

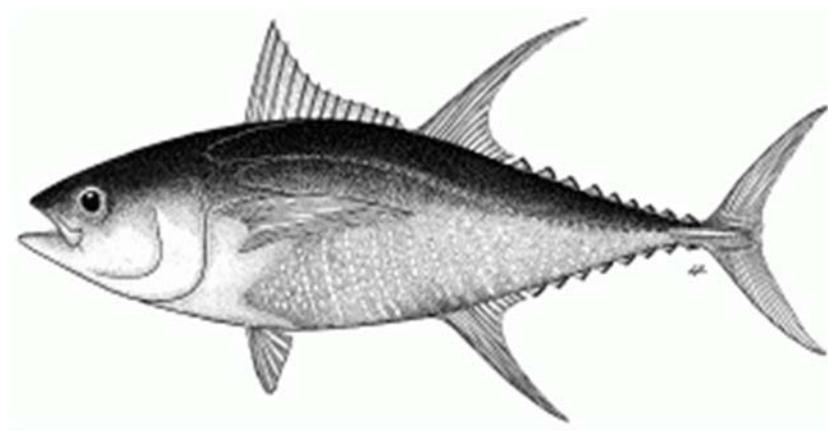
**CHARACTERISATION OF THE
FISHERIES SECTOR IN THE INDIAN OCEAN:
With Particular Reference to Tuna Fisheries
in the Bay of Bengal:
*Environmental and Economic Aspects***



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**CHARACTERISATION OF THE
FISHERIES SECTOR IN THE INDIAN OCEAN:
With Particular Reference to Tuna Fisheries in the Bay of Bengal:
(i) Environmental and Economic aspects**



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Report for the World Bank/GEF-funded
Oceans Partnership Project (OPP) – Bay of Bengal
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PREFACE AND REPORT OVERVIEW

The following report presents a preliminary overview of the fisheries sector in the Indian Ocean and more specifically in the Bay of Bengal, with particular reference to the fisheries for the principal market tuna, such as Yellowfin and Skipjack, although the other fisheries for smaller neritic tuna, such as Bullet and Longtail tuna, are also examined to some extent.

The overall aim is to provide a characterisation of the key features using a standard sector profiling framework. The current report focuses in particular on environmental and economic aspects.

A second complementary report (to follow) will address institutional and social aspects.

The underpinning information and data are drawn mainly from published secondary sources.

It is intended that these two preliminary overview reports will contribute to the overall process of research and analysis involved in establishing a sound and up-to-date understanding of the tuna fisheries sector as part of the Oceans Partnership Project –Bay of Bengal (OPP-Bay of Bengal).

The report includes a Summary Table (Page 3) – which highlights the main findings - followed by a series of sections which present the information in greater detail including an Introduction, Objectives and Outputs, Methodology and Schedule, Key Findings and Conclusions, along with a set of supporting Appendices.

One of the main findings of the report is that the estimated *potential* sustainable economic value of both the principal and neritic tuna stocks in the Indian Ocean is **USD 2.06 billion**.

Furthermore, the capitalised asset value of the fish stocks capable of generating this annual ‘income’, @ 8% as a reasonable long-term return, for example, is **USD 26 billion**.

These potential values are significant in the economic context of the Indian Ocean region and for the countries which share the fisheries involved. The OPP-Bay of Bengal plans to further investigate these values and the conditions necessary to generate and share the associated benefits in the future.

ABBREVIATIONS AND ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
ACP	African, Caribbean and Pacific Countries
BOBP-IGO	Bay of Bengal Programme Inter-Government Organisation
CCRF	Code of Conduct for Responsible Fisheries
CPS	Coastal Pelagic Species
CS	Coastal States
DWFN	Distant Water Fishing Nations
EBA	Everything But Arms
EEZ	Exclusive Economic Zone
EPA	Economic Partnership Agreement
EU	European Union
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organisation of the United Nations
FMS	Fisheries Management System
GDP	Gross Domestic Product
GEF	Global Environment Fund
GSP	Generalised Scheme of Preferences (Trade)
HS	Harmonised System (Food Codes, Trade)
ICES	International Council for the Exploration of the Sea
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IQ	Individual Quota
ISSF	International Seafood Sustainability Foundation
ITQ	Individual Transferable Quota
IUU	Illegal, Unregulated and Unreported Fishing
KT	Kilo Tonnes
LOA	Length Overall
MCS	Monitoring, Control and Surveillance
MEY	Maximum Economic Yield
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
OPP	Ocean Partnerships Programme
RSA	Republic of South Africa
SOFIA	State of World Fisheries and Aquaculture (FAO publication)
TAC	Total Allowable Catch
UK	United Kingdom
UNCLOS	United Nations Convention on the Law of the Sea
USD	United States Dollars
WCPO	Western Central Pacific Ocean
WIO	Western Indian Ocean
WPTT	Working Party on Tropical Tuna (IOTC)
WTO	World Trade Organisation

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1. INTRODUCTION

Tuna and tuna-like fishes, which include both neritic and highly migratory oceanic species, are the basis for diverse and economically valuable fisheries in the Indian Ocean which involve some 40 nations, including Indian Ocean Coastal States (CS) and Distant Water Fishing Nations (DWFN).

While many inshore tuna fisheries are operated by local fleets of relatively small-scale vessels, largely supplying national and regional markets, other more offshore fisheries, based on tuna stocks which range into the deep sea, and into Areas Beyond National Jurisdiction (ABNJ), are exploited mainly by fleets of large-scale vessels (belonging to both CS and DWFN) with strong linkages to international markets.

However, in common with many fisheries throughout the world, there are concerns over the future productivity and sustainability of tuna fisheries in the Indian Ocean. The current policy frameworks and fisheries management arrangements have recognisable weaknesses at all levels (local, national and regional), including the limited availability and quality of the underpinning data and information for decision-making, the low level of institutional capacity for policy-making and implementation shown by many CS, and the variable extent of cooperation and coherence between nations, both CS and DWFN, which exploit the same fish stocks.

A new World Bank/Global Environment Fund (GEF)-funded initiative called the Oceans Partnership Programme (OPP) has been established to investigate and address the issues facing the future development and management of tuna and other highly-migratory fish stocks, with a series globally-distributed regional projects. The final output of the programme will be a series of business cases to target particular opportunities for future investment and a clear definition of the likely pay-off and impact of these investments with regards to the so-called 'triple bottom line' (economic, social and environmental benefits) for development. The current report is an initial contribution to the work of the OPP-Bay of Bengal project.

2. OBJECTIVES, OUTPUTS AND APPROACH

The primary objective of this report is to produce a preliminary characterisation of the fisheries in the Indian Ocean and the Bay of Bengal, with a particular focus on tuna fisheries.

The work will specifically address environmental and economic aspects. A follow-on and complementary report will look at social and institutional aspects. The two reports together will therefore establish an up-to-date multi-disciplinary characterisation of the fisheries sector, forming an essential building block for the subsequent sectoral analysis to be carried out by the project.

The approach to be used to develop the detailed characterisation will be based on a standard sector profiling framework (Box 1). This consists of the four primary areas of environment, economy, social and institutions, and sub-divided in a ten key categories to capture the main features of a fisheries sector. A final section sets out to examine key trends and changes.

For this initial project output, the framework will be populated with information from secondary sources, mainly from the international literature and from international sources. In the future, the project will also undertake an in-depth review and analysis of national information and data, and compare and cross-reference the findings.

It is planned that the current characterisation results will be up-dated, improved and refined over time as the OPP-Bay of Bengal Project is implemented, and as further primary and secondary information and data become available.

Table 1. Fisheries Sector – Profiling Framework		
Environment	(I) Environment and Major fish stocks	<ul style="list-style-type: none"> • What are the major aquatic environments and their characteristics? • Identify the major fish stocks, distribution and status
Economy	(II) Production and landings	<ul style="list-style-type: none"> • What are the levels of annual and seasonal production by fishery? • What are the overall production trends by key species and fleets?
	(III) Fishing fleets and fishing activity	<ul style="list-style-type: none"> • Identify the fishing vessel and gear characteristics by fleet • Has technology changed over time?
	(IV) Post-harvest, trade and markets	<ul style="list-style-type: none"> • How is the catch utilised? What products? • What are the main markets, trends, exports and imports?
	(V) Economic valuation	<ul style="list-style-type: none"> • What is the economic value of the fishery (potential and actual)? • What is the contribution to the economy? (local and national)
Social	(VI) People and social aspects	<ul style="list-style-type: none"> • What is the level of employment in the sector? • What is the structure and the activities of communities?
Institutions	(VII) Institutions and organisations	<ul style="list-style-type: none"> • What are the major institutions and organisations? • What is their role and inter-relationships?
	(VIII) Policy and law	<ul style="list-style-type: none"> • Identify the key fisheries policy and associated legal framework; • What are the key objectives and implementation mechanisms?
	(IX) Fisheries management	<ul style="list-style-type: none"> • Identify and describe the fisheries management system; • What are the key objectives, management performance and the factors affecting this?
Trends	(X) Global Trends, changes and issues	<ul style="list-style-type: none"> • What are the key global trends relevant to the fisheries sector? • What are the major factors of change? • Are there specific regional issues affecting the fisheries?

3. RESULTS

The results of the characterisation of the tuna fisheries for the Indian Ocean and the Bay of Bengal – covering the environment and economic aspects – are presented in Table 2 below.

Table 2. Indian Ocean (plus Bay of Bengal) – Tuna Fisheries Sector – Profile

<p>Environment and major fish stocks</p>	<p>INDIAN OCEAN</p> <p><u>Environment:</u></p> <ul style="list-style-type: none"> • Western Indian Ocean (FAO Statistical Area 51) (30 million sq km, 6.3% continental shelf), diverse environments; Arabian Sea is affected by seasonal monsoons, and associated upwellings give productive fisheries (60% total catch); • Eastern Indian Ocean (FAO Statistical Area 57) (2.37 million sq km continental shelf), tropical to temperate environments; Marine and fisheries productivity is low compared to Pacific and Atlantic Oceans; Except Bay of Bengal, which is affected by monsoons and storm surges, other areas have localised upwellings; <p><u>Tuna stocks:</u></p> <ul style="list-style-type: none"> • Principal market species are [1]Yellowfin, [2] Bigeye, [3] Skipjack [4] Albacore and [5] Southern Bluefin (Appendix 2) • Another important species are – Southern Bluefin occurs mainly in the southerly IO Convention Area • Other species of tuna and tuna-like fish include: Neritic tunas, Billfishes. • Stock distribution: Based on catch distribution and catch-and release programmes (Appendix 3) <ul style="list-style-type: none"> [1] Yellowfin: Western IO (Off Somalia, Area R2) [2] Bigeye: Western IO (A1) and Eastern IO (A2) [3] Skipjack: Western IO (R2) and Eastern IO (R1) [4] Albacore: Mainly South of 10°S [5] Southern Blue-fin: Southern waters between 30 and 50°S <p><u>Stock Assessment:</u></p> <ul style="list-style-type: none"> [1] Yellowfin: MSY: 421,000 - Overfished, overfishing (2015 stock assessments); [2] Bigeye: MSY: 132,000 t - Not overfished, no overfishing (2013 stock assessment); [3] Skipjack: MSY: 684, 000 - Not overfished, no overfishing (2014 stock assessment) [4] Albacore: MSY: 33,300 t - Not overfished, no overfishing (uncertainty relating to this assessment)(2014) [5] Southern Bluefin: MSY: 33,000 Heavily overfished, no overfishing (2014 stock assessment) (rebuilding plan in place). <p>BAY OF BENGAL</p> <p>Largely on the periphery of the major distribution areas for the principal market tunas, both tropical and temperate. Maldives has seasonal abundance of all three principal market tunas, especially skipjack, less abundant for India and Sri Lanka. The neritic tunas (various) are distributed widely in coastal waters of all three countries. Some stock of tuna-like species also, although information is limited.</p>
<p>Production and landings</p>	<p>INDIAN OCEAN</p> <p><u>Overview</u></p> <ul style="list-style-type: none"> • Indian Ocean accounts for 20% of World tuna catch (2nd after WCPO) • Total catch of the four principal commercial species were 1,003,400 t (2014)(2% increase from 2013) • Total catch has declined since a peak in 2005 (1.2 million tonnes) • Total catch weight (2010-14): 915,000 t. <p><u>Catch Composition and regulation</u></p> <ul style="list-style-type: none"> • Total catch composition by weight (2010-14): Skipjack (44%), Yellowfin (41%), Bigeye (11%), Albacore (4%) <ul style="list-style-type: none"> [1] Yellowfin catch: 429,800 (2014) (6% increase since 2013)(but 19% decline since 2004 level, 530,000 t) [2] Bigeye catch: 100,200 t (2014) (12% decrease since 2013); [3] Skipjack catch: 432,500 t (2014) (similar level to 2013); <p>Management: IOTC has not established conservation measures for these species (above), or quota allocation (despite advice from the Scientific Committee, Resolution 14/02); (Resolution 15/06 discard ban by purse-seine vessels)(some other mitigation measures in place, but monitoring is weak);</p> <ul style="list-style-type: none"> [4] Albacore catch: 49,900 t (2014) (22% decrease since 2013) <p>Management: There are no conservation and management measures adopted by IOTC for albacore.</p> <ul style="list-style-type: none"> [5] Southern Blue-fin catch: 11,900 t (2014) (1% increase since 2013) <p>Management: Annual TAC (to rebuild stock to 20% of unfished level by 2035) est. 2011; 2015-2017 TAC is 14,647t</p> <p><u>Catch by nation</u></p> <ul style="list-style-type: none"> • There are some 50 countries which currently record some landings of tuna and tuna-like species from the IO • Largest annual catch (2014): Indonesia, Iran, the EU (Spain, France and others), India, Sri Lanka and the Maldives. All of these countries have shown an increased level of annual catch since the early 1980s. <p>BAY OF BENGAL</p> <p>India, Sri Lanka and Maldives are in the Top 6 tuna fishing nations in the IO at present. Landings increased rapidly after 1980. The relative catch composition differs – India catches more ‘other tuna’, Sri Lanka both principal and other tuna, and Maldives almost exclusively focuses on principal tunas. Yellowfin and Skipjack dominate in the region.</p>

<p>Fishing fleets and fishing activity</p>	<p>INDIAN OCEAN <u>Fleets</u></p> <ul style="list-style-type: none"> • Large-scale industrial fishing and flagged-vessels operating: <u>Western and Central Indian Ocean</u> [A] Gillnet (Skipjack and yellowfin): India, Indonesia, Iran (Islamic Republic of), Maldives and Sri Lanka, [B] Longline (Bigeye and yellowfin): China, Belize, Honduras, India, Indonesia, Japan, Panama, Republic of Korea, Réunion, Seychelles, Taiwan Province of China and Thailand [C] Pole and line (Skipjack and yellowfin): Maldives and Sri Lanka [D] Purse seine (Skipjack and yellowfin): Belize, France, Japan, Netherlands Antilles (dissolved), Seychelles and Spain <u>Eastern Indian Ocean:</u> [E] Longline (Albacore, bigeye, southern bluefin, swordfish and yellowfin): Belize, China, Honduras, Indonesia, Japan, Panama, Republic of Korea and Taiwan Province of China [F] Purse seine (Skipjack and yellowfin): Indonesia, Japan and Liberia <p><u>Catch by gear types</u></p> <ul style="list-style-type: none"> • Total catch by gear (2010-14): Purse-seine vessels (36%), longline (19%), gillnets (18%) and pole-and-line (11%) • [1] Yellowfin catch: Purse-seine (35%), longline (20%), gillnet (15%), Misc. (24%), Pole-and-line (5%) Gillnet and Misc. Gears increasingly important (purse-seine and longline decreasing, pole-and-line stable); • [2] Bigeye catch: Longline (55%) (decreasing catch overall, pirate areas avoided recently), purse-seine (28%)(stable); • [3] Skipjack catch: Purse-seine (41%), gillnets (25%), pole-and-line (20%) (all catches decreasing since 2000); • [4] Albacore catch: Drifting longlines (almost 100%); • [5] Southern Blue-fin: Longlines (60%) and purse-seine (40%) (currently at 15% of peak in 1961); <p><u>Small-scale fishing</u> High diversity of coastal tuna fisheries involving neritic tunas (Longtail, Frigate, Bullet, Kawakawa, Spanish Mackerels), wide range of gears involved, both target and by-catch species. Most significant for Indonesia and India.</p> <p>BAY OF BENGAL None of the three Bay of Bengal countries considered – India, Sri Lanka or Maldives – use large-scale purse-seine fishing methods – the dominant method in the IO for principal tunas. However, they all use the other methods – especially gillnets and longlines – for both principal and neritic tuna and tuna like species. Maldives has a specific pole and line fishery for Skipjack and Yellowfin. The fishing methods used for the neritic tunas are very diverse. India in particular has a significant involvement in coastal fishing for neritic tuna (2nd place after Indonesia for the whole IO).</p>
<p>Post-harvest, trade and markets</p>	<p>INDIAN OCEAN <u>Tuna products and marketing channels</u></p> <ul style="list-style-type: none"> • Tuna forms the basis of many different forms of products, which enter a large variety of marketing chains; • Tuna and tuna products are traded internationally, and converted from one product type to another; • Broadly divided into fresh/frozen products, and canned products, along with traditional products such as ‘Maldivian’ fish; <p><u>International markets and values</u></p> <ul style="list-style-type: none"> • ‘Fresh and Frozen Tuna’, major markets, since 2000: Japan (USD 2 billion import value), Thailand (USD 1.4 billion) and the EU (USD 777 million); • ‘Canned Tuna’, major markets - European Union (USD 3 billion), USA (USD 1 billion) and Japan (USD 304 million); • Major exporters ‘Fresh and Frozen Tuna’, Taiwan PC (USD1.2 billion), European Union (USD 740 million) and Korea (USD 365 million); • Major exporters for ‘Canned Tuna’- Thailand (USD 2 billion), European Union (USD 1 billion, Ecuador (USD 564m) <p><u>Indian Ocean Perspective</u> For ‘Fresh and Frozen Tuna’, main IO markets: Mauritius (USD 205 million max), Seychelles (USD 93 million), Iran (USD 59 million) and Indonesia (USD 36 million) All of these countries have developed tuna processing and canning facilities; ‘Canned Tuna’, small market, no IO nations in the top 25 importers; Major exporters ‘Fresh and Frozen Tuna’ : Indonesia (USD 220 million), Maldives (USD 101 million) and Sri Lanka (USD 53 million) in the Top 25 of exporters; For exports of ‘Canned Tuna’ in the Top 25 list - Indonesia (USD 279 million), Mauritius (USD 264 million), Seychelles (USD 230 million), Madagascar (USD 44 million) and Kenya (USD 17 million); Overall, the Seychelles, Mauritius and Indonesia are major processing and export centres in the Indian Ocean.</p> <p><u>Market outlook</u> Overall, demand for canned tuna in the USA and the EU is in decline, giving rise to lower imports, despite an overall decline in raw material prices. EU canneries have increased demand for cooked loins as prices have declined. In contrast, imports grew in the Middle East, East Asia and in non-traditional markets in Latin America as prices softened.</p> <p><u>Trade Conditions</u> Some negotiated decisions still in process regarding tariff and other barriers for a number of countries (e.g.) Economic Partnership Agreements (EPAs) with Europe are important for IO states (Seychelles, Mauritius, African states).</p> <p>BAY OF BENGAL For the principal market tunas, none of countries (India, Sri Lanka, Maldives) are significant importers of raw material (fresh and frozen tuna). For exports of raw material – only Maldives and Sri Lanka – appear in the top 25 of leading nations, with small export volumes. None of the Bay of Bengal countries has a significant tuna canning sector. Trade in neritic tunas and in other tuna-like species is less valuable internationally compared to principal market tunas. However, further analysis will be needed to understand its role in the Bay of Bengal where both fishing and trade for these types of fish do take place.</p>

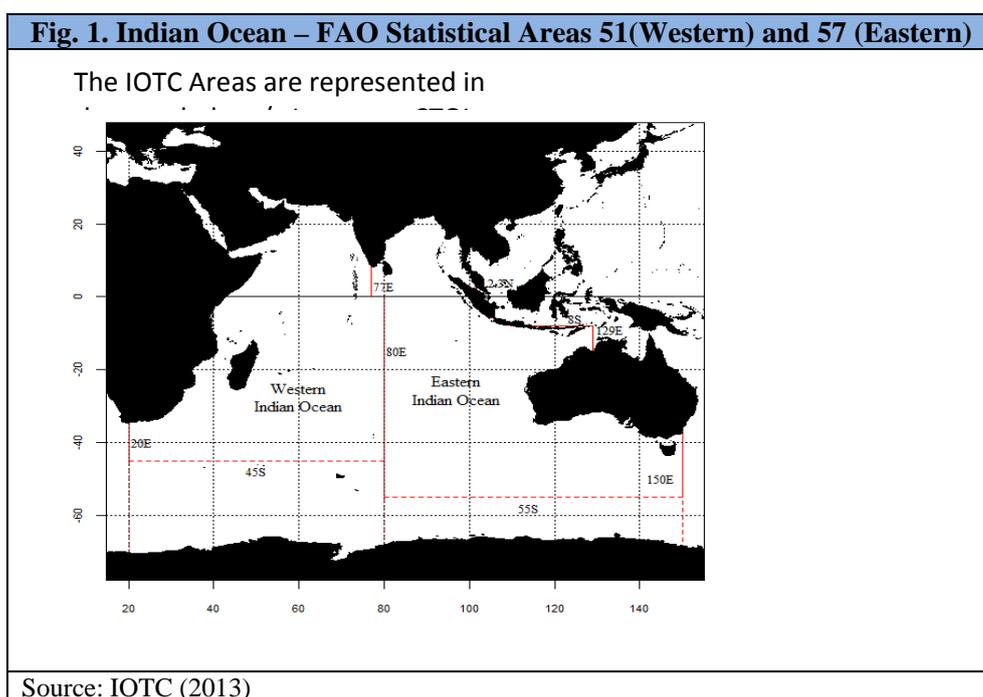
<p>Economic Valuation</p>	<p>Literature scan – limited economic analysis: A preliminary review of the international literature shows limited information on the economic characteristics of the tuna fisheries of the Indian Ocean.</p> <p>Existing coverage: [1] the economic impact of tuna fisheries (employment, revenues from domestic licensing and revenues from fishing agreements with DWFN), [2] the activity/ value of the tuna trade (import and export quantities and values), and [3] the value of fisheries production (measured as the financial turnover of the sector, using landings and price data).</p> <p>Economic valuation – preliminary results – Indian Ocean tuna fisheries The estimated <i>potential</i> sustainable economic value of both the principal and neritic tuna stocks in the Indian Ocean is USD 2.06 billion (therefore, the capitalised asset value of the fish stocks @ 8% [reasonable return, long term] is USD 26 billion).</p> <p>By comparison: India GDP (USD 2, 067 billion), Tamil Nadu (USD 167 billion), Kerala (USD 77 billion), Sri Lanka (67 billion), Maldives (2.3 billion).</p> <p>The actual (current) economic value of the tuna stocks in the IO is not known (in terms of the current levels of resource rent being generated). However, it seems unlikely any of the fisheries involved is generating economic rents at a level close to the potential value (above) under current management arrangements.</p> <p>Improved economic performance in the future could come from three routes: (1) critically from improved management at the harvesting level, (2) from increased catch up to MSY and (3) from improved performance throughout the value chain (but 2 and 3 depend on 1 of course). It should be noted that these results are at the resource level, but the results at country level will depend on how the resources or the economic benefits from their exploitation are shared.</p> <p>Bay of Bengal Perspective At the present time, there are no estimations of the economic value of the tuna stocks on a national basis using the type of approach shown above (to estimate asset value and economic rent). This information would be useful to fisheries policy-makers in the future.</p>
<p>Global Trends, changes and issues</p>	<p>Based on information provided by the FAO (The State of World Fisheries and Aquaculture, SOFIA, 2014).</p> <p>Global landings: Stabilised reaching 86.6 million tonnes in 2012 (excluding anchoveta) – a new maximum production. Total production was 93.7 million tonnes.</p> <p>Marine fisheries: Production was 79.7 million tonnes in 2012. 18 countries (11 in Asia) caught more than an average of one million tonnes per year (76 percent of the total).</p> <p>Tuna fisheries: Landings set a new record of 7 million tonnes in 2012. Seven species (the principal market tunas including Yellowfin) account for 90 percent. Catches of smaller tunas (for example, bullet tunas), seerfishes (<i>Scomberomorus</i> spp.) and albacore have also grown significantly.</p> <p>Exploited Stock Status: Marine fish stocks within biologically sustainable levels (71.2 percent compared to 90 per cent, 1974). Overfished stocks (28.8 percent). Fully fished stocks (61.3 percent) and underfished stocks (9.9 percent).</p> <p>Stock recovery potential: Ten fish species (24 percent of world marine capture fisheries production). Most stocks are fully fished (some overfished). Rebuilding would up production by 16.5 million tonnes and annual rent by US\$32 billion.</p> <p>Fish Trade: Fish is a highly traded food commodity. For some developing countries, fish accounts for > 50% of the total value of traded commodities. In 2012, fish accounted for 10 percent of total agricultural exports and 1 percent of world merchandise trade in value terms. Fish exports (as a share of fish landings) increased from 25 percent (1976) to 37 percent (58 million tonnes, live-weight equivalent) (2012). Fishery exports peaked at US\$129.8 billion in 2011 (up 17 percent from 2010), but declined slightly to US\$129.2 billion in 2012, due to depressed international prices for some fish and fishery products (e.g. tuna). Uncertainties over demand in Europe, Japan and N. America have encouraged exporters to explore new markets in emerging economies (e.g. Middle East Gulf States). Fishery trade appears to show an upward trend from 2013.</p> <p>Fish prices and market access: The aggregate FAO Fish Price Index increased markedly from early 2002, reaching a record high in October 2013. EU is the largest market for imported fish and fish products, with a growing dependence on imports. The USA, Japan and China are also large important markets. China is, by far, the largest exporter of fish and fishery products. Developing economies are increasingly important in world fish trade, with 54 percent of total fishery exports by value in 2012, and 60 percent by quantity (live weight). Developed countries import the largest share of fish and fishery products, but other emerging markets also growing. Exports from developing countries have increased significantly, associated with lower tariffs, following the expansion of WTO membership, new bilateral and multilateral trade agreements, and increased demand from emerging economies.</p>

4. KEY FINDINGS

4.1. Environment and Major Fish Stocks – Indian Ocean Overview

4.1.1. Environment

The Indian Ocean covers a total of over 27 million square miles between latitudes 20°N and 45°S (Western IO) and 55°S (Eastern IO), and longitude 20°E and 150°E. It has an average depth of 12,762 feet, and reaches 26,401 feet at its deepest point. The continental shelf areas are relatively small, extending to 120 miles on average. There are diverse environments contained within the Indian Ocean, ranging from tropical coral reefs to temperate sea areas, and the southern boundary links with the cold Antarctic Ocean. Overall, the marine and fisheries productivity of the Indian Ocean is relatively low compared to the Pacific and Atlantic Oceans.



