IOTC–2014–WPTmT05–07

REVIEW OF THE STATISTICAL DATA AND FISHERY TRENDS FOR ALBACORE

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PURPOSE

To provide the Working Party on Temperate Tunas (WPTmT) with a review of the status of the information available on albacore in the databases at the IOTC Secretariat as of May 2014, as well as a range of fishery indicators, including catch and effort trends, for fisheries catching albacore in the IOTC area of competence. It covers data on nominal catches, catch-and-effort, and size-frequency.

BACKGROUND

Prior to each WPTmT 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 WPTmT 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 albacore, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*[2], for the period 1950–2012.

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 albacore in the IOTC area of competence (Appendix I).

The report covers the following areas:

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

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, which include: 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); and data on imports of albacore from canning factories collaborating with the International Seafood Sustainability Foundation[3].

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.

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

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[2] This Resolution superseded IOTC Resolutions 98/01, 05/01 and 08/01
[3] With catch imports by vessel, trip, species and commercial category forwarded to the IOTC Secretariat on each quarter

Temperate tuna species and main fisheries in the Indian Ocean

Table 1 below shows the three species of tropical tunas under IOTC management.

Table 1. Temperate tuna species under the IOTC mandate

IOTC code	English name	Scientific name
ALB	Albacore	*Thunnus alalunga*
SBF	Southern Bluefin tuna	*Thunnus maccoyii*

DISCUSSION

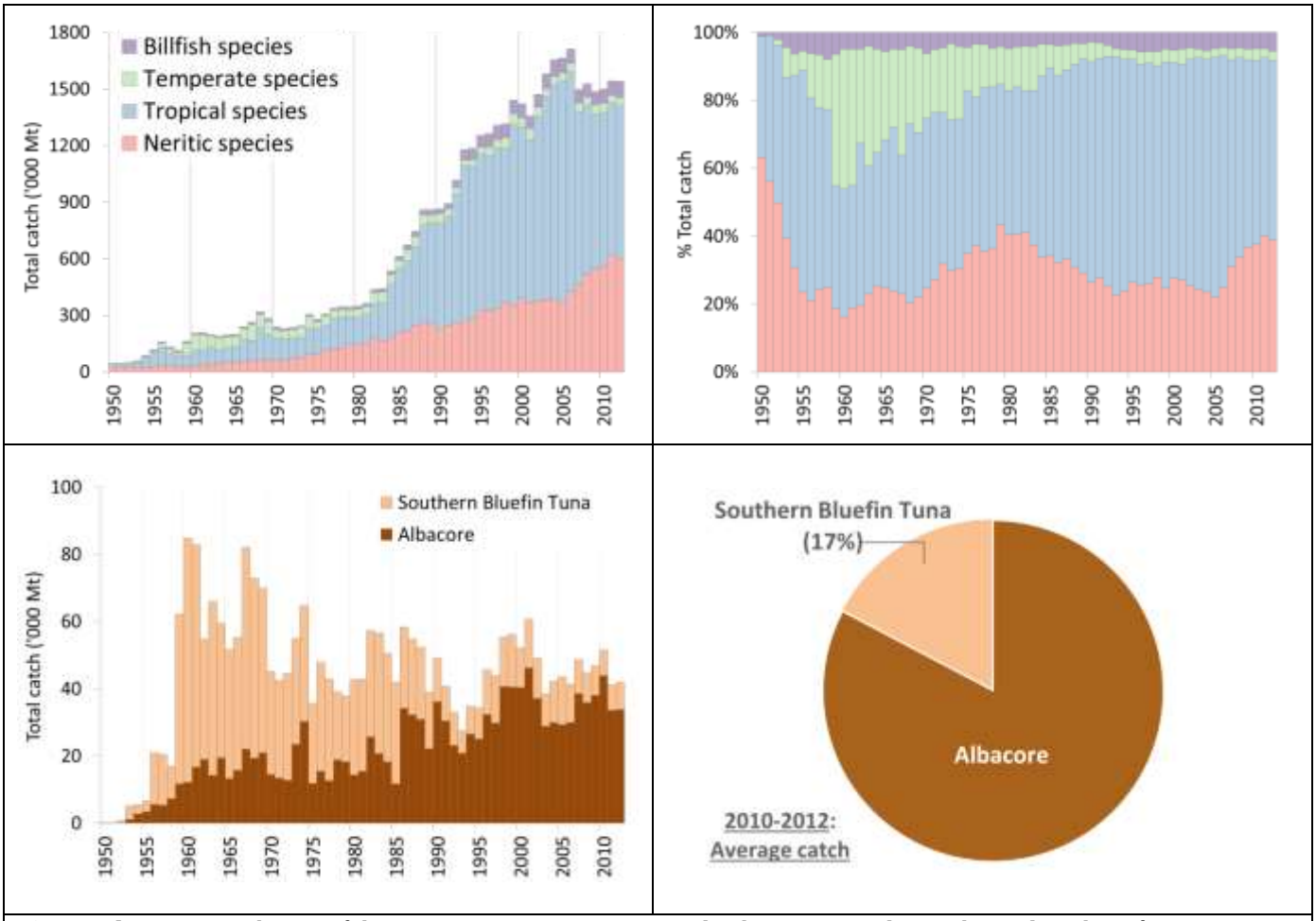
The contribution of temperate tunas to the total catches of IOTC species in the Indian Ocean has changed over the years (Fig. 1a.b.), in particular following the collapse of the Southern bluefin tuna fishery in the Southern Indian Ocean, and changes in the targeting of albacore by some longline fleets, driven by changes in market prices or other reasons. In recent years, increased piracy off Somalia (2009 and 2012) and changes in targeting by the Indonesian fresh-tuna longline fleet (especially since 2007) led to marked increases in the contribution of albacore to the total catches of tunas by some fleets. However, overall, the contribution of temperate tunas to the total catches of IOTC species in the Indian Ocean has remained stable over the period 1993-2012, in which temperate tunas represented around 3% of the combined catches of all IOTC species (Fig.1a-b); on the contrary, the catches of temperate tunas over the period 1956-75 amounted to 25% of the total catches of all IOTC species combined. At present, the majority of the catches of temperate tunas are albacore (2010-12; Fig. 1c-d.). The stock of southern bluefin tuna is managed by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and therefore is not covered in this paper[4].

Albacore is caught mainly by industrial longline fleets, flagged to both coastal countries and distant water fishing nations (Fig. 2): in recent years (from 2010–12; Fig. 2) the fresh-tuna longline fisheries of Indonesia and Taiwan,China caught as much as 28% of the of the total catches of albacore, from all countries and species combined. During the same period, deep-freezing longliners flagged in Taiwan,China and Japan reported around 19% of the total catches of these species, while the remaining catches were reported by industrial purse seiners (EU and Seychelles) and other fisheries, the majority using longlines.

The majority of the catches of albacore are sold to international markets, mostly for canning. A component of the catches of albacore may not go for export, be sold in local markets or retained by the fishermen for direct consumption.

Temperate tunas are caught almost exclusively using longlines, the majority on the high seas. Indonesia, Madagascar, Mauritius, Reunion, and Comoros have also coastal fisheries for albacore, but catch levels are low.

[4] For more information on this species refer to: http://www.ccsbt.org/site/



Figs. 1a-d. Top: Contribution of the two temperate tuna species under the IOTC mandate to the total catches of IOTC species in the Indian Ocean, over the period 1950–2012 (a. Top left: total catch; b. Top right percentage, same colour key as Fig. 1a).; **Bottom:** Contribution of each temperate tuna species to the total combined catches of temperate tunas (c. Bottom left: nominal catch of each species, 1950–2012; d. Bottom right: share of temperate tuna catch by species, 2010–12)

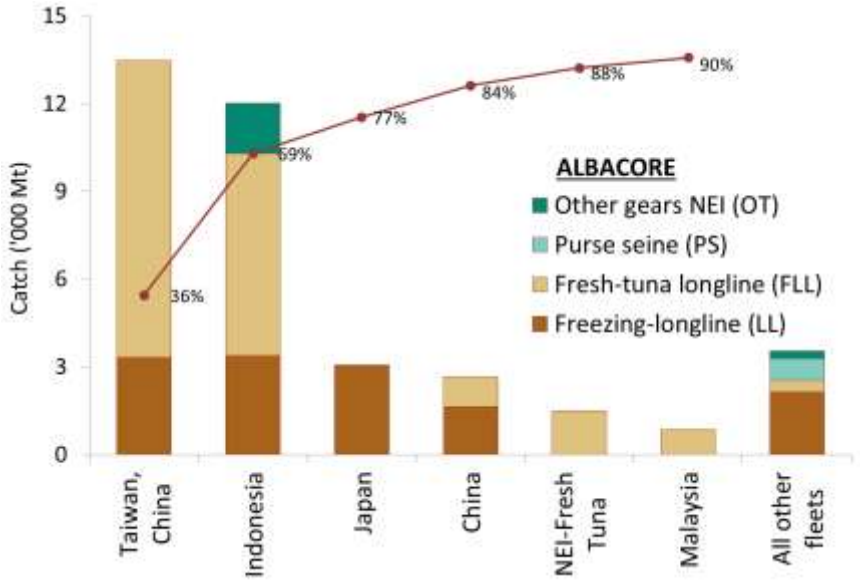


Fig. 2: Albacore: average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of albacore reported. The red line indicates the (cumulative) proportion of catches of albacore for the countries concerned, over the total combined catches of albacore reported from all countries and fisheries.

MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF ALBACORE

The following list is provided by the Secretariat for the consideration of the WPTmT. 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 Industrial Fisheries:**

- Fisheries of **Indonesia**: The catches of albacore estimated for the fisheries of Indonesia, including coastal and offshore fresh-tuna longliners and deep-freezing longliners, account for 33% of the total catches of albacore in the Indian Ocean in recent years (average catch 2010–12; Fig. 2). Following a recommendation from the IOTC Scientific Committee, the Directorate General for Capture Fisheries of Indonesia (DGCF) and the IOTC Secretariat reviewed the estimates of catches of albacore for Indonesia in 2013[5]. As a result of that review Indonesia reported a revised catch series for albacore for recent years. Although the new catches reported are considered more reliable than the previous catches estimated by the DGCF, the poor quality of the catch-and-effort data available for this fishery compromises the ability of the DGCF to validate the new estimates.
- **Fresh-tuna longline** fishery of **Taiwan,China**: In recent years, the catches of albacore estimated for the fresh-tuna longline fishery of Taiwan,China account for 27% of the total catches of albacore in the Indian Ocean (average catch 2010–12). Although the Secretariat has obtained catch-and-effort data for this fishery in recent years (2007-12), and estimates of total catch since 2000, the catches of albacore before 2000 were estimated using data from alternative sources, including port sampling schemes, and information on the activities of fresh-tuna longliners in coastal countries of the Indian Ocean.
- **Longline** fisheries of **India**, **Malaysia, Oman,** and **Philippines:** The catches of albacore estimated for the longline fisheries of India, Malaysia, Oman, and Philippines are uncertain, with current estimates accounting for 3% of the total catches of albacore in the Indian Ocean in recent years (average catch 2010–12). Although catch-and-effort data are available for some of these fleets, they are usually incomplete and fall short of the IOTC standards.
- **Drifting gillnet** fisheries of **Iran** and **Pakistan**: Both Iran and Pakistan have reported nil catches of albacore for their fisheries. To date, the Secretariat has not received catch-and-effort data for these fisheries which compromises the ability of the IOTC Secretariat to assess the amount of gillnet effort exerted by these fisheries in areas where catches of albacore may occur.

2. **Size data from All Fisheries:**

- **Driftnet** of **Taiwan,China**: No size data available over the entire period of activity of the fishery (1982–92).
- **Longline** fishery of **Indonesia**: Indonesia has reported size frequency data for its fresh-tuna longline fishery for some years. However, data are not available for 2010-12 and, where available, 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**: While Taiwan,China has provided length frequency data of albacore since 2010, the levels of coverage remain very low, under the minimum recommended by the IOTC.
- **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.
- Longline fisheries of **India**, **Malaysia**, **Oman**, and **Philippines:** To date, none of these countries has reported size frequency data of albacore.

3. **Biological data:**

- Industrial **longline** fisheries, in particular **Taiwan,China**, **Indonesia**, **and Japan**: The IOTC Secretariat had to use length-age keys, length-weight keys, and processed weight-live weight keys for albacore from other oceans due to the general paucity of biological data available from the fisheries indicated.

