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

Report of the First Session of the IOTC Working Party on Temperate Tunas

Shizuoka (Shimizu) , Japan, 2-5 August 2004

TABLE OF CONTENTS

1. Opening of the Meeting and Adoption of the Agenda

The First Meeting of the Working Party on Temperate Tunas (WPTMT) was opened on 2 August 2004 in Shimizu, Japan, by the Executive Secretary of IOTC, Alejandro Anganuzzi. Mr. Anganuzzi welcomed the participants (Appendix II), and expressed his appreciation for the invitation from the National Research Institute of Far Seas Fisheries, Fisheries Research Agency of Japan to hold the meeting in Shimizu.

The Agenda for the Meeting was adopted as presented in Appendix I.

The participants elected Dr. Yuji Uozumi, from the NRIFSF as the Chairman of the WPTMT for the next biennium (2005 and 2006).

The documents available for discussion are listed in Appendix III.

2. Review of Statistical Data for the Temperate Tuna Species

2.1. Nominal Catch (NC) data

The catches of albacore recorded in the IOTC databases are considered to be complete, at least until the mid-1985s. After this time, the level of non-reporting increased greatly. While the fleets for which the majority of the catches of albacore are recorded have always reported good catch statistics to the IOTC. Catches for non-reporting fleets (recorded as NEI- in the IOTC Database), which have been operating in the Indian Ocean since the early 1980s, have to be estimated by the Secretariat.

Unreported catches: There is very little information for non-reporting deep-freezing longliners (NEI-DFRZ) apart from the total number of vessels operating per year. Catch estimates for these vessels are based on the average catches and species composition recorded by longliners of Taiwan,China in the Indian Ocean, under the assumption that both fleets operate in the same way. A decrease in the catches of NEI-DFRZ longliners since 2000 coincides with a decrease in the number of vessels recorded in the IOTC database. The reasons for this decrease are not fully known. It may in part be due to the re-flagging of NEI-DFRZ longliners to flags of reporting countries (mainly in Philippines and Seychelles); however, the catches recorded for those countries have not increased proportionally to the increase in the number of vessels.

Fresh tuna longline fleet: The catch statistics for several fresh tuna longline fleets (NEI-Fresh Tuna) operating in the Indian Ocean (Thailand, Malaysia, Sri Lanka and Maldives) are uncertain for the years prior to 1992. Recent catch statistics are likely to be more accurate due to the implementation of sampling programs (in some of these countries) to monitor activities. The catches by Indonesian fresh-tuna longliners are likely to be underestimated, especially in recent years up to 2003. This was evident from information collected during the first year of port sampling[1] , where high catches of albacore have been recorded. The port sampling data will be analyzed soon and the catches will be updated accordingly.

Catches uncertain: Catches of tunas and tuna-like species are sometimes reported aggregated[2]. The IOTC estimates the species and gear composition of these aggregates on the basis of all available information but the estimates are uncertain for those fisheries that are poorly documented.

2.2. Catch-and-Effort (CE) data

Catch and effort data are mostly available up to the early 1990’s, but only partially available since then due to an almost complete lack of catch and effort information from non-reporting longline fleets. The catch and effort data available at IOTC for Taiwan,China do not include data for the area between 20-30°E.

[1] Multilateral catch monitoring: Directorate General of Capture Fisheries Indonesia, Research Institute for Marine Fisheries Indonesia, CSIRO Australia, ACIAR Australia and IOTC/Overseas Fisheries Co-operation Foundation of Japan

[2] This is the case notably when data are not reported to the Secretariat and have to be taken from the FAO nominal catch database.

The effort statistics are of good quality for most of the fleets for which long catches series are available. The exceptions are Taiwan,China (1990-92) and the whole time series for the Republic of Korea and Philippines. The use these data is, therefore, limited.

2.3. Size-Frequency (SF) data

For the longline fisheries, size-frequency data is only available since 1964. Japan is the only country that has been reporting size-frequency data on a regular basis; however, in recent years, the numbers of specimens measured in relation to the total catch and has been decreasing year by year. The size-frequency statistics available from the two other main longline fleets are either very incomplete (Taiwan,China for which only four years are available) or inaccurate (Republic of Korea), which invalidates their use.

The collection of albacore size data from port sampling fresh tuna longline fleets operating from Thailand (Phuket), Malaysia (Penang), Sri Lanka and, recently Indonesia, continued in 2002 and 2003. Size data is also available for European purse seiners.

In general, the numbers of albacore measured throughout the fishery are very low compared to the total numbers of fish caught; consequently the albacore size-frequency dataset is probably not representative of the fished population, and has limited use in stock assessments.

The following data related issues were highlighted by the WPTMT:

- Lack of size-frequency data from the Republic of Korea and Philippines, Taiwan,China since 1989 and low sample sizes for the Japanese longline fleet.
- Lack of catch and effort data for the Taiwanese fleets for the area between 20-30°E for the whole series.
- Poor knowledge of the catches, effort and size-frequency from fresh tuna longline vessels, especially those from Taiwan,China and several non-reporting fleets.
- Poor knowledge of the catches, effort and size-frequency from non-reporting fleets of deep-freezing tuna longliners, especially since the mid-eighties.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery in recent years.
- Poor knowledge of the catches, effort and size-frequency data for non-reporting purse seiners.

2.4. General Discussion on Statistics

The Secretariat informed the WPTMT that sampling of Indonesian fresh tuna longline catches began in June 2002 under the Indonesian Multilateral Cooperation Project[3] in Cilacap, Jakarta and Benoa with coverage ranging from 20% to 30% of the total catches landed. While catch estimates of albacore in Indonesia will be available the future, preliminary estimates indicate that albacore catches in Benoa were around 3,400 t which represents 16% of the total tuna catches in Benoa in 2003.

