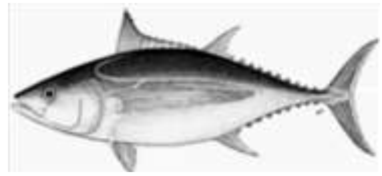
DRAFT: EXECUTIVE SUMMARY: ALBACORE

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi



Status of the Indian Ocean albacore (ALB: *Thunnus alalunga*) resource

TABLE 1. Albacore: Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area[1]	Indicators		2013 stock status determination
Indian Ocean	Catch 2012: Average catch 2008–2012:	33,960 t 37,082 t	
	MSY (80% CI)): F_{2010}/F_{MSY} (80% CI): SB_{2010}/SB_{MSY} (80% CI): SB_{2010}/SB_{1950} (80% CI):	33,300 t (31,100–35,600 t) 1.33 (0.9–1.76) 1.05 (0.54–1.56) 0.29 (n.a.)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

There remains considerable uncertainty about the relationship between abundance and the standardised CPUE series, and about the total catches over the past decade.

Stock status. Trends in the Taiwan,China CPUE series suggest that the longline vulnerable biomass has declined to about 29% of the level observed in 1950. There were 20 years of moderate fishing before 1980, and the catch has more than doubled since 1980. Catches have increased substantially since 2007, attributed to the Indonesian fishery although there is substantial uncertainty remaining on the catch estimates. It is considered that recent catches have been well above the MSY level, recent fishing mortality exceeds F_{MSY} (F_{2010}/F_{MSY} = 1.33). Spawning biomass is considered to be at or very near to the SB_{MSY} level (SB_{2010}/SB_{MSY} = 1.05) (Table 1, Fig. 1). Thus, the 2011 assessment indicated that the stock is **subject to overfishing**, but **not overfished** (Table 1). Fishing mortality needs to be reduced by at least 20% to ensure that spawning biomass is maintained at MSY levels (Table 2). Revisions to the catch history in 2013 indicated that reported landings in 2012 (33,960 t), and those from 2011 (33,605 t) are only slightly above the MSY estimates from the previous assessment.

Outlook. Maintaining or increasing effort in the core albacore fishing grounds is likely to result in further declines in albacore biomass, productivity and CPUE. The impacts of piracy in the western Indian Ocean has resulted in the displacement of a substantial portion of longline fishing effort into the traditional albacore fishing areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on albacore will decline in the near future unless management action is taken. The following key points should be noted:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- The two primary sources of data that drive the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- The lack of consistency in the data inputs to the analysis and the impacts of using different areas for each fleet on the CPUE standardisations, makes interpretation of the results difficult.
- The use of fine-scale versus aggregated data in the CPUE standardisations by fleet introduces substantial uncertainty.
- Current catches (average 37,802 t over the last five years, 33,960 t in 2012) exceed the MSY level (33,300 t, range: 31,100–35,600 t). Maintaining or increasing effort will result in further declines in biomass, productivity and CPUE.

- A Kobe 2 Strategy matrix was calculated to quantify the risk of different future catch scenarios, using the projections from the ASPM model (Table 2). The projections indicated that a minimum reduction in fishing mortality of 20% would be required to ensure that the stock does not move to an overfished state by 2020 (i.e. below SB_{MSY}) (Table 2).
- Provisional reference points: Noting that the Commission in 2012 agreed to Recommendation 12/14 *on interim target and limit reference points*, the following should be noted:
  - **Fishing mortality**: Current fishing mortality is considered to be well above the provisional target reference point of F_{MSY}, but below the provisional limit reference point of $1.4*F_{MSY}$ (Fig. 1; Table 3).
  - **Biomass**: Current spawning biomass is considered to be at or very near the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (Fig. 1; Table 3).

