

# ISSF TUNA STOCK STATUS UPDATE - 2013 (3)

## *Status of the World Fisheries for Tuna*



## **ISSF Technical Report 2013-04B**

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## EXECUTIVE SUMMARY

There are 23 stocks of the major commercial tuna species worldwide (6 albacore, 4 bigeye, 4 bluefin, 5 skipjack and 4 yellowfin stocks). This document summarizes the results of the most recent scientific assessments of these stocks, as well as the current management measures adopted by the RFMOs. In addition, this report ranks the status and management of the 23 stocks using a consistent methodology in terms of three [factors](#): Abundance, Exploitation/Management (fishing mortality) and Environmental Impact (bycatch).

In 2012, the catch of major commercial tunas was 4.5 million tonnes. Fifty-six percent of it was skipjack tuna, followed by yellowfin (27%), bigeye (10%) and albacore (5%). Bluefin tuna accounts for only 1% of the global catch.

Globally, 61% of the stocks are at a healthy level of abundance, 30% are overfished and 9% are at an intermediate level. In terms of exploitation, 43.5% of the stocks are experiencing a low fishing mortality rate, 17.4% are experiencing overfishing, and 39.1% have a high fishing mortality that is being managed adequately (Figure 1).

When viewed from the point of view of total catch (Figure 2), 91% of the catch comes from healthy stocks. This is due to the fact that skipjack stocks contribute more than one half of the global catch of tunas, and they are all in a healthy situation (Table 1). In contrast, most bluefin stocks and 2 out of 6 albacore stocks are overfished, but combined they make a relatively small fraction of the total catch.

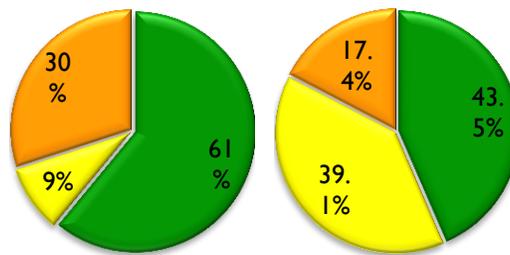


Figure 1. Distribution of stocks of major commercial tunas according to abundance ratings (left) and fishing mortality ratings (right). The percentages correspond to the number of stocks with a given ranking.

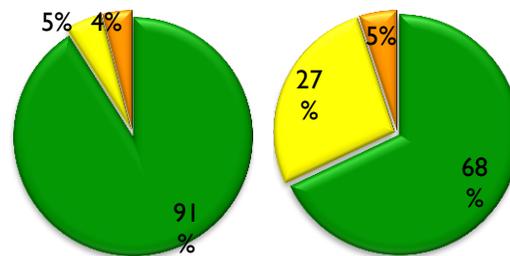


Figure 2. Distribution of stocks of major commercial tunas according to abundance ratings (left) and fishing mortality ratings (right). The percentages correspond to the total catch of all stocks with a given ranking.

Table 1. Biomass, Fishing Mortality (F) and Environmental Impact ratings for 23 tuna stocks. The table is sorted by species. Catch is for 2012 in thousands of tonnes.

STOCK	CATCH	BIOMASS	F	BYCATCH
<b>Albacore tuna</b>				
<a href="#">PO-ALB-N</a>	80			
<a href="#">PO-ALB-S</a>	87			
<a href="#">AO-ALB-N</a>	26			
<a href="#">AO-ALB-S</a>	25			
<a href="#">AO-ALB-M</a>	2			
<a href="#">IO-ALB</a>	34			
<b>Bigeye tuna</b>				
<a href="#">EPO-BET</a>	88			
<a href="#">WPO-BET</a>	156			
<a href="#">AO-BET</a>	71			
<a href="#">IO-BET</a>	116			
<b>Bluefin tuna</b>				
<a href="#">PO-PBF</a>	15			
<a href="#">AO-BFT-E</a>	11			
<a href="#">AO-BFT-W</a>	2			
<a href="#">SH-SBT</a>	10			
<b>Skipjack tuna</b>				
<a href="#">EPO-SKJ</a>	271			
<a href="#">WPO-SKJ</a>	1647			
<a href="#">AO-SKJ-E</a>	208			
<a href="#">AO-SKJ-W</a>	33			
<a href="#">IO-SKJ</a>	315			
<b>Yellowfin tuna</b>				
<a href="#">EPO-YFT</a>	191			
<a href="#">WPO-YFT</a>	644			
<a href="#">AO-YFT</a>	101			
<a href="#">IO-YFT</a>	366			

Table 2. Biomass, Fishing Mortality (F) and Environmental Impact ratings for 23 tuna stocks. The table is sorted by ocean or ocean region. Catch is for 2012 in thousands of tonnes.