The WPTMT acknowledged the contribution of Taiwanese scientists who made available results from analyses of their data (in particular size frequency data) for discussion and assessment of the status of albacore tuna.

The WPTMT noted with concern the scarcity of size frequency statistics from several large scale longline fleets. The WPTMT recommended that all parties with longline vessels fishing for albacore in the Indian Ocean should make every possible effort to improve the size sampling coverage.

[3] This Project involves cooperation from the following institutions: Directorate General of Capture Fisheries of Indonesia (DGCF), Research Institute For Marine Fisheries of Indonesia (RIMF), Commonwealth Scientific and Industrial Research Organization (CSIRO), Australian Center for International Agricultural Research (ACIAR), Indian Ocean Tuna Commission (IOTC) and Overseas Fisheries Cooperation Foundation of Japan (OFCF)

3. Review of information on the biology and stock structure of temperate tunas, their fisheries and related environmental data.

3.1. Biology

Document IOTC-2004-WPTMT-02 provided an overview of the Indian Ocean albacore (*Thunnus alalunga*) stock, reviewing the changes in the various fisheries and the main characteristics of the albacore biology. Albacore is a temperate tuna living primarily in the mid oceanic gyres of the Pacific, Indian and Atlantic oceans. The biology of albacore stock in the Indian Ocean is not well known and some of the more informative references are quite old (such as Lebeau 1971 and Morita 1978[4]).

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 only one southern stock, simply because there is no northern gyre.

Document IOTC-2004-WPTMT-02 also examined the hypothesis that the albacore caught in Atlantic waters off South Africa could have originated from the Indian Ocean stock based on oceanic environment. The results to-date on this topic are inconclusive.

Document IOTC-2004-WPTMT-03 provided a general review of Indian Ocean albacore, including fishery, biology, ecology, stock status and management.

Document IOPTC-2004-WPTMT-06 provided spatial and seasonal patterns of albacore distribution by age derived from Taiwanese longline data 1980-2002. The analyses showed that <3 years old albacore are found mainly in the south of 30˚S (all year round). Albacore aged 3 to 5 years old are also found in the area south of 30˚S during January-August, but they are found in greater numbers in more northern areas - 15˚ -30˚S from September to December. Older albacore, >6 years old, are found in the area south of Lat. 30˚S from May to August but appear to move northward to the area of 15˚ -30˚S in September where they stay until the following April. The presence of older albacore in the area 15˚S-30˚S may be associated with spawning. Previous studies in this area indicated spawning occurred from February to April for fish greater than 90-96cm.

In summary, younger albacore occur in the waters of relatively higher latitude with the narrow range of latitude, while older albacore occur in that region and also lower latitude waters. This is consistent with that in the North and the South Pacific.

Use of a growth curve for aging catch-at-size will be essential for conducting an age structured stock assessment in the future. The WPTMT noted that the lengths of the age 1 Indian Ocean albacore (about 45 cm) were larger than those of one year old albacore from the northern Pacific Ocean. Furthermore, the WPTMT noted the marked differences between the results of several existing studies (Table 1 and Figure 1) and concluded it was necessary to review these results in the future.

Table 1. Von Bertalanffy growth parameter estimates for Indian Ocean albacore.

Authors	Hard parts	Number of sample	Range of size	L_∞	K	to
Huang et al. (1990)	Scales	86	64.6-106	128.1	0.16	-0.90
Lee and Liu (1992)	Vertebrae	391	43-121	163.7	0.10	-2.07
Chang et al. (1993)	(Size freq.)	-	30-128	171.4	0.12	NA
Chang et al. (1993)	(Size freq.)	-	30-128	147.2	0.13	NA
Hsu (1991)	Vertebrae	391	43-121	136	0.159	-1.68

[4] Lebeau, A 1971. Sci. Peche Bull. Inst. Sci. Tech. Peches Marit. Vol. 204, pp. 1-10. Morita, S. 1978. Study on the biology of the albacore of the Indian Ocean. Collect. Vol. Sci. Pap. ICCAT, 7(2), 232-237.

