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REVIEW OF THE STATISTICAL DATA AND FISHERY TRENDS FOR TROPICAL TUNAS

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PURPOSE

To provide the Working Party on Tropical Tunas (WPTT) with a review of the status of the information available on tropical tuna species in the databases at the IOTC Secretariat as of September 2012, as well as a range of fishery indicators, including catch and effort trends, for fisheries catching tropical tunas in the IOTC area of competence. It covers data on nominal catches, catch-and-effort, size-frequency and other data, in particular release and recapture (tagging).

BACKGROUND

Prior to each WPTT meeting the Secretariat develops a series of maps, figures and tables that highlight historical and emerging trends in the fisheries data held by the Secretariat. This information is used during each WPTT meeting to inform discussions around stock assessment and in developing advice to the Scientific Committee.

This document summarises the standing of a range of information received for tropical tuna species, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*[1].

Section 2 identifies problem areas relating to the statistics of tropical tuna species. Section 3 looks into the main fisheries, catch trends and tag release and recovery data available for each species; and main issues identified concerning the statistics available at the IOTC Secretariat for each species.

The report covers the following areas:

- Overview
- Main issues relating to the data available on tropical tunas
- Overview of tropical tuna fisheries in the Indian Ocean:
  - Catch trends
  - Status of fisheries statistics for tropical tuna species
  - Status of tagging data

Major data categories covered by the report

Nominal catches which are highly aggregated statistics for each species estimated per fleet, gear and year for a large area. If these data are not reported the Secretariat estimates a total catch from a range of sources (including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; and data reported by parties on the activity of vessels under their flag (IOTC Resolution 10/08; IOTC Resolution 12/05) or other flags (IOTC Resolution 12/07; IOTC Resolution 05/03); data on imports of bigeye tuna from vessels under the flag concerned (IOTC Resolution 01/06); and data on imports of tropical tunas from canning factories collaborating with the International Seafood Sustainability Foundation[2].

Catch and effort data which refer to the fine-scale data – usually from logbooks –, reported in aggregated format: per fleet, year, gear, type of school, month, grid and species. Information on the use of fish aggregating devices (FADs) and activity of vessels that assist industrial purse seiners to locate tuna schools (supply vessels) is also collected.

[1] This Resolution superseded IOTC Resolutions 98/01, 05/01 and 08/01

[2] With catch imports by vessel, trip, species and commercial category forwarded to the IOTC Secretariat on each quarter

Length frequency data: individual body lengths of IOTC species per fleet, year, gear, type of school, month and 5 degrees square areas.

Tagging data: release and recovery data gathered in the framework of the Indian Ocean Tuna Tagging Programme (IOTTP), which encompass data gathered during the Regional Tuna Tagging Project – Indian Ocean (RTTP-IO) and data gathered during a series of Small-scale tuna tagging projects in Maldives, India, Mayotte, Indonesia and by other institutions, e.g. SEAFDEC, NRIFSF, with the support of IOTC. In 2012, the data from past projects implemented in Maldives in the 1990s was added to the tagging database at the Secretariat, and today this database contains 219,143 releases and 34,249 recoveries.

MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF TROPICAL TUNAS

The following list is provided by the Secretariat for the consideration of the WPTT. The list covers the main issues which the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery.

1. Catch-and-Effort data from Coastal Fisheries:

- **Drifting gillnet** fisheries of **Iran** and **Pakistan**: To date, Iran and Pakistan have not reported catches of bigeye tuna for their gillnet fisheries. Although both countries have reported catches of yellowfin tuna and skipjack tuna (average catches at around 75,000 t during 2007–11) they have not reported catch-and-effort data as per the IOTC standards, in particular for those vessels that operate outside their EEZ. The IOTC Secretariat estimated caches of bigeye tuna for Iran, assuming various levels of activity of vessels using driftnets on the high seas, depending on the year, and catch ratios bigeye tuna:yellowfin tuna recorded for industrial purse seiners on free-swimming tuna schools in the northwest Indian Ocean. Catches of bigeye tuna were estimated for the period 2005–11, with average catches estimated at around 1,500 t per year.
- **Gillnet/longline** fishery of **Sri Lanka**: Although Sri Lanka has reported catches of bigeye tuna for its gillnet/longline fishery (average catches at around 560 t during 2007–11), the catches are considered to be too low. This is probably due to the mislabelling of catches of bigeye tuna as yellowfin tuna. In addition, Sri Lanka has not reported catch-and-effort data as per the IOTC standards, including separate catch-and-effort data for longline and gillnet and catch-and-effort data for those vessels that operate outside its EEZ.
- **Pole-and-line** fishery of **Maldives**: Although the pole-and-line fishery of Maldives do catch bigeye tuna, both yellowfin tuna and bigeye tuna are reported aggregated, as yellowfin tuna. The IOTC Secretariat used samples collected in the Maldives to estimate the amount of bigeye tuna that is reported as yellowfin tuna, per year, with average catches estimated at around 900 t per year. Maldives has not reported catch-and-effort data by gear type and geographic area for 2002–03[3].
- **Coastal** fisheries of **Comoros**[4], **Indonesia, Madagascar, Sri Lanka** (other than gillnet/longline) and **Yemen**: The catches of tropical tunas for these fisheries have been estimated by the IOTC Secretariat in recent years (total average catches of tropical tunas for the period 2007-11 amount to 150,000 t per year, especially skipjack tuna). The quality of the estimates is thought to be very poor due to the paucity of the information available about the fisheries operating in these countries.

2. Catch-and-Effort data from Surface and Longline Fisheries:

- **Longline** fishery of **India**: India has reported very incomplete catches and catch-and-effort data for its commercial longline fishery, with average catches amounting to around 5,000 t per year.
- **Longline** fisheries of **Indonesia** and **Malaysia**: Indonesia and Malaysia have not reported catches for longliners under their flag that are not based in their ports. In addition Indonesia has not reported catch-and-effort data for its longline fishery to date.

[3] It is important to note that Maldives has used the available catch-and-effort data to derive CPUE indices for its pole-and-line fishery, and have undertaken preliminary assessments of skipjack tuna in cooperation with the IOTC Secretariat, presented at the WPTT in 2011. In addition, in October 2012 Maldives provided catch-and-effort data for its pole-and-line fishery for the period 2004-11.

[4] The "Direction national des resources haléutiques" of the Comoros conducted a fisheries census in 2011, with the assistance of the IOTC-OFCF Project. In addition, the IOTC Secretariat provided support for the implementation of a sampling system. These activities will make it possible for Comoros to estimate catches of tropical tunas and other species for 2011 and following years.

- **Industrial tuna purse seine** fishery of **Iran**: To date, Iran has not reported catch-and-effort data as per IOTC standards for its purse seine fleet.
- **Longline** fishery of **Philippines:** The Philippines has reported very low catches of tropical tunas for its longline fishery, in particular catches of bigeye tuna. The amounts of frozen bigeye tuna products exported from the Philippines vessels to other countries (IOTC Bigeye tuna Statistical Document Programme) have been consistently higher than the amounts reported by Philippines as total catch for this species.
- **Discard levels for all fisheries**: The total amount of tropical tunas discarded at sea remains unknown for most fisheries and time periods. Discards of tropical tunas are thought to be significant during some periods on industrial purse seine fisheries using fish aggregating devices (FADs).

3. Size data from All Fisheries:

- **Longline** fisheries of **Japan** and **Taiwan,China:** During the WPTT meeting in 2010, the IOTC Secretariat identified several issues concerning the size frequency statistics available for Japan and Taiwan,China, which remain unresolved. In addition, the number of specimens sampled for length onboard longliners flagged in Japan in recent years remains low.
- **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Pakistan has not reported size frequency data for its gillnet fishery. Even though Iran has reported size frequency data for its gillnet fishery, data are not reported by month or geographic area; in addition, the proportion of fish sampled over the total numbers of fish caught has been decreasing in recent years, for all species.
- **Longline** fisheries of **India, Oman** and the **Philippines:** To date, these countries have not reported size frequency data for their longline fisheries.
- **Gillnet/longline** fishery of **Sri Lanka:** Although Sri Lanka has reported length frequency data for tropical tunas in recent years, sampling coverage is thought to be too low and lengths are not available by gear type or fishing area.
- **Longline** fisheries of **Indonesia** and **Malaysia**: Indonesia and Malaysia have reported size frequency data for its fresh-tuna longline fishery in recent years. However, the samples cannot be fully broken by month and fishing area (5x5 grid) and they refer exclusively to longliners based in ports in those countries.
- **Coastal** fisheries of **Comoros**[5], **India, Indonesia** and **Yemen**: To date, these countries have not reported size frequency data for their coastal fisheries.

4. Biological data for all tropical tuna species:

- Surface and longline fisheries, in particular **Taiwan,China**, **Indonesia**, **Japan**, and **China**: The IOTC database does not contain enough data to allow for the estimation of statistically robust length-weight or non-standard size to standard length keys for tropical tuna species due to the general paucity of biological data available from the Indian Ocean.

[5] *Ibid.* 7

STATUS OF FISHERIES STATISTICS FOR TROPICAL TUNAS

Bigeye tuna (BET)

Fisheries and catch trends

Bigeye tuna is mainly caught by industrial longline (59% in 2011) and purse seine (20% in 2011) fisheries, with the remaining 21% of the catch taken by other fisheries (**Table 1**). However, in recent years the catches of bigeye tuna by gillnet fisheries are likely to be higher, due to the major changes experienced in some of these fleets, notably changes in boat size, fishing techniques and fishing grounds, with vessels using deeper gillnets on the high seas, in areas where catches of bigeye tuna are high.

Table 1. Bigeye tuna: Best scientific estimates of the catches of bigeye tuna (*Thunnus obesus*) by gear and main fleets [or type of fishery] by decade (1950–2009) and year (2002–2011), in tonnes. Data as of September 2012. Catches by decade represent the average annual catch, noting that some gears were not used for all years (refer to Fig. 1).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
LL	6,488	21,970	30,462	45,940	88,106	93,721	109,895	104,613	113,940	94,094	90,668	93,493	69,947	66,761	46,371	51,587
FS				1,575	2,901	4,479	3,580	6,437	3,142	6,292	4,224	4,473	5,154	3,613	3,179	3,710
LS				3,782	14,290	16,959	22,756	13,658	16,760	15,317	15,523	14,988	15,335	18,324	16,221	13,699
OT	146	262	568	2,393	7,928	9,312	4,943	5,045	4,761	7,079	10,375	10,187	17,610	20,021	15,095	18,424
Total	**6,634**	**22,231**	**31,030**	**53,690**	**113,225**	**124,470**	**141,174**	**129,753**	**138,604**	**122,782**	**120,791**	**123,141**	**108,047**	**108,719**	**80,866**	**87,420**

Longline (**LL**); Purse seine free-school (**FS**); Purse seine associated school (**LS**); Other gears nei (**OT**).

Total annual catches have increased steadily since the start of the fishery, reaching the 100,000 t level in 1993 and peaking at 150,000 t in 1999 (**Fig. 1**). Catches dropped since then to values between 120,000–140,000 t (2000–07), further dropping in recent years, to values under 90,000 t in recent years (2010–11). The SC believes that the recent drop in catches could be related, at least in part, with the expansion of piracy in the northwest Indian Ocean, which has led to a marked drop in the levels of longline effort in the core fishing area of these species (**Fig. 5**).

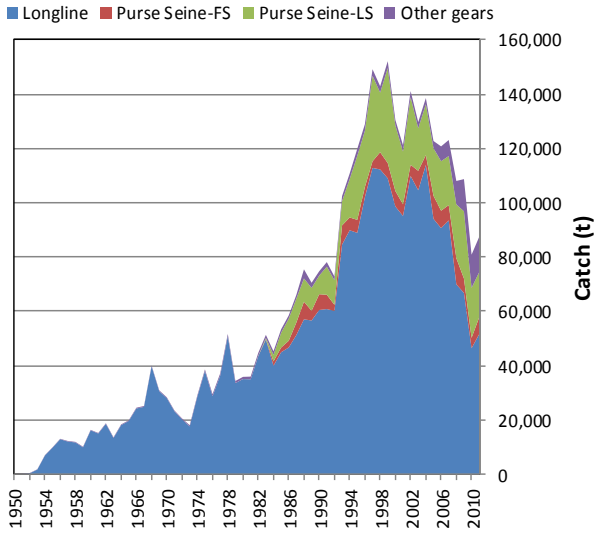


Fig. 1. Bigeye tuna: Annual catches of bigeye tuna by gear (1950–2011). Data as of September 2012.

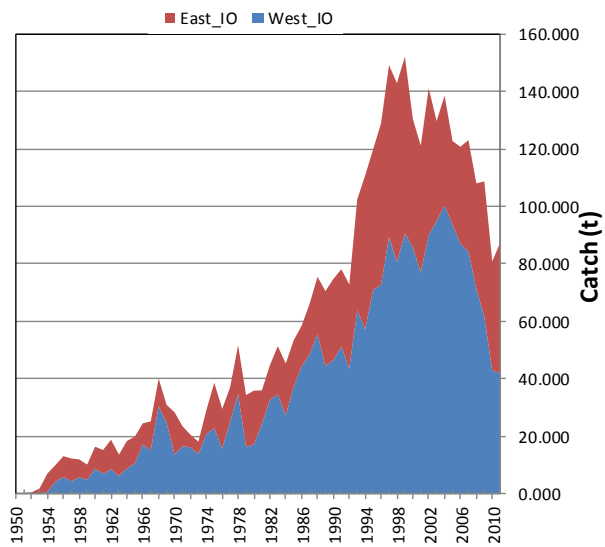


Fig. 2. Bigeye tuna: Annual catches of bigeye tuna by area (1950–2011). Data as of September 2012.

Bigeye tuna have been caught by industrial **longline** fleets since the early 1950's, but before 1970 they only represented an incidental catch. After 1970, the introduction of fishing practices that improved catchabilityof the bigeye tuna resource, combined with the emergence of a sashimi market, resulted in bigeye tuna becomes a primary target species for the main industrial longline fleets. Total catch of bigeye tuna by longliners in the Indian Ocean increased steadily from the 1970's attaining values over 90,000 t between 1996 and 2007, and dropping markedly thereafter (**Fig. 1**). Bigeye tuna catches in recent years have been low representing less than half the catches of bigeye tuna recorded before the onset of piracy in the Indian Ocean. Since the late 1980's Taiwan,China has been the major longline fleet fishing for bigeye tuna in the Indian Ocean, taking as much as 40% of the total longline catch in the

Indian Ocean (**Fig. 3**). However, the catches of longliners from Taiwan,China have decreased in recent years, with current catches of bigeye tuna (≈20,000 t) three times lower than those in 2003. Large bigeye tuna (averaging just above 40 kg) are primarily caught by longlines, in particular deep longlines.

Since the late 1970's, bigeye tuna has been caught by **purse seine** vessels fishing on tunas aggregated on floating objects and, to a lesser extent, associated to free swimming schools (**Fig. 1**) of yellowfin tuna or skipjack tuna. The highest catch of bigeye tuna by purse seiners in the Indian Ocean was recorded in 1999 (≈40,000 t). Catches since 2000 have been between 20,000 and 30,000 t. Purse seiners under flags of EU countries and Seychelles take the majority of purse seine caught bigeye tuna in the Indian Ocean (**Fig. 3**). Purse seiners mainly take small juvenile bigeye (averaging around 5 kg) whereas longliners catch much larger and heavier fish; and while purse seiners take lower tonnages of bigeye tuna compared to longliners, they take larger numbers of individual fish. Even though the activities of purse seiners have been affected by piracy in the Indian Ocean, the impacts have not been as marked as for longline fleets. The main reason for this is the presence of security personnel onboard purse seine vessels of the EU and Seychelles, which has made it possible for purse seiners under these flags to continue operating in the northwest Indian Ocean (**Fig. 5**).

Fig. 3. Annual catches of bigeye tuna by fleet (1950–2011). Data as of September 2012.

By contrast with yellowfin tuna and skipjack tuna, for which the major catches are taken in the western Indian Ocean, bigeye tuna is also exploited in the eastern Indian Ocean (**Fig. 2, Figs. 4, 5**). The relative increase in catches in the eastern Indian Ocean in the late 1990's was mostly due to increased activity of small longliners fishing tuna to be marketed fresh. This fleet started its operation in the mid 1970's (**Fig. 3**, Indonesia). However, the catches of bigeye tuna in the eastern Indian Ocean have shown a decreasing trend in recent years, as some of the vessels moved south to target albacore.

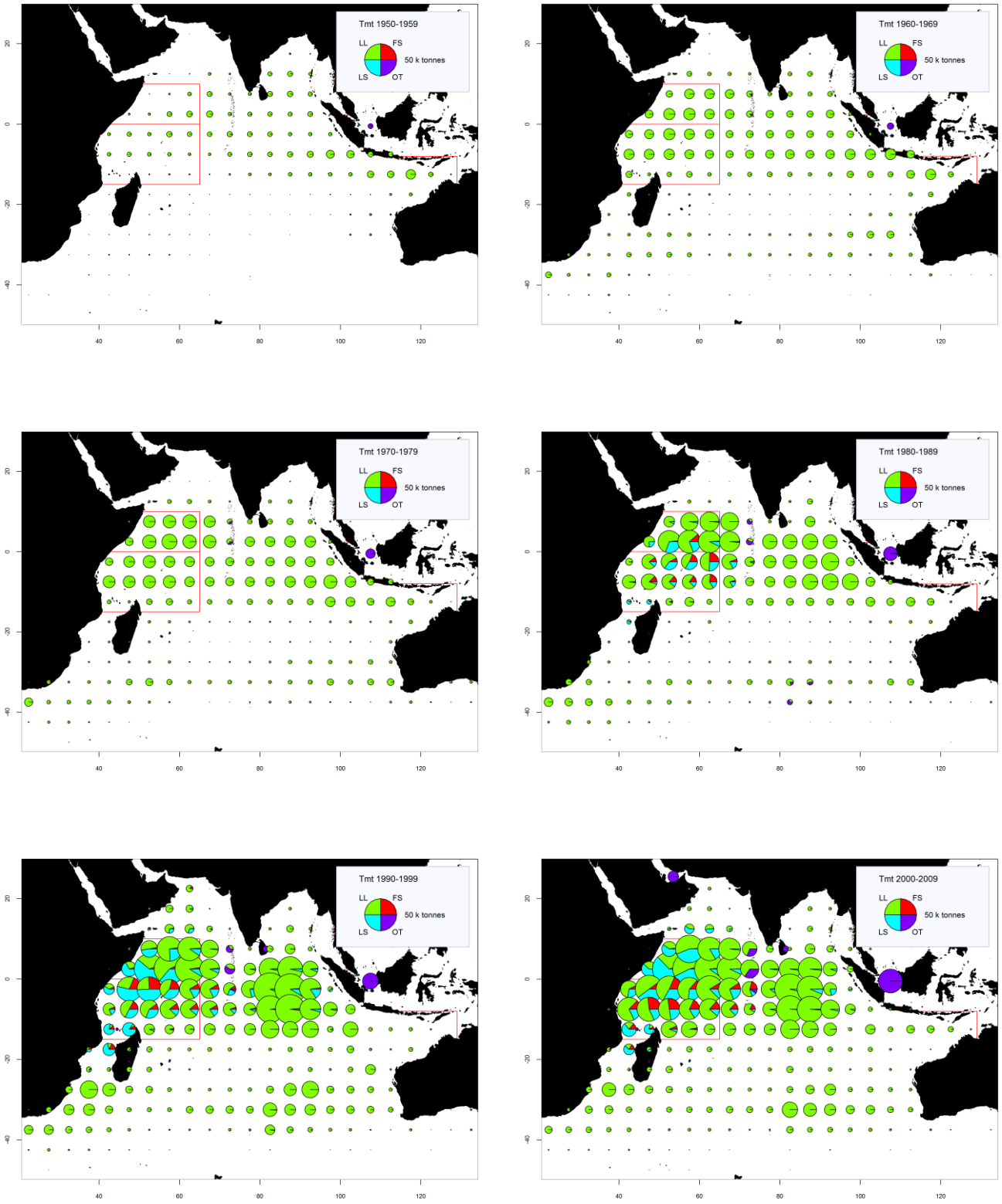


Fig. 4(a-f). Bigeye tuna: Time-area catches (total combined in tonnes) of bigeye tuna estimated for the period 1950–2009, by decade and type of gear.Longline (**LL**), Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), and other fleets (**OT**), including pole-and-line, drifting gillnets, and various coastal fisheries; Data as of September 2012.The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Indonesia.

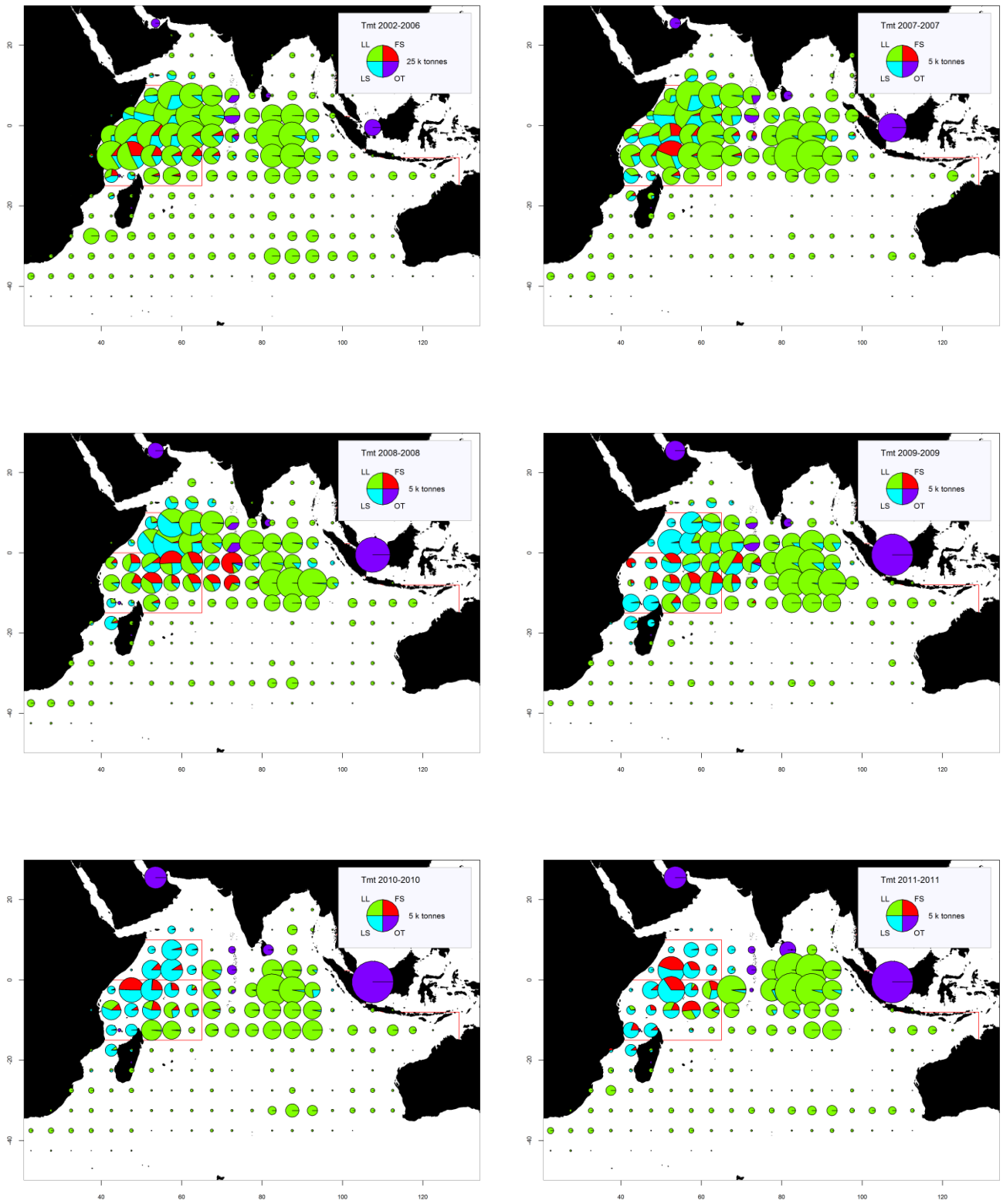


Fig. 5(a-f). Time-area catches (total combined in tonnes) of bigeye tuna estimated for the period 2002–2006 by type of gear and for 2007–11, by year and type of gear. Longline (**LL**), Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), and other fleets (**OT**), including pole-and-line, drifting gillnets, and various coastal fisheries; Data as of September 2012. The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Indonesia.

Bigeye tuna: Status of Fisheries Statistics at the IOTC

Retained catches are thought to be well known for the major fleets (**Fig. 6**); but are less certain for non-reporting industrial purse seiners and longliners (NEI) and for other industrial fisheries (longliners of India and Philippines). Catches are also uncertain for some artisanal fisheries including the pole-and-line fishery in the Maldives, the gillnet fisheries of Iran and Pakistan, the gillnet and longline combination fishery in Sri Lanka and the artisanal fisheries in Indonesia, Comoros and Madagascar.

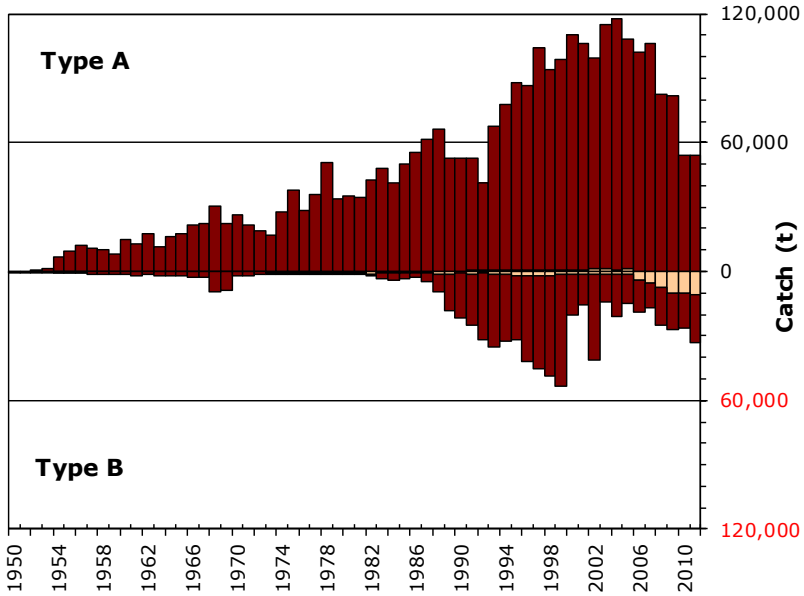


Fig. 6. Bigeye tuna: Uncertainty of annual catch estimates for bigeye tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Discard levels are believed to be low although they are unknown for most industrial fisheries, excluding industrial purse seiners flagged in EU countries for the period 2003–07.

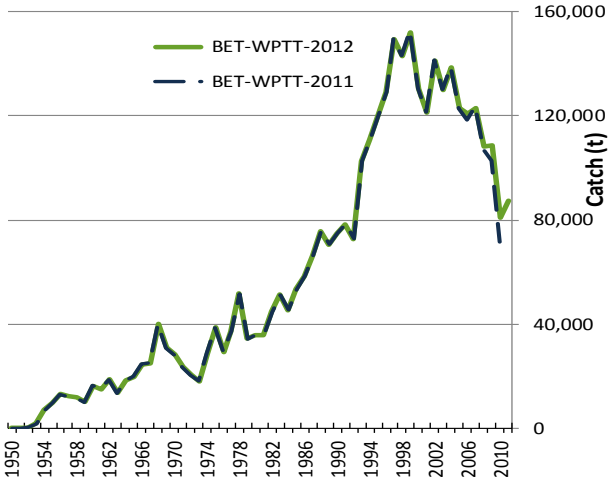


Fig. 7. Bigeye tuna: Catches used by the WPTT in 2011 *versus* those estimated for the WPTT1 in 2012 (1950–2011)

Changes to the catch series: There have not been significant changes to the catches of bigeye tuna since the WPTT in 2011 (**Fig. 7**).

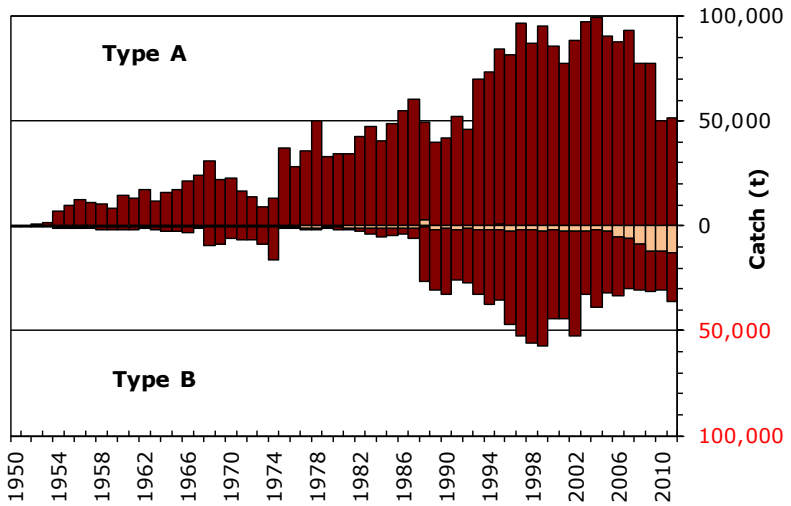


Fig. 8. Uncertainty of time-area catches for bigeye tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch-and-effort data to the IOTC, do not report catch-and-effort data by gear and/or species or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

CPUE Series: Catch-and-effort data are generally available from the major industrial fisheries. However, these data are not available from some fisheries or they are considered to be of poor quality, especially throughout the 1990s and in recent years (**Fig. 8**), for the following reasons:

- non-reporting by industrial purse seiners and longliners (NEI)
- no data are available for the fresh-tuna longline fishery of Indonesia, over the entire time series, and data for the fresh-tuna longline fishery of Taiwan,China are only available since 2006
- uncertain data from significant fleets of industrial purse seiners from Iran and longliners from India, Indonesia, Malaysia, Oman, and Philippines.
- No data available for the driftnet fisheries of Iran and Pakistan and the gillnet/longline fishery of Sri Lanka, especially in recent years.

Trends in average weight can be assessed for several industrial fisheries although they are incomplete or of poor quality for most fisheries before the mid-1980s and for some fleets in recent years (e.g. Japan longline).

Catch-at-Size table: This is available but the estimates are more uncertain for some years and some fisheries due to (**Fig. 9**):

- the paucity of size data available from industrial longliners before the mid-60s, from the early-1970s up to the mid-1980s and in recent years (Japan and Taiwan,China)
- the paucity of catch by area data available for some industrial fleets (NEI, India, Indonesia, Iran, Sri Lanka)

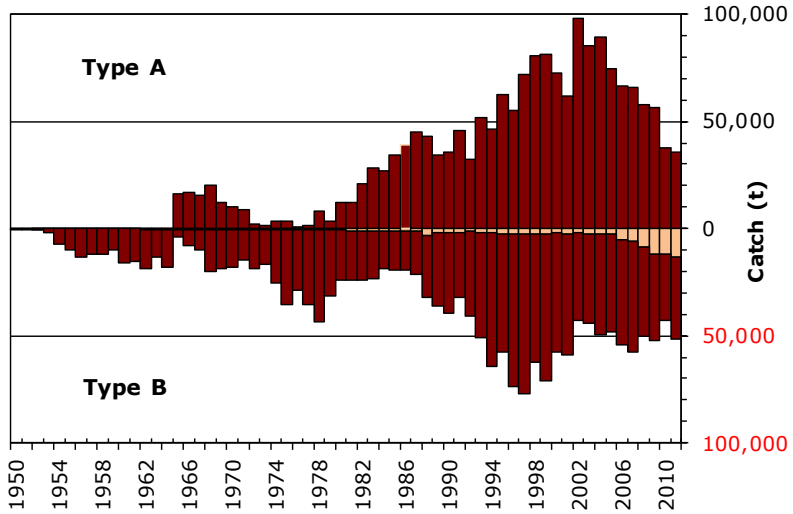


Fig. 9. Bigeye tuna: Uncertainty of catch-at-size data for bigeye tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report length data to the IOTC, do not report length data by gear, species, month, fishing area or any of the other reasons given in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Bigeye tuna Tagging data:

A total of 35,997 bigeye tuna (17.9%) were tagged during the Indian Ocean Tuna Tagging Programme (IOTTP). Most of them (96.0%) were tagged during the main Regional Tuna Tagging Project-Indian Ocean (RTTP-IO) and released off the coast of Tanzania in the western Indian Ocean, between May 2005 and September 2007 (**Fig. 10**). The remaining were tagged during small-scale projects, and by other institutions with the support of the IOTC Secretariat, in the Maldives, Indian, and in the south west and the eastern Indian Ocean. To date, 5,740, (15.9%), have been recovered and reported to the IOTC Secretariat. These tags were mainly reported from the purse seine fleets operating in the Indian Ocean (91.5%), while 4.9% were recovered from longline vessel

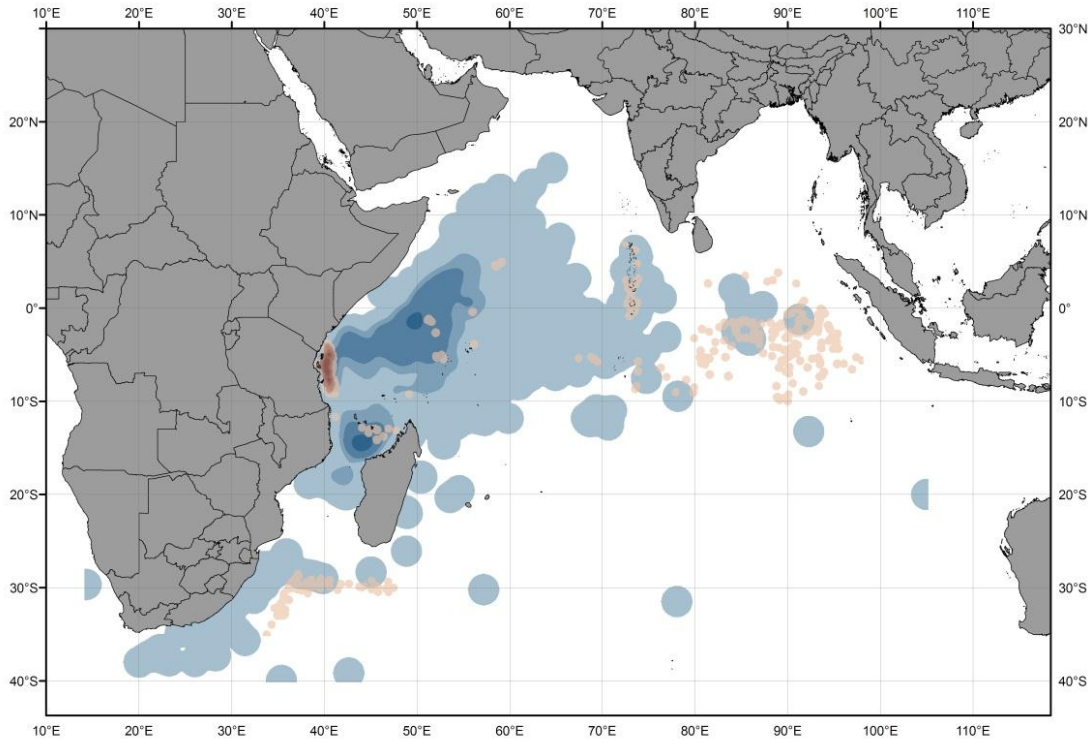


Fig. 10. Bigeye tuna: Densities of releases (in red) and recoveries (in blue). Data as of September 2011.

