Comprehensive Report

IOTC-OFCF Project (Phase III)

(June 2010 ~ March 2013)

March 2013

Indian Ocean Tuna Commission (IOTC)

Overseas Fishery Cooperation Foundation of Japan
(OFCF)

Contents

IOTC and associated species

Sp.Code	English Name	Scientific Name
YFT	Yellowfin tuna	*Thunnus albacares*
SKJ	Skipjack tuna	*Katsuwonus pelamis*
BET	Bigeye tuna	*Thunnus obesus*
ALB	Albacore	*Thunnus alalunga*
SBF	Southern bluefin tuna	*Thunnus maccoyii*
LOT	Longtail tuna	*Thunnus tonggol*
FRI	Frigate tuna	*Auxis thazard*
BLT	Bullet tuna	*Auxis rochei*
FRZ	Frigate & bullet tunas	*Auxis spp.*
KAW	Kawakawa	*Euthynnus affinis*
TUN	Tunas & bonitos *NEI	*Thunnini* and *Sardini* *NEI
COM	Narrow barred Spanish mackerel	*Scomberomorus commerson*
GUT	Indo-Pacific king mackerel	*Scomberomorus guttatus*
STS	Streaked Seerfish	*Scomberomorus lineolatus*
WAH	Wahoo	*Acanthocybium solandri*
KGX	Wahoo and seerfishes *NEI	*Scomberomorini* *NEI
SWO	Swordfish	*Xiphias gladius*
BLM	Black marlin	*Makaira indica*
BUM	Blue marlin	*Makaira manza*
MLS	Striped marlin	*Tetrapturus audax*
SFA	Indo-Pacific sailfish	*Istiophorus platypterus*
SSP	Short-billed spearfish	*Tetrapturus angustirostris*
BILL	Billfish *NEI	*Xiphioidei* *NEI
TUX	Tuna-like fishes *NEI	*Scombroidei* *NEI
SKH	Sharks*NEI	

*NEI: Not elsewhere included

Foreword

It is our pleasure to offer this Comprehensive Report on activities of the IOTC-OFCF Project (Phase III), which has been implemented since June 2010, to all people engaged in data collection and statistics in the field of fisheries for tuna and tuna-like species, the government authorities and the private sector in IOTC member countries, especially the developing coastal countries in the region.

New activities of the IOTC-OFCF Project formed in line with Observer Program targeting to coastal artisanal fisheries, which began after Phase II of the Project ended in March 2010, is funded by OFCF, and involves the participation of staff from the IOTC Secretariat, working in conjunction with an OFCF expert attached to the Secretariat as previous activities in Phase I and II. It is governed by a Memorandum of Understanding (MOU) between the two parties, which has been reviewed and agreed to annually.

Thanks to the work of a dedicated team of Project staff and national counterparts, we have established cooperative programmes in the region that are making a difference. However, the resources of the Project are finite, and they cannot replace the long-term national commitments needed to establish a solid system. The Project is intended to build capacity, *i.e.*, provide the training and initial resources required to launch a data collection and processing system relating the Observer Program. However, unless there is a commitment on the part of national authorities to provide sustained support for the collection of statistics, there is a risk that these initiatives will not be continued after the Project ends.

To avoid this, the authorities and the private sector need to be made aware that it is in their best interests to support a data collection system that will give them the information required to better plan for future development.

Based on this principle, we are providing this Comprehensive Report, which consists of a description of the implementation of various Project activities, an overall evaluation of Project results, and recommendations for future development. We hope that it will be useful, and that it will be a proof of the achievement of the goal of contributing to "the realization of sustainable utilization of the tuna resources, by improving the accuracy of data collection and statistical systems of the coastal countries in the Indian Ocean".

Alejandro Anganuzzi
Executive Secretary, IOTC

Executive Summary

The Memorandum of Understanding (MOU) between the IOTC and the Overseas Fishery Cooperation Foundation of Japan (OFCF) was initiated in April 2002, with providing technical guidance for Projects to assist developing countries in the Indian Ocean region to improve the data collection and quality of fisheries statistics. Phases I (April 2002 - March 2007) and II (June 2007 -March 2010) of the Project ran for eight consecutive years.

The success of Phase I and II of the Project, the OFCF agreed to support the implementation of a new phase (Phase III) for a maximum of three years from 2010 to 2012. The Terms of Reference of Phase III focus on support of IOTC coastal countries in the strengthening of activities related to the Regional Observer Scheme, specially focusing on artisanal fisheries in IOTC Resolution 11/04,

> *4. The number of the artisanal fishing vessels landings shall also be monitored at the landing place by field samplers. The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total levels of vessel activity (i.e. total number of vessel trips or total number of vessels active).*

A new MOU between the IOTC and the OFCF was signed in June 15th 2010 including the provision of funds and detachment of an OFCF Expert to the IOTC Secretariat in June 30th to coordinate the activities of the Project, along with the IOTC Data Coordinator and other staff from the Secretariat, as required. The duration of Phase III of the Project is three years, until March 2013, with funds committed for each year and extension of the Project agreed through exchange of letters between the IOTC and the OFCF.

The Project keeps the following three main principles since 2002:

- The activities undertaken under the Project follow the recommendations of the Commission and its relevant subsidiary bodies: the Working Parties and the Scientific Committee.
- There will be no direct financial implications for IOTC Member countries.
- The activities of the Project should be directed towards reinforcing the statistical systems of developing countries from the region.

The present comprehensive report covers the activities of the IOTC-OFCF Project from June 2010 to March 2013, and also includes an overview of the activities implemented through Phase I and Phase II. The following activities were implemented by the Project during Phase III:

1. **Comoros**: The Project carried out frame survey and Census during January and May 2011, and July and September 2012 in line with the port sampling activities funded by IOTC and EU, and also provided the training course on catch estimation based on the data collected from the frame and census survey and port sampling activities. Preliminary estimates of catch and effort were made by the Project. Port sampling scheme used this program showed possibility of 5% coverage of vessels activities

2. **Indonesia**: The Project held a workshop on the Indonesia catch estimation in

March 2012, with the collaboration of the Indonesian Directorate General of Capture Fisheries and other national and international organizations including non-government. The Project also published workshop reports in English ad Indonesia in September 2012.

3. **Sri Lanka**: The Project carried out upgrading the Centralized Database Management System. This System was in place in the Ministry of Fisheries and Aquatic Fisheries Resource Development in March 2012. The Project also assisted to improve port sampling from November 2012 to February 2013. The improved sampling aims to cover at least 5% of vessels activities around Sri Lanka

4. **Iran:** The Project carried out upgrading the Centralized Database Management System through technical advices including provision of equipment. This System was in place in the Ministry of Fisheries

5. **Mauritius**: The Project sent a mission to assess and evaluate the collection and processing system of local fisheries including foreign fresh-tuna longline fisheries, especially focusing on Albacore, following a recommendation made by the working party on Temperate Tunas in August 2012.

The Project contributed to improving the quality and quantity of the statistics available at the IOTC, including better catch and effort and size data in conjunction with port sampling activities under the Observer scheme.

In addition, the Project addressed recommendations for future cooperation with OFCF which may lead to significant improvements in the area of data collection, processing and reporting.

On numerous occasions, the IOTC Scientific Committee and other IOTC technical bodies stressed the importance of the activities initiated by the Project, noting that the information collected is of key importance for the assessments of some of the main IOTC stocks.

The IOTC-OFCF Project at a glance

The activities of the present project including Phase I and Phase II are summarized in Figure 1 and Table 1.

Figure 1. Project activities through Phases I , Phase II and Phase III of the IOTC-OFCF Project, by country
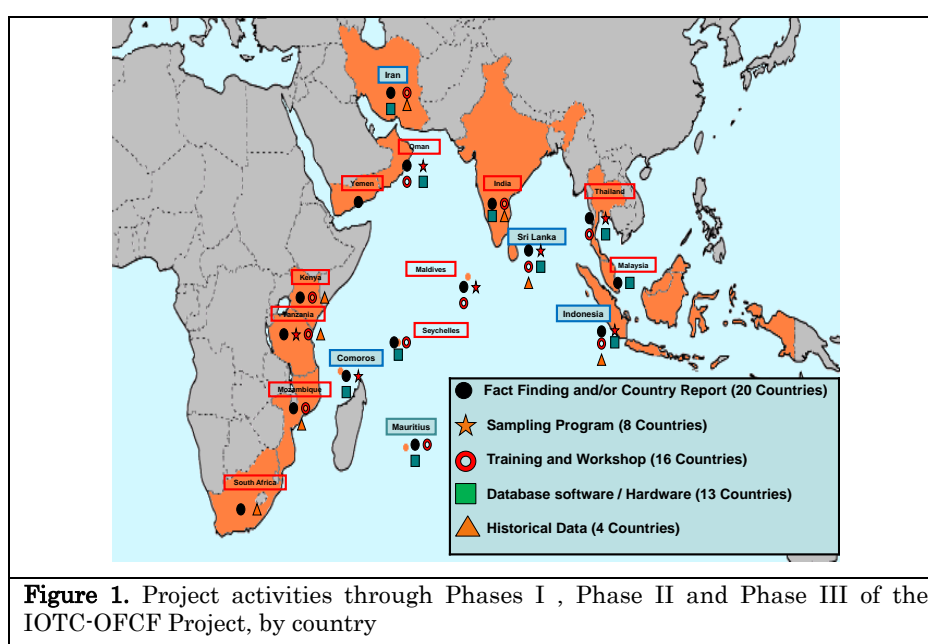
Table 1. Summary of the activities implemented during Phases I, II and III of the IOTC-OFCF Project

Country-Fleet	Activities implemented			Fact-finding	Country report	Sampling activities	Training/ Workshop	Hardware/ Software/ Database	Historical data	Recommendations addressed
	Phase I	Phase II	Phase III							
India	Yes			Yes	Yes		Yes			No
Indonesia-FLL	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Indonesia-ART	Yes		Yes	Yes	Yes		Yes			Yes
Iran	Yes		Yes	Yes	Yes		Yes	Yes		No
Kenya	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes
Malaysia	Yes			Yes			Yes	Yes		No
Maldives	Yes			Yes	Yes	Yes	Yes			Yes
Mauritius	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes
Mozambique	Yes			Yes	Yes		Yes			No
Oman	Yes	Yes		Yes	Yes	Yes	Yes			No
Seychelles	Yes			Yes	Yes		Yes	Yes		Yes
South Africa	Yes				Yes					Yes
Sri Lanka-G/L	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes
Sri Lanka-ART	Yes		Yes	Yes	Yes	Yes	Yes	Yes		Yes
Tanzania	Yes			Yes.	Yes			Yes		No
Thailand-FLL	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	No
Thailand-PSS	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes
Thailand-PS		Yes		Yes				Yes		Yes
Yemen		Yes		Yes,					Yes	No
Comoros		Yes	Yes	Yes		Yes	Yes	Yes		Yes

FLL: Fresh tuna longline; ART: Artisanal fishing vessel; G/L: Gillnet with longline; PSS: Small purse seine: PS: Industrial purse seine.

Photos of Activities during June 2010 and March 2013 in Phase III

Discussion of possible assistance for Sri Lankan costal fisheries (September 2010)

Discussion of possible assistance for Sri Lankan costal fisheries (September 2010)

Training of samplers on 1st Frame Survey and Census with Port Sampling in Anjouan Island, Comoros (January 2011)

Training of samplers on 1st Frame Survey and Census with Port Sampling in Moheli Island, Comoros (January 2011)

Monitoring of 1st Frame Survey and Census in Grande Comoro, Comoros (March 2011)

Discussion of upgrading database for SHILAT, Tehran, Iran (September 2011)

Discussion on Centralized Database System for Sri Lankan costal fisheries (September 2011)

Provision of equipment for establishment of Centralized Database System, Sri Lank (November　2011)

Testing new Centralized Database System, Sri Lanka (December 2011)

Monitoring of Sampling Activities in Jakarta Fishing Port, Indonesia (January 2012)

Provision of Equipment for SHILAT Database upgrading (February 2012)

Measuring Fish by Calliper provided, Busher Province, Iran (March 2012)

Workshop on Catch Estimation, Jakarta, Indonesia (March 2012)

Workshop on Catch Estimation, Jakarta, Indonesia (March 2012)

Training on Catch Estimation for Comoros, IOTC Secretariat, Seychelles (May 2012)

Training of samplers on 2nd Frame Survey and Census in Grande Comoro Island, Comoros (July 2012)

Training of samplers on 2nd Frame Survey and Census in Grande Comoro Island, Comoros (July 2012)

Preparation of Workshop Report on Catch Estimation, Indonesia (September 2012)

Artisanal fishing boats, Anjouan Island, Comoros (September 2012)

Discussion of improvement of port sampling activities, Colombo, Sri Lanka (October 2012)

Training on port sampling data collection, Negombo, Sri Lanka (November 2012)

Leadership Training course on fisheries resource management offered by OFCF, Shizuoka, Japan (November 2012

Assessment of data collection and processing in Mauritius, Port Louis, Mauritius (November 2012)

IOTC-OFCF Joint Committee Meeting, IOTC Secretariat, Seychelles (December 2012)

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1. Introduction

The Memorandum of Understanding (MOU) between the IOTC and the Overseas Fishery Cooperation Foundation of Japan (OFCF) was initiated in April 2002, with providing technical guidance for Projects to assist developing countries in the Indian Ocean region to improve the data collection and quality of fisheries statistics. Phases I (April 2002 - March 2007) and II (June 2007 -March 2010) of the Project ran for eight consecutive years. The activities implemented during Phase I and II contributed substantially to improving the quality of the data in the IOTC databases, in particular the quality of nominal catch and size-frequency data for the fleets involved. On numerous occasions, the IOTC Scientific Committee (SC) and other IOTC technical bodies stressed the importance of the activities initiated by the Project, noting that the information collected is of key importance for the assessments of some of the main IOTC stocks. The activities of the Project Phase I and II are summarized in reports, "Comprehensive Report of the IOTC-OFCF Project (April 2002-March 2007)" and "Comprehensive Report IOTC-OFCF Project Phase II (June 2007-March 2012)", which are available from the IOTC or the OFCF.

Following the success of the Phase I and II of the Project, the IOTC and the OFCF considered the implementation of a new Phase with the objective of addressing the concerns of the Commission regarding the quality of the data available for some of the important artisanal fisheries in the region related to the Regional Observer Scheme, specially focusing on artisanal fisheries in IOTC Resolution 10/04 (superseded by 11/04).

A new MOU (Annex 1) between the IOTC and the OFCF was signed in June 15th 2010 including the provision of funds and detachment of an OFCF Expert to the IOTC Secretariat in June 30th to coordinate the activities of the Project, along with the IOTC Data Coordinator and other staff from the Secretariat, as required. Phase III of the Project lasted for two years and nine months, coming to and end in March 2013.

This comprehensive report presents a summary of the activities implemented through Phase III of the Project. Section 1 contains general information about the IOTC, the OFCF, and the Project since its inception in April 2002. The main activities implemented during Phase III of the Project are summarized in Section 2, as are the main results and achievements. Section 3 contains proposed activities for further cooperation with improvement of the statistics on IOTC species, based on the experience gained through the implementation of Project activities. Section 4 contains some final remarks and conclusions concerning the Project, in particular the need for IOTC coastal countries to devote more time and resources to the collection of fisheries data and the processing system, and the need for the IOTC to maintain support for capacity-building activities in countries of the IOTC region.

1.1. What is IOTC?

The Agreement for the Establishment of the Indian Ocean Tuna Commission (IOTC), elements of which are summarized below, was adopted on 25 November 1993 by the FAO (Food and Agriculture Organization of the United Nations) Council at its 105th Session in Rome (Italy). The Agreement entered into force upon the accession of the tenth Member on 27 March 1996. The Financial Regulations were adopted at the First Special Session of IOTC, held in Rome on 21-24 March 1997 and the Rules of Procedure were adopted at the Second Session, held in Victoria (Seychelles) on 22-25

September 1997.

IOTC is an intergovernmental organization established under Article XIV of the FAO constitution. Its mandate is to manage tuna and tuna-like species in the Indian Ocean and adjacent seas.

The objective of the Commission is to promote cooperation among its current 31 Members (Australia, Belize, China, Union of Comoros, Eritrea, European Union, France, Guinea, India, Indonesia, Islamic Republic of Iran, Japan, Kenya, Republic of Korea, Madagascar, Malaysia, Maldives, Mauritius, Mozambique, Sultanate of Oman, Pakistan, Philippines, Seychelles, Sierra Leone, Sri Lanka, Sudan, Tanzania, Thailand, United Kingdom, Vanuatu, and Yemen) and two Cooperating Non-Contracting Parties (Senegal and South Africa), with a view to ensuring, through appropriate management, the conservation and optimum utilization of stocks covered by the IOTC Agreement and encouraging sustainable development of fisheries based on such stocks.

In order to achieve these objectives, the Commission has the following functions and responsibilities, in accordance with the principles expressed in the relevant provisions of the United Nations Convention on the Law of the Sea:

1. Keep under review the conditions and trends of the stocks, and gather, analyze and disseminate scientific information, catch and effort statistics and other data relevant to the conservation and management of the stocks and to fisheries based on the stocks covered by the IOTC Agreement;

2. Encourage, recommend, and coordinate research and development activities in respect of the stocks and fisheries covered by the IOTC Agreement, and such other activities as the Commission may deem appropriate, including activities connected with transfer of technology, training and enhancement, having due regard to the need to ensure the equitable participation of Members of the Commission in the fisheries and the special interests and needs of Members in the region that are developing countries;

3. Adopt, on the basis of scientific evidence, conservation and management measures to ensure the conservation of the stocks covered by the IOTC Agreement and to promote the objective of their optimum utilization throughout the IOTC Area;

4. Keep under review the economic and social aspects of the fisheries based on the stocks covered by the IOTC Agreement, bearing in mind, in particular, the interests of developing coastal states.

Conservation and management measures binding on Members of the Commission must be adopted by a two-thirds majority of Members present and voting. Individual members objecting to a decision are not bound by it. If objections to a measure are made by more than one-third of the Members of the Commission, the other Members are not bound by that measure, but this does not preclude any or all of them from implementing it.

Recommendations concerning conservation and management of the stocks for furthering the objectives of the Agreement need only be adopted by a simple majority of Members present and voting.

It is the responsibility of Members to ensure that action is taken under their national legislation to implement conservation and management measures.

The Members of the Commission are also expected to cooperate in the exchange of

information regarding any fishing for stocks covered by the IOTC Agreement by nationals of any State or Entity which is not a Member of the Commission.

Further information is available on the IOTC website, www.iotc.org .

1.2. What is OFCF?

The Overseas Fishery Cooperation Foundation of Japan (OFCF) was established in June 1973, with the objectives of promoting the development of fisheries in coastal countries and the effective management of international marine resources by regional fisheries organizations, with both of which Japan has a close relationship in the fisheries field, in order to maintain and enhance amicable relations through technical and economic cooperation.

In order to contribute to the development and promotion of the fisheries in the coastal countries concerned, OFCF provides various types of technical cooperation, such as project-type cooperation, dispatch of fisheries technical expert(s) and invitation of overseas fisheries trainees.

1. Restoration of function of fisheries-related facilities

   OFCF dispatches advisers and engineers, with the necessary materials and equipment, to coastal countries concerned in order to transfer techniques of rehabilitation and maintenance of fisheries-related facilities and equipment that have been damaged by natural disasters or other causes.

2. Development of fishing grounds, promotion of fisheries, promotion of fish processing and distribution, and conducting surveys of living marine resources.

   OFCF conducts surveys of the development of fishing grounds within the Exclusive Economic Zones (EEZs) of the coastal countries concerned, with related advice and guidance. Studies are carried out and technical guidance is provided on the development of coastal fisheries and processing of fish products and on the improvement of their distribution.

3. Measures for the protection of the environment and conservation of international fisheries resources

Technical transfer is carried out in the fields of (1) research and development in such aspects of stock enhancement as fish-rearing and optimum feed development, to contribute to the restoration of declining fish stocks, (2) marine resource management and stock enhancement techniques within the coral reef area of Pacific island nations, to restore declining fish stocks and (3) improving statistical information systems for tuna resources.

Based on the results of an assessment and evaluation conducted upon the completion of an OFCF-led cooperation project, follow-up activities are implemented by dispatching expert(s) and providing the necessary materials and equipment to complement the project, to further improve and establish the relevant technique.

In order to promote mutual understanding with the fisheries organizations of the coastal countries concerned and international fisheries-related organizations, OFCF organizes symposiums and meetings on specific themes in fisheries, such as global resources management.

To date, OFCF has extended its cooperation programmes to more than 110 nations, regions and international organizations worldwide. These programmes are diverse in

nature, ranging from acceptance of overseas technical trainees, dispatch of experts, implementation of project-related technical cooperation, and personnel exchange.

Further information is available on the OFCF website, www.ofcf.or.jp .

1.3. Framework for Phase I and II

1.3.1. Background information

Systematic data collection has taken place in the industrial fisheries for tuna and tuna-like species in the Indian Ocean since the beginning of their operations in the early 1950s, and in the artisanal fisheries of some of the coastal countries. However, efforts to gather that information into a centralized database did not begin until 1982, when FAO established the Indo-Pacific Tuna Management and Development Programme (IPTP).