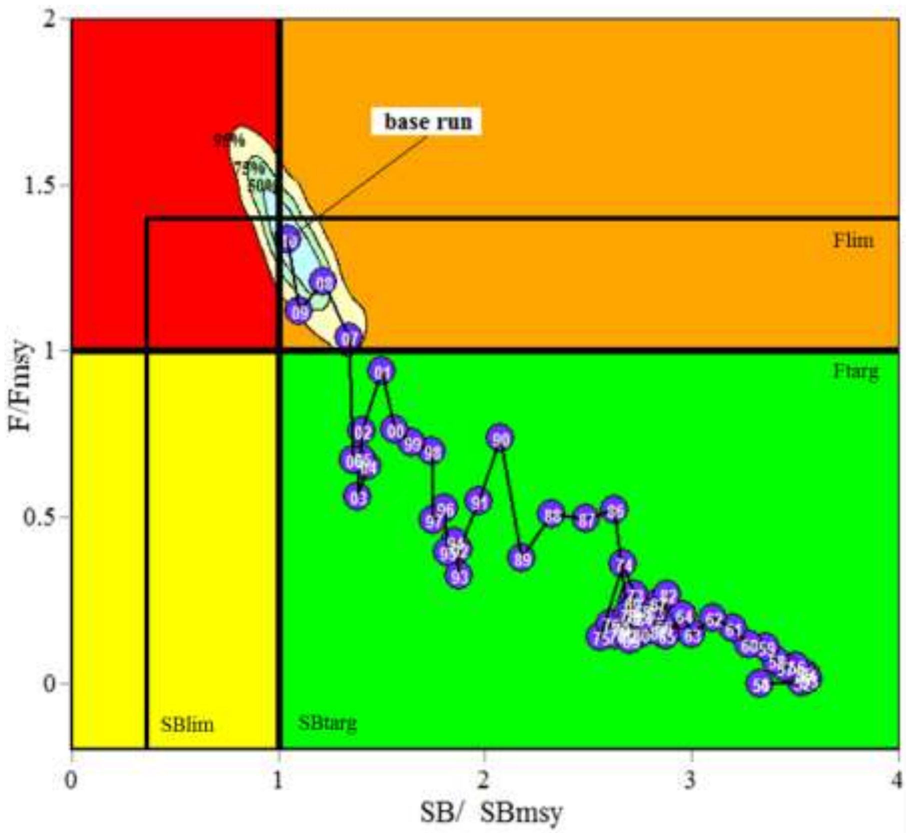


Fig. 1. Albacore: ASPM Aggregated Indian Ocean assessment Kobe plot (95% bootstrap confidence surfaces shown around 2010 estimate). Blue circles indicate the trajectory of the point estimates for the SB ratio and F ratio for each year 1950–2010. Target (Ftarg and SBtarg) and limit (Flim and SBlim) reference points are shown.

TABLE 2. Albacore: ASPM Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target reference points for nine constant catch projections (2010 catch level, ± 10% ± 20%, ± 30% and ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to 2010) and probability (%) of violating MSY reference points**								
	60% (25,749 t)	**70%** (30,041 t)	**80%** (33,332 t)	**90%** (38,624 t)	**100%** (42,915 t)	**110%** (47,207 t)	**120%** (51,498 t)	**130%** (55,790 t)	**140%** (60,081 t)
$SB_{2013} < SB_{MSY}$	<1	1	8	15	23	35	46	55	65
$F_{2013} > F_{MSY}$	<1	2	18	47	74	91	98	>99	>99
$SB_{2020} < SB_{MSY}$	<1	<1	12	40	69	90	>99	>99	>99
$F_{2020} > F_{MSY}$	<1	<1	20	67	94	>99	>99	>99	>99

TABLE 3. Albacore: ASPM Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based limit reference points for nine constant catch projections (2010 catch level, ± 10% ± 20%, ± 30% and ± 40%) projected for 3 and 10 years.

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$SB_{2013} < SB_{LIM}$	<1	<1	<1	<1	<1	<1	<1	<1	<1
$F_{2013} > F_{LIM}$	<1	<1	<1	7	26	53	75	89	97
$SB_{2020} < SB_{LIM}$	<1	<1	<1	<1	5	28	51	70	83
$F_{2020} > F_{LIM}$	<1	<1	<1	30	69	94	>99	>99	>99

SUPPORTING INFORMATION

(Information collated from reports of the Working Party on Temperate Tunas and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Albacore (*Thunnus alalunga*) in the Indian Ocean is currently subject to a number of Conservation and Management Measures adopted by the Commission:

- Resolution 13/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*
- Resolution 13/07 *concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information*
- Resolution 13/09 *on the conservation of albacore caught in the IOTC area of competence*
- Resolution 12/11 *on the implementation of a limitation of fishing capacity of Contracting Parties and Cooperating Non-Contracting Parties*
- Resolution 10/02 *mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*
- Resolution 10/08 *concerning a record of active vessels fishing for tunas and swordfish in the IOTC area*

FISHERIES INDICATORS

Albacore: General

Overall, the biology of the albacore stock in the Indian Ocean is not well known and there is relatively little new information on albacore stocks. Albacore (*Thunnus alalunga*) life history characteristics, including a relatively late maturity, long life and sexual dimorphism, make the species vulnerable to over exploitation. Table 4 outlines some of the key life history traits of albacore specific to the Indian Ocean.

TABLE 4. Albacore: Biology of Indian Ocean albacore (*Thunnus alalunga*)