Skipjack tuna (SKJ)

Fisheries and catch trends

Catches of skipjack increased slowly from the 1950s, reaching around 50,000 t during the mid-1970s, mainly due to the activities of fleets using pole-and-lines and gillnets (**Table 2**; **Fig. 11**). The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and skipjack became one of the most important commercial tuna species in the Indian Ocean. Annual catches peaked at over 600,000 t in 2006 (**Fig. 11**).. Though preliminary, the catch levels estimated for 2011, at around 400,000 t, represent the lowest catches recorded since 1998.

Table 2. Skipjack tuna: Best scientific estimates of the catches of skipjack tuna (*Katsuwonus pelamis*) by gear and main fleets [or type of fishery] by decade (1950–2009) and year (2002–2011), in tonnes. Data as of September 2012. Catches by decade represent the average annual catch, noting that some gears were not used for all years (refer to Fig. 11).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
BB	9,497	13,368	22,797	40,538	77,729	111,118	124,300	116,672	114,567	140,346	147,391	106,509	98,819	77,555	69,032	69,032
FS				1,626	1,602	897	22,801	30,992	18,565	43,123	34,954	24,198	16,277	10,458	8,853	8,906
LS				3,776	8,147	13,385	215,781	180,556	137,882	168,012	211,940	120,925	128,596	148,717	144,139	123,012
OT	6,596	16,809	30,752	52,490	101,765	185,519	137,693	172,988	204,444	195,670	223,817	211,689	205,587	208,144	199,899	197,291
Total	**16,093**	**30,177**	**53,549**	**98,430**	**189,244**	**310,918**	**500,575**	**501,209**	**475,457**	**547,151**	**618,102**	**463,321**	**449,278**	**444,874**	**421,923**	**398,240**

Pole-and-Line (**BB**); Purse seine free-school (**FS**); Purse seine associated school (**LS**); Other gears nei (**OT**).

The increase in skipjack tuna catches by **purse seiners** (**Fig. 13**) is due to the development of a fishery in association with Fish Aggregating Devices (FADs) (**Fig. 14**). In recent years, 85% of the skipjack tuna caught by purse seine vessels is taken from around FADs (**Table 2**; **Fig. 11**). Catches by purse seiners increased steadily since 1984 with the highest catches recorded in 2002 and 2006 (>240,000 t). The catches dropped in the years 2003 and 2004, probably as a consequence of high purse seine catch rates on free schools of yellowfin tuna during those years. In 2007 purse seine catches declined by around 100,000 t, from those taken in 2006. The constant increase in catches and catch rates of purse seiners until 2006 are believed to be associated with increases in fishing power and in the number of FADs (and the technology associated with them) used in the fishery. The sharp decline in purse seine catches since 2007coincided with a similar decline in the catches by Maldivian baitboats.

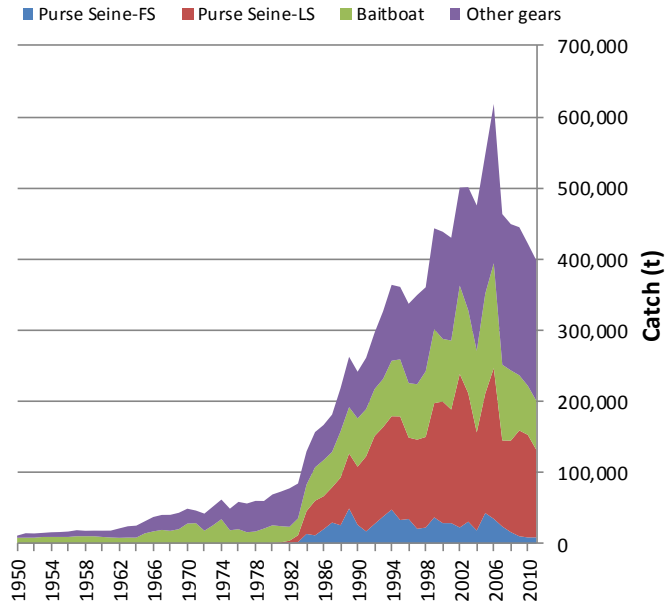


Fig. 11. Skipjack tuna: Annual catches of skipjack tuna by gear (1950–2011). Data as of September 2012.

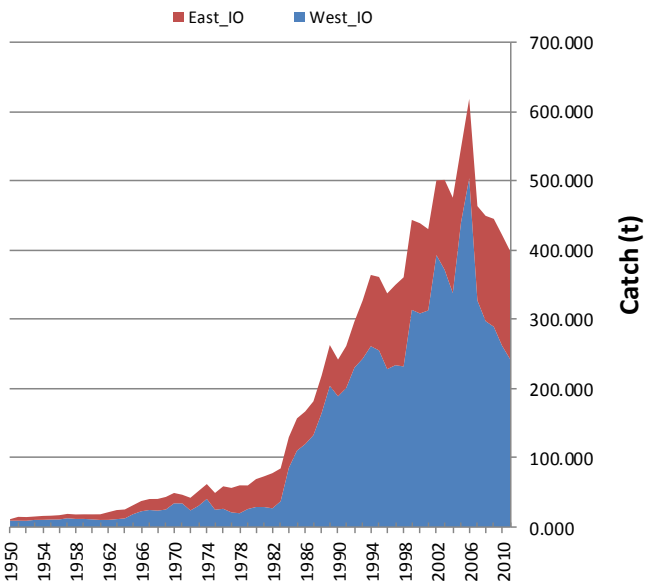


Fig. 12. Skipjack tuna: Annual catches of skipjack tuna area (1950–2011). Data as of September 2012.

The Maldivian fishery (**Fig. 13**) has effectively increased its fishing effort with the mechanisation of its **pole-and-line** fleet since 1974, including an increase in boat size and power and the use of anchored FADs since 1981. Skipjack tuna represents some 75% of its total catch, and catch rates regularly increased between 1980 and 2006, the year in which

the maximum catch was recorded for this fishery (≈135,000 t). The catches of skipjack tuna have declined since, with catches in recent years estimated to be at around 55,000 t, representing less than half the catches taken in 2006.

Several fisheries using **gillnets** have reported large catches of skipjack tuna in the Indian Ocean (**Fig. 11**), including the gillnet/longline fishery of Sri Lanka, driftnet fisheries of Iran and Pakistan, and gillnet fisheries of India and Indonesia. In recent years gillnet catches have represented as much as 20 to 30 % of the total catches of skipjack tuna in the Indian Ocean. Although it is known that vessels from Iran and Sri Lanka (**Fig. 13**) have been using gillnets on the high seas in recent years, reaching as far as the Mozambique Channel, the activities of these fleets are poorly understood, as no time-area catch-and-effort series have been made available for those fleets to date.

Fig. 13. Skipjack tuna: Catches of skipjack tuna by fleet by year (1950–2011). Data as of September 2012.

The majority of the catches of skipjack tuna originate from the western Indian Ocean (**Figs. 12, 14 and 15**). Since 2007 (**Fig. 15**) the catches of skipjack tuna in the western Indian Ocean have dropped considerably, especially in areas off Somalia, Kenya, Tanzania and around the Maldives. The drop in catches are considered by the SC to be be partially explained by the drop in catch rates and fishing effort by some fisheries due to the effects of piracy in the western Indian Ocean region, including all industrial purse seiners and fleets using driftnets from Iran (**Fig. 13**) and Pakistan; and the drop in the catches of skipjack tuna by Maldives baitboats (**Fig. 13**) following the introduction of handlines to target large specimens of yellowfin tuna.

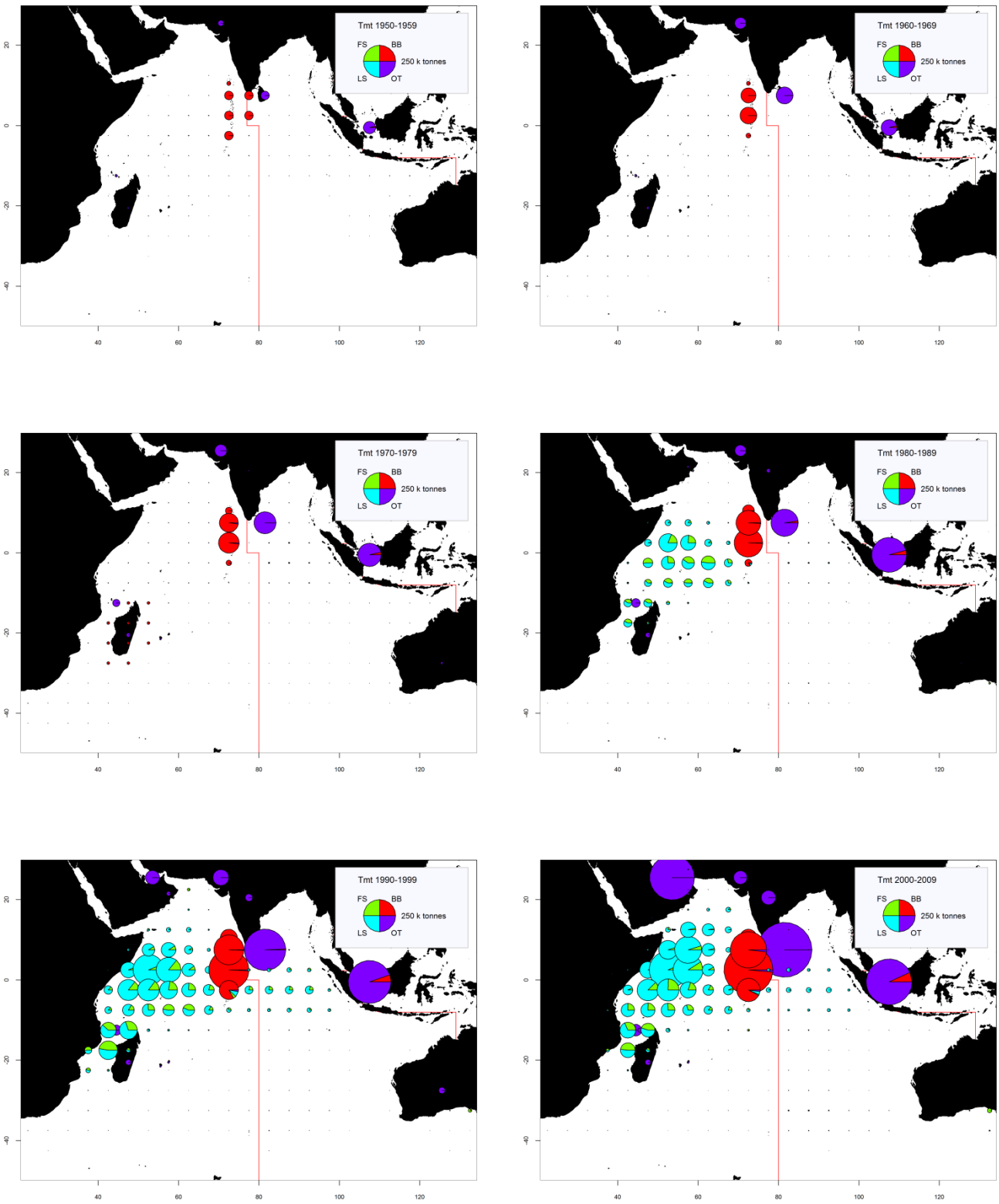


Fig. 14(a-f). Skipjack tuna: Time-area catches (total combined in tonnes) of skipjack tuna estimated for the period 1950–2009, by decade and type of gear. Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), pole-and-line (**BB**), and other fleets (**OT**), including longline, drifting gillnets, and various coastal fisheries. Data as of September 2012. The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran and Pakistan, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Comoros, Indonesia and India.

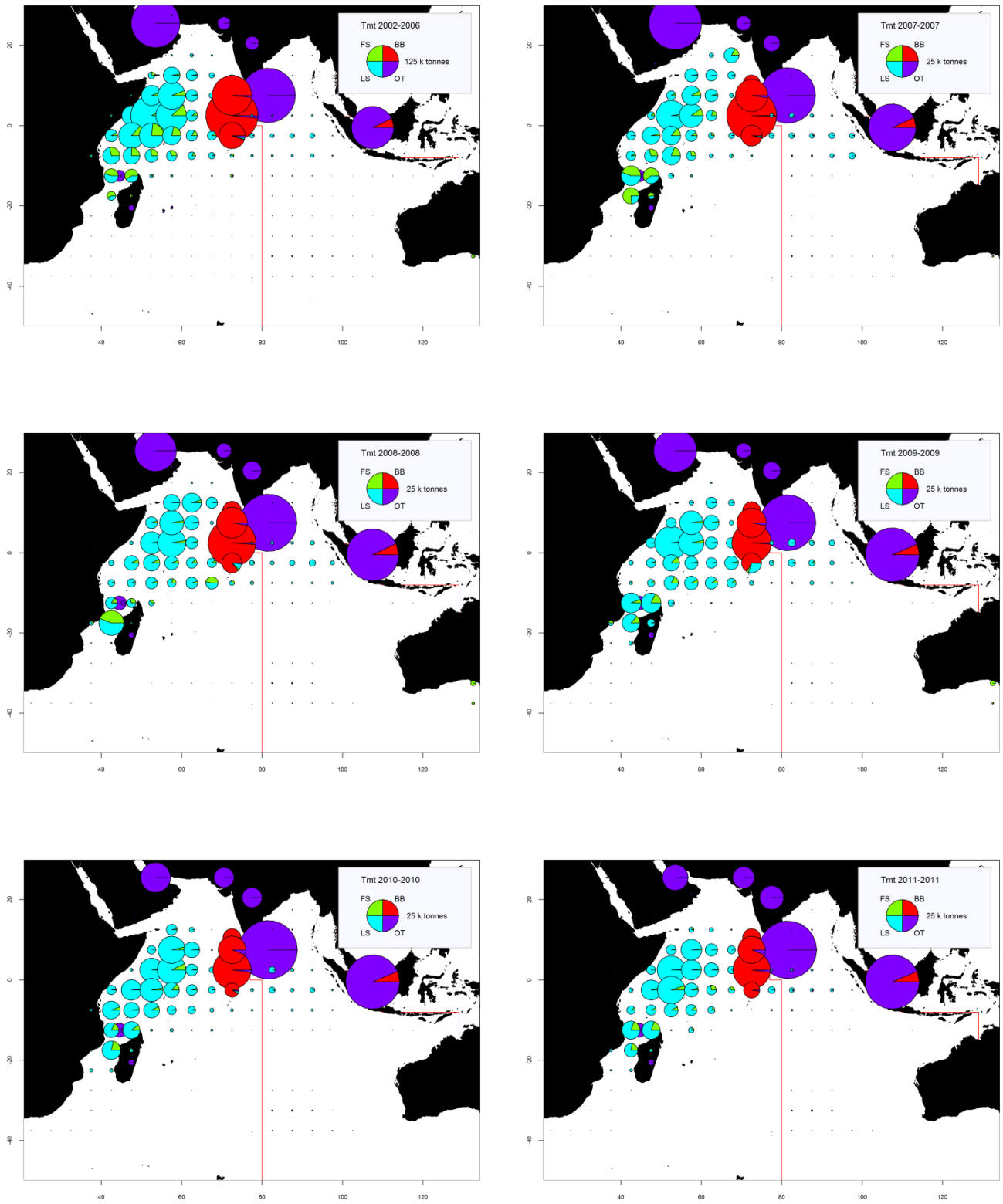


Fig. 15(a-f). Skipjack tuna: Time-area catches (total combined in tonnes) of skipjack tuna estimated for the period 2002–06 by type of gear and for 2007–11, by year and type of gear. Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), pole-and-line (BB), and other fleets (**OT**), including longline, drifting gillnets, and various coastal fisheries. Data as of September 2012. The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran and Pakistan, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Comoros, Indonesia and India.

Skipjack tuna: Status of Fisheries Statistics at the IOTC

Retained catches are generally well known for the industrial fisheries but are less certain for many artisanal fisheries (**Fig. 16**), notably because:

- catches are not being reported by species
- there is uncertainty about the catches from some significant fleets including the Sri Lankan coastal fisheries, and the coastal fisheries of Comoros and Madagascar.

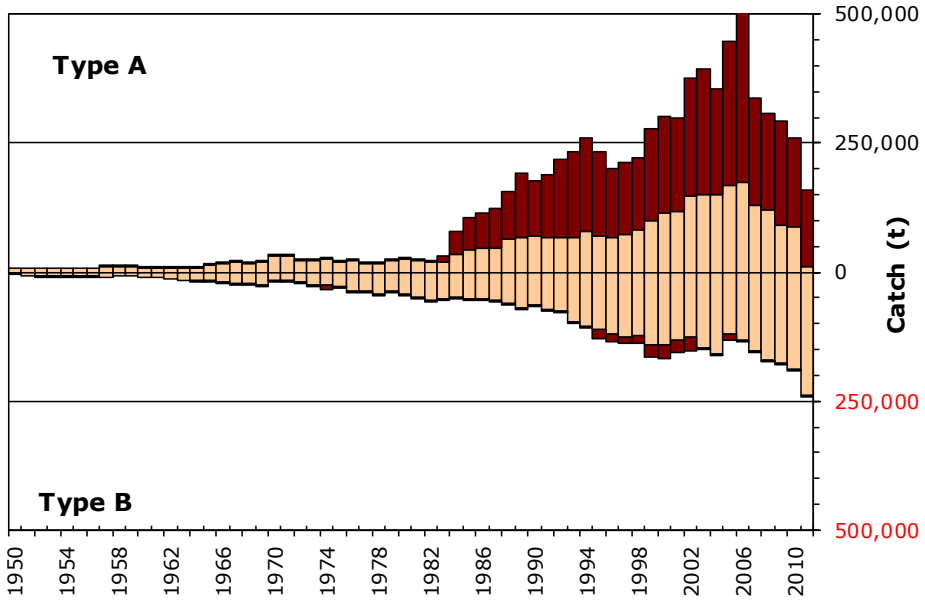


Fig. 16. Skipjack tuna: Uncertainty of annual catch estimates for skipjack tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Discard levels are believed to be low although they are unknown for most industrial fisheries, excluding industrial purse seiners flagged in EU countries for the period 2003–2007.

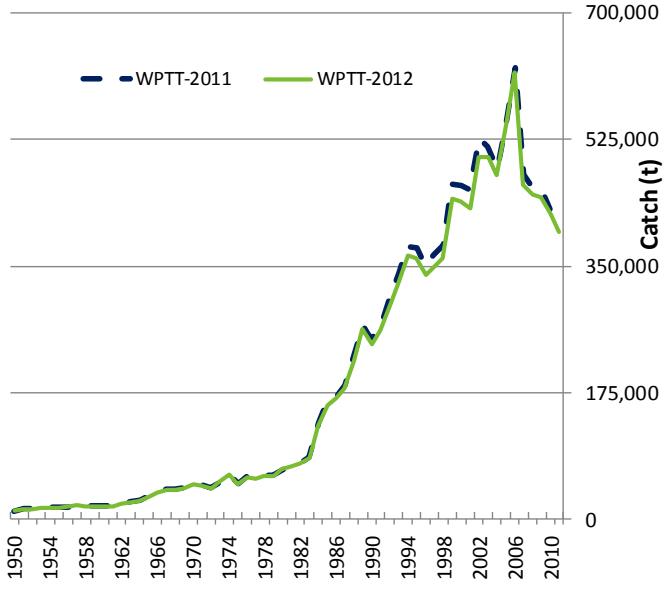


Fig. 17. Skipjack tuna: Catches used by the WPTT in 2011 versus those estimated for the WPTT in 2012 (1950–2011).

Changes to the catch series: There have been no major changes to the catches of skipjack tuna, as a whole, since the WPTT in 2011 (**Fig. 17**). However, the IOTC Secretariat used new information compiled during 2011-12 to rebuild the catch series for the coastal fisheries operated in some countries, in particular Madagascar, Sri Lanka, and India. In general, the new catches of skipjack tuna estimated by the IOTC Secretariat are lower than those used in the past by the WPTT. More details about these reviews can be found in **Appendix 2**.

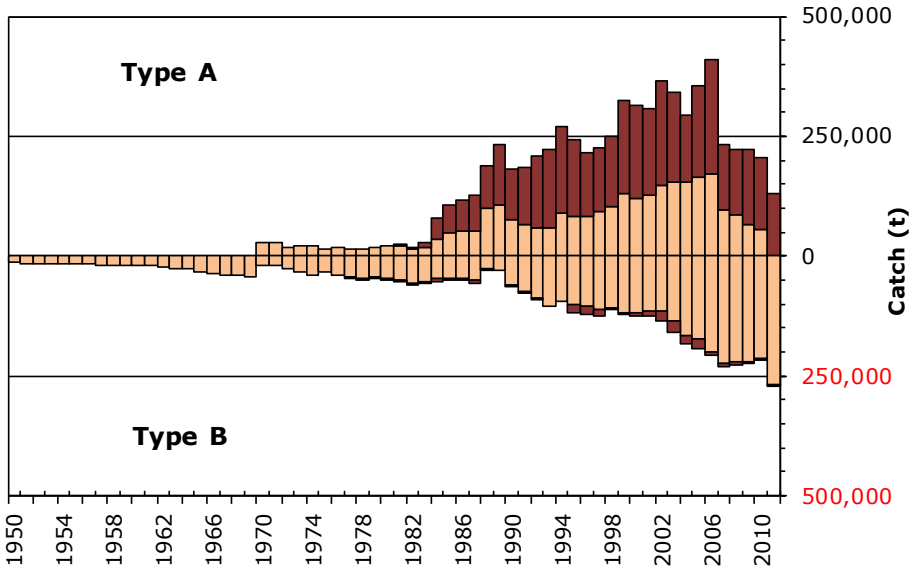


Fig. 18. Skipjack tuna: Uncertainty of time-area catches for skipjack tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch-and-effort data to the IOTC, do not report catch-and-effort data by gear and/or species or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

CPUE Series: Catch and effort data are available from various industrial and artisanal fisheries (**Fig. 18**). However, these data are not available from some important fisheries or they are considered to be of poor quality for the following reasons:

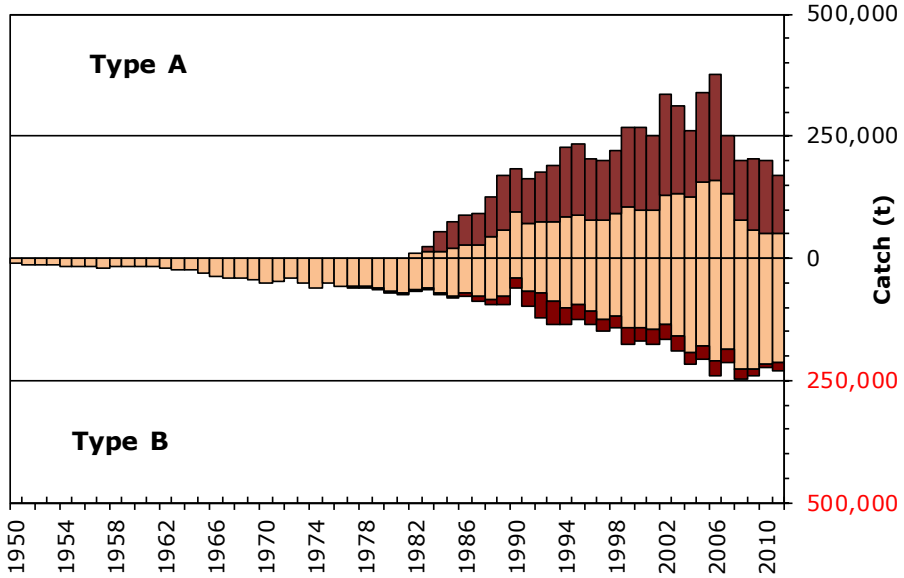


Fig. 19. Skipjack tuna: Uncertainty of catch-at-size data for skipjack tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report length data to the IOTC, do not report length data by gear, species, month, fishing area or any of the other reasons given in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

- no data are available for the gillnet fisheries of Iran and Pakistan
- the poor quality effort data for the gillnet/longline fishery of Sri Lanka
- no data are available from important coastal fisheries using hand and/or troll lines, in particular Indonesia, India, Madagascar and Comoros.

Trends in average weight cannot be assessed before the mid-1980s and are incomplete for most artisanal fisheries thereinafter, namely hand lines, troll lines and many gillnet fisheries (Indonesia).

Catch-at-Size table: CAS are available but the estimates are uncertain for some years and fisheries due to (**Fig. 19**):

- the lack of size data before the mid-1980s
- the paucity of size data available for some artisanal fisheries, notably most hand lines and troll lines (Madagascar, Comoros) and many gillnet fisheries (Indonesia, Sri Lanka).

Skipjack tuna Tagging data:

A total of 101,212 skipjack (representing 50.2% of the total number of fish tagged) were tagged during the Indian Ocean Tuna Tagging Programme (IOTTP). Most of them, 77.4%, were released during the main Regional Tuna Tagging Project-Indian Ocean (RTTP-IO) and were released around Seychelles, in the Mozambique Channel and off the coast of Tanzania, between May 2005 and September 2007 (**Fig. 20**). The remaining were tagged during small-scale tagging projects, and by other institutions with the support of IOTC, around the Maldives, India, and in the south west and the eastern Indian Ocean. To date, 15,729 (15.5%), have been recovered and reported to the IOTC Secretariat. Around 78% of the recoveries were from the purse seine fleets operating from the Seychelles, and around 20% by the pole-and-line vessels mainly operating from the Maldives. The addition of the data from the past projects in the Maldives (in 1990s) added 14,506 tagged skipjack tuna to the databases, or which 1,960 were recovered mainly in the Maldives.

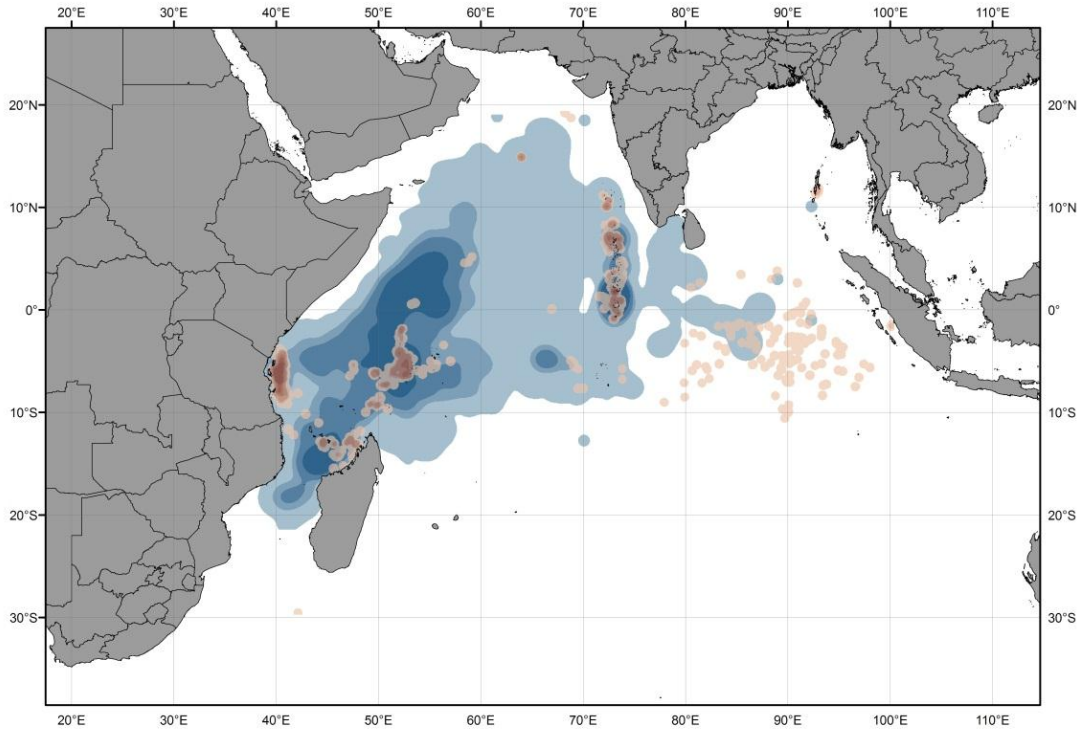


Fig. 20. Skipjack tuna: Densities of releases (in red) and recoveries (in blue). Data as of September 2011.

Yellowfin tuna (YFT)

Fisheries and catch trends

Catches by gear, area, country and year from 1950 to 2011 are shown in **Figs. 21**, **22** and **23**. Contrary to the situation in other oceans, the artisanal fishery component in the Indian Ocean is substantial, taking 20–30% of the total catch. Catches of yellowfin tuna (**Table 3**; **Fig. 21**) remained more or less stable between the mid-1950s and the early-1980s, ranging between 30,000 and 70,000 t, owing to the activities of longliners and, to a lesser extent, gillnetters. The catches increased rapidly with the arrival of the purse seiners in the early 1980s and increased activity of longliners and other fleets, reaching over 400,000 t in 1993. Catches of yellowfin tuna between 1994 and 2002 remained stable, between 330,000 and 350,000 t. Yellowfin tuna catches during 2003, 2004, 2005 and 2006 were much higher than in previous years with the highest catches ever recorded in 2004 (over 520,000 t) and average annual catch for the period at around 470,000 t. Yellowfin tuna catches dropped markedly after 2006, with the lowest catches recorded in 2009. Catch levels in 2011 are estimated to be at around 300,000 t, although they represent preliminary figures.

Table 3. Yellowfin tuna: Best scientific estimates of the catches of yellowfin tuna (*Thunnus albacares*) by gear and main fleets [or type of fishery] by decade (1950–2009) and year (2002–2011), in tonnes. Data as of September 2012. Catches by decade represent the average annual catch, noting that some gears were not used for all years (refer to Fig. 21).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
FS			18	32590	64942	89761	77,058	137,492	168,799	124,024	85,021	53,529	74,990	36,263	32,022	36,591
LS			17	18090	56304	61909	61,934	86,585	59,597	69,873	74,454	43,843	41,453	51,565	73,387	76,460
LL	21990	41257	29513	33889	66689	57032	53,125	55,727	86,597	117,324	70,388	51,240	25,973	20,014	18,139	19,027
LF			615	4286	47570	32955	34,425	31,290	31,303	34,083	30,741	30,642	29,675	22,776	24,390	26,152
BB	1795	1490	4693	6830	11005	15675	17,291	17,150	15,686	16,235	17,302	15,569	17,975	16,719	12,755	12,755
GI	2376	6838	11395	18560	54805	74081	57,363	82,354	101,902	85,053	88,414	68,543	73,437	70,918	91,722	85,754
HD	681	1170	2660	6823	18854	31346	33,857	31,379	39,337	36,824	30,126	30,438	30,036	24,914	20,600	20,612
TR	630	1066	3185	5489	10366	17929	13,828	13,272	19,824	14,545	17,299	22,238	28,225	24,271	24,545	24,909
OT	118	130	497	686	851	1165	670	1,170	1,581	1,286	1,546	1,228	1,564	1,036	747	679
Total	**27,589**	**51,951**	**52,593**	**127,242**	**331,386**	**381,854**	**349,551**	**456,419**	**524,626**	**499,247**	**415,291**	**317,270**	**323,328**	**268,476**	**298,307**	**302,939**

Purse seine free-school (**FS**); Purse seine associated school (**LS**); Deep-freezing longline (**LL**); Fresh-tuna longline (**LF**); Pole-and-Line (**BB**); Gillnet (**GI**); Hand line (**HD**); Trolling (**TR**); Other gears nei (**OT**).

Table 4. Yellowfin tuna: Best scientific estimates of the catches of yellowfin tuna (*Thunnus albacares*) by area by decade (1950–2009) and year (2002–2011), in tonnes. Data as of September 2012. Catches by decade represent the average annual catch. The areas are presented in Fig. 2(a).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
R1	1,912	4,502	7,506	18,021	79,714	90,252	81,265	90,744	134,533	136,556	106,021	80,660	75,150	60,035	68,998	71,660
R2	11,869	23,064	21,137	73,042	135,201	175,180	154,305	254,089	261,289	240,184	189,622	122,182	132,649	100,288	110,034	116,774
R3	643	7,299	4,169	7,470	24,425	27,828	28,634	25,251	29,579	28,471	28,019	28,909	27,011	25,864	25,407	25,817
R4	997	1,919	1,639	1,321	3,555	3,503	4,618	4,255	5,878	4,780	3,218	1,349	1,449	1,501	1,866	1,707
R5	12,169	15,168	18,142	27,389	88,491	85,092	80,728	82,082	93,348	89,252	88,409	84,166	87,076	80,792	92,002	86,977
Total	**27,590**	**51,953**	**52,592**	**127,243**	**331,386**	**381,855**	**349,550**	**456,420**	**524,627**	**499,242**	**415,289**	**317,267**	**323,336**	**268,479**	**298,307**	**302,935**

Areas: Arabian Sea (**R1**); Off Somalia (**R2**); Mozambique Channel (**R3**); South Indian Ocean (**R4**); East Indian Ocean (**R5**). See Fig. 22 for areas.Totals from Table 3 and 4 may differ, due to rounding.

Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the **purse seine (Fig. 21)** fishery developed rapidly with the arrival of European vessels between 1982 and 1984. Since then, there has been an increasing number of yellowfin tuna caught, with a larger proportion of the catches made of adult fish, as opposed to bigeye tuna catches, of which the majority refers to juvenile fish. Purse seine vessles typically take fish ranging from 40 to 140 cm fork length (FL) and smaller fish are more common in the catches taken north of the equator. Catches of yellowfin tuna increased rapidly to around 130,000 t in 1993, and subsequently they fluctuated around that level, until

2003–05 when they were substantially higher (over or close to 200,000 t). The amount of effort exerted by the EU purse seine vessels (fishing for yellowfin tuna and other tunas) varies seasonally and from year to year.