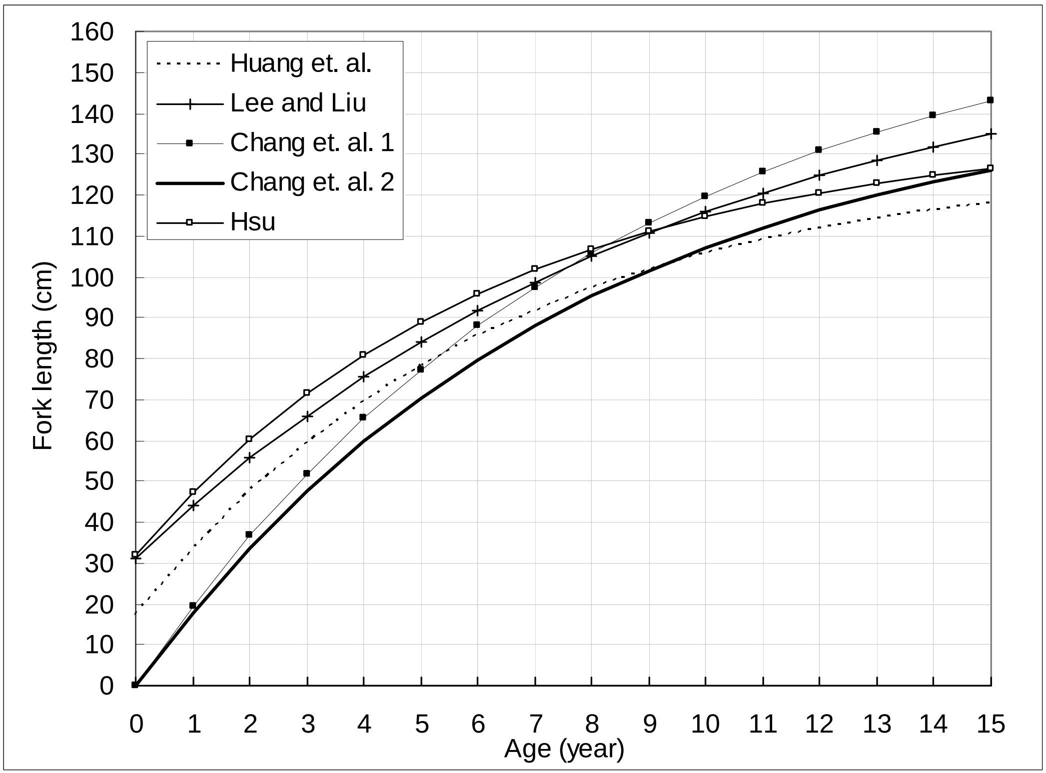


Figure 1. Comparison of albacore growth curves.

3.2. Fisheries

IN GENERAL

Albacore are caught almost exclusively under drifting longlines (98%), and between 20° and 40°S (Figures 2 and 3), with remaining catches recorded under purse seines and other gears.

A fleet using drifting gillnets targeting albacore operated in the Indian Ocean between 1985 and 1992 harvesting important amounts of this species. This fleet, from Taiwan,China, had to stop fishing in 1992 due to a worldwide ban on the use of drifting gillnets. Albacore is currently both a target species and a bycatch of industrial longline fisheries and a bycatch of other fisheries.

The catches of albacore increased rapidly during the first years of the fishery, remaining relatively stable until the mid-1980s, except for some very high catches recorded in 1973, 1974 and 1982. The catches increased markedly during the 1990's due to the use of drifting gillnets, with total catches reaching around 30,000 t. Catches have steadily increased since 1993, after the drop recorded in 1992 and 1993 as a consequence of the end of the drifting gillnet fishery. Current catch levels are above 40,000 t (Figures 4 and 5).

Longliners from Japan and Taiwan,China have been operating in the Indian Ocean since the early 1950s and they have been the major fishers for albacore since then. While 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 changing the target species mainly to southern bluefin and bigeye tuna, then ranged between 200 t to 2,500 t as albacore became a bycatch fishery. In recent years the Japanese albacore catch has been around 2,000 to 3,000 t. By contrast, catches by Taiwanese longliners have increase steadily since the 1950's, averaging around 10,000 by the mid-1970s'. Since 1998 catches have been around 20,000 t, equating to just over 60 % of the total Indian Ocean albacore catch.

The catches of albacore by longliners from the Republic of Korea, recorded since 1965, have never been above 10,000 t. Other fleets for which important catches of albacore have been recorded in recent years are a fleet of fresh-tuna longliners operating in Indonesia, with catches recorded around 3,000 t, and a fleet of deep-freezing longliners operating under flags of non-reporting countries (NEI-Deep freezing), with current catches of albacore between 5,000 t and 10,000 t (Figure 4).

TAIWANESE LONGLINE FISHERY

Taiwanese longline fleets joined the Indian Ocean albacore fishery in 1963; and the Taiwanese gillnet fishery fished the stock from 1985 to 1992, taking a significant amount of Indian Ocean albacore from 1987 to 1990. Conventional Taiwanese longline fishing occurred mainly south of 15°S and targeted albacore. During 1973-1984, conventional Taiwanese longliners concentrated on areas south of 10°S to exploit sub-adult and adult albacore (11-22 kg fish). However, in 1986 some Taiwanese longline vessels started to use "super-cold freezers" and deep longline gear to target bigeye tuna and yellowfin tuna, and the fishing operations moved to areas north of 15°S. For these vessels, this meant that bigeye tuna and yellowfin tuna were the dominant species in the catch, and albacore was third.

The Indian Ocean albacore catch by Taiwanese longliners has steadily increased since 1990. It reached 26,100 t in 2001, then decreased to 20,300 t in 2002. In 2003, 348 licensed, large-scale vessels (> 24 m) actively fished for tuna and tuna-like species — this was an increase of seven vessels from 2002. The preliminary catch estimate for albacore in 2003 is 20,000 t, similar to the 2002 catch.

For the conventional Taiwanese tuna longline fishery (that mainly targets albacore), fishing operations generally commence off the west coast of Australia from February to the end of July. After July, vessels move west. In the southwest Indian Ocean, albacore are harvested from March to August. From October to January, albacore are harvested mainly in the waters off Madagascar.

A WPTMT participant asked the reason of recent increase of albacore catch by the Taiwanese longline fishery. The respondent indicated that one reason was the introduction of catch limits for south Atlantic albacore in 1995, and the consequent move by part of the fleet from the south Atlantic to the Indian Ocean.

JAPANESE LONGLINE FISHERY

Document IOTC-2004-WPTMT-08 described the Japanese longline fishery and its albacore catch in the Indian Ocean. This fishery has caught albacore since the early 1950s. Catches ranged from 8,000 t to 18,000 t in the period 1959 to 1969, with a part of the fleet targeting albacore. After this period the catch rapidly decreased to 1,000 t in 1972 due to an increase in the targeting of southern bluefin and bigeye tuna. After this time, albacore was a bycatch and catches ranged from 200 t to 2,500 t. In recent years (1997-2002) catches of albacore have been around 2,000 t.

