TRAINING WORKSHOP REPORT NO. 01 – TRAINING PROGRAMME ON ENHANCING BY-CATCH LANDING, VALORISATION, TRACEABILITY, AND QUALITY

'TECHNICAL ASSISTANCE TO IORA FOR THE IMPLEMENTATION AND COORDINATION OF IORA ACTION PLAN ON FISHERIES, AQUACULTURE AND MARINE ENVIRONMENT'

REFERENCE NO. DOE/NAT/ARB/DCP/2019-290

Authors: Dave Japp, Mike Copeland and Stewart Norman

June 2022

Project implemented by

COFREPECHE SOFRECO

INTERNAL REFERENCE: IO349TWR01A

TABLE OF CONTENTS

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AFD	Agence Française De Développement
AI	Artificial Intelligence
BET	Big Eye Tuna
BRC	British Retail Consortium
CAB	Conformity Assessment Body
CCP	Critical Control Point
CCCS	Central Common Cold Store
CFP	Ciguatera Fish Poisoning
CFSAN	Centre for Food Safety and Applied Nutrition
CGFM	Core Group on Fisheries Management
CHP	Chapter
CMM	Conservation and Management Measures
COFI	Committee on Fisheries
CPC	Contracting Parties
CSIRO	Commonwealth Scientific and Industrial Research Organization
DAP	Defect Action Point
EM	Electronic Monitoring
EMS	Electronic Monitoring Systems
ETP	Endangered, Threatened and Protected
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
GHP	Good Hygiene Practice
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Points
IO	Indian Ocean
IOC	Indian Ocean Commission
IORA	Indian Ocean Rim Association
IOTC	Indian Ocean Tuna Commission
IPHS	Ile du Port Handling Services
IUU	Illegal, Unreported and Unregulated (fishing activities)
KE	Key expert
m	Metre
M&E	Monitoring and Evaluation
MCS	Monitoring Control and Surveillance
MoU	Memorandum of Understanding
MS	Member States
MSC	Marine Stewardship Council
Mt	Metric Ton
MTC	Minimum Terms and Conditions
MTC	Minimum Terms and Conditions
PRP	Prerequisite Program
Q&A	Questions and Answers
SOP	Standard Operating Procedure
SSOP	Sanitation Standard Operating Procedure
SWIO	Southwest Indian Ocean
TA	Technical Assistance

TBC	To be confirmed
TVBN	Total Volatile Basic Nitrogen
UK	United Kingdom
UoA	Unit of Assessment
UoC	Unit of Competency
USA	United States of America
WGBE	Working Group on the Blue Economy
WHO	World Health Organization
WIO	Western Indian Ocean
YFT	Yellowfin Tuna

1. Introduction

The Indian Ocean Rim Association (IORA) is a dynamic inter-governmental organisation aimed at strengthening regional cooperation and sustainable development within the Indian Ocean region through its 23 Member States and 10 Dialogue Partners.

As the third largest ocean woven together by trade routes, commands control of major sea-lanes carrying half of the world's container ships, one third of the world's bulk cargo traffic and two thirds of the world's oil shipments, the Indian Ocean remains an important lifeline to international trade and transport.

The Association has the aim to facilitate and promote economic cooperation, bringing together inter-alia representatives of Member States' governments, businesses and academia. In a spirit of multilateralism, the Association seeks to build and expand understanding and mutually beneficial cooperation through a consensus-based, evolutionary and non-intrusive approach.

The Indian Ocean Rim Association (IORA) and France, through the Agence Française de Développement (AFD) signed a Memorandum of Understanding (MoU) on the 9th March, 2020 for "Strengthening the Capacities of IORA in Promoting the Blue Economy and Fisheries Management".

The partnership will support the implementation of the IORA Action Plan (2017-2021) with an allocation of EUR1 million over three years. It will offer expertise, training, networking and material resources to decision makers, officials and experts working to promote regional cooperation in blue economy and fisheries management issues. In addition, the project will strengthen the capacity of the IORA Secretariat. The support is constituted of a main resident expert who will provide continuous technical assistance to the IORA Secretariat in implementing the Work Plan of the Working Group on the Blue Economy (WGBE) and IORA Core Group on Fisheries Management (CGFM) Work Plan. The AFD awarded the consortium COFREPECHE/SOFRECO the task of executing the technical assistance.

The overall objective of the Technical Assistance (TA) is to "support IORA and its Member States in the coordination and implementation of the Work Plan of the WGBE and Work Plan of the IORA CGFM, with a strong focus on fisheries, aquaculture and protection of marine environment." The strong focus of the technical assistance is, therefore, on building the capacity of IORA and its Member States to achieve the specific objectives listed in the IORA CGFM Work Plan and the WGBE Work Plan concerning mainly fisheries, aquaculture and protection of the marine environment through the implementation of various activities also listed within the WGBE work plan. One of the objectives of the WGBE Work Plan is to **promote sustainable fisheries management**. Under this objective, one of the activities planned in the Work Plan is to **develop a training programme on enhancing by-catch landing, valorisation, traceability and quality**, including the development of safe handling guides and species identification guides.

Since Seychelles is an IORA–Member State and is already heavily involved in the sustainable utilisation of bycatch, it was proposed that a training course will be organised under the AFD TA to IORA in Seychelles to provide a 3.5-day programme, including a theoretical and practical demonstration of relevant practices and site visits to processing facilities. The training workshop included two distinct themes:

I. **Sea, ship to shore** – Bycatch species identification, on-vessel operational matters, catching and storing, vulnerable species, Minimum Terms and Conditions for foreign-flagged vessels fishing in coastal waters, lessons learnt from countries and WIO region.
II. **Onshore offloading, processing and valorisation** – Critical control points for bycatch handling during offloading and processing, local market opportunities and examples, minimum regulatory requirements for commercial fisheries products entering export markets, especially traceability and sanitary aspects, infrastructure and the processing

environment for common tuna fisheries bycatch species, processing and value addition – working examples from the region including a review of current best-practice and existing export channels.

To undertake this assignment COFREPECHE sub-contracted Capricorn Marine Environmental (Pty) Ltd (CapMarine) which provided two fisheries management experts to participate towards the completion of a training programme on enhancing by-catch landing, valorisation, traceability and quality, including the development of safe handling guides and species identification guides if necessary. The two fisheries management experts, Mr Dave Japp and Mr Mike Copeland have the technical expertise and practical experience in a) Operational matters from sea, ship to shore (including traceability), b) Fisheries management and stock assessments, and c) Onshore offloading, and processing and valorization (including sanitary aspects).

2. Workshop objectives and approach

Coastal states that land neritic and other tuna species are encouraged to improve quality control that enhances the value of the catch – this is a fundamental issue in IORA member states that are characterized by relatively simple and inadequate landing facilities. Simple interventions are already encouraged - cold chain, use of ice bins, onboard handling etc., to maintain the quality that then encourages the next phase, i.e. middlemen that purchase the product for sale either at national or international levels. Fish quality must be assured from catch to landing in order for the product to then be safely sold fresh or frozen.

Whereas major industrial ports are advanced in sustainable utilisation of bycatch and have access to established value chains, the overwhelming majority of “coastal communities" do not have the knowledge/training or facilities to meet the basic, but stringent, requirements for safe handling and quality control and are therefore excluded from lucrative value chains. The valorisation of bycatch species originating from large and small scale regional tuna fisheries in the Indian Ocean can be strengthened through simple interventions that will improve the value of the catch if it is correctly handled, and cold-chain integrity can be maintained.

Bycatch however should not be misunderstood as it has different meanings. There are many minor bycatch fish species that have little or no commercial value, as well as seabirds, turtles and sharks that may be critically endangered. Bycatch utilisation should therefore be exploited responsibly and within acceptable international limits.

Value addition of these commercial “bycatch” species is the focus of this workshop. Many, such as the neritic tuna (bullet, Frigate, kawakawa and longtail tuna) as well as King and Spanish mackerels and the marlins and sail fishes are undervalued in national and potential international markets. The key to extracting maximum economic value from these bycatch species is to ensure their good management and quality assurance from the time of capture to when they are landed and processed.

It was proposed that a short training course be developed that can be broadly distributed throughout the IORA countries. The general approach and workflow are summarised in Figure 1. The Technical Expert(s) developed a short course on the sustainable utilisation of bycatch (offloading, processing and value-adding) and incorporated training on species ID, the importance of quality control/safe handling/HACCP and product traceability and value chains. The training materials were reviewed ahead of the workshop by the Resident Expert. A short (1-week) training workshop was convened at the Eden Bleu Hotel in Seychelles and attended by relevant stakeholder representatives from IORA Member States including industry partners and national technical departments in the host country (Seychelles). Site visits to processing and storage facilities were arranged in order to demonstrate the relevant safety and safe-handling practices in use and to compare what was observed with what is considered best international practice. The workshop was conducted in-person over 4 days.

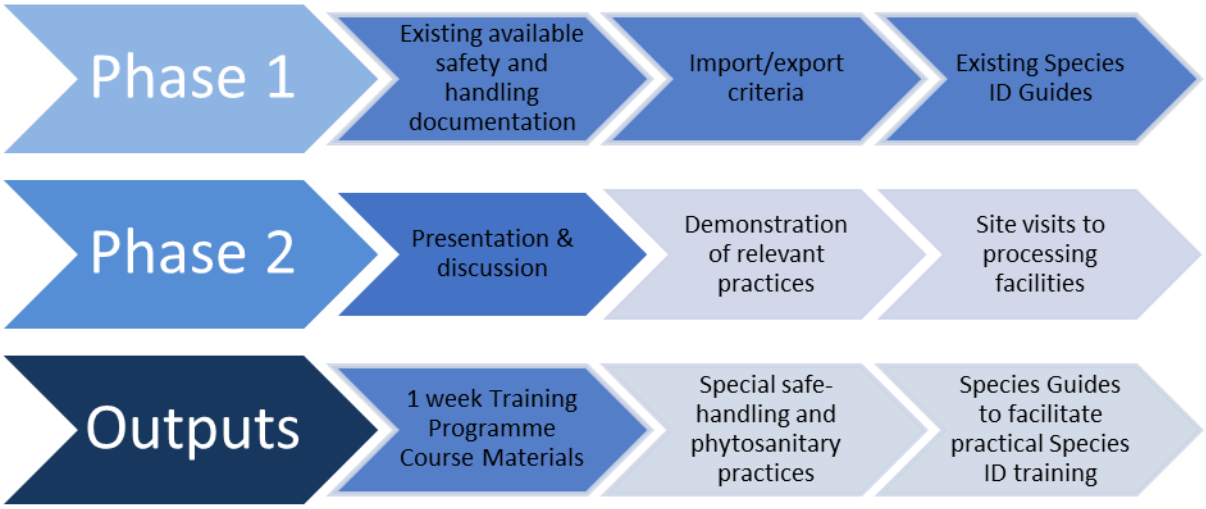


Figure 1: Proposed 2 Phase approach to the Assignment.

This workshop aimed to demonstrate how to benefit from the valorisation of bycatch species caught in commercial tuna fisheries through applying best international practice by navigating through the many regulations and requirements to ensure production of value added products that can be safely eaten by communities and exported, but also potentially creating income from these resources in IORA State waters.

The principle result of the training workshop was a refined training programme and training materials that can be broadly applied throughout the IORA countries and that will be of great benefit to both large industrial processor and small scale coastal communities.

Secondary outputs included reference to existing applicable safe handling guides, and special safe-handling and phytosanitary practices and species identification guides. It was decided that these guides did not need to be produced by the workshop once participants became aware of existing available safety and handling documentation and species identification guides.

3. Attendees

The workshop was attended in person in the Seychelles, however it was also open to attendance virtually and each session was recorded – the recording can be requested to the IORA Secretariat.

24 participants from 10 IORA Member States attended the workshop physically over the four days. In addition 8 participants included representatives from IORA Secretariat, Agence Française de Développement, COFREPECHE and CapMarine. The list of registered participants from the IORA Member States is found in 7.3 Appendix 3. List of Participants Countries represented for the duration of the workshop were: Australia 1; Bangladesh 1; India 1; Comores 1; Iran 1; Maldives 1; Mauritius 1; Tanzania 2; Seychelles 13; Somalia 1; Sri Lanka 1.

Figure 2 provides the distribution of the participating countries in the workshop over the four days.

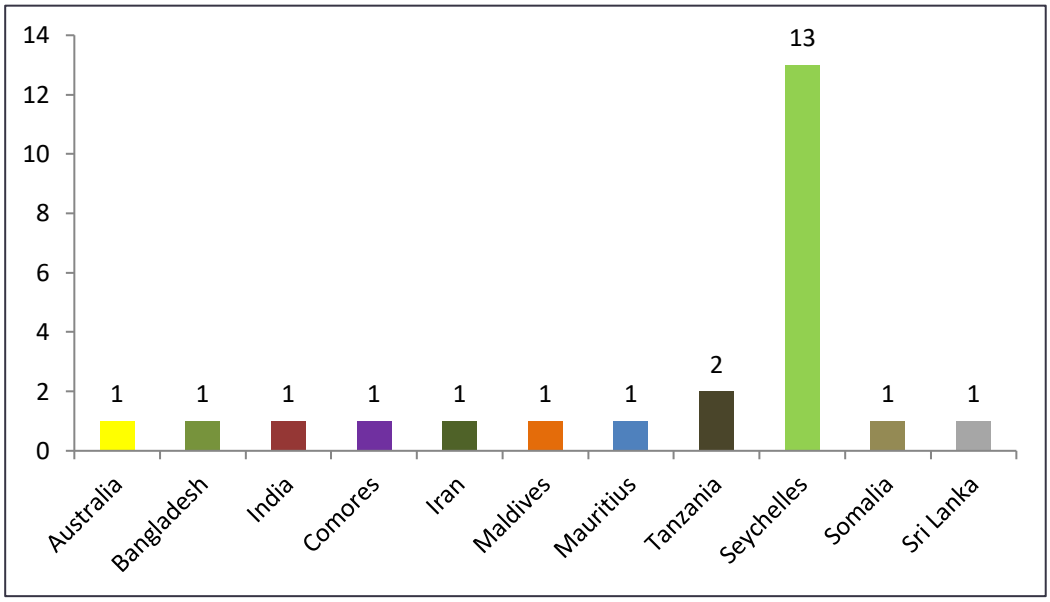


Figure 2: Participating Countries on Day I to Day IV

Figure 3: Workshop Participants

4. Summary of the four days workshop sessions

4.1. Day 1: Tuesday 29 March 2022

4.1.1. Opening Addresses (7.2 Appendix 2)

The workshop was officially opened by the **Honourable Jean-Francois Ferrari**, Minister for Fisheries and Blue Economy who welcomed the delegates. He expressed his gratitude for the efforts of IORA and stressed the importance of developing better bycatch usage and development in a sustainable way. A full extract of his opening address is provided in 7.2. Appendix 2. His Excellency**, Mr. Dominique Mas, French Ambassador to the Republic of Seychelles**, Dr Gatot Gunawan, Director for Blue Economy, IORA Secretariat and **Mrs Sadna Ammearally-Nistar** Assistant Director Agence Française de Développment joined in welcoming participants to the meeting. Their opening and closing remarks of Dr Gatot Gunawan are also provided in 7.2. Appendix 2.

Figure 4: Opening by the Honourable Minister Jean-Francois Ferrari

Figure 5: Opening address by Mrs Sadna Ammearally-Nistar

4.1.2. Session 1: Training Workshop Objectives, Schedule and Introduction

CapMarine Introduction

Mr Dave Japp of CapMarine introduced himself and co-presenter Mr Mike Copeland. The proposed agenda and process were explained to delegates noting that a flexible approach was to be followed and that the workshop would be interactive.

Figure 6: Opening presentation by Technical Expert Mr Dave Japp.

4.1.3. Session 2: Indian Ocean Tuna Fisheries

Defining Bycatch and the Importance of Bycatch to Fisheries in the Indian Ocean

In the first session of the day Mr Japp presented a broad overview of bycatch in the Indian Ocean, focused on bycatch from the large-scale purse seine fleet. The presentation materials are provided in Appendix 7.4.1.

The Indian Ocean is one of the four major tropical oceans, which includes the Atlantic, Western Pacific and Eastern Pacific oceans. Fishing communities in the coastal African states, the ocean islands and further east towards Malaysia and Indonesia have exploited their fish resources for many centuries. The growth of industrialised fisheries globally has put increasing pressure on many stocks traditionally exploited by these communities. The formation of Regional Fishery Management Organisations such as the Indian Ocean Tuna Commission (IOTC) aims to support the sustainable management of the principle tropical tuna stocks, that is yellowfin, bigeye and skipjack tuna. Members states of the IOTC such as the Seychelles, Tanzania, Indonesia and many other states found on Indian Ocean Rim, have an obligation to ensure that these resources are not only managed sustainably, but also economically optimally utilised for the benefit of their communities. Industrialised fisheries such as the tuna purse

seine in the Indian Ocean are some of the biggest tuna fisheries in the world, exploiting some 500 000 Mt of skipjack, 400 000 Mt of yellowfin and 80 000 Mt of bigeye tunas. However, while these species are the main target and are the focus of value addition and lucrative markets, the many minor species also caught in these fisheries are becoming increasingly important, particularly for coastal states.

Value addition of these "bycatch" species is the focus of this workshop. Many, such as the neritic tuna (bullet, Frigate, kawakawa and longtail longtail tuna) as well as King and Spanish mackerels and the marlins and sail fishes are undervalued in national and potential international markets. The key to extracting maximum economic value from these bycatch species is to ensure their good management and quality assurance from the time of capture to when they are landed and processed. It was recognised that these species, while they may be a by-catch in some fisheries, they are also targeted by fisheries in other regions of IORA.

This workshop aimed to demonstrate how to benefit from these bycatch species through applying best international practice, by navigating through the many regulations and requirements to ensure products that can not only be safely eaten by communities, but also potentially creating income from these resources in their own waters.

Bycatch, however should not be misunderstood as it has different meanings. There are many minor bycatch fish species that have little or no commercial value, as well as seabirds, turtles and sharks that may be critically endangered. Bycatch utilisation should therefore be exploited responsibly and within acceptable international limits.

General Fish Processing Factory Design (see Appendix 7.4.2)

Fish Processing plants, equipment and facilities should be located, designed and constructed to ensure that hygienic and safe processing is possible. The following key features are important:

- Choose a suitable location with good access where there is limited chance of contamination from the surrounding environment and no flooding
- design and layout permit appropriate maintenance, cleaning and disinfection and prevent damage and minimize airborne contamination
- surfaces and materials, in particular those in contact with food, are non-toxic for their intended use
- where appropriate, suitable facilities are available for temperature, humidity and other controls
- there is effective protection against pest access and harbourage and
- there are sufficient and appropriate washroom facilities, change rooms and dining areas for personnel.

When the necessary attention is given to good hygienic design and construction, and an appropriate location is found, and adequate facilities are provided then it is possible to effectively control contaminants.

Question and answer:

Should staff facilities be a part of the processing plant or can they be separate from the factory?

It is preferable that staff facilities are part of and attached to the factory, however no part of the facilities should open directly into processing areas or stores. They should be connected by a passage way.

Where staff facilities are completely separate from the processing plant then provision must be made for hygienic control of protective clothing, to ensure that no protective clothing worn inside fish processing areas and stores is contaminated from the factory yard and surroundings.

What colour bins are used for fish waste?

Red bins are used for fish waste as this makes them easily identifiable that they will only be used for this purpose.

Recommended Reading

FAO and WHO. 2020. Code of Practice for Fish and Fishery Products. Rome. https://doi.org/10.4060/cb0658en

https://www.fao.org/documents/card/en/c/cb0658en/

Codex General Principles of Food Hygiene CXC 1-1969

https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf

Design of Fish processing factories

https://www.fao.org/3/r1076e/R1076E07.HTM

Prerequisite Programmes (see Appendix 7.4.3).

Internationally, food safety laws generally give special consideration to the safety and wholesomeness of fishery products. Emphasis is placed on product safety hazards, but there is also a tendency to consider non-safety mandatory requirements which are necessary to protect the consumer's interest. Such minimum standards are being harmonized by the Codex Alimentarius Committee for fishery products (under the auspices of the WHO and FAO) specifically under General Principles of Food Hygiene CXC 1-1969.

Correctly implemented and managed HACCP (Hazard Analysis and Critical Control Points) plans should protect consumer safety. The HACCP tool can also be used to control essential quality characteristics such as labelling and correct net mass.

HACCP implementation is considerably simplified when some prerequisite requirements are already in place. Consequently, Good Manufacturing Practice (GMP) and Good Hygiene Practice (GHP) should be in place prior to HACCP implementation.

Prerequisites pertaining to GMP and GHP could include the following:

- Water quality
- Construction and maintenance of buildings and equipment
- Process control (including proper calibration of measuring instruments)
- Approval, hygienic storage and correct use of ingredients and additives
- Approval, safe storage and correct application of chemicals such as pesticides, cleaning and disinfecting chemicals and lubricants
- Approval, hygienic storage and correct use of packaging materials and food containers
- Pest control
- Waste management
- Training requirements for staff
- Traceability and Recall procedures.

Once hazards related to the prerequisite programmes are under control, it is then only necessary to consider hazards that are species or product related.

Questions and Answers:

What is the difference between SOPs and SSOPs and Prerequisite Programmes?

There is little difference, and they describe the same process and form the fundamental foundation of HACCP plans. As the HACCP process has evolved from its inception from Codex CXC 1-1969, it seems that these processes have been preferred to be called Prerequisite Programmes and these include all the written instructions contained in SOPs and SSOPs.

Recommended Reading :

General Principles of Food Hygiene CXC 1-1969

https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf

FAO and WHO. 2020. Code of Practice for Fish and Fishery Products. Rome. https://doi.org/10.4060/cb0658en

https://www.fao.org/documents/card/en/c/cb0658en/

4.2. Day 2. Wednesday 30 March 2022

4.2.1. Factory visits

Site visits took place first to IPHS Fishing Harbour (Ile du Port Handling Services) and to CCCS (Central Common Cold Store) and thereafter to Unique Ocean Seafood Factory. The purpose of the site visits was to provide participants with first-hand experience of a working harbour and factory and assess the level of cold-chain integrity throughout (a key learning outcome of the workshop). It also served to give the participants an opportunity to make comparisons with operations in their home-countries and return with lessons and observations from the Seychelles. The participants also had the opportunity to observe landing and transhipment in the harbour.

Under the Blue Economy initiative, the new fishing harbour and cold store provide facilities will ensure more efficient and quick off-loading, better logistical outcomes and sorting operations to enhance value adding.

The 12 600-ton cold store offers storage facilities for tuna at -20°C and -40°C plus has 3 sorting and grading lines which are able to species sort and size sort fish directly from the purse seiners. There will also be an area of 1 950m² which will be available for fish processing.

The cold store has ample space for loading into and off-loading from 4 refrigerated vehicles.

Health and Safety and Critical Control Points for Hazard Analysis can be addressed differently, and more efficiently, depending on the local environment, legislation and necessity of producers/retailers. During theoretical training participants were thoroughly briefed on the minimum and maximum HACCP requirements necessary to ensure both health and safety and maximise raw material and product quality. The site visit to Unique Ocean Seafood Factory reinforced the lessons theory through immediate application of knowledge with guidance and support provided by technical experts who were available to draw attention to particular events and processes and answer questions from participants. In addition participants were permitted to handle fish raw products for species identification, an otherwise rare opportunity for those outside of the fishing industry and processing environment.

Figure 7: Workshop participants in required health and safety clothing at the Central Common Cold Store.

The Unique Ocean Seafood Factory is one of the new factories that has opened to add-value to non-cannable fish species for both the local and international markets.

The new fishing harbour with a 425m of quay space offers superb off-loading facilities for 5 tuna purse seiners and a separate area for net repairs. The tuna can be off-loaded directly into refrigerated containers or vehicles, or can be off loaded directly into the cold store which offers sorting and grading facilities.

