish are prevalent throughout the region and independent of the type of fisheries, although their contextual occurrence, magnitude, types and root causes may vary.

... that in the absence of actual assessments of fish discards, waste and loss, current estimates ranging from 15 to 80 percent of total landings, depending on fisheries and areas, undermine all targets for sustainable aquatic resource use and food security. The Conference underscored the crucial importance of reducing fish food loss and waste in the region to enhance its food supply, enhance the livelihoods and income generating potential for stakeholders along the value chain. To achieve this in an effective and rational manner the Conference discussed and identified an array of approaches, tools and practices that should be implemented through a sound intervention strategy which includes the generation of accurate baseline loss data and loss reduction initiatives .

... that particular attention should be given to the small-scale fisheries sector as it is the major supplier of fish landings and a significant contributor to food security, youth employment generation and income diversification. The Conference recognized that securing the sustainable development of small-scale fisheries and the associated value-chains, posed real challenges that can only be addressed through an effective and equitable partnership between all resource users, national and local authorities and regional or international entities, as relevant.

THE CONFERENCE DECLARED

... that appropriate policies and legislative frameworks and strategies should be established, which include a more participatory approach to fisheries management and to create a supportive and enabling environment for value chain actors in small-scale fisheries. The conference recognized the need for incentives to support the adoption of sustainable practices, good policies, and necessary infrastructure and services, including the cold chain, which will ultimately foster sustainable fisheries while averting an increase of fishing effort.

... that countries in the region develop and build the capacity of resource users and managers, including post-harvest stakeholders and service providers, in order to pursue and achieve a significant reduction of loss and waste, throughout the fish supply chain from the catch to the consumer's table. This would be achieved through adopting proper by-catch and discard management, fish by-product utilization and value addition practices, and therefore actively contribute to food security and fisheries sustainability.

... that there is an important need for accurate and reliable information with regards to by-catch and discards, losses throughout the supply chain, and by-product utilization. Decisions and actions should be made according to evidence based information and recommendations on losses and waste throughout the value chain. The Conference also emphasized the need to build capacity to properly undertake this research in the region.

... that national, regional and international cooperation should address the common challenges such as by catch and discards management, particularly in the case of shared fisheries resources. Such cooperation should include addressing Illegal, Unreported and Unregulated (IUU) fishing at the domestic and regional scale.

... that countries, donor agencies, international organizations, fishery and aquaculture stakeholders and communities across the region to work proactively together to promote the use of identified best practices, experience and knowledge to address the reduction of fisheries discards, waste and loss. The Conference urged governments in the region to give incentives and support to fishers, cooperatives and associations.

... that FAO, in conjunction with member countries, partners and donors coordinate the efforts and actions for the implementation of recommendations, findings and follow-up of the Conference.

The Conference concluded declaring that fisheries and aquaculture resources can and should generate much more wealth and health without increasing the often excessive fishing pressure on stocks by making optimal use of what is currently, discarded, lost and wasted, in coherence with the FAO Code of Conduct on Responsible Fisheries and other instruments aiming at sustainable natural resources management.

The participants unanimously adopted this Declaration of the Regional Conference on Food Security and Income Generation through Reduction of Losses and Waste in Fisheries as the 'Nouakchott Declaration', on 17 December 2013 in Nouakchott, Islamic Republic of Mauritania.

The Conference participants expressed their appreciation to, the Government of the Islamic Republic of Mauritania, FAO and INFOSAMAK, for having organized and made this important event possible.

Appendix 1 – Prospectus and agenda

REGIONAL CONFERENCE ON FOOD SECURITY AND INCOME GENERATION THROUGH REDUCTION OF LOSSES AND WASTE IN FISHERIES

15-17 December 2013, Nouakchott, Mauritania

BACKGROUND

Fish is a highly perishable commodity and if not properly, harvested, handled and stored, the quality deteriorates rapidly. The problem is particularly acute in warm climates where infrastructure facilities in boats, landing centers and in subsequent operations are not adequate. This quality deterioration leads to economic loss and also loss of fish as food, as fish becomes unfit for human consumption. The extent of postharvest loss of fish varies in different countries and losses in the range of 20-30 percent is not uncommon. In addition to the economic loss, these losses also contribute to increased pressure on the fisheries resources. Postharvest loss may occur even in case of processed fish; for example dry fish may become unfit for consumption by insect infestation and mold growth. Even in situations where fish is processed, considerable volumes of waste is generated through discarding fish heads, viscera, bones, fins, tail, which contain meat that can be used for food. In some sectors, for example the tuna industry, “scrape” is used for food, for making “pate”, and in many sectors there is considerable potential for the utilisation of processing “waste” for by-products, however this is not yet common. Discarded bycatch are also a critical issue, they can sometimes constitute between 28-80 percent of the catches from industrial trawlers; a large waste of food which could be otherwise utilized.

Fish is a very valuable resource in terms of being an important source of protein as well as an important source of employment for fishers, traders, processors and more, and in many countries, fish is derived only from the natural environment and obtained by capture fisheries. Many fish stocks have already been overexploited or fully exploited and therefore to increase fish availability for the population, it is important to fully utilise the harvested resource by minimising postharvest losses, minimising waste generation and utilising byproducts. FAO estimates indicate that annually about 7.3 million tons of fish are discarded and about half of these come from trawl fishing for shrimp and demersal fish. By-products are also a good option for utilisation of fish that are often discarded for various reasons. This principle is laid out in the FAO Code of Conduct for Responsible Fisheries, Article 11. Thus to comply with the Code of Conduct, countries need to develop policies and programmes directed towards minimising postharvest losses, utilisation of discards and by-products while setting an effective mechanism to control fishing effort. To improve income generation, it is also important to provide assistance for stakeholders to enhance their role in the value chain.

OBJECTIVES

The objectives of the workshop are to (a) review the current practices in the sector in the Near East and North Africa region, (b) examine case studies of best practices globally and discuss the best options for the region, and (c) identify policy level and operational level interventions to improve food security and income generation through reduction of losses and waste in fisheries in Near East and North Africa region.

PARTICIPATING COUNTRIES

Algeria, Bahrain, Egypt, I.R. Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen.

THE PROCESS

Four experts will deliver key note addresses covering: (a) Best practices and strategies for minimising postharvest losses and waste; (b) Fishery by-products and co-products for minimising waste (c); Value chain based approach for minimising fish loss and waste; and (d) Best practices in fish bycatch and discard management.

There will be an overview of post-harvest losses and waste including presentation of baseline information on the status of post-harvest losses and waste in the participating countries, and case studies of good practices in the region and identification of capacity building needs by national experts from countries in Near East and North Africa region. This will be followed by group work to draft regional strategies, policy interventions that can facilitate improvements in fish handling and processing practices at operational level and contribute to minimising fish losses, waste and facilitate bycatch management. FAO partners and donor agencies active in the region will be invited for the workshop to facilitate drafting of project concept notes, outlines of proposals that can be taken forward for support by the donor agencies.

EXPECTED OUTPUTS

1. Proceedings of Regional Conference containing four reports of global best practices presented by key note speakers, case studies of best practices in the region, capacity building needs, content elements of strategies for improvement, policy level and operational level interventions.
2. Project concept notes, proposal outlines for support by donor agencies active in the region.

TENTATIVE AGENDA**14 December 2013**

Arrival of participants and registration

15 December 2013

09.00 – 10.00 Opening addresses

10.00 – 10.30 *Coffee break*

Technical Session 1

10.30 – 13.00

- The FAO Global initiative Food Loss and Waste reduction
- Overview of the national survey questionnaire findings

- Overview of case studies of best practices from the region
 - Egypt: Post harvest fish losses in the Gulf of Suez fisheries, Egypt
 - Iran: An overview on Post-Harvest fish losses in Islamic Republic of Iran
 - Mauritania: Revue sur les pertes post-capture en Mauritanie
 - Morocco: Approche stratégique pour la gestion des captures accessoires et la réduction des rejets en mer au Royaume du Maroc
 - Yemen: National review on post-harvest fish losses in the Republic of Yemen

13.00 – 14.00 *Lunch break*

14.00 – 15.30

- Key note address: Best practices and strategies for minimising postharvest losses and waste
- Planning for group work: assignment of tasks
- Group work on best practices and strategies for minimising post harvest losses and waste.

15.30 – 16.00 *Coffee break*

16.00 – 17.00

- Group work cont'd

16 December 2013

09.00 – 10.00

- Feedback/plenary presentation and discussions on group work outcomes.

TECHNICAL SESSION 2

10.00-10.45

- Key note address: Fishery by-products and co-products for minimising waste

10.45-11.15 *Coffee break*

11.15 - 12.45 Technical Session 2 Continued

- Key note address: Value chain based approach for minimising fish loss and waste
- Key note address: Best practices in fish bycatch and discard management

12.45 – 13.45 *Lunch break*

13.45 – 15.30 Planning for and group work on:

- Fishery by-products and co-products for minimising waste
- Value chain based approach for minimising fish loss and waste
- Best practices in fish bycatch and discard management

15.30 – 16.00 *Coffee break*

16.00 – 17.00 Plenary presentation of group work

- Discussions on content elements of strategies, policy interventions, capacity building, improvements at operational level and recommendations of the regional workshop.

- Discussions with donor agencies on concept notes of project proposals, drafting concept notes.

17 December 2013

Morning:

Field visit

14.00

Afternoon session

- Presentation for endorsement of draft summary report, project concept notes

Appendix 2 – List of participants

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Appendix 3

POST HARVEST FISH LOSSES IN THE GULF OF SUEZ FISHERIES EGYPT

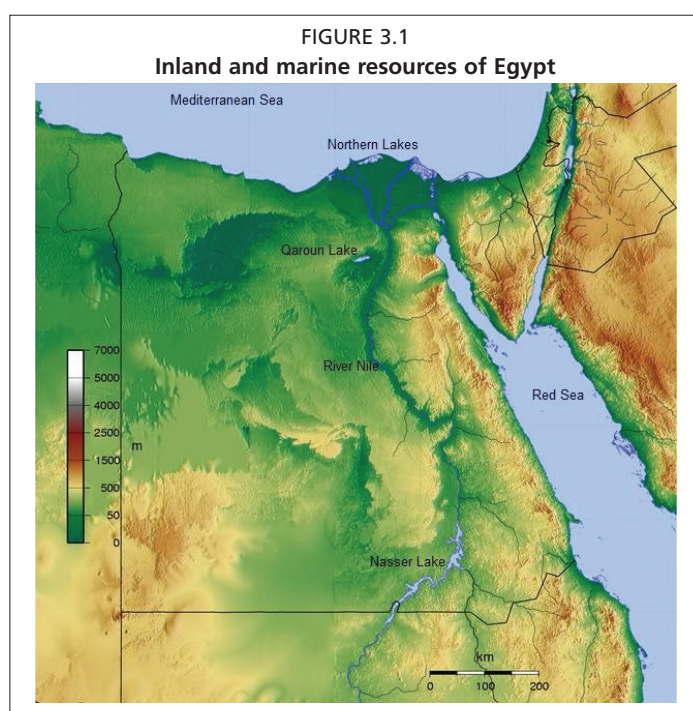
By: Ms Azza El Ganainy,
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Introduction

Fish is the world's largest wild food harvest that provides a vital source of protein as well as cash income for many people in the developing countries. An estimate of more than 120 million people throughout the world depend on fish for all or part of their income.

Egyptian capture fisheries are divided into two sectors, the marine coastal resources and the inland waters. The marine resources represented by a long coastline, extending for about 2 500 km, together with a continuous continental shelf of about 53 000 km bordering the country on the north along the Mediterranean Sea coast and to the east along the Red Sea, with the Suez and Aqaba Gulfs. Moreover, the inland resources, include the Nile River with many irrigation canals, six northern coastal lagoons opening to the Mediterranean Sea (Mariut, Edku, Burollus, Manzala, Port Fouad and Bardawil) and two opening to the Suez Canal (Timsah and Bitter Lakes), with two closed lakes (Qarun and Wadi Al Raiyan), and the great reservoir behind the Aswan High Dam (Lake Nasser) (Figure 3.1).

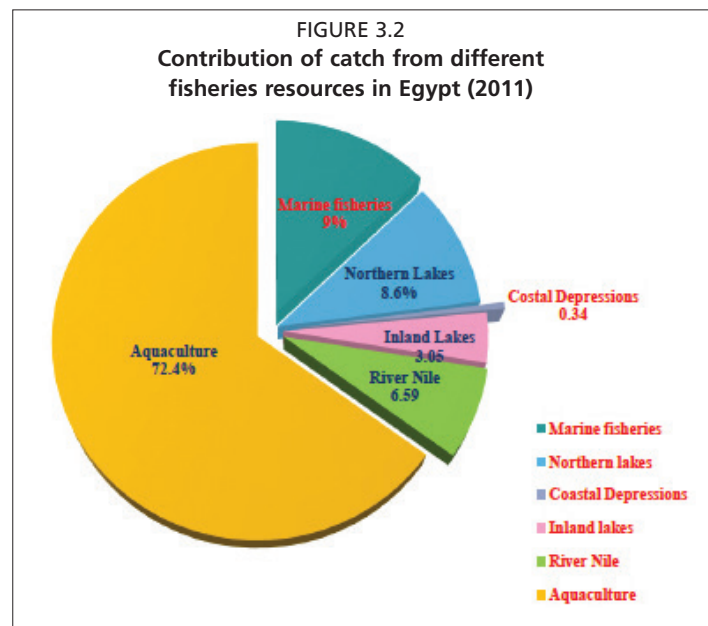
Marine fisheries are of lesser importance to Egypt than its major freshwater fisheries and aquaculture industries, and represent only about 9 percent of total fish production in Egypt. However, of the marine fisheries, approximately 36 percent of the total marine fish catch comes from the Red Sea and Gulf of Suez; with the remainder coming from the Mediterranean coast (GAFRD, 2011).



The inland water fisheries in Egypt cover an area of over 8 700 km² in five northern lakes on the Egyptian Mediterranean coast, including rivers, lakes, reservoirs and brackish water lagoons. The inland fishing fleet comprises over 38 500 small wooden boats (4–6 m in length) catching about 253 051 tonnes (Figure 3.2). Most of the fishermen are unregistered.

Both commercial and sport fishing take place on these waters. Approximately 3.5 million fishermen are engaged in the fisheries sector. There are about 270 registered landing sites and many unregistered.

Within the primary fisheries legislation, there are no policy objectives established for the management of marine fisheries in Egypt and the Act is primarily an administrative tool. Transitioning to sustainable fisheries in Egypt is crucial and challenging. Achieving sustainable fishing requires long term fisheries management regulations that should be conducted in the near future.



Aquaculture in Egypt has witnessed a significant and rapid expansion over the last few years. Today Egypt has the largest aquaculture industry in Africa which is currently the main single source of fish supply representing 72 percent of the total supply in the country. Egyptian fish production reached 1 362 174 tonnes in 2011 (and close to 1.5 million tonnes in 2012) with a total market value of about EGP 16 819.1 million for the same year. Over 99 percent of production comes from small and medium-scale privately owned farms. Aquaculture products tend to be consumed in the domestic market as Egypt is not yet self-sufficient in fish production (about 182 222 tonnes were imported in 2011 to ensure an annual *per capita* consumption of 16.82 kg). The Ministry of Agriculture and Land Reclamation plans to increase Egypt's total fish production to 1.7 million tons by 2017 (including at least one million tons from aquaculture).

GULF OF SUEZ FISHERIES

There are three main landing sites along the Suez Gulf (Attaka, Salakhana and Tur). Three fishing methods are used in the Gulf of Suez, trawling, purse-seining and artisanal methods dominated by hand line, long line, gill nets and trammel nets. The fishing fleet in 2012 was composed of 78 trawlers and 83 purse seiners in the Suez Gulf, and 711 boats using longline, hooks, trammel nets and gill nets along the

whole fishing ground, in addition to about 128 trawlers working outside Egyptian territorial waters, around the Gulf of Aden (El Ganainy and Yassien, 2012).

The catch of the Gulf of Suez represented by 33.6 percent of the total landing of the Egyptian Red Sea fisheries. Major pelagic stocks caught by purse-seining include horse mackerel, round herring, Indian mackerel, sardines and anchovy. Demersal species supporting trawl fisheries include shrimps, cuttlefish, striped snapper, lizardfish, red mullet and thread-fin bream while reef fish, and predominately the high value groupers (*Serranidae*) and emperors (*Lethrinidae*) are the most important species for the artisanal fishery. There is a marked differentiation in catches down the coast which is due primarily to different habitats, but also reflects different gear usage and market demands (Barrania, 1997).

Post-harvest fish losses (PHFL) are a major concern and occur in most fish distribution chains throughout the world. Not only do losses constitute lost income to fishers, processors and traders, they also contribute to food insecurity – a loss of fish means less fish available for the consumer.

PHFL refers to fish that is either discarded or sold at a relatively low price because of quality deterioration or owing to market dynamics. This means that fish operators (fishers, processors, traders, and other stakeholders involved in ancillary operations) lose potential income. It also means that less fish is available to consumers, or that consumers are supplied with low-quality fish and fish products. There are also important negative implications for food security (Kumolu & Ndimele, 2011).

Post-harvest fish losses are often caused by biochemical and microbiological spoilage changes that occur in fish after death. A live fish has natural defense mechanisms that help to prevent spoilage. However, once a fish dies its defense mechanisms stop and enzymatic, oxidative and microbiological spoilage begins to cause quality deterioration (Akande and Ouadi, 2010).

In Egypt, no studies have been conducted to evaluate the post harvest fish losses. This study is the first to give a preliminary overview on the post harvest fish losses in the Gulf of Suez.

MATERIALS AND METHODS

Due to the political situation in Egypt and time limitation it was difficult or impossible to carry out loss assessment in all locations in all fisheries and at all stages of fish distribution chains, therefore the Attaka landing site in the Gulf of Suez was chosen for conducting the survey. Data included in this report were gathered through several interviews and questionnaires conducted with many skippers, fishermen, market traders and enumerators from the General Authority for Fish Resources Development to understand the type of fish loss incurred and reasons of loss.

Photos were taken in the main two fishing harbours in the Gulf of Suez, Attaka, and El Salahkana. Attaka lies some 15 km south of Suez city, El Salahkana fishing port is in Suez city in the northern part of the Gulf of Suez.

RESULTS AND DISCUSSION

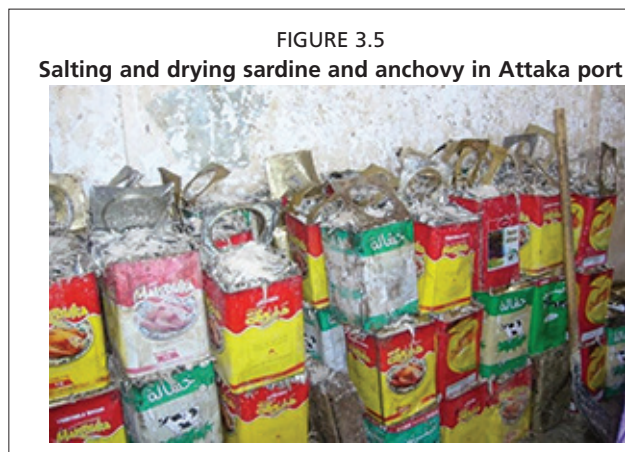
All fishing vessels (trawlers, purse seiners and liners) that land their catch in Attaka harbor use ice for preserving fish (Figure 3.3). Catch is sold within one to three hours after landing through an auction to the local marketing agents who are readily available at the port. Sold fish is transported to the market in Suez and the central market in Cairo by refrigerated trucks (Figure 3.4). Until this stage the loss can be considered negligible.



The distribution of fish from the central market to the small markets in Cairo can cause some loss due to the spoilage of fish, particularly in summer due to high temperature and deficiency of ice. A preliminary estimate of the physical loss during this stage indicated an 18 percent loss.



Fish that is undersized, particularly anchovy and sardine, are often processed at the landing site, salting and drying is the common way of processing (Figure 3.5) This type of processed fish is transported for marketing in Upper Egypt at very low prices.



POST HARVEST PROCESSING INDUSTRY

A general review of the post harvest fish processing in Egypt indicated that the fish processing industry in Egypt is represented by smoking, salting and canning and depends on imported fish such as herring and mackerel. There are only three factories working in the canning of sardines and 200 factories for fish smoking (particularly herring), 80 percent of which are primitive. The smoking factories production capacity is estimated at 1 048 tonnes/year with capacity range between 8-300 tonnes/year, and all of these units rely on imported herring. As for the canning industry factories production capacity is about 8 000 tonnes/year.

In addition to the many traditional small units of local salting, there are four factories for salting fish and their production capacity is estimated at 2 800 tonnes/year, mainly depending on grey mullets and small pelagics, in particular anchovies and sardines. Fishmeal are manufactured in three factories with estimated total production capacity of about 70 tonnes/day, they also produce small amounts of value-added products.

BOTTOM TRAWL DISCARDS

The first attempt to investigate the discards of trawl catches in the northern part of the Gulf of Suez was conducted through a bottom trawl survey carried out on a commercial trawler for a period of 11 days in March 2003 (El Ganainy *et al*, 2005). Data was collected on board from approximately 77 hauls. After hauling the gear, the catch was discharged onto the stern fish deck. Fish of commercial value were sorted by the fishermen (Figure 3.6), the numbers of boxes of each species group category were counted and their weight calculated. The discarded portion of the catch was sorted into major species and weighed. The species composition of discards was listed as fish, crustaceans and cephalopods, where the identification was made to the species level. Discard rate was estimated as (weight discarded/total weight). Relationships between discards, depths, duration of the hauls, and landings were established by multiple regression analysis.

The results showed that the trawl fishery in the Gulf of Suez is directed for shrimp but many finfish species and invertebrates are caught as bycatch which is defined as incidental catch and discarded or released catch. The mixed-species trawl fishery in the Gulf of Suez generates the most bycatch and also produces a large amount of discards. The ratio of shrimp catch to bycatch in the Gulf of Suez is 1:15.

The estimated discard rate was found to be 56.1 percent of the landed weight. It was also found that the average discarded catch per hour was $31.52 \pm 20\ 781$ kg/hr while the average landed catch per hour was $22\ 619 \pm 13\ 067$ kg/hr. These results indicate that the discards rate is 28 239 percent higher than the landed catch rate.

FIGURE 3.6
Fishers sorting and discarding fish on board a trawler



The species composition of fish and invertebrates discarded by the trawl fishery in the Gulf of Suez showed that 85 percent of discarded fishes are unmarketable species and 15 percent are commercial species, while most the discarded invertebrates are unmarketable species except squids the most important discarded invertebrates which is a valuable commercial species, the main reason for discarding this species is the unmarketable sizes that have low or negligible value (Table 3.1).

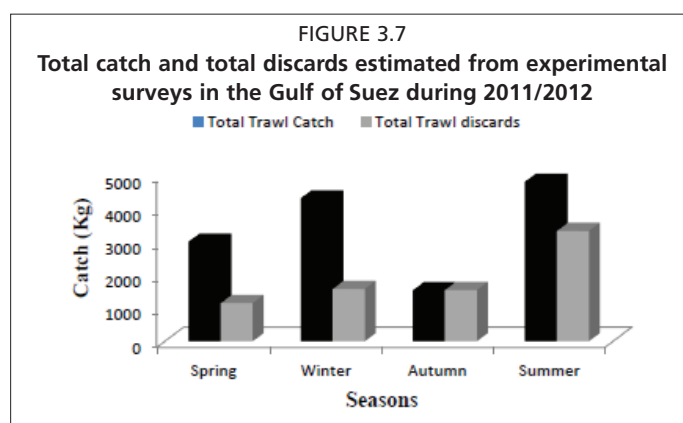
TABLE 3.1
Percentage and catch per unit effort of the most abundant fish and invertebrate species in discards of the trawl fishery in the northern part of the Gulf of Suez

Species	English name	Local name	Percentage	kg/hr
Fishes			85%	
<i>Leiognathus berbis</i>	Slip mouth	Erian	35%	8-25
<i>Champsodon capensis</i>	Gapers	Haret Kheshen	25%	6-18
<i>Leiognathus elongatus</i>	Slip mouth	Abou El-erian	15%	10-15
<i>Pseudorhombus arsius</i>	Flat fishes	Moussa	10%	5-8
Invertebrates			65%	
<i>Charybdis helleri</i>	Swimming crab	Kaboria	20%	9-20
<i>Lagunum depressum</i>	Sand dollars		10%	10-22
<i>Clypeaster reticulatus</i>	Sand dollars		10%	5-12
<i>Callyspongia monilata</i>	Finger sponge	Esphing	7%	15-25
<i>Cliona vastifica</i>	Red sponge	Esphing	5%	15-25
<i>Algae</i>	Algae	Tahaleb	8%	7-16

During the fishing season 2011/2012 four bottom trawl surveys were conducted in the Gulf of Suez to estimate the discards quantity and composition (ElGanainy *et al.*, in prep). The estimated discard rate varied according to fishing season, the total trawl discards was found to be 35.75 percent of the landed weight (Table 3.2). The minimum percentage of discards was 26.8 percent recorded during winter. While the maximum percentage of discarded was 50.1 percent recorded during autumn.