The activities of IPTP resulted in a number of advances in the area of data collection in the region. Sampling programmes were implemented in various coastal countries, and the data available for most of the industrial fisheries were centralized. In 1998, the IPTP's data collection responsibilities and databases were transferred to the IOTC. The IOTC Secretariat has been working since then to improve the quality and the quantity of the data available.

However, despite the best efforts of IPTP and IOTC, there are still gaps in the information necessary for the best management of the tuna resources in the Indian Ocean. These inadequacies affect a wide range of the data requested by IOTC, including some of the most fundamental types of data, such as nominal catch statistics. These highly aggregated data are what is most likely to be available from reporting sources, but more than 15% are considered to be of poor or uncertain quality. The situation is particularly serious regarding the availability of data on the size composition of the catches, which are fundamental for most modern stock assessment techniques and which are unavailable for several important fisheries in the Indian Ocean.

The origin of these problems could be traced, in many instances, to data collection and processing systems which are not suitable for producing the type of statistics required by IOTC.

These deficiencies in data availability have affected the quality of the stock assessments, thus compromising the management of some stocks. Achieving a significant improvement in the data situation will require concerted actions with the countries involved.

Early in 2001, the IOTC Secretariat and OFCF initiated work on a project that would address the main needs regarding data collection and statistics in the developing countries of the region. This project was largely funded by OFCF, and involved the participation of members of the IOTC Secretariat, working in conjunction with two fisheries experts seconded to the Secretariat by OFCF. The Project has been a landmark for OFCF, as it was the first OFCF project involving a regional fisheries management organization (RFMO) as a partner. In the past, OFCF has implemented its cooperation programmes on a bilateral basis. OFCF's decision to go beyond this bilateral framework and engage in a multi-lateral cooperation programme was based on the recognition by the government and the fishery-related industries of Japan that cooperating with international organizations for the sustainable utilization of marine

resources is indispensable for achieving the goal of adequate conservation and management of marine resources.

OFCF chose IOTC as a partner for several reasons. Compared to other international organizations, IOTC had a short history and therefore needed to set up various measures for resources management in the future. The large proportion of developing nations among its membership also made IOTC an ideal partner for an OFCF project. Another rationale for choosing IOTC was because upgrading data collection and statistical systems was considered to be a good starting point for extending cooperation from OFCF. This offer from OFCF was very timely, since at the time IOTC needed to improve the accuracy of its statistical data.

1.3.2. Framework for Phase I

The title of Phase I of the IOTC-OFCF Project was "Cooperation Project for Enhancing the Data Collection and Processing Systems for Tuna Resources in the Indian Ocean". The objective of Phase I of the IOTC-OFCF Project was to implement the recommendations of the IOTC Working Parties on Data Collection and Statistics (WPDCS)[1], Tropical Tunas (WPTT), Billfish (WPB), and Temperate Tunas (WPT), as well as the Scientific Committee (SC), which could not be implemented before because of insufficient resources at the IOTC Secretariat. It also addressed requests for training made by IOTC Members at past meetings, fulfilling the mandate of the Commission to encourage and coordinate activities connected with transfer of technology, training and enhancement, with due regard to the special interests and needs of Members in the region that are developing countries.

The Project embodied three main principles:

- The activities carried out under the Project would follow the recommendations of the Commission and its relevant subsidiary bodies, in particular the WPDCS and the Scientific Committee;

- There would not be any direct financial implications for IOTC Member countries.

- The activities of the Project were to be directed towards reinforcing the statistical systems of developing countries in the region.

The MOU for the Project of Phase I was signed by both parties in January 2002, and the Project itself was launched in April until March 2007. The OFCF dispatched two long-term experts for the Project.

The main objective of the Project was to promote the sustainable utilization of tuna resources in the Indian Ocean, through strengthening the collection and processing of fisheries statistics from the fisheries that target IOTC species in the Indian Ocean region.

The main activities carried out under the Project covered the following areas:

1. Conduct studies to determine the current status of data collection, processing and analysis in the coastal countries of the IOTC region, including fact-finding missions by Project staff to those countries, and documentation of the fisheries and fisheries information systems in those countries (through the preparation of Country Reports);

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[1] The WPDCS was suspended in 2003, and the responsibility for monitoring progress regarding data collection and statistics was transferred to the Scientific Committee. The WPDCS was re-instated in 2009.

2. Provide technical guidance and assistance to coastal countries in the IOTC region for reducing any problems discovered through the studies carried out under 1), in particular strengthening of existing data collection systems (Sampling Programmes);

3. Organize seminars or workshops aimed at mitigating any problems discovered through the studies carried out under 1);

4. Promote the use of integrated database management systems among the coastal countries of the IOTC region, including training and support in the implementation of software developed by the IOTC staff (*e.g.* FINSS: Fisheries Integrated Statistical System)

5. Endeavour to obtain any historical datasets from the fisheries in coastal countries of the IOTC region that may be of relevance for the assessments of IOTC species.

6. Implement any other activities that both IOTC and OFCF consider necessary to achieve the objectives of the Project.

The fisheries targeted by the Project Phase I were those that were of sufficient size to influence stock assessments or future management measures, or catch fish at sizes not well represented in other fisheries. However, some of the planned activities also benefited developing countries in the region that were not identified by these criteria. The IOTC Secretariat identified initially the following four priority areas of concern relating to tuna statistics in the region.

Statistics from Indonesia: Indonesia is a major tuna-fishing nation in the region. However, the data available from Indonesia were, in general, of uncertain accuracy and incomplete until 2002. Of particular concern was the large fleet of Indonesian fresh-tuna longliners. This fleet is catching yellowfin, bigeye, albacore and southern bluefin tunas, swordfish and sharks. Catches of other tunas such as skipjack and seerfish species by gears other than longline are also important but not well known.

To improve data collection systems in developing coastal countries: The collection of high-quality fisheries statistics in developing countries is an important requirement for further development of their fisheries, and greatly assists in the assessment of the status of tuna stocks by regional bodies such as IOTC. In addition to **Indonesia**, countries participating in this category include **India, Kenya, Maldives, Oman, Sri Lanka, Tanzania, Thailand,** and **Yemen.**

Statistics from gillnet fisheries: These fisheries operate primarily from **Iran**, **Oman**, **Pakistan** and **Sri Lanka,** and are an important component of the fisheries for tropical tunas, as they catch a range of sizes that are not usually available to other gears during the same seasons and areas.

Statistics from new longline and purse-seine industrial fisheries: These fisheries currently operate from **Iran**, **Malaysia, Mauritius, South Africa**, **Seychelles**, and **Thailand,** and are of major importance in terms of the volumes of tropical tunas they catch.

1.3.3. Framework for Phase II

The MOU for Phase II of the Project was signed by both parties on 25th June 2007, when the Project itself was launched. This phase of the Project continued for three years, until March 2010.

The title of Phase II was "Cooperation Project for Enhancing the Data Collection and

Processing Systems for Tuna Resources in the Indian Ocean Phase II"

The objective of Phase II was "to contribute to the realization of sustainable utilization of tuna resources, by improving the accuracy of data collection and statistical analysis of the catch and resources of tuna in the Indian Ocean".

The OFCF dispatched one long-term expert for Phase II. The following activities were carried out under Phase II:

1. Providing technical guidance and assistance to coastal countries in the IOTC Region in order to enhance the fisheries data collection and processing systems in those countries.

2. Transfer of technology, as necessary to achieve the above.

3. Implementing any other activities that both IOTC and OFCF consider necessary to achieve the objectives of the Project.

Phase II of the Project succeeded to framework of Phase I including the main three principles, described in the previous section.

The activities implemented during Phase II of the Project were, as far as possible, in line with the recommendations of the IOTC and its technical bodies, in particular the Scientific Committee. Overall, the priority areas identified for Phase I apply also to Phase II.

1.3.4. Implementation strategy for Phase I and II

Before implementing any activities supported by Phase I and II in a country, the importance of that country's fisheries in the context of the IOTC and these activities was assessed.

The activities for implementing the Project described in Sections 1.3.2 and 1.3.3 above were then initiated, in the following four elements:

- Fact finding mission/Country report

- Technology transfer

- Training/Workshops

- Technical assistance

The process by which particular activities were selected and assigned to priority work areas was similar to that used in Phase I. Figure 1-1 outlines the steps taken to determine which activities would be implemented in each country.

Establishing a knowledge base

Although the major problems pertaining to fisheries data were already well known to the IOTC Working Parties and the Secretariat's data group, the amount of information available to the IOTC-OFCF staff to determine how best to address the problems varied considerably. When sufficient information was available, the IOTC-OFCF staffs were readily able to decide which actions were most appropriate for addressing the problems that had been identified. When little information was available, there was an obvious need to include a step to collect more information. This was mainly achieved through fact-finding missions, country reports, and an initial workshop involving relevant experts:

- **Fact-finding missions**: Missions by IOTC-OFCF staff to particular countries to

identify the institutions responsible for the collection and processing of fisheries data, the types of information that were being collected, and how the statistics were derived and produced. The information collected during a fact-finding mission served three purposes:

1. To confirm the importance of the issues identified for the fisheries concerned;

2. To assess the level of commitment from the governments in the country concerned to improving their data collection and processing systems, if required;

3. To be able to determine or confirm which activities and approaches would be necessary to achieve the particular requirements.

Figure 1-1. Sequence of steps taken to determine which activities are implemented in each country.
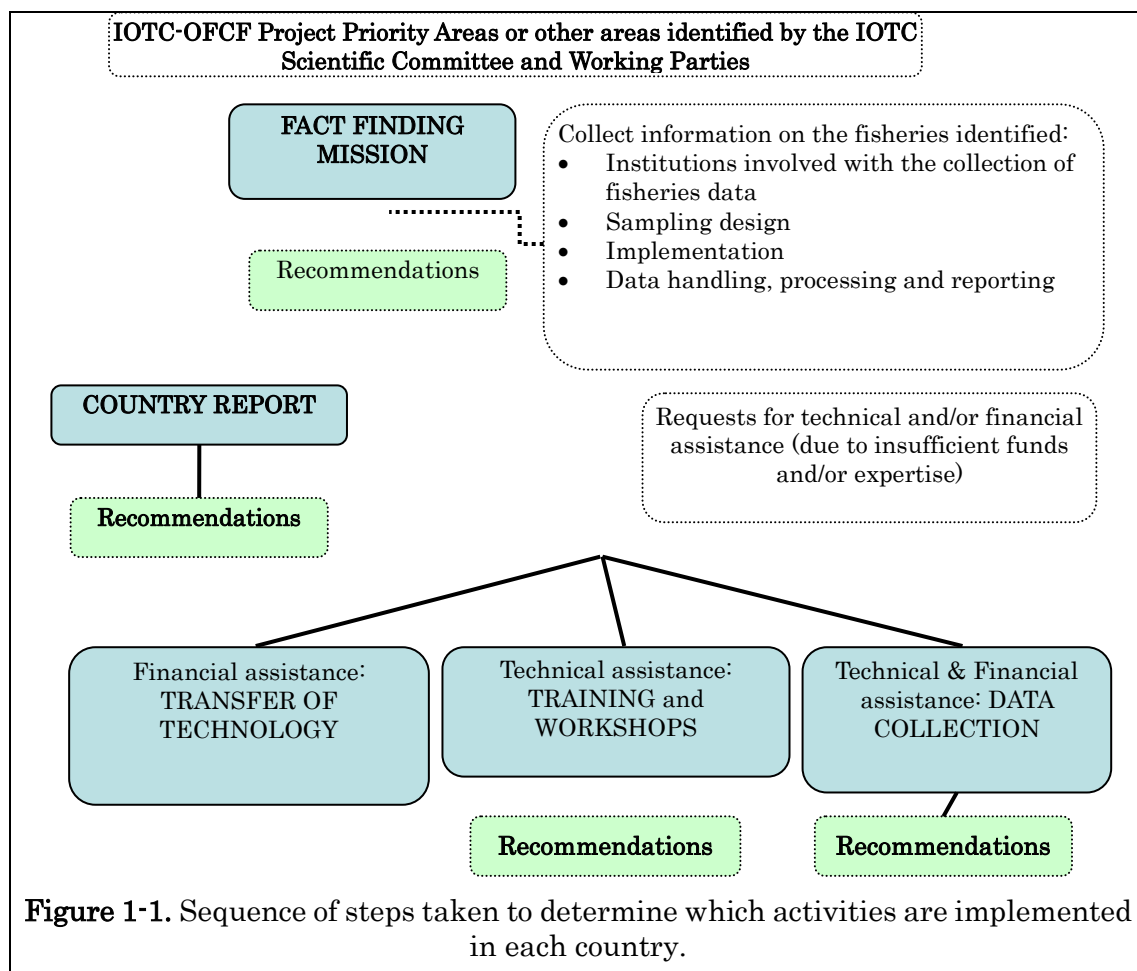
- **Country reports**: For each country visited, these reports contain an up-to-date description of current fishing activities, the institutions responsible for the collection and processing of fisheries data (including the names and contact details of relevant people), the types of data collected and their use, the major problems related to the collection and processing of statistics, and a list of recommendations to address the issues relevant to the Project. The production of a Country Report involved staff from one or more institutions in each of the countries, who were responsible for the final edition of the report, with the help of staff from the Project or from other scientists with experience of the fisheries concerned, hired by the Project as consultants. The publication of a country report came as a follow-up

action after a fact-finding mission or was decided on the basis of the background information available at the IOTC Secretariat relating to the fisheries data collection and processing systems in that country. The cooperation of the country's institutions was, in either case, a prerequisite before going ahead with the completion of a country report.

- **Major Workshop:** The mission and country reports include lists of recommendations intended to provide guidance for the country concerned to be able to address the deficiencies identified concerning its ability to produce accurate fisheries statistics. These recommendations were revised during a workshop that took place after the completion of the first round of country reports, which was attended by the scientists from the country concerned, IOTC-OFCF experts, and any other scientists or experts involved. The main objectives of the workshops were to share the experiences from the different fisheries involved and try to find common solutions to address the problems that had been identified. The recommendations arising from the above activities covered a range of areas, notably:

Institutional issues: In most countries, the collection and processing of fisheries data involve two or more institutions, but the systems in use and the statistics produced are frequently conflicting. The main reasons for this are the lack of communication and exchange of data among the institutions involved.

Data collection issues: These generally included one or more of the following:

- **Deficient sampling design:** The sampling strategy in use is not appropriate for the fishery concerned. This is usually a consequence of changes in the fisheries that occurred over time, and sampling designs that were not modified to incorporate the changes that occurred.

- **Poor implementation of data collection procedures:** The sampling protocols for data collection for all the fisheries concerned are not strictly followed, due to (a) insufficient sampling effort, when the funds allocated to data collection were not enough for the implementation of the activities as planned (for most of the fisheries concerned, this reduced the precision of the statistics produced from the data collected); and (b) insufficient supervision, which results in the enumerators not doing their jobs to the levels required, despite a good sampling design.

Data processing and data dissemination issues: Most of the problems identified with data processing and data dissemination are due to a lack of adequate computer hardware and/or software in the countries concerned. The main consequences of this are:

- **Poor data validation and verification routines:** In many cases, data verification was mainly carried out by hand; this is time-consuming, does not allow for the level of rigour required, and is prone to error.

- **Late dissemination of statistics:** The lack of adequate computer hardware and/or software in some countries made it difficult to produce the statistics in time, due to a lengthy and laborious data compilation and processing.

Identifying how to best proceed in each country

The next step for the IOTC-OFCF experts was to assess if the issues identified for each country could be addressed with support from the Project, and exactly what type of actions or activities were required. This is summarised below:

- **For institutional issues: Training or Workshops** were used to increase the awareness in the recipient countries of the need for the institutions involved with data collection and processing to communicate regularly and exchange the data collected with a view to improving the quality of the statistics produced. Training sessions were held in the countries concerned or at IOTC headquarters. **Transfer of Technology** was used to increase the capability of the institutions involved in data collection to exchange and verify data. This involved training sessions in the use of the hardware and/or software provided. FINSS (Fisheries Integrated Statistical System), developed by the IOTC Secretariat, was the software of choice in most cases, as it includes modules covering the entry, validation, and reporting of fisheries data.

- **For data collection issues: Training or Workshops** were used to increase the ability of the scientists or other staff responsible for the collection of statistics in the recipient countries to maintain the relevant data collection systems. The training or workshop sessions were held in the countries concerned or at IOTC headquarters. **Technical and/or financial support** for one or more institutions in the countries concerned, in order to strengthen its capacity relating to the collection of fisheries data. The level of support provided to data collection activities varied depending on the following:

  1. **The species involved and their levels of catches:** In general, the IOTC-OFCF experts prioritized the implementation of activities for fisheries reporting high catches of yellowfin tuna and/or bigeye, albacore, and skipjack tunas, and/or swordfish, because these species are of great interest to the IOTC.

  2. **The types of fisheries involved:** The way in which the fishing units for some of the fisheries operate limited, in some cases, the type of support that the Project was able to provide.

     This is the case with most of the artisanal fisheries, in which large amounts of fishing units usually operate from a large number of landing locations that extend, in most cases, over large areas. The implementation of sampling activities for these fisheries had to be dropped due to the considerable human and financial resources that had to be devoted to the task, something that was beyond the capacity of the Project.

     In contrast, the implementation of field activities relating to semi-industrial or industrial fisheries was possible in most cases, mainly when the amount of fishing units involved and landing locations were not high.

  3. **The types of data required:** The programmes implemented focused on the following data types:

     - Vessel information (*e.g.* vessel identification, dimensions) and catch and effort data (total catches and vessel activities, including operating range and average time at sea).
     - Length-frequency data: individual lengths of the fish caught.
     - Biological data, including length, weight and other biological information on individual specimens.

     In general, the above information was collected by strengthening the existing sampling programmes in the countries concerned, or by implementing new programmes in cooperation with the local institutions responsible for carrying out these activities. In some cases, the data collection activities were extended

to include the collection of historical data.

4. **The existing data collection systems** in the countries concerned before the implementation of the new activities: The type of activities implemented in each country varied, depending on the amount of data that was collected by the local institutions and its quality. The Project experts tried in all cases to maximize the use of the resources available by modifying the existing sampling schemes rather than implementing new sampling activities from scratch.

5. **The amount of resources available** for the implementation of the activities concerned: Prior to initiating a programme in a particular country, the IOTC-OFCF experts evaluated the importance of each fishery, based on the above criteria, with a view to sorting the activities according to their importance and estimating the proportion of the total funds available for operation that could be devoted to each activity.

- **For data processing and data dissemination issues:** Training sessions were held in the countries concerned to increase the ability of the scientists, database administrators, or other staff responsible for the computerization, processing and reporting of fisheries statistics in the recipient countries, to use and maintain databases and other processes related to data verification, processing and reporting.

Once the IOTC-OFCF experts and the institutions in the recipient countries agreed on the activities required, the IOTC-OFCF experts drafted Memoranda of Understanding (MOUs) or Technical Agreements (TAs), to be signed by the representatives of IOTC and OFCF and the counterpart individuals or institutions in the recipient country, which addressed the following:

- Total funds to be provided by the Project in support of the activities identified, and terms of payment;

- Name of the programme, main purpose, and details of the activities to be carried out[2];

- General conditions for the use of funds, responsibilities, intellectual property rights, staff, and other similar issues;

- Information to be reported to the Project, and reporting timelines;

- Date of entry into force, and duration;

- Commitment from the recipient organization to maintaining the activities implemented or addressing the recommendations made with respect to those activities on termination of support by the Project.

In general, the results of the activities implemented with the support of the Project were assessed by the experts involved, and in each case new recommendations were made regarding any remaining problems. The continuation or extension of the field activities implemented through the programme was sought in all cases. To this end, the Project experts approached the institutions involved in the recipient countries with a view to seeking their commitment to the continuation of these activities. This was agreed by all countries, and a country's commitment was reflected in the last MOU or TA it signed. All countries also sent plans indicating that the activities were to be maintained under the same or similar terms and conditions after the termination of support by the Project.

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[2] Technical details are set out in the appendices to the MOU or TA

1.4. Framework for Phase III

The MOU for Phase III of the Project between both parties was signed completely by 15th June 2010. This phase of the Project continued for three years, until March 2013.

The title of Phase III was "Cooperation Project in support of activities related to the Regional Observer Scheme in the Indian Ocean."

The objective of the Project was "to realization of tuna resources, by improving accuracy of data collection and statistical analysis of the catch and resources of tuna in the Indian Ocean".

The Terms of Reference of the activities focused on support of IOTC coastal countries to provide technical guidance and assistance for improving fisheries data collection and processing systems, with particular focus on enhancing the systems for collection/processing of port sampling data from artisanal fisheries in the coastal countries related to the Regional Observer Scheme (Phase III), as identified in the following provisions of IOTC Resolution 10/04 (superseded by Resolution 11/04),:

4. The number of the artisanal fishing vessels landings shall also be monitored at the landing place by field samplers. The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total levels of vessel activity (i.e. total number of vessel trips or total number of vessels active).