Figure 8: Workshop participants receiving pre-factory visit briefing of health and safety requirements

Figure 9: Workshop participants at Unique Ocean Seafood Factory weighing the frozen fish dorado also known as mahi-mahi or common dolphinfish (*Coryphaena hippurus*).

	
A bin of frozen large yellowfin tuna	Landing in progress

	
Packing of marlin cubes	Visit to the fishing quay
	
Group work following the site visits	Debriefing after the site visits

Figure 10: Photos of the site visits and group discussions

Questions and Feedback post factory Visits:

- Participants were interested to understand at what temperature the cold store would reject fish from the vessel. Tuna direct from the vessel is rejected at a temperature of -9°C. The cold store offers facilities to reduce the temperature again rapidly to below -18°C. They were also keen to understand how traceability and chain of custody would be guaranteed by the cold store and were comforted by the response that the cold store would have a complete electronic record of all movements to guarantee these.

Site Visit Questions and Discussion:

- What did you notice about the pest control systems during the site visit?
  - Bait stations installed where required. It would be useful to have bait stations numbered as this eases managing this part of the pest control program.
  - Vehicle loading stations are well designed with dock seals for thermal efficiency as well as for preventing vermin entry.

  - An insectocutor was installed in an appropriate place for flying insects that manage to gain access through the loading and unloading anteroom. It is important that one door of the anteroom is closed at all times.

- Were there any thoughts that come to mind about the floor in the fish sorting/grading area?
  - Well designed with good product flow.
  - Easy to clean with good drainage. Some slope to the drains would be preferable.

- What did you notice about the offal bin that was being used?
  - A different colour bin was being used for offal to those bins for human consumption.
  - Offal bins should only be used for offal and must have a distinctly different colour.

- Could you clearly identify the bycatch species in the bins?
  - It was difficult to separate bycatch as it was mostly damaged bonito and some spotted oceanic triggerfish.
  - Most of the fish in the bins seemed not good enough for further processing for human consumption and was likely destined for fishmeal production.

- Is the Central Common Cold Store MSC certified for traceability?
  - Yes it has had a traceability audit and does separate MSC certified fish from specific vessels as needed.

At the end of the session participants were asked to consider the following two questions, so that the answers could be fed into the conclusions and recommendations of the workshop:

- How do we facilitate more bycatch being landed?
- How do we improve the quality of bycatch?

4.2.2. Hazard Analysis and Critical Control Point (HACCP)

How to prepare a HACCP Plan (see Appendix 7.4.4)

The Hazard Analysis and Critical Control Point (HACCP) plan is a preventative science-based system. HACCP prevents food safety problems from occurring rather than having to react to non-compliance of the finished product.

The HACCP system (CXC 1-1969) consists of seven principles:

- Principle 1 Conduct a hazard analysis.
- Principle 2 Determine the critical control points (CCPs).
- Principle 3 Establish critical limits.
- Principle 4 Establish a system to monitor control of the CCPs.
- Principle 5 Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
- Principle 6 Establish procedures for verification to confirm that the HACCP system is working effectively.
- Principle 7 Establish documentation concerning all procedures and records appropriate to these principles and their application.

These principles have to be followed in the development and implementation of an effective HACCP plan.

The presentation describes one procedure that can be adopted in developing and implementing a HACCP plan in a fish processing facility, with detail pertaining to the steps that are necessary to have a logical development.

Recommended Reading :

General Principles of Food Hygiene CXC 1-1969

https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf

FAO and WHO. 2020. Code of Practice for Fish and Fishery Products. Rome. https://doi.org/10.4060/cb0658en

Understanding Hazards and Controls (see Appendix 7.4 Part 5)

Once a Prerequisite Program is in place and managed effectively, then the HACCP team can consider developing a HACCP plan based on the 7 principles of HACCP as per CXC 1-1969.

The hazards that the team need to take into account are referred to as species related hazards and these relate to the species of fish that is being processed. Once these have been identified then the team should consider the process related hazards and these relate to the specific process that is being undertaken in the factory and the type of product that is being produced.

Hazards can be grouped together into the following categories:

- Pathogens from the Harvest Area
- Parasites
- Natural Toxins
- Scombrotoxin (Histamine) Formation
- Other Decomposition-Related Hazards
- Environmental Chemical Contaminants and Pesticides
- Methylmercury
- Aquaculture drugs
- Pathogenic Bacteria Growth and Toxin Formation (Other than Clostridium botulinum) as a Result of Time and Temperature Abuse
- Clostridium botulinum Toxin Formation
- Pathogenic Bacteria Growth and Toxin Formation as a Result of Inadequate Drying
- Staphylococcus aureus Toxin Formation in Hydrated Batter Mixes
- Pathogenic Bacteria Survival Through Cooking or Pasteurization
- Pathogenic Bacteria Survival Through Processes to Retain Raw Product Characteristics
- Introduction of Pathogenic Bacteria After Pasteurization and Specialized Cooking Processes
- Undeclared Major Food Allergens and Certain Food Intolerance Substances
- Metal Inclusion
- Glass Inclusion

HACCP teams need to evaluate the fish species being processed as well as the process involved carefully when formulating their plans. Apart from consulting the literature in their deliberations, they should also call on the advice of outside experts to assist them if there is any doubt.

Questions and Answers:

Are heavy metals, and in particular mercury, a species related hazard?

Yes, definitely a hazard and falls under the category of Environmental Chemical Contaminants and Pesticides. Your Competent Authority will routinely be analysing for heavy metals and particularly from experience with different species, for the larger fish, and if they exceed tolerances will not issue a health certificate.

In addition, the Competent Authority will also be regularly analysing for other Environmental Chemical Contaminants and Pesticides and will be closing areas for the harvesting of fish in those areas where contamination levels are exceeded.

In the manufacture of fish oil for human consumption is the histamine content of the incoming raw material considered important?

In this process, this should not be the important parameter but rather TVBN, and in any case histamine will end up in the fish meal. Fish oil for human consumption should be manufactured from fresh ingoing raw material. High histamines are probably coming from raw viscera, so would be important to heat these as soon as possible.

Recommended Reading :

General Principles of Food Hygiene CXC 1-1969

https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXC%2B1-1969%252FCXC_001e.pdf

Food and Drug Administration, Centre for Food Safety and Applied Nutrition, Office of Food Safety. Fish and Fishery Products Hazards and Controls Guidance Fourth Edition - June 2021

https://www.fda.gov/media/80637/download

4.3. Day 3 : Thursday 31 March 2022

4.3.1. Common Indian Ocean commercial fisheries bycatch

Frozen Fish Example (see Appendix 7.4.6).

A generic evaluation of the production of frozen fish fillets (skin-on or skinless) from the receipt of frozen raw material is considered.

The steps associated in the process include receipt, pre-processing storage, thawing, filleting, trimming, washing, packing, freezing and storage.

At each step in the process the potential hazards associated with different fish species and with that process step in fillet production is considered and discussed.

Questions and Answers:

At what point in the process should fish processors be concerned with heavy metal content (particularly mercury)?

If there is any doubt as to the mercury content of the fish, then fish processors should decline to buy the fish.

Is a dial indicating thermometer acceptable for a fish factory cold store?

Although a recording device thermometer is preferred, and should be calibrated and regularly checked for accuracy against a control instrument, a dial thermometer is acceptable for a processing factory if the temperature of the cold store is regularly checked (at least twice daily) and recorded. On the other hand, at a commercial cold store, an automatic recording thermometer should be installed.

Which method of freezing is preferred blast freezing or plate freezing?

It depends on the process and on factory space and capital constraints. For instance, on factory trawlers plate freezers are preferred because of space limitations. However, because of the faster freezing time refrigeration capacity needed is far higher than blast freezers. Blast freezers on the other hand are more versatile. Brands producing retail packs prefer plate freezers because of the uniform and square pack shapes.

Recommended Reading:

FAO and WHO. 2020. Code of Practice for Fish and Fishery Products. Rome.

https://doi.org/10.4060/cb0658en

Food and Drug Administration, Centre for Food Safety and Applied Nutrition, Office of Food Safety. Fish and Fishery Products Hazards and Controls Guidance Fourth Edition - June 2021

https://www.fda.gov/media/80637/download

Common IO fish bycatch (see Appendix 7.4.7).

The group were shown and tested on typical (expected) bycatch species. The process followed was through a series of slides showing species and their main identification characteristics (see Appendix 4 part 7). Identifying and separating bycatch can be difficult once frozen, so separation at source (catching) is always best. In most cases all product goes into the wells on board and mixed with "target" species. For a few species, crew remove bycatch species for freezing in the ships domestic freezers. There are a few vessels that carry both brine freezers and conventional freezers, but this is not the norm in the purse seine sector. The freezing process is different on longliners where blast freezers are used to reduce temperature rapidly for sashimi quality product.

Recommended Reading:

IOTC Inspectors Guide:

https://www.iotc.org/documents/iotc-psm-%EF%BF%BCspecies-identification-guide-fisheries-inspectors

IOTC Ide3ntification Cards :

https://www.iotc.org/node/3390

Bycatch Processing (see Appendix 7.4.8)

The following typical bycatch species were reported for geographical distribution, world catch, potential products that can be produced and possible hazards:

- Bullet tuna, Mahi mahi, Rainbow runner and Swordfish.

The type of products produced would depend on the quality of the incoming raw material. Poor quality in will never result in good quality out.

Note: there are potentially a large number of bycatch species that can be landed by the purse seine vessels – many of these are described in para 4.7. It is stressed however that defining bycatch depends on may factors including : gear type, area fished, season, market demand and separation when caught.

IORA Group Presentations

In addition to the questions posed post Factory visit (SEE PAGE 8), others were posed to the groups aimed at stimulating discussions and also as "homework" to be followed up on Day 4. Groups were broadly created for this purpose as follows:

Group 1: Bangladesh, India, Sri Lanka, Seychelles

Group 2: Mauritius, Maldives, Comoros, Seychelles

Group 3: Iran, Somalia, Tanzania, Mozambique, Seychelles

Figure 7: Working group exercices

4.3.2. Case Studies

Pioneer Example (Appendix 7.4.9)

The South African example of a Food Safety and Quality Management Plan was presented. The plan presented was that of Pioneer Fishing (West Coast) Ltd and involved their canning operation based in St Helena Bay.

The operation involves canning of both fresh sardine delivered direct to their canning factory as well as the canning of frozen imported sardine cutlets from Morocco. The process that was described was from imported frozen raw material.

Frozen cutlets are received at the plant from the cold store. The cutlets are removed from the packaging material and then thawed under controlled conditions. The thawed cutlets are loaded into slots on the automatic packing machine where a pre-determined number of cutlets are automatically packed into the cans. The cans are then pre-cooked in an exhaust box, the cooked-out juice is drained, the cans are vacuum sauced, a lid is seamed on and the cans are sterilized in a retort. After cooling the cans are stacked on pallets for storing in the warehouse. After clearance for sale the cans are labelled, cartonned and dispatched.

Questions and Answers

- Should the fish not also be checked for metal detection?

The processor has determined that the risk from metal contamination in the fish from the vessel is low, and the risk during heading and gutting is low (as the fish is handled and there is a cutting blade check). However, we agreed that there should be a metal detector check.

A subsequent relook at the flow diagram at step 18f reveals that the open cans after filling with fish and sauce run through a metal detector prior to seaming the can closed.

- What happens to product that has been inadequately processed?

If the product involved has been declared unsafe by the Thermal Processing expert then it should be destroyed under controlled conditions.

Participant Examples

Presentations were made by participants from selected countries as examples of processing in their own countries. The countries that presented were: i) Mauritius; ii) Iran; iii) India; iv) Seychelles; and v) Maldives

Group Homework: For each GROUP:

- Do you have a good example of a national processing plant? Please select one or two examples – describe its location, and target species, employment, markets?
- Do these facilities need to be modified for bycatch?
- If so, what changes do you think are needed?
- What bycatch species would you target?
- Is the regulatory framework adequate?
- Identify problem areas and gaps – please relate this to what we have discussed in the workshop

The presentations were excellent and stimulated discussion, providing good examples of bycatch processing across the region.

Summary of Country Presentations:

India - Overview of Indian Fishing Industry - Dr Nilesh Pawar

An overview of Indian Fishing Industry including legislative and compliance requirements, vessels and fishers, landings, processors and cold stores was presented which provided details on Seafood trade statistics and approval and control of pocessing units and cold stores and of seafood products both for the local and export markets. A Case study on the Purse Seine Fishery in Maharashtra involving reduction of effort, spatial and seasonal management and prohibition of hydraulic winch technologies was discussed as well.

Figure 8: Presentation on Indian Fishing Industry

Iran - Bycatch processing- Mr. Shahram Safiyary

There have been many projects on harvesting lanternfish in the Gulf of Oman. His presentation focused on the catching of the oily mesopelagic fish Lanternfish by mid-water trawlers in the Gulf of Oman which resulted as well in the catching of human consumption by-catch species. Lanternfish is reduced to fish meal and oil and the by-catch is frozen whole or processed into fish fingers. He added that unfortunately, this project is currently on hold because of the impact of the harvesting of the by-catch on the local fishing communities.

Mauritius - Bycatch handling- Mr. Dharmendra Degambur

In Mauritius, the by-catch is defined as species caught by tuna longline vessels that are not specified in their licenses and include "downgraded" fish which is basically damaged fish. His presentation described the history of handling this fish and now the current practice is all the by-catch is marketed through the Agricultural Marketing Body and sold to the local traders and processors. In addition, many other processors import by-catch species for value-adding.

Maldives – Bycatch Identification – Mr. Ashan Mohamed

The presentation described the process that is used in the Maldives to identify by-catch based on fish size and fish value. Identified by-catch is processed in EU approved facilities into a range of products sold locally and internationally.

Recognition that there's need to be more marketing plans, promotions, innovative production technologies and products in order to grow the business and create more jobs was noted. He emphasised on the importance of quality from the time of catching and through the value chain for a successful outcome.

Seychelles - Regulatory Framework for Bycatch

The problems associated with by-catch were described. They are split into three aspects of the value chain namely at sea, at the landing and the market. A better regulatory framework was proposed, which could assist in solving the issues.

4.4. Day 4 : Friday 1 April 2022

4.4.1. Export Requirements and Programs

IORA and Marine Stewardship Council (see Appendix 7.4.10)

An overview of the Marine Stewardship Council and the implications of MSC certification relating to bycatch was presented. It was pointed out that several purse seine and longline fisheries targeting tropical tuna in the Indian Ocean are MSC-certified and that management and exploitation of bycatch in these fisheries had potential implications for certification. It is also possible that some bycatch species, if a fishery developed as such, could be promoted for MSC certification. This could potentially add value to the exploitation of these species, assuming done sustainably in terms of the MSC Standard.

Requirements for exporting to EU / USA (Appendix 7.4.11)

This presentation firstly gave a general overview of export requirements for fishery products. The specific requirements for export to the EU, USA and China are then described.

Recommended Reading :

European Union:

https://ec.europa.eu/food/index_en

https://ec.europa.eu/food/system/files/2018-06/ia_trade_import-cond-fish_en.pdf

https://www.cbi.eu/market-information/fish-seafood/what-requirements-should-your-product-comply

United States :

https://www.fda.gov/food/guidance-documents-regulatory-information-topic-food-and-dietary-supplements/seafood-guidance-documents-regulatory-information

United Kingdom : Importing or moving fish to the UK - GOV.UK (www.gov.uk)

China : http://jckspj.customs.gov.cn/spj/zwgk75/2706880/2811812/2812040/index.html

Applications of an Artificial Intelligence (AI) and an Electronic Monitoring (EM) System in Small-scale Tuna Fishery Data Collection (Appendix 7.4.12)

An invited speaker, Mr Ahmad Catur Widyatmoko working with CSIRO and the University of Tasmania presented a stimulating talk on artificial intelligence and the use of Electronic Monitoring to assist monitoring and research in an Indonesian line fishery. Those interested can contact Mr Widyamoko directly through his contacts as provided in Appendix 7.4.12.

4.4.2. Closing Session

The workshop was wrapped up with an open discussion session. The aim of the final session was to get feedback on the way forward and on how any future workshops could be improved. The presenters and Cofrepeche consolidated the inputs into suggestions for improvement and recommendations (see below).

The workshop was officially closed by Dr Gatot Gunawan. In his closing remarks, he reiterated the importance of enhancing the value derived from commercial tuna fisheries bycatch species. He applauded participants for their participation and communication during the workshop and emphasised the importance of sharing insights amongst IORA member States through interactive workshops such as this on programme on enhancing by-catch landing, valorisation, traceability, and

quality. He thanked the organizers from France, AFD and Cofrepeche, and also expressed gratitude to the Government of Seychelles for hosting the event and the Seychelles Port Authority for providing access for the field visit.

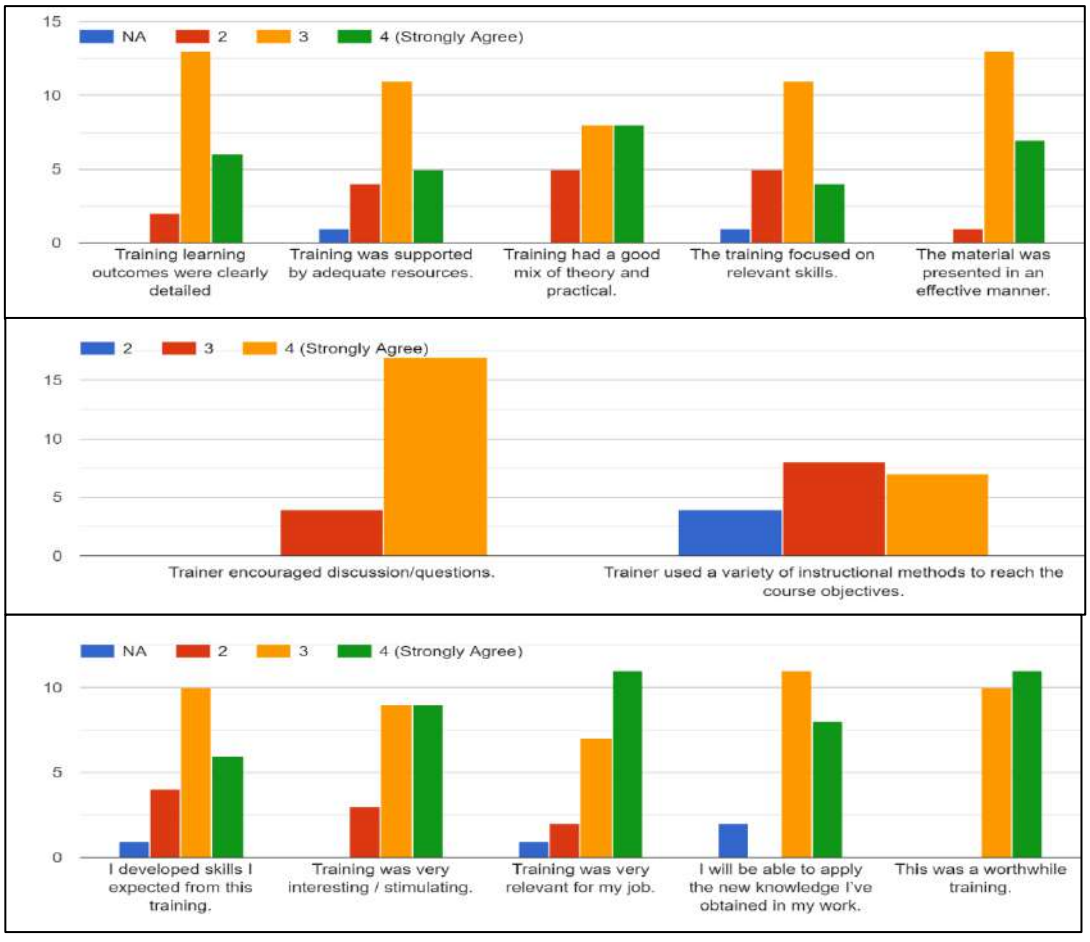
5. Workshop evaluation and participant feedback

5.1. Workshop evaluation

The workshop attendees responded to a questionnaire/critique that included presenter performance, materials, logistics and other aspects.

In summary, workshop participants either 'agreed' or 'strongly agreed' that the training programme covered materials that were relevant and that the training workshop outcomes were clearly defined and that materials were presented in an effective manner. Participants emphasized the value of the harbour site visits including to the processing plant and cold storage facility and that in future training workshops should be centred around these types of site visits and possibly include additional practical training such as fish species identification and access to vessels during offloading.

Participants mostly either 'agreed' or 'strongly agreed' that they developed skills that they had expected to from the training and that were relevant to their work in their home countries. Overall the training arrangements were rated by the 21 participants as 'good' (38.1%), 'very good' (42.9%) and 'excellent' (19%). Summarised responses to the workshop performance assessment are shown in 11 and 12 below.



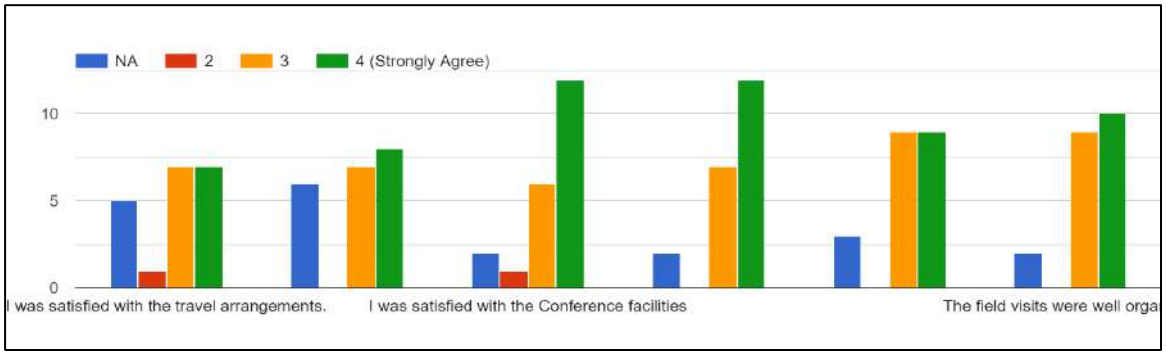


Figure 11: Summarised responses to the workshop performance assessment

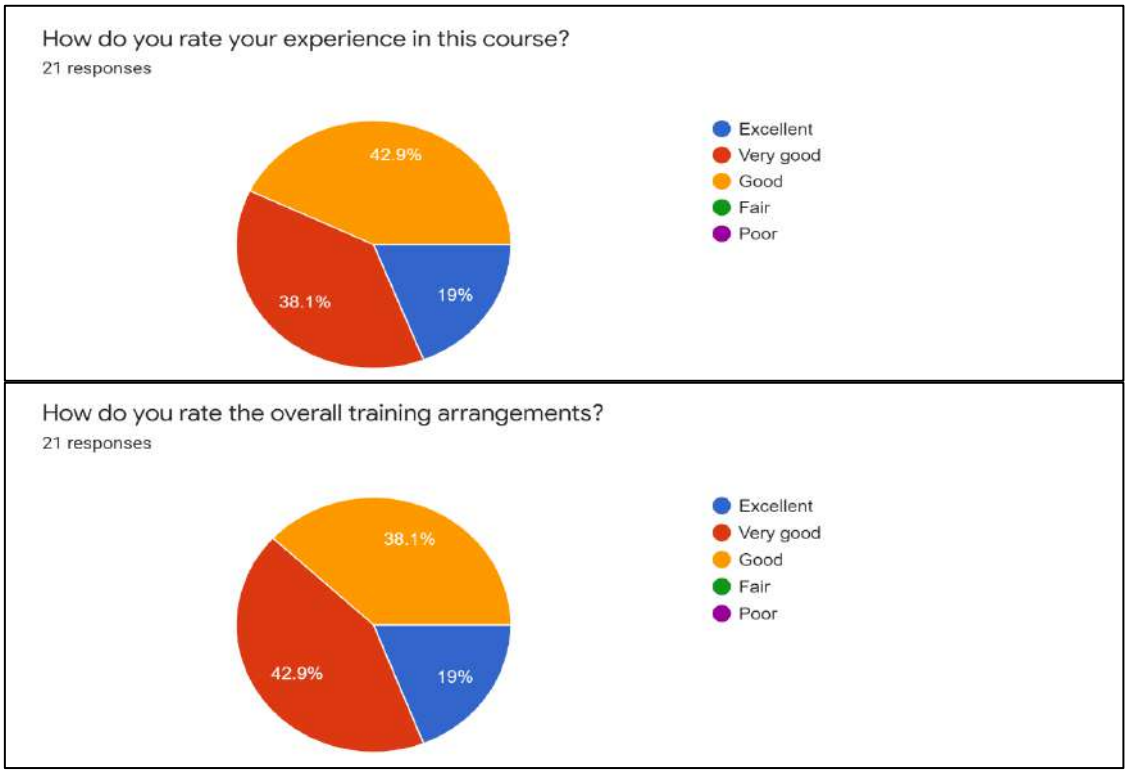


Figure 12: Summarised responses to the workshop experience.