TABLE 3.2
Total catch and total discards estimated from experimental surveys in the Gulf of Suez during 2011/2012

Fishing Season	Catch	Discards	Total	Discards percentage%
Spring	3 011	1 154	4 165	27.7
Winter	4 317.5	1 582	5 899.5	26.8
Autumn	1 538.5	1 547	3 085.5	50.1
Summer	4 812.5	3 330	8 142.5	40.9
Total	13 679.5	7 613	21 292.5	35.7



The results of this study showed that the maximum abundance of demersal fishes were recorded in summer where the total trawl catch per hour was (64.5 kg/hour) caught by 40 fishing shots. While the minimum total trawl catch per hour was (19.1 kg/hour) recorded during the autumn 2011 and caught by 60 fishing shots. The maximum total discards per hour was 44.6 kg/hour recorded during summer 2012 caught by 40 fishing shots, while the minimum discards per hour was 8.3kg/hour recorded during the winter of 2012 by 85 fishing shots (Table 3.3).

TABLE 3.3:
Total catch and total discards per hour in the Gulf of Suez during four seasons 2011/2012 as estimated from experimental surveys

Fishing seasons	Total Catch	Total discards	No of hours	No of shots	Catch/ hours	Discards/ hours
Spring	3 011	1 154	114.4	43	26.3	10.1
Winter	4 317.5	1 582	191.3	85	22.6	8.3
Autumn	1 538.5	1 547	80.4	60	19.1	19.2
Summer	4 812.5	3 330	74.6	40	64.5	44.6

CONCLUSION

The results of this study revealed that the bulk of fish post harvest losses generated by the semi-industrial fleet in the Gulf of Suez is represented by the bottom trawl discards. Post harvest losses also occurred during the marketing chain transportation and was estimated at 18 percent of landed fish. Potential solutions of the discard problem might include:

- Spatial closures in certain areas and continuous monitoring of the fishery in addition to prohibition of fishing in shallow waters.
- Another regulation of great effect is increasing the cod-end mesh size of the trawl gear and applying the most advanced gear technology that reduces the amount of discards.
- Development of factories for producing different useful fish by-products.

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Appendix 4

AN OVERVIEW ON POST-HARVEST FISH LOSSES IN THE ISLAMIC REPUBLIC OF IRAN

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INTRODUCTION

Fish is known as one of the most significant resources of high quality protein worldwide. Because of unique nutritional values, a majority of experts recommend fish as healthy food for various groups of people. Nowadays not only is fish consumed vastly by communities who live close to seashores, it is also quite popular in large urban centers. Product diversification, affordable prices and accessibility are among main reasons may place fish at the top of other protein resources. Importantly, to millions of people around the world especially in developing countries fisheries is a key source of food, income and employment.

All abovementioned indicates the importance of fish key role in food security and economy. However, this valuable protein resource is highly perishable due to its special characteristics. Immediately after fish are dead, bacterial spoilage and autolysis processes begin. Microorganisms that exist in the environment together with those live on fish skin, gills and internal organs, begin to deteriorate fish quality. Environmental conditions, especially temperature is critically vital in this stage. Unquestionably, poor post-harvest practices will cause fish losses. Post-harvest fish losses are a major concern in fisheries worldwide and occur in most fish distribution chains.

Fish losses not only directly affects income to fishermen, seafood processors and traders but it also considered as a threat for food security since fish losses means less food available for people. Quality loss and spoilage may convert fish from healthy food and source for income generation to a harmful source for environment human health. For this reason, loss reduction and spoilage prevention must begin quickly after harvest. All efforts should be made to improve catch quality and avoid deterioration of this valuable food resource.

Since post-harvest losses has been raised as an issue at the national level, plenty of measures also have been taken, albeit there remains a long way to go. Fisheries activities are considered as a factor to develop poor rural areas and it is not acceptable to lose this capacity in the form of changing valuable resources to waste.

The Islamic Republic of Iran is a leading fish producing country in the region. Both capture fisheries and aquaculture have been noticeably developed during last decades. Fish per capita consumption has been rapidly grown during last decade from 5 kg to 9.1 kg.

A few traditional small fish processing workshops have been undertaken to several modernized seafood processing plants. Iranian seafood products are produced based on approved standards and exported to many international markets.

Despite all stated, post-harvest losses is a major problem for Iran's fisheries sector. Small-scale fisheries still account for more than half of total fish production

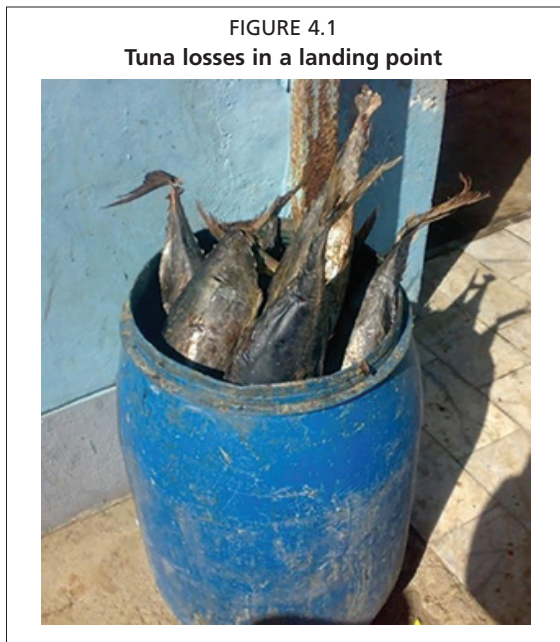
with its all challenges. Unsustainable fishing methods, illegal unreported unregulated fisheries and a high amount of losses and quality deterioration are major problems of small scale fisheries.

Annually thousands of tonnes of fish from wild catch or farms, lost due to different types of spoilage or converted to animal feed. In fact, the outcome of serious efforts by fishermen, easily thrown away or changed to a product with unusually lower prices.

Some other factors have intensified the negative effect of post-harvest losses in Iran recently. Costs of fishing and fish farming have been escalated steeply. Fuel subsidies have been cut gradually and the cost of fishing gear rose noticeably. The pressure on fish stocks has reached to the highest levels and some regional fishing management

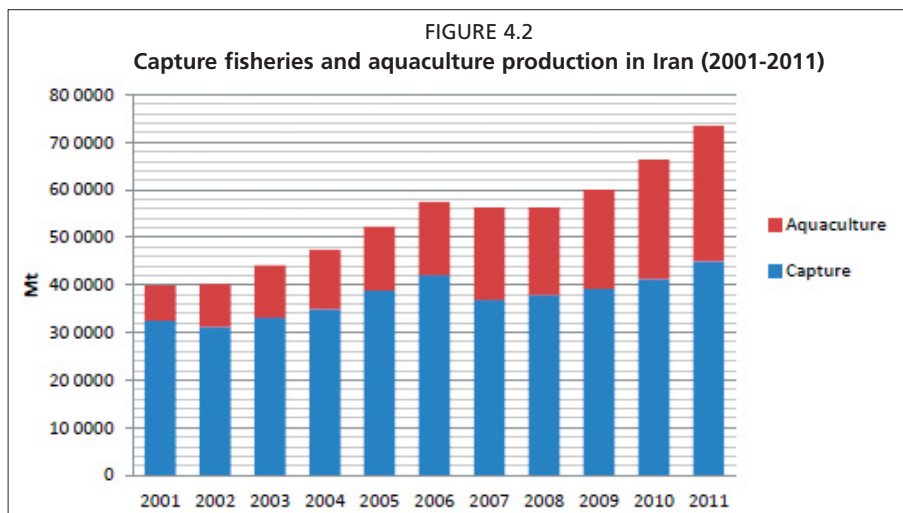
organization are planning to set quotas on fishing. In fish farming, also feed and drug fees have been increased dramatically. Hence in order to keep the business of fishing profitable, it is essential to reduce the costs and make the best use of stocks. Post-harvest losses prevention therefor is vitally important subject to country's fisheries sector.

To avoid fish losses it is necessary to first know the key features of the sector. Definitely the sector's characteristics are key to understand the main causes of fish losses and finding solutions to prevent and reduce them. In this report we initially review the status of fish production in Iran. Additional to this the summary of catch methods and aquaculture systems, processing and market conditions will be overviewed. Then main species and post-harvest losses, measures have been so far taken and future strategies will be discussed.

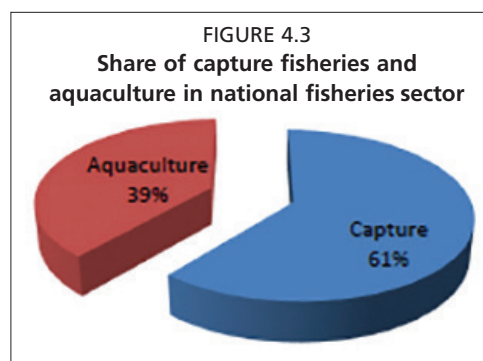


FISH PRODUCTION

Fish production in Iran, during last 10 years has been approximately doubled in volume and reached to about 735 000 tonnes in 2011, providing almost 9 kg per capita supply. Capture fisheries accounted for almost 450 000 tonnes while this figure for aquaculture increased to 285 000 tonnes in 2011. (Figure 4.2)

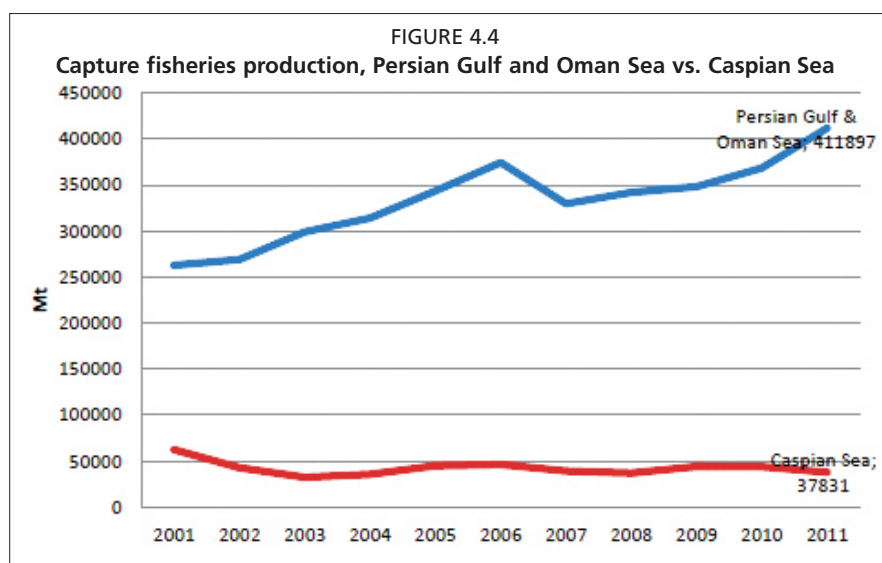


It is planned to even raise this amount to more than 1 million metric tonnes over the next five years. Aquaculture now constitutes 39 percent of total production while capture fisheries is higher and about 61 percent. (Figure 4.3) The main sub sector to develop production in future is aquaculture however efforts for gain more fish from high seas and Indian Ocean will be continued. To understand the condition in each sub sector, capture fisheries and aquaculture will be distinctly described.



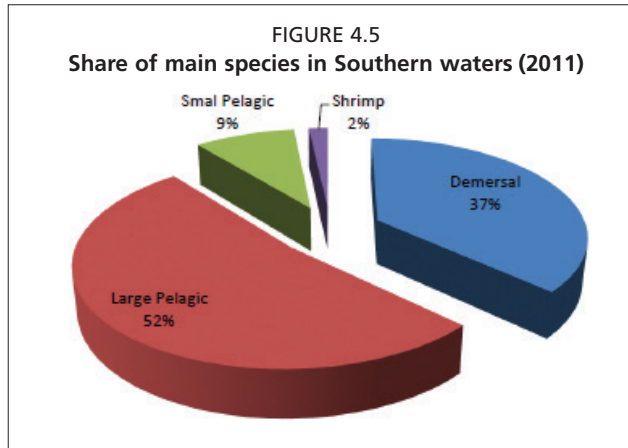
CAPTURE FISHERIES

Marine fisheries accounted for almost 60 percent of whole fish production. Total capture fisheries has reached to more than 450 000 tonnes in 2011. The Caspian Sea in the north of the country and the Persian Gulf and Oman Sea in the southern part are the source of marine capture fisheries. Species from these two sources are entirely different. The total catch from the Persian Gulf and Oman Sea is prominently greater than the Caspian Sea. In 2011 the total catch of southern waters was about 411 897 tonnes, while in the same year the fish harvest from the Caspian Sea recorded at 37 831 tonnes. (Figure 4.4)

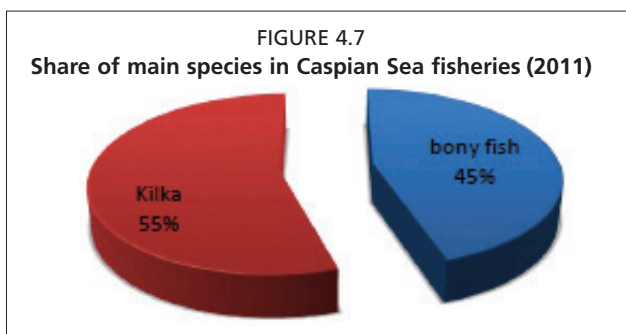


Large pelagic, small pelagic, demersal species and shrimp are the main catch groups in the Persian Gulf and Oman Sea. The harvest methods, catch amount, vessels types, fishing gears, caught species and temperature and environmental conditions are completely different in the Caspian Sea compared with the Persian Gulf and Oman Sea.

Temperature conditions and the tropical climate in the southern part of country is a critical factor for quality deterioration. Major markets including the capital and other big cities are located far from southern landing points and more care is needed for handling. In addition, the total catch from southern waters is almost ten times more than the Caspian Sea, demonstrating the priority for fishing in the southern waters. The large pelagic tunas have a great role in economy of sector. Figure 4.5 shows the share of these 4 groups in southern waters.



The Caspian Sea in the north of Iran is the largest lake in the world and it is a special habitat for some rare species. Sturgeon fishes (*Acipenser* spp. and *Huso* spp.) and kilka (a three species mixture of the family Clupeidae) are particular species that live in the Caspian Sea. Because of its exclusive conditions, the Caspian Sea has a significant role in the fisheries sector in Iran.



Kilka, bony fishes and sturgeon are the main species caught from Caspian Sea waters. Figure 4.7 demonstrates the share of each one in the Caspian Sea by volume in 2011. Kilka with more than 20 000 tonnes is the main catch followed bony fish with about 17 000 tonnes. Sturgeon harvest has been dramatically reduced to almost 80 tonnes, forming less than 1 percent of the Caspian Sea harvest.

AQUACULTURE

Aquaculture production has increased to a production of nearly 285 000 tonnes in 2011 from almost 73 600 tonnes in 2001. In fact aquaculture is the fastest growing activity in the sector, with farmed products currently categorized into three main products namely: warm water species, fresh water fish and shrimp culture. Carp family species, including common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Hypophthalmichthys nobilis*) are the main warm water farmed species. In recent years most of warm water cultured fish are exported directly to Iraq. Rainbow trout (*Oncorhynchus mykiss*) is the only fresh water cultured species. Major species from leading origins and the production amount in each group based on 2011 statistics are shown in Table 4.1.

TABLE 4.1
Main marine and farmed species (2011)

Origin	Main species	Production (tonnes)
Persian Gulf and Oman Sea	Large pelagics Small pelagics Demersal Shrimp	411 897
Caspian Sea	Kilka Sturgeon	37 831
Aquaculture	Carp Trout Shrimp	285 351
Total		735 079

THE STATE OF POST-HARVEST FISH LOSSES IN IRAN

Fish losses in general are defined as fish that are discarded or sold at noticeably lower prices because of low quality. Physical loss and quality loss are two main types of post-harvest fish loss, both exist in Iran. In physical loss, fish that was captured or landed is not used and is totally discarded at sea or on land. The example of this type of loss is bycatch from tropical shrimp trawls, which comprise more than 50 percent of total catch. The juvenile and undersized fish are discarded while larger size species are used for human consumption. It is noticeable that the majority of fish losses are used for producing fish meal, however these fish are sold at considerably lower prices, thus reducing the fisher's income.

Quality loss is more common in Iran and usually happens because of poor post-harvest practices and lack of cold chain conditions during transportation. For most consumers it is difficult to distinguish quality products. Most major cities with large markets are located far from the main landing sites for wild species i.e. the Persian Gulf and Oman Sea. It means the average time for reaching the markets is more than 10 hours. Due to the vast diversity and various species produced in Iran it is not easy to assess the loss rate, but the loss amount is estimated averagely between 2 to 15 percent across different species. Generally the rate of losses in aquaculture is lower than for capture fisheries and the fish harvested from Caspian Sea constitute less fish losses than marine products from southern waters (Persian Gulf and Oman Sea).

To understand the cause of losses, finding proper solutions and preparing an integrative national strategy for post-harvest fish losses reduction it is essential to know the all key features of the main capture and aquaculture species. Some factors such as production amount, harvest method, and market parameters are necessary to understand before any assessment and action plan. Therefore a summary of key species and losses assessment will be mentioned in this report. Some measures taken so far and solutions for future are also stated.

TUNA

Large pelagic fish constitute the biggest catch amount when compared with all other catch groups. Tuna and tuna-like fish in this category also are the most important species. Tuna has a key role in fisheries economics in Iran. With more than 130 tuna canning factories, Iran has the most number of tuna canneries in the world. Iran also is among the countries with highest canned tuna per capita consumption. Almost all tuna caught from southern waters is consumed by canneries; in fact tuna is raw material for more than 130 canneries with a total capacity of 550 million cans per year.

Most tuna is caught in the waters of the two southern provinces, Hormozgan and Sistan-o-Baluchestan. Many canneries are located near landing points in these two provinces, but there are many of them also located far from these sites and transporting fish to these plants needs much care. The main tuna species caught in Iran included longtail tuna (*Thunnus tonggol*), skipjack tuna (*Katsuwonus pelamis*), yellow fin tuna (*Thunnus albacares*) and kawakawa (*Euthynnus affinis*). Longtail tuna however has the biggest share and more than 80 000 tonnes of long tail tuna was harvested in 2011.

Unfortunately, the biggest post-harvest losses are seen in the tuna sector. It is estimated that the post-harvest tuna losses are approximately 15 percent prior to being received in canning plants. It means that poor post-harvest practices and improper handling causes this amount of loss. The main tuna harvest method is gillnetting, which is not considered a sustainable fishing method. Fish remains for long hours in the water after harvest and the deterioration process has already begun once fish is hauled onto the vessel. The tuna fishing fleet is comprised of more than 6 400 fishing vessels. Only seven vessels from the tuna harvest fleet are mechanized purse seiners. About 5 600 tuna harvest vessels are artisanal small scale fishing vessels. Increasing the number of vessels as well as catch effort extended the sea trips to more than a week. Most fishermen use ice blocks to chill the catch, however this was not efficient and additional measures were needed.

The installation of an ice crushing machine onboard was undertaken, as well as the insulation and shelving for fish storage, which was primarily applied in tuna fishing vessels. However for long trips icing was again demonstrated to be insufficient and another solution needed. Installing freezing systems onboard helped artisanal vessels to extend their fishing trip to more than week and search for fish schools in far fishing grounds. Currently more than 800 vessels are semi-mechanized and equipped with onboard freezing systems that have influenced the losses rate. Although harvest method modification and shifting to longline method is a long term goal in the tuna fisheries, these measures reduced the tuna losses considerably.

Poor landing and handling practices also cause quality problems. During landing and transportation to processing plants the rate of losses is increased. Histamine formation is a serious quality problem that originates from poor post-harvest and handling manners. Many canneries avoid receiving fish with high levels of histamine and so they are sold to fish meal producing factories.



Establishing special landing points for tuna and equipping them with cranes and conveyer belts facilitate the tuna landing and could lead to loss reduction.



KILKA

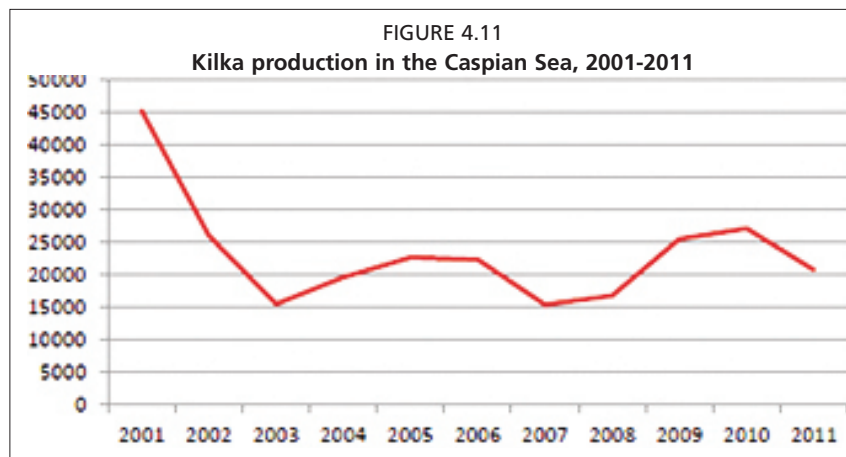
Kilka fish (*Clupeonella*) are one of the most valuable stocks in the Caspian Sea. High protein content is the prominent characteristic of these species. These small fish live in shallow, close to shore waters. There are three types of Kilka in Caspian Sea waters:

- *Clupeonella Caspia* or common Kilka
- *Clupeonella Engrauliformiss* or Anchovy Kilka
- *Clupeonella Grimmi* or Big eye Kilka

Kilka is caught at night by artisanal commercial vessels equipped with conical nets and underwater electric lights. (Figure 4.10) Kilka is harvested throughout the year with no special season.



Kilka industries in Iran are highly influenced by the increasing demand of feed producing plants to fish meal. Enormous stocks of kilka in the Caspian Sea are primarily considered as the main source for feed production. After the invasion of the comb jellyfish (*Mnemiopsis leidyi*) into the Caspian Sea, kilka populations dramatically declined. (Figure 4.11)



Fish meal industries are the main consumers of kilka in the Caspian Sea provinces, which offer a minimum price. After being harvested from sea, kilka is collected in sacks without icing and is landed. In fact the fish meal producing factories receive low quality kilka at lower prices. In spite of all efforts to expand kilka to human consumption and promote kilka products, the majority of kilka caught from Caspian Sea is used by fish meal producers.

The Iranian Fisheries Organization encourages the fishermen to enhance post-harvest practices and use CSW containers to hold the catch with ice water combination. Moreover, it tries to reduce the number of fish meal producing factories and as an alternative promote kilka products. The final solution for reducing post-harvest kilka losses is shifting from fish meal production to human food products.



BONY FISH

Bony fishes are the second major catch group from the Caspian Sea. Several species are included in this group. But only two of them constitute a considerable amount. Fresh water white fish (*Stenodus leucichthys*) and mullet (*Mugilidae*) constitute about 90 percent of bony fishes caught in the Caspian Sea. The fishing method is similar to gillnet. The nets spread by boats close to the shore and hauled to land by tractors (Figure 4.13). The bony fish harvest season is from October to March.



Fresh bony fish are supplied mostly to local markets at high prices. Demand for this type of fish is extremely high. The capital city, Tehran, is not far and traditionally during fall and winter the demand for bony fish from the Caspian Sea is high. During the harvest season the temperature is not so high. Post-harvest bony fish losses are estimated at around 2 percent. The main reason for losses is a lack of washing as well as icing, and improper handling procedures even within short distances leads to quality deterioration. Based on an incorrect belief, fishermen deliberately add sand to the fish to prove catch freshness. The solution for this problem could include awareness raising and obligatory washing.

To reduce losses and avoid deterioration, a code of practice for bony fish handling has been produced by the Iran Fisheries Organization. Establishing post-harvest stations along the seashore in designated places is another solution to decrease losses. These post-harvest stations are places for washing, icing (if necessary) and using suitable fish containers for further handling.



SHRIMP

Shrimp is one of the most valuable fisheries commodities. It is both harvested and farmed in Iran. Wild shrimp is mostly caught in the Persian Gulf. The catch method is bottom trawling and the harvest season is from August to October. Based on statistics wild shrimp catch was 6 861 tonnes in 2011. Although wild shrimp was exported to international markets during last decade, currently almost this entire amount is consumed locally.

