IOTC–2019–WPTmT07(DP)–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 December 2018, 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 15/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*[2], for the period 1950–2017.

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:

Major data categories covered by the report

Nominal catches: Total annual retained catches and discards (in live weight) by fleet, IOTC Area, species, and gear. If these data are not reported the IOTC Secretariat, estimates of total retained catch are made from a range of sources (including: 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, or data reported by parties on the activity of vessels under their flag (IOTC Resolution 10/08; IOTC Resolution 14/06) or other flags (IOTC Resolution 14/05; 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: Refers to 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 area.

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[2] This Resolution superseded IOTC Resolutions 98/01, 05/01 and 08/01, and 10/02.
[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*

SECTION 1: OVERVIEW OF DATA FOR TEMPERATE TUNA SPECIES IN THE INDIAN OCEAN

Fisheries and catch trends for neritic species

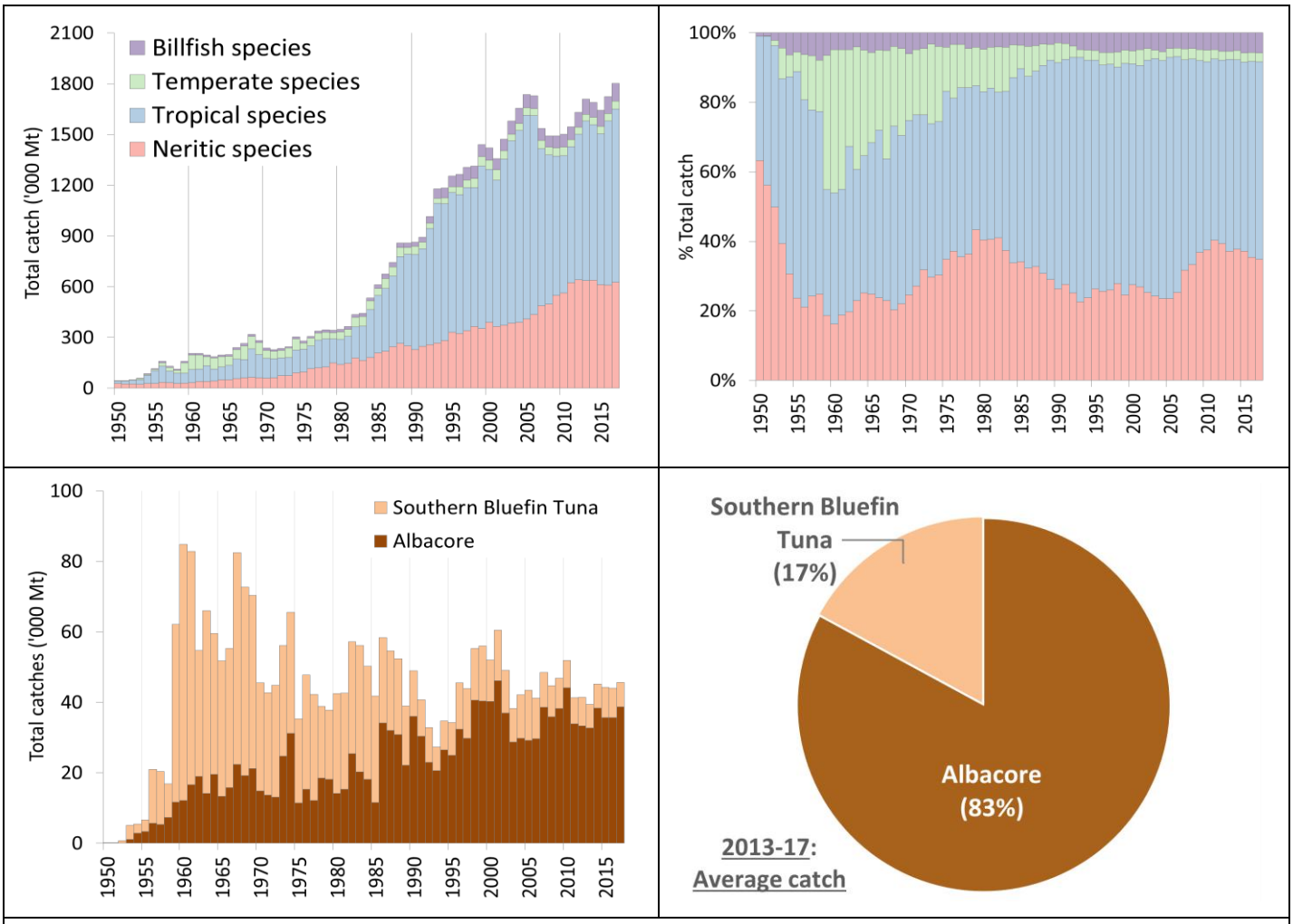
- Main species: Albacore is the main temperate tuna species, accounting for around 83% of total catches of temperate tunas in recent years (**Figs.1c-d.).** The stock of southern bluefin tuna is managed by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and therefore is not covered in this paper[4].
- Main fisheries: Albacore is caught mainly by industrial longline fleets, with the majority of catches occurring on the high seas by vessels flagged to both distant water fishing nations (Taiwan,China, Japan) and coastal countries (e.g., Indonesia, Malaysia) (**Figs.2 & 3**).

  Indonesia, Madagascar, Mauritius, La Réunion, and Comoros also have coastal fisheries for albacore, although catch levels are low.
- Retained catch trends:
  The contribution of temperate tunas to the total catches of IOTC species in the Indian Ocean has changed over the years (**Figs.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.

  The threat of piracy in waters off-Somalia in the late-2000s, and changes in targeting by the Indonesian fresh-tuna longline fleet (especially since 2007), have also contributed increases in the contribution of albacore to the total catches of tunas by some fleets.

  Nevertheless, since the 1990s the overall contribution of temperate tunas to the total catches of IOTC species in the Indian Ocean has remained stable (at around 3% of total catches of all IOTC species); compared to the period 1956-75 in which catches of temperate tunas accounted for around 25% of total catches of all IOTC species combined.
- Economic markets:
  The majority of the catches of albacore are sold to international markets, mostly for canning – although 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.

[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 1950–2017 (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, 1950–2014; d. Bottom right: share of temperate tuna catch by species, 2013–17) .

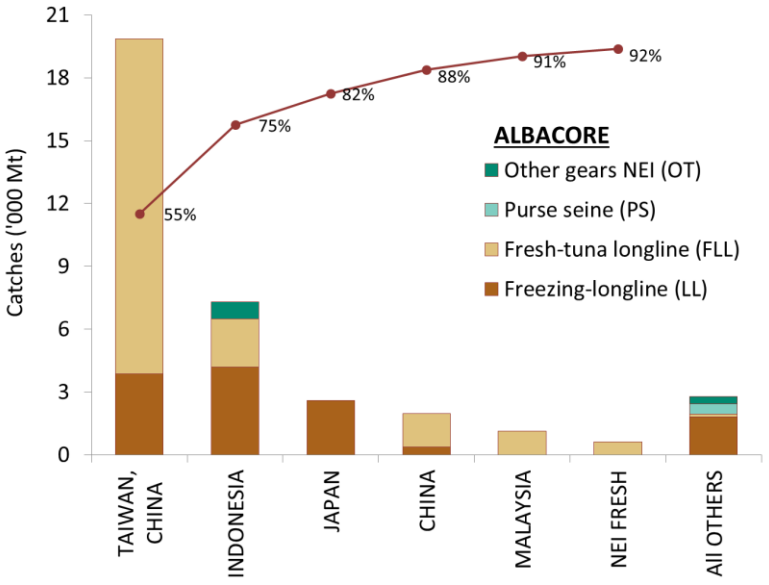


Fig. 2. Albacore: average catches in the Indian Ocean over the period 2013–17, by country. Countries are ordered from left to right, according to the importance of catches of albacore reported. The red line indicates the (cumulative) proportion of catches of albacore for the countries concerned, over the total combined catches of albacore reported from all countries and fisheries. Notes: *Other gears NEI* includes troll line, coastal purse seine, gillnet, Danish seine.

STATUS OF FISHERIES STATISTICS FOR ALBACORE

Albacore (ALB: Thunnus alalunga)

Fisheries and main catch trends

- Main fisheries: albacore tuna are currently caught almost exclusively using drifting longlines (accounting for over 90% of the total catches) (**Table 1; Fig.3**), with remaining catches recorded using purse seines and other gears. Catches from the longline fisheries are split between deep-freezing longliners, and fresh-tuna longliners:

  Deep-freezing longline fishery:

  - Deep-freezing 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, since the early-1970s 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.
  - 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, accounting for over 55% of the total Indian Ocean albacore catch. Since 2006 albacore catches by Taiwan,China deep freezing longliners have been between 1,500 and 5,000 t, with the lowest catches recorded in 2012.

  Fresh-tuna longline fishery:

  - Unlike deep-freezing longliners, catches of albacore for the fresh-tuna longline fishery of Taiwan,China have increased in recent years to over 15,000 t compared to less than 5,000 t in the mid-2000s, leading to a shift in the proportion of catches of albacore by deep-freezing and fresh-tuna longliners. Catches by fresh-tuna longliners currently account for between 80% - 90% of catches by Taiwanese longliners.
  - Catches of albacore reported for the fresh tuna longline fishery of Indonesia have also increased considerably since 2003, ranging between 3,000 t and 9,000 t in recent years.

- Main fleets (i.e., highest catches in recent years):

  In recent years nearly three-quarters of the total catches of albacore in the Indian Ocean are accounted for by Taiwan,China and Indonesia, followed by Japan – with the majority of catches reported by fresh-tuna longline, and deep-freezing fisheries (**Fig.2**).

- Main fishing grounds:

  While most of the catches of albacore have traditionally come from the southwest Indian Ocean (i.e., South of 20°S), in recent years a larger proportion of the catch has come from the southern and eastern Indian Ocean (**Table 2; Figs.4, 6 & 7**). 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 which has led to an increased contribution of albacore to the total catches of some longline fleets.

  Offshore gillnet vessels from I.R. Iran and Pakistan, as well as gillnet-longline vessels from Sri Lanka have extended their area of operation in recent years, and are now thought to operate on the high seas closer to the equator. However the lack of catch-and-effort data from these fleets makes it difficult to assess whether they are operating in areas where catches of juvenile albacore are likely to occur.

