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Global status of tuna stocks: summary sheets

Haritz Arrizabalaga[1], Hilario Murua[1] & Jacek Majkowski[2]

Abstract

Tuna stocks are harvested by many countries in all oceans and managed by Regional Fishery Management Organizations (RFMOs). The FAO Fisheries & Aquaculture Department periodically reviews the state of world marine fishery resources, which includes a summary chapter for tunas and tuna like species. This world summary requires a review and synthesis of assessment reports, as well as additional preparatory work which is not then documented elsewhere. Thus, the objective of the present publication is to present the information used and summarized by FAO. It essentially includes a review of worldwide tuna catch, fisheries and stock status for the most commercially important 23 tuna populations, which was done between late 2010 and early 2011. The review not only focuses on the stock status, but also on its evolution over time. On one hand, time trends on the stock status (as perceived in the stock assessments available by early 2011) are summarized, focussing on three reference periods. In addition to this, and when enough stock assessment information is available for the historic period, the early 2011 perception of stock status is compared with the stock status as perceived in stock assessments conducted in the past, allowing a retrospective analysis.

Resumen

Los stocks de túnidos son explotados por varios países en todos los océanos, y gestionados por Organizaciones Regionales de Pesca (ORPs). El Departamento de Pesquerías y Acuicultura de la FAO revisa periódicamente el estado de los recursos pesqueros marinos de todo el mundo, incluyendo un capítulo sobre el estado de los stocks de túnidos y especies afines. Este trabajo requiere de una revisión y síntesis de informes de evaluaciones de stock, así como de trabajo preparatorio adicional que generalmente no se documenta. Por tanto, el objetivo de esta publicación es presentar la información utilizada y resumida por FAO. Esencialmente incluye una revisión mundial de la captura, pesquerías y estado del stock de las 23 poblaciones de túnidos de mayor interés comercial, que fue realizada entre finales del 2010 y principios del 2011. La revisión se centra en el estado de los stocks, pero también en su evolución temporal. Por una parte, se resumen las tendencias temporales en el estado de los stocks (según las evaluaciones disponibles en 2011), enfocando el análisis en tres períodos de referencia. Además, esta evolución temporal del estado del stock es comparada con su estado estimado en evaluaciones realizadas en el pasado, permitiendo hacer, cuando existe suficiente información disponible, un análisis retrospectivo.

Introduction

Tuna and tuna-like species are important socio-economic resources as well as a significant source of protein for the society. They include approximately forty species occurring in the Indian, Pacific and Atlantic Oceans. The most commercially important tuna species are albacore *(Thunnus alalunga,* ALB*)*, bigeye *(Thunnus obesus,* BET*)*, Atlantic bluefin *(Thunnus thynnus,* BFT*)*, Pacific bluefin *(Thunnus orientalis,* PBF*)*, skipjack *(Katsuwonus pelamis,* SKJ*)*, southern bluefin *(Thunnus maccoyii,* SBF*)* and yellowfin *(Thunnus albacares,* YFT*)*. They can perform long migrations and their spatial distribution includes temperate and tropical regions of all oceans. SKJ, YFT and BET are tropical tunas, while ALB, BFT, PBF, SBF are temperate tunas. These species are caught by several industrial fleets of different countries as well as by artisanal fleets of coastal states, landed and processed in many locations around the world, traded in a global market, and finally consumed worldwide.

For management purposes, 23 stocks of these tuna species are considered. There are three albacore tuna stocks in the Atlantic (namely the North Atlantic, South Atlantic and Mediterranean stocks), two albacore stocks in the Pacific (the North Pacific and the South Pacific stocks), and a single stock in the Indian ocean. Atlantic bluefin tuna is subdivided into a western stock and an eastern stock (that includes the Mediterranean sea). There is a single stock of Pacific bluefin tuna, as well as a single stock of southern bluefin tuna inhabiting the southern parts of all the three oceans. For both bigeye and yellowfin tunas, two stocks are considered in the Pacific Ocean (the eastern and western stocks, respectively), while a single stock is considered in the Atlantic and Indian Oceans. Regarding skipjack tuna, two stocks are

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considered in both the Pacific and Atlantic oceans (the eastern and western stocks, respectively), while a single stock is considered in the Indian Ocean.

A number of international tuna Regional Fishery Management Organizations (RFMOs) have been created in order to manage these stocks: the International Commission for the Conservation of Atlantic Tunas (ICCAT, www.iccat.int), the Indian Ocean Tuna Commission (IOTC, www.iotc.org), the Western and Central Pacific Fisheries Commission (WCPFC, www.wcpfc.int), the Inter-American Tropical Tuna Commission (IATTC, www.iattc.org) and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT, www.ccsbt.org). ICCAT, IOTC, WCPFC and IATTC are responsible for the management of tunas in the Atlantic Ocean, Indian ocean, Western Pacific Ocean and Eastern Pacific Oceans, respectively, while CCSBT is responsible for the conservation of southern bluefin tuna that inhabits the three oceans. In addition, the Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC, http://isc.ac.affrc.go.jp/) and the Secretariat of the Pacific Community (SPC, www.spc.int) conduct or facilitate the assessment of tuna stocks in the North and South Pacific, respectively.

Over the last decades, tuna fleets and their catches have been growing (Allen, 2010), to the extent that some stocks are overexploited or are at risk of being overexploited. The different tuna commissions face with similar situations and problems and they have recently started to cooperate through information sharing and common discussion (see Kobe I and Kobe II reports at www.tuna-org.org). Among other things, they have discussed and agreed on the use of phase diagrams (i.e. "Kobe Plots") as a common tool for the tuna RFMOs to communicate the condition of stocks.

The FAO Fisheries & Aquaculture Department periodically reviews the state of world marine fishery resources, which includes a summary chapter for tunas and tuna like species (Majkowski *et al.* 2011). This world summary requires a review and synthesis of assessment reports, as well as additional preparatory work, which is not then documented elsewhere. Thus, the objective of the present publication is to present the information used and summarized by Majkowski *et al.* (2011). It essentially includes a review of worldwide tuna catch, fisheries and stock status for the most commercially important 23 tuna populations, which was done between late 2010 and early 2011. The review not only focuses on the stock status, but also on its evolution over time. On one hand, time trends on the stock status (as perceived in the stock assessments available in early 2011) are summarized, focussing on three reference periods. In addition to this, and when enough stock assessment information is available for the historic period, the early 2011 perception of stock status is compared with the stock status as perceived in stock assessments conducted in the past, allowing a retrospective analysis.

The manuscript is organized in three main sections. Section 2 describes the sources of information used and the criteria used to present this information, which is used to classify stocks according to their status. Section 3 presents a global summary of tuna catches by species, gear and ocean. Finally, Section 4 presents the summary sheets for each of the stocks. These summary sheets include (wherever information is available) a description of fisheries and catches, state of the stock, relevant recommendations and/or regulations, and a comparative analysis of the outcomes of different assessment efforts conducted in the past. Each summary sheet typically includes two self-explanatory plots, one with the catch time series and another one with the Kobe Plot reflecting stock status (which is described in Section 2). Moreover, it also includes a summary table with numeric information about catch and stock status relative to reference points for the last stock assessment as well as for previous stock assessments (if available).

Sources of information and methods

Catches

Information on the annual tuna catches for section 3 of this document is taken from the Global Tuna Catches database provided by FAO's Fisheries Global Information System (FIGIS) and freely available at the FAO webpage (http://www.fao.org/fishery/statistics/tuna-catches/en).

This Global Tuna Catches database contains nominal catches by species, ocean, stock and gear for the main marketed tuna (i.e. albacore, bluefin, bigeye, Pacific bluefin, southern bluefin, skipjack and yellowfin tuna) since 1950 onwards. The gears are divided into longline, trolling, pole-and-line, purse-seine, and "other gears". At the time of writing this document, 2007 was the last year available, which may be reviewed in the future. The database contains data submitted by the different tuna RFMOs (CCSBT, IATTC, ICCAT, IOTC, and SPC).

However, the catch by gear information for each stock presented in the summary sheets (section 4) is taken from the respective RFMO assessment working group reports, including, in most cases, catch data up until 2008 (i.e. the last year used in the assessment).

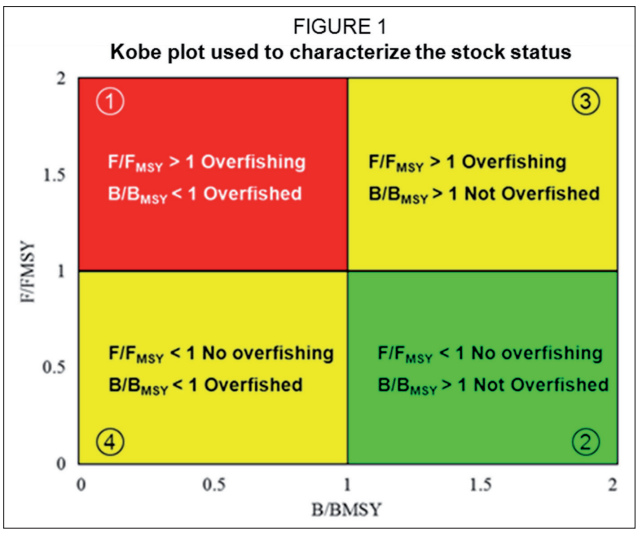
Stock status and management considerations

The information on the status of the stocks and management considerations were obtained from stock assessment reports and/or annual reports of Scientific Committees from different tuna Regional Fishery Management Organizations (CCSBT, IATT, ICCAT, IOTC, and WCPFC). The stocks were classified using current and commonly used biological and fishing mortality reference points to assess the stock status in most of the tuna RFMOs: B/B_{MSY} defined as the spawning stock biomass (B) relative to the spawning stock biomass at MSY and F/F_{MSY} defined as the fishing mortality (F) relative to the F at which MSY can be obtained. In some cases, especially for past assessments, only qualitative information on stock status is available (*e.g.* spawning stock biomass and fishing mortality were high/low, and F/F_{MSY} and B/B_{MSY} were higher or lower than 1). For some stocks, no MSY based reference points are available. In these cases, the stock status is reflected according to the reference points used by the scientific working groups

assessing those stocks. If available, the Maximum Sustainable Yield estimate is also presented for all the stocks and for the different time periods.

In the summary sheets (section 4), the status of each stock is represented by a Kobe Plot (if available), as produced by the scientific bodies of each Tuna RFMO (Figure 1). The Kobe plot represents B/B_{MSY} and F/F_{MSY} in a figure which gives 4 different zones, each representing a different stock status: (1) red zone, representing an overfished stock and that overfishing is occurring, (2) green zone, representing a situation where no overfishing is taking place and where the stock is not overfished, (3) yellow or orange zone, where overfishing is occurring while the stock is not overfished, and (4) alternative yellow area where overfishing is not taking place but the stock is overfished.

FIGURE 1
Kobe plot used to characterize the stock status



When more than one assessment scenario were considered by the RFMOs, the information on section 4 reflects the estimates for the base case or for the scenario used to provide management advice. When alternative scenarios have equal weight in the management advice, the range of alternative estimates is provided. In either case, the Kobe plot is used as provided by the scientific reports. Some plots include time trends in stock status, and some do not. Similarly, some plots include confidence intervals around the current stock status, and some do not. Where available, the summary tables in section 4 reflect confidence intervals for the reference points and the text try to describe the different sources of uncertainty that have been considered for the stock. These uncertainties are the result of deficiencies in the data, methods applied to analyse the data, or even the lack of information about biological processes.

The stock status was reviewed for 3 different time periods:

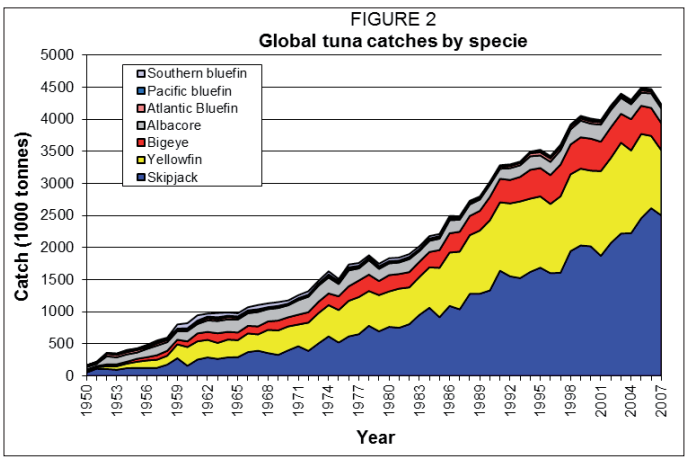
- "Present": last assessment performed for the stock which is usually the 2009 assessment year including, in most cases, catch data up to 2008.
- "Recent past": 2000 to 2003 assessment years when the last review on tuna stock status was done by de Leiva and Majkowski (2005).
- "Early past": assessments conducted around the mid-1980s.

The intention was to compare the perception of stock status around 1985, with the status of the stocks at the beginning of 2000s, as well as the current perceptions. In some cases, it was not possible to review as far back in time because at that time the stocks were not commonly assessed and because the actual reference points used to appraise the stock status were not calculated, were not comparable to those used more recently, or were not available. When B/B_{MSY} and F/F_{MSY} reference points are available for recent past and early past assessments, these are included in the Kobe plot, indicating the reference year.

Global Summary of the catches

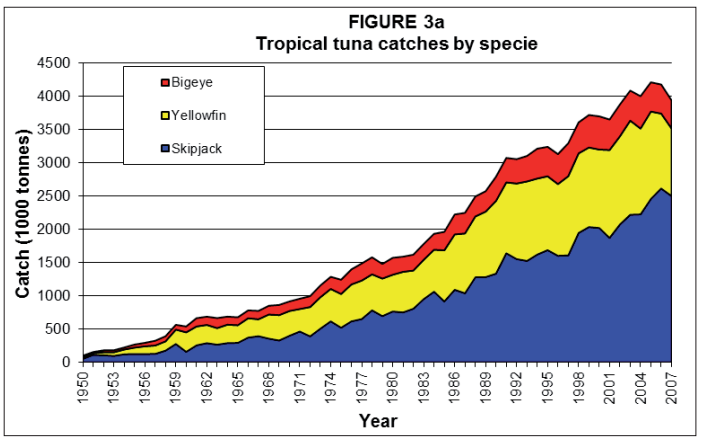
Tuna and tuna-like species include approximately forty species, with a current global production of almost 6 million tonnes. The most commercially important tuna species are albacore *(Thunnus alalunga,* ALB*)*, bigeye *(Thunnus obesus,* BET*)*, Atlantic bluefin *(Thunnus thynnus,* BFT*)*, Pacific bluefin *(Thunnus orientalis,* PBF*)*, skipjack *(Katsuwonus pelamis,* SKJ*)*, southern bluefin *(Thunnus maccoyii,* SBF*)* and yellowfin *(Thunnus albacares,* YFT*)*. The total catch of marketed tuna species has increased continuously from 1950 to 2007, with the highest level, around 4.5 million tonnes, observed in 2005 (Figure 2). In 2007, their catch was above four million tonnes, which represents around 65 percent of the total catch of all tuna and tuna-like species. The tropical tunas (BET, SKJ, and YFT) accounted for most of the catches (93 percent), being the total catch around 3.9 million tonnes in 2007, while temperate tunas worldwide catch was around 0.3 million tonnes. The individual contribution to total catch of principal commercial tuna species in 2007 was around 59 percent for SKJ, around 24 percent for YFT, 10 percent for BET, 5 percent for ALB, and around 1 percent, 0.5 percent and 0.5 percent for BFT, PBF and SBF, respectively.