The Indian Ocean is divided into two FAO Statistical Areas. The Western Indian Ocean (FAO Statistical Area 51) and the Eastern Indian Ocean (FAO Statistical Area 57).

Area 51 contains diverse environments from the Arabian Peninsula and south along the eastern coast of Africa. The Arabian Sea which is affected by seasonal monsoons and upwellings contains the most productive fisheries, accounting for over 60% of total fish catch.

By contrast, Area 57 has relatively lower marine and fisheries production, with the notable exception of the Bay of Bengal which is relatively shallow, enclosed, with significant riverine inflow, such as the Ganges, and it is also affected by seasonal monsoon and upwellings, along with powerful tropical cyclones and storm surges.

4.1.2. Tuna stocks

There are some 15 tuna and tuna-like species in the Indian Ocean, including billfishes, swordfish and marlin (Appendix 2). These include the highly migratory species, such as skipjack and yellowfin, and the neritic or coastal species, such as longtail and bullet tuna.

The Indian Ocean contains five principal market tuna species including 1] Yellowfin, [2] Bigeye, [3] Skipjack [4] Albacore and [5] Southern Bluefin .

The first four tuna species are thought to constitute single discernible fish stocks, and are monitored and managed by the Indian Ocean Tuna Commission (IOTC). The fifth species – the Southern Bluefin – occurs mainly in the southerly part of the Indian Ocean and Antarctic Ocean border, and is managed under the southerly IO Convention Area.

The neritic tunas and other highly migratory tuna-like species (Appendix 3) are also monitored and managed under the IOTC.

The distribution of the different stocks follows particular patterns, based on catch data and also from the results of catch and release programmes from the IOTC. The principal market tunas are located mainly in the Western Indian Ocean, although they also occur to a lesser extent in the Eastern Indian Ocean. They are highly migratory and range over large distances, which include both EEZ and the high seas or ABNJ. The larger tuna-like species (billfishes, marlin, swordfish) also follow similar patterns, but are less abundant. The neritic tunas are concentrated in coastal waters, and are less migratory.

Yellowfin tend to be found mostly in the Western Indian Ocean, off Somalia (Area R2). Bigeye is also found mainly in the Western Indian Ocean (Area A1), but they are also distributed across the Eastern Indian Ocean (Area A2). Skipjack are mostly concentrated in the Western Indian Ocean (R2) but also in the Eastern Indian Ocean (near Maldives). Albacore (a temperate tuna) is thought to be found south of the 10°S latitude, although there is limited data. Southern Bluefin is distributed in the southern part of the Indian Ocean, between 30 and 50°South.

4.1.3. Stock Productivity and Stock Assessment

The IOTC has estimated the current level of potential stock productivity (in terms of maximum sustainable yield) for each of the major market tunas, as well as the current stock assessment in relation to this as a result of current levels of fishing exploitation (IOTC, 2015).

In terms of MSY, the current estimates for the principal market tuna include: Yellowfin (421,000 t), Bigeye (231,000 t), Skipjack (684,000 t), Albacore (33,300 t) and Southern Bluefin (33,000 t, one of the lowest estimates).

For stock assessment (Appendix 4), the Yellowfin is the only tropical tuna which is considered overfished and where overfishing is taking place. Neither Bigeye or Skipjack are considered overfished or subject to overfishing. For the temperate tunas, Albacore is not considered to be overfished or subject to overfishing, although the current assessment has been upgraded compared to 2013, when there appeared to be cause for concern. The Southern Bluefin is heavily overfished, although measures have been put in place to reduce overfishing.

4.1.4. Bay of Bengal Perspective

Largely on the periphery of the major distribution areas for the principal market tunas, both tropical and temperate.

Maldives has seasonal abundance of all three principal market tunas, especially skipjack, less abundant for India and Sri Lanka.

The neritic tunas (various) are distributed widely in coastal waters of all three countries. Some stock of tuna-like species also, although information is limited.

4.2. Production and Landings

4.2.1. Overview

The Indian Ocean accounts for 20% of the World's tuna catch, after the Western and Central Pacific Ocean. The overall catch statistics are presented by year in Appendix 5 below.

The total catch of the four main principal commercial species was 1,003,400 t (2014) (2% increase from 2013) (Fig.2.). There is also a small catch of Southern Blue fin. The total catch of all tuna and tuna-like species currently exceeds 1.7 million tonnes (Fig.3.).

The total catch has declined since a peak in 2005 (1.2 million tonnes). The total annual average catch weight (2010-14) was 915,000 t.

4.2.2. Catch Composition by Species

Total catch composition by weight for the IO (2010-14) was Skipjack (44%), Yellowfin (41%), Bigeye (11%), and Albacore (4%) (Fig.2).

[1] The Yellowfin catch was 429,800 (2014) (6% increase since 2013) (but 19% decline since 2004 level, 530,000 t). [2] The Bigeye catch was 100,200 t (2014) (12% decrease since 2013); and [3] the Skipjack catch: 432,500 t (2014) (similar level to 2013). In all these three cases, the IOTC has not established conservation measures or quota allocation (despite advice from Scientific Committee, Resolution 14/02); (Resolution 15/06 discard ban by purse-seine vessels) (some other mitigation measures in place, but monitoring is weak).

[4] The Albacore catch was 49,900 t (2014) (22% decrease since 2013) There are no conservation and management measures adopted by IOTC for albacore. And finally, [5] for Southern Blue-fin, the catch was 11,900 t (2014) (1% increase since 2013). An annual TAC (to rebuild stock to 20% of unfished level by 2035) was established in 2011. The 2015-2017 TAC is 14,647 t.

4.2.3. Catch by Country

There are about 50 countries which currently record some landings of tuna and tuna-like species from the IO. A summary of the IOTC data-set is provided in Appendix 6 below.

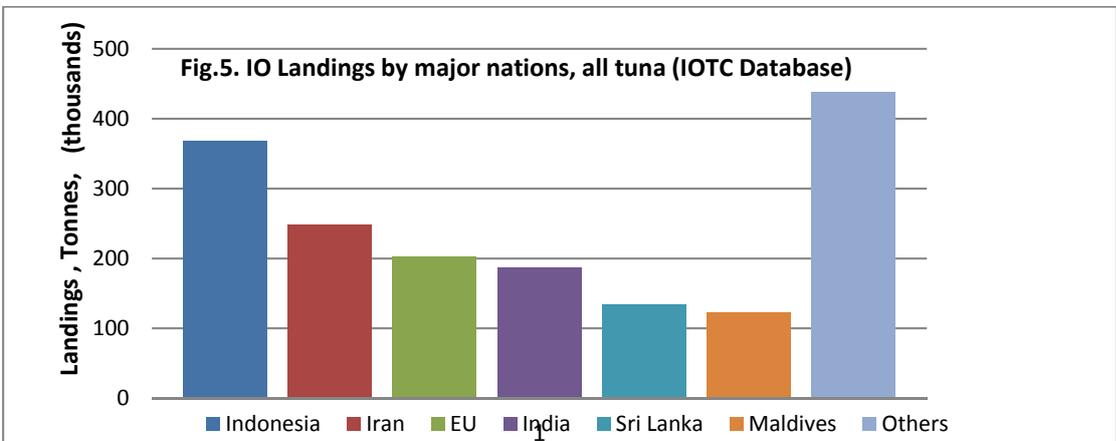
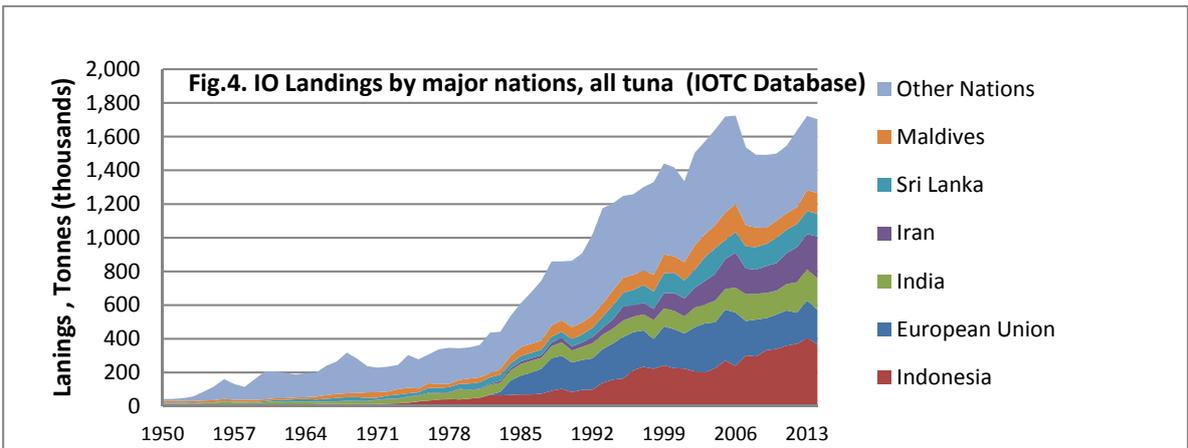
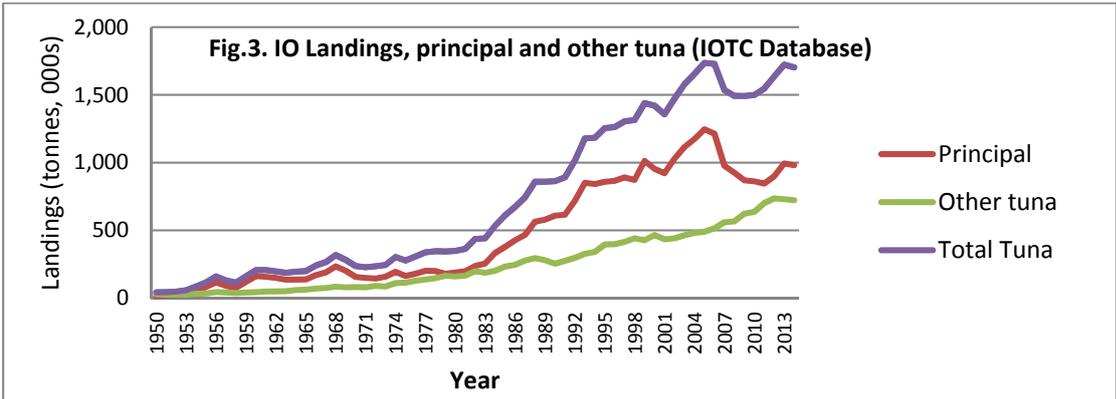
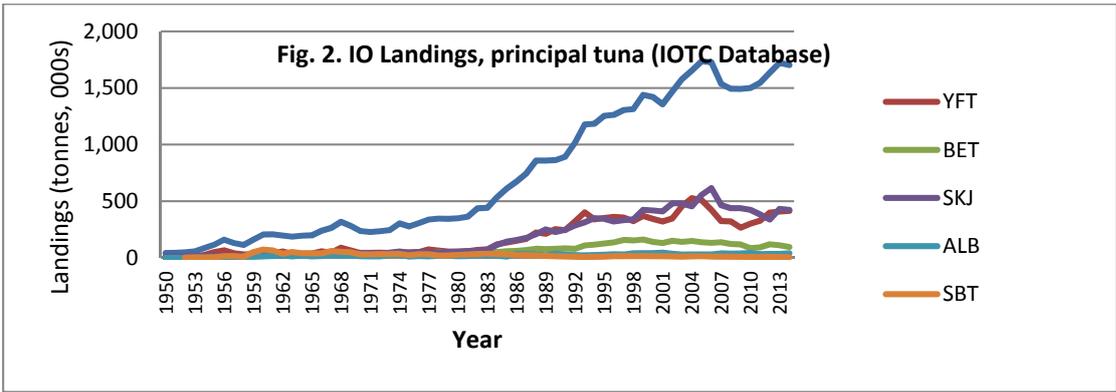
The countries with the largest annual catch at present include Indonesia, Iran, the EU (Spain, France and others), India, Sri Lanka and the Maldives (Fig. 5). All of these countries have shown an increased level of annual catch since the early 1980s (Fig.4).

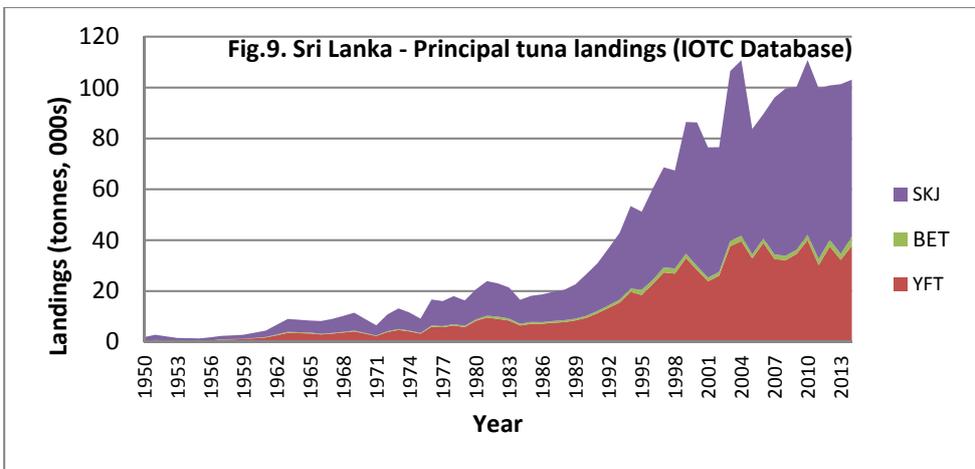
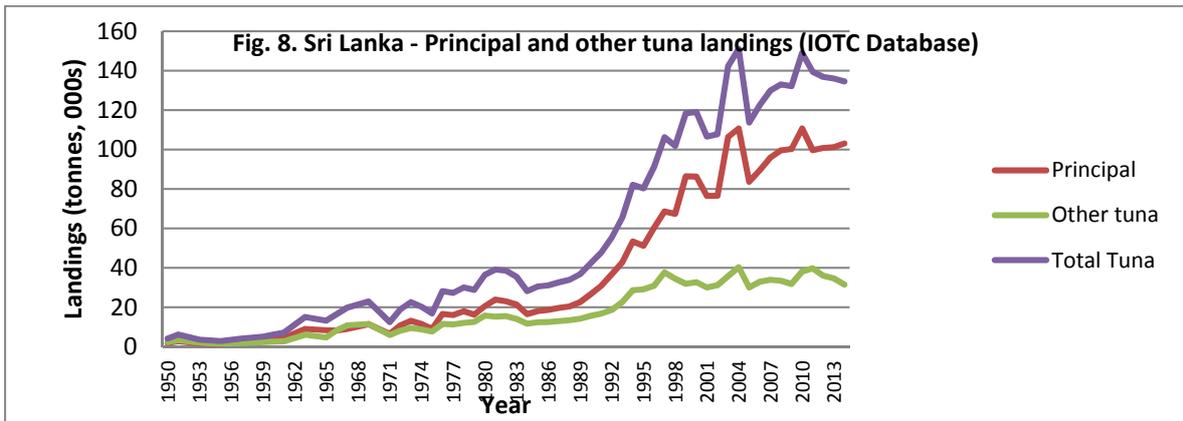
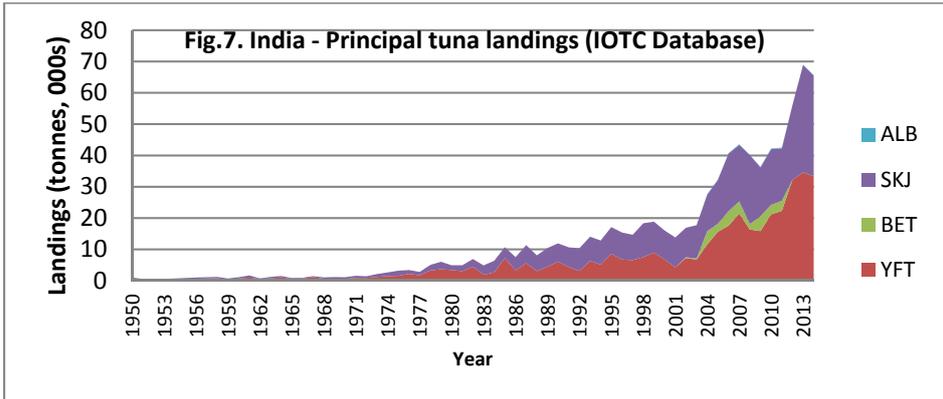
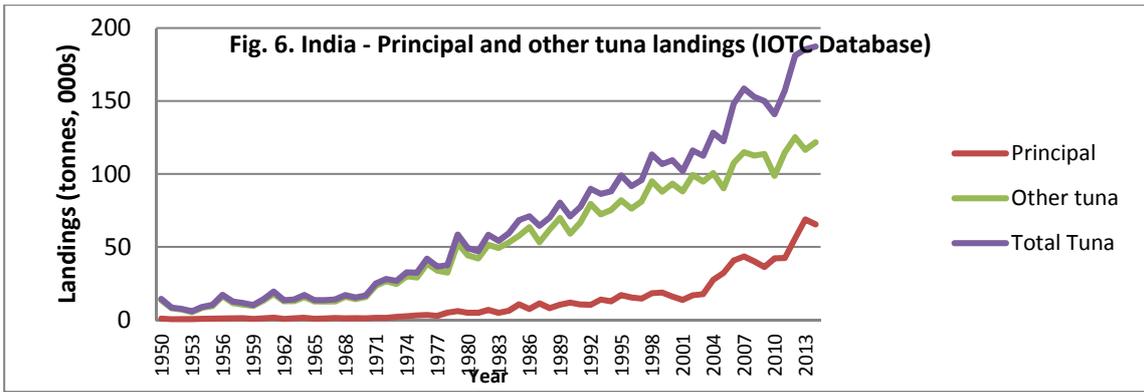
4.2.4. Bay of Bengal Perspective

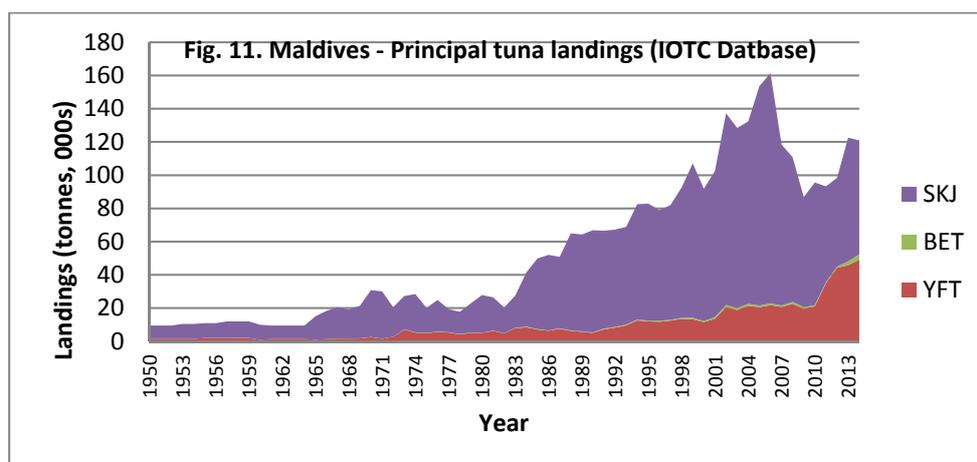
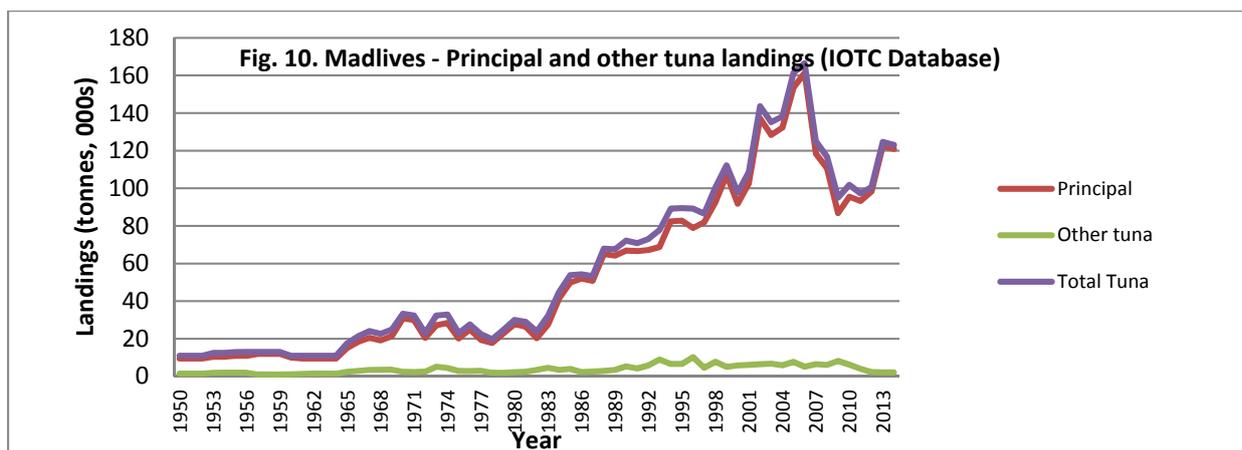
India, Sri Lanka and the Maldives are currently among the top 6 countries for total tuna catches in the IO.

Landings data since 1960 (IOTC) is presented in Appendix 6, and in Figures 6-11.

All three countries have shown a rapid increase in landings since the early 1980s. However, there are







noticeable differences in the overall catch composition.

India's total tuna catch is dominated by 'other tuna' which includes both neritic tuna and tuna-like species (mainly coastal fish types). India's catch of the valuable principal market tunas is proportionately lower compared to neighbouring countries, and catches mainly Yellowfin and Skipjack, with some Bigeye.

In contrast, Sri Lanka's total tuna catch is dominated by the principal tunas with a lower proportion of other tunas (and tuna-like) species). Skipjack is the largest component followed by Yellowfin and a small amount of Bigeye.

Finally, in the case of the Maldives, the total tuna catch is dominated by principal market tunas, with only a very small proportion of other tunas. Once again, Skipjack and Yellowfin are the major species landed.

4.3. Fishing Fleets and Fishing Activity

4.3.1. Fleets by flag and gear types (Larges-scale fishing)

With a large number of countries participating in the IO tuna fisheries, covering a range of environments and tuna stocks of differing distribution, migratory patterns and economic value, there are unsurprisingly a large range of fishing fleets, strategies, methods and gears in operation.