- Retained catch trends:

  Between the early 1960s until the mid-1980s, catches of albacore remained relatively stable at around 15,000 – 20,000 t, except for high catches recorded in 1973 and 1974 (**Table 1, Fig.3**). From the mid-1980s catches increased markedly due to the use of drifting gillnets by Taiwan,China, with total catches over 30,000 t, mostly targeting 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 Taiwanese drifting gillnet fleet, catches dropped to less than 21,000 t by 1993 (**Fig.5**).

From 1993 catches increased to 46,000 t (in 2001) – the year in which the highest catches of albacore were reported – mostly as a result of increased fishing effort by the Taiwanese deep-freezing longline fleet. Since 2001, catches have been almost exclusively taken by deep-freezing longlines and fresh-tuna longlines.

- Discard levels**:** are thought to be very low, although estimates of discards are unknown for most fisheries.

TABLE 1. Albacore: Best scientific estimates of the catches of albacore by gear and main fleets (or type of fishery) by decade (1950s–2000s) and year (2008–2017), in tonnes. Catches by decade represent the average annual catch. Data as of December 2018.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
DN				5,823	3,735		0	0	0	0	0	0	0	0	0	0
LL	3,715	17,313	17,136	15,602	22,992	21,350	13,043	13,971	20,211	12,318	9,858	9,494	15,539	12,862	12,215	14,370
FLL			80	314	1,309	11,702	19,332	21,662	21,380	18,361	20,547	21,528	21,234	21,148	22,068	22,749
PS				194	1,682	912	1424	392	207	725	1,297	501	534	535	433	438
OT	20	33	94	485	754	1,375	2,091	2,181	2,337	2,498	1,654	1,168	1,108	1083	1,013	1,156
Total	**3,736**	**17,347**	**17,310**	**22,417**	**30,472**	**35,339**	**35,890**	**38,205**	**44,135**	**33,902**	**33,355**	**32,691**	**38,414**	**35,628**	**35,729**	**38,713**

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 by (stock assessment) fishing area by decade (1950s–2000s) and year (2008–2017), in tonnes[5]. Data as of December 2018.

	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1-NORTHWEST	1,092	5,453	4,720	3,488	5,472	7,162	4,255	6,582	10,353	7,824	7,320	9,449	8.275	6,177	6,406	7,865
2-NORTHEAST	2,292	3,010	3,607	2,918	3,972	7,537	13,371	6,996	9,934	5,910	4,750	2,920	2,520	3,025	2,116	2,432
3-SOUTHWEST	250	7,255	6,782	6,421	10,932	10,543	7,103	11,911	8,547	9,522	9,004	12,005	15,129	15,291	17,806	18,035
4-SOUTHEAST	101	1,629	2,201	9,591	10,096	10,097	10,811	12,716	15,301	10,647	12,281	8,317	12,491	11,135	9,402	10,381
Total	**3,736**	**17,347**	**17,310**	**22,417**	**30,472**	**35,339**	**35,890**	**38,205**	**44,135**	**33,902**	**33,355**	**32,691**	**38,414**	**35,628**	**35,729**	**38,713**

Areas: 1-NORTHWEST (North of 25S, West of 75 E); 2-NORTHEAST (North of 25S, East of 75 E); 3-SOUTHWEST (South of 25S, West of 75 E); 4-SOUTHEAST (South of 25S, East of 75 E)

[5] Catches exclude a small number of (artisanal) fisheries that were not included due to the paucity of information available in the IOTC database.

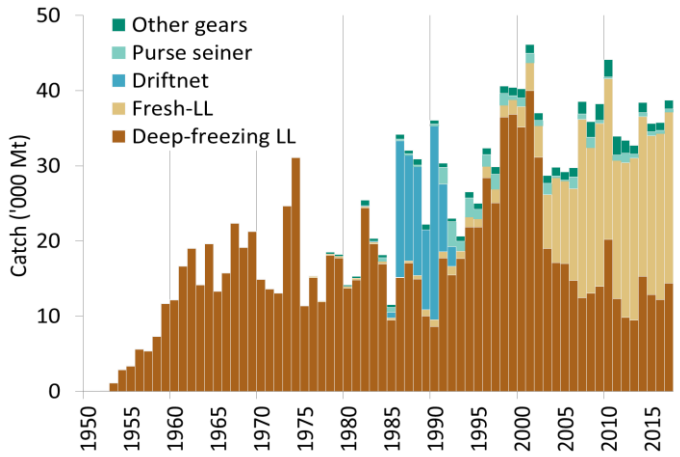


Fig.3. Albacore: catches by gear. Driftnet (DN; Taiwan,China); Freezing-longline (LL); Fresh-tuna longline (FLL); Purse seine (PS); Other gears NEI (OT).

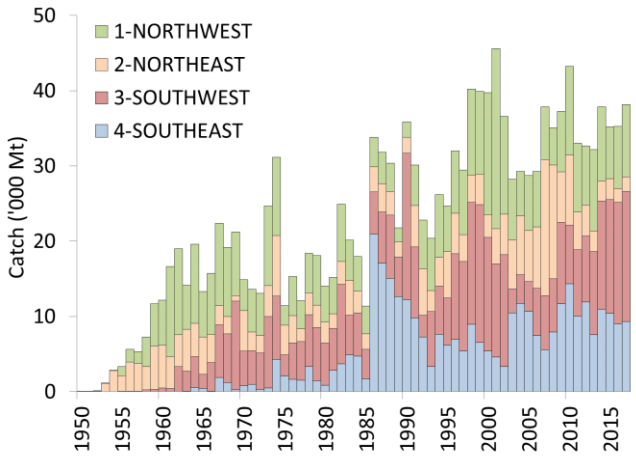


Fig.4. Albacore: catches recorded in Stock Assessment Areas.

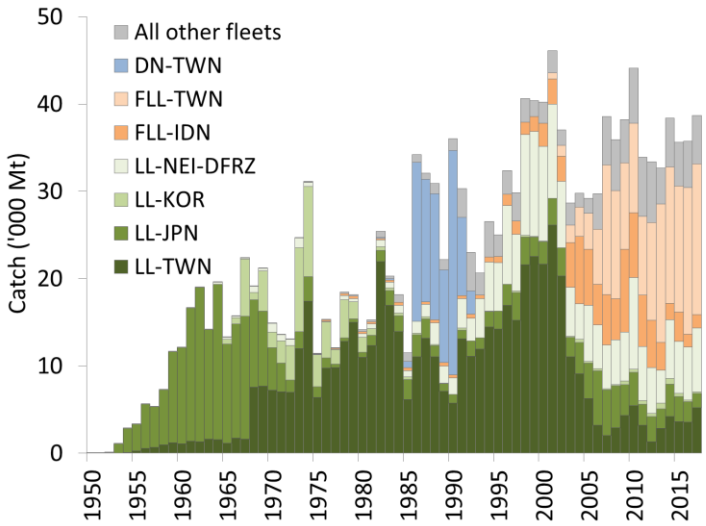


Fig.5. Albacore: Catches by fleet recorded in the IOTC Database (1950–2018). Data as of December 2018.

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).

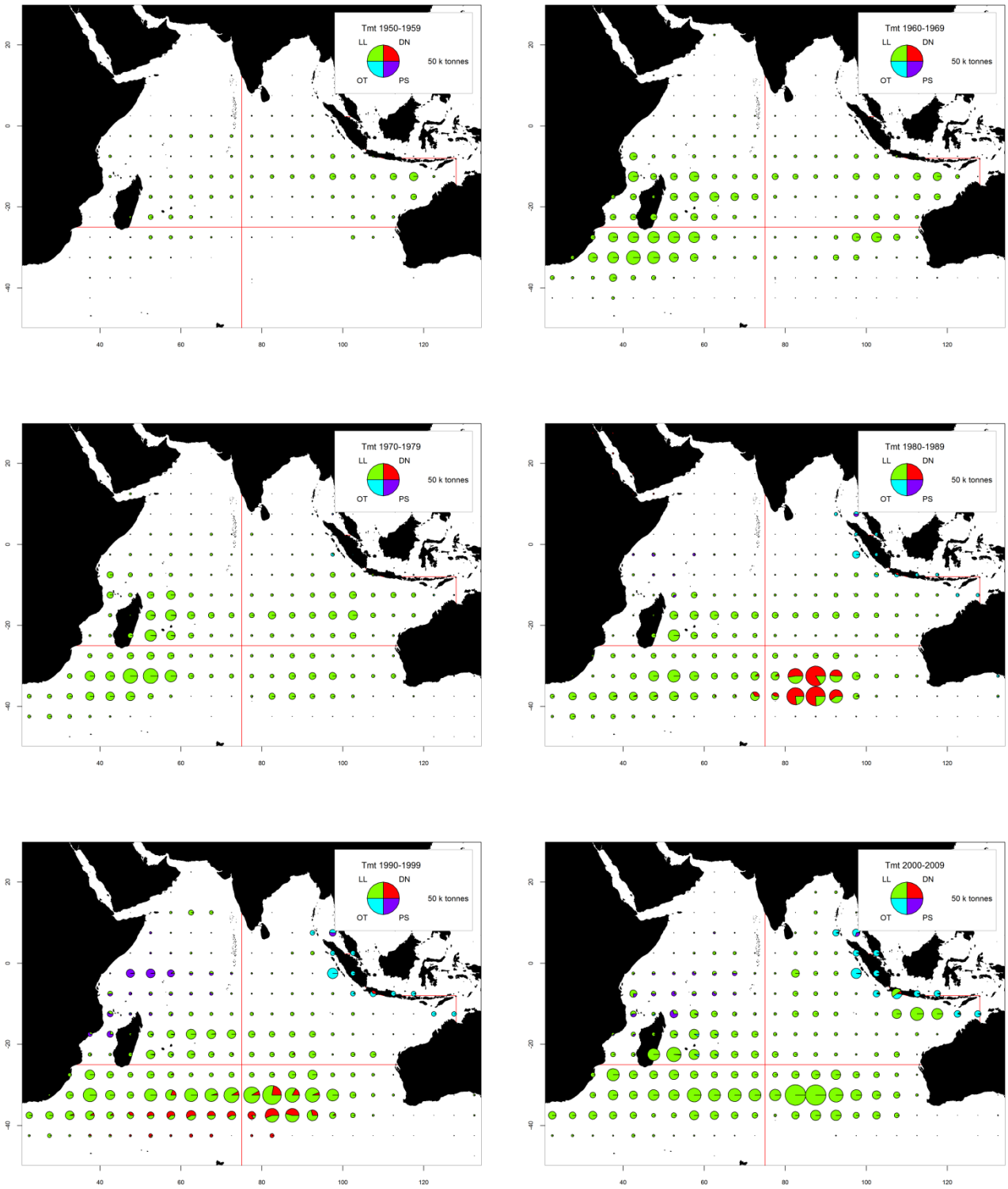


Fig.6a–f. Albacore: Time-area catches (total combined in tonnes) of albacore estimated for the period 1950-2009, by decade and type of gear. Albacore stock assessment areas shown in red.

