REVIEW OF THE STATISTICAL DATA AND FISHERY TRENDS FOR BILLFISH

PREPARED BY: IOTC SECRETARIAT, 25 JULY 2012
Miguel Herrera[1]& Lucia Pierre[2]

PURPOSE

To provide the Working Party on Billfish (WPB) with a review of the status of the information available on billfish species in the databases at the IOTC Secretariat as of June 2012, as well as a range of fishery indicators, including catch and effort trends, for fisheries catching billfish in the IOTC area of competence. It covers data on nominal catches, catch-and-effort, and size-frequency.

BACKGROUND

Prior to each WPB 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 WPB 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 by the secretariat for billfish, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*[3], for the period 1950–2010.

The document describes the progress achieved in relation to the collection and verification of data and identifies problem areas as assessed from the information available.

The document also provides a range of fishery indicators, including catch and effort trends, for fisheries catching billfish in the IOTC area of competence (Appendix I).

The report covers the following areas:

- Overview
- Main issues relating to the data available on billfish
- Overview of billfish fisheries in the Indian Ocean:
    - Catch trends
    - Status of fisheries statistics for billfish.

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 other parties on the activity of vessels (IOTC Resolution 10/08; IOTC Resolution 05/03; IOTC Resolution 11/03; IOTC Resolution 12/05; IOTC Resolution 12/07)).

Catch and effort data which refer to the fine-scale data – usually from logbooks, and reported per fleet, year, gear, fishing mode, month, grid and species. Information on the use of fish aggregating devices (FADs) and supply vessels is also collected.

Length frequency data: individual body lengths of IOTC species per fleet, year, gear, fishing mode, quarter and 5 degree square areas.

[1] Data Coordinator IOTC (mh@iotc.org)
[2] Data Assistant IOTC (data.assistant@iotc.org)
[3] This Resolution superseded IOTC Resolutions 98/01, 05/01 and 08/01

MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF BILLFISH

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

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

- **Drifting gillnet** fisheries of **Iran** and **Pakistan**: To date, Iran has not reported catches of swordfish and marlins for its gillnet fishery. Although Pakistan has reported catches of swordfish and black marlin, they are considered to be too low for a driftnet fishery and the catches of black marlin are thought to contain other marlins (misidentification). Although very significant catches of marlins are likely to be taken on driftnet fisheries, the paucity of the data available makes it difficult to assess catch levels for driftnet fleets.
- **Gillnet/longline** fishery of **Sri Lanka**: In recent years Sri Lanka has caught over 20% of the catches of marlins in the Indian Ocean. Although Sri Lanka has reported catches of marlins by species for its gillnet/longline fishery, the catch ratio of blue marlin to black marlin has changed dramatically over time. This is thought to be a sign of frequent misidentification rather than the effect of changes in catch rates for this fishery. Although the IOTC Secretariat adjusted the catches of marlins using proportions derived from years with good monitoring of catches by species, the catches estimated remain uncertain.
- **Artisanal** fisheries of **Indonesia**: The catches of billfish reported by Indonesia for its artisanal fisheries in recent years are considerably higher than those reported in the past, and represent around 9% of the total catches of billfish in the Indian Ocean. In 2011 the Secretariat revised the complete nominal catch dataset for Indonesia, using information from various sources, including official reports. However, the quality of the dataset for the artisanal fisheries of Indonesia is thought to be poor, with a likely underestimation of catches of billfish in recent years.
- **Artisanal** fisheries of **India**: In early 2012 the Secretariat revised the complete nominal catch dataset for India, using new information available. The catches of billfish estimated in recent years represent around 20% of the total catches in the Indian Ocean, and refer mainly to Indo-Pacific sailfish. To date, India has not reported catch-and-effort data for its artisanal fisheries.

2. Catch-and-Effort data from Sport Fisheries:

- **Sport** fisheries of **Australia, France(Reunion)**, **India**, **Indonesia**, **Madagascar**, **Mauritius**, **Oman, Seychelles**, **Sri Lanka**, **Tanzania**, **Thailand** and **UAE**: To date, no data have been received from any of the referred sport fisheries. Sport fisheries are known to catch billfish species, in particular blue marlin, black marlin and Indo-Pacific sailfish. Although data are available from other sport fisheries in the region (Kenya, Mauritius, Mozambique, South Africa), this information cannot be used to estimate levels of catch for other fisheries.

3. Catch-and-Effort data from Industrial Fisheries:

- **Longline** fishery of **Indonesia**: The catches of swordfish and marlins estimated for the fresh tuna longline fishery of Indonesia may have been underestimated in recent years due to them not being sampled sufficiently in port and to the lack of logbook data from which to derive estimates. The catches of billfish estimated in recent years (all species combined) represent around 10% of the total catches in the Indian Ocean, especially swordfish and blue marlin.
- **Longline** fishery of **India**: In recent years, India has reported very incomplete catches and catch-and-effort data for its commercial longline fishery The Secretariat has estimated total catches for this period using alternative sources, the final catches estimated considerably higher than those reported (representing 3.5% of the total catches of billfish in recent years).
- **Longline** fishery of the Republic of **Korea**: The nominal catches and catch-and-effort data series for billfish for the longline fishery of Korea are conflicting, with nominal catches of swordfish and marlins lower than the catches reported as catch-and-effort for some years. Although in 2010 the IOTC Secretariat revised the nominal catch dataset to account for catches reported as catch-and-effort, the quality of the estimates remains unknown. However, the catches of longliners of the Rep. of Korea in recent years are very small.
- **Longline** fishery of **EU-Spain:** To date, the Secretariat has not received catch-and-effort data for marlins and sailfish for the longline fishery of EU-Spain.

- **Purse seine** fisheries of **Seychelles**, **Thailand**, **Iran** and **Japan**: To date, the referred countries have not reported catches of billfish from purse seiners, although they are thought to be very low.

4. Size data from All Fisheries:

- **Longline** fishery of **Taiwan,China**: Size data have been available for the longline fishery of Taiwan,China since 1980; however, the length frequency distributions of striped marlin and blue marlin differ from those reported by Japan for its longline fishery, with average weights of striped marlin likely to be too large for a longline fishery. Therefore, it is likely that there has been overspread miss-identification of striped marlin and blue marlin on board longliners flagged in Taiwan,China.
- **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Iran and Pakistan have not reported size frequency data for their gillnet fisheries.
- **Gillnet/longline** fishery of **Sri Lanka:** Although Sri Lanka has reported length frequency data for swordfish and marlins in recent years, the lengths reported are considered highly uncertain, due to misidentification of marlins and likely sampling bias (large specimens of swordfish and marlins are highly processed and not sampled).
- **Longline** fisheries of **India** and **Oman:** To date, India and Oman have not reported size frequency data for their longline fisheries.
- **Longline** fishery of **Indonesia**: Indonesia has reported size frequency data for its fresh-tuna longline fishery in recent years. However, the samples cannot be fully disaggregated by month and fishing area (5x5 grid) and refer mostly to the component of the catch that is unloaded fresh. The quality of the samples in the IOTC database is for this reason uncertain.
- **Fresh-tuna longline** fishery of **Taiwan,China**[4]**:** Data are only available for striped marlin and swordfish for the year 2010, with no size data available for other species or years.
- **Longline** fishery of **Japan:** The number of samples reported and total number of fish sampled for the longline fishery of Japan since 2000 has been very low.
- **Artisanal** fisheries of **India** and **Indonesia**: To date, India and Indonesia have not reported size frequency data for their artisanal fisheries.

5. Biological data for all billfish species:

- Industrial **longline** fisheries, in particular **Taiwan,China**, **Indonesia**, **EU**, **China** and the **Republic** of **Korea**: The Secretariat had to use length-age keys, length-weight keys, and processed weight-live weight keys for billfish species from other oceans due to the general paucity of biological data available from the fisheries indicated.
- Industrial **longline** fisheries, in particular **Taiwan,China**, **Indonesia**, **EU**, **China** and the **Republic** of **Korea**: There has not been regular reporting of length frequency data by sex from any of the referred fisheries.

[4] Refers to Taiwan Province of China

1. STATUS OF FISHERIES STATISTICS FOR BILLFISH SPECIES

Swordfish (SWO)

- **Catch trends**

Swordfish are caught mainly using drifting longlines (95%), on longline fisheries directed to tunas (**Table 1, Fig. 1**, LL) or swordfish (**Table 1, Fig. 1**, ELL), the catches remaining taken by other fisheries, especially drifting gillnets. Between 1950 and 1980, catches of swordfish in the Indian Ocean slowly increased in tandem with the level of coastal state and distant water fishing nation longline effort targeting tunas (**Figs. 1, 2**). Swordfish were mainly a bycatch of industrial longline fisheries before the early 1990's with catches slightly increasing from 1950 to 1990 proportionally to the increase in the catches of target species (tropical and temperate tunas).

The catches of swordfish markedly increased after 1990, reaching 35,000 t in 1998 and 36,000 t in 2003 and 2004. The change in target species from tunas to swordfish by part of the fleet of Taiwan,China along with the development of longline fisheries in Australia, Reunion island, Seychelles and Mauritius and the arrival of longline fleets from the Atlantic Ocean (Portugal, Spain the UK and other fleets operating under various flags[5]), all targeting swordfish, are the main reasons for this significant increase.

Since 2004, annual catches have declined steadily (**Fig. 2**), largely due to the continued decline in the number of active Taiwan,China longliners in the Indian Ocean (**Fig. 3**). Annual catches since 2004 have been dominated by the Taiwan,China and EU fleets (Spain, UK, France and Portugal), with the fishery extending eastward due to the effects of piracy actions (**Fig. 3**).

TABLE 1. Best scientific estimates of the catches of swordfish by type of fishery for the period 1950–2010 (in metric tons). Data as of July 2012.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ELL				9	1,842	10,416	7,970	8,903	10,700	13,414	15,625	13,629	12,008	8,580	8,262	9,253
LL	282	1,426	2,134	4,337	21,580	17,213	19,600	20,449	23,032	21,012	14,660	14,148	12,780	10,159	11,149	9,282
OT	41	42	47	319	1,097	2,292	2,379	2,560	2,693	2,579	1,621	2,552	1,830	2,210	1,430	2,373
Total	**323**	**1,468**	**2,181**	**4,665**	**24,519**	**29,921**	**29,949**	**31,912**	**36,425**	**37,005**	**31,905**	**30,328**	**26,618**	**20,948**	**20,841**	**20,908**

Fisheries: Swordfish longline (**ELL**); Longline (**LL**)**;** Other gears (**OT**)

TABLE 2. Best scientific estimates of the catches of swordfish by fishing area for the period 1950–2010 (in metric tons). Data as of October 2011.

Area	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NW	117	551	650	1,469	7,245	9,820	7,969	12,281	15,108	12,276	10,865	10,355	8,719	6,625	4,998	2,204
SW	14	256	405	620	8,599	7,591	8,887	7,359	3,969	6,293	9,680	8,833	7,349	6,188	6,678	6,513
NE	122	405	725	2,017	5,787	6,352	6,379	5,783	8,166	7,775	4,680	6,138	4,973	4,753	6,661	7,393
SE	27	167	271	342	2,518	5,644	6,051	5,737	8,297	9,729	5,753	4,337	5,258	3,507	3,014	2,788
OT	41	88	137	215	368	628	664	734	864	1,079	757	621	752	84	97	58
Total	**322**	**1,467**	**2,188**	**4,664**	**24,516**	**30,035**	**29,950**	**31,893**	**36,405**	**37,152**	**31,735**	**30,285**	**27,051**	**21,157**	**21,448**	**18,956**

Areas: Northwest Indian Ocean (**NW**); Southwest Indian Ocean (**SW**); Northeast Indian Ocean (**NE**); Southeast Indian Ocean (**SE**); Southern Indian Ocean (**OT**)

Longliners from **Taiwan,China** have been operating in the Indian Ocean since 1954, with catches of swordfish rarely higher than 1,000 t until 1979. Swordfish catches increased gradually from 1,000 in 1979 to 5,500 t in 1988. The catches by the Taiwanese fleet increased dramatically during the 1990's to over 12,000 t per year as the species was increasingly targeted by the fleet. After a peak of 18,000 t recorded in 1995, catches dropped to 12,000 t in 2004, and again in the following years, with catches in 2010 amounting to around 4,500 tons (**Fig. 2**).

[5] Senegal, Guinea, etc.

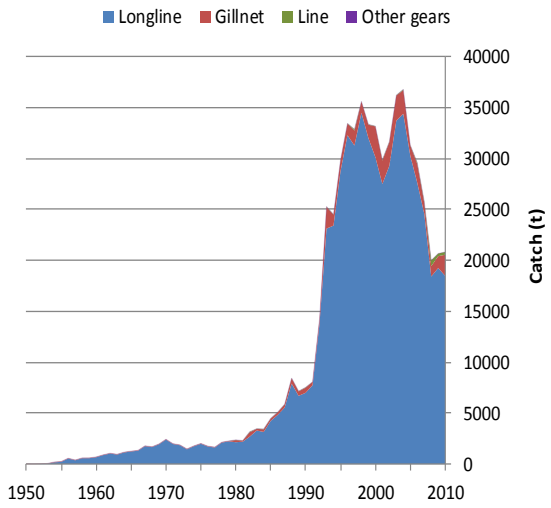


Fig. 1. Catches of swordfish per gear and year recorded in the IOTC Database (1960–2010).

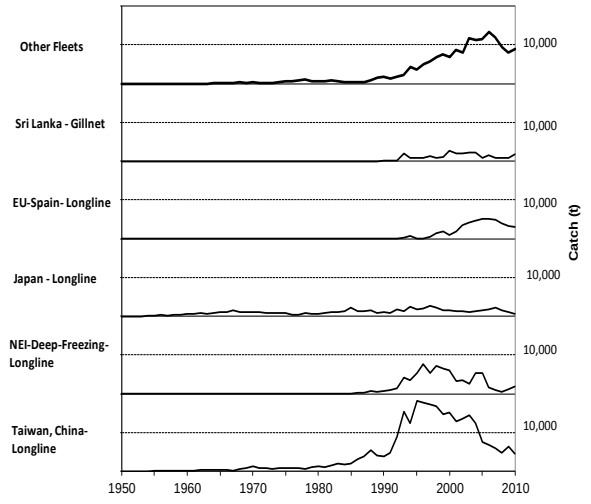


Fig. 2. Catches of swordfish by fleet recorded in the IOTC Database (1960–2010).

Catches of swordfish of up to 6,000 t have been recorded in recent years for a fleet of deep-freezing and fresh tuna longliners operating under flags of non-reporting countries (**NEI**). The catches have been low since 2006 (**Fig. 2**).

The catches of Swordfish of industrial longliners from **Japan** (**Fig. 2**) increased proportionally to those of yellowfin tuna, target species of this fleet during the first years of the fishery, to remain quite stable until the early 1990's. The average annual catches amounted to 1,600 t during the last two decades and catches over 2,500 t were recorded in 1994 and 1997.

In **Sri Lanka**, swordfish catches have fluctuated between 800 and 2,000 t over the last decade. These are taken mostly by boats that use a combination of drifting gillnets and longlines. This said, the first results from the sampling conducted by NARA[6] during 2005 and 2006 with the support of the IOTC-OFCF[7] Project in different locations in Sri Lanka appear to indicate that the estimates of historical catches of this species may need to be revisited.

The catches of **Indonesian** fresh-tuna longliners operating in Indian Ocean waters increased steadily until 2003 (3,000 t), having shown a decreasing trend since then. It is, however, likely that the catches recorded for years before 2003 are incomplete, as the statistics for this period are thought to be more uncertain (port sampling was initiated in 2003).

During the last two decades, several domestic longline fisheries targeting swordfish started to operate in Reunion (EU-**France**), **Australia**, **Seychelles, South Africa** and, more recently, **Mauritius**, with total accumulated catches estimated to be between 1,500 t and 2,000 t in recent years.

Spanish, Portuguese and UK longliners coming from the Atlantic Ocean have been operating in the Indian Ocean since the early 90s with current accumulated catches around 5,000 t (**Table 1**, **Fig. 1; ELL**). Around 25% of the catches of swordfish in the Indian Ocean have been taken by vessels operating under EU flags in recent years.

The annual catches of swordfish by longliners from the **Republic of Korea**, recorded since 1965, have rarely exceeded 1,000 t. The highest catch, 1,100 t, was recorded in 1994. In 2010 the Secretariat revised the catches of swordfish for Korea over the time-series using catches reported as nominal catches and catch-and-effort.

Swordfish is mostly exploited in the western Indian Ocean (**Fig. 3a-f**), in waters off Somalia, and in the southwest Indian Ocean. Other important fisheries operate in waters off Sri Lanka, Western Australia and Indonesia. In recent years (**Fig. 4a-f**) the catches of swordfish in the western tropical Indian Ocean have dropped considerably, especially in areas off Somalia, Kenya and Tanzania particular in 2008 and, even more so in 2009-10. The drop in catches is the consequence of a drop in fishing effort in the area by longline fisheries, due to either piracy or decreased fish abundance, or a combination of both.

[6] National Aquatic Resources and Development Agency of Sri Lanka
[7] Overseas Fisheries Cooperation Foundation of Japan

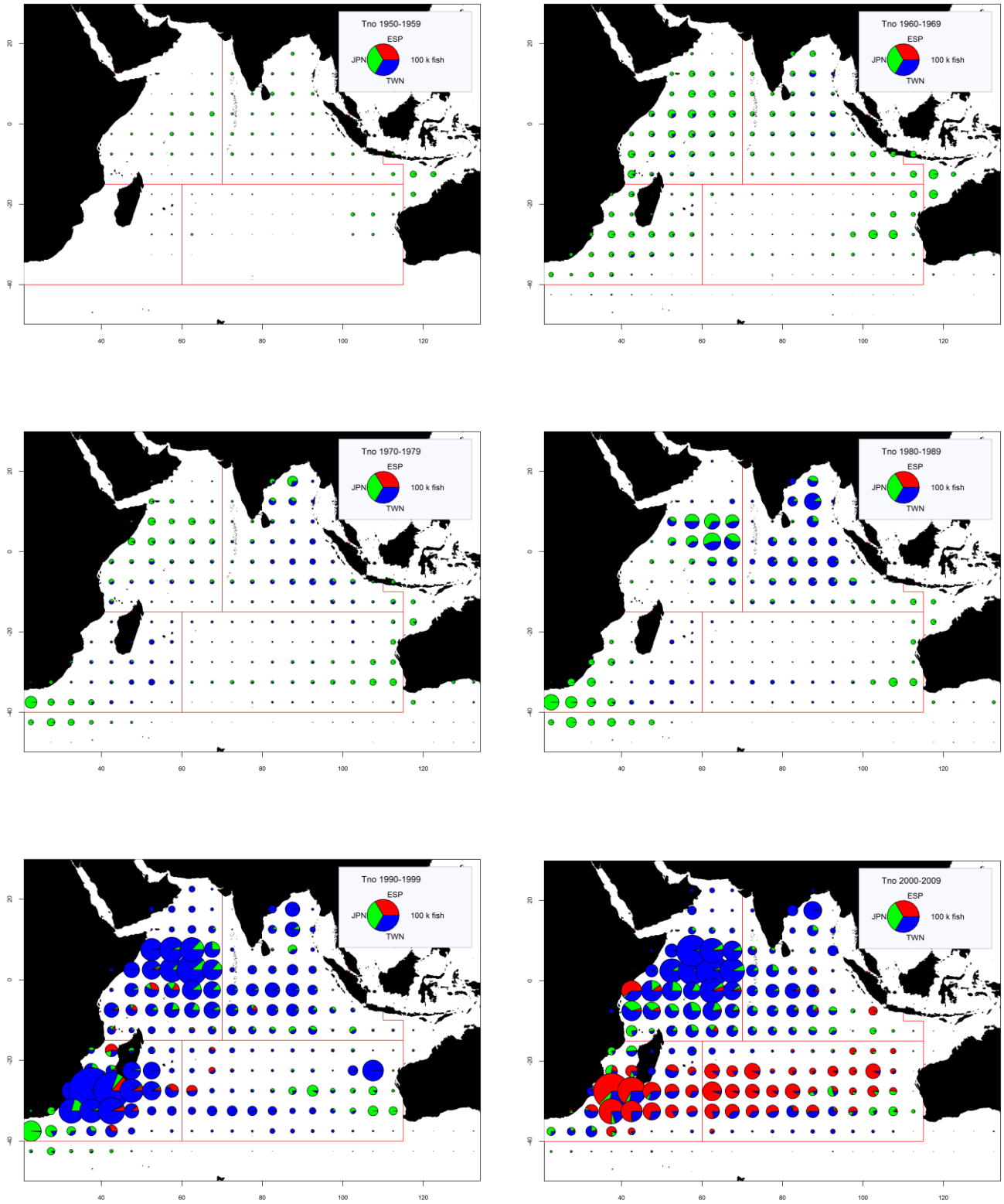


Fig. 4a-f: Time-area catches (total combined in tonnes) of swordfish as reported for the longline fleets of Japan (**JPN**), Taiwan,China (**TWN**), and EU-Spain (**ESP**), the latter directed at swordfish, for the period 1950-2009, by decade and type of gear. Red lines represent the boundaries of the areas used for the assessments of swordfish.

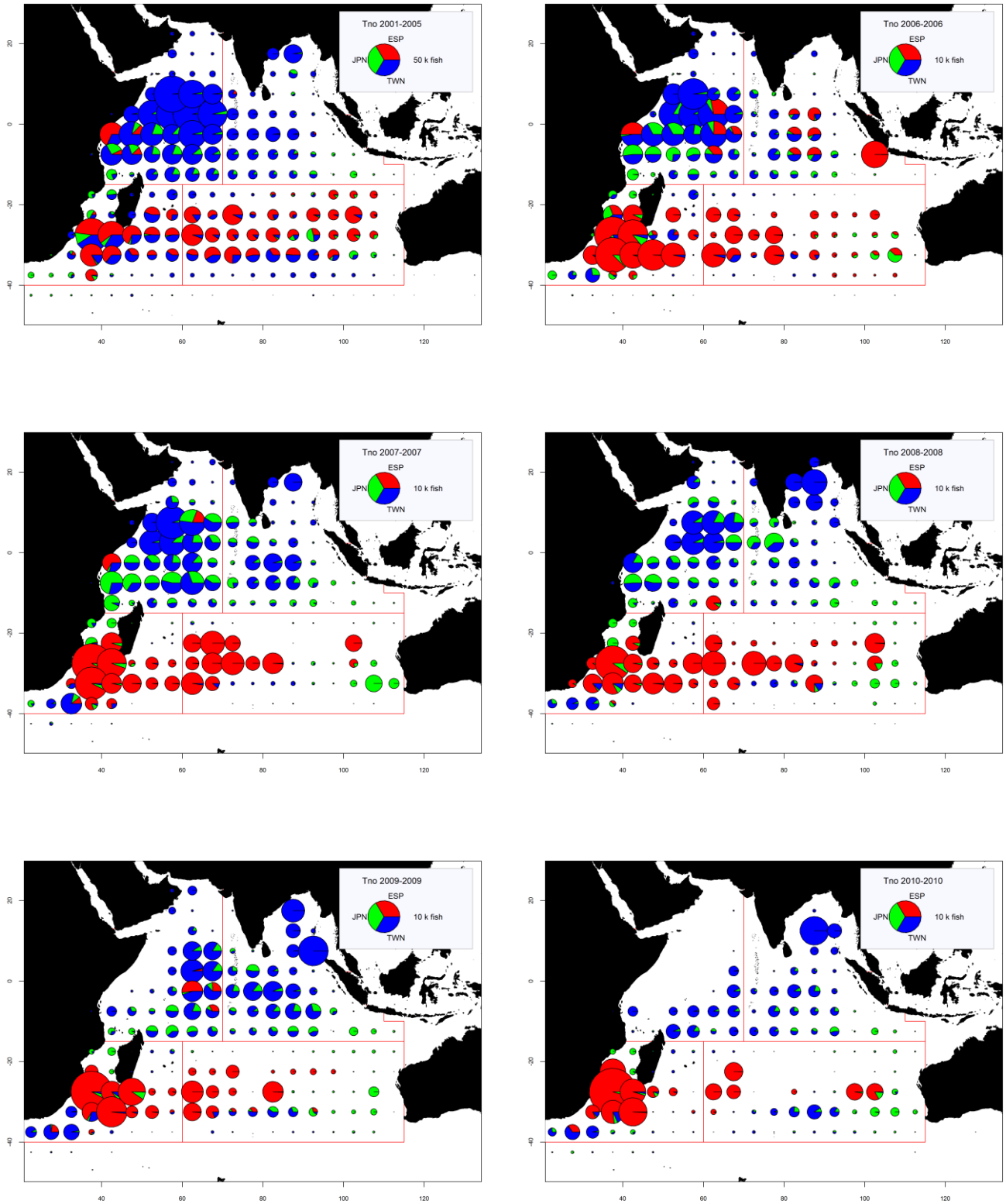


Fig. 5a-f: Time-area catches (total combined in tonnes) of swordfish as reported for the longline fleets of Japan (**JPN**), Taiwan,China (**TWN**), and EU-Spain (**ESP**), the latter directed at swordfish, for the period 2001-2005 by type of gear and for 2006-10, by year and type of gear. Red lines represent the boundaries of the areas used for the assessments of swordfish.