Adopting with target market standards and international seafood regulations was an opportunity for the shrimp sub-sector. Many processing plants succeeded to acquire an EEC approval code for fish and fishery products. Receiving shrimp in chilled seawater (CSW) containers with an ice and water combination is accepted as a requirement. These procedures create quality improvement and prevent post-harvest shrimp losses.

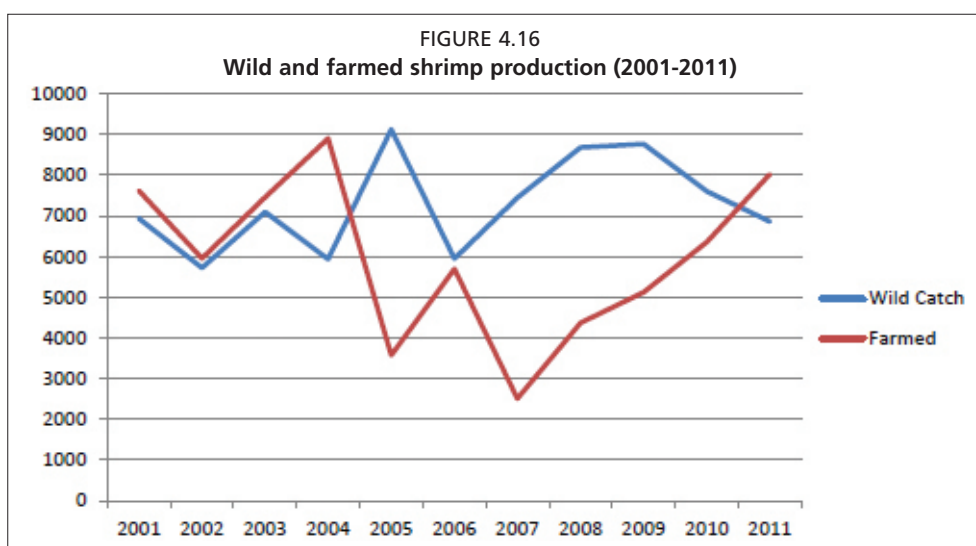
Almost all shrimp processing plants are located in southern seashore provinces. Wild shrimp is received by processing plants immediately after harvest with a sea water and ice combination in CSW containers. Then it is processed and frozen under hygienic conditions. Prior to the fishing season, the fisheries research institute estimates the catch amount, and based on field studies the period of season is announced to fishermen. Banana shrimp (*Penaeus merguensis*), Green tiger shrimp (*Penaeus semisulcatus*) and Indian white shrimp (*Fenneropenaeus indicus*) are the main species from wild catch.

Similar to other countries, the tropical shrimp harvest in Iran encounters a high amount of bycatch. Results obtained from studies have been completed in several fishing grounds show that shrimp constitutes only 15 to 25 percent of the catch that is hauled onboard. Up to 70 percent of the catch is comprised of juvenile and undersized species and discarded at sea, which seriously and enormously threatens the fish stocks and sea environment. Additionally, 5 to 10 percent is also comprised of relatively large size commercial species which are separated onboard from shrimp. The process of catch separation is a time consuming task. More bycatch needs more time to separate shrimp and this keeps the catch at high temperature and sun exposure. This could seriously deteriorate shrimp quality just after hauling.



A number of bycatch reduction devices (BRDs) have been tried to find the most efficient one for this type of fisheries. A project with FAO and GEF to reduce bycatch was completed in 2008. The results gained from all those experiments revealed that Nordmore Grid 80 is the most effectual BRD for Iran's shrimp trawling.

Farmed shrimp forms almost half of shrimp production in Iran. In 2011 the farmed shrimp production increased to more than 8 000 tonnes. Dissimilar to a steady trend of wild shrimp production, cultured shrimp involved fluctuations especially during the last decade. (Figure 4.16) Farmed shrimp production, which had faced constraints due to white spot breakdown, has been gradually revived during last years. Additionally, Indian white shrimp (*Fenneropenaeus indicus*) which was the main cultured species, has been substituted with white leg shrimp (*Litopenaeus vannamei*).



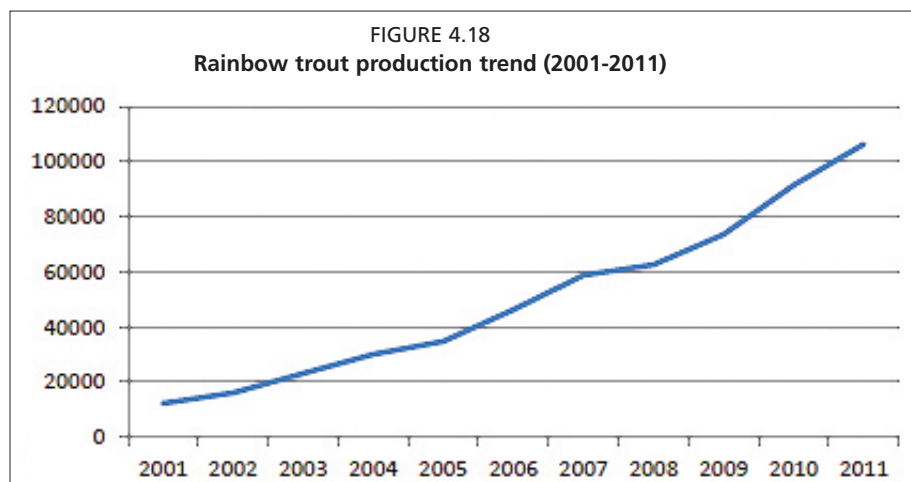
The majority of shrimp farms are located along the southern coasts and post-harvest losses are estimated at around 2 percent. Some farms are far from freezing plants and it takes a relatively long time to deliver shrimp to them. Poor icing and poor handling practices are also the main causes of shrimp losses from farms to processing plants. Lack of ice, sanitary clean water in aquaculture sites and suitable containers could be considered the main reasons of quality deterioration and losses.



IFO in collaboration with shrimp farming cooperatives is trying to reduce the post-harvest shrimp losses through taking some measures. Building sun protection shades and equipping them with sanitary water, ice crushing machine and adequate standard containers are the immediate need of farms. In the mid- and long-term however, raising awareness through workshops and the implementation of national traceability system are the key measures. The completion of all aforesaid measures will noticeably reduce post-harvest losses.

RAINBOW TROUT

Rainbow trout is the only freshwater cultured fish that gradually became the most popular farmed fish in Iran. Many caterings and restaurants serve trout and it is largely supplied to the supermarkets and chain stores. Trout production has increased remarkably during the last decade and increased to more than 106 000 tonnes in 2011. (Figure 4.18)



As it is shown above in figure 4.18, the trout production has dramatically increased, in response to huge demands from the market. This noticeable increase in production could raise the concerns of more post-harvest losses. The post-harvest loss in freshwater aquaculture is currently estimated at about 2 percent, as most of trout farms are located close to consuming markets and big cities.

Trout is mainly supplied fresh to the market. To avoid losses and improve quality some measures have been taken. Installing flake ice making facilities and gutting machines on farm site, building sun protection shades close to farms, promoting fish proper icing and using suitable fish boxes are major measures to decrease losses.

For awareness raising, the code of practice for farmed fish handling and storage has been issued, issuing permission for processing and freezing plants close to the fish farms. In recent years, demands for fresh trout live fish supply is being sharply promoted. Live fish supply to the market is increasingly developing and significantly affects the loss amount. Any losses from harvest, handling and storage are not assumed in live fish supply, albeit maximum care should be taken to avoid mortality during transportation and presentation.

Post-harvest losses in distribution and at market level

Fish and seafood products are distributed daily among consuming centers. Various vehicles are used for this purpose based on the distances and type of the catch. The most critical issue to improve quality and avoid post-harvest losses is cold chain managing and maintaining.

Establishing transportation on land specially designed for fish and seafood products could be the solution. Fish losses in retail market level, have not been assessed yet. To control fish losses and quality improvement in retail level, minimum sanitary conditions and required equipment must be defined as a standard for shops and retailers.

Establishing fish wholesale markets and fish landing terminals close to large cities are the main policies to reduce losses. These places are the contact point for wholesalers and retailers to shorten the lag times between harvest and consumption. Most of them are equipped with proper facilities such as ice making facilities and are managed under hygienic conditions.



LOSSES IN PROCESSING

The volume losses in seafood processing sector directly depends to quality of raw material received by them. Processing itself is not able to improve quality of raw material already deteriorated. During processing steps low quality materials quickly omitted and sold to fish meal producing industries.

Most of seafood processing plants are recently established and the rate of losses during processing steps are very low. In addition leftovers from processing are used for some value added products. Chunk meat from bone separation in canned tuna production is used for tuna salad and the leftovers of the filleting process are collected and used for imitated paste products.

RESULTS AND SUGGESTIONS

Table 4.2 displays the post-harvest losses in the fisheries sector in Iran, as well as measures should be taken to reduce losses until the last year of fifth national socioeconomic plan.

TABLE 4.2
Post-harvest fish losses in Iran

Target group by priority	Production (Mt)	Current Losses (%)	Main measures for Loss reduction
Large Pelagic (Tuna)	187 609	15	<ul style="list-style-type: none"> • Shelving vessels storage • Insulation of vessels fish storage • Installing onboard freezing system • Catch method modification • Mechanization of fish landing and handling • Using new chilling methods such as slurry ice • Full Implementation of National seafood safety plan with IVO collaboration
Small pelagic (sardine, lantern fish)	637	5	<ul style="list-style-type: none"> • Vessels structure modification to maintain cold chain • Establishing cold storage onboard • Full Implementation of National seafood safety plan with IVO collaboration
Demersal fishes	131 733	5	<ul style="list-style-type: none"> • Equipping vessels with chilling facilities • Fish storage and handling in standard fish boxes • Implementation of National traceability system • Full Implementation of National seafood safety plan with IVO collaboration
Bony fish (from Caspian sea)	17 034	2	<ul style="list-style-type: none"> • Establishing post-harvest stations • Using refrigerator trucks for handling • promoting catch icing • using fish standard boxes • Implementation of National traceability system • Full Implementation of National seafood safety plan with IVO collaboration
KILKA	20 717	5	<ul style="list-style-type: none"> • promoting use of CSW containers • encourage processing industries to produce value added new products from KILKA • Full Implementation of National seafood safety plan with IVO collaboration
Farmed species	276 675	2	<ul style="list-style-type: none"> • Establishing post-harvest stations • Promoting catch primary washing and Icing • Using standard fish boxes • Full Implementation of National seafood safety plan with IVO collaboration
Farmed shrimp	8 026	2	<ul style="list-style-type: none"> • Harvest method modification • Using CSW containers • encourage processing industries to produce value added new products • Full Implementation of National seafood safety plan with IVO collaboration • Implementation of National traceability system

As demonstrated, post-harvest losses are the biggest in the tuna fisheries. Therefore, as a priority this should be the main focus. Diversification of harvest methods, catch species, and fishing grounds in Iran have made loss reduction operations complicated.

Additionally, new activities in both capture fisheries and aquaculture are underway. Lantern fish harvest expansion and efforts to culture species such as sturgeon and tilapia are examples of these activities. It is essential to produce an efficient plan from the beginning and utilize the experiences previously gained.

A true definition of loss is needed for correct planning. It seems that for each type of catch a specific working group should be assembled to gather specific data and produce efficient procedures. The key challenge for loss reduction and further planning is still lack of precise and accurate information. All estimations are obtained

based on non-scientific data gathering methods, while for planning and decision making in loss reduction field an accepted standard method for fish loss assessment should be applied.

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Appendix 5

STRATEGIC APPROACH TO BYCATCH MANAGEMENT AND DISCARDS REDUCTION FOR THE KINGDOM OF MOROCCO

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Chief fisheries engineer and maritime affairs administrator

INTRODUCTION

The Code of Conduct for Responsible Fisheries, of the Food and Agriculture Organization of the United Nations recommends the optimal use of aquatic ecosystems and the rational and sustainable exploitation of fisheries resources. It also aims to promote the preservation, safeguarding and conservation of biodiversity of ecosystems by reducing the impact of fishing on non-target species.

Although all FAO Members have adopted the Code, concerns are growing as fishing mortality resulting from bycatch and discards threaten the sustainability of many fisheries and biodiversity in many regions.

Indeed, the catching and discarding at sea of occasionally large quantities of non-target species and especially juveniles are a spectacular illustration of the waste and damage caused by fishing activities. And the phenomenon is far from marginal since the quantity of discards represents almost 8 percent of world production, some 7 million tonnes per year. This rate differs obviously according to the fisheries, fishing techniques and areas. However there is a real concern that cannot be ignored by those involved in fisheries management.

At its 64th session, the UN General Assembly adopted Resolution A/RES/64/72 urging States and relevant organizations to reduce or eliminate bycatch, catch due to lost or abandoned gear, discards at sea and post-harvest losses and to support studies and research to reduce or eliminate by-catches of juveniles.

At its 28th Session held in Rome in March 2009, the FAO Committee on Fisheries recommended developing international guidelines on bycatch management and reduction of discards.

Following this recommendation, considered a priority, the Director General of FAO convened a technical consultation, held in Rome in December 2010, to discuss the draft international guidelines developed by an expert consultation held in December 2009.

The consultation adopted the draft of the guidelines and invited FAO to pursue its action plan to counter this problem. Its report was in turn adopted by the FAO Committee on Fisheries at its 29th session held in Rome in February 2011. The Committee recommended that FAO support capacity building and the implementation of these guidelines as well as ensuring that they will not impede international trade.

It is for this reason that the Centre for Information and counseling on marketing of fishery products in the Arab Region (INFOSAMAK) has convened a regional consultation on the subject: "Food security and income generation through the reduction of post-harvest losses" in Nouakchott from the 15th to the 17th December 2013..

This paper examines this issue in the Moroccan context and attempt to contribute to the identification of ways to counteract this matter and to a global reflection to develop a national strategy in light of the International Guidelines for the Management of Bycatch and Discards.

DEFINITION OF BYCATCH AND DISCARDS

Before discussing the different aspects that this paper will attempt to address, it would be useful to examine the definition of “bycatch” and “discards” as reflected in the International Guidelines.

Various terms are used in the literature on fishery waste and many definitions have been proposed. The term “bycatch” has been used in the scientific literature for over half a century and has been subject to various interpretations, some of which overlap or contradict each other. The text of the Guidelines recognizes the impossibility to stop an international standard definition as bycatch because of the wide variety of fisheries and ambiguities related to the terminology associated with non-desired catches.

In those fisheries which are subject to a management plan, the species and sizes which are considered relevant by-catch should be defined in the plan. In default, we consider by-catch the portion of the total catch which is not consistent with the fisheries management plan. The definition of bycatch can also be applied to species whose capture is prohibited in those fisheries.

In fisheries with less selective multi-gear targeting multiple species, bycatch refers to the proportion of samples that should not be captured, particularly owing to the adverse ecological or economic consequences that result.

The “total catch” is the amount taken by the fishing gear that is emptied onto deck of the fishing vessel. “Discards” or “rejects” are the part of the catch returned to the sea (for one reason or another). The remainder constitutes the “landed catch” or “retained catch”, which can then be divided into “targeted catch” and “accidental catch”, given that the same species can move from one category to another depending fish size, market demand, the fishing season or other criteria, while other species may be undesirable or of no commercial value.

It appears from the preceding text that it will be up to states to develop the definition that seems best suited to the reality of their fisheries, which would also be in harmony with their regulations and practices.

THE LEGAL FRAMEWORK GOVERNING BYCATCH AND DISCARDS

The new policy adopted in 2009 pays special attention to the preservation of fishery resources within its first strategic axis “Sustainability”. Each of the 16 projects contained within the strategy entitled “HALIEUTIS” were pondered to satisfy the principles of sustainable development.

Among the priorities of this strategy recognized as environmentally responsible, socially acceptable and economically viable, we can mention:

- the preservation of marine biodiversity,
- the fight against overfishing,
- the replenishment of harvested species,
- the protection of endangered species,
- the promotion of sustainable fishing practices, and
- the adaptation of the appropriate legislation.

The issue of bycatch and discards is therefore considered in the new strategy, although it is not explicitly named, and the term “sustainability” can serve as a framework for engaging in any discussion on the issue of discards.

Regarding the legal framework which may govern the issue of bycatch and discards, it is necessary to take into consideration both the national legislation, and international or regional recommendations and resolutions, on multilateral and bilateral levels, related to the issue of discards.

International Level

The marine environment and biological resources it contains are governed by a set of international and regional agreements that provide either guidance or binding resolutions and guidelines that states must observe and apply.

The Kingdom of Morocco, following the example of other nations and coastal states signed and ratified several conventions and agreements which already anticipate a number of provisions relating to the preservation of the marine ecosystem and living marine resources, and more measures are already taken in this regard as discussed below.

Even if the precise issue of bycatch and discards is not listed as such in the current fisheries policy, the provisions that come closest possible to the issue of discards are going to be identified.

a The Convention on the Law of the Sea (UNCLOS)

The 1982 United Nations Convention on the Law of the Sea, (which Morocco ratified 17 April 2007), particularly the Article 61, stipulates that States must take the appropriate conservation and management measures to avoid that the maintenance of living resources in their exclusive economic zone is not compromised and not endangered by over-exploitation. These measures must also take into consideration the effects on species associated with or dependent upon harvested species.

Bycatch species seem to belong to the group called “species associated with the exploited species or dependent on them.” But is there a real association? As per trophic considerations, if both species groups (exploited and dependent) are part of the same trophic chain. As per spatio-temporal order, if they share the same geographic or bathymetric area.

b. The London Convention

The 1972 London Convention regulates disposal of objects at sea, and its Amending Protocol “Protocol 96” lists the objects allowed to be immersed. Morocco has ratified this Convention. Whether or not discards can be assimilated as part of this agreement is an issue, the issue of discards seems far from the spirit of this agreement. However it is indeed a disposal and should be treated as such.

c. International Convention for the Prevention of Pollution from Ships (MARPOL)

International Maritime Organization’s (IMO) MARPOL and its Annexes 1, 2, 3, 4, 5 and 6 relating to the discharge of pollutants at sea, also contain provisions which have value of bonds, to protect the marine environment of all forms of pollution. This agreement is cited as an indication because, as the previous one, its spirit is different from the issue of bycatch and discards.

d. The Barcelona Convention

The 1976 Barcelona Convention and its seven Protocols, even amended, is also a binding framework for the protection of the Mediterranean Sea.

- Protocol 1: “immersions” (by ships and aircraft)
- Protocol 2: “Prevention and Emergency”
- Protocol 3: “LBS”
- Protocol 4: “Specially Protected Areas and Biodiversity”
- Protocol 5: “offshore” (pollution resulting from exploration and exploitation)
- The Protocol 6: ‘hazardous waste’
- The Protocol 7: “integrated coastal zone management”

Protocols 4 and 7 relate to protected areas, biodiversity and integrated coastal zone management plan provide of necessary measures and directly linked to the issue of bycatch and discards.

Regional Level

As noted above, fisheries management certainly falls within national legal and regulatory agreements, but it must be complemented by provisions in bilateral agreements and conventions, including measures dictated by regional bodies to which states are party.

For Morocco, the case of the driftnets is more than common, since late 2012 this fishing gear was removed following a plan initially dictated by the International Commission for the Conservation of Tuna in the Atlantic (ICCAT) and adopted by the General Fisheries Commission for the Mediterranean (GFCM).

This gear, known for its low selectivity and its adverse effects on the marine ecosystem because once lost or abandoned it continues to catch fish, marine mammals and birds, in addition to the risks it generates for navigation. It had a disastrous impact on the populations of harvested species as well as non-targeted species or sharing the same area. Banning this gear was pure common sense and an answer to the spirit of the Code of Conduct for Responsible Fisheries.

In total, 245 ships, mostly longliners targeting swordfish, were compensated to a total amount of approximately 19 million Euros. This program was complemented by a training plan which was allocated a budget of 3.5 million Euros to facilitate the conversion of 1800 fishers to new fishing industries.

It was a difficult exercise, which certainly helped ease the swordfish stock, but has had social and economic impacts for which this settlement could not fully compensate.

Both RFMOs have also adopted other resolutions that are related to bycatch and discards and that States must incorporate into their national regulations, particularly those recommending the establishment of protection zones in areas for spawning and with a high concentration of juveniles, encouraging fishing practices using selective gear, strengthening the monitoring of fishing activities, introducing biological rest periods, and strengthening research and scientific monitoring.

National Level

The national laws governing the activities of sea fishing in Morocco do not currently have special provisions to counteract the problem of discards from marine fisheries as identified by FAO.

However, it would be useful to recall that Moroccan legislation already provides for some provisions which partially address these aspects and which deserve to be mentioned, namely:

- Law No. 1-73-255 of November 23, 1973 forming marine fishing regulation as amended and supplemented, and in particular Title IV which stipulates that:
 - Article 17: It is prohibited to carry on board fishing vessels and to use for the capture of seafood any toxic substance or bait that may poison or intoxicate fish, molluscs, sea urchins or shellfish, or to infect or pollute water;
 - Article 18: It is forbidden to intentionally throw into the sea any toxic substance or bait that may be susceptible to infect, to intoxicate or poison fish, molluscs, sea urchins or shellfish, or to infect or pollute water;
 - Article 19: It is forbidden for owners and plant operators established on the coast of spread or intentionally let spread in the sea water used to the needs of their industry if they are likely to cause the destruction of marine species. Any proposed settlement of such discharges of waste water must be subject to prior authorization of the Minister of Marine Fisheries.

- Decree No. 2-10-164 (BO of May 5, 2011) establishing the conditions and fishing methods of fishing species requiring specific regulations due to local custom and special circumstances, constitutes a relevant legal instrument to counteract discards for fisheries with high rates of discards and requiring the introduction of special conservation measures.
- Decree No. 2-07-230 of November 4, 2008, fixing the conditions and fishing rules for small pelagics, establishes the list of species of small pelagics (sardine, sardinella, horse mackerel, anchovies and mackerel) and precise, between alia, that for this fishery a percentage of bycatch it is accepted.
- Order No. 2806-09 of 10 November 2009 establishing a protection zone of monk seals in Atlantic southern Morocco banning all fishing activities.
- Order No. 1175-13 of 8 April 2013, amending and supplementing Order No. 3279-10 of 16 December 2010 on the small pelagic fishery in the South Atlantic, fix the by-catch limit as 5 percent for seiners less than 150 GRT and as 2 percent for other vessels, and lists 20 species which can be considered as bycatch in the small pelagics fishery. The other provisions include:
 - The total allowable catch is set at 1 million tonnes/year,
 - Prohibited fishing areas (coastal strips of 2 nautical miles for purse seine 2-150 GRT, 8 nautical miles for pelagic or semi-pelagic trawlers and seiners over 150 GRT engaging fresh or chilled fisheries and 15 nautical miles for other vessels including pelagic freezer trawlers).
- Since 2009, nearly 22 Decrees were adopted to regulate the market size, protection or temporary prohibition of several species (monk seal, clams, cockles, swordfish, coral, sharks etc).
- Decision No. RE4/11 dated 24 October 2011 concerning the conservation of sharks prohibited fishing, retention on board, transshipment, storage and commercialization of three species, namely the hammerhead, oceanic whitetip and fox shark.

This decision provides that the volume of shark species should not exceed a maximum threshold of 5 percent of the catch of each vessel by tide and the whole bodies/individuals must be retained in full. Any manipulation of sharks on board (gutting, liver extraction and removal of fins) is prohibited.

Certainly if any regulation does not specifically mention bycatch and discards, the regulations in force are likely to limit the impact of fishing on all species, both those targeted and associated, allowing escape when fishing or regeneration during breeding and reproduction.

Bilaterally

Morocco has concluded fisheries agreements with some partners, such as the European Union, the Russian Federation and Japan, allowing foreign fishing vessels to operate in its exclusive economic zone.

These fishing agreements set the level of fishing option, the financial contribution, but also the conditions in which these vessels may operate, including the allowable by-catch which differ from one fishery to another, and from one agreement to another.

The relevant provisions of fisheries agreements will be detailed below in the section on technical provisions on bycatch.

Structure of the national fisheries sector

Although in principle only trawling units are singled out and required to hold records of discards, especially those specializing in shrimp fishing, this issue will affect all sectors, and so coastal activities should have a description of all components likely to produce discharges at sea or in the maritime sector of fishery products.

The marine fisheries sector in the Kingdom of Morocco is only 2 to 3 percent of its gross domestic product (GDP), but plays a significant role in contributing to the national economy and as well in its contribution to social and nutritional dimensions.