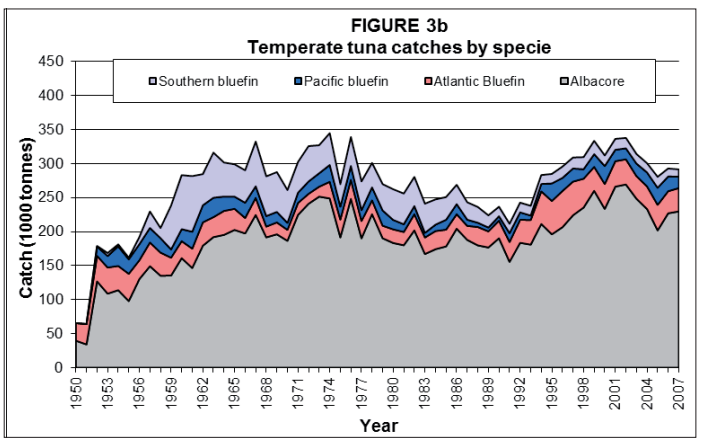
FIGURE 2
Global tuna catches by specie



The increasing trend in total catch is mainly due to the expansion of tropical tuna fisheries (Figure 3a). In fact, tropical tuna catch increased continuously since 1950 till the highest

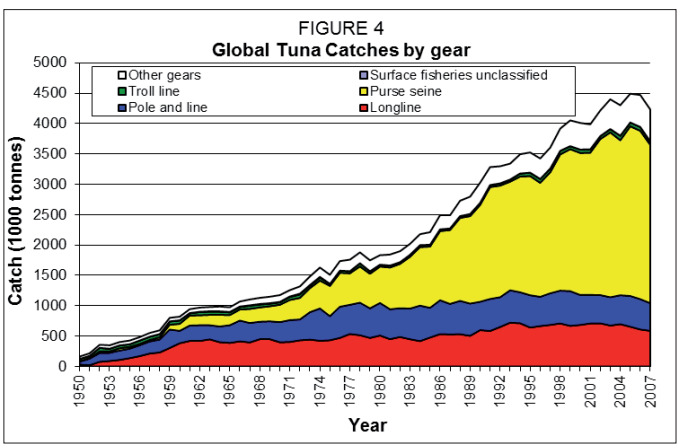
catches of the time series in 2005 of about 4.2 million tonnes. The same increasing trend can be observed in each of the tropical tuna species: for example, BET reached the highest records of about 0.5 million tonnes in 2000, decreasing to levels around 0.4 million tonnes in 2007; YFT catch was highest, around 1.4 million tonnes in 2003, decreasing afterwards to 1 million in 2007, whereas SKJ catch was highest in 2006 with a total catch of about 1.6 million tonnes, similar to the 2007 level. On the contrary, temperate tunas showed an increasing trend from 1950 up to the highest catch levels (about 0.35 million tonnes) in the time series in 1974 (Figure 3b). Since then, the catches showed a decreasing trend reaching a minimum catch level at around 0.2 million tonnes in 1991 which was not observed since 1958. More recently catches increased again to reach a second peak (about 0.34 million tonnes) of similar magnitude to the peak observed in 2001 and 2002. After that, temperate tuna catches slightly decreased to around 0.3 million tonnes in the last four years.



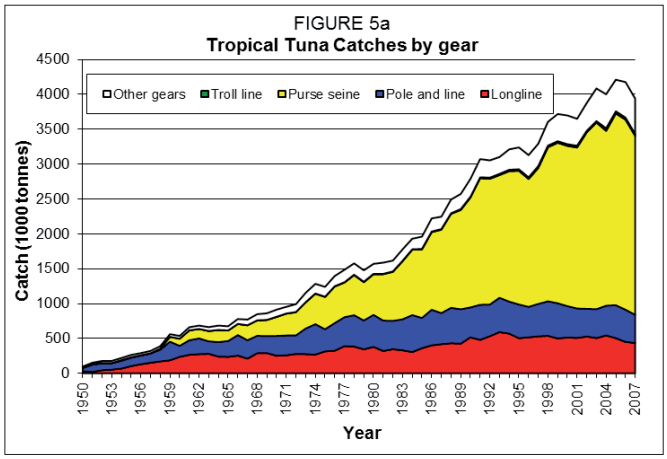


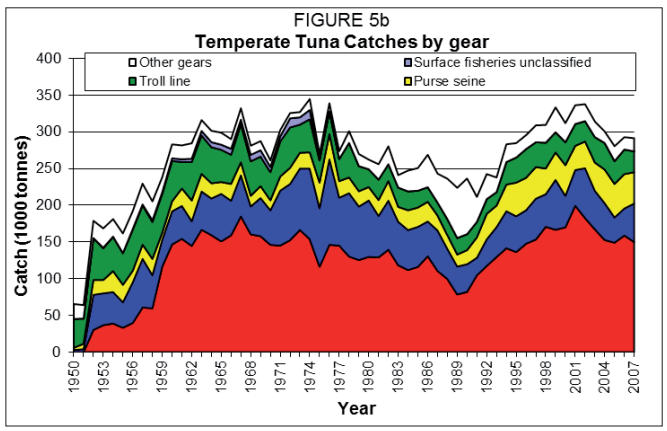
The relative contribution of each gear to the total tuna catch has changed over time. At the beginning of the time series, most of the catches were taken with troll line and pole-and-line gears which accounted for 20 percent and 40 percent of the catches, respectively. However, their contribution rapidly decreased with the expansion of longline fleets which accounted for around 50 percent of the catches by 1960. At that time, pole-and-line gear and troll line gear reduced their contribution to 25 percent and 7 percent, respectively, while the contribution of purse-seine gear increased up to 14 percent of the total catch. From 1960 onwards, the contribution of longline continuously decreased to around 30 percent in 1973 and kept at that level up to (5) the mid-1980s, the contribution of pole-and-line remained at about 30 percent up to the mid-1980s, and the contribution of purse-seine increased continuously reaching 40 percent of the total catch by the mid-1980s. The continuous increase of total catch since then has been mainly supported by the expansion of purse-seine fisheries from mid and late 1980s. In the last years, purse-seine gear contributed approximately to 60 percent of the total catch (Figure 4).

Longline catches increased continuously since 1950 to reach their highest level of about 0.7 million tonnes in 1993 and since then they have been between 0.6 and 0.7 million tonnes. Similarly, pole-and-line catches have been increasing since 1950 to the highest level on records of about 0.6 million tonnes in 1984 and since then they have remained relatively constant around 0.5 million tonnes. On the contrary, purse-seine catches have increased continuously from 1950 to 2007, with the highest level ever observed of around 2.8 million tonnes in 2005 (Figure 4).



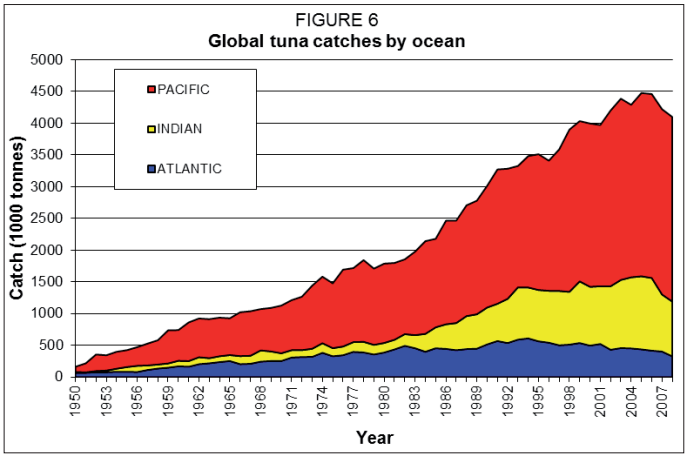
In relation to the contribution of different gears to the catch of temperate and tropical tunas, it is observed that the temporal pattern of relative contribution of different gears to the total catch of tropical tunas is similar to the overall temporal pattern described above (Figure 5a). However, in the case of temperate tunas, the contribution of different gears has not changed significantly since 1960. The main gears targeting temperate tunas are longline and pole-and-line, although the contribution of purse-seine has slightly increased during the last 3 years (Figure 5b).



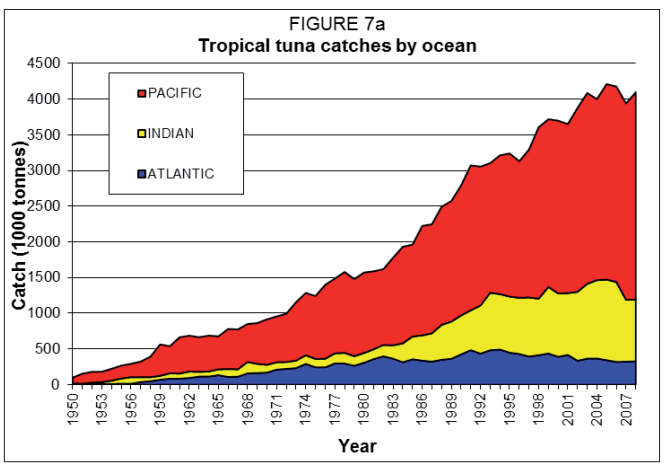


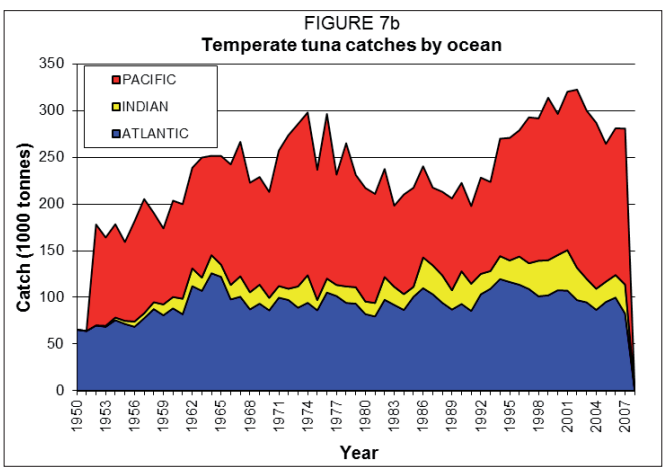
Highest catches of the principal market tuna species are from the Pacific, which accounted for around 70 percent of the total catch of principal market tuna species in 2007, followed by the Indian ocean and by the Atlantic ocean and Mediterranean Sea with a contribution of around 20 percent and 10 percent, respectively. The relative contribution of each ocean to the total tuna catches has not changed significantly over time. Although the contribution of the Atlantic was between 30 percent and 40 percent in the beginning of the 1950s when the overall catches were rather low, since the mid-1950s the contributions of the Atlantic and Indian oceans have been quite stable at around 20 to 25 percent for the Atlantic and around 10 percent for the Indian ocean up to the mid-1980s. Since then, mainly due to the development of the industrial purse-seine fishery in the Indian ocean, the relative contributions have changed and remained relatively stable during the last 25 years: around 65 percent of the catches are from the Pacific ocean, 20 to 25 percent from the Indian ocean and 10 to 15 percent from the Atlantic (including the Mediterranean Sea).

The Pacific and Indian ocean catches increased continuously since 1950 to reach their highest levels of about 2.9 and 1.1 million tonnes in 2007 and 2006, respectively. Similarly, the Atlantic and Mediterranean Sea catches have been increasing since 1950 to the highest level on records at around 0.6 million tonnes in 1994 and since then they have slightly decreased to remain relatively stable at around 0.4 million tonnes in the last years (Figure 6).



The relative contribution of different oceans to the total catches of tropical tunas is similar to the overall temporal pattern described above. The relative contribution of the Pacific ocean to the total tropical tuna catches has been around 70 percent throughout the whole time period. The Atlantic and Indian oceans contributed with around 20 percent and 10 percent respectively until the mid-1980s, and with around 10 percent and 20 percent since then, respectively (Figure 7a). In the case of temperate tunas, the contribution of different oceans has not changed significantly since 1950, being around 50 percent for the Pacific, 40 percent for the Atlantic and Mediterranean, and 10 percent for the Indian ocean (Figure 7b).





The contribution of each species within each of the oceans is shown in Figures 8a, 8b and 8c. In the Pacific, most of the catches consisted mainly of skipjack and yellowfin tuna, followed by albacore up to 1976 and by bigeye tuna afterwards (Figure 8a). In the Indian ocean, from 1950 to 1980, most of the catches (at relatively low levels at that time) consisted of yellowfin tuna followed closely by skipjack and bigeye tuna. From 1980 to around 1998 the proportions of yellowfin and skipjack tuna were comparable, and since then, generally, skipjack tuna catches have been larger than yellowfin tuna catches (Figure 8b). In the Atlantic, the figure is somewhat different as temperate tuna catch is relatively more important than in other oceans. Bluefin and albacore tuna dominated the catches obtained up to 1960. During the 1960s the catches of tropical tunas were comparable to those of temperate tunas. However, since then, tropical tunas contributed more to the total catch than temperate tunas (Figure 8c).

FIGURE 8a
Pacific Ocean Global Tuna Catches

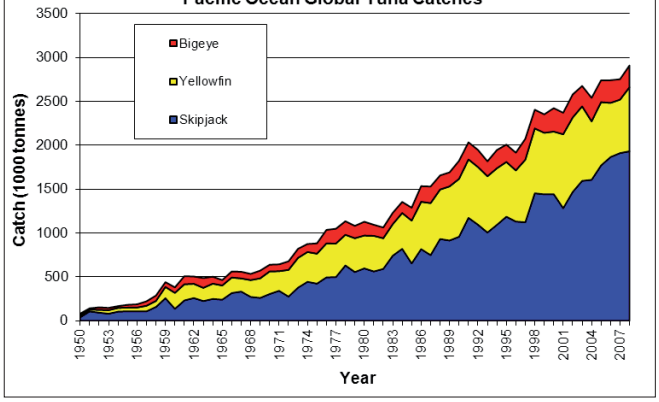


FIGURE 8b
Indian Ocean Global Tuna Catches

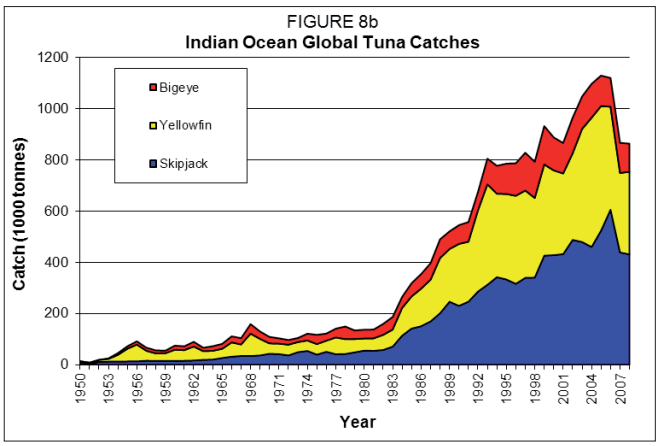
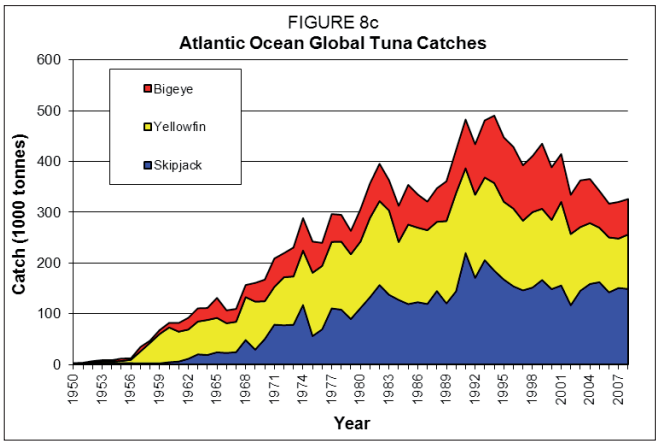


FIGURE 8c
Atlantic Ocean Global Tuna Catches

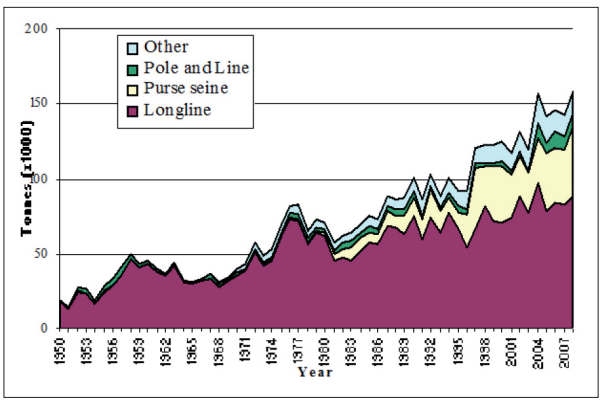


Summary Sheets

Bigeye tuna *(Thunnus obesus)* in the Western Central Pacific ocean

Fishery and Catches: Bigeye tuna are an important component of tuna fisheries throughout the Pacific ocean and are taken by both surface gears, mostly as juveniles, and longline gear, as valuable adult fish.

The catches of BET in the Western and Central Pacific ocean WCPO increased continuously from 1950 onwards. Longline catches increased continuously reaching a peak of about 84 000 tonnes in 2004 and decreasing afterwards. Since about 1994, there has been a rapid increase in purse-seine catches of bigeye tuna, being less than 20 000 tonnes until 1996 and increasing to 55 000 tonnes up to 2001, primarily as a result of increased use of fish aggregation devices (FADs), and since 2001 catches have averaged over 28 000 tonnes annually. The bigeye tuna catch for 2008 (157 054 tonnes) was the second highest on record (slightly lower than the record catch of 157 173 tonnes taken in 2004).