- **Status of Fisheries Statistics at the IOTC**

Retained catches are fairly well known (**Fig. 6**); however catches are uncertain for:

- **Drifting gillnet** fisheries of **Iran** and **Pakistan**: To date, Iran has not reported catches of swordfish for its gillnet fishery. Although Pakistan has reported catches of swordfish they are considered to be too low for a driftnet fishery (catches of swordfish in recent years represent less than 2% of the total catches of swordfish in the Indian Ocean).
- **Longline** fishery of **Indonesia**: The catches of swordfish for the fresh tuna longline fishery of Indonesia may have been underestimated in recent years due to insufficient sampling coverage. Although the new catches estimated by the Secretariat are thought to be more accurate, swordfish catches remain uncertain, especially in recent years (where they represent around 6% of the total catches of swordfish in the Indian Ocean).
- **Longline** fishery of **India: India** has reported very incomplete catches and catch-and-effort data for its longline fishery. Although the new catches estimated by the Secretariat are thought to be more accurate, catches of swordfish remain uncertain (catches of swordfish in recent years represent less than 3% of the total catches of swordfish in the Indian Ocean).
- **Longline** fleets from **non-reporting** countries (NEI): The Secretariat had to estimate catches of swordfish for a fleet of longliners targeting tunas or swordfish and operating under flags of various non-reporting countries. The catches estimated since 2006 are, however, low (they represent around 6% of the total catches of swordfish in the Indian Ocean).
- There have not been significant changes to the catch series of swordfish since the WPB in 2010 (**Fig. 7**). Changes since the last WPB refer to revisions of historic data series for the artisanal fisheries of Indonesia and India. These changes, however, did not lead to significant changes in the total catch estimates (**Fig. 7**).

Discards are believed to be low although they are unknown for most industrial fisheries, mainly longliners. Discards of swordfish may also occur in the driftnet fishery of Iran, as this species has no commercial value in this country.

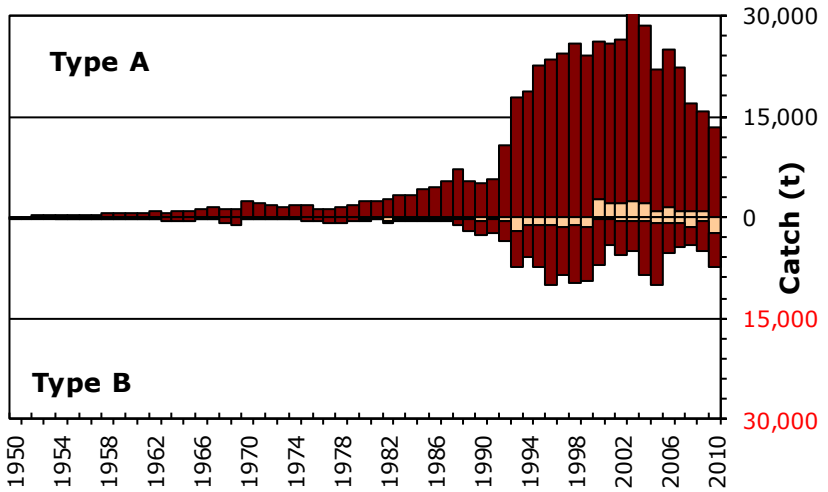


Fig. 6. Uncertainty of annual catch estimates for swordfish (Data as of July 2012).

*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.*

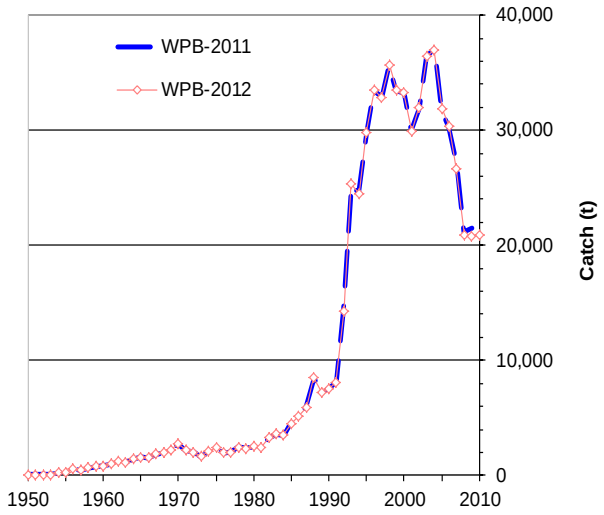


Fig. 7. Swordfish: Catches used by the WPB in 2011 *versus* those estimated for the WPB in 2012 (1950–2010).

Catch–per–unit–effort (CPUE) Series (Fig. 8): Catch and effort series are available from some industrial longline fisheries. Nevertheless, catch and effort are not available from some fisheries or they are considered poor quality, especially since the early 90s (**Indonesia**, fresh-tuna longliners from **Taiwan,China**[8], Non-reporting longliners (**NEI**)).

In addition, catch-and-effort data are not available for the drifting gillnet fisheries of **Iran** and **Pakistan**.

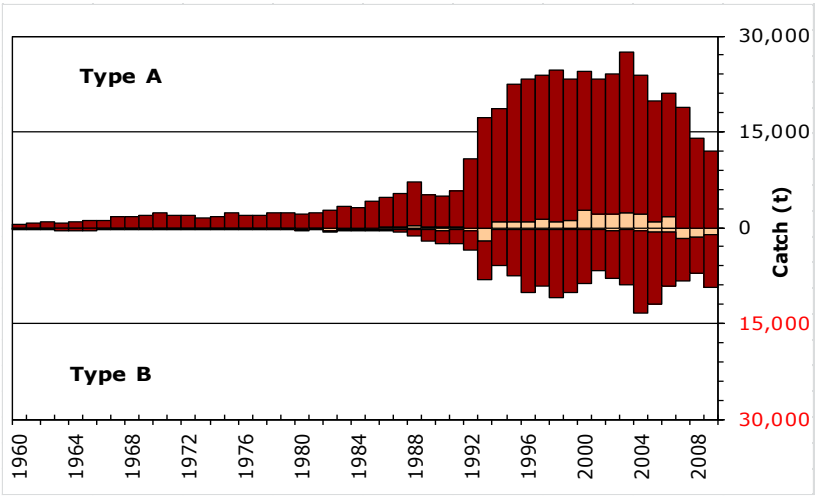


Fig. 8. Uncertainty of time-area catches for swordfish (Data as of May 2011).

*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.*

[8] Catch-and-effort statistics for the fresh-tuna longline fishery of Taiwan,China are available since 2007, although logbook coverage levels are still low.

Fish size or age trends (e.g. by length, weight, sex and/or maturity): In general, the amount of catch for which size data for the species are available before 2005 is still very low and the number of specimens measured per stratum has been decreasing in recent years (**Fig. 9**).

- **Average fish weight** (**Appendix 1**) can be assessed for several industrial fisheries although they are incomplete or poor quality for most fisheries before the early-80s and in recent years (low sampling coverage and time-area coverage of longliners from Japan). The average weights of swordfish are variable but show no clear trend. It is considered encouraging that there are no clear signals of declines in the size-based indices, but these indices should be carefully monitored, as females mature at a relatively large size, therefore, a reduction in the biomass of large animals could potentially have a strong effect on the spawning biomass.
- **Catch-at-Size(Age)** data are available but the estimates are thought to have been compromised for some years and fisheries due to:
    - the uncertainty in the catches of swordfish for the drifting gillnet fisheries of **Iran** and the fresh-tuna longline fishery of **Indonesia**.
    - the total lack of size data before the early-70s and poor coverage before the early-80s and for most artisanal fisheries (**Pakistan**, **India**, **Indonesia**).
    - the paucity of size data available from industrial longliners since the early-1990s (**Japan**, **Philippines**, **India** and **China**).
    - the lack of time-area catches for some industrial fleets (**Indonesia**, **India**, NEI).
    - the paucity of biological data available, notably sex-ratio and sex-length-age keys.

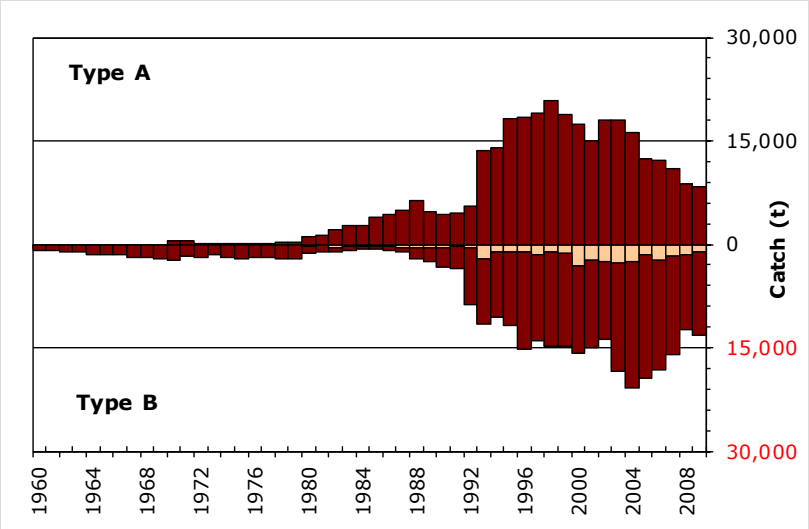


Fig. 9. Uncertainty of catch-at-size data for swordfish (Data as of May 2011).

*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.*

Blue Marlin (BUM)

- **Catch trends**

Blue marlin are caught mainly under drifting longlines (60%) and gillnets (30%) with remaining catches recorded under troll and hand lines (**Table 3**, **Fig. 10**). Blue marlins are considered to be a bycatch of industrial and artisanal fisheries. The catches of Blue marlin are typically higher than those of black marlin and striped marlin combined. In recent years, the fleets of Taiwan,China (longline), Indonesia (longline and gillnet), Sri Lanka (gillnet) and India (gillnet) are attributed with the highest catches of blue marlin (**Fig. 11**). The distribution of blue marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean (**Figs. 12, 13**).

Catch trends for blue marlin are variable; however, this may reflect the level of reporting. The catches of blue marlin under drifting longlines were more or less stable until the mid-80's, at around 3,000 t, steadily increasing since then. The largest catches were recorded in 1997 (~14,000 t). Catches under drifting longlines have been recorded under **Taiwan,China** and **Japan** fleets and, recently, **Indonesia** and several **NEI** fleets (**Fig. 11**). In recent years, deep-freezing longliners from **Japan** and **Taiwan,China** have reported most of the catches of blue marlin in waters of the western and central tropical Indian Ocean and, to a lesser extent, the Mozambique Channel and the Arabian Sea (**Fig. 13**).

TABLE 3: Best scientific estimates of the catches of blue marlin by type of fishery for the period 1950–2010 (in metric tons). Data as of July 2012.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
LL	2,563	3,512	3,474	4,961	7,120	7,163	5,950	7,442	8,791	8,512	7,425	7,548	6,000	5,830	5,950	6,345
GN	3	4	10	192	2,407	2,787	4,732	2,219	2,124	1,972	3,188	3,843	2,061	1,922	2,281	4,260
HL	11	23	34	313	345	36	29	27	33	25	45	27	30	38	42	54
OT	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**2,576**	**3,540**	**3,518**	**5,466**	**9,872**	**9,986**	**10,711**	**9,689**	**10,948**	**10,508**	**10,657**	**11,418**	**8,090**	**7,790**	**8,272**	**10,660**

Fisheries: Gillnet (**GN**); Longline (**LL**); Hook-and-Line (**HL**), including handline, trolling, baitboat, and sport fisheries; Other gears (**OT**)

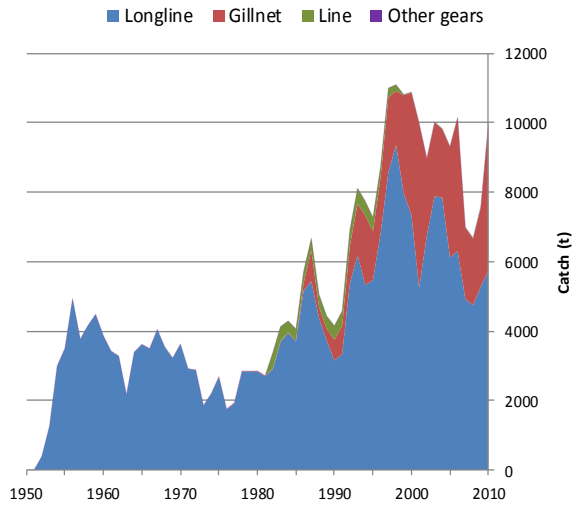


Fig. 10. Catches of blue marlin per gear and year recorded in the IOTC database (1950–2010).

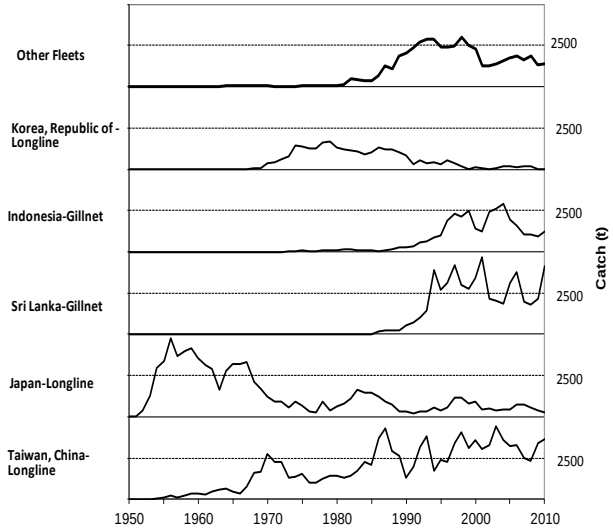


Fig. 11. Catches of blue marlin by fleet recorded in the IOTC database (1950–2010).

The catches of blue marlin in **Sri Lanka** (**Fig. 11**) have been high since the mid-80's as a result of the development of a fishery using a combination of drifting gillnets and longlines. The highest catch (4,600 t) was recorded in 2001, while current catches are around 2,500 t. However, the catches of marlins have been frequently misidentified in Sri Lanka making it uncertain the catches by species.

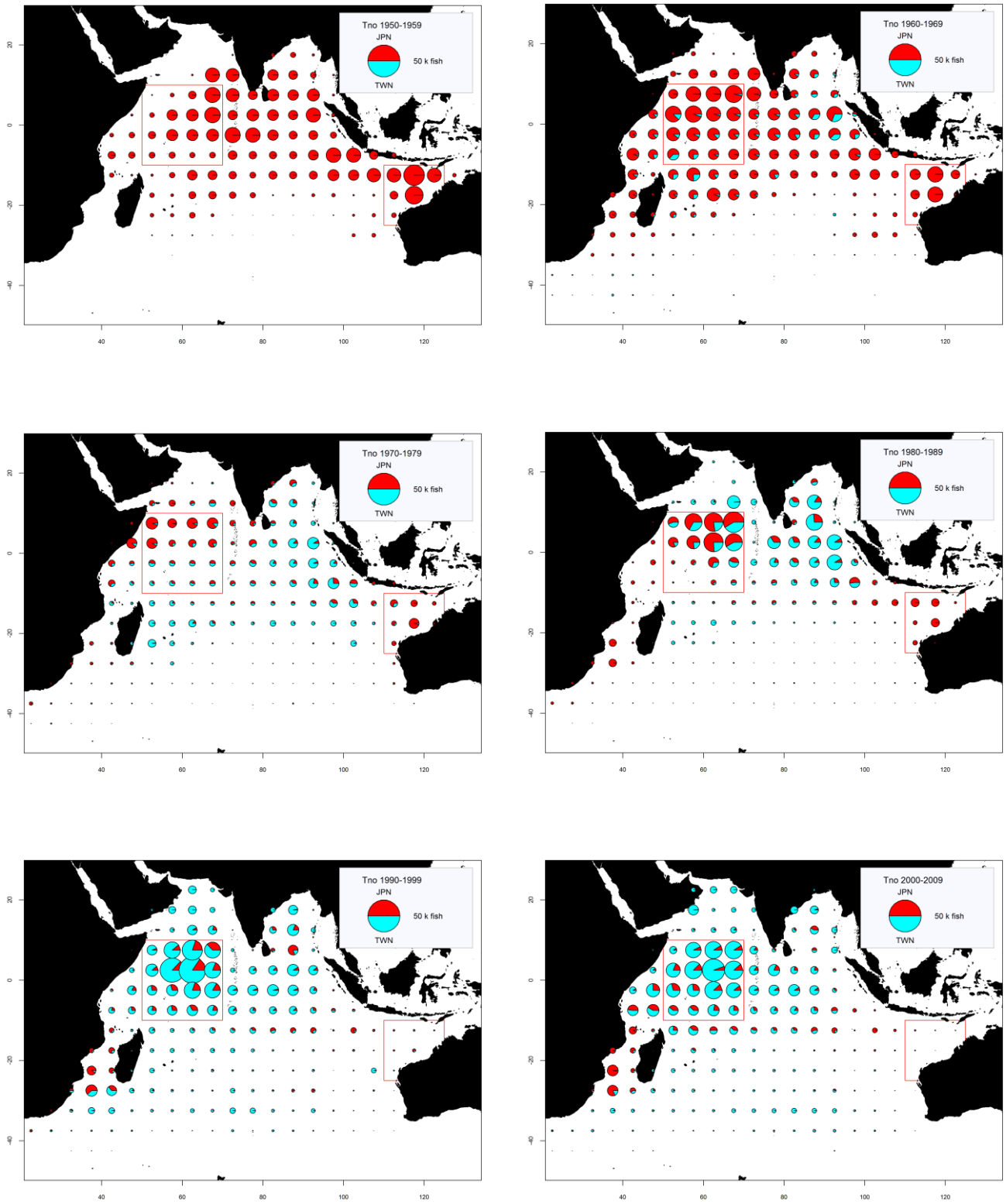


Fig. 12a-f. Time-area catches (in number of fish) of blue marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 1950-2009, by decade and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

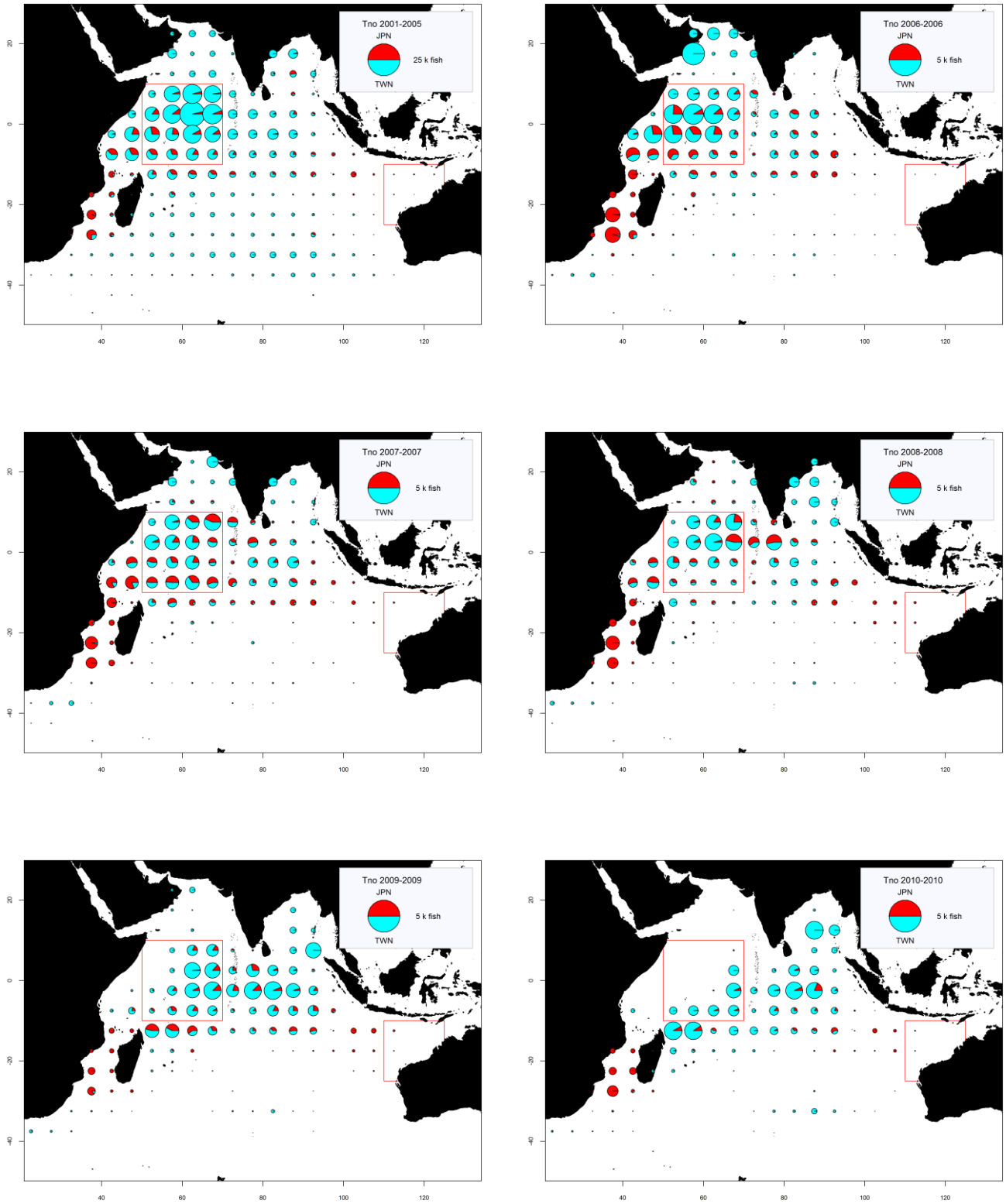


Fig. 13a-f. Time-area catches (in number of fish) of blue marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 2001–05 by fleet and for 2006–10, by year and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

- **Status of Fisheries Statistics at the IOTC**

Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

Retained catches are poorly known for most fisheries (**Fig. 14**) due to:

- catch reports often refer to total catches of all three marlin species combined; catches by species are estimated by the Secretariat for some artisanal (gillnet/longline fishery of **Sri Lanka** and artisanal fisheries of **India**, **Iran** and **Pakistan**) and industrial (longliners of **Indonesia** and **Philippines**) fisheries
- catches of non-reporting industrial longliners (**India**, **NEI**) and the gillnet fishery of **Indonesia** are estimated by the Secretariat using alternative information
- catches are likely to be incomplete for industrial fisheries for which the blue marlin is not a target species
- conflicting catch reports: Longline catches from the **Republic of Korea** are reported as nominal catches, and catch and effort reports are conflicting, with higher catches recorded in the catch and effort table. For this reason, the Secretariat revised the catches of blue marlin for the Republic of Korea over the time-series using both datasets. Although the new catches estimated by the Secretariat are thought to be more accurate, catches of blue marlin remain uncertain for this fleet.
- a lack of catch data for most sport fisheries.

There have not been significant changes to the catches of blue marlin since the WPB in 2011 (**Fig. 15**).

Discards are unknown for most industrial fisheries, mainly longliners. Discards of blue marlin may also occur in the driftnet fishery of I.R. Iran, as this species has no commercial value in this country.