The sector generates approximately 650 000 jobs, including 170 000 direct (operating) and 480 000 indirect (processing and distribution). In the southern region of Morocco, 3 million people are directly or indirectly affected by fishing. In the Northern Provinces, fishing is the main economic activity.

The consumption of fish products is estimated between 10 and 12 kg per capita/year. This represents about 30 percent of total animal protein intake. Sardines are not expensive and their protein content is high.

The sector is a source of foreign currencies earnings. In 2011, Morocco exported 360 000 tonnes worth 11.7 billion dirhams, registering a fall of 29 percent by weight and 11 percent by value compared with 2010. The marine products represent 5-6 percent of the value of total exports and 45 to 50 percent of the value of total exports of food products.

The components of the fisheries sector in Morocco that may have a direct bearing on the issue of bycatch and discards are the fishing fleet, the processing industry and commercial trade of fishery products.

The fishing fleet and coastal activities

There are three categories of fishing:

- **Artisanal fisheries** with approximately 16 635 boats operating in almost all fisheries. This category is generally described as “selective” because of the gear used, with the exception of driftnets that were eliminated in 2012;
- **Coastal fisheries**, with a total of 2 562 units divided into several groups, seiners, trawlers, longliners, and mixed units,
- **Offshore fisheries**, with a total of 452 units including 333 operational, including two types of vessels, fresh or chilled and freezer vessels. Freezers are composed of trawlers targeting cephalopods, demersal fish or shrimp and pelagic trawlers or purse seiners targeting small pelagics.

Additionally, coastal activities, exploiting marine resources should also be taken into account, such as collecting seaweed, shellfish gathering, coral mining and traps, as they can lead to discards. Aquaculture is also a part of the overall sector, but is only included here for information, as it is not likely to be discharged into the sea, however, the risk of pollution from intensive aquaculture must be a concern of managers.

To identify the importance of each of these fishing categories and better understand their place on the fishing spectrum, a few statistics on the production achieved in 2011, during which production reached 957 000 tonnes is as follows:

TABLE 5.1
Moroccan capture fisheries production in 2011

Type of fishery	Total catch (tonnes)	Catch composition
Coastal and artisanal fishing	680 000	(83.5% pelagic species, cephalopods 4.8%, 10.1% white fish, shellfish 1.4%)
Benthic deep-sea fishing	56 578	(Cephalopods: 28 815 t (50.9%), white fish: 23 020 t (40.6%), shrimps: 4 743 t (8.3%))
Pelagic oceanic fisheries	216 988	
Coastal activities	7 253	(algae: 5800 t (80%), traps: 1100 t (15%) aquaculture: 280T (4%))

This distribution demonstrates once again the predominance of small pelagic fish in the landings, which represent 74 percent of volume landed and only 20 percent of the total value of fisheries production (including all categories).

Discards of these industries have not been scientifically monitored to date, or at least no data is currently available. However, it is necessary to report that a study on discards of Moroccan trawlers operating in the Mediterranean is currently underway and the results cannot be yet communicated.

As we talked already about the particular case of shrimp trawlers, it is interesting to indicate that the catches by freezer trawlers during 2011 are 4 743 tonnes of which 83 percent are prawns, and catches of coastal trawlers amounted to 7 138 tonnes, of which 90 percent are prawns. The total volume of shrimp represents about 1.24 percent of the total fisheries production.

As such, and in order to determine the extent of discards, the various entities concerned should be more engaged in formulating and maintaining a discards database (sampling, data collection system, logbook, direct observation on board and disembarking) to assess the causes of discards, opportunities to “incriminate” and identify appropriate measures to address them.

The industrial sector

Once landed, these fish are destined for several markets: domestic consumption, processing and export. The following simplified diagram shows the product distribution chain from the sea in Morocco.

In 2011, the distribution of fish production in the coastal and artisanal fishing sectors (680 000 tonnes), since the contribution of oceanic fisheries are almost entirely for export, was as follows:

- Consumption: 319 600 t (47%)
- Freezing: 53 392 t (8%)
- By-products: 190 117 T (28%)
- Canning: 116 891 T (17%)

The industrial sector includes several types of units (422)

- Preserved 45 units
- Semi-preserved 34
- Freezing on-land 190
- Packaging 76
- By-products 25
- Other (shellfish, seaweed, etc.) 52

It should be noted that the freezing industry encompasses nearly half of the sector and the industries of freezing and canning comprise over 70 percent of the overall turnover of the industrial sector.

What is interesting to note in the industrial component in relation to the issue of bycatch and discards, it is the place of the by-products industry. During the last six years, this category covered the following tonnages:

	2006	2007	2008	2009	2010	2011
Inshore production	702 323	680 256	779 385	884 623	895 327	676 179
Quantities processed	138 061	179 410	259 897	343 536	277 977	190 117

The fall in the tonnage processed by by-products units in 2011 (- 40%) is due to the decrease in landings of inshore fishing. Supplies intended for the by-products actually depend on several factors, both economic and geographic, and following the recorded movement of the purse seine activity to the southern ports.

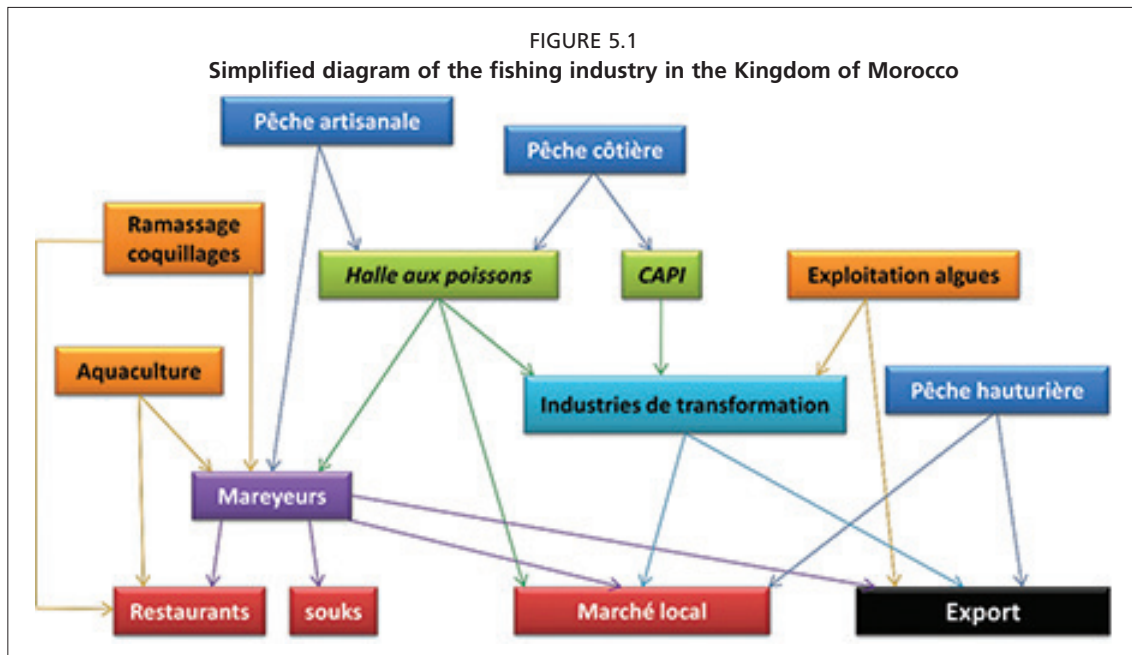
This is in fact a typical case of a processing technique, in principle supposed to value the falls of the canneries turning heads, tails and viscera to meal and fish oil (by-products). However, its development has been conditioned by the market requirements, since users of fish meal, poultry farmers especially preferred flour with a high protein content and which are more expensive. Therefore, these units began with the time to deal with time also with falls canneries estimated one third of treated tonnages recent, large tonnages of whole fish and sometimes as cool as the one delivered for direct consumption.

Given the magnitude of the treated quantities and the increase in the number of by-products units, this technique has become a demeaning activity of a resource of a good protein source for human nutrition affordable for the average consumer because cheap.

This typical case in the future deserve to be deepened to identify more precise indicators but should also be considered in case of preferring a further processing of waste into products for animal feed.

Commercialization

As shown in the simplified diagram of the fishing industry in Morocco, the commercialization of marine products is quite complex.



In order to simplify the issue of fish trade in Morocco, it is necessary to distinguish the fish called “industrial” from “small-scale”. The first category includes small pelagic species (sardines, sardinella, anchovies, mackerel and horse mackerel). The second consisted of demersal or benthic species which do not undergo any major transformation, except for the packaging.

A third category includes frozen species, usually on board off-shore trawlers specialized on shrimps and cephalopods fisheries and seiners specialized in small pelagic along the Moroccan Atlantic coast. Catches of this category are generally intended for export.

For trade in industrial fish, a system of grading counters was established ensuring the ability to reconcile between the shipowner and the trader by defining fish that can be used in the fish meal and oil factories, which reflects the value of landings. Again, this is a system which could be drawn from in the future as a model arrangement for evaluating the price of a commodity fish.

Small-scale fish are sent to the auction system at the fish markets which are located at all fishing ports and artisanal fishing villages and whose management is entrusted to the National Board of Fisheries, the body responsible for organizing the first sale after landing.

Thus, fish trade is conditioned by the systems in place (CAPI, auction), but also by the one established between some artisanal fishing communities and fishmongers who finance fishing campaigns and provide logistics on land (food supply production and marketing) and establishing links of dependencies.

The authorities have begun a reorganization from fish trading site because it has proven to be the key area which slows domestic consumption of seafood, in addition to hygiene and quality issues which needed to be addressed at the early 1990. A law (No. 14-08) was adopted from June 2011 to organize this industry.

Furthermore, it should be mentioned, without going into details that are likely to move us away from the issue of bycatch and discards, problems of certification and traceability of fishery products, within the scope of the fight against IUU fishing has been improved in recent years primarily to allow the flow of fish products on the EU market, at the same time allowing a reduction of the composition of informal fisheries in collected statistics.

Finally, the issues of quality and hygiene standards need full attention because the fishery products caught, landed, are generally perishable and in the case of any interruptions in the cold chain they can become waste if their quality is not the subject of any attention. The problems (epidemics, animal diseases, diseases, etc.) known in other sectors (beef, poultry, salmon etc.) should serve as lessons to avoid bad practices, particularly as it is critical for consumer health.

CASE OF FOREIGN FLEETS OPERATING IN THE MOROCCAN EEZ

Case of the European Union

For EU vessels, the provisions of the 4th Partnership Agreement Morocco-European Union, which expired in 2011, and referred to renewing the protocol for a further period of four years, specify for each fishing category capturing permissible levels bycatch is allowed, as specified below:

Fishing category	Target species	By-catch rate
Artisanal fishing in the north: Pelagic	Sardines, anchovies and other pelagics	-
Artisanal fishing in the north: Longliners	Scabbardfish, bream and other demersal	0% swordfish and surface sharks
Artisanal fishing in the south	Croaker, sea bream and crustaceans	0% cephalods and crustaceans 10% crabs 10% other demersal species
Demersal fishing	Black hake, scabbardfish, lich, bonito and crustaceans	0% cephalods and crustaceans 5% crabs
Tuna fishing	Tunas	-
Industrial pelagic fishing	Sardines, sardinella, anchovies, mackerel, scad	Up to : 3.5% other small pelagic species 0% cephalods and other demersal and benthic species

It should be noted that scientific observers boarded the vessels authorized to operate in Morocco's fishing zone to ensure compliance with the agreement, but also to collect scientific information, including discards of fish.

Available data for a group of five vessels with onboard observers for a 35-day observation period indicate a volume of 187 tonnes of waste composed of mackerel (40%), scads (27%), sea bream (21%), sardine (14%), sardinella (6%), bream (4%) and croaker (1%).

Discards constituted 1.4 percent of the catches made by these 5 vessels during the period from 26 July to 31 August 2013.

This data could obviously not be extrapolated to all 120 ships, but gives an idea about the magnitude of releases. A better assessment would require a more substantial monitoring and a more detailed study.

The case of the Russian Federation

For Russian vessels operating in the framework of the partnership agreement signed February 14, 2013, for a term of four years, the authorized overall quota is 100 000 tonnes/year and the permitted species are sardine and sardinella which must represent 30 percent of the catch, mackerel, horse mackerel and anchovy which should represent 65 percent of the catch and the rest of species may not exceed 5 percent of the total catch.

Skipper of vessels should keep a daily logbook which must include among other data, the discards and the causes of the generation of those discards (Appendix 8 of Annex II).

As for EU vessels, the observations made on a group of eight ships for a period of 45 days indicate that the discards (210 tonnes) accounted for 1 percent of catches made. These discards were made up of pelagic species (43%), dentex spp (16%), hake (11%), St. Pierre (9%) sar (3.5%) and others (16%).

The data review of all of the Russian fleet (12 pelagic trawlers) operating in Morocco's fishing zone during the period from December 2012 to October 2013, nearly 10 months, indicate an overall rejection rate 0.6 percent and a proportional distribution to that already observed since 825 tonnes of waste to 127 721 tonnes caught, are composed of pelagic fish (52.5%), dentex spp (20.5%), hake (14.5 %), Saint-pierre (12.25%) and others (0.5%).

As in the case of EU vessels, any extrapolation of this data would be avoided to properly assess the extent of discards aboard Russian ships.

Case of Japanese Tuna fishing

The fisheries agreement between Morocco and Japan, dated 11 September 1885, granting Japanese longline tuna fishing vessels rights in the exclusive economic zone of Morocco. This agreement has no provisions regarding bycatch and discards.

Admittedly, these vessels use selective fishing techniques and mainly target major tunas (Bluefin/Red Tuna, Bigeye, Yellowfin/Albacore, Skipjack, Swordfish/Espadon, Billfishes).

During the 2002-2011 period, Japanese tuna catches by species were distributed as follows:

Species	Maximum	Minimum	Median	%
Bluefin	372 t (2008)	0 t (2011)	101.1 t	32.9%
Bigeye	124 t (2006)	4 t (2008)	55.6 t	17.6%
Yellowfin	295 t (2004)	2 t (2007)	100.6 t	31.8%
Germon	25 (2011)	0 t (2003)	7.4 t	7.4%
Skipjack	0 t	0 t	0 t	0 %
Swordfish	31 t (2011)	0 t (2002)	13.6 t	13.6%
Billfishes	4 t (2011)	0 t (2008)	1.3 t	1.3%
Autres	91 t (2008)	13 t (2003)	37.0 t	11.7%
Total	652 t (2006)	75 t (2009)	316.6 t	100%

It should be noted that in addition to fishing licenses of rights, each Japanese tuna fishery pays a fee of USD 2 000, which will be increased in case of exceeding 100 tonnes catch, by 28 USD/tonne.

It is remarkable that in 2011 the category “others” represented 23.3 percent of recorded catches. This category mainly includes sharks and sunfish, skipjack, blue butterfishes and big scale pomfrets. Should we consider these species as bycatch? In any case, the Moroccan-Japanese joint committee which meets in the framework of annual consultations can define for each campaign the conditions of the activity of Japanese longliners in the case that Morocco establishes a special system for the management of bycatch and discards.

THE VOLUNTARY GUIDELINES

International guidelines are now the main framework for reflection but also for action to develop a strategy to manage bycatch and discards.

These guidelines, although they are voluntary and non-binding, provide guidance in all directions for managers concerned about this issue.

The main directions of the guidelines on bycatch and discards, as submitted to the States for inspiration for their own fisheries management needs can be grouped according to the objectives, namely:

The establishment of good governance

States should rely on the advice of the competent fisheries management authorities to help achieve the objectives of the management of bycatch and discards. As such, managers must make use of the national legal and regulatory legislation, but also the measures recommended by the regional fisheries management bodies and the instruments provided by the international conventions. All strategies must be adopted in accordance with the provisions of the UN Convention on the Law of the Sea.

The principles of the precautionary approach, the ecosystem approach and the participatory approach must be integrated, even prioritized, in the strategies of States.

This will require integrating in the management of the fisheries all relevant principles acknowledged to date and taken into account in the conduct of fishing activities.

Planning

Management plans should be properly established and based on a good grasp of the situation and the context of the fisheries concerned by the problem of bycatch and discards. States should identify the types of fishing, fishing techniques, fishing areas and species concerned to ensure the compatibility and consistency between the various applied management measures.

In other words, it must be predicted in advance the various stages that will require the establishment of proper management of the issue of bycatch and discards.

Data collection

As noted above, controlling the scale of the problem of bycatch and discards requires appropriate monitoring of the fisheries concerned. More efficient and more responsive systems must be put in place, involving research programmes, sampling, observation and analysis, to establish comprehensive, high quality and significant databases.

The understanding of data and evaluation parameters of the situation of the fisheries will be very useful in the development of sound management of bycatch and discards.

The scientific research

States should encourage their research institutions to have all the necessary parameters and indicators (fishing gear, species biology, range, habitats and seabed, etc.). These databases are the basis for further action and the justification of any policy to fight against the waste of natural resources.

This certainly requires a review of research priorities, especially where resources are limited.

The measures for the management of bycatch and discards

States should use the means already in place for the management of fishing capacity (limiting fishing effort, biological rest, quotas, fishing gear, etc.), the monitoring of fishing activities (at sea and on land).

States should consider the use of technological measures or innovations to improve the selectivity of fishing gear to reduce interactions with highly vulnerable species (spatio-temporal measurements) protecting areas of spawning grounds, but also economic measures or incentives to avoid bycatch and discards.

Existing means and instruments already available should be used to initiate a bycatch and discards management policy, a policy which must be scalable.

CONCLUSION

This document does not pretend to have comprehensively covered the issue of bycatch and discards in the Kingdom of Morocco, but rather the goal was to consolidate fragmented information and to offer links with the International Guidelines.

However, it is clear that in Morocco, several actions are already implemented to limit, incidentally or intentionally, bycatch and discards. All the measures already taken, with the exception of the national plan to eliminate drift nets and the perimeter protection of the population of monk seals in the southern Moroccan Atlantic, were actually designed in a spirit of fisheries management and rebuild overfished stocks or reduce fishing effort.

Presently, if managers are aware of the bycatch problem, for which provisions have already been taken, both for national fishermen to foreign fleets operating under fishing agreements, the issue of discards has not made, in my opinion, its place as an important issue. The general public is still not sensitive to this problem, if it is not the case of sharks and cetaceans criticized by non-governmental organizations and who advocate for certain protection measures such as the ban of finning sharks.

Certainly, other projects of la (coastal development, marine protected areas, etc.) should reinforce the manager of the fisheries sector, but the issue of bycatch and discards need to broaden the fields of investigation in technological, and scientific and technical innovation matters.

The European Union, based on the same text of the guidelines, has already gone ahead and decided on a plan of action that consist in a first phase to raise awareness and to adhere all stakeholders and decision makers to address the issue of discards. Possibly the scale of the problem is specific to Europe owing to the huge quantities of fish discarded at sea (between 10 and 60 percent of catches), because of the quota

management system and strong control on catches, so much so that plans to install observation and registration systems, using cameras in particular, in addition to devices already in place (fishing logbook, daily reporting to the control centers, etc.).

Finally, and irrespective of the extent of the phenomenon and the importance of discharges, related or not to bycatch, the waste associated with discharges cannot leave any manager who is convinced of the Code of Conduct of Responsible Fisheries, indifferent and inactive.

Certainly, any measure of protection has a price, sometimes economic, sometimes social, sometimes both. However sustainability is now an expression of wisdom and awareness of the vulnerability that characterizes the marine environment, the ecosystem and living biological resources of the sea.

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Appendix 6

NATIONAL REVIEW ON POSTHARVEST FISH LOSSES IN MAURITANIA

By: Mr Mohamed Lemine Abdel Hamid

INTRODUCTION

The Mauritanian exclusive economic zone covers a surface area of 230 000 km². It is characterized by an abundance of marine resources. This wealth is essentially due to upwelling, and the particular morphology of the coast characterized by the width of the continental shelf and the presence of trade winds during a large part of the year.

The fisheries sector constitutes an important part of the economy of Mauritania. It contributes approximately 4 to 6 percent of the gross domestic product (GDP), 16.3 percent in total exports, 16 percent in the budgetary receipts and creates more than 40 000 jobs (directly and indirectly). Also, the sector plays an important role in the food safety of the country.

The total capture fishery catch realized in the exclusive economic zone (EEZ) are estimated to be greater than one million tonnes, constituted essentially of small pelagic species. Fish landed in-country represents less than 20 percent of the total catch.

In spite of its important fisheries potential, the contribution of the fisheries sector is still small. The country suffers from an enormous lack of infrastructures of landing, processing, conservation and marketing of the products which causes many losses and waste of the resources at the post harvest level. In a context of overexploitation of the stocks and in order to increase fish availability for the population, it is important to fully utilize the harvested resource by minimizing post-harvest losses. This principle has been well laid out in the FAO Code of Conduct for Responsible Fisheries. Thus to comply with the Code of Conduct, countries need to develop policies and programs directed towards minimizing post-harvest losses.

This report contains the following:

- a case study on post-harvest and waste that may occur, or that took place at the national level;
- an analysis of operational policies and interventions to reduce postharvest losses and waste at the national level;
- an inventory of the status of bycatch and discards and their management at the national level;
- an inventory of fish discards management in the fishing industries at national level and possibilities of producing different useful fish by-products;
- an analysis of potential to improve food security and generate employment at the national level through reduction of post-harvest losses and waste.

DESCRIPTION OF POST HARVEST

Generally, products landed in Mauritania are marketed from two main zones of production, storage and processing: Nouadhibou and Nouakchott or pass almost all of national captures. We distinguish several types of treatment of captures after their landing, according to the species, the type of fishing and the market of destination.

The octopus, constitutes by far the main species looked for in Mauritania, considering its high market value. This species takes almost all of the effort of the fishing units and factories. The post harvest activities show the imprint of this domination: except

some traditional workshops of transformation, all other companies, as soon as they can have a tunnel of freezing, are quickly converted to the freezing of octopus. The product is plentiful and remunerative on the overseas market, and the access had been widely opened to the small producers by the Société Mauritanienne de Commercialisation de Poisson (SMCP) which assured the selling of small quantities produced by these small producers who, otherwise, would have had no access to the market, dominated by the Japanese large companies, which do not come down below a certain quantity of products.

The statistics of the SMCP, which contain all the Mauritanian frozen products, highlight this domination of cephalopods, with always more than 70 percent of the total volume of the sales of the society.

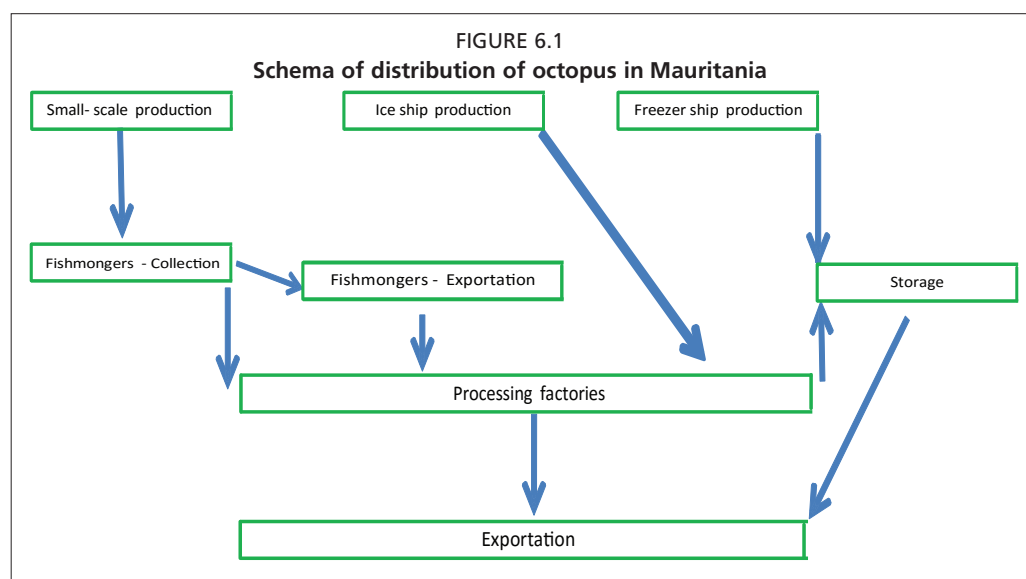
Organization of post harvest activities

a. Octopus

We distinguish two main distribution channels of the Mauritanian octopus as the product is frozen aboard fishing units or at the level of processing firms:

Frozen on ground: captures landed by boats, coastal and industrial units are sent to the factories of conditioning to be classified and calibrated according to the specifications of the markets of destination before being sent frozen in cargo freezers by the SMCP towards the Japanese and European markets.