State of the Stock: In 2009, the status of the stock of the Western and Central Pacific bigeye stock was assessed using a length based, age structured assessment model (MULTIFAN-CL).

MSY: Based on the assessment results, the MSY was estimated to be 56 880 (52 120 – 67 800) when long-term recruitment is considered and 118 000 tonnes (110 000 – 146 114 tonnes) when assuming recent high recruitment. Recent catches in 2008 (134 315 tonnes) are well above the MSY levels estimated regardless the recruitment levels assumed. Catches are still around 20 percent higher than the re-calculated MSY based on recent high recruitment.

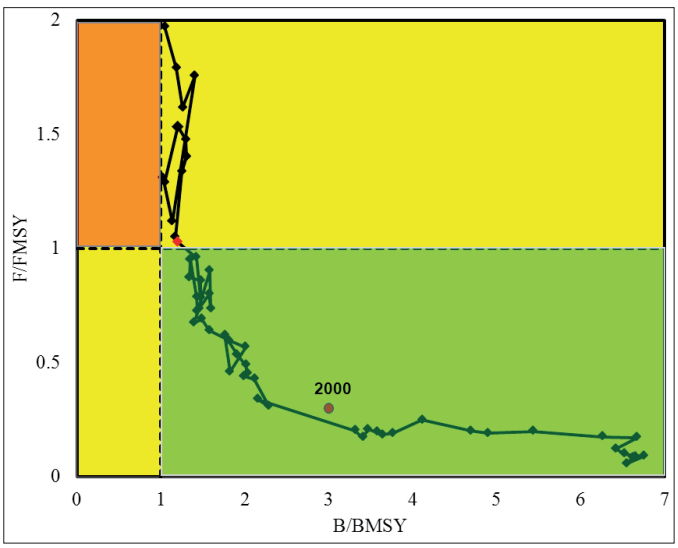
Biomass: $B_{2004\text{-}2007}$ exceeds B_{MSY} in five of the six assessment scenarios considered, indicating that the WCPO bigeye tuna stock is not in an overfished state. However, B_{2008} exceeds B_{MSY} in only one scenario.

Fishing mortality: For all six model runs, $F_{2004\text{-}2007}/F_{MSY}$ is considerably greater than 1, ranging from 1.51 to 2.01. A 34 to 50 percent reduction in fishing mortality would be required from the 2004 to 2007 level to reduce fishing mortality to sustainable levels at a steepness of 0.98.

In summary, based on the last assessment, it can be concluded that overfishing is occurring in the bigeye tuna stock and that it is in a slightly overfished state, or will be in the near future.

Recommendation: The Scientific Committee (SC) recommended a minimum of 30 percent reduction in bigeye tuna fishing mortality from the average levels in 2004 to 2007 with the goal of reducing the fishing mortality rate to F_{MSY}.

Comparative analysis: A comparison of the results from the 2009 and 2002 assessments are given in the table and figure below. The results are very different for both the estimated B/B_{MSY} and F/F_{MSY}. The difference in the MSY estimate is around 30 000 tonnes. The retrospective analysis shows that B/B_{MSY} is greatly overestimated and F/F_{MSY} is underestimated in 2000 in relation to the new figures estimated in the 2009 assessment for the year 2000.

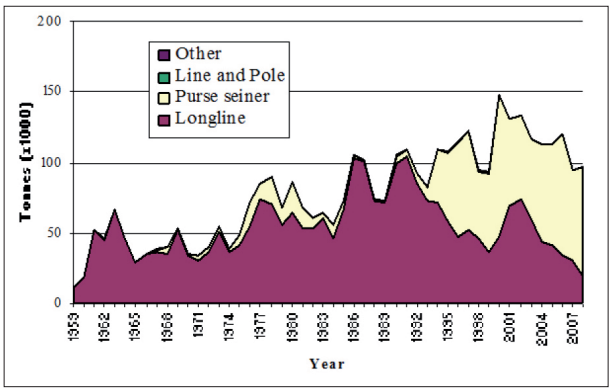


Assessment year	2009[1]	2009	2002
Reference year	2004-2007	2000	2000
Catches	157 865		124 445
MSY	56 880		87 000
$B_{2004\text{-}2007}/B_{MSY}$	1.22	1.2	3.0
$F_{2004\text{-}2007}/F_{MSY}$	1.79	1.5	0.3

[1] Values of BET base case assessment (run 10)

Bigeye tuna *(Thunnus obesus)* in the Eastern Pacific ocean

Fishery and Catches: The stock has been exploited mainly by longline and purse-seine fisheries. Total catch increased up to the late-1970s reaching around 90 000 tonnes in 1978, decreased the following years until 1984 and increased again to around 105 000 tonnes in 1986. Since then catches fluctuated around 100 000 tonnes until 2000 when the highest historic catches of 148 000 tonnes were observed. During the last decade, catches have been steadily decreasing and total catch was 98 000 tonnes in 2008, the lowest observed since 1999. The contribution of longline to the total catch was around 89 percent in the period from 1959 to 1993. However, with the introduction of the FAD fishery in 1994, the contribution of longline has decreased to around 45 percent.



State of the Stock: In 2009, the Stock Synthesis 3 (SS3) stock assessment model was applied to the Eastern Pacific Ocean (EPO) bigeye tuna stock.

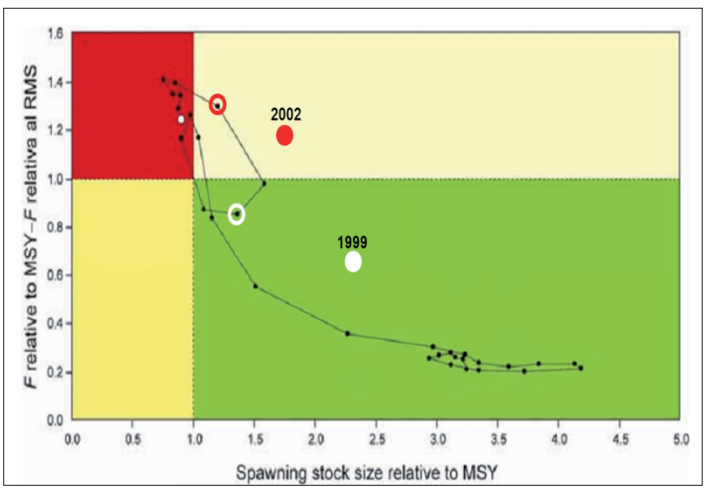
MSY: The base case assessment estimate of MSY was 83 615 tonnes. The preliminary estimate of catches in 2008 (97 330 tonnes) is above the MSY and more recent catches are estimated to have significantly exceeded MSY.

Biomass: Spawning stock biomass of bigeye tuna in 2009 is near the lowest observed value of the historic time series and is below the level that would produce MSY. Biomass trajectories indicate that the spawning stock biomass in 2009 is below the MSY level and, therefore, the bigeye tuna stock in EPO is considered to be overexploited.

Fishing mortality: Fishing mortality in the period from 2006 to 2008 appears to be above the MSY level. Fishing mortality trajectories indicate that the fishing mortality has recently exceeded the MSY level and, therefore, it is considered that overfishing is taking place in the EPO bigeye tuna stock.

Recommendation/Regulation: Considering the stock status of BET together with that of YFT, the 80th meeting of the IATTC decided (i) an area closure for the purse-seine fishery defined by the coordinates 96º and 110ºW and between 4°N and 3°S, from 29th of September to 29th of October, (ii) total closure of the EPO for the purse-seine fishery for 62 days in 2010 and 73 days in 2011, and (iii) that China, Japan, Korea and Chinese Tapei longline fleet ensure lower total catches of BET than 2 507, 32 372, 11 947, and 7 555 tonnes, respectively (less than 500 tonnes for other longline countries).

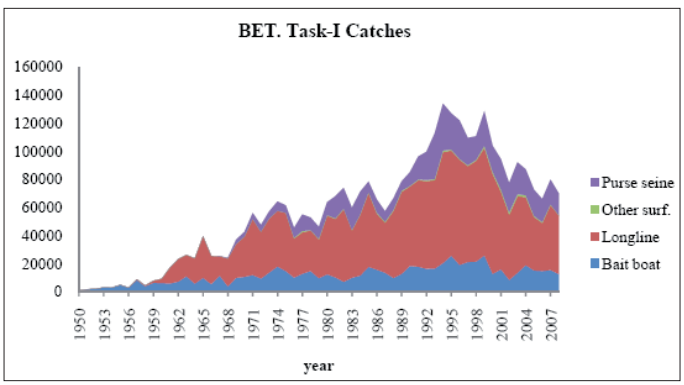
Comparative analysis: A comparison of the results from the 2009, 2003 and 2000 assessments are given in the table and figure below. The results are quite different, showing a clear retrospective pattern. For example, an increasing trend in the MSY can be observed, which can be expected due to changes in the fishery. Differences in the estimate of B/B_{MSY} and F/F_{MSY} are also observed. The retrospective analysis suggests that the B/B_{MSY} was overestimated and F/F_{MSY} was underestimated in previous assessments in relation to the new figures estimated in 2009. The change in the assessment method from A-SCALA (2000 and 2003) to SS-3 can have contributed to the observed differences.



Assessment year	2009	2009	2009	2003	2000
Reference year	2008	2002	1999	2002	1999
Catches	97 330	132 825	93 078	132 825	93 078
MSY	83 615			77 199	73 177
B/B_{MSY}	0.89	1.33	1.30	1.68	2.29
F/F_{MSY}	1.23	1.30	0.81	1.19	0.63

Bigeye tuna *(Thunnus obesus)* in the Atlantic ocean

Fishery and Catches: The stock has been exploited by three major gears (longline, baitboat and purse-seine fisheries) and by many countries throughout its range of distribution. The total annual catch increased up to the mid-1970s reaching 60 000 tonnes and fluctuated over the next 15 years. In 1991, catch surpassed 95 000 tonnes and continued to increase, reaching a historic high of about 132 000 tonnes in 1994. Reported and estimated catch has been declining since then and fell below 100 000 tonnes in 2001, and reached 65 873 tonnes in 2006, which is the lowest recorded level since 1988. The total catch increased in 2007 reaching 79 597 tonnes. The preliminary estimate for 2008 was 69 821 tonnes.



State of the Stock: In 2007, various stock assessment models were applied to the Atlantic ocean bigeye tuna stock. Consistent with previous assessments of Atlantic bigeye tuna, the results from non-equilibrium production models are used to provide the status of the stock.

MSY: The current MSY estimated using two types of production models was around 90 000 tonnes and 93 000 t, although uncertainty in the estimates broadens the range.

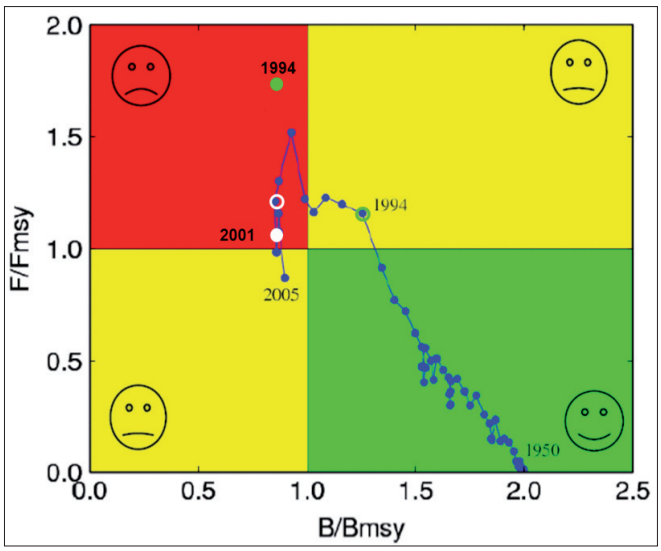
Biomass: The biomass at the beginning of 2006 was estimated to be nearly 92 percent of the biomass at MSY. Biomass trajectories indicate that the spawning stock biomass is below the biomass at MSY level since 1998.

Fishing mortality: The fishing mortality rate in 2005 was estimated to be about 13 percent below the fishing mortality rate at MSY. However, fishing mortality in recent years (1998 to 2004) was at or above the F_{MSY}.

In summary, while estimated values of fishing mortality are below MSY-related values, the B for 2006 is below MSY-related values, indicating an overexploited stock.

Recommendation: The assessment indicated that the stock declined rapidly during the 1990s due to the large catches taken in that period, and recently it has stabilized at around or below the level that produces MSY in response to a large reduction in reported catches. Although recent fishing mortality was below F_{MSY}, it exceeded MSY related values for the period 1998 to 2004. The projection results suggest that the biomass of the stock would possibly decline further with constant catches of 90 000 tonnes or more. Some increase in biomass, leading to the rebuilding of the B_{MSY}, is expected with catches lower than 85 000 tonnes.

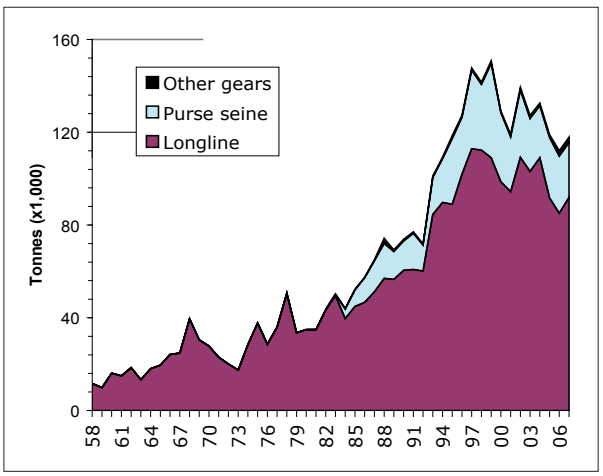
Comparative analysis: A comparison of the results from the 2009 and 2002 assessments are given in the table and figure below. The retrospective analysis shows that results are somewhat similar although F/F_{MSY} was somewhat overestimated in 1995 in relation to the new figures estimated in 2009. The MSY estimated in 1999 was around 20 000 tonnes lower than the most recent estimate.



Assessment year	2007	2007	2007	2002	1995
Reference year	2006	2001	1994	2001	1994
Catches	65 873			96 482	110 091
MSY	90 000 - 93 000			75 000 – 105 000	65 000 (50 000 - 78 000)
B/B_{MSY}	0.92 (0.85 - 1.07)	0.85	1.25	0.81-0.91	0.92 (0.67-1.25)
F/F_{MSY}	0.87 (0.7 – 1.24)	1.40	1.15	1.15	1.71

Bigeye tuna *(Thunnus obesus)* in the Indian ocean

Fishery and Catches: Bigeye tuna is mainly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Total annual catches have increased steadily since the start of the fishery in the late 1950s, reaching the 100 000 tonnes level in 1993 and peaking at 150 000 tonnes in 1999. Total annual catches averaged 122 000 tonnes over the period 2004 to 2008.



State of the Stock: In 2009, four stock assessment models were applied to the Indian ocean bigeye tuna stock using an agreed list of input parameters and ASPM model was chosen as a base case. The results of the stock assessments conducted in 2009 were broadly similar to previous work.

MSY: From the range of MSY estimates, the SC chose the value of 110 000 tonnes. The preliminary estimate of catches in 2008 (107 000 tonnes) is below the current estimate of MSY (110 000 tonnes), although catches in the past (1997 to 1999) have significantly exceeded MSY. Given that the mean annual catch for the period 2003 to 2008 was 123 000 tonnes, it appears that the stock is being exploited at around its maximum level.

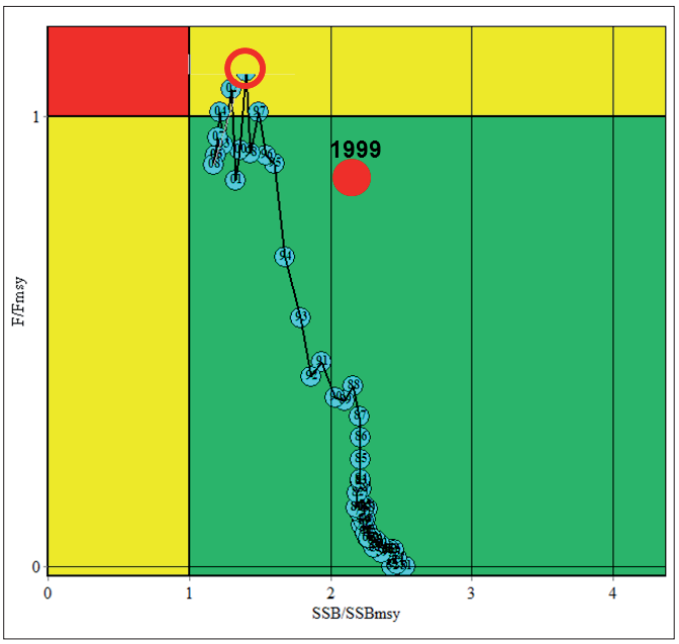
Biomass: Biomass trajectories indicate that the spawning stock biomass is currently (2008) just above the B_{MSY} level, but it has been declining since the late 1970s.