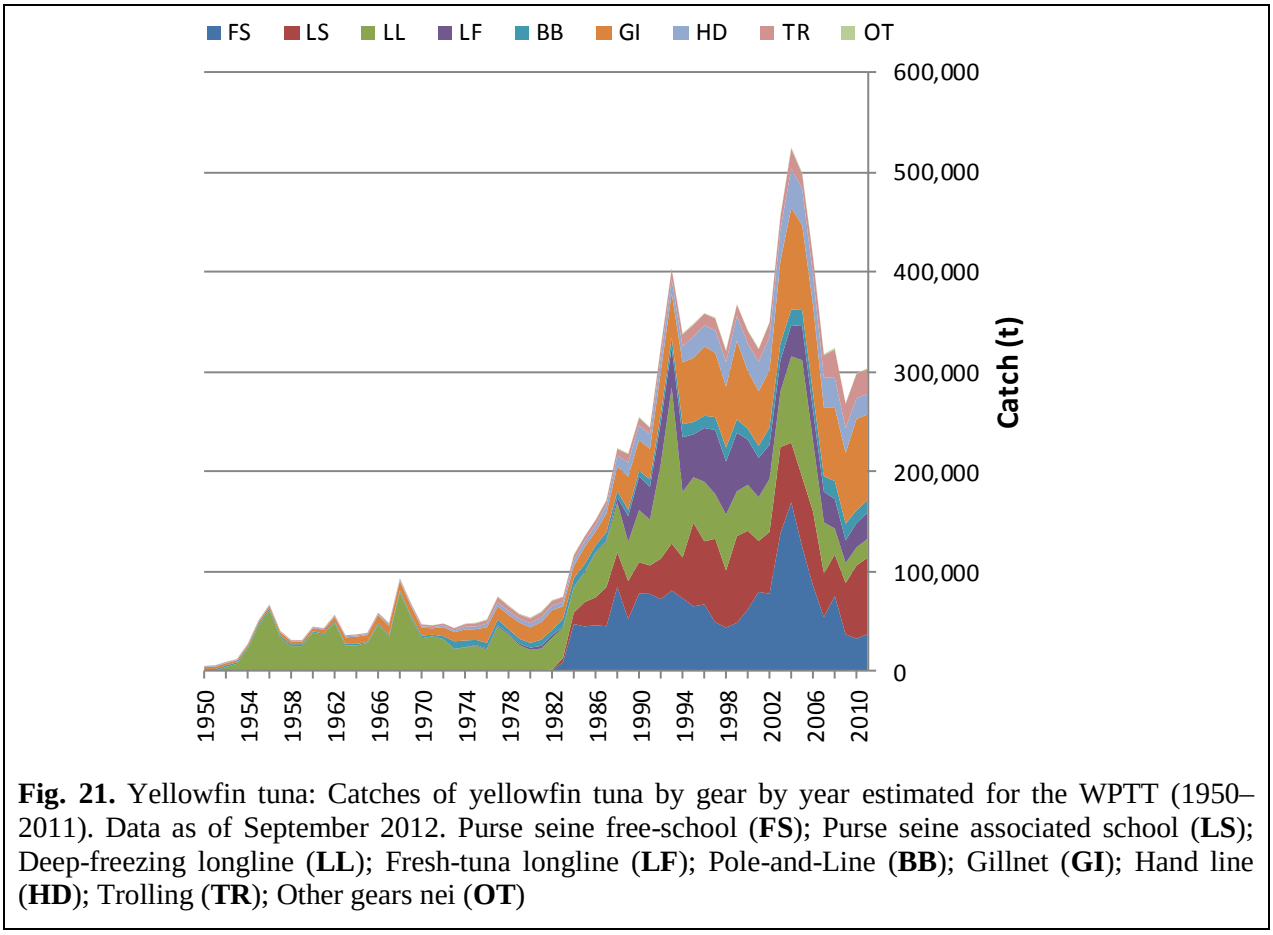


Fig. 21. Yellowfin tuna: Catches of yellowfin tuna by gear by year estimated for the WPTT (1950–2011). Data as of September 2012. Purse seine free-school (**FS**); Purse seine associated school (**LS**); Deep-freezing longline (**LL**); Fresh-tuna longline (**LF**); Pole-and-Line (**BB**); Gillnet (**GI**); Hand line (**HD**); Trolling (**TR**); Other gears nei (**OT**)

The purse seine fishery is characterized by the use of two different fishing modes (**Table 3**; **Figs. 21, 24 and 25**). The fishery on floating objects (FADs), which catches large numbers of small yellowfin tuna in association with skipjack tuna and juvenile bigeye tuna, and a fishery on free swimming schools, which catches larger yellowfin tuna on multi-specific or mono-specific sets. Between 1995 and 2003, the FAD component of the purse seine fishery represented 48–66% of the sets undertaken (60–80% of the positive sets) and accounted for 36–63% of the yellowfin tuna catch by weight (59–76% of the total catch). The proportion of yellowfin tuna caught (in weight) on free-schools during 2003–06 (64%) was much higher than in previous or following years (at around 50%).

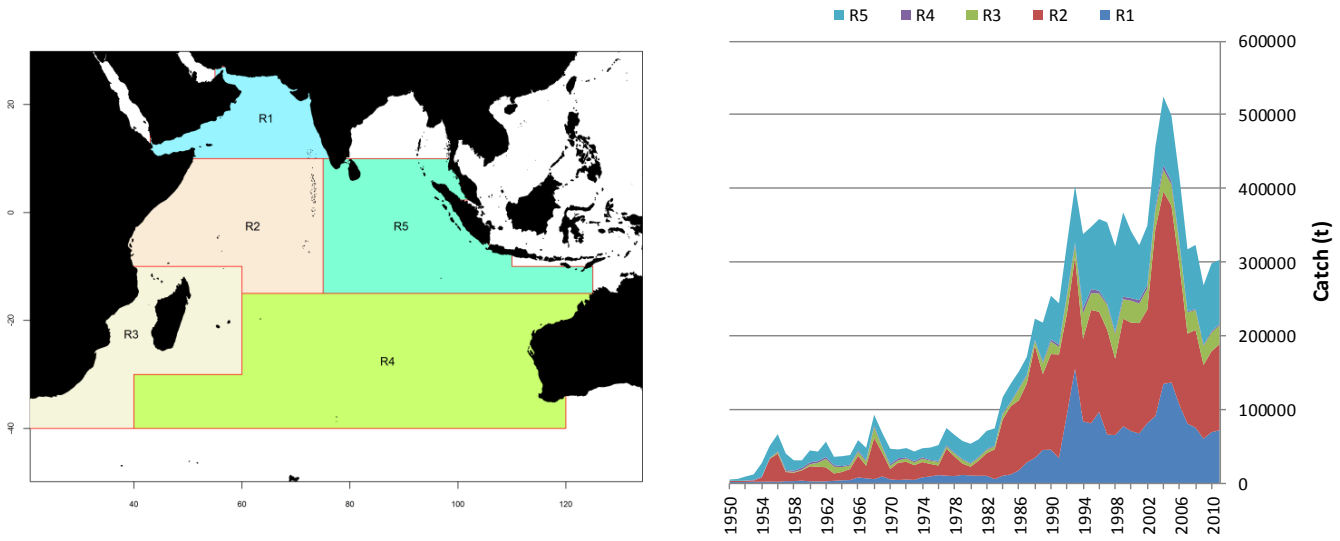


Fig. 22(a-b). Yellowfin tuna: Catches of yellowfin tuna by area by year estimated for the WPTT (1950–2011). Data as of September 2012. Catches outside the areas presented in the Map were assigned to the closest neighbouring area. Arabian Sea (**R1**); Off Somalia (**R2**); Mozambique Channel (**R3**); South Indian Ocean (**R4**); East Indian Ocean (**R5**)

The **longline** fishery (**Table 3**; **Fig. 21**) started in the early 1950's and expanded rapidly over throughout the Indian Ocean. Longline gear mainly catches large fish, from 80 to 160 cm FL, although smaller fish in the size range 60 cm – 100 cm (FL) have been taken by longliners from Taiwan,China since 1989 in the Arabian Sea. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin tuna and bigeye tuna being the main target species in tropical waters. The longline fishery can be subdivided into a deep-freezing longline component (large scale deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and a fresh-tuna longline component (small to medium scale fresh tuna longliners from Indonesia and Taiwan,China). The total longline catch of yellowfin tuna reached a maximum in 1993 (≈200,000 t). Catches between 1994 and 2004 fluctuated between 85,000 t and 120,000 t. The second highest catches of yellowfin tuna by longliners were recorded in 2005 (≈150,000 t). As was the case for the purse seine fleets, since 2005 longline catches have declined with current catches estimated to be at around 45,000 t, representing a three-fold decrease from the catches taken in 2005. The SC believes that the recent drop in longline catches could be related, at least in part, with the expansion of piracy in the northwest Indian Ocean, which has led to a marked drop in the levels of longline effort in one of the core fishing areas of the species (**Fig. 25**).

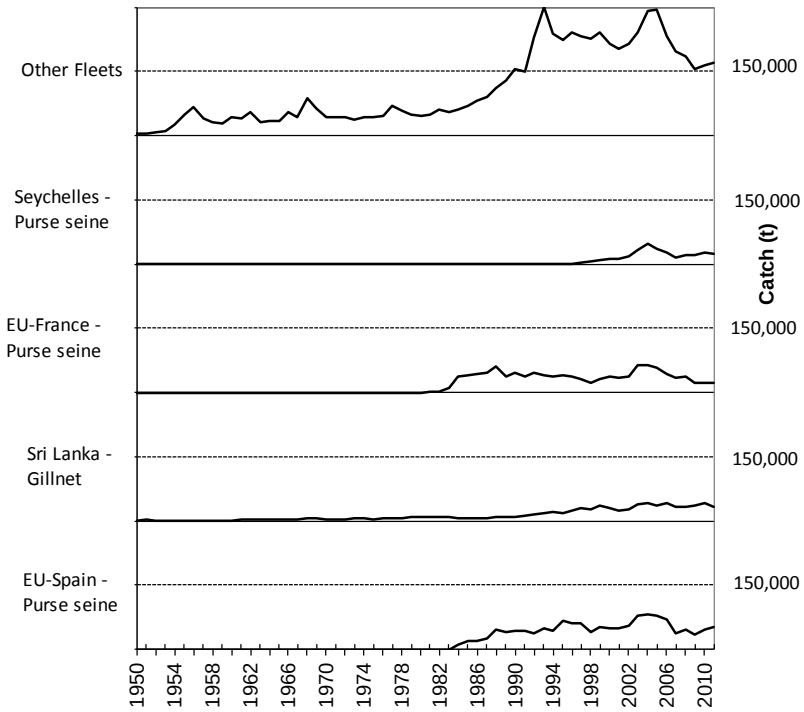


Fig. 23. Yellowfin tuna: Catches of yellowfin tuna by fleet by year estimated for the WPTT (1950–2011). Data as of September 2012.

Catches by **other gears**, namely pole-and-line, gillnet, troll, hand line and other minor gears, have increased steadily since the 1980s (**Table 3**; **Figs. 21 and 23**). In recent years the total artisanal yellowfin tuna catch has been around 140,000–160,000 t, with the catch by gillnets (the dominant artisanal gear) at around 80,000 t. During the year 2004 the catches by artisanal gears attained its maximum over the time series, peaking at 180,000 t.

Yellowfin tuna catches in the Indian Ocean during 2003, 2004, 2005 and 2006 were much higher than in previous years (**Fig. 25**), while bigeye tuna catches remained at their average levels. Purse seiners currently take the bulk of the yellowfin tuna catch, mostly from the western Indian Ocean, around Seychelles (**Table 4**; **Fig. 22;** Off Somalia (R2) and Mozambique Channel (R3); **Figs. 24 and 25**). In 2003 and 2004, total catches by purse seine vessels in this area were around 225,000 t — about 50% more than the previous largest purse seine catch, which was recorded in 1995. Similarly, artisanal yellowfin tuna catches have been near their highest levels and longliners have reported higher than normal catches in the tropical western Indian Ocean during this period.

In recent years the catches of yellowfin tuna in the western Indian Ocean have dropped considerably, especially in areas off Somalia, Kenya and Tanzania and in particular between 2007 and 2011 (**Figs. 22 and 25**). The drop in catches is the consequence of a drop in fishing effort due to the effect of piracy in the western Indian Ocean region. Even though the activities of purse seiners have been affected by piracy in the Indian Ocean, the effects have not been as marked as with longliners, for which current levels of effort are close to nil in the area impacted by piracy. The main reason for this is the presence of security personnel onboard purse seine vessels of the EU and Seychelles, which has made it possible for purse seiners under these flags to continue operating in the northwest Indian Ocean.

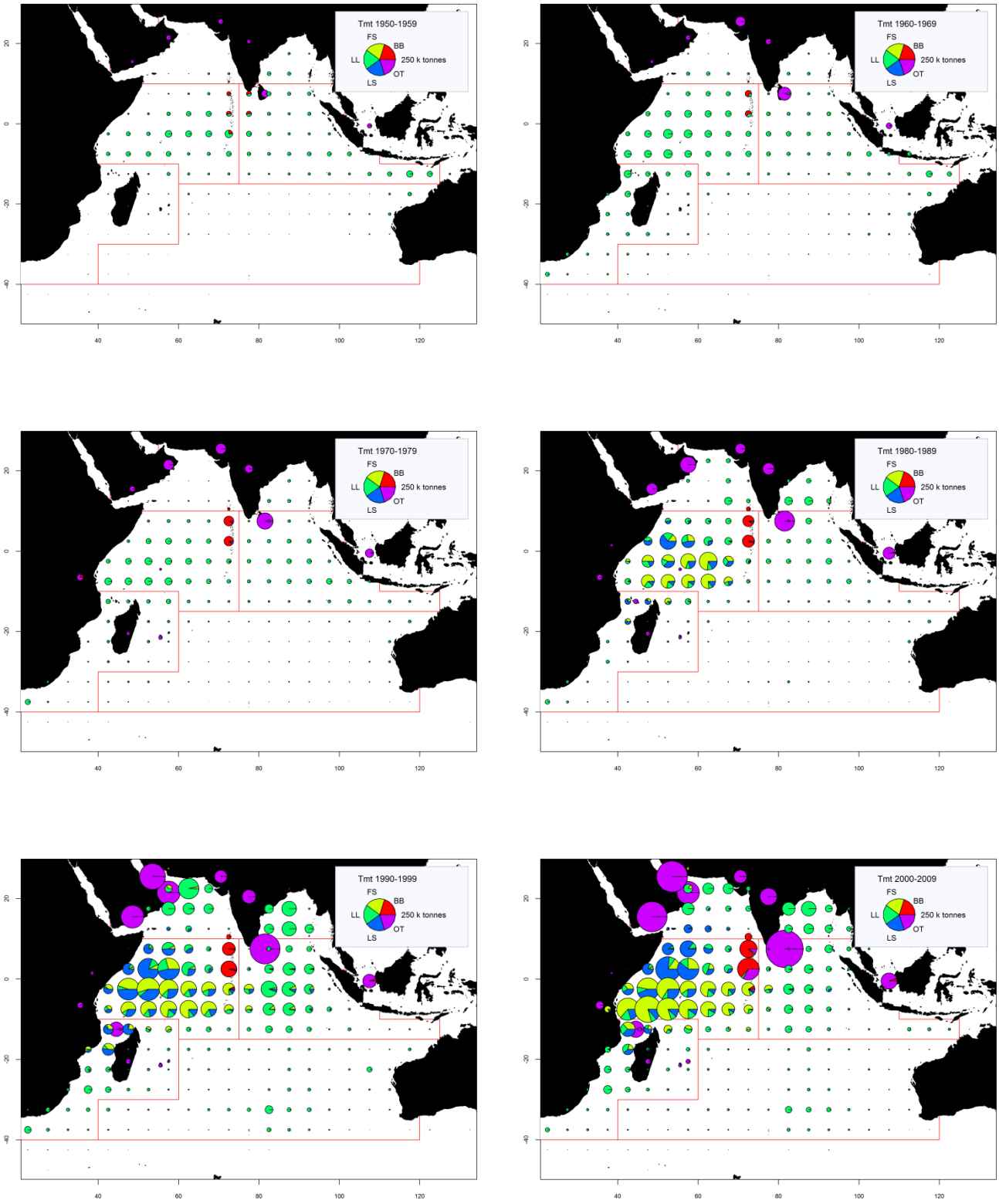


Fig. 24(a-f). Yellowfin tuna: Time-area catches (total combined in tonnes) of yellowfin tuna estimated for the period 1950–2009, by decade and type of gear. Longline (**LL**), Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), pole-and-line (**BB**), and other fleets (**OT**), including drifting gillnets, and various coastal fisheries. Data as of September 2012. The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran and Pakistan, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Yemen, Oman, Comoros, Indonesia and India.

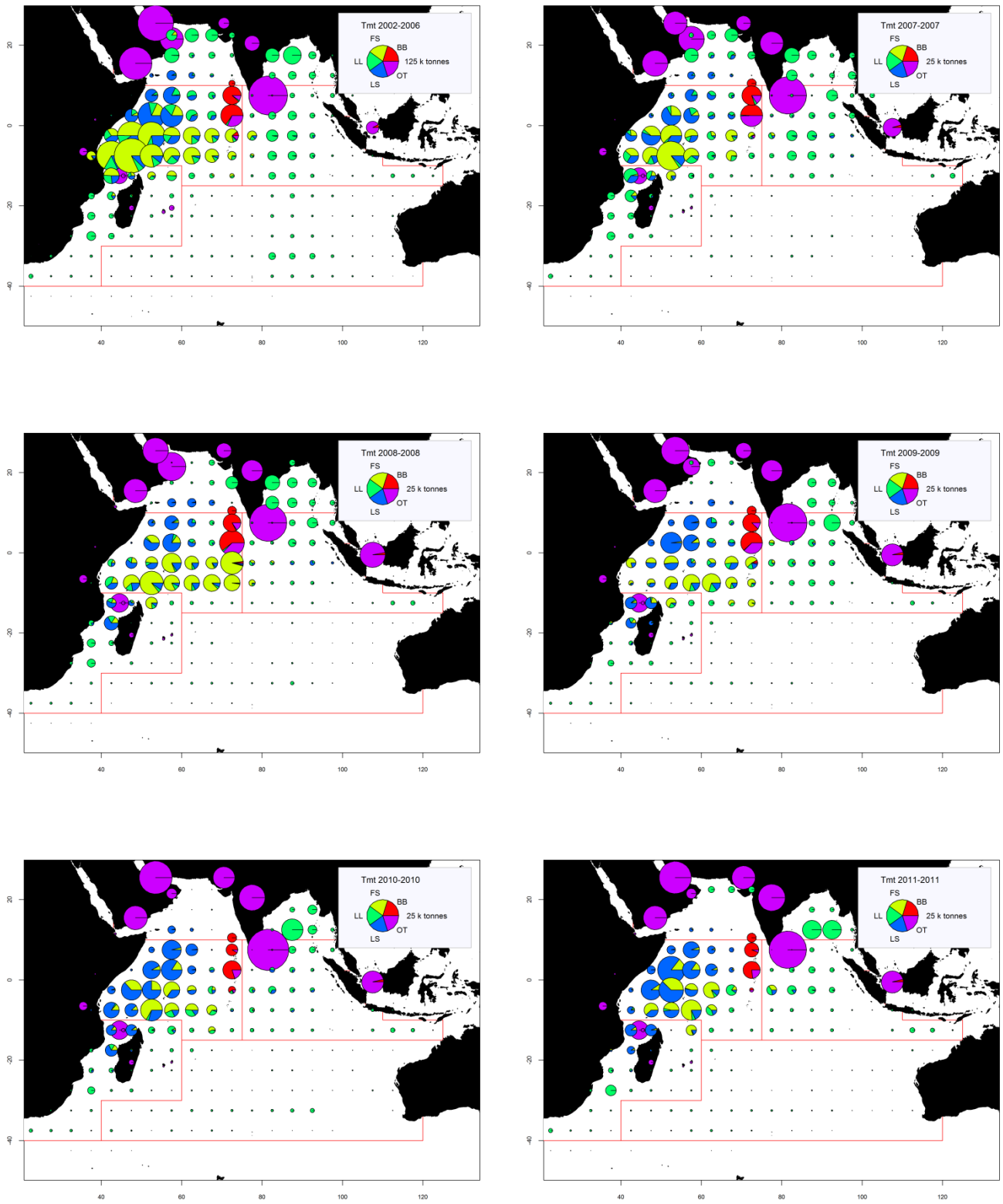


Fig. 25(a-f). Time-area catches (total combined in tonnes) of yellowfin tuna estimated for the period 2002–2006 by type of gear and for 2007–2011, by year and type of gear. Longline (**LL**), Purse seine free-schools (**FS**), Purse seine associated-schools (**LS**), pole-and-line (**BB**), and other fleets (**OT**), including drifting gillnets, and various coastal fisheries. Data as of September 2012. The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular driftnets from Iran and Pakistan, gillnet and longline fishery of Sri Lanka, and coastal fisheries of Yemen, Oman, Comoros, Indonesia and India.

Yellowfin tuna: Status of Fisheries Statistics at the IOTC

Retained catches are generally well known (**Fig. 26**); however, catches are less certain for:

- many coastal fisheries, notably those from Indonesia, Sri Lanka, Yemen, Madagascar, and Comoros
- the gillnet fishery of Pakistan
- non-reporting industrial purse seiners and longliners (NEI), and longliners of India.

Discard levels are believed to be low although they are unknown for most industrial fisheries, excluding industrial purse seiners flagged in EU countries for the period 2003–2007.

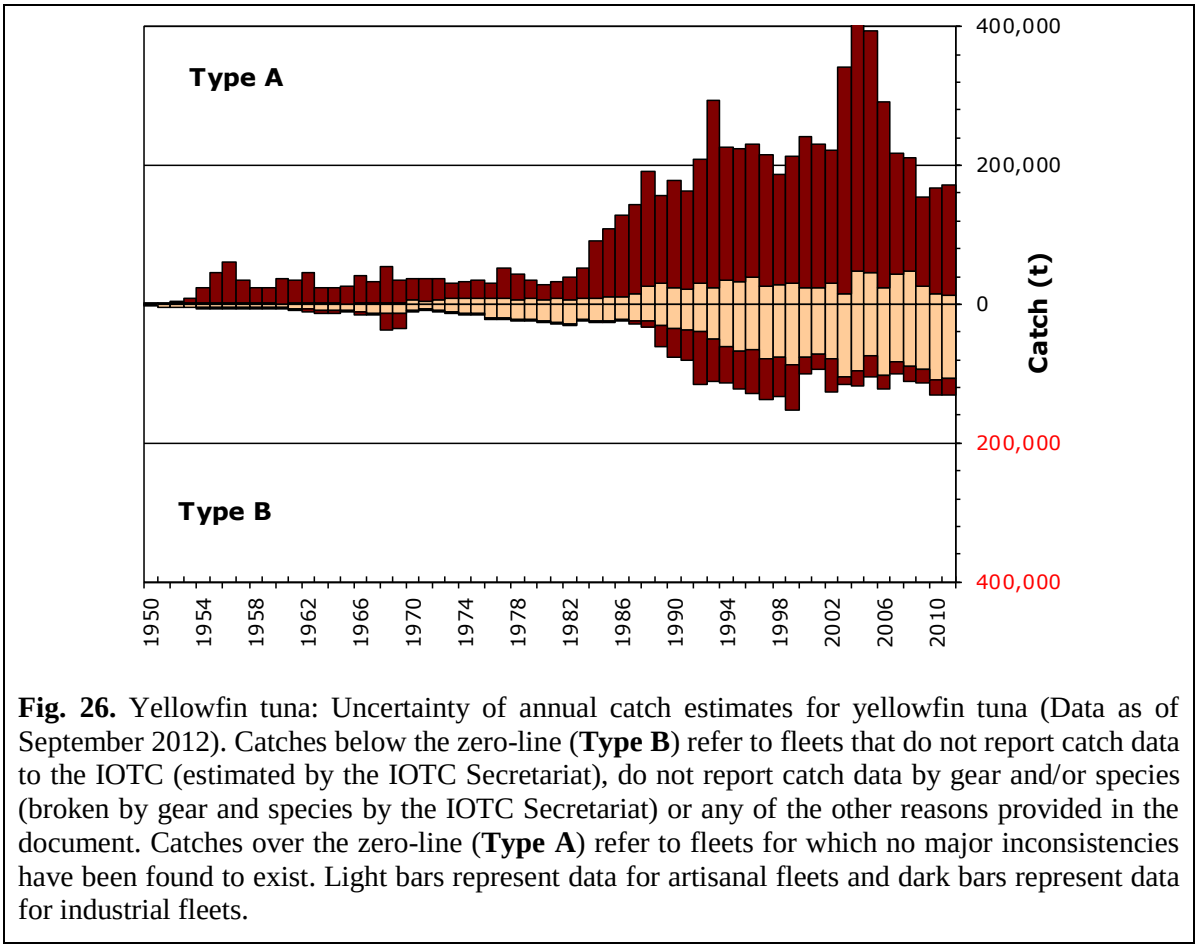


Fig. 26. Yellowfin tuna: Uncertainty of annual catch estimates for yellowfin tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Changes to the catch series: There have not been significant changes to the total catches of yellowfin tuna since the WPTT in 2011 (**Fig. 27**).

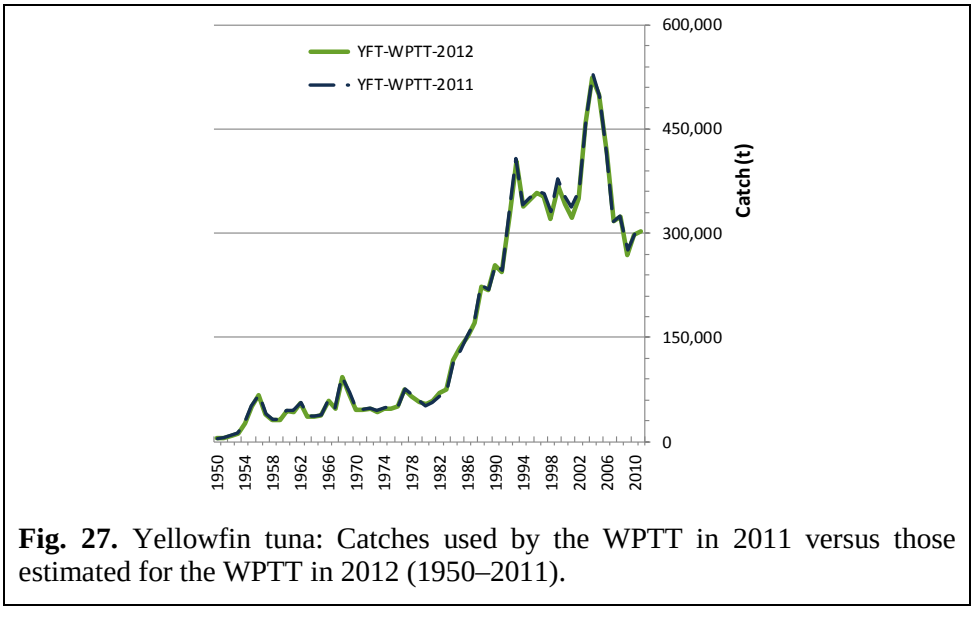


Fig. 27. Yellowfin tuna: Catches used by the WPTT in 2011 versus those estimated for the WPTT in 2012 (1950–2011).

However, the IOTC Secretariat used new information compiled during 2011–12 to rebuild the catch series for the coastal fisheries operated in some countries, in particular Madagascar, Sri Lanka, and India. In general, the new catches of yellowfin tuna estimated by the IOTC Secretariat are lower than those used in the past by the WPTT. More details about these reviews can be found in **Appendix 2**.

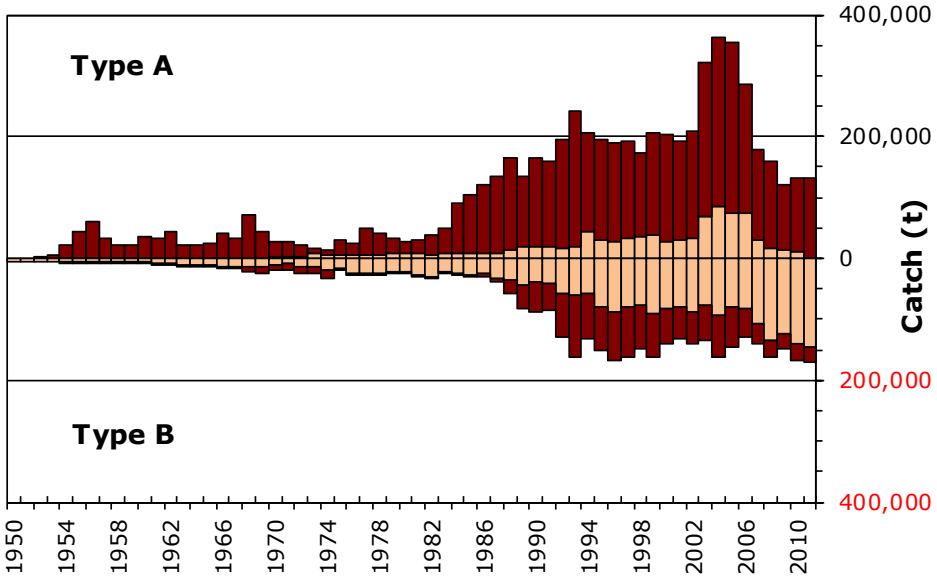


Fig. 28. Yellowfin tuna: Uncertainty of time-area catches for yellowfin tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report catch-and-effort data to the IOTC, do not report catch-and-effort data by gear and/or species or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

CPUE Series: Catch-and-effort data are available from the major industrial and artisanal fisheries (**Fig. 28**). However, these data are not available for some important fisheries or they are considered to be of poor quality for the following reasons:

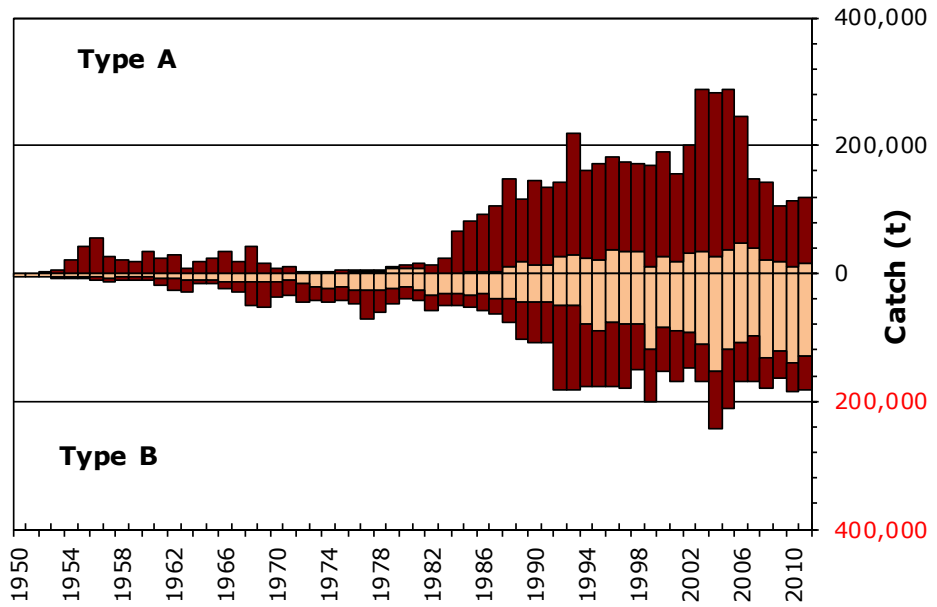


Fig. 29. Yellowfin tuna: Uncertainty of catch-at-size data for yellowfin tuna (Data as of September 2012). Catches below the zero-line (**Type B**) refer to fleets that do not report length data to the IOTC, do not report length data by gear, species, month, fishing area or any of the other reasons given in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

- no data are available for the fresh-tuna longline fishery of Indonesia, over the entire time series, and data for the fresh-tuna longline fishery of Taiwan,China are only available since 2006
- no data are available for the gillnet fisheries of Iran and Pakistan
- the poor quality effort data for the significant gillnet/longline fishery of Sri Lanka
- no data are available from important coastal fisheries using hand and/or troll lines, in particular Yemen, Indonesia, Madagascar and Comoros.

Trends in average weight can be assessed for several industrial fisheries but they are very incomplete or of poor quality for some fisheries, namely hand lines (Yemen, Comoros, Madagascar), troll lines (Indonesia) and many gillnet fisheries.

Catch-at-Size table: This is available (**Fig. 29**) although the estimates are more uncertain in some years and some fisheries due to:

- size data not being available from important fisheries, notably Yemen, Pakistan, Sri Lanka and Indonesia (lines and gillnets) and Comoros and Madagascar (lines)
- the paucity of size data available from industrial longliners from the late-1960s up to the mid-1980s, and in recent years (Japan and Taiwan,China)
- the paucity of catch by area data available for some industrial fleets (NEI, Iran, India, Indonesia, Malaysia).

Yellowfin tuna tagging data:

A total of 63,328 yellowfin tuna (representing 31.4% of the total number of specimens tagged) were tagged during the Indian Ocean Tuna Tagging Programme (IOTTP). Most of them (86.4%) were released during the main Regional Tuna Tagging Project-Indian Ocean (RTTP-IO) and were released around Seychelles, in the Mozambique Channel, along the coast of Oman and off the coast of Tanzania, between May 2005 and September 2007 (**Fig. 30**). The remaining were tagged during small-scale tagging projects, and by other institutions with the support of IOTC Secretariat, in Maldives, India, and in the south west and the eastern Indian Ocean. To date, 10,662 (16.8%), have been recovered and reported to the IOTC Secretariat. More than 87% of these recoveries we made by the purse seine fleets operating in the Indian Ocean, while around 8.5% were made by pole-and-line and less than 1% by longline vessels. The addition of the data from the past projects in the Maldives (in 1990s) added 3,211 tagged skipjack to the databases, or which 151 were recovered, mainly from the Maldives.