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 June 2016. Source: Catch-and-effort, raised to total nominal catches.

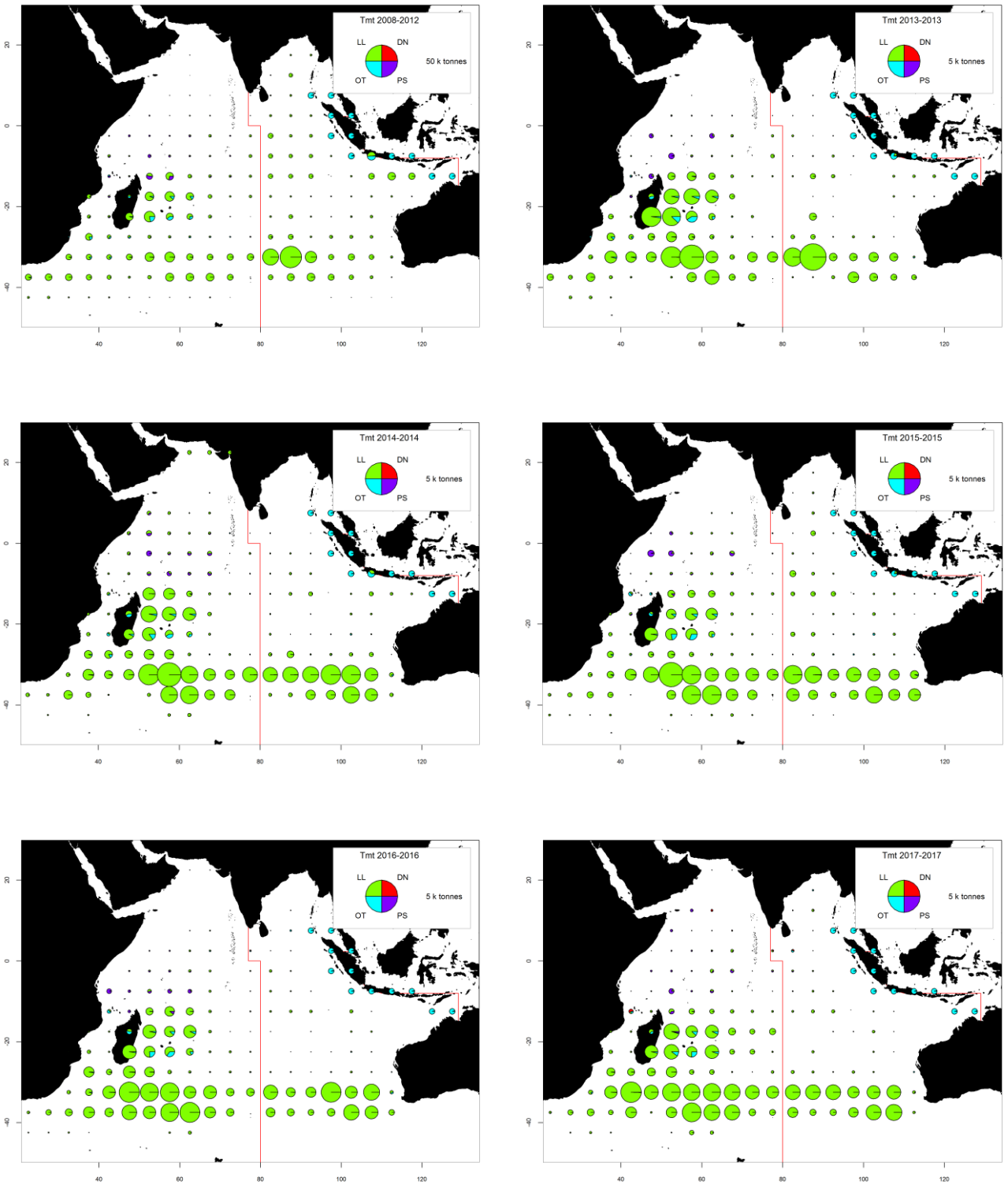


Fig.7a–f. Albacore: Time-area catches (total combined in tonnes) of albacore estimated for the period 2008–12 by type of gear and for 2013–17, by year and type of gear. Albacore stock assessment areas shown in red.

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 June 2016. Source: Catch-and-effort, raised to total nominal catches.

- Discard levels: are thought to be low, although they are unknown for industrial fisheries other than European (EU) purse seiners (2003–07).

***Changes to the catch series*:** there have been no major changes to the estimates of total catches of albacore tuna since the WPTmT meeting in 2016.

Albacore tuna – Catch-per-unit-effort (CPUE) trends

- Availability: Standardized catch-and-effort series are available from the various industrial fisheries (see below). Nevertheless, catch-and-effort reported to the IOTC Secretariat are not available from some fisheries or are considered to be of poor quality, especially during the last decade, for the following reasons (**Fig. 8d-f**):
    i. uncertain data from significant fleets of longliners, including: India, Indonesia, Malaysia, Oman, and Philippines;
    ii. no catch-and-effort data for fresh-tuna longliners flagged as Taiwan,China, from 1990 (i.e., the start of the fishery) up to 2009;
    iii. non-reporting by industrial purse seiners and longliners (NEI).
- Main CPUE series available: Rep. of Korea (longline), Japan (longline), Taiwan,China (longline).

Albacore tuna – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Average fish weight: In general, the amount of catch for which size data is available for albacore before 1980 is very low (**Fig. 8g-i**). The deep-freezing longline fleets account for the majority of size data for albacore in the IOTC database. Size data are also available for industrial purse seiners flagged in EU countries and the Seychelles, however few data are available for all other fleets.

  Average fish weights can be assessed for several industrial fisheries although they are incomplete or of poor quality due to the issues identified below:

  i. Tawain,China longliners: size frequency data is available for the period 1980–2014. However, the length distributions of albacore available for Taiwan,China since 2003 are different than compared to earlier years (**Fig. 9**). Since 2003 higher average weights derived from length data have also been reported, compared to average weights from catch-and-effort (for the same time-periods and areas), which suggests changes in the sampling protocols of specimens measured for lengths – particularly the proportion of smaller sized fish measured for lengths.
  ii. Japan longliners: data for the Japanese longline fleet is available; however, the number of specimens measured per stratum has been decreasing since the early-1990s.

- Catch-at-Size(Age) table: are available but estimates are highly uncertain for some periods and fisheries, including:
    i. 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;
    ii. no size samples from the driftnet fishery of Taiwan,China over the entire fishing period (1982–92);
    iii. lack of size data for some industrial fleets (Taiwan,China (fresh longline), NEI, India, Indonesia, and NEI fleets).

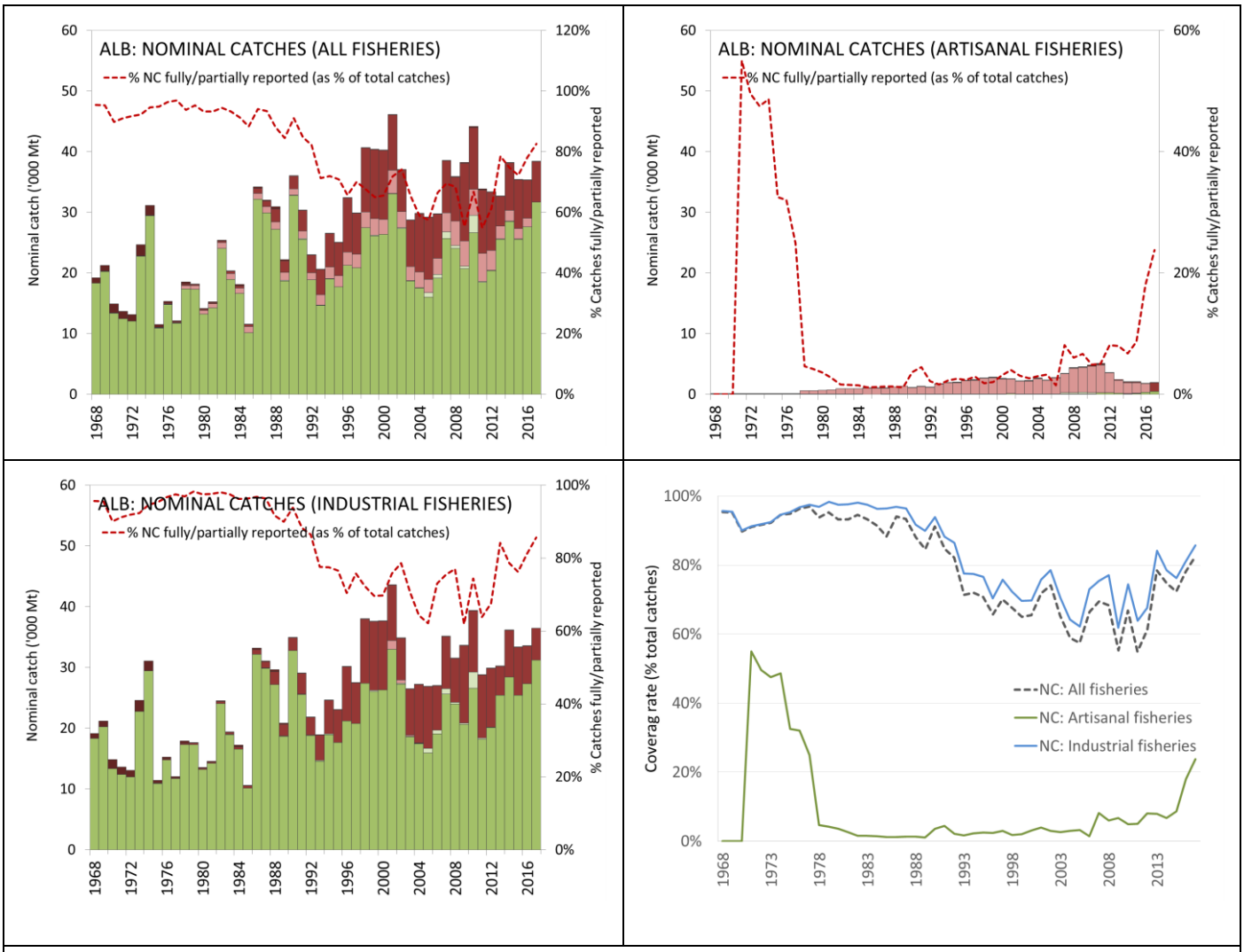


Fig. 8a-c. Albacore tuna: nominal catches data reporting coverage (1968–2017). Data as of December 2018.