Parameter	**Description**
Range and stock structure	A temperate tuna living mainly in the mid oceanic gyres of the Pacific, Indian and Atlantic oceans. In the Pacific and Atlantic oceans there is a clear separation of southern and northern stocks associated with the oceanic gyres that are typical of these areas. In the Indian Ocean, there is probably only one southern stock, distributed from 5°N to 40°S, because there is no northern gyre. Albacore is a highly migratory species and individuals swim large distances during their lifetime. It can do this because it is capable of thermoregulation, has a high metabolic rate, and advanced cardiovascular and blood/gas exchange systems. Pre-adults (2–5 year old albacore) appear to be more migratory than adults. In the Pacific Ocean, the migration, distribution availability, and vulnerability of albacore are strongly influenced by oceanographic conditions, especially oceanic fronts. It has been observed on all albacore stocks that juveniles concentrate in cold temperate areas (for instance in a range of sea-

	surface temperatures between 15 and 18°C), and this has been confirmed in the Indian Ocean where albacore tuna are more abundant north of the subtropical convergence (an area where these juvenile were heavily fished by driftnet fisheries during the late 1980's). It appears that juvenile albacore show a continuous geographical distribution in the Atlantic and Indian oceans in the north edge of the subtropical convergence. Albacore may move across the jurisdictional boundary between ICCAT and IOTC. It is likely that the adult Indian Ocean albacore tunas do yearly circular counter-clockwise migrations following the surface currents of the south tropical gyre between their tropical spawning and southern feeding zones. In the Atlantic Ocean, large numbers of juvenile albacore are caught by the South African pole-and-line fishery (catching about 10,000 t yearly) and it has been hypothesized that these juveniles may be taken from a mixture of fish born in the Atlantic (north east of Brazil) and from the Indian Ocean. For the purposes of stock assessments, one pan-ocean stock has been assumed.
Longevity	10+ years
Maturity (50%)	**Age**: females 5–6 years; males 5–6 **Size**: females n.a.; males n.a.
Spawning season	Little is known about the reproductive biology of albacore in the Indian Ocean but it appears, based on biological studies and on fishery data, that the main spawning grounds are located east of Madagascar between 15° and 25°S during the 4th and 1st quarters of each year. Like other tunas, adult albacore spawn in warm waters (SST>25°C).
Size (length and weight)	Reported to 128 cm FL in the Indonesian longline fishery $W = aL^b$ with $a = 5.691\times10^{-5}$, $b = 2.7514$.

n.a. = not available. Sources: Lee & Kuo 1988, Lee & Liu 1992, Lee & Yeh 2007, Froese & Pauly 2009, Xu & Tian 2011, Setyadji et al. 2012

Albacore – Catch trends

Albacore are currently caught almost exclusively using drifting longlines (86%) (Figs. 2, 3, 4; Table 5), South of 10°S (Table 6), with remaining catches recorded using coastal longlines, handline and trolling (10%), purse seines, and other gears (Fig. 2). Catches of albacore were relatively stable until the mid-1980s, except for high catches recorded in 1973 and 1974 (Fig. 2). The catches increased markedly during the mid-1980's due to the use of drifting gillnets by Taiwan,China (Fig. 3), 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 around 21,000 t by 1993 (Figs. 2, 3). However, catches more than doubled over the period from 1993 (20,000 t) to 2001 (46,000 t), the year in which record catches of albacore were recorded. Catches for 2010 were estimated to be around 44,000 t, the second highest catch of albacore ever recorded, while catches in 2011 and 2012 amount to around 34,000 t (Table 5).

The majority of the catches of albacore in recent years have come from vessels from Indonesia and Taiwan,China, although the catches of albacore reported for longline and other fisheries in Indonesia have increased considerably in recent years, to around 12,000 t per year (average 2010–12; Fig. 3), which represents approximately 33% of the total catches of albacore in the Indian Ocean.

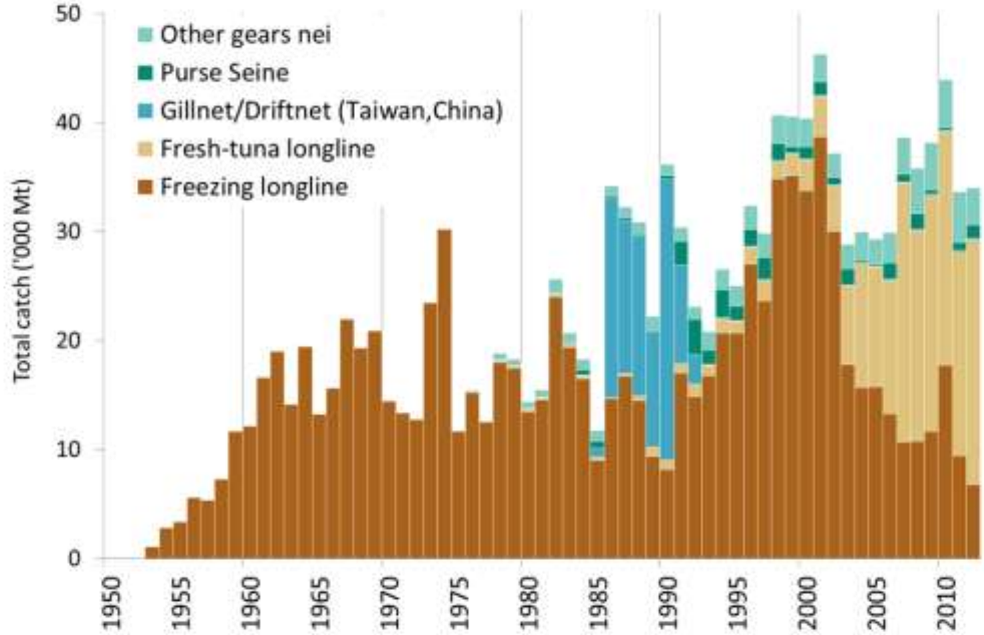

Fig. 2. Albacore: Annual catches of albacore by gear recorded in the IOTC Database (1950–2012) (Data as of October 2013).