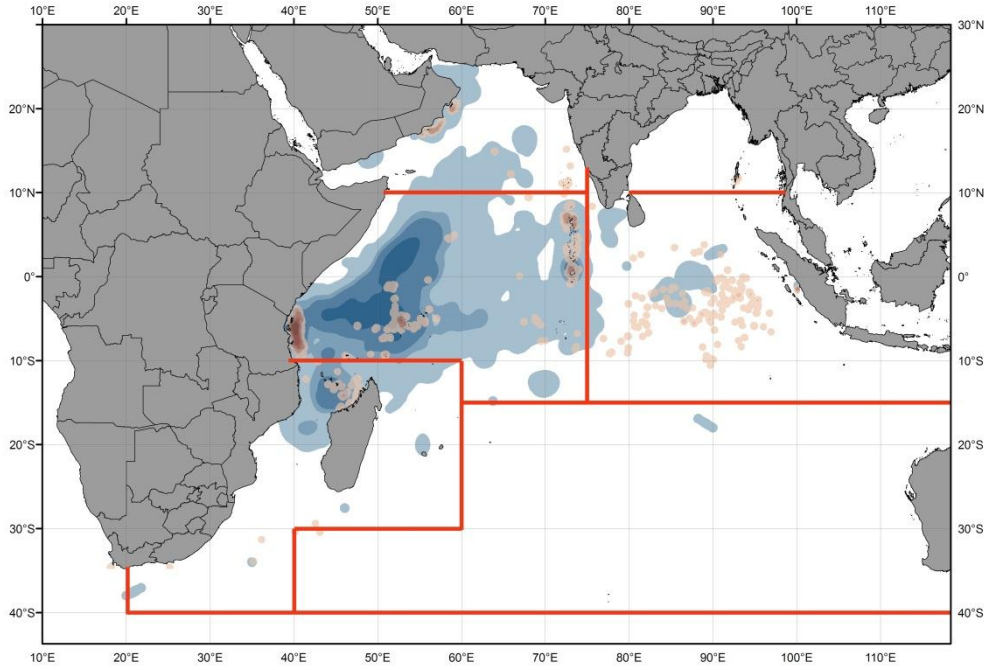


Fig. 30. Yellowfin tuna: Densities of releases (in red) and recoveries (in blue). The red line represents the stock assessment areas. Data as of September 2011.

APPENDIX I

ESTIMATION OF CATCHES OF NON-REPORTING FLEETS

The estimates of catches of non reporting fleets were updated in 2012:

The high number of non-reporting fleets operating in the Indian Ocean between the mid-1980's and the late 1990's led to large increases in the amount of catch that need to be estimated during those years. This reduced confidence in the catch estimates for yellowfin tuna and bigeye tuna, and to a lesser extent, skipjack tuna during that period. In recent years the number of fleets from non-IOTC Parties has decreased significantly. However, the decrease in the numbers of industrial vessels fishing in the Indian Ocean from non-IOTC parties has coincided with an increase in the numbers of vessels fishing under flags of some IOTC parties, including coastal countries in the IOTC region (India, Indonesia, Iran, Kenya, Malaysia, Oman, Seychelles, Tanzania and Thailand) and deep-water fishing nations (Belize, Guinea and Senegal), the quality of the statistics collected by these countries varying depending on the case.

- **Purse seine** (**Fig. 31**): Catches for the six former Soviet Union purse seiners, currently under the Thailand flag, were estimated for January-August 2005 and those for the remaining purse seiner (Equatorial Guinea) for 2005–2006. Total catches were estimated using the number of vessels available, the average catches of the former Soviet Union purse seiners in previous years, and average catches available for other fleets for 2005–2006. Total catches were assigned to species and type of school fished according to data available for Thailand purse seiners during the same period (2005–2006). The amount of catch that the Secretariat has to estimate for this fleet has decreased considerably in recent years. It is thought that there are no longer purse seiners operating under flags of non-reporting countries.

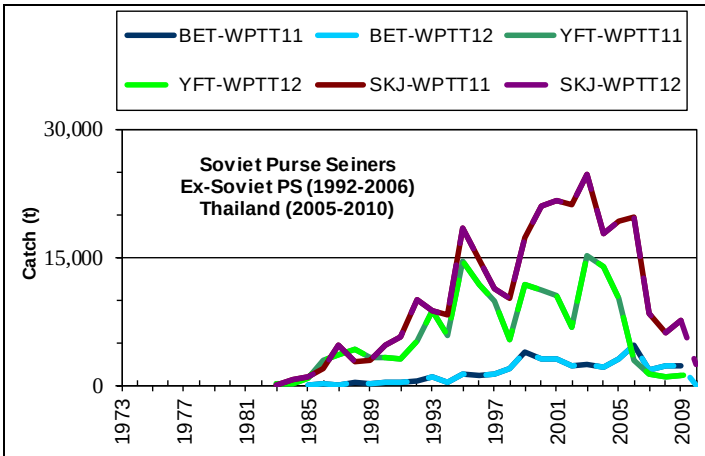


Fig. 31. Catches of Soviet, ex-Soviet and Thai purse seiners estimated in 2012 versus previous catches estimated in 2011 (1983–2010)

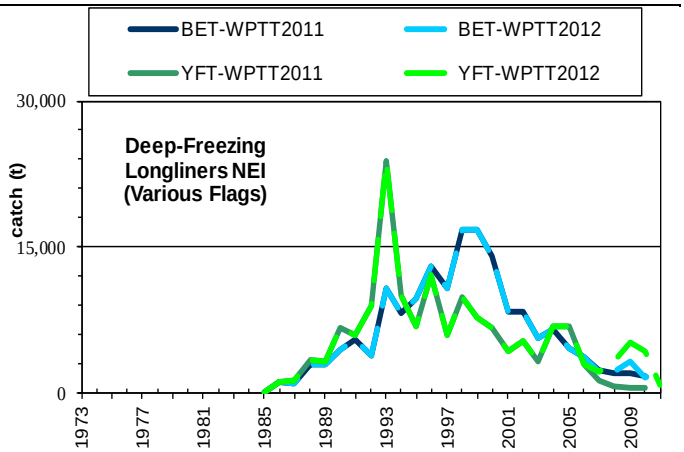


Fig. 32. Catches of deep-freezing longline vessels in the Indian Ocean estimated in 2012 versus catches estimated in 2011 (1985–2011)

- **Deep-freezing longline** (**Fig. 32**): The catches by large longliners from several non-reporting countries were estimated using IOTC vessel records and the catch data from Taiwanese, Japanese or Spanish longliners, based on the assumption that most of the vessels operate in a way similar to the longliners from Taiwan,China, Japan or Spain. The collection of new information on the activities of non-reporting fleets during the last year, in particular the numbers and characteristics of non-reporting longliners, led to improved estimates of catches. Since 1999 the number of non-reporting longliners in the Indian Ocean has decreased considerably leading to a marked decrease in catch levels. Such decrease has coincided with an increase in the numbers of vessels operated by some IOTC CPC's. Although these countries usually report catches to the Secretariat, the data reported are, in some cases, considered incomplete (as indicated in Section 3)
- **Fresh tuna longline** (**Fig. 33-34**): Fresh tuna longline vessels, mainly from China, Taiwan,China, India, Malaysia, Belize and Indonesia, have been operating in the Indian Ocean since the early 1970's. The catches of these fleets have been estimated by the IOTC Secretariat by using information from the following three sources:
    - Catches reported by the flag countries: Although China reported total catches for its longline fleet they were not reported by type of longline until 2006 (fresh-tuna longline or deep-freezing longline). The Secretariat estimated the catches of fresh-tuna longliners for 1999–2005 by using the total catches

reported, the numbers of fresh-tuna longline vessels provided by China and catch rates for fresh-tuna longliners available from other years.

- Information on catches and vessel activity collected through several catch monitoring schemes implemented in the main ports of landing for these vessels, involving the IOTC-OFC[6] and/or institutions in the countries where the fleets are based and/or foreign institutions. This applies to Indonesia (2002–2006), Thailand (1998–2006), Sri Lanka (2002–03), Malaysia (2000–2006), Oman (2004–2005) and Seychelles (2000–2002). Since 2007 Indonesia and Malaysia have reported catches for their longline fleets. However, the catches reported are thought to be incomplete as Indonesia and Malaysia do not monitor the activities of vessels under their flags based in other countries. The Secretariat estimated the catches of this component as for the countries indicated below.
- Information available on the number of fresh-tuna longline vessels operating in other ports or on the activity of those vessels (e.g. the number of vessel unloading or total catches unloaded). This applies to India (2005-11), Indonesia (1973–2001), Thailand (1994–2011), Sri Lanka (1990–2001; 2004–11), Malaysia (1989–2011), Singapore, Mauritius and Maldives (recent years). The catches in these ports and years were estimated from the known/presumed levels of activity of the vessels and the average catches obtained in ports that were covered through sampling.

In 2006 Taiwan,China provided total catches for its longline tuna fleet operating in the Indian Ocean for the period 2000 to 2005. The catches for 2006-11 have also been provided, including time area catches and effort for 2007-11. The catches published by Taiwan,China were slightly higher than those that the IOTC Secretariat had estimated from the data collected through port sampling. The new catches provided for 2001-05 were used to replace those in the IOTC database. This was done on the assumption that vessels from Taiwan,China had operated in ports of non-reporting countries, their catches not accounted for in estimates made by the Secretariat. The Secretariat has been using the catches published by Taiwan,China since 2006.

The catches for fleets other than Taiwan,China for 1973–2011 and for Taiwan,China in years prior to 2001 were estimated as explained in the three bullet points above.

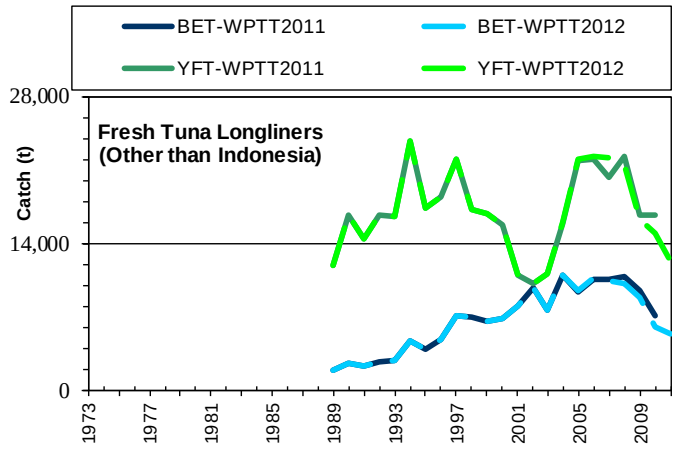


Fig. 33. Catches of fresh-tuna longline vessels based in India, Malaysia, Maldives, Mauritius, Oman, Seychelles, Singapore, Sri Lanka, Thailand and Yemen (mainly registered in China, Taiwan,China and Indonesia) estimated in 2011 versus catches estimated in 2012 (1989–2011)

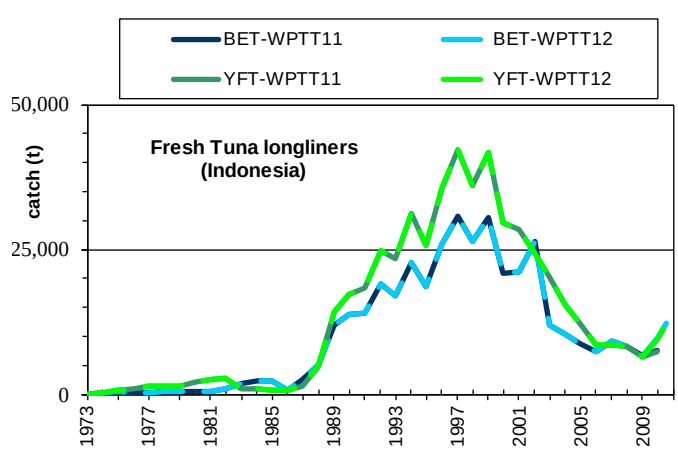


Fig. 34. Catches of fresh-tuna longline vessels based in Indonesia (domestic and foreign) estimated in 2011 versus catches estimated in 2012 (1973–2011)

[6] Overseas Fishery Cooperation Foundation of Japan

APPENDIX II

SUMMARY OF MAIN REVISIONS TO CATCH SERIES

The main data revisions in 2012 include the following fisheries:

India – Artisanal and Longline Fisheries

Artisanal Fisheries -

- Data published by the Central Marine Fisheries Research Institute (CMFRI) and research by IOTC consultant[7] indicates catch levels and fishing activities are lower than those previously reported by India official sources[8], and also lower than revisions to the historical series published by Bhatal[9], particularly for the period 1990 to 2000.
- Secondly, a new artisanal fishery – shrimp trawlers converted to longline and troll vessels – which started in early 2000 has also been added to the total artisanal catch for India. Details of the fishery were provided to the IOTC Scientific Committee in December 2011; the main targets of the fishery are yellowfin tuna and skipjack tuna. Vessels have been in operation from early 2000, and catches from 2002 to 2009 have been estimated based on the information of catch reported for 2010.
- The artisanal data series has subsequently been revised to take account of the new data sourced from CMFRI publications, research by IOTC consultant and additional fishery data. The revised 2012 data series (**Fig. 35**) show the largest revisions to the data from 1990 onwards, with the largest reductions in catch estimates of over 20% for Skipjack tuna in particular.

Longline fisheries -

- In the case of India's longline fisheries, the data series has also been revised downwards following the removal of catch estimates of vessels reported as Indian flagged vessels and also reported as active as Taiwan-China flagged vessels for the same years. Only vessels recorded under the India flag were included in the revised catch series.
- Due to the lack of data on India longline fishing fleets, estimates of longline catch and species composition for were also based on fishing activities of the Taiwan,China fleet fishing in Indian waters. As a result, the proportion of bigeye tuna have also been reduced (**Fig. 36**).

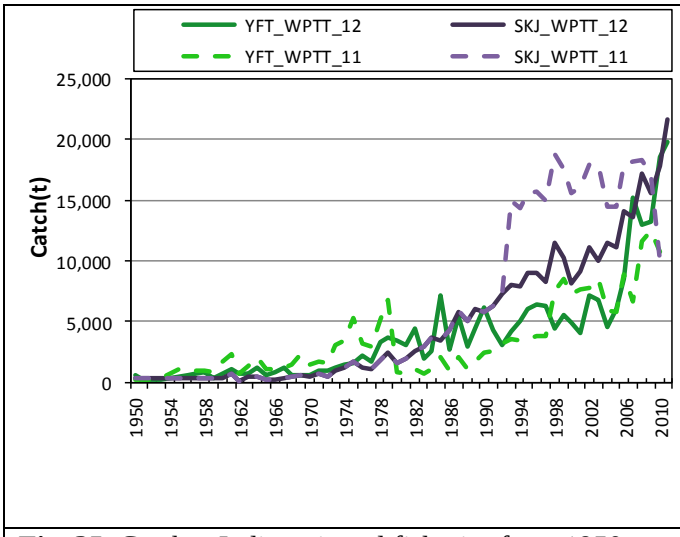


Fig. 35. Catches India artisanal fisheries from 1950–2011 estimated in 2012 versus catches estimated in 2011 (1950–2010)

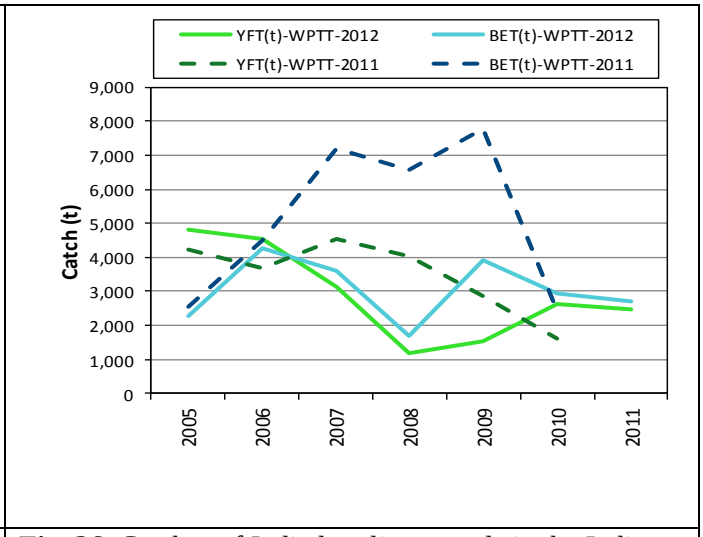


Fig. 36. Catches of India longline vessels in the Indian Ocean estimated in 2011 versus catches estimated in 2010 (2005–2011)

[7] Based on research findings and data collated by Moreno, G. (IOTC) in 2012.
[8] Previous data published by the Ministry of Animal Husbandry, Dairying, and Fisheries.
[9] Bhatel, B. (2005), 'Historical reconstruction of Indian marine fisheries catches, 1950-2000, as a basis for testing the Marine Trophic Index', Fisheries Centre, University of British Columbia, Canada.

Madagascar and Sri Lanka – Artisanal Fisheries

Madagascar

- Yellowfin tuna and skipjack tuna catch estimates for Madagascar were originally based on catch estimates calculated as a fixed proportion of the total catch reported as 'Marine Fisheries' by FAO and Scombridae, containing only small tunas and neritic tuna species.
- However, using this methodology produces very high catch estimates for tropical tunas. The findings of Le Manach et al[10] and research by an IOTC consultant[11], produced evidence that the category of Scombridae used by Madagascar contained all tuna species. The revised data series disaggregates the total catch from scombridae species into tunas and neritic species, with relatively low proportions assigned as skipjack and yellowfin tuna.
- The scale of the revisions to the original data series is significant; for most years, the data has been reduced by up to 80–90% compared to the data series reported in the 2011 WPTT (**Fig. 37**).

Sri Lanka

- Catch estimates for yellowfin tuna and skipjack tuna of Sri Lankan coastal fisheries from 2006 have previously been estimated by assigning a fixed proportion of the total coastal catch reported by the Statistical Unit of Sri Lanka.
- Substantial increase in coastal catch has been reported relative to the number of coastal boats, which prompted a reassessment of the accuracy of catch estimates.
- In 2012 a new estimation method was introduced which takes 1995 as the baseline for the catch. The average catch from the one-day boats reported in 1995 was applied to the total number of one-day boats reported from 1996–2011. The assumption is that these vessels are mainly catching tuna and tuna-like species. Species and gear type have been assigned based on proportions taken from the IOTC database.
- By aligning the catch estimates more closely to the number of reported boats, catch estimates of yellowfin tuna and skipjack tuna have generally been reduced – on average by around 5%, but for some years (such as 2005 and 2010) by around 25% (**Fig 38**).

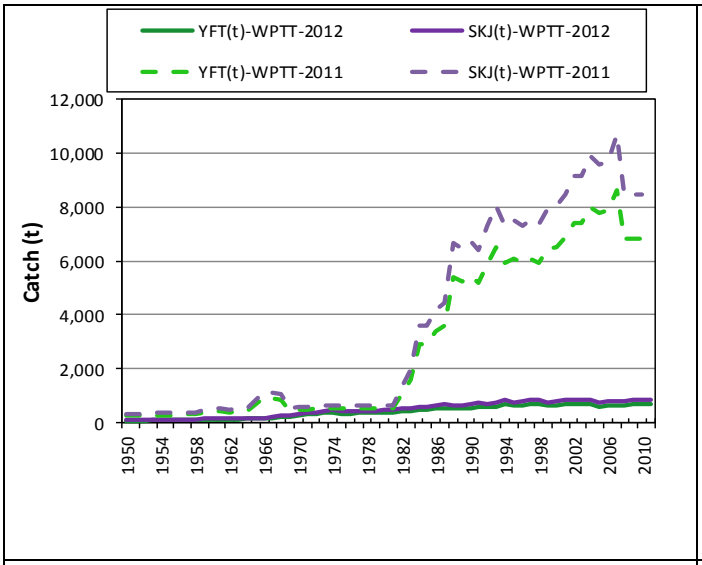


Fig. 37. Catches Madagascar artisanal fisheries from 1950–2011 estimated in 2011 versus catches estimated in 2012 (1950–2010)

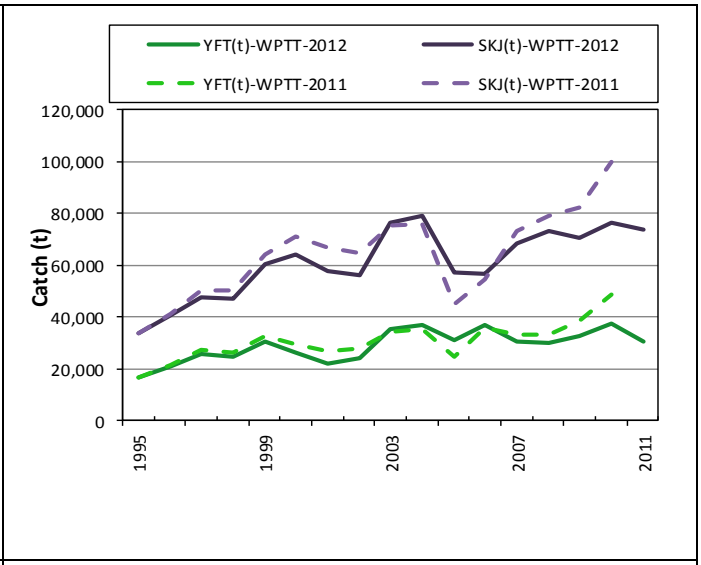


Fig. 38. Catches of Sri Lanka artisanal fisheries in the Indian Ocean estimated in 2011 versus catches estimated in 2012 (1996–2011)

[10] Le Manach, F., Humber, F., Gough, C., Harper, S., Zeller, D. (2011), 'Reconstruction of total marine fisheries catches for Madagascar (1950–2008)'.
[11] Based on research findings and data collated by Moreno, G. (IOTC) in 2012.

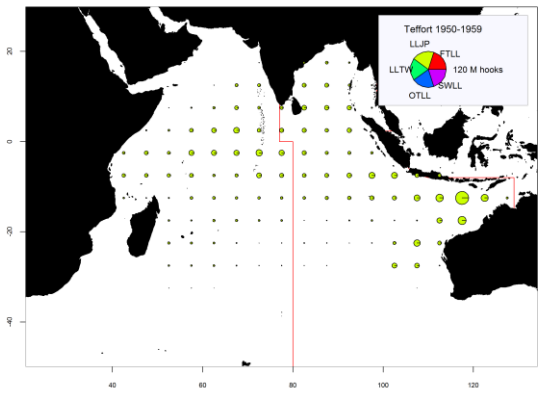
APPENDIX III

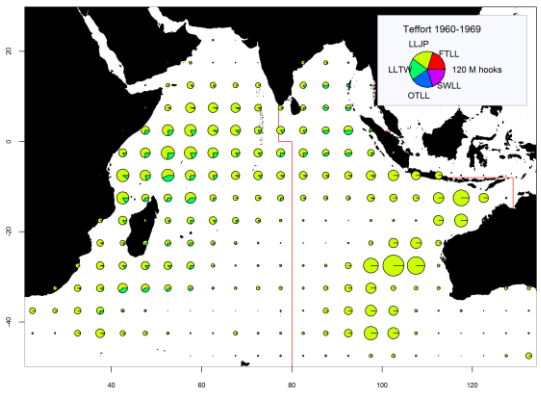
REVIEW OF FISHERIES TRENDS FOR TROPICAL TUNAS

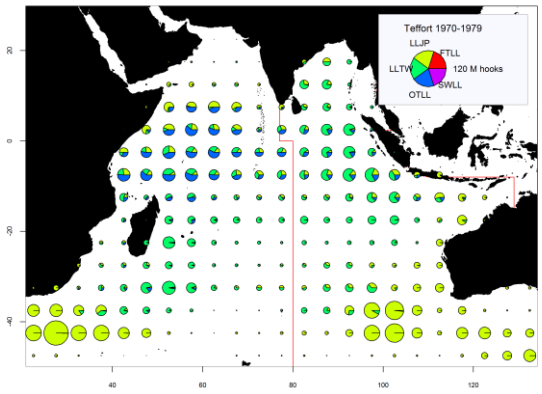
1. EFFORT

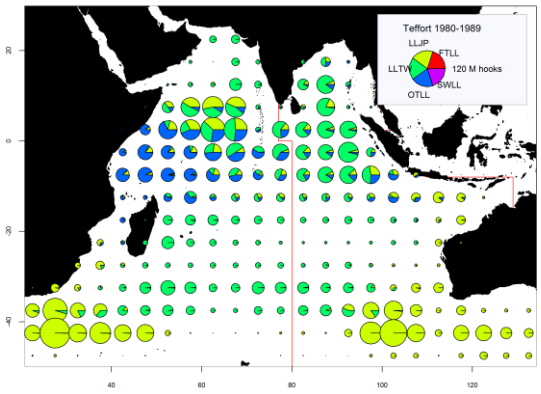
a) Longline

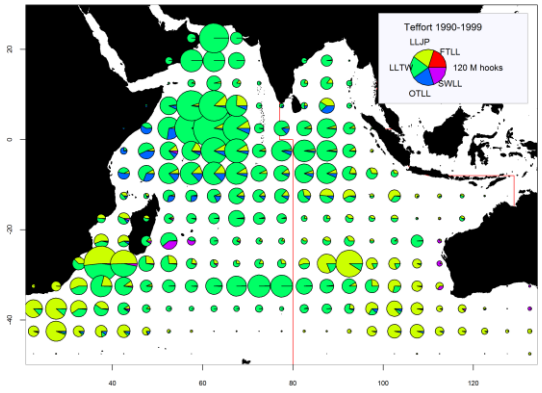
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, by decade and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

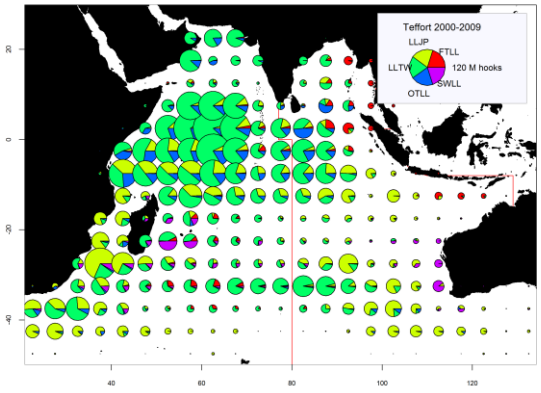




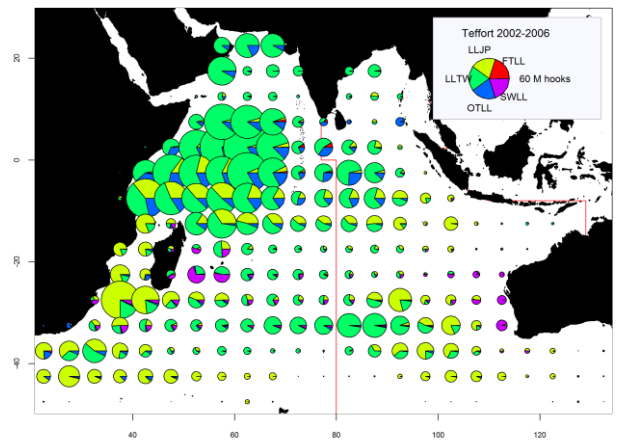


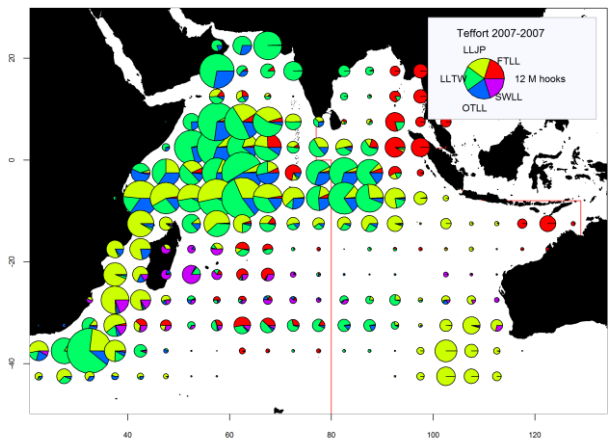


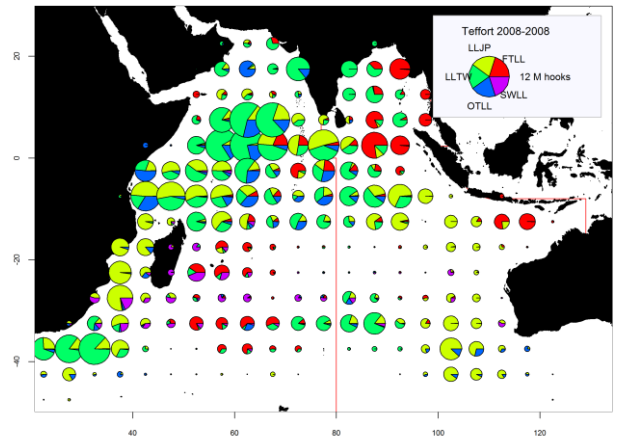


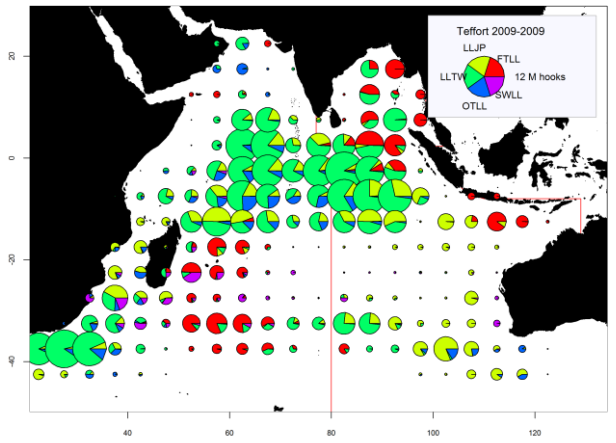


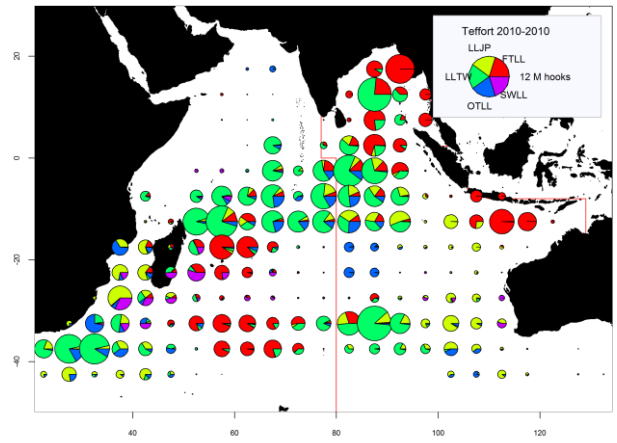
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2002-06 and 2007-11, by year, and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

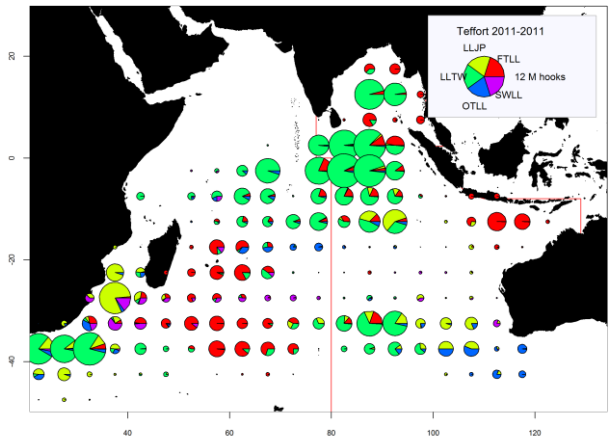




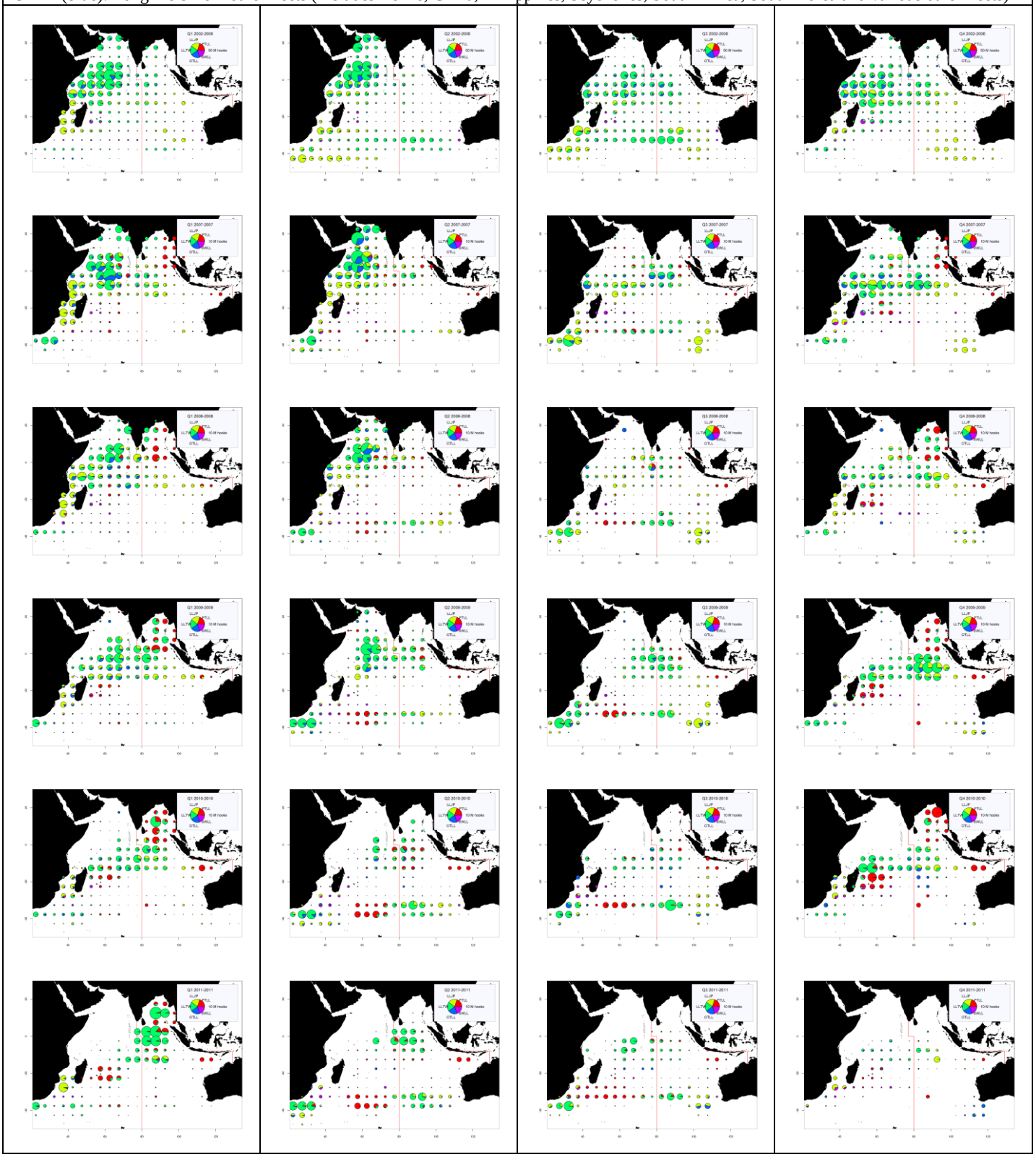






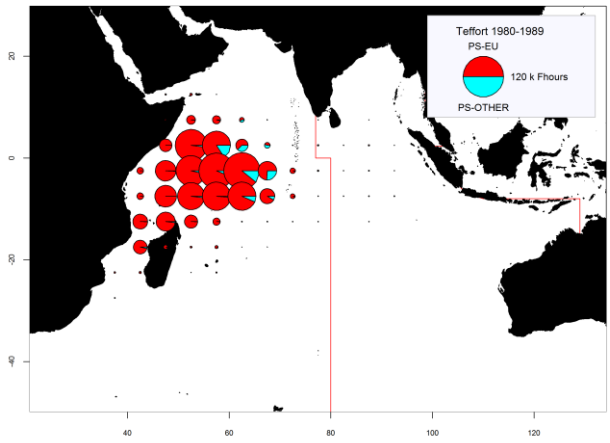


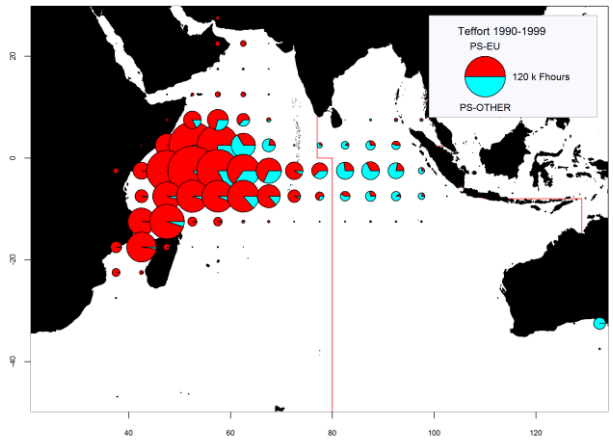
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2002-06 and 2007-11, by year, quarter, and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