Frozen on board: the part produced by ships freezers is directly landed in factories for the storage before being sent in cargo freezers by the SMCP towards markets. Figure 6.1 below describes the distribution of octopus production.

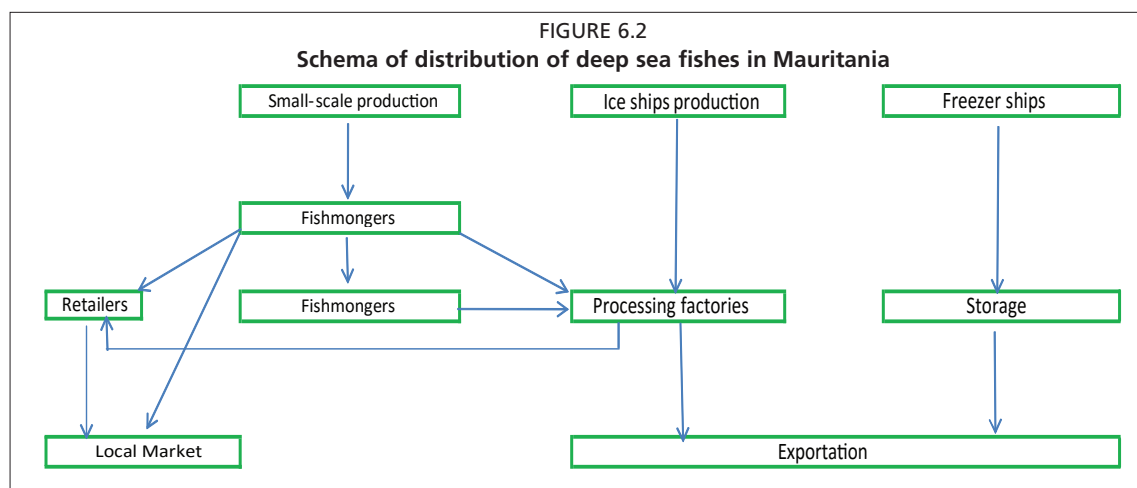


b. Deep sea fishes

The captures of national units have mainly two outlets:

- Catches of industrial fishing are directly landed fresh or frozen in factories to be sorted out and calibrated according to the specifications of the market.
- Catches of small-scale fishing are preserved under ice in factories and fishmongers workshops until their sale on the international market (1st choice) and the national market (2nd choice).

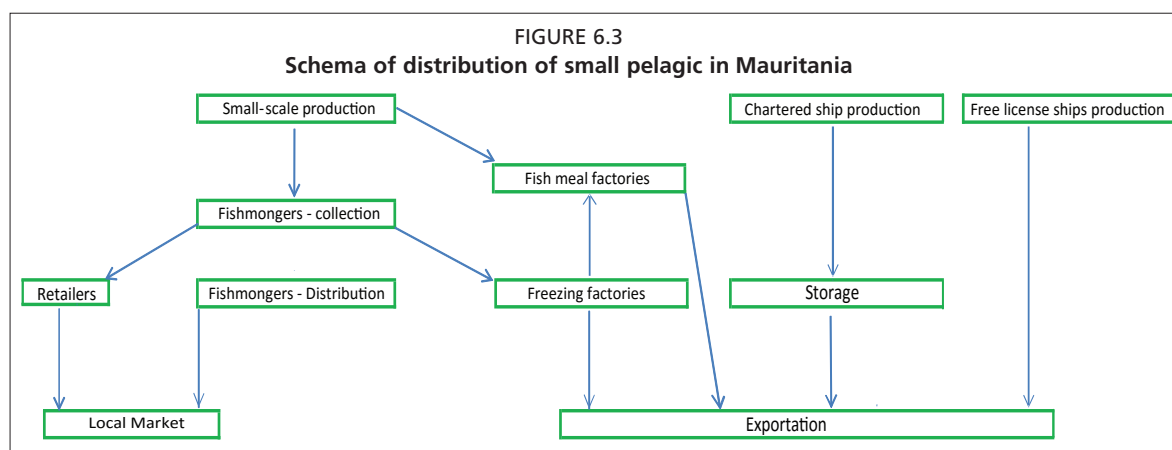
It is important to indicate that the discard of factories is directly put back in the national market of consumption. The figure 6.2 below describes the schema of distribution of deep sea fishes in Mauritania.



c. Small pelagic

Small pelagic fisheries constituted approximately 90 percent of catches realized in the EEZ. Only 20 percent of these catches are landed in Mauritania, and these constituted essentially (90 percent) of small-scale and coastal fishing. The great part realized by foreign vessels under free license is processed on board and forwarded directly to the international market without passing by the national ports.

The national catches of small pelagic concern essentially sardinella, sardines, ethmaloses, horse mackerel and mackerel. The outlets are essentially fish meal, a lesser portion is frozen in factories and modest quantities are sold fresh on the national market. The Figure 6.3 below describes the general schema of distribution of small pelagics in Mauritania.



Post harvest actors

a. SMCP

In view of the structure of the system of production and marketing of fish products, widely dominated by the preparation of frozen fish, the SMCP is in the heart of the post harvest activities, including for small-scale and coastal fishing.

The SMCP is an industrial and commercial public undertaking, endowed with the monopoly for the export of frozen products subjected to the obligation of landing according to the decree n°82-145. The objectives of the SMCP are:

- To create a sales force for the little operators
- To avoid the leak of currencies generated by the sector.
- To secure the taking of taxes.

b. Fishmongers

The fish trade consists in buying sea products intended for human consumption (fishes, shellfish, and cephalopods) directly from the fishermen, to be re-sold, or towards the export, after a treatment in industrial or artisanal workshops or towards the local market (retailers).

The fish trade in Mauritania, in spite of its importance, remains a poorly organized activity with many different professional organizations and characterized by an important mobility with a big part of the operators not always faithful to the profession.

The decree concerning the profession (Decree N 2009-172 of 02-04-2009) defines in its 1st article the fishmonger as “persons or institutions which proceed regularly to the marketing of fish products either of purchases, made with the producers, or with their own catches, by their means of production having satisfied the necessary conditions for the reception, the preservation of these products and their transport.”

According to this definition, Article 5 of the same decree distinguishes three main categories of fishmongers: the collecting fishmongers, the distributing fishmongers and the exporting fishmongers.

- The collecting fishmongers are physical persons who frequent the areas of landing, buy the fish products in small quantities and resell them without treatment nor conditioning and who have places and receiving equipment of products.
- The distributing fishmongers are persons or institutions which buy wholesale fish product to resell it after conditioning and transport.
- The exporting fishmongers are moral persons wishing to export fish products according to the current laws and regulations.

According to the official file of the DIPIS, the number of approved fishmongers is approximately 1 000 among which 700 specialized in collection, 230 in distribution and 70 in exportation.



c. Freezing/cooling factories

Factories approved to export towards European Union (EU) are exclusively distributed between both large cities of the coast: 20 and 37 factories respectively in Nouakchott and Nouadhibou. Additionally, there are approximately fifty ships freezers (DIPIS, 2013).

The technological line of the factories is uniform: almost all the factories are turned to the freezing of octopus as whole products or in blocks. A single factory in Nouakchott, specialized in the fine transformation of products, for very high added value, (MIP-Frigo), another firm in Nouadhibou specialized in the elaboration of sardinella (SEPH). Most of the factories have their own capacities of storage. The total theoretical capacity of treatment is estimated to approximately 360 000 tonnes per year or 1 000 tonnes per day.

d. Fish meal and fish oil factories

After fruitless attempts at the beginning of the past century, we await since 2008 a massive return of the industry of fish meal in Mauritania. The return of this industry would be encouraged by the considerable increase of the price of this product noticed on the international market (Russia and China in particular). The number of factories is increasing, we count at present nine operational factories in Nouadhibou of which one has a large capacity (600 tonnes/day) and four in Nouakchott. To this number is added a Chinese factory actually in implementation in Nouadhibou within a complex consisting of a shipping company and a factory of freezing and elaboration of fish, beside several demands which are at present in process at the level of the Ministry of Fisheries and Maritime Economy. The total theoretical capacity of treatment in fresh fish of the six active factories in 2011 was estimated at approximately 325 000 tonnes a year. Factories are totally supplied by small-scale and coastal units using the technique of the rotating seine and practicing a system of chartering. The very high demand on the resources intended for fish meal would be at the origin of the increase of catches of small-scale and coastal fishing which registered an unprecedented growth rate (80 percent) between 2008 and 2009 (90 000 tonnes in 2008, approximately 160 000 tonnes in 2009 and nearly 200 000 tonnes in 2010).

The exports of fish meal did not stop increasing these last years. They grew from less than 1 million USD in value in 2008 to more than 30 000 t, representing 28 million USD in 2010.

FIGURE 6.5
Photo of a fish meal factory in Nouadhibou



Source: IMROP 2011

e. Artisanal processing

It is an activity essentially occupied by foreigners coming from various countries of the sub region (Ghanaians, Nigerians, Bissau Guineans, Senegalese and Malians) and some Mauritians (Imraguens), particularly women. We estimate the part of this

activity in the total production of small-scale and coastal fishing at approximately 5 percent in 2009, constituted mainly of elasmobranchs, walking catfish and Yellow mullet. Various processes lead to the elaboration of traditional products:

- Dried and salted dried fish made from tollo, and sharks: this product is intended for the export by the Ghanaian and Nigerian,
- The guedj (fermented dried) made from catfishes and rotten fish intended for the supply of the local markets and those nearby countries (Senegal and Mali),
- Tichtar and dhin made by Imraguens women from the flesh and the heads of Yellow mullet and intended for auto consumption and sale in shops installed on the road Nouadhibou - Nouakchott.

In spite of its importance in terms of valuation of non-consummate species and discards, this activity remains little developed in Mauritania and its weight is still very low on the scale of the sector, and it is because of:

- Its informal character
- The absence of adapted infrastructures
- The low experience of national actors



Post harvest waste in Mauritania

We distinguish three main types of waste of the resource in Mauritania:

a. Waste caused by bycatches and discards

Bycatches and discards constitute one of the most important causes of waste of the resource in the world. According to an FAO report, published in 2008 (Kelleher 2008), the global volume rejected annually is estimated around 7 million tonnes, representing 7 percent of total world catches. The great rate of discards is realized by shrimp trawlers and deep fish trawlers which realize together more than 50 percent of world total discard. In Mauritania, the great part of discard is the effect of foreign fleets. The country doesn't possess a shrimp fleet. The importance of EU fleet discard realized in the MEEZ is difficult to evaluate because of the lack of reliable data. The data available are not complete and concern only some observations reported by Scientifics who embark aboard vessels of the EU fleet. According to an IMROP study the rate of bycatch for the principal types of trawls is very significant: 56 percent in the case of the cephalopods trawls, 80 percent among shrimp's trawls.

The juveniles represent the major part of these by catches (more than 50 percent in the case of hakes). The data used covers the period 1996-2002 and come from scientific observers program (Mahfoudh, T.S, Inejih, C.A and Beyah. M). Another study estimates the global volume of bycatches of shrimpers and hakers operating in the Mauritanian waters at 24 000 tons in 1992 for a value of about USD 21 300 000. This volume represents 87 to 89 percent of total catches of those two types of fleet (Mika. D). The report RIVO 2003, estimates the rate of by catch occurred by the demersal fleet operating in Mauritania, during the period 1996 to 2002, to 80 percent in the case of shrimps and 58 percent for octopus.

b. Waste caused by processing factories

The most important waste is that realized by the industry of fish meal and oil. As we said in the precedent chapter, the operational factories are turned totally to the exploitation of fresh products of very good quality and in important quantities (approximately 100 000 tonnes of fresh fish a year). As we know that we need, on average, five tonnes of fresh fish to produce one tonne of fish meal, the fast increase of the production of fish meal causes a large wasting of resources and provides a real risk for stocks, especially as the species transformed into fish meal are the most consumed in Mauritania (sardinella) because of their accessibility to the populations with low purchasing powers, so there is a real danger for food safety.

For freezers factories the waste is considered as negligible, the reason that they are quasi- totally turned to the freezing of fish as whole products or in blocks. However, the production of bottarga caused a great waste in the past. The processing factories extracted bottarga from *Mugil cephalus* and meager, because of its great market value, the carcasses are rejected on the beach and it was common to see “dunes of yellow mullet ” there. In this period, the consumption of *Mugil cephalus* was not so developed in Mauritania. Things have totally changed, in the past few years, especially after the interdiction of exportation in fresh of some kinds of fishes in 2008. The exportation of bottarga has declined in comparison of its weight in the end of 1990 years/beginning of 2 000 years. Now, the bottarga is extracted and the carcasses are sold for consumption in local market (see statistics of exportation of bottarga in annex).

c. Waste caused by the lack of valuation and infrastructures

More than 300 species are identified in the catches realized in the Mauritanian EEZ, within, 30 species with high market value, are commercialized either in the international market or locally, the other species are rejected or transformed in fish meal and oil.

The lack of infrastructures of conservation causes many wasting in the post harvest, especially for small scale fisheries. In spite of the importance of fish for the national food auto- sufficiency, Mauritania suffers from a lack of adequate infrastructures for distributing and marketing of fish products. In the case of sardinella, the most consumed specie in Mauritania for example, it is estimated that approximately 35 percent of the total volume commercialized in the national market is lost during the process of distribution and marketing of the product (Tarbiya and all 2011, Analysis of fisheries of octopus and small pelagic in Mauritania).

Analysis of policies and interventions to reduce post harvest losses

In spite of its fish wealth, Mauritania began to turn to sea only from the end of 1970s. The implementation of a real policy of fishing dates the same period with the adoption of the New Policy of fishing in 1979. Since 1987, the Government adopted successively six other new policies. The most recent of which, the Strategy of Development of the

Sector of fisheries and aquaculture (2008-2012), is structured around two objectives: conservation of the resource and integration of the sector into national economy.

Although the sector possesses an important development potential for which are placed many hopes for the government in terms of employment and food safety, the level of development of the sector is always below hopes because of its extroversion and its low integration in the economy of the country.

The Mauritanian fish products are sold as raw products. The local valuation is limited essentially to traditional transformation (salted dried products) and fish meal and oil. The landed production represents only less than 20 percent of total catches realized in the Mauritanian EEZ. 90 percent of these products are exported fresh, frozen or in form of fish meal. Products with high added value are little developed or non-existent, which causes an important loss of income for the country.

In spite of the number of factories approved in Nouakchott and Nouadhibou, those who continue to work are confronted with the low degree of supply and work only at the level of 30 percent to 40 percent of their capacity.

The industry on the ground remained dependent on constraints which make in danger the essential objective of integration of the sector into the national economy:

- The absence of sufficient and regular supply in products;
- The absence of integrated transformation systems
- The high price of the energy and the inputs;
- The imperatives of the quality for the access to markets;
- The effect of the export market which incites rather to the sale of products in fresh state for the species with high market value, leading the orientation of the system of production on a single resource (octopus) that represents less than 4.5 percent of the national potential.

The infrastructures are limited actually to a single industrial Port (PAN) and one artisanal port (EPBR) in Nouadhibou, and some points of landing situated in the center and the South of the coast area. These fishing ports and landing beaches of small-scale fishing as well as more than 60 factories and refrigerated units absorb less than 20 percent of the total production realized in the Mauritanian EEZ.

The past strategies identified a development program of infrastructures in particular, the construction of a port in Tanit, a pelagic industrial port in Nouadhibou, the rehabilitation and the strengthening of the existing structures, the construction and the equipment of pontoons and access roads.

Unfortunately, we have to admit that this program was not executed. The country is widely overdrawn in this domain, what handicaps seriously the development of the sector, its integration in the national economy and its sustainable management. This insufficiency is harmful, as it constitutes an obstacle to the objective of catches unloading. Indeed, domestication of fishing activity is necessary for the creation of local added value and employment. This domestication remains, however closely conditioned by the existence of adapted infrastructures both for small-scale, coastal and industrial fishing.

In this order, Mauritanian Government engaged in 2013 some important efforts to strengthen the existing infrastructures in order to create conditions for the domestication of the activity.

The extension of the two ports of Nouadhibou has already started. Also, works are not going to delay starting for the construction of a port for small-scale and coastal fishing in 70 km in the North of Nouakchott and a landing point in the PK 144 in the South of Nouakchott. Besides, Government registered in the new agreement with European Union the obligation to land and / or transship the totality of catches realized by EU fleet in Mauritanian ports.

It was also decided in term of this agreement to dedicate a portion of 2 percent of European catches of horse mackerel and/or sardinella for national consumption to improve food safety of the country.

Mauritania also signed an agreement with the Chinese company POLY HONDONE for a value of 100 million dollars over a period of 20 years. The agreement, very controversial, has for objective the implementation of infrastructures of valuation, development of new processes of transformation of fish products in Mauritania and creation of about 2 000 jobs for Mauritians. The planned infrastructures consist of a freezing factory, a transformation / elaboration unit and a fish meal and oil factory. The Ministry of fisheries, with the support of Spanish cooperation, has started a project to strengthen food safety through the popularization of fish consumption in the whole country. The project allowed until now to acquire trucks refrigerator, to open fishmonger's shops and points of sale in several cities of the country. The objective is to reach a level of consumption per capita of 9 kilograms a year in 2015 such as defined in the strategic frame of struggle against poverty (CSLP), version III 2012-2015.

It is also important to highlight the recent efforts aiming to develop new producing field through the valuation of species not being object of exploitation previously. It concerns sea cucumber, cymbium and Hairtail. These species which are fished-in important quantities as bycatch by artisanal boats, coastal and industrial ships-find actually important outlets on the Chinese market and begin to become more important for Mauritanian fishermen. According to the statistics of IMROP, in 2010, approximately 1 000 tons of cymbium were sold to an average price of 350 000 UM/t, and 40 t of sea cucumber to 1 000 000 UM the ton. According to ONISPA approximately 1 000 tons of Hairtail, were sold in 2012 to an average price of 150 000 UM the ton.

More specifically, in terms of efforts aiming to reduce post harvest losses and waste, the following actions were realized:

- The improvement of the surveillance by the control in harbor;
- The adoption of a management plan for the fishery of octopus and the elaboration of several other management plans (shrimp, Migil, small pelagic)
- The adoption of a code ISPS for the safety of port installations ;
- The implementation of the plan of management of Mauritanian coast;
- The implementation of a maritime credit;
- The putting in the standards of the ENEMP (according to the convention STCW-95);
- The signature of the maritime collective agreement;
- The dredging of Ports of Nouadhibou);
- The construction of the Centers of social animation and learning of small-scale and continental fishing jobs;
- The implementation of a National office of sanitary inspection of fish and aquaculture products (ONISPA)
- The opening of fishmonger's shops and points of sale of fish inside the country
- The signature of a new agreement with European Union with the obligation of landing / transshipment of the totality of catches
- The signature of an agreement with the Chinese company Pholly Handong
- The organization of fishmonger activities
- The development of new field of production: sea cucumber, cymbium and Hairtail

Analysis of the status of by catch and discards and their management

By catch and discards constitute a real problem which, face the fisheries of the world. Aware of the gravity of this problem, Mauritania has integrated into its legislation specific regulations to reduce by catch and discards. So, the article 30 of the application

decree of the law 2000-025 (the fishing law) stipulates that the rate of by catch authorized cannot exceed, at any time for any ship, the following proportions:

- 20 percent of fish and 15 percent of cephalopods for ships with license categories shrimp fishing langostinos and shrimp fishing Gambas;
- 5 percent of shrimps, for ships with license of the category cephalopods;
- 25 percent of fishes for ships trawlers with license of the category of fishing of hake;
- 50 percent of fishes for ships with license of the category of fishing of hake;
- 10 percent of the total of species or the group of authorized target species (weights expressed in lively), among which at most 5 percent of shrimps, 5 percent of squids and cuttlefishes, for ships with license of the category of fishing of deep sea fishes;
- 3 percent of the total of species or the group of authorized target species (weight expressed in lively), for ships with license of small pelagic;

According to the same decree it is forbidden:

- For ships with license of shrimps Langostinos and shrimps Gambas, to hold bycatch of spiny lobster;
- For ships with license of hake, to hold by catch of cephalopods or shellfish;
- For ships with license of deep sea fishes other than hake, to hold by catch of hake, cephalopods or shellfish;
- For ships with license of deep sea fishes, to hold by catch of octopus;
- For ships with license pink spiny lobster, to hold by catch of fishes, cephalopods, shrimps, green spiny lobsters, or crabs;
- For ships with license of deep crab, to hold by catch of fishes, cephalopods or shellfish other than the deep crab;
- For ships with license of tuna, to hold by catch of other species than the species or the group of target species;
- For ships with license of small pelagic, to hold by catch.

The article 31 of the same decree stipulates that for the purposes of rational management of the resource, the Minister of fisheries can take additional measures concerning by catch.

Also, it was clearly announced in the new agreement signed in 2013 between Mauritania and European Union, the commitment of two parties to fight against sea discards. Regarding the non selectivity of machines used for the capture of shrimps, both parties agreed to decrease the tolerance of by catch. So, the rate becomes 4 percent of cephalopods and 15 percent of fishes instead of 15 percent and 20 percent respectively in the precedent agreement.

The Mauritanian research institute continues to experiment more selective machines of fishing for this fishery, in particular with tries considered encouraging of the selective filter called “filter Normore”.

Fish discards management in the fishing industries and possibilities of producing different useful fish by-products

As we said in the precedents chapters, the main types of valuation used by the fishing industries consist essentially to the freezing of products and their sale as whole products or in blocks. The products of high value added still small developed and are now limited to: filet, head- cutting, scales and tail cutting.

The management of discards in the fishing industries consists essentially to:

- The fish of lower caliber: This product is directly put back in the national market of consumption by retailers.
- Heads, tail and scales rejected by the factories of elaboration are generally thrown and not valued except in two precise cases:

1. The rubbishes of the factory of elaboration of the sardinella (SEPH) are transformed into fish meal
 2. The rubbishes of meager are resold by the retailers (the women especially) on the local market of consumption.
- The carcasses of Yellow mullet rejected by the production of bottarga are resold on the local market of consumption by the retailers.

Analysis of potential to improve food security and employment by reducing post harvest losses and waste

Considering its very diversified halieutic wealth, Mauritania possesses a great potential that must allow, if it is well managed, to improve the situation of food safety and employment at the level of the country. So, it is important for Mauritania to work on the reduction of post harvest losses and waste. To do it, the efforts have to be essentially on:

a. Products valuation

It is obvious to say that Mauritania has a big interest to encourage products landing on its ground and their transformation. Indeed, the optimal market value of the octopus being in its freshness and its integrity as natural product, the opportunities are essentially situated in the valuation of fish of which the treatment on ground allows to increase appreciably its market value. It concerns deep sea fishes and pelagic intended for European and African markets.

Other possibilities exist at the level of the preparation of cuttlefish fillets and medallion, head cutting of demersal fishes as well as ready-made meal and cans of food. The increase of landing may generate advantages in terms of employment.

The artisanal transformation of products constitutes a very important field considering the possibilities that it offers for the valuation of products of low value and discards. However, this sector always remains little developed and weakly integrated into the national economy because of the absence of infrastructures and the lack of organization and supervision of the sector. So, the efforts must be focused on the management of modern sites dedicated to this activity, the organization of the sector and the training of national actors on various processes of transformation and the standards of quality and hygiene.

It is also important to proceed to a reframing of the industry of fish meal and oil which cause presently an important wasting of the resource. Indeed, the operational factories now (approximately 13) are totally turned to the exploitation of fresh products of very good quality and in important quantities (approximately 100.000 t of fresh fish a year). So, it is necessary to stop granting new authorizations in this field and to encourage factories already operational towards the exploitation of discards. It could be intended to attribute to these factories a quota in fresh fishes according to the availability of the resource and the needs of local market of consumption.

b. Creation of landing and storage infrastructures

Needs in infrastructures of unloading, maintenance, and assistance are enormous for Mauritania. The cost is very poor in basic harbor facilities. Indeed, to achieve the expected objective for development of small-scale and coastal fishing and to assure the landing of the production in national ports, it is necessary to build these infrastructures as soon as possible, what would open important perspectives in terms of local added value and employment

It is important also to improve the infrastructures of storage and preservation of fish, both at the level of two big centers of reception of products (Nouadhibou and Nouakchott), and on the scale of the country in general, to facilitate the access of rural populations to sea products.