5.2. Comments and Suggestions from participants

The participants made the following observations on the training on how it could be improved in the future.

- Visits to more processing plants - more partners in the fishing industries to be on board for two-way resolution
- The training was very interesting. I would suggest more site visits to processing facilities, species identification on-site/port sampling could have also been organised
- It can be organised later for training or another workshop as a refresher

- Need to consider about fish harvesting and unloading - Eg, Sri Lanka harvest purse seine by catch as our country need to include long line fishing and gill net fishing - considering other species like crustaceans - value added products, fertiliser, fish oil
- If possible, please invite/allow minimum 2 experts from each country for the programmes that deal with multiple subjects such as capture and post-harvest
- more field visits - to visit a purse seine vessel to observe the work need to know what are the products the produce each and every country who involved in the training - need practical sessions
- IORA can take in hand some training programme on - international regulations, law, bindings etc -international reporting capacity development by member countries - use of electronic devices (VMS, AIS) for developing MCS activities
- It's my first time to participate IORA training. The training was useful to my country and my skill.
- That would be very useful I think to invite some knowledgeable people from the sector such as technical people to describe their observations and experiences
- Need more people in different fish sector and processor also here in Seychelles
- There is also a need for hands on training that will involve practice for the participants
- Elaborate a road map for this initiative so that was can have some satisfactory results - the formalisation for the management of by catch should be effective and should be organised so that everyone benefits
- The training was very relevant and compromising because the ocean provides good resources, so good management must value and protect said resources for future generations.
- the training was a great experience, I got to learn new and exciting topics regarding the by-catch and the whole value-adding chain
- Need for practical experience and demonstration
- training was very good and full of knowledge - need to mark a framework to addressing this issue
- Overall the programme is excellent
- Before participating in this useful training I did not know about the by catch species, the coastal state or the vessel.
- The programme was excellent and unique and concepts such as Traceability, Ecolabeling etc
- We could have more information if the respective person was here. Overall was well.
- The training has been fruitful to me and skills and knowledge will be applied to my work
- I appreciate the organisation, especially for the registration and travel to Seychelles and I appreciate the hospitality of Seychelles.

6. Conclusions and Recommendations

The training took the form of theoretical presentations followed through with practical on site visits to a cold storage facility and fish processing factory to apply what was learnt and see firsthand the methods used in commercial enterprises to ensure bycatch species are treated properly to guarantee improvement in value potential.

The workshop was well received by all participants and provided important lessons to all on the value of improving bycatch handling from the point fish are caught at sea throughout the value chain. Participants were satisfied with the training materials and presentations and the site visits provided valuable insights into best-practice handling techniques for bycatch species.

6.1. Suggestions for training workshop improvement

1. Participants from IORA Member States should be given an opportunity to present country-specific fishery background at the start of workshop
2. Field trips – there is a need for more direct experience of on-board vessel processing and catching systems to fully understand the implications for bycatch. A field trip to a vessel and demonstrating discharge would be useful.
3. Improve IORA Member States representation at the workshop. The attendance was good but some key countries were missing.
4. Workshop on topic relating to processing fishing products should involve the participation of on-the ground processors, harvesters, downstream (post catching) experience to allow for direct interaction and experience.
5. More time should be allocated to visiting different processors and viewing of value-added products and options for processing e.g. canning, smoking, fishmeal.
6. The exchange of information and facilitation of regional engagement is very valuable and should be strongly supported. i.e. share experiences and best practices between countries in the region

6.2. Recommendations and workshop follow-up

The workshop made the following recommendations in response to the main questions posed by the workshop: How do we facilitate more bycatch being landed? How do we improve the quality of bycatch?

1. To organise bycatch workshop focusing on other fishery types and issues is recommended e.g. Shrimp, longline in the future
2. To recognise the importance of by-catch in small island developing states, developing countries and least developing countries fisheries
3. To apply the IOTC resolution on the landing of all species
4. To acknowledge the difference between bycatch usage between countries and fishery types e.g. industrial and artisanal. It should be noted that “bycatch” usage is largely not relevant in artisanal fisheries which tend to utilise everything
5. To pay attention and understand specific national systems and not compromise established fishery-specific usage of resources (by-catch or discarded fish) through poorly considered changes that might impact livelihoods
6. To support the adoption of a bycatch policy and related regulations in IORA Member States and at regional level that are consistent with management and resources sustainability
7. To support through the by-catch workshop participants the evaluation of IORA Member States national bycatch management systems (if at all) and provide feedback
8. To undertake a regional assessment of fisheries and bycatch level, usage, and needs in the IORA region (e.g., a catch benefit assessment might be helpful which could be assessed through a questionnaire)
9. To support the establishment a system for bycatch separation, retention, freezing and quality assurance that allows for value addition of bycatch[1]
10. To ensure that quality controls of by-catch species should adhere to the same standards as any other fish landed

[1] There is an established “bycatch” system of trade in purse seine and probably other fisheries – currently it seems very *ad hoc* and for crew benefit only.

11. To better integrate the bycatch aspects including the use of observers to monitor and support bycatch separation in the next IORA Blue Economy Work Plan
12. To evaluate technology needs in IORA Member States to improve options for extracting bycatch from the catching process on purse seiners– e.g., selective brailing, alternative chutes etc
13. To undertake a regional cost benefit assessment of bycatch utilisation, gaps, problem areas (i.e. identify what is needed and the likely cost implications and potential benefits).

7. Appendices

7.1. Appendix 1. Workshop Agenda

IORA Training programme on enhancing by-catch landing, valorisation, traceability, and quality.

Date: 29 March - 1 April 2022

Location: Eden Island, Mahé, Seychelles - Eden Bleu Hotel.

Attendees: Public Officers of National Fisheries Institutions representing each of the 23 IORA Member States

Trainers: Mr David Japp (CapMarine, South Africa) and Mr Mike Copeland (CapMarine, South Africa)

Facilitator: Mr Rondolph Payet (Cofrepeche – Main Resident Expert of the AFD TA to IORA)

Background

On the 1st of January 2018, the IOTC resolution 17/04 came into force. This resolution banned discards of bigeye, skipjack, yellowfin tunas and non-target species caught by purse seine vessels in the Indian Ocean. As part of their Blue Economy initiatives, several countries have since been seeking to capture this opportunity to protect vulnerable and endangered species whilst at the same time derive greater benefit from the resources fished within their waters. SWIO countries have adopted guidelines on the minimum terms and conditions (MTC) of fishing access that support landing and utilization of bycatch within their ports while recognising some of the operational difficulties that arise across that region.

Many of these bycatch species are used for food by coastal communities. With processing, they may also form a lucrative export market of salted, smoked or otherwise value-added fish products. Of critical importance is hygiene, safe handling practices and quality control. Increasingly importing countries (e.g. those of the EU) also require traceability of fisheries products entering their markets.

Large amounts of bycatch are captured in bottom fish and prawn trawl fisheries of Southeast Asia. These are largely used by communities or as fish-feed for aquaculture, but some may be discarded. Food security, livelihoods, and alternative income generation opportunities including utilization of sustainable bycatch and discards are being examined in South-East Asia (FAO, COFI 2018).

The AFD is providing Technical Assistance (TA) to the IORA and its Member States to “support IORA and its Member States in the coordination and implementation of the Work Plan of the WGBE and Work Plan of the IORA CGFM, with a strong focus on fisheries, aquaculture and protection of marine environment.”

The strong focus of the project is therefore on building the capacity of IORA and its Member States to achieve the specific objectives listed in the IORA CGFM Work Plan and the WGBE Work Plan concerning mainly fisheries, aquaculture and protection of the marine environment through the implementation of various activities also listed within the WGBE work plan. One of the objectives of the WGBE Work Plan is to **promote sustainable fisheries management**. Under this objective, one of the activities planned in the Work Plan is to **develop a training programme on enhancing by-catch landing, valorisation, traceability and quality**, including the development of safe handling guides and species identification guides.

Since Seychelles is an IORA–Member States and is already heavily involved in **the sustainable utilisation of bycatch,** it was proposed that a training course will be organised under the AFD TA to IORA in Seychelles to provide a 3.5-day programme, including a theoretical and practical demonstration of relevant practices and site visits to processing facilities. The workshop will include two distinct themes:

1. **Sea, ship to shore** – Bycatch species identification, on-vessel operational matters, catching and storing, vulnerable species, Minimum Terms and Conditions for foreign-flagged vessels fishing in coastal waters, lessons learnt from countries and WIO region.
2. **Onshore offloading, processing and valorisation** – Critical control points for bycatch handling during offloading and processing, local market opportunities and examples, minimum regulatory requirements for commercial fisheries products entering export markets especially traceability and sanitary aspects, infrastructure and the processing environment for common tuna fisheries bycatch species, processing and value addition – working examples from the region including a review of current best-practice and existing export channels.

The training course would also serve to validate what kind of species guide should be prepared or alternatively the possibility of project circulating copies of existing identification guides such as on sharks, shark fin identification, and existing practical solutions to identification of small-sized and unmarketable tunas within the catch.

Depending on the outcome of the training workshop, other IORA Member States may wish to host similar training workshops subsequently.

Training Workshop Schedule

Day 1 : Tuesday 29 March 2022

07h30 – 09h00	**Attendee Registration**
09h00 to 09h30	Opening Remarks • Dr. Gatot Hari Gunawan, Blue Economy Director, IORA Secretariat- • Ms. Sadna Ammearally-Nistar, Deputy Director, Agence Française de Développement (Mauritius and Seychelles) • His Excellency Mr. Dominique Mas, French Ambassador to the Republic of Seychelles • Honourable Minister Mr. Jean-Francois Ferrari, Designated Minister & Minister for Fisheries and Blue Economy
09h30 to 10h00	Tea Break and Group Photo
10h00 – 11h00	Training Workshop Objectives, Schedule and Introduction (David Japp (Trainer) • Introductions, each delegate to provide area of specific interest • Arrange 3-4 working groups for the workshop to include "regional" interests and commonalities • The groupings could be clustered such as "African Coastal States", "Indian Ocean Island States", "Asian States group" and "other" etc. • Q & A
11h00 – 13h00	Presenter : Dave Japp (Trainer) • IOTC fisheries • Key Conservation Measures • Fishery gears and species targeted • Species Identification • What is bycatch? • Potential alternate species for processing • Group inputs and regional dynamics or preferences? • Q & A
13h00-14h00	Lunch Break
14h00-17h30	Presenter: Mike Copeland (fish processing specialist/Trainer) • setting up a fish processing plant - basics and essential requirements • Pre-requisite programmes • Basics - hygiene practices and best management • Q & A

Day 2: Wednesday 30 March

08h30 -09h00	**Leave Hotel for site visits**
09h30 – 10h45	Site Visit 1: IPHS Fishing Harbour and the Common Cold Room (CCCS)
11h00 – 12h30	Site Visit 2: Providence Unique Ocean Seafood Factory
12h30	Return to hotel
13h00-14h00	Lunch Break
14h30 – 15h30	Presenter : Dave Japp (Trainer) • Discussion and feedback on the site visits • Delegate groups will be asked to give a 5 min (interactive) presentation / feedback on their observations. • The intention here is to identify any specific areas of interest or gaps that may assist in the discussions observations • Q & A
15h30-16h00	Tea Break
16h00 – 17h00	Presenter : Mike Copeland (Trainer) • How to prepare a HACCP plan • Understanding Hazards and Controls • Q & A
17h00 - 17h30	Group exercises Groups will be asked to do some homework and prepare short presentations on : • Case examples from the region of their interest • What species are processed or are likely • National regulatory requirements their region and gaps • What species are likely to be landed in your region, what is currently done, what are the gaps • Q & A Presenters will assist with a framework with questions e.g. • Identify the hazards and control points for frozen fillet • HACCP for fresh fillet and processed food - like burger/ or dried/smoked processing • Q & A
	End of Day 2

Day 3

08h00 – 08h30	**Arrival and Registration**
09h00 – 09h30	Group presentations (homework report back)
09h30 – 10h30	Presenter : Mike Copeland - Processing of bycatch • General frozen fish fillets • Receipt of frozen / ship product • Differences in quality species specific and brine / blast frozen examples Processing and value addition : • Mahi mahi • Kingfish • Rainbow Runner • Swordfish • Any other species
10h30 – 11h00	Tea Break
11h00 – 12h00	Bycatch Identification
12h00 to 13h00	Group Homework : 1. Do you have a good example of a national processing plant ? Please select one or two examples – describe it location, target and bycatch species. 2. Does it process bycatch le
	Lunch Break
14h00 – 15h30	South African Example - Pioneer Fishing **Presenter :** Mike Copeland (Trainer) • Quality Management Plan • Visual examples • Example of Critical Control Point • Q & A
15h30 – 16h00	Tea Break
16h00 – 17h00	Case Study presentations Group 1 Group 2 Group 3
18h00 – 20h00	Closing Refreshments
	End of Day 3

DAY 4

08h00 – 08h30	**Arrival and Registration**
09h00 – 10h30	Presenter : Dave Japp (Trainer)

	• Traceability • Catch certificate from vessel and significance of IUU • M & E and compliance • Ecolabels and their significance to bycatch in target fisheries • Marine Stewardship Council – an example • The MSC Standard and fisheries certified in the IORA • Chain of Custody and IUU products • Q & A Presenter : Mike Copeland (Trainer) • Import export requirements • Q & A
10h30 – 11h00	Tea Break
11h00 – 11h45	Presenter : Moko Widya (PhD Student) Electronic monitoring and Artificial Intelligence based data processing in resource limited/small scale fisheries, based in Indonesia.
11h45– 12h30	Workshop wrap-up & evaluation: • How can it be improved • Any suggestions moving forward or gaps
12h30-13h00	Closing Remarks (TBC)
	Lunch Break
	End of Training

7.2. Appendix 2. Opening and closing addresses

Training programme on enhancing by-catch landing, valorization, traceability, and quality, including the development of safe handling guides and species identification guides

29 March – 1 April 2022 : Eden Blue Hotel, Seychelles

Opening Speech by : Honourable Minister Jean-Francois Ferrari

His Excellency Mr. Dominique Mas, French Ambassador to the Republic of Seychelles

Dr. Gatot Hari Gunawan, Blue Economy Director, IORA Secretariat

Ms. Sadna Ammearally-Nistar, Deputy Director, Agence Française de Développement (Mauritius and Seychelles)

Distinguished Participants

Good morning.

Let me start by welcoming you all to the opening of this training programme and I wish to extend a special welcome to those coming from overseas. I hope besides the training, you will enjoy your stay in Seychelles.

The Indian Ocean Rim Association (IORA) and France through the Agence Française de Développement (French Development Agency - AFD) signed a Memorandum of Understanding (MoU) on the 9th of March 2020 for 'Strengthening the Capacities of IORA in Promoting the Blue Economy and Fisheries Management'. This partnership, is supporting the implementation of the IORA Action Plan (2017-2021) with an allocation of EUR1 million over three years, offering expertise, training, networking and material resources to decision-makers, officials and experts working to promote regional cooperation in blue economy and fisheries management.

We are very pleased to be a recipient of this support through our engagement in IORA, and for this, I thank you your Excellency, the Government of France and the IORA Secretariat. This two days' regional IORA training programme on Enhancing bycatch landing, valorisation, traceability and quality is but one of the initiatives emanating from this partnership, on a subject matter that is very important for the region, which is not being given the full attention and importance it deserves.

Bycatch, or the capture of non-target fish and ocean wildlife, remains one of the biggest threats to the health of ocean ecosystems, contributing to overfishing and the decline of fish populations and bio-diversity around the world. As you may already know, fishers discard fish for three main reasons: regulations prohibiting them from being kept, the fish that are of poor quality, or the fish having little to no market value. International guidelines have called for the reduction of discards in order to contribute to achieving the United Nations' Sustainable Development Goal 14—to conserve and sustainably use the oceans, seas and marine resources for sustainable development. However, discards are usually a bycatch of the main target fisheries. Throwing, bycatch back that their retention onboard is not prohibited is a waste of valuable protein that should enter our food systems. We do not want bycatch to be discarded at sea.

On the 1st January 2018, the IOTC resolution 17/04 came into force. This resolution banned the discards of bigeye, skipjack and yellowfin tunas including non-target species caught by purse seine vessels in the Indian Ocean. As some of you will recall, this proposal for a Resolution was originally brought to the IOTC by Seychelles and supported by many IORA states who are members of the IOTC.

Despite all our efforts, we are aware that discards still occur at sea beyond the watchful eyes of the authorities. But with the introduction of technology through Electronic Monitoring, we are extending our visions far beyond our coasts. The Seychelles Fishing Authority has embarked on the introduction of Electronic Monitoring System (EMS) on purse seiners operating in Seychelles waters and we have the ambition of pushing this to IOTC so that it can applicable in the whole Indian Ocean, complementing the human observer programme and also in instances where human observation is not practical.

In parallel, we believe that as we promote our local industries to increase the use of bycatch, the fish industry will realise there is value in these species. In fact, they already know but there are other factors in play which needs addressing. As part of their Blue Economy initiatives, several countries have since been seeking to capture this opportunity to protect vulnerable and endangered species whilst at the same time derive greater benefit from the resources fished within their waters. It is encouraging to note that South West Indian Ocean countries have adopted guidelines on the minimum terms and conditions (MTC) of fishing access that support landing and utilization of bycatch within their ports, while recognising some of the operational difficulties that arise across that region.

Many of these bycatch species are used for food by coastal communities. With processing, they may also form a lucrative export market of salted, smoked or otherwise value-added fish products. Of critical importance is hygiene, safe handling practices and quality control. Increasingly importing countries (e.g. those of the EU) also require traceability of fisheries products entering their markets. Thus, it remains important that our industries are brought up to the expected standards, whilst the Competent Authorities are equally empowered to deliver on their regulatory mandate.

The region has its' diversity. For example, large amounts of bycatch are captured in bottom fishing and prawn trawl fisheries of Southeast Asia. These are largely used by communities or as fish-feed for aquaculture, but some may be discarded. In the purse seine fishery of the western Indian Ocean, these bycatch billfish and other tuna-like species that can be used for food security, livelihoods, and alternative income generation opportunities. The utilization of sustainable bycatch is very important. This training session organised by IORA and finance by France through AFD is a clear message to the industry that we would like to see that all fish caught are landed. It is no longer ethical to just throw everything that you do need overboard. The fishing industry may consider the initial investment of reducing bycatch as a burden, but instead, should look to the benefits of reducing waste to improve long-term revenues.

I would like to draw two examples from our own local experience, as I understand that you will have a chance to visit some of our facilities. First, we have two main businesses that are currently involved in trading and processing the bycatch that otherwise would have been discarded by the tuna fishing industry. But complementing this, we also have downstream businesses that use the bycatch such as bonitos in the productions of snacks such as samosas which are popular with the locals. The food take-away business that provides the most lunches for our workforce uses the dorado (Mahi Mahi) fillet as fried fish with chips, steaks and other salted fish as example. Second, we recently welcomed the opening of the Common Cold Storage facility on Ile Du Port that sorts out fish by species and sizes. Thus, fishers have no longer have the need to sort at sea and discard their bycatch. Government have supported and facilitated this investment as it will also help in the reduction of waste in the industry.

These are little steps we have made, and this training is a step in the right direction. Many, tuna and tuna-like species such as the neritic tuna (bullet, Frigate, kawakawa and longtail longtail tuna) as well as King and Spanish mackerels, the marlins and sail fishes are undervalued at national and potentially international markets. But the key to extracting maximum economic value from these bycatch species is to ensure their good management, post-harvest handling and quality assurance from the time of capture to when they are landed, processed and reaching the destined market.

I hope that you take the maximum from this training and I am glad that it is happening in Seychelles. I know many of the countries in the IORA region are facing similar challenges, so let us share our experiences to ensure our fisheries are fully utilised sustainably, and bycatch are not seen as a burden to those that catch them, but rather a complimentary opportunity. In concluding, I would like to once aging thank France for their support to IORA, which is critical for enhancing the sustainable use of our fisheries within the Blue Economy context. I would like to thank IORA for organising this training and Cofrepeche as the Project Leader, and I wish you all a fruitful session.

Opening Address by Dr Gatot H. Gunawan, Director, IORA Secretariat

Excellencies, Distinguished Delegates, Ladies and Gentlemen

First of all, allow me to convey my deep appreciation and extend a warm welcome to all the distinguished invitees present here today for the Training programme on enhancing by-catch landing, valorisation, traceability, and quality, including the development of safe handling guides and species identification guides.

Let me take this opportunity to extend my heartfelt appreciation and gratitude to the Republic of France and the Government of Seychelles for hosting this event, as well as for their continued support to the Secretariat. I must also commend the efforts of the AFD and COFREPECH team for the excellent hospitality and arrangement made for the training programme.

Since France joined IORA, it has played an active and constructive role within the Association. In fact, the IORA and France through the Agence Française de Développement (French Development Agency) (AFD) signed a Memorandum of Understanding (MoU) on 9th March 2020 for 'Strengthening the Capacities of IORA in Promoting the Blue Economy and Fisheries Management'. This partnership supports the implementation of the IORA Action Plan (2017-2021) and offers expertise, training, networking and material resources to decision-makers, officials and experts working to promote regional cooperation in blue economy and fisheries management issues.

Promoting Sustainable Fisheries Management is among one of the objectives of the Technical Assistance and conducting this training programme is part of the broader IORA-AFD cooperation. I must thank France for taking the lead to assist IORA in sustainably manage their fisheries sector, which provide food to hundreds of millions of people and greatly contributes to the livelihoods of coastal communities.

I would like to reiterate that Fisheries Management is one of the priority sectors of IORA and is also an important focus area of the Blue Economy that has received great interest of Member States, which represents significant opportunities for extending the socio-economic development of the rim countries of the Indian Ocean in an inclusive manner. In this regard, several capacity building programs and projects have been organised by Member States, including France, through AFD and COFREPECHE, in view of enhancing cooperation in this field. The IORA Core Group on Fisheries Management, which is being led by Indonesia also plays an important role in this regard by providing a coordinated mechanism for engaging relevant fisheries management stakeholders across Member States, which will not only pave the way for sustainable fisheries management in the IORA region, but also ensure the conservation and sustainable use of marine resources, as well as enhance the capacity of Member States in the protection and preservation of the coastal and marine environment. In addition, the Fisheries Support Unit of IORA is also tasked to address strategic issues in the fisheries and aquaculture sectors in the IOR region and capacity building programmes to address issues pertaining to highly migratory species is also part of the FSU's agenda.