STOCK	CATCH	BIOMASS	F	BYCATCH
<b>Eastern Pacific</b>				
<a href="#">EPO-BET</a>	88			
<a href="#">EPO-YFT</a>	191			
<a href="#">EPO-SKJ</a>	271			
<b>Western Pacific</b>				
<a href="#">WPO-BET</a>	156			
<a href="#">WPO-YFT</a>	644			
<a href="#">WPO-SKJ</a>	1647			
<b>Pacific Ocean</b>				
<a href="#">PO-ALB-N</a>	80			
<a href="#">PO-ALB-S</a>	87			
<a href="#">PO-PBF</a>	15			
<b>Atlantic Ocean</b>				
<a href="#">AO-BET</a>	71			
<a href="#">AO-YFT</a>	101			
<a href="#">AO-SKJ-E</a>	208			
<a href="#">AO-SKJ-W</a>	33			
<a href="#">AO-ALB-N</a>	26			
<a href="#">AO-ALB-S</a>	25			
<a href="#">AO-ALB-M</a>	2			
<a href="#">AO-BFT-E</a>	11			
<a href="#">AO-BFT-W</a>	2			
<b>Indian Ocean</b>				
<a href="#">IO-BET</a>	116			
<a href="#">IO-YFT</a>	366			
<a href="#">IO-SKJ</a>	315			
<a href="#">IO-ALB</a>	34			
<b>Southern Hemisphere</b>				
<a href="#">SH-SBT</a>	10			

# INTRODUCTION

## Purpose

There are 23 stocks of the major commercial tuna species worldwide. These stocks are assessed and managed by five Tuna Regional Fishery Management Organizations (RFMOs). The purpose of this document is to summarize the status of the stocks according to the most recent scientific assessments, as well as the current management measures adopted by the RFMOs. Note that stock status can change between consecutive assessments because the stocks and fisheries are dynamic. While this report does not pretend to replace the information available directly from the RFMOs, it does serve as a single source in which the information is presented uniformly. The report is organized by Ocean or by Ocean Region to try to match as closely as possible the mandates of the different RFMOs.