TRAINING AND RAISING AWARENESS OF NATIONAL ACTORS

Considering the absence of fish tradition in Mauritania, Mauritians who succeeded to integrate the sector, turned mainly to octopus, the reason is that this activity is very profitable and not asking for a lot of technicality. As the durability of octopus is not assured because of the strong overexploitation of stocks, it is important to diversify the activities and promote new processes of products valuation of high added value. For that, it is necessary to make a focus on the training of national actors both at the level of fishermen and post harvest. Also, a particular effort of raising awareness and supervision on behalf of the research (IMROP and ONISPA) is necessary to support the development of emergent fisheries (sea cucumber, cymbium and Hairtail).

c. Strengthening of control at sea and on ground

To reduce the wasting of the resource, it is important to strengthen controls at sea and on ground to make sure of the strict application of the regulations. The strengthening of the sanitary aspects and the quality constitutes a condition for the access of Mauritanian products to the overseas markets.

Regarding the obstacles which can result from a simple failure in this domain, efforts must be centered on the assistance to the private sector to put ships and factories in international standards.

d. Financing the sector

The financing of the sector constitutes a real constraint in upstream as downstream. If this constraint is very perceptible in small-scale fishing, it is also at the level of coastal fishing, industrial fishing and the subsector of valuation. There is good reason however, to note the importance of economic and social effects from the financing of the sector and the contribution which it would make in terms of restructuring and integration into the national economy.

In terms of profitability, the necessary investments can be quickly got back in an optic of sustainable management and domestication of the rent.

The opportunities of financing of the fishing sector depend on conditions of durability of the resource and the system of sharing of the rent.

In particular the investment in the sector could be promoted through:

- The use of a part of the rent within a fund of promotion of investment in the sector;
- The improvement of the policy of investment;
- The promotion of national and foreign partnership;
- The promotion and the development of a credit policy.

CONCLUSION

In spite of its fish wealth, Mauritania has not got yet its food auto-sufficiency. The contribution of the fishing sector still small and the sector is highly extraverted. The majority of the landed captures are commercialized as whole products or in blocks without any valuation and the products of high added value still undeveloped.

The wasting of the resources is important and limits the possibilities to reach the national objectives in terms of employment, added value and food safety. The waste of the resource is principally caused by: bycatch and discards and the lack of valuation.

In order to reduce the wasting postharvest and to increase income and employment, Mauritania engaged recently many actions in terms of:

- Regulation of by catch and discards
- Improvement of infrastructures of landing and conservation of products
- Development of new field of products

Regarding its important potential, Mauritania has great interest to create, as soon as possible, the conditions for the domestication of the captures and their valuation, to improve the situation of food safety and to create added value and employment. For that, it is necessary to work on:

- The products valuation
- The creation of infrastructures
- The training of national actors
- The strengthening of controls
- The improvement of sanitary quality
- The financing of the sector

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Appendix 7

NATIONAL REVIEW ON POST-HARVEST FISH LOSSES IN THE REPUBLIC OF YEMEN

By: Eng. Abdullah Saeed Al Kasadi

INTRODUCTION:

The Republic of Yemen occupies a key strategic position on the south west of the Arabian peninsula with extensive coasts bordering the Red Sea, the Gulf of Aden and the Arabian sea in addition to important sea areas around Socotra Island and its Archipelago. The length of the coastline is approximately about 2 500 km in total with the majority of the population being involved in rural enterprises particularly in the coastal areas.

The Fisheries sector in the ROY is regarded as one of the most important among the promising economic sectors after oil. Fisheries is a major source of employment and nutrition and plays an important role in alleviating poverty. It is estimated that some 400 000 people earn their livelihoods from fishing or fish related activities.

The national authority with responsibility for fisheries management in Yemen is MFW, which is based in Sana'a having four regional fishery authorities in the governorates of Hodeidah (The General Fisheries Authority in the Red Sea), Aden (The General Fisheries Authority in the Gulf of Aden), Hadhramout (The General Fisheries Authority in the Arabian Sea) and Almahara (The General Fisheries Authority in the Arabian Sea) as well as the Marine Sciences and Resources Research Centre (MSRRC) in Aden. Private sector is represented by Yemeni Seafood Exporters Association (YSEA) under which comes all the fish processing plants and the fishermen are represented by the Fishery Cooperative Union (FCU) under which comes all the fishermen cooperatives in the country.

ROY possesses significant fish stocks, among them pelagic, demersal fish as well as high valued species such as lobster, shrimp and cuttlefish.

Given the limitations of the domestic market, the importance of trade and its link with economic growth becomes apparent and the private fishery sector is represented by YSEA whereby trade becomes a source for growth and a method for enhancing productivity and adherence to professional values. The orientation towards exports must be a strategic option and a stimulus for the desired economic growth. The development of exports should become the number one issue that concerns the economy and all the groups within the society, not just an issue that concerns a particular sector. This would require that the people's appreciation and comprehension of these variables become part of their culture and behavior(1).

The Artisanal Fisheries plays an important role in ROY capture fisheries as it constitutes of the following:

TABLE 7.1
Constitution of the artisanal fisheries

Governorate	Number of Cooperatives	Number of Fishermen	Number of Fishing Boats	Number of Landing Sites
Abyan	8	4 462	1 077	8
Taiz	12	3 638	81 046	12
Hajah	4	1 550	295	3
Al-Hodeidah	34	33 582	6 531	25
Hadhrumout	19	14 781	4 639	15
Shabwah	12	1 473	791	6
Aden	8	3 750	2 032	8
Lahej	4	1 930	408	5
Al-Maharah	16	6 139	2 758	22
Socotra	11	3 552	1 266	18
Total	129	74 857	20 803	122

Capture fishery in the Republic of Yemen is composed of two main actors, artisanal and industrial fishing. The results of the fishing activities in the ROY for the period 2007-2012 can be illustrated here as shown in table (1) below Table (1):

TABLE 7.2
Fishery production 2007 – 2012

Item	2007	2008	2009	2010	2011	2012
Artisanal	174 382	130 591	175 486	160 153	155 201	228 655
Abyan	13 771	18 243	15 211	15 742	0	19 513
Taiz	3 470	2 626	3 350	3 149	3 369	4 388
Hajah	1 129	2 427	4 781	2 779	10 349	6 142
Hodeidah	24 032	25 113	23 829	24 325	26 027	31 583
Hadhrumout	37 316	34 642	39 951	37 303	39 914	52 604
Shabwah	3 118	8 545	7 098	6 254	0	9 393
Aden	12 684	6 569	11 014	10 089	10 795	14 313
Lahej	5 780	1 872	1 543	3 065	3 280	2 017
Maharah	71 335	28 986	66 775	55 699	59 597	86 161
Socotra	1 747	1 568	1 934	1 750	1 872	2 541
Industrial	5 534	1 471	4 118	3 708	2 060	1 861
Aden Gulf & Arabian Sea	3 666	368	1 869	1 968	2 060	1 861
Red Sea	1 868	1 103	2 249	1 740	0	0
Total	179 916	132 062	179 604	163 861	157 261	230 516

Also the results are summarized for the same period in table (2) as Pelagic, Demersal and others that include shrimps, lobsters and cuttlefish.

TABLE 7.3
Fishery production 2007 – 2012

Item	2007	2008	2009	2010	2011	2012
Pelagic Fish	14 720	115 081	145,141	133,647	127,150	184,413
Demersal Fish	28 342	9 930	22 224	20 165	18 169	27 662
Others	10 854	7 051	12 239	10 048	11 942	18 441
Total	179 916	132 062	179 604	163 861	157 261	230 516

The above mentioned figures are not accurate as the landed production was not weighed on the landing sites but the quantities was put forth by guessing by the responsible people who are encharged of the statistics. The trend of the production as

summarized above depends on the quantities of landed fish by four governorates. These figures would be exactly shown more than what is shown in the above mentioned tables, if the fishery information centre in Sana'a is activated and connected with the important fish landing sites like Al-Hodeidah, Aden, Hadhramout and Al-Maharah governorates.

The private sector in fishery processing is represented by YSEA who represents all the fish processing plants all over Yemen. The exports of fish products during 2012 were directed towards the following countries :

Middle East: Saudi Arabia, Egypt, Oman, Jordan, United Arab Emirates, Syria, Tunisia, Lebanon, Qatar and Kuwait.

Asian Countries: Vietnam, Thailand, Hong Kong, China, Srilanka, Malaysia, Bangladesh, Indonesia, Singapore, Korea, Philippine, Taiwan and India.

African Countries: Tanzania, Cameroon, Kenya, Ghana, Libya, Ivorycoast, Liberia, Sirloin, Morescius, Benin and Ethiopia.

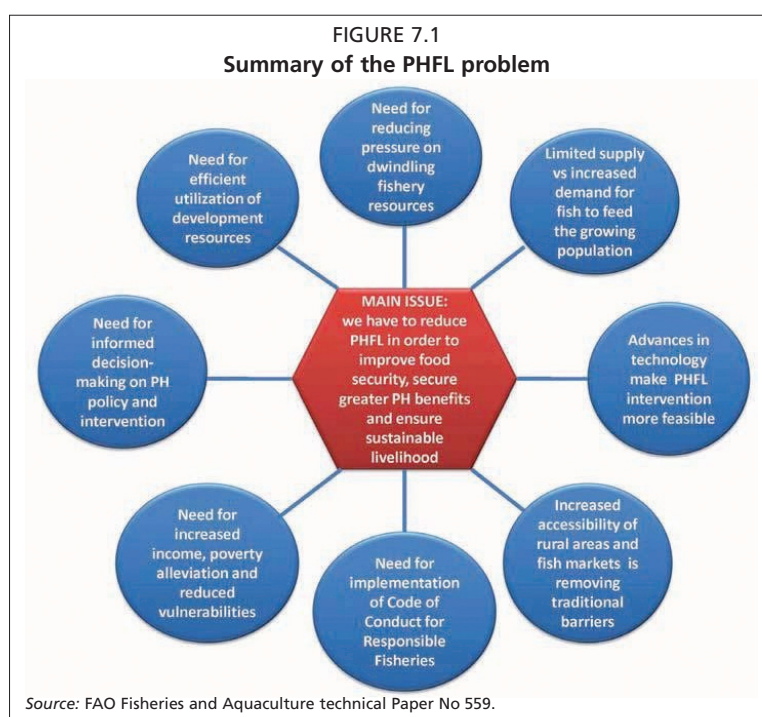
European Countries: Belgium, Spain, Italy, France, Greece, Portuguese, Holnd and Turkey.

This review concerns with the national situation of post harvest fish losses in the ROY, as there are no records available for PHFL, it is worth wise to say using the Questionnaire Loss Assessment Method (QLAM) shall be discussed in this review. This method was one the three methods mentioned by FAO which was planned in such a way to visit many locations on the coastline in order to interview the concerned stakeholders in the fishery sector (fishers, processors, traders, and other stakeholders involved in ancillary operations).

Post-harvest fish losses are a major concern and occur in most fish distribution chains throughout the world. Not only do losses constitute lost income to fishers, processors and traders but they also contribute to food insecurity – a loss of fish means less fish available for the consumer.

DISCUSSION

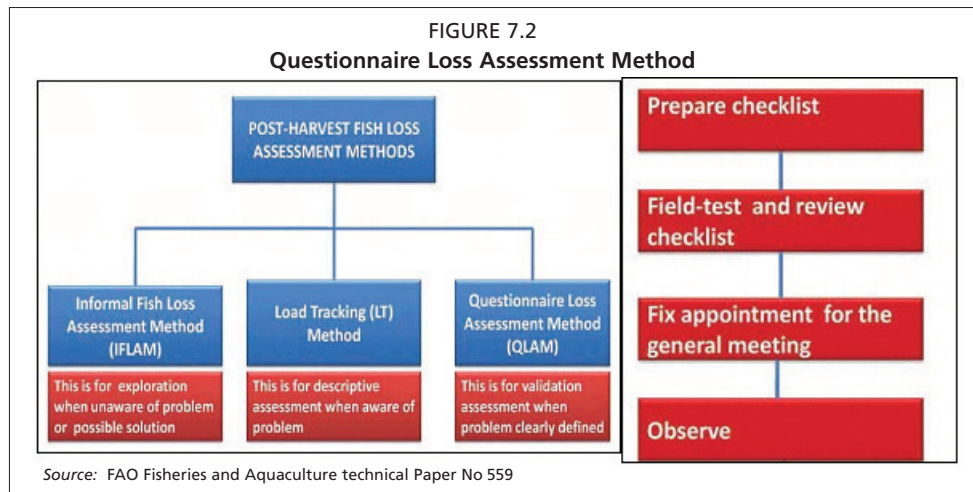
Assessing losses and understanding them is key to addressing the post-harvest fish loss problem. Reducing losses is therefore an important development goal in the fisheries sector.



However, reducing PHFLs is not straightforward owing to the multiplicity of species, fishing gear and methods, as well as numerous dispersed and inaccessible landing sites. The complexity is compounded by a diversity of products, long or fragmented fish distribution systems and the involvement of many different types of stakeholder socio-economic factors related to poverty, skills and knowledge, access to services, culture and traditions.

Generally speaking, PHFL refers to fish that is either discarded or sold at a relatively low price because of quality deterioration or owing to market dynamics. This means that fish operators (fishers, processors, traders, and other stakeholders involved in ancillary operations) lose potential income. It also means that less fish is available to consumers, or those consumers are supplied with low-quality fish and fish products.

As there are no records available for PHFL in the Republic of Yemen, it is worth wise to say using the Questionnaire Loss Assessment Method (QLAM) shall be discussed in this review. This method was one the three methods mentioned by FAO which was planned in such a way to visit many locations on the coastline in order to interview the concerned stakeholders in the fishery sector (fishers, processors, traders, and other stakeholders involved in ancillary operations).



The QLAM method was chosen to be the possible to achieve in a situation like Yemen as the PHFL had never been tackled by any expert before. The QLAM method was implemented in accordance with the following chart

It should be noted that the term “post-harvest fish losses” may not always be used in literature. Therefore, when reviewing, it is important to see losses in the context of fish quality, utilization, wastage, hygiene, sanitation and food safety issues, market access and price variations.

It is important to take into consideration the following table that illustrates the relation between the fish distribution stages and causes of fish post harvest losses:

TABLE 7.4
Distribution stages and causes of losses

Distribution stage	Causes of loss
Fishing	Fish falls from the net during hauling back into water. Handling causes bruising. No chilling on board means fish exposed to high ambient temperature on the boat for long.
Landing	Fish drops from containers during unloading and transport on shore. Spoilage occurs as fish is left on beach and no ice is used.
Processing	Capacity too low to absorb landing. Adverse weather conditions make drying difficult. Insect infestations,
Transport	Mechanical damage of fish. Delays.
Storage	Poor storage facilities leading to spoilage Insect infestations
Marketing	Insect infestations Supply and demand

In many tropical countries where Yemen is one of them, post harvest fish losses starts from the fishing boat as there is no GHP practices are followed even though there are enforced legislations in this respect but no one is concerned. No ice is used on board fishing boats and caught fish are laid up on the floor directly under the sun light or moon light until they are landed at fish landing site.

Fish landing sites may be selected because they are known to be locations where development is required or are home to particularly vulnerable post-harvest stakeholders. Isolated remote locations are also important as they are often where high losses can occur compared with more easily accessible locations with good roads.

Local fishermen usually use fishing gears like drift nets, traps and purse seining where the quality of the caught fish is affected and post-harvest fish losses in quality are of importance to be looked into.

A live fish has natural defense mechanisms that help to prevent spoilage. However, once a fish dies, its defense mechanisms stop and enzymatic, oxidative and microbiological spoilage begins to cause quality deterioration. In the mean time ice is not used to chill the caught fish but only after it is landed and auctioned.

Quality loss is the deference between the value of the fish or fish product if no deterioration had taken place (best quality) and the actual value of the fish after it had undergone change due to spoilage (lower quality) and was sold for a low price. Quality loss cannot be adequately expressed in weight terms alone. This is because in many cases the protection of a batch of fish that had suffered a loss in quality still has same residual value.

Post-harvest fish losses are often caused by biochemical and microbiological spoilage changes that occur in fish after death. A live fish has natural defense mechanisms that help to prevent spoilage. However, once a fish dies its defense mechanisms stop and enzymatic, oxidative and microbiological spoilage begins to cause quality deterioration.

In some communities, consumers think that fish that has been iced is not good quality and they are suspicious of such fish. Such customers prefer to buy fish that has been exposed to ambient temperature. They need to be educated about the benefits of using ice and the positive effect it has on fish quality. Otherwise, it will be difficult to implement loss reduction interventions, such as good use of ice.

The first-in, first-out rule is not always applied in many small-scale fish markets where the most recently arrived fish is the first to be sold and fish already in storage is left and can suffer quality deterioration, which will affect its eventual selling price. In such situations, good business practices and good storage practices can help to ensure good-quality fish.

The landed fish is auctioned for under very bad practices as the GHP is not followed strictly causing deterioration of the fish quality. From the fish landing site, the fish is transported in insulated or un-insulated vehicles without taking GHP practices into consideration causing further deterioration of the quality.

Another aspect to be tackled here is fish salting and drying. Typical fish drying yards are not used and small-sized fish such as sardine and anchovy are sun dried in the open air before being packed and distributed. When catches are high, e.g. during the rainy season, the fish cannot be dried properly and spoil. Severe spoilage means that the fish are often thrown away. The same situation can be applied for shark drying. The processing of shark fish starts with cutting fish fins from the body and taken for processing and drying in the open air, then the meat is cutted salted and dried in the open air. There are a number of reasons why a significant proportion of dried fish is spoiled by the time it reaches the markets. The fish may have been spoiled before drying. The drying process may not have been quick and, therefore, the fish took a long time to dry and quality deteriorated in the process. Weather conditions can affect the efficiency of sun drying. The dried fish may have been held in storage at the market for a prolonged period leading to quality deterioration during storage.

Quality loss refers to fish that has undergone changes owing to spoilage or physical damage and has suffered quality deterioration (Figure 6). Such fish is sold for a lower price than that which would have been achieved if the fish were of “best quality”. This is the most common PHFL in many areas of the developing countries.

Market force loss is a loss caused by unexpected market demand and supply situations. These cause operators to sell their product at a price below expectations. The loss is the difference between the expected price and the actual price. Sites were selected because they are known to be locations where development is required or are home to particularly vulnerable post-harvest stakeholders. Isolated remote locations are also important as they are often where high losses can occur compared with more easily accessible locations with good roads.

The monetary values of physical and quality loss are combined to give the financial loss which is used to quantify and summarize overall losses incurred by an individual or group in particular fishery or distribution stage. Another aspect to be looked into is storing fresh fish at the local markets as the principle of first-in, first-out rule is not always applied in many small-scale fish markets where the most recently arrived fish is the first to be sold and fish already in storage is left and can suffer quality deterioration, which will affect its eventual selling price.

Fishing for high-value species such as shrimp is and cuttlefish often associated with high levels of by-catch. In some fisheries, most by-catch is discarded at sea as it consists of low-value, small fish that are not worth landing. Quality loss Quality loss refers to fish that has undergone changes owing to spoilage or physical damage and has suffered quality deterioration. Such fish is sold for a lower price than that which would have been achieved if the fish were of “best quality”. This is the most common PHFL in many areas. Examples Poor transport as well as inadequate market information result in operators storing their fish and fish products for long periods. In the process, spoilage occurs and the quality of fish is degraded, leading to low selling prices. Some fresh-fish traders do not use ice. They buy fresh fish early in the morning and struggle to sell the bulk during the day. The fish is exposed to high ambient temperatures and sold for high price in the morning, and the price gradually declines during the course of the day; Any leftover fish at the end of the day has to be sold for less price to traditional fish processors. Given the situation, most customers wait until evening, when a fish seller is desperate for buyers as the quality is degrading fast.

The Questionnaire Loss Assessment Method (QLAM) is a formal questionnaire survey approach used to quantify and validate key loss data. According to the answers of the responsible people and officers in the fishery sector who were asked all over

the country in Sana'a, Al-Hodeidah, Aden and Hadhramout governorates, the ratio of the losses in quantity wise as estimated by them would reach about 30–35 percent for the production of the artisanal fisheries. This ratio if reflected in the above mentioned table (2), one would get the estimated figures as shown in Table 5 as follows:

TABLE 7.5
Post harvest fish losses for the artisanal fisheries 2007-2012

Item	2007	2008	2009	2010	2011	2012
Artisanal Fisheries	53 315- 61 034	39 177- 45 707	52 646- 61 420	48 050- 56 054	46 560- 54 330	68 599- 114 328
Industrial Fisheries	2 614- 3 267	588	1 647- 2 059	1 483- 1 854	615	558 651
		735			718	
Total	55 929- 64 301	39 765- 63 479	54 292- 63 479	49 533-	47 175-	69 157-
				57-908	55 048	114 979

And accordingly the ratio of the fish losses in the industrial fisheries as the asked officers in the fishery sector would reach about 40-50 percent of the caught fish which is discarded by throwing them to the sea due to their low value or given to the local fishermen after deterioration of the quality of dead fish. This ratio if reflected in the above mentioned table (2), one would get the estimated figures as shown in Table 7.6 as follows:

TABLE 7.6
Post harvest fish losses 2007 – 2012

Item	2007	2008	2009	2010	2011	2012
Pelagic Fish	56 288- 70 360	46 032- 57 540	58 056- 72 571	53 459- 66 823	50 860- 63 575	73 765- 92 207
Demersal Fish	11 337- 14 171	3 812- 4 765	8 889- 11 112	8 066- 10 082	1 907- 2 384	11 065- 13 831
Others	4 342-5 427	2 820- 3 525	4 896- 6 119	2,435- 3 044	2,034- 2 534	7 376- 9 221
Total	71 967-	52 664-	71 841-	63 960-	54 801-	92 206-
	89 958	65 830	79 802	79 949	68 493	115 259

This national review of PHFLs in the ROY seems to be very high and requires from MFW and the CFU to take urgent measures to improve the fishery sector towards maintaining the quality of landed fish, introducing GHP on board fishing boats and reducing the post harvest fish losses.

These fish losses, if the recent situation is not improved, all the stakeholders in the fishery sector would be affected i.e. the Government side, the fishers, the handlers, the traders and the fish processing plants.

The importance of the fishery sector in the ROY, attracted many international donors to implement many projects without any cooperation or coordination in a way that might create projects that require rehapitation after one year or more ,where it is time for MFW to review the recent situation to maintain and promote the GHP practices on board the fishing boats, fish landing sites, local markets and increase exports of fishery products through fish processing plants.

The main reason for assessing losses is to determine whether they are significant and whether they can be reduced, and what benefits this is likely to bring. Study cases of this aspect should be continued from time to time in order to stand on whether this situation is improved or need for more promotion. The PHFL suggested study cases should provide the information required to determine the significance of the problem

and to begin planning the next step in the light of national policy, the expected impact of intended interventions, the activities necessary for achieving objectives and the inputs required for implementation.

CONCLUSIONS

The QLAM method was chosen to be the possible to be achieved in a situation like Yemen as the PHFL had never been tackled by any expert before. The QLAM is a formal questionnaire survey approach used to quantify and validate key loss data.

This national review of PHFLs in the ROY seems to be very high as the losses was found to be 30 percent - 35 percent in the artisanal fisheries and 40 percent - 50 percent in the industrial fisheries. This was caused by not implementing GHP on board fishing boats and at fish landing sites as well as by the type of the fishing gears used by the fishermen. These losses in case of their reduction, require to be looked into by further study cases after providing the required will and funding from MFW and the CFU to take urgent measures to improve the fishery sector towards maintaining the quality of landed fish, introducing GHP on board fishing boats and reducing the post harvest fish losses. These fish losses, if the recent situation is not improved, all the stakeholders in the fishery sector would be affected i.e. the Government side, the fishers.

The orientation towards exporting fishery products must be a strategic option and a stimulus for the desired economic growth as this shall force the stakeholders towards promoting the GHP on board fishing boats and fish landing sites. The development of exports should become the number one issue that concerns the economy and all groups within the society, not just an issue that concerns a particular sector.

RECOMMENDATION

As a result of this review and towards reducing the significant PHFLs in ROY, one can recommend the following:

1. The use of ice on board the fishing boats is essential which should be a must that requires changing the design of the recent situation either as part of the boat or to be taken going to the sea in order to have insulated fish boxes to maintain the quality of the caught fish. It is worth wise to spend some of the current projects finance for this purpose as the result will benefit from all the stakeholders as well as the government.
2. The recent sanitation conditions on board fishing boats and fish landing sites should be promoted by MFW to have new measures towards maintaining the quality of fish. One of these measures can enforcing a new bylaw concerning regulating quality of fish on board fishing boats and fish landing sites.
3. The infrastructure of the fish landing sites unfortunately is not suitable to perform the GHP as landed fish are laid up on dirty floors and they should be promoted to maintain the quality of landed fish and usage of GHP practices by creating actual coordination between the projects implemented by International Donors.
4. The fish drying yards should be introduced in order to reduce the extent of fish losses during the primitive drying process especially for small pelagic fish and shark processing..
5. Awareness programmes regarding the importance of reducing PHFL should be implemented by MFW and FCU in order to raise a awareness among all stakeholders (fishers, , processors, traders, and other stakeholders involved in ancillary operations).
6. The fish landing sites should be provided with new techniques of network and information sharing by activating the fisheries information centre of the MFW.