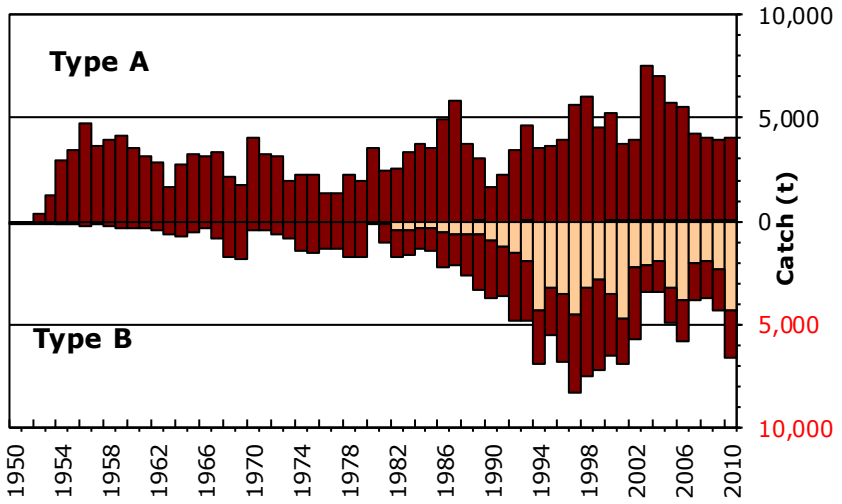


Fig. 14. Uncertainty of annual catch estimates for blue marlin (Data as of July 2012).

*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.*

Catch–per–unit–effort (CPUE) Series: Nominal CPUE series are available from some industrial longline fisheries (primarily the Japanese longline fleet; **Appendix 1**) although catches are thought to be incomplete (catches of non-target species are not always recorded in logbooks). No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; or other artisanal (gillnet fisheries of Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

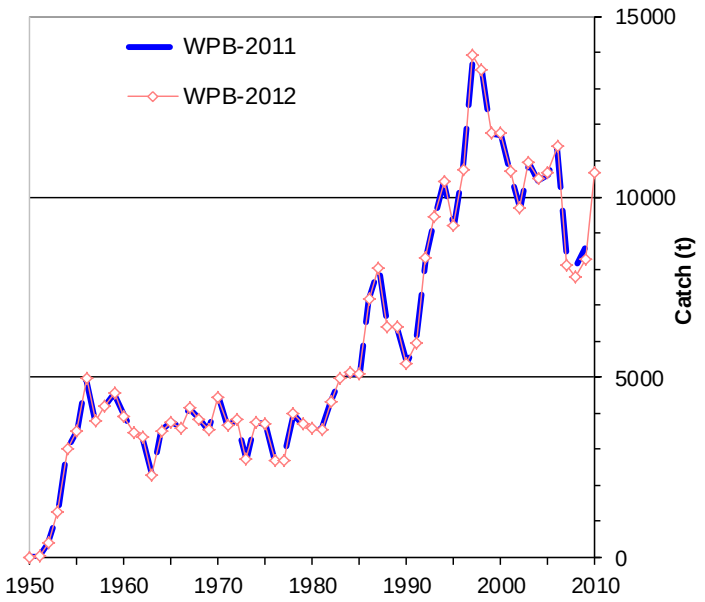


Fig. 15. Blue Marlin: Catches used by the WPB in 2011 *versus* those estimated for the WPB12 (1950–2010).

Fish size or age trends (e.g. by length, weight, sex and/or maturity): Average fish weight can only be assessed for the longline fishery of **Japan** since 1970 and **Taiwan,China** since 1980. However, the number of specimens measured on Japanese longliners in recent years is very low and miss-identification of striped and blue marlin may be occurring in the Taiwanese longline fishery; the length frequency distributions derived from samples collected on Taiwanese longliners differ greatly from those collected on longliners flagged in Japan (**Appendix 1**).

Catch-at-Size(Age) tables have not been built for blue marlin due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

Black Marlin (BLM)

- **Catch trends**

Black marlin are caught mainly under drifting longlines (44%) and gillnets (49%) with remaining catches recorded under troll and hand lines (**Table 4, Fig. 16**). Black marlin are the bycatch of industrial and artisanal fisheries. In recent years, the fleets of **Taiwan,China** (longline), **Sri Lanka** (gillnet), **Indonesia** (gillnets) and **India** (gillnets) are attributed with the highest catches of black marlin (**Fig. 17**). The minimum annual catch estimated for the period 2006 to 2010 is around 4,680 t (**Table 4**).

TABLE 4. Best scientific estimates of the catches of black marlin by type of fishery for the period 1950–2010 (in metric tons). Data as of July 2012.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
LL	846	1,633	1,288	1,370	1,500	1,943	1,235	1,440	2,288	2,005	2,003	2,109	1,847	2,634	2,230	1,374
GN	47	60	118	491	1,781	2,278	2,608	1,634	1,626	1,629	2,259	2,687	2,063	2,469	3,412	4,172
HL	15	19	25	177	244	694	196	451	574	926	487	624	773	1,063	1,580	1,389
OT	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**908**	**1,712**	**1,435**	**2,038**	**3,525**	**4,914**	**4,040**	**3,525**	**4,487**	**4,560**	**4,750**	**5,420**	**4,682**	**6,166**	**7,221**	**6,935**

Fisheries: Gillnet (**GN**); Longline (**LL**); Hook-and-Line (**HL**), including handline, trolling, baitboat, and sport fisheries; Other gears (**OT**)

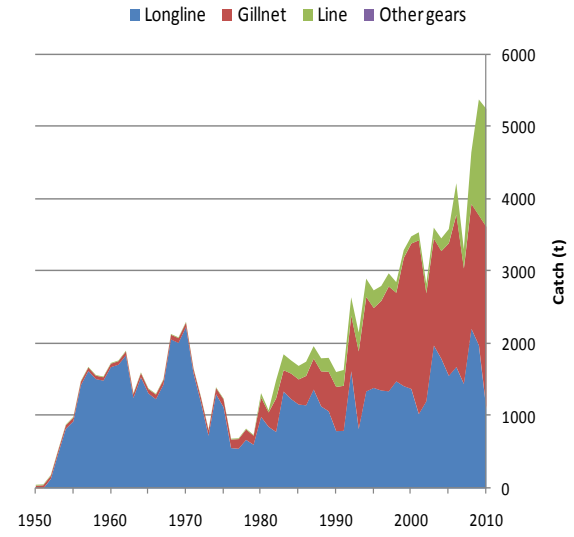


Fig. 16. Catches of Black Marlin per gear and year recorded in the IOTC Database (1960–2010).

Fig. 17. Catches of Black marlin by fleet recorded in the IOTC Database (1960–2010).

Between the early-1950s and the late-1980s part of the Japanese fleet was licensed to operate within the EEZ of Australia, and reported very high catches of black marlin in that area, in particular in waters off northwest Australia (**Fig. 18**). In recent years, deep-freezing longliners from Japan and Taiwan,China have reported lower catches of black marlin, mostly in waters off the western coast of India and, to a lesser extent, the Mozambique Channel (**Fig. 19**).

The catches of black marlin in **Sri Lanka** (**Fig. 17**) have been high since the mid-1990's as a result of the development of a fishery using a combination of drifting gillnets and longlines. The highest catch (1,600 t) was recorded in 2001, while current catches are around 1300t. However, the catches of marlins have been frequently misidentified in **Sri Lanka** making catches by species uncertain.

In recent years (2008–10) **India** has reported higher catches of black marlin for its fisheries, amounting to around 1000t (**Fig. 17**, increase in category **Others**).

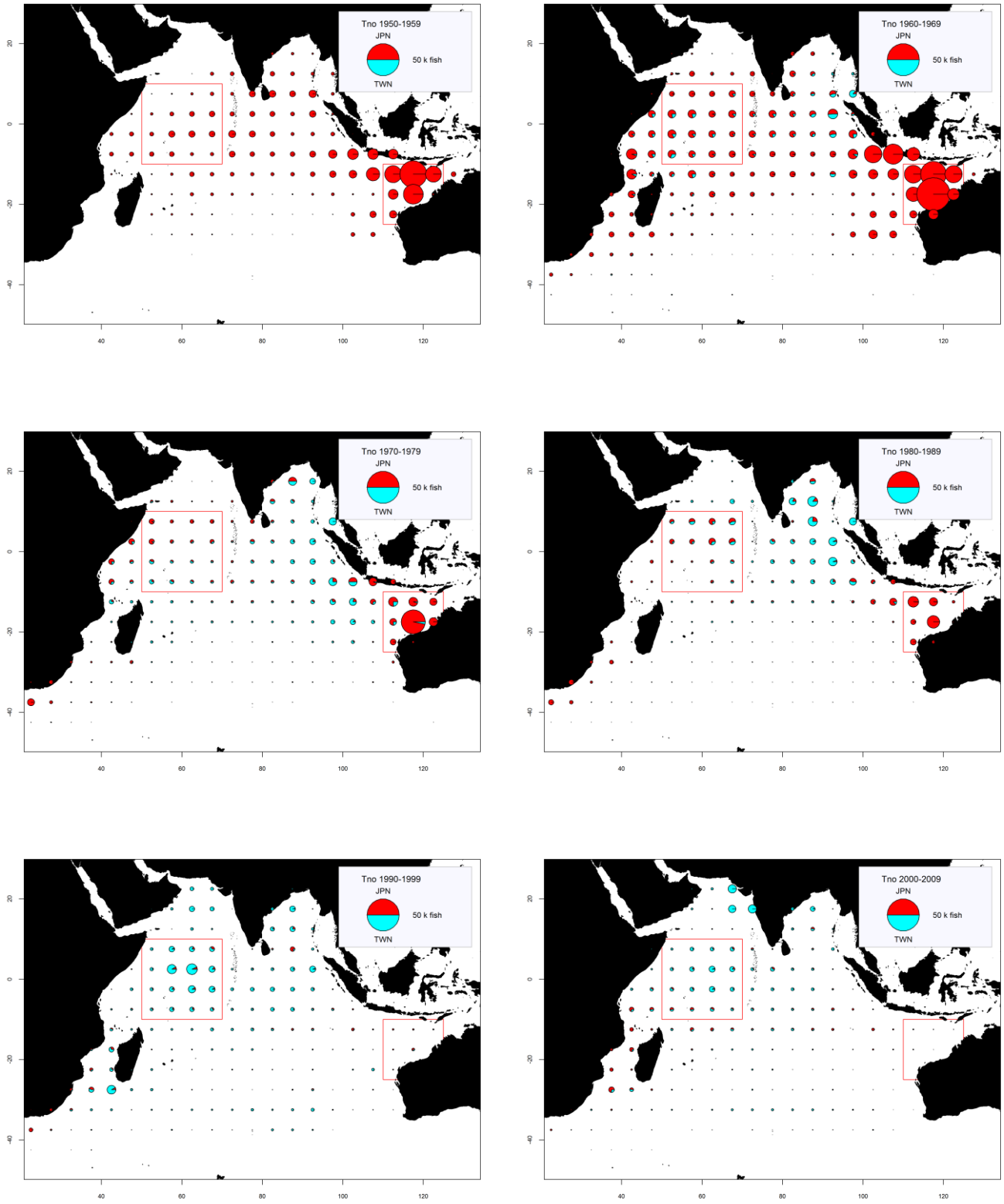


Fig. 18a-f. Time-area catches (in number of fish) of black marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 1950–2009, by decade and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

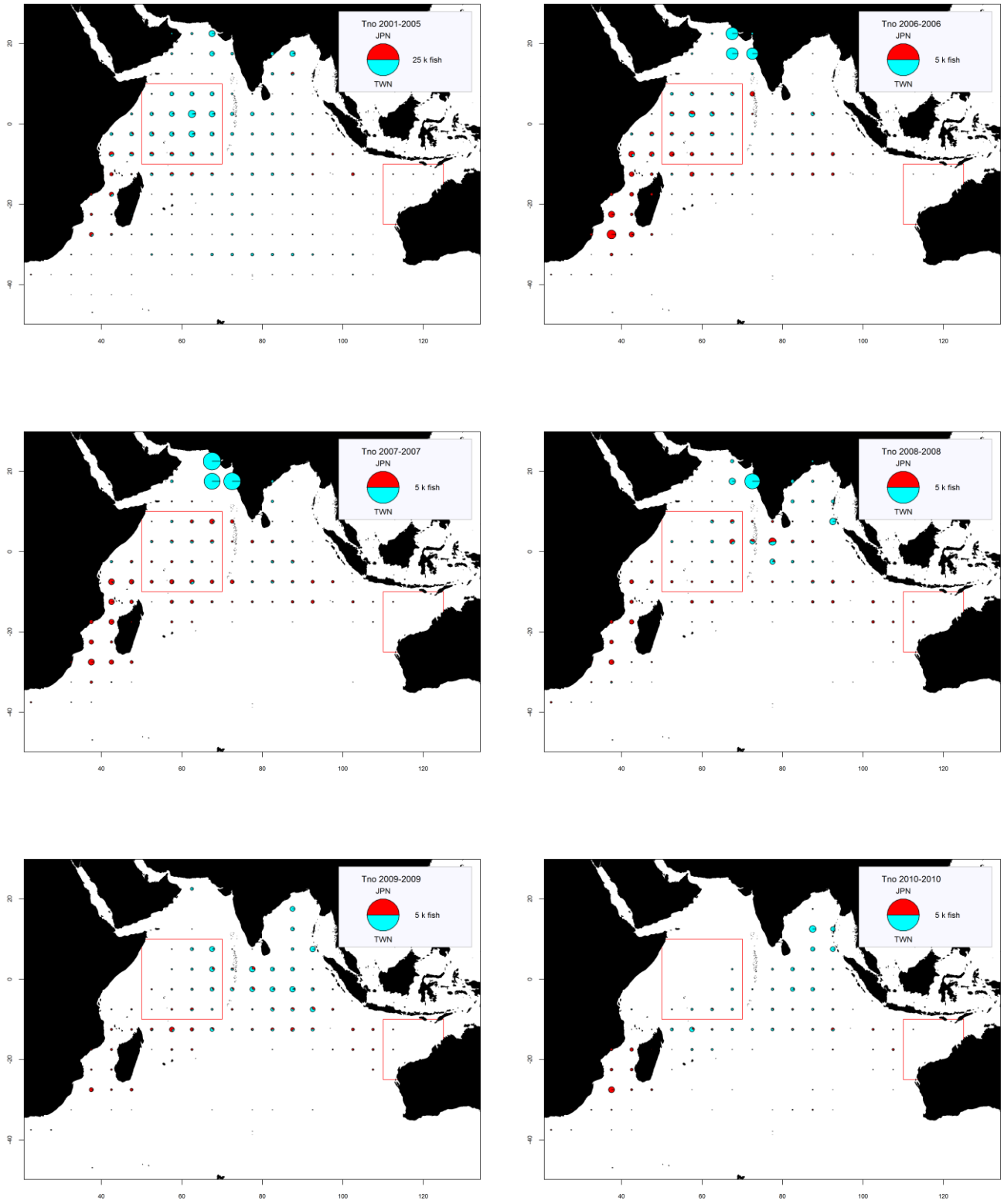


Fig. 19a-f. Time-area catches (in number of fish) of black marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 2001–05 by fleet and for 2006–10, by year and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

- **Status of Fisheries Statistics at the IOTC**

Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

Retained catches are uncertain for some fisheries (**Fig. 20**), due to the fact that:

- catch reports often refer to total catches of all three marlin species combined; catches by species are estimated by the Secretariat for some artisanal (gillnet/longline fishery of **Sri Lanka** and artisanal fisheries of **India**, **Iran** and **Pakistan**) and industrial (longliners of **Indonesia** and **Philippines**) fisheries.
- catches of non-reporting industrial longliners (**India**, **NEI**) and the gillnet fishery of **Indonesia** are estimated by the Secretariat using alternative information.
- catches are likely to be incomplete for industrial fisheries for which the black marlin is not a target species.
- conflicting catch reports: Longline catches from the **Republic of Korea** are reported as nominal catches, and catch and effort reports are conflicting, with higher catches recorded in the catch and effort table. For this reason, the Secretariat revised the catches of black marlin for the Republic of Korea over the time-series using both datasets. Although the new catches estimated by the Secretariat are thought to be more accurate, catches of black marlin remain uncertain for this fleet.
- a lack of catch data for most sport fisheries.
- the catch series used by the WPB in 2011 and that to be used for the WPB in 2012 (**Fig. 21**) are slightly different, following an increase in the catches estimated in recent years for the fleets of India (longline and trolling), and Indonesia (gillnet).

Discards are unknown for most industrial fisheries, mainly longliners. Discards of black marlin may also occur in the driftnet fishery of I.R. Iran, as this species has no commercial value in this country.

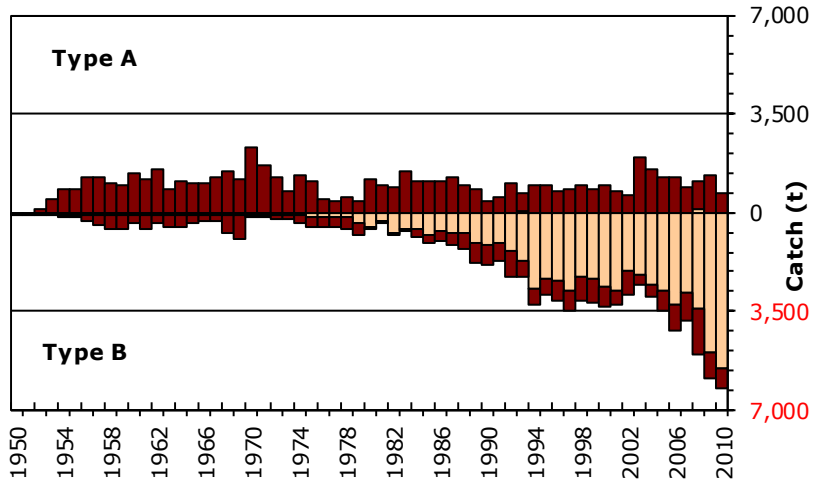


Fig. 20. Uncertainty of annual catch estimates for black marlin (Data as of July 2012).

*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.*

Catch–per–unit–effort (CPUE) Series: Standardised CPUE series have not yet been developed. Nominal CPUE series are however available from some industrial longline fisheries (primarily the Japanese longline fleet; **Appendix 1**) although catches are thought to be incomplete (catches of non-target species are not always recorded in logbooks). No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; or other artisanal (gillnet fisheries of Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

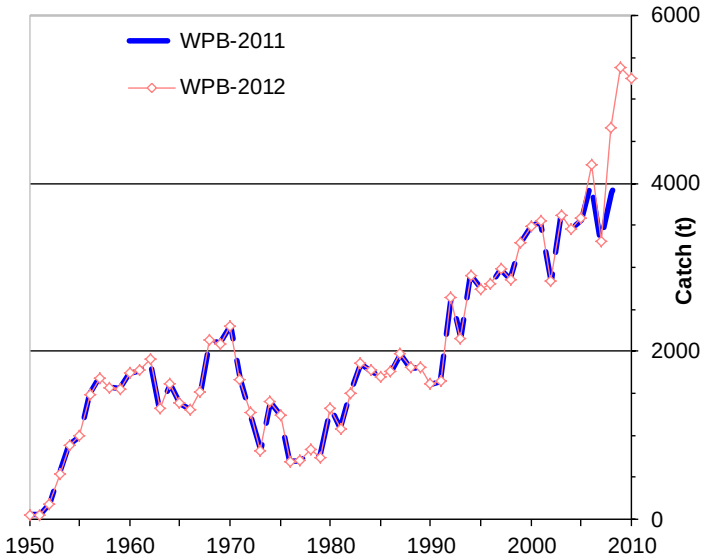


Fig. 21: Black Marlin: Catches used by the WPB in 2011*versus* those estimated for the WPB in 2012 (1950–2010).

Fish size or age trends (e.g. by length, weight, sex and/or maturity): Average fish weight can only be assessed for the longline fishery of Japan since 1970 and Taiwan,China since 1980. The number of specimens measured on Japanese longliners in recent years is, however, very low.

Catch-at-Size(Age) tables have not been built for black marlin due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

Striped Marlin (MLS)

- **Catch trends**

Striped marlin are caught almost exclusively under drifting longlines (98%) with remaining catches recorded under gillnets and troll lines (**Table 5, Fig. 22**). Striped marlin are generally considered to be a bycatch of industrial fisheries. Catch trends for striped marlin are variable; however, this may reflect the level of reporting. The catches of striped marlin under drifting longlines have been changing over time, between 2,000 t and 8,000 t (**Fig. 22**).

TABLE 5: Best scientific estimates of the catches of striped marlin by type of fishery for the period 1950–2010 (in metric tons). Data as of July 2012.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
LL	1,024	3,077	3,614	5,042	5,040	2,945	3,071	3,114	3,115	3,709	2,946	3,075	2,405	2,263	1,904	1,883
GN	2	3	6	24	60	117	92	65	66	74	81	125	96	351	132	149
HL	-	-	2	11	47	71	51	41	65	39	127	41	48	71	54	59
OT	-	-	2	-	-	0	-	0	-	0	-	-	-	-	-	-
Total	**1,026**	**3,080**	**3,624**	**5,077**	**5,147**	**3,133**	**3,213**	**3,220**	**3,246**	**3,822**	**3,154**	**3,242**	**2,550**	**2,685**	**2,090**	**2,090**

Fisheries: Gillnet (**GN**); Longline (**LL**); Hook-and-Line (**HL**), including handline, trolling, baitboat, and sport fisheries; Other gears (**OT**)

Catches under drifting longlines have been recorded under **Taiwan,China**, **Japan**, **Republic of Korea** fleets and, recently, **Indonesia** and several **NEI** fleets (**Fig. 23**). Taiwan,China and Japan have reported large drops in the catches of striped marlin for its longline fleets since the mid-1980's and mid-1990's, respectively. The reason for such decreases in catches is not fully understood. Between the early-50s and the late-80s part of the Japanese fleet was licensed to operate within the EEZ of Australia, reporting relatively high catches of striped marlin in the area, in particular in waters off northwest Australia. High catches of the species were also reported in the Bay of Bengal during this period, by both Taiwan,China and Japanese longliners. The distribution of striped marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean (**Fig. 24**). These changes of fishing area and catches over the years are thought to be related to changes in the type of access agreements to EEZs of coastal countries in the Indian Ocean, rather than changes in the distribution of the species over time. However, since 2007, catches in the northwest Indian Ocean have dropped markedly, in tandem with a reduction of longline effort in the area as a consequence of maritime piracy off Somalia (**Fig. 25**).

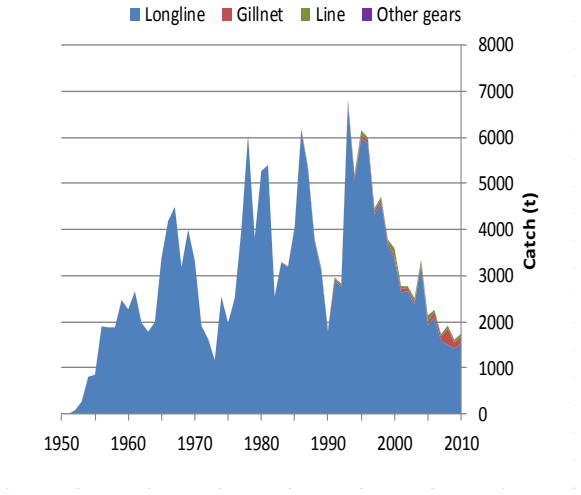


Fig. 22. Catches of Striped Marlin per gear and year recorded in the IOTC Database (1960-2010).

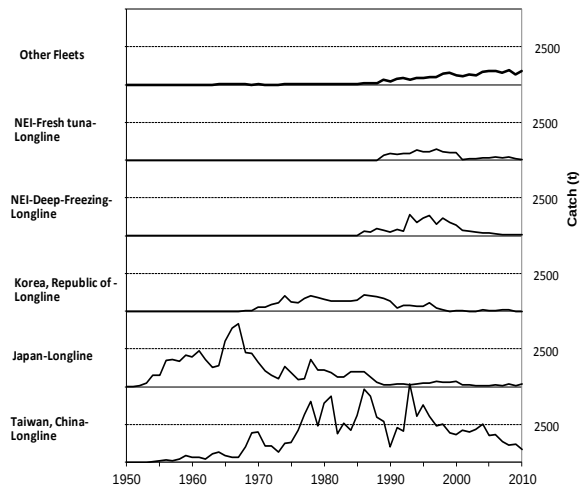


Fig. 23. Catches of Striped marlin by fleet recorded in the IOTC Database (1960-2010).