Fishing mortality: The current (2008) fishing mortality is estimated be to just below the F_{MSY} level, but fishing mortality has been increasing steadily since the 1980s.

Estimated values of fishing mortality and B for 2008 are also close to MSY-related values, indicating a fully exploited stock.

Recommendation: The SC recommended that catches of bigeye tuna should not exceed the estimated MSY of 110 000 tonnes.

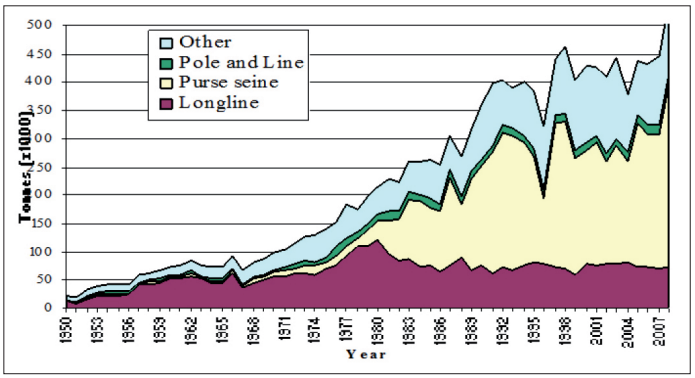
Comparative analysis: A comparison of the results from the 2009 and 2001 assessments are given in the table and figure below. The retrospective analysis shows that the B/B_{MSY} was overestimated and F/F_{MSY} was underestimated in 1999 in relation to the new figures estimated in the 2009 assessment for 1999. The MSY estimated in 1999 was around 20 000 tonnes lower than the current estimate.



Assessment year	2009	2009	2001
Reference year	2008	1999	1999
Catches	107 000		151 400
MSY	110 000 (100 000 - 115 000)		90 000
B/B_{MSY}	1.17	1.45	2.1
F/F_{MSY}	0.9	1.13	0.85

Yellowfin tuna *(Thunnus albacares)* in the Western Central Pacific ocean

Fishery and Catches: The catches of YFT in the WCPO increased continuously from 1950 onwards. Since 2000, the total yellowfin **tuna** catch in the WCPO has ranged between 370 000 and 440 000 tonnes. In 2008, total catch of yellowfin **tuna** was 543 000 tonnes, which was around 20 percent higher than in 2007. Longline catches increased continuously reaching a peak of about 122 000 tonnes in 1980, they showed a decreasing trend afterwards, and fluctuated between 65 000 and 80 000 tonnes since 1984. There has been a rapid increase in purse-seine catches of yellowfin tuna, being less than 30 000 tonnes in 1980, when the peak of longline catches was observed, and reaching rapidly the level of 100 000 tonnes in 1983 and the level of 200 000 tonnes in 1991. Since then, purse-seine catches fluctuated between 200 000 tonnes and 260 000 tonnes. In 2008, purse-seine catch was 326 555 tonnes, the highest on the records.



State of the Stock: In 2009, the status of the stock of the Western and Central Pacific yellowfin tuna stock was assessed using MULTIFAN-CL. Four assessment runs were selected to represent the stock status of yellowfin tuna.

MSY: The estimates of MSY for the four selected models are between 552 000 and 637 000 tonnes. Recent catches in 2008 (543 000 tonnes) are close to the lower range of MSY estimates. However, catches previous to 2007 were below the lower range of MSY.

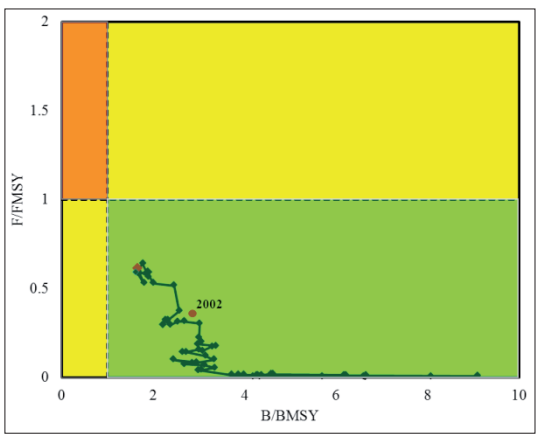
Biomass: Current spawning biomass exceeds the estimated spawning biomass at MSY for four of the models selected (B/B_{MSY} ranging from 1.46 to 1.88), indicating that the WCPO yellowfin tuna stock is not in an overfished condition.

Fishing mortality: For all four model runs, F/F_{MSY} is lower than 1, ranging from 0.58 to 0.68. For a moderate value of steepness (0.75), which can be considered the base case, the F/F_{MSY} was estimated to be between 0.54 and 0.68.

In summary, based on the last assessment, it can be concluded that overfishing is not occurring in the yellowfin tuna stock and that neither it is overfished.

Recommendation: Although the yellowfin tuna stock status has shown an improvement from the last assessment, the SC also noted that exploitation rates were highest in the western equatorial region, which accounts for around 95 percent of the total yellowfin tuna catch, and that the spawning biomass in this region is estimated to have declined to about 30 percent of the unexploited level. Therefore, the SC recommended that there should not be an increase in fishing mortality in the western equatorial region.

Comparative analysis: A comparison of the results from the 2009 and 2003 assessments are given in the table and figure below. The results are somewhat similar, with the main difference found in the upper range and lower range of B/B_{MSY} and F/F_{MSY}, respectively. The MSY range estimated in 2003 is lower than the current estimate (i.e. the upper limit in 2003 is similar to the lower limit of the current MSY range). The retrospective analysis shows that the B/B_{MSY} was slightly overestimated and F/F_{MSY} was slightly underestimated in 2003 in relation to the new figures estimated in the 2009 assessment.



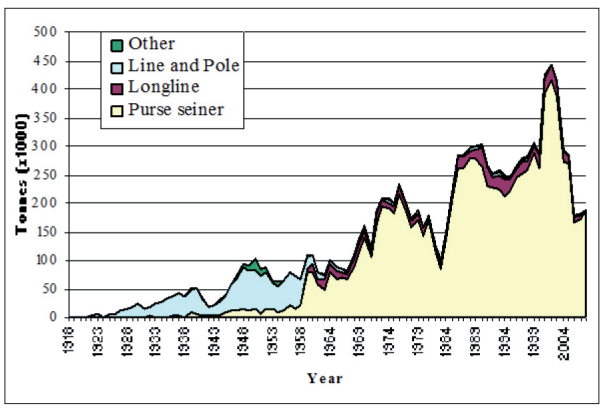
Assessment year	2009[1]	2009	2003[2]
Reference year	2008	2002	2002
Catches	543 214		409 836
MSY	552 000 – 637 000		381 000 – 554 000
B/B_{MSY}	1.46 – 1.88	1.65	1.47 – 2.86
F/F_{MSY}	0.58 – 0.68	0.62	0.36-0.61

[1]2009 assessment data: base case with a moderate value of 0.75 of steepness.

[2]2003 assessment data: Multifan CL using SHBS for abundance indices.

Yellowfin *(Thunnus albacares)* in the Eastern Pacific ocean

Fishery and Catches: The fishery for YFT in the Eastern Pacific started in the beginning of the 1920s. Since then, total catches increased continuously reaching 100 000 tonnes in 1950 and remaining at around that level until 1968. Until about 1960, fishing was dominated by pole-and-line vessels. However, in the early 1960s pole-and-line vessels were converted into purse seiners. From 1968 onwards, total catch increased again to 200 000 tonnes in 1973 and 300 000 tonnes in 1990, with the exception of the 1982 to 1983 period due to El Niño. Since then, catches fluctuated around 250 000 and 300 000 tonnes until 2000 when they increased to the highest observed level of more than 400 000 tonnes in the period 2001 to 2003. Since 2003, catches substantially decreased and the catch during 2008, 188 000 tonnes, was the lowest since 1985.



State of the Stock: In 2009, the SS3 stock assessment model was applied to the EPO YFT stock for the first time. A base case assessment and different sensitivity analysis were carried out.

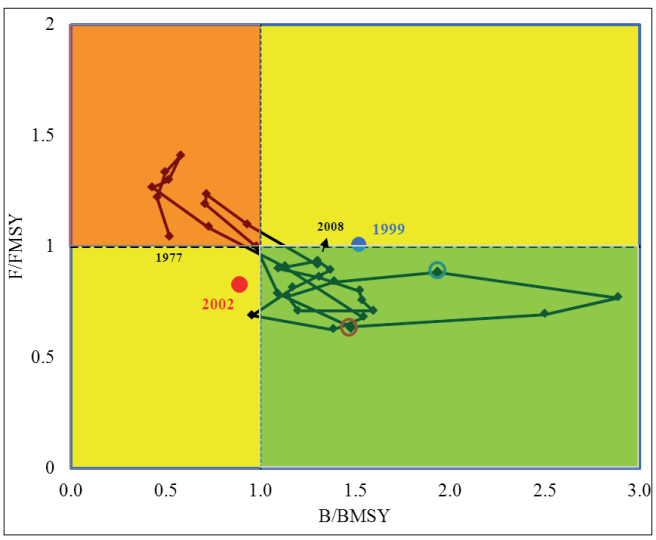
MSY: The base case assessment estimate of MSY was 273 159 tonnes. Recent (2006 to 2007) catches, as well as the preliminary estimate of catches in 2008 (188 000 tonnes) are below the MSY value. Catches since 1985, with the exception of high catches from 2001 to 2003, have been around the MSY value.

Biomass: The B of yellowfin in 2009 is estimated to be above the level corresponding to the MSY. Historically, the yellowfin B in the EPO was below the level corresponding to the MSY during the lower productivity regime from 1975 to 1983, but above that level for most of the following years, except for the recent period between 2004 and 2007.

Fishing mortality: Fishing mortality, as averaged fishing mortality from 2006 to 2008, was estimated to be below the level corresponding to the MSY level. Fishing mortality trajectories indicate that the fishing mortality was below the F_{MSY} level during the recent period, except between 2004 and 2007.

Recommendation: Considering the stock status of YFT together with that of BET, the 80th meeting of the IATTC decided (i) an area closure for the purse-seine fishery defined by the coordinates 96º and 110ºW and between 4°N and 3°S, from 29th of September to 29th of October and (ii) a total closure of the EPO for the purse-seine fishery for 62 days in 2010 and 73 days in 2011.

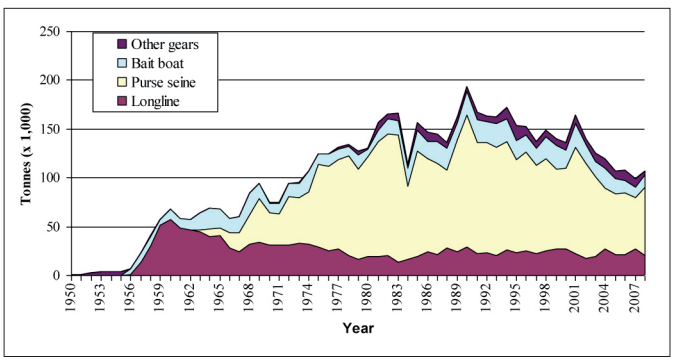
Comparative analysis: A comparison of the results from the 2009, 2003 and 2000 assessment are given in the table and figure below. An increasing trend in the MSY can be observed, as well differences in the estimates of B/B_{MSY} and F/F_{MSY}. The retrospective analysis shows that the B/B_{MSY} is underestimated and F/F_{MSY} is overestimated in the assessment year in relation to the new figures estimated in the 2009 assessment. The change in the assessment method from A-SCALA (2000 and 2003) to SS-3 can have contributed to the observed differences.



Assessment year	2009	2009	2009	2003	2000
Reference year	2008	2002	1999	2002	1999
Catches	188 000	443 677	304 636	443 677	304 636
MSY	273 159			254 723	235 685
B/B_{MSY}	1.32	1.48	1.93	0.89	1.52
F/F_{MSY}	0.92	0.64	0.88	0.83	1.01

Yellowfin tuna *(Thunnus albacares)* in the Atlantic ocean

Fishery and Catches: The catches of YFT in the AO have increased steadily since the start of the fishery in the late 1950s, reaching the 100 000 tonnes levels in 1974, the 150 000 tonnes level in 1981 and fluctuating around 160 000 till 1989. In 1990, the maximum catch of 193 000 tonnes was reached and, since then, a general decline was observed, being the catches around 100 000 tonnes since 2005 (at the same level as in 1974). This overall decline of 45 percent since 1990 contrasts with the increasing catches of yellowfin tuna in other oceans These variations in global catches correspond, mostly, to variations in the purse-seine catch, which is the major component of the total catch.



State of the Stock: A full stock assessment was conducted for yellowfin tuna in 2008, applying both an age-structured model and a non-equilibrium production model to the available catch data through 2006.

MSY: The current MSY point estimates using two alternative models were 130 600 tonnes and 146 600 tonnes, respectively. Current catches are estimated to be well below MSY levels.

Biomass: The spawning stock biomass at the beginning of 2006 was estimated to be nearly 96 percent of the B at MSY and, thus, B is estimated to be close to the ICCAT Convention Objective.

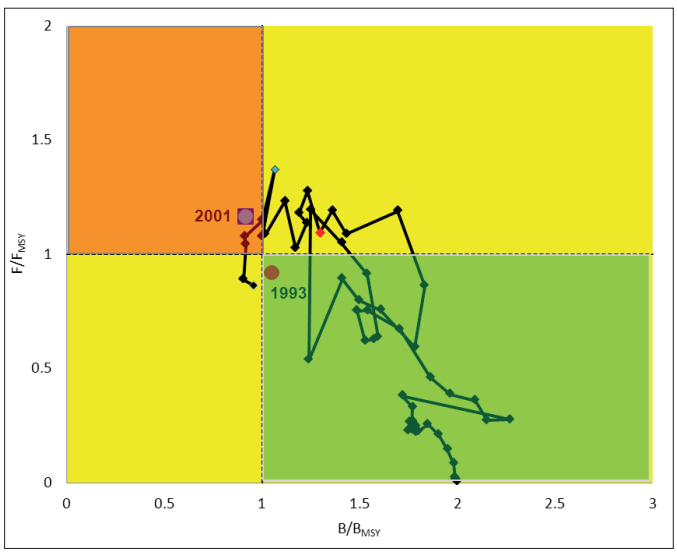
Fishing mortality: The fishing mortality rate in 2006 was estimated to be about 14 percent below the fishing mortality rate at MSY.

In summary, while estimated values of fishing mortality are below MSY-related values, the B for 2006 is just below MSY-related values, indicating an slightly overexploited stock.

Recommendation: The status of yellowfin has shown some improvement between the 2003 and 2008 assessments, which is not surprising as the catches and fishing effort have generally declined. Currently, stock biomass is estimated to be near the Convention Objective and recent fishing mortality rates are somewhat below F_{MSY}.

The projections results suggest that catches of 130 000 tonnes or less are sustainable, while catches in excess of 130 000 tonnes can lead the population to overfishing. Maintaining current catch levels (110 000 tonnes) is expected to increase the spawning biomass to above B_{MSY}.

Comparative analysis: A comparison of the results from the 2009, 2003 and 1994 assessment are given in the table and figure below. The results are somewhat similar. MSY estimation in 1994 and 2003 assessments was similar (around 148 000 tonnes), which is in the upper range of the 2008 estimates. The retrospective analysis shows that both the B/B_{MSY} and F/F_{MSY} were underestimated in 1994 in relation to the new figures estimated in 2009 assessment.