7. Further PHFLA. Should be monitored by MFW and to be evaluated from time to time to keep records at the fisheries information centre.
8. The fish processing plants should implement new processing and value-added techniques.
9. MFW should prepare and enforce a new bylaw concerning the regulation of quality practices on board the fishing boats and fish landing sites.
10. MFW, YSEA and Fishery Cooperative Union should achieve actual partnership between them to implement GHP on board fishing boats and fish landing sites.

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Appendix 8

POST-HARVEST FISH LOSS REDUCTION IN THE NEAR EAST AND NORTH AFRICA REGION

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INTRODUCTION

This report describes a technical assignment to provide guidance in support of post-harvest fish loss and waste reduction in the Near East and North Africa Region. The objectives of the assignment were to produce a paper on best practices for loss reduction in the region, present the paper at a regional conference in Mauritania and assist with the finalisation of the conference report.

The main text of the report includes the desk study on best practices for post-harvest fish loss reduction including a series of case studies from different continents that show how different factors combine in loss reduction. Guiding principles for best practice for loss reduction are summarised before a review of national post-harvest loss overviews is presented. This helped to inform the final part of the paper which proposes how different best practice factors can be combined to tackle some of the key losses that appear to be typical in the region.

BEST PRACTICES IN REDUCING POST-HARVEST LOSSES: DESK STUDY

Producers require access to appropriate technology, services, infrastructure, knowledge and skills and to be able to work in an effective enabling environment. Therefore, effective post-harvest fish loss reduction does not rely on a single factor or variable such as the introduction of a new technology. It requires a combination of the right policy, legislation, capacity building, services and infrastructure and last but not least technology. These are what we refer to here as the “building blocks” for effective loss reduction and waste minimisation.

In order to reduce losses we need to ensure that a number of different conditions are in place. If we can provide fishermen with knowledge and skills in good fish handling, and access to insulated holds and cold chain equipment, and they can use the equipment properly, and they have access to the right services and infrastructure in order to land their fish well and at the same time we have in place legislation which supports good handling and hygiene and marketing and that the legislation is enforced properly, then the chances of reducing losses will be high and sustaining. Understanding how these different factors interact in a given situation is important but the interaction and priorities will vary according to location, species, climate and culture.

This section now summarises the five “building blocks”: policy, legislation, capacity building, services and infrastructure and technology. A simple expression of the relationship between these factors and loss reduction is shown in the equation in Box 1.

BOX 8.1

Loss reduction equation

Supportive policy environment + Appropriate technology + Skills and knowledge +
Services and infrastructure + Enforced legislation = Minimum losses

Policy

Policy is the driving force behind many features of loss reduction. It is a foundation stone for change and good practice. At the international level and FAO Code of Conduct for Responsible Fisheries (CCRF) is an obvious example of global policy guidance for best practice. The CCRF offers voluntary policy guidance, designed to persuade and encourage countries as well as regional organizations, to adopt practices that ultimately will lead to more sustainable fisheries and the optimal use of fishery resources. One of the obvious loss reduction/waste minimisation aspects of the CCRF is Article 11.1.8 which asks “states to encourage those involved in fish processing, distribution and marketing to reduce post-harvest losses and waste”.

Also at the international level, another example of policy guidance designed to reduce waste and losses are aspects of the Millennium Development Goals (MDG) which include the objectives:

- Halve, between 1990 and 2015, the proportion of people whose income is less than \$1 a day
- Halve, between 1990 and 2015, the proportion of people who suffer from hunger

Both these objectives clearly encourage more efficiency in the food production and distribution chain as well as the reduction in food loss or waste for better food security.

An example of how policy has led to significant change is that of the European Union’s (EU) move towards tighter food safety standards and consumer protection. Since the mid 1990s the EU has gradually strengthened its policy with regard to consumer protection. This led to dramatic changes in food safety requirements for anyone supplying the EU market. Subsequently national policy was influenced in many countries leading to new legislation and positive changes in terms of improved handling, hygiene and sanitation standards. All contributing to better quality and safer products.

Policy does not necessarily need to be fisheries or food orientated to have a positive effect on loss reduction. National policy related to the development of services and infrastructure such as rural electrification and road construction will contribute to improved market access and use of technology such as ice and freezing. One of the major constraints stakeholders face in terms of access to new technology is funding and access to credit. Consequently national policy that promotes micro-finance and access to loans and credit amongst fishery stakeholders will also contribute to the objective of loss reduction by enabling better access to modern technology.

Legislation

One of the building blocks of effective loss reduction is the implementation of legislation that encourages better practices and waste reduction.

Perhaps the best example of legislation that can influence losses is food safety legislation. Most countries have rules and regulations relating to the way in which food is handled, processed and prepared. Usually the objective of food safety legislation is to ensure that the consumer receives safe good quality food to eat. In order to comply with legislation fishermen, processors and traders will by necessity have to implement

practices which will reduce losses and wastage. Legislation can also influence the type of fishing gear and hence the presence or not of bycatch. Fisheries management legislation will influence the quantity of fish landed, species composition and size of fish all of which have implications for the post-harvest sector. Legislation not directly related to fishery activities, can also have an effect on fish handling, hygiene and distribution. For example, legislation related to vehicle maintenance may have implications on the reliability and road worthiness of vehicles with the presumption that a well maintained vehicle is less likely to break down and have problems and lead to problems with fish consignments being carried. Legislation may also be translated into local bylaws which can be used to govern the way in which infrastructure such as fish landing sites are managed and maintained, or the way fish are handled and processed.

Hand in hand with legislation are codes of practice and guidelines designed to help those involved to meet the required standards and hence comply with legislation. A good example of a code of practice is the Codex Alimentarius Code of Practice for Fish and Fishery Products.¹ This particular set of guidelines is designed to help countries develop their own management systems including legislation and, at the same time, provide a resource that can be used to educate and raise awareness on key fish handling and food safety issues.

One of the biggest challenges regarding legislation, however, is its effective implementation. Whilst sound and modern legislation may be in place on paper, so often its effectiveness is let down by a lack of implementation and proper enforcement.

Capacity building, knowledge and skills

Understanding where and why losses are occurring and how to reduce them is key to loss reduction. An assessment process will help develop this understanding. But individuals will often benefit from new knowledge and skills in loss reduction. Particularly, in relation to better handling and processing practices as well as business management and marketing. It is not unusual to find many people within fishing communities who lack basic education for whatever reason. This characteristic can be reflected in their capacity to understand basic issues related to fish spoilage, handling and hygiene. Assisting them to learn is a key aspect of any loss reduction strategy.

Whilst extension services exist and have the mandate to train and educate, so often they lack the resources and incentives to carry out their duties effectively. Taking a more co-management approach to learning and training, which relies more on community based trainers is one alternative or complementary approach to consider.

The learning process must be adapted to the capacity and needs of the end user. The style of training or awareness raising and the materials and methods used all have a bearing on how messages are received and used by beneficiaries. Training is often an integral part of commercial operations. Staff often must have a specific level of education in order to fulfil the requirements for a particular post. Once employed there maybe regular training to upgrade skills and knowledge as well as keep abreast of changes in legislation and standards. But we must also take into consideration the fact that knowledge and skills can be passed on in other ways. For example, from father to son or mother to daughter, through the media, from reading, from observing others.

What is important is that learning leads to a positive change in behaviour and attitude. We often see that losses are due to a person's attitude. A more knowledgeable fishermen may be more careful and diligent and such individuals often are less likely to have significant losses and will earn more income than a less diligent, aware fisherman.

¹ <http://www.codexalimentarius.org/codex-home/en/>

Education and awareness raising is not just for fishermen, processors and traders. It is also important for consumers. Encouraging consumers to demand better quality and higher standards can be an important economic driver to change and better practices upstream in the value chain.

Assessing and monitoring losses is important in terms of knowledge and understanding. Therefore research capacity and the ability to carry out periodic assessments is also a key to ongoing and successful loss reduction.

Finally, whilst training and education to increase knowledge and skills is part of loss reduction it will obviously not be effective unless the beneficiaries have the ability to put this knowledge and skills into practice. For example, we can train fishermen in the merits of using ice and how to use it properly, but if there is no ice or ice boxes available then there will be no benefit.

Services and infrastructure

Reducing and preventing losses is best achieved in environments and locations which have the required infrastructure and services. Typical infrastructure which promotes loss prevention includes modern well-designed fish landing centres, harbours, processing establishments and markets as well as roads. Services will include potable water, electricity, ice, extension services, other public services such as fish inspection, environmental health inspection and market management. As we can see the onus to provide many of these facilities and services is often on government and the public sector or through a public private partnership arrangement. On the other hand services such as ice plants or cold stores are often managed more effectively by the private sector.

Importantly services and infrastructure enable fishermen, processors and traders to put into practice skills and knowledge, be able to use equipment properly, handle and process fish well, get their fish to market quickly and to meet the required standards and legislative requirements in terms of handling, hygiene, quality and food safety. A modern well equipped fish landing centre or market will have electricity, ice, potable water, toilets and will be designed in such a way that fish can be handled properly and the facility can be easily managed and maintained. Likewise, buyers and consumers will find the environment attractive and thus will want to visit. All this will help to reduce losses.

Well maintained roads will ease market access. Well resourced and motivated public services such as fishery inspectors will be able to perform their duties and make sure that standards are being met. A reliable electricity supply will enable ice plants, freezers and cold stores to function. It will enable value-added processing methods to be used more easily.

Crucial to services and infrastructure is their effective management and maintenance. To a certain extent this is linked with revenue generation and use. For management and maintenance to be effective then the right management, with the proper knowledge and skills must be in place and revenue generated from user fees must be used to achieve long-term sustainability of the site or service. So often infrastructure is built from grants and loans and by projects, however, less attention is given to the effective management and long term viability of such initiatives.

Technology and equipment

Technology has a number of definitions, in the context of post harvest fish loss reduction we can say that technology is the application of scientific knowledge to enable the production and marketing of desired fish products. It is safe to conclude that without technology e.g. fishing gear and methods or aquaculture, fish would not be harvested and even enter the post-harvest sector.

Examples of technology which can help reduce losses include such things as drying racks, ice machines, insulated boxes, freezers, insulated vehicles, improved fish smoking kilns and mechanical dryers. Processing methods can also be classed as technology for example smoking, salting, and freezing can be termed the application of scientific knowledge e.g. equipment and a process to preserve fish and prevent losses. Technology however often requires knowledge and skills in order for it to be used correctly.

Technology is important because it can be used to prevent and retard bacterial and enzymatic spoilage, which is perhaps the greatest threat and cause of losses. For example, ice and insulated boxes, drying racks or canneries all prevent or retard spoilage. Technology can also be used to access the market, for example, the mobile phone for undertaking transactions and vehicles to transport the fish. Technology has become essential.

Nevertheless technology per se is not necessarily a guarantee that losses will be reduced. Technology has to be in good condition, used properly and fit for purpose. For example a cold store should be used for storing already properly frozen fish not to freeze fish. Leaving the cold store door open likewise will reduce efficiency and increase costs. Likewise, using a broken insulated box and not enough ice is not using technology optimally.

One of the major issues related to technology, apart from maintenance and proper use, is access to the technology in the first place. Technology may simply be unavailable to beneficiaries or if it is available it may be too expensive for those that could benefit from it. Linked to this is access to credit. It is not uncommon to find a situation whereby a processor would like to invest in drying racks or a good store, and to do this needs to borrow money, but finds banks and other lenders unwilling to assist.

CASE STUDIES: LOSS REDUCTION INTERVENTION EXPERIENCES

In this section five examples of intervention related to loss reduction have been examined using available information. The aim has been to highlight factors which influenced the success of the initiative or hindered progress. Each example includes a summary of the so called building block factors, remembering that successful loss reduction will rely on a combination of factors rather than a single “magic bullet”. The conclusion summarises a set of guiding principles identified from these examples, which should be considered as part and parcel of attempts at future loss reduction.

Peruvian anchovy: food vs. fishmeal

This example is based on work by FAO and the Centre for Environmental Sustainability Cayetano Heredia University, Lima, Peru. It looks at the issue of loss in value and in terms of food security of fish when used for fishmeal as opposed to being used for direct human consumption.

The Peruvian anchovy fishery is one of the largest fisheries in the world in terms of volume, at approximately 2.5 million tonnes harvested per annum, worth approximately US\$ 1.5 billion. 98 percent of the catch is reduced to fishmeal to be used in aquaculture and animal feed production. But such large catches were seen as being unsustainable and having a negative impact on the marine ecosystem. Furthermore, anchovy itself is a rich source of protein and omega 3 and could be a cheap, affordable source of animal protein for Peruvians and improve national food security. Added value would also mean more value for less fish harvested.

Until about 2005 the anchoveta (*Engraulis ringens*) was almost exclusively used for making fishmeal. Since 2005 anchoveta however, it has been increasingly been used for direct human consumption, as fresh fish, as canned fish or as salted-matured fillets packed in oil. This new use is sometimes called the second anchoveta boom, the first boom being the discovery and subsequent fishery and fishmeal production in

the 1960s/70s. The second boom was kick-started by the Peruvian Fish Technology Institute, assisted by FAO. A large scale promotion campaign supported by the Peruvian President at the time, Alan Garcia, helped to make the anchoveta known by rich and poor alike as a foodstuff. Previously it was not considered as food and hardly known among the population, now it is found in supermarkets and served in restaurants. Yet still, only 1 percent of anchovy catches are used for direct human consumption and 99 percent continue to be reduced to fishmeal and oil!

The main thrust of the work centred on increasing the knowledge and skills of consumers of the benefits of eating anchoveta and how to eat it. Major publicity events and advertisement were key to the strategy.

Within 5 years there was a 285 percent increase in anchovy consumption as food and by 2010 this was equivalent to 2 percent of the TAC. A number of fish processing and food companies had invested in processed products (over 56 different anchovy products in local markets). New frozen anchovetas were made available to people in the highland are of the country and 95 percent of people surveyed said they liked it, would eat it again, would give it to their families & consider the fish as a nutritious, tasty food. There was also a campaign to promote exports of canned and frozen anchovies.

The matrix below in Table 8.1 summarises some of the key issues related to the loss reduction building blocks which have helped or hindered the switch from fishmeal to human consumption. Whilst policy and knowledge and skills have been supportive factors, legislation and market demand have been possible weak points.

TABLE 8.1
Key features of Peruvian anchovy for human consumption

Building block	Key issues
Policy	National objective to increase domestic fish consumption by 50% amongst more vulnerable ² . There was political will for change. Creation of the National Council for Promoting the Human Consumption of Anchoveta. All artisanal fishermen must sell anchovy for human consumption.
Legislation	Pro-domestic consumption Artisanal fishermen allowed to land fish but must sell for domestic consumption. This fleet is also now more managed. Regulations however unclear and encouraged commercial fishing companies to catch for fishmeal and not for human consumption.
Skills & knowledge	Visual campaign to educate consumers and restaurants on anchovy preparation and consumption. Seminars, tastings. Media attention. Website http://www.comeanchoveta.pe/
Services & infrastructure	Enable anchovy to be made widely available for human consumption. Export systems in place. Unfortunately prices paid by fishmeal producer's higher and artisanal fishermen sell catch for fishmeal rather than human consumption.
Technology	Emphasis on promoting the taste and presentation of products Ice, canning and freezing all used to enable product to be marketed at affordable prices. Processing companies invested in processing. There is an anchovy producers association and most product is canned for export http://www.anchoasperu.com/eng/default.htm

Monsoon losses in India

This example is based on work by the DFID Renewable Natural Resources Research Strategy Post-Harvest Fisheries Research Programme and the College of Fisheries, Mangalore, India in the late 1990s. The aim was to generate a better understanding of

² Thorpe A (2005) Mainstreaming fisheries into national development and poverty reduction strategies: current situation and opportunities. Fisheries Circular 997. FAO, Rome

post-harvest fish losses and then assist small-scale fish processors on the east coast of India to reduce losses.

An assessment of fishing communities in Kerala, Tamil Nadu, Orissa and Andhra Pradesh found that small-scale women processors, mainly involved in salting and sun drying small-pelagics, incur both physical and quality losses due to insect infestation and rain interfering with the drying process. The project team drew up a list of potential loss reduction interventions that would either reduce loss, improve income or reduce risks during processing. The intervention ideas were based on existing coping strategies used by processors in other areas of India and appropriate technical ideas. This menu of simple technical ideas was discussed with beneficiaries who chose which ideas they felt would help them. The project then assisted the target beneficiaries to test the ideas in practice. This identified seven intervention ideas that were deemed appropriate for further dissemination and promotion for uptake by processors on a wider scale. The processors felt that the successful interventions reduced insect infestation and produced better quality products which sold more quickly.

Dissemination of the project results to the Department for Rural Development of the State Government of Andhra Pradesh led to the incorporation of the results into a state level support programme for women's self help groups.

The matrix below in Table 8.2 summarises some of the key issues related to the loss reduction building blocks which have helped or hindered the intervention. Certainly the participatory nature of the engagement with processors and involving them in decision making as well as focussing on existing coping strategies and simple low-cost solutions helped the success of the project.

TABLE 8.2
Key features of monsoon loss reduction in India

Building block	Key issues
Policy	Government of India policy was pro-poverty reduction
Legislation	No information
Skills & knowledge	The assessment generated knowledge on losses Beneficiaries were involved in information sharing and decision making Processors provided with new skills and knowledge and able to test intervention ideas with the help of the project Dissemination of results to the State Government
Services & infrastructure	Local NGO support was important in terms of training and monitoring small-scale processors during the intervention phase
Technology	Technical ideas were simple and low cost meeting the needs of beneficiaries and based on existing coping strategies.

Value-added milkfish

This example is based on work funded by the American Red Cross and implemented by FAO in conjunction with the Provincial and District Fisheries Departments of Nanggroe Aceh Darussalam Province (NAD), Indonesia. The work was part of a post-tsunami rehabilitation programme and the aim was to strengthen fish handling, processing and marketing activities. One of the major farmed species in NAD is milkfish (*Chanos chanos*). At the time of the project, most of the fish was sold fresh with no processing or value-addition. Yet in other countries of the region the fish is turned into a variety of value-added products. Whilst not exactly a loss reduction intervention, this is an example of value-addition which highlights some important building block issues.

Milkfish from Bireuen is an important source of animal protein for consumers in NAD and North Sumatera. Whilst the quality of the fish is generally good and can be controlled there was a limited market and a perception that prices were also low. Seasonal oversupplies of fresh fish tended to depress prices as did competition with

marine fish. At the same time it could be seen that there was no processing or value-added products being produced in the district.

The project recruited an experienced manager who had previously worked in the commercial fish processing industry. His mandate was to work with two women processor groups, train them and help them to establish small-scale milkfish processing businesses. As well as enabling the groups to produce boneless and pressure cooked products, the project carried out a series of promotional activities at markets, supermarkets and restaurants culminating in a televised breakfast with the Governor of Aceh. A promotional manual “Milkfish processing and marketing for Aceh” was also produced. The marketing activities eventually led to the inclusion of boneless milkfish on the menu of a traditional fast food restaurant chain. This helped to establish the product and ensured the sustainability of the work of the project and one of the women’s groups businesses.

The matrix below in Table 8.3 summarises some of the key issues related to the loss reduction building blocks which have helped or hindered. Certainly the involvement of a dynamic project manager with business management experience, aggressive marketing as well as securing demand from a fast food chain for one of the products were important positive factors.

TABLE 8.3
Key features of value-added milkfish, Indonesia

Building block	Key issues
Policy	Provincial and District government support was in place. District government involved in planning and promotion and kept informed of progress
Legislation	Products and processing carried out to prevailing standards
Skills & knowledge	Needs assessment helped understand the opportunities and potential Project manager had important business experience and management skills and was able to make the link between the women processors groups and the market and ensure orders were met. He understood the market and how to satisfy it. Women’s groups trained in GMP and processing methods Consumer and market awareness campaign Skills were transferred from region.
Services & infrastructure	Adequate infrastructure and services were in place: raw material supply, electricity, building, water, roads, market access, supermarkets and restaurants. Involvement of a fast food restaurant
Technology	Technology used was relatively simple and easily available. Domestic freezers were important for stabilising the product and enable road transport of final products in insulated boxes. Vacuum packer and labelling.

Morocco cold chain and landing sites, markets

This example is based on work by the Moroccan government in conjunction with the Millennium Challenge Corporation (MCC) and the US Trade and Development Agency to upgrade the cold chain infrastructure, services and knowledge and skills of artisanal fishery operators in better handling practices to reduce quality losses and improve the contribution of fish to national food security. Much of this information is from the MCC website.

Total annual value-at-landing of Morocco’s fish catch is about \$832 million, making fishing one of the most important industries in the country. Despite this volume, Morocco has been unable to satisfy current domestic demand for quality fish. Demand is expected to increase, driven by an expanding tourist sector and expected growth in domestic fish consumption, which is currently well below Morocco’s neighbours. Due to inadequate coastal landing sites and port infrastructure, lack of unbroken cold chain from sea to consumer, weak integrity of the value chain, limited access to open markets, and insufficient training for fishers and their cooperatives, small-scale fisheries remains the most undeveloped segment of Morocco’s fishing sector.

The Government of the Kingdom of Morocco launched a national growth strategy, the Plan Emergence, in 2005, which aimed to “modernize and strengthen existing industrial sectors, and target investments in sectors such as textiles, agribusiness, fishing and the crafts industries, where the country has domestic and international competitive advantage.” As a complement to this strategy the MCC’s Small-Scale Fisheries project has aimed to transform the Moroccan small-scale fisheries sector by constructing new landing sites, building and upgrading fishery facilities, improving fisherman’s access to markets, providing technical training, and helping to fund fresh-fish transportation for mobile fish vendors in coastal areas of Morocco.³

This modernisation is designed to improve the quality of the catch, maintain the value chain, and increasing fishers’ access to both local and export markets. Eleven fish landing sites (“PDAs”) have been built along both coasts, facilities in up to 11 major ports developed; 5 modern wholesale markets will be completed in selected cities along with technical assistance and training to ensure proper management. Support has also been provided to help mobile fresh-fish traders invest in motorbikes with insulated boxes, better transportation along with associated technical assistance and training. There are also efforts to establish a network of Marine Protected Areas and increasing monitoring efforts to ensure the sustainable catch of fish resources. More than 125 000 people are expected to benefit from the Small-Scale Fisheries Project, and household income is expected to rise more than \$273 million over 20 years.

For all three of these components, a very strong and sustained training program was developed and adapted to the targeted beneficiaries, designed to ensure that all beneficiaries become stewards of the new infrastructure and equipment after the end of the project. The training modules ranged from practical safety training for the fishermen to road safety for the mobile vendors.

Most of the targeted trainees had not received education beyond the primary school level. The Agency of Partnership for Progress (Agence de Partenariat pour le Progrès or APP), the local Moroccan entity responsible for implementing Morocco’s MC 16 000 artisanal fishers in 16 port towns with Arabic literacy, numeracy, job-specific, and entrepreneurial skills to build their business. Over 400 of the fishermen participated in both the artisanal fisheries training and APP’s functional literacy program.

An important element that favoured MCC’s selection of a fisheries component in Morocco was the fact that the Moroccan government had already accrued a wealth of knowledge and experience in starting PDA sites and building a major wholesale market in Casablanca. The MCC project was thus conceived as a way of doing more of what was already working with the addition of some targeted improvements. This approach was beneficial from two different standpoints. On the one hand, the project built on approaches that had been field-tested by the government in its own time, incorporating some of the lessons that had been learned through trial and error. For instance, the project decided to focus on PDAs rather than so-called Villages de Pêcheurs, which had previously been funded by another donor and proved exceedingly difficult to implement because they required the construction of marine infrastructure, namely jetties and other devices, which proved to be too technically difficult to implement. On the other hand, building on the past experiences of the Government of Morocco was an excellent way to build trust with our partners and to show the extent to which their existing knowledge and “know-how” were appreciated and valued. The first lesson, then, is to try to identify and recognize past successes by the partner country and build on existing strengths.