Data reporting scores:

	0
	2
	4
	6
	8

Each IOTC dataset (nominal catch, catch-and-effort, and size data) are assessed against IOTC reporting standards, where:

- **Score: 0** indicates the amount of nominal catch associated with each dataset fully reported according to IOTC standards.
- **Score: 2 – 6** indicates the amount of nominal catches associated with each dataset partially reported by gear and/or species (i.e., adjusted by gear and species by the IOTC Secretariat or for any of the other reasons provided in the document).
- **Score: 8** indicates the amount of nominal catches associated that is fully estimated by the IOTC Secretariat (i.e., nominal catches) or data that is not available (i.e., catch-and-effort or size data).

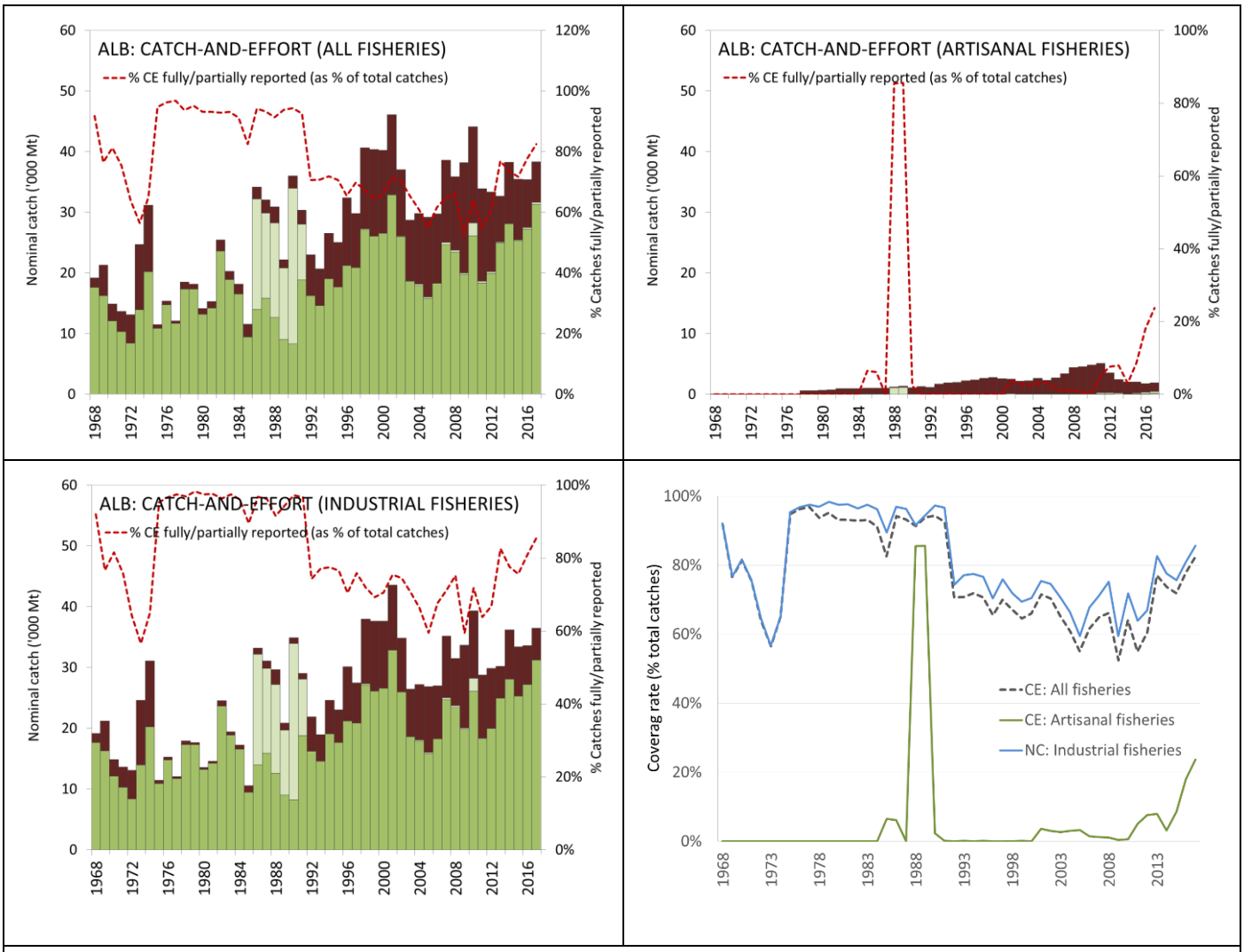


Fig. 8d-f. Albacore tuna: catch-and-effort data reporting coverage (1968–2017). Data as of December 2018.

Data reporting scores:

	0
	2
	4
	6
	8

Each IOTC dataset (nominal catch, catch-and-effort, and size data) are assessed against IOTC reporting standards, where:

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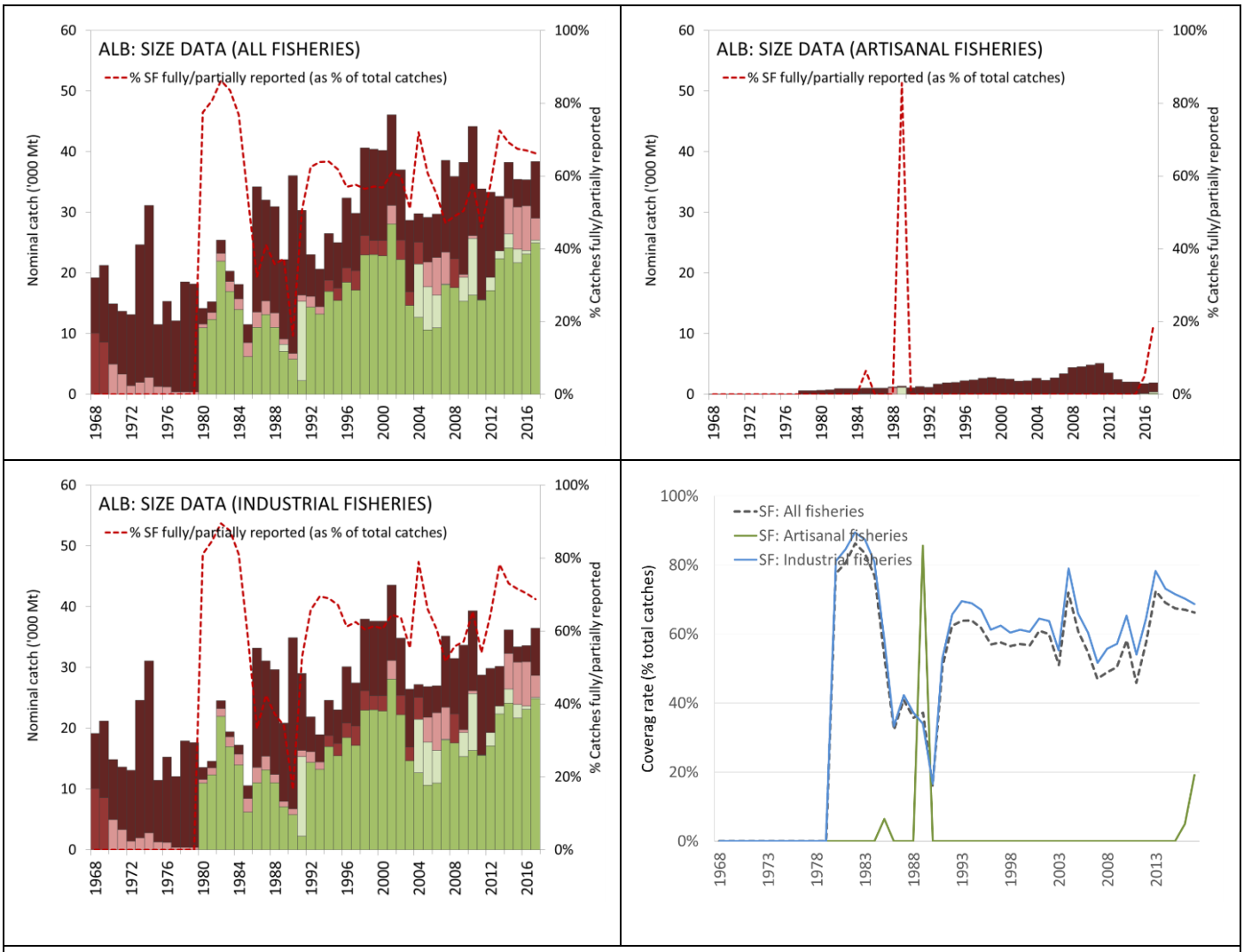

Fig. 8g-i. Albacore tuna: size frequency data reporting coverage (1968–2017). Data as of December 2018.