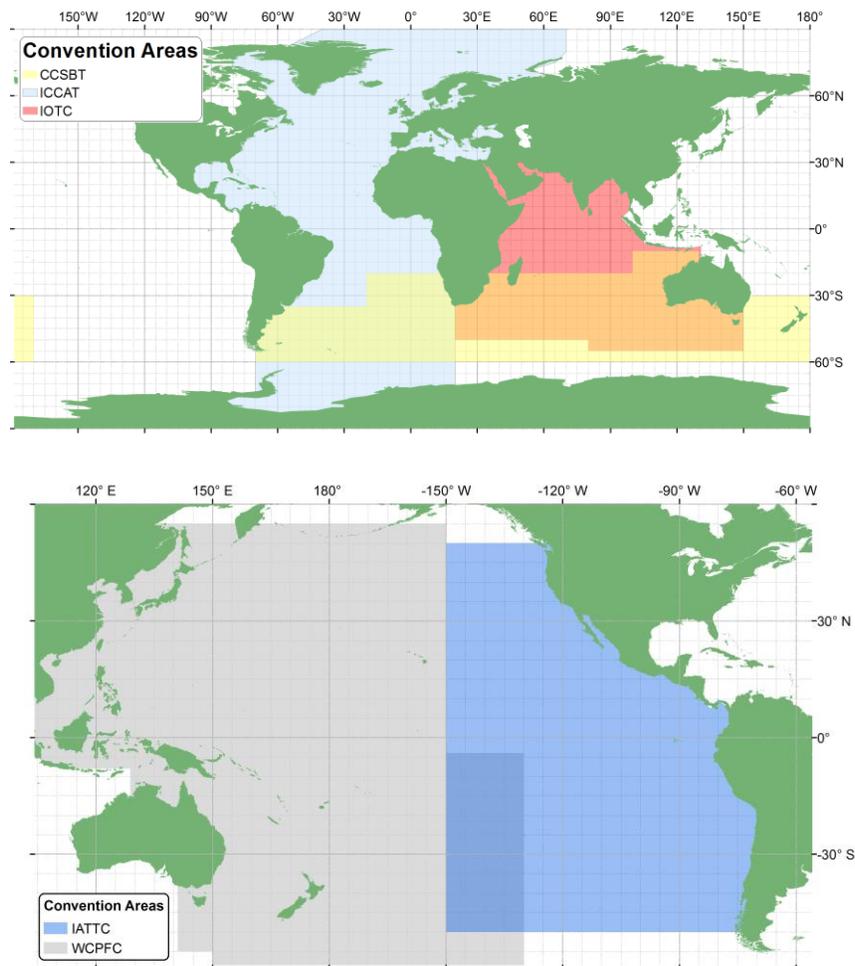


Figure 3. RMFOs' convention areas.

Top: Commission for the Conservation of Southern Bluefin Tuna (CCSBT),  
International Commission for the Conservation of Atlantic Tunas (ICCAT)  
and Indian Ocean Tuna Commission (IOTC)

Bottom: Inter-American Tropical Tuna Commission (IATTC)  
and Western and Central Pacific Fisheries Commission (WCPFC)

In addition, this report ranks the status and management of the 23 stocks using a consistent methodology (further explained below) in terms of three factors: Abundance, Exploitation/Management and Environmental Impact (bycatch).

This report is updated several times each year, usually after an RFMO assesses the stocks it is responsible for, or adopts management recommendations. [Appendix 2](#) provides a log of the updates.

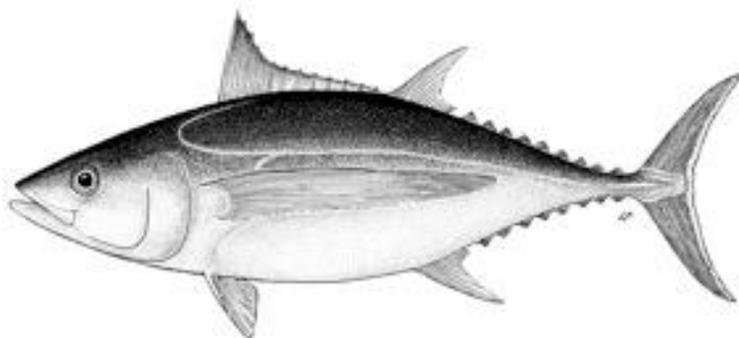
Note that the IATTC and WCPFC Convention Areas have a region of overlap (Figure 3, bottom). In this report, catches of tropical tunas that occur in the overlap region are provided in the EPO summary. Similarly, the CCSBT Convention Area overlaps with those of ICCAT, IOTC and WCPFC. In this report, catches of southern bluefin tuna are provided in the Southern Hemisphere summary.

## Major commercial tunas

Seven species of tunas are of major commercial importance on a global scale: Three species of bluefin tuna, albacore, bigeye, yellowfin and skipjack. Due to differences in their distributions and the different fisheries that exploit them, the species are classified as "temperate" or "tropical". The temperate tunas are the bluefins, plus albacore; they are found in waters as cold as 10°C, but can also be found in tropical waters. Skipjack and yellowfin are classified as tropical and are found in waters with temperatures greater than 18°C (although they can dive in colder waters). Bigeye could be classified as intermediate, but is often treated as a tropical species in fishery statistics. Ages/sizes at maturity relate to when 50% of females are expected to be mature.

### ALBACORE TUNA

Albacore (*Thunnus alalunga*) is a temperate tuna species, widely distributed in temperate and tropical waters of all oceans. The main fisheries are in temperate waters. In the Atlantic, their geographic limits are from 45-50° N and 30-40° S, while in the Indian Ocean, their distribution ranges from 5° N to 40° S with adults occurring from 5° N to 25° S. There are six albacore stocks assessed and managed by the RFMOs: North Pacific Ocean, South Pacific Ocean, North Atlantic Ocean, South Atlantic Ocean, Mediterranean Sea and Indian Ocean.