The numbers of industrial vessels (>15m LOA) increased rapidly in the mid-1980s, especially in the 15-24 m category (Fig. 12). The fleet of EU purse-seine vessels arrived also at this time, to increase the overall fishing capacity in the IO.

The information presented in this section is based on the fleet databases of the IOTC. A number of key points should be noted. First, the fleet information is the best available data for the IO, but there is acknowledged weaknesses, with some countries not reporting regularly for example. Second, there is some confusion created by the definition of industrial and artisanal vessels – which stems from the fact that vessels of the same characteristics (vessels below 24 m) may fit in one category or the other depending on whether they fish outside (industrial) or inside (artisanal) their EEZ. Thirdly, the best available estimate of fishing capacity is fleet size (across size categories) (a measure of input), but the estimate of an output based fishing capacity remains a major challenge, especially when attempting to compare and include both large-scale and small-scale fishing operations. A recent IOTC report (Moreno and Herrera, 2013) provides an overview of these issues.

The best estimate of large-scale fishing vessels (Table 3) in the IO and fishing for tuna and tuna-like species is 6,532. The two largest categories, by number, are longline vessels (2,041) and gillnet/longliners (2,482), with over 2,700 vessels below 24m in length.

Further details of the structure of the industrial fleet are provided in Table 4. Although the purse seine vessels are few in number (67), they catch a significant amount of the total catch (292 KT or 36%).

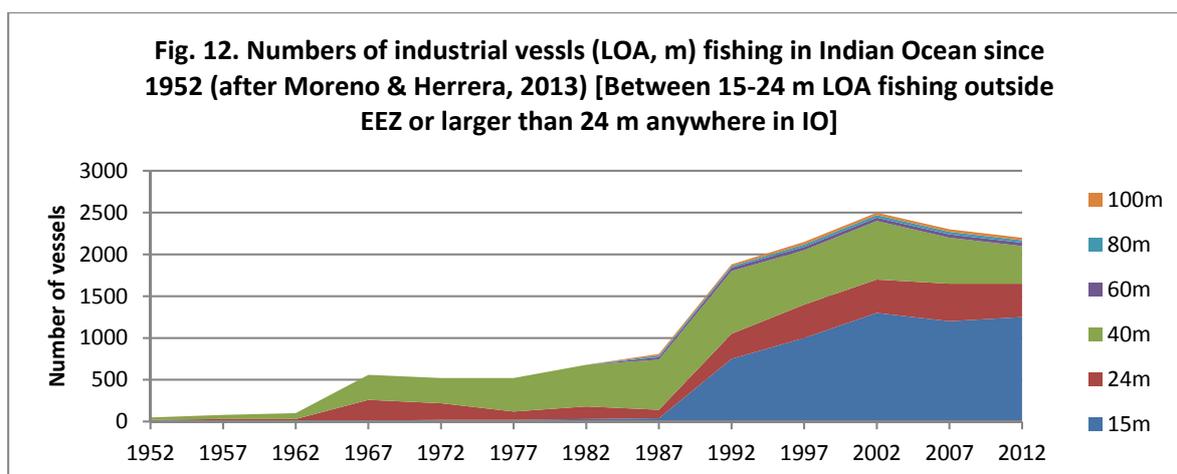


Table 3. Estimates of numbers of vessels by gear, length category, and year for all vessels fishing outside the EEZ of their flag country in the Indian Ocean or inside their EEZ but larger than 24 m LOA from 2006—2012 (Adapted from Moreno & Herrera, 2013).

	2006	2007	2008	2009	2010	2011	2012	2008		2012	
								<24m	>24m	<24m	>24m
Purse seine	83	82	76	81	71	57	68	0	76	3	65
Longline	2272	2279	2062	2028	1928	1948	2041	1158	904	1293	748
Pole and line	925	894	867	920	708	608	698	0	0	424	274
Oceanic Gillnet	1007	1099	1195	1296	1270	1261	1243	808	387	812	413
Gillnet/Longline	2394	2460	2809	2934	3346	3319	2482	2809	0	2481	1
Total	6681	6814	7009	7259	7323	7193	6532	4775	1367	5013	1519

Category	Nations (Fleets)	No.vessels	Total Catch (Tonnes)	Catch per vessel (Tonnes)
Purse Seine	EU	36	225,699	6,269
	Indonesia	19	53,298	2,805
	Iran	4	5,120	1,280
	Japan, Korea	4	5,062	1,266
	Rus sia, Thailand	4	3,629	907
	Sub-Total	67	292,808	2,505 (Mean)
Longline	EU (Swordfish)	55	9,174	167
	African (Swordfish semi-industrial)	58	2,879	50
	Taiwan, China (deep-freeze)	285	90,461	317
	Japan, Korea, Thailand (deep-freeze)	107	19,273	180
	Taiwan, China (Fresh tuna)	391	37,315	95
	Indonesia (Fresh tuna)	1,179	33,560	28
	Sub-Total	2,075	192,662	140 (Mean)
Gillnet	Iran, Pakistan	1,253	35,897	29
	Iran (Arabian Sea)	4,355	153,543	35
	Oman	698	4,252	6
	Sub-Total	6,306	193,692	23 (Mean)
Pole and Line	Maldives	698	63,522	91
	Sri Lanka	2,482	64,268	26
	Sub-Total	3,180	127,790	59 (Mean)
Total		11,628	806,952	682 (Mean)

Table 5. Estimates of numbers of artisanal vessels as per IOTC definition and their catches

Country	No. boats	Catch(tonnes)	Main gears
Indonesia	116,861	322,145	PS, GN, LN
Iran	5,209	155,065	GN
India	199,244	150,149	GN, LN
Pakistan	3,126	58,060	GN
Yemen	16,890	39,313	LN
Sri Lanka	42,792	36,101	GN, LN, LL
Maldives	64	32,065	LN
Malaysia	8,178	26,509	PS
Oman	19,943	17,121	GN, LN
Thailand	925	15,064	PS
Sub-Total (Top 10)	413,232 (71%)	851,592 (93%)	
Others	170,836		
Total	584,068	915,112	

Source: Adapted from Moreno & Herrera (2013)

Note: Data collected between 2003-2012 (using a wide range of sources) (some boat data may not be specific to tuna fisheries, and may represent the national fleet engaged in small-scale fishing)

Key: PS (Purse seine), GN (Gillnet), LN (Line), LL (Longline)

4.3.2. Fishing effort and catch distribution by Areas 51 and 57

In terms of the large-scale industrial fishing and flagged-vessels operating in the Western and Central Indian Ocean (Area 51), for the principal market tuna, there are four main gear strategies.

First, gillnets are used to catch surface Skipjack and Yellowfin by India, Indonesia, Iran (Islamic Republic of), Maldives and Sri Lanka.

Second, longlines are used to catch deeper Bigeye and Yellowfin by China, Belize, Honduras, India, Indonesia, Japan, Panama, Republic of Korea, Réunion, Seychelles, Taiwan Province of China and Thailand.

Third, pole and line for used for surface Skipjack and Yellowfin by the Maldives and Sri Lanka.

Finally, purse seines are used to catch surface Skipjack and Yellowfin) by vessels flagged by Belize, France, Japan, Netherlands Antilles (dissolved), Seychelles and Spain. Over 70% of the tuna caught using modern large-scale purse seines in the IO are associated with Fish Aggregating Devices (FADs). The number of artificial FADs set each year is thought to be increasing, but there is great uncertainty as to the precise numbers in use, with associated concerns for catching of undersized fish.

By contrast, in the Eastern Indian Ocean (Area 57), there are fewer gear strategies for the principal market tunas.

First, longlines are used to catch Albacore, Bigeye, Southern Bluefin, Swordfish and Yellowfin) by Belize, China, Honduras, Indonesia, Japan, Panama, Republic of Korea and Taiwan Province of China.

Second, purse seines are used for Skipjack and Yellowfin mainly by fishing vessels flagged to Indonesia, Japan and Liberia.

Given the large variety of fishing methods, technology and strategies, and the uncertainty concerning the data, the description and analysis of fishing effort in the IO has been limited.

The IOTC website (www.iotc.org) provides some useful information in its reports and databases concerning the patterns of use of specific gears over time. For example, a range of mapping exercises have been undertaken to show the use of gears such as longlines (number of hooks) and purse-seines (searching time) by quadrants across the IO.

4.3.3. Catch by gear types

A summary of the gears used in the fisheries for principal market tuna in the IO (2010-14) is presented in Figure 13.

The overall situation - Total catch by gear (2010-14) – shows that the purse-seine accounted for the largest portion (36%), followed by longlines (19%), gillnets (18%) and pole-and-line (11%).

For the Yellowfin catch, again the purse-seine (35%) was most important, followed by longlines (20%), gillnet (15%), miscellaneous others (24%), and pole-and-line (5%). Gillnet and various miscellaneous gears have become increasingly important, whereas purse-seine and longlines are decreasing, pole-and-line usage is stable.

For the Bigeye catch, longlines (55%) are important (all there has been a decrease in catch overall, vessels have avoided pirate areas, of Somalia recently), and purse-seines (28%) have been stable.

The Skipjack catch relies on purse-seines (41%), gillnets (25%), and pole-and-line (20%). All catches have been decreasing since 2000.

The Albacore catch come entirely from drifting longlines (100%).

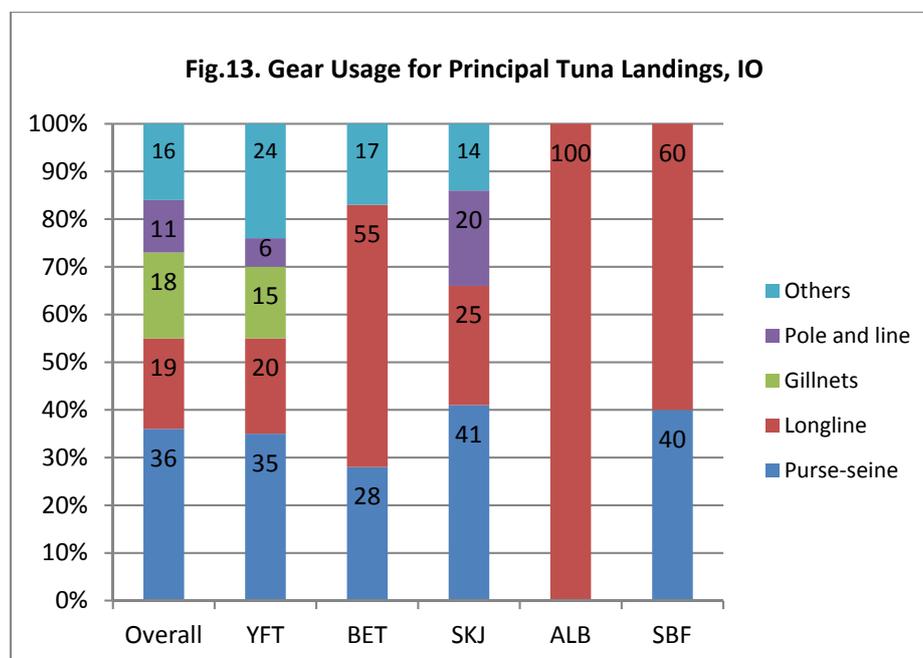
For the Southern Blue-fin, longlines (60%) and purse-seine (40%) are important, but the overall catch is currently at 15% of the peak reached in 1961.

4.3.4. Small-scale fishing

Exploitation of tuna and tuna like species, which fall under the IOTC mandate, using small-scale fishing operations (as opposed to large-scale industrial fishing), includes both the principal and the neritic tunas. While small-scale fishing operations, operating mainly in coastal waters exploit some of the principal tunas (mainly skipjack and yellowfin) during seasonal inshore migrations, there are also opportunities provided by the neritic (coastal) tunas and tuna-like species. These include the

Table 6. Major fishing Gears – Principal Market Tuna			
Area	Gear Type	Target	Flagged vessels
Western (Area 51)	Gillnets	Skipjack, Yellowfin	India, Indonesia, Iran, Maldives, Sri Lanka
	Longlines	Bigeye, Yellowfin	China, Belize, Honduras, India, Indonesia, Japan, Panama, Korea, Reunion, Seychelles, Taiwan, Thailand
	Pole and line	Skipjack and Yellowfin	Maldives, Sri Lanka
	Purse-seine	Skipjack, Yellowfin	Belize, France, Japan, Netherlands Antilles, Seychelles, Spain
Eastern (Area 57)	Longlines	Albacore, Bigeye, Southern Bluefin, Swordfish, Yellowfin	Belize, China, Honduras, Indonesia, Japan, Panama, Korea, Taiwan
	Purse-seine	Skipjack, Yellowfin	Indonesia, Japan, Liberia

Source: FAO (2011)



Longtail Tuna, Frigate Tuna, Bullet Tuna, Kawakawa, Narrow-barred Spanish Mackerel, and the Indo-Pacific King Mackerel. The available catch data and analysis for all of these species indicate that they form part of a wide variety of local fisheries throughout the India Ocean – Indonesia and

India appear to have the largest fisheries (Appendix 3B). In all cases, they are taken as both target catches and by-catch using many types of gear including nets, lines, hooks and handlines (Appendix 3B.)

4.3.5. Bay of Bengal Perspective

None of the three Bay of Bengal countries considered – India, Sri Lanka or Maldives – use large-scale purse-seine fishing methods – the dominant method in the IO for principal tunas. However, they all use the other methods – especially gillnets and longlines – for both principal and neritic tuna and tuna like species. Maldives has a specific pole and line fishery for Skipjack and Yellowfin. The fishing methods used for the neritic tunas are very diverse. India in particular has a significant involvement in coastal fishing for neritic tuna (2nd place after Indonesia for the whole IO).

4.4. Post-harvest, Trade and Markets

4.4.1. Range of product forms and marketing channels

Once captured and taken onboard a fishing vessel, tuna can then to be processed and stored, to enter a variety of different marketing chains. The tuna (whole) or tuna meat can also take many different forms, which are also recorded in the official market and trade statistics. The two major categories are fresh and frozen tuna, and canned tuna. The type of tuna product, the quality of the tuna and the market entry-point will all affect the price and overall value. It should also be recognised that tuna is a widely-traded international commodity, and the trade routes can often be complex, involving conversion to different product forms in different countries. Therefore, the issues of catch origin and traceability can also be complicated. In addition, there are a wide variety of specialised and often traditional products and markets in different parts of the world. For example, the highest quality (and most valuable) tuna products are centred on the trade in *sashimi* grade tuna in Japan. In other parts of the world, such as Maldives and Sri Lanka, ‘Maldivian fish’ is produced from dried/smoked skipjack, and enters local markets. It should also be recognised that international markets and consumer preference for tuna are subject to fluctuations and change, which are reflected in changing trade patterns, private sector activity and product development. One of the major factors involved is the nature of international trade regulations and fisheries management systems (see below).

4.4.2. Major International Markets and Trade Patterns – Review

For ‘Fresh and Frozen Tuna’, the major markets, since 2000, have been Japan (USD 1,855 – 2,308 million import value), Thailand (USD 454 – 1,417 million) and the EU (USD 380 – 777 million) (Spain, Italy, France, Portugal, Belgium) (Appendix 7 and Fig. 14.).

For ‘Canned Tuna’, the major markets, since 2000, have been the European Union (USD 1,410 – 3,092 million) (Italy, France, UK, Spain, Germany, Netherlands, Belgium, Portugal and Austria), the USA (USD 503 – 1,038 million) and Japan (USD 129 - 304 million) (Appendix 7 and Fig.15.).

In terms of the major exporting nations, for ‘Fresh and Frozen Tuna’, since 2000, the top three have been Taiwan PC (USD 711 – 1,232 million), the European Union (USD 508 – 740 million) (Spain, France, Croatia, Malta) and Korea (USD 219 – 365 million) (Appendix 7 and Fig. 16).

The major exporters for ‘Canned Tuna’, since 2000, have been Thailand (USD 707 – 2,274 million), the European Union (USD 558 - 1,124 million) (Spain, Italy, Netherlands, Germany, Portugal, France, Belgium, and the UK) and Ecuador (USD 197 – 564 million) (Appendix 7 and Fig. 18).

4.4.3. Tuna Markets and Trade – IO perspective

For 'Fresh and Frozen Tuna', the main IO markets are Mauritius (import value range, since 2000, of USD 32 – 205 million), Seychelles (USD 22 - 93 million), Iran (USD 7 – 59 million) and Indonesia (USD 0.8 – 36 million) (Fig.15). All of these countries have developed tuna processing and canning facilities.

In terms of 'Canned Tuna', the IO market has been relatively small, compared to the major international markets, and there are no IO nations which appear in the top 25 importers (Appendix 7).

The major exporters of 'Fresh and Frozen Tuna' include a number of IO nations. Since 2000, the value of exports for Indonesia (USD 120 – 220 million), Maldives (USD 28 – 101 million) and Sri Lanka (USD 10 – 53 million) has appeared in the Top 25 of exporters (Appendix 7 and Fig. 18).

For exports of 'Canned Tuna' a number of IO nations also appear in the Top 25 list including Indonesia (USD 86 – 279 million), Mauritius (USD 68 – 264 million), Seychelles (USD 162 – 230 million), Madagascar (USD 21- 44 million) and Kenya (USD 3-17 million) (Fig. 19 and Fig. 20).

Overall, then, the Seychelles, Mauritius and Indonesia are major processing and export centres in the Indian Ocean.

Poseidon *et al.* (2014) highlight the key features of IO tuna fishing and trade as follows. In the case of Seychelles, 80% of the frozen purse seine catch taken in the Western IO is landed in Victoria (30% landed for processing in Seychelles, 70% transhipped for processing elsewhere). Other vessels land in Mauritius, Madagascar and Kenya for canning and production of tuna loins.

It is estimated that 90% of the purse seine catch, predominantly in the WIO, undertaken by EU vessels, is destined for EU markets.

According to Poseidon *et al* (2014) In the case of Mauritius, a new processing plan is being developed for a new generation of purse seiners (-40°C dry deep frozen) for fillets, steaks and saku (frozen sashimi grade) blocks. Port Louis handles 50% of the longline catch in the WIO, and most of the exports for Asian markets. Frozen catches of YFT and BET are destined for the Asian sashimi market. The smaller catches of high quality Albacore is used for canning or for the sashimi markets in Asia (ultra-frozen).

Swordfish and shark longliners (Spain, Portugal and UK) land in Durban RSA, also Diego Garcia (targeting markets in Europe, Asia and South America).

In Maldives, pole and line catches are consumed domestically in fresh form, but some quantity is exported to Thai canneries, or canned in Maldivian canneries, or processed as 'Maldivian Fish' (a smoked and sun-dried product) for local consumption or export (high demand in Sri Lanka).

Small volumes of South African catches of albacore are frozen for export to canneries, mainly in the EU.

In Oman, India, Yemen, Pakistan and Iran, gillnet tuna catches are landed mainly in fresh/chilled form.

Fig. 14. Imports, Fresh and Frozen Tuna (Top 10 countries (FAO Globefish, 2014))

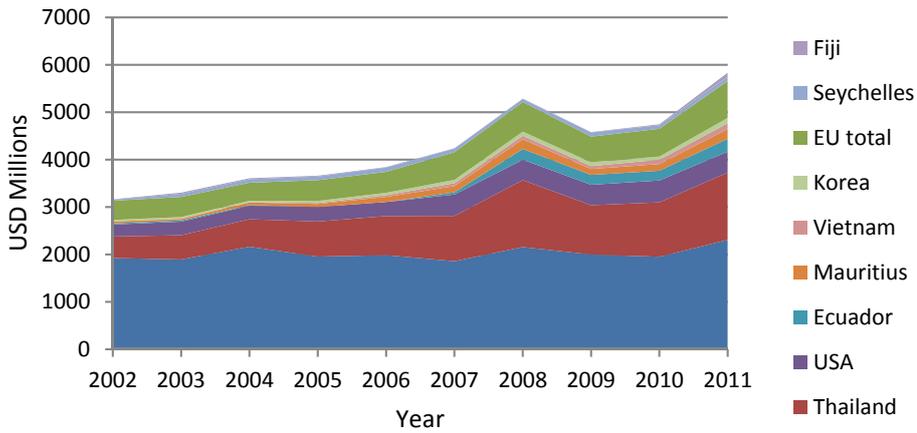


Fig. 15. Imports, Fresh and FROZEN Tuna (Major IO countries)(FAO Globefish 2014)

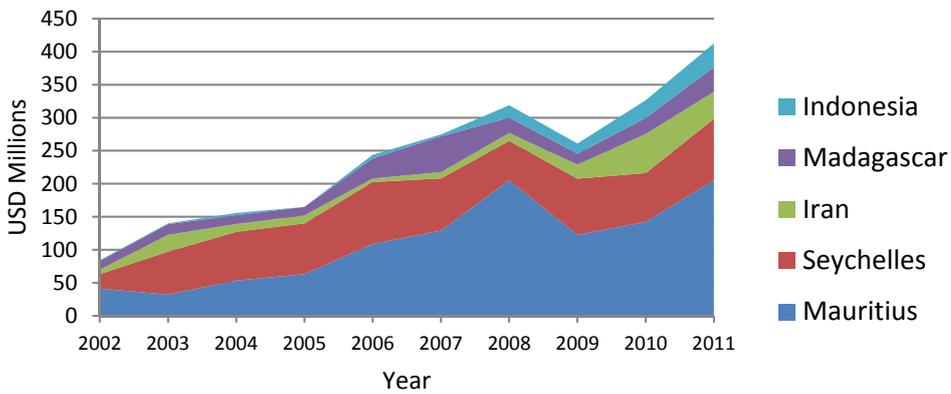
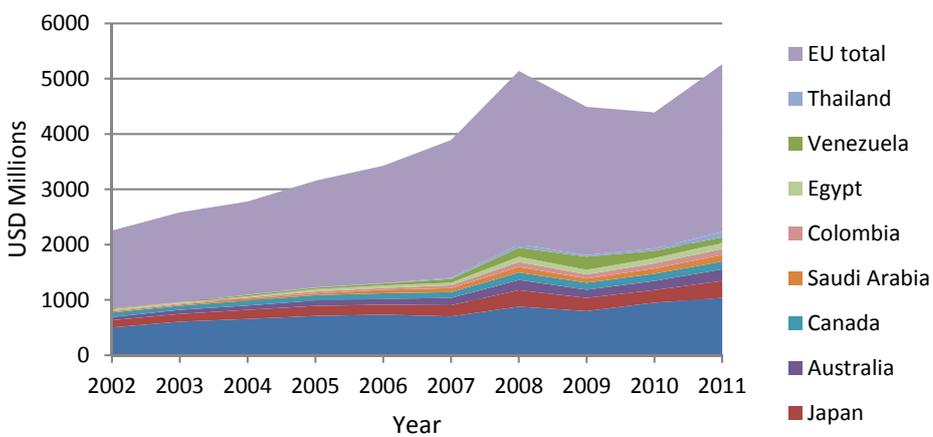
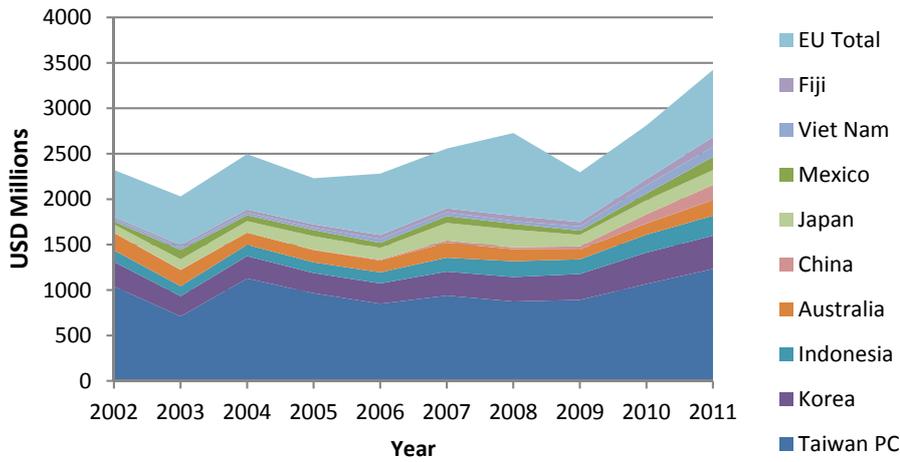