Basically, activities of Phase III is to strengthening data collection and data processing, as similar activities of the Phase I and II, paying attention to artisanal fisheries along coastal countries.

The OFCF dispatched one long-term expert for Phase III. The following activities were carried out under Phase III:

1. Providing technical guidance and assistance to coastal countries in the IOTC Region in order to enhance the fisheries data collection and processing systems in those countries relating to the Regional Observer Scheme.

2. Transfer of technology, as necessary to achieve the above.

3. Implementing any other activities that both IOTC and OFCF consider necessary to achieve the objectives of the Project.

Phase III of the Project followed three main principles and framework of Phase I and II, described in the previous section.

The activities implemented during Phase III of the Project were, as far as possible, in line with the recommendations of the IOTC and its technical bodies, in particular the Scientific Committee by on focusing coastal fisheries associated with the coastal countries in the IOTC region. Detail work plan as an implementation schedule was jointly prepared by the IOTC Secretariat and the OFCF expert at the beginning of each fiscal year. Work plans in 2010, 2011, and 2012 are shown in Annex 2.

Implementation strategy was almost followed during Phase I and II of the Project. As major problems were already well described to the IOTC Working Parties and the Secretariat's data group, and information collected through Phase I and II, activities of Fact-Finding and Country report were skipped (see Figure 1.1).

As following the process during Phase I and II, once the IOTC-OFCF experts and the institutions in the recipient countries agreed on the activities required, the

IOTC-OFCF experts drafted Memoranda of Understanding (MOUs) or Technical Agreements (TAs), to be signed by the representatives of IOTC and OFCF and the counterpart individuals or institutions in the recipient country. Examples of TA and MOU are shown in Annex 3 and 4.

2. Results of implementation of activities by the Project

This section describes and summarizes the results of the activities carried out under the Project.

2.1. Summary of implementation of activities by Project Phase I and II

The activities of the IOTC-OFCF Project are classified into six main areas in Section 1.3.2). Tables 2-1 and 2-2 summarize the activities that were implemented in each area. Figures 2-1 and 2-2 show the Project activities in each country.

Table 2-1. Summary of implementation of Project activities in Phase II from April 2002 to March 2007

Area 1: Conduct studies to determine the current status of data collection, processing and analysis in coastal countries of the IOTC region, including fact-finding missions by Project staff to those countries and documentation of the current fisheries and fisheries information systems in those countries
Summary of activities implemented: (1) Fact-finding missions to Indonesia, Thailand, and Oman in 2002, Sri Lanka, Iran, India, Maldives, Mozambique, Mauritius, and Seychelles in 2003, Tanzania and Kenya in 2005. (2) Compilation of Country Reports for all the above countries (Indonesia's report was not prepared through the Project). The missions sent to Indonesia, Oman and Maldives in 2002, Sri Lanka in 2004, and Kenya, Tanzania, and Thailand in 2005, led to the implementation of data collection and processing activities in those countries.
Area 2: Provide technical guidance and assistance to coastal countries in the IOTC region for reducing any problems discovered through the studies carried out under (1), in particular strengthening of existing data collection systems
Summary of activities implemented: The following sampling programmes were implemented in order to strengthen data collection systems for the fisheries concerned: (1) Fresh tuna longline fishery of Indonesia: carried out from June 2002 to December 2006 in Indonesia, involving the collection of catch and size-frequency data. (2) Fresh tuna longline fisheries of China, Taiwan,China[3], and Indonesia: carried out from June 2002 to December 2006 in Thailand, involving the collection of catch and size-frequency data. (3) Artisanal gillnet and handline fisheries in the Arabian Sea: carried out from January to March 2003 in Oman, involving the collection of size-frequency data for yellowfin tuna. (4) Pole-and-line fisheries of the Maldives: carried out from June 2003 to March 2005 in Maldives, involving the collection of size-frequency data for the species caught. (5) Offshore gillnet and longline fisheries and coastal longline fishery of Sri Lanka: carried out from October 2004 to December 2006, involving the collection of catch, effort and size-frequency data. (6) Coastal purse-seine fisheries of Thailand: carried out from November 2005 to October 2006, involving the collection of catch, effort and size-frequency data, in particular for neritic tuna species.
Area 3: Organize seminars or workshops aimed at mitigating any problems discovered through the studies carried out under (1)
Summary of activities implemented: (1) Regional workshop on data collection and statistical systems in countries of the IOTC region: Held in Seychelles in March 2004; review of the Country Reports compiled by the Project during 2002-03, including Indonesia. (2) International workshop on the collection and management of statistics from fresh-tuna longline fisheries based in Thailand and Indonesia: Held in December 2004 in Indonesia (3) Workshop on the collection and management of statistics from offshore gillnet and longline fisheries and coastal longline fisheries based in Sri Lanka: Held in December 2005 in Sri Lanka (4) Workshop on the collection and management of statistics from coastal purse-seine fisheries based in Thailand: Held in November 2005 in Thailand (5) International workshop on the collection and management of statistics from industrial tuna

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[3] Taiwan,China refers to Taiwan Province of China

purse-seine fleets based in the Islamic Republic of Iran and Kenya: Held in December 2005 in Seychelles
In addition to the above activities, the OFCF organized five annual Fishery Resource Management Courses (FRMCs) between 2002 and 2006. Although the FRMCs were organized independently from the IOTC-OFCF Project (and therefore not covered through Project funds), they involved the participation of 16 persons from countries in the IOTC region.

Area 4: Promote the use of integrated database management systems among the coastal countries of the IOTC region, including training and support in the implementation of software developed by the IOTC staff
Summary of activities implemented:
The activities implemented under this area are closely related to those implemented through area (3) above; the workshops under area (3) included also components related to database management, and therefore apply also to this area. In addition, the following workshops referred exclusively to this area:
(1) International workshops on data processing and database management using IOTC FINSS software: Held in August 2002 in the Seychelles and December 2004 in Indonesia.
(2) International workshop on database administration: Held in February 2005 in Seychelles
Other activities implemented under this area concerned the transfer of technology to countries in the IOTC region, including the provision of IOTC FINSS software and related training activities:
(1) Training in the use of IOTC FINSS software for the fisheries operating in Mauritius, including the provision of the software and one Desktop PC in 2002.
(2) Training on the use of IOTC FINSS software for the fisheries of Indonesia in May 2003 in Seychelles
(3) Provision of the software FINSS and the user manual to countries in the IOTC Region since 2004, including provision of technical assistance to those countries.
(4) Provision of Desktop PCs and motorbikes to Tanzania in 2007 in order to strengthen monitoring of the fisheries in this country.

Area 5: Endeavour to obtain any historical datasets from the fisheries in coastal countries of the IOTC region that may be of relevance for the assessments of IOTC species.
Summary of activities implemented:
(1) Compilation of fisheries statistics through the preparation of Country Reports and missions from IOTC-OFCF staff to the relevant countries
(2) Compilation and computerization of historical data from the sport fisheries of Kenya (extending from 1980 to 2006).
(3) Compilation of historical data on the catches and sizes of specimens unloaded in processing plants in Indonesia: The collection of historical data was not successful due to the lack of cooperation from the industry in this area.

Area 6: Implement any other activities that both IOTC and OFCF consider necessary to achieve the objectives of the Project
Summary of activities implemented:
The Project provided support for the preparation of the IOTC Field Manual, following a recommendation from the IOTC Scientific Committee. The draft manual prepared by the consultant is still under review.

Table 2-2. Summary of implementation of Project activities in Phase II from June 2007 to March 2010.

Area 1: Conduct studies to determine the current status of data collection, processing and analysis in coastal countries of the IOTC region, including fact-finding missions by Project staff to those countries and documentation of the current fisheries and fisheries information systems in those countries
Summary of activities implemented:
(1) Fact-finding mission to Mauritius to investigate data collection for landings and transhipments by foreign fresh-tuna longline in Port Louie in 2007.
(2) Fact-finding mission to Yemen to assess status of data collection and data management for catching IOTC species including finding historical data in March 2008.
(3) Fact-finding mission to Comoros to assess status of data collection and data management for fisheries catching species under IOTC mandate in December 2009.
(4) Fact-finding mission to Thailand to assess institutional arrangements, details of operation of tuna

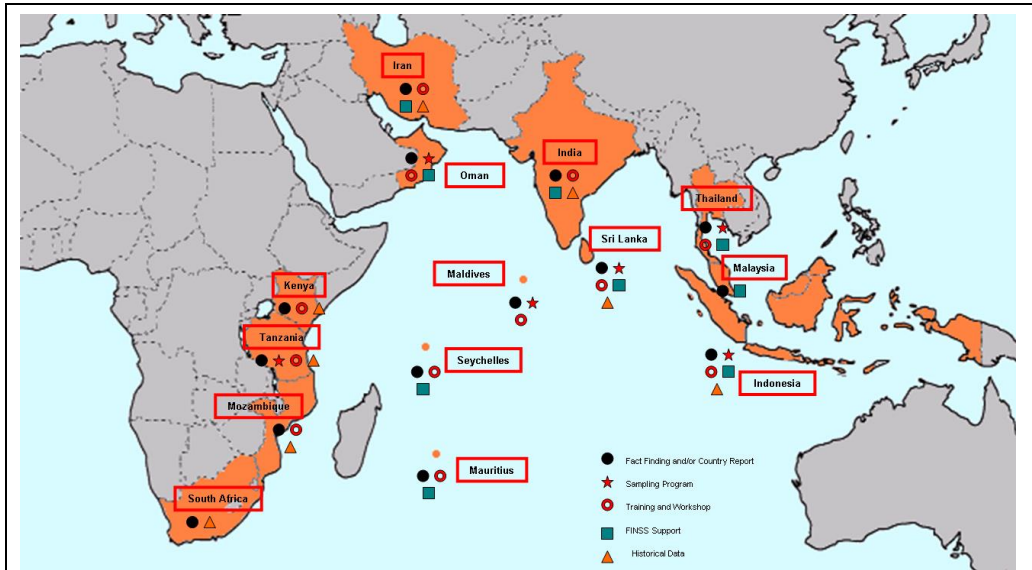| |
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| purse seine fleets, existing fisheries data, data storage, and data processing by the Department of Fisheries (DOF), Thailand in December 2007. |
| **Area 2:** Provide technical guidance and assistance to coastal countries in the IOTC region for reducing any problems discovered through the studies carried out under (1), in particular strengthening of existing data collection systems |
| **Summary of activities implemented:**
(1) The sampling programmes was implemented for artisanal gillnet and handline fisheries in the Arabian Sea: carried out from January to March 2003 in Oman, involving the collection of size-frequency data for yellowfin tuna, narrow-barred Spanish mackerel, and longtail tuna from January to December 2009.
(2) Supporting Directorate General of Capture Fisheries (DGCF), Indonesia, in the implementation of a vessel marking scheme for fresh-tuna longlines based in Indonesia. The Project supported to provide stickers in unique numbers, and necessary equipment for data entry.
(3) Although discussion on implementation of the sampling program in Yemen was made, this could not be realized due to country's security. |
| **Area 3:** Organize seminars or workshops aimed at mitigating any problems discovered through the studies carried out under (1) or recommended by the IOTC. |
| **Summary of activities implemented:**
(1) Workshop on logbook program for Indonesian fisheries in Indonesia held in Jakarta in May 2009 and a report on this workshop was published.
(2) In addition to the above activities, the OFCF organized Leadership Training Course on Fishery Resource Management (previously called FRMC during Phase I) between 2007 and 2009. Although these course were organized independently from the IOTC-OFCF Project (and therefore not covered through Project funds), they involved the participation of 4 persons from four countries in the IOTC region. |
| **Area 4:** Promote the use of integrated database management systems among the coastal countries of the IOTC region, including training and support in the implementation of software developed by the IOTC staff and assist necessary database system recommended under (1) |
| **Summary of activities implemented:**
Constructing database to store data collected from industrial purse seine, employing IT expert in Phuket from March 2008 to February 2009, including necessary equipment provided to the Andaman Sea Fisheries Development Center (AFRDEC) under DOF, Thailand. |
| **Area 5:** Endeavour to obtain any historical datasets from the fisheries in coastal countries of the IOTC region that may be of relevance for the assessments of IOTC species. |
| **Summary of activities implemented:**
(1) The project examined all the historical sport fishing data entered in the spreadsheet at Fisheries Department, Kenya during Phase I. All records from Malindi were transferred from spreadsheet to Microsoft Access Database during 2008.
(2) The Project approached to the Marine Science and Biological Research Authority, Aden and Ministry of Fish Wealth, Sanaa, Yemen to collect historical data on yellowfin tuna caught by artisanal fisheries data in Yemen, but due to the situation in Yemen, the project could not make any further implementation this work. |
| **Area 6:** Implement any other activities that both IOTC and OFCF consider necessary to achieve the objectives of the Project |
| **Summary of activities implemented:**
There was no specific activities implemented in this area. |

Figure 2-1. Summary of activities implemented during Phase I of the IOTC-OFCF Project, and countries involved
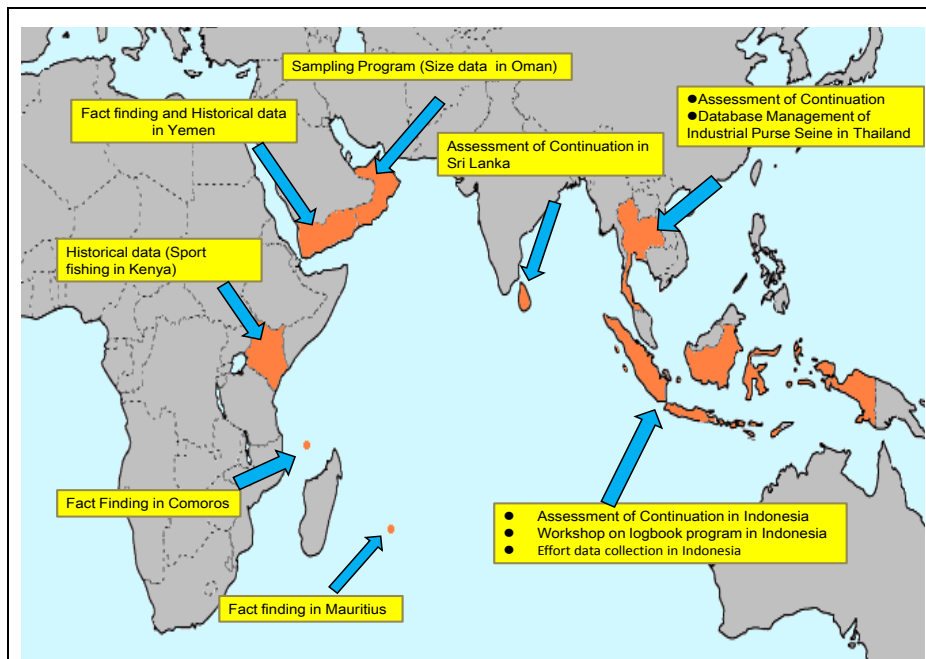
Figure 2-2. Activities during Phase II.

2.2 Results of implementation of Project Phase III

The activities during Phase III of the Project are summarized in Figure 2.3.
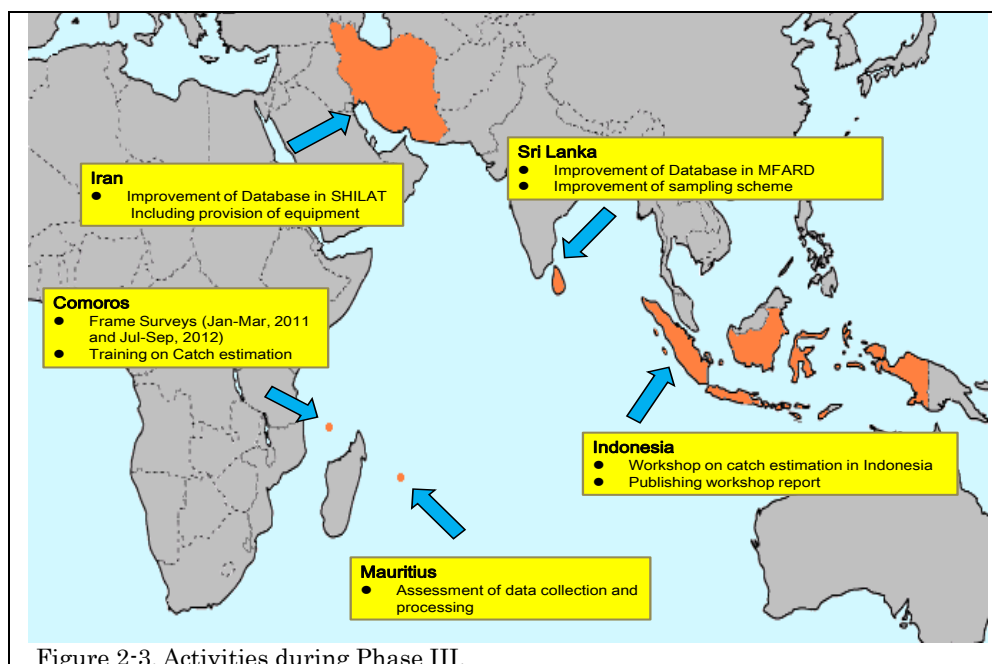
Figure 2-3. Activities during Phase III.

2.2.1. Activities in Comoros

2.2.1. a Census of marine fisheries in the Union of Comoros

Background information

The types of fisheries operated in the Comoros are summarized in the following points:

- Several types of fishing vessels are used in Comoros (Figure 2-4). The majority of boats are around 3.9m in length, motorized or non-motorized wooden or fibre glass non-decked vessels.
- The coastal areas around islands in Comoros are very deep. Due to the size of boats and geographical conditions, Comorians fishing occurs along very near coastal waters, and exploits mainly pelagic species (*Thunnus albacares*, *Katsuwonus pelamis*, *Thunnus alalunga*, *Istiophorus platypterus*, *Thunnus obesus*, *Euthynnus affinis*), providing 55% of total jobs in the agricultural sector, i.e., about 8,000 fishermen.
- Troll line, drop line and gill nets targeting pelagic species are the main gear types used in the fisheries.
- A typical trip lasts between one and seven days. In 1994, Comoros implemented a data collection at unloading sites, and estimated overall catch in about 7,000 tons of tunas unloaded around Comorian coastal waters.
- There is no industrial fishing at national level. This fishing activity is operated by a foreign fleet under a Fishing Agreement. None of the catch of this fleet is unloaded or transshipped within the country.

 a) Wooden Canoe with outrigger(s) called Galawa pulled by oar "pagaie", using hand lines or nets.	 b) FRP coated outrigger canoe with outboard engine called "Fedawa I", using hand lines.
 c) FRP coated boat with outboard engine called "Fedawa II", using troll lines.	 d) FRP coated Small boat with outboard engine. Yamaha made called "Yamaha G18"
 e) Small vessel with outboard engine like "Yamaha G18", Sogawa made in Comoros. Fishing along coast using handlines.	 f) Larger boat than Yamaha 18 or Sogawa with inboard engine, called "Japawa" or "Komcat". Fishing offshore using handline.

Figure 2-4. Different type of fishing vessels in Comoros.

The last systematic data collection of fisheries in Comoros was in 1996, while the last full census was in 1994; a partial census of fishing vessels was carried out in 2008, however the results are considered incomplete (amounting to 920 fishing vessels in total) and not representative of the fishing fleet operating during that period.

For a number of years the estimation of catch has been based on the number of active vessels or catches monitored at certain times and locations, however the lack of information available on the method of estimation means that these figures are considered highly unreliable.

The IOTC Secretariat currently estimates the catch based on information provided by FAO's FishStat database, however – again – the estimates are generally considered to be of very low quality. Catch levels estimated by the IOTC are around 17,000 metric tons, of which the majority (70-80%) are composed of tuna or tuna-like species.

In 2009 the IOTC Scientific Committee reiterated the need for Comoros to implement a fisheries statistical data collection, management and reporting system as soon as

possible. Comoros has never reported nominal catches of tuna and tuna-like species to the IOTC, while the last data collection of fisheries was in 1996.

The Centre National des Ressources Halieutiques (National Centre for Aquatic Resources) of Comoros, aware of the need to address this recommendation, requested assistance from the OFCF Project. A mission to Comoros in December 2009 was scheduled as part of the planned activities of Phase II of the Project to assess the status of the artisanal fisheries in the country and the availability of information for IOTC species.

The recommendations of the mission are detailed below.

Main recommendations of the Project

1. Comoros should establish a data collection and management system as soon as possible that enables Comoros to derive catch-and-effort and length-frequency data for its artisanal fleets, following standards agreed by the IOTC. Specifically:

    a. Total catch by species and total number of fishing trips by type of vessel, gear, fishing type (e.g. FAD fishery), month, and landing site for vessels operating in coastal waters.

    b. Total catch by species and effort (e.g. number of fishing days), by vessel type, gear, month, and 1-degree square for vessels operating in offshore waters (e.g. outside the EEZ of Comoros)

    c. Individual length measurements by species, vessel type, gear, fishing type, month, and landing site, from all fisheries.