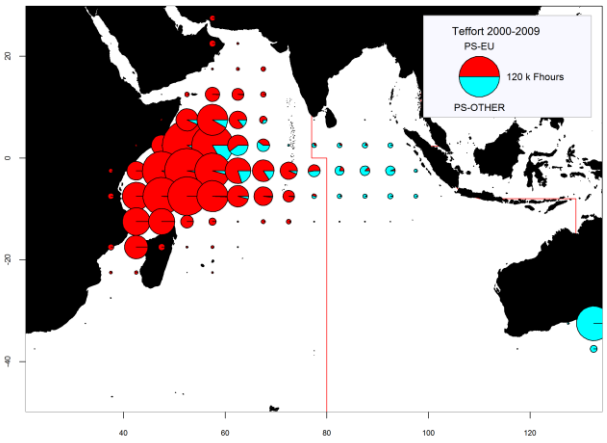


b) *Purse seine*

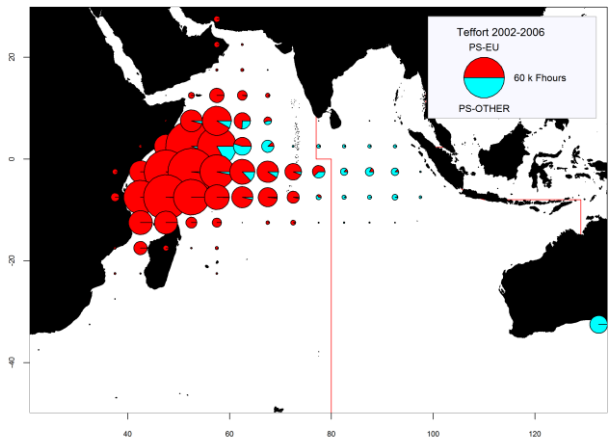
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), by decade and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin)
(excludes effort data for purse seiners of Iran and Thailand)

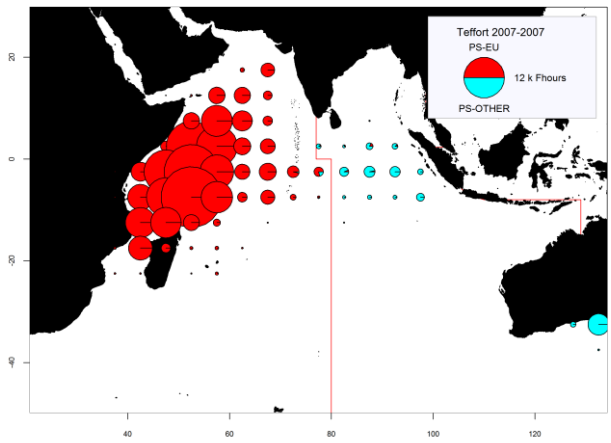


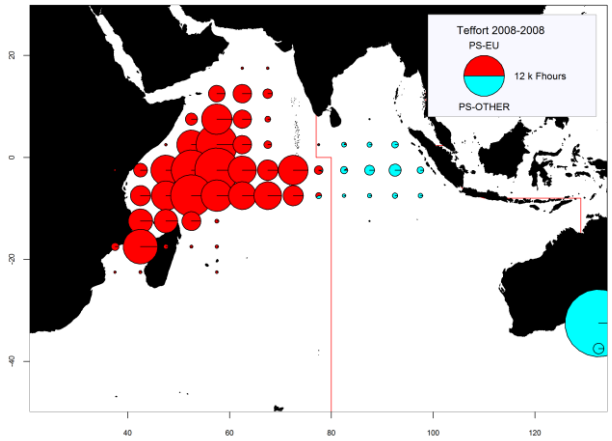


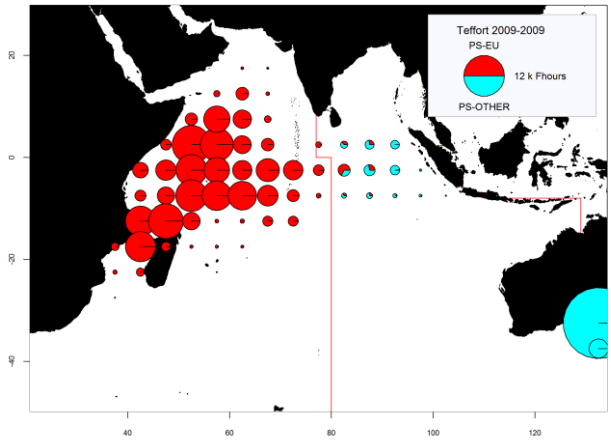


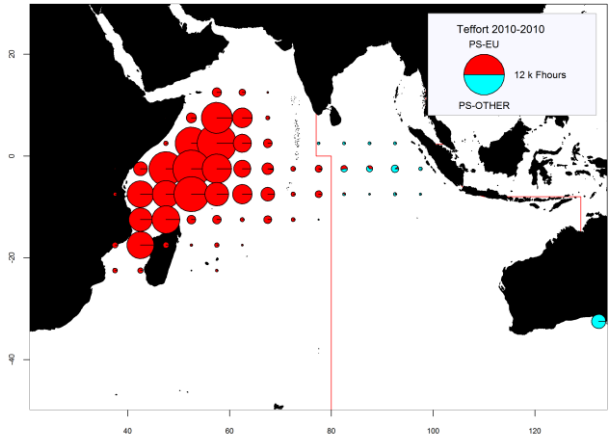
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2002-06 and 2007-11, by year, and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin)
(excludes effort data for purse seiners of Iran and Thailand)

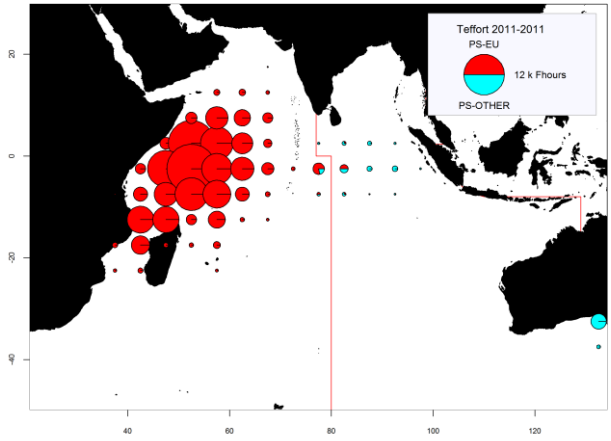




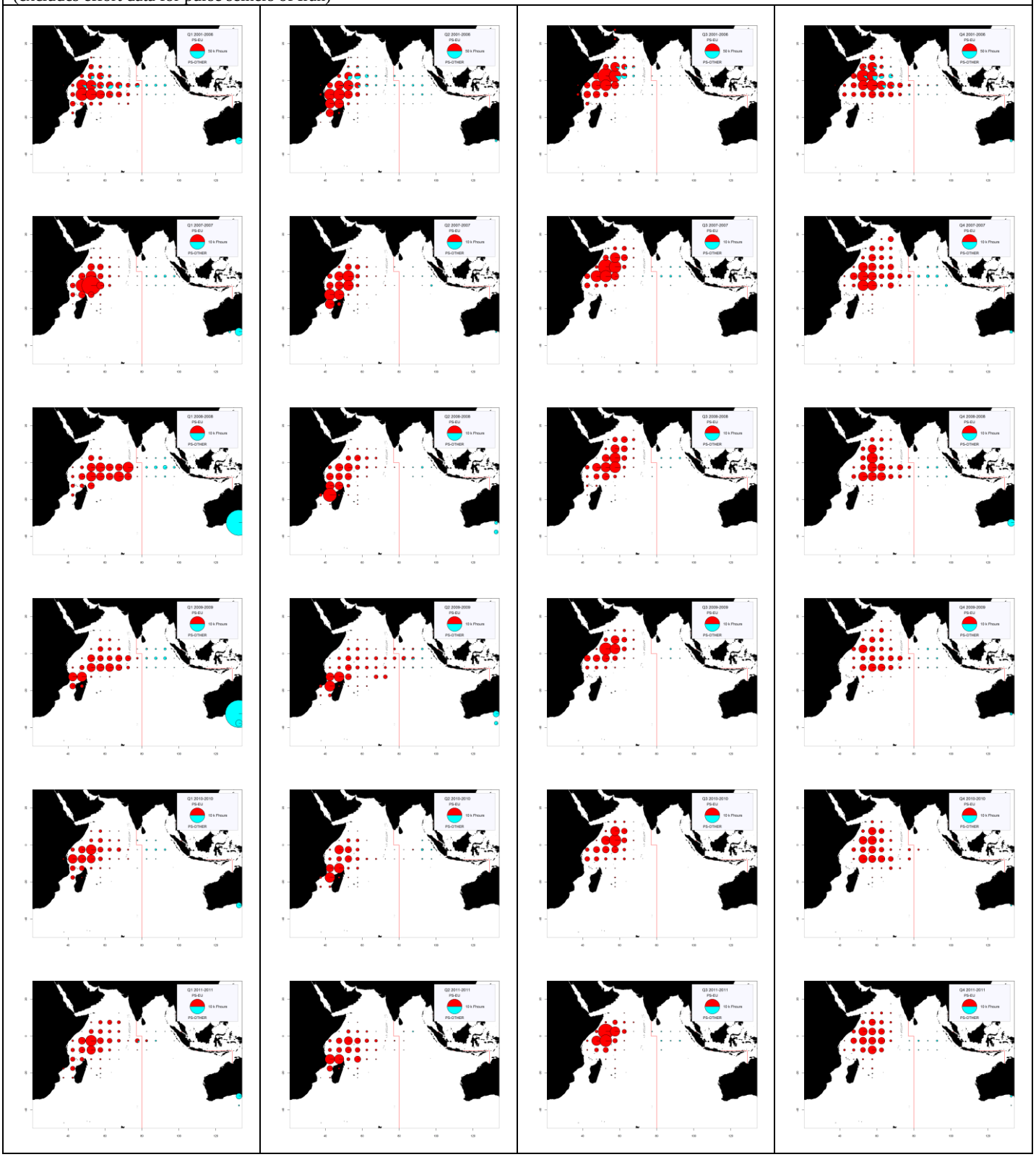






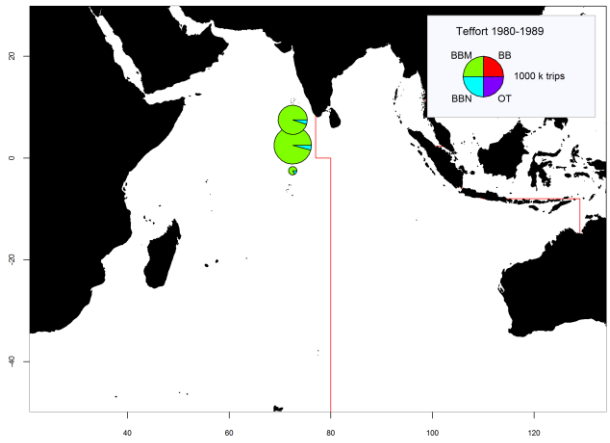


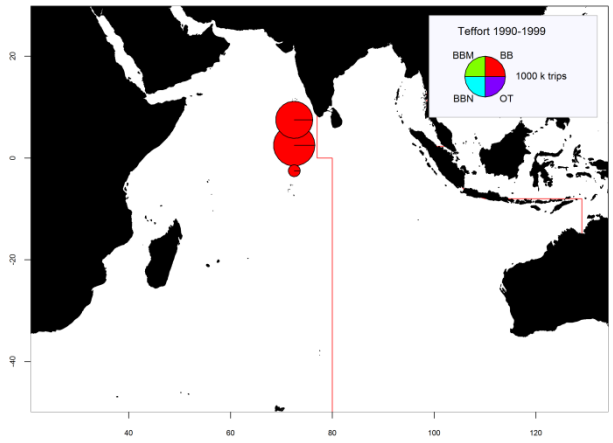
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2002-06 and 2007-11 by year, quarter, and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin)
(excludes effort data for purse seiners of Iran)

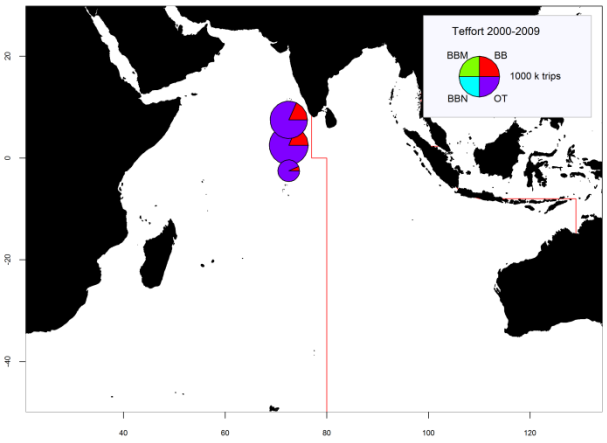


c) *Pole-and-line*

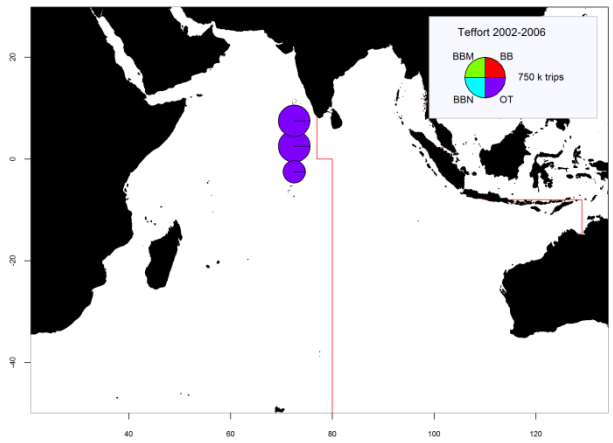
Effort exerted by POLE-AND-LINE fleets in the Indian Ocean, in thousands (k) of trips (equivalent to fishing days), by decade and type of boat:
BBM (green): Pole-and-line (mechanized baitboats)
BBN (blue): Pole-and-line (non-mechanized baitboats)
BB (red): Pole-and-line (all baitboats, especially mechanized)
OT (purple): Pole-and-line and other gears unidentified

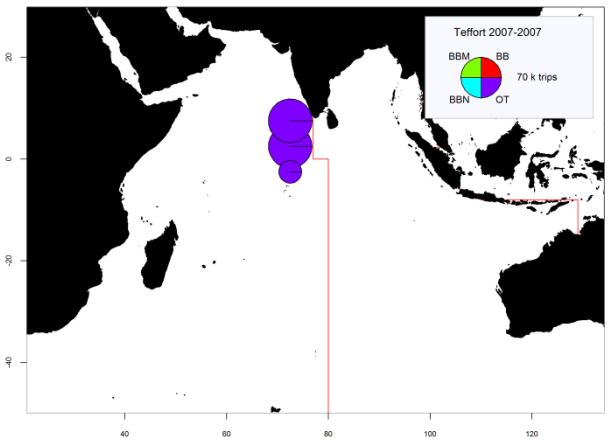


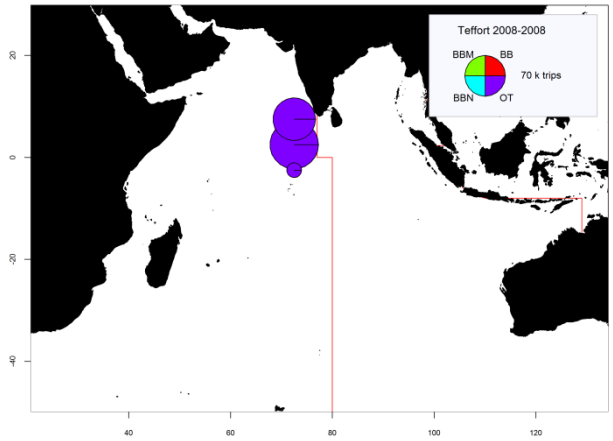


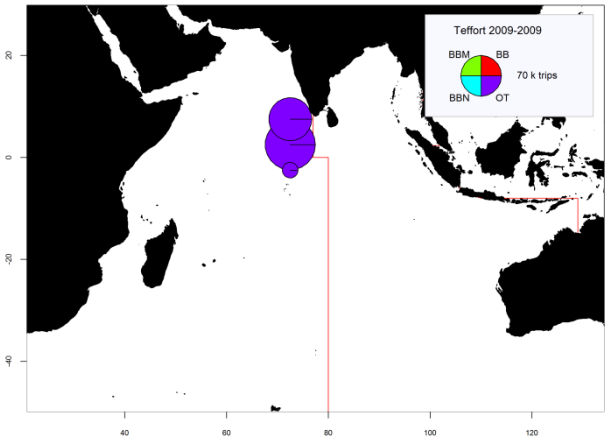


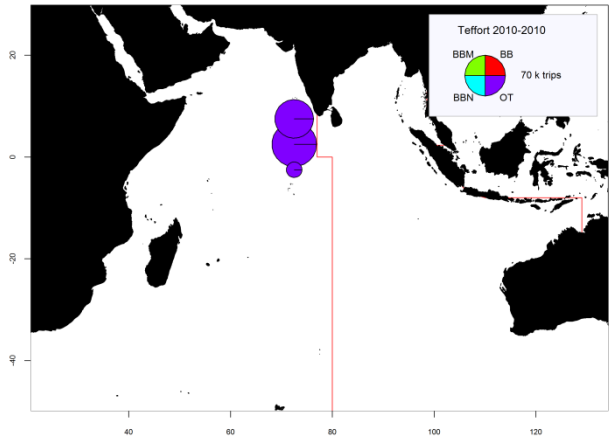
Effort exerted by POLE-AND-LINE fleets in the Indian Ocean, in thousands (k) of trips (equivalent to fishing days), for 2002-06 and 2007-11, by year, and type of boat:
BBM (green): Pole-and-line (mechanized baitboats)
BBN (blue): Pole-and-line (non-mechanized baitboats)
BB (red): Pole-and-line (all baitboats, especially mechanized)
OT (purple): Pole-and-line and other gears unidentified







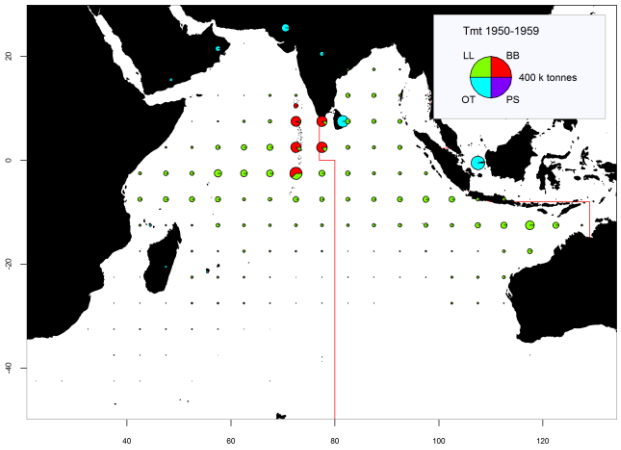


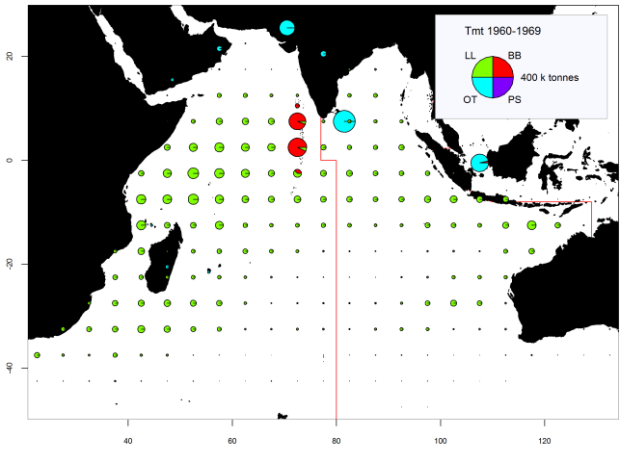


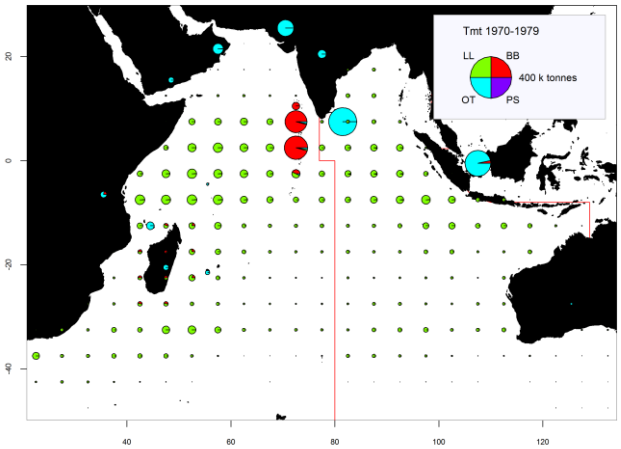
2. TIME-AREA CATCHES

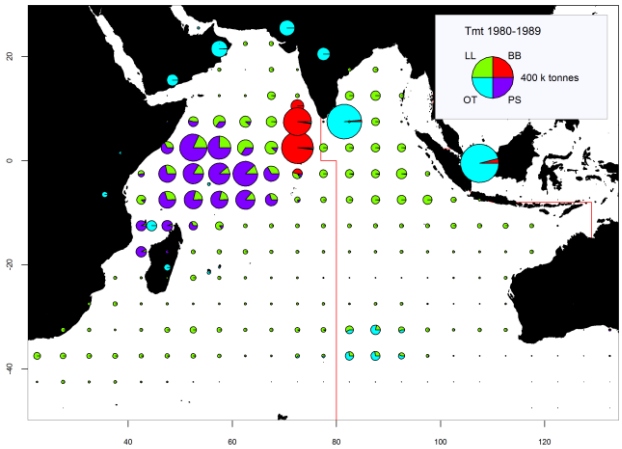
a. Major species: By gear

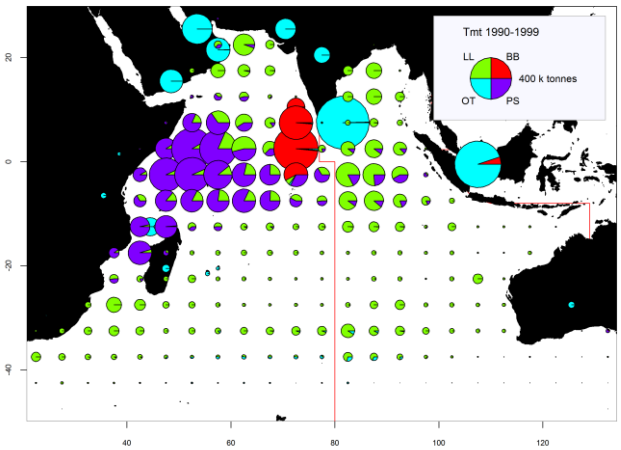
Time-area catches (total combined in tonnes) of major IOTC species (tropical tunas, albacore and swordfish) estimated by gear and decade (1950-2009):
Longline (LL, bright green): freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.
Purse seine (PS, purple) from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets.
Pole-and-line (BB, red): baitboat fisheries from Maldives, India, and other countries.
Other fleets (OTHR, blue): other fleets, especially small-scale fisheries operating in coastal waters.

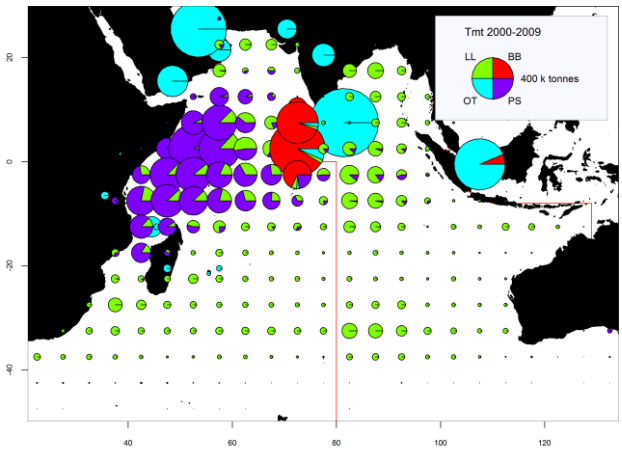




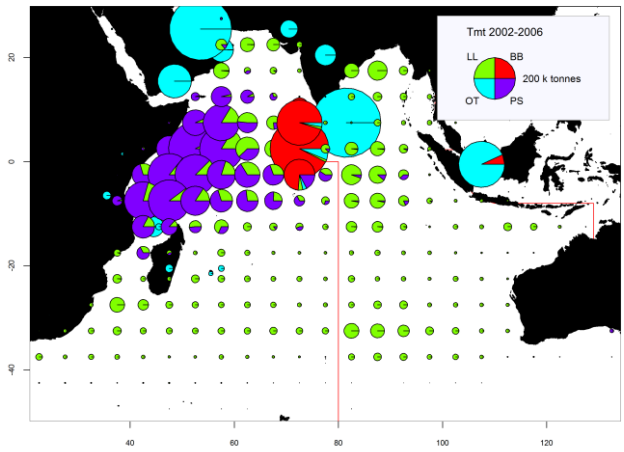


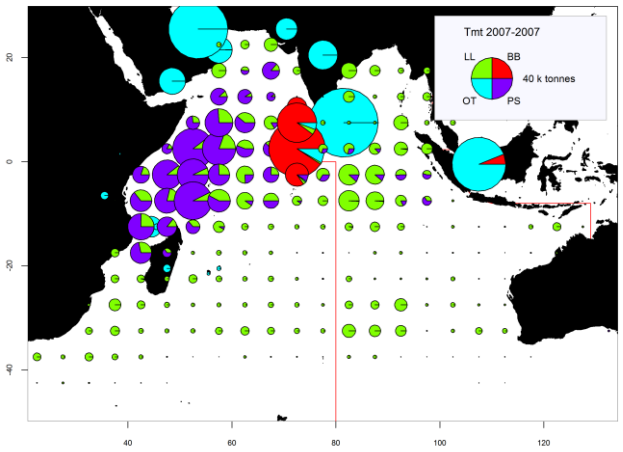


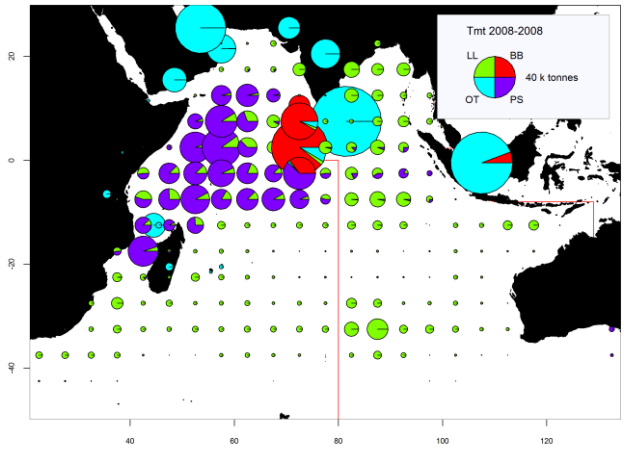


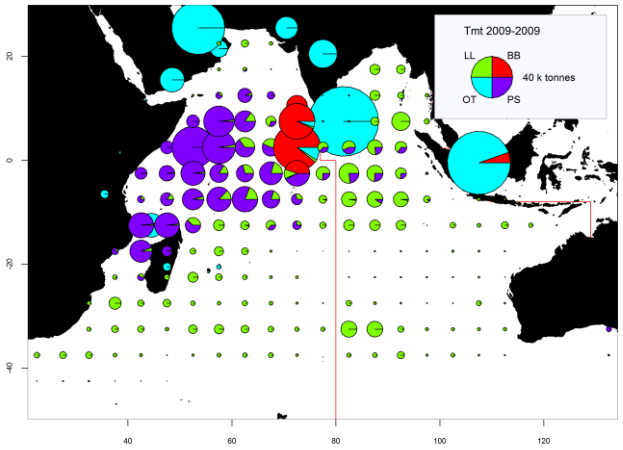


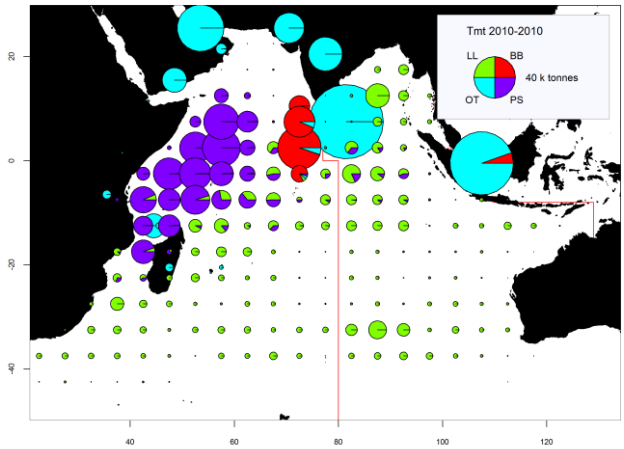
Time-area catches (total combined in tonnes) of major IOTC species (tropical tunas, albacore and swordfish) estimated for 2002-06 and 2007-11, by year and gear:
Longline (LL, bright green): freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.
Purse seine (PS, purple) from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets.
Pole-and-line (BB, red): baitboat fisheries from Maldives, India, and other countries.
Other fleets (OTHR, blue): other fleets, especially small-scale fisheries operating in coastal waters.