RÉUNION LONGLINE FISHERY

Some results obtained by IFREMER Réunion as part of the PPR (Réunion Longline Programme; 1998-2001) were presented. The Indian Ocean swordfish longline fishery based in Réunion Island (France) started in 1991. IFREMER has been compiling information on this domestic longline fishery operating in the French EEZ and targeting swordfish since 1993. A logbook monitoring system had been implemented by IFREMER–Reunion in association with longlining fishermen between 1994 and 2000. Albacore has always been a bycatch of this fishery, representing around 12% of the total catch. The catches of Albacore were 94 t in 1991 and continuously increased to reach 307 t in 2002.

ENVIRONMENT

Document IOTC-2004-WPTMT-INF01 indicated that there may be a relationship between longline tuna catch and chlorophyll concentration in the interior subtropical gyre in the Indian Ocean. This suggests that tuna longline catch maybe associated with high levels of primary productivity as a result of nutrient-rich pycnocline water moving into the photic zone.

The WPTMT encouraged further investigation on the relationship between albacore abundance and oceanographic conditions.

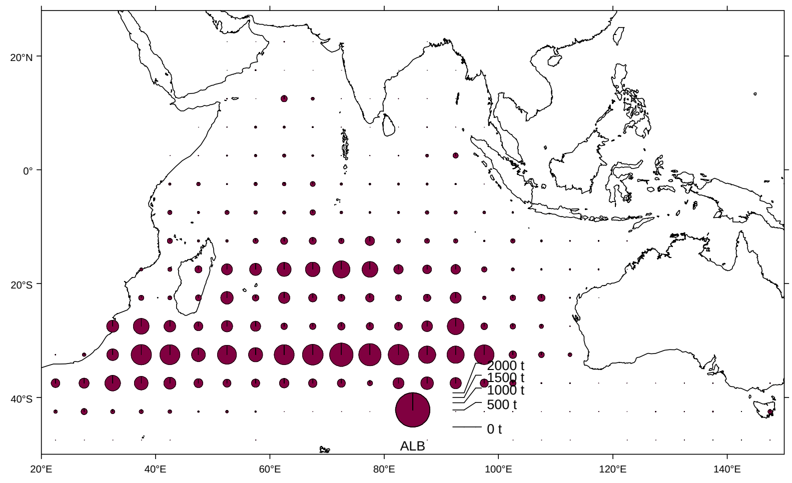


Figure 2. Mean of annual total catches (t) of albacore tuna by Japanese and Taiwanese longline vessels operating in the Indian Ocean over the period 1990 to 1999.

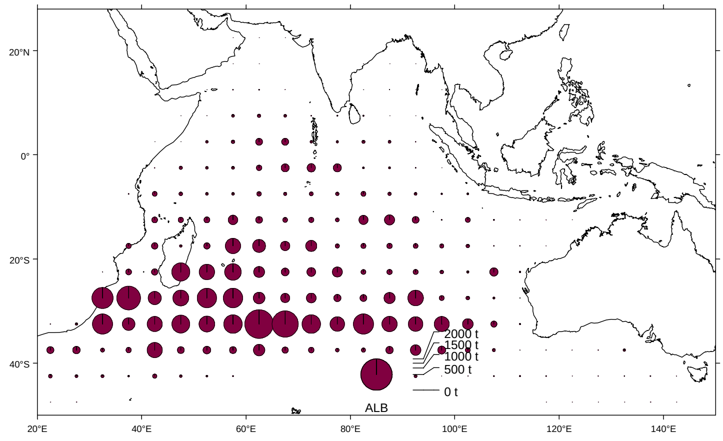
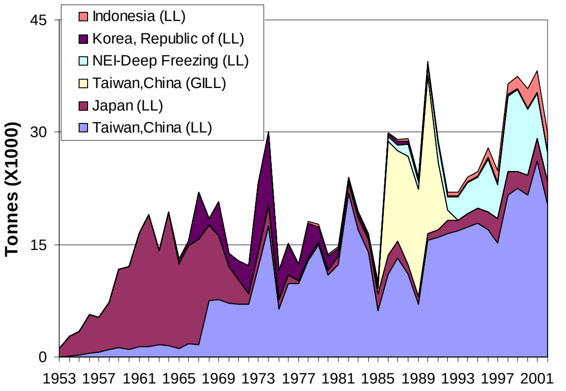
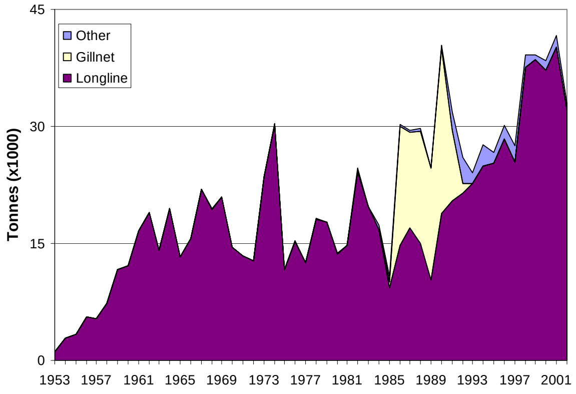


Figure 3. Mean of annual total catches (t) of albacore tuna by Japanese and Taiwanese longline vessels operating in the Indian Ocean over the period 2000 to 2002.





Note that the catches series estimated during 2003 include catches assigned to each species after allocation of species aggregates to individual species by the Secretariat (2002 catches series only accounted for catches recorded under individual species in the IOTC database).