*Albacore tuna. Courtesy of Fisheries and Aquaculture Department/Food and Agriculture Organization of the United Nations.*

Albacore tend to travel in single species schools, without the level of mixing as seen in other species. Association with floating objects is not common, as seen with tropical tunas.

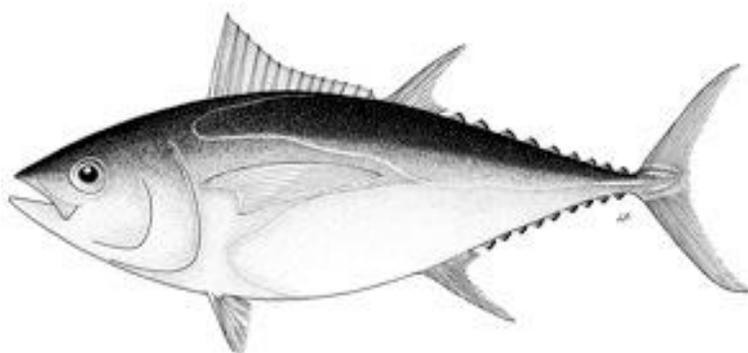
Albacore is one of the smaller major commercial tuna species, reaching sizes intermediate between skipjack and yellowfin.

*Albacore: Approximate characteristics.*

	SIZE (CM)	WEIGHT (KG)	AGE (Y)
COMMON	40-100		
MAXIMUM	130		
MATURITY	75-90	8-15	2-5

## BIGEYE TUNA

Bigeye (*Thunnus obesus*) are found in the subtropical and tropical areas of the Atlantic (but not in the Mediterranean), Indian and Pacific Oceans. Their geographical limits range from 55-60° N and 45-50° S. Juveniles and reproductively active adults are found in equatorial waters as well as at higher latitudes.. Four stocks are assessed and managed by the RFMOs: Atlantic Ocean, Eastern Pacific, Western Pacific and Indian Ocean.



*Bigeye tuna. Courtesy of Fisheries and Aquaculture Department/Food and Agriculture Organization of the United Nations.*

Bigeye can form either free schools or those associated with floating objects. Juvenile bigeye will form schools with juvenile yellowfin and skipjack tunas.

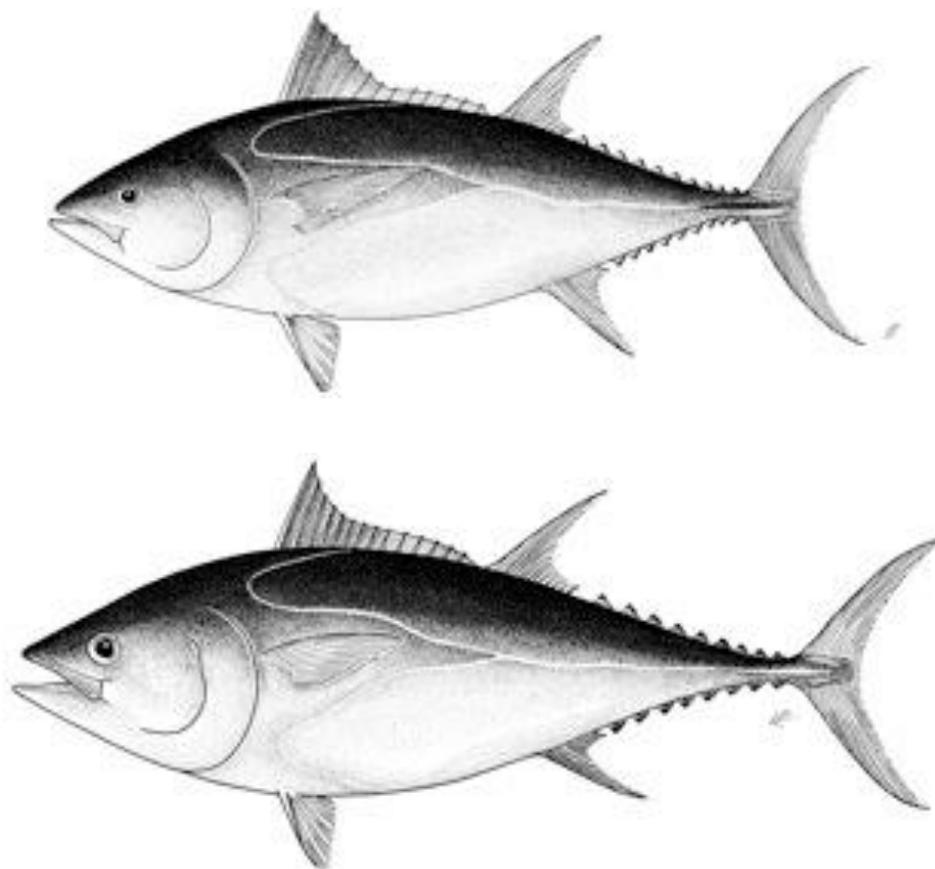
Bigeye reach similar maximum sizes to that of yellowfin. Individuals as large as 150 cm are common in some fisheries.