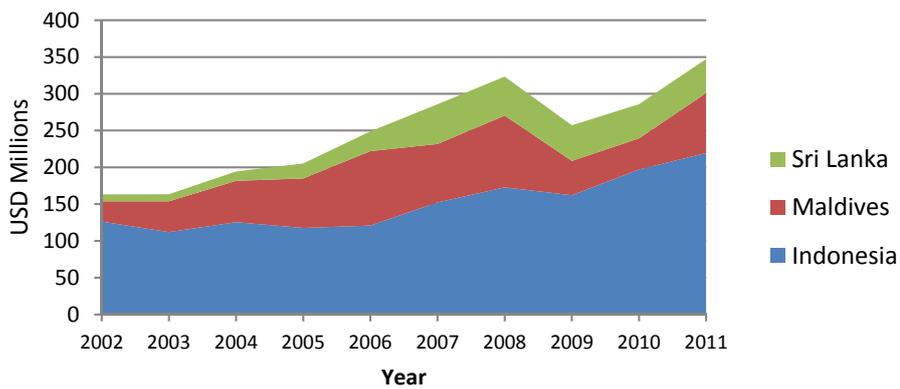
Fig. 16. Imports, Canned tuna (Top 10 countries) (FAO GLOBefish, 2014)



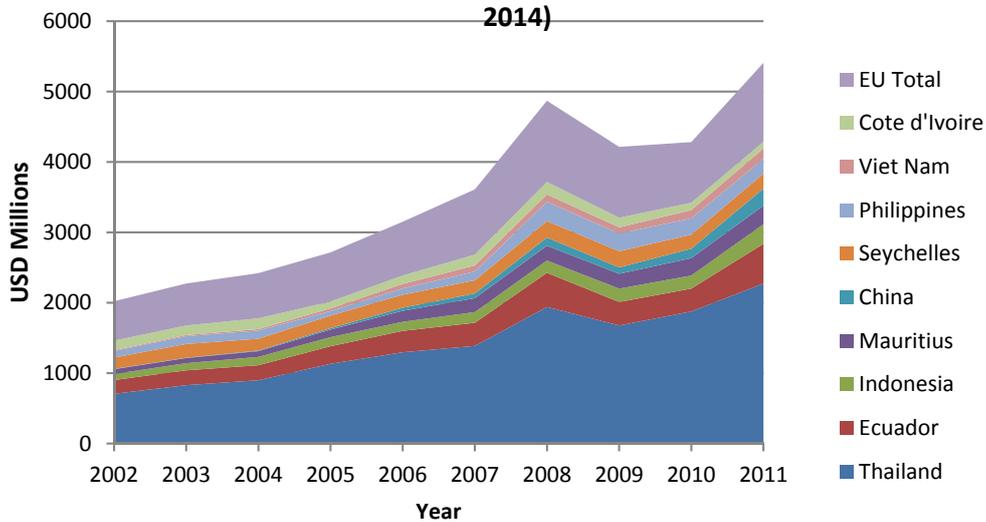
**Fig. 17. Exports, Fresh and Frozen Tuna (Top 10 countries)
(FAO Globefish, 2014)**

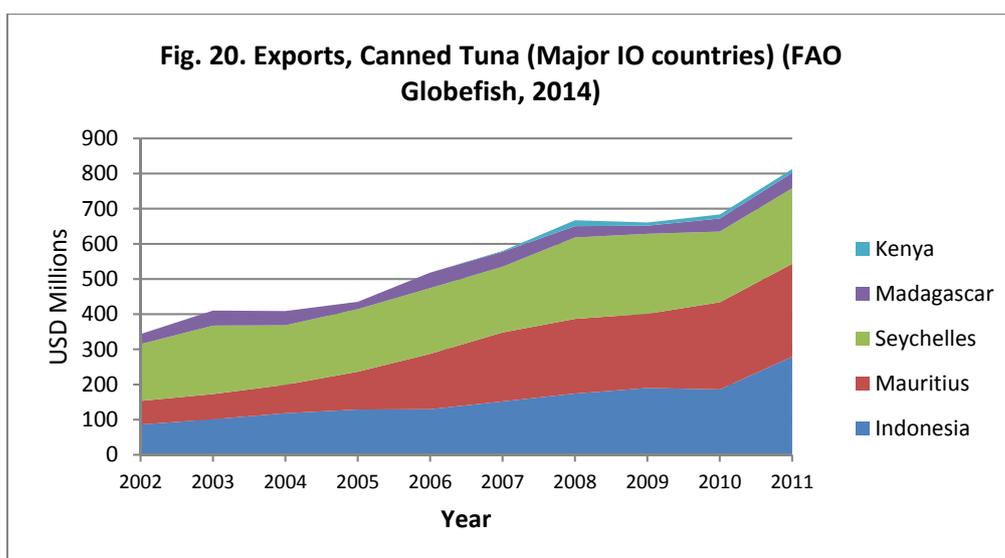


**Fig. 18. Exports, Fresh and Frozen Tuna (Major IO countries)
(FAO Globefish, 2014)**



**Fig. 19. Exports, Canned Tuna (Top 10 countries) (FAO Globefish,
2014)**





In Pakistan, India and Iran, tuna landings are used mainly in canneries in Iran, and for markets in the Middle East.

In Pakistan there is some local marketing of fresh/chilled form, which is consumed by the large Bangladeshi population in Karachi. There is also raw material supply for Korean surimi plants, and small tuna (kawakawa and frigate tuna) are processed and exported to Sri Lanka in salted/dried form.

In Iran, catches not destined for local canneries are probably consumed locally.

Catches from the Yemeni gillnet fleet are sent to Yemeni canneries or domestic consumption, but also purchased by canneries in Iran. In Oman catches are mainly sold locally in fresh or smoked form, with some small amount of canning also.

The important artisanal handline fisheries in the Maldives, Yemen and Oman tend to focus on exports, with local processing into loins for export primarily in EU and Middle Eastern markets.

4.4.4. Price Trends

Recent landed (ex-vessel) price trends for tuna (March 2010 – March 2014) available from FAO Globefish (2015) are shown in Fig. 21 and Fig. 22. (It should be noted that all prices presented here, and also used in the valuation analysis below, are ‘nominal prices’).

Yellowfin tuna, in both the Indian Ocean and Atlantic regions, has increased from USD 1.6/Kg to USD 2.5/Kg, whereas Skipjack prices have declined recently (about USD 1/Kg) despite an earlier increase to USD 2.4/Kg.

By comparison, both Bigeye (sashimi grade) and Southern Bluefin tuna have attained much higher prices at auction in Japan (between USD 10-30/Kg). The highest price Southern Bluefin (sashimi) has varied in price between USD 30-85/Kg.

Canned tuna from Thailand exported to the USA has varied in price from USD 3.6 - 4.6/Kg. This is approximately three and half times higher than the ex-vessel price for Skipjack (Fig. 23).

Fig. 21. Monthly Tuna Prices, Ex-Vessel - Seychelles (S) and Cote d'Ivoire (CI) (FAO Globefish, 2014)

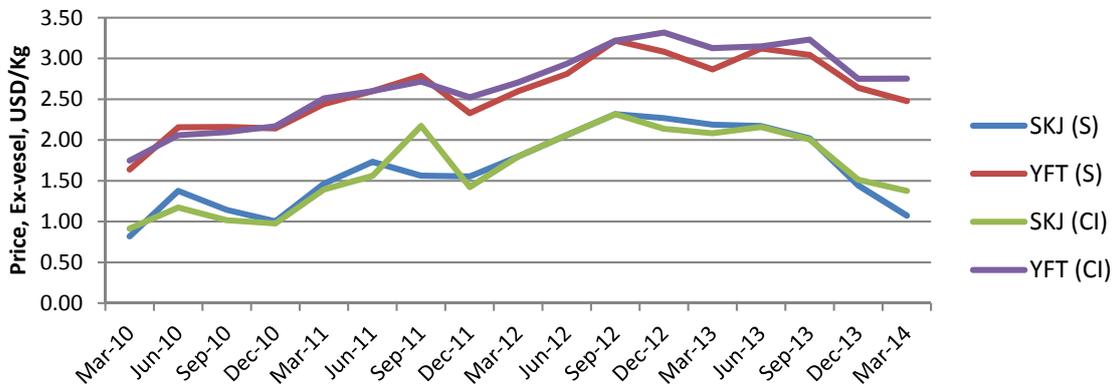


Fig. 22. Monthly Tuna Prices, Ex-Vessel - Japan Auction Fresh Bigeye Tuna Indonesian Origin (High -Low prices, Sashimi Grade) Southern Bluefin tuna Australian origin (High and Low prices) (FAO Globefish, 2014)

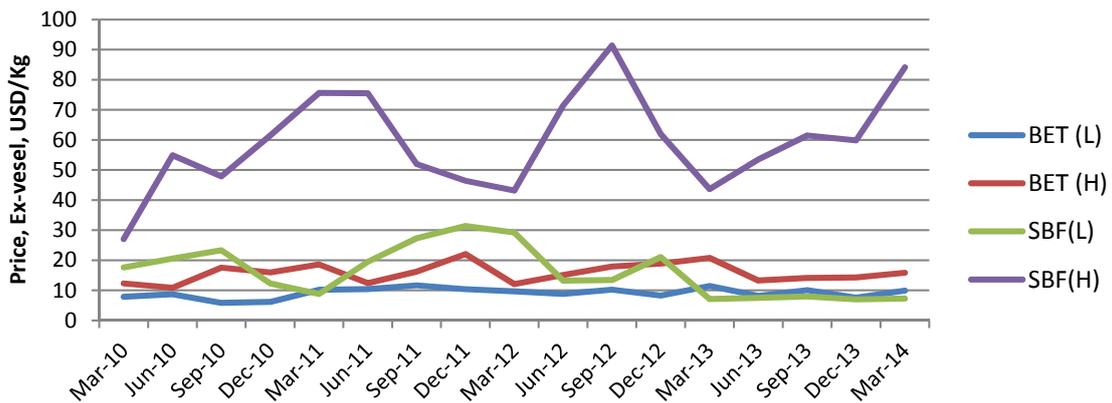
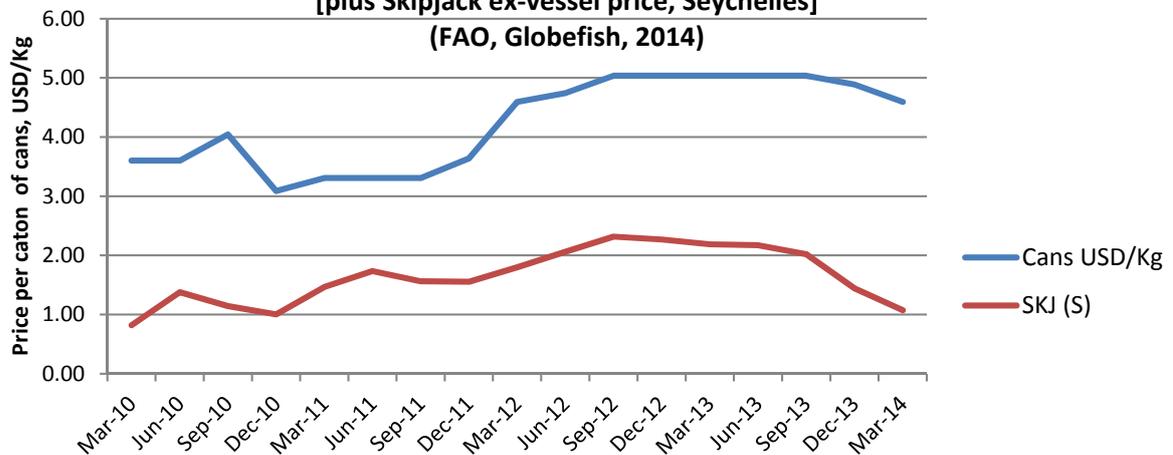


Fig. 23. Monthly canned tuna in brine prices into USA, lightmeat 48*6oz (48*170g) cartons, origin Thailand, USD/Kg, FOB [plus Skipjack ex-vessel price, Seychelles] (FAO, Globefish, 2014)



4.4.5. Markets and Trade - Current International Outlook

4.4.5.1. Overview

The following section provides the most up-to-date account of the status of international markets and trade for tuna and tuna products, based on FAO Globefish statistics (January – September 2015).

Overall, demand for canned tuna in the USA and the EU is in decline, giving rise to lower imports, despite an overall decline in raw material prices. EU canneries have increased demand for cooked loins as prices have declined. In contrast, imports grew in the Middle East, East Asia and in non-traditional markets in Latin America as prices softened.

4.4.5.2. Supply

By the end of 2015, fishing in the Pacific region had reduced. A low demand from tuna canneries worldwide also led to a reduction in Skipjack tuna prices (< USD 1000/tonne). Thai canneries reported a strong inventory of raw material. By comparison, Yellowfin tuna prices remained stable.

In the Atlantic Ocean, fishing continued at a moderate to good level, although canneries also have strong inventories of raw material. Skipjack prices have declined since last year by up to 20%. Prices for whole tuna and frozen loins have stabilised recently due to increased demand in Europe.

Thai imports of frozen raw material for canning have declined, due to weak demand for canned tuna in Europe and the USA. Imports dropped by 20% (Jan-Sept 2015) compared to 2014 (from 715,182 to 574,382 tonnes). By contrast, imports of semi-processed cooked loins to Thailand increased by 12% compared with the same period in 2014, mainly from China, Viet Nam and Indonesia.

Raw material imports to the Philippines have doubled (84,115 tonnes), due to a strong domestic demand, and a lower tariff rate facilitating exports to the EU. Yellowfin imports (30,000 tonnes) have increased (+124%), to produce cooked loins for the EU and Thailand.

The low demand internationally also affected Ecuador, a leading exporter of processed tuna. Frozen tuna imports totalled 43,554 tonnes, which is 2% less compared with the same period in 2014. Frozen Yellowfin imports fell by 7%.

China showed some positive developments, importing nearly 70,000 tonnes of frozen Skipjack, Yellowfin and Albacore during this period (compared with over 61,000 tonnes during the same time period in 2014), for cooked loin preparation and canning.

Lower tuna prices, particularly for Skipjack, induced imports of cooked loins among European canners for processing higher value products. EU imports of cooked Skipjack loins reached 43,639 tonnes during January-August 2015.

Non-canned tuna market (fresh and frozen)

USA

Demand for non-canned tuna products have shown good growth leading to increased imports of high value Bigeye and Bluefin tuna. Imports of fresh tuna into the USA have remained higher than for Japan (the world's largest sashimi market).

Japan

The weak Yen has impacted negatively on tuna imports. During 2015 (Jan-Sept), fresh tuna imports declined significantly compared with the same period in 2014, with sharp drops in Yellowfin and Bigeye supplies. Salmon sales have exceeded tuna both in the supermarket and sashimi markets.

Demand for sashimi tuna improved for a short period during the summer holiday season with stronger preference for the cheaper and shelf-stable frozen Bigeye.

Frozen tuna imports increased by 6% year-on-year during the January-September 2015 period, due to improved demand for the cheaper Bigeye. Lower prices of Skipjack helped support demand from *katsuobushi* (dried Skipjack) and canned tuna processors in Japan.

China

Although less significant in volume, Chinese imports of high-value fresh Bluefin tuna increased from 52 tonnes in 2014 to 85 tonnes during January-September 2015.

Canned Tuna

Exports

Thailand, Ecuador and Spain were the top exporters of canned and prepared tuna, followed by China, the Philippines and Indonesia. Only Indonesia showed an increase in exports compared to 2014.

For Ecuador, exports declined by 13.2% to 131,846 tonnes. The EU was the largest importer, taking a 56% share (74,307 tonnes. 1.4% increase overall). Cooked loins comprised 37% of the total. Supplies of cooked loins to the main market, Spain, increased by 55% reaching 22, 196 tonnes. Exports also increased to the UK (+20%), USA (+19%) and Argentina (+18%) but declined to Colombia and Chile.

For China, exports of prepared and canned tuna fell by 2.7% reaching a total 59,085 tonnes. The Philippines reported significantly lower export volumes (58,386 tonnes in total)

Indonesian exports increased by 3.5% to reach 47, 470 tonnes. Exports increased to the number one destination the EU (+15%), followed by Saudi Arabia (+12%), the USA (7.5%), and Australia (+63.3%), but declined to Japan (-13.6%). There is a strong focus now on Middle Eastern and Asian Pacific markets.

For Thailand, exports of prepared and canned tuna (HS 160414 category) declined by 5.5% in quantity to a total 420 514 tonnes. In value terms, exports totalled USD 1.48 billion (-16.7% decline) due to a decline in global prices. Top export destinations (by value) included the USA, Australia, Japan, Egypt and Canada. For total exports of prepared tuna, nearly 300, 000 tonnes were canned tuna, along with cooked loins, pouched and other value-added tuna products.

4.4.5.3. Imports

For 2015, the average price of canned tuna in the international market was lower than in 2014 but this did not revive import demand from the two largest markets, the USA and the EU. However, there were higher imports of cooked tuna loins into the EU meant for reprocessing.

The USA remained the top import market (despite 10% shrinkage of imports) followed by Spain (+24.6%), Italy (-13.7%), the UK (+7.4%), France (-6.5%), and Germany (+15.6%). Under the HS

160404 code, products including cooked tuna loins for Spain and Italy are often used for further processing.

Lower Skipjack prices stimulated higher imports of canned tuna to a range of countries including Canada, the Middle East (Egypt, Saudi Arabia, UAE, Kuwait, Oman), Japan, Hong Kong SAR, Taiwan PC and Australia.

USA

Lower USA imports of canned and prepared tuna in 2015 reflects weaker consumer demand in the market. Despite the relatively lower prices of tuna raw material, particularly frozen Skipjack, imports have declined year-on-year by almost 10% in quantity and 12.3% in value. Among the top five sources, including Thailand, China, Ecuador, Viet Nam and the Philippines, supply increased only from Ecuador (+28%) and Viet Nam (+6%) while declining from others.

Nearly 51,000 tonnes of the total of processed tuna imports in the USA were cooked or frozen loins, supplied mostly by China, Thailand, Fiji, Mauritius and Colombia. For cooked loins, import demand weakened by 12%.

EU

Current EU trade data for the first eight months of 2015, shows that imports of prepared/canned tuna from extra-EU countries increased marginally (+2.41%) to a total 337,428 tonnes.

Approximately 27% of this total consisted of cooked loins imported for further processing by Spain, Italy, France and Portugal.

Among the individual markets in the EU, Spanish imports of prepared tuna including cooked loins were 25% higher to total 95 339 tonnes during the January-September 2015 period compared with the same period a year ago. The majority (71%) of this total was comprised of cooked loins. Italy, the UK, France, Germany, and the Netherlands were the other leading importers in the EU. Yet again, Italy and France imported cooked loins for reprocessing whereas the other markets imported canned and pouched tuna for direct consumption.

EU imports of cooked loins from extra-EU countries were estimated to be over 100,000 tonnes in 2015, compared with an estimated 88 000 tonnes in 2014. Supplies from Ecuador and China increased significantly. Spain continued to be the largest importer of cooked loins in the EU for the domestic market and re-export to Portugal, France and Italy.

Compared to 2014, canned/processed tuna imports increased in the UK and German markets by 7.4% and 15.6% respectively during 2015, but declined by 16.7% in the Dutch market.

Other markets

Other large import markets for canned tuna during 2015 were Egypt, Japan, Australia and Canada, with marked imports increases on 2014.

Imports into Egypt almost doubled (to 60,000 tonnes). Imports also increased for Saudi Arabia, UAE, Kuwait and Oman compared with 2014, mainly from Thailand and Indonesia.

Supported by lower raw material prices, Japanese imports of canned tuna increased by 3% to 41,855 tonnes in 2015, mainly from Thailand, the Philippines, China, Viet Nam and the Maldives.

The Australian market, known for importing high-value canned tuna, remained positive with a 4% rise in imports. Canada also grew their canned tuna imports, by 10%.

4.4.5.4. Outlook

On the supply side, moderate fishing continues in the Western and Central Pacific as the FAD closure ended in October. However, fishing efforts are likely to slow down due to the falling prices of Skipjack and healthy raw material inventories in Thailand, where most canneries were closed for annual maintenance during late December. Canneries in the Eastern Pacific are also reporting moderate-to-high raw material inventories. The second IATTC 'veda' closure of two months started on 18 November 2015 resulting in about half of the fleet ceasing fishing efforts.

In terms of global trade, import demand for canned tuna in the USA is likely to rise in early 2016 in order to take advantage of the quota at lower duty. The low demand situation in the EU may persist until the second quarter of 2016. Meanwhile, low tuna prices will allow for more trade in the non-traditional markets worldwide.

4.4.6. Trade conditions

In the past, the Lome/Cotonou trade agreements proved to be successful, especially for tuna. This enabled the development of an ACP tuna industry most especially in Dakar (Senegal), Abidjan (Ivory Coast), Tema (Ghana), and also the Seychelles, Madagascar, Mauritius, Kenya. EU/ACP fisheries agreements also enabled a fully integrated and interdependent supply chains between ACP and EU countries.

FAO Globefish (2014) indicates that more recently, Thailand, the Philippines and Ecuador, have been trying to gain better access to the EU markets for canned tuna. While Ecuador successfully extended its GSP status with their 0% duty for canned tuna entering the EU continuing until the end of 2014, Thailand and the Philippines were not in this position. The vote on the proposed trade agreement between the EU and Thailand was postponed and no conclusion on whether Thai canned tuna will receive a reduced tariff was reached in 2014. Meanwhile, the Philippines applied in February 2014 to be included under the new EUGSP+ scheme (the EU is the second most important market for tuna for Philippines). In 2013, the EU-27 imported almost 31 400 tonnes of prepared/preserved tuna (HS 160141) from the Philippines, marginally up by 3.9% compared with 2012. The outcome of decisions on these various agreements and the current trading relationships will be further investigated and analysed in specific studies to be undertaken by the OPP-Bay of Bengal from 2016 onwards.

According to Poseidon *et al* (2014), in the WIO there are three Economic Partnership Agreements (EPAs) under negotiation. Whilst the thrust towards regional economic integration of the WIO African, Caribbean and Pacific (ACP) countries has progressed through the Interim EPAs (IEPAs), regional EPAs still remain outstanding, and negotiations for comprehensive

- EPAs with all WIO ACP countries are still in progress.
- By 1 October 2014, the ACP countries that have not ratified interim EPAs (or concluded full EPAs) with the EU will be delisted from the Market Access Regulation.

Least developed countries (LDCs) could then use the Everything But Arms (EBA) arrangement (i.e. 0 % tariff access on tuna) but other more developed countries would lose their 0 % tariff access.

4.4.7. Bay of Bengal perspective

Based on this preliminary review of the post-harvest, trade and market aspects of the tuna fisheries sub-sector, with particular reference to the Indian Ocean, a number of key points can be identified concerning the Bay of Bengal region.

For the principal market tunas, none of countries (India, Sri Lanka, Maldives) are recorded as significant importers of raw material (fresh and frozen tuna). For the IO, three countries – Seychelles, Mauritius and Indonesia – are major importers (which help to underpin large fish processing and canning operations).

In terms of exports of raw material – only Maldives and Sri Lanka – appear in the top 25 of leading nations, and their export volumes are relatively small compared to the major exporters (e.g. EU, Korea, Taiwan).

None of the Bay of Bengal countries has a significant tuna canning sector, and there is little involvement in this activity. In the IO region, the major exporters of canned tuna are Seychelles, Mauritius and Indonesia.

The trade in neritic tunas and in other tuna-like species is less valuable at a national and international level compared to the principal market tuna trade. However, further studies and analysis will be needed to understand the role of this trade in the Bay of Bengal region – where both fishing and trade for these types of fish do take place.

Finally, the relationship between fish landings, traded tuna and tuna products, and tuna stocks, should also be reviewed in future studies. For example, Yellowfin tuna caught on the high seas in the IO by DWFN will be recorded as part of the national statistics of the home country in the first instance, but should also be reported to the IOTC, to indicate the origin of this catch. Clearly, this information is important for fisheries assessment and fisheries management. The often complicated trading routes for tuna raw material and tuna products (between countries and regions) provides a difficult challenge for documentation systems which are required to establish the origins of the fish in the first place.

4.5. Economic Valuation

4.5.1. Availability of economic Information

A preliminary review of the international literature indicates that there is limited information on the economic characteristics of the tuna fisheries of the Indian Ocean, compared to other topics such as fisheries science, stock assessment and environmental aspects (a common finding throughout the world where natural scientists and the scientific community play a central role in information generation and advisory support for the fisheries sector in general).

The information which is available includes analyses in three areas [1] the economic impact of tuna fisheries (measured in terms of employment, revenues from domestic licensing and revenues from fishing agreements with DWFN), [2] the activity and value of the trade in tuna products (import and export quantities and values), and [3] the value of fisheries production (measured as the financial turnover of the sector, using landings and price data).