Figure 4. Catches of albacore per fleet and year

Figure 5. Catches of albacore per gear and year

recorded in the IOTC Database (1963-2002)	recorded in the IOTC Database (1963-2002)

4. Review information on the status of Albacore

4.1. Stock status indicators.

CPUE INDICES OF RELATIVE ABUNDANCE

Document IOTC-2004-WPTMT-09 described a standardised CPUE index for the Japanese longline fleet from 1960 to 2002 derived using a GLM (with a log-normal error). The standardized CPUE was high at about 10 fish / 1000 hooks for 1960-1964, before declining sharply to about 2 fish / 1000 hooks in 1975. From 1975 to 1988, the CPUE has remained at a level of around 2 fish/1000 hooks. Since 1989 the CPUE has been less than 2 but stable. The WPTMT questioned whether the CPUE was a robust measure of abundance. It was noted that the sharp decrease beginning in 1965 could be attributed to a major change of targeting strategy, rather than a decrease in abundance; and current CPUE is low despite catches being historically high. Furthermore, the modified model used only data from Area 2 and Area 4 (Figure 6) where albacore is considered to be relatively more abundant than other areas. The results showed that the CPUE trend of the modified model was similar to the reference model, but that the trends of the CPUEs were different from that in reference model in the past 15 years (Figure 7).

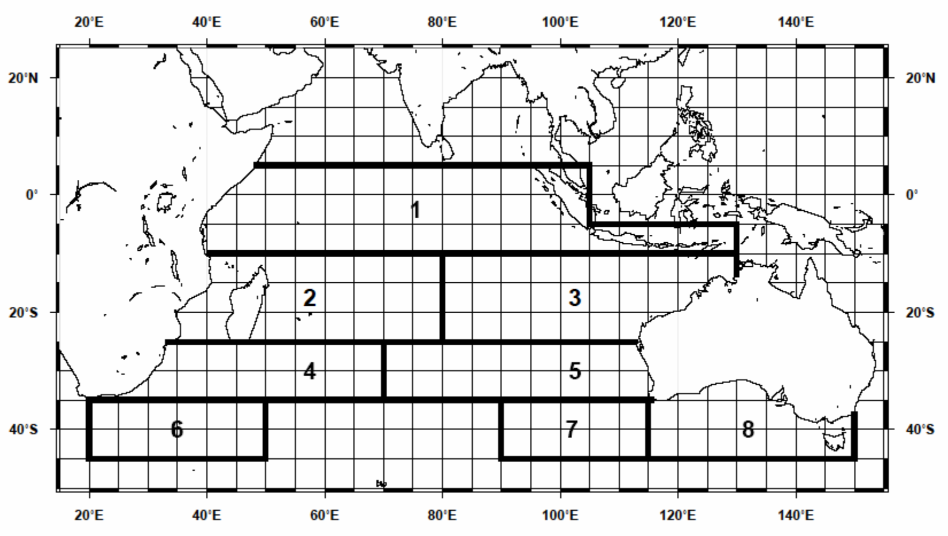


Figure 6. Areas used in the CPUE analysis of Japanese longline data.

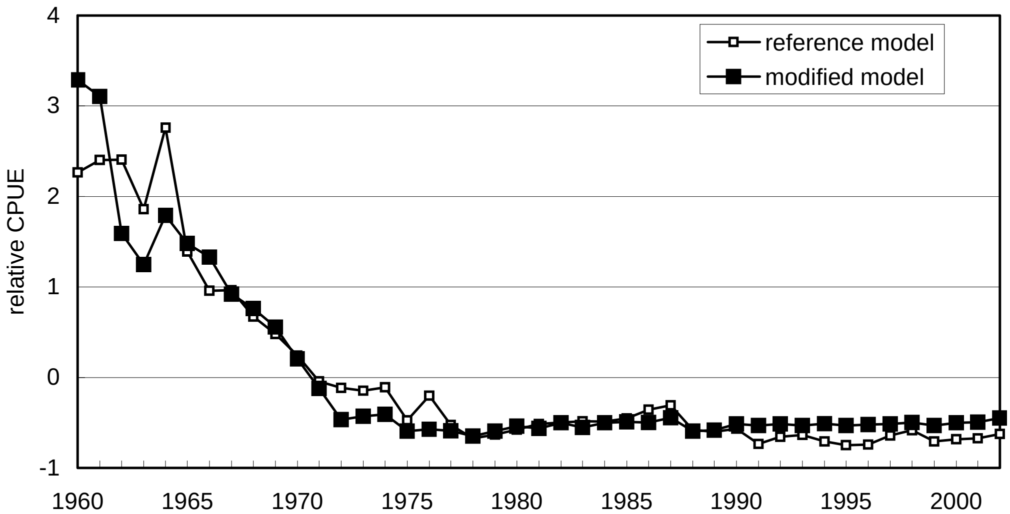


Figure 7. Standardized CPUEs for the reference and modified models. The CPUE for the modified model were calculated using only from Area 2 and Area 4 where albacore is generally abundant. Both CPUEs were adjusted with taking the difference to mean and dividing it by the standard deviation.

The WPTMT suggested that the year and area interaction should be examined in a future GLM model to better understand the effects of the shifting of target species by fishers.

Document IOTC-2004-WPTMT-05 provided an age-aggregated CPUE and age specific CPUE for Taiwanese longline in the Indian Ocean from 1967 to 2002. The abundance indices were standardized using a GLM with lognormal error structure for albacore caught by the Taiwanese longline fishery. Depending on size data available, overall abundance indices were estimated from 1967 to 2002; and age-specific indices from 1980 to 2002. Factors including year, quarter, sub-area and two-way interaction were used for the selected GLM model of standardizing abundance indices. The age-specific abundance index was computed by multiplying annual standardized abundance index with its corresponding catch at age composition. In doing so, the catch-at-age matrix was converted from catch-at-size matrix by MUTIFAN, and the age composition was used to derive age-specific abundance index. The resulting standardized abundance index showed a variable but overall decreasing trend from 1979 to 1991, then a variable but relatively stable trend from 1992 to 2002. The age composition illustrated that albacore catch at age 1, 7, 8, or 9+ accounted for less than 10% of the sampled population from year to year and catch at the main target ages (age 3 to age 5) accounted for about 20-30%. Although the age 3, 4 and 5 indices are all highly variable from year to year, the age 3 index has no overall trend but has clear peaks in 1986, 1992 and 2001; the age 4 index has an overall decreasing trend since 1980 with a peak in 1982; and the age 5 index has no overall trend but has peaks in 1981, 1986, 1992 and 2002.