2. Comoros should make the necessary arrangements for a sampling scheme to cover at least 5% of the total number of vessel unloadings, and ensure sampling is representative of the fishery as a whole, as specified in paragraph 4 of IOTC Resolution 09/04[4].

3. The following actions should be undertaken by Comoros as a matter of priority in order to address the above issues:

    a. Conduct a census of the fisheries in the country, including a full account of landing locations and fishing vessels operated in each location, by type of vessel (including hull material, type of mechanization, vessel length and power, number of crew, etc.), type of gear(s) used, target species, average number of days at sea, main fishing grounds, average catch by gear, etc. The vessel identification number and ownership should also be recorded, where available.

    b. Establish a new sampling scheme, using the results from the above study, with a view to covering at least 5% of the fishing effort in each sampling stratum.

4. Comoros should set up a database system for computerizing and processing all data collected through the above system, including data verification, estimation of catches and reporting services, so as to facilitate the timely provision of the information requested by government institutions, stakeholders, the FAO and the

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[4] IOTC Resolution 09/04 on a Regional Observer Scheme, Paragraph 4: "The number of the artisanal fishing vessels landings shall also be monitored at port by observers. The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total landings."

IOTC.

5. Comoros should provide the IOTC with estimates of catches for the 1995-2008 period, including information on the type of data collected, data sources, and estimation procedures, as specified in IOTC Resolution 08/01.

6. Comoros should provide the IOTC with estimates of total number of fishing vessels active for the period 1995-2008, including information on the type of data collected, data sources and estimation procedures, as specified in IOTC Resolution 08/01

7. Comoros should request the support of the IOTC for the implementation of the new data collection and management system, where required[5].

Actions implemented through the Project

- Census: Prior to implementation of the sampling program by DGRH in January 2011, the IOTC-OFCF Project prepared the MOU for the census, working with DGRH, and reached agreement of the MOU in December 2010. The census was conducted between January and March 2011.
- Sampling of landing places: IOTC secured the IOTC accumulated funds from the Commission (channelled through the IOTC Secretariat) to carry out sampling program at landing place, following the recommendations by the IOTC-OFCF Mission in December 2009, and IOTC Secretariat prepared the MOU between 'Direction Generale des Ressources Halieutiques (DGRH) and the Secretariat. The MOU was signed in August 2010.

The activities of the census survey were commenced through support to the DGRH in January 2011 in parallel with a sampling program initiated with the assistance of the IOTC Secretariat, using funds from the Commission. The sampling activity was completed in January 2012.

Design of Census Survey

During January-March 2011, the project implemented the census survey in three Comorian Islands (Anjouan, Grande Comore, and Mohéli) to identify landing sites of fishing vessels and record the number of fishing vessels operating in the country (Figure 2-5)
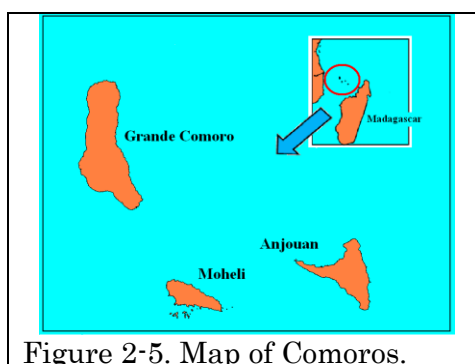
Figure 2-5. Map of Comoros.

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[5] IOTC Resolution 09/04 on a Regional Observer Scheme, Paragraph 7: "The observer scheme referred in paragraph 4 will be covered by the Commission's accumulated funds and voluntary contribution on a provisional basis. The Commission will consider at its 14th Annual meeting an alternative for the financing of this scheme"; Paragraph "13. The funds available from the IOTC balance of funds may be used to support the implementation of this programme in developing States, notably the training of observers."

A total of 10 enumerators were temporally employed for the census. Four enumerators to work in coastal villages in Grande-Comore Island, two enumerators in Mohéli Island and four enumerators in Anjouan Island.

Two enumerators as a team surveyed the three islands. Each group was equipped with a tape measure to obtain length of boats, and portable GPS to record position of landing sites.

Three data collection forms were used:

> Form 1: Information on the village: availability of motor and boat reparation, catch selling facilities and the number of the landing sites near or far from village.

> Form 2: General information on landing sites: GPS position, the availability or unavailability of equipment us (access road, taxi, market, electricity etc.), and placement of the fishing vessels in the site.

> Form 3: Information of fishing Units: number of different fishing boats categorized in Table 2-3, including the boats on the sea and on land. Vessel types were categorized in the following table. More information from the boats present on the land was required during the enumerators (boat lengths, year of building, kind of propulsion, number of crew onboard, fishing gear and kind of conservation etc.).

Table 2-3. Artisanal fishing vessel types in Comoros with code for data collection.	
Vessel Code	Description of Type of boat
GAP	Small no-moralized wooden canoe with oar "Pagaie" called "Galawa" using handlines as fishing gear (see Figure 2-X a).
GAF	"Galawa" using nets
FD1	FRP coated "Galawa" with outboard engine called Fedawa I (see Figure 2-X b)
FD2	FRP coated small boat with outboard engine called "Fedawa II", using troll lines called Fedawa II(see Figure 2-X c)
G18	FRP coated small boat with outboard engine called "Yamaha G18" or "Sogawa" (see Figure 2-X d and e)
JAK	Relatively larger boat than "Yamaha 18" or "Sogawa" with inboard engine called "Japawa" or "Komcat" (see Figure 2-X e)

All information collected during the census was obtained either through direct observations and the enumerators asked questions to fishermen or to the village Chief.

Data have been collected by the investigators and sent regularly to the DGRH office at Moroni in Grande-Comore. Verified data are then entered into Microsoft Access database designed and provided by the IOTC Secretariat.   This census was completed during March 2011.

Once port sampling activities funded by the IOTC ended at the end of January, 2012, EU funding continued to finance port sampling activities from February 2012. Upon request from DGRH to implement the second census in a different season, the IOTC-OFCF Project reached agreement of the MOU with DGRH in June 2012. The DGRH commenced the second census from July to September, 2012, employing the same design. The second census was completed at the end of September, 2012.

However, the DGRH were unable to complete the planned port sampling activities funded EU.

Main results of the Census Survey

The results of the first census were presented during the IOTC Working Party of Tropical Tunas (WPTT) in October 2011 (IOTC-2011-WPTT13-13), and represent the first census of fishing vessels since 1994.   The following main results were cited from this report.

Preliminary results of artisanal fishing vessels of the 2011 census are shown below in table 2-4

Table 2-4. Provisional number of Comorian artisanal fishing boats composed by category by the census from January to March 2011.

Type of Boat	GAP	GAF	FD1	FD2	G18	JAP	Total
Number of boat	3,619	106	49	200	1,263	86	5,323

Source: Direction Générale des Ressources Halieutiques
Note: Further analysis of the census database by IOTC has revised the number of boats (see chapter 2.2.1. b for more details).

Many of the landing sites were surveyed multiple times during each census to ensure accurate counts of total and active vessels. In many cases large differences in the number of total vessels were reported by enumerators during each visit, meaning that several different estimates exist for each landing site. The official number of vessels for each site is currently being agreed by IOTC and Comoros. Section 2.2.1 b discusses the issue in more detail.

Only the GAP category is not totally motorized. The motorized boat represents 32% to the total boats while the part of non- motorized boats is 68%.

Figure 2-6. Number of fishing boats according to the categories at three Islands between January and March 2011
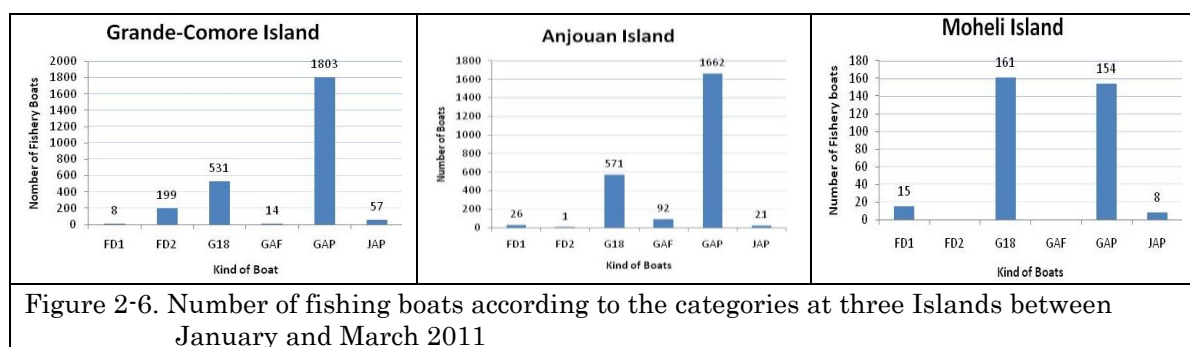
Figure 2-6 shows number of fishing boats by type of boast by Islands.
- Grande Comore Island acounts for 2,612 fishing boats include different types, and a total number of boats represent 49 % of all Comorian boats. Among them, 31 % are motorized and 69 % are non-motorized in Grande Comoro.
- Anjouan Island has a total of 2,373 fishing boats of all categories that represent 45 % of the national fishing fleet. Motorized boats are about 30 % and 70 % are non-motorized boats.
- At Moheli Island, 338 fishing boats were counted that represent 6% of the national fishery fleet. 54 % are motorized and 46 % are non-motorized.

The number of the artisanal fishing fleet increased from the last census in 1994 except for FD1 (Figures 2-7 and 2-8). This also shows more boats become motorized in 2011.

Figure 2-7. Comparison of artisanal fishing boats of Comoros in 1994 and 2011.

Figure 2-8. Comparison of artisanal fishing boats for each Island in 1994 and 2011.
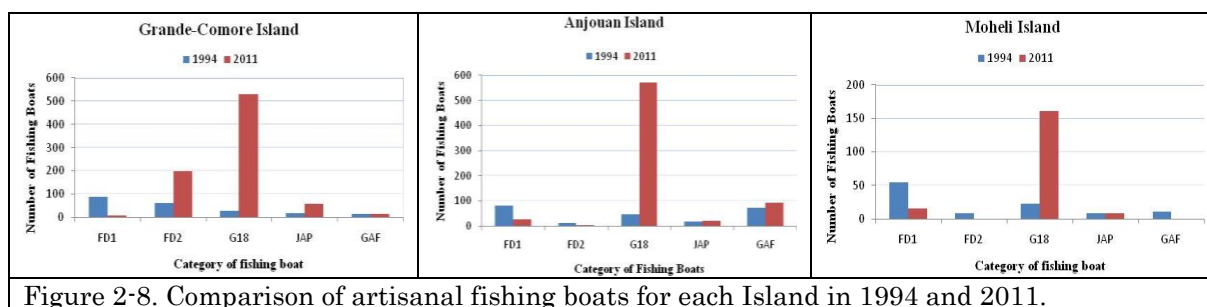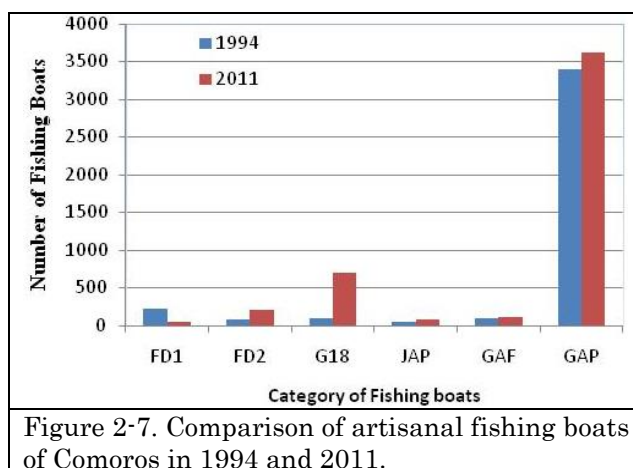
Compared to the 1994 census, two key trends emerge – an increase in the number of fishing vessels, mostly in the G18 and GAP categories; and a higher number of motorized vessels and mechanization of the Comoros fleet.

Evaluation of the Results

Arrangements were successfully made with the authorities of Comoros to implement the Census survey, consisting of two fisheries censuses, at different times during the year, and the catch monitoring survey, funded by the IOTC. Thanks to authorities' efforts, the censuses and catch monitoring surveys were successfully completed, for the first time since the last surveys, which occurred in 1994.
The implementation of the census surveys and catch monitoring programme has assisted Comoros in the implementation of IOTC provisions, in particular minimum levels of coverage for catches sampled at the landing place (well above the minimum 5% of fishing activity), and minimum reporting requirements.

Recommendations

Further training on supervision of data collection activities and data management are required to ensure the smooth continuation of activities in Comoros, under the responsibility of the DGRH.

2.2.1b Comoros: Catch Estimation Training

Background

In January 2011, the Research Centre for Aquatic Resources of Comoros received support from the IOTC for the implementation of a catch monitoring programme for the marine fisheries of Comoros, for a year. In addition, the IOTC-OFCF Project provided support to conduct two fisheries censuses, between January and March 2011, and between July and September 2012. As a follow-up to these activities, the Project conducted a training course on catch estimation in May 2012, inviting two officers from Comoros to the IOTC Secretariat, Seychelles, to analyse the data collected through the census and sampling activities.

The objectives of this training course were to 1) to examine the data and 2) to finalize the estimation method and procedures in the database.

Main Results

This report presents main results covering activities from the training course and preliminary estimates of total levels of catch and effort by the marine fisheries of Comoros.

Total Vessel Numbers

Table 2-5 presents estimates of total number of fishing vessels in the Comoros, as compiled during the two Census events, in 2011 (Kaskasi) and 2012 (Kusi).

The totals presented refer to the minimum, maximum, and average number of vessels at each landing site (i.e., across multiple visits), and the number of vessels from the visits identified by RCAR staff as the most reliable.

The large difference in the numbers of vessels reported on the different visits to each landing place, and results from the two Census events, need to be further explored.

The numbers identified by RCAR staff (i.e. Cor) were used as total number of vessels in the estimation of total catches. The procedure that RCAR used for the selection of the most reliable visits, however, has not been sufficiently explained, and needs to be clarified.

Table 2-5. Total number of vessels recorded on each Census event, by type of boat
- Total number of vessels estimated using the lowest number of vessels recorded over all visits to each landing site (Min)
- Total number of vessels estimated using the highest number of vessels recorded over all visits to each landing site (Max)
- Total number of vessels estimated using the average number of vessels recorded over all visits to each landing site (Avg)
- Total number of vessels estimated using the most representative/reliable visit, as selected by RCAR staff (Cor)

Type	2011 Kaskasi-Matulai				2012 Kusi-Myonbeni			
	Min	Max	Avg	Cor	Min	Max	Avg	Cor
Fedawa	354	390	372	289	55	56	56	38
G18	1403	1937	1667	1275	1334	1863	1602	1428
Galawa	3749	4712	4240	3971	3189	4563	3877	3685
Japawa	158	168	161	75	73	86	80	57
Total	5677	7220	6453	5623	4651	6568	5615	5208

Vessel activity rates

Results of sampling report very low vessel activity rates of around 25%-40% throughout the year. Low levels of activity are similarly recorded for each vessel type, including the two most common vessels (G18, and GAP vessels), were up to 7 out of 10 vessels are recorded as inactive in each month (Table 2-6).

There is some evidence of a decrease in activity during the Monsoon period (Nov-Apr); however given the general low activity rates throughout the year the seasonal trend is weak at best.

Table 2-6. Sample vessel activity rates.

Month	G18 Vessel type			GAP Vessel type			All Vessel types		
	Total	Active	Activity Rate	Total	Active	Activity Rate	Total	Active	Activity Rate
Feb-11	669	316	47%	980	161	16%	1,731	488	28%
Mar-11	1,155	535	46%	1,440	444	31%	2,764	1,031	37%
Apr-11	955	435	46%	1,402	508	36%	2,445	958	39%
May-11	987	477	48%	1,425	490	34%	2,508	996	40%
Jun-11	1,069	424	40%	1,552	482	31%	2,709	931	34%
Jul-11	1,056	406	38%	1,505	292	19%	2,646	717	27%
Aug-11	1,095	425	39%	1,560	405	26%	2,745	852	31%
Sep-11	942	281	30%	1,384	304	22%	2,399	599	25%
Oct-11	1,040	437	42%	1,393	367	26%	2,533	824	33%
Nov-11	1,047	456	44%	1,266	395	31%	2,401	874	36%
Dec-11	1,033	420	41%	1,363	345	25%	2,469	784	32%
Jan-12	1,108	369	33%	1,358	309	23%	2,537	693	27%
Feb-12	49	1	0%	102	7	0%	152	9	0%
Total	12,205	4982	41%	16,728	4508	27%	30,040	9756	32%

Direct comparisons of activity rates reported by the census and sampling are not possible due to differences in timing of both data collections. However a close approximation can be made is between the first census, conducted Jan-Mar 2011, and sampling which started in February 2011 (but which recorded low vessel numbers and activity for the first month).

Despite differences in the total and active number of vessels reported by the census and sampling, the activity rates of both data sources are very similar at around 35% (Table 2-7), and confirm the low activity levels reported by the sampling.

Table 2-7. Comparison of Census and Sample activity rates.

	Census 1: Jan-Mar 2011	Sample: Feb-Mar 2011 (average)
Total vessels	3,409	2,248
Active vessels	1,211	759
Activity rate	36%	34%

Total catch estimates

Two of the main inputs of the estimation procedure are the census vessel totals and sample weight by species. There are major quality and methodological issues to be resolved with both data sets, before final catch estimates can be developed.

Major Issues of Data collected
i. Census data Variations in total vessels

Many landing sites were surveyed multiple times during each census to ensure accurate counts of total and active vessels. In many cases large differences in total vessels are reported by enumerators during each visit, – variations in vessel numbers between visits, which raises two issues:

- to what extent are there reliability issues with the accuracy of data recorded according to visit? Should vessel numbers from the first survey round be

considered more reliable than subsequent visits – i.e., do enumerators make more effort to count total vessels at the first visit?

● given the range of total vessels reported at some landing sites, what is an appropriate method for calculating total vessels used as the denominator when in vessel activity rates. Taking a simple average of the total vessels at a site may not be appropriate given the extreme range of values reported by some sites (i.e., if the distribution is skewed or bi-modal); alternatively taking the highest number of vessels from each landing site or village (and ignoring which visit it occurs under) although this may lead to double-counting of vessels.

ii. Inconsistency in the identification and classification of landing sites.

Several landing sites have almost identical GPS coordinates, or are located so close to other sites that consideration should be made as to whether they be merged into larger site units to ensure consistency in reporting. This raises a number of questions on the accuracy of total and activity vessels recoded at each site, by different enumerators, and on different visits. The problem of accurately reporting of neighboring sites could be one factor explaining the large differences in total and active vessels observed at some landing sites.

iii. Quality issues of estimated and calculation weights

Two methods of calculating total catch weight are possible from data collected by the sampling:(1) sample catch based on individual weights estimated by enumerators at the site; and (2) sample catch weights derived by standard formula based on individual length measurement readings, again taken by enumerators in the field.

Each methods produces very different results for total sample catch, for two main reasons:

● *Sampling variability of sub-sets*
Not all sampled catch are measured for both lengths and weights; instead length measurements and weights estimates are taken for two different, albeit overlapping, subsets of the sample catch. Differences in the total weights of each sample subset should therefore be expected due to sampling variability.

● *Differences in estimated and calculated weights*
More importantly, there are often large differences in the weights recorded for catch sampled for both weights and lengths. Table 2-8 illustrates this point by aggregating a subset of sampled catch by species, for records in which lengths and weights were taken for all individual catch.

Table 2-8. Comparison of estimated and calculated weights, for main species.

Species	No. Catch	Estimated weights (by enumerators) (kg)	Length-derived weights (kg)	Difference in weights (kg)
YFT	4,251	112,024	114,012	-1,988
BET	1,017	20,662	23,192	-2,530
DLP	1,073	14,324	10,573	3,752
SKJ	1,191	8,548	7,867	681
WAH	406	8,311	24,237	-15,926
BLT	293	5,441	4,844	597
MER	333	4,697	1,971	2,726
ALB	88	2,666	2,416	250
CAR	188	2,318	109	2,209
SKH	68	1,410	425	985
KAW	122	1,325	850	475
SFA	41	1,231	105	1,126
BLM	13	903	361	542
DEM	51	429	66	363
BAR	51	397	37	360
SWO	9	224	24,449	-24,225

The general assumption is that length-based weights are more accurate than weights estimated (often by eye) by enumerators in the field. The assumption presupposes that the quality of length measurements is better than those of estimated weights, which is plausible. Nevertheless, there can also be issues with the quality of length measurements.

iv. Wide variances in the sample catch weights

A second issue regarding sample catch weights is the range in values recorded by enumerators – in particular for the two most common vessel types (G18, and GAP boats). Table 2-9 below shows the catch per day per vessel type which shows, on average, generally reasonable values for each vessel type.

What the table fails to show is the wide variation in sample catch – importantly in many cases for records for which there is also no inconsistency between estimated and calculated weights (as discussed in issue iii.).