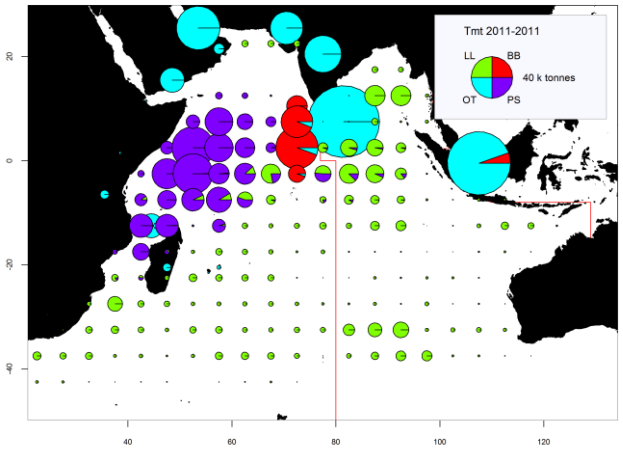






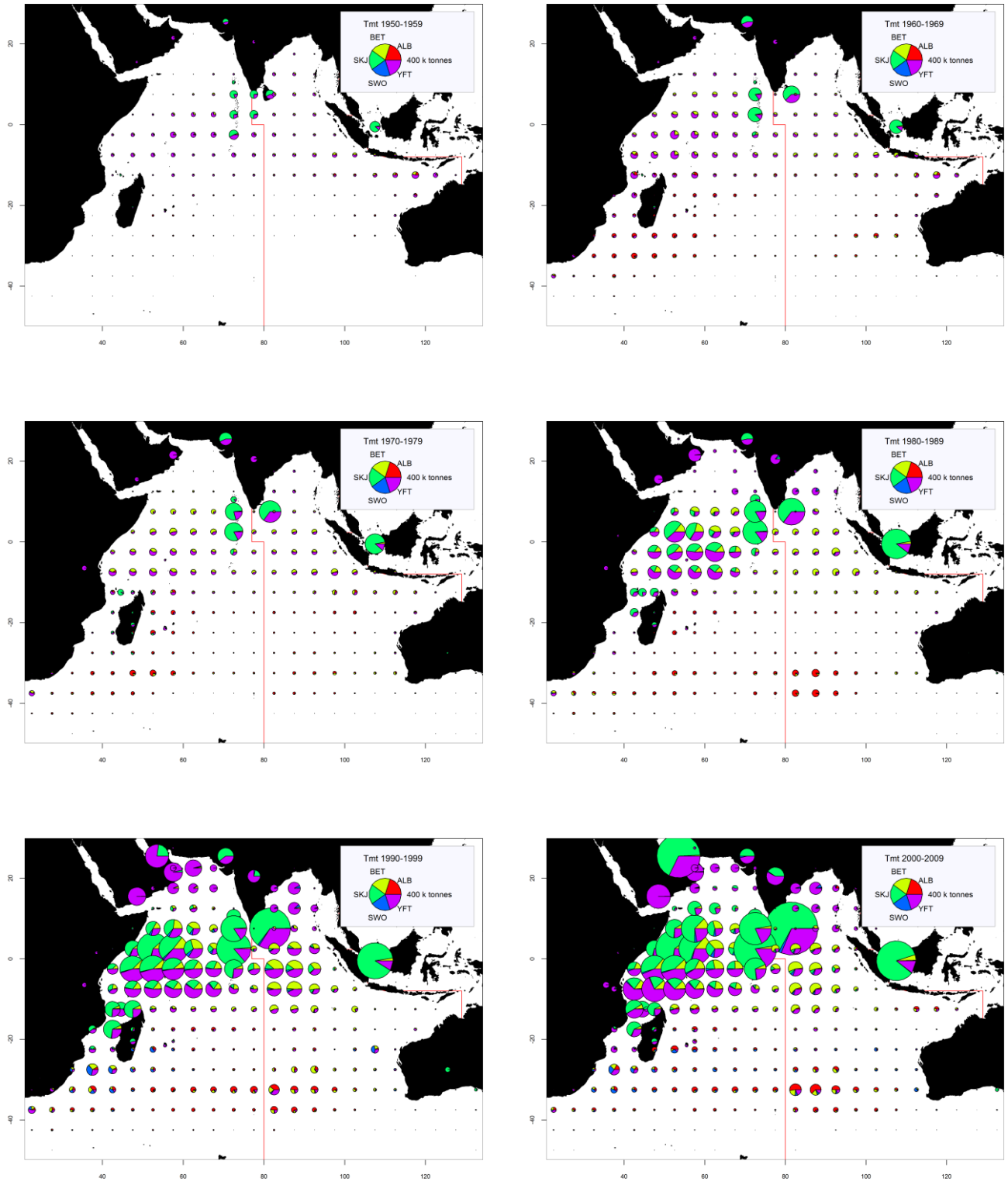




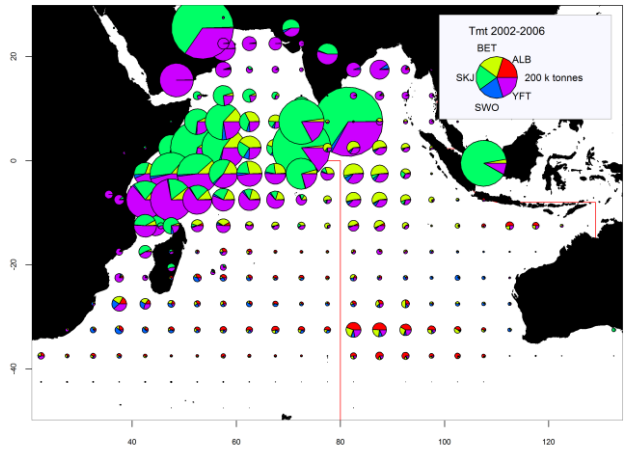


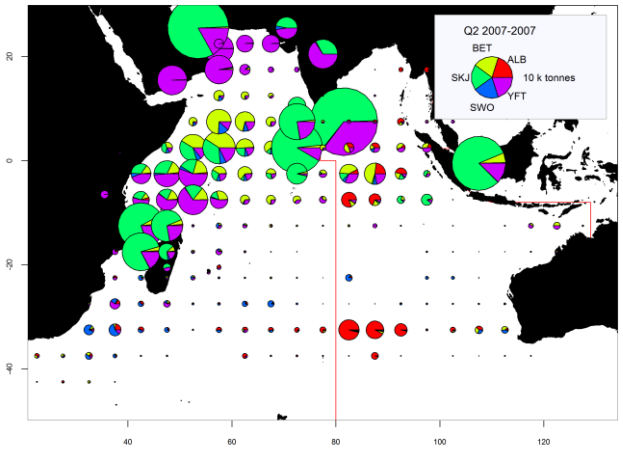
b. Major species: By species

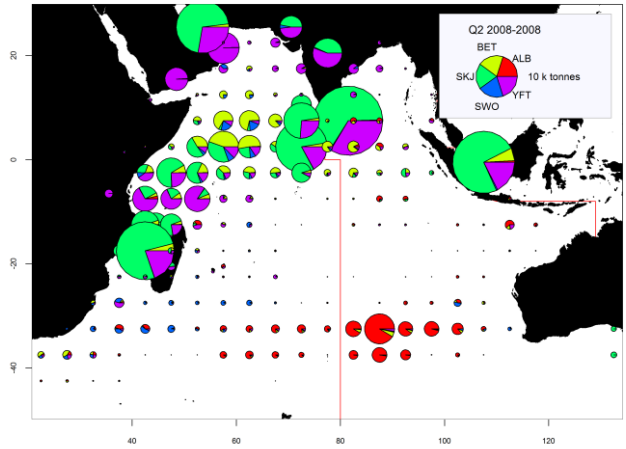
Time-area catches (total combined in tonnes) of major IOTC species (tropical tunas, albacore and swordfish) estimated by species and decade (1950-2009):
Albacore (ALB, red); yellowfin tuna (YFT, purple); swordfish (SWO, dark blue); skipjack tuna (SKJ, bright green); bigeye tuna (BET, light yellow)

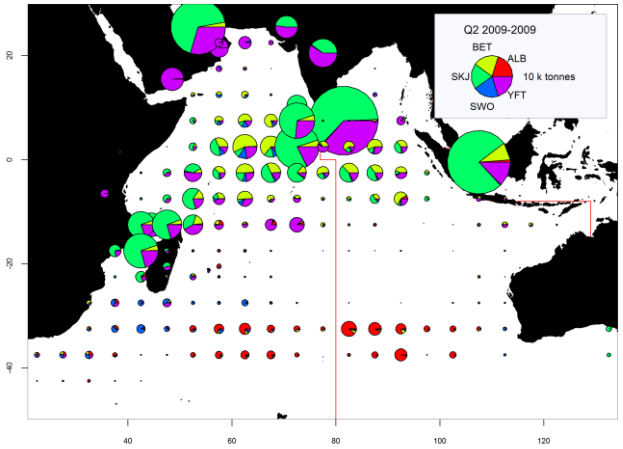


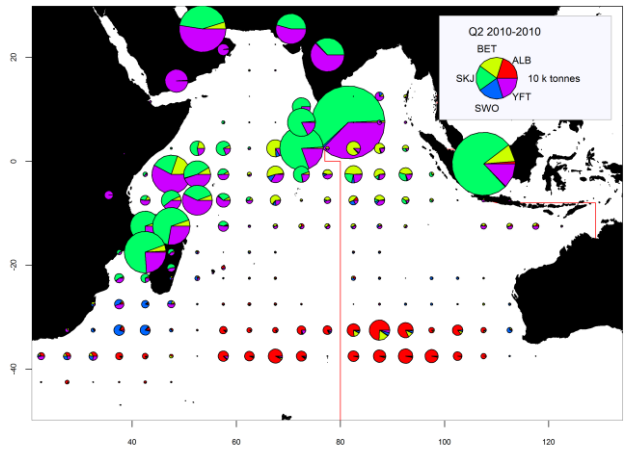
Time-area catches (total combined in tonnes) of major IOTC species (tropical tunas, albacore and swordfish) estimated for 2002-06 and 2007-11, by year and species:
Albacore (ALB, red); yellowfin tuna (YFT, purple); swordfish (SWO, dark blue); skipjack tuna (SKJ, bright green); bigeye tuna (BET, light yellow)

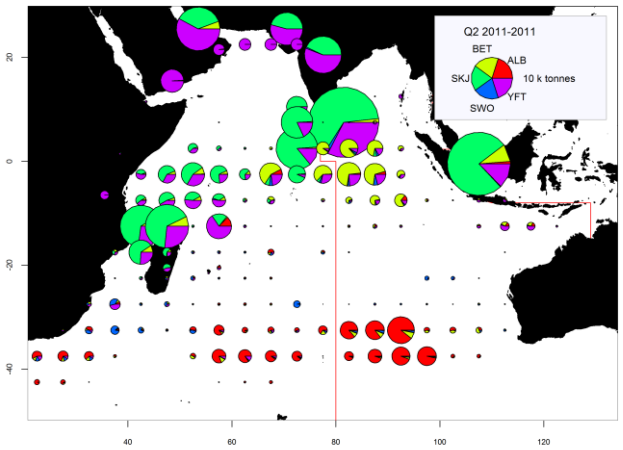






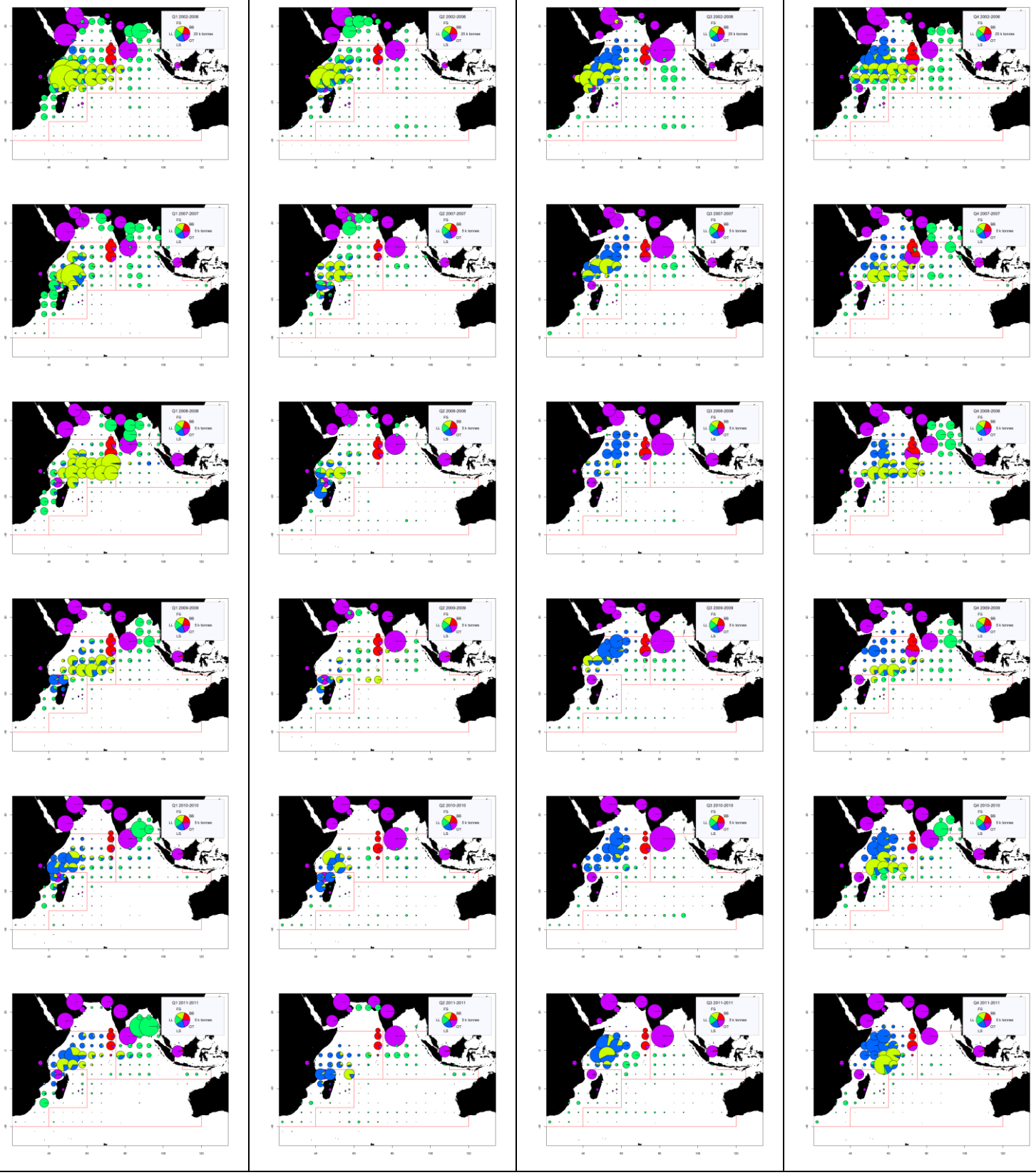






c. Yellowfin tuna (YFT): Recent catches

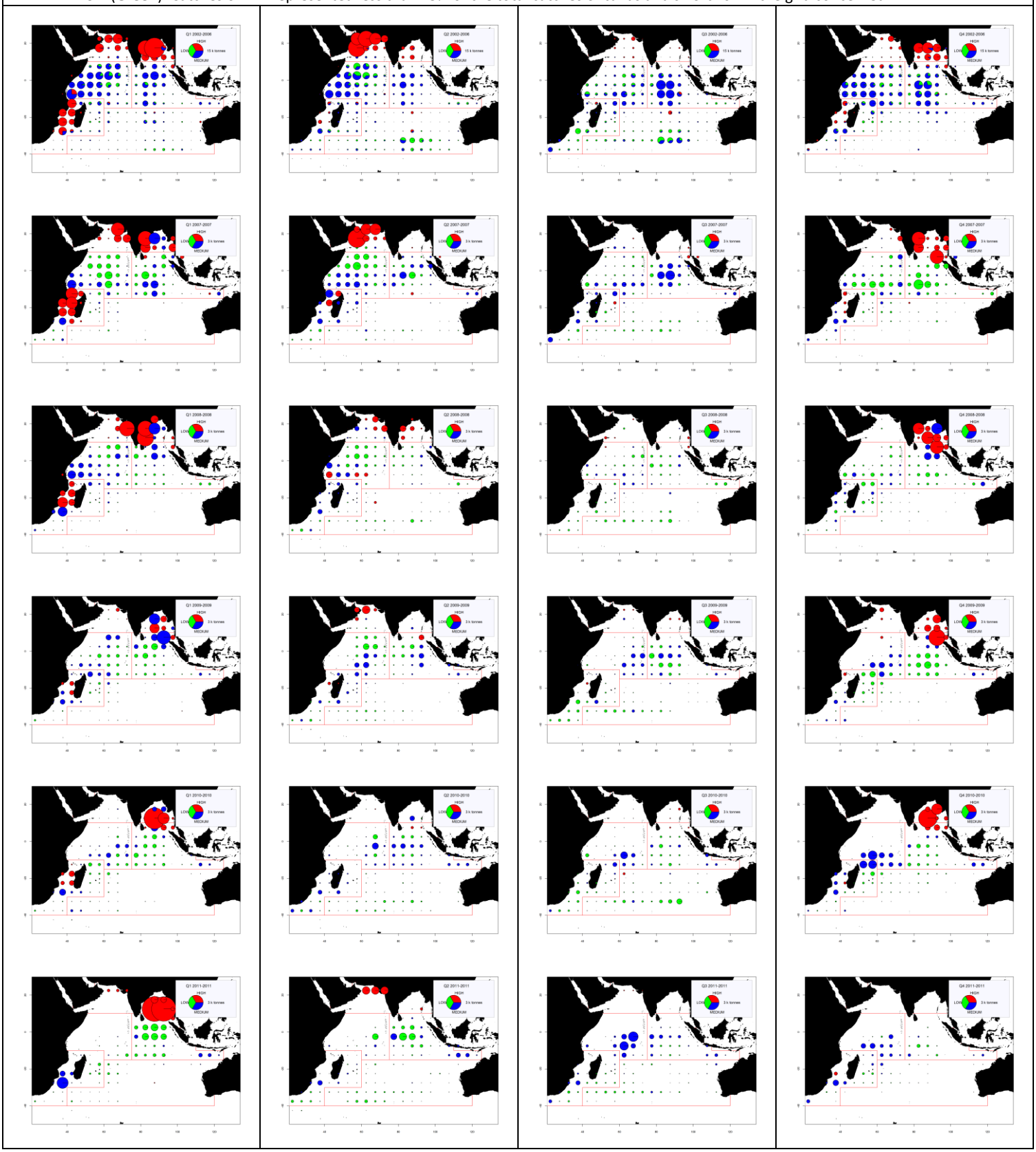
Time-area catches (total combined in tonnes) of YFT estimated for 2002-06 and 2007-11, by year, and quarter:
Longline (LL, bright green): freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.
Purse seiners from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets, on free-swimming (FS, dark yellow) or associated (LS, dark blue) schools.
Pole-and-line (BB, red): baitboat fisheries from Maldives, India, and other countries.
Other fleets (OTHR, purple): other fleets, especially small-scale fisheries operating in coastal waters.



d. Yellowfin tuna (YFT): Main Fishing Areas

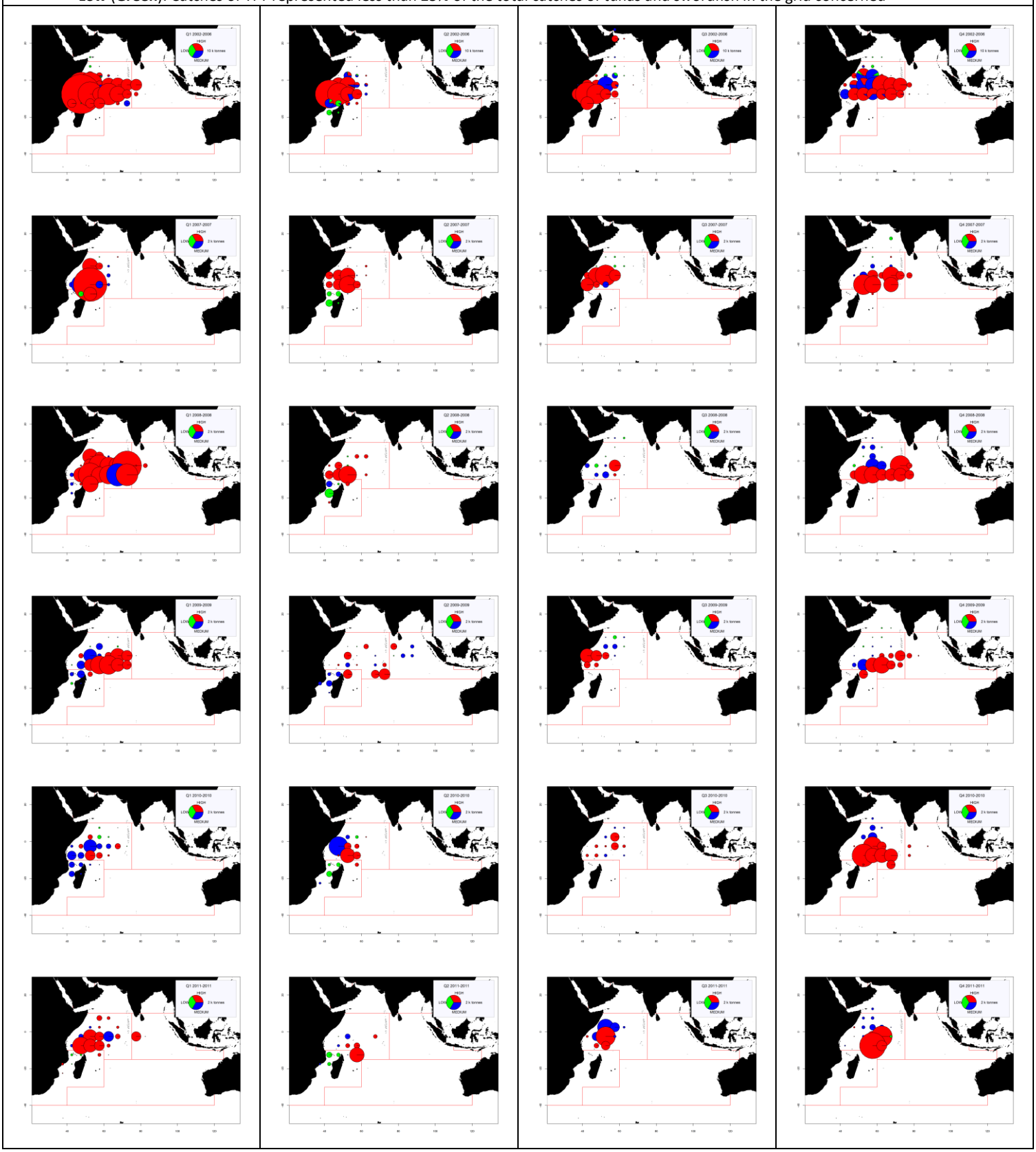
Catches of yellowfin tuna (YFT) taken by longline vessels by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of YFT represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of YFT represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of YFT represented less than 25% of the total catches of tunas and swordfish in the grid concerned



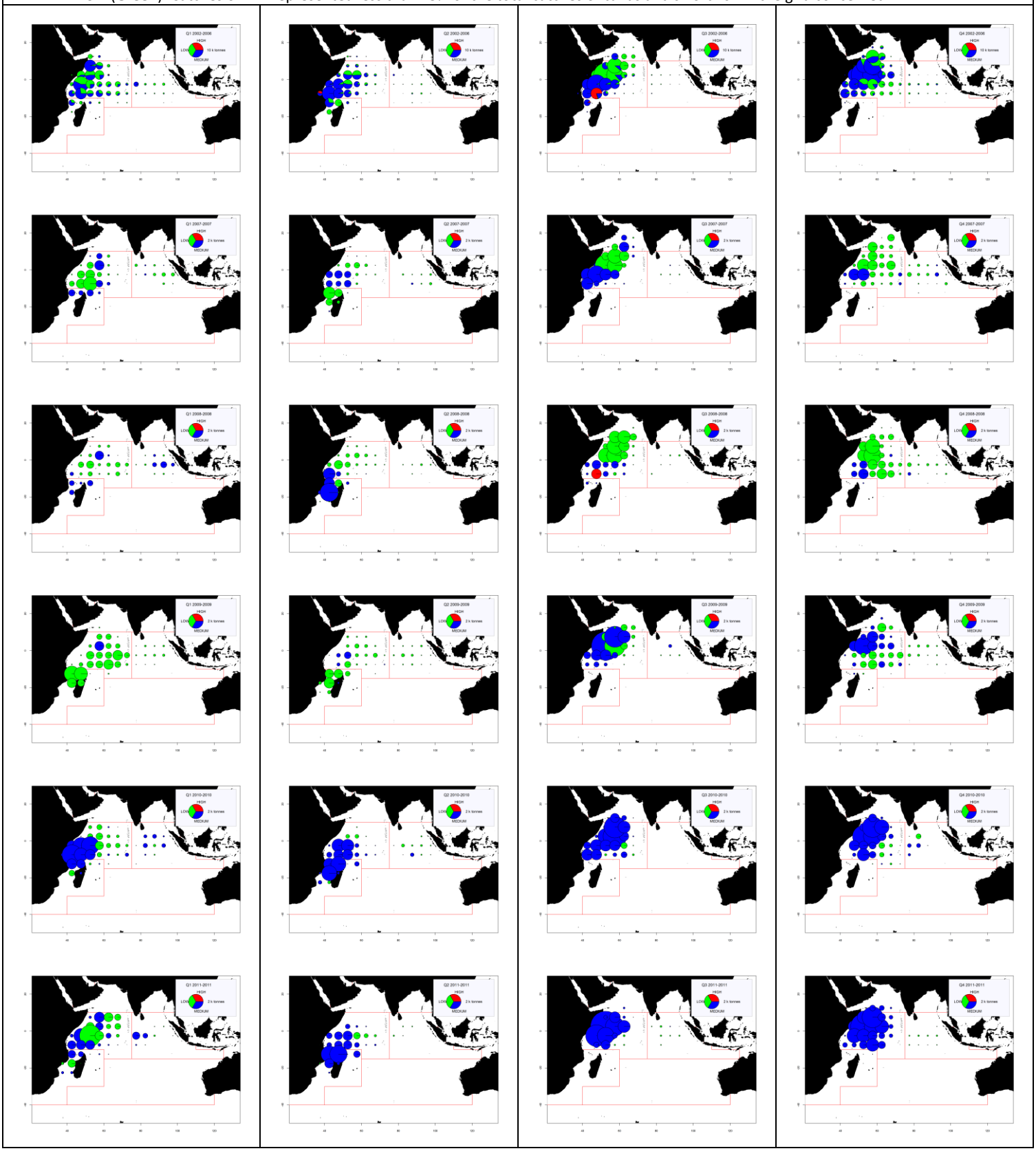
Catches of yellowfin tuna (YFT) taken by purse seine vessels on free swimming schools by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of YFT represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of YFT represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of YFT represented less than 25% of the total catches of tunas and swordfish in the grid concerned



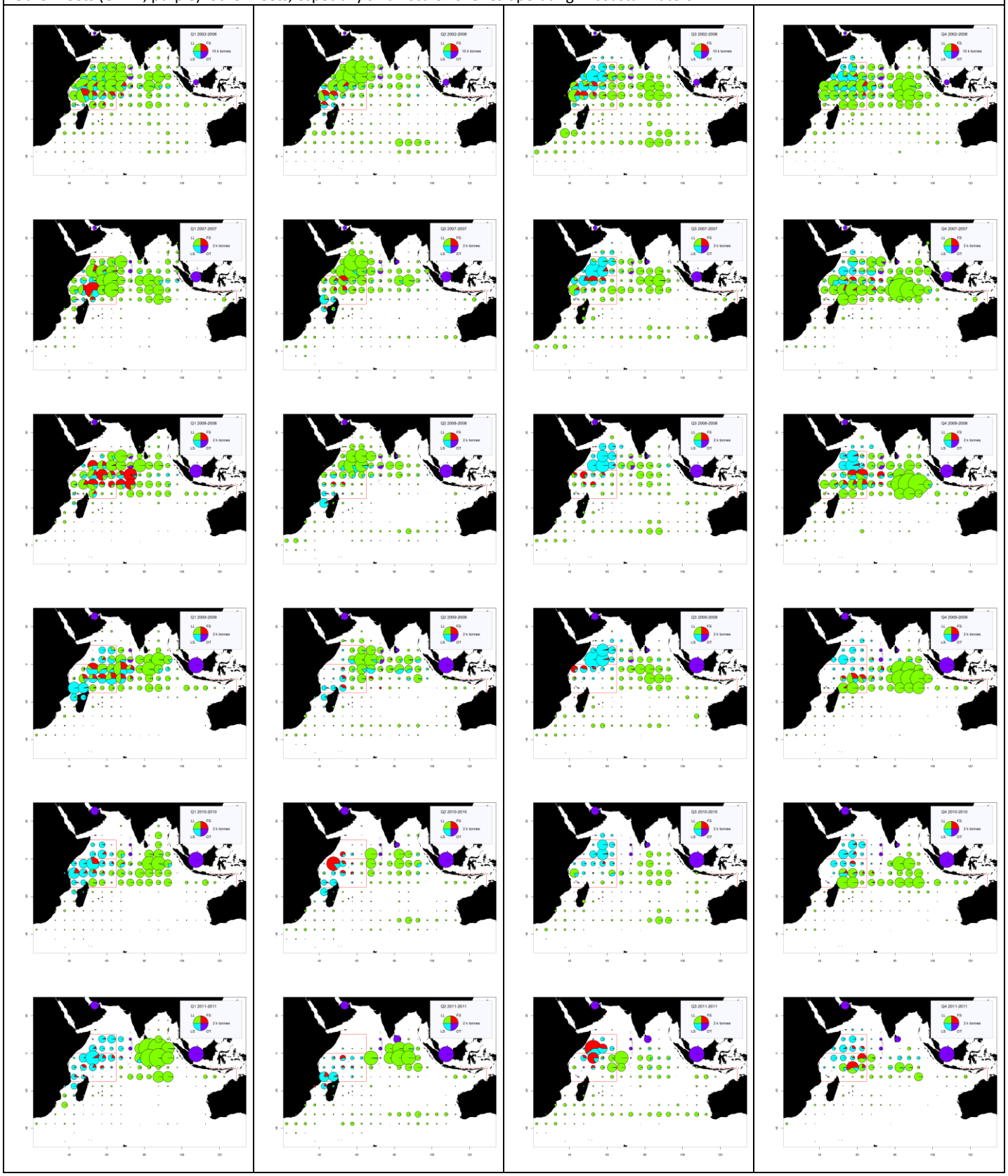
Catches of yellowfin tuna (YFT) taken by purse seine vessels on associated schools by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of YFT represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of YFT represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of YFT represented less than 25% of the total catches of tunas and swordfish in the grid concerned



e. Bigeye tuna (BET): Recent catches

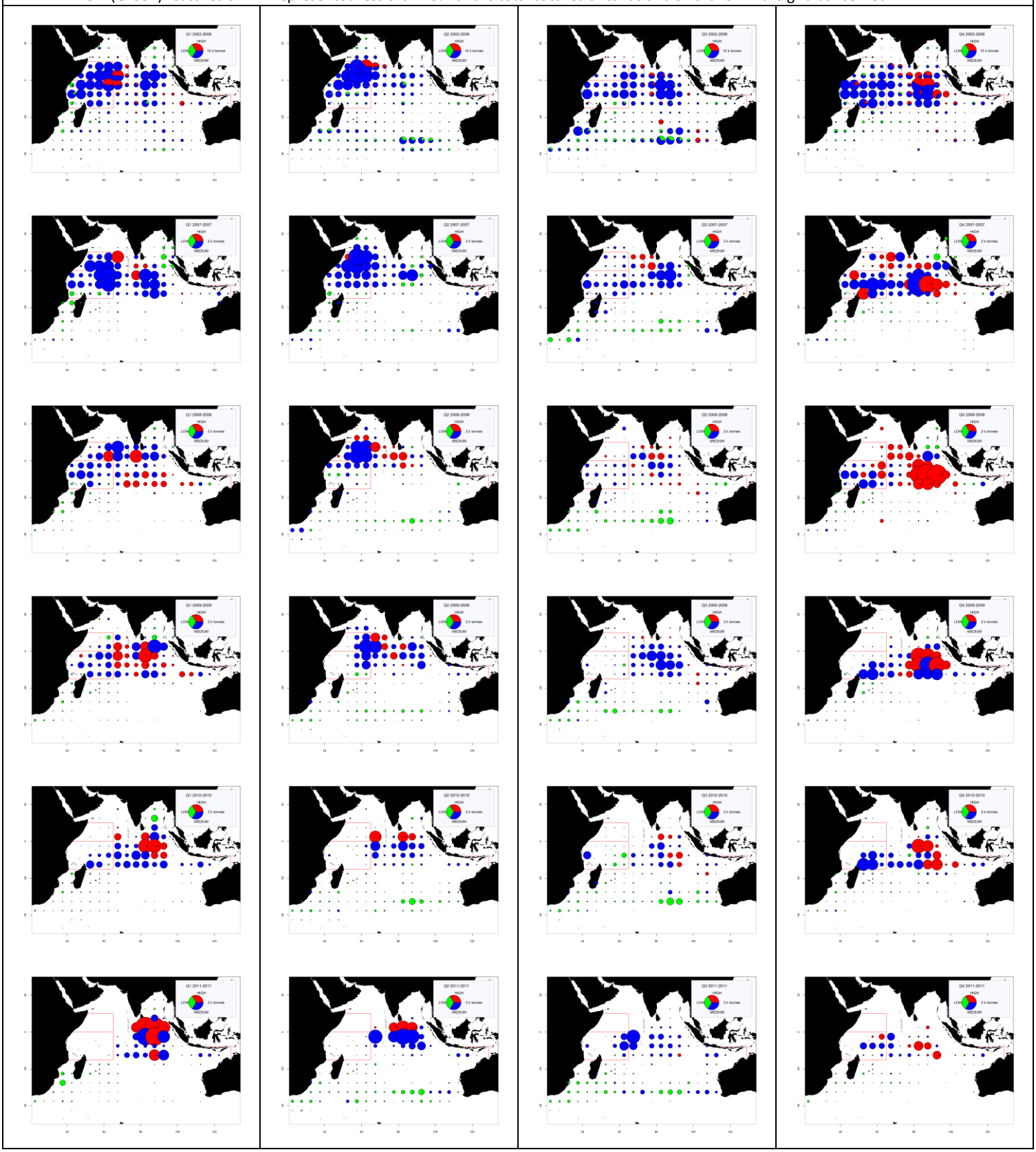
Time-area catches (total combined in tonnes) of BET estimated for 2002-06 and 2007-11, by year, and quarter:
Longline (LL, bright green): freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.
Purse seine: industrial tuna purse seiners from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets, on free-swimming (FS, red) or associated (LS, light blue) schools.
Other fleets (OTHR, purple): other fleets, especially small-scale fisheries operating in coastal waters.