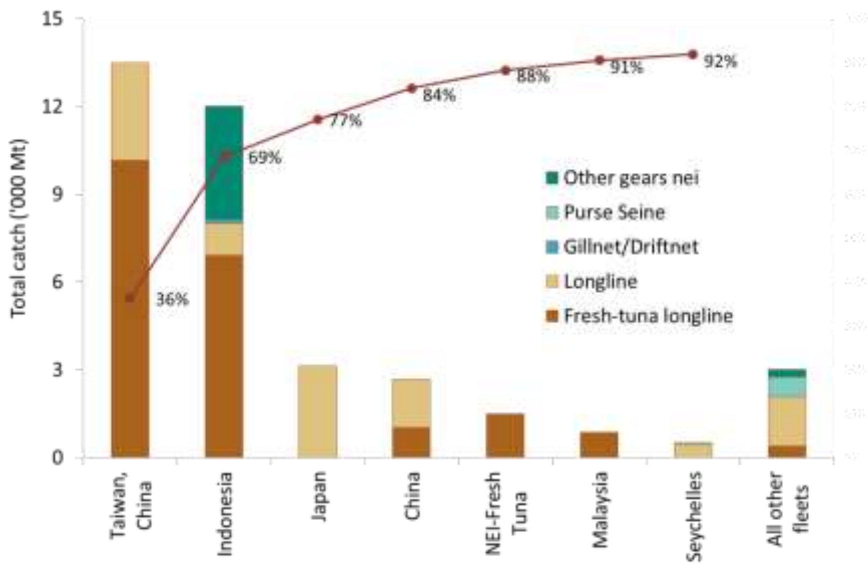

Fig. 3. Albacore**:** Average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of albacore reported. The red line indicates the (cumulative) proportion of catches of albacore for the countries concerned, over the total combined catches of albacore reported from all countries and fisheries. (Data as of October 2013)

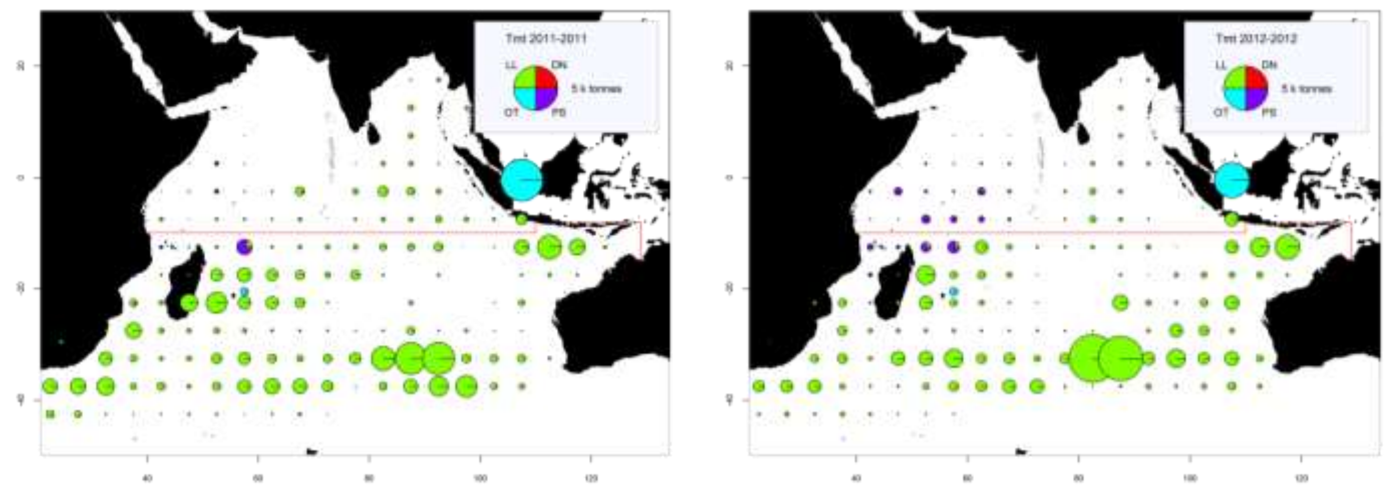

Fig. 4a–b. Albacore: Time-area catches (total combined in tonnes) of albacore estimated for 2011 (left) and 2012 (right) by type of gear: Longline (LL, green), Driftnet (DFRT, red), Purse seine (PS, purple), Other fleets (OT, blue). The catches of fleets for which the flag countries do not report detailed time and area data to the IOTC are recorded within the area of the countries concerned, in particular the coastal fisheries of Indonesia (Data as of October 2013).