Data reporting scores:

	0
	2
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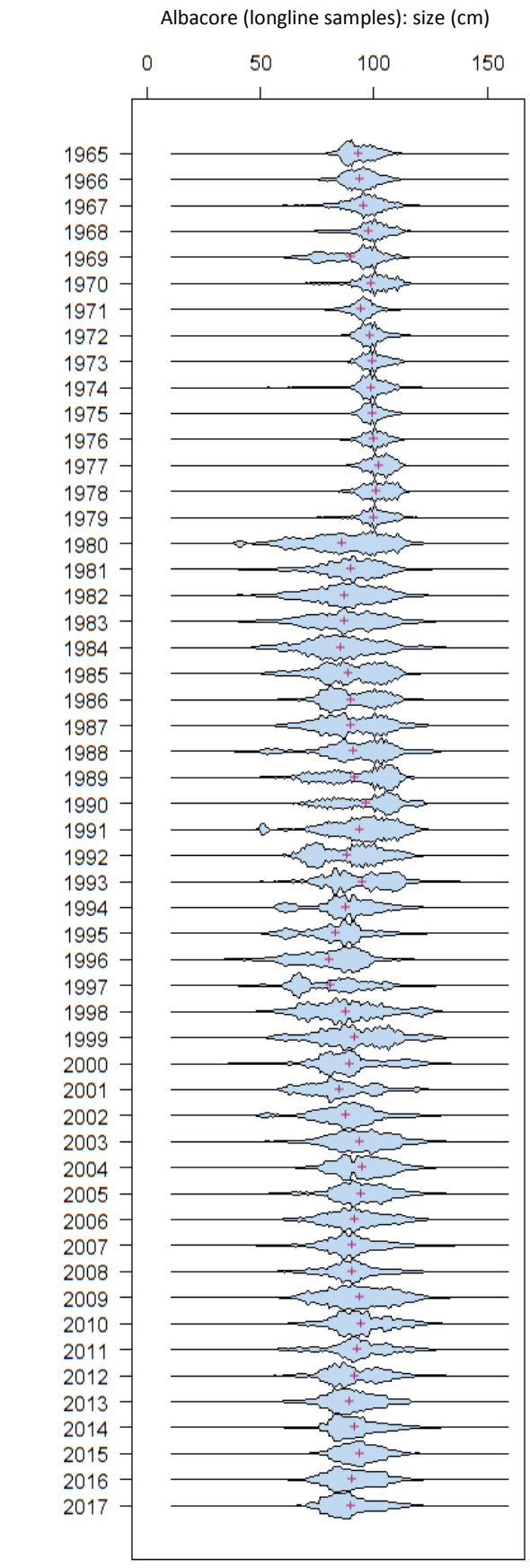


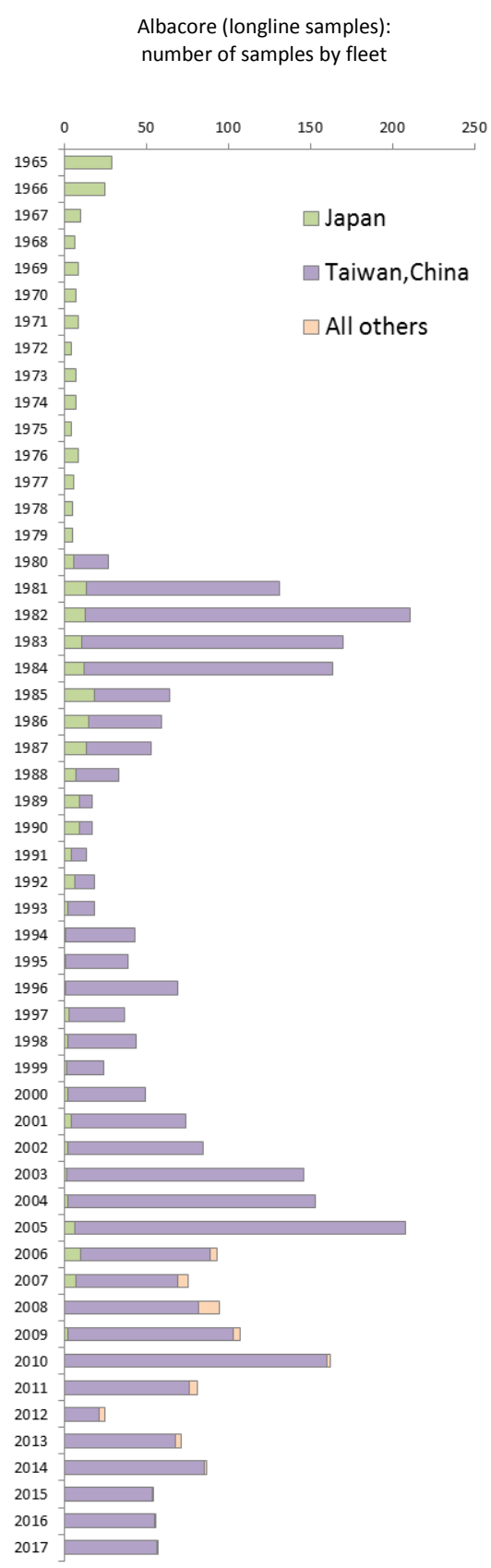


Fig. 9: **Left:** Albacore: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for freezing longline fisheries, by year.

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

SECTION 2: SUMMARY OF DATA ISSUES RELATED TO THE STATISTICS OF ALBACORE TUNA REPORTED TO THE IOTC

The following section provides a summary of the main issues that the IOTC Secretariat considers to negatively affect the quality of the statistics available at the IOTC for albacore tuna, by type of dataset.

Albacore tuna: estimation of total catches – data related issues

1. Nominal (retained) catches

Retained catches are considered to be fairly reliable until the early-1990s (**Fig. 8a-c**); since then the quality of catch estimates since then has been compromised due to poor catch reports from some fleets, in particular:

- Fisheries of Indonesia: Catches of albacore tuna for the fisheries of Indonesia – including fresh-tuna longliners and deep-freezing longliners and coastal fisheries – are estimated to account for around 20% of the total catches of albacore in the Indian Ocean in recent years (**Fig.2**). However the quality of the catch estimates is generally considered to be of relatively low quality.

  Following a recommendation from the IOTC Scientific Committee, in 2013 the Directorate General for Capture Fisheries of Indonesia (DGCF) and the IOTC Secretariat reviewed the estimates of albacore catches for Indonesia[6]. As a result of the review Indonesia submitted a revised catch series for albacore for the most recent years. While the new estimates are considered more reliable than previous catches reported by DGCF, the lack of catch-and-effort data available for the longline fishery data and issues with the monitoring of albacore landings in Indonesia compromises the ability of DGCF (and the IOTC Secretariat) to validate the new estimates which are still considered to be uncertain.

  Large fluctuations in total catches of albacore continued to be reported by Indonesia to the IOTC Secretariat, in addition to relatively large revisions between provisional and final catch estimates. The number of active longline vessels reported by Indonesia in previous years also remains highly uncertain, particularly prior to 2013. In 2018 the IOTC Secretariat revised the methodology for estimating the catches of Indonesia's fresh longline fleet, in collaboration with Indonesia. While catches for the most recent years are considered more reliable, catch estimates prior to 2013 continue to remain highly uncertain.

- Malaysia (longliners): In previous years, Malaysia has reported incomplete catches of albacore for its longline fleet, as monitoring of the fishery by Malaysia did not include the large component of the longline fleet that is based in ports outside Malaysia (e.g., in particular unloadings of albacore in Port Louis, Mauritius). In recent years Malaysia has reported around 5 longliners in the Indian Ocean, while catches of albacore range between nil and 2,000 t for the same period. To compensate the under-reporting of catches, an additional 500–2,000 t of albacore have been estimated in previous years for Malay longliners not based in Malaysia, unloaded in foreign ports (with catches instead reported as NEI longline fleet).

- Other longline fleets (e.g., India, Oman, and Philippines)**:** The catches of albacore for the longline fisheries of India, Oman, and Philippines appear to be only partially reported (i.e., compared to the number of active vessels operating), with current estimates accounting for 3% of the total catches of albacore in the Indian Ocean in recent years.

- Non-reporting industrial longliners (NEI): catches from longliners operating under flags of non-reporting countries (e.g., Malaysia, foreign unloadings) have been estimated by the IOTC Secretariat. While the catches were moderately high during the 1990s, they have not exceeded 3,000 t in recent years.

- Taiwan,China (fresh-tuna longliners): catches of albacore estimated for the fresh-tuna longline fishery of Taiwan,China are only available from 2001 onwards. Prior to 2001, catches for the Taiwanese fleet remain relatively uncertain.

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

- Indonesia (all fisheries): no catch-and-effort has been reported by Indonesia's industrial longline fishery. In 2015 an IOTC-OFCF mission was conducted to assist Indonesia with the reporting of catch-and-effort data, however to date, no information has been received. Submission of logbook data to DGCF also remains very low – at less than 10% for some years – raising concerns over the level of coverage.

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

- Taiwan,China (fresh-tuna longliners): catch-and-effort data for this fishery is only available since 2010, compared to nominal catches from 2001. Estimates of total catches, and time-area catches, prior to these periods therefore remains highly uncertain.
- Longline fisheries of India, Malaysia, Oman, and Philippines**:** Although catch-and-effort data are available for some of these fleets, they are usually incomplete and fall short of the IOTC data reporting standards of Resolution 15/02.

3. Size data from all Fisheries:

- Driftnets of Taiwan,China: No size data available over the entire period of activity of the fishery (1982–92).
- Indonesia (fresh-tuna longliners): has only reported size data for its fresh-tuna longline fishery for a limited number of years, during the mid-2000s. However samples, where available, cannot be fully disaggregated by month and fishing area (5x5 grid) and refer mostly to the component of the catch that is unloaded fresh. For this reason, the quality of the samples in the IOTC database are considered low quality.
- Taiwan,China (deep-freezing longliners): size data is available for the period 1980–2014. However, the length distributions of albacore available since 2003 are different than compared to earlier years. In addition, since 2003 higher average weights derived from length data have also been reported, compared to average weights from catch-and-effort (for the same time-periods and areas), which suggests changes in the sampling protocols of specimens measured for lengths – particularly the proportion of smaller sized fish measured for lengths.

  In 2010, the IOTC Scientific Committee noted several issues concerning the reliability size frequency statistics available for Japan and Taiwan,China, and which remain unresolved. In 2013 the IOTC Secretariat presented a paper to the Working Party on Tropical Tunas documenting the current data quality issues and inconsistences between the length frequency data and catch-and-effort reported in particular by Taiwan,China since the mid-2000s[7]. A consultancy has been planned for 2019 to address a number of longstanding issues with the longline size data – with an update to be provided at subsequent WPTmT meetings.
- Taiwan,China (fresh-tuna longliners): size data of albacore has been provided since 2010, however the levels of coverage remain very low, and well below the minimum sampling coverage recommended by the IOTC (1 fish per Mt of catch).
- Japan (deep-freezing longliners): data for the Japanese longline fleet is available; however, the number of specimens measured per stratum has been decreasing since the early-1990s, and since 2000 the number of samples has been very low.
- Longline fisheries of India, Malaysia, Oman, and Philippines**:** To date, none of these countries have reported size frequency data of albacore.

***4. Biological data*:**

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

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

The estimates of catches of non-reporting fleets were updated by the IOTC Secretariat in 2018 (for 2017 catches). The high number of non-reporting fleets operating in the Indian Ocean since the mid-1980's has led to a large increase in the amount of catch that needs to be estimated by the IOTC Secretariat. 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

[7] See IOTC Secretariat, IOTC-2013-WPTT15-41 Rev_1, for more details.