A recent publication by Pew Charitable Trust ‘*Netting Billions: A Global Valuation of Tuna*’ (Pew 2016) has estimated the annual value of global tuna fisheries at about USD 40 billion. Using the best available data on tuna landings and market prices for 2014, this study estimated global “landings” at 4.99 million metric tons, the “dock value” (ex-vessel value) at USD 9.76 billion and the “end value” (end of the value chain) at USD 42.21 billion.

Pew (2016) also estimate that the value of Indian Ocean tuna fisheries for 2014 at USD 8.72 billion (“end value”) or USD 2.32 billion (“dock value”).

4.5.2. An alternative approach to tuna fisheries valuation

There is no doubt that the valuation approach used by Pew (2016) is a useful entry point to attempt to put a value on global tuna fisheries. The large value figure generated will help to raise awareness in general regarding ‘what is at stake’ in exploiting these huge ocean resources.

However, it is also possible to use an alternative valuation approach, in an attempt to extend the analysis and to bring in a number of important inter-related considerations relating to sustainable wealth generation and use, as follows:

First, a simple arithmetic valuation of fisheries turnover (landings x price) takes no account of the cost of fishing, and it is well known that unmanaged (or weakly managed) fisheries will tend towards overexploitation – a situation whereby costs equal (or exceed) revenues - as fishermen increasingly compete with one another for a greater share of the potential catch.

Second, fish stocks are valuable forms of natural capital, and when managed carefully can generate a resource rent (the inherent wealth). This important characteristic of renewable natural resources has been analysed and measured both theoretically and empirically. For a well-managed fishery, the expected sustainable level of resource rent will be at least 40% of the turnover of the fishery (a useful ‘rule of thumb’). With further dedicated management and sector adjustments (as fishing firms react to appropriate market incentives, adopt greater operational efficiencies and consider alternative product development), the level of rent generation will increase (as the gap between total costs and revenues widen).

Third, once the inherent wealth of the fish resources is generated, it can be shared by the stakeholders involved (government and industry in the first instance). What is often overlooked, however, is that the wealth generated has the potential to contribute to economic growth through different routes. Re-investing the fisheries wealth (the investable surplus) in the fisheries sector is certainly one option – but this investment should also be weighed against other non-fishery investments also – in order to secure the best return – which will be good for economic growth and good for society too in the long run.

5.5.3. Economic valuation objectives

For this preliminary exercise, an attempt will be to:

- Estimate the potential sustainable economic value of both the principal and neritic tuna stocks in the Indian Ocean
- Comment on the results and the implications for the future

5.5.4. Economic valuation results – Indian Ocean tuna fisheries

The results of the valuation exercise are presented in Table 7, together with an explanation of the steps within the methodology and calculations.

The estimated potential sustainable economic value of both the principal and neritic tuna stocks in the Indian Ocean is USD 2.06 billion. The capitalised asset value of the fish stocks capable of generating this annual ‘income’, @ 8% as a reasonable return for example, is USD 26 billion.

The potential asset value of IO tuna stocks is significant relative to the value of current economic activity in the region: India GDP (USD 2, 067 billion), Tamil Nadu (USD 167 billion), Kerala (USD 77 billion), Sri Lanka (67 billion), Maldives (2.3 billion) (Government of India, 2015, World Bank, 2014).

The actual (current) economic value of the tuna stocks in the IO is not known (in terms of the current levels of resource rent being generated). However, it seems unlikely any of the fisheries involved is generating economic rents at a level close to the potential value (above) under current management arrangements. The OPP-Bay of Bengal will address this issue in the future through various follow-up studies.

5.5.5. Comment on the economic valuation results

The realisation of the potential economic returns from both the principal (highly migratory) and neritic tuna fisheries, indicated above, would be significant for the countries involved.

Improved economic performance in the future could come from three routes: (1) critically from improved management at the harvesting level, (2) from increased catch up to MSY and (3) from improved performance throughout the value chain (but 2 and 3 depend on 1 of course). It should be noted that these results are at the resource level, but the results at country level will depend on how the resources or the economic benefits from their exploitation are shared.

These preliminary results are based on the best available data (along with various assumptions about price in particular). In the future, it will be important to work towards improving this type of analysis, including developing an understanding of the potential economic contribution of well-managed fisheries to the countries which exploit the fisheries.

5.5.6. Bay of Bengal Perspective

At the present time, there are no estimations of the economic value of the tuna stocks on a national basis using the type of approach shown above (to estimate asset value and economic rent). Clearly, this information would be useful to fisheries policy-makers in the future.

Table 7 Indian Ocean Tuna Fisheries Potential and Actual Values Compared (2014)										
	Tuna Stock	MSY	Landing price	Potential Value		Estimated Actual Value			Difference	
Units		(Tonnes)	Ex-vessel (USD/t)	Gross landed value (USD)	Resource rent (USD)	Actual Landings (Tonnes)	Landing value (USD)	Status of Exploitation	Resource Rent (USD)	(+/- USD)
Notes	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
								Not Overfished	No Overfishing	
Principal market tuna	Yellowfin	421,000	2,500	1,052,500,000	421,000,000	430,327	1,075,817,500	Critical	Critical	
	Skipjack	684,000	1,000	684,000,000	273,600,000	432,467	432,467,000	Agreed	Agreed	
	Bigeye	132,000	12,000	1,584,000,000	633,600,000	100,231	1,202,772,000	Agreed	Agreed	
	Albacore	47,600	2,500	119,000,000	47,600,000	40,981	102,452,500	Agreed	Agreed	
	Southern Bluefin	33,000	35,000	1,155,000,000	462,000,000	11,900	416,500,000	Critical	Critical	
	Sub-Total	1,317,600		4,594,500,000	1,837,800,000	1,015,906	3,230,009,000			
Neritic tuna	Bullet tuna	17	1,000	8,117,000	3,246,800	8117	8,117,000	Critical	Critical	
	Frigate tuna	97,980	1,000	97,980,000	39,192,000	97,980	97,980,000	Critical	Critical	
	Kawakawa	152,000	1,000	152,000,000	60,800,000	162,854	162,854,000	Agreed	Agreed	
	Longtail tuna	122,000	1,000	122,000,000	48,800,000	147,587	147,587,000	Agreed	Critical	
	Indo-Pacific King Mackerel	43,000	1,000	43,000,000	17,200,000	45,953	45,953,000	Critical	Critical	
	Narrow-barred Spanish Mackerel	127,700	1,000	127,700,000	51,080,000	153,425	153,425,000	Critical	Critical	
	Sub-Total	550,797		550,797,000	220,318,800	615,916	- 615,916,000			
Grand total		1,868,397		5,145,297,000	2,058,118,800	1,631,822	- 3,845,925,000			
Capitalised Asset Value (8%)					25,726,485,000					
Notes						[6]	As defined by IOTC (2015)			
[1]	As defined by IOTC (2015)					[7]	Calculated by multiplying [3] price by [6] Actual landings			
[2]	As defined by IOTC (2015)					[8]	As defined by IOTC (2015)			
[3]	For principal market tuna - prices derived from FAO Globefish (2014) , updated by FAO Globefish (2015)					[9]	To investigated in the future under OPP-Bay of Bengal			
[4]	Calculated by multiplying [2] MSY by [3] Price					[10]	To investigated in the future under OPP-Bay of Bengal			
[5]	Calculated by multiplying [4] Gross landed value or turnover by 40% (after Defra, 2010; Wilen, 2005)									

4.6. Global Trends, Changes and Issues

In this brief section, the objective is to provide an overview of the issues and trends relating to fisheries on a global scale, in order to consider the wider setting for tuna fisheries for the Indian Ocean. The information is summarised from the current FAO SOFIA (2014).

Global Landings

First, global capture fisheries production has remained stable in recent years, and reached 86.6 million tonnes in 2012 (excluding anchoveta) – a new maximum production. Total production was 93.7 million tonnes.

Marine fisheries

Second, marine fisheries production was 79.7 million tonnes in 2012. At least 18 countries (11 in Asia) caught more than an average of one million tonnes per year (76 percent of the total). The most productive areas are the Northwest and Western Central Pacific. Catches in the Northeast Pacific remain stable, whereas the Southeast Pacific continues to experience catch fluctuations, attributable to climatic variations. In the Indian Ocean, catch levels continue to grow. Tuna catches in the Western Indian Ocean have recovered (after disruption due to piracy). The Northern Atlantic areas and the Mediterranean and Black Sea have continued to experience declining catches, whereas landings from the Southwest and Southeast Atlantic have recently been improving.

Tuna fisheries

Third, landings of tuna and tuna-like species set a new record of more than 7 million tonnes in 2012. Seven species (the principal or market tunas including Yellowfin and Skipjack) account for over 90 percent of the total tuna catch. Catches of smaller tunas (for example frigate and bullet tunas), seerfishes (*Scomberomorus* spp.) and albacore have also grown significantly. In 2012, Yellowfin landings exceeded their 2000 level, while Bigeye appeared to be in decline (minus 5 percent).

Exploited Stock Status

Fourth, the proportion of assessed marine fish stocks fished within biologically sustainable levels was 71.2 percent in 2011 (compared to 90 per cent in 1974). Overfished stocks made up 28.8 percent of the total. In addition, it was possible to determine fully fished stocks (61.3 percent) and underfished stocks (9.9 percent).

Stock recovery potential

Ten fish species accounted for about 24 percent of world marine capture fisheries production in 2011. Unfortunately, most of their stocks are fully fished (some are overfished). Addressing this situation through rebuilding overfished stocks could increase production by 16.5 million tonnes and annual rent by US\$32 billion.

Fish Trade

Fish is one of most traded food commodities, involving almost all countries worldwide. For some developing countries, fish represents more than half of the total value of traded commodities. In 2012, fish accounted for 10 percent of total agricultural exports and 1 percent of world merchandise trade in value terms. Fish exports (as a share of fish landings) increased from 25 percent (1976) to 37 percent (58 million tonnes, live-weight equivalent) (2012). Fishery exports peaked at USD129.8

billion in 2011 (up 17 percent from 2010), but declined slightly to USD129.2 billion in 2012, due to depressed international prices for some fish and fishery products (e.g. tuna). Uncertainties over demand in Europe, Japan and N. America have encouraged exporters to explore new markets in emerging economies (e.g. Middle East Gulf States). Fishery trade appears to show an upward trend from 2013.

Fish prices and market access

The aggregate FAO Fish Price Index increased markedly from early 2002, reaching a record high in October 2013. The EU is the largest market for imported fish and fish products, with a growing dependence on imports. The USA, Japan and China are also large and important markets. China is, by far, the largest exporter of fish and fishery products. Developing economies are increasingly important in world fish trade, with 54 percent of total fishery exports by value in 2012, and more than 60 percent by quantity (live weight). Although developed countries import the largest share of fish and fishery products, this appears to be changing, with other emerging markets also growing. Exports from developing countries have increased significantly, associated with lower tariffs, following the expansion of WTO membership, new bilateral and multilateral trade agreements, and increased demand from emerging economies.

5. CONCLUDING REMARKS AND NEXT STEPS

The primary objective of this report has been to produce a preliminary characterisation of the fisheries in the Indian Ocean and the Bay of Bengal, with a particular focus on tuna fisheries. The work has specifically addressed environmental and economic aspects. A follow-on and complementary report will look at social and institutional aspects. The two reports together will therefore establish an up-to-date multi-disciplinary characterisation of the fisheries sector, forming an essential building block for the subsequent sectoral analysis to be carried out by the OPP- Bay of Bengal project. In completing this initial report there are three observations which can be made, which are relevant to the follow-on work.

First, the tuna fisheries of the Indian Ocean are clearly multi-faceted and complicated. The reality of the situation - that there are over 50 nations involved in fishing at least ten stocks of tuna and tuna-like species over a vast Ocean area – represents a major challenge in attempting to document, analyse and understand the overall situation. Some thought will have to be given to how different issues, levels and scales can be handled in this respect, and made manageable.

Second, there are a wide range of organisations and institutions involved in the Indian Ocean tuna fisheries. An initial institutional mapping exercise would prove useful as way of understanding the inter-relationships involved. The IOTC holds a pivotal place for IO tuna fisheries at present and the fact that the OPP-Bay of Bengal project intends to build a future working relationship with this organisation is important.

Third, the availability and quality of data and information concerning IO tuna fisheries should be examined very carefully in the future. The literature and data review undertaken for this current report revealed that this is also a very challenging area; which is further complicated, for example, by the increasingly dynamic and global nature of the fisheries and fish trade involved. The limited amount of information (or accessible information) on neritic tuna fisheries should be examined. Furthermore, the linkages between tuna fisheries and national development in the IO will require further and careful analysis, to consider economic and social issues.

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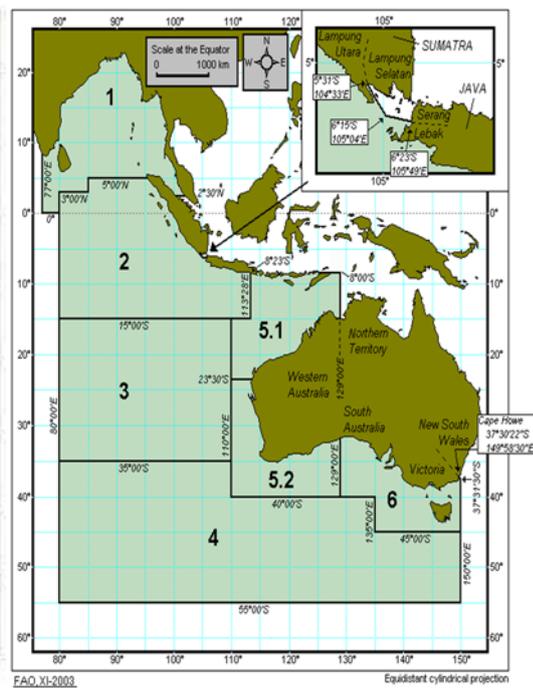
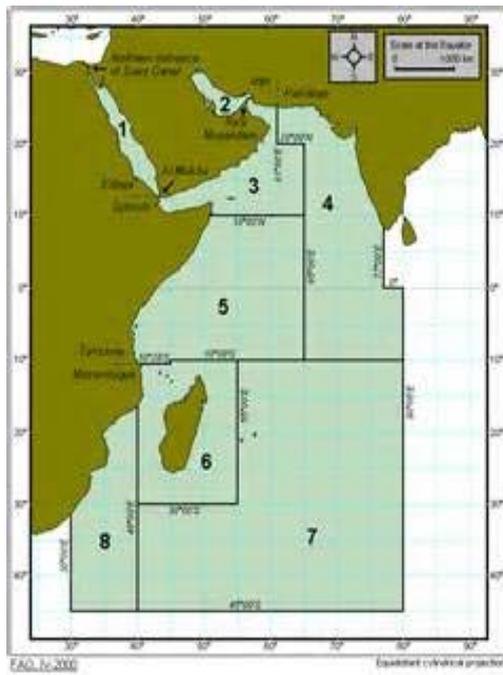
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7. APPENDICES

Appendix 1: Maps of the Indian Ocean

Western Indian Ocean (FAO Fisheries Statistical Area 51)

Eastern Indian Ocean (FAO Fisheries Statistical Area 57)



Appendix 2

Tropical tuna and tuna-like species under the IOTC mandate

IOTC Code	English Name	Scientific
<i>Tropical tuna</i>		
YFT	Yellowfin tuna	<i>Thunnus albacores</i>
BET	Bigeye tuna	<i>Thunnus obesus</i>
SKJ	Skipjack tuna	<i>Katsuwonus pelamis</i>
<i>Temperate tuna</i>		
ALB	Albacore	<i>Thunnus alalunga</i>
	Southern Bluefin tuna	<i>Thunnus maccoyi</i>
<i>Neritic tuna</i>		
LOT	Longtail tuna	<i>Thunnus tonggol</i>
FRI	Frigate tuna	<i>Auxis thazard</i>
BLT	Bullet tuna	<i>Auxis rochei</i>
KAW	Kawakawa	<i>Euthynnus affinis</i>
COM	Narrow-barred Spanish mackerel	<i>Scomberomorus commerson</i>
GUT	Indo-Pacific king mackerel	<i>Scomberomorus guttatus</i>
<i>Billfishes</i>		
	Swordfish	<i>Xiphias gladius</i>
	Black marlin	<i>Makaira indica</i>
	Blue marlin	<i>Makaira nigricans</i>
	Striped marlin	<i>Tetrapturus audax</i>
	Indo-Pacific Sailfish	<i>Istiophorus platypterus</i>

Appendix 3A
Stock distribution maps – Principal Tunas

Table 3A.1. Indian Ocean – Bigeye Tuna

Table 3 A.1.1 & 2. Bigeye tuna: Catches of bigeye tuna by area by year estimated for the WPTT (1950–2012). Data as of September 2013. Catches outside the areas presented in the Map were assigned to the closest neighbouring area for the assessment.

Areas: West Indian Ocean (A1); East Indian Ocean (A2); Southwest and Southeast Indian Ocean (A3); Other Areas (A0)

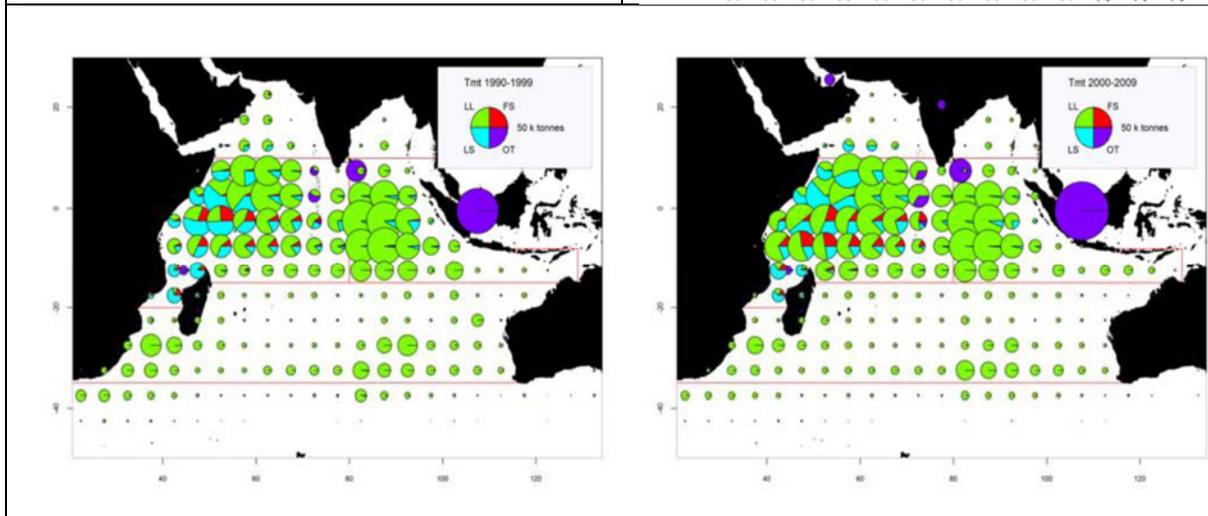
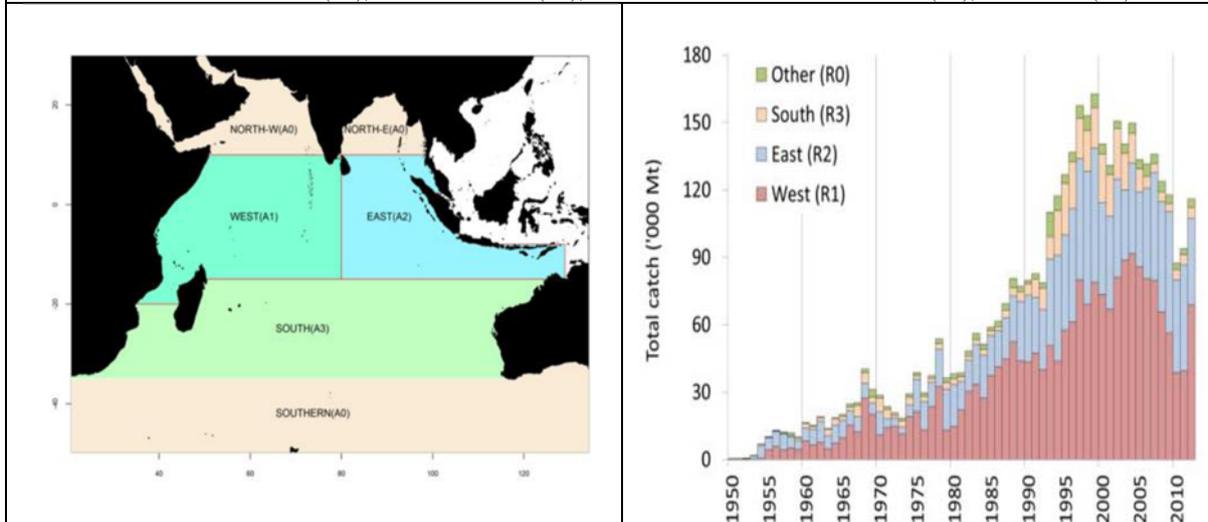


Table 3A.1.3. Bigeye tuna: Time-area catches (total combined in tonnes) of bigeye tuna estimated for the period 1990–2009, by decade and type of gear. Longline (LL), Purse seine free-schools (FS), Purse seine associated-schools (LS), and other fleets (OT), including pole-and-line, drifting gillnets, and various coastal fisheries; Data as of September 2013.

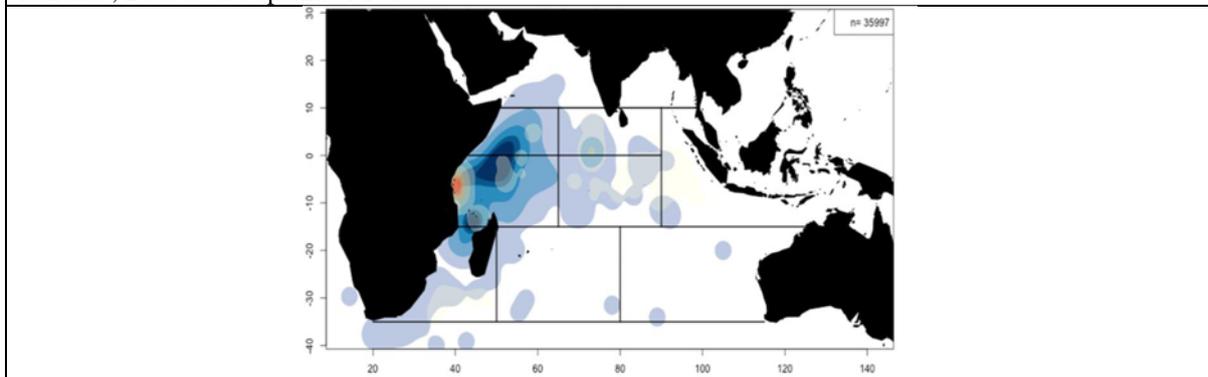


Table 3A.1.4. Bigeye tuna: Densities of releases (in red) and recoveries (in blue). Data as of September 2012.

Source: IOTC–2013–WPTT15–07_Rev1

Table 3A.2. Indian Ocean – Skipjack Tuna

Table 3A.2.1 &2. Skipjack tuna: Catches of skipjack tuna by area by year estimated for the WPTT (1950–2012). Data as of September 2013.