[5] http://www.iotc.org/documents/report-review-catches-albacore-fisheries-indonesia

STATUS OF FISHERIES STATISTICS FOR ALBACORE

Albacore (ALB) – Fisheries and catch trends

Albacore are currently caught almost exclusively using drifting longlines (over 90% of the total catches) (Table 1; Fig. 3), and South of 20°S (Table 2; Fig. 4) with remaining catches recorded using purse seines and other gears. Catches of albacore were relatively stable until the mid-1980s, except for high catches recorded in 1973 and 1974 (Figs. 4, 5). The catches increased markedly during the mid-1980's due to the use of drifting gillnets by Taiwan,China (Fig. 5), with total catches in excess of 30,000 t. The drifting gillnet fleet targeted juvenile albacore in the southern Indian Ocean (30°S to 40°S). In 1992 the United Nations worldwide ban on the use of drifting gillnets effectively closed this gillnet fishery.

Following the removal of the drifting gillnet fleet, catches dropped to less than 21,000 t by 1993 (Figs. 3, 5). However, catches more than doubled over the period from 1993 (less than 21,000 t) to 2001 (46,000 t), the year in which the highest catches of albacore were reported. Since 2001, catches have been almost exclusively taken by drifting longlines (Figs. 3, 5, 6). Catches for both 2011 and 2012 are estimated to be approximately 34,000 t (Table 1), 10,000 t lower than the catches recorded in 2010 (44,000 t), the second highest catches recorded.

TABLE 1. Albacore: Best scientific estimates of the catches of albacore (*Thunnus alalunga*) by gear and main fleets [or type of fishery] by decade (1950s–2000s) and year (2003–2012), in tonnes. Data as of May 2014. Catches by decade represent the average annual catch, noting that some gears were not used for all years (refer to Fig. 3).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
DN				5,823	3,735											
LL	3,715	17,230	16,971	15,828	23,039	21,370	19,012	17,115	17,018	14,766	12,473	13,024	13,974	20,193	11,993	8,466
FLL			80	314	1,325	11,718	7,195	11,299	10,971	12,250	23,736	19,332	21,662	21,399	18,696	22,451
PS				194	1,683	912	1,496	232	164	1,548	725	1,424	392	207	725	1,296
OT	20	33	94	406	764	1,436	1,106	1,288	1,147	1,307	1,653	2,137	2,105	2,119	2,203	1,650
Total	**3,735**	**17,263**	**17,145**	**22,565**	**30,546**	**35,436**	**28,809**	**29,934**	**29,300**	**29,871**	**38,587**	**35,917**	**38,133**	**43,918**	**33,617**	**33,863**

Fisheries: Driftnet (**DN**; Taiwan,China); Freezing-longline (**LL**); Fresh-tuna longline (**FLL**); Purse seine (**PS**); Other gears nei (**OT**).

TABLE 2. Albacore: Best scientific estimates of the catches of albacore (*Thunnus alalunga*) by fishing area by decade (1950s–2000s) and year (2003–2012), in tonnes. Data as of May 2014. The areas used are shown in Fig. 4.

Area	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1-North	2,904	6,742	6,439	5,004	7,388	10,983	8,479	8,501	8,605	11,985	17,358	15,420	10,734	16,082	12,212	11,433
2-South	831	10,521	10,706	17,561	23,159	24,453	20,331	21,434	20,695	17,887	21,229	20,498	27,399	27,836	21,405	22,431
Total	**3,735**	**17,263**	**17,145**	**22,565**	**30,547**	**35,436**	**28,810**	**29,935**	**29,300**	**29,872**	**38,587**	**35,918**	**38,133**	**43,918**	**33,617**	**33,864**

Areas: North of 10ºS (**N**); South of 10ºS (**S**)

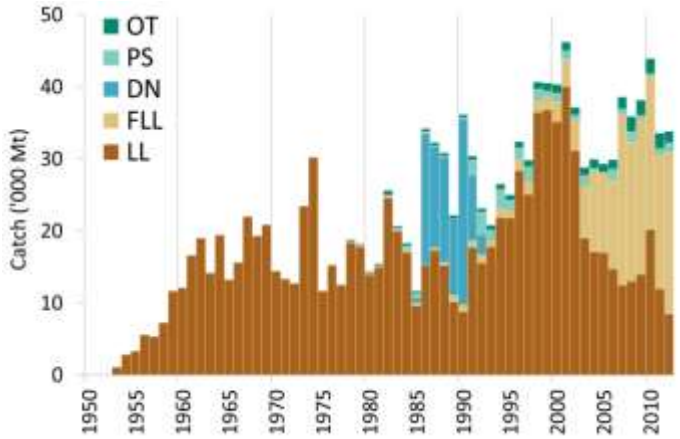


Fig. 3. Albacore: Catches of albacore by gear. Driftnet (DN; Taiwan,China); Freezing-longline (LL); Fresh-tuna longline (FLL); Purse seine (PS); Other gears NEI (OT). Data as of May 2014.

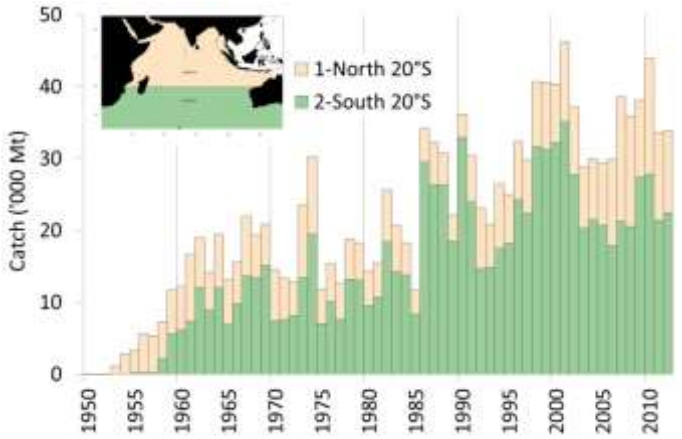


Fig. 4. Albacore: Catches of albacore recorded North of 20°South (North 20S) and South of 20°South (South 20S). Data as of May 2014.

Catches of albacore in recent years have come almost exclusively from vessels flagged in Indonesia and Taiwan,China (Fig. 2). The catches of albacore reported for the fresh tuna longline fishery of Indonesia have increased considerably since 2003, ranging between 8,000 t and 15,000 t during those years (Fig. 5), which represents approximately 31% of the total catches of albacore in the Indian Ocean.

Longliners from Japan and Taiwan,China have been operating in the Indian Ocean since the early 1950s (Fig. 3). Although the Japanese albacore catch ranged from 8,000 t to 18,000 t in the period 1959 to 1969, in 1972, catches rapidly decreased to around 1,000 t due to a change in the target species, mainly to southern bluefin tuna and bigeye tuna. Albacore became a bycatch species for the Japanese fleet with catches between 200 t and 2,500 t. In recent years the Japanese albacore catch has been around 2,000 to 4,000 t (Fig. 5).

In contrast to the Japanese longliners, catches by Taiwan,China deep-freezing longliners increased steadily from the 1950's to average around 10,000 t by the mid-1970s. Between 1998 and 2002 catches ranged between 20,000 t to 26,000 t, equating to just over 55% of the total Indian Ocean albacore catch. Between 2005 and 2012 the albacore catches by Taiwan,China longliners have been between 1,500 and 6,000 t, with the lowest catches recorded in 2012.

Unlike deep-freezing longliners, the catch levels of albacore for the fresh-tuna longline fishery of Taiwan,China have increased in recent years, leading to a shift in the proportion of catches of albacore by deep-freezing and fresh-tuna longliners. In recent years, the catches of fresh-tuna longliners of Taiwan,China have represented 75% of the total catches of Taiwanese longliners during 2010–12 (Fig. 5).

While most of the catches of albacore have traditionally come from the southwest Indian Ocean, in recent years a larger proportion of the catch has come from the southern and eastern Indian Ocean (Table 2; Figs. 7, 8). The relative increase in catches in the eastern Indian Ocean since the early 2000's is mostly due to increased activity of fresh-tuna longliners from Taiwan,China and Indonesia. In the western Indian Ocean, the catches of albacore mostly result from the activities of deep-freezing longliners and purse seiners. One consequence of Somali maritime piracy in the western tropical Indian Ocean in recent years has been the movement of part of the deep-freezing longline fleets from this area, for which the target species were tropical tunas or swordfish, to operate in southern waters of the Indian Ocean (Fig. 8) which has led to an increased contribution of albacore to the total catches of some longline fleets (Fig. 6).

Fleets of oceanic gillnet vessels from Iran and Pakistan and gillnet and longline vessels from Sri Lanka have extended their area of operation in recent years, to operate on the high seas closer to the equator. The lack of catch-and-effort data from these fleets makes it impossible to assess whether they are operating in areas where catches of juvenile albacore are likely to occur.

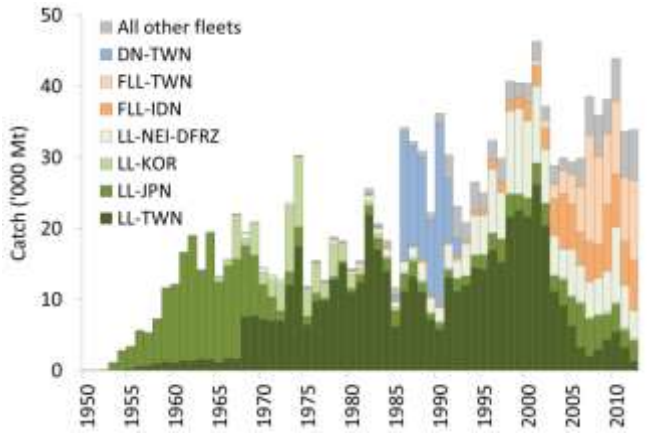


Fig. 5. Albacore: Catches by fleet recorded in the IOTC Database (1950–2012). Data as of May 2014.

Freezing Longlines of Taiwan,China (LL-TWN), Japan (LL-JPN), Rep. of Korea (LL-KOR), and other nei fleets (LL-NEI-DFRZ); Fresh-tuna longlines of Indonesia (FLL-IDN), and Taiwan,China (FLL-TWN); Driftnets of Taiwan,China (DN-TWN); all other fleets combined (Other Fleets).

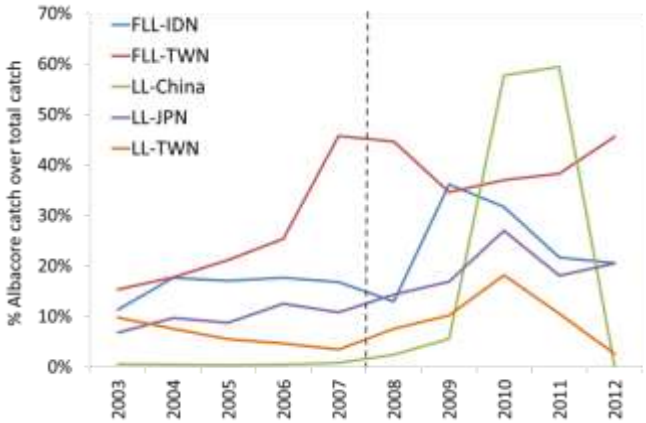
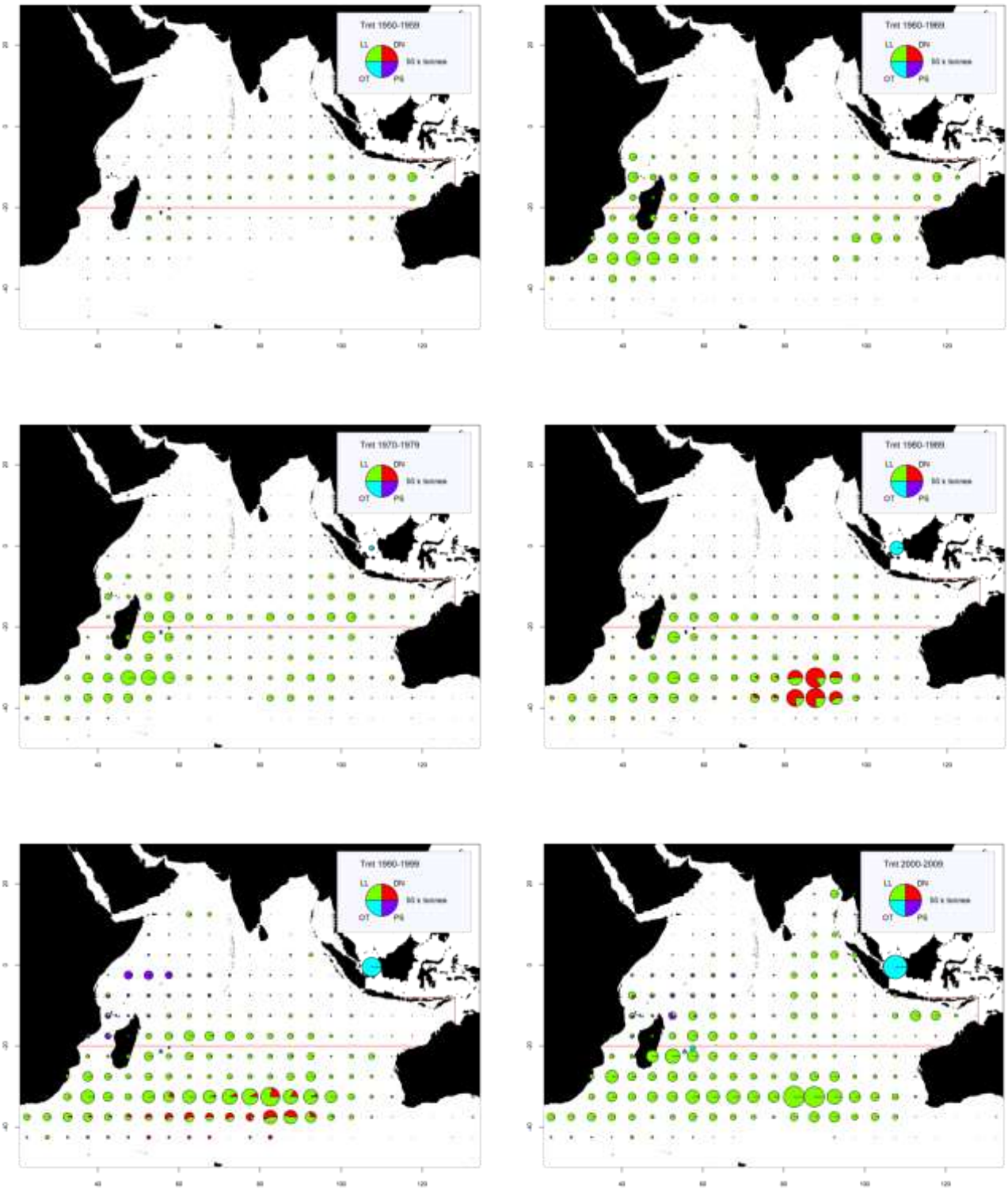