Table 2-9. Average catch per day per vessel-type			
Vessel type	No. vessels	% total vessels	Average sample weight per vessel per day (kg)
G18	11581	59%	30.5
GAP	7460	38%	11.5
GAF	333	2%	23.6
FD2	100	1%	21.6
JAP	47	0%	231.7
FD1	40	0%	18.6
Total	19561	100%	

Figure 2-9 shows the boxplots for G18 and GAP vessels, which show the extent of deviation from the median and skew towards higher sample catch weights. In the case of G18 vessels, approximately 30% of vessels sampled recorded sample catch weights of over 100kg.

Figure 2-9. Range of sample catch weight recorded by G18 and GAP vessels.
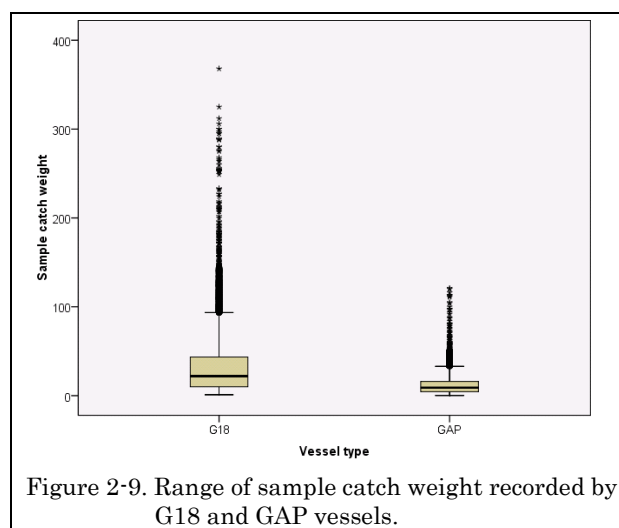
The deviation from the average sample catch is generally consistent throughout the year. There is no evidence that the higher-than-average sample catch weights are related to seasonality and occur in specific months, as Figure 2-10 shows for G18 vessels.

In each month there is significant numbers of vessels which report sample catch weights well above the median – in many cases the values seem to exceed, or come

close to exceeding, the physical capacity of the vessels themselves. Further investigation is required to understand the reasons why such wide variations in sample catch weight are recorded for the same vessel type. Secondly, the value of outliers – particularly at the upper end of the scale call into question the reliability of the data, given that most of the vessels are small artisanal craft with a limited storage capacity.
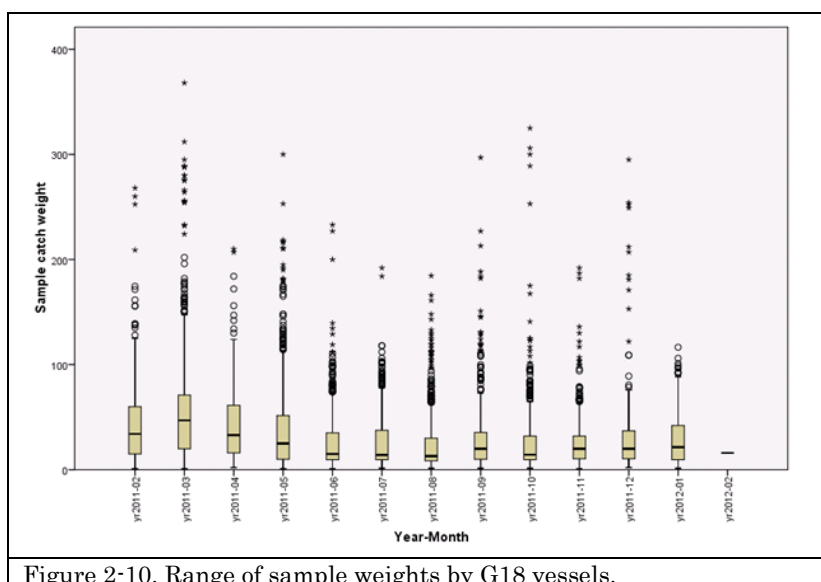

Figure 2-10. Range of sample weights by G18 vessels.

Recommendations for further activities

The results of Comoros catch and effort based on the information from the 2011-2012 Boat Censuses and sampling over the same period is still preliminary including various aspects of data issues. One recommendation is to re-visit some of inconsistent data to improve the quality of analysis of the data.

2.2.2. Strengthening of data management systems for marine fisheries in Iran

Background Information

In repeated occasions, the IOTC Scientific Committee and Commission have expressed concern regarding Iran's status of compliance with IOTC measures, in particular activities of vessels under the flag of the Islamic Republic of Iran using driftnets on the high seas and statistics available at the IOTC for those vessels.

Following a request from SHILAT (Fisheries Organization of Iran) in 2010, at the end of February 2011the IOTC-OFCF Project sent a mission to , the Islamic Republic of Iran, with the following objectives: .

➢ To assess the status of fisheries data collection and processing in the Islamic Republic of Iran, in particular for the following fisheries and data types, as recommended by the IOTC Scientific Committee:
   a. Total catches of bigeye tuna, swordfish, marlins, sharks and other bycatch from gillnet fisheries
   b. Time-area catch-and-effort data from oceanic gillnet fisheries and industrial purse seine fisheries
   c. Time-area catch-and-effort data from coastal fisheries, in particular coastal gillnets
   d. Size frequency data from all fisheries

➤ To assess the feasibility of near to real time reporting of catches of yellowfin tuna and bigeye tuna by month from the fisheries in the Islamic Republic of Iran, according to the provisions in IOTC Resolution 10/01.

➤ To explore the type of actions that the Fisheries Organization of the Islamic Republic of Iran will need to undertake to achieve full compliance with IOTC data requirements, where required; and whether SHILAT will require assistance from the IOTC in the implementation of any of such actions.

Status of fisheries and data collection systems in Iran

The mission identified several issues concerning Iran's fisheries statistics systems, proposing actions to address them, as detailed in Tables 2-10 and 2-11 below:

Table 2-10. Issues on Data collection
Area | **Issues identified, fisheries involved and actions recommended**

Area	Issues identified, fisheries involved and actions recommended
Stratification: Province, gear type and vessel category. The following vessel categories are used: GT<3; GT 3-20; GT 20-50; GT>50	**All coastal and oceanic gillnets** • Issue: Iranian fisheries have changed substantially in recent years; vessel categories may need to be revised, as larger vessels have entered the fishery. GT values for large gillnet vessels range from 50 t to 250 t, with some vessels operating in coastal waters and others on the high seas. *Recommendation:* **Average catches and species composition for vessels within each category need to be assessed in order to determine if those categories still apply, especially for vessels over 50GT.** • Issue: Even though two types of gillnets are used by Iranian vessels, with different target species, samples are not stratified by type of gillnet. *Recommendation:* **Catches and species composition from both types need to be assessed in order to determine if a separate category needs to be created.** **Surface fisheries:** *Oceanic gillnets* • Issue: The same stratification is used for coastal and oceanic gillnets. At present, around 1300 Iranian vessels are using gillnets on the high seas, in the Arabian Sea or other areas in the Western Indian Ocean. Catch rates and species composition are likely to vary in a significant way depending on the area and time fished. *Recommendation:* **The stratification for oceanic gillnets may need to be revised to incorporate time-area strata, especially if this leads to significant gains in the precision of the estimates. This would require the completion of logbooks on oceanic gillnet vessels.**
Effort data: Effort is collected through total enumeration. All fishing vessels need to be registered with SHILAT and the registration number is displayed on the vessel hull. Both SHILAT and the Coast Guard monitor the activities of fishing vessels. Each vessel is assigned an operating port where all catches shall be unloaded. Other ports can be used only in case of *force majeure*. Currently there are 63 designated landing places in Iran.	**Coastal fisheries** • Issue: Some vessels of the small category are known to be operating from locations other than the 63 designated by SHILAT. Their main target is several species of demersal fish. SHILAT estimates that the catches of these vessels represent around 10% of the total. *Recommendation:* **Need to initiate a pilot survey in order to assess the importance of these catches and verify current estimates, including:** o **CPUE and total catches of non-reporting vessels** o **Type of gear used and main species unloaded from non-reporting vessels** **Surface fisheries: Oceanic gillnets** • Issue: Effort data is collected in port and expressed as the total number of days-at-sea. Trips of oceanic gillnet vessels may be long, lasting around one month in most cases. The number of days fishing, gear configuration and amount of gear set (i.e. number of net panels) may vary considerably depending on the type of vessel, time and area exploited and weather in the area.

Table 2-10. Issues on Data collection	
Area	**Issues identified, fisheries involved and actions recommended**
	Recommendation: The effort measure shall be changed to number of gillnet panels set by fishing event for oceanic gillnets. These data shall be collected through logbooks. Other details on the type of gear used shall also be collected. **Surface fisheries: Purse seines** • Issue: Effort data is collected in port and expressed as the total number of days-at-sea. Trips of purse seine vessels may be long, lasting more than one month in most cases. The number of days fishing and fishing mode (i.e. free-schools or associated schools) may vary considerably depending on the type of vessel, time and area exploited and weather in the area. *Recommendation:* The effort measure shall be changed to number of sets where fishing using fish aggregating devices (FADs) and searching hours or number of fishing days where fishing for free-swimming schools. These data shall be collected through logbooks. Other details on the type of fish aggregating devices used shall also be collected.
	Catch data: A sampling scheme exists for the collection of catch and effort data. SHILAT enumerators (one by landing location) collect landing statistics in 42 out of the 63 designated landing places. A sample of vessels making up 10% of the total number of vessels registered for each year and category are selected at the beginning of each year and all landings from those vessels are systematically monitored. The selection of vessels to sample is made on the basis of several criteria, the main being cooperation from the vessel skipper. **All coastal and oceanic gillnets**: • Issue: The selection of vessels having friendly skippers may introduce a bias towards overestimation of total catches. Good skippers, i.e. those having the best catch rates, are likely to be friendlier than poor skippers (unlikely to cooperate due to poor catch rates). *Recommendation:* The criteria used for the selection of fishing vessels needs to be revised. A pilot survey shall be initiated in order to verify that CPUE and species composition for selected and non-selected vessels do not differ significantly • Issue: Some Iranian vessels are known to collect/transfer catch from/to other vessels, including from Pakistani vessels. Different types of demersal species may be transshipped and, to a lesser extent, tunas. According to SHILAT, catches are generally transshipped from small vessels on to large vessels and vessels having collected catches from other vessels can be identified by looking at CPUE values for the trip. This, however, may be difficult when the catches transshipped are small. At the same time identification of vessels having transshipped catches to other vessels may be difficult. *Recommendation:* Information on amounts transshipped and main species can only be reliably collected through scientific observers. Logbooks can also be used but need to be validated using observer data. Data requirements for logbooks shall include the reporting of catches transferred/collected to/from other vessels, by species. • Issue: The catches of some IOTC species are not identified at unloading, usually reported aggregated. This includes bigeye tuna, swordfish, marlins and sharks. *Recommendation:* Need to extend the species list to incorporate bigeye tuna, black marlin, blue marlin, striped marlin and the main species of sharks. This species shall also be recorded in vessel logbooks and monitored by observers. **Surface fisheries: Oceanic gillnets** • Issue: Catches of oceanic gillnets are sampled in port. Logbook data are not collected at present. SHILAT will initiate a pilot logbook programme in April 2011 and will extend it to cover all oceanic gillnets in the future. *Recommendation:* Logbooks for oceanic gillnets shall be in line with minimum data requirements agreed by the IOTC. A draft Resolution for the collection of logbook data has been presented for the consideration of the Commission during its next Session. SHILAT indicated that it may need some time to make the logbook fully operational as it is planning for a phase-in implementation, over a period of two or three years. Iran will need to request amending the current draft to accommodate this. • Issue: Discards of IOTC species and incidental catches of marine turtles and sea mammals are not collected. *Recommendation:* Information on incidental catches and discards by species can only be reliably collected through scientific observers. Logbooks can also be used but need to be validated using observer data. Data requirements for logbooks shall include the reporting

Table 2-10. Issues on Data collection	
Area	**Issues identified, fisheries involved and actions recommended**
	of catches transferred/collected to/from other vessels, by species.
	Length frequency data: Length frequency samples are collected in 13 landing locations. However, the amount of IOTC species measured, other than narrow-barred Spanish mackerel, is very low. All research activities involving the collection of size data for yellowfin tuna and longtail tuna have been discontinued. **Coastal fisheries** • Issue: The number of IOTC species measured is insufficient, less than one specimen by metric ton fished in most cases. 　*Recommendation:* Need to strengthen sampling activities for coastal fisheries. Length frequency samples shall be collected at unloading, where possible from the same vessels than those selected for sampling of catch. 　　**Oceanic gillnet fisheries** • Issue: The number of IOTC species measured is insufficient, with less than one specimen by metric ton fished in most cases. Samples are collected in port. Samples by fishing area are not available. 　*Recommendation:* Need to strengthen sampling activities for oceanic fisheries. Length frequency samples shall be collected at unloading, where possible from the same vessels than those selected for sampling of catch. In addition, length (weight) samples shall be collected onboard fishing vessels, through observers or by the vessel crew. **Purse seine fisheries** • Issue: The number of IOTC species measured is insufficient, with less than one specimen by metric ton fished. Samples are collected in port. Samples by fishing area are not available. 　*Recommendation:* Need to strengthen sampling activities for purse seine fisheries. Length frequency samples shall be collected at unloading, where possible from the same vessels than those selected for sampling of catch. Fishing times and areas for fish stored on board shall be recorded in the logbook to make possible sampling of catches by fishing mode, time and area.

Table 2-11. Issue on Data handling and processing	
Area	**Issues identified, fisheries involved and actions recommended**
	Database system: SHILAT uses an MS-SQL Server 2000 database. The database is accessed using forms, designed using DELPHI. The database was created by a consultant, who is still working for SHILAT for database upgrades or other maintenance work. The database is used to store individual vessel data, including vessel registration fishing license details, and vessel activities, including effort and catch data collected at the landing place. A separate database is used for length frequency data. • Issue: At present, the database does not contain tables to store logbook or size frequency data. 　*Recommendation:* Upgrade the database to MS-SQL Server 2008 to make it possible to handle GIS data. The database to be extended to handle logbook and size frequency data.
	Computerization of data: Data are input in several locations, using copies of the database. Enumerators input the catch and effort data at the landing place. Data is transferred every three months from the provinces to Tehran. • Issue: Computers are not connected through a network. 　*Recommendation:* Need to explore if data from the different stations can be transferred more timely, e.g. every week.
	Verification of data: The data input software (DELPHI) contains several routines to verify data before and after computerization. The database itself does not contain routines for the validation of data (e.g. triggers or stored procedures). • Issue: Data that would not pass the validation criteria can still be input in a table if the input form is not used. 　*Recommendation:* Need to incorporate validation procedures in database tables to avoid inputting inconsistent data.

Table 2-11. Issue on Data handling and processing	
Area	**Issues identified, fisheries involved and actions recommended**
	Estimation of catches: Catches by month are estimated in each Province and for each stratum, usually between 10-20 days after the end of the month for which catches are estimated. Final catches for the month are estimated around 40-60 days after the end of the month. Data for three consecutive months are sent to Tehran and transferred into the main database. A substitution scheme is in place for the estimation of catches from strata not sampled. • Issue: Computers are not connected through a network. Logbook and size frequency data shall also be used in the estimation of catches for surface fisheries (gillnet and purse seine). *Recommendation:* **Need to explore how to combine samples in port and logbook and size frequency data for the estimation of catches for surface fisheries.**

	Reports: The database contains several types of reports.
	• The database does not contain routines to prepare the data that need to be reported to the IOTC.
	Recommendation: **Need to incorporate routines to prepare the data that has to be reported to the IOTC, including:**
	  o *All fisheries: Estimates of total catches by gear, species, IOTC Area and year for IOTC and main shark species*
	  o *All fisheries: Estimates of discards of IOTC and main shark species and incidental catches of other shark species and other bycatch (marine turtles, marine mammals, etc.) by species and year.*
	  o *Surface fisheries: Time (month)-area (1 degree square grid) catch-and-effort data for IOTC and main shark species*
	  o *Coastal fisheries: Time (month)-area (representative area; e.g. province) catch-and-effort data for IOTC and main shark species*
	  o *Surface fisheries: Time (month)-area (5 degree square grid) size frequency data for IOTC and main shark species*
	  o *Coastal fisheries: Time (month)-area (representative area; e.g. province) size frequency data for IOTC and main shark species*

Actions proposed

Iran's full compliance with IOTC Data Requirements could be achieved through the implementation of the following activities (Table 2-12).

Table 2-12. Activities to be implemented to achieve Iran's compliance IOTC Data requirements			
Activity	**Description of tasks**	**Execution**	**Importance**
Extension of database system			
	• Upgrading of MS-SQL 2000 to MS-SQL 2008 • Incorporate module for the computerization and processing of logbook data (gillnet and purse seine) • Incorporate module for the computerization of length frequency data and transfer of historical data into the new tables • Add routines to facilitate the reporting of data to the IOTC • Incorporate routines to facilitate timely (by month) transfer of data from the landing places into the central database, including connecting computers through a network, active permanently or upon request	To be carried out by a local consultant (the same that maintains the database at the moment) SHILAT to request support from the IOTC for the implementation of these activities, where required	**Very important** Will facilitate reporting of data to the IOTC, including data by month for main species
Strengthening of sampling activities for the collection of length frequency data in port			

	• Design of sampling activities including selection of landing places and fisheries and species involved:
	  o Gillnet fisheries: yellowfin tuna, longtail tuna, skipjack tuna, bigeye tuna, albacore, swordfish, black marlin, blue marlin, striped marlin, Indo-Pacific sailfish, narrow-barred Spanish Mackerel, Indo-Pacific king mackerel and other IOTC and shark species
	  o Purse seine fisheries: yellowfin tuna, longtail tuna, skipjack tuna, bigeye tuna, albacore, frigate tuna, bullet tuna, kawakawa
	• Hire eight new enumerators to sample lengths of IOTC species at unloading
		SHILAT SHILAT to request support from the IOTC for the implementation and execution of these activities, where required	**Very important** Will help Iran to comply with IOTC requirements for size data

Implementation of pilot sampling activities to assess SHILAT's current sampling design and implementation		
	• Design of sampling activities including selection of landing places and fisheries and species involved (refer to the previous section for details concerning the type of activities to be undertaken) • Hire eight new enumerators to carry out the survey in Horzmogan and Sistan-Baluchistan provinces • Data analysis and update of sampling design, where required	SHILAT SHILAT to request support from the IOTC for the implementation and execution of these activities, where required	**Important** Will help Iran to streamline its data collection system
Implementation of logbook systems for oceanic gillnet fisheries		
	• Design of logbooks to accommodate Iran's needs and IOTC requirements • Selection of fishing vessels and timeline of implementation of logbooks • Assess the needs in terms of staff for the monitoring, computerization and validation of data collected • Data analysis and update of estimation procedures, where required	SHILAT SHILAT plans to initiate this activity in April 2011	**Important** Will facilitate reporting of catch-and-effort data by IOTC standards

Actions undertaken by the IOTC-OFCF Project

Even though port sampling in Iran is among the best in the region, the existing database needs to be upgraded to:

- accommodate the new information collected from the fisheries, in particular operational data collected through a new logbook system, recently introduced by SHILAT, and size frequency data, which are currently stored in a separate database;
- incorporate new routines so as the data required by national and international organizations, such as the IOTC, can be extracted and disseminated in a timely manner.

For the above reasons, following a new mission of the IOTC-OFCF Project to Iran in June 2011, SHILAT requested financial support and technical advice from the IOTC-OFCF Project in the expanding of the database and purchase of additional hardware and software to be used by SHILAT.

To this purpose, in November 2011 the IOTC-OFCF Project and SHILAT signed a technical agreement: *Terms of reference for the strengthening data Collection and reporting system in SHILAT* (Annex X), which included a number of tasks to be executed between November 2011 and March 2012, in particular:

➢ *Task 1. Upgrading the existing database system from MS-SQL 2000 to MS-SQL 2008 to allow management of GIS data*

➢ *Task 2. Building a module to manage operational catch-and-effort data, as reported in the fishing logbooks*

➢ *Task 3. Building a module to integrate the existing length frequency data*

➢ *Task 4. Building a user-friendly data entry interface for the computerization of operational catch-and-effort and length frequency data*

➢ *Task 5. Creating basic data processing routines to facilitate the reporting of statistics to the IOTC, and a user-friendly interface to facilitate this task*

➢ *Task 6. Improving database connectivity or procedures to allow for more timely transfer of data from the landing place to the Province and SHILAT headquarters in Tehran*

➢ *Task 7. Documenting database structure, definitions of data, database processes and any other related systems; and training of staff at SHILAT*

Results

For the implementation of the above tasks, SHILAT hired an additional IT expert, to work with its regular IT staff, and staff from the IOTC-OFCF Project, in the upgrading and further development of SHILAT's databases and procedures, A review of the tasks implemented and progress achieved can be found below:

Task 1. Upgrading the existing database system from MS-SQL 2000 to MS-SQL 2008 to allow management of GIS data
SHILAT updated the software as planned.