Another abundance index was calculated by WPTMT scientists using Taiwanese gillnet data from 1986-1992 during the meeting (for use in the assessment models). The abundance indices were standardised using a model similar to that used for the Taiwanese longline analysis. The CPUE was standardised to number of albacore per day per net piece, and the CPUE trend indicated that the highest CPUE occurred at 1986, and then decreased to the lowest level at 1988. From 1989 to 1992, the CPUE trend remained stable, except for a small peak in 1990.

WPTMT scientists suggested that spatial and seasonal effects should be considered in the development of age-specific CPUE, and that the two longline fishing types (deep and regular) and the target effect should also be examined. Analyses using the Taiwanese longline data (related to the development of a CPUE index) carried out during the meeting showed that there were some differences between the two CPUE approaches. As a result, the WPTMT scientists suggested that the misclassified ratio for the regular longline fishing type by the separation method used in the above study should be explored in the future.

The WPTMT noted that the CPUE series shows characteristics that cast some doubt about how well they reflect the abundance of the stock. In the first years of the fishery a moderate increase in catch is accompanied by a large decline in CPUE. By contrast, in recent years, large increases in catch, which are expected to cause a decline in the stock abundance, are not followed by a decline in CPUE. This pattern, which has been observed in several tuna species and albacore in particular, is inconsistent with the assumptions about the response of a stock to exploitation. Therefore, extreme caution has to been exercised when using albacore CPUE as an index of abundance.

For the Réunion albacore longline fishery, a CPUE has been derived from the logbook data. The mean annual CPUE decreased from 6.8 fish per 1000 hooks in 1994 to 2.8 fish per 1000 hooks before increasing up to 5 fish per 1000 hooks in 2000. A seasonal trend was observed with highest catch rates during the summer (November to January), when CPUEs ranging from 7 to 20 fish per 1000 hooks have been recorded.

A significant correlation between albacore CPUE and the moon phase has been also observed (from 2009 longline sets) with the highest CPUEs occurring during the full moon.

4.2. Albacore stock assessment

THE MODEL

Document IOTC-2004-WPTMT-INF04 contained the results from a forward VPA analysis conducted in 1998. In reviewing these results, uncertainties in the size frequency data for longline were noted, in particular the unexplained high number of large fish in the catch-at-size data in some years. The WPTMT agreed to postpone updating the VPA assessment until these issues were further resolved.

The WPTMT undertook a stock assessment for Indian Ocean albacore using a Schaeffer production model as implemented using ASPIC software.

DATA INPUTS

In addition to the catch data, the model used the standardized CPUE indices derived from the Taiwanese LL (TWLL) and Japanese LL (JPLL), respectively, and Gillnet (GN) CPUE provided by Taiwanese scientists. Two standardized CPUE series of JPLL, reference and modified (IOTC-2004-WPTMT-09), were used. Due to the extremely high values at the beginning of the JPLL CPUE series, and the rapid decline inconsistent with catch levels in those early years, the WPTMT agreed to consider primarily use of the JPLL CPUE data after 1972. Because Indian Ocean albacore fishery started in 1950s, the stock was assumed to be at its virgin level in the starting year of analysis (1952).

Five scenarios, consisting of two to four fishery categories, were considered (Table 2).

RESULTS

Results of the assessment are summarized in Table 3. For case 1, the estimating procedure of ASPIC did not find convergence within the given parameter constraints. For case 3, there was a negative correlation between TWLL CPUE and JPLL CPUE (modified). Outputs from Case 2 were considered by the WPTMT to be the most realistic of all the cases. Case 2 estimated MSY as 26,380 t with the intrinsic rate of growth (r) estimated at 0.397. Case 2 indicated that over-fishing of albacore was occurring (Fcurrent/FMSY > 1), and that the stock is presently in an over-fished state (Bcurrent/BMSY < 1).

The CPUE trend predicted by this run followed the general trend of observed CPUE (Figure 8) but large residuals were observed in recent years of LL CPUEs, as the model predicted steep declines in both LL CPUEs which have not been observed. The results of Case 4, were considered unrealistic due to the very low MSY and r estimates. The results for Case 5 were broadly similar to those observed` for Case 2.

In addition to the above five cases that used the complete data series of 1952 – 2002, additional runs were conducted using only the data from 1952 – 1992 (Table 4). These runs are intended to test the influence of the most recent years in the performance of the model, as the CPUE in those years appears to be insensitive to the large increase in catches. The additional runs gave reasonable parameter estimates for Case 3 only, but still showed a poor fit to the CPUE series. Another set of runs were conducted to obtain estimates of the B1/Bmsy ratio, but the estimates obtained were unrealistically high.

The WPTMT noted the difficulties that the ASPIC estimating procedure encountered in finding estimates of the parameters for the model for most runs, and that even when convergence in parameter values was achieved the estimates exceeded the biologically meaningful range of values. The WPTMT further noted with concern that the discrepancy between observed and estimated CPUE trends for the most recent years and concluded that the model could not explain appropriately the apparent lack of response in the CPUE to the increase in the catch. Several explanations were proposed, including a possible increase in productivity of the albacore stock due to a change in environmental conditions, or the inability of the CPUE series to adequately reflect changes in the population abundance. Regarding the first hypothesis, the WPTMT noted that the size frequency data does not offer any evidence supporting the hypothesis of recent increased recruitments.