Fig. 6. Albacore: Proportion of catches of albacore from the total combined catches of all species, per year, for the major longline fisheries in the Indian Ocean (2003–12). Data as of May 2014.

The dotted vertical line corresponds to the onset of maritime piracy in the western tropical Indian Ocean

Fig. 7a–f. Albacore: Time-area catches (total combined in tonnes) of albacore estimated for the period 1950-2009, by decade and type of gear.



Longline (**LL**, green), Driftnet (**DN**, red), Purse seine (**PS**, purple), Other fleets (**OT**, blue)

Time-area catches are not available for all fleets; catches for those were assigned by 5x5 square and month using information from other fleets. Data as of May 2014.

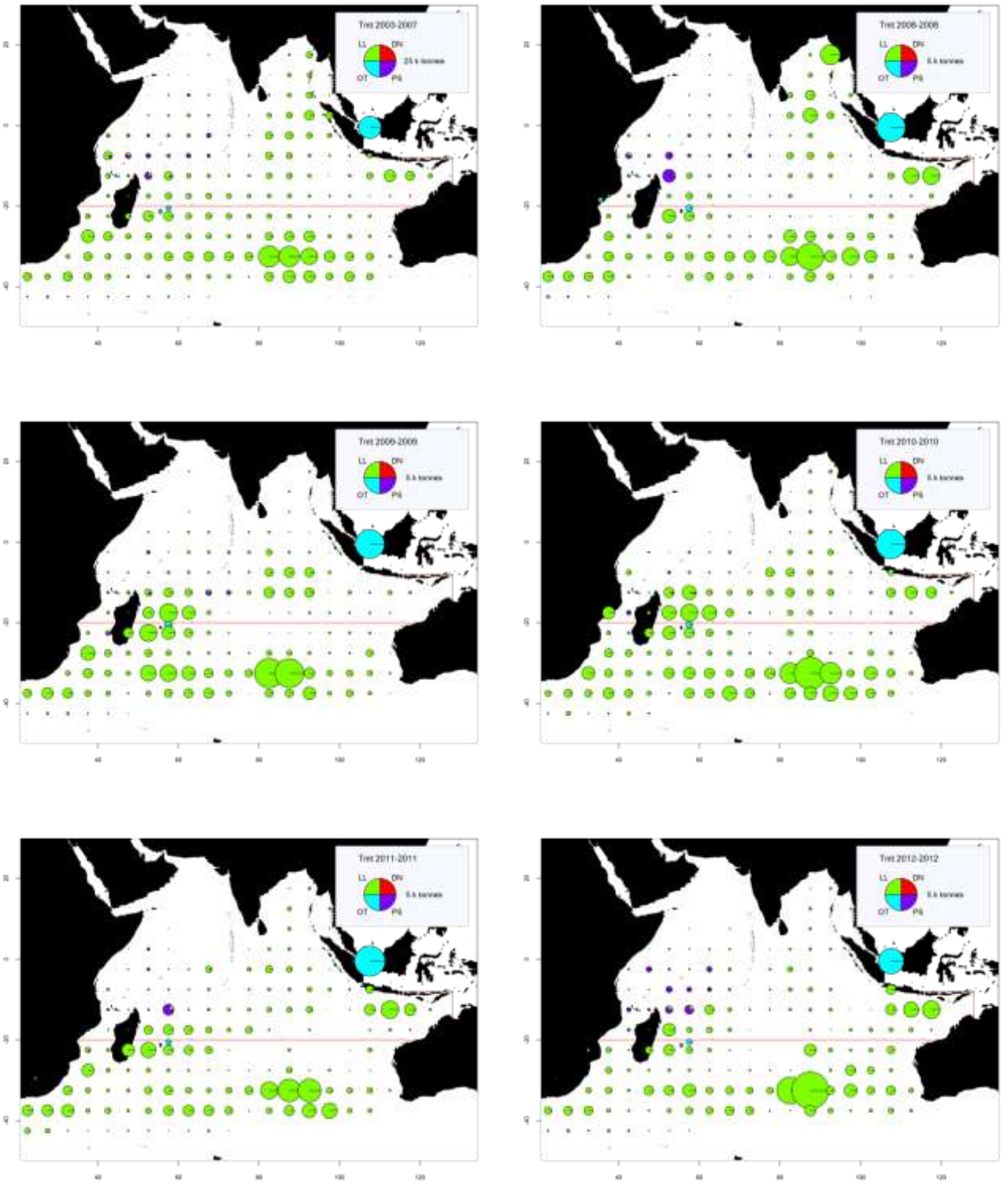


Fig. 8a–f. Albacore: Time-area catches (total combined in tonnes) of albacore estimated for the period 2003–07 by type of gear and for 2008–12, by year and type of gear.

Longline (**LL**, green), Driftnet (**DN**, red), Purse seine (**PS**, purple), Other fleets (**OT**, blue)

Time-area catches are not available for all fleets; catches for those were assigned by 5x5 square and month using information from other fleets. Data as of May 2014.

Albacore (ALB) – Status of Fisheries Statistics at the IOTC

While retained catches were fairly well known until the early-1990s (Fig. 9), the quality of catch estimates since that time has been compromised due to poor catch reports from some fleets (Fig. 10c), in particular:

- Longliners of Indonesia: The catches of albacore for the longline fleet of Indonesia were revised in 2013 by the DGCF and the IOTC Secretariat, using previous reports from Indonesia and information obtained from canning factories cooperating with the International Seafood Sustainability Foundation (ISSF). While the new catch estimates are considered more reliable than the previous, the lack of catch-and-effort data and insufficient monitoring of albacore landings in Indonesia makes it difficult to validate such estimates. According to the new estimates Indonesia has been catching 32% (around 12,000 t in average over the period 2008-12) of the total catches of albacore in the Indian Ocean.
- Longliners of Malaysia: To date, Malaysia has reported incomplete catches of albacore for its longline fleet, as monitoring by Malaysia does not cover the large component of the longline fleet that is based in ports outside Malaysia (in particular in Mauritius). In recent years Malaysia has reported between 5 and 59 active longliners in the Indian Ocean, with catches of albacore ranging between nil and 2,000 t for the same period. An additional 500–2,000 t of albacore were estimated for Malay longliners not bases in Malaysia.
- Fleets using gillnets on the high seas, in particular Iran, Pakistan and Sri Lanka: Catches are likely to be less than 1000 t.
- Non-reporting industrial longliners (NEI): Refers to catches from longliners operating under flags of non-reporting countries. While the catches were moderately high during the 1990s, they have not exceeded 3,000 t in recent years.

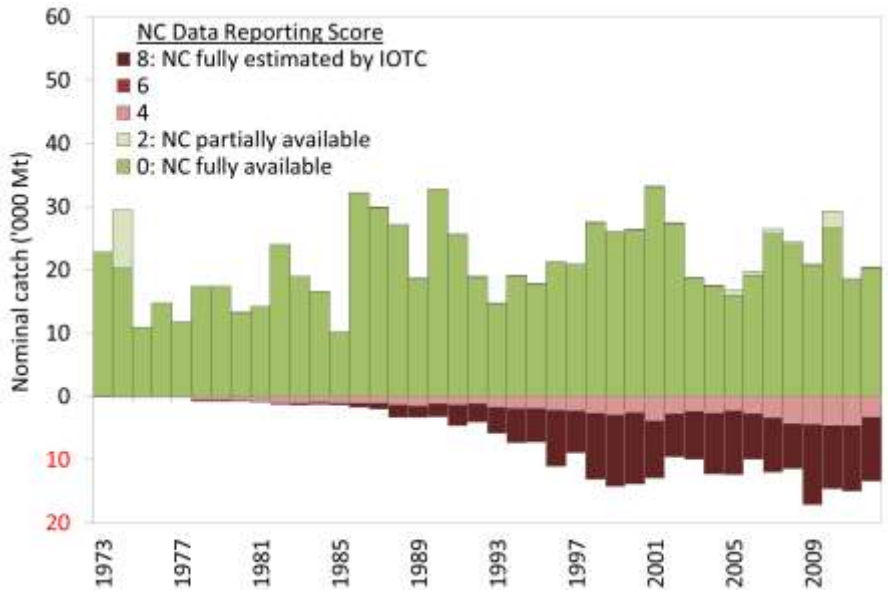


Fig. 9. Albacore nominal catch: Uncertainty of annual catch estimates (1950–2012).

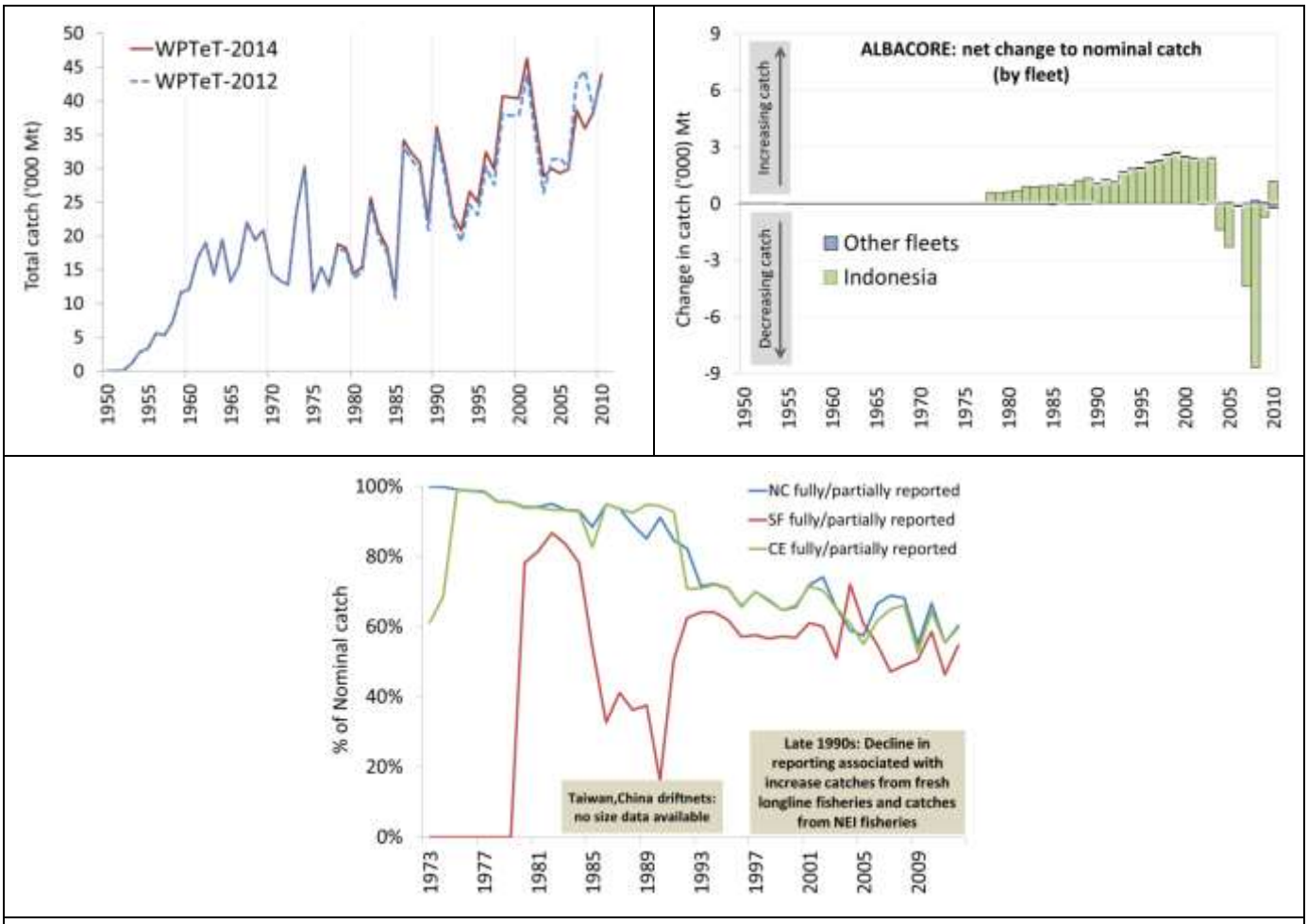
Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

Data as of May 2014.