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 8,500 t to 18,000 t in the period 1959 to 1969, in 1972 catches rapidly decreased to around 1,500 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 and catches remained at values between 400 t and 2,500 t for 1972–96. Catches of albacore between 1997 and 2012 were around 2,500 to 6,000 t (Fig. 3), with the highest catches recorded between 2006 and 2008.

In contrast to the Japanese longliners, catches by Taiwan,China longliners increased steadily from the 1950’s to average around 10,000 t by the mid-1970s. Between 1998 and 2002 catches ranged between 22,000 t to 27,000 t, equating to over 70% of the total Indian Ocean albacore longline catch. Between 2003 and 2010 the albacore catches by Taiwan,China longliners have been between 9,500 and 16,000 t, with catches in recent years dropping to values at around 12,000 t (2011–12). There has been a shift in the proportion of catches of albacore by deep-freezing and fresh-tuna longliners in recent years, with increasing catches of fresh-tuna (75% of the total longline catches for 2008–12) as opposed to deep-freezing longliners (Fig. 2; Table 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 (Fig. 4; Table 6). 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 out of this area, where the target species were tropical tunas or swordfish, to operate in southern waters of the Indian Ocean. This led to increased catches of albacore by some longline fleets, in particular vessels from China, Taiwan,China and Japan.

In recent years (2008–12) the fisheries of Indonesia have reported increasing catches of albacore, especially by fleets of fresh-tuna longliners operating in coastal waters or on the high seas, and vessels using trolling or hand lines in coastal waters off southern Indonesia. Catches for 2008–12 ranged between 9,000 and 15,000 t.

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.

TABLE 5. Albacore: Best scientific estimates of the catches of albacore (*Thunnus alalunga*) by gear and main fleets [or type of fishery] by decade (1950–2000) and year (2003–2012) in tonnes. Data as of October 2013. 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	0	0	0	5,823	3,735	0	0	0	0	0	0	0	0	0	0	0
LL	3,715	17,230	16,895	15,210	21,875	19,802	17,807	15,695	15,773	13,261	10,712	10,739	11,635	17,751	9,422	6,782
FLL	0	0	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	0	0	0	194	1,683	912	1,496	232	164	1,548	725	1,424	392	207	725	1,297
OT	20	33	165	987	1,915	2,992	2,310	2,708	2,391	2,810	3,422	4,301	4,446	4,556	4,762	3,431
Total	**3,736**	**17,264**	**17,140**	**22,527**	**30,533**	**35,424**	**28,808**	**29,934**	**29,300**	**29,870**	**38,596**	**35,797**	**38,134**	**43,914**	**33,605**	**33,960**

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

TABLE 6. Albacore: Best scientific estimates of the catches of albacore (*Thunnus alalunga*) by fishing area for the period 1950–2013 (in metric tons). Data as of October 2013.

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
N	769	1,223	1,292	1,486	3,713	6,040	4,662	4,610	4,808	5,860	13,929	9,262	5,379	5,723	5,632	4,519
S	2,967	16,041	15,848	21,041	26,820	29,383	24,146	25,324	24,492	24,010	24,667	26,535	32,755	38,190	27,973	29,441
Total	**3,736**	**17,264**	**17,140**	**22,527**	**30,533**	**35,424**	**28,808**	**29,934**	**29,300**	**29,870**	**38,596**	**35,797**	**38,134**	**43,914**	**33,605**	**33,960**

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

Albacore – Uncertainty of catches

While retained catches were fairly well known until the early-1990s (Fig. 5), the quality of catch and effort estimates since that time has been compromised due to poor catch reports from some fleets, in particular:

- Longliners of Indonesia and Malaysia: to date, Indonesia and Malaysia have reported incomplete catches of albacore for their longline fleets, as they do not monitor activities of longliners under their flags based outside of their ports (e.g. Mauritius, Sri Lanka, and Thailand). The IOTC Secretariat estimated these catches using alternative data, mainly vessel activity and landing data reported by third parties.
- Fleets using gillnets on the high seas, in particular Iran, Pakistan and Sri Lanka: Catches are likely to be less than 1,000 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 2,000 t in recent years.
- Levels of discards are believed to be low although they are unknown for industrial fisheries other than European (EU) purse seiners (2003–07).
- 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, and Malaysia;
    - no data for fresh-tuna longliners flagged in Taiwan,China during 1990–2006;
    - non-reporting by industrial purse seiners and longliners (NEI), especially during the 1990s.
- The catch series for albacore has changed since the WPTmT in 2012, following a review of the catch series of albacore for Indonesia. The major changes include revisions to the catch series for 2007 and 2008, with revised catches of between 30%-50% lower than those previously recorded by Indonesia (equivalent to a decrease in catch of ≈ 4,500 in 2007 and 7,500 in 2008).