Table 2. Indian Ocean albacore assessment. Combinations of CPUE and catch data series of five scenarios for the ASPIC analysis.

	Fishery 1		Fishery 2		Fishery 3		Fishery 4	
Case	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch
1	TWLL 1967-2002	all catch except for GN	TWGN 1986-1992	GN catch				
2	TWLL 1967-2002	all catch except for GN & JPLL	TWGN 1986-1992	GN catch	JPLL reference 1972-2002	JPLL catch		
3	TWLL 1967-2002	all catch except for GN & JPLL	TWGN 1986-1992	GN catch	JPLL modified 1972-2002	JPLL catch		
4	TWLL 1967-2002	all catch except for GN & JPLL	TWGN 1986-1992	GN catch	JPLL reference 1960-2002	JPLL catch		
5	TWLL 1967-2002	all catch except for GN & JPLL	TWGN 1986-1992	GN catch	JPLL reference 1960-1971	JPLL catch 1952-1971-(2002)	JPLL reference 1972-2002	JPLL catch (1952)-1972-2002

Table 3. Indian Ocean albacore assessment. Summary of parameter estimates from ASPIC for the period 1952 to 2002. B1/Bmsy is fixed at 2.0

Case	Data period	B1/Bmsy	MSY	r	q(1)	q(2)	q(3)	q(4)	K	Bmsy	Fmsy	B/Bmsy	F/Fmsy
1	full	Estimated r is at the minimum constaraint, 0.02											
2	full	2.0	26,380	0.397	4.99E-05	4.37E-05	9.81E-06		265,600	132,800	1.99E-01	0.80	1.52
3	full	Negative correlation between TWLL CPUE and JPLLmodified CPUE											
4	full	2.0	5,341	0.020	1.60E-05	1.36E-05	4.04E-06		1,056,000	527,900	1.01E-02	0.45	12.86
5	full	2.0	23,760	0.278	4.00E-05	3.53E-05	7.96E-06	2.44E-05	341,400	170,700	1.39E-01	0.74	1.80

Table 4. Indian Ocean albacore assessment . Summary of parameter estimates from ASPIC for the period 1952 to 1992. B1/Bmsy is fixed at 2.0

Case	Data period	B1/Bmsy	MSY	r	q(1)	q(2)	q(3)	q(4)	K	Bmsy	Fmsy	B/Bmsy	F/Fmsy
1	till 1992	2.0	27,270	2.878	4.51E-04	3.49E-04			37,900	18,950	1.44E+00	1.16	0.74
2	till 1992	2.0	29,570	3.600	1.93E+01	4.38E-04	9.82E-05		32,860	16,430	1.80E+00	0.00	4.45
3	till 1992	2.0	27,000	0.883	1.17E-04	1.03E-04	2.12E-05		121,600	60,780	4.44E-01	1.23	0.64
4	till 1992	2.0	6,425	0.040	4.40E-05	2.84E-05	8.53E-06		643,300	321,600	2.00E-02	0.44	7.00
5	till 1992	2.0	68,920	1.956	7.37E-05	7.28E-05	1.56E-05	5.30E-05	140,900	70,470	9.78E-01	1.82	0.17

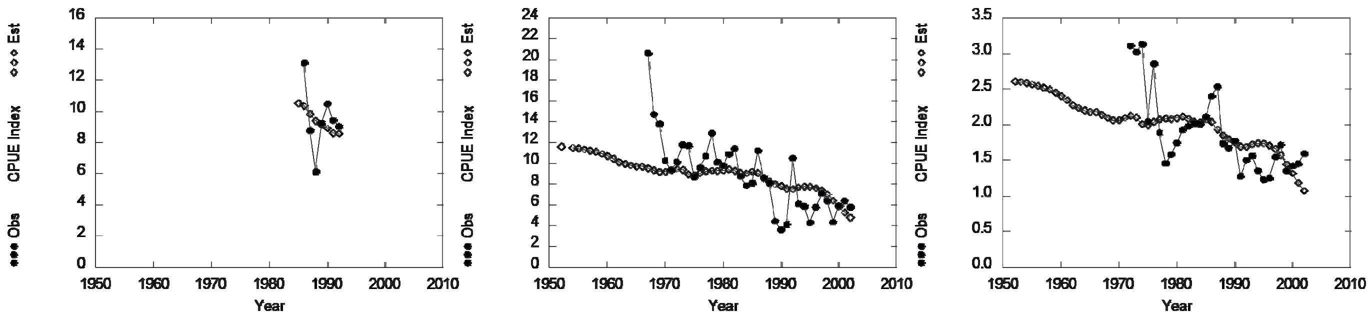


Figure 8. Indian Ocean albacore assessment. Observed CPUEs (closed circle) for ASPIC and estimated CPUEs (open diamond) by ASPIC run with the condition of case 2, full data period, B1/Bmsy=2.0 fixed. Left: Gillnet, middle: Taiwanese LL, right: Japanese LL

5. Technical advice for albacore tuna

The variable results from the attempts at fitting a production model illustrated the difficulties the model had interpreting the data. This also indicated that the outputs from the stock assessment are highly uncertain. Results from the most realistic run suggest that current catch levels are not sustainable. Although other indicators, such as the average size in the catch and CPUE trends have been stable in recent years, the WPTMT has noted that CPUE may not be a reliable index of abundance. On balance, the 2004 assessment and previous similar analyses suggest that current catch levels are not sustainable. The WPTMT also noted with concern that preliminary estimates for the Taiwanese fleet indicate a drastic reduction of the catch of albacore tuna in 2003.

With these considerations in mind, the WPTMT agreed that any further increase in effort in the Indian Ocean could be detrimental for the albacore tuna stock.