Areas: East Indian Ocean plus Maldives (R1); West Indian Ocean excluding Maldives (R2)

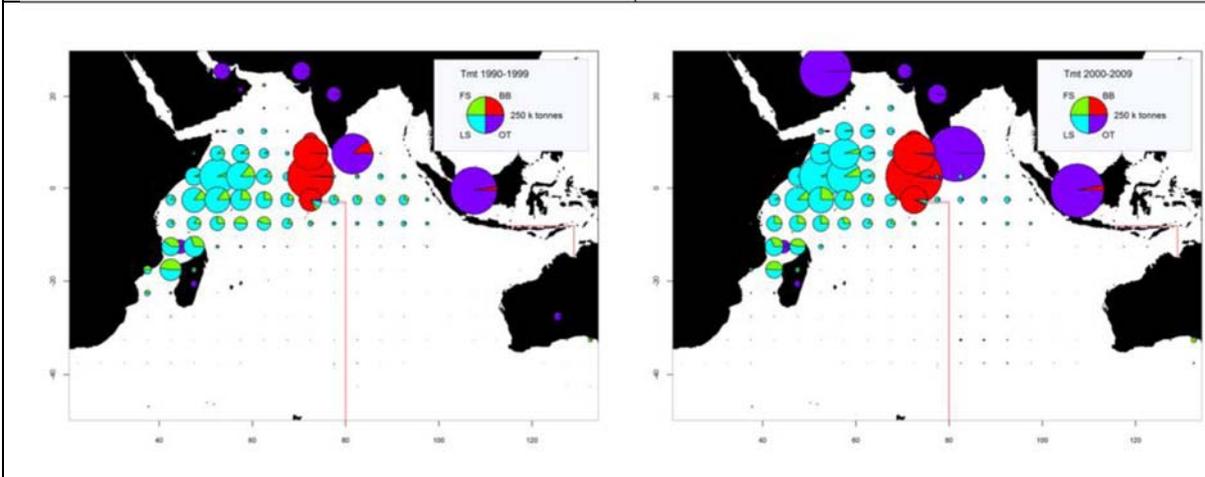
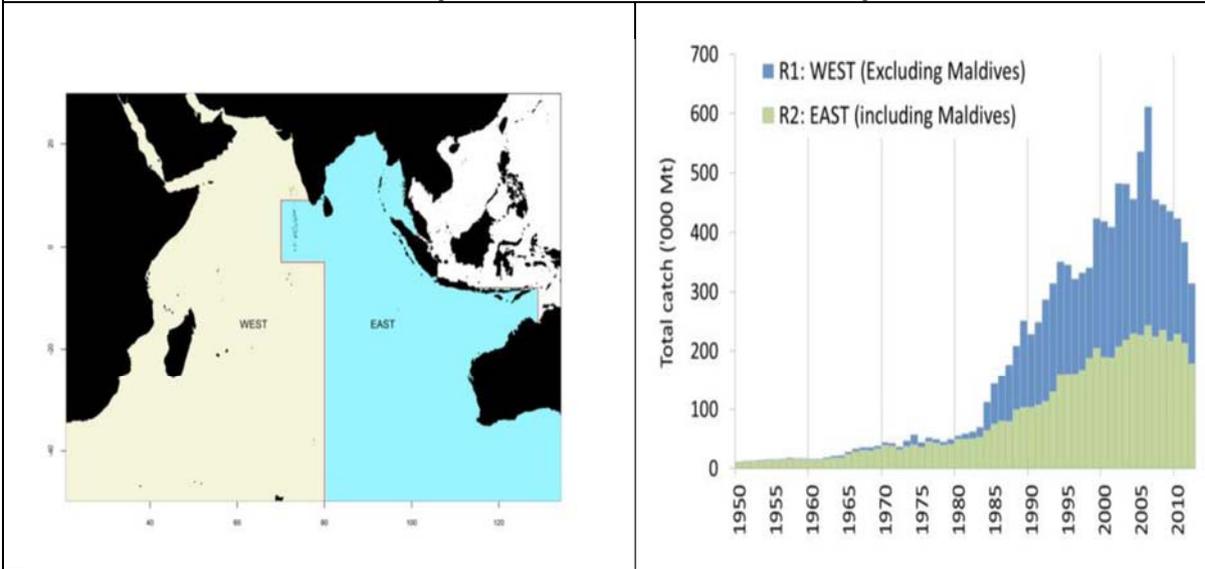
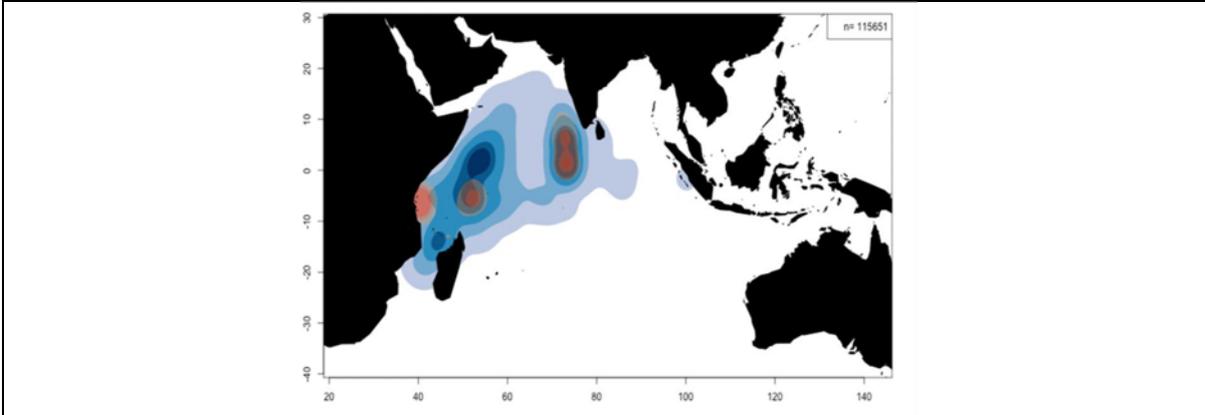


Table 3A.2.3. Skipjack tuna: Time-area catches (total combined in tonnes) of skipjack tuna estimated for the period 1990–2009, by decade and type of gear. Purse seine free-schools (FS), Purse seine associated-schools (LS), pole-and-line (BB), and other fleets (OT), including longline, drifting gillnets, and various coastal fisheries. Data as of September 2013



Skipjack tuna: Densities of releases (in red) and recoveries (in blue). Data as of September 2012.

Source: IOTC–2013–WPTT15–07_Rev1

Table 3A.3. Indian Ocean – Yellowfin

Table 3A.3.1.&2. Yellowfin tuna: Catches of yellowfin tuna by area by year estimated for the WPTT (1950–2012). Data as of September 2013. Catches in areas R0 were assigned to the closest neighbouring area for the assessment.

Areas: Arabian Sea (R1); Off Somalia (R2); Mozambique Channel (R3); South Indian Ocean (R4); East Indian Ocean (R5); Bay of Bengal (R0(North)); OtherArea (R0(Other))

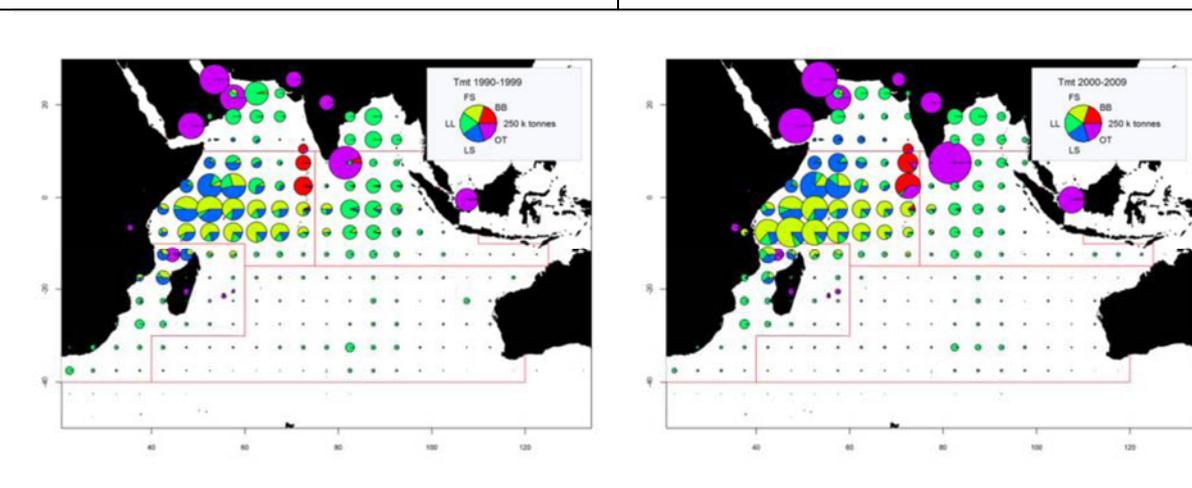
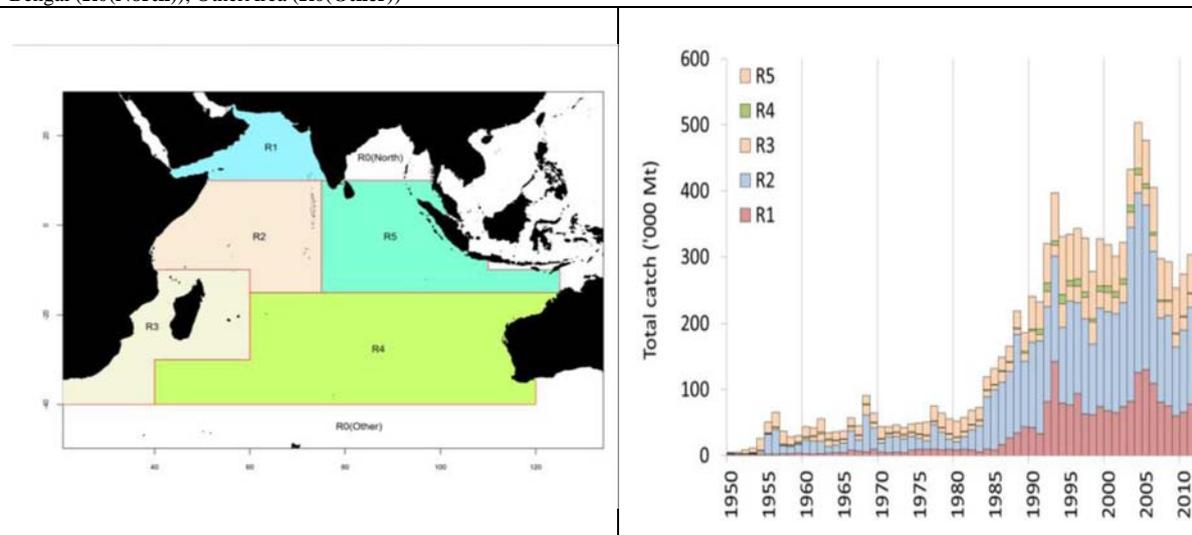


Table 3A.3.3. Yellowfin tuna: Time-area catches (total combined in tonnes) of yellowfin tuna estimated for the period 1990–2009, by decade and type of gear. Longline (LL), Purse seine free-schools (FS), Purse seine associated-schools (LS), poleand-line (BB), and other fleets (OT), including drifting gillnets, and various coastal fisheries. Data as of September 2013.

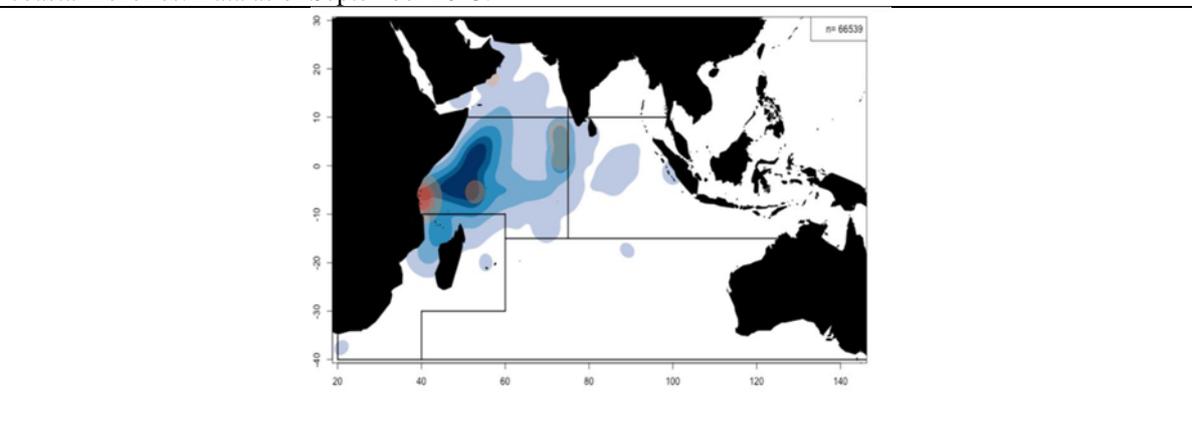


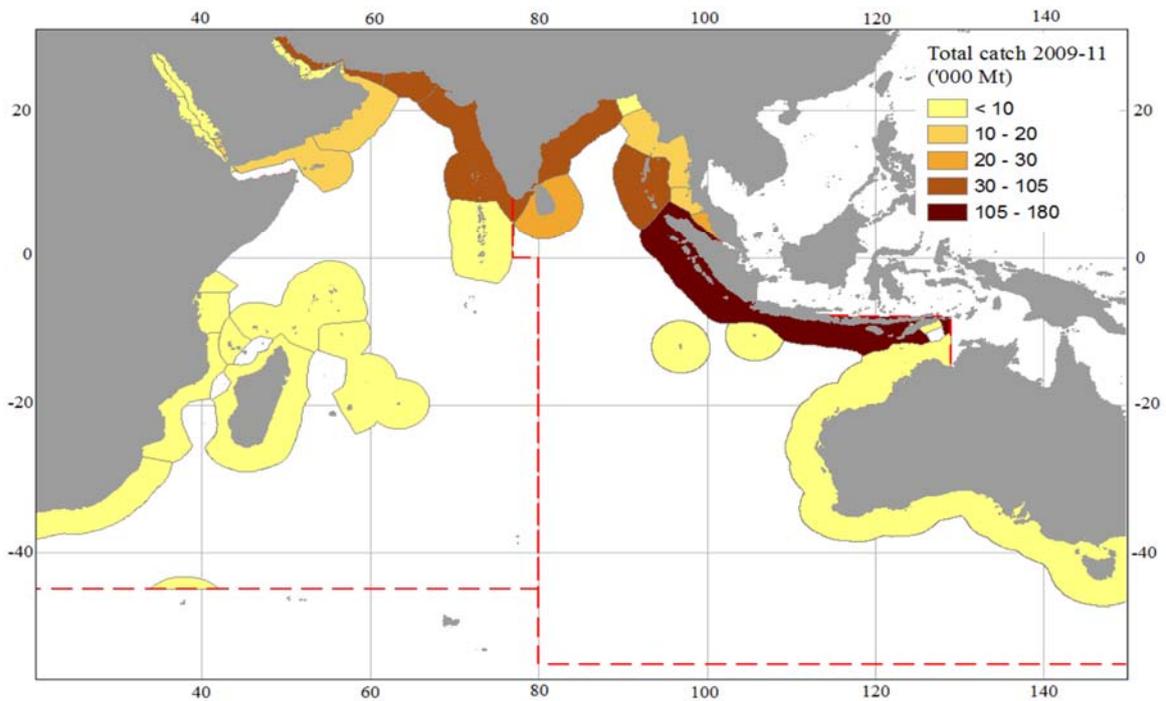
Table 3A.3.4. Yellowfin tuna: Densities of releases (in red) and recoveries (in blue). The black line represents the stock assessment areas. Data as of September 2012.

Source: IOTC–2013–WPTT15–07_Rev1

Appendix 3B

Stock distribution maps – Neritic Tunas

Fig. 3.b.1. Average catches of neritic tunas in the Indian Ocean over the period 2009–11, by country EEZ.



Note: The intensity of the shading of EEZs represent the importance of catches of all IOTC neritic species in each country (refer to the key at the top right of the map for details). Boundaries separating the IOTC east and west Indian Ocean areas are denoted by the red dashed line. Definition of EEZ from the Flanders Marine Institute (<http://www.vliz.be/vmdcdata/marbound/download.php>)
Source: IOTC IOTC-2013-WPNT03-07 Rev_

Table 3.B.1.. Main fisheries, fishing areas and catches status of neritic tuna species under the IOTC mandate.

Species	Known fisheries	Area	Status	Main fleets	Important catches
Longtail tuna	Industrial Purse seine	Arabian Sea	Target: In association with YFT	Iran	Low-Medium
	Coastal purse seine	Andaman Sea	Target: along with KAW, FRZ	Thailand, Malaysia, Indonesia	Medium(?)
	Gillnet	Persian Gulf, Arabian Sea South Indonesia	Target: Bycatch	Iran, Pakistan, Oman Indonesia	High Medium (?)
	Longline, line, sport and other gears	Various	Bycatch	Yemen, India	Low-Medium(?)
Frigate tuna	Industrial purse seine	Western Indian Ocean	By-catch: tuna schools associated under FAD	EC, Iran, Seychelles, Thailand	Low-Medium
	Coastal purse seine	Andaman Sea India	Target: along with KAW, LOT Bycatch (?)	Thailand India	Low Low
	Ring net	Sri Lanka Indonesia	Target Target (?)	Sri Lanka Indonesia	Medium High (?)
	Pole and line	Maldives	Bycatch	Maldives	Medium
	Gillnet	India, Indonesia, Sri Lanka, Iran	Bycatch	India, Indonesia, Sri Lanka, Iran	High
	Longline, line and other gears	India and other areas	Bycatch	India, Sri Lanka	High(?)
Bullet tuna	Coastal purse seine	India and other (?)	Bycatch (?)	India	Medium(?)
	Danish seine	Indonesia	Bycatch (?)	Indonesia	High (?)
	Gillnet	India, Sri Lanka, Indonesia and other (?)	Bycatch (?)	India, Sri Lanka, Indonesia, Other	High (?)
	Hand line and troll line	India, Sri Lanka and other (?)	Bycatch (?)	India, other (?)	High (?)
Kawakawa	Industrial purse seine	Western Indian Ocean	Bycatch: tuna schools associated (FAD) in coastal waters	EC, Iran, Seychelles, Thailand	Low
	Coastal purse seine	Andaman Sea Indonesia India	Target: along with FRZ, LOT Target: along with SKJ, FRZ Bycatch (?)	Thailand, Malaysia, Indonesia, India	High
	Gillnet	Arabian Sea, India	Bycatch	India, Iran, Yemen, Pakistan, Oman	High
	Hand line and troll line	India and other (?)	Bycatch (?)	India, other (?)	Medium (?)
	Other gears	Maldives and other	Bycatch	Maldives and other (?)	Low (?)
Narrow-barred Spanish mackerel	Gillnet	India, Indonesia, Arabian Sea and Persian Gulf	Target	India, Indonesia, Pakistan, Iran, UAE, Sri Lanka and other	High
	Hand line and troll line	Madagascar, India and other	Target (?)	Madagascar, India, other (?)	Medium (?)
	Other gears (trawl)	Andaman Sea, India	Bycatch	Thailand, India	Medium (?)
Indo-Pacific king mackerel	Gillnet	India, Indonesia	Bycatch	India, Indonesia	High
	Hand line and troll line	Indonesia and other (?)	Bycatch	Indonesia, other (?)	Low (?)
	Other gears (trawl)	India and other (?)	Bycatch	India, other (?)	Medium (?)

Source: IOTC–2013–WPNT03–07 Rev_1

Appendix 4

Stock Assessment – Principal Tunas – Summary

EXTRACT from

IOTC-SC18 2015. Report of the 18th Session of the IOTC Scientific Committee, Bali, Indonesia 23-27 November 2015. IOTC-2015-SC18-R. 175pp.

EXECUTIVE SUMMARY

STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN AND ASSOCIATED SPECIES

Tuna – Highly migratory species

SC18.01 (para. 121) The SC **RECOMMENDED** that the Commission note the management advice developed for each tropical and temperate tuna species as provided in the Executive Summary for each species, and the combined Kobe plot for the three species assigned a stock status in 2015 (Fig. 4):

- Albacore (*Thunnus alalunga*) – Appendix VIII
- Bigeye tuna (*Thunnus obesus*) – Appendix IX
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix X
- Yellowfin tuna (*Thunnus albacares*) – Appendix XI

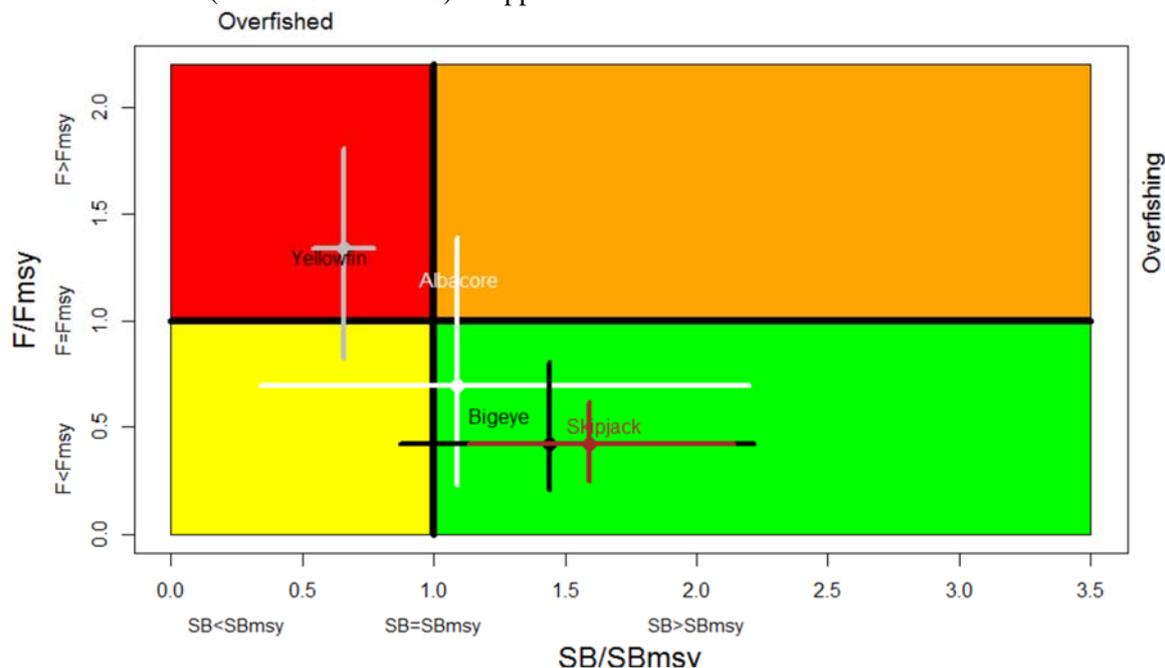


Fig. 4. Combined Kobe plot for bigeye tuna (black: 2013), skipjack tuna (brown: 2014), yellowfin tuna (grey: 2015) and albacore (white: 2014) showing the estimates of current stock size (SB) and current fishing mortality (F) in relation to the interim target spawning stock size and interim target fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Note that for skipjack tuna, the estimates are highly uncertain as F_{msy} is poorly estimated, and as suggested for stock status advice it is better to use B_0 as a biomass reference point and $C(t)$ relative to C_{msy} as a fishing mortality reference point.