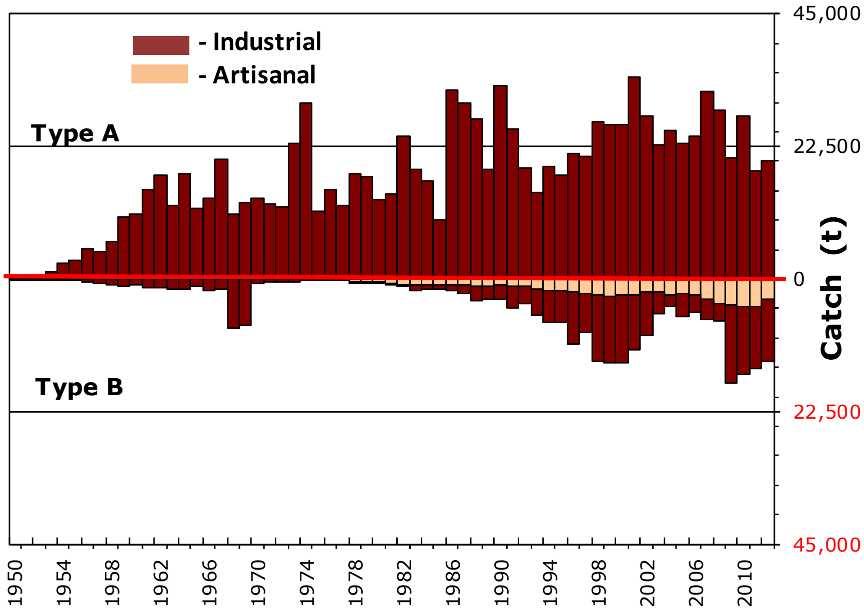

Fig. 5. Albacore: Uncertainty of annual catch estimates for albacore (1950–2012) (Data as of October 2013). Catches below the zero-line (**Type B**) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (**Type A**) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Albacore – Effort trends

Total effort from longline vessels flagged to Japan, Taiwan,China and EU,Spain by five degree square grid in 2011 and 2012 are provided in Fig. 6, and total effort from purse seine vessels flagged to the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags), and others, by five degree square grid and main fleets, for the years 2011 and 2012 are provided in Fig. 7.

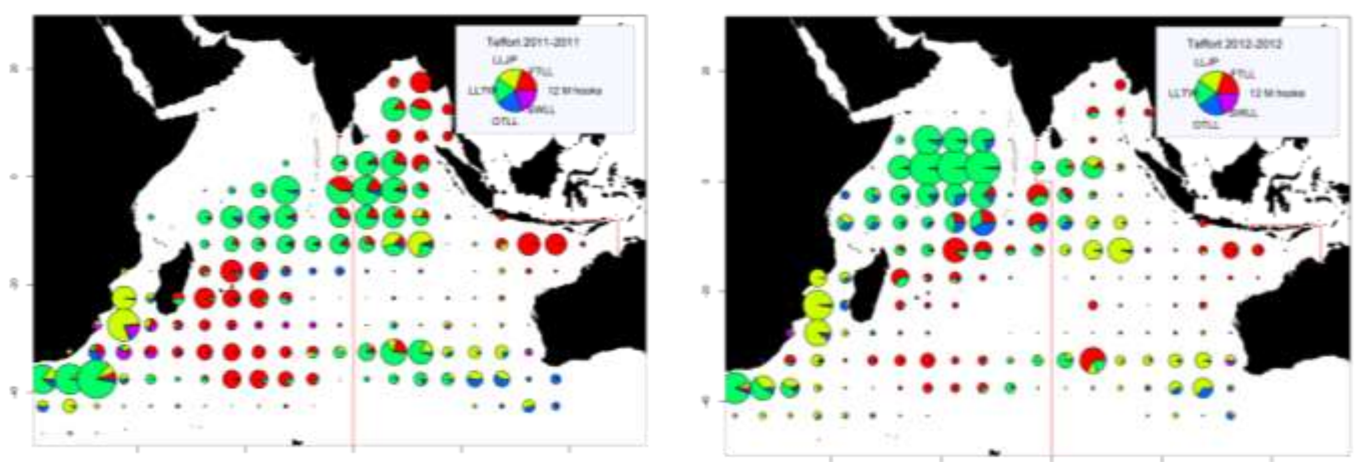

Fig. 6. Number of hooks set (millions) from longline vessels by five degree square grid and main fleets, for the years 2011 (left) and 2012 (right) (Data as of October 2013)
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): 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, Rep. of Korea and various other fleets)