In retrospect, one can note that the number of sites to be built, both ports and landing sites, was cut drastically from the original target of 39 to 22. The 17 sites that were discarded mostly failed because the Government of Morocco and local

³ <http://www.mcc.gov/pages/countries/program/morocco-compact>

authorities failed to secure the land on which they were to be built. From the early days of compact negotiations, it had been agreed that the land would represent the contribution of the receiving government. However, in spite of considerable support from project stakeholders, some local authorities simply chose not to welcome the project and prevented the construction of a landing site because they wanted to keep land available for hypothetical tourism development. One lesson learned is the need to maintain close and continual communication with local authorities, especially with respect to land issues, and to be able to demonstrate that large tourism development is not necessarily preferable to a smaller, lower impact landing site. Where the potential for tourism exists, it will more often than not supersede any other priorities in the eyes of local authorities. This is probably true for most, if not all, marine fisheries projects in countries with beach tourism potential and should be actively addressed as part of the planning process for a fisheries project. In many cases, an integrated fisheries-eco-tourism approach is possible, where smaller tourism infrastructures are planned and integrated with existing fishing activities. This option is currently the subject of a World Bank/Global Environment Facility project along the Mediterranean coast, hopefully paving the way for a more integrated approach to the development of the coastal zone.

Finally, another important lesson is drawn from the tremendous delays that resulted from a slow start and lengthy feasibility studies before construction could begin. The original work plan called for the completion of the first tranche of sites (almost 10 sites) at least two years before the end of the compact in September 2013. Yet, at the time of this article's writing, only two sites have been completed and become operational. As a result, 25 sites need to be completed or become operational between now and September 2013, which is sure to put inordinate pressure on all parties involved. Without a doubt, the delays in the feasibility studies were in great part the result of differences in norms and standards, including environmental and social standards, between MCC and the beneficiary country.

The original work plan was adopted based on a number of assumptions as to the capacity of the consultants and building firms to adopt MCC standards and criteria, which proved to be overly optimistic. These standards obviously cannot be lowered to respond to the abilities of local partners, so the most salient lesson here is the importance of focusing on outreach, training and support to these partners at the onset. The principle of country ownership is one of the fundamental pillars of the MCC approach, but it should also include an honest assessment of existing local capacities and a focus on investing heavily in training of the national drivers of the project as to MCC's methods, ways and standards.⁴

The matrix in Table 8.4 below summarises some of the key issues related to the loss reduction building blocks which have helped or hindered the initiative. Effort was made to support 3 building blocks building on a clear policy objective and political will. Skills and knowledge were upgraded along with services, infrastructure and equipment. However, access to land for infrastructure and weakness in the service providers would be lessons learned for similar initiatives in future.

⁴ <http://reliefweb.int/sites/reliefweb.int/files/resources/pub-2013001132901-kin-volume-two-number-one.pdf>

TABLE 8.4
Key features of cold chain development, Morocco

Building block	Key issues
Policy	Govt committed to economic improvement and development with the 2005 national growth strategy and fisheries a priority sector
Legislation	Various standards developed to help implement better practices
Skills & knowledge	Learning from previous projects assisted in planning and implementation Capacity building a strong aspect of project and associated with infrastructure and equipment modernization including basic literacy as well as technical Capacity building for local construction companies to meet donor standards should have been provided earlier in project to enable them to meet donor standards
Services & infrastructure	Focus on modernization of infrastructure and services Access to land problematic in some locations and more communication with local authorities required during planning. Feasibility studies completed slower than expected due to differences in environmental and social standards
Technology	Equipment upgraded to enable better handling and cold chain

Bycatch reduction in the Gulf of Mexico shrimp trawl fishery

This example is based on work carried out in the US to reduce discards and bycatch in the Gulf of Mexico shrimp trawl fishery. The work is on-going but highlights some key issues related to bycatch reduction that could influence work in the region. It refers to data in the 2011 US National Bycatch Report⁵ which establishes a baseline for tracking changes in bycatch over time, and is designed to assist the National Marine Fisheries Service (NMFS) in meeting legislative mandates for bycatch reduction, guiding policy, and setting priorities.

Bycatch has long been recognized as a global issue and occurs because fishing methods are not perfectly selective for the target species (including targeted size range and/or sex), or because incidental take of marine mammals, sea turtles, or seabirds may occur as a result of fishing activities. Bycatch may also occur when regulatory restrictions prohibit retention of particular species, sexes, or size ranges.

Reducing the unintentional capture, or bycatch, of fish, marine mammals, sea turtles, and seabirds is an essential part of this goal and is required under NMFS' guiding legislation. The first step in reducing bycatch is accurate characterization of current bycatch levels; this provides a benchmark for evaluating the effectiveness of efforts to reduce bycatch. Understanding the amounts and types of bycatch is also an important component of ecosystem-based management, which seeks to account for the complex connections among organisms, including humans and their environment.

Management measures have been implemented in many U.S. fisheries to reduce bycatch; these include regulatory measures that place limits on bycatch quantities or close target fisheries when bycatch limits are reached. In some cases, other mitigation measures such as gear modifications have also been required. Under the MSA, all fishery management plans (FMPs) and their implementing regulations must be consistent with ten "National Standards." National Standard 9 requires that bycatch be avoided to the extent practicable or, where it cannot be avoided, that bycatch mortality be minimized; 16 U.S.C. 1851(a) (9). NMFS regulations implementing MSA bycatch provisions require various factors to be considered in determining the practicability of a particular management action to minimize bycatch or bycatch mortality. The MSA also requires all FMPs to include a Standardized Bycatch Reporting Methodology (SBRM) to assess the amount and type of bycatch in managed fisheries; 16 U.S.C. 1853(a)(11). These reporting methods are intended to improve the collection and estimation of bycatch, and to support the development of effective conservation and management strategies and mitigation measures.

⁵ National Marine Fisheries Service. 2011. U.S. National Bycatch Report [W. A. Karp, L. L. Desfosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p.

In general bottom trawl fisheries such as the Southeast Gulf of Mexico shrimp trawl fishery have high bycatch ratios. This trawl fishery is no exception and is managed by the Federal government using the Shrimp Fishery of the Gulf of Mexico FMP. While shrimp stocks are not overfished, many finfish species, sea turtles, small tooth sawfish, and bottlenose dolphins are caught as bycatch during trawling operations. Beginning in the late 1980s, TEDs were required in various parts of the shrimp fishery through regulations implemented under the ESA. By the mid-1990s, TEDs were required in all shrimp trawls, with limited exceptions. It has been estimated that TEDs exclude 97 percent of the turtles caught in shrimp trawls. Regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g. width of bar spacing), flotation, and more widespread use. NMFS published a final rule to require larger escape openings.

All South-eastern shrimp fisheries now require BRDs to reduce finfish bycatch. These requirements were implemented in 1997 under Amendment 2 to the Shrimp Fishery of the South Atlantic Region FMP. New regulations implemented in February 2008 were intended to improve the quality of BRDs used by the South Atlantic and Gulf shrimp fishery to reduce bycatch. The regulations provide for a consistent criterion throughout the southeast by which a BRD can be certified for use in the fishery. In addition, three new BRDs were certified for use, which are more efficient than the industry-standard BRDs used today.

Although the Gulf of Mexico and Southeast Atlantic shrimp trawl fisheries have been observed since 1992, participation in the observer program has been voluntary. Amendment 13 to the Shrimp Fishery of the Gulf of Mexico FMP (finalized in October 2006) and Amendment 6 to the Shrimp Fishery of the South Atlantic Region FMP (finalized in December 2005) established a mandatory observer program for Southeast shrimp fisheries. These amendments improve the observer program's ability to collect catch and bycatch data for these fisheries. Additional regulations implemented in 2008 are specifically intended to reduce fishing mortality on juvenile red snapper.

In 2010, the Secretary of Commerce approved the Comprehensive Ecosystem-Based Amendment 1 (CE-BA 1). The intent of CE-BA 1 is to protect over 23 000 square miles of sensitive habitat, deemed coral Habitat Areas of Particular Concern (HAPCs) from impacts associated with bottom tending fishing practices. The coral HAPCs are located off the coasts of the Carolinas, Georgia, and eastern Florida in waters ranging from 400 meters (1 200 feet) to 700 meters (2 300 feet) deep. The South Atlantic region is believed to contain the largest distribution of deepwater corals in the world, including the common *Lophelia* coral, largely responsible for reef mound construction in these cold water areas. These deep water coral areas are relatively undisturbed by the impacts of fishing. The amendment establishes deepwater coral HAPCs, where the possession of coral species and the use of all bottom-tending gear is prohibited, including bottom longline; trawl (bottom and mid-water); dredge; pot or trap; or the use of an anchor, anchor and chain, or grapple and chain by all fishing vessels

The matrix in Table 8.5 below summarises some of the key issues related to the loss reduction building blocks which have helped or hindered the bycatch reduction programme. The determination of the Federal government is perhaps the key issue which has led to mandatory BRDs and data collection.

TABLE 8.5
Key features of shrimp bycatch reduction, USA

Building block	Key issues
Policy	NOAA is the Federal Agency with the mandate to manage and conserve fishery resources. http://www.nmfs.noaa.gov/by_catch/index.htm Fishery management plans (FMP)s are implemented by regional councils or the Federal govt.
Legislation	Key legislation is the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the U.S. Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) National Standard 9 requires that bycatch be avoided to the extent practicable or, where it cannot be avoided, that bycatch mortality be minimized; 16 U.S.C. 1851(a) (9). A Standardized Bycatch Reporting Methodology (SBRM) must be used. Observer programme mandatory. BRDs and TEDs are mandatory by law
Skills & knowledge	Data on bycatch levels and composition Self-reported log book data Opportunities to improve data collection identified such as increase in the number of observer days
Services & infrastructure	Ability to regularly monitor and measure bycatch through research and observer programmes. Federal government and industry funds for observer program of US\$53 million 2008.
Technology	Effective BRDs and TEDs have been developed

CONCLUSIONS

From the basic analyses of the interventions described in the previous section, certain positive and negative factors related to the five building blocks of loss reduction can be identified. These have been summarised below as a set of guiding principles or best practices that should be used to inform future loss reduction interventions in the region:

- Technology must be well researched, proved to be effective and tried and tested
- Infrastructure and services to be upgraded/modernized
- Government support given in terms of policy and commitment
- Legislation to support adoption of technology and use of infrastructure clear
- An intervention to meet national and international standards
- Capacity building in knowledge, skills and understanding for all beneficiaries including project service providers in technical and non-technical issues
- Involve consumers
- Local government to be involved in planning and kept informed
- Access to land if required, secured as a priority
- Infrastructure and services designed and built to high environmental and social standards
- Lessons learnt from previous initiatives incorporated into planning and implementation
- Technology simple/appropriate and easily available
- Understand the market for products and the opportunities for improved quality and value-added
- Learn from and use existing coping strategies
- Involve and communicate with beneficiaries

This should not be seen as a definitive list or guide but more of a starting point, that could be developed further using more case studies and experience from the region.

Review of national consultant overviews

One of the objectives of the assignment was to review five national overviews from the region which describe post-harvest losses and related issues. The national overviews are for Egypt, Iran, Mauritania, Morocco and Yemen. The objective of the review was to summarise how the research or study was conducted, the representativeness of the data, loss reduction opportunities and provide recommendations for further action, based on the understanding of each overview. Whilst Table 6 summarises the results of the review process, it can be said that the overviews provide a number of entry points for more detailed primary data collection as they are basically desk studies. Certainly, if the objective is to see losses reduced by 50 percent in the region then there needs to be an attempt to establish more accurate baseline data on loss levels, at least in key fisheries. Therefore one of the main recommendations would be for systematic loss assessment studies using recognised methods. This process can be helped by the fact that each overview has highlighted fisheries or stages in the value chain where losses are more of an issue. It is suggested that these already identified losses or “hot spots” are where assessment should be carried out. A more systematic assessment process would also help clarify certain losses which have been identified but are still not fully explained. Hot spots identified from each overview and which could form the basis of further investigations are:

- **Egypt** - artisanal inland fishery and aquaculture which are more important in terms of volume and people. More information on the 18 percent physical loss during urban marketing required.
- **Iran** - artisanal tuna fishery and Kilka required now.
- **Mauritania** – small pelagics
- **Morocco** – small pelagic, utilisation of canning waste
- **Yemen** - remote artisanal landing sites that land pelagics and use gill nets.

Please see Table 8.6 for more details. The overviews are also different in terms of the way in which they have approached the subject and the structure of the reports. It would have been useful to encourage the authors to follow the same report structure given to them prior to the study. There are examples of report structures that could have been used or adapted in various post-harvest fish loss publications.

TABLE 8.6
Summary of review comments for national overviews

National overview	Overview approach (number of locations, representative fisheries & value chains, secondary source data, primary data and data collection methods)	Data on losses (losses classified into quality and physical, calculations for losses clear, causes of losses, where losses are occurring, key stakeholders, who is affected, seasonality)	Loss reduction opportunities identified	Recommendations (additional data, validation, interventions, overview)
Egypt	<p>One location where primary data collection was said to have been undertaken. Focus was on a less important fishery and the semi-industrial sector of that. Much data taken from a 10 year old bycatch study. Not clear what field assessment approach was used. PHFLA methods not used. Method may have influenced conclusions as it was not rigorous. Observation not used. The assessor appears to be a biologist and may lack a thorough understanding of PH issues?</p>	<p>Quality loss appears not to have been investigated. Normally trawled fish and fish stored on ice at sea do reduce in quality before landing. If ice is used at sea, what ratios are used and the same on landing. Is good icing practice used? There may be poor handling practices at Attacka which are causing the physical loss further down the chain.</p> <p>18% physical loss is mentioned but not clear how this is calculated and its value on a wider scale.</p>	<p>More information on the 18% physical loss at marketing stage required before any ideas can be formed. The loss at marketing may be associated with fish from inland fishery and aquaculture so could be very significant. Bycatch reduction mentioned.</p>	<p>More detail required generally using a more systematic approach. Focus more on artisanal inland fishery and aquaculture which are more important in terms of volume and people. More information on the 18% physical loss required. This could be a discreet study.</p>
Iran	<p>Useful desk study that has helped shape the next steps. Key fisheries and sectors summarised. Primary data now required to clarify the current situation more accurately.</p>	<p>An effort has been made to differentiate between physical and quality losses. % data is given but it is not clear how this has been estimated and whether it applies to physical waste, value etc...more clarity needed which would come from a proper field assessment.</p>	<p>Yes. A number of priority targets have been identified and ideas. Intervention work underway with a number of interesting and well thought initiatives for capture and aquaculture handling.</p>	<p>More systematic assessment of hot spots such as artisanal tuna fishery and Kilka required now. Lesson learning from current and past interventions will help inform future work. Infrastructure and services improvement to be accompanied by capacity building and good management supported by legislation/bylaws. Lessons from elsewhere e.g. Peru will assist the objective of switching Kilka to human consumption. Value-added products also to be explored e.g. fresh yellow fin tuna. MSC could be interested. Consumer awareness campaign to encourage demand for better quality.</p>

National overview	Overview approach (number of locations, representative fisheries & value chains, secondary source data, primary data and data collection methods)	Data on losses (losses classified into quality and physical, calculations for losses clear, causes of losses, where losses are occurring, key stakeholders, who is affected, seasonality)	Loss reduction opportunities identified	Recommendations (additional data, validation, interventions, overview)
Mauritania	<p>Appears to be a desk study. Several recent studies have been consulted. No primary data as part of this overview.</p> <p>The overview could be used to plan primary assessment of losses to generate some baseline data and measure the effectiveness of interventions.</p>	<p>Indications of hot spots given such as the small pelagic sector.</p> <p>Loss % quoted but not clear how these were calculated and whether physical or quality.</p>	<p>Good set of entry points for loss reduction given. Some work has already been undertaken e.g. Spanish project to encourage fish consumption in the interior.</p> <p>Project ideas related to improvement of infrastructure, capacity building.</p>	<p>Good overview and draws on some recent studies by different projects.</p> <p>Better utilisation of small-pelagics for human consumption both domestic and regional market. Peru example.</p> <p>Morocco development of small-scale landing sites and cold chain could give ideas. Senegal also.</p> <p>Legislation has been developed however the key will be its implementation.</p> <p>Consumer awareness campaign to encourage demand for more fish consumption and better quality fish.</p> <p>Opportunities for value-addition clarified.</p> <p>Is there a canning industry? If not why not?</p>
Morocco	<p>Desk study focussed on bycatch and discards.</p>	<p>Limited data on bycatch but no attempt to investigate quality or physical losses.</p> <p>Would have been useful to highlight lessons learnt related to bycatch and discard management.</p>	<p>Ideas related to best practice for bycatch and discard management presented based on international guidance</p>	<p>Conduct loss assessment in potential hot spot fisheries such as small pelagics.</p> <p>Utilisation of canning waste also a potential entry point.</p> <p>Understand lessons learnt from efforts to reduce bycatch and discards.</p>

National overview	Overview approach (number of locations, representative fisheries & value chains, secondary source data, primary data and data collection methods)	Data on losses (losses classified into quality and physical, calculations for losses clear, causes of losses, where losses are occurring, key stakeholders, who is affected, seasonality)	Loss reduction opportunities identified	Recommendations (additional data, validation, interventions, overview)
Yemen	Reference made to PHFLA methods and definition of losses. Much repetition of issues. QLAM was said to be used but not clear how. Questionnaire should be attached as Annex.	Loss levels quoted are very high. An effort was made to extrapolate data to give overall values but not clear.	A number of good intervention entry points identified. On board handling Poor hygiene and sanitation New bylaws Improved salting and sun drying	Legislation is exists or is proposed but how can we ensure enforcement? Hot spot appears to be remote artisanal landing sites that land pelagics and use gill nets. These could be the focus of more systematic studies. Consumer education about eating good quality fish Morocco cold chain work and development of artisanal landing sites. Capacity building in terms of knowledge & skills also important. If focus on exports then consumer awareness maybe counterproductive. Appears interventions have taken place but these are not mentioned. Learning from these will be important and they should be reviewed.

APPLICATION OF BEST PRACTICES FOR LOSS REDUCTION IN THE NEAR EAST NORTH AFRICA REGION

Development resources are often scarce and need to be used efficiently. This section begins by providing a simple tool (Table 8.7) that could be developed further and used to help identify potential post-harvest fish loss hotspots that would be the target of assessment and/or intervention. Based on available national case studies from the region, a series of generic loss situations are then presented with suggested loss reduction application ideas given based on best practices presented earlier in the paper.

TABLE 8.7
Regional hot spots in the context of infrastructure, technical capacity & species

Variable	Low	Medium	High
Gillnets & static gear	•	••	•••
Longline	•••	••	•
Trawl	•	••	•••
Traps	•••	••	•
Small pelagics	•	••	•••
Demersal	•••	••	•
Large pelagics	•	••	••
Artisanal fleet	•	••	•••
Large landings/harvests	•	••	•••
Remote location	•	••	•••
No ice or cold chain	•	••	•••
No landing site infrastructure	•	••	•••
High ambient temperature	•	••	•••

Using this table a basic guide then we can deduce that assessing or reducing losses should target locations or fisheries where there is an artisanal fleet, using gillnets, harvesting small-pelagics, in a remote location with relatively high ambient temperatures, without access to ice or landing infrastructure. Any situation such as this is likely to be associated with high post-harvest fish losses and should be considered as priority for intervention. On the other hand, where we have a non artisanal fishery, using long lines, catching demersal fish, operating in a location close to an urban centre or market, where the ambient temperature is relatively low and ice is accessible and used on-board as well as there being landing infrastructure, then we can see this as lower priority in terms of intervention, as losses are likely to be relatively low. Within the region it will be possible use such criteria to map what could be called post-harvest loss hot spots.

Once we have identified loss hot spots then how should we apply loss reduction best practices? Here we use three generic examples to illustrate how best practices could be applied within the region. The first is the artisanal, small-pelagic fishery example described above (Table 8.8). The other examples are the fish for food vs fishmeal scenario (Table 8.9) and reducing shrimp bycatch (Table 8.10). It is proposed that these generic examples are used as start points that can be adapted and used to plan interventions at national or regional level.

TABLE 8.8
Artisanal small-pelagics fishery

Building block	Key issues
Policy	Government commitment in policy and national development strategy. Loss reduction will contribute to income, poverty reduction and food security Local government involved in planning and kept informed Lessons learnt from previous initiatives either nationally or regionally incorporated into planning and implementation Involve and communicate with the beneficiaries, involve them in decision making
Legislation	Legislation to support better handling, hygiene and sanitation and adoption of new technology and management of infrastructure. International standards adopted Implementation of legislation by motivated work force Bylaws developed at local level using a co-management approach
Skills & knowledge	Capacity building in knowledge, skills and understanding for all beneficiaries and project service providers in technical and non-technical issues e.g. fish handling, hygiene, sanitation, marketing, business management, food safety, value-addition, cold chain management. Service providers trained to meet construction and design standards Consumer awareness raised on benefits of small pelagic and how to buy and choose and prepare good quality products Understand market for improved quality and value-added products
Services & infrastructure	Access to land secured Infrastructure and services upgraded/modernized to meet high environmental and social standards Basic modern landing site infrastructure introduced Access to ice provided Road access improved
Technology	Learn from coping strategies used nationally and regionally Introduce appropriate technology to improve handling, hygiene, cold chain, processing and value-addition, access to market, reducing time and temperature e.g. fish boxes, insulated boxes, vehicles, drying racks, freezers, cold stores, packing and packaging.

TABLE 8.9
Fish for food vs. fishmeal

Building block	Key issues
Policy	National objective to increase domestic fish consumption. Political will for change. Local government involved in planning and kept informed Lessons learnt from previous initiatives either nationally or regionally incorporated into planning and implementation Involve and communicate with the beneficiaries, involve them in decision making
Legislation	Pro-domestic consumption e.g. fishermen must sell a certain proportion of catch for human consumption. Encouragement for domestic consumption as oppose fish meal production for export
Skills & knowledge	Visual campaign to educate consumers and restaurants on fish preparation and consumption. Seminars, tastings. Media attention involving high profile people e.g. politicians, celebrities Understand market for improved quality and value-added products
Services & infrastructure	Basic services such as electricity, water, ice, landing site and roads required to facilitate handling for food and market access
Technology	Learn from coping strategies used nationally and regionally Emphasis on taste and presentation of products. Cold chain developed Ice, canning and freezing all used to enable product to be marketed at affordable prices. Processing companies encouraged to invest in processing.

TABLE 8.10
Shrimp bycatch reduction

Building block	Key issues
Policy	Political will in place Benefits of bycatch reduction made clear Industry must accept need for change Local government involved in planning and kept informed Lessons learnt from previous initiatives either nationally or regionally incorporated into planning and implementation Involve and communicate with the beneficiaries, involve them in decision making
Legislation	Bycatch reduction enshrined in law On-board monitoring / observer system mandatory Use of appropriate BRDs and TEDs made mandatory by law Implementation of legislation by motivated work force
Skills & knowledge	Data collection system implemented to measure and monitor bycatch levels and composition Awareness raising amongst producers and market Capacity building for producers and managers in technology
Services & infrastructure	Ability to regularly monitor and measure bycatch through research and observer programmes. Government and industry commit sufficient funds
Technology	Effective BRDs and TEDs tested and used Learn from coping strategies used nationally and regionally

Regional Conference on food security and income generation through the reduction of losses and waste in fisheries

Nouakchott, Mauritania,
15–17 December 2013

The Regional Conference on food security and income generation through reduction of losses and waste in fisheries was held from 15 to 17 December 2013 at the Wissal Hotel, Nouakchott, Islamic Republic of Mauritania. It was jointly convened by the Food and Agriculture Organization of the United Nations (FAO), the Center for Marketing Information and Advisory Services for Fishery Products in the Arab Region (InfoSamak) and the Ministry for Fisheries and Maritime Economy. The 78 participants included representatives from 14 countries, civil society organizations, fishers' associations and research institutes. The objectives were to: i) review current fisheries practices in the Near East and North Africa region; ii) examine case studies of best practices to identify suitable options for the region; and iii) identify policy-level and operational-level interventions to improve food security and income generation by reducing losses and waste. The conference identified various tools and practices that would reduce fishery losses and waste through the generation of accurate baseline data and loss-reduction initiatives. Case studies of best practices in five countries were considered, after which group discussions focused on: i) best practices for minimizing post-harvest losses and waste; ii) improved utilization of fishery by-products to minimize waste; iii) approaches based on value chains for minimizing fishery losses and waste; and iv) best practices for managing fish bycatches and discards.

The conference drafted and adopted the Nouakchott Declaration, which includes a call to implement policies and legislative frameworks supporting a participatory approach to fisheries management and to create an enabling environment for value-chain actors in small-scale fisheries. The Declaration calls on countries in the region to build the capacities of resource users, managers and post-harvest stakeholders and service providers with a view to reducing losses and waste in the fish supply chain.