Discards are believed to be low although they are unknown for most industrial fisheries, mainly longliners. Discards of striped marlin may also occur in the driftnet fishery of the I.R of Iran, as this species has no commercial value in this country.

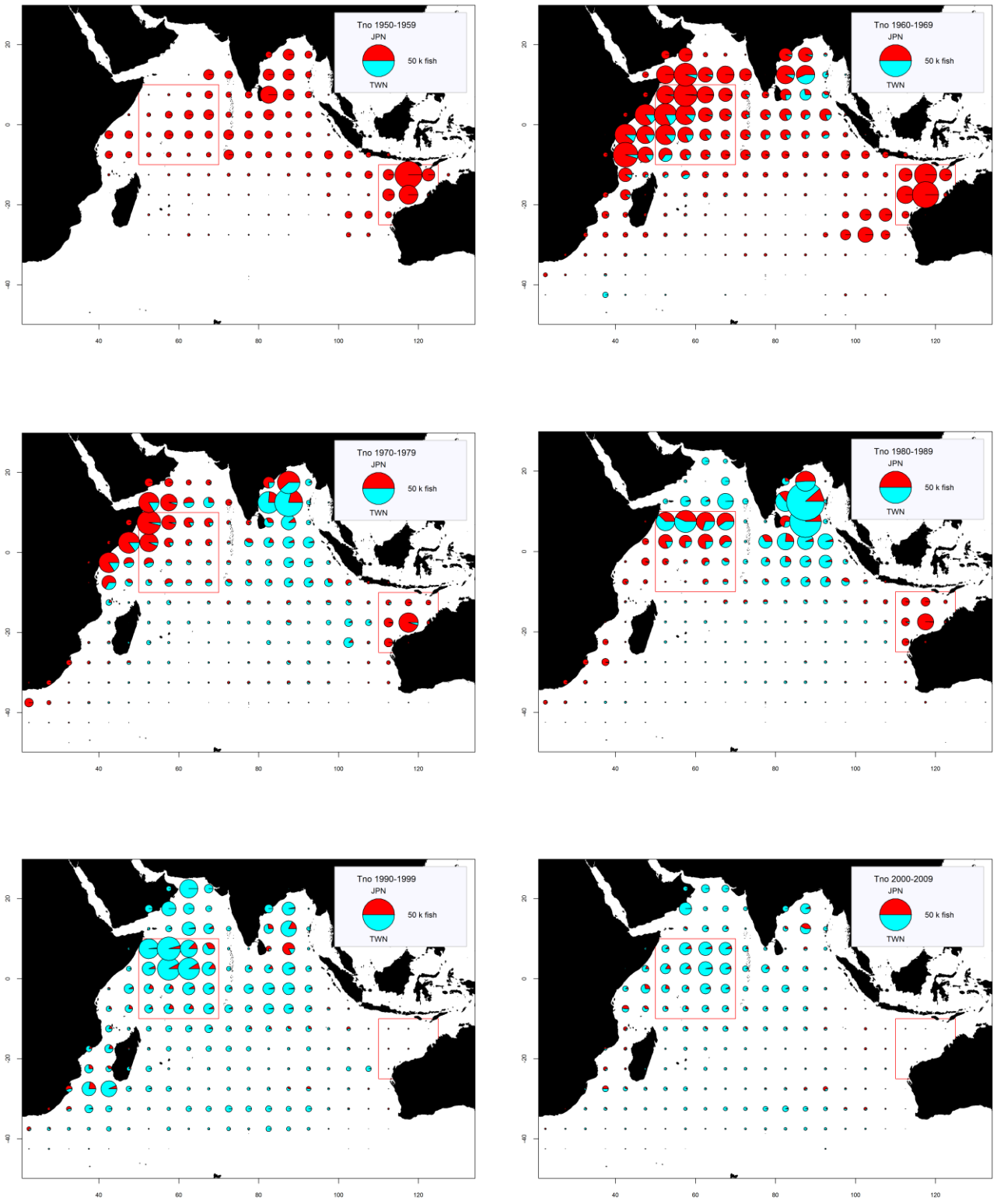


Fig. 24a-f. Time-area catches (in number of fish) of striped marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 1950–2009, by decade and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

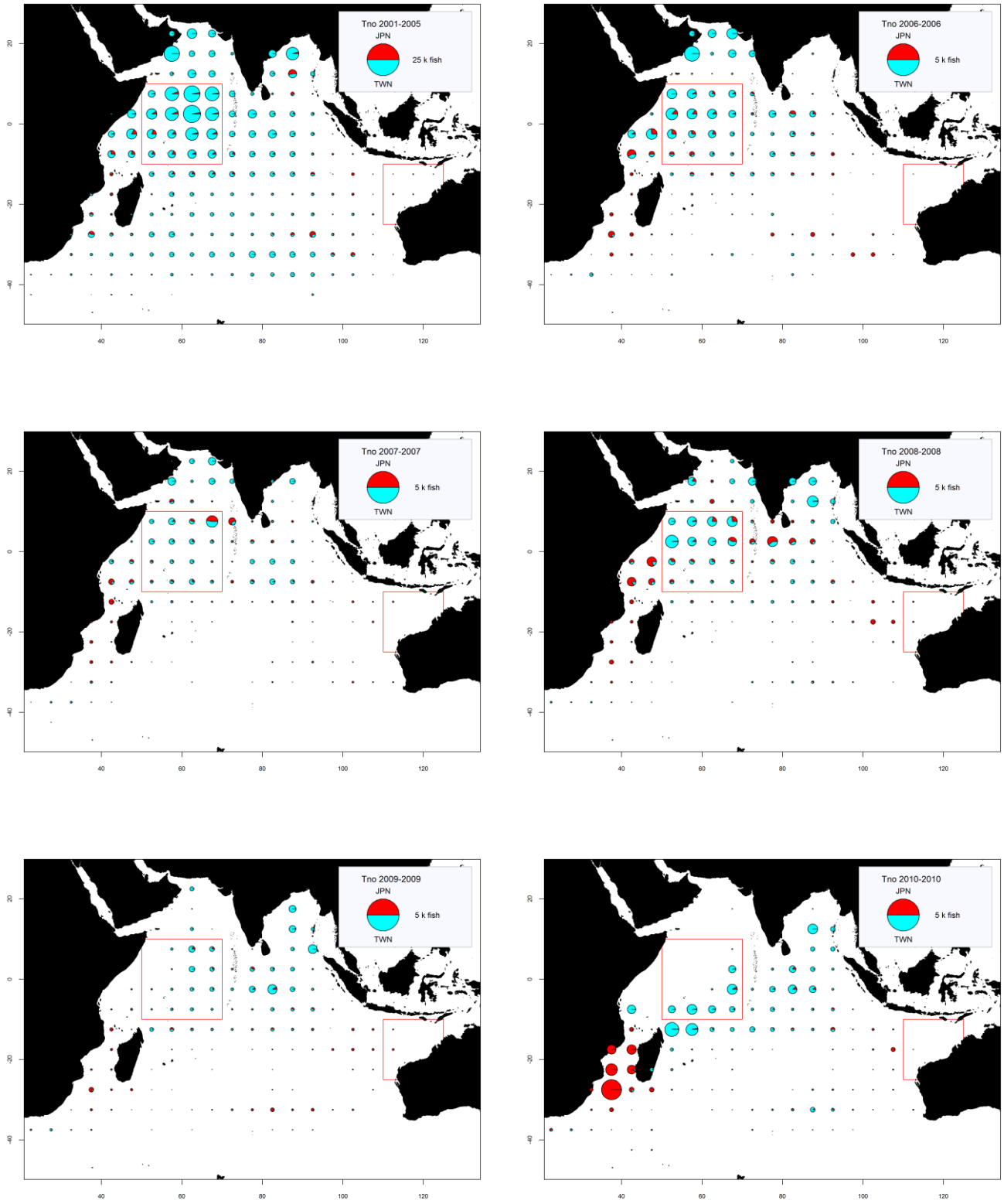


Fig. 25a-f. Time-area catches (in number of fish) of striped marlin as reported for the longline fisheries of Japan (JPN) and Taiwan,China (TWN) for the period 2001–05 by fleet and for 2006–10, by year and fleet. Red lines represent the boundaries of the marlin hot spots identified by the WPB.

- **Status of Fisheries Statistics at the IOTC**

Retained catches are reasonably well known (**Fig. 26**) although they remain uncertain for some fleets:

- Catch reports refer to total catches of all three marlin species; catches by species have to be estimated by the IOTC Secretariat for some industrial fisheries (longliners of **Indonesia** and **Philippines**).
- Catches of non-reporting industrial longliners (**India**, **NEI**) estimated by the IOTC Secretariat using alternative information. As they are not reported by the countries concerned, catches are likely to be incomplete for some industrial fisheries for which the striped marlin is seldom the target species.
- Conflicting catch reports: The catches for longliners flagged to the **Republic of Korea**, reported as nominal catches and catches and effort, are conflicting with higher catches recorded in the catch and effort table. For this reason, the IOTC Secretariat revised the catches of striped marlin over the time-series using both datasets. Although the new catches estimated by the IOTC Secretariat are thought to be more accurate, catches of striped marlin remain uncertain for this fleet.

There have not been significant changes to the catches of striped marlin since the WPB in 2010 (**Fig. 27**).

Discards are thought to be low although they are unknown for most industrial fisheries, mainly longliners. Discards of striped marlin may also occur in the driftnet fishery of Iran, as this species has no commercial value in this country.

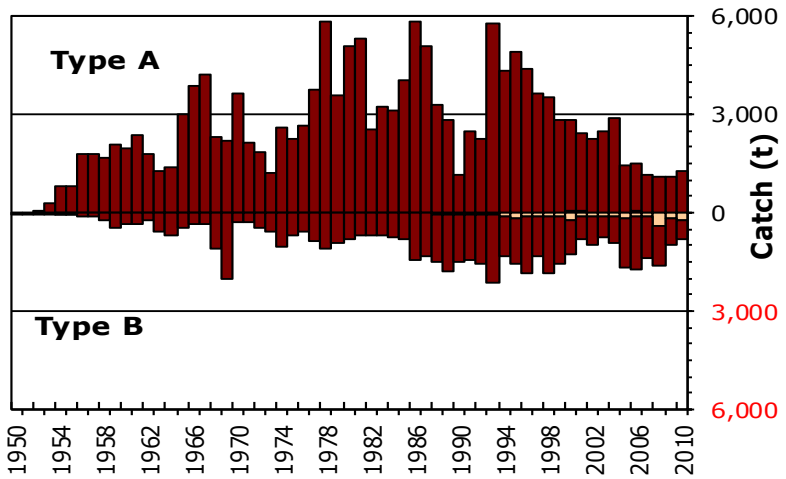


Fig. 26. Uncertainty of annual catch estimates for striped marlin (Data as of July 2012).

*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.*

Catch–per–unit–effort (CPUE) series: Standardised CPUE series have not yet been developed. Nominal CPUE series are however available from some industrial longline fisheries (primarily the Japanese longline fleet; **Appendix 1**) although catches are thought to be incomplete (catches of non-target species are not always recorded in logbooks). No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; or other artisanal (gillnet fisheries of I.R. Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

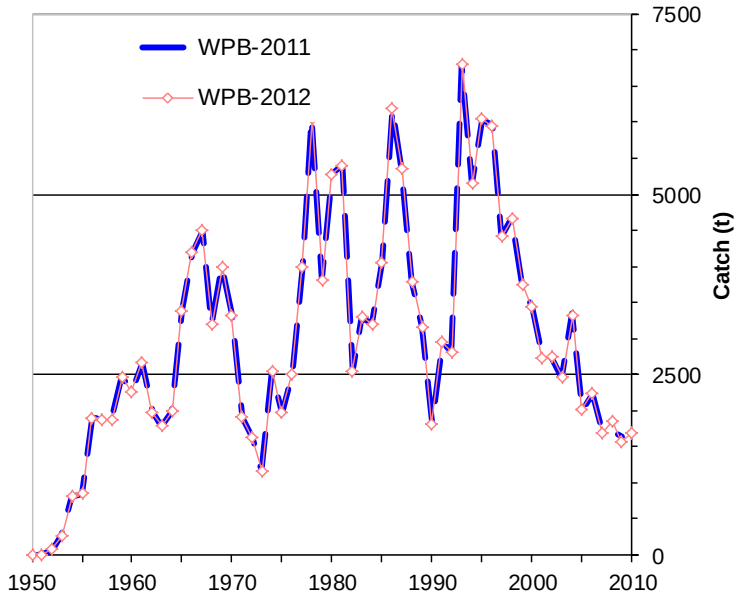


Fig. 27. Striped Marlin: Catches used by the WPB in 2011 *versus* those estimated for the WPB12 (1950–2010).

Fish size or age trends (e.g. by length, weight, sex and/or maturity): Average fish weight can only be assessed for the longline fishery of Japan since 1970 and Taiwan,China since 1980. However, the number of specimens measured on Japanese longliners in recent years is very low and miss-identification of striped and blue marlin may be occurring in the Taiwanese longline fishery; the length frequency distributions derived from samples collected on Taiwanese longliners differ greatly from those collected on longliners flagged in Japan (**Appendix 1**).

Catch-at-Size(Age) tables have not been built for this species due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

Indo-Pacific Sailfish (SFA)

Indo-Pacific sailfish is caught mainly under gillnets (78%) with remaining catches recorded under troll and hand lines (15%), longlines (7%) or other gears (**Table 6, Fig. 28**). The minimum average annual catch estimated for the period 2006 to 2010 is around 21,500 t. In recent years, the countries attributed with the highest catches of Indo-Pacific sailfish are situated in the Arabian Sea (India, Iran, Pakistan and Sri Lanka). Smaller catches are reported for line fishers in Comoros and Mauritius and by Indonesia longliners. This species is also a popular catch for sport fisheries (e.g. Kenya, Mauritius, Seychelles).

TABLE 6: Best scientific estimates of the catches of indo-pacific sailfish by type of fishery for the period 1950–2010 (in metric tons). Data as of July 2012.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
LL	299	819	449	343	1,425	1,417	791	1,149	2,037	934	1,397	1,402	2,062	2,270	1,243	1,144
GN	155	166	509	2,360	7,620	16,057	10,707	10,721	16,486	23,049	20,600	19,917	13,910	14,284	17,790	22,711
HL	164	240	416	1,271	2,370	5,365	2,979	5,143	4,728	7,493	4,528	5,076	5,591	6,228	8,951	7,795
OT	9	9	86	49	1	55	-	297	-	240	-	-	-	12	-	-
Total	**627**	**1,235**	**1,459**	**4,022**	**11,416**	**22,893**	**14,478**	**17,310**	**23,250**	**31,716**	**26,525**	**26,395**	**21,563**	**22,793**	**27,984**	**31,650**

Fisheries: Gillnet (**GN**); Longline (**LL**); Hook-and-Line (**HL**), including handline, trolling, baitboat, and sport fisheries; Other gears (**OT**)

Catches of Indo-Pacific sailfish greatly increased since the mid-1990's in response to the development of a gillnet/longline fishery in Sri Lanka (**Fig. 29**) and, especially, the extension in the area of operation of Iranian gillnet vessels to areas beyond the EEZ of I.R. Iran. The catches of Iranian gillnets (**Fig. 29**) increased dramatically, more than six-fold, after the late 1990's, from the values averaging 2,000 t in the late 1980's to a maximum of 12,600 t in 2005.

Catches of Indo-Pacific sailfish under drifting longlines (**Table 6**) and other gears do not show any specific trends in recent years, with total catches amounting to about 5,000 t. However, it is likely that longline fleets under report catches of this species due to its little commercial value. In recent years, deep-freezing longliners from Japan have reported catches of Indo-Pacific sailfish in the central western Indian Ocean, between Sri Lanka and the Maldives and the Mozambique Channel (**Fig. 30**).

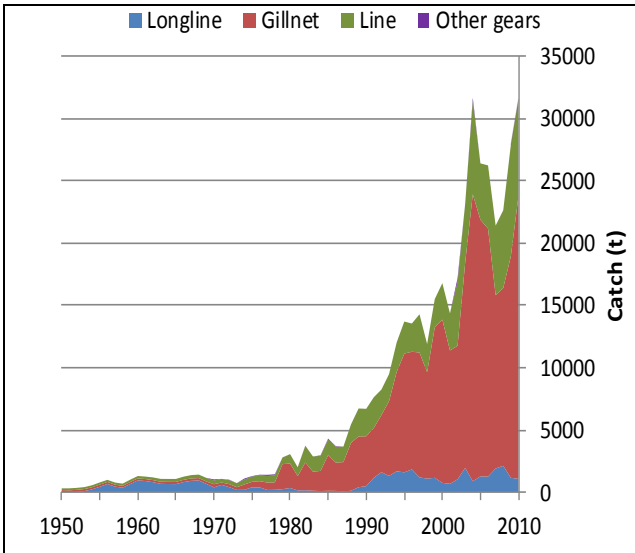


Fig. 28. Catches of Indo-Pacific sailfish per gear and year recorded in the IOTC Database (1960-2010).

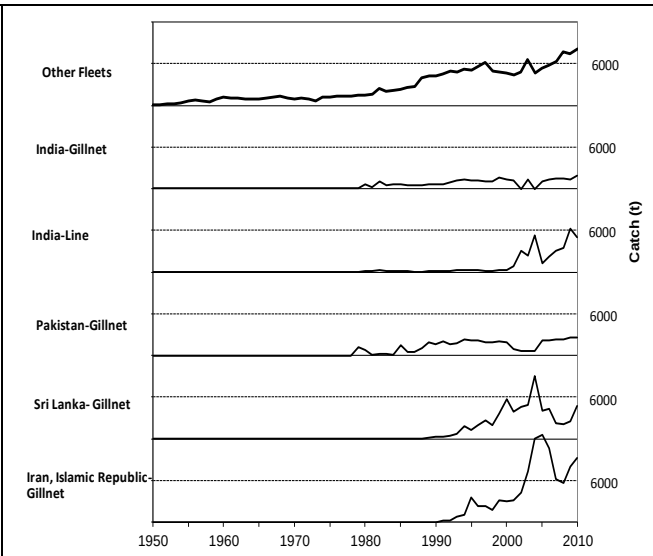


Fig. 29. Catches of Indo-Pacific sailfish by fleet recorded in the IOTC Database (1960–2010).

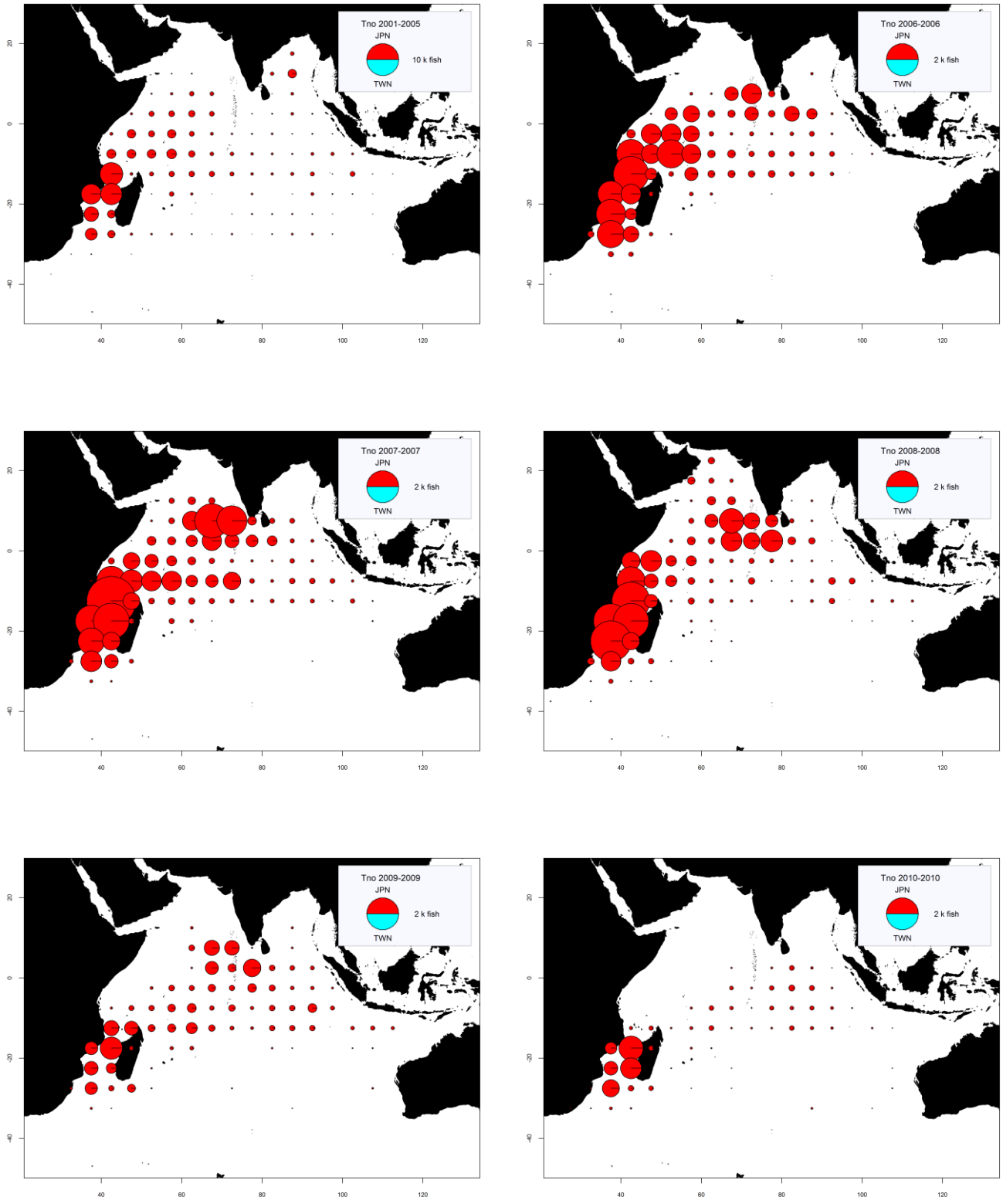


Fig. 30a-f. Time-area catches (in number of fish) of Indo-Pacific sailfish as reported for the longline fisheries of Japan (JPN) for the period 2001–05, by fleet and for 2006–10, by year and fleet.

- **Status of Fisheries Statistics at the IOTC**

Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Unlike the other billfish, Indo-Pacific sailfish are probably more reliably identified because of the large and distinctive first dorsal fin that runs most of the length of the body.

Retained catches are poorly known for most fisheries (**Fig. 31**) due to:

- Catch reports often refer to total catches of all billfish species combined; catches by species are estimated by the Secretariat for some artisanal (gillnet/longline fishery of Sri Lanka and artisanal fisheries of India and Pakistan) and industrial (longliners of Indonesia and Philippines) fisheries.
- Catches of IP sailfish reported for some fisheries may refer to the combined catches of more than one species of billfish, in particular marlins and shortbill spearfish (gillnet fishery of Iran and many coastal fisheries).
- Catches likely to be incomplete for some artisanal fisheries (gillnets of Pakistan, pole and lines of Maldives) due to under-reporting.
- Catches are likely to be incomplete for industrial fisheries for which the Indo-Pacific sailfish is not a target species.
- A lack of catch data for most sport fisheries.

There have not been significant changes to the catches of Indo-Pacific sailfish since 2011 (**Fig. 32**).

Discards are unknown for most industrial fisheries, mainly longliners (for which they are presumed to be moderate-high).