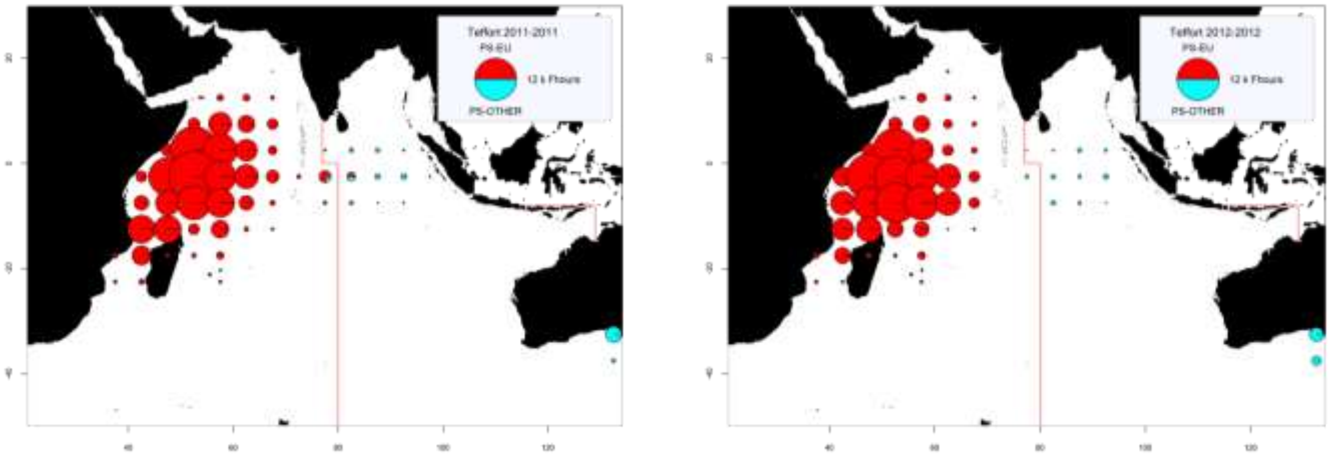

Fig. 7. Number of hours of fishing(Fhours) from purse seine vessels by 5 degree square grid and main fleets, for the years 2011 (left) and 2012 (right) (Data as of October 2013)
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles 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)

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

The size frequency data for the deep-freezing longline fishery from Taiwan,China for the period 1980–2012 is available. In general, the amount of catch for which size data for the species are available before 1980, across all fleets, is still very low. The data for the Japanese longline fleets is available; however, the number of specimens measured per stratum has been decreasing in recent years. 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 most fisheries before 1980, between 1986 and 1991, and in recent years, due to the lack of length samples for the fleets referred to above (Fig. 8).
- Catch-at-Size/Age tables are available but the estimates are highly uncertain for some periods and fisheries 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) and the small-scale fisheries of Indonesia (1950-2012).
    - the paucity of catch by area data available for some industrial fleets (Taiwan,China, NEI, India and Indonesia)

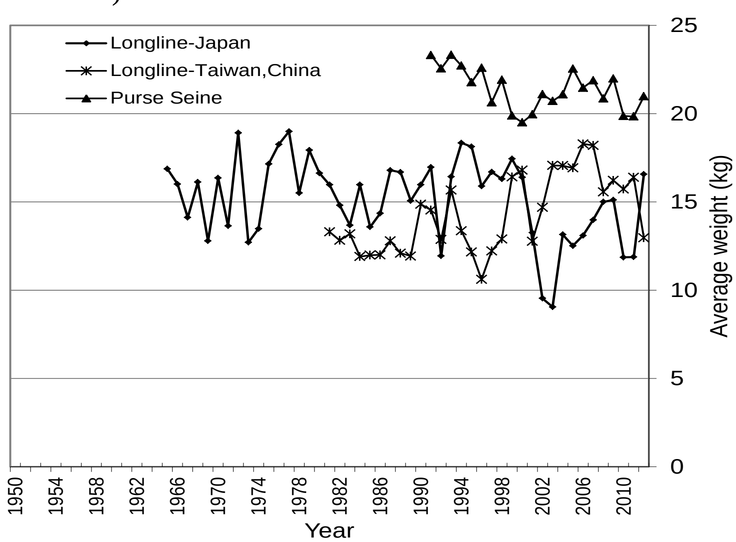

Fig. 8. Albacore: Average weight in kg of the catches of gillnet, longline–JPN, longline–TWN,CHN, purse seine and other gears from 1950 to 2012.

Standardised catch–per–unit–effort (CPUE) trends

Catch-and-effort series are available from various industrial fisheries. 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 large fleets of longliners, including India, Indonesia, Malaysia, Oman, and the Philippines
- no data for fresh-tuna longliners flagged in Taiwan,China during 1990–2006 and poor coverage the following years (2007–10)
- non-reporting by industrial purse seiners and longliners (NEI)

The CPUE series available for assessment purposes are shown in Fig. 9, although only the Taiwan,China series or a combined CPUE (weighted average of Japan and Taiwan,China) were used in the stock assessment models for 2012 for the reasons discussed in IOTC–2012–WPTmT04–R.