Ladies and gentlemen,

Bycatch landing, valorisation, traceability and quality is one component of the IORA blue economy agenda, and it is an important issue in IORA Member States. I must admit that our countries differ in terms of economic development and all of them do not have the landing facilities and lack capacities to properly handle, preserve and process their fisheries products. In fact, most of them are characterized by relatively simple and inadequate landing facilities. However, they all recognised the importance to maintain fish quality from catch to landing to promote access to fish markets but the majority of “coastal communities" do not have the knowledge/training or facilities to meet the basic, but stringent, requirements for safe handling and quality control and are therefore excluded from lucrative value chains. The valorisation of bycatch species originating from large- and small-scale regional tuna fisheries in the Indian Ocean, is another issue that requires the attention of the IORA Member States given that many of these bycatch species could form a lucrative market and alternative income generation opportunities for coastal communities.

This training will thus highlight the importance of quality control/safe handling and product valorisation and traceability of fisheries products in the IORA region. Participants would also be exposed to existing species identification and safe handling guides that could be used in their respective countries.

I wish to highlight that IORA attributes high importance to building capacity of its Member States and we rely on the support and collaboration of regional/international organisations, Dialogue Partners and other relevant stakeholders, to share their technical knowhow, experiences and best practices.

Excellencies, Ladies and Gentlemen,

I am confident that this 2-day workshop will advance knowledge through the sharing of experience and best practices for the sustainable management of the fisheries sector, more specifically on enhancing by-catch landing, valorisation, traceability, and quality. I take this opportunity to convey to our Member States the Secretariat’s full commitment to the strengthening of the IORA’s blue economy agenda. Fisheries management will continue to be an intrinsic part of IORA’s mandate and I trust that this meeting will provide us with tangible outcomes that could be implemented for further sustainable development of the fisheries sector in the Indian Ocean region.

Ladies and Gentlemen, I once again thank the French Republic, through the AFD and COFREPECHE, for the excellent arrangements made and I do hope that this workshop will provide Member States with necessary information and expertise to better manage and develop their fisheries sector in a sustainable manner.

I thank you all and wish you fruitful deliberations.

Closing Remarks : Dr Gatot H. Gunawan, Director, IORA Secretariat

Excellencies, Distinguished Delegates, Ladies and Gentlemen

I would like to thank you all for attending the Training programme on enhancing by-catch landing, valorisation, traceability, and quality, including the development of safe handling guides and species identification guides I wish to extend my deep appreciation and gratitude to the organisers, France, AFD and COFREPECHE, for the excellent arrangements made and the hospitality provided to all of us.

I must admit that this training programme was successful in meeting its objectives set and I must thank the experts for the insightful presentations and for sharing their experiences with the participants during the past 4 days. I also wish to thank the Government of Seychelles for hosting this event and for all the support provided to facilitate our travel and stay in Seychelles, as well as the Seychelles Port Authority for providing us access for the field visit.

Ladies and Gentlemen,

I also wish to thank you for your active participation during the training and for the various exercises that were carried out. One of the interesting parts of the training was the field visit, which enable participants to learn from the best practices and experiences of Seychelles. The interactive sessions, the group exercises and presentation were also very useful in enabling Member States, not only share information, but also to indicate national regulatory requirements of the region and identify the gaps that would be really useful for IORA and AFD to plan for future activities. I understand that COFREPECHE will provide us with the report and the recommendations made during this training and I encourage you to provide us with your recommendations on the types of future projects that you wish IORA and AFD to consider implementing for the benefit of the region.

Before concluding, I would like to thank once again France, AFD and COFREPECHE for organizing this event for their active role in implementing and carrying out projects under the France-IORA MoU and for their continuous support to IORA.

I look forward to our next events and wish you safe travel back to your respective country. And please enjoy the rest of your stay in Seychelles. Thank you.

7.3. Appendix 3. List of Participants

AUSTRALIA

Ahmad Catur Widyatmoko

PhD Candidate, University of Tasmania

ahmadcatur.widyatmko@utas.edu.au

moko.widyatmoko@csiro.au

BANGLADESH

Mohammad Nazim Uddin

Assistant Director, Department of Fisheries

Tel: + +88 (0) 2333317390 Mobile: +88 0 1716566752 Email: nazim.ict94@yahoo.com

COMORES

Soifa Ahamed

Inspector Sanitaire, Office de Certification, Moroni, Comores

Mobile: +269 3337122 Email: soifaahamed@yohho.fr

INDIA

Dr. Nilesh Pawar

Deputy Director (Ag), Department of Fisheries

Tel: +91 11 2331 0351 Mobile: +91 9224753075 Email: nilesh.pawar85@dof.gov.in or nilesh.dof@gmail.com

IRAN

Shahram Safiyary

Seafood Quality and Processing Officer, Iran Fisheries Organisation

Tel: +98 21 66942584 Mobile: +98 91 21506931 Email: pars2002@gmail.com

MALDIVES

Ashan Mohamed

Fisheries Officer, Ministry of Fisheries, Marine Resources and Agriculture

Mobile +960 7993484 Email: acchancy@gmail.com
ahsan.mohamed@fishagri.gov.mv

MAURITIUS

Mr. Dharmendra Degambur

Divisional Scientific Officer, Ministry of Blue Economy, Marine Resources. Fisheries and Shipping, Mauritius. MCS/VMS and Import/Export Division. Trade and Marketing Centre, Freeport Zone, Mer Rouge, Port Louis.

Tel: +230 2062823 Mobile: +230 59116180 Email: ddegambur24@gmail.com

TANZANIA

Masui Vincent Munda

Senior Fisheries Technologist, Ministry of Livestock and Fisheries

Tel: +255 262 333612 Mobile: +255 754 589693 Email: masui287@gmail.com

Mwanamkuu Ali Imam

Analyst, Ministry of Foreign Affairs and East Africa Cooperation

Mobile: +255 712 134662 Email: mwanamkuu.imam@got.go.tz

SEYCHELLES

Ronny Antat

Development and Assessment Manager, Post-Harvest & Value Addition Section, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670378 Mobile: +248 2517772 Email: rantat@sfa.sc

Ms. Rona Arissol

Quality Control Analyst, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670378 Mobile: +248 2543454 Email: rarrisol@sfa.sc

Cindy Assan

Statistician, Seychelles Fishing Authority, P.O Box 449, Victoria

Tel: +248 670300 Email: cassan@sfa.sc

Margaret Prea

Senior Statistical Officer, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670328 Mobile: +248 258970 Email: mfigaro@sfa.sc

Christopher George Hoareau

Chief Fish Inspector, Fish Inspection and Quality Control Unit, Seychelles Bureau of Standards, Victoria

Tel: +248 434768/15 Mobile: +248 2530535 Email: vetfiqcu@seychelles.net

Mr Karl Seraphine

Senior Fish Inspector, Fish Inspection and Quality Control Unit, Seychelles Bureau of Standards, Victoria

Tel: +248 432768/15 Mobile: +248 2636461 Email: ikaseraphine@yahoo.com

Samentha Francoise

Quality Control Technician, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670378 Mobile: +248 2611590 Email: sfrancoise@sfa.sc

Margaret Ally

Senior Development Officer, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670328 Mobile: +248 2577299 Email: mally@sfa.sc

Nelson Jean

Enforcement Officer (Port Control), Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670321 Mobile: +248 2804592 Email: njean@sfa.sc

Carmel Rene

Inspection Officer, Seychelles Fishing Authority, P.O. Box 449, Victoria

Tel: +248 670300 Mobile: +248 2517904 Email: crene@sfa.sc

Daryn Mederic

Development Officer, P.O. Box 449, Victoria

Tel: +248 670300 Mobile: +248 2533630 Email: dmederic@sfa.sc

Moise Julius

Development Chef, P.O. Box 449, Victoria

Tel: +248 670300 Mobile: +248 2581595 Email: mjulius@sfa.sc

Natifa Pillay

Fish Processing Technician, P.O. Box 449, Victoria

Tel: +248 670300 Mobile: +248 2561602 Email: npillay@sfa.sc

SOMALIA

Mohamed Muse Adawe

Head of Licence and Compliance, Ministry of Fisheries and Compliance

Mobile: +252 618450626 Email: moha.adaawe@gmail.com

SRI LANKA

Sinesha Nuwan Karunarathne

Assistant Director, Department of Fisheries

Tel: +94 2283798 Mobile: +94 0 71 4048170 Email: sinesak@gmail.com

IORA SECRETARIAT

Dr Gatot Hari Gunawan

Director, Blue Economy, IORA Secretariat, Mauritius

Tel: +230 57214845 Email: gh.gunawan@iora.int

Dr Shamimtaz Bibi Sadally Roomaldawo

Project Manager, Blue Economy, IORA Secretariat , Mauritius

Tel: +230 59128252 Email: shamimtaz.sadally@iora.int

AGENCE FRANÇAISE DE DÉVELOPPEMENT

Sadna Ammearally-Nistar

Assistant Director, AGENCE FRANÇAISE DE DÉVELOPPEMENT

Regional Office for Mauritius and Seychelles, Le Caudan, Waterfront, Port-Louis, MAURICE

Tel: +230 213 6400 Email: nistarsa@afd.fr

COFREPECHE

Charline Caudin-Goeser : Director International Development

Bureau d'études en pêche et aquaculture/Fisheries and Aquaculture Consultancy, 32, rue de Paradis, 75010 PARIS, FRANCE

Tel: +33 (0)644321335/+33 (0)142681710 Email: charline.gaudin@cofrepeche.fr

COFREPECHE

Rondolph PAYET

Main Resident Expert :AFD Technical Assistance for the Implementation and Coordination of the IORA Action Plan in fisheries, aquaculture, and the marine environment

Tel: + 248 2618939 Email: r.payet@cofrepeche.fr

CAPMARINE

David Japp

Fisheries Specialist : Capricorn Marine Environmental, Cape Town, South Africa

Tel : +27 21 4252161 Mobile : +27 827886737 Email : dave@capfish.co.za

Mike Copeland

Fish Processing Specialist : Capricorn Marine Environmental, Cape Town, South Africa

Tel : +27 21 4252161 Mobile : +27 825721852 Email : copeland.fishconsult@gmail.com

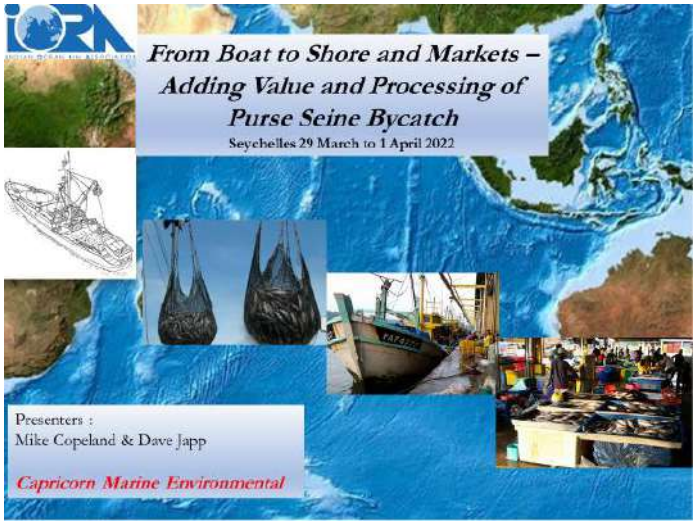
Stewart Norman

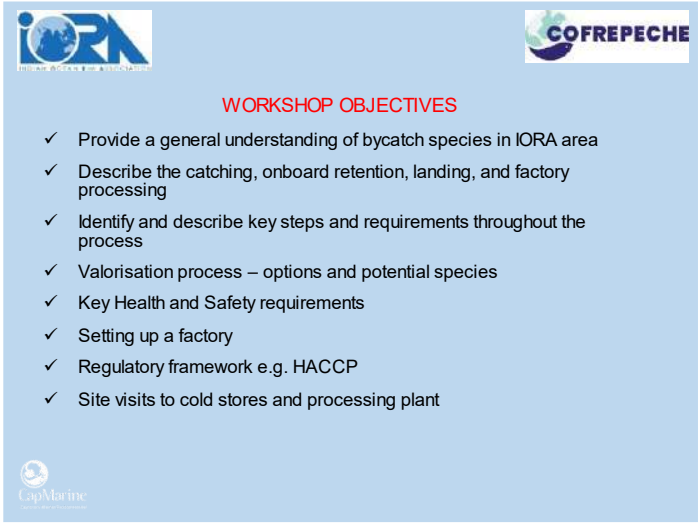
Fisheries Specialist : Programme Manager - Capricorn Marine Environmental, Cape Town, South Africa

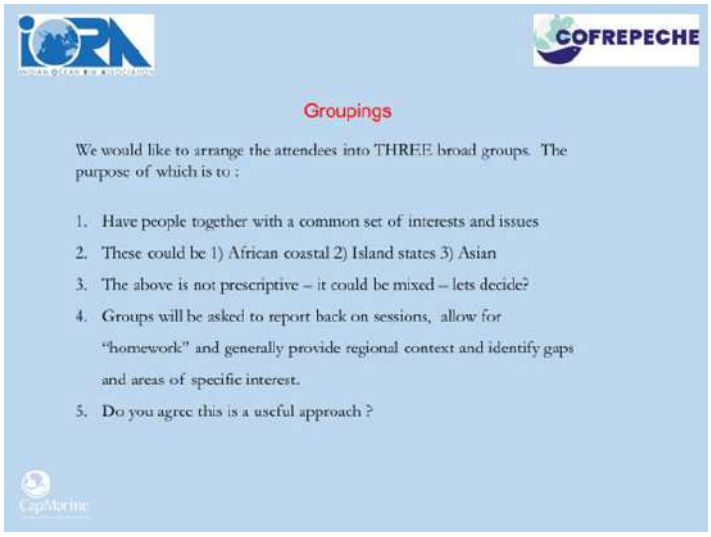
Tel : +27 21 4252161 Mobile : +27 826606141
Email : stewart@capfish.co.za

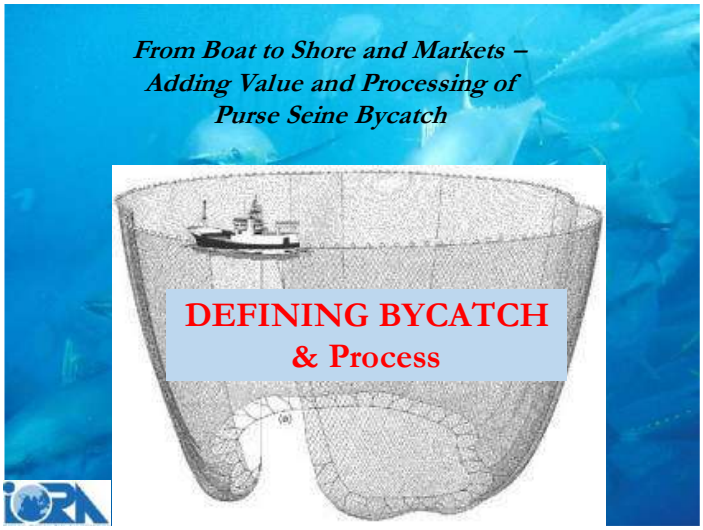
7.4. Appendix 4. Training Materials Presented

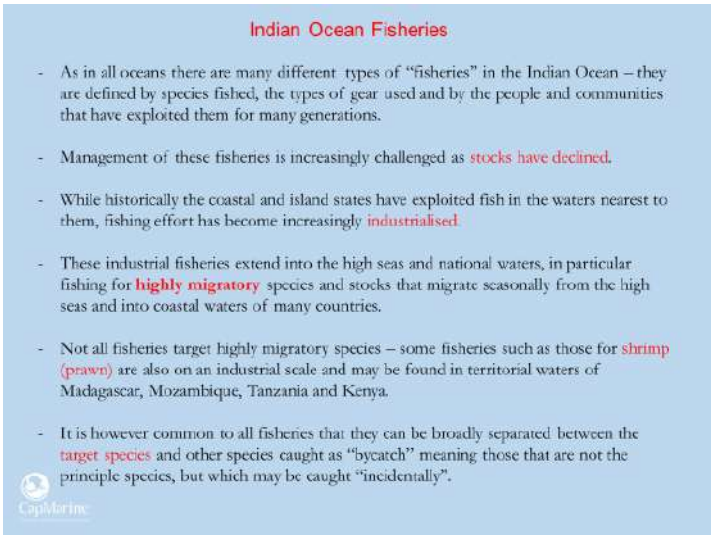
7.4.1 Workshop Objectives & Defining Bycatch











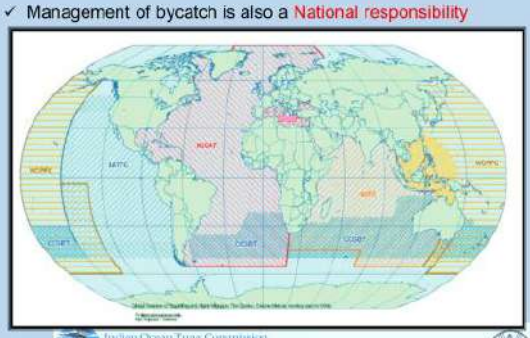
Defining BYCATCH

- We should be careful using the term "bycatch" –
- Bycatch may also include **incidental** species such as birds, sharks, marine mammals, and species commonly found in Vulnerable Marine Ecosystems (VMEs)
- In our workshop we focus only on **fish** "bycatch" and in particular those that are "non-target" which are generally not "optimally" utilised.
- These bycatch species have **commercial value** but are generally unwanted
- These species can be broadly defined as species that are
  - retained on board,
  - are not processed (value added)
  - are under some form of management measures
  - are recognised as having commercial potential if greater attention is paid to their quality management for processing and marketing
- In this workshop we focus only on one fishery, the **purse seine**, which is the largest single fishery in the Indian Ocean targeting the three main tropical tuna species – Skipjack, yellowfin and bigeye tuna.
- There are other fisheries of course – longline, gill net, pole and line etc – they too have bycatch but differ in scale and intensity, gear selectivity, species targeted and bycatch.

That is for another day

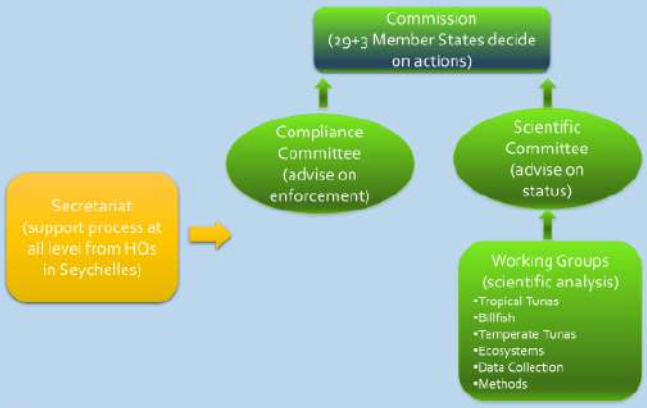
Management of Bycatch IOTC

- ✓ Promote conservation and optimum utilization of tuna stocks
- ✓ Promote sustainable development of fisheries
- ✓ Management of bycatch is also a National responsibility



Indian Ocean Tuna Commission
Commission des Thons de l'Ocean Indien
iotc cto

The structure of IOTC



Indian Ocean Tuna Commission
Commission des Thons de l'Ocean Indien
iotc cto

IOTC Conservation Measures on Bycatch

- There are many **Conservation and Management Measures** in place (called CMMs) updated annually.
- Contracting parties (CPCs) are obligated to enforce these measures and report annually to the IOTC
- The typical control method is to set "catch limits" on the **target species.** That is not however the case in the Indian Ocean.
- Yellowfin tuna is managed by obliging CPCs with high catches to reduce their catch by upwards of 20% (include purse seiners from flags catching >500t per annum). Skipjack is managed through a **Harvest Control Rule.** Bigeye has a **Maximum Sustainable Yield** of 110 000 tons but no specific catch limit.
- The main bycatch limits are on Endangered Threatened and Protected species in particular birds, marine mammals, turtles, sharks and some billfish species – where the limit is often zero.

IOTC Conservation Measures on Bycatch

- In general the many relatively minor bycatch species have NO management measures or catch limits, however:
- **Resolution 19/05** requires that all **purse seine vessels** retain on board and then land, to the extent practicable, the following non-targeted species or species groups:
  - Other tunas
  - Rainbow runner
  - Dolphinfish,
  - Triggerfish
  - Billfish
  - Wahoo
  - Barracuda
- Except when unfit for human consumption or prohibited to retain
- For other gear types CPCs are only encouraged to release bycatch if alive and retain for landing if dead (as opposed to a obligation)

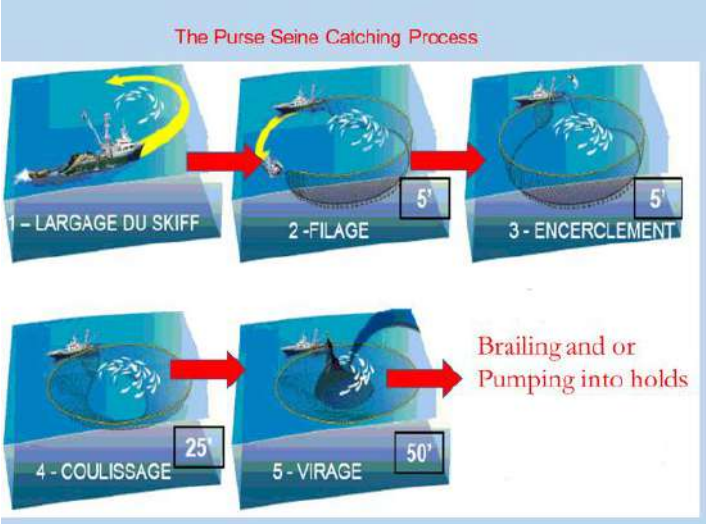
THE PROBLEM ?