➢ **Task 2. Building a module to manage operational catch-and-effort data, as reported in the fishing logbooks**
The implementation of a new logbook programme is under way, including:
- **Gillnet Fisheries**
SHILAT initiated a Pilot Logbook Programme for Iran's gillnet fisheries in August 2011, with logbooks distributed to 50 fishing Dhows, of which some were completed and returned by fishermen. The logbook programme will be extended in the future to incorporate additional information and cover more fishing vessels, as required.

- **Purse Seine Fisheries**
Since 2011, new logbook forms, designed by SHILAT, have been completed and returned by the skippers of purse seiners flagged in Iran. The new template is similar to that proposed by the IOTC, which will allow reporting of catch and effort data as per the standards agreed by the IOTC.

At present, SHILAT is still using MS-Excel to input logbook data from Iran's gillnet fisheries. However, SHILAT is making efforts to upgrade its software AMAR (Iran Fisheries Data Collection System in Persian), including the addition of a reporting

module to manage logbook data and a module for the computerization of gillnet logbook data. . Due to budget constraints SHILAT has been unable to finalize this work, and is hoping to identify additional funds to complete this work in the future.

➢ *Task 3. Building a module to integrate the existing length frequency data*

SHILAT is still using a dedicated database to input size frequency data from the fisheries, which need to be connected to the AMAR software. However, the fish measurement database has been upgraded to incorporate additional information, more in line with IOTC requirements.

In addition to database work, , since 2011 SHILAT has extended the coverage of its length frequency data collection system, with samples also collected in the ports of Ramin and Pasabandar, in Sistan-Baluchestan Province. The quality of length measurements has also improved, through collection of more precise length and weight measurements, using the proper measuring tools, as provided by the IOTC-OFCF Project. However, the amount of length frequency data collected are still insufficient for most species, as it represents less than one fish measured for length per metric ton of catch estimated, by year, month, species and gear type.

➢ *Task 4. Building a user-friendly data entry interface for the computerization of operational catch-and-effort and length frequency data*

Further work is required to connect the length frequency database to the software AMAR and incorporate a module for the management of logbook.

➢ *Task 5. Creating basic data processing routines to facilitate the reporting of statistics to the IOTC, and a user-friendly interface to facilitate this task*

SHILAT has initiated this work but will not be able to finalize it unless more funds can be secured.

➢ *Task 6. Improving database connectivity or procedures to allow for more timely transfer of data from the landing place to the Province and SHILAT headquarters in Tehran*

SHILAT has completed a pilot project which included development of web based services and a web interface to facilitate data input and transfer of data from Khozestan Province to the server at SHILAT. SHILAT will carry out further work to connect all data entry points to the main server in the future..

➢ *Task 7. Documenting database structure, definitions of data, database processes and any other related systems; and training of staff at SHILAT*

SHILAT has finalized documentation of all available databases and procedures and carried out training sessions to increase the capacity of SHILAT's staff in the areas of data collection and management.

➢ *Other Activities*

The IOTC-OFCF Project provided funds to allow SHILAT's purchase of additional equipment, as required for the implementation of the above tasks.

The IOTC-OFCF Project continue providing technical advice to SHILAT in order to complete the above tasks.

2.2.3.a Sri Lanka: Centralized Database Management System

Background

During the IOTC annual meeting at Korea in 2010, the Indian Ocean Tuna Commission (IOTC) requested the Executive Secretary of IOTC, Mr. Alejandro Anganuzzi, to inform the government of Sri Lanka about a number of issues that had been identified by the Commission concerning compliance by Sri Lanka with some of the IOTC Measures in place. The Executive Secretary of IOTC visited Sri Lanka in August 2010. During his visit Mr. Anganuzzi stressed the need for Sri Lanka to address the issues identified by the Commission in the areas of Compliance and Statistics and, following a request from the government of Sri Lanka, agreed that the IOTC Secretariat provide further support and guidance to Sri Lanka in order for those issues to be addressed as soon as possible.

In the area of Statistics the government of Sri Lanka requested the assistance of the IOTC-OFCF Project in the strengthening of its fisheries data collection and processing systems with a view to produce statistics as per the standards agreed by the IOTC. The IOTC-OFCF Project sent a mission to Sri Lanka in September 2010 in order to assess the data collection and data management activities carried out by the Ministry of Fisheries and Aquatic Resources Development (MFARD).

Status of fisheries and data collection systems in Sri Lanka

The mission identified several issues concerning Sri Lanka's fisheries statistics systems, proposing actions to address them, as detailed in the Tables 13, 14 and 15:

i) Data collection

Table 2-13. Issues and proposed actions concerning data handling for Coastal fisheries (Fisheries other than gillnet/longline and longline) in Sri Lanka.	
Issue (measure involved)	Description

Data on catches and effort:
 • The catch-and-effort data collected for the coastal fisheries of Sri Lanka is highly aggregated and not by IOTC standards
 • Incomplete collection of statistics by officers from the Statistical Unit of DFAR
 • Insufficient sampling coverage by NARA
 (IOTC Resolutions 10/02 & 10/04)
	Reasons
	 • DFAR collects information on the catches from both coastal and offshore fisheries and the number of fishing vessels based in each landing location. However, the number of vessels is not a good measure of effort as not all vessels operate during a given month and vessels usually change of landing location during the year. In addition, DFAR does not collect catches by gear and the catches refer to commercial categories instead of individual species.
	 • Sampling coverage of coastal fisheries by NARA is likely to be insufficient and this may compromise the quality of the estimates of catch-and-effort derived from it, in particular due to the lack of catch-and-effort by gear and, in some cases, by species (e.g. marlins).
	 Main needs and recommended actions
	 • Total enumeration of fishing effort (number of vessel trips) in all landing places
	 • Validation of reports of total catches using alternative information, including:
	    o Comparison of DFAR and NARA estimates for locations covered through sampling by NARA
	    o Total enumeration of catches in selected locations to validate estimates of total catches and catches by commercial category (DFAR) and estimates of catches using NARA sampling

Table 2-13. Issues and proposed actions concerning data handling for Coastal fisheries (Fisheries other than gillnet/longline and longline) in Sri Lanka.	
Issue (measure involved)	Description
	• Estimation of precision of estimates of total catches and catches by species for different levels of coverage, in particular 5% • Re-design data collection on the basis of the above results, where required
Length frequency data: • The length frequency data collected for the coastal fisheries of Sri Lanka is highly aggregated and not by IOTC standards (IOTC Resolution 10/02)	**Reasons** • DFAR does not collect size data. • Sampling coverage of coastal fisheries by NARA is likely to be insufficient and this may compromise the representativeness of the size data collected. In particular: o Size data is never collected by gear and not always by species (e.g. marlins). o Size samples are likely to be biased towards smaller sizes due to the large specimens of some species, in particular marlins, being highly processed onboard (where each specimen is cut into several pieces), and not sampled in the landing place. o Lengths are taken using different measurement tools and types of measurement. o Equations for the conversion from non-standard lengths into standard lengths are not provided. **Main needs and recommended actions** • Increase coverage of length frequency sampling, including collection of size data by month, fishing location and gear. • Collection of length frequency samples from all specimens unloaded from the vessel selected for sampling, including highly processed fish. Explore the use of different non-standard measurements for highly processed fish (e.g. weight/length of fish parts versus round weight/fork length). Explore the need for implementing at-sea sampling for highly processed fish where sampling at the landing place is not possible. • Promote the use of straight length measurements (preferably using calipers) instead of curved length measurements (using tape measures). • Promote the use of measurements in standard length (e.g. length from the tip of the snout to the fork of the tail for all tuna and shark species), where possible • Collection of alternative information for the conversion from non-standard lengths into standard lengths, where required (e.g. collection of standard length and non-standard length measurements on the same specimens in order to be able to derive non-standard to standard length keys) • Re-design length data collection on the basis of the above results, where required

Table 2-14 Issues and proposed actions concerning data collection for Coastal fisheries (Fisheries other than gillnet/longline and longline) in Sri Lanka Offshore fisheries (gillnet/longline and longline) in Sri Lanka.	
Issue (measure involved)	Description
Nominal catches: • Incomplete collection of statistics by officers from the Statistical Unit of DFAR • Insufficient sampling coverage by NARA (IOTC Resolutions 10/02 & 10/04)	**Reasons** • DFAR does not collect catches by gear and the catches refer to commercial categories instead of individual species. Catches for IOTC species and main shark species shall be reported by species, gear, IOTC Area and year (IOTC Resolution 10/02) • DFAR and NARA collect catches by landing location. However, offshore vessels may operate areas far from the location where the catches are unloaded and therefore collection of data at the landing place is likely to be insufficient. **Main needs and recommended actions**

Table 2-14 Issues and proposed actions concerning data collection for Coastal fisheries (Fisheries other than gillnet/longline and longline) in Sri Lanka Offshore fisheries (gillnet/longline and longline) in Sri Lanka.	
Issue (measure involved)	**Description**

	• Total enumeration of fishing effort (number of vessel trips) in all landing places
	• Validation of reports of total catches using alternative information, including:
	   o Comparison of DFAR and NARA estimates for locations covered through sampling by NARA
	   o Total enumeration of catches in selected locations to validate estimates of total catches and catches by commercial category (DFAR) and estimates of catches using NARA sampling
	• Estimation of precision of estimates of total catches and catches by species for different levels of coverage, in particular 5%
	• Re-design data collection on the basis of the above results, where required

Catch-and-effort: • DFAR has not collected operational catch-and-effort data from the offshore fisheries of Sri Lanka to date • NARA has been collecting operational catch-and-effort data from the offshore fisheries of Sri Lanka in recent years but this information has not been made available to the IOTC (IOTC Resolution 10/02)	**Reasons** • DFAR has not collected catch-and-effort data from the offshore fisheries of Sri Lanka to date. However, DFAR is currently implementing a logbook system for the offshore fishery which will incorporate most of the requirements of the IOTC. Completion of logbooks will be made compulsory for all offshore vessels in the future. • The logbook system implemented by NARA contains all the information required by the IOTC. NARA has indicated that it does not collect information from all offshore vessels, noting that the information collected has no statistical value as it is for forecasting purposes. **Main needs and recommended actions** • DFAR and NARA to cooperate in the implementation of the new logbook system. • NARA to assess if the logbook data collected from the offshore fisheries is representative of the fishery, including its use in the estimation of catches for this fishery • DFAR/NARA to make available catch-and-effort data for the offshore fisheries of Sri Lanka as per IOTC standards (total effort and catch (in weight and/or number) by species by gear type by month and 5 degrees square areas)

Length frequency data:
• The length frequency data collected for the offshore fisheries of Sri Lanka is highly aggregated and not by IOTC standards
(IOTC Resolution 10/02)
	Reasons
	• DFAR does not collect size data.
	• Sampling coverage of offshore fisheries by NARA is likely to be insufficient and this may compromise the representativeness of the size data collected. In particular:
	   o Size data is never collected by gear or fishing area (i.e. by 5 degrees square area) and not always by species (e.g. marlins).
	   o Size samples are likely to be biased towards smaller sizes due to the large specimens of some species, in particular marlins, being highly processed onboard (where each specimen is cut into several pieces), and not sampled in the landing place.
	   o Lengths are taken using different measurement tools and types of measurement.
	   o Equations for the conversion from non-standard lengths into standard lengths are not provided.
	Main needs and recommended actions
	• Increase coverage of length frequency sampling, including collection of size data by month, fishing location (5 degrees square area, where possible) and gear.
	• Explore the need to collect size data onboard offshore fishing vessels, in particular where the length samples taken at unloading cannot be allocated to individual 5 degrees square areas or months.

Table 2-14 Issues and proposed actions concerning data collection for Coastal fisheries (Fisheries other than gillnet/longline and longline) in Sri Lanka Offshore fisheries (gillnet/longline and longline) in Sri Lanka.	
Issue (measure involved)	Description
	• Same as recommendations 2-6 for coastal fisheries.
Observer data: • Sri Lanka has not used observers for its offshore fishery to date, in particular on those vessels that operate outside the EEZ (IOTC Resolution 10/04)	**Reasons** • DFAR does not have information on the area of activity of the vessels registered in Sri Lanka. **Main needs and recommended actions** • DFAR to use the data collected through the new logbook system to identify vessels that operate outside the EEZ • DFAR to implement a VMS system in order to verify the above reports • DFAR to assess the amount of observers required for its offshore fishery and implement the observer programme as soon as possible.

ii) Data handling

Table 2-15. Issue and proposed actions for data handling for all fisheries in Sri Lanka.	
Issue	Description

Sri Lanka does not have a centralized database system	**Reasons**
	 • Data are input independently by each institution/ department and not shared in electronic format. The following databases are used in Sri Lanka:
	   o DFAR Vessel record: Microsoft SQL server database engine plus Access interface. Contains the record of fishing vessels in Sri Lanka, including licensing information.
	   o DFAR fisheries statistics database (in prep.): DFAR has been involved in the preparation of a centralized database system for the fisheries of Sri Lanka. This database, however, is not operational yet.
	   o NARA PELAGOS: Microsoft Access database. Contains the statistics of coastal and offshore fisheries collected by NARA
	   o NARA Fishery forecasting database: MySQL Database plus php interface (under construction). Contains the logbook data collected by NARA.
	   o Other data is input in Excel spreadsheets in an ad-hoc manner (e.g. DFAR statistics for coastal and offshore fisheries)
	 • No data validation and verification routines exist in electronic form: data verification is conducted by each institution in an ad-hoc manner, generally involving the verification of information by hand
	 • Although some procedures exist for the estimation of catches and the preparation of data to be reported they are not comprehensive enough and they are run in an ad-hoc manner.
	 Main needs and recommended actions
	 • Design a fisheries information system trying to maximize the use of the information already existing. This shall consist on a centralized database system that contain all the information required, including:
	 • Module containing a list of vessels registered in Sri Lanka or operating within the territory, including:
	   o Record of fishing vessels registered in Sri Lanka and licensing details and history (DFAR)
	   o Record of foreign vessels using Sri Lankan ports or operating within the EEZ of Sri Lanka, where required (DFAR)
	 • Module containing details on the activities of domestic and foreign vessels, including:
	   o Details on the individual fishing trips by vessel (DFAR)
	   o Details on the catches unloaded by vessel by unloading event (DFAR)
	 • Module containing logbook data for both, domestic and foreign vessels, where required (DFAR)

Table 2-15. Issue and proposed actions for data handling for all fisheries in Sri Lanka.	
Issue	Description
	• Module containing the data collected through sampling at the landing place for coastal and offshore fisheries (NARA), including catch, effort, length frequency data and other biological information required (e.g. conversion factors). • Module containing routines for the verification of the data input in the database (DFAR + NARA) • Module containing routines for the estimation of catches using the above information (DFAR + NARA) • Module containing routines for the preparation of data for reports within or outside Sri Lanka (e.g. international obligations) (DFAR) Most of the above elements are already available with DFAR and NARA. The main task at this stage would be the consolidation of the existing databases into a single database system.

Actions proposed

Sri Lanka's full compliance with IOTC Data Requirements could be achieved through the implementation of the following activities.

• **Strengthening of existing sampling**: The IOTC has provided assistance to Sri Lanka in different areas, including the strengthening of data collection systems for Sri Lanka off-shore fisheries (NARA) and monitoring of the activity of foreign vessel unloading in ports in Sri Lanka (NARA). The statistics collected through the existing data collection schemes in Sri Lanka, run by DFAR and NARA, are insufficient compromising the ability of Sri Lanka to produce statistics as per IOTC standards. In this regard, the IOTC-OFCF Project could assist Sri Lanka in the short term through strengthening the data collection system for coastal and offshore fisheries and coordination of data collection by DFAR and NARA.

• **Development of Centralized Database system**: The IOTC-OFCF Project could assist Sri Lanka in the consolidation of the existing database systems into a Centralized database.

• **Assist the implementation of the logbook system**: The IOTC-OFCF Project has organized Work Shops and Training Sessions on the implementation of logbook systems for purse seine, longline and other fisheries (Iran, Kenya, Indonesia). The Project could assist Sri Lanka in the implementation of the new logbook system through the organization of an inception workshop. The cooperation could be extended to other areas (e.g. database development) in the future, on the basis of further needs identified by the Work Shop.

The IOTC-OFCF Project and the MFARD agreed that the Development of a Centralized Database Management System (CDMS) contains various components under MFARD. The Project exchanged a Memorandum of Understanding with MFARD on September 30, 2011, including the provision of funding for the MFARD to hire a private IT company to work in the development of CDMS for a period of six months from October 2011. The private IT company LASIR was selected following a call for tenders from the government of Sri Lanka. The technical specifications in the call for tenders contained the following tasks to be carried out by the Consultant:

• Task 1: _Design, development and documentation of data warehouse architecture and database structure_
• Task -2: _Design, development and documentation of data entry interface_
• _Task 3: Raw-testing and deployment of the CDMS_

- *Task 4: Preparation of data input manuals and training of data input staff*
- *Task 5: Design, development, deployment and documentation of data processing module*
- *Task 6: Design, development, deployment and documentation of reporting services module*
- *Task 7: Preparation and delivery of database administration manuals and training of database administrators*
- *Task 8: Operation of database system and (short term)technical support*

Results

A review of the tasks implemented and progress achieved can be found below:

Task 1: *Design, development and documentation of data warehouse architecture and database structure*
Two servers, three desktop computers and the required software were purchased and installed in the server room of MFARD.

Task -2: *Design, development and documentation of data entry interface*
LASIR built a Centralized Database Management System (CDMS) in line with the majority of the technical specifications, as follows:
(1) Vessel record data, including details of individual fishing vessels, fishers, licensing, and related information, as recorded by the Department of Fisheries and Aquatic Resources (DFAR), in the database it maintains;
(2) Landing Permits, granted to foreign vessels that unload fish in ports in Sri Lanka, as stored by the DFAR;
(3) Catch and effort information from the coastal fisheries, which the Statistical Unit (SU) of the MFARD is planning to collect in the near future;
(4) Vessel, catch, effort, and size frequency data as collected by the National Aquatic Resources Research and Development Agency of Sri Lanka (NARA) and stored in Access database format (PELAGOS);
   (4) Logbook data, as collected by DFAR;
(5) Catches unloaded by foreign fishing vessels to processing plants in Sri Lankan harbors, as collected by the Ceylon Fisheries Harbor Cooperation (CFHC) and the Ceylon Fisheries Cooperation (CFC); and
(7) Export and import information, as collected by the Sri Lankan Customs.

Table 2-16 presents the type of information included in the CDMS, as provided by the different departments of the MFARD (technical meeting of December 2011). LASIR also developed data input forms, as per the formats provided by MFARD (an example is shown on Figure 2-11).

Table 2-16. Type of data included in the CDMS, as provided by the different departments of MFARD.

Data Entry Program	Institute/ Unit	Remarks
1. *Marine Fisheries Catch Statistics*	*SU*	*Information is collected through field officers of DFAR monthly*
2. *Catch and Effort Monitoring Survey Data*	*SU*	*Information is collected through field officers of DFAR monthly for selected fisheries*
3. *Fish Prices Data*	*SU*	*Information is collected by SU daily, weekly from selected markets and CFC*

4.	Fish Exports and Imports	SU	Required data tables are imported from Sri Lanka Custom monthly
5.	Foreign Fishing Vessel catch data	SU	Required data tables are imported from CFHC monthly
6.	Beach Seine Fisheries Information	SU	Information is collected through field officers of DFAR annually
7.	Fish Landing Permits for Foreign Vessels	DFAR	Data tables are imported from DFAR monthly
8.	Offshore Vessels Log Book Data	DFAR	Data tables are imported from DFAR monthly (Proposed to implement) monthly
9.	Vessel Registry Data	DFAR	Required data tables are imported from vessel registry of DFAR monthly
10.	Foreign Vessels information at Modara	CFHC	Required data tables are imported from Foreign vessel registry of CFHC monthly
11.	Fish Purchases information	CFC	Required data tables are imported from Foreign vessel registry of CFC monthly
12.	Large Pelagic Fisheries Data	NARA	Required data tables are imported from large pelagic database NARA monthly
13.	Offshore Fishing information	NARA	Required data tables are imported from fishing grounds database NARA annually

Figure 2-11. An example of data entry interface for catch and effort monitoring survey by Statistical Unit

Task 3: Raw-testing and deployment of the CDMS
Data formats were tested by the relevant offices.

Task 4: Preparation of data input manuals and training of data input staff
LASIR prepared the documentation required and trained staff at MFARD as planned.

Task 5: Design, development, deployment and documentation of data processing module
LASIR prepared data processing modules and documentation, as required by MFARD.

Task 6: Design, development, deployment and documentation of reporting services module

LASIR developed Web based reporting modules for MFARD, DFAR, and NARA, so as data can be prepared and disseminated according to national (e.g. MFARD), and international requirements (e.g. IOTC, FAO, etc.). Figure 2-12 shows an example of Menu screen for Marine Fish Catch statistics reporting of SU and an exaple for monthly fish production by major commercial groups.