*Bigeye: Approximate characteristics.*

	SIZE (CM)	WEIGHT (KG)	AGE (Y)
COMMON	40-180	1.4-130	
MAXIMUM	230	210	15
MATURITY	102-135	25-57	3-4

## BLUEFIN TUNA

Bluefin tuna (*Thunnus spp.*) are a temperate water fish comprised of 3 species, North Atlantic bluefin (*Thunnus thynnus thynnus*), Pacific bluefin (*Thunnus orientalis*), and southern bluefin tuna (*Thunnus maccoyii*), with the widest geographical distribution of the tunas. There are four bluefin stocks assessed and managed by the RFMOs: Western Atlantic, Eastern Atlantic (including the Mediterranean), Pacific and Southern hemisphere.



*Southern (top) and Atlantic (bottom) bluefin tunas. Courtesy of Fisheries and Aquaculture Department/Food and Agriculture Organization of the United Nations.*

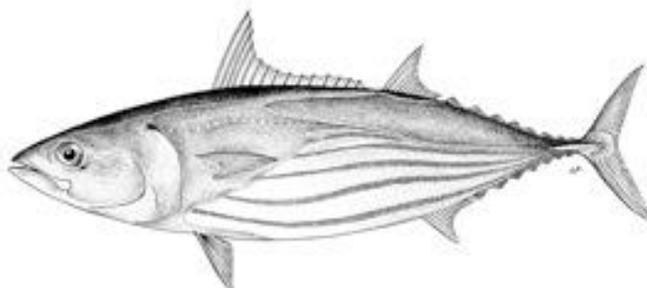
Bluefin are the largest of the tunas. Atlantic bluefin can reach 3 m in length.

*Bluefin: Approximate characteristics.*

	SIZE (CM)	WEIGHT (KG)	AGE (Y)
COMMON	80-200		
MAXIMUM	300 (BFT)	668 (BFT)	25+
MATURITY	110-190	30-120	4-14

## SKIPJACK TUNA

Skipjack (*Katsuwonus pelamis*) are found mainly in the tropical areas of the Atlantic, Indian and Pacific Oceans. Their geographic limits are 55-60° N and 45-50° S, with the greatest abundance seen in equatorial waters. Five stocks are assessed and managed by the RFMOs: Eastern Atlantic, Western Atlantic, Eastern Pacific, Western Pacific and Indian Ocean.



*Skipjack tuna. Courtesy of Fisheries and Aquaculture Department/Food and Agriculture Organization of the United Nations.*

Skipjack form both free schools and schools associated with floating objects. They are the principal species associated with FADs and are caught in conjunction with juvenile yellowfin and bigeye tunas.

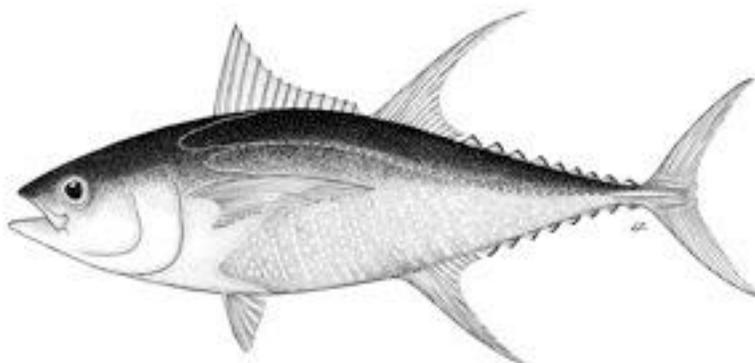
Skipjack are the smallest of the major commercial tuna species.