Taking into account the limited information available to assess the status of albacore tuna and the need for a precautionary approach, the WPTMT recommended that, at least, no increases in catch or fishing effort be allowed until further analyses are conducted.

6. Identify research priorities, and specify data and information requirements, necessary for the Working Party to fulfill its responsibilities.

6.1. Data

The following problem areas were identified in the IOTC database for albacore:

- Lack of size-frequency data from the Republic of Korea and Philippines, Taiwan,China since 1989 and low sample sizes for the Japanese longline fleet.

- Lack of catch and effort data for the Taiwanese fleets for the area between 20-30°E for the whole time series.
- Poor knowledge of the catches, effort and size-frequency from fresh tuna longline vessels, especially from Taiwan,China and several non-reporting fleets.
- Poor knowledge of the catches, effort and size-frequency from non-reporting fleets of deep-freezing tuna longliners, especially since the mid 1980s.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery in recent years.
- Poor knowledge of the catches, effort and size-frequency data for non-reporting purse seiners.

6.2. Biology

- The WPTMT recommend that review of existing age and growth information be undertaken with a view to obtaining robust information for input into an albacore stock assessment. If the existing information is uncertain then new work to estimate age and growth should be carried out.
- The stock structure of albacore is uncertain. It is possible that mixing occurs between the Indian Ocean and south Atlantic Ocean populations. The WPTMT noted the need for a large scale tagging program, including archival tags, in the Indian Ocean, and possibly incorporating with other fishery organizations, ICCAT. Tagging program may also provide important information to the knowledge of albacore migration in the Indian Ocean.
- Study related to the maturity of albacore is strongly encouraged by the WPTMT.

6.3. Stock assessment

- The WPTMT acknowledged the effort made to collect length information by many fishing entities, and strongly encouraged them to carry on the collection and to improve their data quality. The WPTMT also noted the need for evaluation of these length data before further application.
- The WPTMT acknowledged the importance of age structure information to stock assessment, and strongly encouraged all scientists and fishing entities to carry on constructing the catch at age and age specific abundance indices, based on the evaluated size data and size at age information.
- The WPTMT acknowledged the research contribution from Taiwanese participants, particularly for their effort in the improvement of data collection and analyses, as these are essential components for the assessment of the Indian Ocean albacore tuna resources.

7. Other business

8. Adoption of the Report

The report of the WPTMT was adopted on 5 August 2004.

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APPENDIX II. AGENDA OF THE MEETING

1. Election of a Working Party Chair for the next biennium

2. Review the statistical data for the temperate tuna species and the situation in reporting countries on data acquisition, for reporting to the WPDCS.

3. Review information on the biology and stock structure of temperate tunas, their fisheries and related environmental data.

4. Review information on the status of temperate tuna.

    1. Stock status indicators.

    2. If possible, undertake stock assessment for albacore tuna.

5. If possible, develop technical advice on management options, their implications and related matters for albacore tuna.

6. Identify research priorities, and specify data and information requirements, necessary for the Working Party to fulfill its responsibilities

7. Any other business

8. Adoption of the Report

APPENDIX III. LIST OF DOCUMENTS PRESENTED TO THE MEETING

Document	**Title and authors**
IOTC-2004-WPTMT-AG	Preliminary Agenda *IOTC Secretariat*
IOTC-2004-WPTMT-01	Status of IOTC databases for albacore *IOTC Secretariat*
IOTC-2004-WPTMT-02	An overview of Indian Ocean albacore : fisheries, stocks and research *Alain Fonteneau (to be presented by Alejandro Anganuzzi, IOTC)*
IOTC-2004-WPTMT-03	General reviews of Indian Ocean Albacore (Thunnus alalunga) *Tom Nishida and Miyako Tanaka*
IOTC-2004-WPTMT-04	cancelled
IOTC-2004-WPTMT-05	Age Specific Abundance Indices for the Indian Ocean Albacore Caught by the Taiwanese Longline Fishery, 1980-2002 *Hui-Hua Lee, Chien-Chung Hsu, and Yu-Min Yeh*
IOTC-2004-WPTMT-06	The seasonal distribution of Indian albacore *Chiee-Young Chee*
IOTC-2004-WPTMT-07	Description of Albacore Fisheries of Taiwan in the Indian Ocean *Fisheries Agency, Council of Agriculture, R. O. C.*
IOTC-2004-WPTMT-08	Brief review of Japanese longline fishery and its albacore catch in the Indian Ocean. *Koji Uosaki*
IOTC-2004-WPTMT-09	Update of the standardized CPUE of albacore caught by Japanese longline fishery in the Indian Ocean. *Koji Uosaki*
IOTC-2004-WPTMT-INF01	Influence of Coupled Rossby Waves on primary productivity and tuna abundance in the Indian Ocean *Warren B. White, Katheryn A. Gloersen, Francies Marsac and Yves M. Tourre (to be presented by François Poisson, IOTC)*
IOTC-2004-WPTMT-INF02	Reviews and prospects on approaches reflecting actual dynamics of Taiwanese longline fisheries in CPUE standardizations when number of hook per basket information not available - THE TREATMENTS OF CLASSIFICATIONS AND TARGETING FOR THE TAIWANESE LONGLINERS IN CPUE STANDARDIZATIONS *Tom Nishida, Ying-Chou Lee, Chien-Chung Hsu and Shui-Kai (Eric) Chang*
IOTC-2004-WPTMT-INF03	Brief review of the past stock assessments of te Indian Ocean albacore (Thunnus alalunga) resource *Local Secretariat*
IOTC-2004-WPTMT-INF04	Adaptive virtual population analysis of the Indian albacore stock *Shu-Hwei Wang, Chien-Chung Hsu, and Hsi-Chiang Liu*