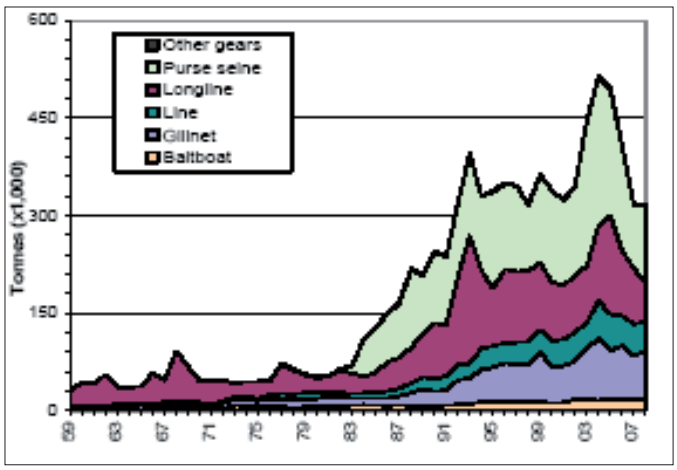


Assessment year	2008	2008	2008	2003	1994
Reference year	2006	2001	1993	2001	1993
Catches	108 170			164 650	162 753
MSY	130 600[1] - 146 600[2]			148 000 (147 200 - 161 300)	149 000 (123 000 - 164 000)
B/B_{MSY}	0.96 (0.72 - 1.22)	1.06	1.30	0.73 - 1.10	1.05 (0.81 - 1.3)
F/F_{MSY}	0.86 (0.71 – 1.05)	1.37	1.09	0.87 - 1.46	0.92 (0.67 - 1.34)

[1] Virtual Population analysis (VPA, range 124 100-136 500 tonnes)
[2] Production Model (ASPIC, range 128 200-152 500 tonnes)

Yellowfin *(Thunnus albacares)* in the Indian ocean

Fishery and Catches: Contrary to the situation in other oceans, the artisanal fishery component in the Indian ocean (mainly using pole-and-line, driftnet and hand line) is substantial, contributing with 35 percent to the total YFT catches during recent years (2000 to 2008). Total annual catches have increased steadily since the start of the fishery in the late 1950s, reaching the 100 000 tonnes level in 1984, the 200 000 tonnes level in 1989 and peaking at around 400 000 tonnes in 1993. Total annual catches averaged 345 000 tonnes over the period 1993 to 2002. Yellowfin catches in the Indian ocean during 2003, 2004, 2005 and 2006 were much higher than in previous years (an average catch of 466 000 tonnes) but have returned to a lower level in 2007 and 2008 (318 000 tonnes).



State of the Stock: In 2009, the Multfifan-CL stock assessment model was applied to the Indian ocean yellowfin tuna stock.

MSY: Assuming a steepness of the stock recruitment relationship of 0.8, the MSY was estimated to be 300 000 tonnes. The preliminary estimate of catches in 2008 (322 000 tonnes) is above the current estimate of MSY. Catches over the period 2003 to 2006 (averaging 464 000 tonnes) have significantly exceeded the MSY. Given that the mean annual catch for the preceding period of extraordinarily high catches (1998 to 2002) was 338 000 tonnes, it appears that the stock is being exploited over its maximum level.

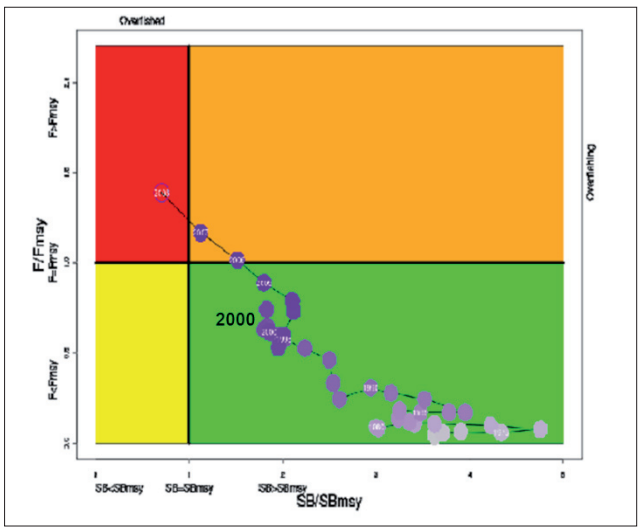
Biomass: The most recent estimate of biomass (2007) is above the MSY-related reference value. Biomass trajectories indicate that the spawning stock biomass is currently just above the MSY level, but it has been declining since the late 1970s. Preliminary estimates for 2008 show that the stock is below B_{MSY}.

Fishing mortality: Fishing mortality in 2007 is estimated to be above F_{MSY}. Preliminary estimates of F in 2008 might be even higher than in 2007. The fishing mortality has been increasing steadily since the 1990s.

The SC considers that the stock of yellowfin tuna has recently been overexploited and is probably still being overfished.

Recommendation: The SC recommended that catches of yellowfin tuna should not exceed the estimated MSY of 300 000 tonnes, which would be required to return exploitation rates to those related to MSY.

Comparative analysis: A comparison of the results from the 2009 and 2002 assessments are given in the table and figure below. The results are somewhat similar, with the main difference found in the estimated F/F_{MSY} which was slightly overestimated in 2002 in relation to the values estimated in 2009. Both, B/B_{MSY} and MSY values estimated in 2009 are similar to the values estimated in 2002. Note that the values of Biological Reference Points in 2002 were obtained from ASPM results over a range of assessment methods reviewed by the IOTC SC.



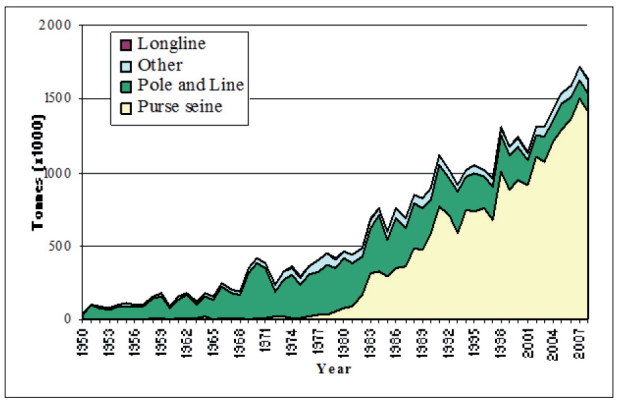
Assessment year	2009	2009	2002
Reference Year	2007	2000	2000
Catches	322 000	304 000	304 000
MSY	300 000		280 000 - 350 000
B_{2007}/B_{MSY}	1,12	1.65	1.71[1]
F_{2007}/F_{MSY}	1,16	0.62	0.70[1]

[1] ASPM results

Skipjack *(Katsuwonus pelamis)* in the Western Central Pacific ocean

Fishery and Catches: Skipjack tuna is caught by a variety of fisheries which can be classified into the Japan distant-water and offshore pole-and-line fleets, domestic pole-and-line fleets based in island countries, artisanal fleets based in the Philippines, eastern Indonesia and the Pacific Islands, and distant-water and Pacific-Island-based purse-seine fleets.

Skipjack tuna catches in the WCPO increased steadily since 1970, more than doubling during the 1980s. Catches were relatively stable during the early 1990s, approaching 1 000 000 tonnes per year. They started to increase again in the late 1990s and reached almost 1 500 000 tonnes in 2006. Pole-and-line fleets, primarily Japanese, initially dominated the fishery, with the catch peaking at 380 000 tonnes in 1984, but the relative importance of this fishery has declined and the annual skipjack tuna catches increased during the 1980s due to the international purse-seine fleet, combined with increased catches by domestic fleets from the Philippines and Indonesia.



State of the Stock: In 2009, the status of the Western and Central Pacific skipjack tuna stock was assessed using MULTIFAN-CL. The results of the stock assessments conducted in 2009 were broadly similar to previous work.

MSY: From the range of cases analysed, the SC adopted the *equatorial* model, restricted to only the 2 equatorial regions, to base the management advice. The equatorial model gives a MSY value of 1 280 000 tonnes, while the base case model encompassing the whole WCPO gives a MSY of 2 260 000 tonnes. The preliminary estimate of catches in 2006 was around 1 300 000 tonnes for the equatorial area, which is close to the MSY value for equatorial area, and 1 600 000 tonnes for the whole area.

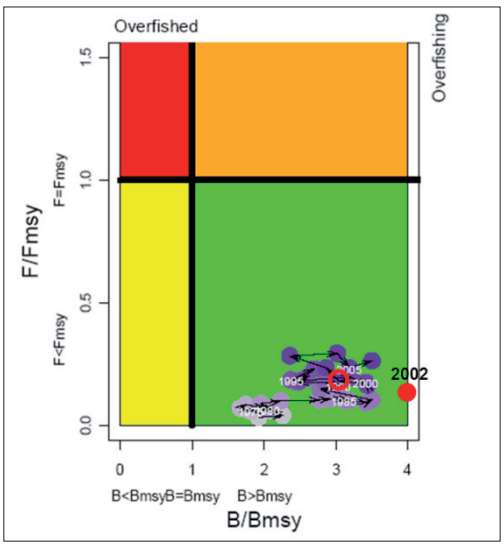
Biomass: The spawning stock biomass is estimated to be above the level that would produce MSY. Biomass trajectories indicate that the biomass is well above the B_{MSY} level.

Fishing mortality: Current fishing mortality (computed as the average for the period 2003 to 2006) appears to be well below the F_{MSY} level.

The principal conclusions are that skipjack tuna is currently exploited at a moderate level relative to its biological potential. Furthermore, the estimates of B/B_{MSY} and F/F_{MSY} reveal that overfishing of skipjack is not occurring in the WCPO, nor is the stock in an overfished state. The SC noted the increasing trend in recruitment throughout the entire time series of the fishery.

Recommendation: These high recent catches are considered to be sustainable unless recruitment falls persistently below the long-term average. However, any increases in purse-seine catches of skipjack tuna may result in a corresponding increase in fishing mortality for bigeye and yellowfin tunas.

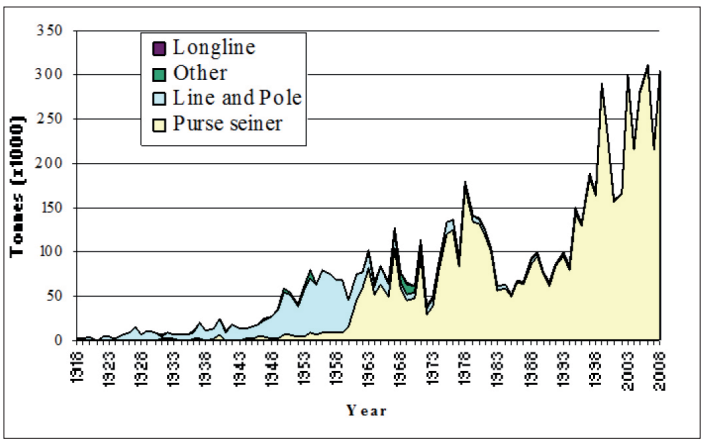
Comparative analysis: A comparison of the results from the 2009 and 2003 assessments are given in the table and figure below. The retrospective analysis shows that although the results are somewhat similar, the B/B_{MSY} was overestimated and F/F_{MSY} was slightly underestimated in 2003 in relation to the new figures estimated in 2009.



Assessment year	2009	2009	2003
Reference year	2007	2002	2002
Catches	1 592 338		1 313 357
MSY	1 280 000 - 2 260 000		
B/B_{MSY}	2.99	3.1	4
F/F_{MSY}	0.26	0.2	0.15

Skipjack tuna *(Katsuwonus pelamis)* in the Eastern Pacific ocean

Fishery and Catches: Skipjack tuna are caught almost exclusively by surface gears throughout the eastern Pacific, although some minor catches are made by longliners. The catches of SKJ in the Eastern Pacific started in late 1920s and increased steadily from the late 1950s, reaching 100 000 tonnes in 1963 when the fleet converted from pole-and-line vessels to seiners. After that the catches fluctuated, without a clear trend, between 65 000 and 100 000 tonnes, until 1978 when a catch of 180 000 tonnes was taken. Afterwards a general declining trend was observed until 1994, with a catch of 85 000 tonnes, and since then, with the development of FAD fishing, the catch level continuously increased to the highest catch level observed in 2008 (305 000 tonnes). Since 1995 the catches have been much higher than previous years remaining above 150 000 tonnes.



State of the Stock: Traditional stock assessment models have been difficult to apply to skipjack because of their particular biological and fishery characteristics.

The standardized effort indicator of exploitation rate has increased since about 1991 but declined in the last 2 years. The average weight of skipjack has declined since the peak in the year 2000 and in 2008 was at the lower reference level. The relative biomass indicator has been increasing since about 2001 and in 2008 was at the second highest level of the time series. In summary, the biomass, recruitment, and exploitation rate have been increasing over the past 20 years.

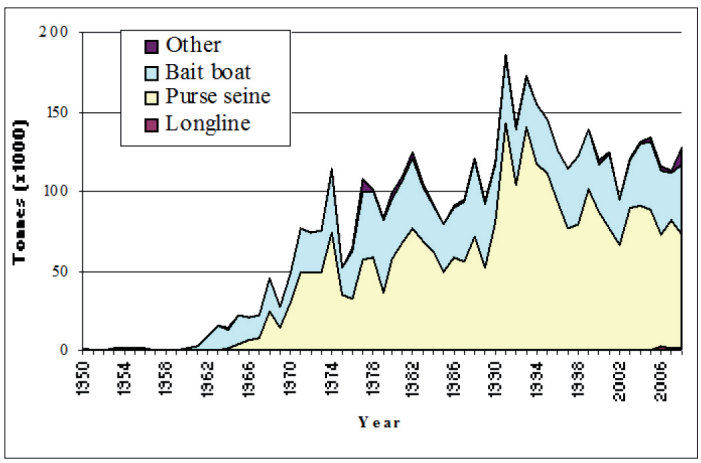
As with other skipjack stocks, the main concern is the constantly increasing exploitation rate. However, a range of stock indicators has not detected any adverse consequence of this increase yet.

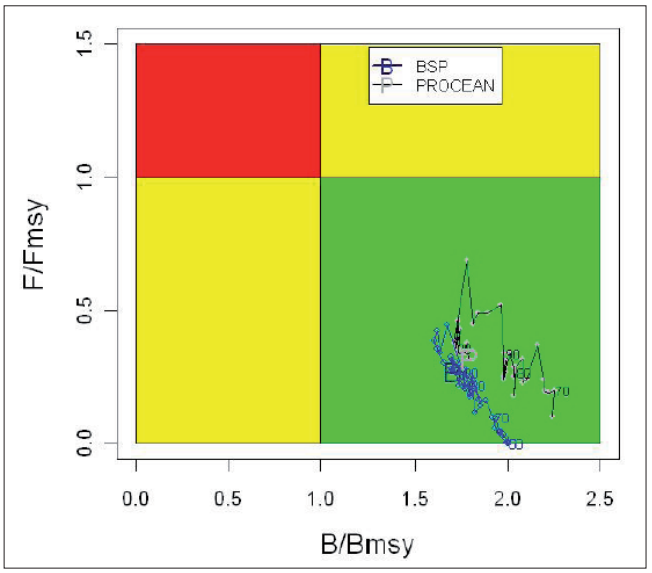
Recommendation: Although there is no specific management recommendation/regulation for skipjack tuna, a seasonal and area closure for purse-seine in the Eastern Atlantic is in place to reduce the fishing effort for YFT and BET (see respective sections) which are taken together with SKJ.

Assessment year	2009	2002
Reference year	2008	2001
Catches	305 524	158 072
MSY		
B/B_{MSY}		
F/F_{MSY}		

Skipjack tuna *(Katsuwonus pelamis)* in the Eastern Atlantic ocean

Fishery and Catches: Skipjack **tuna** are caught almost exclusively by surface gears throughout the Atlantic, although some minor catches are made by longline as by-catch. The catches of SKJ in the eastern Atlantic increased steadily from the late 1960s, reaching around 115 000 tonnes in 1974. After that the catches fluctuated without a clear trend at the level of around 100 000 tonnes, until 1991 when the maximum catch of 186 000 tonnes was taken with the introduction of FADs in the fishery. Since then, a general declining trend was observed, the catch level remaining relatively stable during the last 11 years at around 120 000 tonnes, although it is notably lower than that of 1991 and 1993.





Assessment year	2008	1999
Reference year	2006	1998
Catches	115 700	159 000
MSY	143 000 - 170 000	
B/B_{MSY}	> 1	
F/F_{MSY}	< 1	

State of the Stock: Traditional stock assessment models have been difficult to apply to skipjack because of their particular biological and fishery characteristics. However, several different methods were used to overcome these difficulties.