Separating target species and bycatch

Skipjack – 500 000 t

Yellowfin – 400 000 t

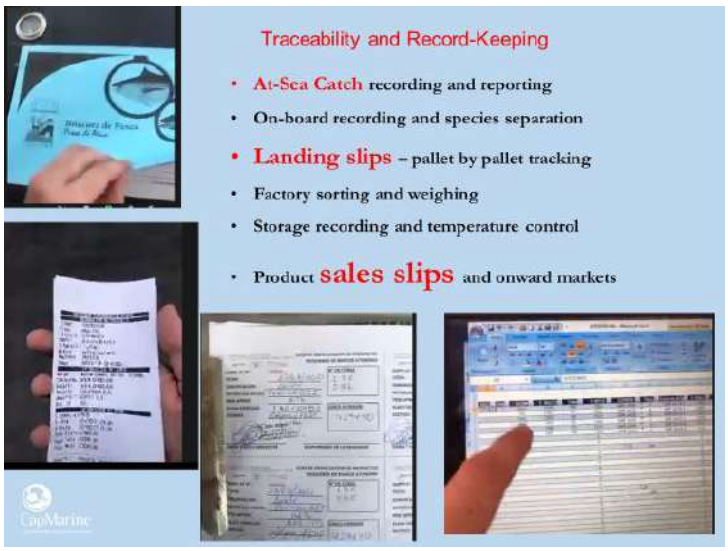
Bigeye – 80 000 t


The Purse Seine Catching Process
1 – LARGAGE DU SKIFF
2 -FILAGE
5'
3 - ENCERCLEMENT
5'
4 - COULISSAGE
25'
5 - VIRAGE
50'
Brailing and or
Pumping into holds

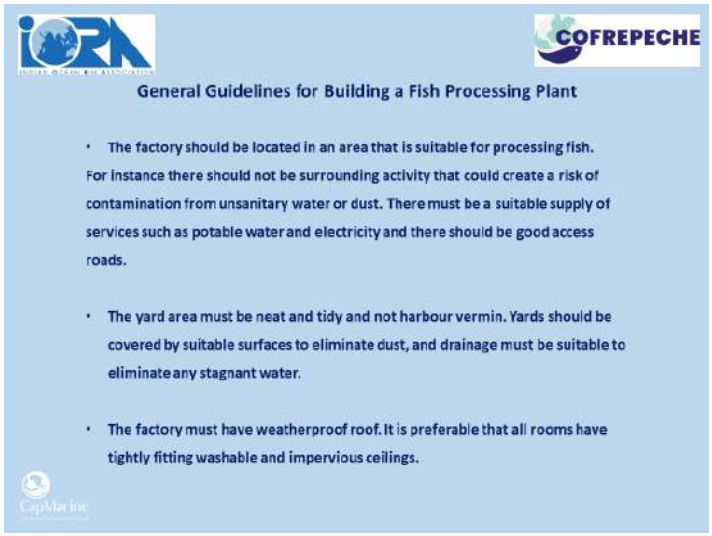

THE PROBLEM ? On Board
• species segregation
• Handling
• Freezing / cold chain
• Salt content management
• Poor quality management

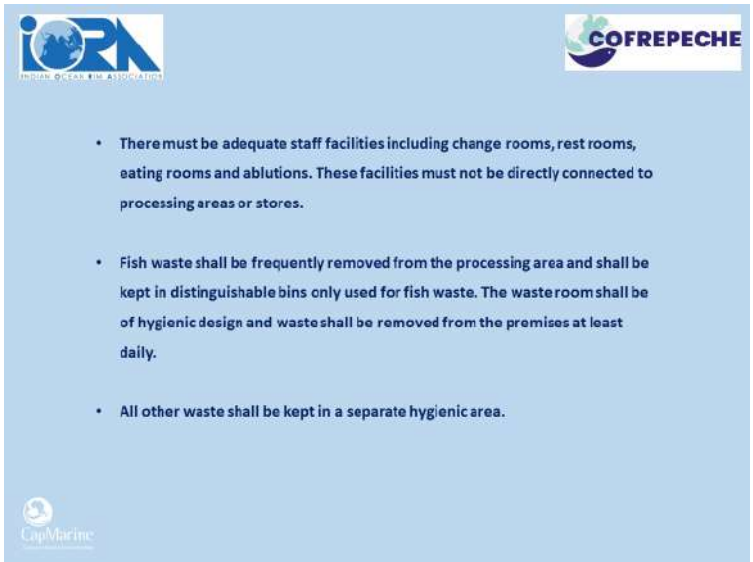

Ship to Shore
✓ Minimise handling
✓ Process quickly and efficiently
✓ Maintain Quality – process must be kept hygienic, clean to minimise bacterial growth
✓ Ensure safety and tracking (security)
Hold Extraction
Slinging ship to shore
TRUCKING


Shore to Factory
✓ Handling limited
✓ Smooth logistics and minimal delays
✓ Cold chain recording and maintenance
✓ Hand sorting and grading – handling kept to a minimum
✓ Stock holding and storage


Traceability and Record-Keeping
• At-Sea Catch recording and reporting
• On-board recording and species separation
• Landing slips – pallet by pallet tracking
• Factory sorting and weighing
• Storage recording and temperature control
• Product sales slips and onward markets

7.4.2 General Fish Processing and Factory Design





7.4.3 Prerequisite Programmes

Prerequisite Programs in Fish Processing Plants

Prior to the application of Hazard Analysis and Critical Control Point (HACCP) to any segment of the product processing chain, that segment must be supported by prerequisite programmes based on good hygienic practice or as required by the competent authority.

The establishment of prerequisite programmes will allow the HACCP team to focus on HACCP application to food safety hazards that are directly applicable to the product and to the process selected, without undue consideration and repetition of hazards from the surrounding environment.

Facilities should include product through-flow pattern designed to prevent sources of contamination, minimize process delays and prevent cross-contamination of finished product from raw materials.

Fish are highly perishable and should be kept chilled throughout the process, and the facilities should allow rapid processing and subsequent storage.

General Design Considerations of Factories and equipment

Ensure that the design will facilitate ease of cleaning and disinfection.

So in essence they need to be smooth, hard, impervious, rust resistant, non-toxic, cleanable and drainable.

Ensure that the design of the facility and equipment will minimize contamination

Easy to maintain and clean and in good repair
Physically separate where necessary
Adequate potable water and separate and adequate facilities for washing and disinfecting equipment and bins
Separate and suitable ice storage
Physically separate and suitable storage facilities
Exclusion of insects, pests etc
Good ventilation and flow and temperature control
Adequate staff facilities shall be provided
Good personnel flow
Minimal accumulation of solid, semi-solid or liquid wastes
Containers for offal and waste clearly identified, of suitable material and suitably constructed with fitted lid
Adequate lighting and suitable light covers
Good design of all service supplies such as plumbing, water, electricity, air, steam etc
All plumbing and waste should be able to cope with peak demand

Hygiene Control Programme

Schedules should be implemented to:
- prevent the build-up of waste and debris
- dispose of any rejected material in a hygienic manner
- monitor personal hygiene and health standards
- monitor the pest control programme
- monitor cleaning and disinfecting programmes
- monitor the quality and safety of water and ice supplies

Cleaning personnel should be well trained in the use of special cleaning tools and chemicals, methods of dismantling equipment for cleaning and knowledgeable in terms of the significance of contamination and the hazards involved.

A permanent cleaning and disinfection schedule should be drawn up to ensure that all parts of the processing facility and equipment therein are cleaned appropriately and regularly.

In each processing plant a trained individual should be responsible for the sanitation of the processing facility.

Personal hygiene and health

Personal hygiene and facilities should be such to ensure that an appropriate degree of personal hygiene can be maintained in order to avoid contamination.
Staff facilities shall be appropriate and adequate.
People involved in handling, processing or transportation shall be healthy and without open wounds.
Hand washing behaviour shall be strictly adhered to.
Personnel shall be appropriately attired.
Personnel shall not smoke, spit, eat or sneeze in processing areas.
There shall be written procedures on wearing of personal effects

Transportation

Suitably designed to avoid contamination and refrigerated where necessary

Recall Procedure

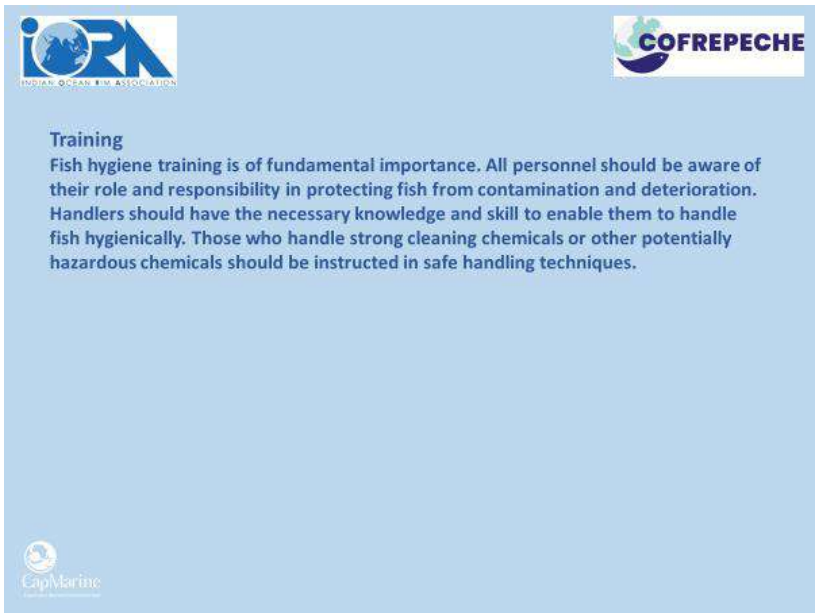
There shall be a written recall procedure in place in the event that products need to be traced and recalled from the market
Product tracing, which includes lot identification, is essential for an effective recall procedure.

Maintenance of premises, equipment and utensils
- They shall be maintained in a good state and order
- Shall be kept clean and in good repair
- Procedures for maintenance, repair, adjustment and calibration of apparatus shall be established. For each item of equipment, these procedures should specify the methods used, the persons in charge of their application, and their frequency

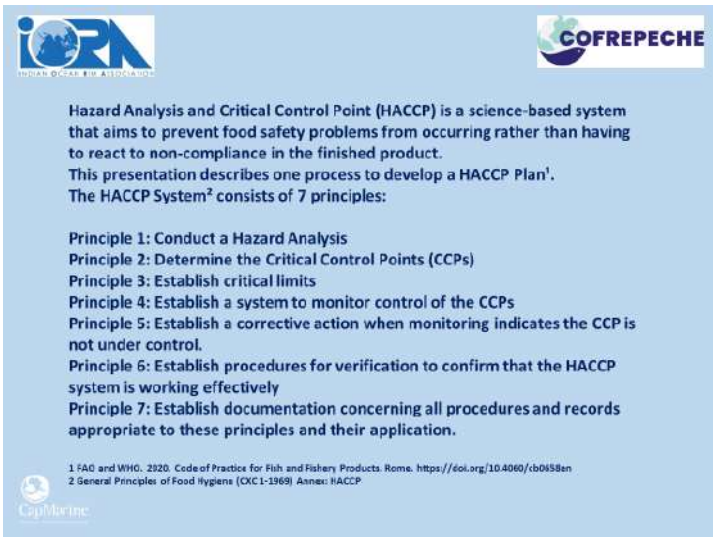
Pest Control systems
- Good hygienic practices should be employed to avoid creating an environment conducive to pests
- Have a written pest control programme
- Pest control agents should be applied by trained personnel

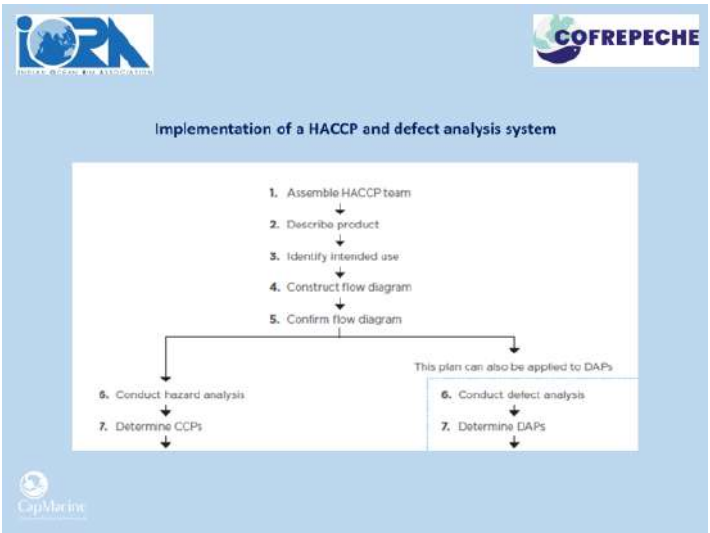
Water and Ice
- Use potable water if possible. If you have your own supply of water or seawater design control systems together with the competent authority.
- Manufacture ice from potable water or clean water

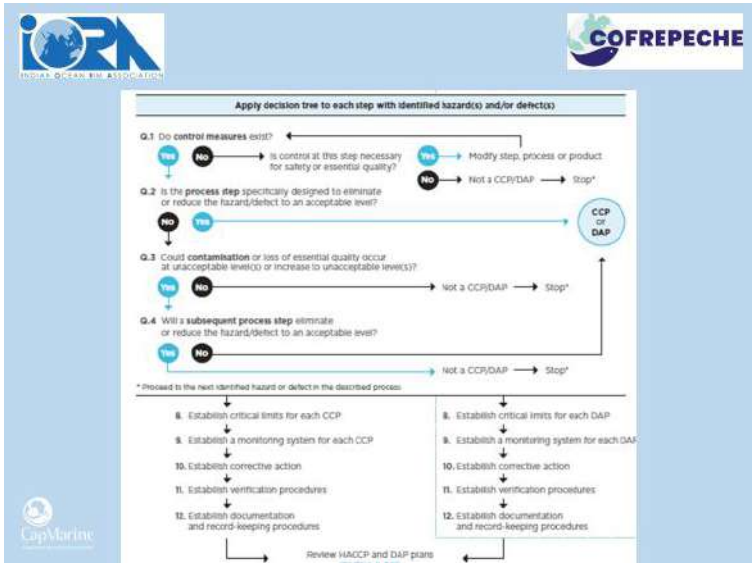
Waste Management
- Remove offal and waste materials regularly
- Suitable and separate, well maintained facilities for storing offal and waste materials



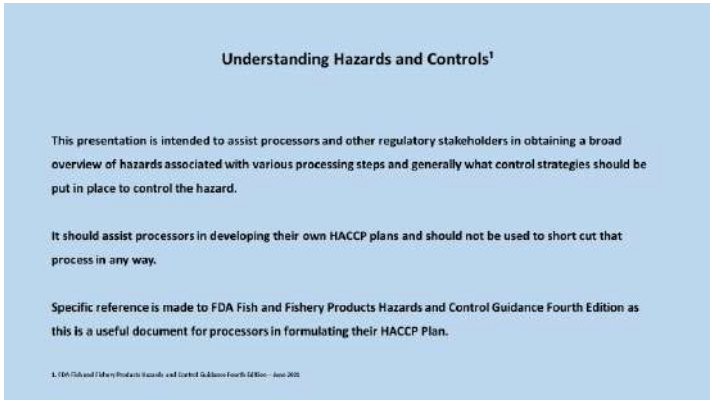
7.4.4 How to prepare HACCP plan

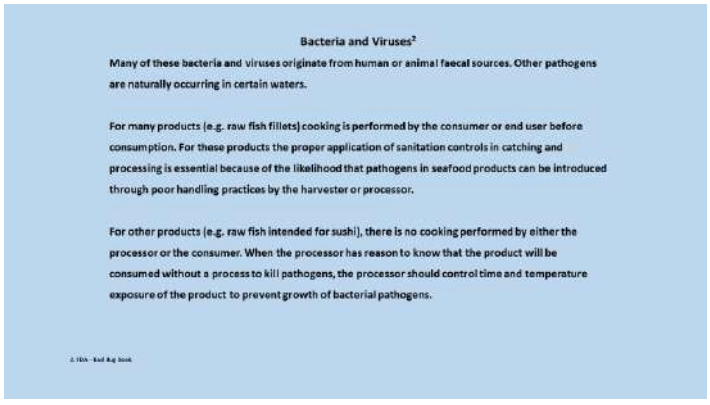


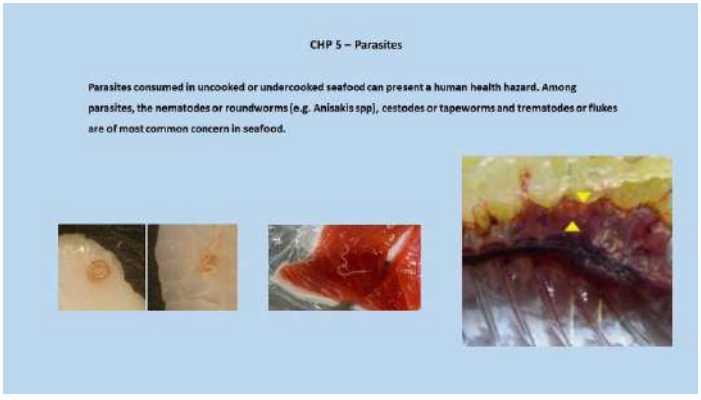




7.4.5 Understanding Hazards and Controls







Controlling Mechanisms

The process of heating raw fish sufficiently to kill bacterial pathogens is also sufficient to kill parasites.

The effectiveness of freezing to kill parasites depends on the temperature of the freezing process, the length of time needed to freeze the fish, the length of time it is kept frozen and the type of parasite present.

Typically freezing and storing at below -20°C for 7 days are sufficient to kill parasites. The lower the temperature the shorter the time.

Brining and pickling may reduce the parasite hazard but they do not eliminate it.

Trimming away the belly flaps and physically removing parasites are effective methods for only reducing the numbers of parasites.

CHP 6: Natural Toxins

Fish contaminated with natural toxins from the waters in which they lived can cause consumer illness. Most of these toxins are produced by naturally occurring marine algae (phytoplankton). Fish consume the algae, or animals that have consumed the algae, which causes the toxin to accumulate in the feeding animals body and results in higher levels up the food chain.

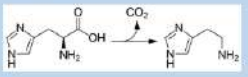
Ciguatera fish poisoning (from ciguatoxin) is commonly related to the consumption of subtropical and tropical reef fish which have accumulated naturally occurring ciguatoxins through their diet. Because ciguatoxin endemic areas are localized, the primary seafood processors should recognise and avoid purchasing fish from known areas of concern.

Gempylotoxins are wax esters naturally found in high concentrations in the meat of escolar and oilfish. These particular wax esters are indigestible and may cause diarrhoea and vomiting when consumed in sufficient quantities.
Tetrodotoxin poisoning is usually associated with the consumption of puffer fish from waters of the Indo-Pacific regions. Care should also be taken when handling venomous fish such as lionfish, scorpion fish and certain catfish.



CHP 7: Scombrotoxin (Histamine) Formation

Scombrotoxin (histamine) formation as a result of time temperature abuse of certain species of fish (e.g. tuna, mahi mahi, marlin etc) can cause consumer illness. The illness is closely linked to the development of histamine in these fish. However there is some evidence that other chemicals (e.g. biogenic amines such as putrescine and cadaverine) may also play a role in the illness.
Certain bacteria produce the enzyme histidine decarboxylase during growth. These bacteria are present in the marine environment or in the gills and viscera of fish. This enzyme reacts with histidine, a naturally occurring amino acid that is present in larger quantities in some fish than others (normally darker oily fish). The result is the formation of histamine.



Rapid chilling immediately after death is the most important element in any strategy for preventing the formation of histamine, especially for fish that are exposed to warm waters or air, and for tunas which generate heat in their tissues. Scombrotoxin-forming fish should be kept at temperatures below 4,4°C during processing.

CHP 9: Environmental Chemical Contaminants and Pesticides

Fish can be harvested from waters that are contaminated by varying amounts of industrial chemicals, including heavy metals and pesticides. These contaminants may accumulate in fish at levels that can cause human health problems. Concern for these contaminants in the tuna fishery primarily focuses on fish harvested from near-shore coastal waters (e.g. areas subject to shoreside contaminated discharges) rather than from open ocean.

Many contaminants accumulate in the edible fatty tissues of fish. Concentrations of these contaminants can vary considerably in individual fish of the same species from the same location, depending on factors such as their fat content, size, age and gender.

No fish may be harvested from an area that is closed to commercial fishing either by the state or Competent Authority or is harvested from an area that is under a consumption advisory.

At receipt of fish at the processing facility ensure that fish is harvested from safe areas. Monitoring of chemical contaminants and pesticides in coastal and open ocean waters is normally conducted by the Competent Authority on a regular basis.

CHP 12: Pathogenic Bacteria Growth and Toxin Formation (Other than C. botulinum) as a result of Time and Temperature Abuse

Pathogenic bacteria growth and toxin formation as a result of time and temperature abuse of fish and fishery products can cause consumer illness. This hazard is limited to bacterial pathogens since viruses are not able to grow in food. Of particular concern are the pathogenic forms of L. monocytogenes, Vibrio spp, E. coli, Salmonella spp, Shigella spp, S. aureus, C. perfringens, B. cereus, C. jejuni, and Yersinia enterocolitica.

Pathogenic bacteria can enter the process on raw materials. They can also be introduced from the air, unclean hands, insanitary utensils and equipment, contaminated water and through cross-contamination between raw and cooked product.

The primary method for control is to reduce levels through cooking or other treatments, or minimize the potential for recontamination and to maintain products at temperatures that do not support pathogenic growth.

Time and temperature abuse occurs when a product is allowed to remain at temperatures favourable for pathogenic growth for sufficient time to result in unsafe levels of either bacteria or their toxins in the product.

Fish and fishery products generally provide sufficient nutrients for pathogenic bacteria growth. Certain pathogenic bacteria grow well in time and temperature abused fish, others may grow if the natural condition of the raw fish is changed, such as through salting or reduced oxygen packing. Most pathogenic bacteria will grow well in temperature-abused cooked fish if their growth is not controlled by means such as drying, salting or acidification, because competing bacteria are destroyed by the cooking process.

The levels of a pathogen that are likely to be present in a fish or fishery product is dependent on factors such as the quality of the harvest water, how the raw material was handled before it was delivered to the plant, and the effectiveness of the sanitation control program.

Consider carefully the process to identify the pathogens that presents the greatest challenge with respect to managing time and temperature abuse in the product. This then becomes the target pathogens for time and temperature control and can be used to establish the safe exposure times.

There are a number of strategies for the control of pathogenic bacteria in fish and fishery products and these include for example managing the time that fish is exposed to high temperatures, killing bacteria by cooking or pasteurization, controlling moisture content in the product and controlling the amount of salt or preservative in the product or the pH of the product.

CHP 13: Clostridium botulinum Toxin Formation

C. Botulinum toxin formation can result in consumer illness and death. It is the toxin responsible for botulism.

C. Botulinum is an anaerobic spore forming rod that produces a potent neurotoxin. The spores are heat-resistant and can survive in foods that are incorrectly or minimally processed. Seven types of botulinum are recognised (A, B, C, D, E, F and G). Types A, B, E and F cause human botulism. The organism and its spores are widely distributed in nature. They are found in soil, bottom sediments of lakes and coastal waters, in intestinal tracts of fish and mammals and in gills and viscera of crabs and shellfish. The bacterium grows well in places with low oxygen.

There are a number of strategies to prevent C. botulinum growth and toxin formation during processing, storage and distribution of fish and fishery products.

Note that the prevention strategies are complex and require intense analysis and monitoring and control in the process.

1. For products that do not require refrigeration (i.e., shelf-stable products)
   - Heating the finished product in its final container sufficiently by retorting to destroy cells of C. botulinum types A, B, E and F (e.g. Canned fish)
   - Controlling the level of acidity (pH) in the finished product to 4,6 or below, to prevent growth and toxin formation by C. botulinum types A, B, E and F.
   - Controlling the amount of moisture that is available in the product (water activity) to 0,85 or below by drying, to prevent growth and toxin formation by C. botulinum types A, B, E and F and other pathogens that may be present in the product (e.g. shelf-stable dried products).
   - Controlling the amount of salt in the product to 20% water phase salt or more, to prevent the growth of C. botulinum types A, B, E and F and other pathogens that may be present in the product (e.g. shelf-stable salted products).




2. For products that require refrigeration (for example):

- Heating the finished product in its final container sufficiently by pasteurization to destroy the spores of C. botulinum types E, and non-proteolytic types B and F, and then minimizing the risk of recontamination and controlling the growth of the surviving C. botulinum bacteria with refrigerated storage (e.g. pasteurised crab meat).
- Heating the product sufficiently to destroy the spores of C. botulinum type E and non-proteolytic types B and F. and then minimizing the risk of recontamination by hot filling into the final container and then controlling the growth of the surviving C. botulinum bacteria with refrigerated storage (e.g. vacuum packed sauces).
- Controlling the amount of moisture that is available in the product (water activity) to 0,97 or below to inhibit the growth of C. botulinum type E and non-proteolytic types B and F by drying, and then controlling the growth of C. botulinum bacteria and other pathogens that may be present by refrigerated storage (e.g. refrigerated dried fish).
- Controlling the level of pH to 5 or below, salt to 5% water phase salt or more, moisture (water activity) to 0,97 or below or some combination of these barriers, sufficiently to prevent the growth of C. botulinum bacteria and other pathogens with refrigerated storage (e.g. refrigerated pickled fish).
- Controlling the amount of salt and preservatives (e.g. sodium nitrite) in the finished product, in combination with other barriers such as smoke, heat damage and other bacteria, sufficiently to prevent the growth C. botulinum bacteria and other pathogens in the finished product with refrigerated storage (e.g. smoked fish).

CHP 14: Pathogenic Bacteria Growth and Toxin Formation as a result of Inadequate Drying

Pathogenic bacteria growth and toxin formation in the finished product as a result of inadequate drying of fishery products can cause consumer illness. The primary pathogens of concern are S. aureus, and C. botulinum.