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. 10): The catches by large longliners from several non-reporting countries[8] were estimated using IOTC vessel records and the catch data from Taiwan,China, Japanese or Spanish longliners, on the assumption that most of the vessels operate in a way similar to the longliners from these countries. 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. However 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.

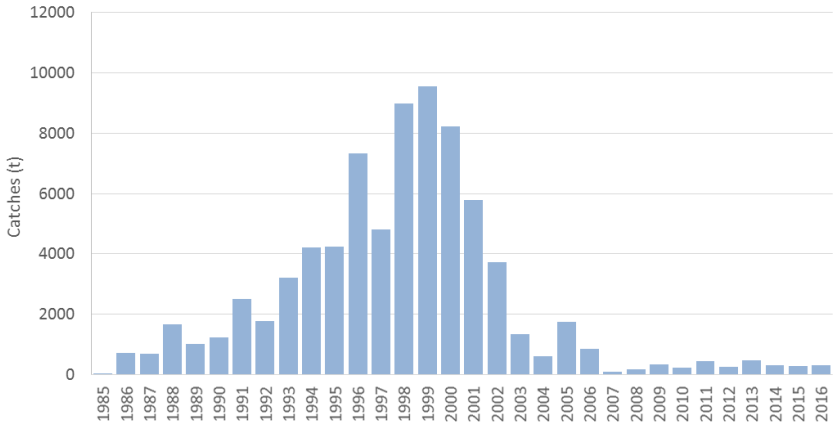


Fig. 10. Albacore: Catches of NEI deep-freezing longline vessels in the Indian Ocean estimated in 2018 (1973–2016).

- **Fresh tuna longline**: 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 four sources:

    1. Catches reported from the flag countries: Although China reported total catches for its longline fleet, before 2006 catches were not reported by gear (i.e., 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.
    2. 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 Project[9] 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).
    3. 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

[8] For example Bolivia, Togo, Honduras, Equatorial Guinea, Tuvalu, Mongolia, Cambodia, Kiribati, plus countries like Belize, Indonesia, Oman, Tanzania which are considered to under report catches.

[9] Overseas Fisheries Cooperation Foundation of Japan

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.

4. Market data, including exports of frozen Albacore recorded in Indonesia and imports of Albacore for canning, provided through ISSF (from 2008 to date). These data are used to compare with the catches reported by Indonesia and Malaysia.

In 2006 Taiwan,China provided total catches for its longline tuna fleet operating in the Indian Ocean for the period 2001 to 2005. Since then, Taiwan,China has provided catches regularly on an annual basis. The catches provided by Taiwan,China are higher than those previously estimated by the IOTC Secretariat for most years, which were replaced in the IOTC database. The rationale for replacing the catch estimates was 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 IOTC estimates.

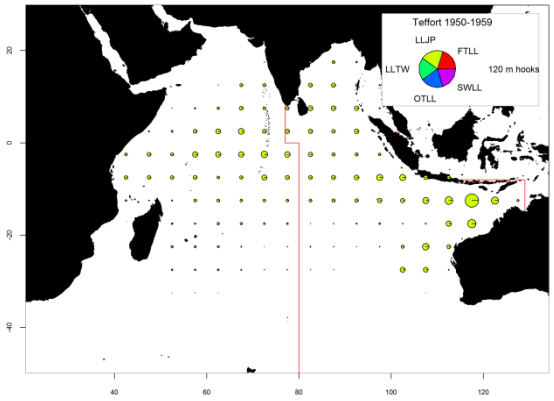
APPENDIX I

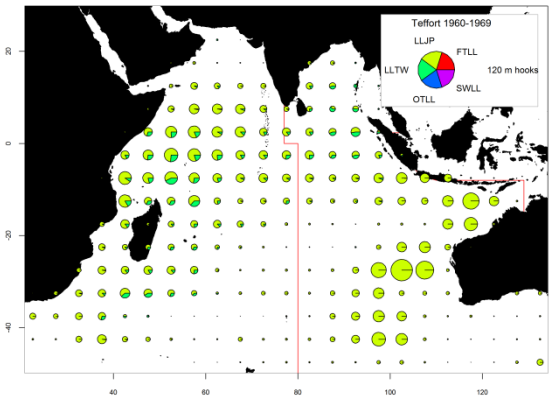
REVIEW OF FISHERIES TRENDS FOR MAIN FISHERIES

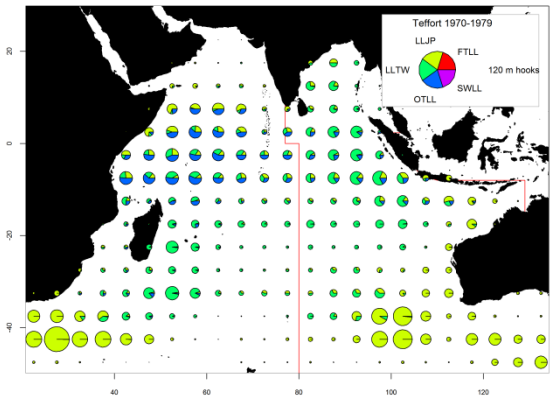
1. EFFORT

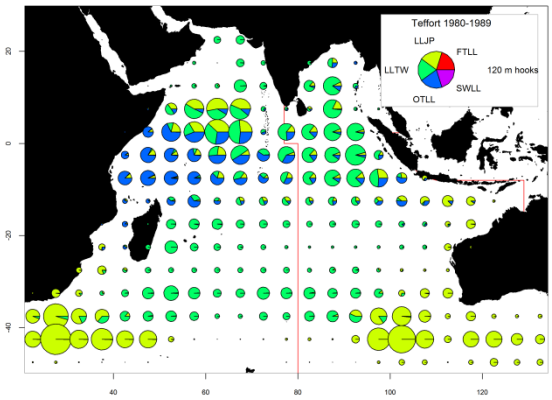
a) Longline

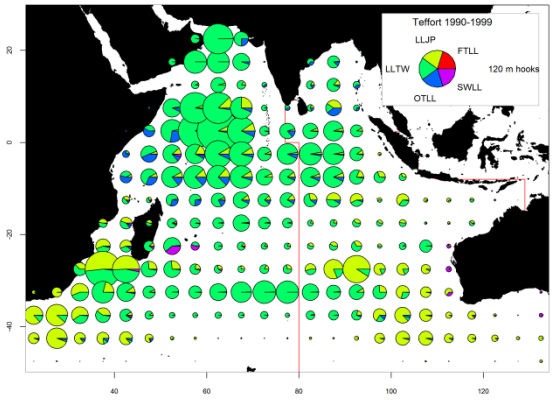
Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, by decade and main fleet:
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles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

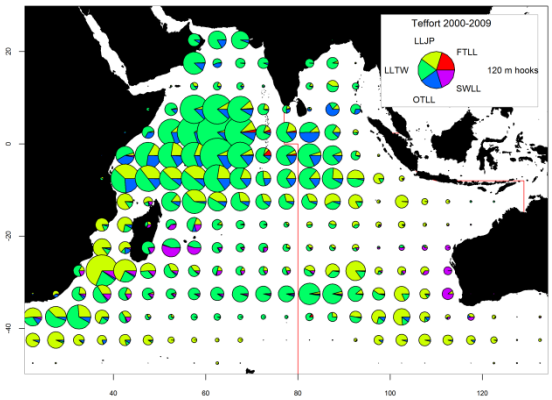












Effort exerted by LONGLINE fleets in the Indian Ocean, in millions (M) of hooks set, and main fleet for 2006-2010, and 2012 to 2016:

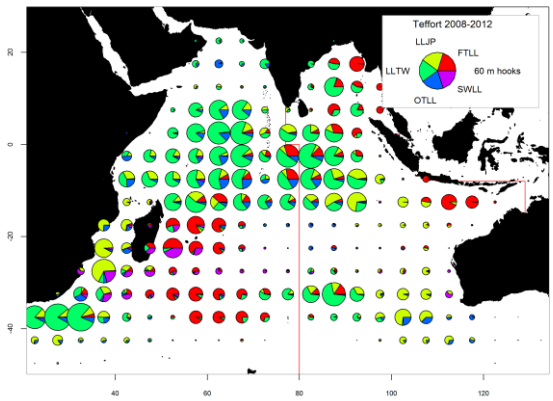
LLJP (light green): deep-freezing longliners from Japan

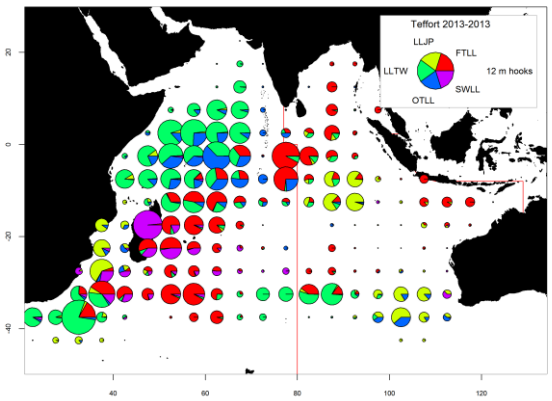
LLTW (dark green): deep-freezing longliners from Taiwan,China

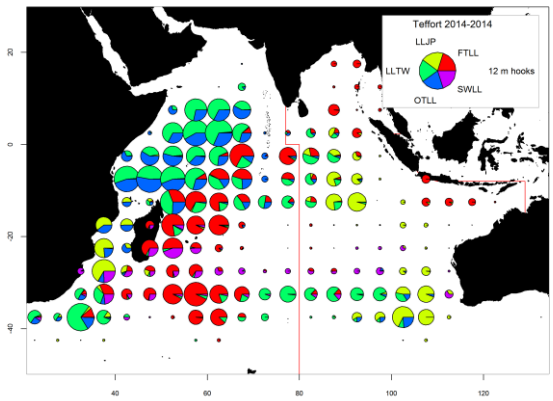
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)

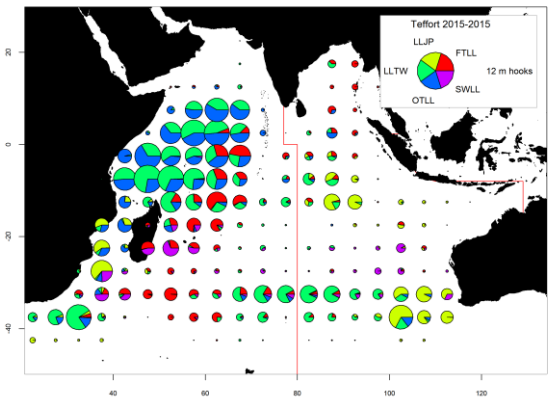
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)