MSY: The current MSY estimated using various assessment methods ranged between 143 000 tonnes and 170 000 tonnes. Current catches are estimated to be well below MSY levels.

Biomass: The biomass in 2008 was estimated to be well above the biomass at MSY.

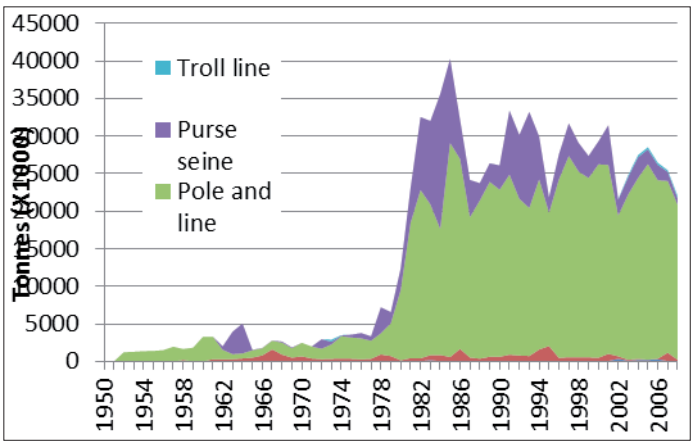
Fishing mortality: The fishing mortality rate in 2008 was estimated to be well below the fishing mortality rate at MSY.

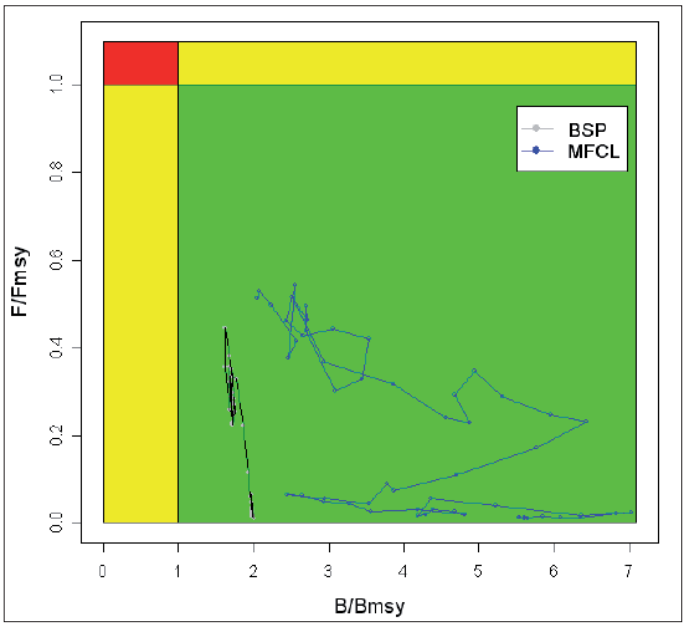
Based on the results of the last assessment, it is unlikely that the skipjack is overexploited in the Eastern Atlantic.

Recommendation: The Standing Committee on Research and Statistics recommended that catches should not exceed MSY.

Skipjack tuna *(Katsuwonus pelamis)* in the Western Atlantic ocean

Fishery and Catches: Skipjack tuna are caught almost exclusively by surface gears throughout the Atlantic, although some minor catches are made by longline as by-catch. In the Western Atlantic, the most important fisheries are the Brazilian and Venezuelan baitboat fisheries. Catches increased in the late 1970s, reaching the historical maximum of 40 000 tonnes in 1985. Since then, a decline was observed, the catch remaining relatively stable around 25 000 to 30 000 tonnes from the mid-1980s. The catch in 2007 was 25 440 tones.





Assessment year	2008	1999
Reference year	2006	1998
Catches	26 450	29 000
MSY	30 000 - 36 000	
B/B_{MSY}	> 1	
F/F_{MSY}	< 1	

State of the Stock: Traditional stock assessment models have been difficult to apply to skipjack tuna because of their particular biological and fishery characteristics. However, several different methods were used to overcome these difficulties.

MSY: The current MSY estimated using various assessment methods was between 30 000 tonnes and 36 000 tonnes. Current catches are estimated to be well below MSY levels.

Biomass: The biomass in 2008 was estimated to be well above the biomass at MSY.

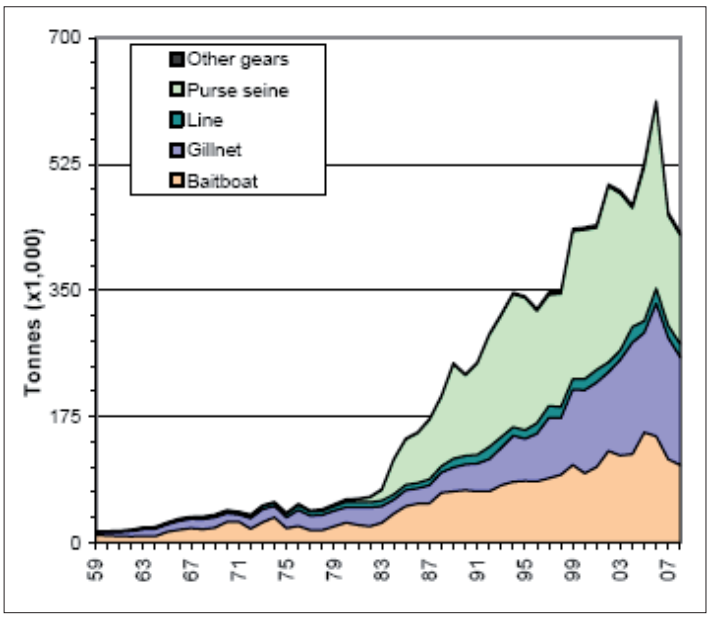
Fishing mortality: The fishing mortality rate in 2008 was estimated to be well below the fishing mortality rate at MSY.

Based on the trajectories of B/B_{MSY} and F/F_{MSY} for the Western Atlantic stock, it is unlikely that the current catch is larger than the current replacement yield.

Recommendation: The Standing Committee on Research and Statistics recommended that catches should not exceed the MSY.

Skipjack tuna *(Katsuwonus pelamis)* in the Indian ocean

Fishery and Catches: Contrary to the situation in other oceans, the artisanal fishery component in the Indian ocean (mainly using pole-and-line, driftnet and hand line) is substantial, taking between 55 and 60 percent of the total skipjack tuna catches during recent years (2000 to 2008). Catches of skipjack tuna increased slowly from the 1950s, reaching around 50 000 tonnes at the end of the 1970s, mainly due to baitboats (or pole-and-line) and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and since then annual total catches have continuously been increasing until the highest level of around 610 000 tonnes in 2006. The average annual catch for the last five years, 2003 to 2007, was 509 000 tonnes. Preliminary data indicate that catches in 2008 (405 000 tonnes) may have been the lowest reported since 1999 (426 100 tonnes).



State of the Stock: No quantitative stock assessment is currently available for skipjack tuna in the Indian ocean. The range of stock indicators available to the Scientific Committee does not indicate any current problem regarding the state of the stock.

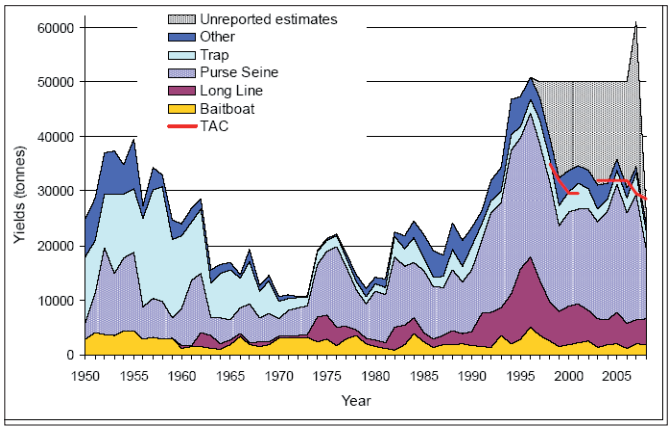
Analyses on the tagging data were conducted in 2008. Exploitation rates of skipjack tuna are relatively low, not exceeding 20 percent even for the most selected age-range of the stock. Abundance in 2006 was estimated to be higher than that in 2007, while the relative age-structure remained stable, with a similar decrease in relative abundance from ages 2 to 5. This indicates that the population has a reasonably stable year-class regime at least for the cohorts that encompass the data used in the analysis (2000 to 2005).

Recommendation: The high productivity and life history characteristics of skipjack tuna suggest this species is resilient and not easily prone to overfishing. However, the analysis of some indicators of stock status for recent years recommends that the situation of the stock should be closely monitored in 2010.

Assessment year	2009
Reference Year	2008
Catches	431 000
MSY	
B/B_{MSY}	
F/F_{MSY}	

Bluefin tuna *(Thunnus thynnus)* in the East Atlantic and Mediterranean

Fishery and Catches: Reported catches peaked at 40 000 tonnes in the mid-1950s and, after remaining below 20 000 tonnes for many years, peaked again at 50 000 tonnes in 1996. After this year, reported catches remained mostly around 33 000 tonnes, although real catches are believed to have remained around 50 000 tonnes and even over 60 000 tonnes in 2007. The catches (both reported and estimated) in 2008 were around 25 000 tonnes. Although traps used to be the main fishing gear in the late 1950s, nowadays purse-seine is the main fishing gear, followed by longline. Most important fishing countries include EU, Japan, Morocco, Algeria, Libya, Tunisia and Turkey.



State of the Stock: In 2008, a full stock assessment of East Atlantic and Mediterranean bluefin tuna was conducted using VPA-2box and Pro-2box and considering a suite of alternative scenarios.

Yield: Expected short term sustainable yields (in the range of 8 500 to 15 000 tonnes under $F_{0.1}$ and F_{MAX}, respectively) are far below the yields in the last decade. Long term yields could range between 29 000 and 91 000 tonnes (under a suite of alternative scenarios).

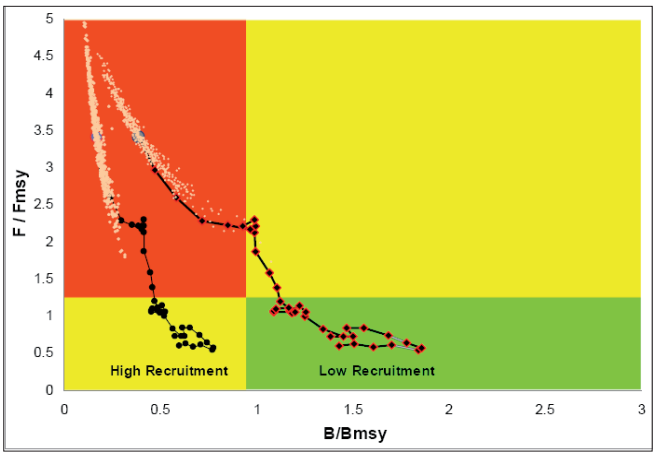
Biomass: B has been declining rapidly in the last several years, and the decline in B appears to be more pronounced during the more recent years. Recent (2003 to 2007) B is less than 40 percent of the highest historical levels, and is most likely to be about 36 percent or less than the level needed to support MSY.

Fishing mortality: Fishing mortality has been increasing rapidly, especially for large bluefin tuna (i.e. ages 10+), consistently with a shift in targeting towards larger individuals destined for fattening and/or farming in the last part of the time series. Substantial overfishing is occurring, and current fishing mortality is three times the rate that would produce the MSY.

In summary, the stock is overfished and overfishing is occurring.

Recommendation: The Scientific Committee recommended reducing catches to 15 000 tonnes or less so as to increase chances of recovery.

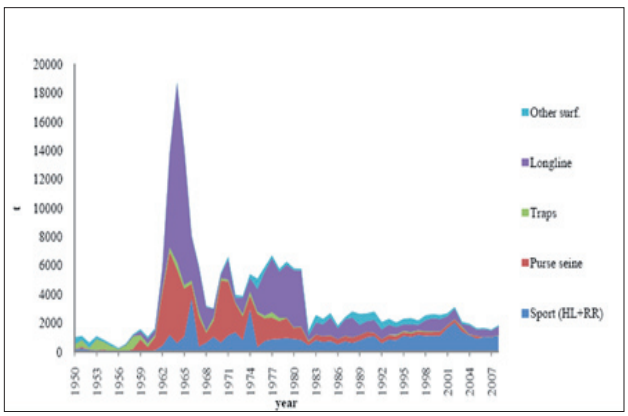
Comparative analysis: In 1985 there were neither important downward trends nor signs of overfishing detected. However, predicted yields at F_{MAX} were substantially lower than those estimated nowadays. In 2000, an important decrease in biomass was already detected, and the overfished and overfishing condition of the stock is confirmed by the most recent assessments.



Assessment year	2009	2009	2009	2000	1985
Reference Year	2008	2000	1985	1999	1984
Catches	23 868 - 34 120	33 766	22 010	31 487	22 200
Long term potential yield	About 50 000			About 25 000	17 400 – 19 600
B/B_{MSY}	0.14 - 0.35	0.4 - 0.9	0.7 - 1.3	$B_{97}/B_{70} = 0.19$	
F/F_{MSY}	3.04 - 3.42	2.2 - 2.3	0.7-1.1		<1

Bluefin tuna *(Thunnus thynnus)* in the Western Atlantic

Fishery and Catches: The total catch for the West Atlantic peaked at nearly 20 000 tonnes in 1964, mostly due to the Japanese longline fishery for large fish off Brazil and the United States purse-seine fishery for juvenile fish. Catches dropped sharply thereafter with the collapse of the longline fishery off Brazil and decline in purse-seine catches, but increased again to average over 5 000 tonnes in the 1970s due to the expansion of the Japanese longline fleet into the northwest Atlantic and Gulf of Mexico and an increase in purse-seine effort targeting larger fish for the sashimi market. The total catch for the West Atlantic including discards has generally been relatively stable since 1982 due to the imposition of quotas.



State of the Stock: In 2008, a full stock assessment of Western Atlantic bluefin tuna was conducted using VPA-2box and Pro-2box and considering a suite of alternative scenarios.

MSY: Since the early 1980s, most of the yearly catches have remained below the estimated MSY, and only occasionally have been slightly higher than the MSY estimated under the low recruitment scenario.

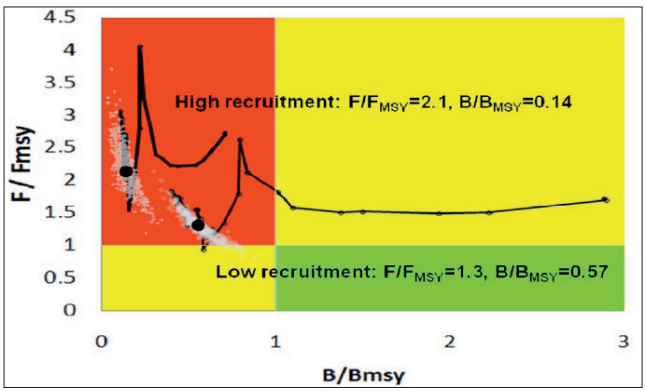
Biomass: B declined steadily between the early 1970s and 1992. Since then, B has fluctuated between 18 percent and 27 percent of the 1975 level. Assuming that average recruitment cannot reach the high levels from the early 1970s, recent B is about half of the B_{MSY}. Estimates of stock status are more pessimistic if a high recruitment scenario is considered ($B/B_{MSY} = 0.14$).

Fishing mortality: The stock has experienced different levels of fishing mortality over time, depending on the size of the fish targeted by various fleets. Fishing mortality on spawners (ages 8 and older) declined markedly between 2002 and 2007. Assuming that average recruitment cannot reach the high levels from the early 1970s, recent F (2004 to 2006) is about 30 percent higher than the F_{MSY} level. Estimates of stock status are more pessimistic if a high recruitment scenario is considered ($F/F_{MSY} = 2.1$).

In summary, the stock is overfished and overfishing is occurring.

Recommendation: In 1998, the Commission initiated a 20-year rebuilding plan. However, halfway through the rebuilding program, biomass was still below what it was at the beginning. Accordingly, the Scientific Committee advised against an increase in TAC.