Dried products are usually considered shelf-stable and are often stored and distributed unrefrigerated (e.g. dried shrimp). The characteristics of dried products that makes them shelf-stable is their low water activity. Water activity is the measure of the amount of water in food that is available for the growth of microorganisms. A water activity of 0,85 or below will prevent the growth and toxin production of all pathogenic bacteria, including S. aureus and C. botulinum and is critical for the safety of a shelf-stable dried product. S. aureus grows at a lower water activity than other pathogenic bacteria, and should therefore, be considered the target pathogen for drying for shelf-stable products.

Controlling pathogenic bacteria growth and toxin formation by drying is best accomplished by:

- Scientifically establishing a drying process that reduces the water activity to 0,85 or below if the product will be stored and distributed unrefrigerated. Note that a heat treatment, addition of chemical additives or further drying may be necessary to inhibit spoilage organisms such as mould.
- Scientifically establish a drying process that reduces water activity to below 0,97 if the product will be stored refrigerated in reduced oxygen packaging.
- Designing and operating the drying equipment so that every unit of a product receives at least the established minimum process.
- Packaging the finished product in a container that will prevent rehydration.

CHP 15: Staphylococcus aureus Toxin Formation in Hydrated Batter Mixes

S. aureus toxin formation in hydrated batter mixes can cause consumer illness. This results from time temperature abuse at the hydrated batter mix storage or recirculation step. This toxin is a concern because it is not likely to be destroyed by subsequent heating steps that the processor or the consumer may perform.

S. aureus can enter the process on raw materials. It can be introduced into foods during processing, from unclean hands and insanitary utensils and equipment. The hazard develops when a batter mix is exposed to temperatures favourable for S. aureus growth for sufficient time to permit toxin formation. S. aureus toxin does not normally reach levels that will cause food poisoning until the numbers of the pathogen exceed 500 000.

However, toxin formation is not likely at temperatures below 10°C and thus toxin formation can be controlled by keeping batter mixes below 10°C.

CHP 19: Undeclared Food Allergens and Food Intolerance Substances

Food allergens are a significant public health concern. Consumers with allergies must avoid food containing allergenic materials to avoid severe allergic reactions. Successful avoidance requires that food manufacturers develop, implement and maintain the necessary controls to ensure allergens that are intended to be present in a food are declared on a the label and that the presence of unintended allergens is prevented. Product labelling, label control, and allergen cross-contact controls are an important part of a processor's HACCP program.

Certain food and colour additives can cause hypersensitivity reactions, or food intolerances, in some consumers.

Ensure that all allergens and food intolerance substances are declared on the label and that the correct label is applied to the finished product.

CHP 20: Metal Inclusion

Ingesting metal fragments can cause injury to the consumer.

Either have an on-line metal exclusion device (e.g. flotation, screen or magnet) or a metal detector. Frequent equipment checks for damage that can contribute metal fragments to the product is also useful.

CHP 21: Glass Inclusion

Ingesting glass fragments can cause injury to the consumer.

Glass inclusion can occur whenever processing involves the use of glass containers. Normal handling and packaging methods, especially mechanised methods, can result in breakage. Glass fragments originating from sources such as overhead light fixtures must be addressed in a prerequisite sanitary program.

ERC2-03-2 HAZARD ANALYSIS MATRIX

Methodology

9 – 36: High risk – indicates that the identified hazard needs to be managed my means of a CCP. Use Decision Tree to determine where the Critical Control Point (CCP) will be.

1 - 8: Low risk – indicates that the identified hazard needs to be managed by means of a prerequisite program – attention to be given to the preventative measures

TOTAL RISK = LIKELIHOOD x SEVERITY	
Likelihood	Severity
1 = Improbable event – once every five years	1 = Negligible – no impact or not detectable
2 = Remote possibility – once every year	2 = Marginal – Isolated complaint / concerned customer
3 = Occasional event – once per month	3 = Significant – Minor injury to consumer
4 = Probable event – once per week	4 = Major – Consumer admitted to hospital / serious short-term injury
6 = Frequent event – once per day	6 = Critical – all consumers at risk / product recall

Likelihood (Chance)	Severity (Effect)				
	1	2	3	4	6
1	1	2	3	4	6
2	2	4	6	8	10
3	3	6	9	12	18
4	4	8	12	16	20
6	6	10	18	20	36

Verification of the HACCP Plan

The plan is verified at regular intervals to ensure that it is meeting the objective of producing safe food.

Ways in which the system can be verified include:

- Collecting samples for analysis by a different method from the monitoring procedure
- Asking questions of staff
- Observing operations at CCPs
- Formal audit by independent person

Keeping Records

Record keeping is an essential part of the HACCP process.

Records that are kept include: all processes and procedures linked to PRP, CCP monitoring, deviations and corrective actions.

7.4.6 Frozen fish examples

Example of Frozen fillet production from Frozen raw material

(globalsources.com)

(Gardengrocer.com)

EXAMPLE OF FROZEN FISH FILLETS PRODUCTION

1. Receive Frozen Fish
2. Storage
3. Thawing ← Water
4. Filleting and Trimming ← Water
5. Washing ← Water
6. Packing ← Packaging Material
7. Freezing
8. Storage

Processing Step 1. Receiving Frozen Fish

It is important that the processor only accept fresh, frozen, wholesome fish into the establishment for further processing, and that information about the harvest area is known to be safe.

Potential safety hazards and quality defects include: Microbiological contamination, viable parasites, biotoxins, scombrotoxin, chemicals, salt and physical contamination.
If there is any doubt then further testing should be conducted before the consignment is accepted. Testing could include organoleptic evaluation (appearance, odour, texture), chemical indicators (e.g. TVBN, histamine, heavy metals, pesticide residues), microbiological test and foreign matter.

Temperature at receipt: Consignment should be rejected if the temperature exceeds that allowed by the Competent Authority and/or Fish Processing company standard.

Fish should be rejected if it is known to contain harmful, decomposed or extraneous substances that will not be reduced or eliminated to an acceptable level by normal procedures of sorting or preparation.

Salt content: The salt content of the incoming fish will determine what products can be manufactured from the raw material. If the fish has been brine frozen confirm with the Competent Authority, the markets to which products from the raw material can be sold.

Traceability: Make sure you have the Catch Certificate or similar as accepted by the Competent Authority.

2. Storage

Potential safety hazards and quality defects include microbiological contamination, biotoxins, parasites, dehydration and rancidity.

Move the raw material to frozen storage without delay.

The facility should hold the frozen product at a temperature of at or below -18°C, and with minimal fluctuations.

Calibrated indicating thermometer is a minimum, though a recording thermometer is recommended.

Product should be stored in a manner that allows stock rotation and traceability.

If product is going to be stored for a long time take measures to prevent dehydration.

3. Thawing

Potential hazards include microbiological contamination, biotoxins, scombrotoxin and decomposition.

The thawing method should be clearly defined and should address the time and temperature of thawing, temperature measuring instrument used and placement of device for measurement. The thawing schedule (time and temperature parameters) should be carefully monitored.

Where water is used as the thawing medium it should be of potable quality. Recycling of water must be controlled to prevent the build-up of microorganisms, and the water flow shall be sufficient to produce even thawing.

Product should not be exposed to high temperatures during thawing.

After thawing, fish should be immediately processed or refrigerated or kept at adequate safe temperature with ice.

4 & 5: Filleting, Trimming and Washing

Potential hazards and quality defects: Parasites, microbiological contamination, biotoxins, scombrotoxin, bones, decomposition and objectionable matter (e.g. scales).

To minimize delays, the design of the line shall be continuous and sequential to permit uniform flow without stoppages and removal of waste. Gutting process should be physically separate from filleting process.

An adequate supply of potable water or clean seawater shall be available for not only removing any signs of blood, scales or viscera but also for keeping the processing area and equipment clean.

Bones should be removed as appropriate and candling recommended in skinless fillets if parasites are an issue.

6. Packing

Potential hazards and defects include microbiological contamination, scombrotoxin, decomposition, metal inclusion, incorrect weight, labelling shortcomings and coding.

Only packaging materials and labels complying with the specifications of the processors should be used.

Packaging materials and labels shall be stored separately and in a dry appropriate store and in a manner that prevents cross contamination and any contamination.

Inks and dyes shall be approved.

Mass meters and metal detectors shall be calibrated.

Label according to appropriate Codex Standard and/or other relevant national legislative requirement.

(Sea Harvest)

(Woolworths)

7. Freezing

Potential hazards and defects include viable parasites, scombrotoxin, texture deterioration, rancidity, freezer burn and decomposition.

There should be no delay in starting the freezing process and the product should be frozen as quickly as possible. Facility production should be geared to the capacity of freezers.

Time and temperature regimes shall be established, detailed and monitored that it is adhered to. Accurate records shall be kept.

Frozen products shall be moved to the cold store as quickly as possible after removal from freezers.

For killing parasites ensure that established procedures are followed, monitored and recorded.

8. Storage

Store at or below -18°C.

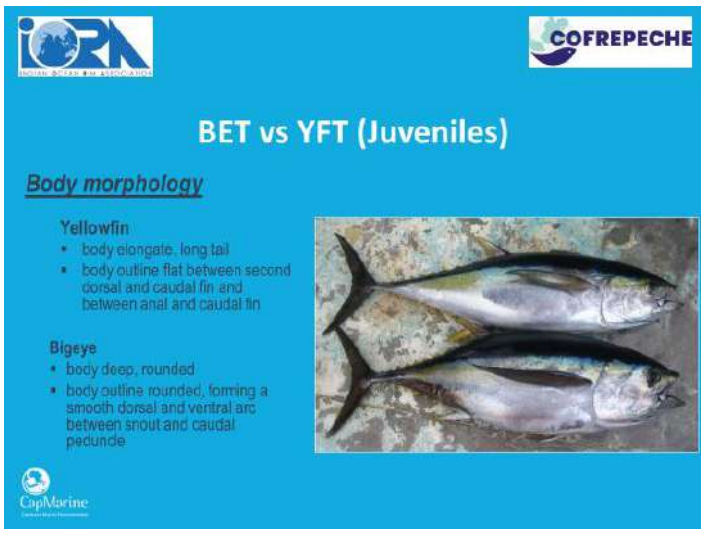
Monitor temperatures preferably by calibrated automatic temperature recorders.

Good stock rotation.

If parasites are a hazard, good inventory control to ensure sufficient cold treatment.

Labelling and Coding for Traceability.

7.4.7 Common IO bycatch



Difference between yellowfin and bigeye tuna

BET vs YFT (Juveniles)

Internal Characteristics
Swim bladder

Yellowfin
1. only in anterior half of body cavity
2. inconspicuous, usually deflated or slightly inflated

Bigeye
1. occupies almost entire body cavity
2. large, conspicuous, often inflated

Skipjack

(Katsuwonus pelamis)

1 – Black horizontal stripes on the belly
2 - Blue on the back
3 - Silver on the sides

SMALL TUNA

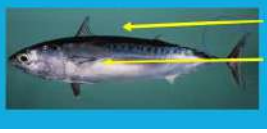
KAWAKAWA
Euthynnus affinis
CODE: KAW

- Extended 1st dorsal fin to 2nd dorsal fin
- Broken oblique stripes
- Black spots on the belly close to pelvic fin

FRIGATE TUNA
Auxis thazard
CODE:FRI

- 1st dorsal fin and 2nd dorsal fin spaced apart
- Short pectoral fins, reaching past vertical line from anterior margin of scaleless area

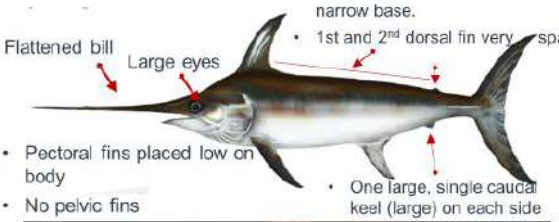
BULLET TUNA
Auxis rochei
CODE: BLT



- 1st dorsal fin and 2nd dorsal fin spaced apart
- Short pectoral fins, reaching past vertical line from anterior margin of scaleless area

SWORDFISH (*Xiphias gladius*)

- Prominent falcate dorsal fin with a narrow base.
- 1st and 2nd dorsal fin very spaced

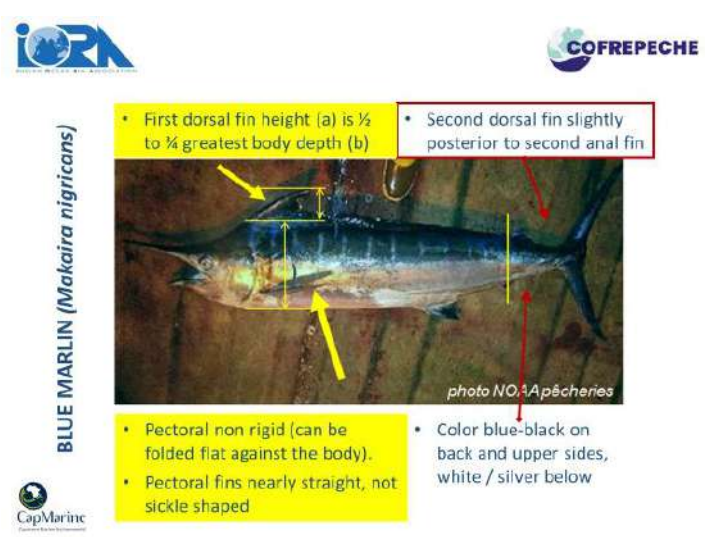


- Pectoral fins placed low on body
- No pelvic fins
- One large, single caudal keel (large) on each side

SHORTBILL SPEARFISH (*Tetrapterus angustirostris*)

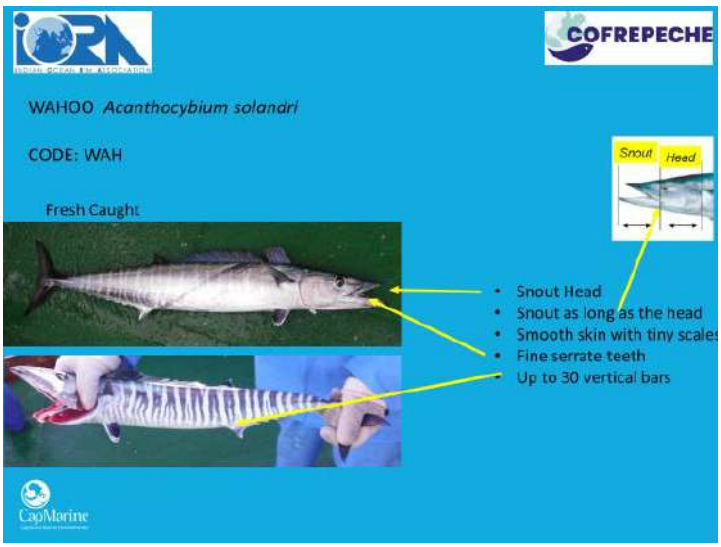
- Very short, stout bill (little overlap past lower jaw)
- Body very long, slender and laterally compressed
- Elongated, dark blue 1st dorsal fin, other fins are darker blue.

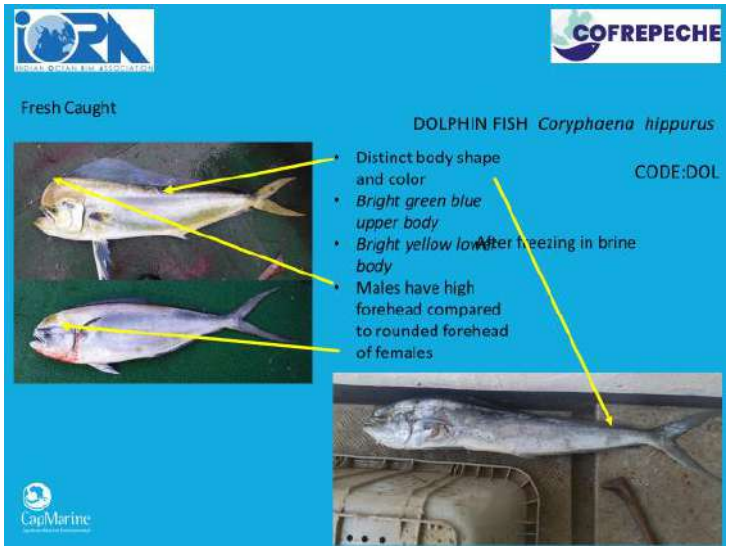
- Dark blue dorsal region cleanly separated from silvery white sides and belly
- Not clearly marked with vertical bars or stripes
- Low sloping nape (between bill and first dorsal fin)

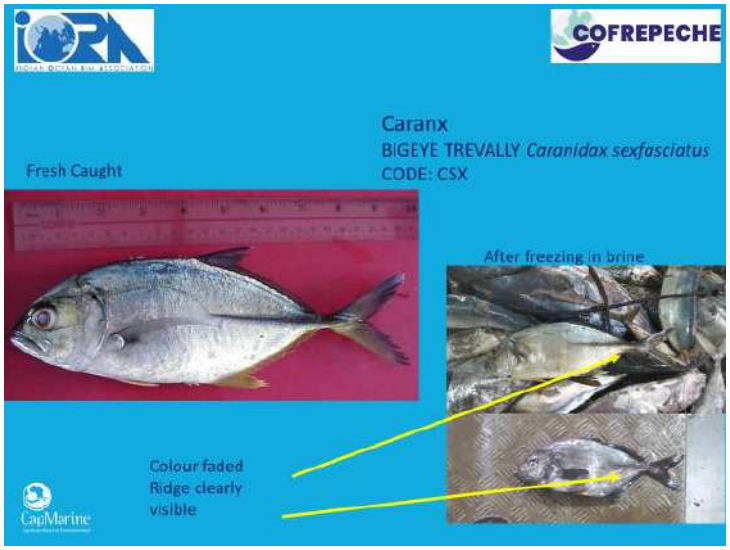

COFREPECHE
BLUE MARLIN (Makaira nigricans)
First dorsal fin height (a) is ½ to ¼ greatest body depth (b)
Second dorsal fin slightly posterior to second anal fin
photo NOAA pêcheries
Pectoral non rigid (can be folded flat against the body).
Pectoral fins nearly straight, not sickle shaped
Color blue-black on back and upper sides, white / silver below
CapMarine

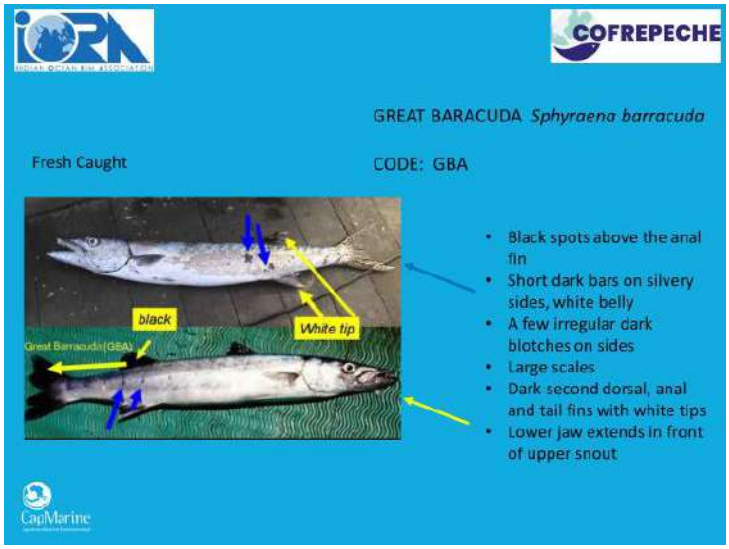

COFREPECHE
Fresh Caught
SPOTTED OCEANIC TRIGGERFISH
Canthidermis maculatus
CODE: TRI
After freezing in brine
White spots clearly visible
Spine (1 or 2) visible
White spots faded or fish appears completely black
CapMarine


COFREPECHE
RAINBOW RUNNER Elagatis bipinnulata
Fresh Caught
CODE: RRU
After freezing in brine
Blue and yellow stripes clearly visible
Two rayed finlets behind second dorsal and anal fins
Stripe colures faded but diagnostic finlets still visible
CapMarine


COFREPECHE
WAHOO Acanthocybium solandri
CODE: WAH
Fresh Caught
Snout
Head
Snout Head
Snout as long as the head
Smooth skin with tiny scales
Fine serrate teeth
Up to 30 vertical bars
CapMarine

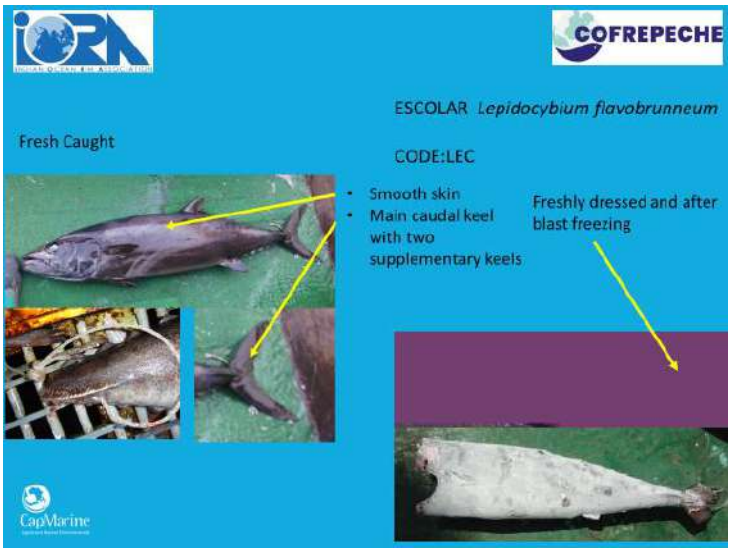

COFREPECHE
Fresh Caught
DOLPHIN FISH Coryphaena hippurus
CODE:DOL
Distinct body shape and color
Bright green blue upper body
Bright yellow lower body
After freezing in brine
Males have high forehead compared to rounded forehead of females
CapMarine


COFREPECHE
Caranx
BIGEYE TREVALLY Caranidax sexfasciatus
CODE: CSX
Fresh Caught
After freezing in brine
Colour faded
Ridge clearly visible
CapMarine


COFREPECHE
GREAT BARACUDA Sphyraena barracuda
Fresh Caught
CODE: GBA
black
White tip
Great Barracuda(GBA)
Black spots above the anal fin
Short dark bars on silvery sides, white belly
A few irregular dark blotches on sides
Large scales
Dark second dorsal, anal and tail fins with white tips
Lower jaw extends in front of upper snout
CapMarine


COFREPECHE
MACKEREL SCAD Decapterus macarellus
CODE: MSD
Fresh Caught
Black mark on the upper operculum
Body elongate and slender
Black metallic green upper body
Lower belly is silvery white
After freezing in brine
Black mark on the upper operculum
Body elongate and slender
CapMarine

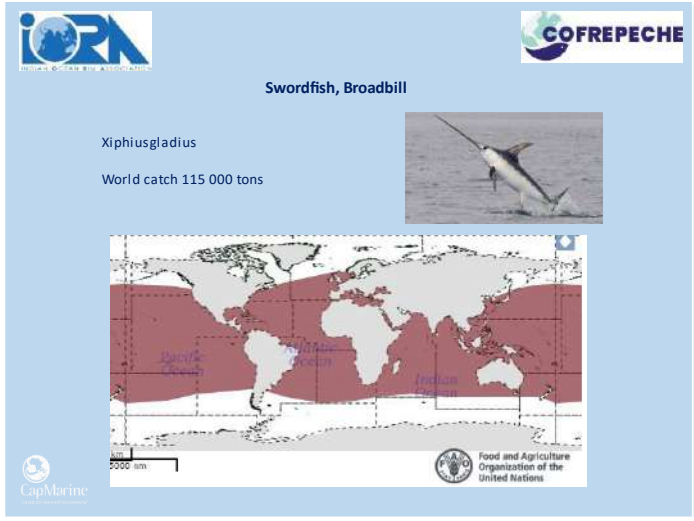

COFREPECHE
BIGEYE SCAD Selar crumenophthalmus
CODE:BIS
Diagnostic features
Body elongate and compressed
Lateral line with 30 to 42 scutes
Operculum with black spot
Large eye
After freezing in brine
Body compressed
Lateral line clearly visible
CapMarine