Appendix 5 Landings Data – IOTC Database

Year	OVERVIEW									
	All tuna	Landings in metric tonnes							Other tuna	
	Total	YFT	BET	SKJ	ALB	BF	SBF	S.Total	S.Total	
1950	42,481	4,296	21	10,833	8			15,158	27,323	
1951	43,094	4,740	46	13,681	18			18,486	24,605	
1952	47,904	8,393	321	13,466	80		647	22,908	24,996	
1953	58,178	11,519	1,695	14,327	1,114		4,040	32,694	25,484	
1954	86,454	26,969	6,900	15,077	2,847		2,594	54,386	32,069	
1955	116,386	50,689	9,795	15,342	3,358		3,235	82,419	33,966	
1956	160,036	66,466	12,904	15,992	5,629		15,287	116,277	43,759	
1957	130,778	40,171	12,212	17,654	5,341		15,068	90,445	40,333	
1958	113,914	31,042	11,883	16,782	7,299		9,549	76,555	37,359	
1959	160,503	30,941	10,105	16,906	11,660		50,456	120,068	40,435	
1960	205,785	44,372	16,354	16,700	12,146		72,696	162,268	43,516	
1961	206,431	42,797	15,245	16,575	16,648		66,152	157,416	49,016	
1962	197,063	56,068	18,883	18,920	19,013		35,717	148,602	48,462	
1963	186,997	35,383	13,802	21,329	14,178		51,782	136,474	50,523	
1964	195,619	36,026	18,300	22,313	19,379		40,001	136,019	59,600	
1965	198,811	37,361	19,531	28,457	13,034		38,483	136,866	61,945	
1966	239,893	56,918	24,082	33,689	15,465		39,607	169,761	70,132	
1967	264,412	46,521	24,924	36,182	21,919		60,097	189,644	74,769	
1968	317,978	88,447	37,514	35,936	18,349		53,499	233,745	84,233	
1969	281,784	65,223	29,479	38,478	20,300		49,100	202,581	79,204	
1970	236,891	42,549	25,679	44,314	13,425		30,657	156,623	80,267	
1971	228,320	43,483	21,125	42,554	12,458		29,066	148,686	79,634	
1972	234,639	45,210	18,729	36,442	12,049		31,718	144,148	90,491	
1973	244,538	41,624	16,451	46,537	22,810		31,462	158,884	85,654	
1974	303,834	45,698	27,179	56,761	29,523		34,421	193,582	110,252	
1975	278,042	47,786	36,625	44,564	11,002		23,873	163,849	114,192	
1976	307,165	51,095	28,545	52,276	14,978		32,389	179,284	127,881	
1977	338,096	74,246	35,246	49,664	11,906		30,104	201,166	136,929	
1978	346,096	63,974	52,030	45,299	18,140		20,346	199,790	146,306	
1979	343,646	56,153	36,008	49,470	18,139		19,607	179,377	164,268	
1980	348,806	53,643	37,303	55,538	14,041		28,292	188,816	159,990	
1981	363,674	59,299	37,674	58,771	15,134		27,369	198,247	165,427	
1982	436,215	70,580	47,417	62,333	25,311		31,708	237,349	198,866	
1983	441,764	74,111	54,934	69,908	20,280		35,891	255,123	186,641	
1984	534,608	120,249	50,181	112,058	17,820		32,129	332,438	202,171	
1985	611,704	135,452	58,452	143,533	11,499		30,227	379,163	232,541	
1986	674,037	151,117	60,725	157,852	33,923		24,234	427,851	246,186	
1987	744,607	168,043	68,361	176,397	31,924		22,528	467,254	277,354	
1988	858,624	223,266	79,779	208,685	30,543		21,472	563,746	294,878	
1989	859,018	212,559	76,471	251,303	21,980		16,785	579,099	279,919	
1990	863,349	252,864	79,068	228,375	35,994		12,977	609,278	254,071	
1991	891,803	244,827	82,374	248,328	30,294		10,353	616,176	275,626	
1992	1,016,047	321,425	78,249	286,374	22,977		9,845	718,869	297,178	
1993	1,178,561	401,637	109,221	313,628	20,582		6,716	851,784	326,777	
1994	1,183,821	339,616	117,105	351,141	26,489		8,254	842,605	341,217	
1995	1,254,863	352,883	126,558	345,194	24,978		9,265	858,878	395,985	
1996	1,263,270	362,480	136,523	321,274	32,338		13,238	865,852	397,418	
1997	1,305,229	356,666	157,214	332,165	29,816		14,092	889,952	415,277	
1998	1,314,251	324,687	152,722	340,261	40,603		14,713	872,986	441,265	
1999	1,440,058	370,355	162,251	424,217	40,349		15,647	1,012,819	427,239	
2000	1,421,043	343,449	140,223	418,813	40,181		11,788	954,454	466,589	
2001	1,356,688	321,956	130,582	409,407	46,096		14,435	922,476	434,213	
2002	1,471,253	347,988	150,437	481,910	37,002		1	1,029,351	441,902	
2003	1,579,067	455,961	140,283	480,757	28,662		14	1,115,244	463,823	
2004	1,655,454	527,602	149,548	455,303	29,796			1,174,542	480,913	
2005	1,736,245	510,768	137,434	555,012	29,196		8	1,246,666	489,579	
2006	1,729,262	424,909	132,342	615,732	29,732		48	1,214,193	515,069	
2007	1,536,270	324,212	137,838	465,527	38,528		82	976,151	560,118	
2008	1,492,609	320,922	122,161	438,289	35,766		10	925,953	566,656	
2009	1,491,614	266,608	118,096	437,713	38,019			869,101	622,513	
2010	1,499,669	301,553	85,104	423,906	43,902			862,184	637,485	
2011	1,547,121	328,703	92,397	383,124	33,573		0	845,239	701,882	
2012	1,636,358	400,096	119,769	338,712	33,338		0	900,045	736,313	
2013	1,723,403	408,008	111,770	433,283	33,720		0	993,800	729,603	
2014	1,703,503	414,341	96,159	424,866	40,091			980,832	722,671	

	1	2	3	4	5	6	7	8	9	10	11	12
	Aus	Bhr	BGD	BLZ	CHN	TWN	COM	DJI	TMP	EGY	ERI	EUBGR
1950	100	90					234					
1951	100	90					234					
1952	200	90					117					
1953	500	90					117					
1954	600	100				492	117					
1955	400	100				1,515	234					
1956	600	102				2,905	234					
1957	1,100	118				3,596	117					
1958	1,100	98				5,421	117					
1959	2,200	88				6,713	117					
1960	2,500	84				5,819	117					
1961	3,400	200				7,581	117					
1962	3,800	198				7,323	117					
1963	4,148	191				8,716	117					
1964	6,234	221				8,418	117					
1965	4,905	141				6,241	117					
1966	6,209	290				9,534	175					
1967	3,602	294				8,809	175					
1968	3,204	189				41,360	234					
1969	3,835	241				42,146	234					
1970	2,603	92				39,486	561					
1971	3,236	131				29,832	970					
1972	4,985	114				29,657	1,379					
1973	7,347	77				24,889	1,787					
1974	7,955	69				32,359	2,196					
1975	5,760	109				20,927	2,604					
1976	8,193	158				21,620	3,012					
1977	9,739	47				29,443	3,419			30		
1978	7,125	85				28,085	3,827			14		
1979	6,847	44				31,343	4,234			175		2
1980	9,896	66				30,855	4,641			239		
1981	13,172	109				30,498	5,049			327		
1982	20,717	121				43,363	5,455			292		
1983	17,712	123				41,109	5,862	79		300		
1984	15,990	165				37,436	6,269	118		6		
1985	14,839	59	95			34,478	6,675	110		32		
1986	13,625	77	67			75,364	7,082	133		68		
1987	12,328	54	16			82,071	7,488	108		53		
1988	11,022	169	60			82,638	7,894	58		16		
1989	6,280	84	60			72,026	8,301	48		49		
1990	6,144	45	60			91,862	8,301	77		86		
1991	5,188	25	40			92,960	8,301	59		144		
1992	9,120	161	30			110,342	8,629	64		188		
1993	6,733	161	40			165,644	8,956	70		427		
1994	5,507	161	50			94,851	9,575	75		313		
1995	4,835		50		444	96,614	9,147	82		168	50	
1996	6,009		40		1,497	99,477	8,910	80		521	225	
1997	7,367		50		2,964	91,975	8,664	75		949	257	
1998	7,793		60		3,080	110,169	8,427	75		1,068	343	
1999	13,243		60		5,975	99,153	8,150	75	2	496	314	
2000	10,674		60		6,409	98,131	7,946	75	6	684	260	
2001	11,112		500	9,242	5,722	116,109	7,652	75	6	583	412	
2002	8,851		1,000	24,329	4,922	125,458	7,409	75	6	731	313	
2003	8,434		1,500	1,375	7,873	126,179	7,146	75	6	986	244	
2004	6,315		1,932	1,207	13,070	139,653	6,884	75	6	849	263	
2005	6,565		1,143	1,078	14,074	132,839	6,622	65	6	856	94	
2006	8,887		2,738	847	13,656	94,155	6,361	65	6	669	240	
2007	5,635		2,316	1,235	10,639	90,184	6,101	80	6	1,043	928	
2008	5,831		1,559	590	6,589	66,239	5,842	292	6	341	1,085	
2009	5,907		1,548	252	3,941	70,891	5,583	182	6	341	1,213	
2010	5,375		2,350	195	7,649	57,851	5,311	266	6	621	837	
2011	4,873		2,539	200	2,088	53,763	5,026	345	6	407	781	
2012	5,244		3,038	583	5,142	76,149	4,508	408	6	489	217	
2013	4,839		3,038	111	7,220	65,426	5,064	408	6	489	217	
2014	4,312		3,038	428	7,199	61,291	6,217	408	6	489	217	
	422,900	5,522	29,077	41,671	130,154	3,411,435	272,597	4,279	92	15,540	8,510	2

13	14	15	16	17	18	19	20	21	22	23	24	
EU FRA	EUMYT	EUREU	EU DEU		EUPRT	EUESP	EUGBR	EU TOTAL	GIN	IND	IDN	IRN
		100						100		14,469	995	939
		100						100		8,515	5,737	939
		100						100		7,678	6,236	939
		100						100		5,972	6,330	939
		100						100		9,006	7,815	939
		100						100		10,362	7,815	939
		100						100		17,293	8,291	872
		100						100		12,695	7,918	872
		100						100		11,660	7,910	872
		100						100		10,304	7,918	872
		100						100		14,368	7,815	872
		100						100		19,527	8,383	872
		100						100		13,606	10,383	872
		100						100		14,138	10,581	872
		100						100		17,140	10,778	751
		100						100		13,562	11,363	804
		100						100		13,545	13,149	811
		200						200		14,108	13,364	872
		300						300		17,047	13,347	1,073
		300						300		15,478	13,836	925
		400						400		16,834	12,118	1,215
		500						500		25,052	11,748	676
		500						500		28,094	14,645	1,241
		400						400		26,848	16,950	1,491
		482						482		32,629	19,937	3,134
		359						359		32,334	29,160	3,226
		384						384		42,050	32,543	4,764
		323						323		36,608	38,494	4,663
		446	2					448		37,498	41,911	3,208
		394	1					397		58,570	39,735	3,595
		329						329		49,285	44,795	3,034
369		309				542		1220.01999		47,178	50,129	3,960
2,018		241						2259.00999		58,448	66,399	5,897
20,089		231				69		20389.00001		54,223	64,205	12,713
66,557		221				18,802		85580.2596		59,413	66,810	13,218
73,976		182				38,534		112691.561		68,433	69,474	15,515
86,746		191				40,959		127895.619		71,116	69,552	15,829
89,560		215				59,097		148872.419		64,593	73,489	15,987
102,288		264				91,501		194053.09		70,243	91,255	22,285
85,068		250				110,848		196166.139		80,378	102,970	26,032
78,923		250				96,573		175745.809		71,035	83,242	24,594
83,838		357				92,909		177103.509		77,480	97,428	26,448
95,555		602				89,629		185785.924		89,922	97,719	35,352
93,057		987				105,609		199652.628		86,476	138,185	40,338
99,908		1,576				113,190		214674.604		88,180	157,499	54,997
95,918	333	1,576				147,544		245370.932		99,135	164,073	83,949
82,933	553	2,694				139,164		225344.315		91,751	213,960	67,426
70,866	601	2,841				141,558		215866.352		95,924	233,298	67,129
59,571	1,639	3,392			110	110,221		174933.678		113,454	222,604	66,522
82,135	1,363	3,272			241	144,609		231620.231		106,845	241,890	90,495
84,824	782	3,404			216	142,013		231238.607		109,480	225,482	106,130
76,589	737	3,300			642	126,681		207948.639	30	102,032	223,150	106,278
98,562	947	1,958			859	160,244		262569.906	585	116,222	206,118	117,712
108,333	707	1,997			953	181,057		293046.132	372	112,540	198,473	138,387
107,410	1,084	2,492			956	159,605	388	271934.874	1,174	128,297	225,602	160,407
106,957	1,158	3,769			1,134	188,640	596	302254.916	872	122,520	270,697	178,007
101,560	813	3,013			2,471	206,860	1,170	315887.363	703	148,255	239,436	206,980
78,636	810	3,525			2,202	118,629	1,102	204904.388	694	158,607	300,931	153,175
85,013	841	2,660			581	128,616	1,174	218885.071	630	152,889	295,270	143,632
69,510	837	2,135			616	116,016	1,034	190148.057	552	150,076	332,349	158,688
65,455	840	2,284			1,205	134,385	660	204828.737	443	140,963	339,921	163,991
69,504	850	2,445			957	134,010	727	208494.314		157,305	359,535	183,497
66,157	865	2,152			789	113,820	772	184554.01		181,262	370,009	207,547
65,740	865	2,200			1,204	152,971	638	223618.357		185,559	402,933	209,641
59,415		2,352			1,481	139,201	636	203083.942		187,354	368,474	248,661
2,613,040	16,626	66,354	3	0	16,618	3,744,106	8,896	6,465,644	6,056	4,293,863	7,144,557	3,219,506

Appendix 5

Landings Data – IOTC Database

25	26	27	28	29	30	31	32	33	34	35	36
ISR	JPN	JOR	KEN	KOR	KWT	MDG	MYS	MDV	MUS	MOZ	MMR
						1,246	1,100	11,000			
						1,323	800	11,000			
	5,231					1,403	800	11,000			
	15,420					1,484	800	12,500			
	38,363					1,568	800	12,500			
	65,672					1,655	800	13,000			
	101,043					1,744	800	13,000			
	69,349					1,835	800	13,000			
	55,356					1,878	800	13,000			
	98,028					1,999	800	13,000			
	140,937					2,123	900	11,000			
	132,387					2,215	1,100	11,000			
	119,309					2,309	1,277	11,000			
	99,274					2,405	1,000	11,000			
	96,970					2,503	2,100	11,000			
600	96,762			800		2,603	2,700	17,600			
200	119,259			961		2,705	3,100	21,400			
100	134,306			7,194		2,867	2,900	24,100			
	140,874			13,196		3,033	2,900	22,700			
	98,685			21,612		3,203	2,600	25,000			
	61,374			11,807		3,426	2,492	33,371			
	57,812			16,434		3,655	1,739	32,429			
	47,884			20,596		3,711	1,992	23,135			
	37,519			29,232		9,268	1,000	32,471			
	44,726			41,216	87	15,424	1,589	32,934			
	34,714		40	47,497	135	5,680	2,589	23,082			
	32,294		191	43,209	144	4,020	1,713	27,718			
	27,507		314	65,792	148	4,161	6,682	22,475	2		
	34,432		110	70,779	161	4,305	7,919	19,766	39		
	23,831		81	45,808	20	4,524	7,443	24,757	41		
	31,508		406	37,848	19	4,747	9,641	30,074	1,029		
	31,090		886	35,812	24	4,975	7,831	29,031	1,764		
21	35,402		1,247	42,361	96	5,208	8,483	23,858	2,536		
45	50,919		1,489	36,876	65	5,445	7,970	32,205	2,848		
50	45,782		855	24,544	30	5,687	6,287	44,996	4,186		
100	50,520		916	28,115	14	5,934	8,659	53,878	3,965		
	45,100		979	30,628	76	5,999	9,833	54,337	3,636		
	41,623		1,302	30,904	116	6,061	14,346	53,431	7,033		
40	38,519		974	34,462	53	6,151	8,880	67,967	7,472		
	29,716		1,166	23,597	102	6,236	10,461	67,695	9,035		
	38,348		1,426	20,335	131	6,318	8,881	72,241	6,849		
	41,445		1,765	6,458	4	6,358	9,646	70,867	11,032		
36	66,575		1,503	10,514	125	6,391	13,847	73,114	9,614		
	64,437		1,511	10,811	162	6,420	9,848	77,875	10,643		
	65,855		1,523	14,913	119	6,590	7,314	89,211	8,123		
	57,574		1,439	10,906	224	6,753	6,773	89,508	6,530		
	51,466		1,418	18,772	257	6,910	9,509	89,216	3,144		
	57,529		1,481	18,100	279	7,062	10,079	86,622	5,541		
	55,889	70	1,459	8,408	290	7,208	14,246	100,424	3,742		
	45,900	95	1,497	3,836	338	7,348	11,913	112,250	4,333		
	42,432	91	1,535	6,945	448	7,483	14,804	97,755	1,581		
	39,862	110	1,542	4,023	338	7,674	12,117	108,753	1,228		
	39,410	120	1,490	1,259	311	7,858	19,503	143,699	1,355		
	37,016	106	1,469	3,840	167	8,081	18,491	135,223	1,833		
	39,541	96	1,560	7,735	261	8,201	16,578	138,283	1,978		
	51,451	111	1,008	6,957	187	8,955	17,831	161,380	1,856	0	
	52,356	110	852	7,369	161	8,666	22,418	166,547	2,007	1	
	54,895	107	644	5,848	131	8,703	25,179	125,048	1,423	0	
	38,966	105	983	2,762	131	8,704	22,835	116,915	1,222	2,781	7,738
	26,724	138	920	2,972	131	8,505	25,038	95,047	824	2,783	12,894
	16,302	100	670	2,085	131	8,755	28,533	101,890	833	3,945	12,894
	16,678	100	617	1,532	131	8,691	26,621	97,364	664	4,810	12,894
	16,458	100	464	4,704	131	8,671	29,730	100,674	265	5,676	12,894
	15,202	100	600	14,570	131	8,654	25,192	124,681	1,162	5,378	12,894
	16,260	100	1,163	19,422	131	8,633	21,664	123,035	9,046	5,384	12,894
1,192	3,478,067	1,759	41,496	976,356	6,140	350,309	585,017	3,716,031	140,414	30,758	85,102

	37	38	39	40	41	42	43	44	45	46	47	48
OMN	PAK	PHL	QAT	SAU	SEN	SYC	ZAF	SUN	LKA	SDN	TZA	
	2,729	2,145							4,210			
	2,729	2,145							6,258			
	3,411	2,145							4,951			
	3,411	3,267							3,644			
	3,411	3,369							3,281			
	3,411	3,472							2,918			
	2,729	3,267							3,543			
	2,729	8,373							4,179			
	2,729	4,187							4,670			
	3,411	4,187							5,162			
	2,729	5,104							6,186			
	2,729	4,596							7,210			
	2,729	7,250							11,174			
	2,729	10,723						242	15,138			
	2,729	14,909						1,868	14,188			
	3,070	16,133						1,857	13,237			
	3,070	21,545						1,151	16,624			
	3,752	20,933						397	19,940			
	3,752	21,034						5,652	21,479			
	3,752	18,992						1,373	23,019			
	3,411	17,255				300		4,554	17,786			2,019
	3,752	13,990				300		3,740	12,554			2,601
	4,092	20,195				300		3,410	18,957			2,524
	4,435	14,800				500		2,640	22,656			1,695
	14,382	17,956				550		1,540	20,314			1,990
	16,933	17,958				360		583	16,878			2,090
	19,137	17,693				260		308	28,239			3,817
	20,297	17,987				220		524	27,357			5,252
	22,180	13,270				360		552	30,139			2,948
	20,467	23,194				435	71	37	28,894			1,949
	25,328	8,557				831	101	64	36,519			1,368
	23,984	16,508			890	1,359	136	485	39,190			2,129
	17,633	19,354		193	748	966	141	429	38,592			4,201
	7,870	12,620		170	1,093	513	460	891	35,568			2,607
	23,074	11,644		338	1,233	816	469	2,575	28,288			1,774
	30,585	16,047		324	8,289	596	11	1,827	30,584			2,670
	25,935	19,549		127	9,128	336	1	5,575	31,178			2,715
	52,272	24,256		115	9,120	286	3	9,101	32,736			1,592
	64,736	32,365		143	9,629	160	14	7,660	34,015			2,405
	40,052	32,767		213	9,473	238	10	6,223	36,859			2,650
	32,877	28,354		562	8,934	228	164	6,782	42,348			3,785
	18,798	39,386		716	9,285	2,538	94	8,927	47,792			2,492
	25,180	52,167		766	10,215	1,167	76		55,482			2,600
	24,077	59,475		636	11,087	173	130		65,679			1,663
	30,828	40,015		406	11,774	201	26		82,178			2,306
	35,818	40,240		255	7,387	166	45		80,391			1,930
	26,269	40,714		307	6,357	458	13		91,293			2,179
	25,912	41,672		411	6,892	9,213	105		106,334			2,300
	22,101	42,465	2,797	552	8,310	20,702	620		101,949	19		2,200
	18,494	49,324	1,732	496	7,525	29,533	293		118,475	24		2,280
	19,560	42,754	1,717	768	6,805	28,123	373		119,093	19		3,264
	20,656	35,783	1,404	1,019	8,346	45,373	588		106,596	34		2,662
	17,892	31,150	1,356	963	7,616	55,157	1,502		107,859	34		2,801
	24,498	35,557	3,366	1,971	7,978	220	81,808	1,838	142,340	34		2,169
	40,385	37,642	3,121	1,511	6,792	132	96,156	344	151,163	34		2,877
	35,812	37,153	4,496	1,944	7,841	89	103,727	318	113,786	34		3,580
	32,913	42,950	3,792	2,253	8,541	703	87,678	539	122,638	34		4,999
	33,868	44,605	3,617	2,068	7,632		59,467	542	130,067	34		4,218
	36,315	50,265	3,202	2,931	7,224		63,308	600	133,110	34		4,704
	24,687	50,159	994	1,982	8,359		74,979	541	132,202	34		4,680
	21,748	50,600	705	2,442	7,094		82,303	766	149,028	34		5,745
	30,084	58,060	210	2,568	6,796		70,452	926	139,542	34		6,302
	36,838	58,406	2,744	2,366	6,946		64,442	901	136,951	34		10,296
	34,523	58,406	1,415	2,366	6,946		67,328	664	136,092	34		9,508
	28,531	58,406	762	2,366	6,946		68,877	307	134,678	34		5,460
	1,200,964	1,671,446	37,430	36,248	249,231	1,145	1,123,243	13,731	80,967	3,505,379	532	147,996

49	50	51	52	53	54	55	56	57	58	59	Total
THA	GBRT	ARE	n.a.	VUT	YEM	NEICE	NEIDN	NEIFR	NEIPS	NEISU	
		1,300			1,915						42,571
		1,300			1,915						43,184
		1,300			2,393						47,994
		1,300			2,393						58,268
		1,700			2,393						86,554
		1,700			2,393						116,486
		1,700			1,915						160,138
		2,200			1,915						130,896
		2,200			1,915						114,012
		3,300			2,393						160,591
		3,300			1,915						205,869
		3,300			1,915						206,631
		3,900			1,915						197,261
		3,900			1,915						187,188
		3,900			1,915						195,840
		4,200			2,154						198,952
		4,200			2,154						240,183
		4,400			2,393						264,706
		4,400			2,393						318,167
		4,400			2,393						282,025
673		3,200			1,915						236,893
1,655		3,400			2,154						228,361
1,459		3,400			2,393						234,663
2,486		3,400			2,633						244,525
1,526		5,400			5,408						303,803
3,266		5,400			6,367						278,051
3,359		5,200			7,196						307,221
3,707		5,200			7,632						338,025
3,410		5,200			8,313						346,083
4,255		5,200			7,655						343,602
2,816		5,200			9,590						348,788
4,567		4,080			7,200						363,582
11,543		13,580			6,526						436,069
9,614		10,989			3,719				1,073		441,765
8,672		10,989			10,077				17,181		534,552
7,599		9,347			10,583			264	18,394		611,623
5,729		13,936			10,546		146	3,706	13,821		673,824
16,676		13,151			10,684			3,732	10,768		744,367
7,214		14,145			11,051			5,186	9,906	15,765	858,604
7,604		14,524			10,999	15,197	20,012	8,684	12,954		858,861
9,850		14,523			13,679	21,329	24,394	14,166	24,063	1,541	863,302
17,105		13,934			14,032	18,428	24,979	15,853	24,586	15,753	907,450
15,820		14,384			14,809	21,421	30,160	16,923	20,139	18,430	1,018,771
16,383		13,444			13,774	21,571	24,324	44,535	34,876	14,372	1,174,587
12,331		16,162			15,901	31,604	31,737	27,426	47,116	34,305	1,203,846
19,022		16,764			20,527	23,344	17,200	28,362	45,372	27,586	1,248,035
19,352		17,257			22,078	24,666	7,253	42,520	38,878	22,303	1,257,829
18,448		16,629			24,597	29,811	7,741	28,873	52,732	17,624	1,300,503
22,616		17,062			27,116	24,038	641	45,975	57,114	33,054	1,329,596
13,598		17,641			29,635	22,122	84	42,972	66,905	33,662	1,440,622
18,338		12,739			32,154	20,349		36,950	74,662	30,741	1,418,056
14,981		13,892			34,673	1,808		22,814	48,712	9,659	1,335,497
15,702	29	7,377			37,192	6,026		21,830	55,681	42,256	1,503,729
18,752	29	10,398			33,144	8,464		13,466	47,795	33,782	1,570,470
18,062	29	8,511			42,230	10,384		14,491	15,742	20,440	1,641,947
32,507	29	7,937			38,800	12,129		19,079	9,055	3,915	1,719,660
45,246	21	7,869			32,314	15,180		9,407	8,819		1,725,270
33,020	24	6,040			28,504	13,403		5,548	5,104		1,536,215
27,793	2	4,137			25,719	16,640		6,304	7,331		1,492,440
30,560	22	10,075		298	27,808	9,765		10,665	6,068		1,491,530
16,900	10	10,653		239	30,000	6,022		8,591			1,499,624
23,793	22	10,056			39,313	5,798		4,182			1,547,096
17,241	5	10,040		331	54,583	5,538		9,613			1,636,197
12,560	5	10,040			54,583	6,228		5,414			1,723,242
11,876	2	10,040			54,583	6,624		4,939			1,703,342
609,687	226	510,444	0	869	946,992	397,889	193,856	527,187	780,706	359,424	47,279,636

Appendix 6

Landings Data – IOTC Database (India, Sri Lanka, Maldives)