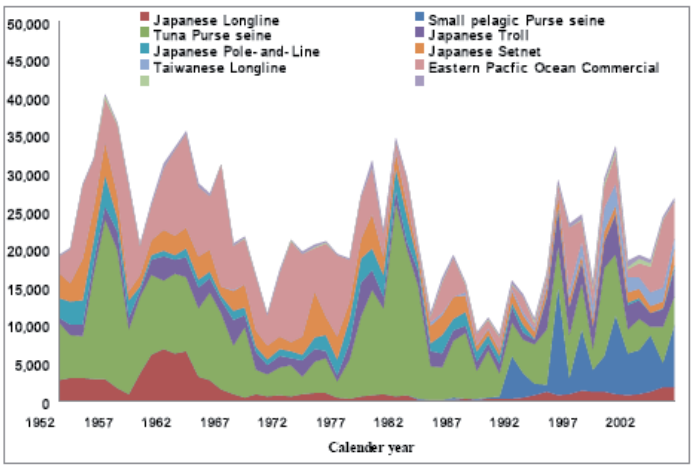
Comparative analysis: The range of long term potential yields is comparable between current and past assessments. Both the overfishing and overfished state of Western bluefin tuna was detected in past assessments, with reference points more or less in accordance with the current ones.



Assessment year	2009	2009	2009	2000	1985
Reference Year	2008	2000	1985	1999	1984
Catches	2 015	2 775	2 685	2 771	2 300
MSY	2852 - 6201			3500 - 7700	$Y_{F0.1}$ = 6 500; Y_{FMAX} = 7 000
B/B_{MSY}	0.57 - 0.14	<1	<1	0.36 - 0.10	B_{85}/B_{70} = 0.33
F/F_{MSY}	1.27 - 2.18	>1	>1	1.37 - 2.22	F/F_{MAX} = 1

Bluefin tuna *(Thunnus orientalis)* in the Pacific

Fishery and Catches: Total catch of Pacific bluefin tuna has fluctuated widely in the range of 9 000 –40 000 tonnes during the assessment period (1952 to 2006). Recent catches are near the average for the assessment period (around 22 000 tonnes). Main fishing gears include purse-seine and longline, and main fishing countries are Japan and Chinese Taipei.



State of the Stock: The Pacific bluefin tuna stock was assessed in 2008 using Stock Synthesis 2 (SS2), SS3 and per recruit analyses.

Yield: Total annual catch over the entire catch history has never attained the equilibrium catch at F_{MAX} (45 000 tonnes).

Biomass: The stock has fluctuated with peaks in the spawning biomass in the early 1960s, late 1970s, and late 1990s. B in 2005 was 20 000 tonnes based on the SS2 model and 23 000 tonnes based on the SS3 model. Applying a revised estimate of M and the SS3 model, B was estimated at 73 000 tonnes. These B estimates for 2005 are above the median level over the assessment period (1952 to 2006). Over the last 50 years, the percent of spawning biomass per recruit with respect to virgin conditions (SPR) remains, at most, about 6 percent. In spite of this low level, there is no evidence of reduced recruitment.

Fishing mortality: Current F (2002 to 2004) is greater than commonly used target reference points. This includes F_{MAX}, a biological reference point that, given the lack of stock recruitment relationship, is theoretically equivalent to F_{MSY}. As such, a reduction of the fishing mortality may improve the yield per recruit and the spawners per recruit. However, current F is lower than commonly used biological reference points as potential recruitment overfishing threshold.

Overall, the evaluation of the status of the stock is not straightforward, and depends in large part on management objectives and specification of an acceptable level of risk.

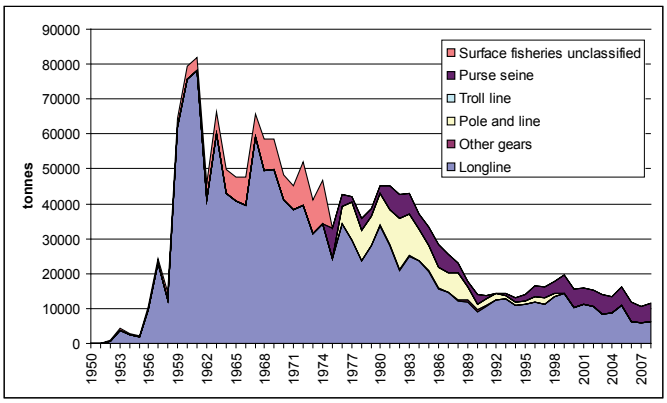
Recommendation: If F remains at the current level and environmental conditions continue to be favorable, then recruitment should be sufficient to maintain current yield well into the future. However, increases in F above the current level, and/or unfavorable changes in environmental conditions, may result in recruitment levels which are insufficient to sustain the current productivity of the stock. Thus, the SC recommended that it is important that the current level of F is not increased. A reduction in F should lead to greater yield per recruit and spawners per recruit and, after some lag, greater sustained yield.

Comparative analysis: In 2004, it was already estimated that the Pacific bluefin tuna fishing morality was above its reference point.

Assessment year	2008	2008	2008
Reference Year	2006	2000	1985
Catches	24 196	33 474	16 089
Yield at F_{MAX}	45 000		
SPR	<6%		
F/F_{MAX}	4.76		

Southern bluefin tuna *(Thunnus maccoyii)*

Fishery and Catches: After the peak in 1961 (81 750 tonnes), catches have decreased progressively and significantly, to reach 12 374 tonnes in 2008. Longline is the main fishing gear, and Japan and Australia are the main producers (both historically and recently).



State of the Stock: The southern bluefin tuna stock was assessed in 2009 using an operating model with a base case and several other alternative scenarios.

Yield: Current TAC (of 11 810 tonnes, which is below the annual catch in most of the past years) or higher future catch levels, increase the risk of future recruitment remaining low or declining, relative to the catch scenarios with lower catches.

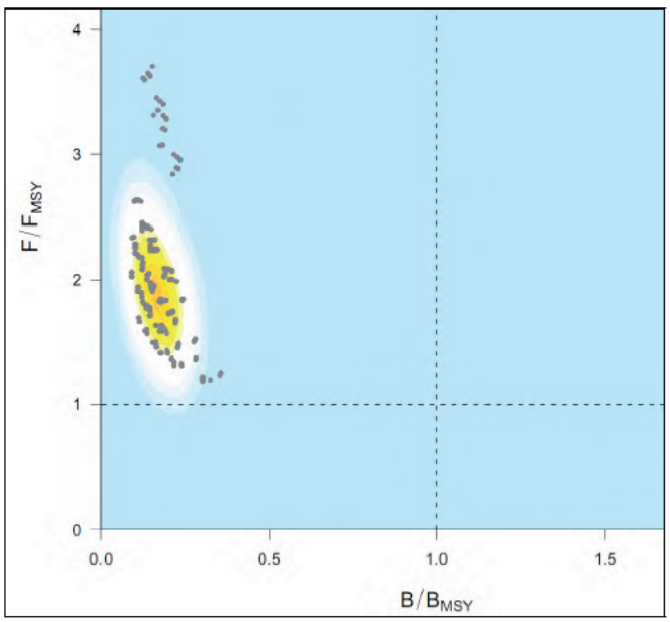
Biomass: Current spawning stock biomass is very low. It is estimated to be at 4.6 percent of the unfished level (B_0) and 17 percent of the level at which MSY could be obtained. B has shown a continuous decline from the late 1950s to the late 1970s, then a short period of stabilization followed by a further decline from the early 1980s to mid-1990s to a very low level. The spawning stock biomass is estimated to have remained at this low level with relatively small annual variation. There is no current evidence of the spawning stock rebuilding.

Fishing mortality: The current fishing mortality is estimated to be 1.91 times the fishing mortality that would achieve MSY. The average fishing mortality (ages 2 to 15) reached a peak in 2005, decreased in 2006, and remained at approximately the same level over 2007 and 2008.

In summary, the stock is overfished and overfishing is occurring.

Recommendation: The SC recommended a reduction in catch below the current TAC of 11 810 tonnes.

Comparative analysis: A comparison of the results from the 2009, 2001 and 1996 assessments are given in the table below. B_{2000}/B_{MSY} estimated in 2009 is similar to the $B_{2000/1980}$ estimated in 2001, and a bit lower than the $B_{1995/1980}$ estimated in 1996 (although no MSY related reference points are available for earlier assessments, the 1980s are considered to be a proxy for save stock levels, and the 1960s a proxy for virgin levels).

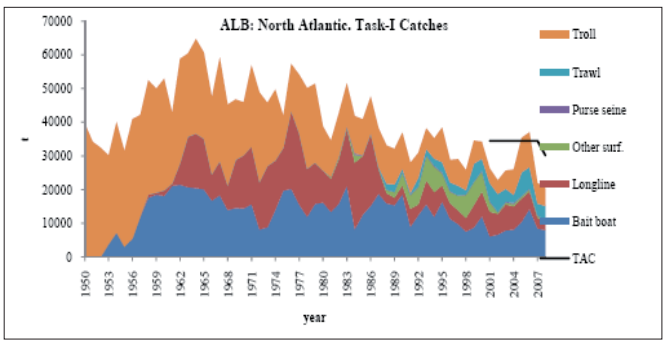


Assessment year	2009	2009	2009	2001	1996
Reference Year	2008	2000	1985	2000	1995
Catches	12 374	15 475	33 325		
B/B_{MSY}	0.17 (0.10 - 0.24)	0.18	0.70	0.29 (0.11 - 0.51) [1]	0.25 - 0.39 [2]
F/F_{MSY}	1.91 (1.46 - 2.45)	2.03	2.33		

[1] $B_{2000/1980}$
[2] $B_{1995/1980}$

Albacore tuna *(Thunnus alalunga)* in the North Atlantic

Fishery and Catches: With some fluctuations, total albacore tuna catches increased since 1930 to 1964, when the maximum catch was taken. After, catches have decreased progressively to less than 30 000 tonnes in most years during the last decade. This is mainly due to a reduction of fishing effort by surface (trolling and baitboat) as well as longline fisheries. The reduction in catch was partially softened by new surface fisheries (gillnets and pelagic trawl) that started in the 1990s. The main surface fisheries are carried out by EC fleets (Ireland, France, Portugal and Spain) and the main longline fleet is from Chinese Taipei.



State of the Stock: North Atlantic albacore was assessed in 2009 using mainly Multifan-CL.

MSY: Although the catch in most of the recent years has been below the MSY estimate, the high historical catches have been well above it.

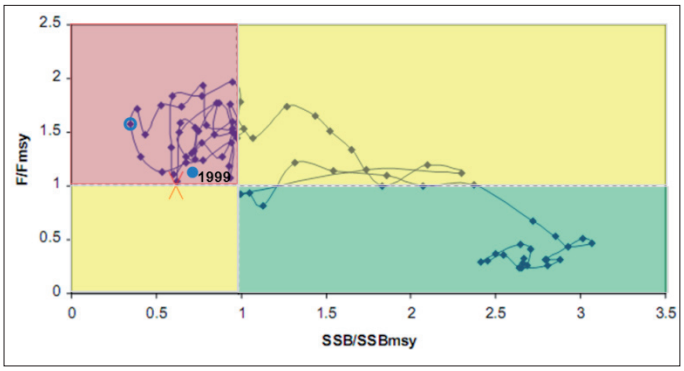
Biomass: Spawning stock biomass declined during the 1950s and the 1960s and remained overfished thereafter with some fluctuations. In 2007 the spawning stock biomass was about one third of the peak levels estimated for the late 1940s and approximately 62 percent of B_{MSY}.

Fishing mortality: The fishing mortality rate has been above F_{MSY} since the mid-1960s, although current levels of fishing mortality are only slightly higher than F_{MSY}.

In summary, the stock is overfished and overfishing is still likely to be occurring.

Recommendation: In order to achieve the ICCAT management objective by 2020, a level of catch of no more than 28 000 tonnes is required.

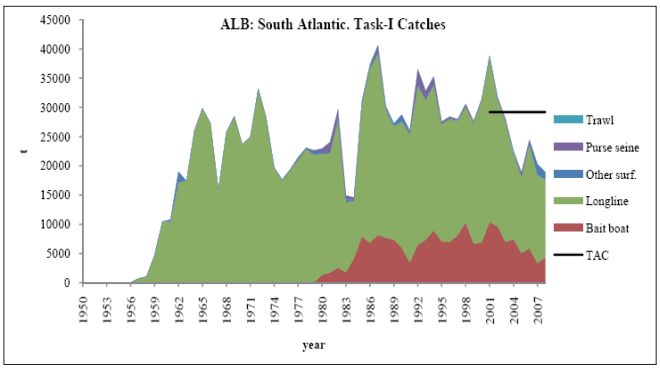
Comparative analysis: Due to changes in selectivity, a gradual increase in MSY between the mid-1950s until the mid-1960s was estimated, concurrent with an increase in fishing by longline fisheries which caught larger fish than the troll fisheries did. In the last 20 years, MSY estimates decreased by about 2 000 tonnes. In general, the MSY estimates did not vary considerably in the assessments conducted in the last 10 years using analytical models. However, estimated MSY in the mid-1980s using production models fitted to data since the 1960s tended to be much more optimistic (twice as much as more recent estimates for the same year range), and the perception was that MSY would be obtained at higher effort levels than those exerted at the 1980s. The assessment conducted in 2000 already identified the overfished and overfishing condition of North Atlantic albacore tuna, but B/B_{MSY} was slightly overestimated and F/F_{MSY} was slightly underestimated with respect to more recent estimates for the same time period.



Assessment year	2009	2009	2009	2000	1985
Reference Year	2008	2000	1985	1999	1982
Catches	20 359	34 200	40 826	34 557	42 100
MSY	29 000	30 000	31 000	32 600 (32 400-33 100)	59 800 – 70 400
B/B_{MSY}	0.62 (0.45 - 0.79)	0.4	0.9	0.68 (0.52-0.86)	
F/F_{MSY}	1.05 (0.85 - 1.23)	1.6	1.6	1.12	

Albacore tuna *(Thunnus alalunga)* in the South Atlantic

Fishery and Catches: Total South Atlantic albacore tuna catch increased sharply during the late 1950s, to reach 30 000 tonnes in the early 1960s. Since then, they have had important fluctuations, with a downward trend since the last peak in 2001. In the last years, most of the catch was due to longline fleets (mainly Brazil and Chinese Taipei) and baitboats from South Africa and Namibia.



State of the Stock: South Atlantic albacore tuna was assessed in 2007 using an age structured production model.

MSY: Except peaks in 1988, 1992 and 2001, the catch has been below the estimated MSY (33 300 tonnes) during the time series.

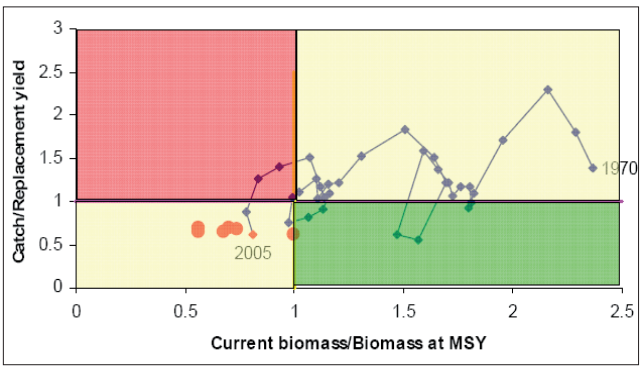
Biomass: The spawning stock biomass declined progressively since the 1950s and in 2005 it was about 25 percent of its unfished level. The spawning stock biomass in 2005 was estimated to be about 90 percent of B_{MSY}.

Fishing mortality: The fishing mortality rate in 2005 was estimated to be about 60 percent of F_{MSY}.

In summary, the South Atlantic albacore tuna is slightly overfished but not any more in overfishing condition.

Recommendation: The present TAC is 29 900 tonnes, and recent catches were well below it. It is expected that B will increase over the next few years, assuming catches will be below the estimated replacement yield of about 29 000 tonnes. The SC considered that the current management regulations are sufficient for the recovery of the southern stock.

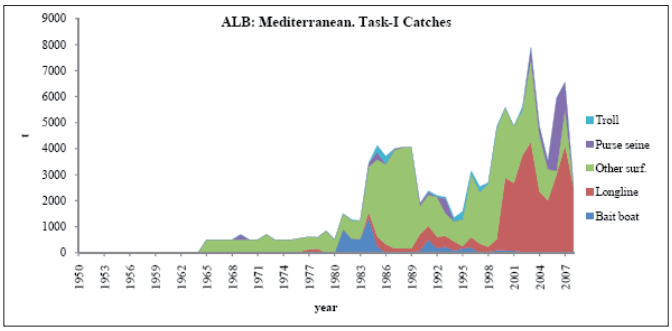
Comparative analysis: In 1985 (before the latest period of high catches between 1987 and 2001), the Scientific Committee estimated MSY values that were considerably lower than those estimated in the early 2000s and nowadays. The perception in 1985 was that the stock was in good condition and that effort could be increased so as to reach MSY. Current estimates for the early 1980s also suggest that the stock was not overfished (B/B_{MSY} = 1.7). The estimate of B/B_{MSY} in 2000 was more optimistic than the most recent perception about B_{2000}/B_{MSY}.