Levels of **discards** are believed to be low although they are unknown for industrial fisheries other than European (EU) purse seiners (2003–07).

Changes to the catch series: The catches of albacore have changed for some years since the WPTmT in 2012 (Figs. 10), including;

- Minor to moderate increase in estimates of catches of albacore recorded for the period 1950-2003, following a review of the catches of albacore by coastal longliners in Indonesia.
- Moderate decrease in estimates of catches of albacore in 2007 (11%) and marked decrease in 2008 (24%), following the review of catches of albacore by all fleets conducted for this period.
- Minor changes in estimates of catches of albacore for other years.



Figs. 10a-c. Top left: Albacore: Catches used by the WPTmT in 2012 versus those estimated for the WPTmT in 2014 (1950–2012). **Top right:** Net change in total catch, by year and flag country.

Bottom: Reporting levels for Albacore nominal catch, size data and catch-and-effort (expressed as the proportion of nominal catch associated with each data set fully or partially reported to the IOTC Secretariat), 1973-2012.

CPUE Series: Catch-and-effort series are available from various industrial fisheries (Fig. 11). Nevertheless, catch-and-effort are not available from some fisheries or they are considered to be of poor quality, especially during the last decade, for the following reasons:

- uncertain data from significant fleets of longliners, including India, Indonesia, Malaysia, Oman, and Philippines;
- no data for fresh-tuna longliners flagged in Taiwan,China during 1990–2006;
- non-reporting by industrial purse seiners and longliners (NEI).

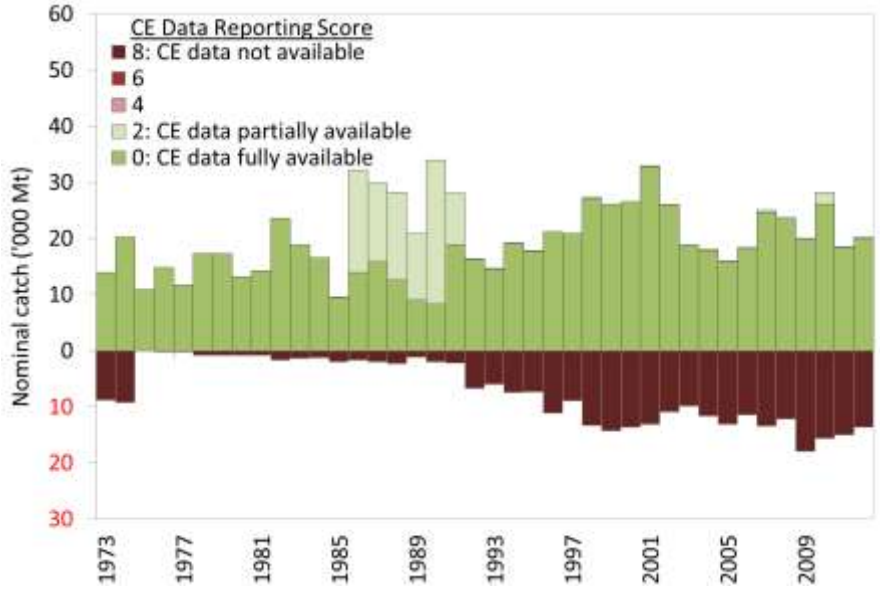


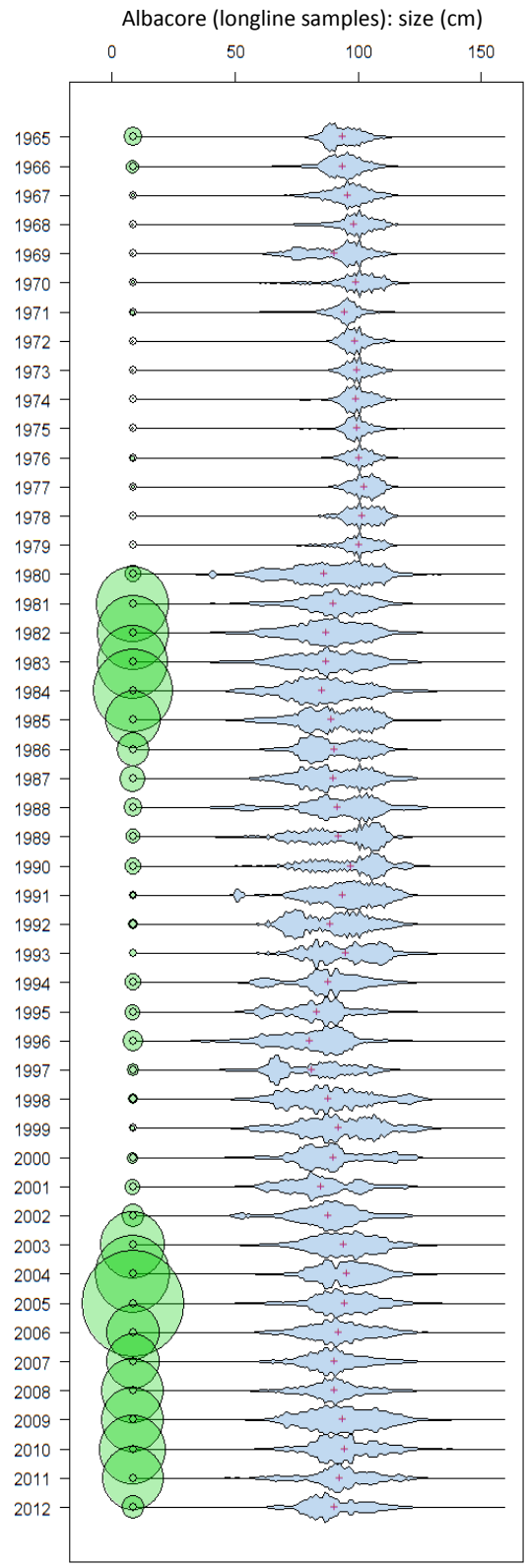
Fig. 11. Albacore catch-and-effort: Uncertainty of time-area catches (1950–2012).

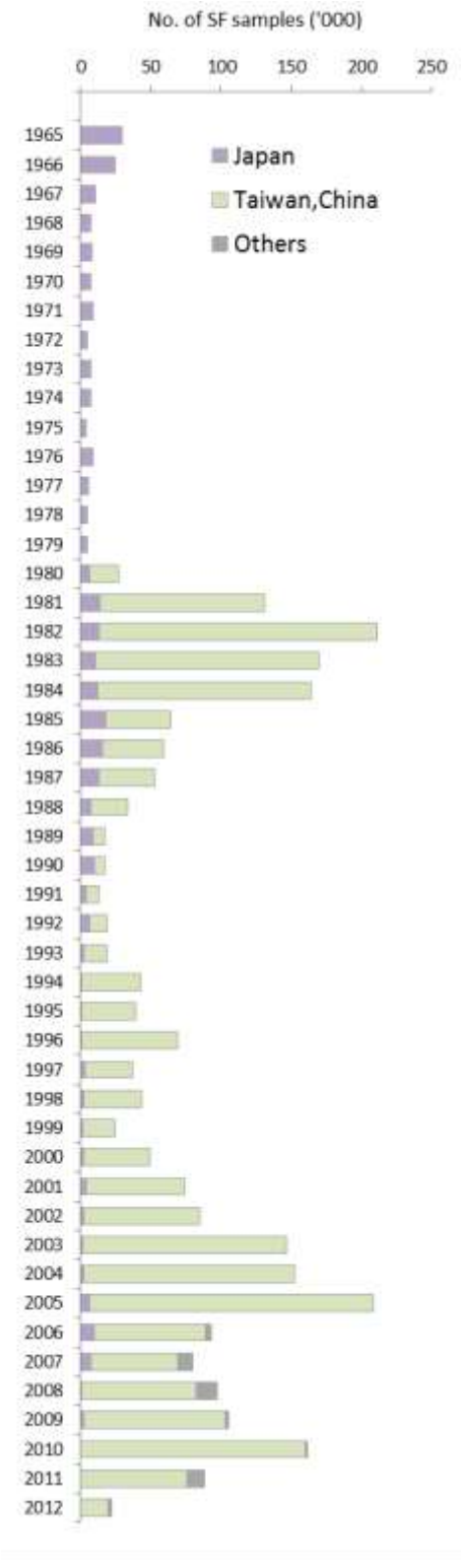
Catches are assessed against IOTC reporting standards, where a score of 0 indicates the nominal catch associated with catch-and-effort data that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 refer to the nominal catch associated with catch-and-effort data partially reported by gear and/or species (i.e., adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to nominal catch associated with catch-and-effort data that is not available.

Data as of May 2014.

The **size frequency data** for the Taiwanese deep-freezing longline fishery for the period 1980–2012 is available. However, the lengths of albacore available for Taiwan,China since 2003 are very different from those available for earlier years and length data and catch-and-effort data for the same time-periods and areas are conflicting over most of the time series (Figs. 12a-b). In general, the amount of catch for which size data for the species are available before 1980 is still very low. The data for the Japanese longline fleet is available; however, the number of specimens measured per stratum has been decreasing in recent years. Size data are also available for industrial purse seiners flagged in EU countries and the Seychelles. Few data are available for the other fleets.

- Trends in **average weight** can be assessed for several industrial fisheries although they are incomplete or of poor quality for some fisheries due to the issues identified above.
- Catch-at-Size(Age) tables are available but the estimates are highly uncertain for some periods and fisheries (Fig. 13) including:
    - all industrial longline fleets before the mid-60s, from the early-1970s up to the early-1980s and most fleets in recent years, in particular fresh-tuna longliners;
    - the complete lack of size samples from the driftnet fishery of Taiwan,China over the entire fishing period (1982–92)
    - the paucity of catch by area data available for some industrial fleets (Taiwan,China, NEI, India and Indonesia).





Figs. 12a-b: **Left:** Albacore: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for freezing longline fisheries, by year. The black outline circles (to the left of each distribution) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year).

Right: Number of specimens sampled for lengths by main longline fleet.

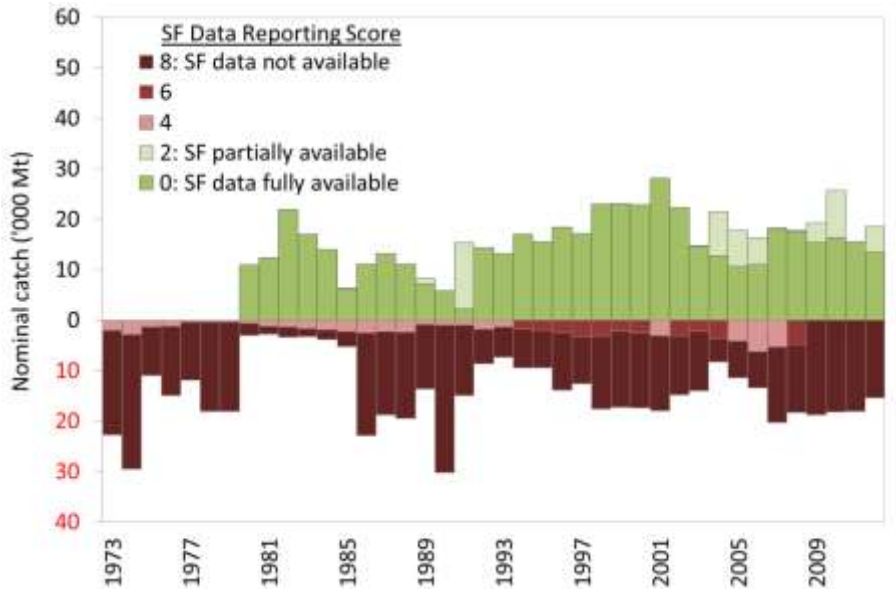


Fig. 13. Albacore: Uncertainty of catch-at-size data for albacore (1950–2012).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates the nominal catch associated with size-frequency data that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 refer to the nominal catch associated with size-frequency data partially reported by gear and/or species (i.e., adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to nominal catch associated with size-frequency that is not available.