COFREPECHE
ESCOLAR Lepidocybium flavobrunneum
Fresh Caught
CODE:LEC
Smooth skin
Main caudal keel with two supplementary keels
Freshly dressed and after blast freezing
CapMarine


COFREPECHE
OILFISH Ruvettus pretiosus
CODE: OIL
Fresh Caught
Freshly dressed and after blast freezing
Very rough skin
CapMarine


COFREPECHE
Fresh Caught
SICKLE POMFRET Taractichthys steindachneri
CODE: TST
After blast freezing
Long dorsal and anal fins
CapMarine

7.4.8 Bycatch Processing



Species Related Hazards:
CHP 7 – Scombrotoxin (Histamine formation)

Process Related Hazards:
CHP 12 – Pathogenic bacteria growth– Temperature abuse
CHP 13 – C botulinum Toxin
CHP 16 – Pathogenic bacteria survival through cooking
CHP 19 – Allergens and Food Intolerance substances
CHP 20 – Metal inclusion

Rainbow runner, Rainbow yellowtail, Spanish jack, Hawaiian salmon

Elagatis bipinnulata

World Catch 15 000 tons

(Wikipedia)

Products typically:

Frozen round, Gutted, Fillets, Steaks, Salted Dried

Species Related Hazards:[1]
CHP 5 – Parasite
CHP 6 – CFP
CHP 7 – Scombrotoxin

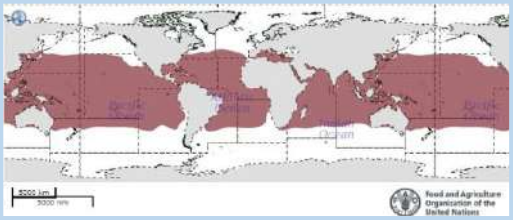
Process Related Hazards:[1]
CHP 12 – Pathogenic bacteria growth– Temperature abuse
CHP 13 – C. botulinum toxin (Vacuum pack)
CHP 14 – Staph aureus toxin (drying)
CHP 19 – Allergens and Food intolerance substances
CHP 20 – Metal inclusions

1 Fish and Fishery Products Hazards and Control Guidance Fourth Edition June 2021

Mahi mahi, Common dolphinfish, Dorado

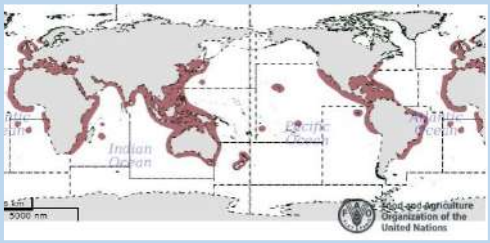
Coryphaena hippurus

Global capture 95 000 tons



Bullet tuna, Bullet mackerel

Auxis rochei
World catch 37 000 tons



Products produced typically fillets or steaks

Products typically:

Canned, Smoked, Dried, Salted

Species related hazard:[1]

CHP 7 – Scombrotoxin

Process related hazards:[1]

CHP 12 – Pathogenic bacteria growth – Temperature abuse

CHP 13 – C. botulinum toxin (Vacuum Pack)

CHP 19 – Allergens and Food intolerance substances

CHP 20 – Metal inclusions

1 Fish and Fishery Products Hazards and Control Guidance Fourth Edition June 2021

Species Related Hazards:

CHP 5 – Parasites
CHP 7 – Scombrotoxin (Histamine) formation

Process Related Hazards:

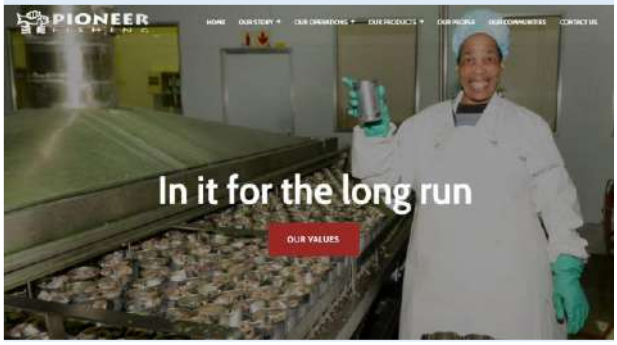
CHP 12 – Pathogenic bacteria growth – Temperature abuse
CHP 13 – C botulinum toxin
CHP 14 – Staph aureus toxin – Drying
CHP 18 – Pathogenic bacteria growth after pasteurization
CHP 19 – Allergens and Food Intolerance substances
CHP 20 – Metal inclusion

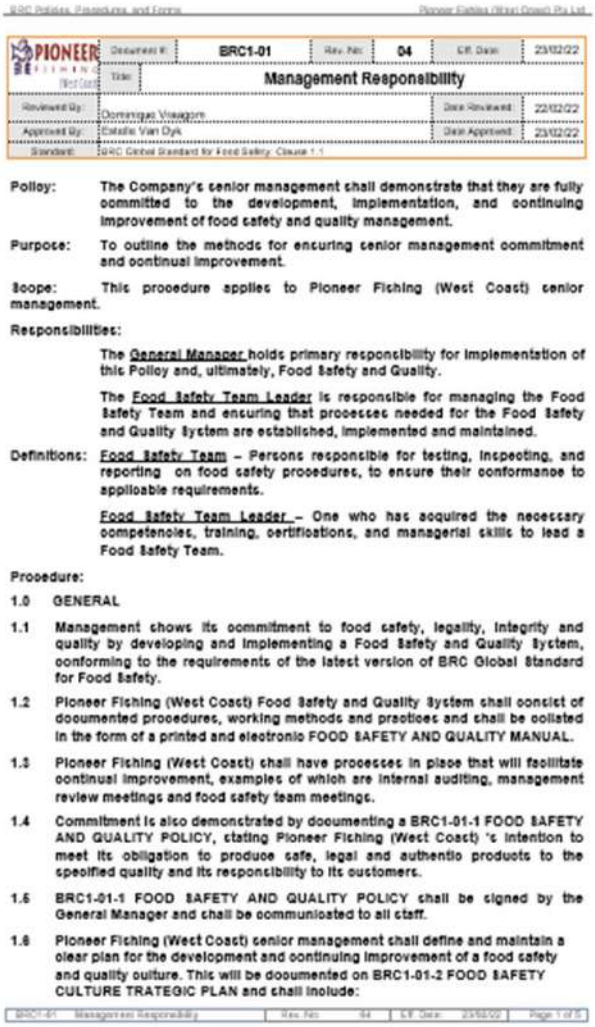
7.4.9 Case Studies

(Note: Not all materials are shown)

Pioneer example

Example of South African Quality Management Plan





PIONEER FISHING (West Coast)

Document #:	BRC1-01	Rev. No:	04	Eff. Date:	23/02/22
Title:	Management Responsibility				
Reviewed By:	Dominique Visagore			Date Reviewed:	22/02/22
Approved By:	Estelle Van Dyk			Date Approved:	23/02/22
Standard:	SANC Global Standard for Food Safety: Clause 1.1				

Policy: The Company's senior management shall demonstrate that they are fully committed to the development, implementation, and continuing improvement of food safety and quality management.

Purpose: To outline the methods for ensuring senior management commitment and continual improvement.

Scope: This procedure applies to Pioneer Fishing (West Coast) senior management.

Responsibilities:

The General Manager holds primary responsibility for implementation of this Policy and, ultimately, Food Safety and Quality.

The Food Safety Team Leader is responsible for managing the Food Safety Team and ensuring that processes needed for the Food Safety and Quality System are established, implemented and maintained.

Definitions: Food Safety Team – Persons responsible for testing, inspecting, and reporting on food safety procedures, to ensure their conformance to applicable requirements.

Food Safety Team Leader – One who has acquired the necessary competencies, training, certifications, and managerial skills to lead a Food Safety Team.

Procedure:

1.0 GENERAL

1.1 Management shows its commitment to food safety, legality, integrity and quality by developing and implementing a Food Safety and Quality System, conforming to the requirements of the latest version of BRC Global Standard for Food Safety.

1.2 Pioneer Fishing (West Coast) Food Safety and Quality System shall consist of documented procedures, working methods and practices and shall be collated in the form of a printed and electronic FOOD SAFETY AND QUALITY MANUAL.

1.3 Pioneer Fishing (West Coast) shall have processes in place that will facilitate continual improvement, examples of which are internal auditing, management review meetings and food safety team meetings.

1.4 Commitment is also demonstrated by documenting a BRC1-01-1 FOOD SAFETY AND QUALITY POLICY, stating Pioneer Fishing (West Coast) 's intention to meet its obligation to produce safe, legal and authentic products to the specified quality and its responsibility to its customers.

1.5 BRC1-01-1 FOOD SAFETY AND QUALITY POLICY shall be signed by the General Manager and shall be communicated to all staff.

1.6 Pioneer Fishing (West Coast) senior management shall define and maintain a clear plan for the development and continuing improvement of a food safety and quality culture. This will be documented on BRC1-01-2 FOOD SAFETY CULTURE TRATEGIC PLAN and shall include:

BRC1-01 Management Responsibility | Rev. No: 04 | Eff. Date: 23/02/22 | Page 1 of 5

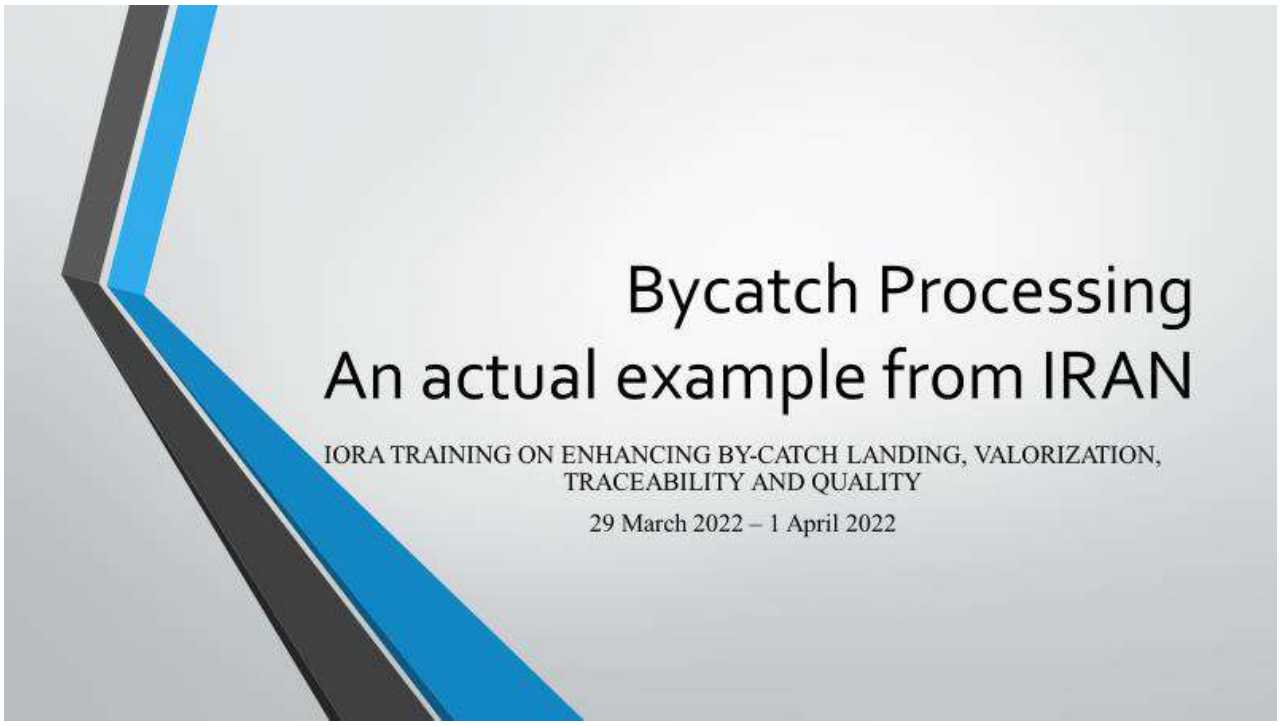
Country Case Studies

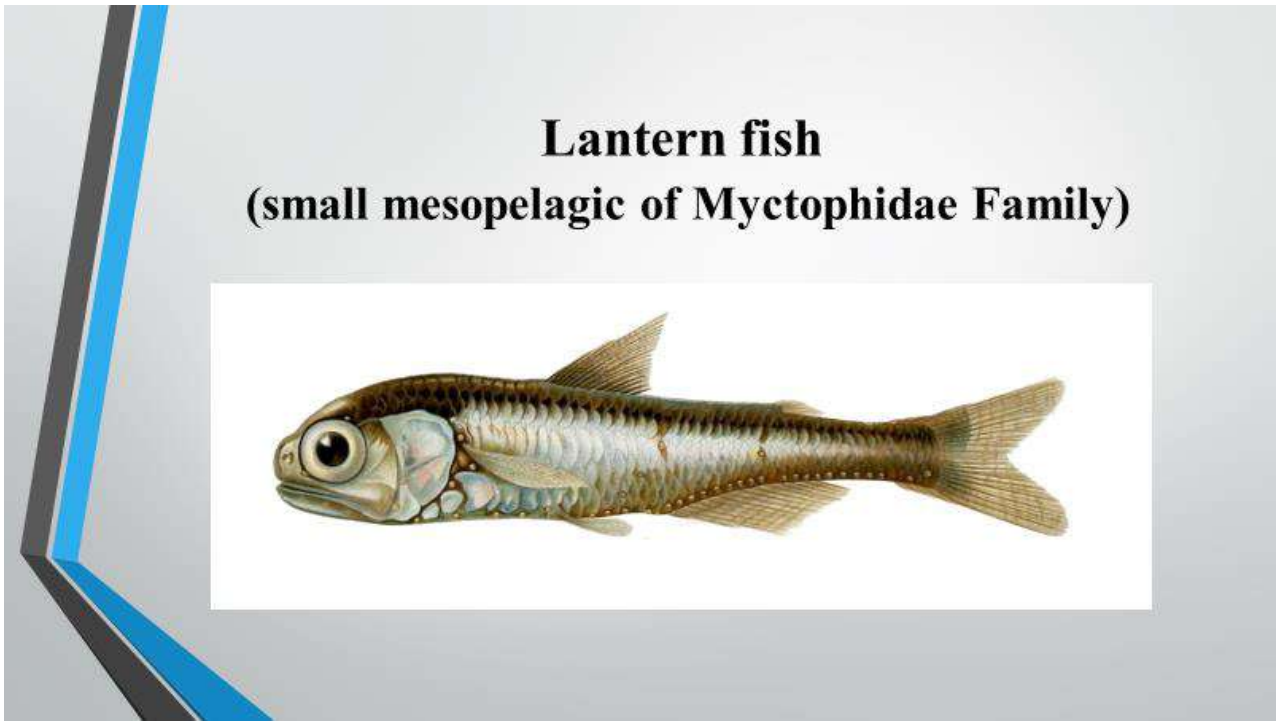
Five country-specific case studies were presented. Only the cover slides are shown below. All presentations were provided to participants at the workshop for reference as needed and can be downloaded from Cofrepeche: please contact charline.gaudin@cofrepeche.fr

India :

Figure 13: India Case Study presented by Dr Nilish Pawar

Iran :

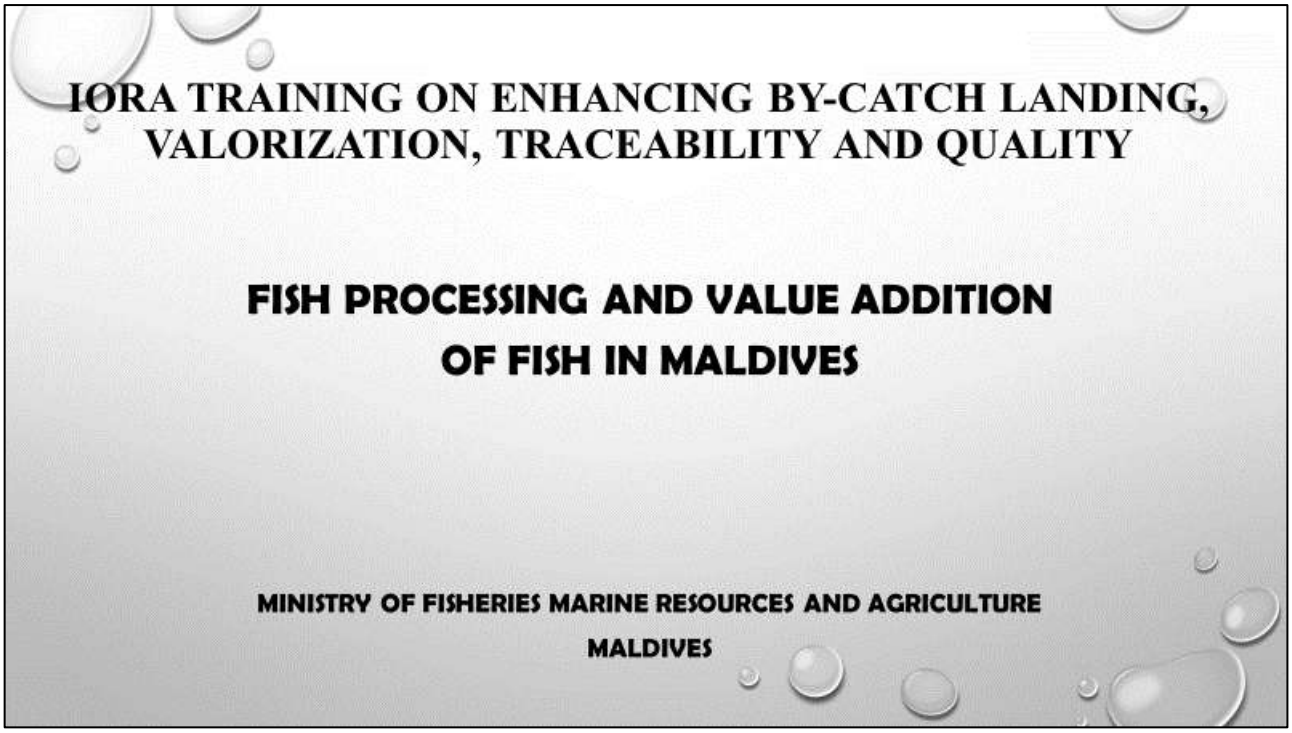

Bycatch Processing
An actual example from IRAN
IORA TRAINING ON ENHANCING BY-CATCH LANDING, VALORIZATION, TRACEABILITY AND QUALITY
29 March 2022 – 1 April 2022


Lantern fish
(small mesopelagic of Myctophidae Family)

Mauritius :

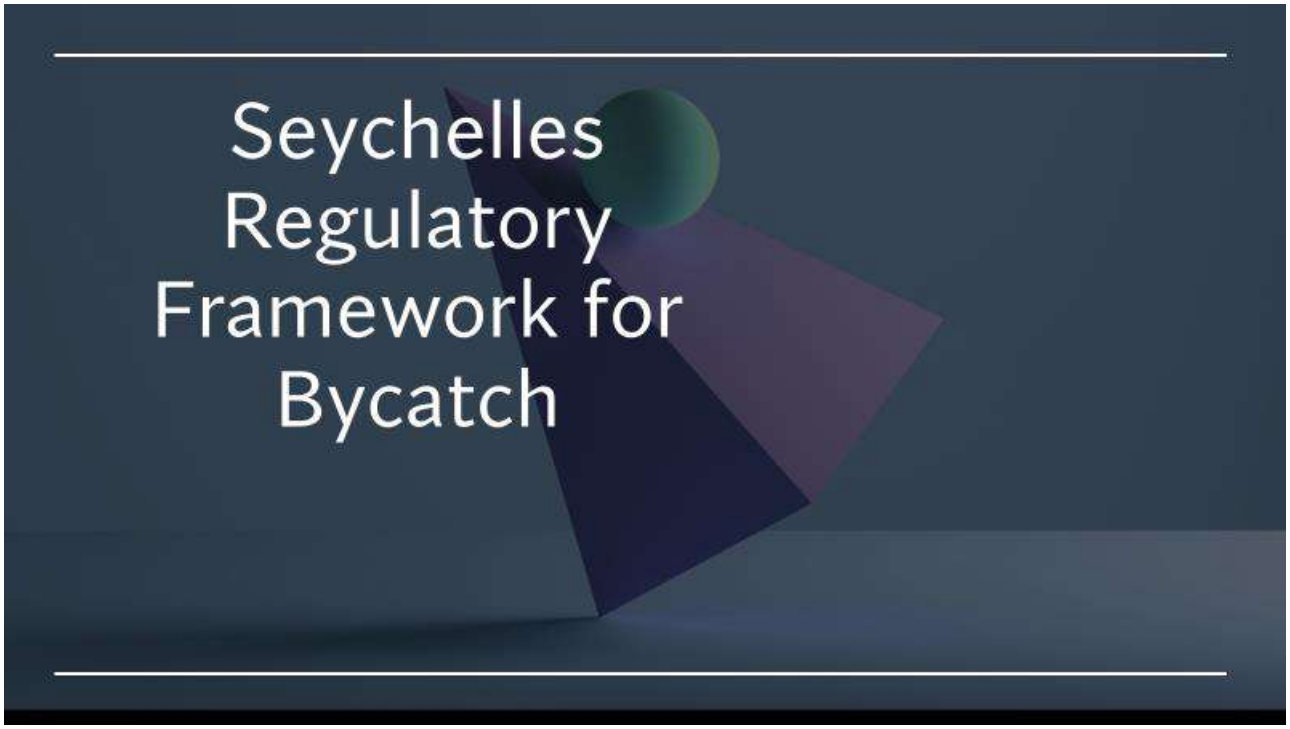
Figure 14: Case study presented by Mr Dharmendra Degambur, Mauritius

Maldives :

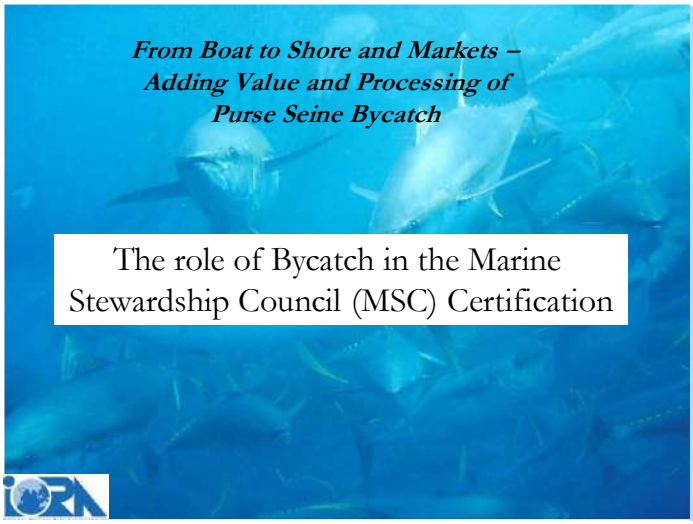

IORA TRAINING ON ENHANCING BY-CATCH LANDING, VALORIZATION, TRACEABILITY AND QUALITY
FISH PROCESSING AND VALUE ADDITION OF FISH IN MALDIVES
MINISTRY OF FISHERIES MARINE RESOURCES AND AGRICULTURE
MALDIVES