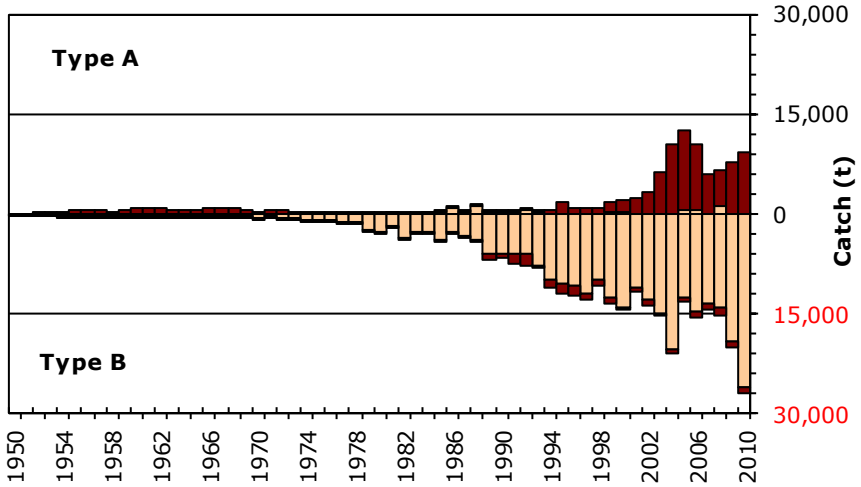


Fig. 31. Uncertainty of annual catch estimates for IP sailfish.

*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.* Data as of July 2012.

Catch–per–unit–effort (CPUE) series: Standardised and nominal CPUE series have not yet been developed. No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya; or other artisanal (gillnet fisheries of I.R. Iran and Pakistan, gillnet/longlines of Sri Lanka, gillnets of Indonesia) or industrial fisheries (NEI longliners and all purse seiners).

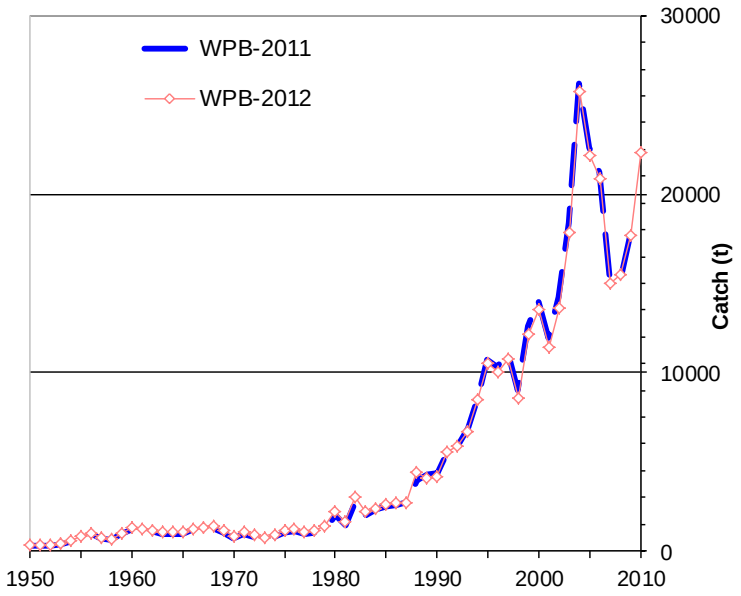


Fig. 32. Indo-Pacific sailfish: Catches used by the WPB in 2011 *versus* those estimated for the WPB in 2012 (1950–2010).

Fish size or age trends (e.g. by length, weight, sex and/or maturity): Average fish weight can only be assessed for the longline fishery of Japan since 1970 and the gillnet/longline fishery of Sri Lanka since the late 1980s (**Appendix 1**). The number of specimens measured on Japanese longliners in recent years is, however, very low. Furthermore, the specimens discarded might be not accounted for in industrial fisheries, where they are presumed to be of lower size (possible bias of existing samples).

Catch-at-Size(Age) tables have not been built for this species due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

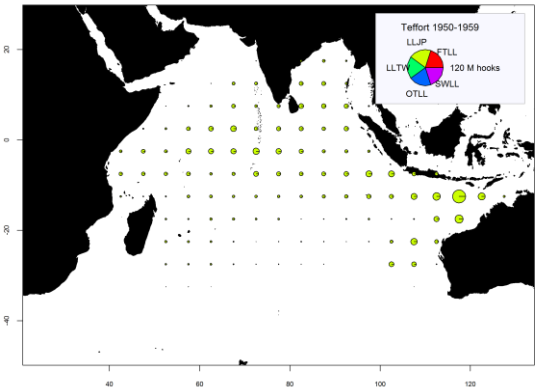
APPENDIX II

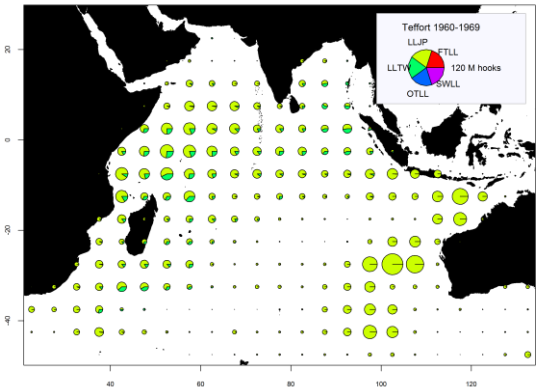
REVIEW OF FISHERIES TRENDS FOR BILLFISH

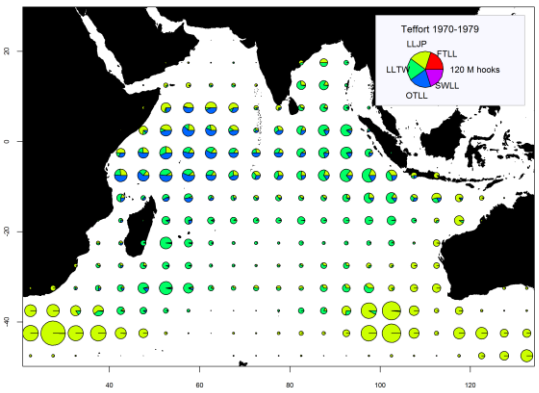
1. EFFORT

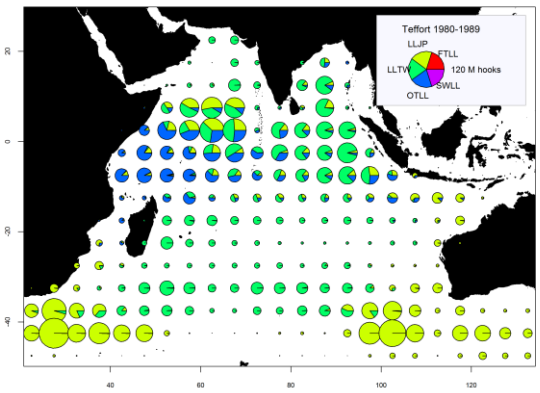
a) Longline

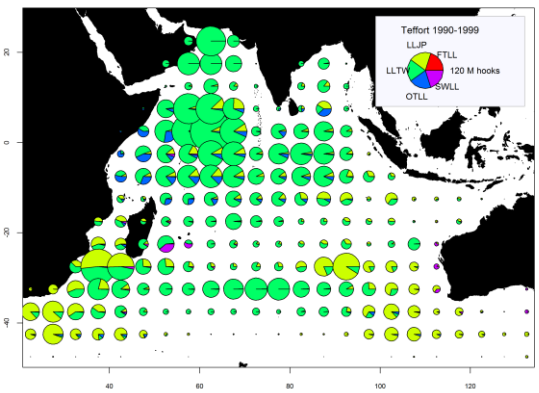
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, by decade and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles 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)

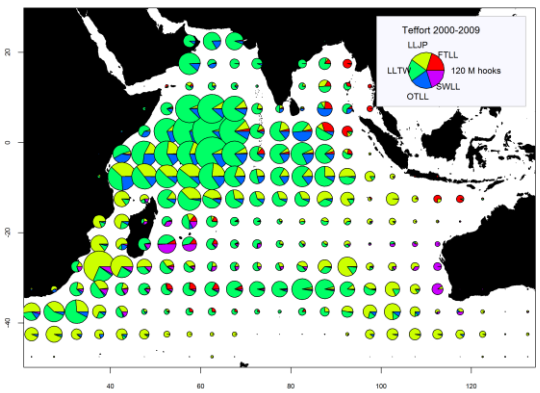




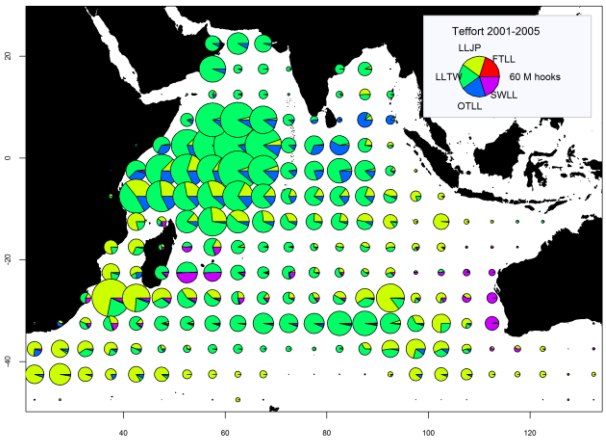


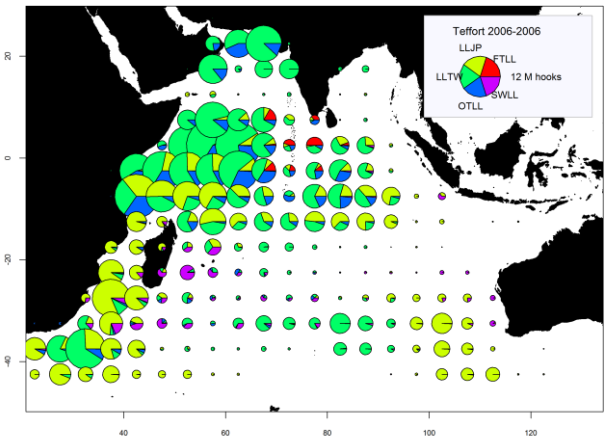


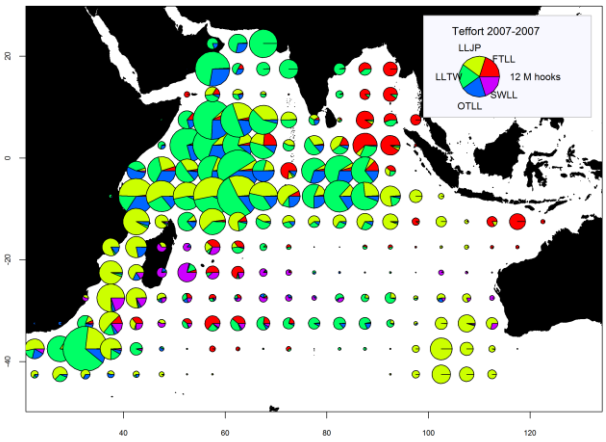


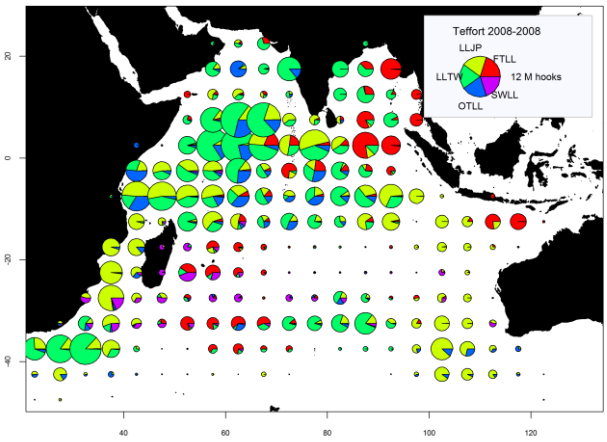


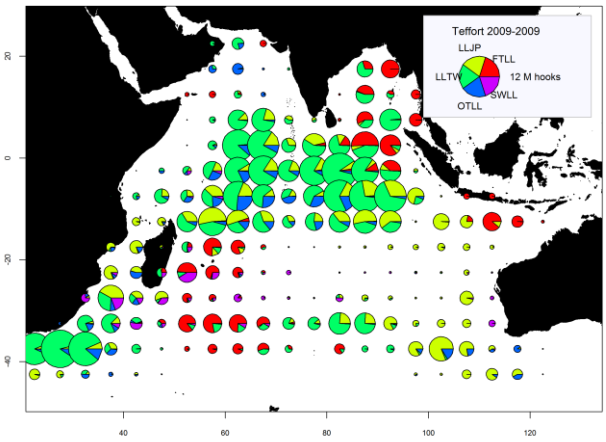
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2001-05 and 2006-10, by year, and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, 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)

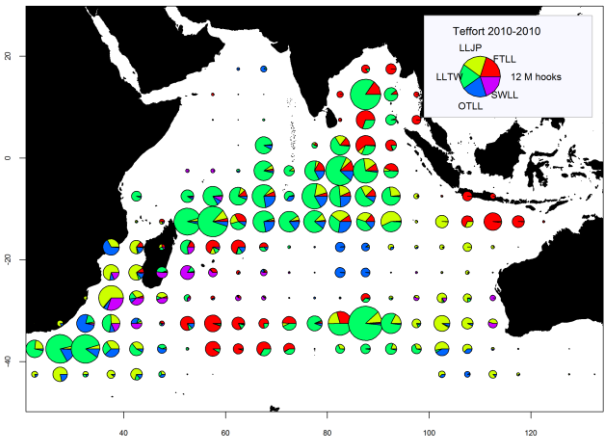




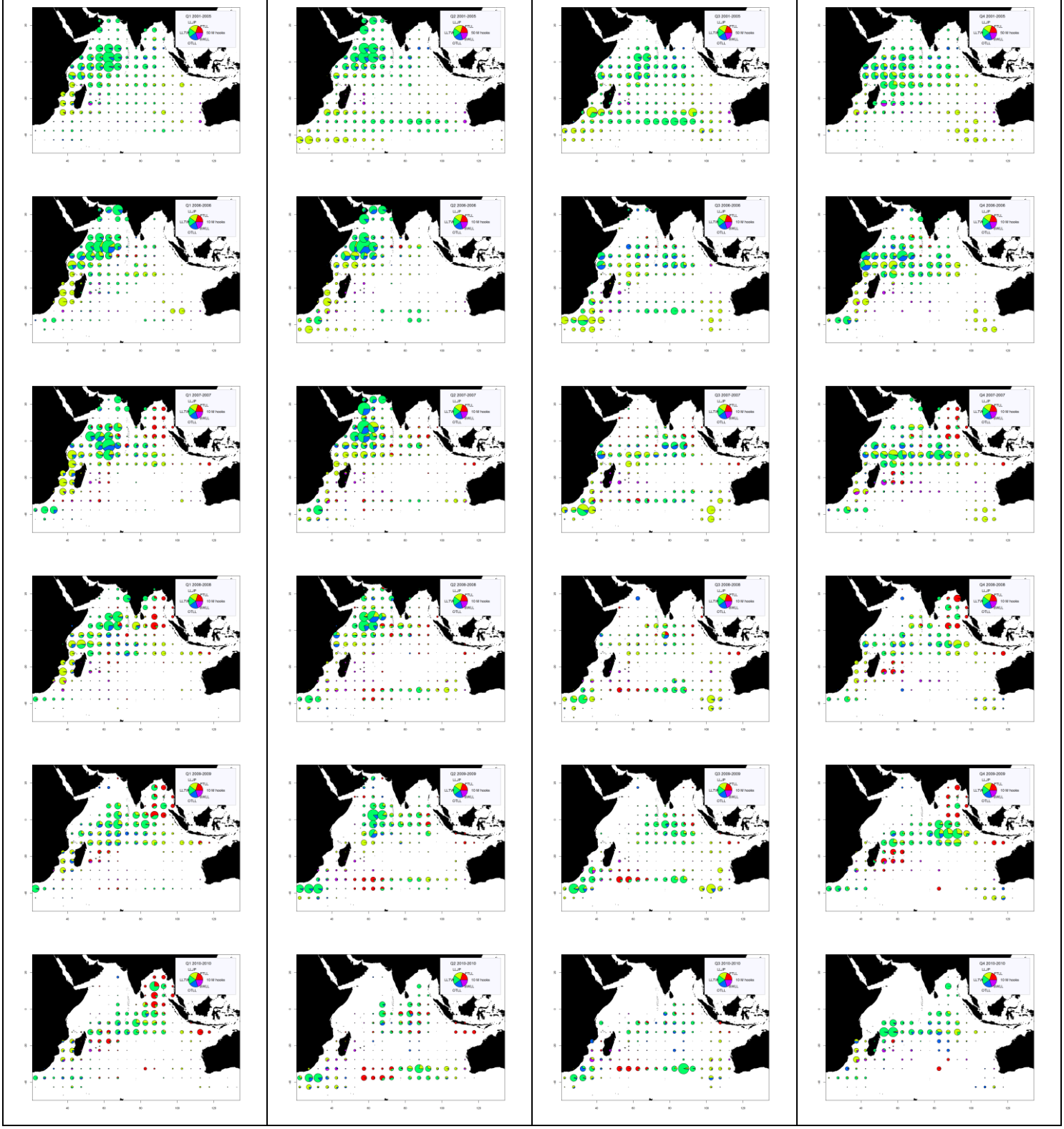






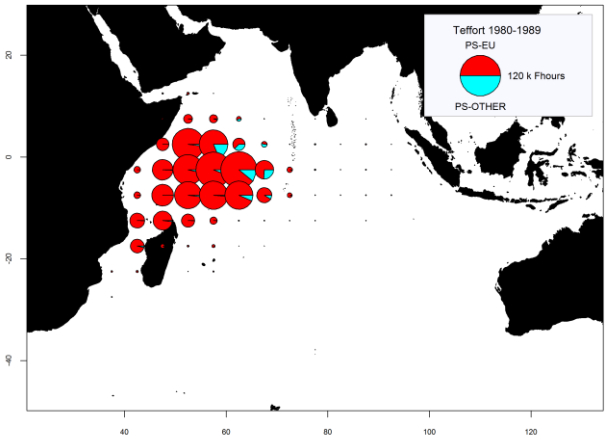


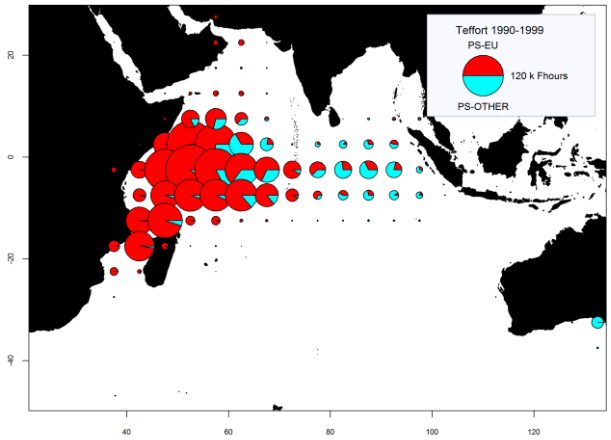
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2001-05 and 2006-10, by year, quarter, and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (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)

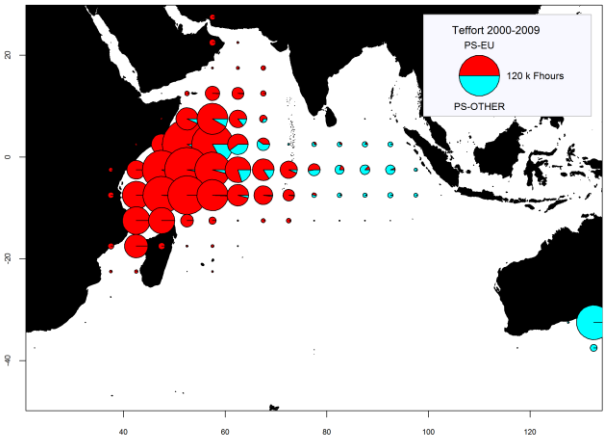


b) ***Purse seine***

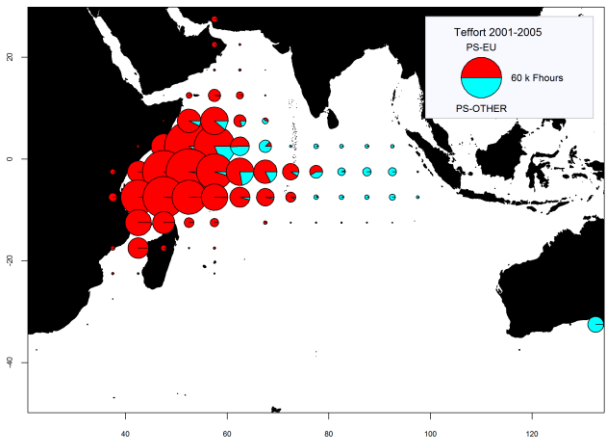
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), by decade and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial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

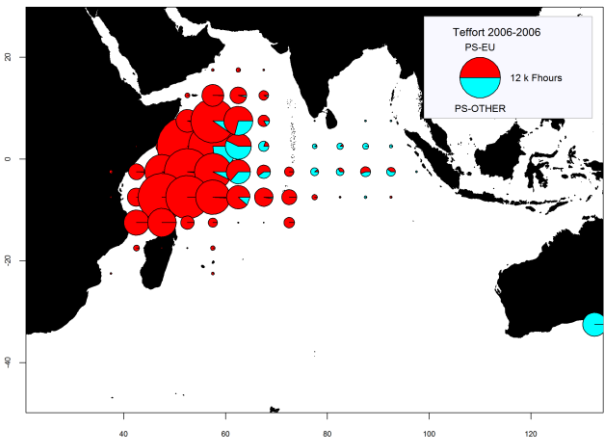


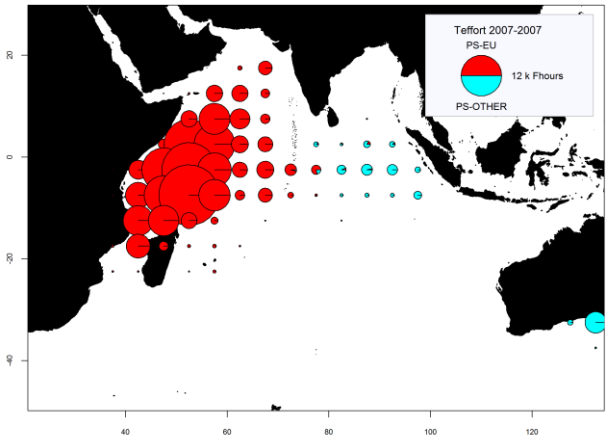


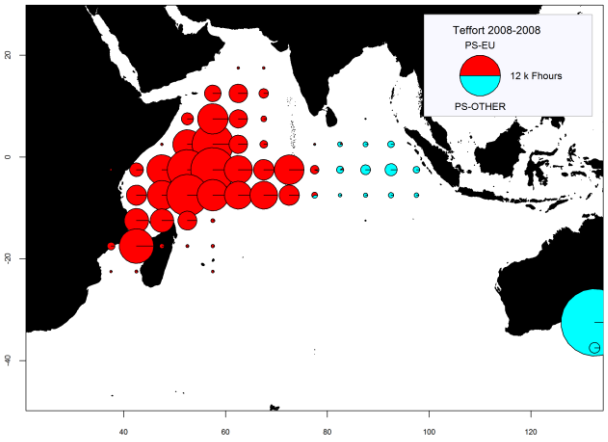


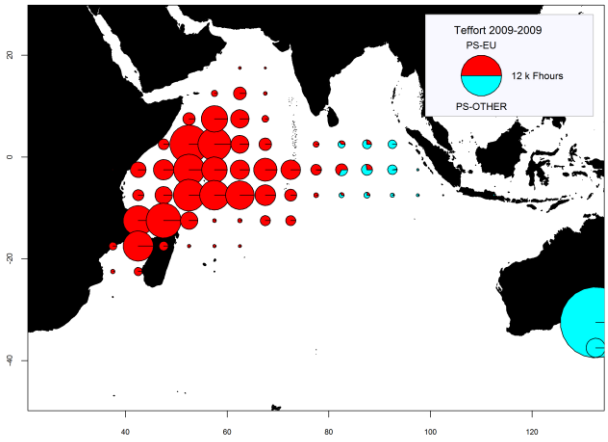
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2000-04 and 2005-09, by year, and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
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)