f. Bigeye tuna (BET): Main Fishing Areas

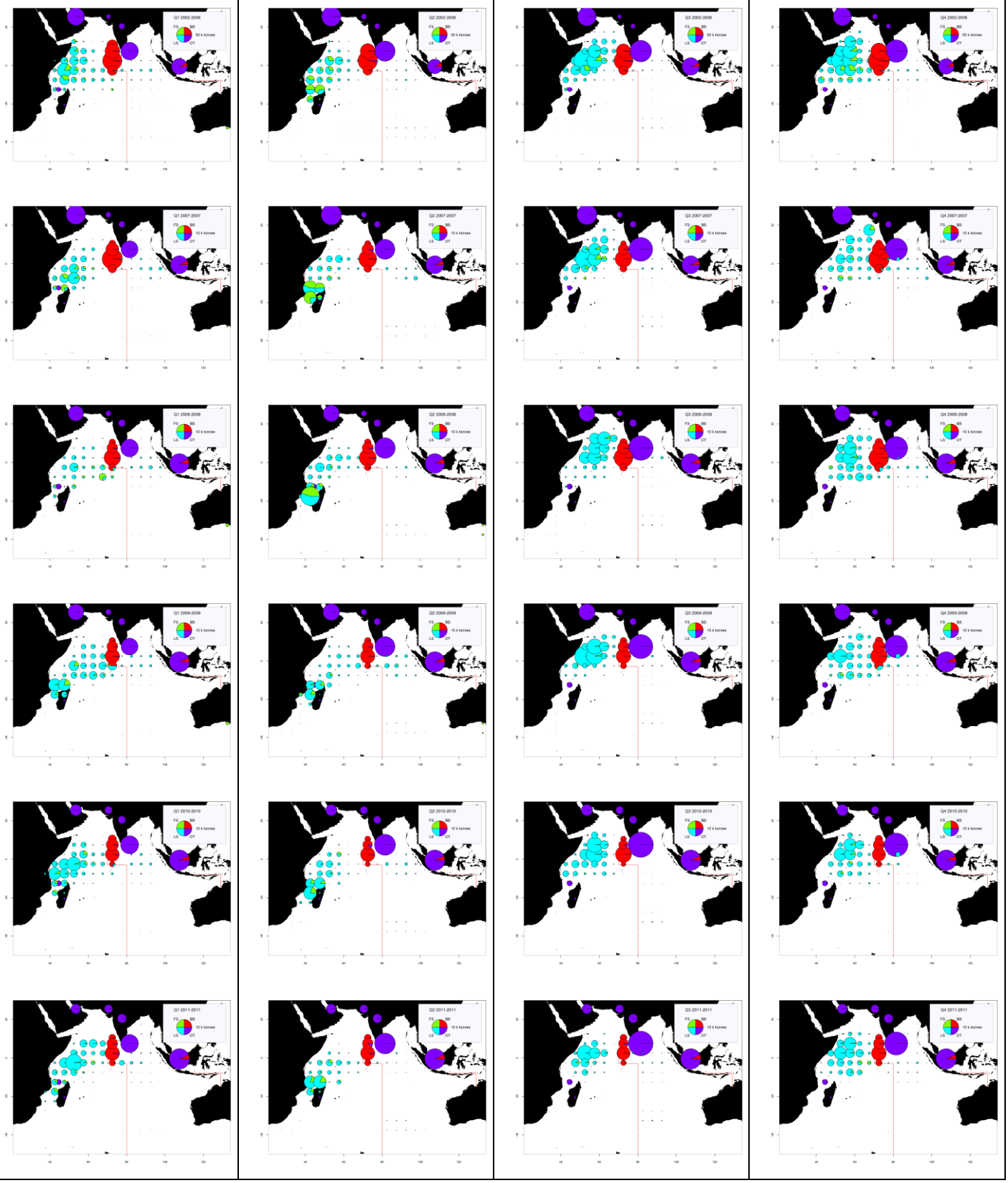
Catches of bigeye tuna (BET) taken by longline vessels by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of BET represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of BET represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of BET represented less than 25% of the total catches of tunas and swordfish in the grid concerned



g. Skipjack tuna (SKJ): Recent catches

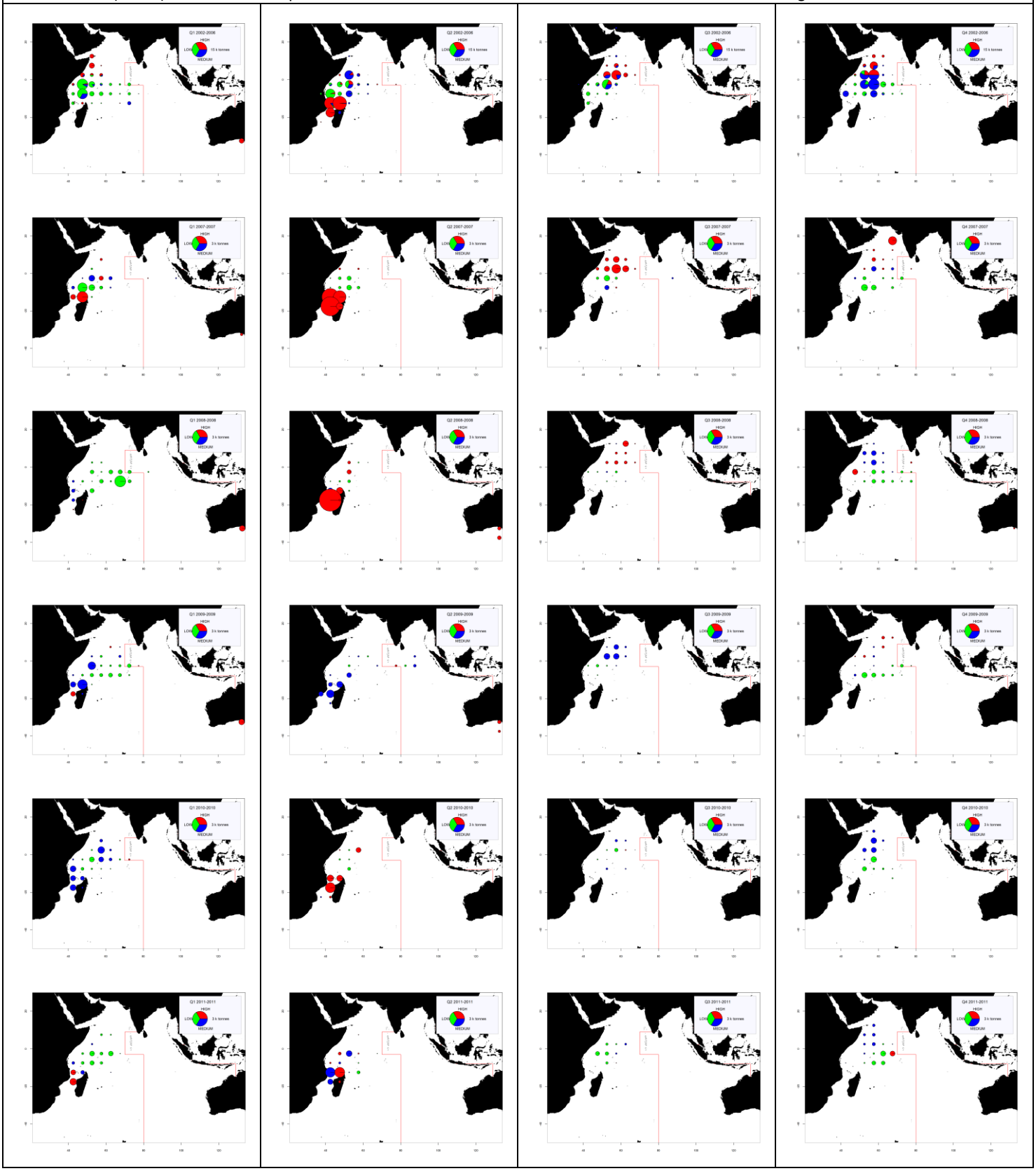
Time-area catches (total combined in tonnes) of SKJ estimated for 2002-06 and 2007-11, by year, and quarter:
Longline (LL, bright green): freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.
Purse seine: industrial tuna purse seiners from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets, on free-swimming (FS, bright green) or associated (LS, light blue) schools.
Pole-and-line (BB, red): baitboat fisheries from Maldives, India, and other countries.
Other fleets (OTHR, purple): longline and other fleets, especially small-scale fisheries operating in coastal waters.



h. Skipjack tuna (SKJ): Main Fishing Areas

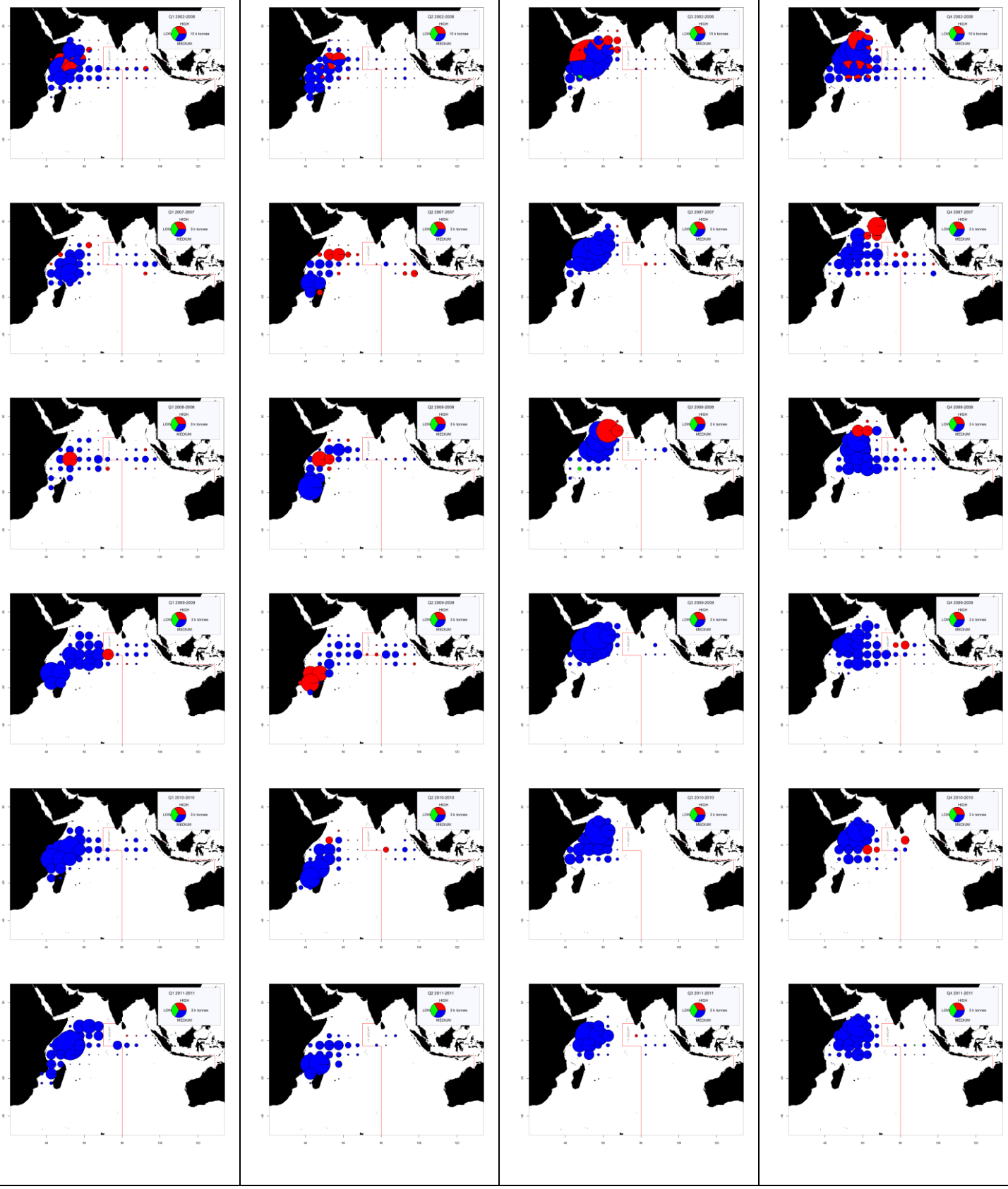
Catches of skipjack tuna (SKJ) taken by purse seine vessels on free swimming schools by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of SKJ represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of SKJ represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of SKJ represented less than 25% of the total catches of tunas and swordfish in the grid concerned



Catches of skipjack tuna (SKJ) taken by purse seine vessels on associated schools by year, quarter and 5 degree square grid, for the years 2002-11. The different colors show the proportion that the catches of yellowfin tuna on each quarter and 5 degrees square grid made out of the total catches of tropical tunas, albacore and swordfish over the same area and period:

- **High** (**Red**): Catches of SKJ represented 75% or more of the total catches of tunas and swordfish in the grid concerned
- **Medium** (**Blue**): Catches of SKJ represented 25-75% of the total catches of tunas and swordfish in the grid concerned
- **Low** (**Green**): Catches of SKJ represented less than 25% of the total catches of tunas and swordfish in the grid concerned

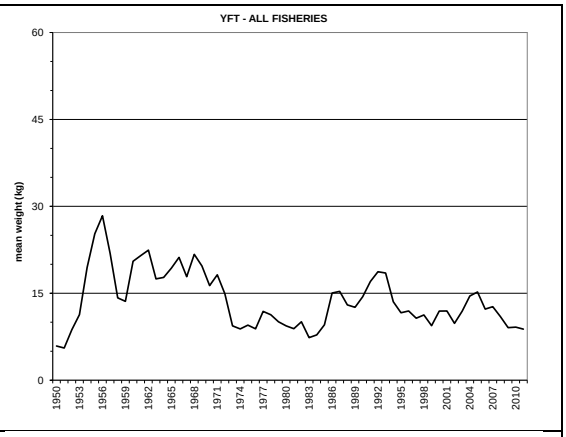


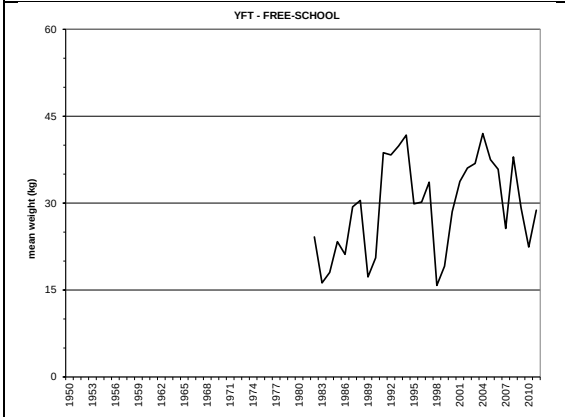
3. AVERAGE WEIGHT

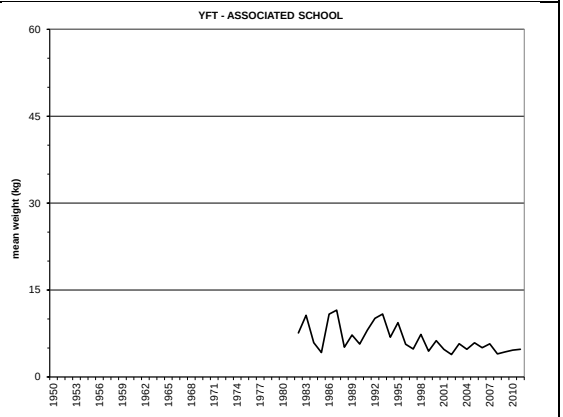
a. Yellowfin tuna (YFT)

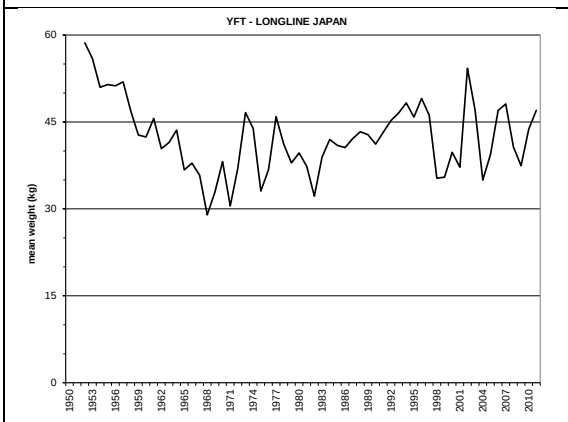
Average weight of yellowfin tuna (YFT) taken by:

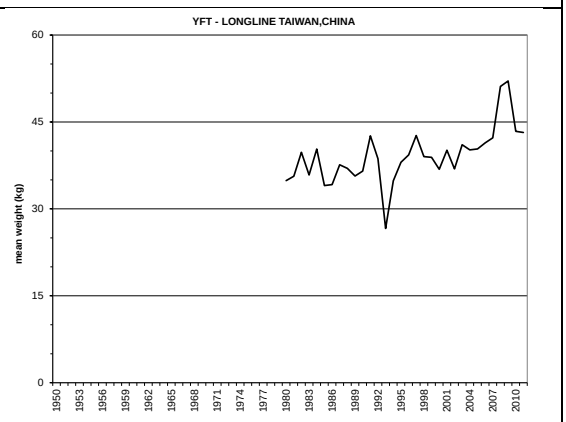
- All fisheries combined (right)
- Purse seine on free (top left) and associated (top right) schools,
- Longlines from Japan (mid left) and Taiwan,China (mid right)
- Pole-and-line from Maldives and India (bottom left)
- Gillnets from Sri Lanka, Iran, and other countries (bottom right)

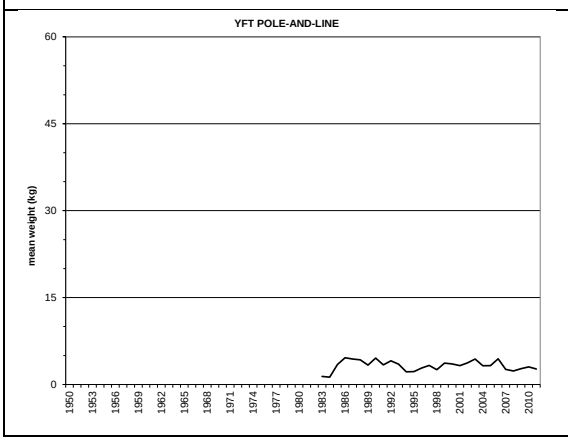


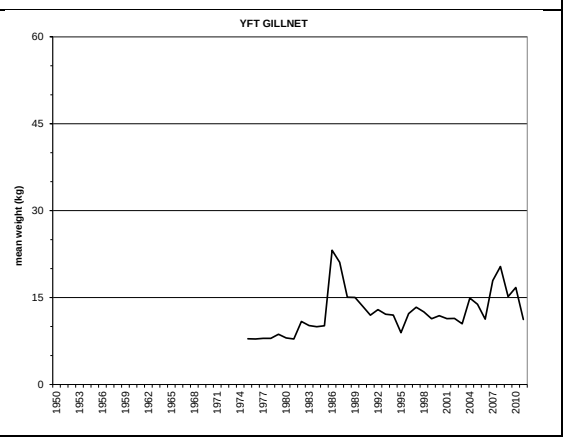






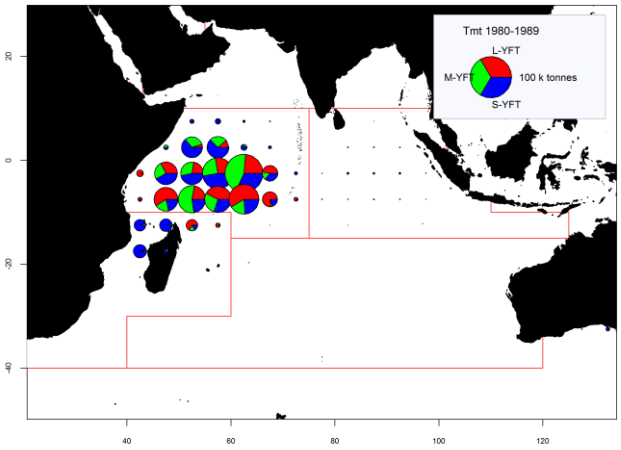


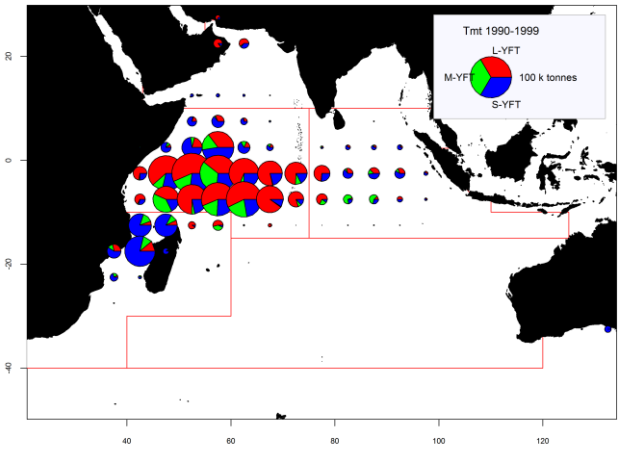


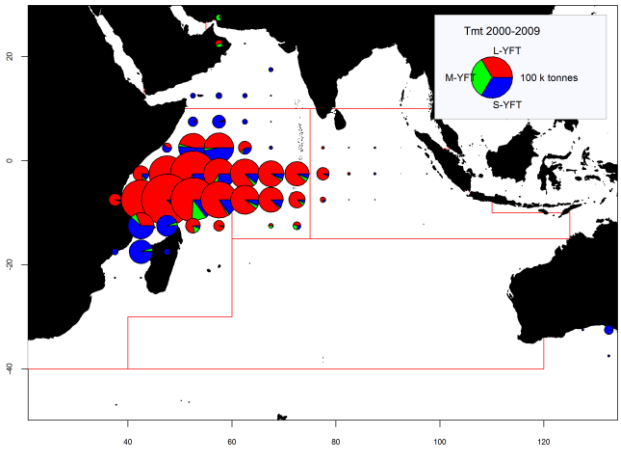


Catches (in metric tons) of yellowfin tuna (YFT) for the purse seine fishery on free-swimming schools for three different periods and types of weight:

- S-YFT (blue): Catches from strata in which the average weight estimated from the CAS is lower then 10kg
- M-YFT (green): Catches from strata in which the average weight estimated from the CAS is between 10kg and 30kg
- M-YFT (green): Catches from strata in which the average weight estimated from the CAS is 30kg or greater



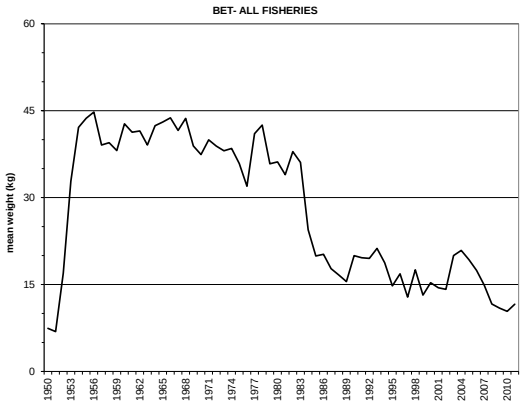


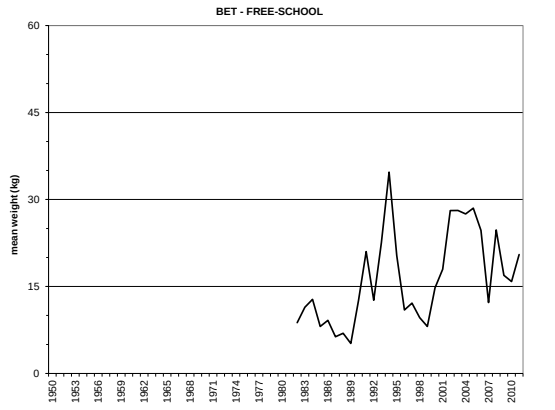


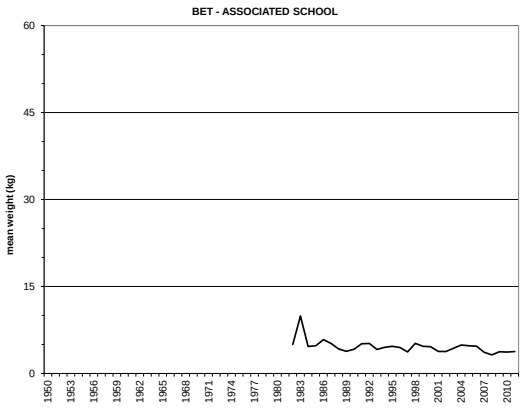
b. Bigeye tuna (BET)

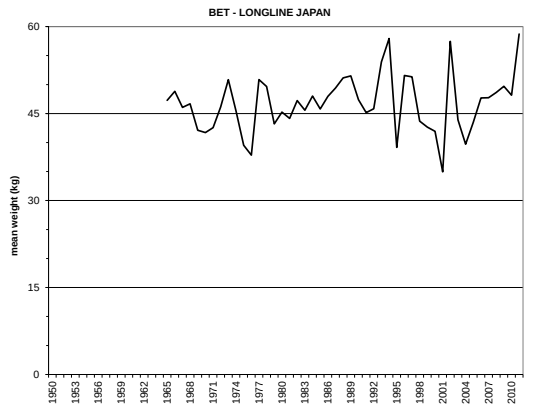
Average weight of bigeye tuna (BET) taken by:

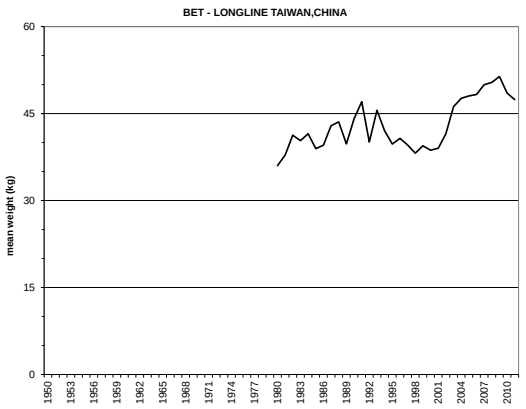
- All fisheries combined (right)
- Purse seine on free (top left) and associated (top right) schools,
- Longlines from Japan (botom left) and Taiwan,China (bottom right)







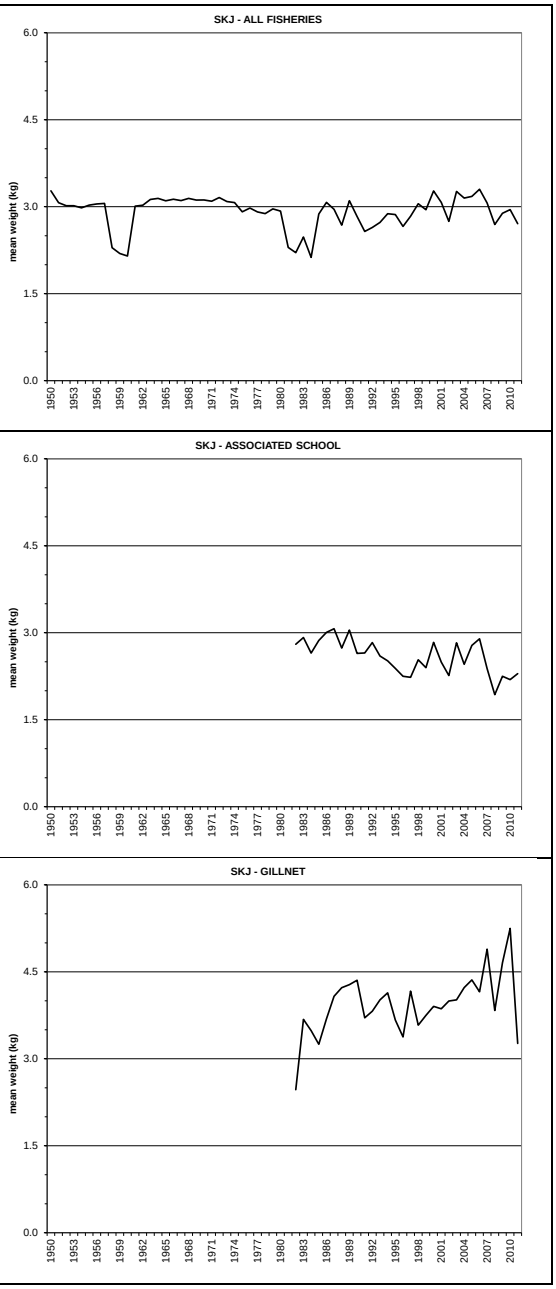




c. Skipjack tuna (SKJ)

Average weight of skipjack tuna (SKJ) taken by:

- All fleets combined (right)
- Purse seine on free (top left) and associated (top right) schools,
- Pole-and-line from Maldives and India (bottom left)
- Gillnets from Sri Lanka, Iran, and other countries (bottom right)

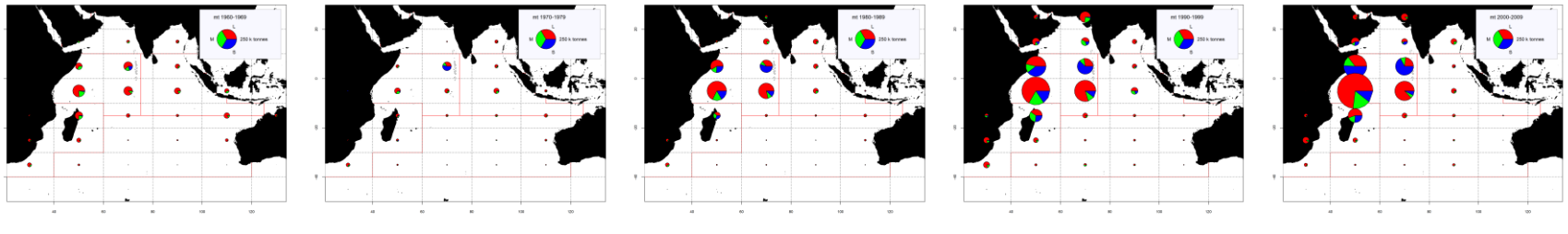


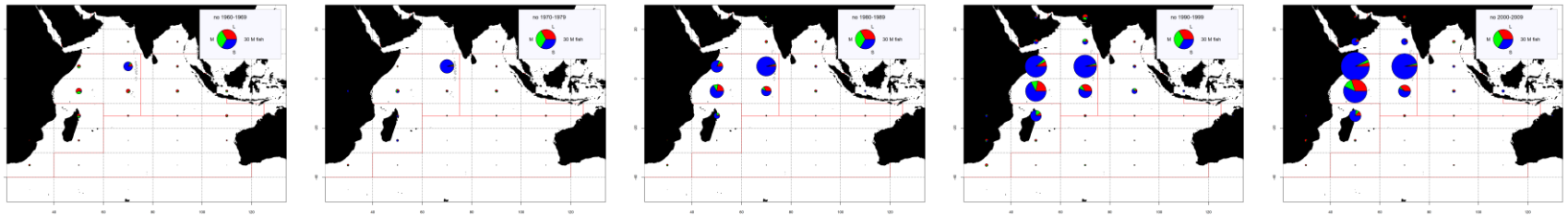
4. CATCH PER SIZE CLASS

a. Yellowfin tuna (YFT)

Total catches of YELLOWFIN TUNA (YFT) in weight (top) and number (bottom) derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

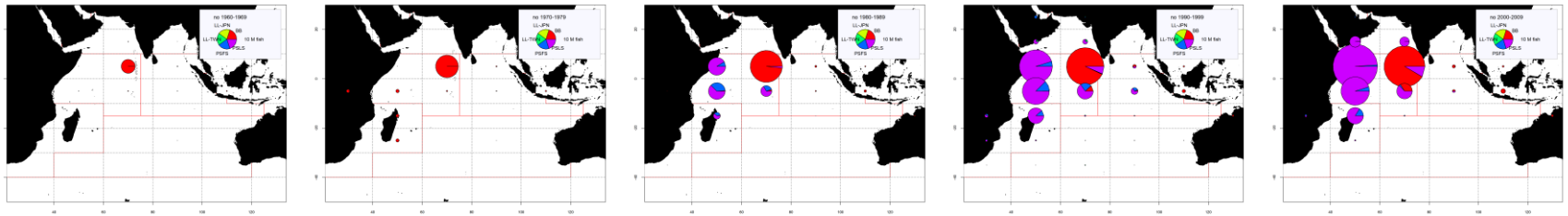
- **Large size** (**Red**): Catches of YFT for which the weight estimated is 30kg or greater
- **Medium size** (**Green**): Catches of YFT for which the weight estimated is between 15kg and 30kg
- **Small size** (**Blue**): Catches of YFT for which the weight estimated is under 30kg





Total catches of yellowfin tuna (YFT) of very small size (under 5kg), in number, derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and fishery, including:

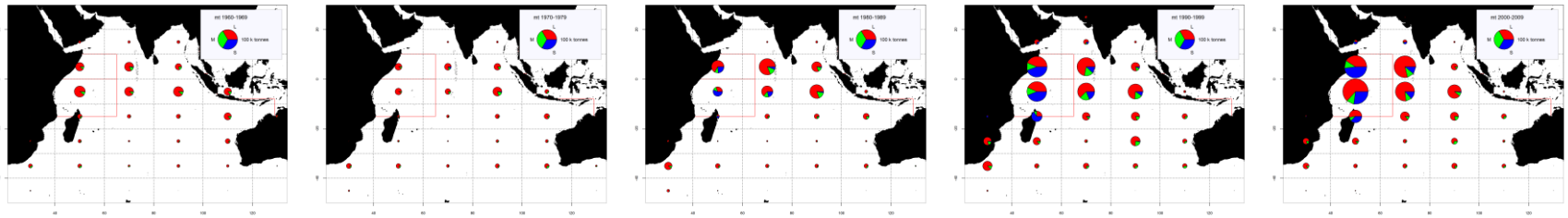
- **BB** (**Red**): Pole-and-line fisheries (Maldives and India)
- **PSLS** (**Purple**): Industrial purse seiners on associated schools (e.g. FAD)
- **PSFS** (**Light blue**): Industrial purse seiners on free-swimming schools
- **LL** (**Green**): Industrial longline fisheries

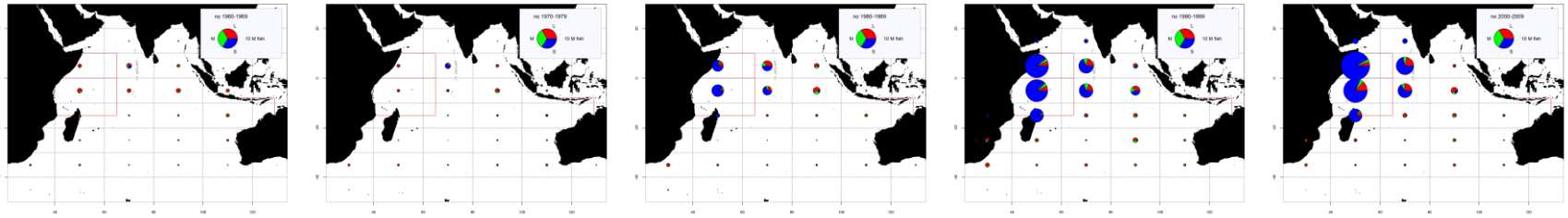


b. Bigeye tuna (BET)

Total catches of BIGEYE TUNA (BET) in weight (top) and number (bottom) derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

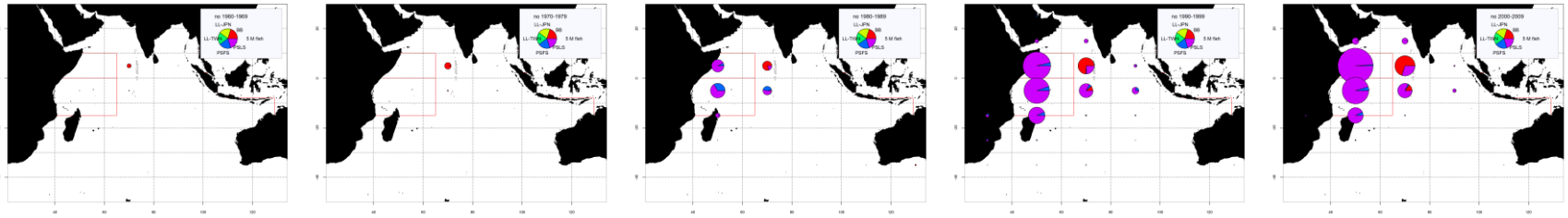
- **Large size** (**Red**): Catches of BET for which the weight estimated is 30kg or greater
- **Medium size** (**Green**): Catches of BET for which the weight estimated is between 15kg and 30kg
- **Small size** (**Blue**): Catches of BET for which the weight estimated is under 30kg





Total catches of bigeye tuna (BET) of very small size (under 5kg), in number, derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and fishery, including:

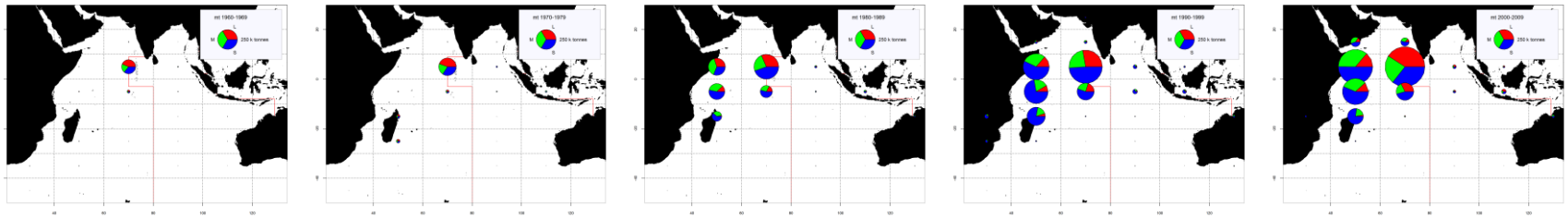
- **LL-TWN** (**Green**): Industrial longline fisheries
- **LL-JPN** (**Red**): Pole-and-line fisheries (Maldives and India)
- **PSLS** (**Purple**): Industrial purse seiners on associated schools (e.g. FAD)
- **PSFS** (**Light blue**): Industrial purse seiners on free-swimming schools

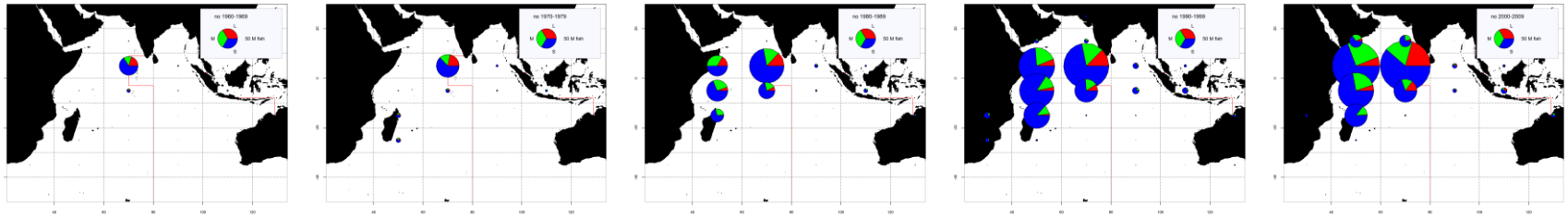


c. Skipjack tuna (SKJ)

Total catches of SKIPJACK TUNA (SKJ) in weight (top) and number (bottom) derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

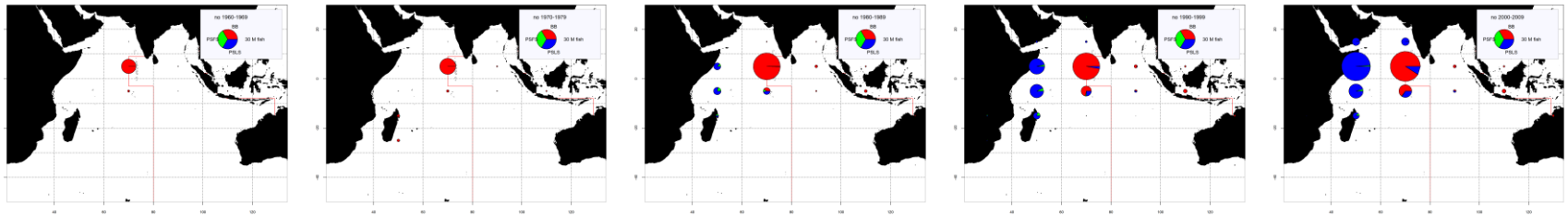
- **Large size** (**Red**): Catches of SKJ for which the weight estimated is 5kg or greater
- **Medium size** (**Green**): Catches of SKJ for which the weight estimated is between 3kg and 5kg
- **Small size** (**Blue**): Catches of SKJ for which the weight estimated is under 3kg





Total catches of skipjack tuna (SKJ) of very small size (under 1.5kg), in number, derived from the catch-at-size of surface (purse seine and pole-and-line) and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and fishery, including:

- **BB** (**Red**): Pole-and-line fisheries (Maldives and India)
- **PSLS** (**Blue**): Industrial purse seiners on associated schools (e.g. FAD)
- **PSFS** (**Green**): Industrial purse seiners on free-swimming schools

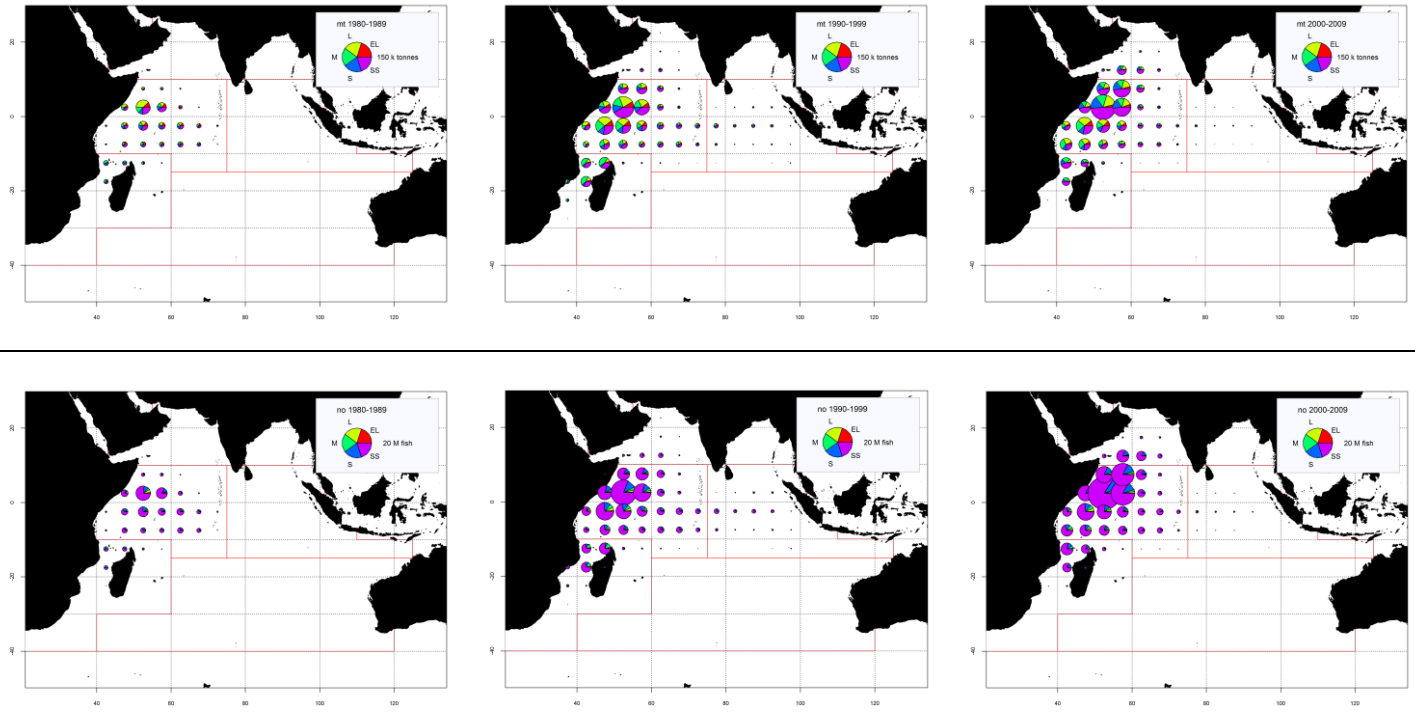


d. By fishery: Yellowfin tuna (YFT)

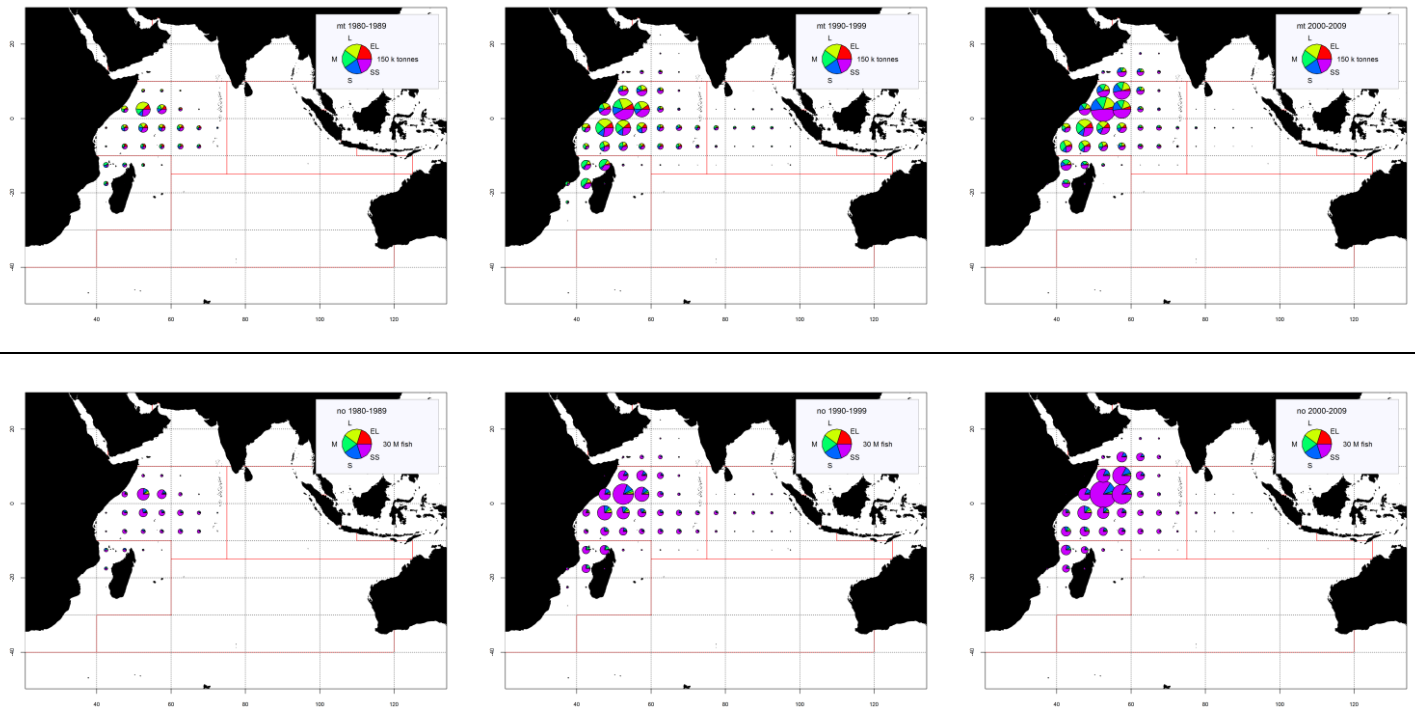
Total catches of YELLOWFIN TUNA (YFT) in weight (top) and number (bottom) derived from the catch-at-size of industrial purse seiners on free-swimming schools (top two rows; PSFS) and associated schools (bottom two rows; PSLS) for 1980-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

- **Very small size** (**SS; purple**): Catches of YFT for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of YFT for which the weight estimated is between5 and 15kg
- **Medium size** (**M**; **green**): Catches of YFT for which the weight estimated is between 15kg and 30kg
- **Large size** (**L**; **yellow**): Catches of YFT for which the weight estimated is between 30kg and 45kg
- **Very large size** (**EL**; **red**): Catches of YFT for which the weight estimated is 45kg or greater

Free-swimming schools



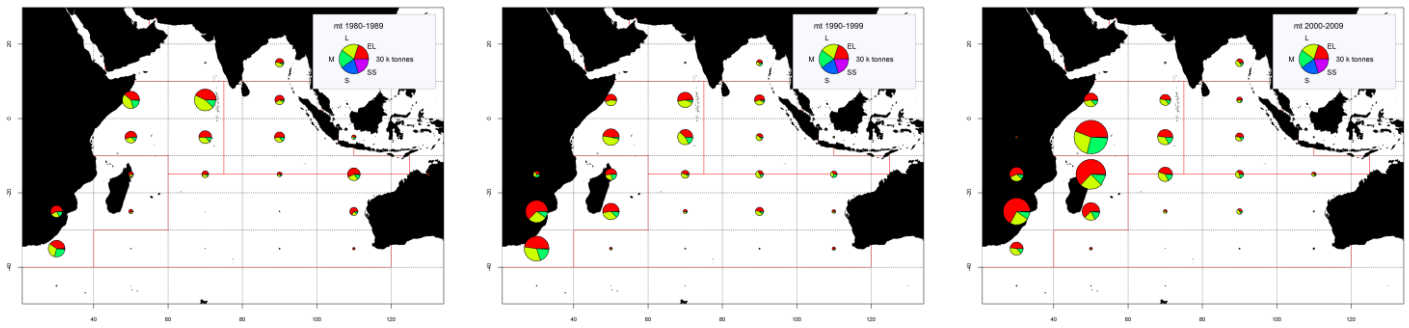
Associated schools

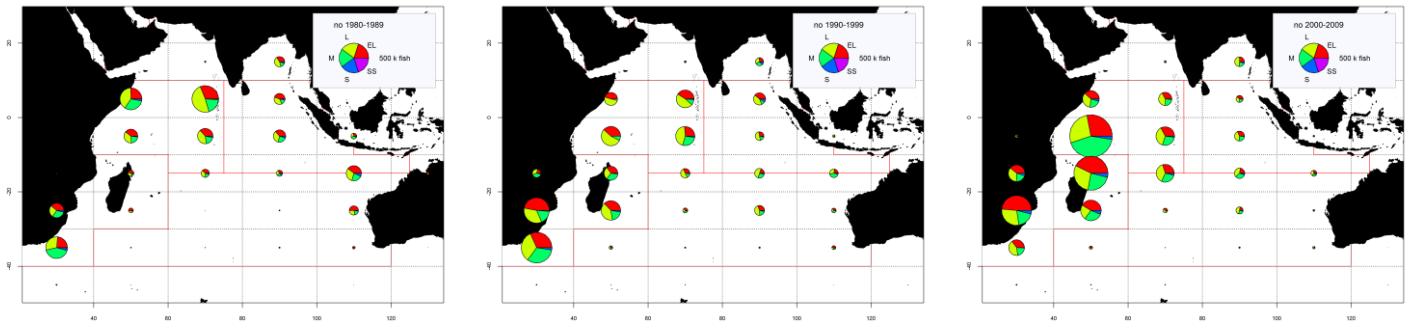


Total catches of YELLOWFIN TUNA (YFT) in weight (top) and number (bottom) derived from the catch-at-size of industrial longliners of Japan (top two rows) and Taiwan,China (bottom two rows) for 1980-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

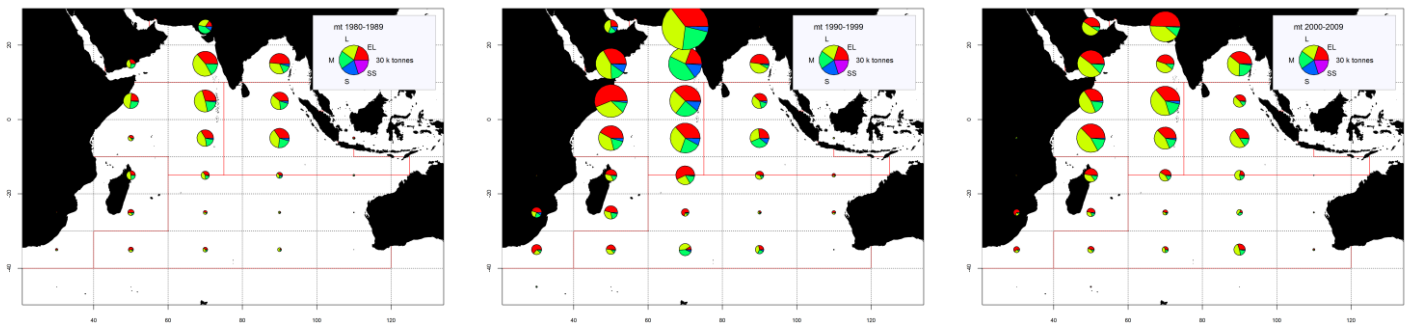
- **Very small size** (**SS; purple**): Catches of YFT for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of YFT for which the weight estimated is between5 and 15kg
- **Medium size** (**M**; **green**): Catches of YFT for which the weight estimated is between 15kg and 30kg
- **Large size** (**L**; **yellow**): Catches of YFT for which the weight estimated is between 30kg and 45kg
- **Very large size** (**EL**; **red**): Catches of YFT for which the weight estimated is 45kg or greater

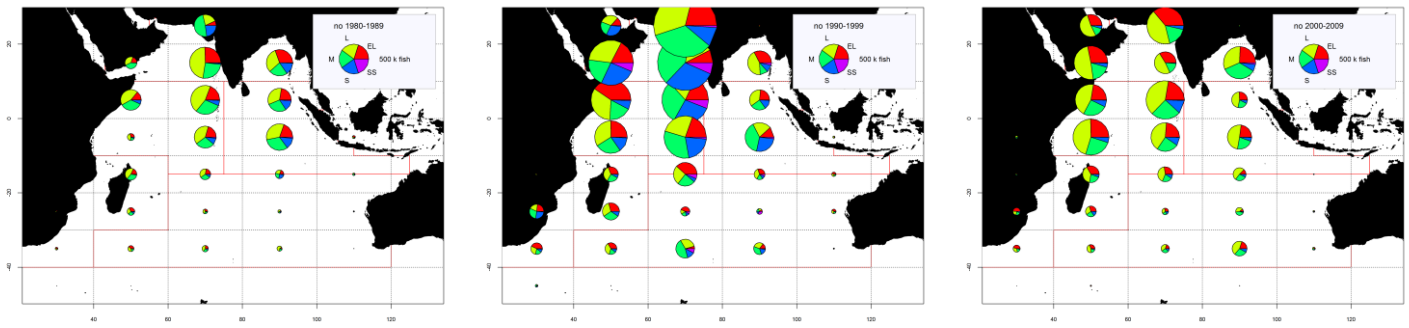
Longline Japan





Longline Taiwan,China



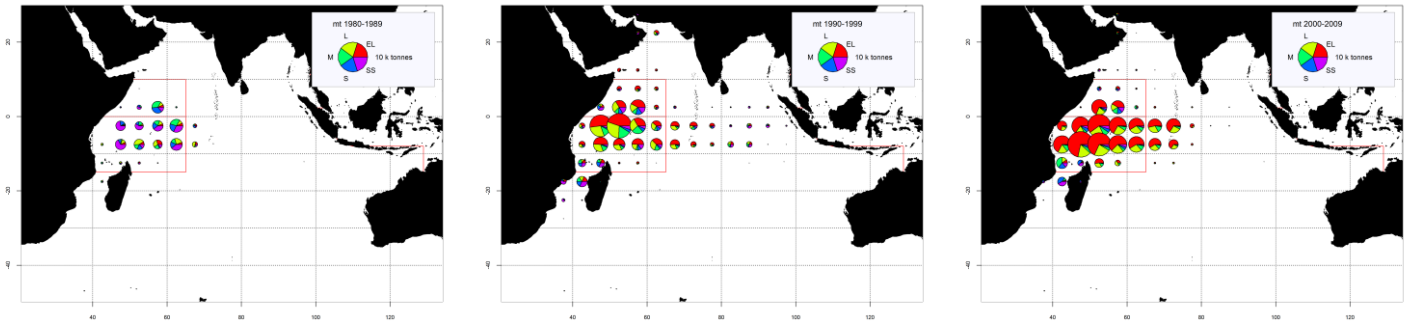


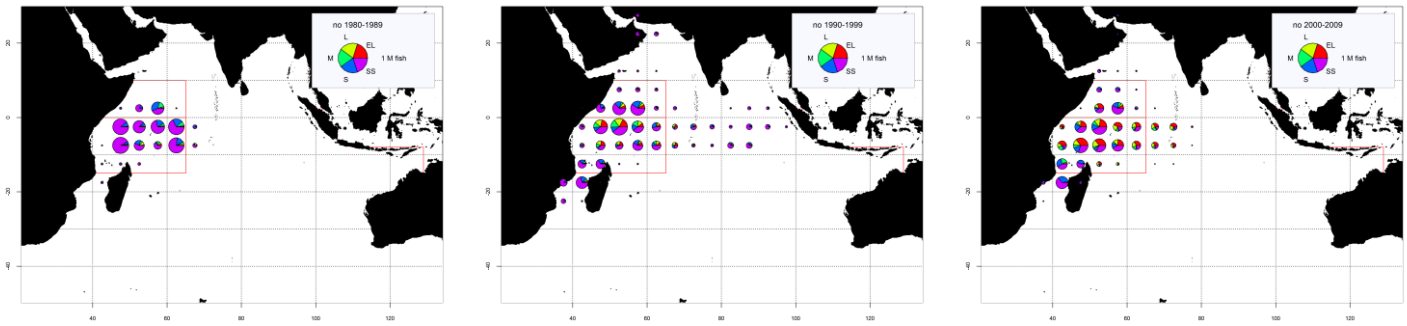
e. By fishery: Bigeye tuna (BET)

Total catches of BIGEYE TUNA (BET) in weight (top) and number (bottom) derived from the catch-at-size of industrial purse seiners on free-swimming schools (top two rows; PSFS) and associated schools (bottom two rows; PSLS) for 1980-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

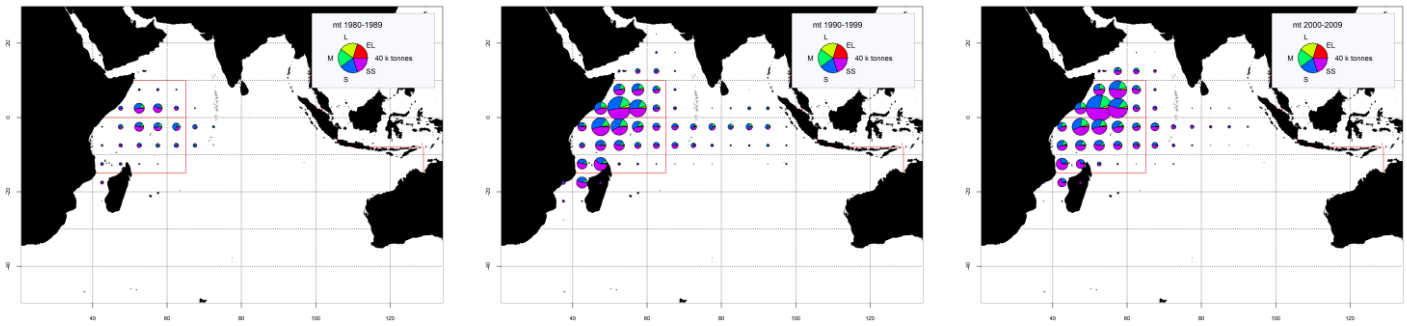
- **Very small size** (**SS; purple**): Catches of BET for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of BET for which the weight estimated is between5 and 15kg
- **Medium size** (**M**; **green**): Catches of BET for which the weight estimated is between 15kg and 30kg
- **Large size** (**L**; **yellow**): Catches of BET for which the weight estimated is between 30kg and 45kg
- **Very large size** (**EL**; **red**): Catches of BET for which the weight estimated is 45kg or greater

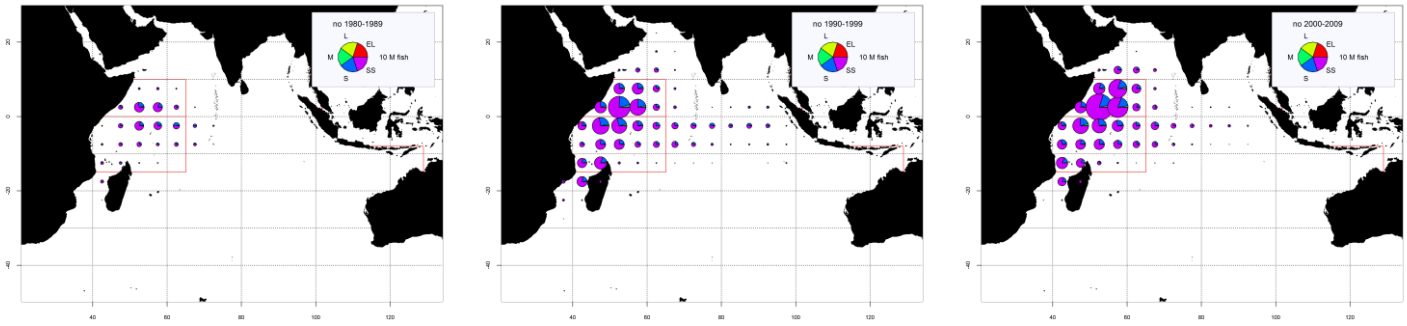
Free-swimming schools





Associated schools

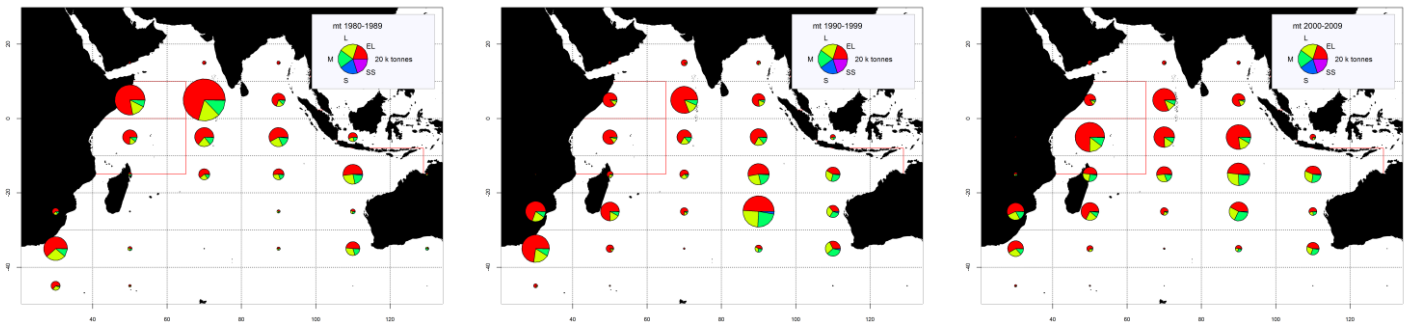


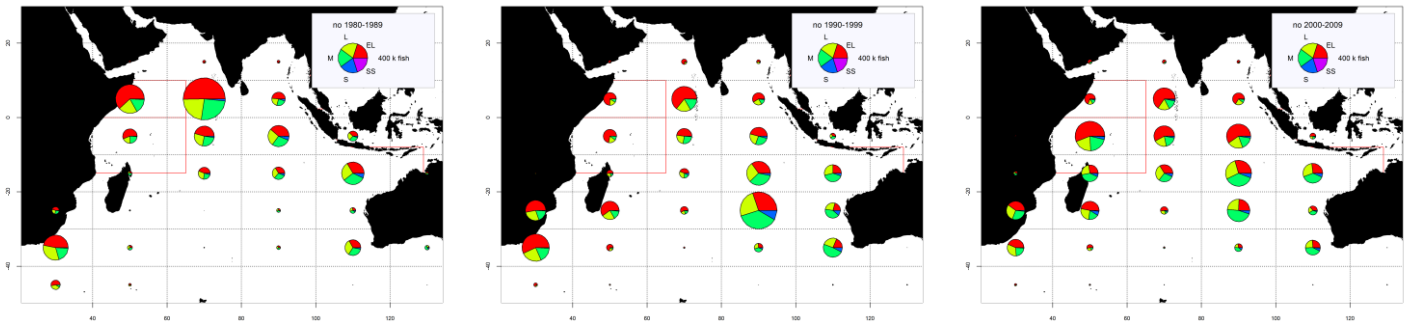


Total catches of BIGEYE TUNA (BET) in weight (top) and number (bottom) derived from the catch-at-size of industrial longliners of Japan (top two rows) and Taiwan,China (bottom two rows) for 1980-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

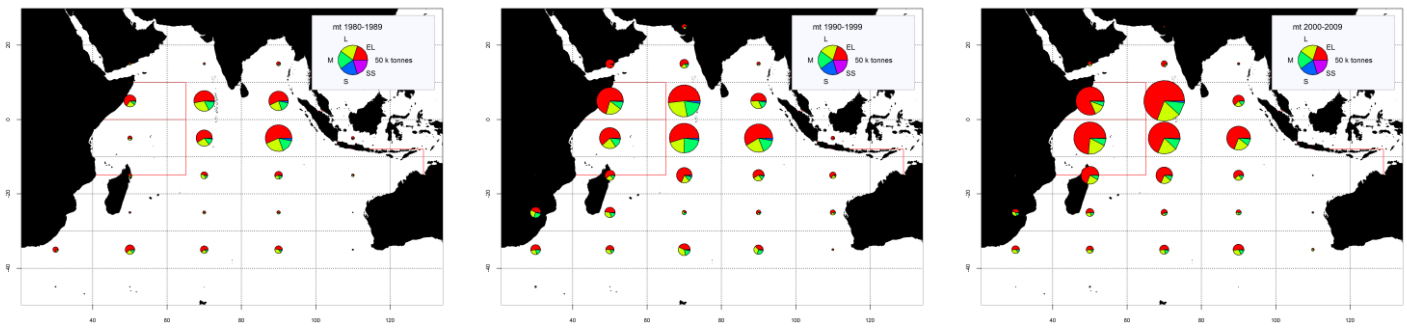
- **Very small size** (**SS; purple**): Catches of BET for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of BET for which the weight estimated is between5 and 15kg
- **Medium size** (**M**; **green**): Catches of BET for which the weight estimated is between 15kg and 30kg
- **Large size** (**L**; **yellow**): Catches of BET for which the weight estimated is between 30kg and 45kg
- **Very large size** (**EL**; **red**): Catches of BET for which the weight estimated is 45kg or greater

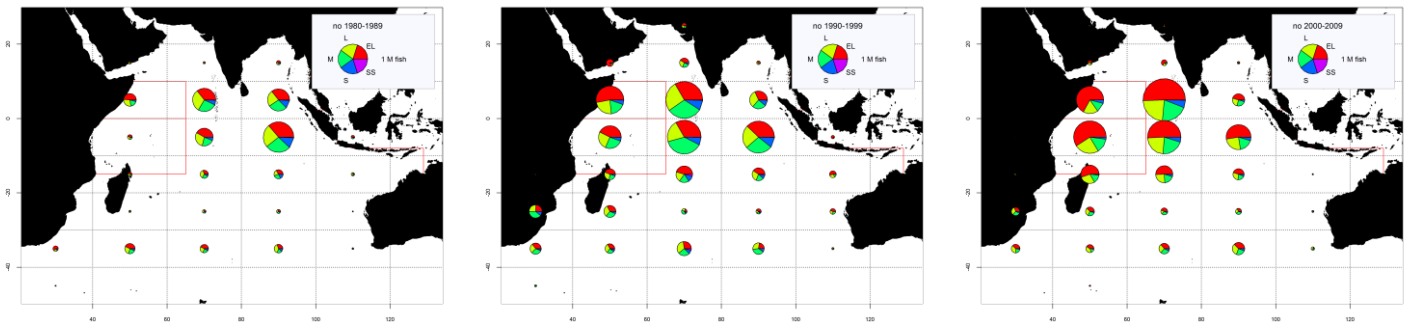
Longline Japan





Longline Taiwan,China



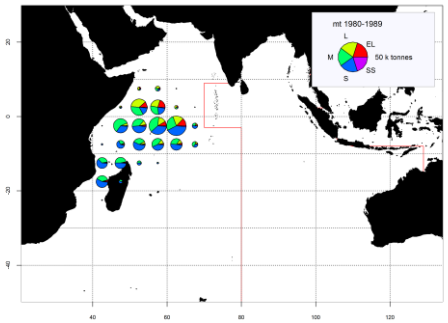


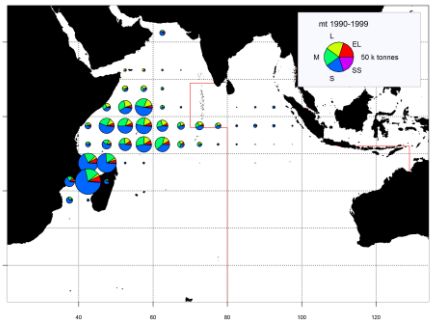
f. By fishery: Skipjack tuna (SKJ)

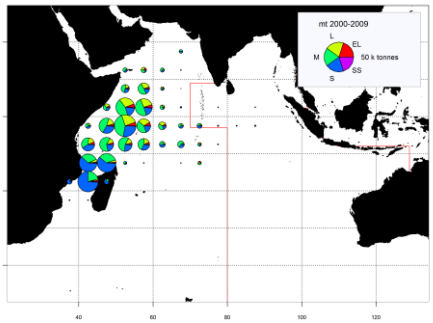
Total catches of SKIPJACK TUNA (SKJ) in weight (top) and number (bottom) derived from the catch-at-size of industrial purse seiners on free-swimming schools (top two rows; PSFS) and associated schools (bottom two rows; PSLS) for 1980-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

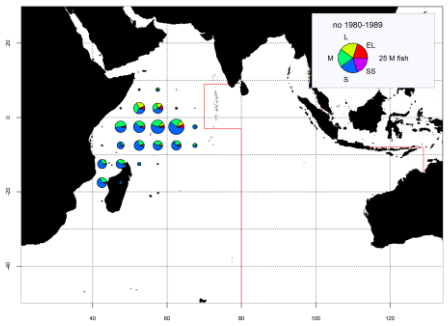
- **Very small size** (**SS; purple**): Catches of SKJ for which the weight estimated is under 1.5kg
- **Small size** (**S**; **blue**): Catches of SKJ for which the weight estimated is between 1.5 and 3kg
- **Medium size** (**M**; **green**): Catches of SKJ for which the weight estimated is between 3kg and 5kg
- **Large size** (**L**; **yellow**): Catches of SKJ for which the weight estimated is between 5kg and 7kg
- **Very large size** (**EL**; **red**): Catches of SKJ for which the weight estimated is 7kg or greater

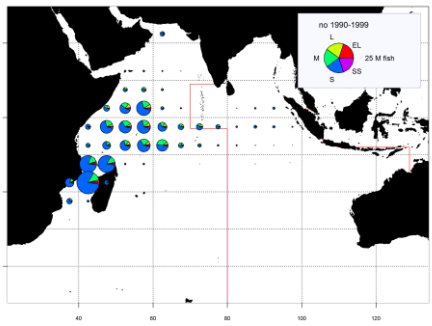
Free-swimming schools

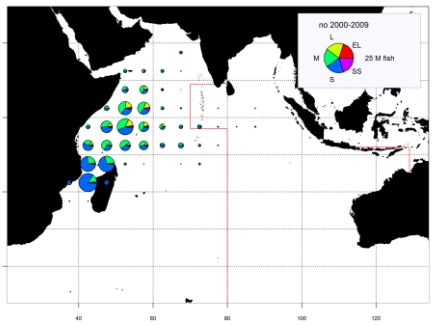












Associated schools