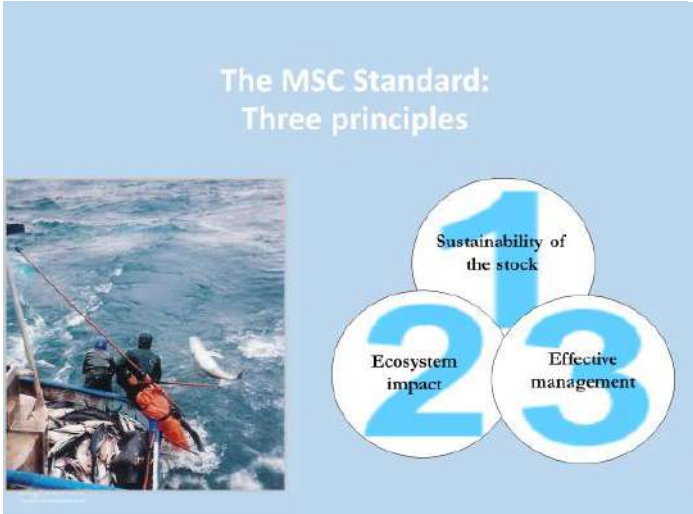

DO THESE FACILITIES NEED TO MODIFIED?
• PRODUCING ALL THE PRODUCTS IN ONE FACTORY WHICH IS EU APPROVED.
• MAINTAIN THE QUALITY OF RAW MATERIALS
• NO DIFFERENCE FOR EXPORT AND LOCAL CONCEPTIONS
CHILLED

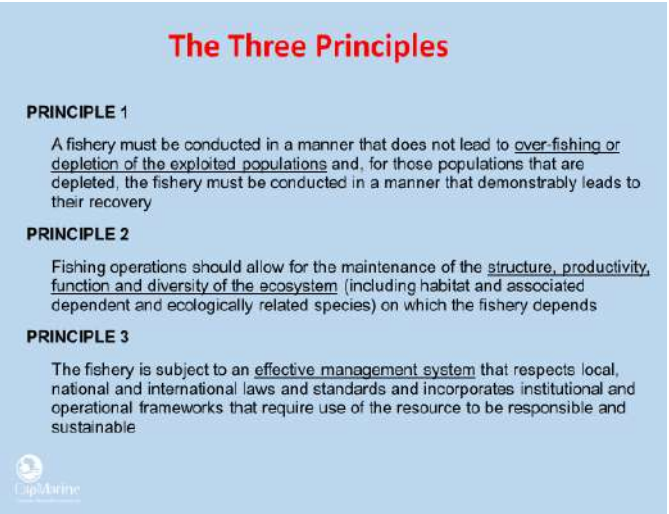
Seychelles :

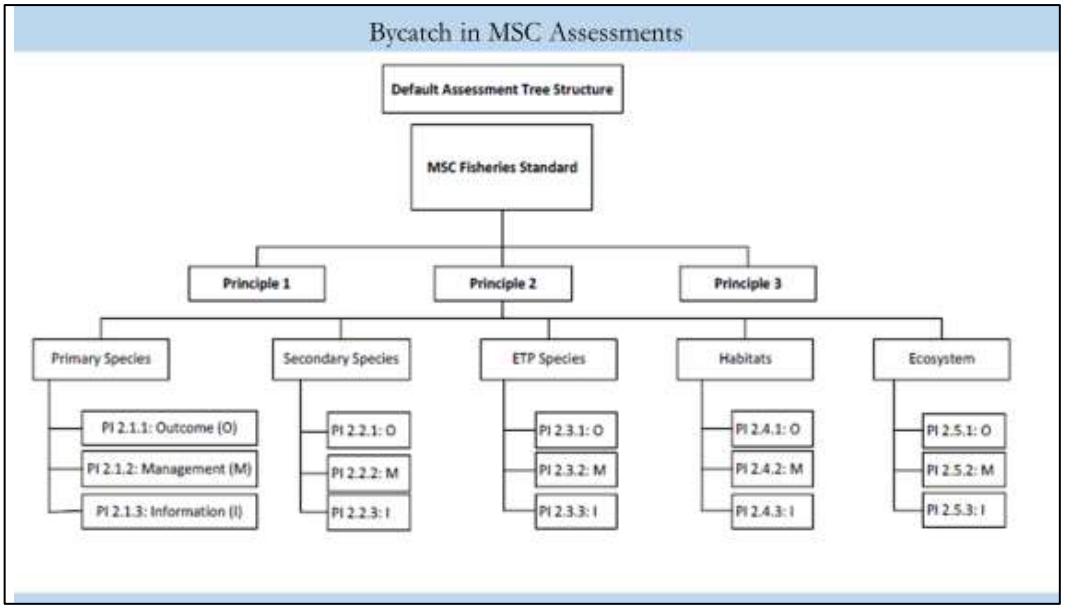


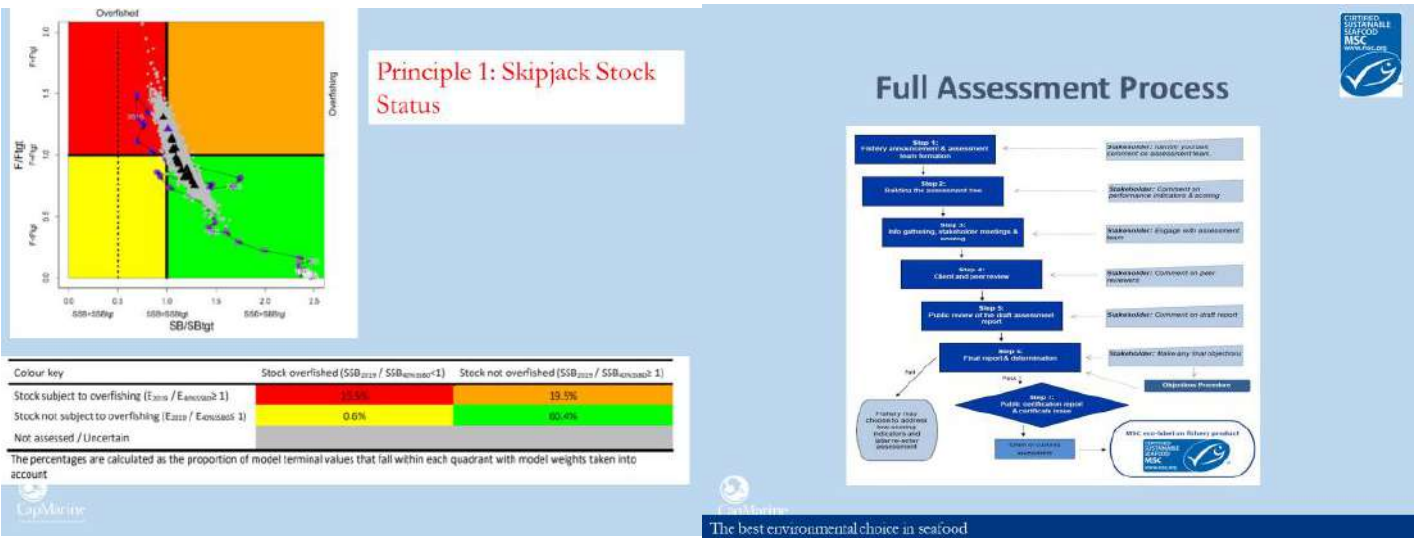
7.4.10 IORA and Marine Stewardship Council

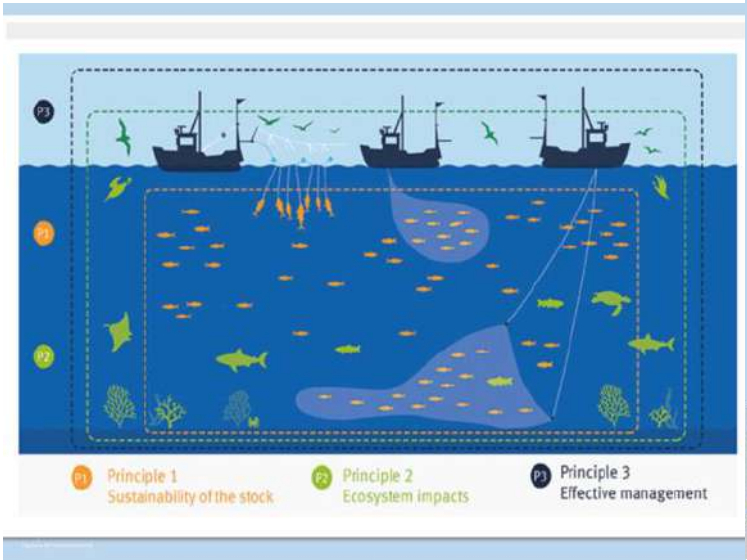







Bycatch in MSC Assessments
Default Assessment Tree Structure
MSC Fisheries Standard
Principle 1
Principle 2
Principle 3
Primary Species
Secondary Species
ETP Species
Habitats
Ecosystem
PI 2.1.1: Outcome (O)
PI 2.1.2: Management (M)
PI 2.1.3: Information (I)
PI 2.2.1: O
PI 2.2.2: M
PI 2.2.3: I
PI 2.3.1: O
PI 2.3.2: M
PI 2.3.3: I
PI 2.4.1: O
PI 2.4.2: M
PI 2.4.3: I
PI 2.5.1: O
PI 2.5.2: M
PI 2.5.3: I


Overfished
Overfishing
F/Fmsy
SB/SBmsy
Principle 1: Skipjack Stock Status
Colour key
Stock overfished (SSB2019 / SSBMSY<1)
Stock not overfished (SSB2019 / SSBMSY≥ 1)
Stock subject to overfishing (E2019 / EMSY≥ 1)
19.9%
19.5%
Stock not subject to overfishing (E2019 / EMSY< 1)
0.6%
60.4%
Not assessed / Uncertain
The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account
CapMarine
Full Assessment Process
Step 1:
Step 2:
Step 3:
Step 4:
Client and peer review
Step 5:
Public review of the draft assessment report
Step 6:
Final report & determination
Step 7:
Public certification report & certificate issue
Objection Procedure
CapMarine
The best environmental choice in seafood



How the Program Works

- Fisheries apply for certification on a **voluntary basis**
- Fisheries are assessed against the MSC Standard by 3rd **party independent certifiers supported by a team of experts**
- Members of the supply chain apply for "Chain of Custody" and audits are completed by **3rd party independent certifiers**
- Fish from successfully certified fisheries can be **marketed with MSC ecolabel** once "chain of custody" is completed

Bycatch in MSC Assessments – Secondary Species

CapMarine

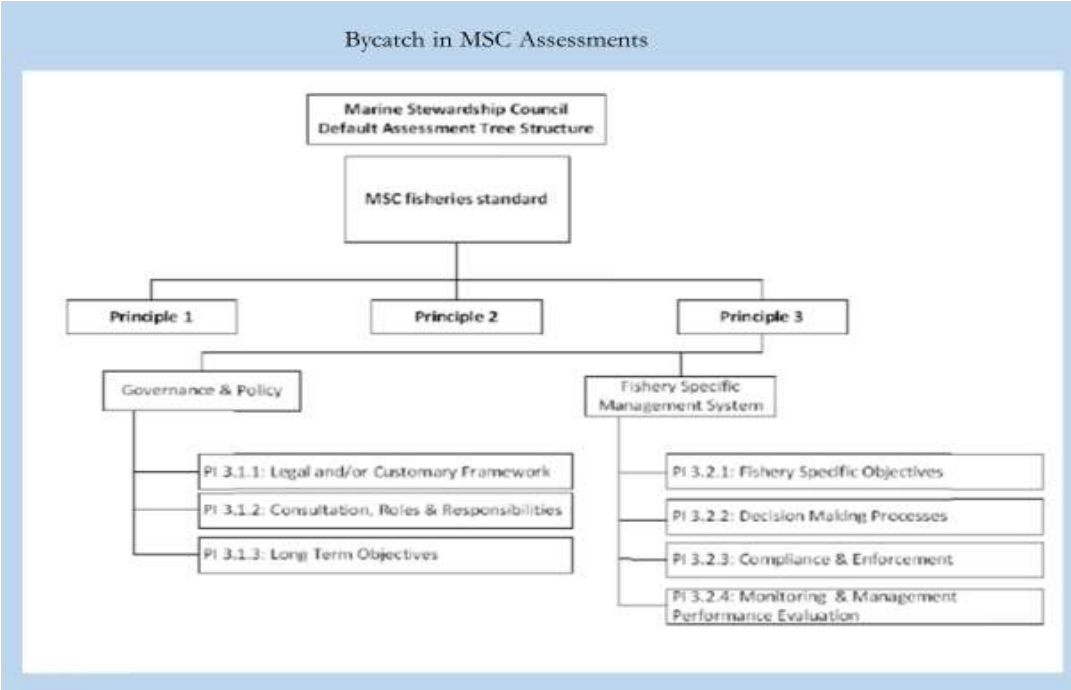
Bycatch in MSC Assessments Primary Species

Bycatch in MSC Assessments - ETP

Species	Catch (% of total)	IOTC	CITES	CMS	IUCN
Silky shark* *Carcharhinus falciformis*	0.297	No specific non-retention ban.	Appendix II: (CITES Appendices)	Appendix II: (CMS Appendices)	Species is 'in scope' for MSC, so IUCN status is not relevant.
Giant oceanic manta ray *Manta birostris* + *Manta sp.*	0.018	Prohibition on retention, transhipment, landing, etc. (IOTC 19/03).	Appendix I: (CITES Appendices)	Appendix I: (CMS Appendices)	Species is 'in scope' for MSC, so IUCN status is not relevant.
Whale shark *Rhincodon typus*	0.014	Prohibition on setting and stipulation for safe release (IOTC 13/05).	Appendix II: (CITES Appendices)	Appendix I: (CMS Appendices)	Species is 'in scope' for MSC, so IUCN status is not relevant.
Oceanic whitetip shark *Carcharhinus longimanus*	0.008	Prohibition on retention, transhipment, landing, etc. (IOTC 13/06).	Appendix II: (CITES Appendices)	Appendix I: (CMS Appendices)	Species is 'in scope' for MSC, so IUCN status is not relevant.
Mobulid rays (NS)	0.003	Prohibition on retention, transhipment, landing, etc. (IOTC 19/03).	Appendix II : (CITES Appendices)	Appendix I: (CMS Appendices)	Species is 'in scope' for MSC, so IUCN status is not relevant.

Bycatch in MSC Assessments ETP

CapMarine


Bycatch in MSC Assessments
Marine Stewardship Council
Default Assessment Tree Structure
MSC fisheries standard
Principle 1
Principle 2
Principle 3
Governance & Policy
Fishery Specific
Management System
PI 3.1.1: Legal and/or Customary Framework
PI 3.1.2: Consultation, Roles & Responsibilities
PI 3.1.3: Long Term Objectives
PI 3.2.1: Fishery Specific Objectives
PI 3.2.2: Decision Making Processes
PI 3.2.3: Compliance & Enforcement
PI 3.2.4: Monitoring & Management
Performance Evaluation

Bycatch in MSC Assessments – Principle 2 : Ranking

Rank	Species	Common name	Observed weight (t) by Year			
			2015	2016	2017	2018
1	Katsuwonus pelamis	Skipjack tuna	27,155.551	18,659.000	22,924.118	43,494.215
2	Thunnus albacares	Yellowfin tuna	25,553.291	12,432.950	8,530.280	8,934.550
3	Thunnus obesus	Bigeye tuna	5,080.935	3,133.070	4,663.010	5,288.534
4	Thunnus alalunga	Albacore tuna	213.200	17.000	203.000	1,577.000
5	Elagatis bipinnulata	Rainbow runner	253.963	152.065	115.778	130.803
6	Coryphaena hippurus	Common dolphinfish	213.126	117.431	112.785	141.709
7	Auxis thazard	Frigate tuna	0.061	21.260	270.895	251.455
8	Carcharhinus falciformis	Silky shark	134.858	111.525	121.415	193.261
9	Auxis spp	Frigate tunas	0.300	17.690	5.984	647.010
10	Canthidermis maculata	Rough triggerfish	58.907	76.835	32.030	49.445
11	Auxis rochei	Bullet tuna	0.340	93.306	41.000	64.780
12	Euthynnus affinis	Kawakawa	0.005	32.500	21.300	184.262
13	Acanthocybium solandri	Wahoo	77.669	30.134	44.152	46.378
14	Todo el banco	'Slipped' catch	14.000	10.000	-	200.000
15	Makaira indica	Black marlin	8.374	15.889	13.106	14.148
16	Makaira nigricans	Atlantic Blue Marlin	15.292	11.672	9.743	16.934
17	Decapterus macarellus	Mackerel scad	6.610	13.103	8.195	16.781
18	Manta birostris	Giant Oceanic Manta Ray	10.506	5.853	13.849	0.983
19	Carcharhinidae sp	Requiem sharks	32.150	-	-	1.500
20	Rhincodon typus	Whale shark	0.536	7.169	13.197	-

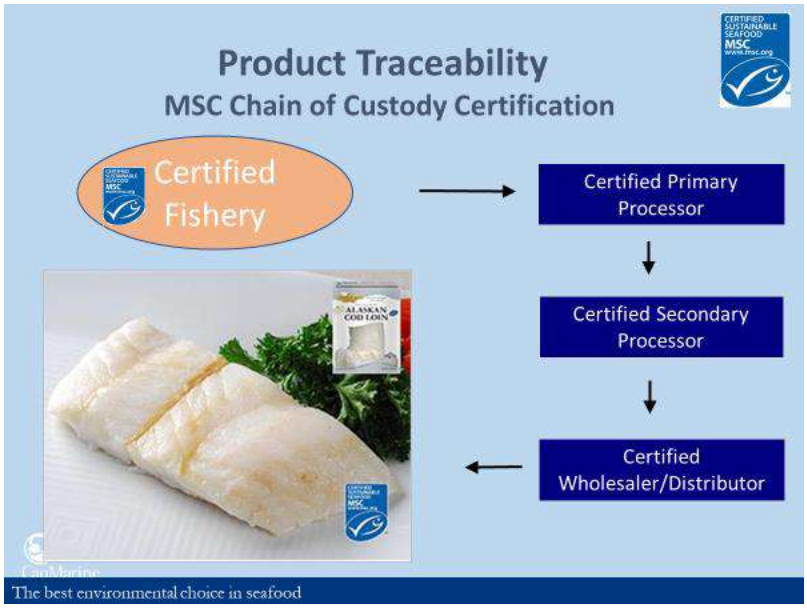
Traceability

- ✓ The CAB shall determine whether the fishery client has sufficient systems of tracking and tracing to ensure all fish and fish products identified and sold as certified by the fishery client originate from an appropriate UoC.
- ✓ Review of traceability risks and systems used in the UoA(s) and plan to review traceability systems at the site visit, if necessary.

CERTIFIED SUSTAINABLE SEAFOOD MSC www.msc.org

Traceability and Record-Keeping

- **At-Sea Catch** recording and reporting
- On-board recording and species separation
- **Landing slips** – pallet by pallet tracking
- Factory sorting and weighing
- Storage recording and temperature control
- Product **sales slips** and onward markets



7.4.11 Requirements for exporting

Health Requirements to Export Fishery Products to the EU

Exporting countries must have a Competent Authority which is responsible for performing official controls throughout the production chain. The authority must be empowered, structured and resourced to implement effective inspection and guarantee credible public health and animal health attestations in the health certificate to accompany fishery products that are destined for the EU.

The Competent Authority must also guarantee that the relevant health and public health requirements are met. EU hygiene legislation contains specific requirements regarding the structure of vessels, landing sites, processing establishments and on operational processes, freezing and storage. These provisions are aimed at ensuring that food is produced safely and that contamination of the product during processing is prevented.

Imports are only authorised from approved vessels and establishments (e.g. processing plants, freezer or factory vessels, cold stores), which have been inspected by the Competent Authority of the exporting country and found to meet EU requirements. A list of approved vessels and establishments is maintained by the European Commission and is published on the website.

Imports of fishery products from non-EU countries must enter the EU via an approved Border Inspection Post under the authority of an official veterinarian in the EU Member State in question.

Each consignment is subject to a systematic documentary check, identity check and, as appropriate, a physical check. The frequency of physical checks depends on the risk profile of the product and also on the results of previous checks.

Verification Requirements for importing Fish / Fishery Products

The Importers verification process must be written and include the following:

Product specifications that ensure the product is not adulterated.
HACCP and sanitation monitoring records that relate to the specific lot of fish being imported.
A health certificate from the Competent Authority certifying that the product was processed in accordance with FDA regulation on fish / fishery products 21 CFR § 123.
Regularly inspecting the foreign processor's facilities to ensure that the imported product is being processed according to FDA regulation.
Maintaining on file a copy of the foreign processor's HACCP plan and a written guarantee that the imported product is being processed according to FDA regulation.

Health Requirements to Export Fishery Products to the China

The exporting country must be authorised by China before products can be imported into China. The exporting country must register with the General Administration of Customs (GACC).

The food processor must be registered through the relevant food safety agency (e.g. AQSIQ) and GACC to be able to export to China.

The Chinese fish importer must be registered with GACC to be able to import fish products into China.

The Chinese importer shall have a Quarantine Inspection Permit from GACC for the importing lot.

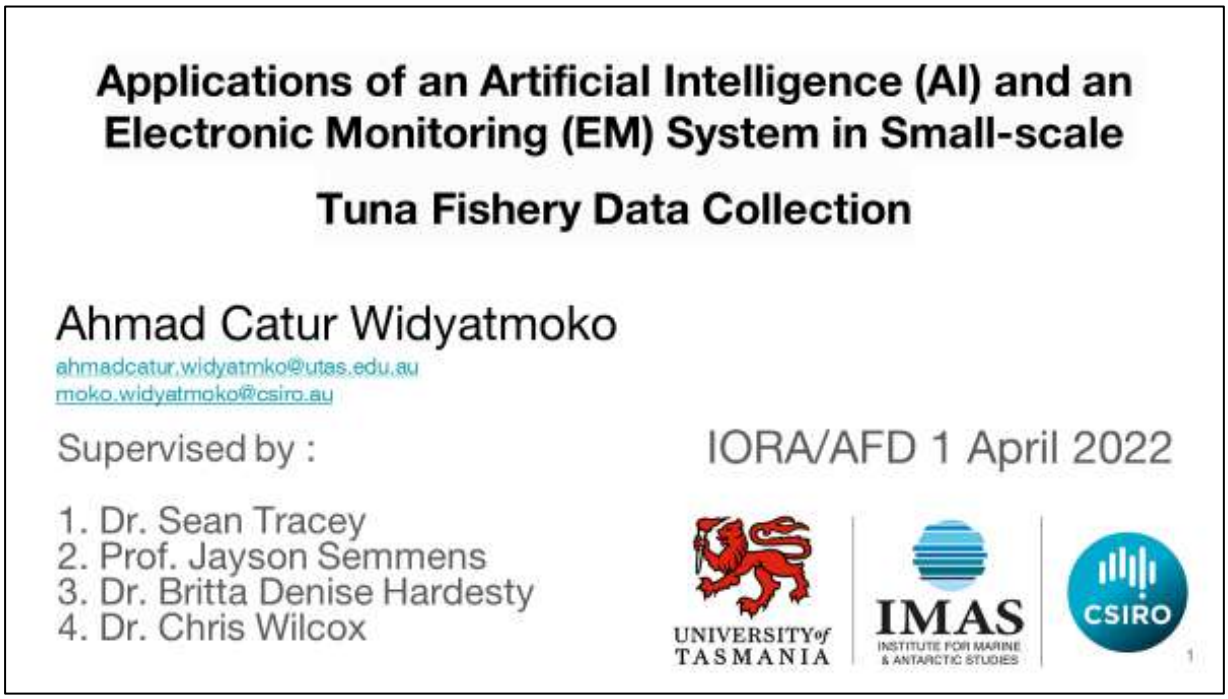
Health Requirements for the United States

There are two ways to verify that a supplier of fishery products from another country is approved:

The US Importer obtains the product from a country that has an active memorandum of understanding (MOU) with the FDA that documents the equivalency of their food safety system. MOUs are not very common.

The US Importer implements verification procedures for ensuring the fishery products being imported were processed in accordance with FDA seafood requirements.

7.4.12 : Applications of an Artificial Intelligence (AI) and an Electronic Monitoring (EM) System in Small-scale Tuna Fishery Data Collection



Thank You