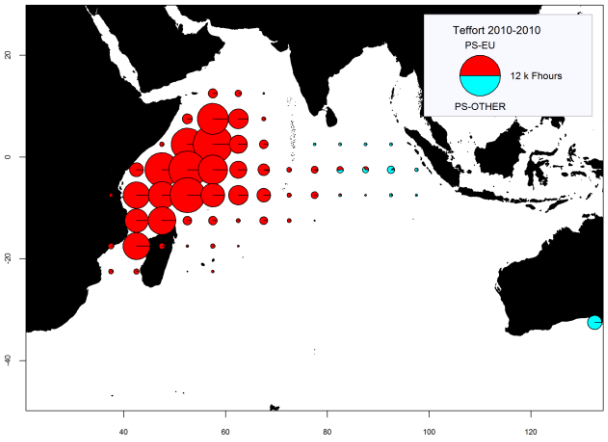












Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2001-05 and 2006-10, by year, quarter, and main fleet:
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
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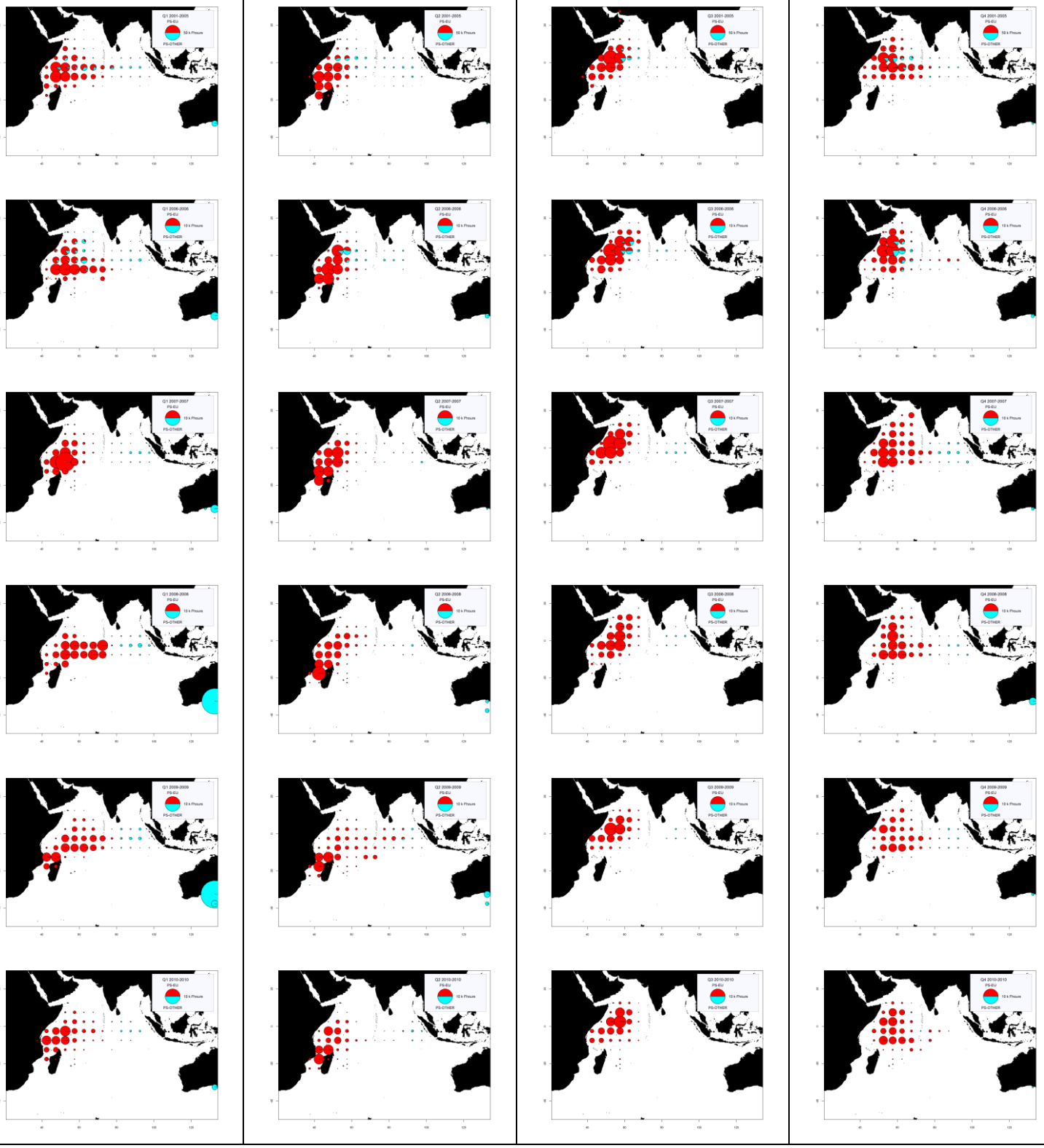
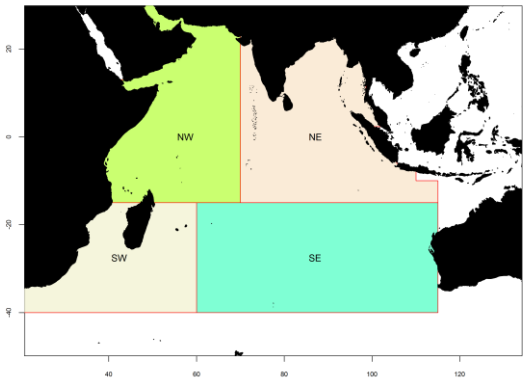
(excludes effort data for purse seiners of Iran)



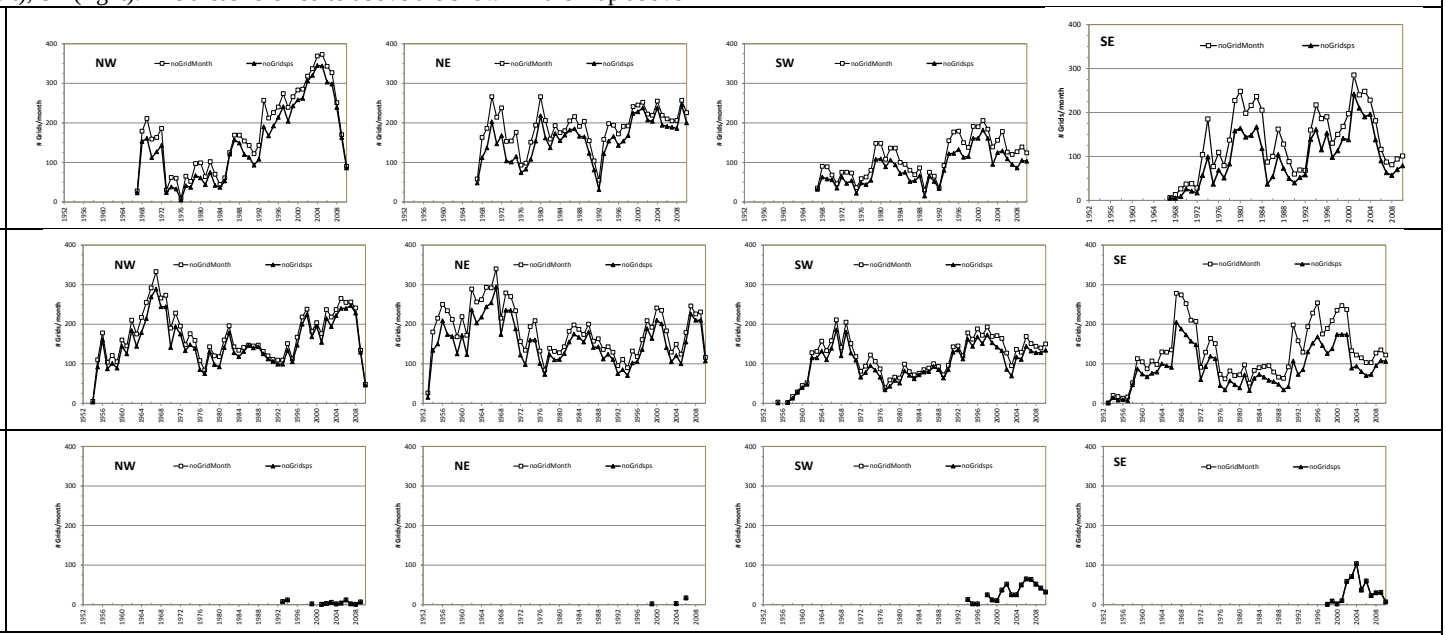
2. SWORDFISH

a. Catch rates and area fished

Areas used for the assessment of the Indian Ocean swordfish stock



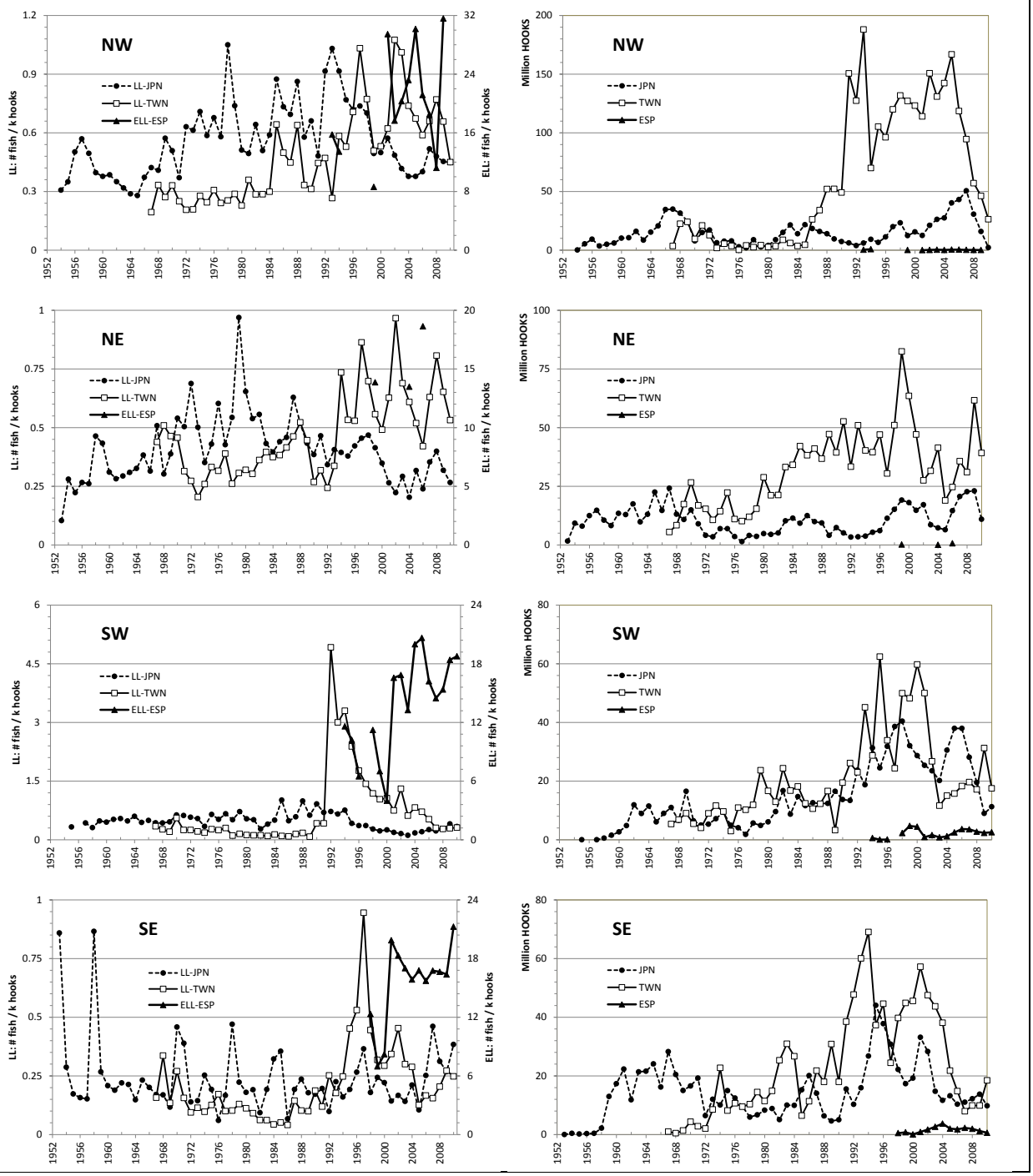
Number of five degree squares/month explored and number of squares/month with catches of swordfish reported by the longline fisheries of EU-Taiwan,China (top), Japan (center), and Spain (bottom), by area and year (1952 to 2010): Indian Ocean NW (left); NE (center right); SW (center left); SE (right). The areas referred to above are shown in the map above



Total number of five degree squares/month on which catches of swordfish have been ever reported: NW (1,175); NE (596); SW (382); SE (645)

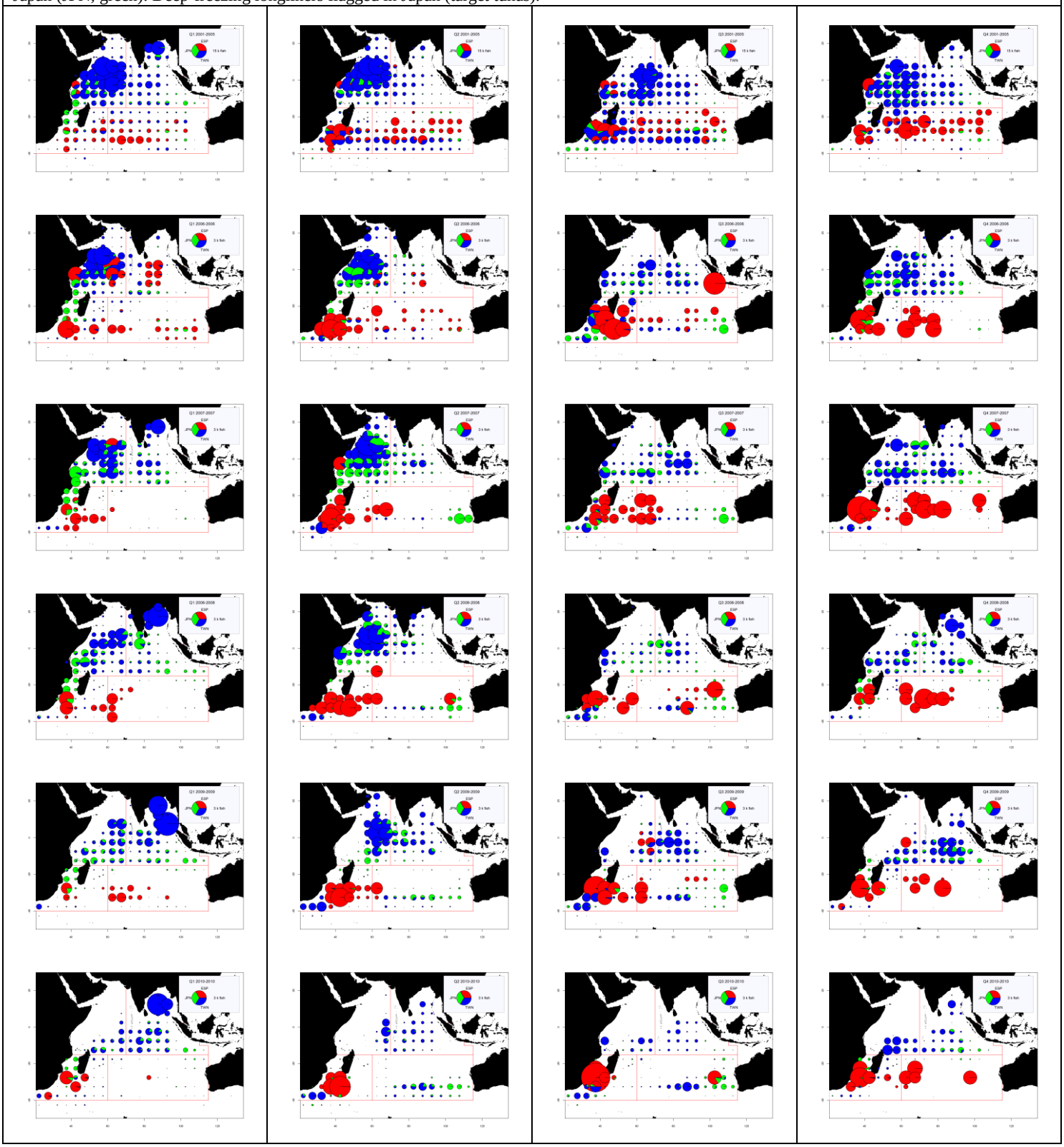
Nominal CPUE (number of fish/1000 hooks; left panel) and total fishing effort (million of hooks set; right panel) for the longline fleets of EU-Spain, Japan, and Taiwan,China fishing in the Indian Ocean, by area and year (1952 to 2010): Indian Ocean NW (top); NE (center Right); SW (bottom left); SE (bottom right). The areas referred to above are shown in the map in the previous page

CPUE number of swordfish per thousand hooks	EFFORT: Number of Hooks (millions)

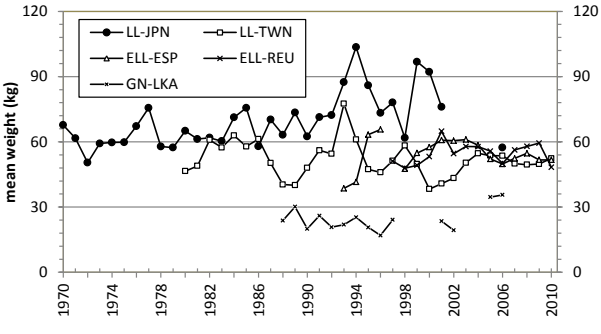


b. Recent catches

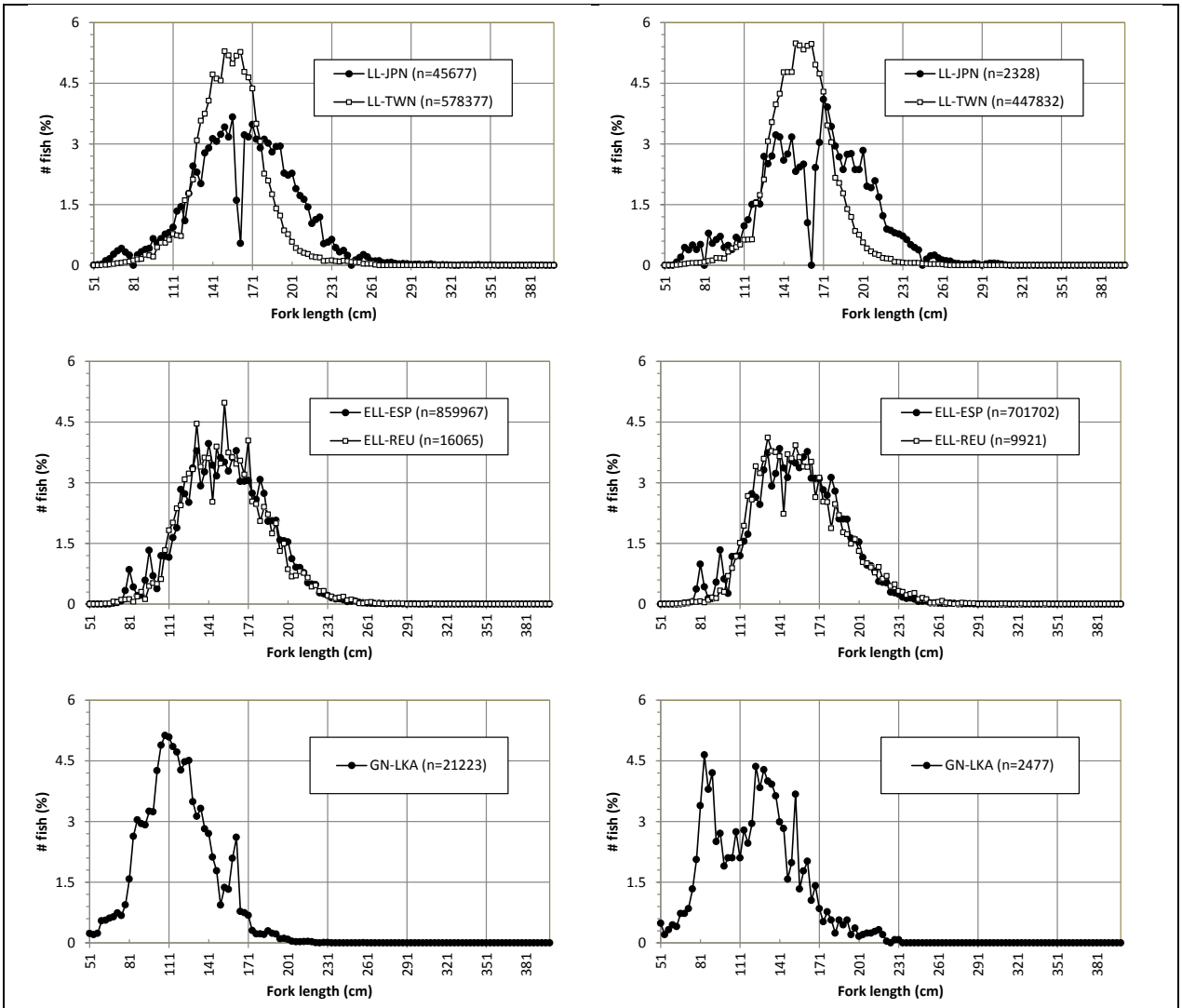
Time-area catches (total combined in number of fish for main longline fleets) of SWORDFISH estimated for 2001-05 and 2006-10, by year, and quarter (Time-area catches are not available for all fleets; catches of fresh-tuna longliners are not represented):
EU-Spain (ESP, red): Longliners from Spain (target swordfish).
Taiwan,China (TWN, blue): Deep-freezing longliners flagged in Taiwan,China (target tunas or swordfish).
Japan (JPN, green): Deep-freezing longliners flagged in Japan (target tunas).



c. Average weight and length frequency samples



Average weight of swordfish (kg) estimated from the size samples available for longliners of Japan (1970-2009), Taiwan,China (1980-2010), EU-Spain (1993-2010), and EU-France-Reunion (1997-2010); and the gillnet fishery of Sri Lanka (1988-2010)
NOTE: Average weights are shown only for years in which 300 or more specimens were sampled for length

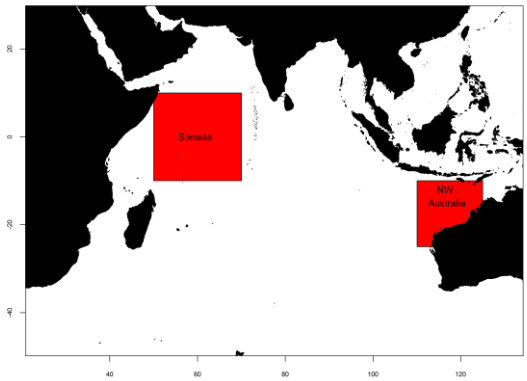


Number of swordfish by length class (fork length; expressed as %) estimated in the Indian Ocean, for 1950-2010 (left) and 2000-09 (right): Longline fisheries of Japan and Taiwan,China (top); swordfish longline fisheries of EU-Spain and EU-France-Reunion (center); gillnet fisheries of Sri Lanka (bottom)