Data as of May 2014.

Albacore (ALB) – Estimation of catches of non-reporting fleets

The estimates of catches of non-reporting fleets were updated in 2013. The high number of non-reporting fleets operating in the Indian Ocean since the mid-1980's has led to large increases in the amount of catch that needs to be estimated. This reduces confidence in the catch estimates for albacore.

- **Purse seine**: 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 2005–06. 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 2005-06. Total catches were assigned to species and type of school fished according to data available for Thailand purse seiners during the same period (2005–06). 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. The catches of albacore estimated for this component have never been above 170 t.
- **Deep-freezing longline** (Fig. 14): The catches by large longliners from several non-reporting countries were estimated using IOTC vessel records and the catch data from Taiwan,China, Japanese or Spanish longliners, based on the assumption that most of the vessels operate in a way similar to the longliners from these countries. The collection of new information on the non-reporting fleets during the last year, in particular the number and characteristics of longliners operating, led to improved estimates of catches. The number of vessel operating since 1999 has decreased and this has led to a marked decrease in catch levels. The reason for this decrease in the number of vessels (and catches) operating in the Indian Ocean is not fully explained. Nevertheless, this decrease is somewhat proportional to an increase in the number of vessels recorded under other flags, such as Philippines, Taiwan,China, the Seychelles and, recently, Oman, India, Malaysia and Indonesia. The catches recorded for India and Philippines are considered uncertain and probably do not account for all the albacore caught by vessels operating under these flags.

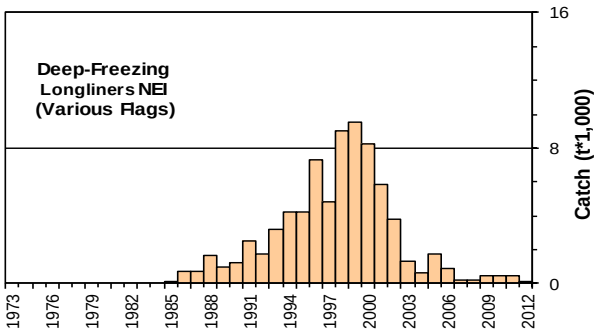


Fig. 14. *Albacore: Catches of NEI deep-freezing longline vessels in the Indian Ocean estimated in 2013 (1973–2012).*

- **Fresh tuna longline** (Figs. 15, 16, 17): Fresh tuna longline vessels, mainly from China, Taiwan,China, India, Malaysia, Belize, India and Indonesia, have been operating in the Indian Ocean since the early 1970's. The catches of some of these fleets were, up to 2006, estimated by the IOTC Secretariat by using information from the following three sources:

  - Catches reported from the flag countries: Although China reported total catches for its longline fleet, before 2006 they were not reported by gear (fresh-tuna longline or deep-freezing longline). The Secretariat estimated the catches of fresh-tuna longliners for this period by using the total catches reported, the numbers of fresh-tuna longline vessels provided by China and catch rates for fresh-tuna and deep-freezing longlines available from other fleets.
  - 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-OFCF[6] and/or institutions in the countries where the fleets are based and/or foreign institutions (Fig. 15). This applies to Indonesia (2002 - 2009), Thailand (1998 – to-date), Sri Lanka (2002–03), Malaysia (2000-06), Oman (2004–05) and Seychelles (2000–02).
  - Information available on the number of fresh-tuna longline vessels operating in other ports or on the activity (e.g. the number of vessel unloadings) or catches of those vessels, as reported by third parties. This applies to ports in India (2004–10), Indonesia (1973–2001), Thailand (1994–97), Sri Lanka (1990–2001; 2004–05), Malaysia (1989–99), Singapore, Maldives and Yemen (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 covered through sampling.
  - Market data, including exports of frozen Albacore recorded in Indonesia and imports of Albacore for canning, provided through ISSF (2008 to date). This applies to Indonesia and Malaysia.

  In 2006 Taiwan,China provided total catches for its longline tuna fleet operating in the Indian Ocean for the period 2000 to 2005. Since then, Taiwan,China has provided catches regularly. The catches provided are higher than those estimated by the IOTC Secretariat for most years. 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 have been operating in ports from non-reporting countries and their catches have not been accounted for in previous estimates.

  The catches for fleets other than Taiwan,China, for 1973–2010, and for Taiwan,China in years prior to 2001 were estimated as explained in the two bullet points above.

[6] Overseas Fisheries Cooperation Foundation of Japan

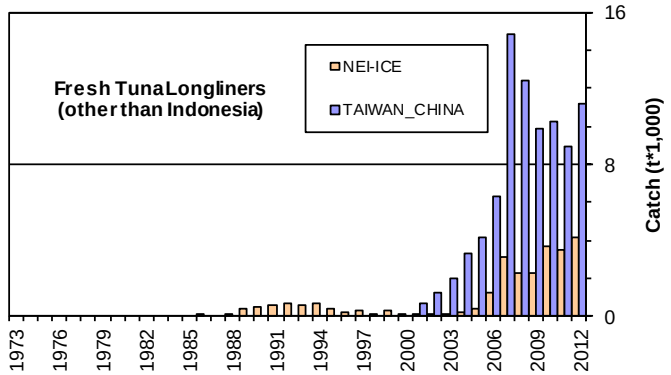


Fig. 15. Albacore: Catches of fresh-tuna longline vessels not based in Indonesia (mainly registered in China, Taiwan,China and Indonesia) estimated in 2013 (1986–2012).

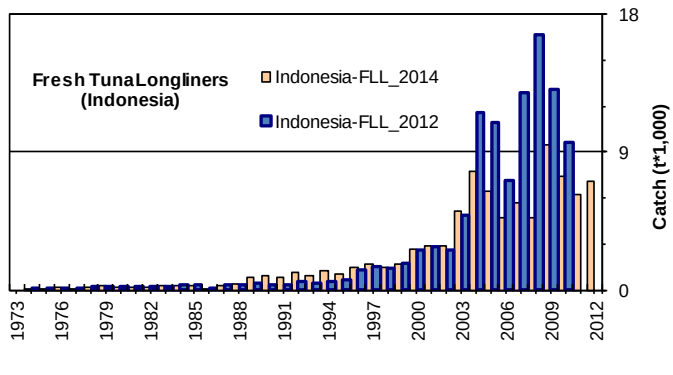


Fig. 16. Albacore: Catches of fresh-tuna longline vessels based in Indonesia (domestic and foreign) estimated for the WPTmT in 2014 (1973–2012) versus catches estimated for the WPTmT in 2012 (1973–2010).

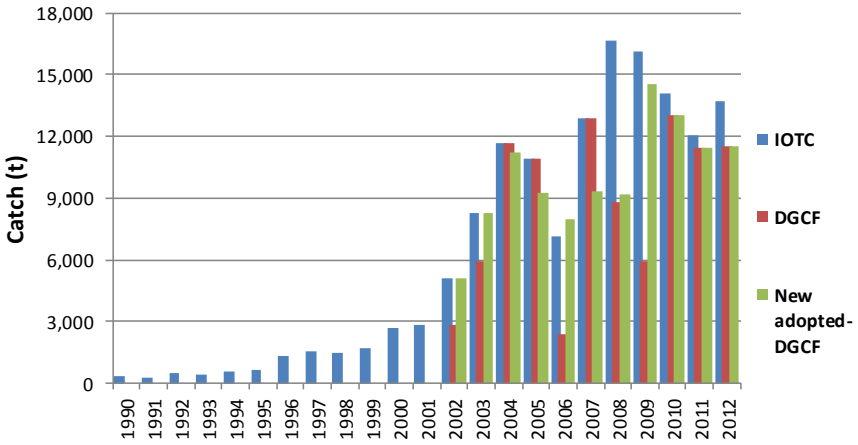


Fig. 17. Albacore: Catch of albacore previously reported by Indonesia (DGCF), Catch estimated by IOTC and new catches reported by the DGCF (New adopted-DGCF) following a review of catches using multiple data sources (1990–2012).

APPENDIX I

REVIEW OF FISHERIES TRENDS FOR ALBACORE

1. EFFORT

a) Longline

Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, by decade and main fleet:

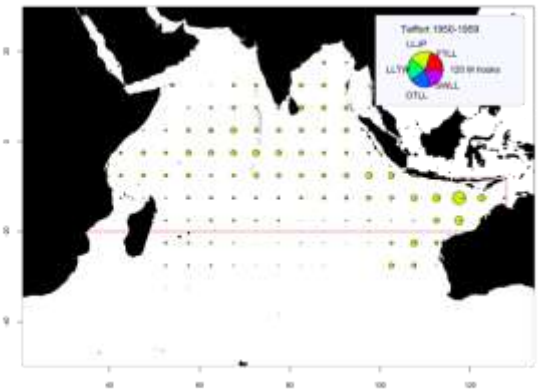
LLJP (light green): deep-freezing longliners from Japan

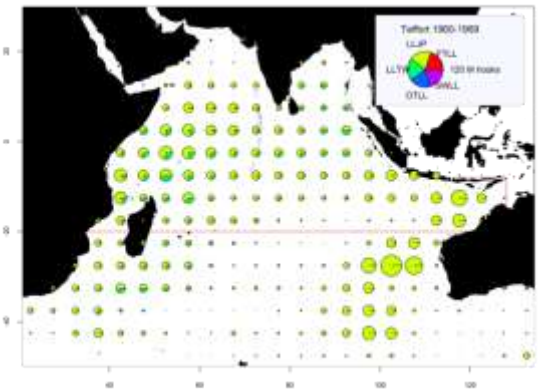
LLTW (dark green): deep-freezing longliners from Taiwan,China

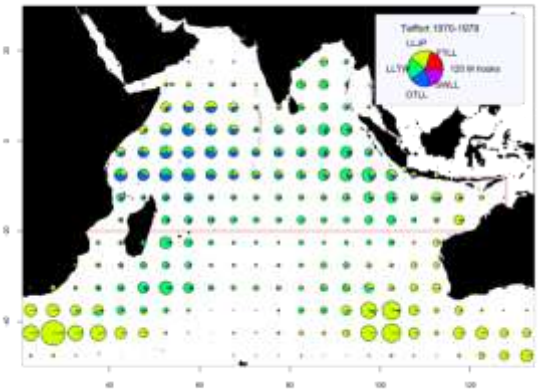
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)

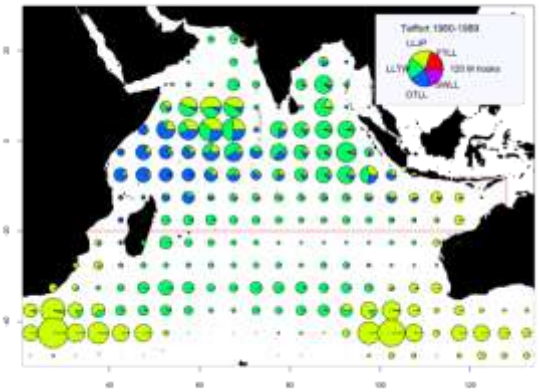
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)

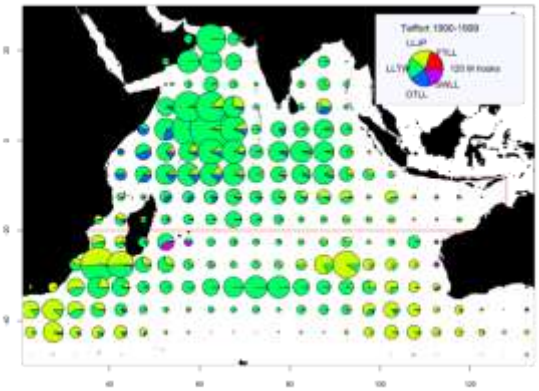
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

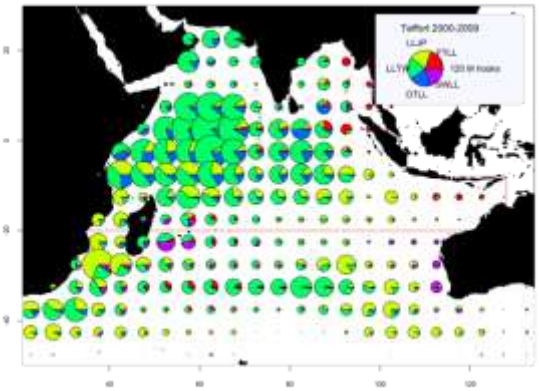












Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2003-07 and 2008-12, by year, and main fleet:

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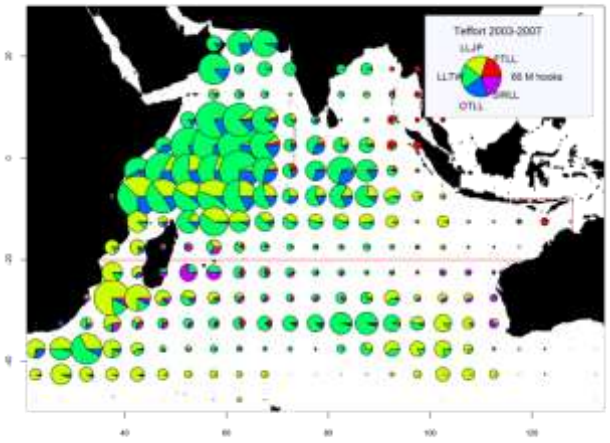
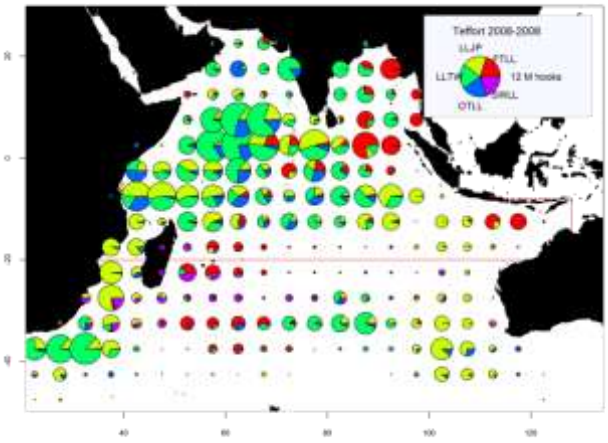
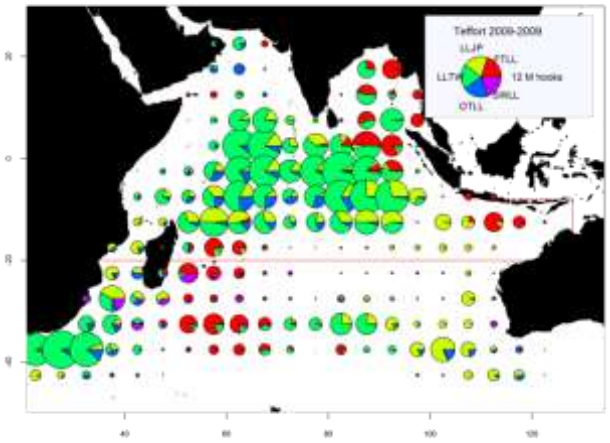
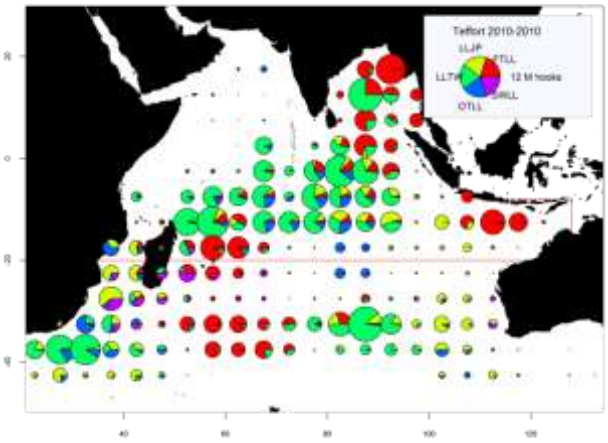
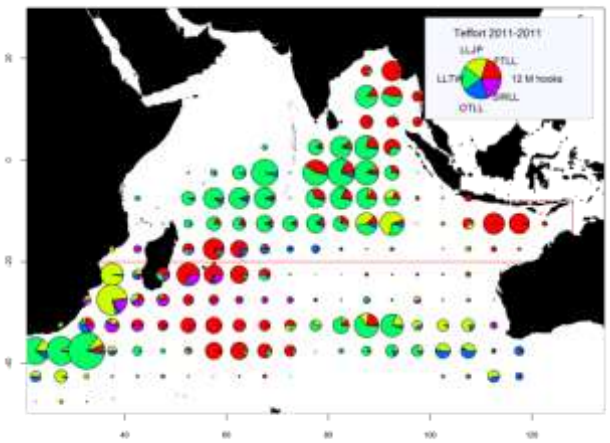
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

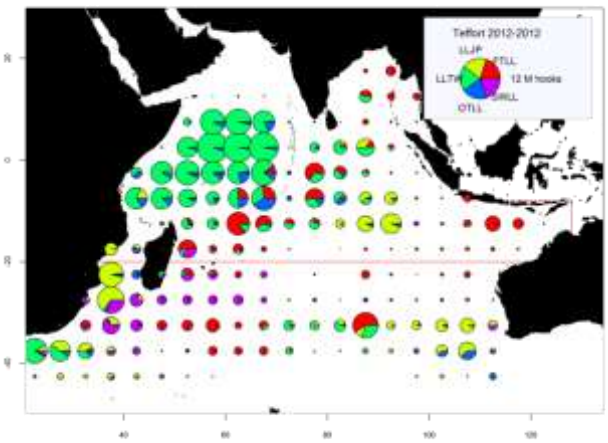












Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, for 2003-07 and 2008-12, by year, quarter, and main fleet:

LLJP (light green): deep-freezing longliners from Japan

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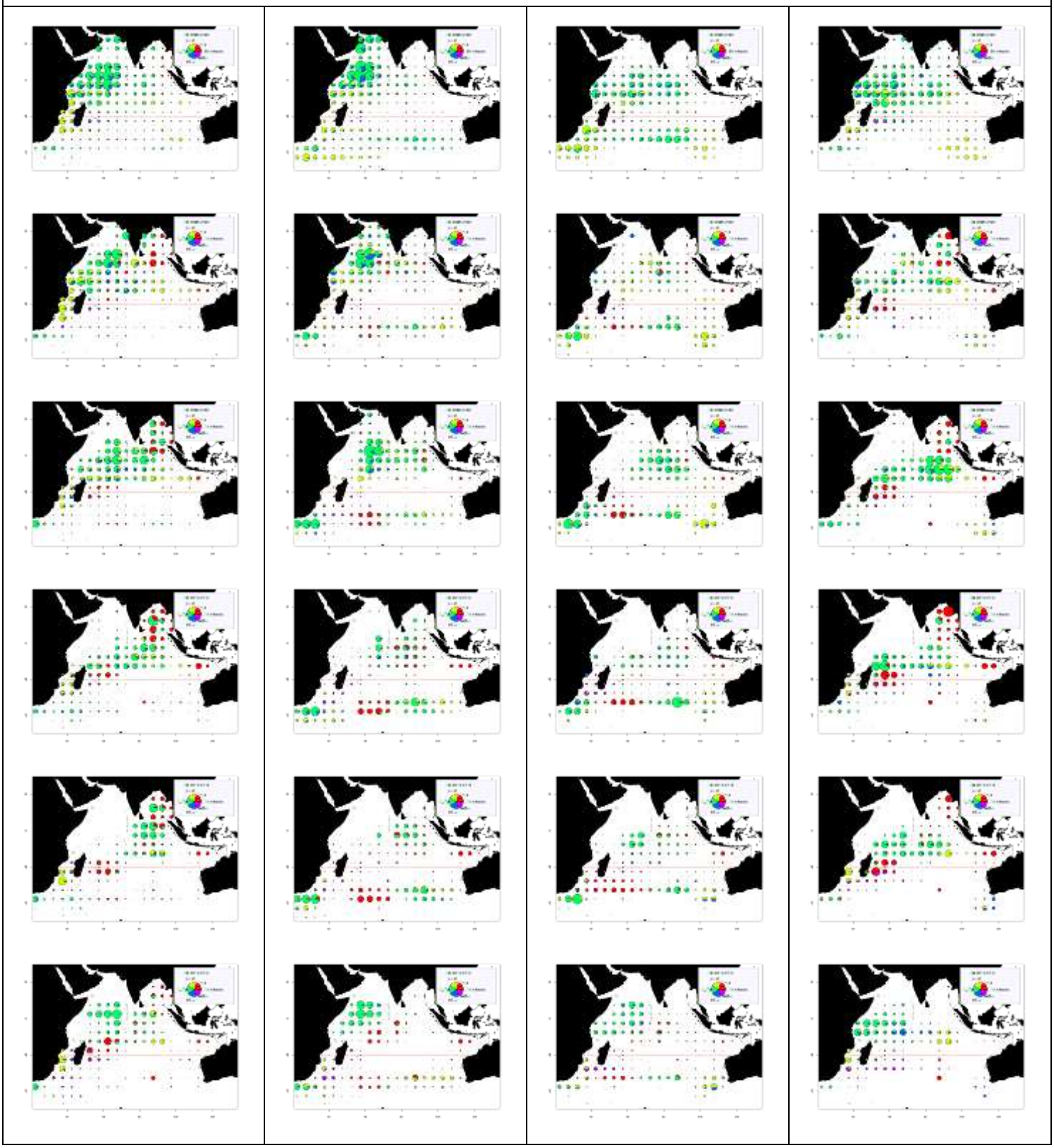


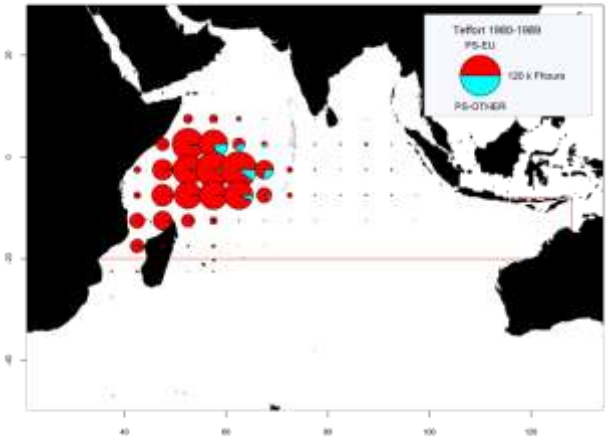
b) *Purse seine*

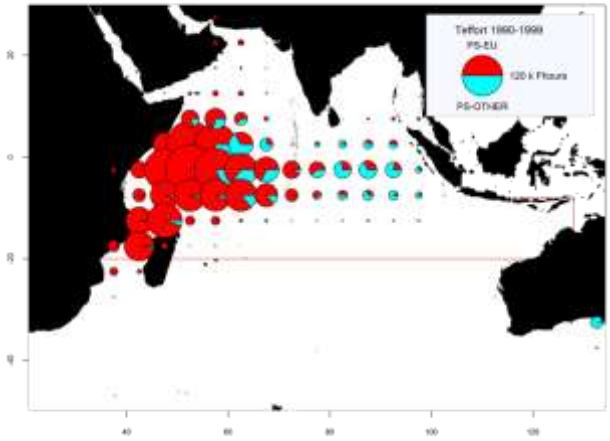
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), by decade and main fleet:

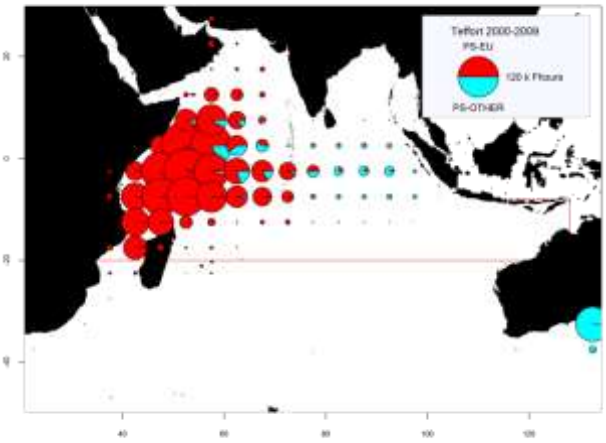
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)

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 2003-07 and 2008-12, by year, and main fleet:

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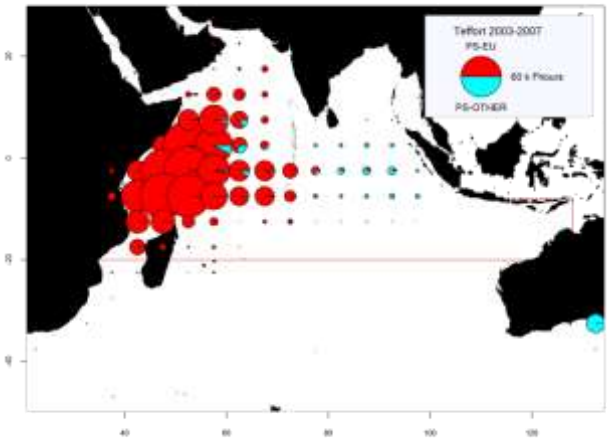