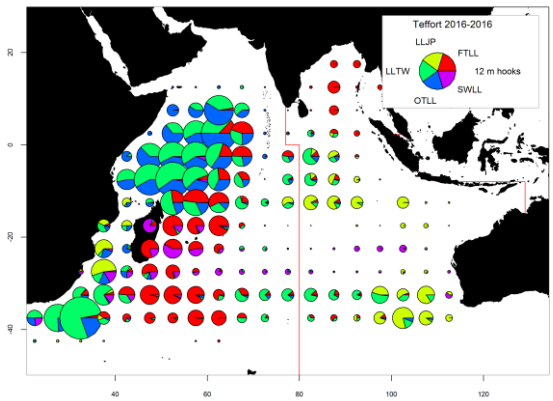
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, South Korea and various other fleets)

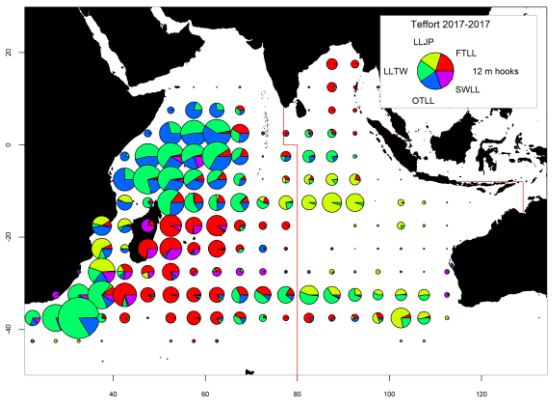






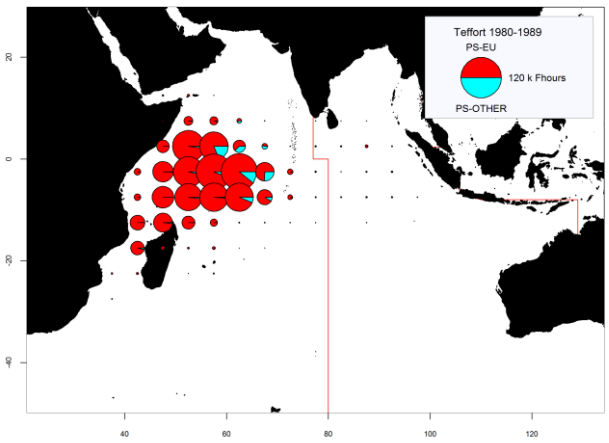


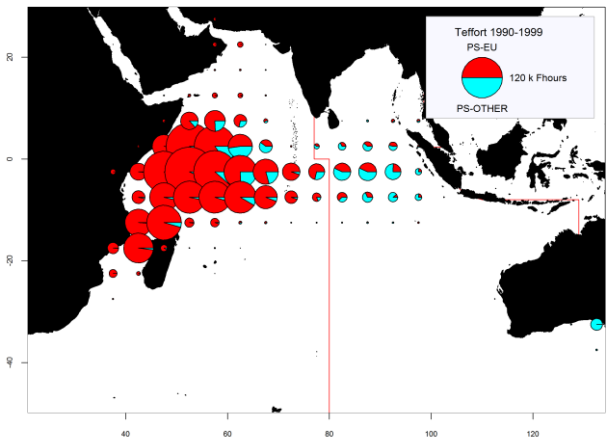


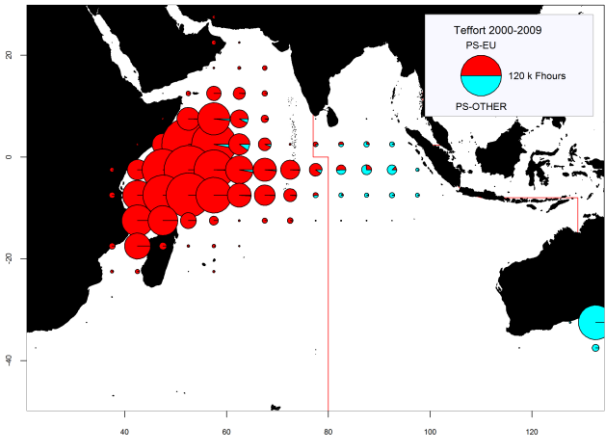


Purse seine

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)
Source: IOTC Catch-and-effort





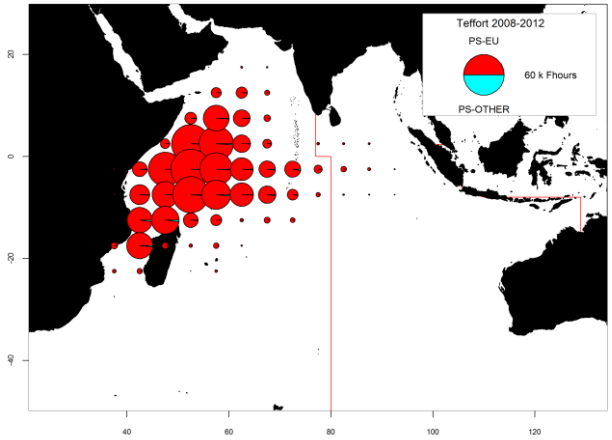


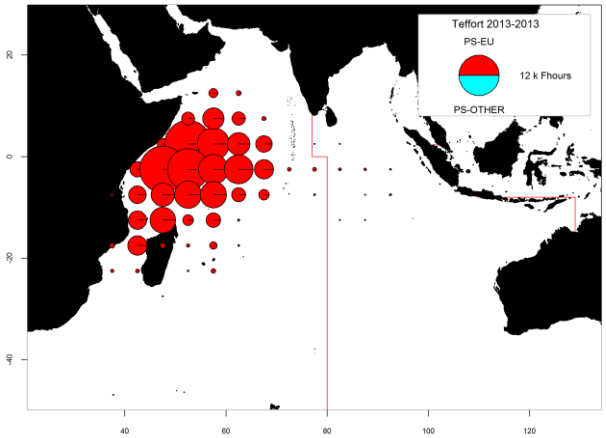
Effort exerted by industrial PURSE SEINE fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), for 2008-12 and 2013-17, by year, and main fleet:

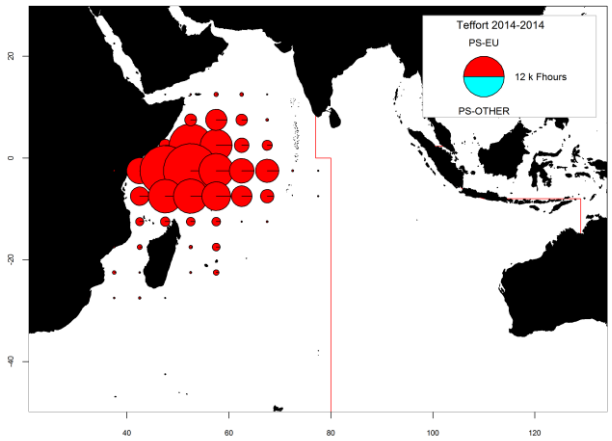
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)

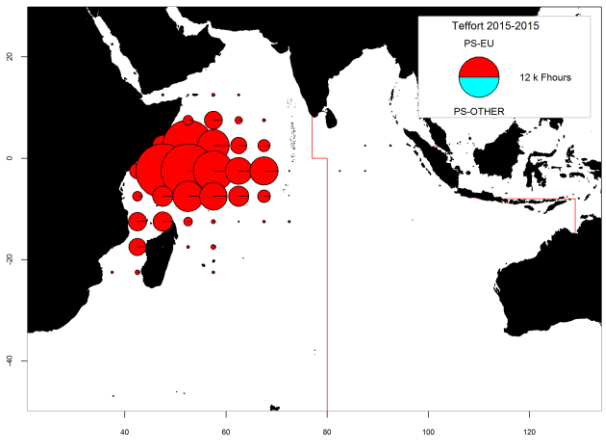
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin)

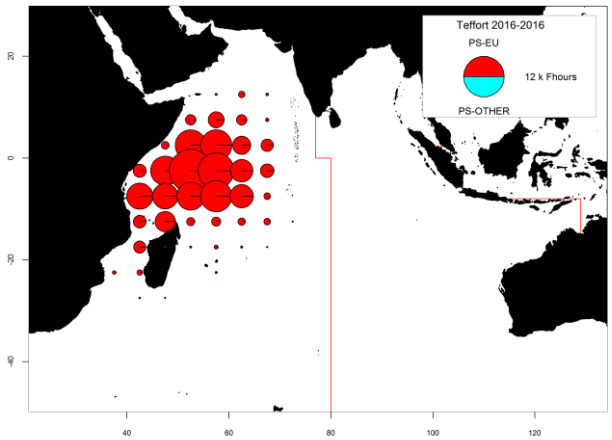
(excludes effort data for purse seiners of Iran and Thailand, and days at sea recorded for Australia)