Reports - Catch Information

Table 1: Fish Production by Fishing Sub-Sectors	Table 3.1: Share of Marine Fish Production by Regions
Table 2: Monthly Fish Production by Major Sectors	Table 4: Fish Production by Districts and Commercial Groups
Table 2.1: Monthly Marine Fish Production	Table 5:Monthly Fish Production by Species
Table 3: Marine Fish Production Estimate by Districts	Enter Targets

Ministry of Fisheries and Aquatic Resources Development

Marine Fish Production by District and Major Commercial Groups , 2012 - All Months - All Fisheries Districts (mt.)

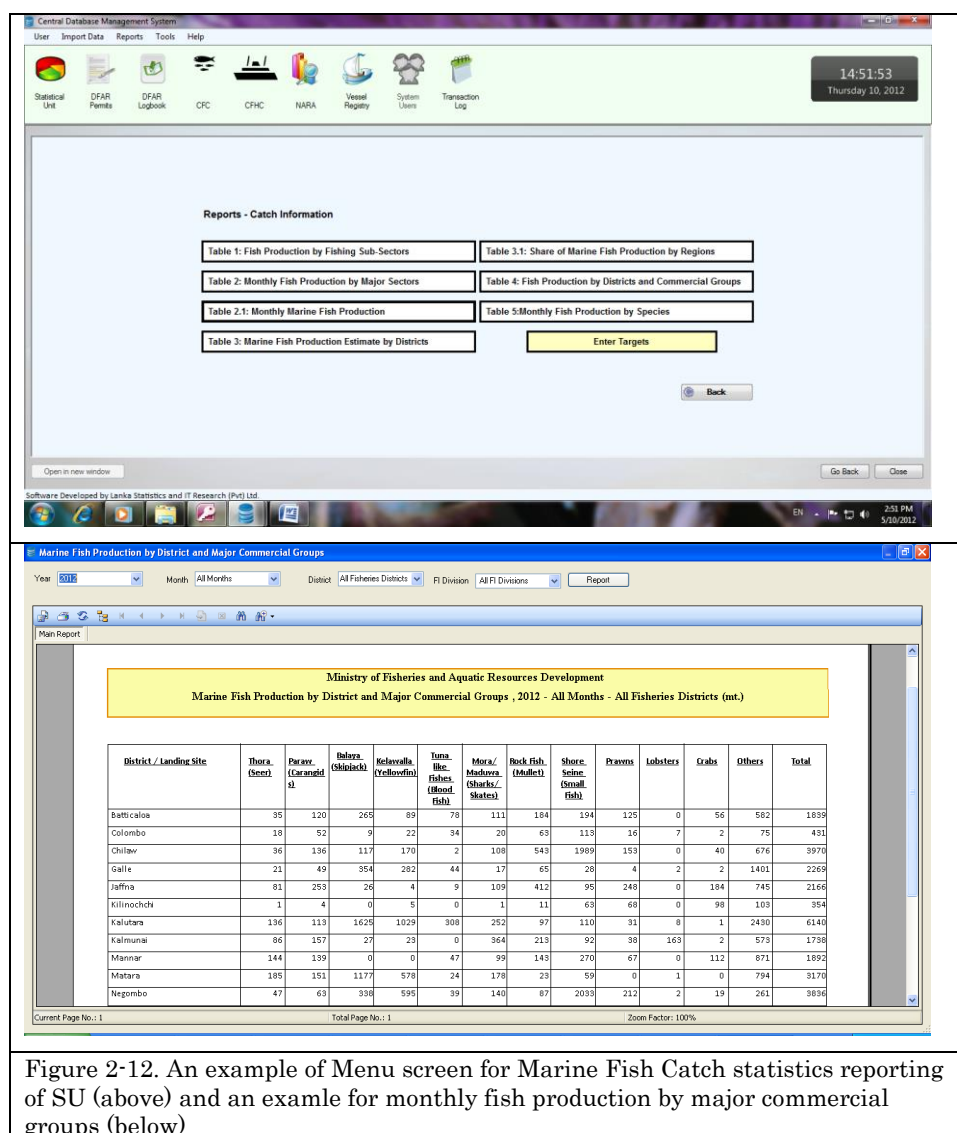| District / Landing Site	Thora (Seer)	Paraw (Carangids)	Balaya (Skipjack)	Kelawalla (Yellowfin)	Tuna like Fishes (Blood Fish)	Mora/ Maduwa (Sharks/ Skates)	Rock Fish (Mullet)	Shore Seine (Small Fish)	Prawns	Lobsters	Crabs	Others	Total
Batticaloa	35	120	265	89	78	111	184	194	125	0	56	582	1839
Colombo	18	52	9	22	34	20	63	113	16	7	2	75	431
Chilaw	36	136	117	170	2	108	543	1989	153	0	40	676	3970
Galle	21	49	354	282	44	17	65	28	4	2	2	1401	2269
Jaffna	81	253	26	4	9	109	412	95	248	0	184	745	2166
Kilinochchi	1	4	0	5	0	1	11	63	68	0	98	103	354
Kalutara	136	113	1625	1029	308	252	97	110	31	8	1	2430	6140
Kalmunai	86	157	27	23	0	364	213	92	38	163	2	573	1738
Mannar	144	139	0	0	47	99	143	270	67	0	112	871	1892
Matara	185	151	1177	578	24	178	23	59	0	1	0	794	3170
Negombo	47	63	338	595	39	140	87	2033	212	2	19	261	3836

Figure 2-12. An example of Menu screen for Marine Fish Catch statistics reporting of SU (above) and an exaple for monthly fish production by major commercial groups (below)

Task 7: Preparation and delivery of database administration manuals and training of database administrators

LASIR prepared the required documentation and trained database administrators and data input staff as planned.

Task 8: Operation of database system and (short term) technical support

After completion of the Project, the Contractor agreed to provide technical assistance for two years to ensure the smooth functioning of the CDMS and also repair the system for any deficiency identified during any of the tasks performed, or any other failure communicated by the database administrators.

As a whole, the implementation of the CDMS was successful, and represents a large improvement when compared with the system that MFARD was using in the past, which was not centralized and too basic for the type of data that was handled.

However, LASIR was unable to complete fully its job due to the insufficient cooperation from some of the government offices, which did not provide examples of their databases or type of data collected in time, including:

- NARA failed to provide copies of the PELAGOS database, providing only a report containing processed data.
- DFARD did not provide logbook data in time, so as to allow proper testing of the logbook module.

The MFARD of Sri Lanka is invited to take the necessary steps to rectify the above, so as the CDMS can be completed as soon as possible.

2.2.3a   Sri Lanka: Centralized Database Management System

Annex 5: Pelagos Database users manual

2.2.4a Indonesia: Workshop on Catch estimation

Background

Indonesia has one of the largest artisanal fisheries in the world with catches over 200,000 t (Indian and Pacific oceans), and catches of the medium-scale vessel component estimated to be over 250,000 tons. In the Indian Ocean, excluding the longline component, catches of tuna were over 170,000t in 2009. However, these figures are thought to be conservative estimates at best. Several reports have pointed to flaws in the sampling system, and in particular the underestimation of catches (e.g., WWF's "Off the Hook Report"), as well as and catches not fully reported by gear and species, especially in the case of small tunas. In order to address these issues, the Directorate General of Capture Fisheries of Indonesia (DGCF) and the IOTC-OFCF Project agreed to conduct a Catch Estimation Workshop for the Fisheries of Indonesia, with focus on small and medium-scale fisheries.

The "Indian Ocean Tuna Fisheries of Indonesia Catch Estimation Workshop" was held in March 13-15, 2012 with 41 participation from DGCF, RCCF (Research Center for Capture Fisheries), RIMF (Research Institution for Marine Fisheries), the IOTC and OFCF. CSIRO (Commonwealth Scientific and Industrial Research organization of Australia), NRIFSF (National Research Institute of Far Seas Fisheries in Japan) and WWF (World Wide Fund for Nature) have also participated in the workshop.

The objective of the Workshop was to improve the quality of the catch and effort derived from data collected from tuna fisheries of Indonesia with a view to improving the management of fish resources.

Results and Issues

After opening of the workshop, invited experts presented and discussed the data collection and data management systems currently in place in Indonesia. The workshop concentrated its efforts in reviewing the status of tuna fisheries data collection and processing system in Indonesia, with a view to improve estimates of

total catch, and catches by gear and species in the future, and review past estimates.

Based on the background information presented at the Workshop, the participants identified a range of issues that need further consideration, covering four broad areas: a) sampling design; b) collection of catch, effort, and size data; c) data management; and d) catch estimates. The main issues were described in the following section.

a) Sampling design

For longline fisheries, changes in the activities of longliners, in particular increases in transshipments of albacore from one or more vessels to a third fishing vessel, and retention of the remainder of the catch on board the fishing vessel to be transshipped to a different fishing vessel, invalidates the current sampling design, and at some ports the sampling protocols are not fully observed, as enumerators do not seem to cover the totality of the catches unloaded from the vessels selected for sampling, especially where unloading events span two or more days. In addition, the sizes of longliners operating in Bali vary markedly, with arrangement from less than 10 GT to over 200 GT, and noted that the sampling design may need to be modified to incorporate additional strata covering different sizes of longliners

The existing sampling design for other fisheries is needed to urgent review due to recent changes in the coastal fisheries of Indonesia, such as increased use of anchored fish aggregating devices (locally known as *rumpons*); discrepancies of gears between registered and used gear for all vessels greater than 5 GT; larger-scale purse seiners entering fisheries; and increasing of fishing vessel movement between FMAs or RFMO areas.

b) Collection of catch, effort, and size data

Collection of catch and effort data from coastal fisheries

The sampling design and protocols are not fully observed in all landing places. The following cases in which the protocols are not observed:

- **Samples assigned to the wrong gear**: While sampling fish at unloading enumerators record in the sampling forms the gear the vessel is registered to operate, on the assumption that vessels use the gear of registration over the entire license period. However, the reality is that in some cases the gear used differs from the gear of registration, or the gear of registration and other non-registered gears are used during the same trip.
- **Insufficient species identification**: The identification of some species of tunas is difficult, in particular specimens of small size, such as juvenile stages of yellowfin tuna and bigeye tuna. This can lead to miss-identification, with specimens of one species recorded under a different species, or aggregation, with two or three species recorded simply as 'tunas', or any other aggregate of species.

Logbook data

Levels of coverage are still poor and the data recorded in logbooks are usually incomplete or inaccurate.

Export data

The Workshop noted that Export data can sometimes be used to cross-verify catch estimates.

Size frequency data

Although some size frequency data seems to be collected at the landing place for fisheries other than longline, this information is not transferred to the DGCF in Jakarta.

With regards to the collection of size data from longline fisheries, changes in the fisheries and insufficient implementation of sampling protocols in some ports are likely to bias length frequency distributions derived from such data.

c) Data management

The Workshop noted that most of the data management in Indonesia is done manually or using Excel, and stressed the need for DGCF to implement a Centralized Database System (CDS) as a matter of priority. The Workshop noted that in the past DGCF had attempted to set-up a CDS, named SISKA (*Sistem Infomasi Statistik Perikanan Tangkap* = Information System of Capture Fisheries Statistics), but implementation of the system had failed. The Workshop agreed on the need for DGCF to re-assess implementation of the CDS. In this regard, the IOTC-OFCF Project informed the Workshop that Sri Lanka had recently implemented a CDS with the assistance of the Project, noting that a similar system could operate in Indonesia. The Workshop thanked the IOTC-OFCF Project for this information, recommending that the IOTC-OFCF Project assist Indonesia with this work.

d) Catch estimates

The Workshop noted that Indonesia had provided good catch estimates for Indonesian flagged longliners based in ports in Indonesia for the period 2003-09, following the implementation of a multilateral catch monitoring programme, involving Indonesian and foreign institutions. However, changes in the way the longline fisheries operate and a reduction in sampling coverage in recent years necessitate a review of catch estimation procedures, including re-estimation of catches by species for recent years, and in particular for albacore.

For catch estimates for fisheries other than longline, the issues identified concerning sampling design, data collection, and data management may influence the estimates substantially, introducing bias.

Recommendations

The main recommendations from the Workshop are summarized below:
1. The sampling design needs to be revised so that more detailed information can be collected from the fisheries as considering issues related to sampling design.
2. The collection of socio-economic data from the fisheries should be promoted.
3. The sampling protocols established by DGCF need to be strictly observed in all landing places. The specific recommendations are that:
    o The minimum number of days and fishing units sampled by month, and the procedures to select days, boats, and gears to be sampled, should be adhered to.
    o More training be provided for enumerators to improve their identification skills for species sampled at the landing place, including juvenile tunas and main species of sharks.
    o Procedures are required for the selection of longline unloadings for sampling and coverage of all catches unloaded from the selected vessel, especially in locations other than Bali.
    In this regard, DGCF needs to increase supervision of landing places to ensure that the sampling protocols are strictly observed and identify any

issues concerning data collection or management at the district or province level.

4. Logbook returns from vessels operated in the IOTC Area are still low and the quality of the data reported is generally poor. DGCF is encouraged to continue efforts to increase the number of logbook returns and data quality, including validation of data using alternative data sources, such as samples collected in port, through observers, and VMS records, where available.

   In addition, DGCF is encouraged to explore the use of logbook data collected from alternative sources, in particular data collected on longliners operated by the State-owned company Perikanan Samudera Besar[6], for which more than 30 years of logbook data are available, including dissemination of existing catch-and-effort data to the IOTC.

5. It is recommended that DGCF uses the experiences gained in the implementation of other scientific observer programmes, and in particular, the Pilot observer programme in Bali, in the planning and implementation of Indonesia's National Observer Scheme.

6. The catch estimation procedures used by DGCF need to be revised to enable a) the following:
   o Data reported in logbooks to be used to assist the estimation of catches for FMAs and for determining estimates of catch-and-effort according to national and international needs;
   o Data collected by observers onboard vessels flagged in Indonesia to be used to assist in the estimation of levels of catch of seabirds, marine turtles, and marine mammals, by species, and for the validation of logbook data;
   o The monitoring of the use of multiple fishing gears during a fishing trip;
   o The monitoring of movements of vessels between FMAs or RFMO areas.

7. The series of historical catches by year, gear, and species produced by DGCF need to be revisited in order to evaluate the need to re-estimate total catches, and/or catches by gear and species. For this purpose DGCF should explore the use of alternative estimates of catches by gear.

8. DGCF should consider strengthening its data management system through the implementation of a centralized database system, to facilitate estimates of catch and effort, validation of those estimates, and timely compilation and dissemination of data by DGCF in Jakarta.

Proposed Work plan

The implementation of some of the above recommendations had to be done sequentially, and other recommendations could be implemented as independent events. In order to provide guidance the Workshop identified the type of activities that will need to be implemented and sequence of events proposed, and amount of time that will be required for the implementation of each activity, as assessed by the Workshop. Five activities are presented below:

Activity A: Sampling design, data collection, and data management (42 months)
1. Interview-based survey to assess the level of implementation of the existing sampling design (6 months)
2. Modification of the sampling design (1 month)

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[6]PT Perikanan Samudera Besar merged, in 2005, with 3 other State-owned companies (PT. Usaha Mina, PT. Tirta Raya Mina, and PT. Perikanan) to become "PT Perikanan Nusantara"

3. Implementation of Pilot Programme to assess the effectiveness of the new design (14 months)
4. Design and implementation of a Centralized Database System (12 months)
5. Developing and implementing new catch estimation procedures (computer-based) (3 months)
6. Training on data collection, supervision, management, and catch estimation (6 months)
7. Full implementation of new sampling design and CDS

Activity B: Logbook Programme (9 months)
1. Survey the quality of the current system (3 months)
2. Develop and implement a scheme to improve logbook returns and the completeness and quality of the data reported (6 months)
3. Establish data processing routines to derive data used in the estimation of catch (Activity A5 above)

Activity C: Scientific Observer Programme (industrial fisheries) (16 months)
1. Finalize training of observers and send List of Certified Observers to the IOTC (3 months)
2. Implement Observer Programme (12 months)
3. Establish data processing routines (computer based) to derive catch rates for bycatch species, validation of logbook data reported by the fisheries (Activity B1 above); and routines to estimate catches of sharks and bycatch rates of marine turtles and seabirds (Activity A5 above).
4. Establish data processing routines (computer based) to obtain trip observer reports and report this information to the IOTC within 150 days after the end of each trip (1 month).

Activity D: Re-estimation of time-series of catches and effort (4 months)
1. Re-estimation of time-series of catches by year, gear, and species (2 months)
2. Compilation of existing logbook data, processing and dissemination, including to RFMOs (2 months)

Activity E: Compilation of socio-economic data (14 months)
1. Identification of socio-economic indicators of importance to Indonesia and sources available (3 months)
2. Compilation and computerization of available historical socio-economic data in the CDS (9 months)
3. Establish routine collection of socio-economic data (1 month)
4. Establish data processing routines (computer based) to derive socio-economic indicators (1 month).

The Workshop recommended implementation of activities A and B is considered a priority.

2.2.5. Mauritius

Background

The IOTC-OFCF Project sent a mission to Mauritius to assess and evaluate data collection and processing in Mauritius, mainly focusing on Albacore, in November 2012. This activity was recommended by the Working Party on Temperate Tunas in August 2012 as follows.

*21   The WPTmT **NOTED** that in recent years many foreign vessels have been unloading catches of albacore in Mauritius, representing around 60% of the total catch, and that Mauritius is making efforts to monitor albacore for catch and length data. The WPTmT **RECOGNIZED** the value of the biological information collected in Mauritius and **RECOMMENDED** that the IOTC-OFCF Project considers supporting Mauritius to collect this information.*

Terms of reference to assess the status of data collection and processing of artisanal and foreign longline fisheries in Mauritius are:

1.   Meet with relevant officials including the Chief of Statistics, personnel responsible for aggregation and handling of fisheries data, and representatives at the provincial and district levels.
2.   Visit various ports to determine the flow of information and possible areas for improvement.
3.   Describe issues affecting the timely report of artisanal fishery data and investigation of possible solutions, implementation and costs (following "Improving Reporting Systems" questionnaire).
4.   Recommend data collection and management activities that would make possible close to real-time reporting of data from artisanal fisheries, including implementation of pilot sampling activities and strengthening of existing data collection and management systems.

Results of the mission

The tuna and tuna-like fishery in Mauritius can easily be divided into an artisanal fishery around Fish Aggregating Devices (FADs), a small local semi-industrial longline fishery, and a licensed foreign tuna longline fleet (around 120 mainly Asian boats). The main species caught by the FAD fishery by local artisanal small vessels and foreign longline vessels is albacore *Thunnus alalunga,* although the local longline fleet targets swordfish *Xiphias gladius*. The proportion of albacore has almost doubled from 2007 to 2011 to around 3,595 MT. Other species caught include yellowfin tuna *T. albacares*, marlins, and various shark species. Mauritius also serves as a transhipment point for purse seiners from the European Union (EU) and longline vessel from Asia.

The FAD fishery catches around 300 MT of fish per year, not a huge amount if we consider the catch offloaded by the semi-industrial and industrial fleets. Because the Ministry of Fisheries, Mauritius, faces budgetary issues, priorities should be identified and current practices modified to maximize gain in data collection through the streamlining of sampling practices. At this time, separate institutions of the Ministry sample the FADs and lagoon fisheries, but this could be changed by combining the two sampling teams into one team as the landing sites are the same. In addition, the amount of work for the samplers can be very low, and there is no reason why they should not gather information on the various fisheries offloading at the same landing sites. Finally, collection of basic biological data (lengths and weights), effort and gear configuration should take place.

The sampling effort might be reduced for the FAD and lagoon fisheries without compromising quality to allow some of the enumerators to help with data gathering in Port Louis, where a large amount of fish are offloaded by the licensed fleet fishing in the EEZ as well as a large number of boats fishing in international waters.

The semi-industrial and industrial fleets fishing in the EEZ have complete enumeration through the logbooks although it is necessary to cross check the data for the latter to ensure agreement between logbooks and actual catches. Cross-checking of areas fished and logbooks are already done through the VMS (Vessel Monitoring System) records. The logbooks for the foreign fleet appear to be filled mainly by the agents due to language difficulties although this is partially addressed with a new

logbook in English and Mandarin, the latter the main language of the foreign fleet (Taiwanese).

Sampling takes place for a great majority of the local semi-industrial fleet where most fish are measured and the logbooks are collected. The logbooks ask most of the questions requested by the IOTC although more detail on the configurations of the gear is needed. The licensed foreign longline fleet consists of around 100 vessels (note that a vessel may renew its license a few times) of which around 60-70% are sampled for length frequencies. They fish in the EEZ of Mauritius and the catches can be confidently assigned to a 5° x 5° square as required by the IOTC. The observer programme is due to start next year for national vessels fishing for tuna in the IOTC area of competence. All information is collected according to flag and data are separated by domestic and foreign fleets.

Non-licensed vessels that come into Mauritius to tranship are not required to have a functional VMS or to submit a logbook although they are required to submit: a) an application form for port access for foreign fishing vessels, and b) a port state inspection form and **c.** an inspection on landing/transhipment of fish form.

Mauritius needs to address issues with its experimental design, sampling and data processing to realise an effective and functional monitoring programme of its fisheries.