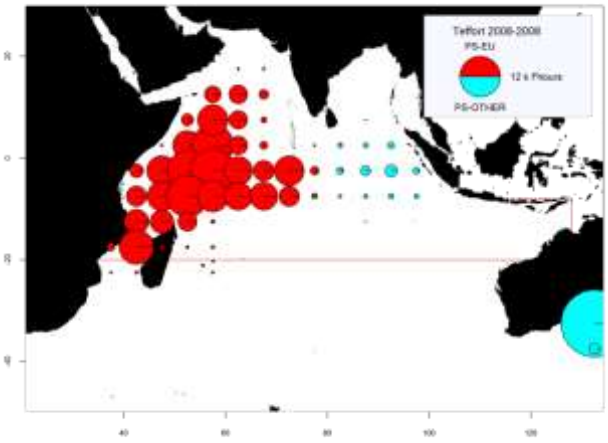

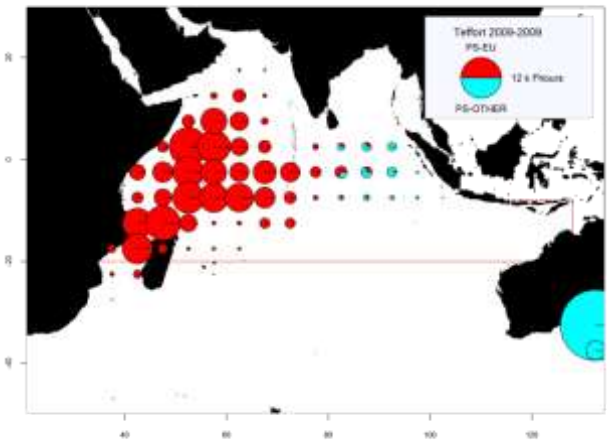

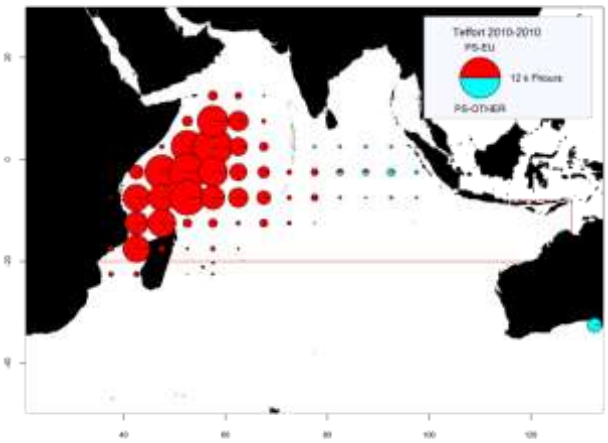

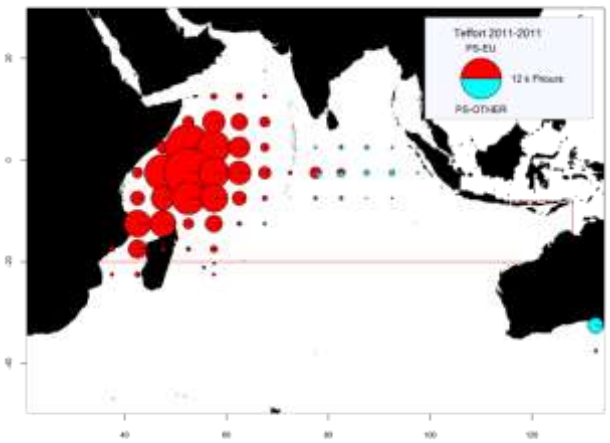

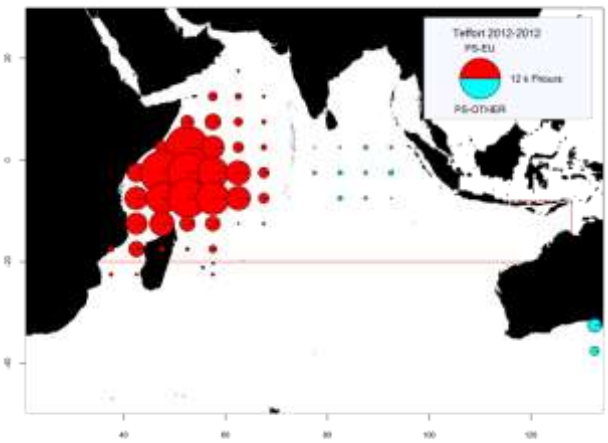

Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2003-07 and 2008-12, by year, quarter, and main fleet:

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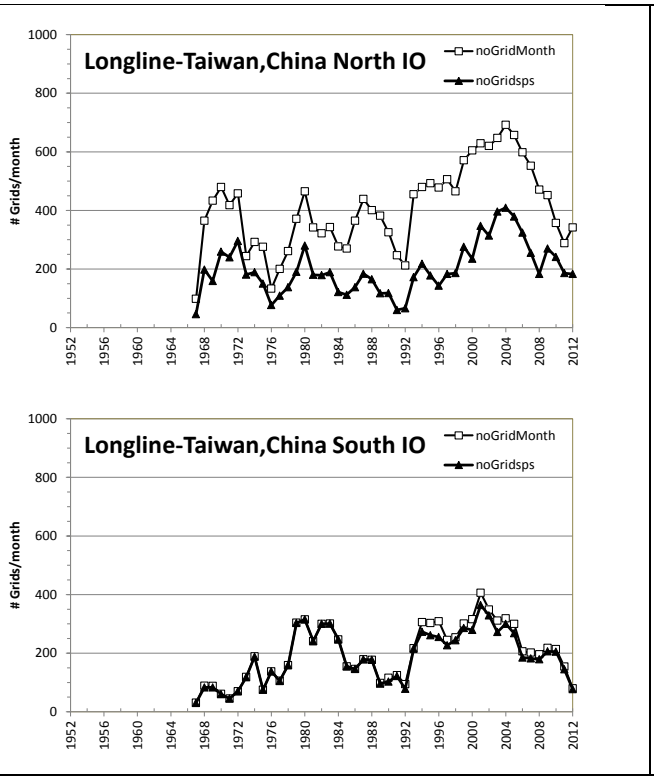
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin)

(excludes effort data for purse seiners of Iran)

c) *Squares fished*

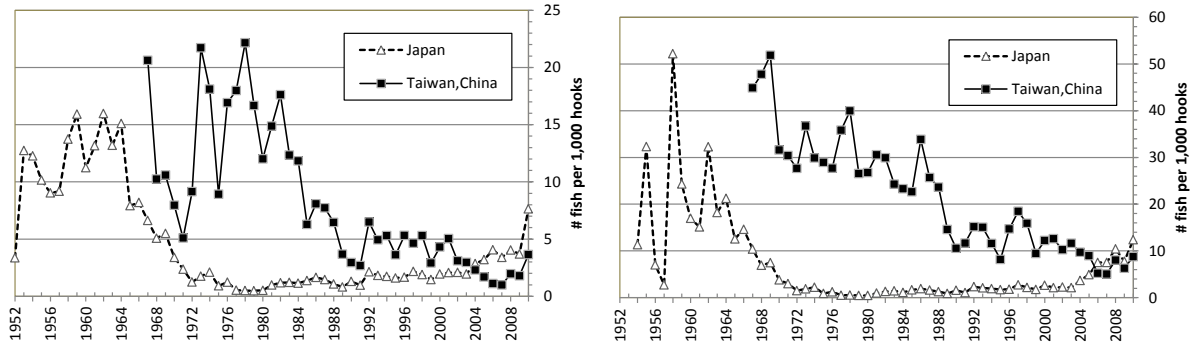


Number of five degree squares explored and number of squares with catches of albacore reported by the longline fisheries of Taiwan,China (left) and Japan (right), in the North (top) and South (bottom) Indian Ocean, from 1952 to 2012, by year.

2. CATCHES & CATCH RATES

a. Catch rates

Nominal CPUE (number of fish/1000hooks) for the longline fleets of Japan and Taiwan,China fishing in the Indian Ocean (1952 to 2012): All Indian Ocean (left) and Indian Ocean South of 20 degrees South (right)



b. Recent catches

Time-area catches (total combined in tonnes) of ALBACORE estimated for 2003-07 and 2008-12, by year, and quarter:

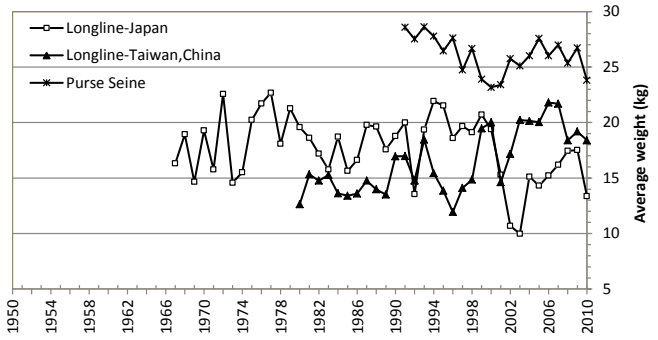
Longline (LL, red): deep-freezing longliners from Japan, Taiwan,China, EU, Seychelles, South Korea, and other fleets.

Purse seine (PS, blue): industrial tuna purse seiners from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets.

Other fleets (OTHR, green): other fleets, especially small-scale fisheries operating in coastal waters.

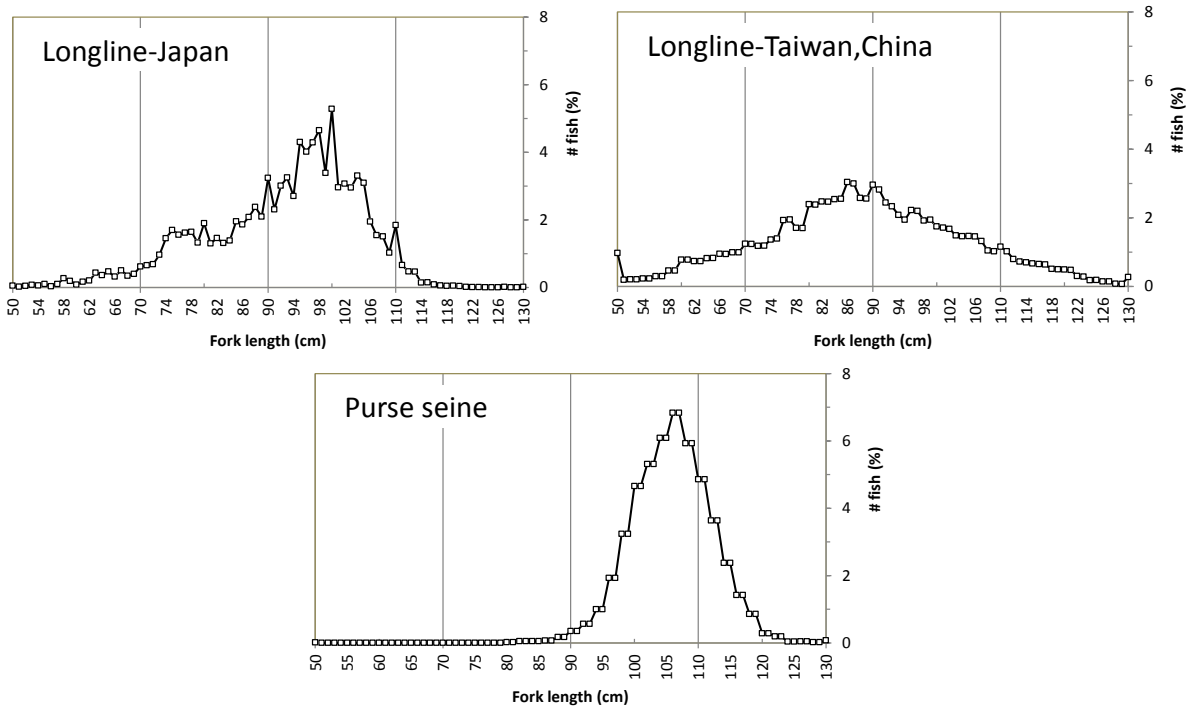
Time-area catches are not available for all fleets; catches of fresh-tuna longliners are not represented.