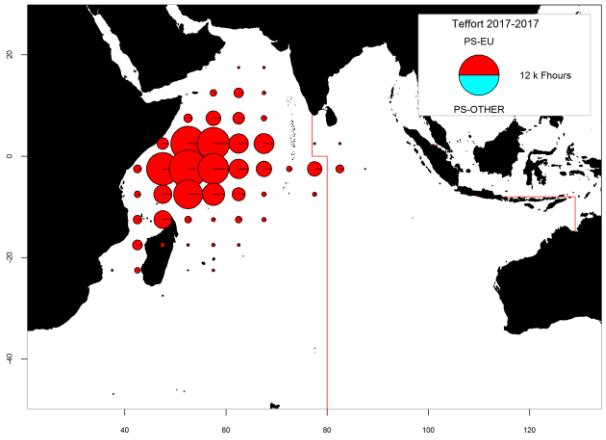








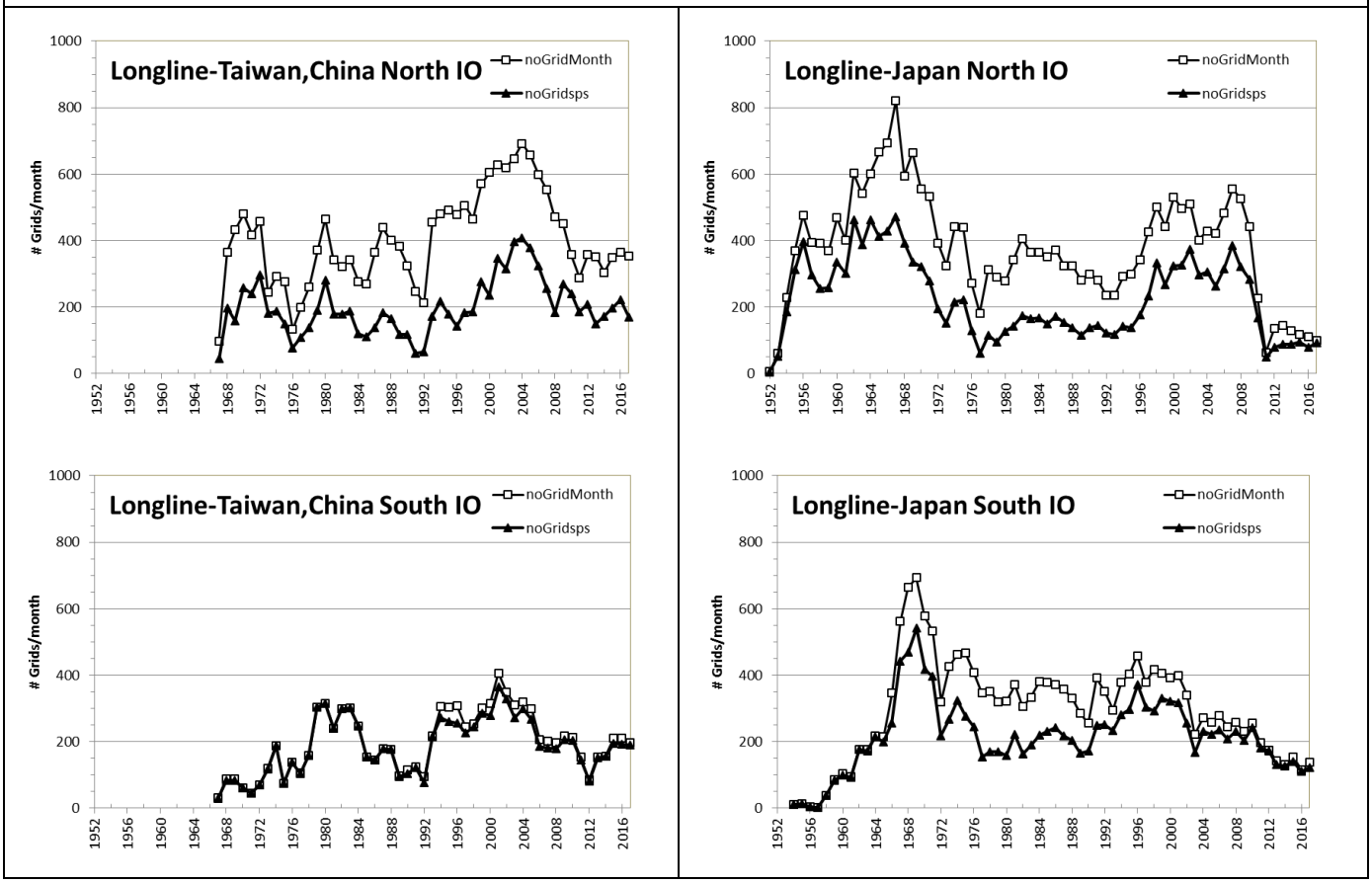




b) *Squares fished*

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 (1952 to 2017).

Data as of December 2018. Source: Catch and effort, IOTC database.

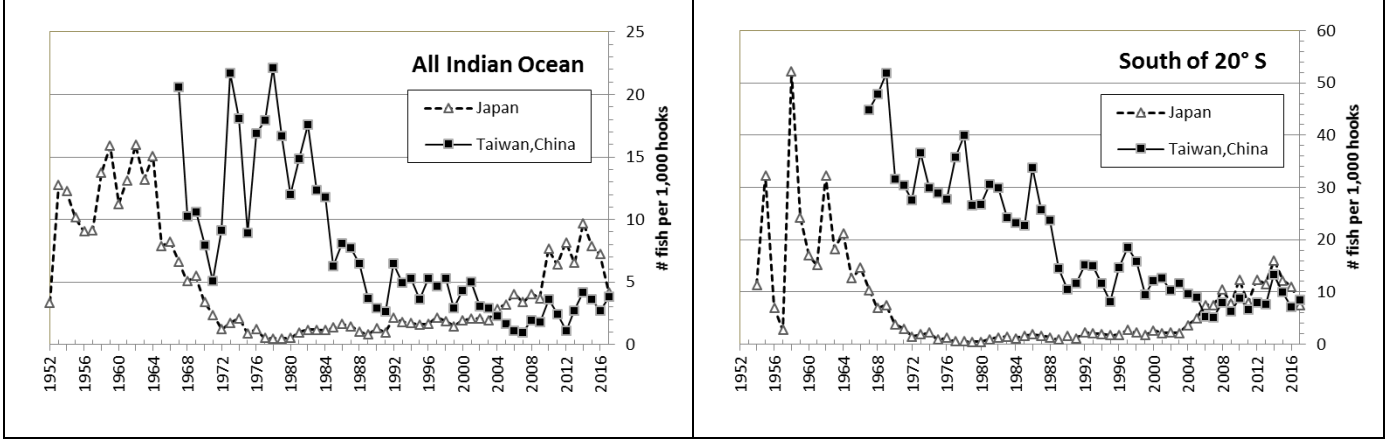


2. CATCHES & CATCH RATES

a. Catch rates

Nominal CPUE (number of fish/1000hooks) for longline fleets of Japan and Taiwan,China fishing in the Indian Ocean (1952 to 2017): All Indian Ocean (left) and Indian Ocean South of 20 degrees South (right).

Data as of December 2018. Source: Catch and effort, IOTC database.



b. Recent catches

Time-area catches (total combined in tonnes) of ALBACORE estimated for 2005-09 and 2010-14, by year, and quarter:

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

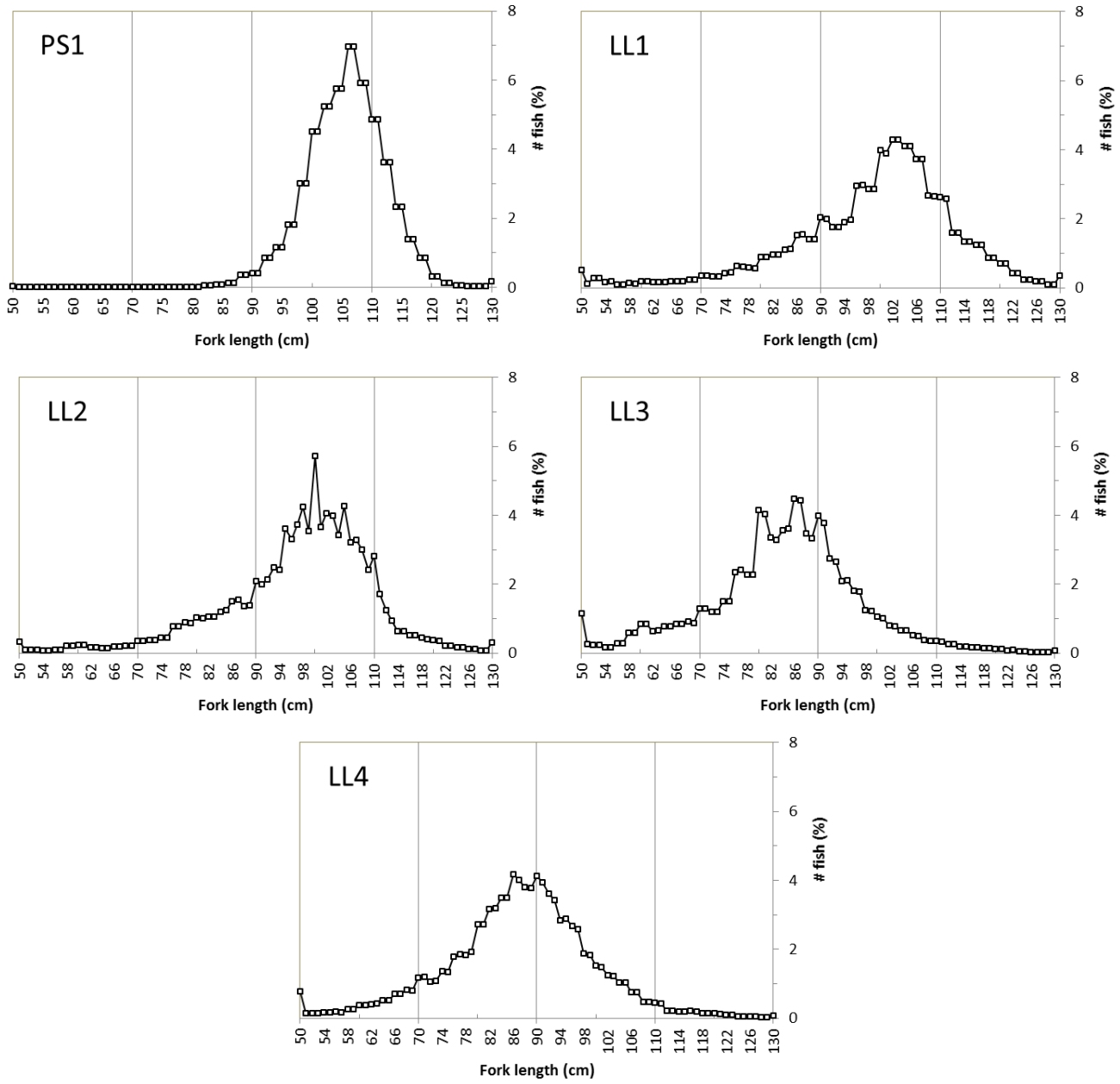
Purse seine (PS, blue): industrial tuna purse seiners from EU, Iran, I.R., Japan, Seychelles, Thailand and other fleets.

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.

Data as of December 2018. Source: Catch and effort (raised to total nominal catches)

3. AVERAGE WEIGHTS AND SIZE



Number of albacore by length class by fishery. Samples accumulated for 1950-2017, expressd as % of samples for each fishery. No samples available for vessels using driftnets (Taiwan,China, 1982-1992) or coastal fisheries (1950-2012)

Data as of December 2018. Source: Catch-at-size (raised size frequency data).