Assessment year	2007	2007	2007	2000	1985
Reference Year	2005	2000	1985	1999	1984
Catches	18 902	31 387	31 097	27 233	13 100
MSY	33 300 (29 900 - 36 700)			30 300	24 000
B/B_{MSY}	0.91 (0.71 - 1.16)	1.1	1.7	1.59 (0.71 - 2.0)	
F/F_{MSY}	0.63 (0.47 - 0.9)			0.54	

Albacore tuna (Thunnus alalunga) in the Mediterranean

Fishery and Catches: The reported catch for this stock is provisional and incomplete to a certain degree. Reported catches remained stable from the beginning of the fishery (early 1960s) until 1980. During the 1980s there was a high catch period of over 4 000 tonnes, followed again by low values till the mid-1990s where an increasing trend started to end up with historical highest catch reported in 2003 (around 8 000 tonnes). Current (2008) catches were lower than 3 000 tonnes.

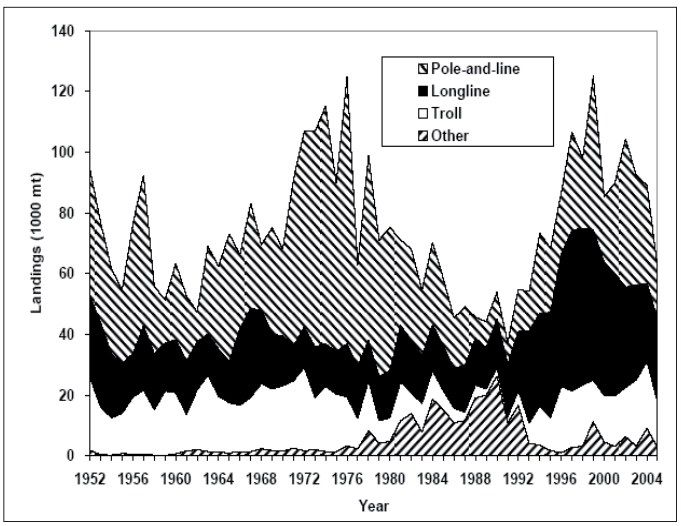


State of the Stock: Due to the lack of appropriate data, an assessment of the Mediterranean albacore tuna stock has never been carried out, and the stock status is unknown.

Recommendation: The Scientific Committee recommends to gather further information about the Mediterranean albacore tuna population and fisheries, so as to be able to conduct a stock assessment.

Albacore tuna *(Thunnus alalunga)* in the North Pacific

Fishery and Catches: The total catch of North Pacific albacore tuna peaked at 1976 and 1999 with over 124 000 tonnes, while catches between both peaks descended down to around 40 000 tonnes. The catch in 2005 (62 000 tonnes) was the lowest observed since the early 1990s. The main fishing gears used are longline, pole-and-line and troll. During the last five years, Japan, United States, Chinese Taipei and Canada were the main fishing countries.



State of the Stock: The North Pacific albacore tuna stock was assessed in 2006 using VPA and SS2. During the stock assessment, a familiar suit of reference points were used to contrast current stock status, including *F*-based MSY proxies and *F*-based limit proxies.

Yield: The equilibrium yield at $F_{0.1}$ was estimated to be 83 000 tonnes, higher than the current catch level and most of the annual catch along the historical time series (except for the peaks around the 1970s and late 1990s).

Biomass: Spawning stock biomass has experienced fluctuations around the time series average of 100 000 tonnes, with a global increasing trend. Since the last valley in 2002 (73 000 tonnes), B has increased year after year till 2005 (113 000 tonnes). The B in 2005 was estimated to be 0.66 times the B at $F_{0.1}$ ($B_{F0.1)}$. This ratio was similar in the year 2000 (0.65) and slightly lower in 1985 (0.58).

Fishing mortality: The current fully selected (ages 8 to 9+) fishing mortality is estimated to be 0.75 $^{y-1}$, which is 1.68 times $F_{0.1}$. This ratio has increased since the year 2000 (1.30) and the year 1985 (0.77). Under the current level of F, the population is being fished at roughly 17% SPR, which is high relative to commonly used reference points.

In summary, the North Pacific albacore tuna stock is probably in overfishing condition.

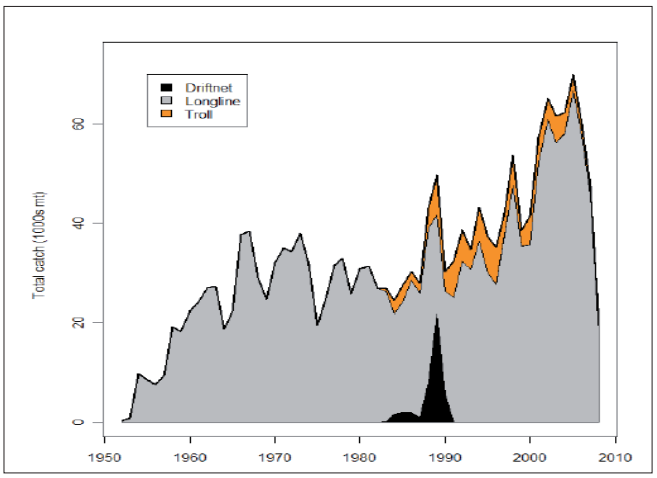
Recommendation: The Scientific Committee recommended that the current fishing mortality rate should not be increased, as it is high relative to most of the F based reference points commonly used in fisheries management.

Comparative analysis: In the 2002 assessment it was also estimated that the F was probably above some commonly used indicators of overfishing (e.g. $F_{30\%}$, $F_{40\%}$).

Assessment year	2006	2006	2006
Reference Year	2005	2000	1985
Catches	62011	85344	58170
Yield at $F_{0.1}$	83000		
$B/B_{F0.1}$	0.66	0.65	0.58
$F/F_{0.1}$	1.68	1.30	0.77

Albacore tuna *(Thunnus alalunga)* in the South Pacific

Fishery and Catches: After an initial period of small-scale fisheries development, annual catches of South Pacific albacore tuna varied considerably and have recently been between 60 000 and 70 000 tonnes. The longline fishery harvested most of the catch, with 25 000 to 30 000 tonnes per year, prior to about 1998. The increase in longline catch to approximately 70 000 tonnes in 2005 is largely due to the development of small-scale longline fisheries in Pacific Island countries. Main fishing countries include Chinese Taipei, Fiji, American Samoa, Japan and Korea.



State of the Stock: South Pacific albacore tuna was assessed in 2009 using Multifan-CL.

MSY: Both the current and the recent average catch have been below the estimated MSY. The yields for the 2005 to 2007 period represent 0.72 times MSY. This suggests potential to expand long-term yields from the fishery at the current pattern of age-specific selectivity.

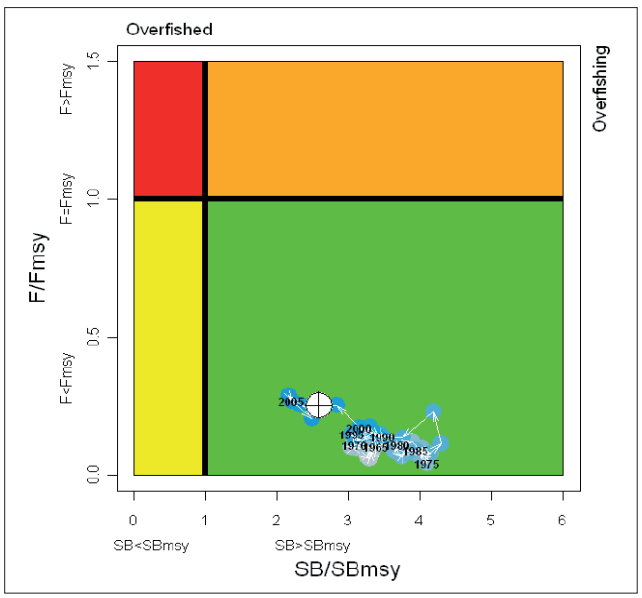
Biomass: Estimated B levels at the early 1960s are uncertain and the trend depends on model assumptions. The biomass trend since 1980 is relatively stable until about 1990, and declining after this as total catches increase to twice their previous level. Biomass and spawning biomass levels are estimated to be close to equilibrium unfished levels until about 1990 due to above average recruitment early in the time series. Current spawning biomass is estimated to be 2.21 times B_{MSY}.

Fishing mortality: Fishing mortality rates for adult albacore tuna are moderately low from the early 1970s to 2000, and show a large increase since that time, particularly for adult fish, in response to higher catches and the lower levels of adult biomass represented by the declining Chinese Taipei catch per unit effort (CPUE). Fishing mortality rates for juvenile albacore tuna are estimated to have gradually increased throughout the history of the fishery with a peak in 1989 to 1990 corresponding to the period of driftnet fishing. Fishing mortality in recent years is estimated to be at 0.44 times the F_{MSY} level, following an increasing trend largely due to the decline in estimated recruitment.

Estimates indicate that overfishing is not occurring and that the fishery is not in an overfished state.

Recommendation: There is no indication that current levels of catch are not sustainable with regard to recruitment overfishing.

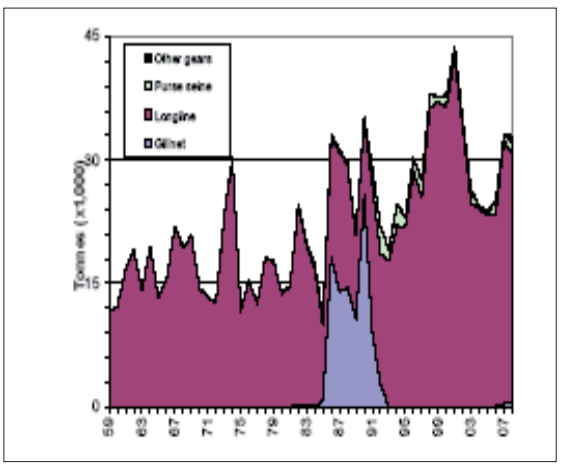
Comparative analysis: F/F_{MSY} has increased and B/B_{MSY} has decreased over the last two decades. The stock assessment in 2000 also perceived a healthy stock ($B/B_{MSY} > 1$ and $F/F_{MSY} < 1$). Current estimates of MSY are slightly higher than the range of MSY estimates obtained during the 1980s before the high catches during the most recent period.



Assessment year	2009	2009	2009	2000	1990
Reference Year	2007	2000	1985	1998	1984
Catches	43 000	42 000	27 000	47 000	16 737
MSY	64 000				38 687 - 55 653
B/B_{MSY}	2.21	3.2	3.9	>1	
F/F_{MSY}	0.44	0.2	0.1	<1	

Albacore tuna *(Thunnus alalunga)* in the Indian ocean

Fishery and Catches: The catches of Indian ocean albacore tuna 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 1990s due to the use of drifting gillnets, with total catches reaching around 30 000 tonnes. 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. Catches between 1998 and 2001 were relatively high (ranging from 37 800 tonnes to 43 800 tonnes). By contrast, the average annual catch for the period 2004 to 2008 was 27 900 tonnes. Albacore tuna are caught almost exclusively under drifting longlines (98 percent), mainly by Japan and Chinese Taipei. A fleet using drifting gillnets from Chinese Taipei targeting juvenile albacore tuna operated in the southern Indian ocean (30° to 40° south) between 1985 and 1992 harvesting important amounts of this population.



State of the Stock: A stock assessment of Indian ocean albacore tuna was conducted in 2008 using an age structured production model.

MSY: MSY estimates using alternative model assumptions ranged from 28 260 tonnes to 34 415 tonnes. This indicated that continuous annual catches at a level approaching 38 000 tonnes (equivalent to the historically high level of catch experienced over the period 1998 to 2001) may not be sustainable in the long term. However, albacore tuna catches over the past five years (27 900 tonnes for the period 2004 to 2008) have been below the MSY level.

Biomass: There are no indications that the albacore tuna stock is over-fished ($B_{2007}/B_{MSY} > 1$).

Fishing mortality: Overfishing is currently likely not occurring for the scenarios envisaged.

In the light of these results, together with the fact that catches, mean weights and catch rates have been stable for over 20 years, Indian ocean albacore tuna is not considered to be overfished and overfishing is not occurring.

Recommendation: The status of the stock is not likely to change markedly over the next one to two years and if the price of albacore tuna remains low compared with other tuna species, no immediate action should be required.

Comparative analysis: In the first albacore tuna stock assessment (2004), the results of one of the analyses suggested that the stock could be below the level that would produce MSY and that the fishing mortality would be above that required to achieve the MSY, while the remainder failed to produce plausible parameter estimates. However, in all analyses, there was a discrepancy between the observed and predicted CPUE trends for the most recent years. The picture in the 2008 assessment is more optimistic, showing no indication of overfishing, neither of an overfished stock.

Assessment year	2008	2004
Reference Year	2008	2003
Catches	32 900	24 000
MSY	28 300 - 34 400	
B/B_{MSY}	>1	
F/F_{MSY}	- 0.91	

Acknowledgements

The information on tuna stocks was obtained from publications of the following tuna bodies and international organizations:

- Commission for the Conservation of Southern Bluefin Tuna (CCSBT),
- Indian Ocean Tuna Commission (IOTC),
- Inter-American Tropical Tuna Commission (IATTC),
- Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC),
- International Commission for the Conservation of Atlantic Tunas (ICCAT),
- Secretariat of the Pacific Community (SPC).

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Acronyms and abbreviations

ALB: Albacore tuna
B: Spawning stock biomass
$\mathbf{B_0}$: Unfished level of spawning stock biomass
BET: Bigeye tuna
$\mathbf{B_{F0.1}}$: Spawning stock biomass at $F_{0.1}$
BFT: Bluefin tuna
$\mathbf{B_{MSY}}$: Spawning stock biomass at the maximum sustainable yield level
CCSBT: Commission for the Conservation of Southern Bluefin Tuna
CPUE: Catch per unit of effort
EPO: Eastern Pacific ocean
F: Fishing mortality rate. F_{2008} is the fishing mortality estimated in the year 2008.
$\mathbf{F_{0.1}}$: Fishing mortality at the point where the slope of the yield per recruit curve is 0.1 times the slope at the origin
FAD: Fish Aggregating Device
FIGIS: Fisheries Global Information System
$\mathbf{F_{MAX}}$: Fishing mortality for maximum yield per recruit
$\mathbf{F_{MSY}}$: Fishing mortality for maximum sustainable yield
IATTC: Inter-American Tropical Tuna Commission
ICCAT: International Commission for the Conservation of Atlantic Tunas
IOTC: Indian Ocean Tuna Commission
ISC: Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
PBF: Pacific Bluefin tuna
RFMO: Regional Fishery Management Organization
SBF: Southern Bluefin tuna
SC: Scientific committee
SKJ: Skipjack tuna
SPC: Secretariat of the Pacific Community
SPR: Proportion of spawners per recruit with respect to virgin conditions
SS2: Stock Synthesis 2
SS3: Stock Synthesis 3
VPA: Virtual Population Analysis
YFT: Yellowfin tuna
WCPFC: Western and Central Pacific Fisheries Commission
WCPO: Western and Central Pacific ocean

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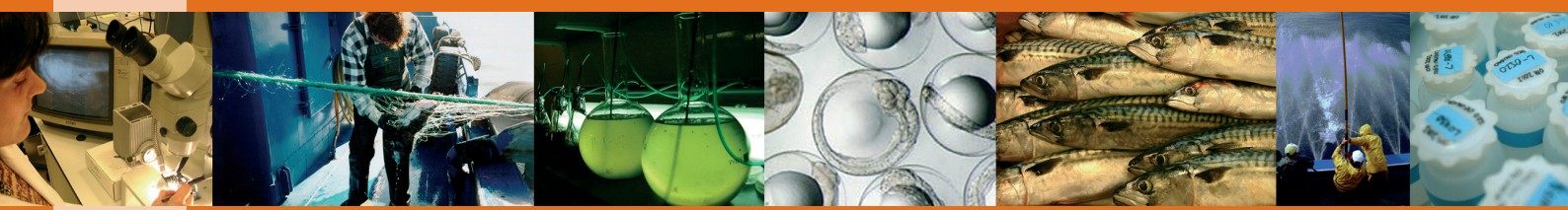

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