Recommendations

- *Database*

The main issue affecting production and reporting of data is the lack of a functioning database. Some institution under the Ministry uses Excel spreadsheet and some uses SPSS database. As the fishery in Mauritius is not complex, accessibility to a unified database would speed up and improve reporting.

- *Verification of Catches from the unlicensed foreign fleet.*

The foreign fleet that is not licensed, and fishes outside the Mauritian EEZ, may offload its catch partially or wholly in Mauritius, into private companies like Froids des Mascareignes (FDM) where the fish are stored, sorted, re-shipped or sent for processing. Although the capture data from licensed vessels are detailed in logbooks, it is suggested that fact checking be done to ensure the reliability of the numbers. Detailed data from these vessels, however, are not readily shared by FDM or other private companies with the Albion Fisheries Research Centre (AFRC) personnel who sample and there are questions about the quantities of fish by species being offloaded. It is here suggested that as the boats are offloading their catches, data are collected on the species to compare to the forms submitted as part of the requirement for offloading in Mauritius. Details on fishing areas, gear configuration, catches, and dates should be required as part of the information presented. A possibility could include the VMS tracks of the non-licensed vessels coming into Mauritius to offload, a possibility that is already being contemplated by the Mauritian government to have better information about the vessels entering its waters.

- *Verification of catches from the licensed foreign fleet.*

The foreign fleet that fishes within the EEZ must submit a logbook and offload the whole catch in Mauritius. There is the need to cross check the validity of the numbers

provided in the logbooks to the catch offloaded.

- *Length and Weight Measurements*

Fish length measurements are done with a measuring tape, and these need to be labelled as such to allow for a conversion to fork length. Although a calliper is preferred, circumstances in the port and unloading do not allow using this. Also, lengths are rounded up instead of down, which is an issue that can be easily resolved during the processing of data. Weights for tuna usually refer to gilled and gutted weight, and for sharks and billfishes headed, tailed, and gutted weight, which needs to be specified explicitly in the forms so they can be converted to live weights. Thus, there is a need to collect information of standard fork vs. curved length and weights before and after processing to be able to create equations specific to the region.

- *Disqualification of entries with discrepancies in positions*

Longline fleets provide position data through log book, but positions of the logbooks do not match those from the VMS records. This should be modified and the catch information kept as the differences are probably due to transcription errors and their elimination from the record results in an underestimation, albeit minor, of the total catch. A comparison of the catches and logbooks showed that errors were minor (30 minutes of latitude and longitude), errors that are attributable to a late registry of the position where the longlines were set.

- Size Measurements from foreign fleet fishing in EEZ of Mauritius

It is necessary to determine the amount of handling of the fish (size sorting) before offloading to determine if special measures need to be taken to ensure a representative sample. Furthermore, samples should be taken randomly from the well as the animals are offloaded to ensure that the samples cover all lines and all sizes.

- *Artisanal FAD sampling regime*

The current sampling scheme needs to be revised. In theory there is complete enumeration per site and each site is weighted by importance although it is not clear how. The data are entered into the SPSS statistical analysis program and total catch calculated. At present, the areas with the least catch (52 landing sites, 25% of the total FAD catch) receive 75% of the effort. These sites although numerous (labelled Stratum 2), receive very few fish daily (and in many cases none) although they may experience changes seasonally. There is a need to allocate sampling effort according to the proportion of the catch.

Additionally, the current sampling scheme is set up to sample the same site six days in a row before moving to the next sampling site. This methodology does not register temporal changes in fish capture through the month. It is here proposed that sites in each Stratum are sampled randomly or systematically depending on the results of the revision of the methodology.

Finally, the FAD fishery catches fish with a variety of gears that are not recorded anywhere: trolling on the way to and from the FAD, vertical longline with eight hooks (50 m between hooks) down to 300 m, and handline to catch dolphin fish and yellowfin tuna at the surface. It is easy and important to collect all information on gears and effort to complete the data set. In addition, if fishing is not productive in a FAD, fishers may move to a total of three FADs and this information needs to be recorded.

An important component aspect of the FAD fishery is the fishes caught as bait which are not studied or recorded anywhere in the system and, which at present, appear to be an important limiting factor to the fishery.

Further Action

There was no further action taken through the IOTC-OFCF Project Phase III. However, as one of future activities implemented by the IOTC-OFCF, the Mission proposed to assist Mauritius in collection and management of data from foreign vessels unloading at Port Louis, where is the main port in the region concerning landings of albacores by foreign flagged vessels as a further action.

2.2.6. Others

2.2.6. a Reporting to the IOTC Meeting

The Project annually submitted progress reports to IOTC Working Party on Data Collection and Statistics (WPDCS) or IOTC Scientific Committee Meeting. One of report submitted to the IOTC Scientific Committee Meeting is shown Annex 6 as an example.

2.2.6. b Provision of Equipment

The Project included a scheme of provision of equipment and material which were required to more effective implementation of each program. A list of equipment and materials provided for related activities is presented in Annex 7.

2.2.6. c Leadership Training on Fisheries Resource Management (LTCFRM)

In response to the urgent needs of the coastal countries to train qualified human resources for developing the fisheries industry, OFCF has been actively assisting in developing qualified personnel by providing various training courses to meet these needs and by accepting overseas trainees in Japan.

The Leadership Training Course on Fisheries Resource Management (LTCRFM) is one of OFCF training courses, and can contribute to the management of international fishery resources in related coastal countries, and to foster amicable relations between the countries and Japan in the fisheries field. The LTCFRM, a one-month training course, has been in place since 2002 to build capacities of relevant personnel closely related to the IOTC-OFCF Project. The budget of the training courses was separated from the Phase II of the Project.

Outline of the LTCFRM

The LTCFRM is designed to train qualified persons in the field of fisheries statistics by providing expert training programmes, thus enabling participants to acquire deeper knowledge and skills related to fishery resources management. Specific training is therefore held at some national research institutes in Japan.

The objectives of the LTCFRM are to provide support for the Project in the following areas:

1. To learn and obtain basic knowledge of fisheries resource management

2. To learn how to organize fisheries statistical systems and obtain knowledge of practical examples for the operation.

3. To learn how to organize fisheries statistics required by IOTC, in accordance with IOTC standards.

4. To learn and obtain knowledge of the effectiveness and utilization of fisheries statistics for appropriate resource management collectively.

Technical training is given at the National Research Institute of Far Seas Fisheries (NRIFSF) of the Fisheries Research Agency of Japan, in the following:

- Introduction to Fisheries Resource Management

  The schedule includes learning the basics of "Theory and Model", which is usually used in studies of fisheries resource management, together with study of the methods of fisheries resources management in Japan, including case studies, in aspects of "Coastal Fisheries Resources", "Far-Seas Fisheries Resources", and "International Fisheries Resources". In the study of "Far Seas Fisheries Resources", the participants learn about the scheme of resource management conducted by IOTC, including the ecological aspects, focusing especially on the resources on tuna and tuna-like species.

- Fisheries Information and Statistical Systems

  Regarding fisheries information and statistical systems in Japan, the entire flow of statistical data from catch level through district, region and national level to be submitted to international organizations is explained in a lecture, then the participants visit relevant institutions, landing sites, and data collection sites to learn about fieldwork, and also have relevant lectures at these places.

At the end of the training course, the participants submit their own reports on what they have learned from the course about the basic information for compiling Country Reports, as well as the countermeasures to various issues regarding fisheries resource management and fisheries statistics in each country, and based on these reports, make final presentations.

Participation

The participants in the LTCFRMs during Phase II of the Project (Japanese fiscal years (FY) 2007 to 2009) are listed in Table 2-7. A total of 11 participants from seven counties and one organization were participated.

FY	Number of participants	Country
Table 2-X. Number of partisans by country or organization in the Leadership Training Course on Fisheries Resource Management (LTCFRM) during Phase III of the Project from Japanese Fiscal Year (FY) 2010 to 2012		
2010	2	Seychelles and Thailand
2011	3	IOTC Secretariat, Iran and Thailand
2012	6	Comoros, India, Indonesia, Iran, Madagascar, and Seychelles
Total	11	7 counties and one Organization

2.2.7. Achievement of the Project Activities Phase III

Table 2-X shows brief results of activities with contribution to the Observer Scheme by country of the Project activities Phase III from Japanese fiscal year (FC) 2010, 2011, and 2012. Japanese fiscal year starts from April and ends to March on the following year.

Table 2-X. Brief results of the planned activities* (showing yellow) in Fiscal year 2010, 2011 and 2012, and contribution to observer scheme.

Country	FC 2010	FC2011	FC2012	Contribution
Sri Lanka	Sri Lanka request assistance to address recommendations from the IOTC SC. The Project sends a mission to discuss about activities to undertake. No response from Sri Lanka about the MOU and TOR proposed by the Project	The MFARD of Sri Lanka request assistance from the Project for the implementation of a Centralized Database Management System (CDMS) in Sri Lanka The Project prepares TOR for the work and provides MFARD of Sri Lanka with funds to carry out this work; an IT Company is hired to create the CDS which is handed over in March 2012	NARA and MFARD of Sri Lanka discuss the draft MOU and TOR that the Project presented in 2010, on strengthening of data collection activities in Sri Lanka. The MOU is finally agreed and signed in October. Activities are initiated in November and are now under way	Sampling coverage increased: Offshore fishery: coverage expected to exceed 20% of the vessel activities. Coastal fishery: expected coverage 5% or higher (was below 5% in the past). Improved monitoring of individual vessels, including identification of non-licensed vessels. Improvements in data quality of species identification, in particular for sharks and billfish, and details of gear breakdown. Improved timeliness of production of National fisheries statistics and dissemination of data.
Comoros	Comoros requests assistance from the Project to reinstate data collection Fisheries Census between January-March IOTC supports sampling activities for one year. The Project assist with the supervision of sampling activities A database is developed for the Comoros		Training on data verification and catch estimation procedures Fisheries Census between July-September (different monsoon season)	Data collection resumed (no sampling activities in place since 1995) Full monitoring of total numbers of fishing vessels 5% or more of the vessel activities covered through sampling Improved monitoring of vessel activities, species and gear identification Improved timeliness of production of National fisheries statistics and dissemination of data.
Iran	Iran requests for assistance to improve its data management and reporting systems; and strengthen collection of length frequency data. Iran considers a proposal by the Project but plans cannot be initiated due to administrative issues.	The Project provides assistance to the strengthening of SHILAT's database and procedures, including provision of hardware The Project provides materials to increase the sampling of lengths and improve species identification, in particular for bigeye tuna	Database work underway Length frequency sampling extended to cover more locations and time-periods.	Sampling in Iran covers around 10% of the vessel activities Substantial increase in the numbers of fish sampled for length, with more than 1 fish measured per metric ton of catch for most species (as requested by the Commission) Improved reporting of catch-and-effort data, although still insufficient. Further improvements in the database are required and the strengthening of the logbook system necessary

Indonesia		Indonesia requests for a meeting to look into catch estimation procedures The Project organizes a Workshop on catch estimation (March) The Workshop identifies a number of issues that need to be addressed by Indonesia	Publication of the Report of the Workshop The Project follows up implementation of recommendations from the Workshop in Indonesia; little progress to date	Industrial fisheries: Sampling coverage of longline fisheries has dropped since 2009 Deficient implementation of logbook systems Deficient data management Artisanal fisheries: Insufficient sampling in some areas Very deficient data management
Madagascar			Madagascar request assistance from the Project with its data collection at a Working Party Meeting The IOTC identifies external funding for the implementation of activities in Madagascar (COI-SMARTFISH) and initiates collaboration to implement activities in 2013	The IOTC Secretariat to cooperate with COI-SMARTFISH in the implementation of activities in Madagascar and resuming of sampling activities in Comoros (sampling discontinued in February 2012) No actions required from the Project
Mauritius			Mauritius request assistance for an evaluation of its data collection and management systems The Project sends a mission in November and prepares and disseminates a Report on the findings, including recommendations	Mauritius may require assistance for the implementation of activities to address recommendations from the Project.

*Planned activities are based on detail work plan (Annex X), which were jointly prepared by staff of the IOTC and OFCF expert at the beginning of Japanese fiscal years starting from April 1.

As conclusions of the activities, planned activities were implemented in timely manner. Implemented activities contributed to successful results to improve port sampling activities along purpose of the Project.

2.3. Joint Committee Meetings

Three Joint Committee Meetings of the Project Phase III was held in December 2010, March 2012, and December 2012. The First and Second Meetings in December 2010 and March 2012 discussed the main topics: (1) review of the activities in present year, and (2) activities in the following year.

For the final third Joint Committee Meeting, Representatives of the OFCF and IOTC met at the IOTC Secretariat on Monday, 17 December 2012, and the Meeting discussed the following topics: (1) review of the activities from June 2010 to date including review of the activities in present year 2012, and (2) future plans. The Record of discussion is attached as Annex 8.

Review of activities, June 2010 – November 2012

The OFCF expert reported on major activities carries out Phase III. His presentation also covered the Financial Report and equipment provided to the program. The Committee noted that the Project activities have generally been implemented in conformity with the Work Plan, which was drawn up on the basis of recommendations from the IOTC Scientific Committee and revised as necessary to reflect changes in situations. The Committee recognized that the anticipated goals of the Project, which was to fill the gaps that had existed in statistical data and thereby enhance the data collection and processing systems in the region, has been duly attained, and agreed that the Project be terminated as of the end of March 2010, as originally planned.

Future plans as Phase IV

The IOTC emphasized that the Project activities carried out during Phase III of the Project were welcomed by both the IOTC Scientific Committee and the member countries. In view of the successful implementation of activities by the Project and the positive results, the Scientific Committee encouraged Japan to continue providing support in the area of data collection and processing to developing coastal countries in the IOTC region.

The OFCF expert explained that its budget had undergone continued cutbacks in recent years, as a result of both the unprecedented financial crisis in Japan and the uncertainty about the new budget allocation system due to the change of government in Japan in December 2009 it had no clear outlook on the availability of government funds in the future. OFCF had concluded that, under the current circumstances, it was unable to commit itself to any project from Japanese fiscal year 2013 onward. The IOTC Secretariat expressed its understanding on the situation of the OFCF.

Possible future areas of cooperation for improvement of IOTC statistics are discussed in the following section.

3. Proposed Activities for future improvement of IOTC statistics

During Phase III, the IOTC-OFCF Project provided support to strengthen data collection and processing in developing coastal states in the IOTC Area described in the previous section, with a view to assist those countries in the implementation of the IOTC Regional Observer Scheme. Although the actions from the Project have resulted in improved data collection and processing systems in those countries, the IOTC Scientific Committee has identified other developing countries in the region that are still to implement the requirements, in particular sampling of at least 5% of the activities of artisanal fleets, noting that such countries may require assistance to do so.

On the other hand, some of the developing countries in the region that have presented fleet development plans to the Commission are in the process of implementing those plans. Unfortunately, increases in the number of industrial vessels in those countries did not always led to the strengthening of data collection and processing systems, hampering implementation of IOTC data requirements, in particular logbook systems and collection of size data, and observer programmes in those countries.

Provisions in the IOTC Resolution on the Regional Observer Scheme indicate that countries having artisanal fisheries shall gradually increase sampling coverage so as to attain the 5% minimum coverage level set by the Commission, by January 2013. In addition, the Commission invites its members to assist countries in the region in the implementation of these provisions, where possible.

As considering all concerned including the future IOTC OFCF Project budget scale and other cooperating activities with the IOTC, the Project proposes implementation of activities in the following countries and fisheries.

- **Industrial longline fishery of Indonesia**
  - Proposal: Evaluation of data collection and management activities, including logbook systems, and where required, revision of sampling design and support to strengthening of sampling activities, in particular sampling of the component of the catches unloaded frozen.
  - Objective: Assist Indonesia to address recommendations from the IOTC Scientific Committee, in particular those relating to collection and reporting of catch-and-effort data, amounts of albacore caught by vessels flagged in Indonesia, and importance of ports in the IOTC Region with regards to unloadings of albacore.
  - Estimated Cost: USD 70,000

- **Artisanal fisheries of Indonesia**
  - Proposal: Evaluation of data management activities, in particular database systems used to record catches, effort and size data from the fisheries; and training on data collection, in particular neritic tuna species and catches of juvenile tunas around anchored Fish Aggregating Devices.
  - Objective: Assist Indonesia to address recommendations from the IOTC Scientific Committee concerning sampling of catches of juveniles of tropical tunas and neritic tuna species and improvement of data collection and reporting from artisanal fisheries; identify areas where future assistance from the Project may be required.
  - Estimated Cost: USD 50,000

- **Fisheries of Maldives**
  - ➢ Proposal: Pilot Project on the implementation of an electronic data collection system, using electronic tablets or pens.
  - ➢ Objective: Assist Maldives in the collection, processing and reporting of data from its pole-and-line fishery, in close-to real time and assess the feasibility of implementing such a system in Maldives and other countries of the region.
  - ➢ Estimated Cost: 65,000

- **Fisheries of Iran**
  - ➢ Proposal: Evaluation of implementation of a logbook system in Iran and strengthening of data reporting systems, in particular catches of bigeye tuna and catch-and-effort and length frequency data.
  - ➢ Objective: Assist Iran to comply with IOTC data requirements and recommendations from the IOTC Scientific Committee concerning provision of catch-and-effort data from Iranian driftnets.
  - ➢ Estimated Cost: USD 25,000

- **Artisanal fisheries of Malaysia and Thailand**
  - ➢ Proposal: Evaluation of data collection systems and support to the collection and reporting of catch and effort and size data from coastal purse seine fisheries directed at species of neritic tunas in these countries.
  - ➢ Objective: Assist Thailand and Malaysia to comply with IOTC data requirements and provide the IOTC Working Party on Neritic Tunas with series of catch-and-effort and size data to be used in the assessments of these species.
  - ➢ Estimated Cost for each country: USD 15,000

- **Foreign fleets based in Mauritius**
  - ➢ Proposal: Strengthening of sampling of albacore from foreign longline fleets unloading in Mauritius and data management systems used for those fisheries.
  - ➢ Objective: Assist Mauritius to address recommendations from the IOTC Scientific Committee concerning collection of size data on albacore and importance of ports in the IOTC Region with regards to unloadings of albacore.
  - ➢ Estimated Cost: USD 30,000

It is important to note that the above list is not exhaustive and the list of activities may need to be extended in the future following recommendations from the IOTC Working Parties or Scientific Committee in 2013, or requests for assistance received from developing coastal countries in the Indian Ocean.

The implementation of activities under the Project, involving the participation of most of the coastal countries in the IOTC region, has helped the Project to identify the main areas that would need improving in order to obtain good statistics from the fisheries involved.

4. Concluding remarks

IOTC tuna statistics are one of the most important elements for assessing tuna resources in order to utilize them in a sustainable manner.   The basis of the statistics compiled by the IOTC Secretariat is the statistics submitted from countries which are involved in tuna fisheries. The statistics from each country have to satisfy IOTC criteria, so data have to be collected and processed appropriately.

Phases III of the Project dealt with support to strengthen data collection and processing in developing coastal states in the IOTC Area described in the previous section, with a view to assist those countries in the implementation of the IOTC Regional Observer Scheme. The Project provided various types of technical supports. As inputs of resources were limited, some of the issues remain unresolved; however, the IOTC Scientific Committee and the other relevant IOTC Working Parties expressed appreciation of the fruitful results of the Project.

The countries in which Project activities were implemented have to improve their own tuna statistics by applying the technical support given through the Project. The Comprehensive Report Phase III describes details of the activities and makes various recommendations for improving and strengthening tuna statistics. Even though countries failed to implement the programmes or receive support from the Project, they can use reports including previous Phase I and II comprehensive reports as a good reference in order to improve their fisheries statistics, especially for tuna.

Provisions in the IOTC Resolution on the Regional Observer Scheme indicate that countries having artisanal fisheries shall gradually increase sampling coverage so as to attain the 5% minimum coverage level set by the Commission, by January 2013. In addition, the Commission invites its members to assist countries in the region in the implementation of these provisions, where possible.

In December 2012, the IOTC Scientific Committee thanked the IOTC-OFCF Project for its continuous support to developing coastal countries in the region in the area of data collection/processing and recommended that Japan consider extending support in the future towards full implementation of the provisions of the IOTC observer scheme and IOTC minimum data requirements. Right after the IOTC Scientific Committee Meeting in December 2012, the IOTC Secretariat and OFCF discussed possible areas of cooperation in the future, bearing in mind that the government of Japan has not considered further support to IOTC activities as yet.

The IOTC-OFCF Project received excellent cooperation from the relevant institutions in the coastal countries, and the IOTC Secretariat and the OFCF express their gratitude to these institutions.

Annex
1. Memorandum of Understanding for IOTC-OFCF Project Phase III
2. Detail Work Plan in FY2010, 2011, and 2012
3. Technical Agreement with Iran
4. Memorandum of Understanding with Sri Lanka
5. Pelagos database user manual provided to Sri Lanka
6. An Example of a IOTC-OFCF Project Activity Report submitted to IOTC meeting
7. List of equipment provided by the Project
8. Record of discussion of final Joint Committee Meeting, December 2012