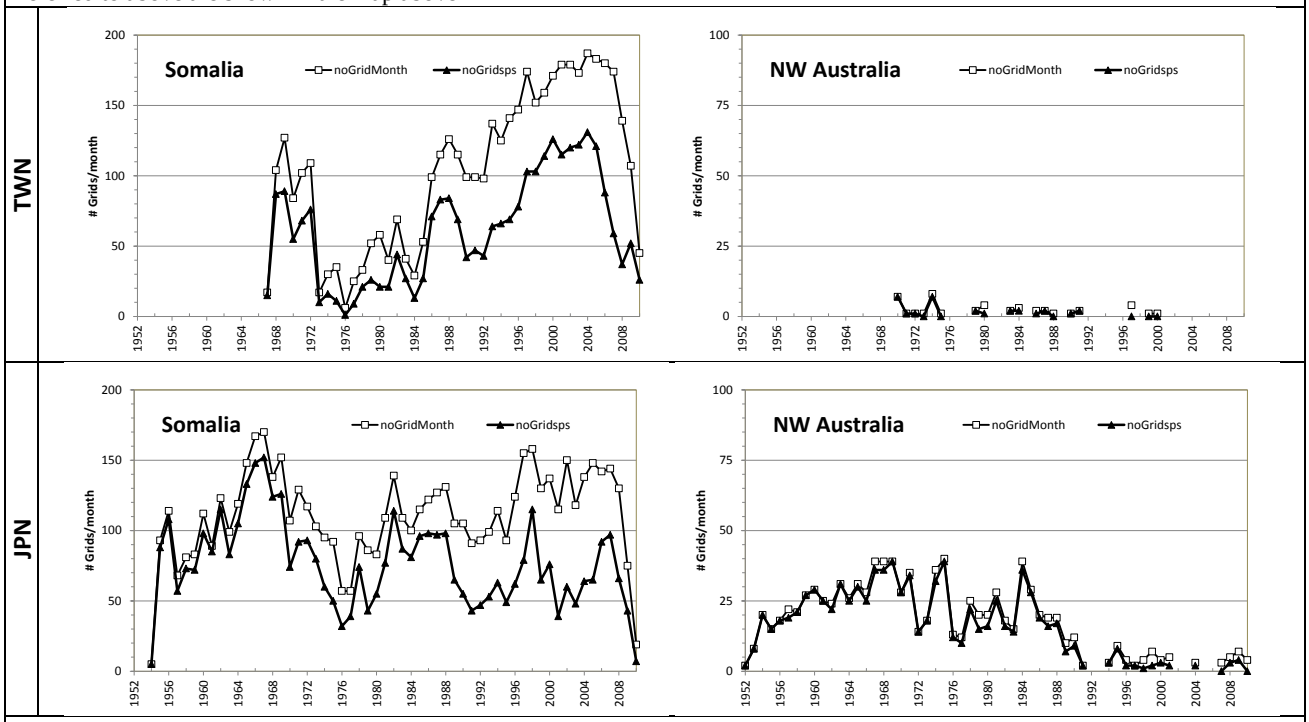
3. BLACK MARLIN

a. Catch rates and area fished

Hot spots of marlins identified by the IOTC WPB



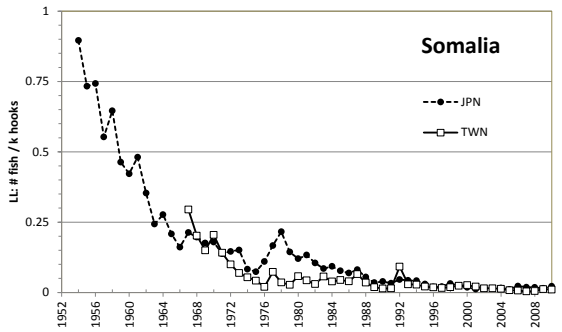
Number of five degree squares/month explored and number of squares/month with catches of black marlin reported by the longline fisheries of Taiwan,China (top), Japan (bottom) by area and year (1952 to 2010): Somalia (left); NW Australia (right). The areas referred to above are shown in the map above

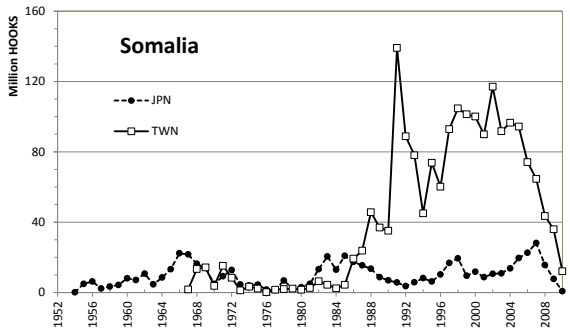


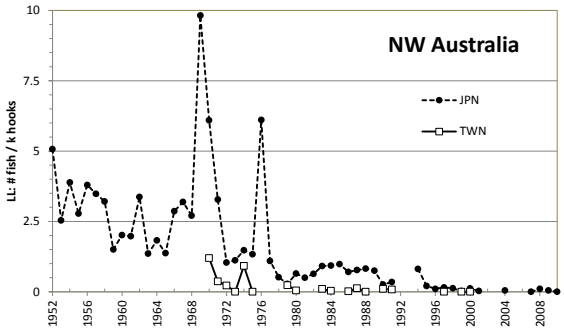
Total number of five degree squares/month on which catches of black marlin have been ever reported: Somalia (192); NW Australia (56)

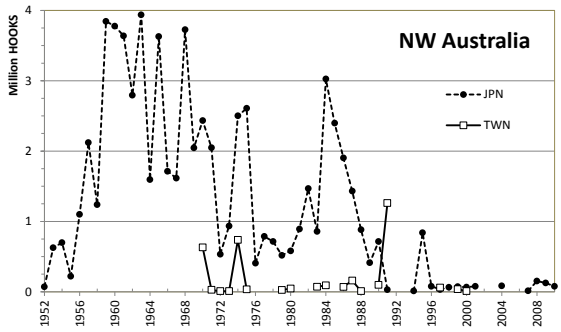
Nominal CPUE (number of fish/1000 hooks; left panel) and total fishing effort (million of hooks set; right panel) for the longline fleets of Japan, and Taiwan,China fishing in the Indian Ocean, by area and year (1952 to 2010): Somalia (top); NW Australia (bottom). The areas referred to above are shown in the map in the previous page

CPUE number of black marlin per thousand hooks	EFFORT: Number of Hooks (millions)

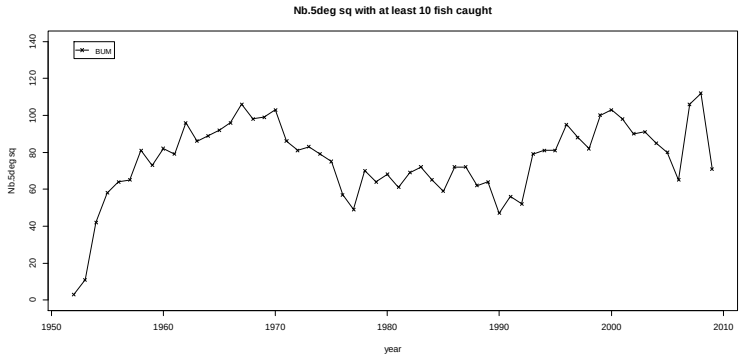


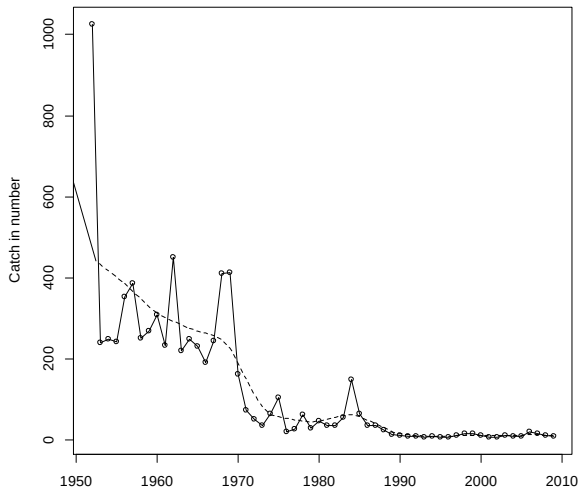






Number of 5 degree squares with at least 10 fish caught for black marlin (BLM)	Average catch (number of fish) in the three 5 degree square grids recording the highest catches of black marlin in the Indian Ocean for the combined Japan and Taiwan,China longline fleets (1952-2009)

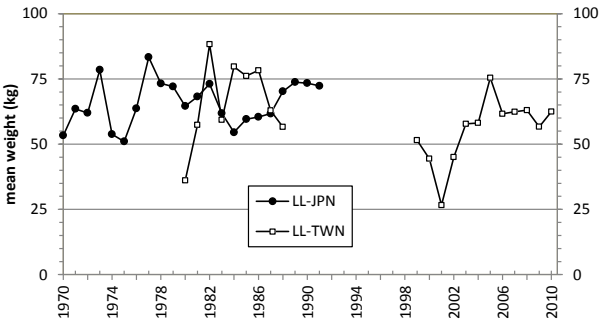




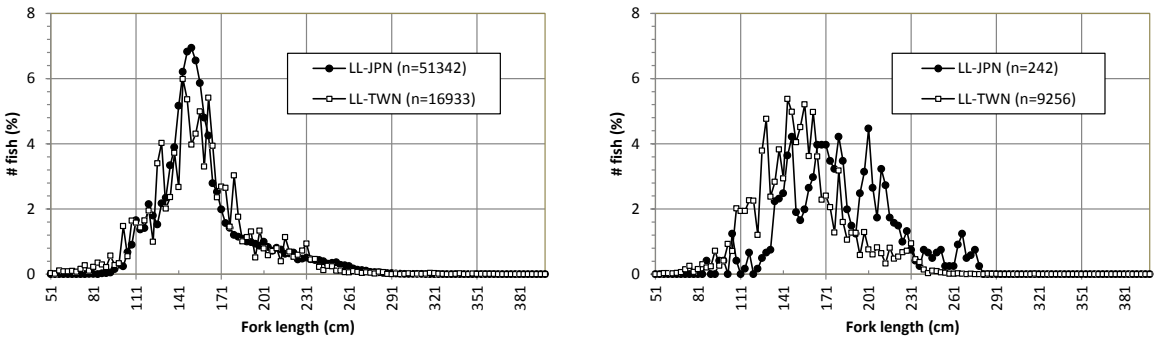
a. Recent catches

Time-area catches (total combined in number of fish for main longline fleets) of BLACK MARLIN estimated for 2001-05 and 2006-10, by year, and quarter:
Taiwan,China (TWN, blue): Deep-freezing longliners flagged in Taiwan,China (target tunas or swordfish).
Japan (JPN, red): Deep-freezing longliners flagged in Japan (target tunas).

b. Average weight and length frequency samples



Average weight of black marlin (kg) estimated from the size samples available for longliners of Japan (1970-2009) and Taiwan,China (1980-2010)
NOTE: Average weights are shown only for years in which 300 or more specimens were sampled for length

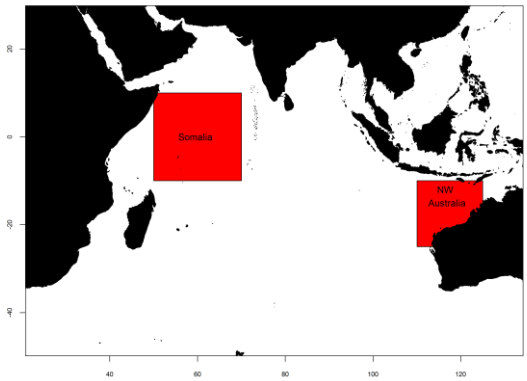


Number of black marlin by length class (eye to fork length; expressed as %) estimated for the longline fisheries of Japan and Taiwan,China in the Indian Ocean, for 1950-2010 (left) and 2000-09 (right)

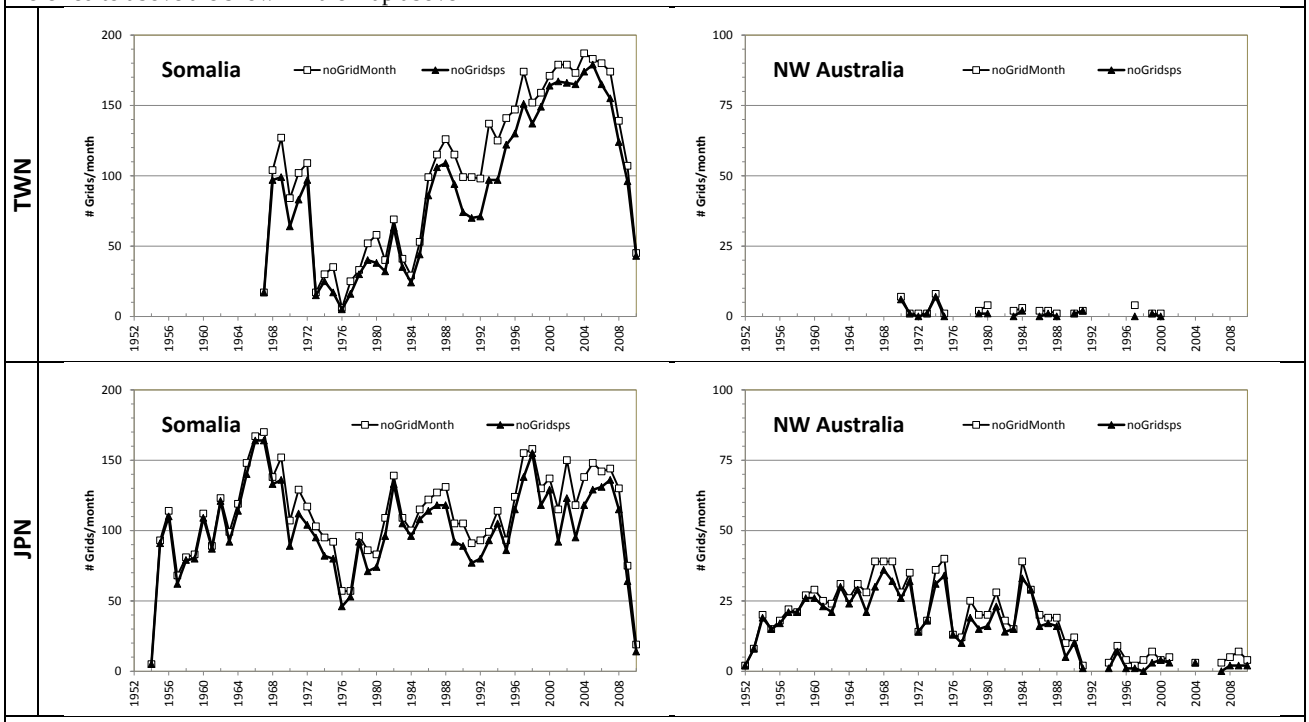
4. BLUE MARLIN

a. Catch rates and area fished

Hot spots of marlins identified by the IOTC WPB



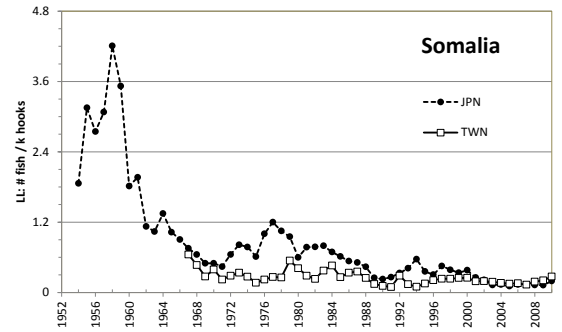
Number of five degree squares/month explored and number of squares/month with catches of blue marlin reported by the longline fisheries of Taiwan,China (top), Japan (bottom) by area and year (1952 to 2010): Somalia (left); NW Australia (right). The areas referred to above are shown in the map above

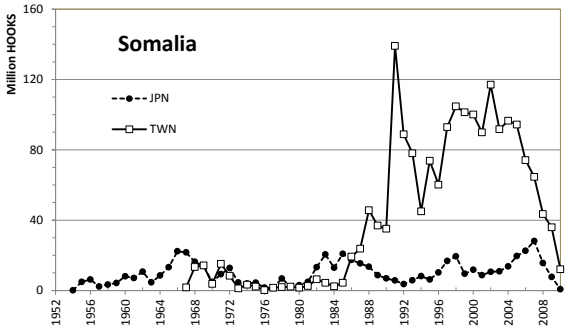


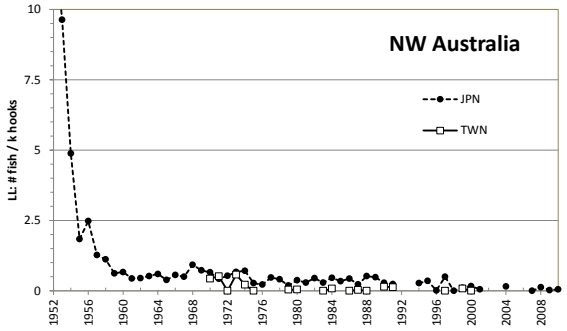
Total number of five degree squares/month on which catches of blue marlin have been ever reported: Somalia (192); NW Australia (56)

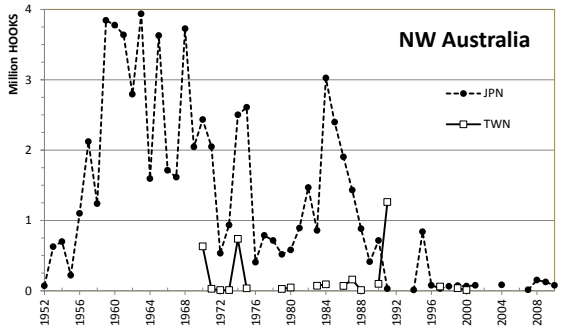
Nominal CPUE (number of fish/1000 hooks; left panel) and total fishing effort (million of hooks set; right panel) for the longline fleets of Japan, and Taiwan,China fishing in the Indian Ocean, by area and year (1952 to 2010): Somalia (top); NW Australia (bottom). The areas referred to above are shown in the map in the previous page

CPUE number of blue marlin per thousand hooks	EFFORT: Number of Hooks (millions)

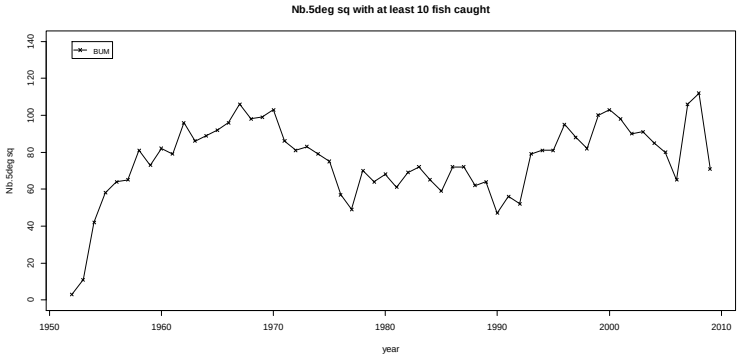


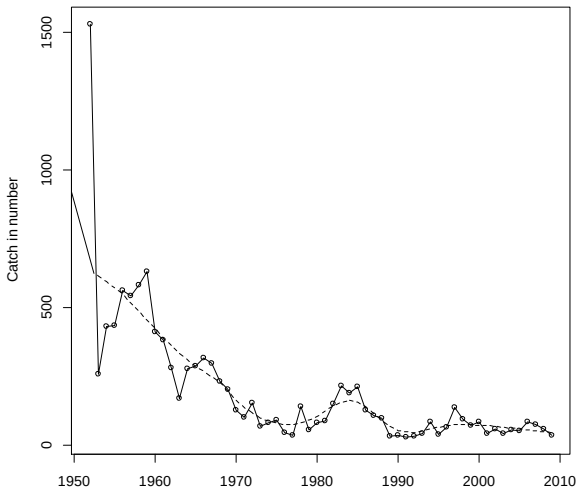






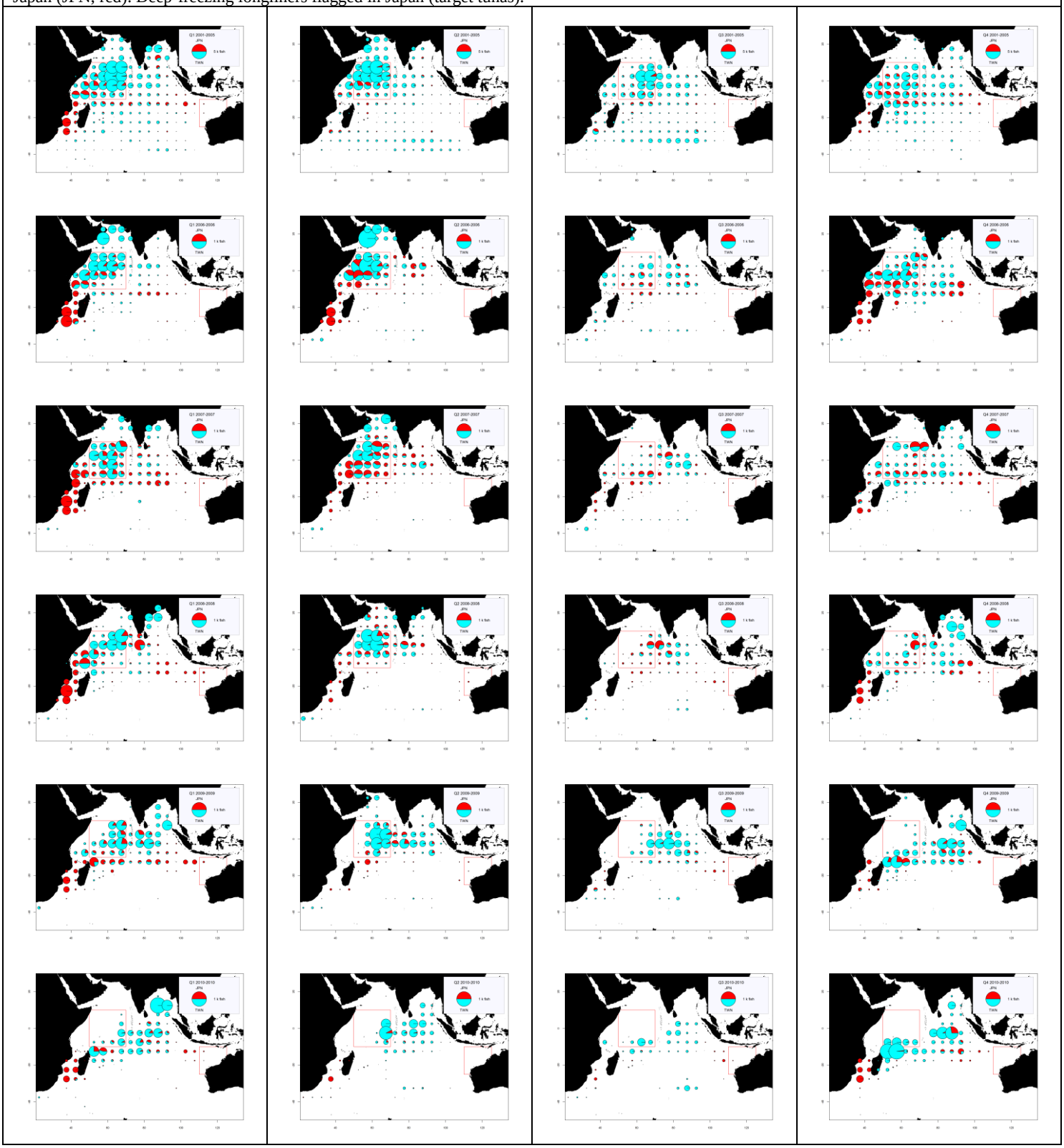
Number of 5 degree squares with at least 10 fish caught for blue marlin (BUM)	Average catch (number of fish) in the three 5 degree square grids recording the highest catches of blue marlin in the Indian Ocean for the combined Japan and Taiwan,China longline fleets (1952-2009)



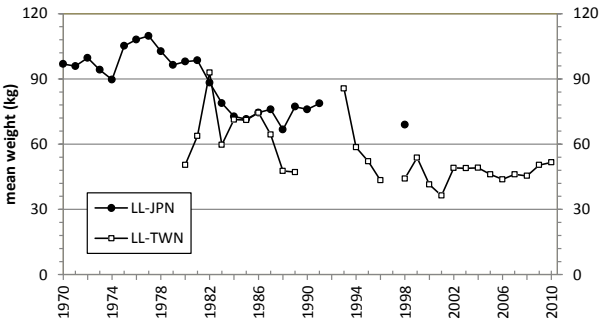


a. Recent catches

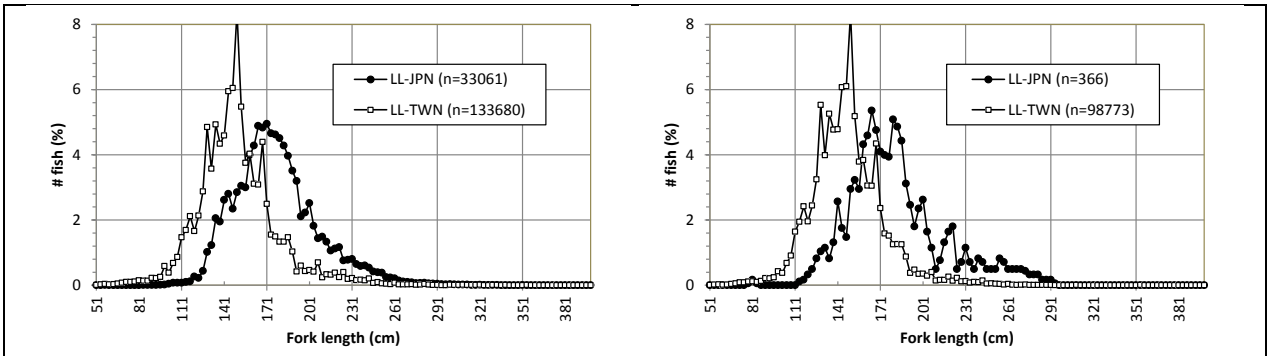
Time-area catches (total combined in number of fish for main longline fleets) of BLUE MARLIN estimated for 2001-05 and 2006-10, by year, and quarter:
Taiwan,China (TWN, blue): Deep-freezing longliners flagged in Taiwan,China (target tunas or swordfish).
Japan (JPN, red): Deep-freezing longliners flagged in Japan (target tunas).