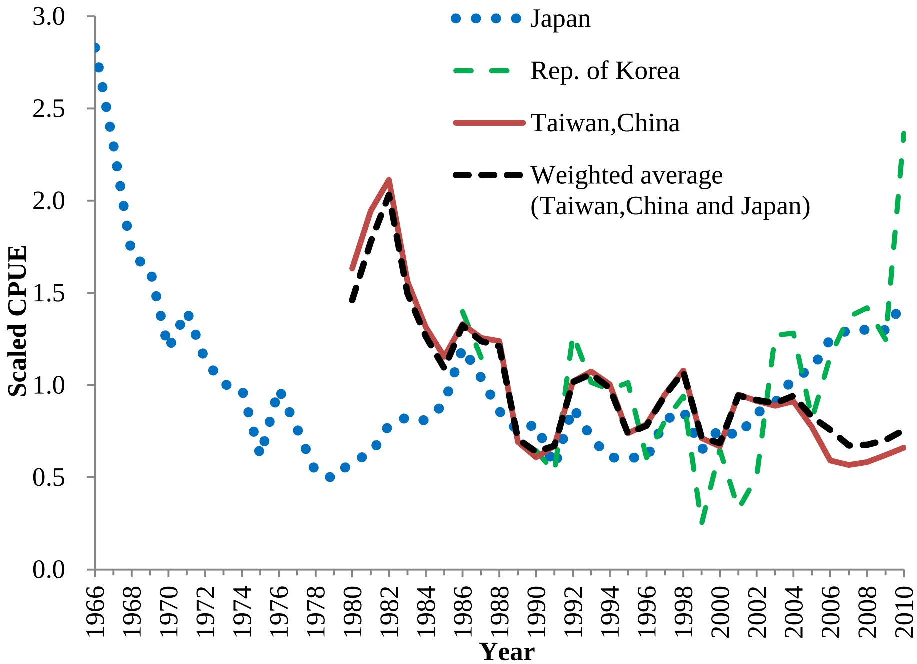

Fig. 9. Albacore: Comparison of the three CPUE series for longline fleets fishing for albacore in the IOTC area of competence, as well as the weight average of the Taiwan,China and Japan series. Series have been rescaled relative to their respective means from 1966–2010.

STOCK ASSESSMENT

A range of quantitative modelling methods (ASPIC, ASPM and SS3) were applied to the albacore assessment in 2012, ranging from the highly aggregated ASPIC surplus production model to the age-, sex- and spatially-structured SS3 analysis.

The following is worth noting with respect to the various modelling approaches used in 2012:

- There was more confidence in the abundance indices this year due to the additional CPUE analyses from Japan and Taiwan,China, and the exploration of the Rep. of Korea catch and effort data. This has led to improved confidence in the overall assessments.
- The Taiwan,China CPUE is more likely to closely represent albacore abundance at this time, because a substantial part of the Taiwanese fleet has always targeted albacore.
- Conversely, the Japanese CPUE seems to demonstrate very strong targeting shifts away from albacore (1960s) and back towards albacore in recent years (as a consequence of piracy in the western Indian Ocean). Similar trends are seen in the Rep. of Korea CPUE series.
- CPUE series should not be average across series with different trends as this is likely to result in spurious trends. Thus, only series which are considered to be most representative of abundance, in this case the Taiwan,China series, should be used in stock assessments while further work is carried out on the Japanese and Korean longline series.

- Albacore stock status should be determined by qualitatively integrating the results of the various stock assessments undertaken in 2012. All analyses were treated as being equally informative, and focus was given to the features common to all of the results.
- It was recognised that the deterministic production models were only able to explore a limited number of modelling options. The structural rigidity of these simple models causes numerical problems when fit to long time series for some cases.

The stock structure of the Indian Ocean albacore resource is under investigation, but currently uncertain. The south-west region was identified as an area of interest, as it is likely that there is stock connectivity with the southern Atlantic albacore population.

In deciding upon the most appropriate way to present the integrated stock assessment results, the output of the ASPM model were considered to most likely numerically and graphically represent the current status of albacore in the Indian Ocean (Table 7). However, this does not represent an endorsement of the ASPM model over the other models used in 2012, as there are still substantial problems with the ASPM model, and all of the models should be considered to be equally informative of stock status.

TABLE 7. Albacore (*Thunnus alalunga*) stock status summary.

Management Quantity	**Aggregate Indian Ocean (TWN,CHN CPUE only) (base case)**
2012 catch estimate	33,960 t
Mean catch from 2008–2012	37,082 t
MSY (80% CI)	33,300 (31,100–35,600)
Data period used in assessment	1950–2010
F_{2010}/F_{MSY} (80% CI)	1.33 (0.90–1.76)
B_{2010}/B_{MSY} (80% CI)	–
SB_{2010}/SB_{MSY} (80% CI)	1.05 (0.54–1.56)
B_{2010}/B_{1950} (80% CI)	–
SB_{2010}/SB_{1950}	0.29 (n.a.)
$B_{2010}/B_{1950,\ F=0}$	–
$SB_{2010}/SB_{1950,\ F=0}$	–

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