3. AVERAGE WEIGHTS AND SIZE



Average weight of albacore (kg) estimated from the size samples available for longliners of Japan (1965-2012) and Taiwan,China (1980-2012), and EU Purse seiners (1991-2012)

No samples available at all for vessels using driftnets (Taiwan,China, 1982-92) and all coastal fisheries (1950-2012)

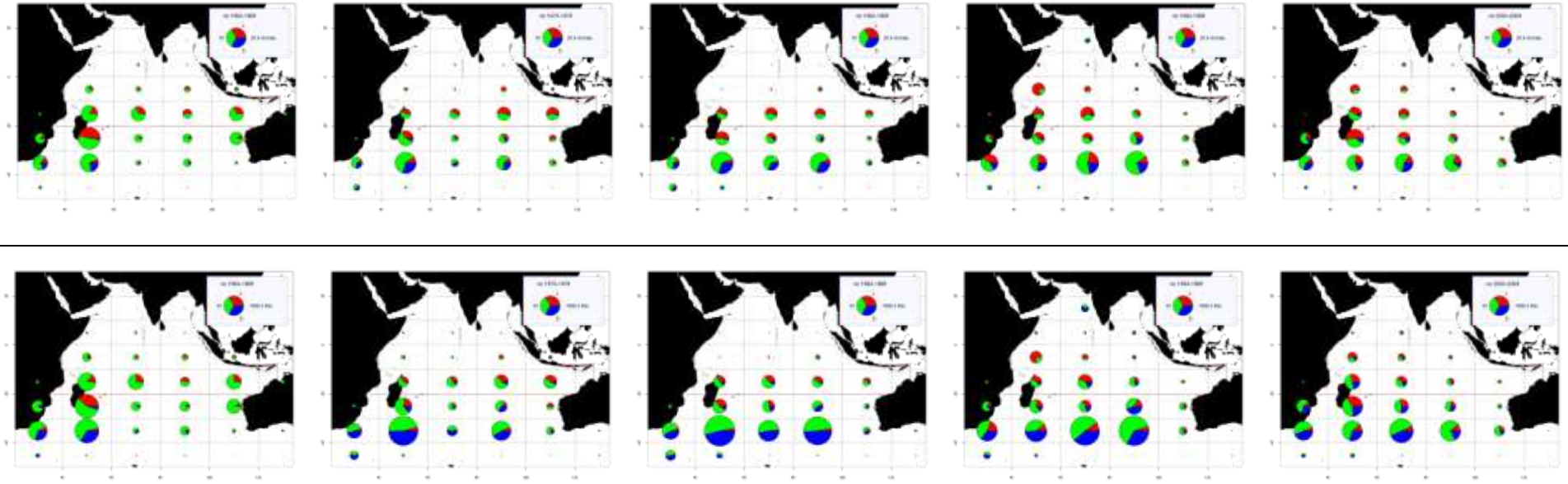


Number of albacore by length class (accumulated for 1950-2012, expressd as %) estimated for the longline fisheries of Japan and Taiwan,China (top) and the purse seine fishery (bottom) in the Indian Ocean

Albacore (ALB): Catch per size class

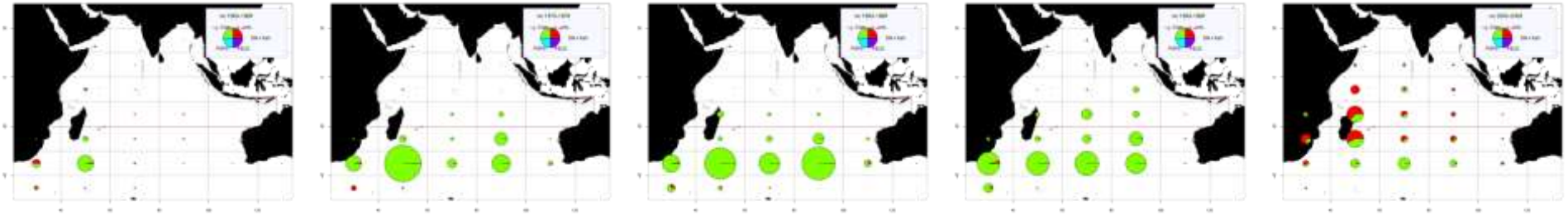
Total catches of ALBACORE (ALB) in weight (top) and number (bottom) derived from the catch-at-size of purse seine and longline fisheries for 1960-2009. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

- **Large size** (**Red**): Catches of ALB for which the weight estimated is 20kg or greater
- **Medium size** (**Green**): Catches of ALB for which the weight estimated is between 10kg and 20kg
- **Small size** (**Blue**): Catches of ALB for which the weight estimated is under 10kg



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

- **PSLS** (**Blue**): Industrial purse seiners on associated schools (e.g. FAD)
- **LL-JPN** (**Red**): Industrial longliners of Japan, Korea, and Thailand
- **LL-TWN** (**Green**): Industrial longliners of Taiwan,China and other countries

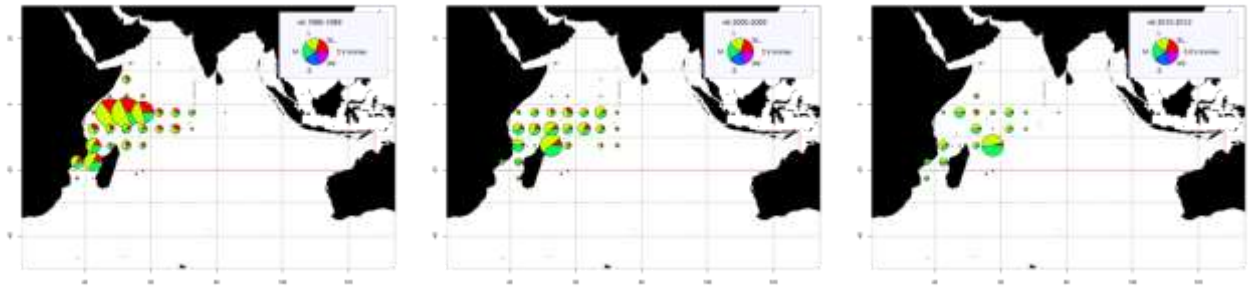


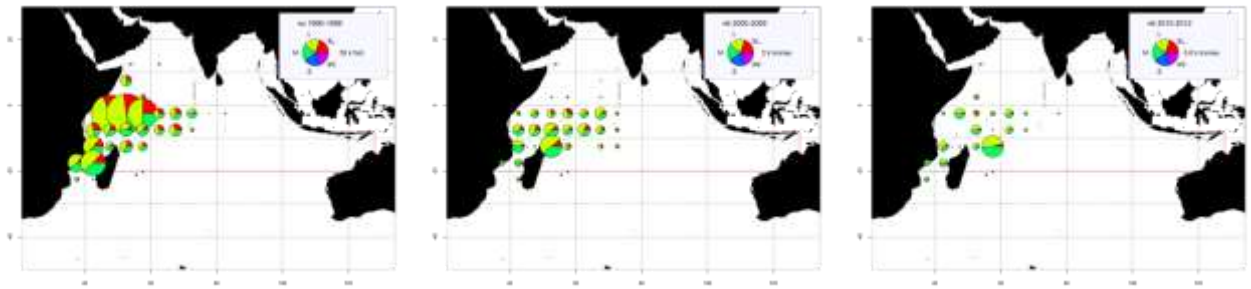
Albacore (ALB): Catch by size class by fishery

Total catches of ALBACORE (ALB) 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 1990-2012. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

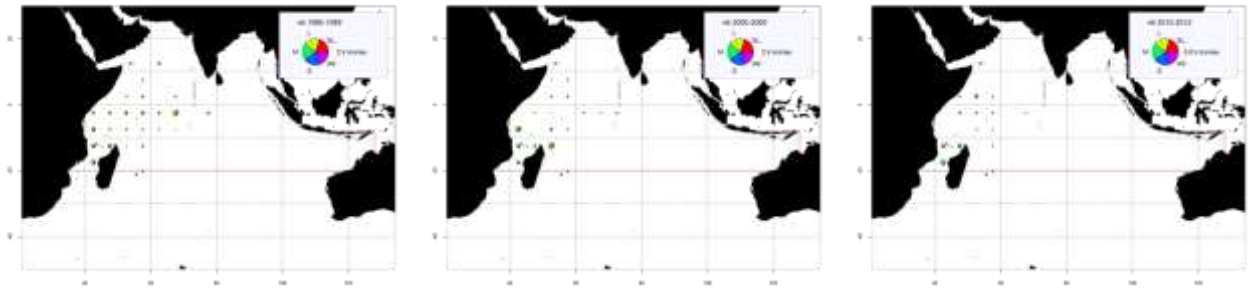
- **Very small size** (**SS; purple**): Catches of ALB for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of ALB for which the weight estimated is between5 and 10kg
- **Medium size** (**M**; **green**): Catches of ALB for which the weight estimated is between 10kg and 20kg
- **Large size** (**L**; **yellow**): Catches of ALB for which the weight estimated is between 20kg and 25kg
- **Very large size** (**EL**; **red**): Catches of ALB for which the weight estimated is 25kg or greater

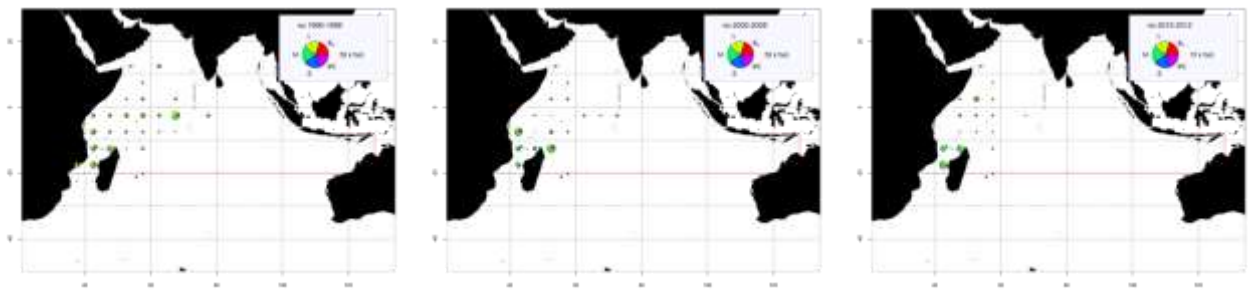
Free-swimming schools





Associated schools

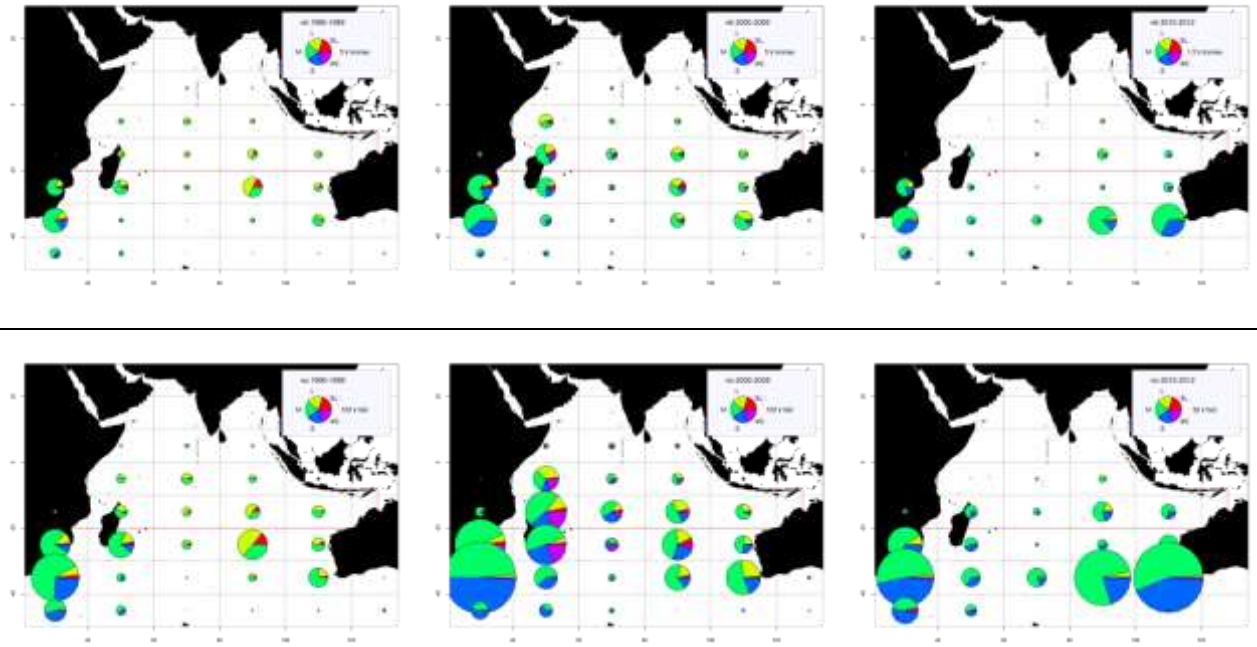




Total catches of ALBACORE (ALB) in weight (top) and number (bottom) derived from the catch-at-size of industrial longliners of Japan (top two rows) and Taiwan,China (bottom two rows) for 1990-2012. Catches are presented by decade, 10 latitude by 20 longitude area and size class, including:

- **Very small size** (**SS; purple**): Catches of ALB for which the weight estimated is under 5kg
- **Small size** (**S**; **blue**): Catches of ALB for which the weight estimated is between5 and 10kg
- **Medium size** (**M**; **green**): Catches of ALB for which the weight estimated is between 10kg and 20kg
- **Large size** (**L**; **yellow**): Catches of ALB for which the weight estimated is between 20kg and 25kg
- **Very large size** (**EL**; **red**): Catches of ALB for which the weight estimated is 25kg or greater

Longline Japan



Longline Taiwan,China