b. Average weight and length frequency samples



Average weight of blue marlin (kg) estimated from the size samples available for longliners of Japan (1970-2009) and Taiwan,China (1980-2010)
NOTE: Average weights are shown only for years in which 300 or more specimens were sampled for length

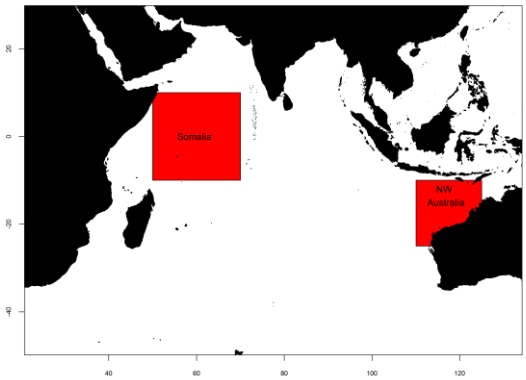


Number of blue marlin by length class (eye to fork length; expressed as %) estimated for the longline fisheries of Japan and Taiwan,China in the Indian Ocean, for 1950-2010 (left) and 2000-09 (right)

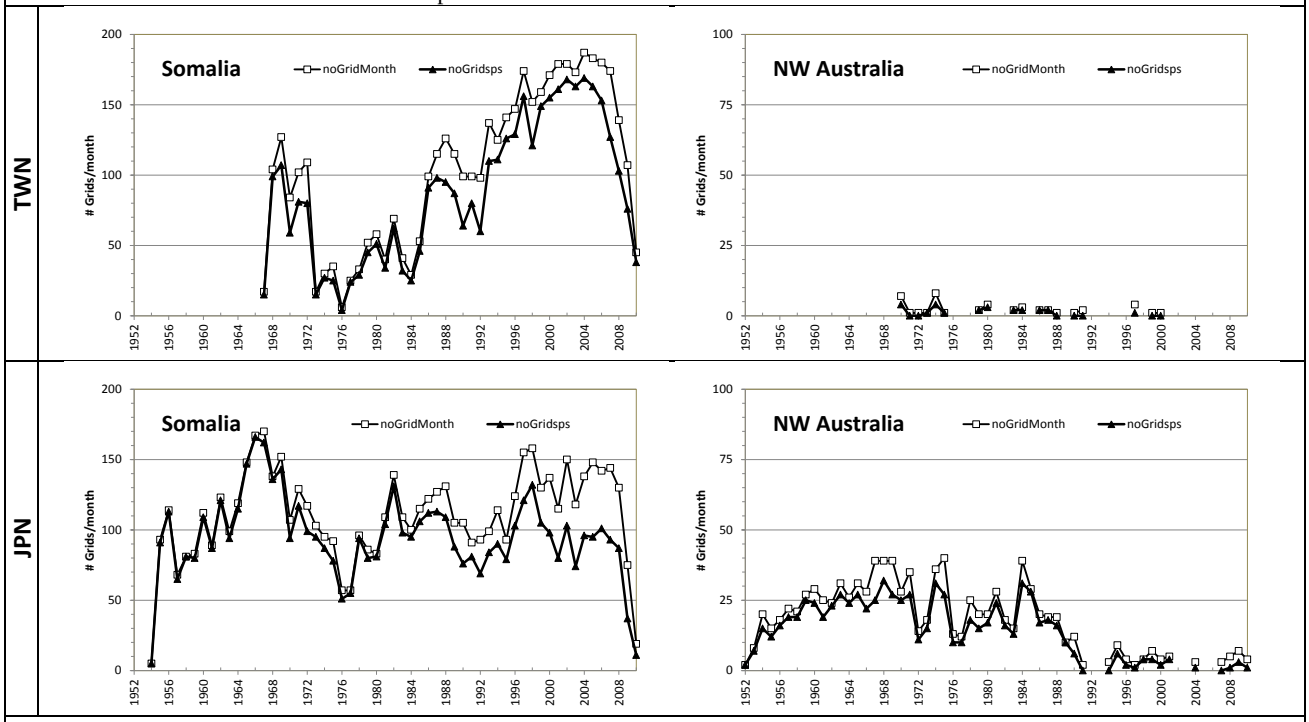
5. STRIPED MARLIN

a. Catch rates and area fished

Hot spots of marlins identified by the IOTC WPB



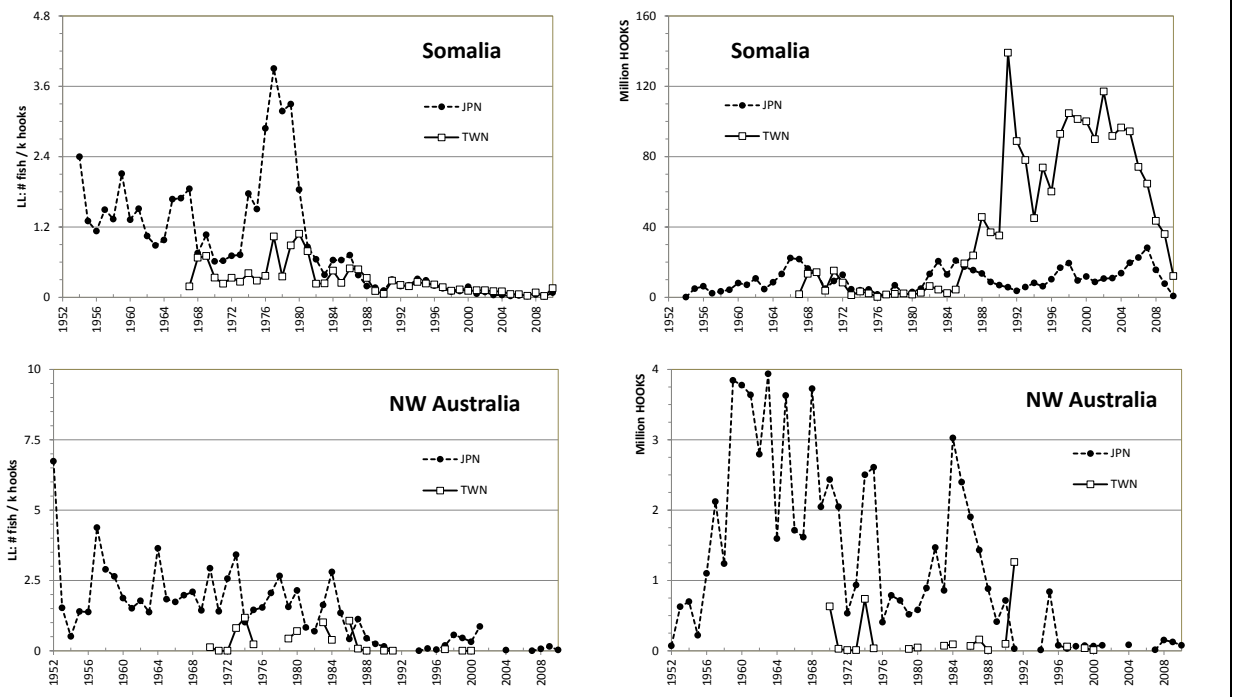
Number of five degree squares/month explored and number of squares/month with catches of striped marlin reported by the longline fisheries of Taiwan,China (top), Japan (bottom) by area and year (1952 to 2010): Somalia (left); NW Australia (right). The areas referred to above are shown in the map above



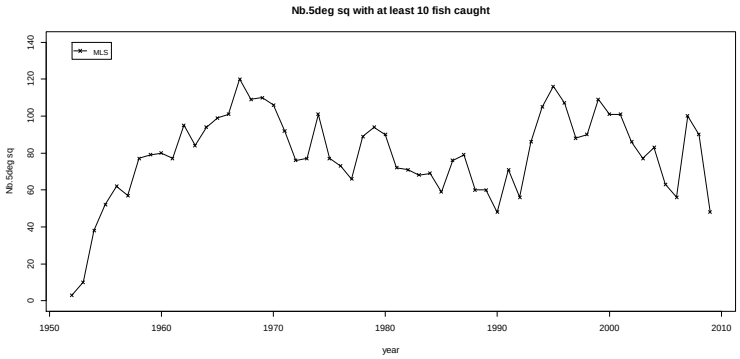
Total number of five degree squares/month on which catches of striped marlin have been ever reported: Somalia (192); NW Australia (54)

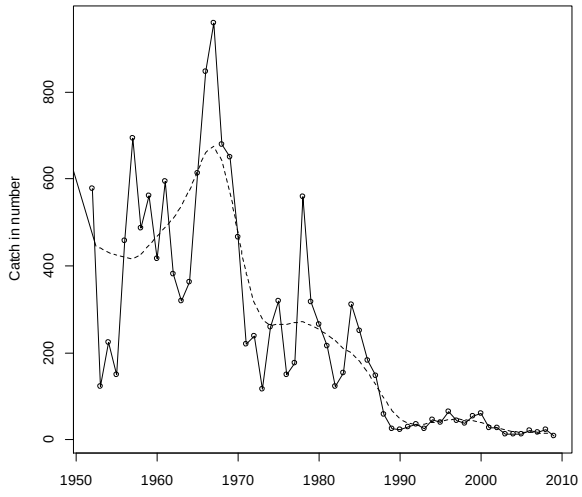
Nominal CPUE (number of fish/1000 hooks; left panel) and total fishing effort (million of hooks set; right panel) for the longline fleets of Japan, and Taiwan,China fishing in the Indian Ocean, by area and year (1952 to 2010): Somalia (top); NW Australia (bottom). The areas referred to above are shown in the map in the previous page

CPUE number of striped marlin per thousand hooks	EFFORT: Number of Hooks (millions)



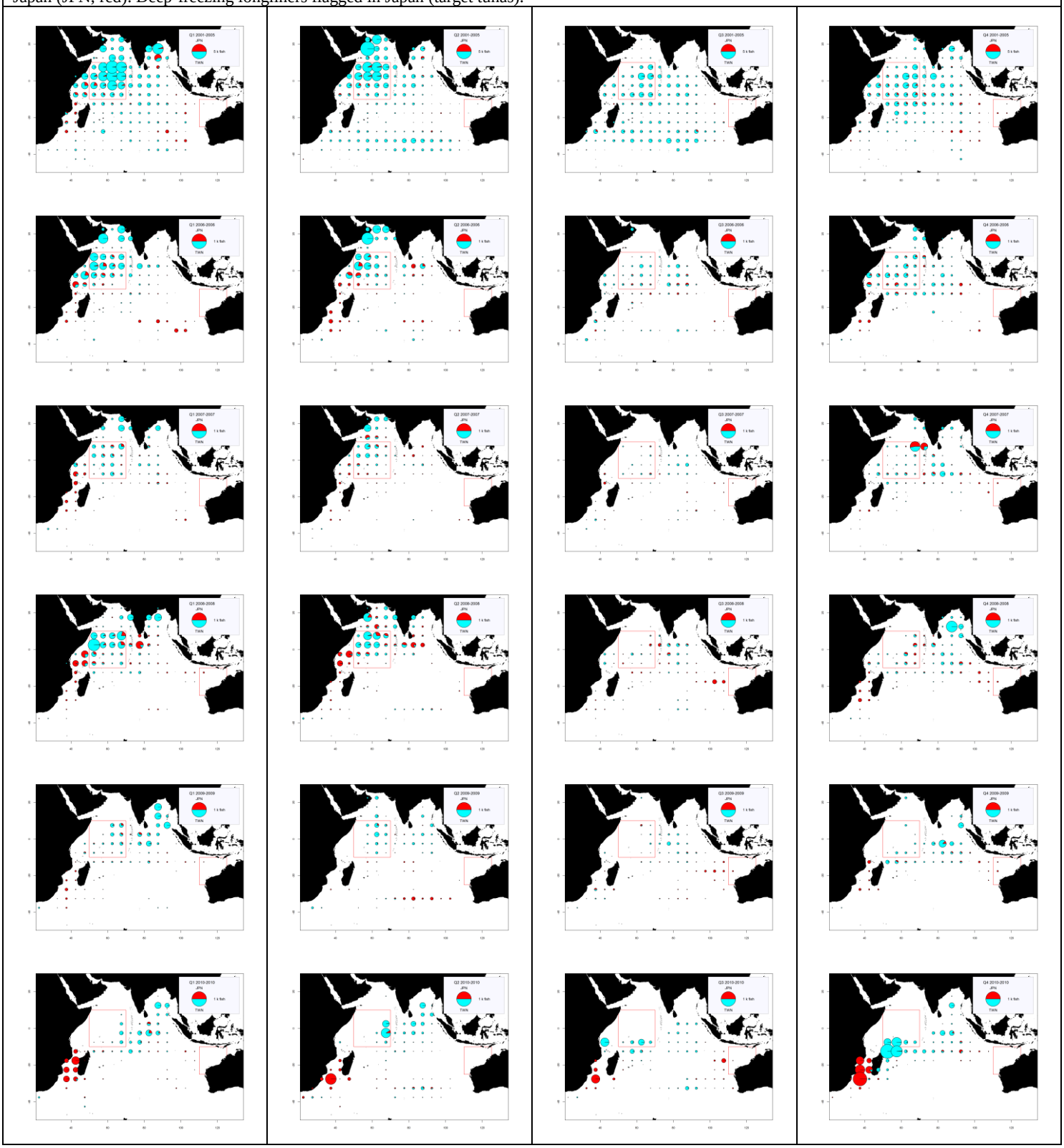
Number of 5 degree squares with at least 10 fish caught for striped marlin (MLS)	Average catch (number of fish) in the three 5 degree square grids recording the highest catches of striped marlin in the Indian Ocean for the combined Japan and Taiwan,China longline fleets (1952-2009)



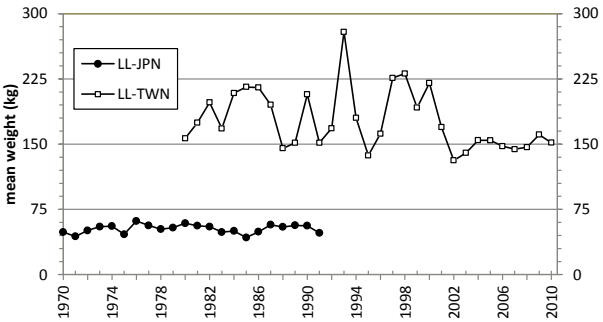


a. Recent catches

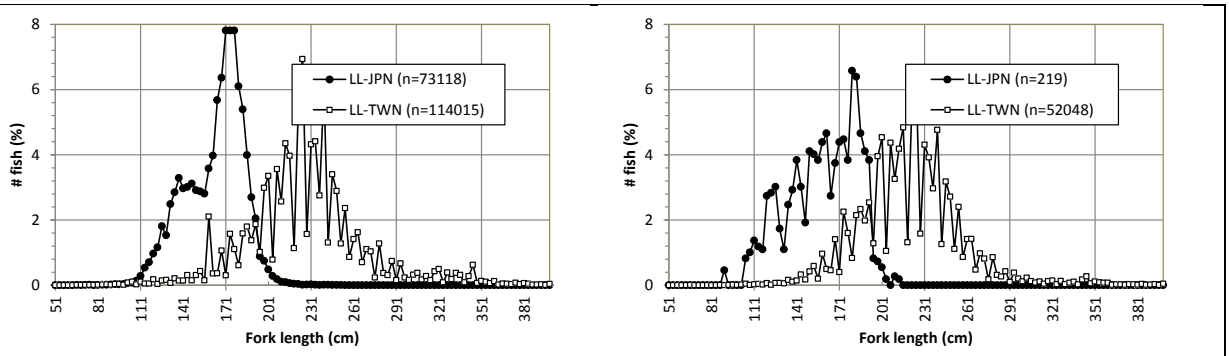
Time-area catches (total combined in number of fish for main longline fleets) of BLUE MARLIN estimated for 2001-05 and 2006-10, by year, and quarter:
Taiwan,China (TWN, blue): Deep-freezing longliners flagged in Taiwan,China (target tunas or swordfish).
Japan (JPN, red): Deep-freezing longliners flagged in Japan (target tunas).



b. Average weight and length frequency samples



Average weight of striped marlin (kg) estimated from the size samples available for longliners of Japan (1970-2009) and Taiwan,China (1980-2010)
NOTE: Average weights are shown only for years in which 300 or more specimens were sampled for length

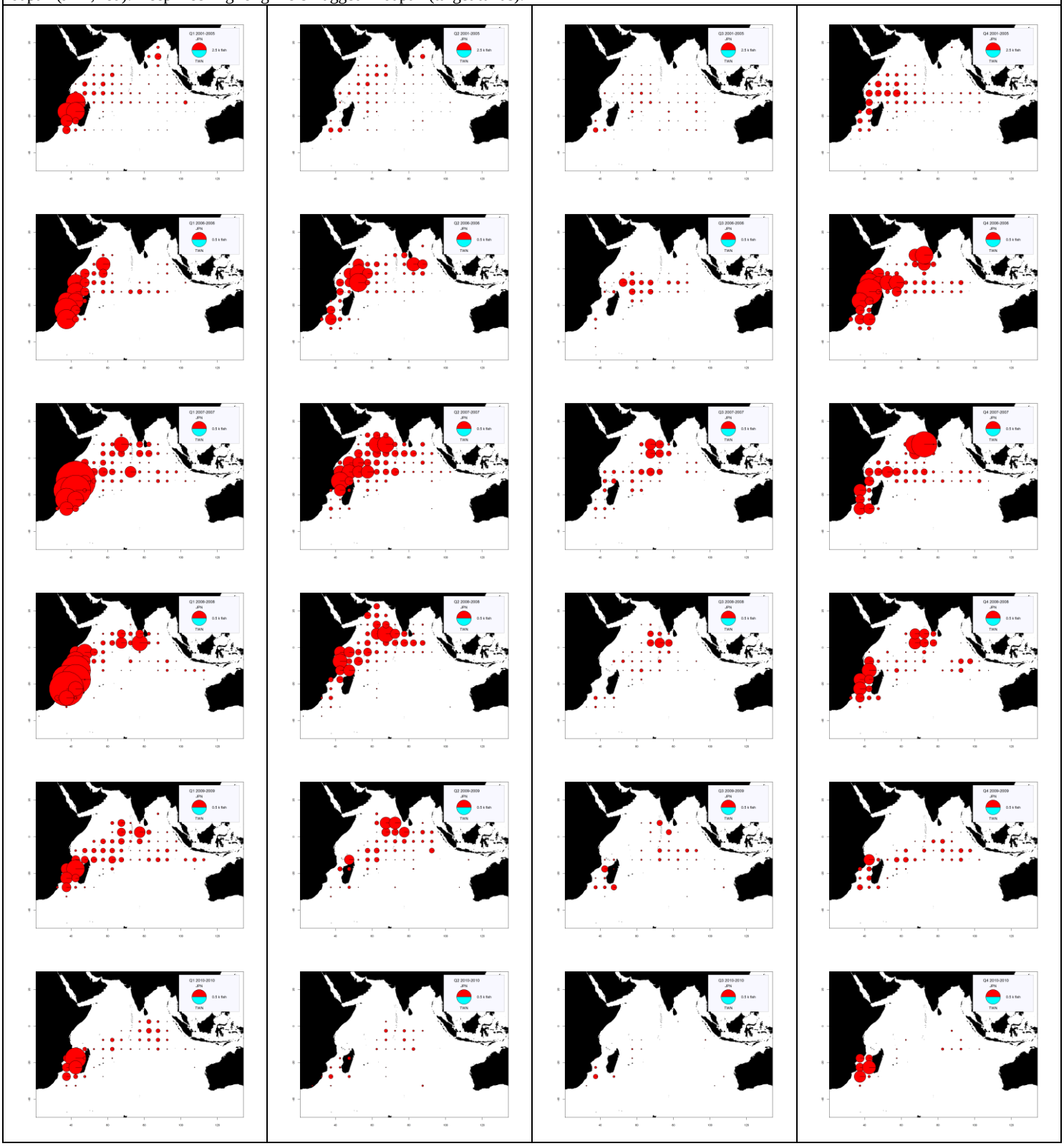


Number of striped marlin by length class (eye to fork length; expressed as %) estimated for the longline fisheries of Japan and Taiwan,China in the Indian Ocean, for 1950-2010 (left) and 2000-09 (right)

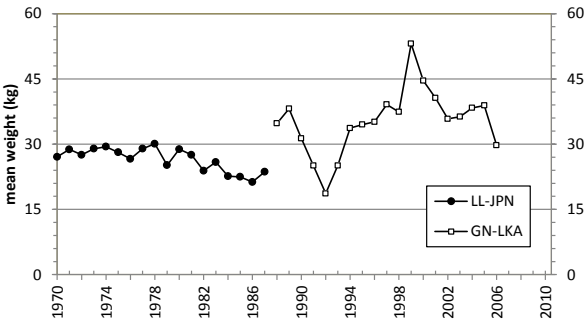
6. INDO-PACIFIC SAILFISH

a. Recent catches

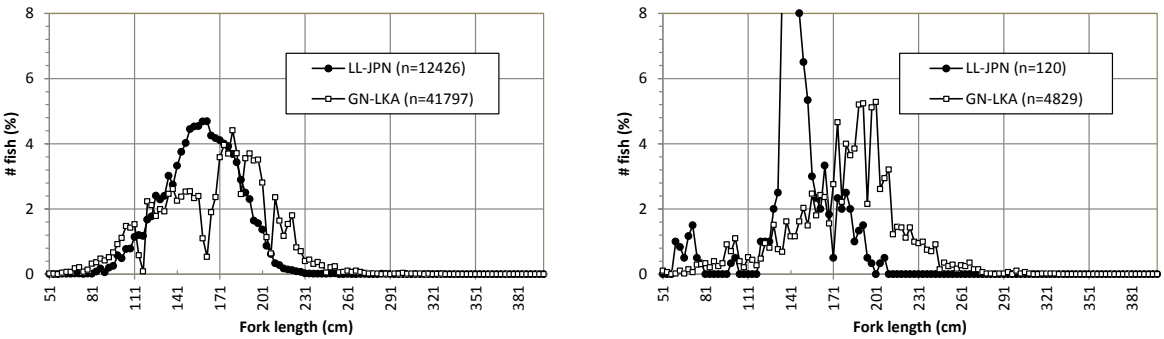
Time-area catches (total combined in number of fish for main longline fleets) of BLUE MARLIN estimated for 2001-05 and 2006-10, by year, and quarter:
Taiwan,China (TWN, blue): Deep-freezing longliners flagged in Taiwan,China (target tunas or swordfish).
Japan (JPN, red): Deep-freezing longliners flagged in Japan (target tunas).



b. Average weight and length frequency samples



Average weight of Indo-Pacific sailfish (kg) estimated from the size samples available for longliners of Japan (1970-2009) and gillnets of Sri Lanka (1980-2010)
NOTE: Average weights are shown only for years in which 300 or more specimens were sampled for length



Number of Indo-Pacific sailfish by length class (eye to fork length; expressed as %) estimated for the longline fishery of Japan and the gillnet fishery of Sri Lanka in the Indian Ocean, for 1950-2010 (left) and 2000-09 (right)