INDIA										
Year	All tuna	Principal tuna						S.Total	Other tuna	
	Total	YFT	BET	SKJ	ALB	BF	SBF	S.Total	S.Total	
1950	14,469	630		393				1,023	13,446	
1951	8,515	192		384				576	7,939	
1952	7,678	169		383				552	7,125	
1953	5,972	193		382				575	5,397	
1954	9,006	338		384				722	8,284	
1955	10,362	503		387				890	9,472	
1956	17,293	598		390				988	16,305	
1957	12,695	681		391				1,072	11,623	
1958	11,660	805		389				1,194	10,466	
1959	10,304	336		381				717	9,587	
1960	14,368	713		386				1,099	13,269	
1961	19,527	1,017		661				1,678	17,849	
1962	13,606	642		123				765	12,841	
1963	14,138	733		475				1,208	12,930	
1964	17,140	1,132		410				1,542	15,598	
1965	13,562	607		267				874	12,688	
1966	13,545	768		191				959	12,586	
1967	14,108	1,174		277				1,451	12,657	
1968	17,047	629		422				1,051	15,996	
1969	15,478	573		591				1,164	14,314	
1970	16,834	594		515				1,109	15,725	
1971	25,052	883		697				1,580	23,472	
1972	28,094	903		496				1,399	26,695	
1973	26,848	1,225		928				2,153	24,695	
1974	32,629	1,489		1,147				2,636	29,993	
1975	32,334	1,549		1,662				3,211	29,122	
1976	42,050	2,200		1,204				3,404	38,646	
1977	36,608	1,702		1,095				2,797	33,811	
1978	37,498	3,277		1,773				5,050	32,448	
1979	58,570	3,683		2,396				6,079	52,491	
1980	49,285	3,393		1,557				4,950	44,336	
1981	47,178	3,061		1,895				4,956	42,222	
1982	58,448	4,403		2,532				6,935	51,513	
1983	54,223	1,926	0	2,946				4,872	49,351	
1984	59,413	2,629	0	3,710				6,339	53,074	
1985	68,433	7,250	1	3,429				10,679	57,754	
1986	71,116	3,280	2	4,276				7,558	63,558	
1987	64,593	5,604	1	5,761				11,366	53,226	
1988	70,243	3,032	0	5,071				8,104	62,139	
1989	80,378	4,408	0	6,022				10,431	69,948	
1990	71,035	6,097	0	5,799				11,896	59,140	
1991	77,480	4,309	0	6,317				10,626	66,854	
1992	89,922	3,096	0	7,302				10,398	79,523	
1993	86,476	6,340	4	7,701				14,046	72,430	
1994	88,180	5,161	0	7,685				12,846	75,334	
1995	99,135	8,542	5	8,569				17,116	82,019	
1996	91,751	6,779	1	8,617				15,396	76,354	
1997	95,924	6,575	1	8,088				14,664	81,260	
1998	113,454	7,510	9	10,841				18,361	95,093	
1999	106,845	8,978	6	9,851				18,835	88,010	
2000	109,480	6,772	4	9,279				16,055	93,426	
2001	102,032	4,256	0	9,565				13,821	88,211	
2002	116,222	7,208	279	9,422				16,908	99,314	
2003	112,540	6,788	304	10,630				17,722	94,818	
2004	128,297	11,542	4,233	11,697	151			27,623	100,674	
2005	122,520	15,657	2,509	13,970	151			32,288	90,232	
2006	148,255	17,577	4,648	18,375	156			40,755	107,499	
2007	158,607	21,430	3,880	18,039	226			43,575	115,032	
2008	152,889	16,349	1,716	22,060	110			40,235	112,654	
2009	150,076	15,842	4,743	15,591	163			36,339	113,737	
2010	140,963	21,215	2,990	17,805	198			42,208	98,755	
2011	157,305	22,343	3,207	16,698	236			42,484	114,821	
2012	181,262	32,187	4	23,865	0			56,056	125,206	
2013	185,559	34,618	0	34,288				68,906	116,652	
2014	187,354	33,427		32,136				65,563	121,791	

Sri Lanka										
Year	All tuna	Principal tuna								Other tuna
	Total	YFT	BET	SKJ	ALB	BF	SBF	S.Total		S.Total
1950	4,210	524		1,380				1,904		2,306
1951	6,258	783		2,064				2,847		3,410
1952	4,951	609		1,605				2,214		2,737
1953	3,644	437		1,151				1,589		2,056
1954	3,281	409		1,077				1,486		1,795
1955	2,918	380		1,000				1,380		1,537
1956	3,543	502		1,323				1,825		1,718
1957	4,179	945	102	1,350				2,398		1,781
1958	4,670	1,025	111	1,465				2,601		2,070
1959	5,162	1,106	120	1,581				2,807		2,355
1960	6,186	1,437	156	2,054				3,647		2,540
1961	7,210	1,769	191	2,527				4,487		2,724
1962	11,174	2,663	288	3,805				6,756		4,418
1963	15,138	3,559	385	5,085				9,030		6,109
1964	14,188	3,444	373	4,920				8,737		5,451
1965	13,237	3,328	360	4,755				8,443		4,795
1966	16,624	2,959	235	5,039				8,232		8,392
1967	19,940	3,254	258	5,543				9,055		10,885
1968	21,479	3,686	292	6,278				10,256		11,223
1969	23,019	4,119	327	7,015				11,460		11,558
1970	17,786	3,237	257	5,512				9,006		8,781
1971	12,554	2,354	187	4,010				6,551		6,003
1972	18,957	3,890	308	6,625				10,823		8,133
1973	22,656	4,727	375	8,050				13,151		9,505
1974	20,314	4,147	329	7,062				11,538		8,777
1975	16,878	3,286	261	5,597				9,143		7,734
1976	28,239	5,993	475	10,208				16,676		11,562
1977	27,357	5,775	458	9,836				16,069		11,288
1978	30,139	6,472	513	11,022				18,007		12,132
1979	28,894	5,863	465	9,986				16,313		12,581
1980	36,519	8,310	547	11,778				20,635		15,884
1981	39,190	9,631	634	13,651				23,916		15,274
1982	38,592	9,022	911	13,097				23,030		15,562
1983	35,568	8,389	847	12,179				21,415		14,153
1984	28,288	6,498	656	9,434				16,588		11,700
1985	30,584	7,104	717	10,313				18,134		12,450
1986	31,178	7,141	672	10,862				18,675		12,502
1987	32,736	7,508	697	11,519				19,724		13,012
1988	34,015	7,808	725	11,979				20,512		13,503
1989	36,859	8,450	747	13,441				22,637		14,222
1990	42,348	9,460	843	16,342				26,646		15,702
1991	47,792	11,277	919	18,747				30,943		16,850
1992	55,482	13,347	1,019	22,462				36,829		18,653
1993	65,679	15,489	1,115	26,333				42,937		22,742
1994	82,178	19,681	1,297	32,433				53,411		28,766
1995	80,391	18,436	2,118	30,673				51,226		29,165
1996	91,293	22,757	1,636	35,969				60,362		30,931
1997	106,334	27,302	2,035	39,285				68,622		37,712
1998	101,949	26,833	2,005	38,573				67,411		34,539
1999	118,475	32,945	1,788	51,769				86,502		31,973
2000	119,093	28,217	1,576	56,486				86,279		32,813
2001	106,596	23,857	1,424	51,232				76,513		30,082
2002	107,859	26,048	1,500	49,038				76,586		31,273
2003	142,340	37,678	2,123	66,702				106,503		35,837
2004	151,163	39,628	2,101	69,030				110,759		40,404
2005	113,786	32,826	1,613	49,262				83,701		30,085
2006	122,638	38,915	1,816	48,846				89,577		33,061
2007	130,067	32,570	1,843	61,645		1		96,059		34,008
2008	133,110	32,139	1,779	65,717				99,635		33,475
2009	132,202	34,587	1,627	64,080				100,294		31,908
2010	149,028	39,949	2,145	68,704				110,797		38,231
2011	139,542	30,215	2,446	67,059				99,720		39,822
2012	136,951	37,520	2,614	60,723				100,857		36,095
2013	136,092	32,231	2,405	66,691				101,327		34,765
2014	134,678	37,775	3,620	61,719				103,113		31,565

Maldives										
Year	All tuna	Principal tuna								Other tuna
	Total	YFT	BET	SKJ	ALB	BF	SBF	S.Total	S.Total	
1950	11,000	1,500		8,000				9,500		1,500
1951	11,000	1,500		8,000				9,500		1,500
1952	11,000	1,500		8,000				9,500		1,500
1953	12,500	1,500		9,000				10,500		2,000
1954	12,500	1,500		9,000				10,500		2,000
1955	13,000	2,000		9,000				11,000		2,000
1956	13,000	2,000		9,000				11,000		2,000
1957	13,000	1,931	69	10,000				12,000		1,000
1958	13,000	1,931	69	10,000				12,000		1,000
1959	13,000	1,931	69	10,000				12,000		1,000
1960	11,000	966	34	9,000				10,000		1,000
1961	11,000	1,449	51	8,000				9,500		1,500
1962	11,000	1,449	51	8,000				9,500		1,500
1963	11,000	1,449	51	8,000				9,500		1,500
1964	11,000	1,449	51	8,000				9,500		1,500
1965	17,600	966	34	14,100				15,100		2,500
1966	21,400	1,449	51	16,900				18,400		3,000
1967	24,100	1,642	58	18,900				20,600		3,500
1968	22,700	1,642	58	17,500				19,200		3,500
1969	25,000	1,738	62	19,600				21,400		3,600
1970	33,371	2,534	81	28,234				30,849		2,522
1971	32,429	1,560	51	28,489				30,100		2,329
1972	23,135	2,691	58	17,819				20,567		2,567
1973	32,471	7,170	130	19,999				27,299		5,172
1974	32,934	5,344	124	22,949				28,417		4,517
1975	23,082	4,900	100	15,192				20,192		2,891
1976	27,718	5,717	142	19,063				24,922		2,795
1977	22,475	5,326	160	13,970				19,456		3,019
1978	19,766	4,276	119	13,433				17,828		1,938
1979	24,757	5,128	132	17,587				22,847		1,909
1980	30,074	5,082	105	22,649				27,836		2,239
1981	29,031	6,251	230	20,060				26,541		2,489
1982	23,858	4,814	98	15,460				20,372		3,486
1983	32,205	7,981	165	19,477				27,623		4,582
1984	44,996	8,486	368	32,668				41,522		3,474
1985	53,878	7,136	317	42,452				49,905		3,973
1986	54,337	6,353	213	45,473				52,039		2,298
1987	53,431	7,595	318	42,909				50,822		2,608
1988	67,967	6,218	317	58,546				65,081		2,886
1989	67,695	5,776	306	58,145				64,227		3,468
1990	72,241	5,140	294	61,426				66,860		5,382
1991	70,867	7,227	484	58,898				66,609		4,259
1992	73,114	8,309	388	58,577				67,274		5,840
1993	77,875	9,605	505	58,740				68,850		9,025
1994	89,211	12,621	506	69,410				82,537		6,674
1995	89,508	12,031	473	70,372				82,876		6,632
1996	89,216	11,811	630	66,502				78,943		10,273
1997	86,622	12,489	540	69,015				82,044		4,578
1998	100,424	13,566	606	78,410				92,582		7,842
1999	112,250	13,261	1,007	92,888				107,156		5,094
2000	97,755	11,625	560	79,683				91,867		5,888
2001	108,753	13,656	923	88,044				102,623		6,130
2002	143,699	20,602	1,323	115,321				137,246		6,453
2003	135,223	18,825	1,285	108,329				128,439		6,784
2004	138,283	21,394	1,189	109,748				132,332		5,951
2005	161,380	20,513	1,047	132,060				153,620		7,760
2006	166,547	21,772	1,111	138,458				161,341		5,206
2007	125,048	20,663	932	96,861				118,455		6,592
2008	116,915	22,609	1,102	87,072				110,783		6,131
2009	95,047	19,611	1,004	66,189				86,803		8,243
2010	101,890	21,068	768	73,721				95,557		6,334
2011	97,364	34,941	634	57,672				93,247		4,117
2012	100,674	44,261	716	53,392				98,369		2,305
2013	124,681	45,857	2,269	74,422		3		122,551		2,130
2014	123,035	49,208	3,199	68,498		12		120,917		2,118

Appendix 7. Market, Price and Trade Data - Principal market tuna

Imports, Fresh and frozen tuna (USD Millions)				(Source: FAO, Globefish, 2015)									
Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011			
1	Japan	1924.2	1894.4	2163.1	1955.5	1982.9	1855.1	2154.5	1998.9	1949.3	2308.1		
2	Thailand	454	510.9	577.9	740.1	825.6	958	1413.5	1040.4	1149.4	1417.9		
3	Spain	270.9	253.2	230.6	274.2	263.3	357.9	386.1	316.8	343	477.6		
4	USA	252.9	286.5	285.7	305.9	295.8	451.9	431.1	430.6	459.8	440.8		
5	Ecuador	21.9	25	15.3	0.5	1.1	47.4	222.8	209.2	207.7	273.4		
6	Mauritius	41.2	32.2	53.3	63.2	108.9	129.2	205.2	122.6	142.2	205.4		
7	Italy	58.5	84.5	63.8	68.2	66.7	78.8	82	65.4	90.1	121.8		
8	Vietnam	0.4	6.2	6.6	20.8	34.6	61	75.4	60.4	90.4	118.4		
9	Korea Rep.	33.4	33.7	31.1	43	51.9	72.2	88	82.1	65.6	116.4		
10	France	52.1	61	60.7	64.6	74.2	90.6	98.8	98.4	98.7	101.9		
11	Seychelles	22	65	73.8	76.8	93.8	79	59.9	85.1	74	93		
12	Fiji	7.6	25.5	20.5	17	10.2	5.2	7.9	6.6	19.3	80.5		
13	Mexico	0.1	0.3	30.8	7.1	29.2	41.2	58.2	13.2	40.5	62.3		
14	Philippines	17	32.6	12.2	38.6	31	49.4	59	76.7	53.1	59.9		
15	China	3	4.8	18.2	7.8	23.5	17.2	26.9	37.6	30.6	53.3		
16	Portugal	18.6	17.3	12.6	18.4	24.4	33.6	37.1	39.5	30.1	41.6		
17	Iran	6.7	25.5	11.9	12.2	5.2	9.5	11.8	21.3	59.1	40.9		
18	Canada	12.8	12.2	16.2	18.9	20.3	22.7	24.9	23.6	28.4	39.2		
19	Madagascar	13.4	16	13.4	12.6	30.5	54.4	23.4	16.7	24.5	37.3		
20	Indonesia	0.8	1.3	3.4	0.2	5.2	2.5	18.7	15.1	26.7	35.8		
21	Belgium	4.6	9.8	12.4	13.3	11	19.9	23.5	22.9	26	34.8		
22	Cote D'Ivoire	79.4	71.7	61.3	43.9	65	83.2	100.3	73.8	37.8	34.6		
23	Others	191.2	200.6	224.1	288.4	311.1	393.7	379.1	459.3	475.3	511		
24	EU total	404.7	425.8	380.1	438.7	439.6	580.8	627.5	543	587.9	777.7		
	Total		3654.4	3985.6	4091.3	4365.2	4913.6	5988.1	5316.2	5521.6	6705.9		

Imports, Canned tuna (USD Millions)				(Source: FAO, Globefish, 2015)									
Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011			
1	USA	503.6	606.8	655	710.1	733.9	702.8	876.6	798.3	950.6	1038		
2	Italy	341.9	434.8	468.7	511.8	571.8	691.5	806.7	733.4	654.1	790.9		
3	France	328.2	343.8	342.9	357.9	391.6	463	551.8	531.5	450.9	568.2		
4	UK	322.8	312.9	338.7	362.4	377.7	429.4	611.1	445.7	418	511.9		
5	Spain	64.2	135.9	141	225.1	307.9	346.6	422.2	411.9	403.7	462.6		
6	Japan	129.1	138.8	165.3	183.6	180.1	201.7	299.3	239	227.6	304.8		
7	Germany	196.2	226.5	220.5	235.5	250.4	275	335.9	254.5	223.3	299.6		
8	Australia	58.4	74.1	77.2	98.1	103.6	130.9	182.7	147.3	165.6	211		
9	Netherlands	75.5	76.1	77.5	125.2	95.1	126.1	199.5	99.8	135.5	169.7		
10	Canada	79.2	75.6	91.3	95.3	103.8	106.4	137.4	125	127.9	140.1		
11	Saudi Arabia	24	20	30.2	28.4	62.8	71.4	100	76.4	95.8	119.1		
12	Colombia	14.3	17.3	23.7	36.6	32.6	51.1	89.4	75.2	91.9	109.4		
13	Egypt	20.7	22.9	20.2	42.1	45	45.9	94.8	82.9	96	108.9		
14	Venezuela	13.3	2.4	25.6	27.3	35.5	68	163.5	237	133.6	102.7		
15	Thailand	0.8	0.9	1.8	5.1	5.5	20.8	61.4	33.4	41.7	98.5		
16	Belgium	41.2	46.1	46.7	53.5	60.7	69.4	89.1	81.5	68.6	88.8		
17	Argentina	8.1	15.4	26	31.6	36.9	55.5	53.3	51.7	66.9	87.9		
18	Chile	16.3	18	21.7	26.6	34.5	38.2	52.8	38.5	61.7	87.2		
19	Portugal	20	28	27.7	29.2	37.1	51	64.5	67	62.4	72.5		
20	Libya	8	4.3	3.3	12.6	24.7	20.8	29.6	28.1	60.2	71.3		
21	Austria	20.6	21.4	25.9	28.9	32.4	40.4	56.1	51.9	43.2	65		
22	Israel	26.3	23.3	28.4	32.8	32.7	39.7	65	54.4	46.3	63.5		
23	Others	309.4	358.5	412.5	505.8	606.5	711.4	927	852	882.5	1097.1		
24	EU total	1410.6	1625.5	1689.6	1929.5	2124.7	2492.4	3136.9	2677.2	2459.7	3029.2		
	Total	2622.1	3003.8	3271.8	3765.5	4162.8	4757	6269.7	5516.4	5508	6668.7		

Exports, Fresh and Frozen Tuna (USD Millions)		(Source: FAO, Globefish, 2015)										
Country		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
1	Taiwan PC	1038.9	711.9	1127.1	965	850.3	939.3	874.3	891.2	1067.4	1232.4	
2	Spain	282	246.2	341.6	294.3	339.4	376.5	464.7	322.6	316.9	448.1	
3	Korea	270.6	219.9	245.7	221.7	223.1	263.2	269.6	284.6	344.6	365.8	
4	Indonesia	126.4	111.9	125.5	117.7	120.8	152.4	172.8	162.1	197.1	219.5	
5	Australia	191.9	176.2	132.3	135.4	130.9	166.6	132.2	107.9	123	171.3	
6	China	4.6	3.6	1.4	4.3	10	23.6	20.3	33.9	100.7	168.4	
7	France	152	185	202.2	171.7	186.3	173	300.3	154.8	154.3	164.4	
8	Japan	88.4	114.7	125.8	148.2	129.3	193.9	195.9	127.5	155.8	161.9	
9	Mexico	33.6	103	64.7	68	55.5	74.5	65.5	45.8	73.7	146.3	
10	Viet Nam	32	27.7	30.7	26.8	43.4	42.4	30.6	46.1	91.3	110.9	
11	Fiji	18.5	26	32.1	34.9	41	42.2	56.3	47.5	66.7	106.6	
12	Philippines	44.5	40.9	36.4	32.8	46.8	79.4	102.1	74.3	104.1	82.6	
13	Colombia	43	37.2	52.7	54.1	46	68.4	93.6	86.2	62.7	82.3	
14	Maldives	27.4	42	56.1	67.1	101.3	79.3	97.6	46.6	42.3	81.4	
15	PNG	31.3	53.3	43.8	0	0	0	0	81.1	0	69.1	
16	Croatia	44.9	72.2	54.5	36	90	64.8	56.5	60.2	42.8	67.7	
17	Ecuador	15	16.4	7.8	8.7	7.5	12.4	32.3	55.3	56.6	67.6	
18	USA	37.7	65.4	74.9	72.6	33.9	59.3	60.9	66.1	70.4	65	
19	Malta	37.7	31.4	11.2	6.8	61.6	44.2	87.7	11.2	78.2	60.1	
20	Thailand	10.6	15.1	24.4	25.5	36.6	51.1	57.2	52.7	33.6	47.2	
21	Sri Lanka	9.5	9.5	12.9	20.5	26.8	54	52.9	48.4	46.5	46.3	
22	New Zealand	19.2	18.7	23.7	18.7	18.1	21.8	26.9	22.2	26.9	44	
23	Others	511.3	640.1	758	826.4	784.8	923.5	1063.9	807.3	781.2	880.7	
24	EU Total	516.6	534.8	609.5	508.8	677.3	658.5	909.2	548.8	592.2	740.3	
	Total	3071	2968.3	3585.5	3357.2	3383.4	3905.8	4314.1	3635.6	4036.8	4889.6	

Exports, Canned Tuna (USD Millions)		(Source: FAO, Globefish, 2015)										
Country		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
1	Thailand	707.3	830.2	900.6	1132.4	1296.2	1386.8	1940.3	1676.8	1878.1	2274	
2	Spain	259.5	303	313.8	325.1	387.5	445.8	543	482	498	709.1	
3	Ecuador	194.6	211.2	212.9	250.9	303.4	330	485.6	334.4	322.6	563.7	
4	Indonesia	86	101.2	118.4	128.6	129.8	151.9	174.3	190.2	186.2	279.2	
5	Mauritius	67.4	71.7	80.9	107.7	157.5	196.4	212.2	211.2	247.5	264.3	
6	China	5.2	5.6	8.1	19.7	41.6	67.6	115.8	91.4	133	241.1	
7	Seychelles	161.5	194.7	169.3	178.1	187.2	187	231.5	227.3	201.1	214.5	
8	Philippines	93.2	111.8	114.1	65.4	89	125	275.7	252.6	231	209.8	
9	Viet	11.8	16.2	21.2	38	62.1	85.1	104.4	87.9	117	148.9	
10	Italy	83.3	71.9	84	95.1	102.2	128.2	142.1	131.8	109.9	121.1	
11	Cote d'Ivoire	136.4	136	154.2	96.9	120.4	155.6	176.5	135.6	104.4	91.6	
12	Netherlands	67.7	48	50.2	79.2	64.8	88.3	163.3	151.6	101.3	89.5	
13	PNG	21	26.7	29.1	43.4	37.4	50.7	76.4	56	74.1	79	
14	El Salvador	0	3.7	31.1	52	49.2	91	106.1	73.7	65	67.7	
15	German	58.9	69.7	74.3	82.5	92.1	91.6	115.2	59.4	41.7	54.2	
16	Portugal	13	9.1	20.5	19	22.5	24.3	31.2	38.6	29.1	50.2	
17	Guatemala	0.1	0.3	12.6	21.2	24.8	36.8	14.2	29	47.6	47	
18	France	54.9	69	72.3	70.2	71.4	101.9	94	81.8	38.9	46.3	
19	Madagascar	28.7	42.7	40.1	20.8	43.7	42.3	32.4	22.9	37.3	43.9	
20	Ghana	58	100	70.3	49	19.7	30.7	19.8	40	39.3	39	
21	Belgium	7.3	9.5	11.4	10.2	13.3	14.5	19.8	22.3	23.3	28.2	
22	UK	14.1	14.9	15.8	17	10.2	31.2	46.8	39.4	20.9	25.2	
23	Colombi	29	33.8	25.3	27.3	21.2	29.9	33.9	23.2	21.5	23.2	
24	Costa Rica	22.3	27.2	19.9	20.6	14.8	15.5	17.7	13.1	13.9	18.2	
25	Brazil	6.3	6.1	8.1	11.3	12.4	21.1	23.9	21.7	12.9	14.9	
26	Korea Rep	2.9	4.7	4.2	4.7	4.8	5.5	5.3	5.9	9.9	14.1	
27	Kenya	0	0	0	0	0	2.5	16.9	9.5	11.5	11.3	
28	USA	3.7	7.6	3.8	4	5.7	4.3	7.1	8.5	9	10.2	
29	Peru	2.2	3.4	5.2	6.5	4.8	6	7.8	6	10.4	9.5	
30	Japan	6.8	6.3	7	6.1	5.8	7.4	8.7	9.2	9.5	9.5	
31	Others	42.5	75.8	82.2	112.1	92.3	94.8	105.6	95	98	113.4	
32	EU Total	558.7	595.1	642.3	698.3	764	925.8	1155.4	1006.9	863.1	1123.8	
	Total	2245.6	2612	2760.9	3095	3487.8	4049.7	5347.5	4628	4743.9	5911.8	



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