*Skipjack: Approximate characteristics.*

	SIZE (CM)	WEIGHT (KG)	AGE (Y)
COMMON	40-80		
MAXIMUM	108	33	6-10
MATURITY	43	1.6	1-1.5

## YELLOWFIN TUNA

Yellowfin (*Thunnus albacares*) are found in the subtropical and tropical areas of the Atlantic, Indian and Pacific Oceans. Yellowfin's geographic limits are from 45°-50° N and South, although in the Pacific they occur mainly from 20° N and South. Four stocks are assessed and managed by the RFMOs: Atlantic Ocean, Eastern Pacific, Western Pacific and Indian Ocean.



*Yellowfin tuna. Courtesy of Fisheries and Aquaculture Department/Food and Agriculture Organization of the United Nations.*

Yellowfin form both free and associated schools with adults generally forming schools of similarly sized individuals. The free-swimming schools tend to contain large individuals and are mono-specific. In the eastern Pacific, schools are often associated with dolphin pods, an association not common elsewhere.

Yellowfin tuna reach intermediate sizes between albacore and bigeye. Individuals as large as 150 cm are common in some fisheries.

*Yellowfin: Approximate characteristics.*

	SIZE (CM)	WEIGHT (KG)	AGE (Y)
COMMON	40-170	1.2-100	
MAXIMUM	205	194	8
MATURITY	85-108	12-26	2-3

## Global summary of catches

The global catch of albacore, bigeye, bluefin, skipjack and yellowfin in 2012 was 4.5 million tonnes, a 6% increase from 2011. Catches increased steadily until the early 2000s and have stabilized since then (Figure Global-1). This plateau is explained by a continuous increase in skipjack catches offset by declining catches of yellowfin and bigeye, followed by a tendency in catches of all species to remain stable since the mid-2000s. (Figure Global-2). Ranked by species (using the 2008-2012 average = 4,404,700 tonnes), the majority of the catch is skipjack (56%), followed by yellowfin (27%), bigeye (10%), albacore (5%) and bluefin (1%). In terms of fishing gear, 64% of the catch is made by purse seining, followed by longline (13%), pole-and-line (10%), gillnets (4%) and miscellaneous gears (9%).

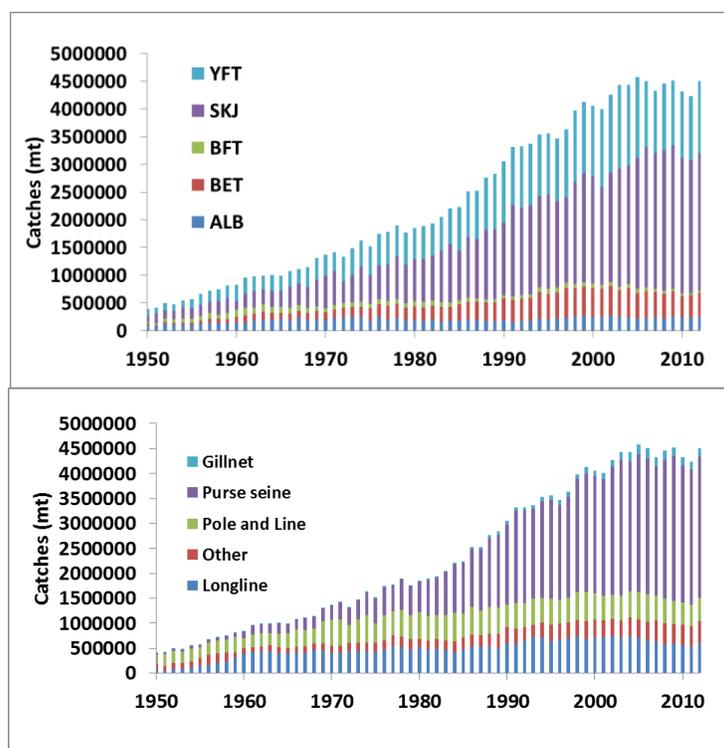


Figure Global-1. Global trends in catch (tonnes) of major commercial tunas, by species (top) and gear (bottom), 1950-2012.

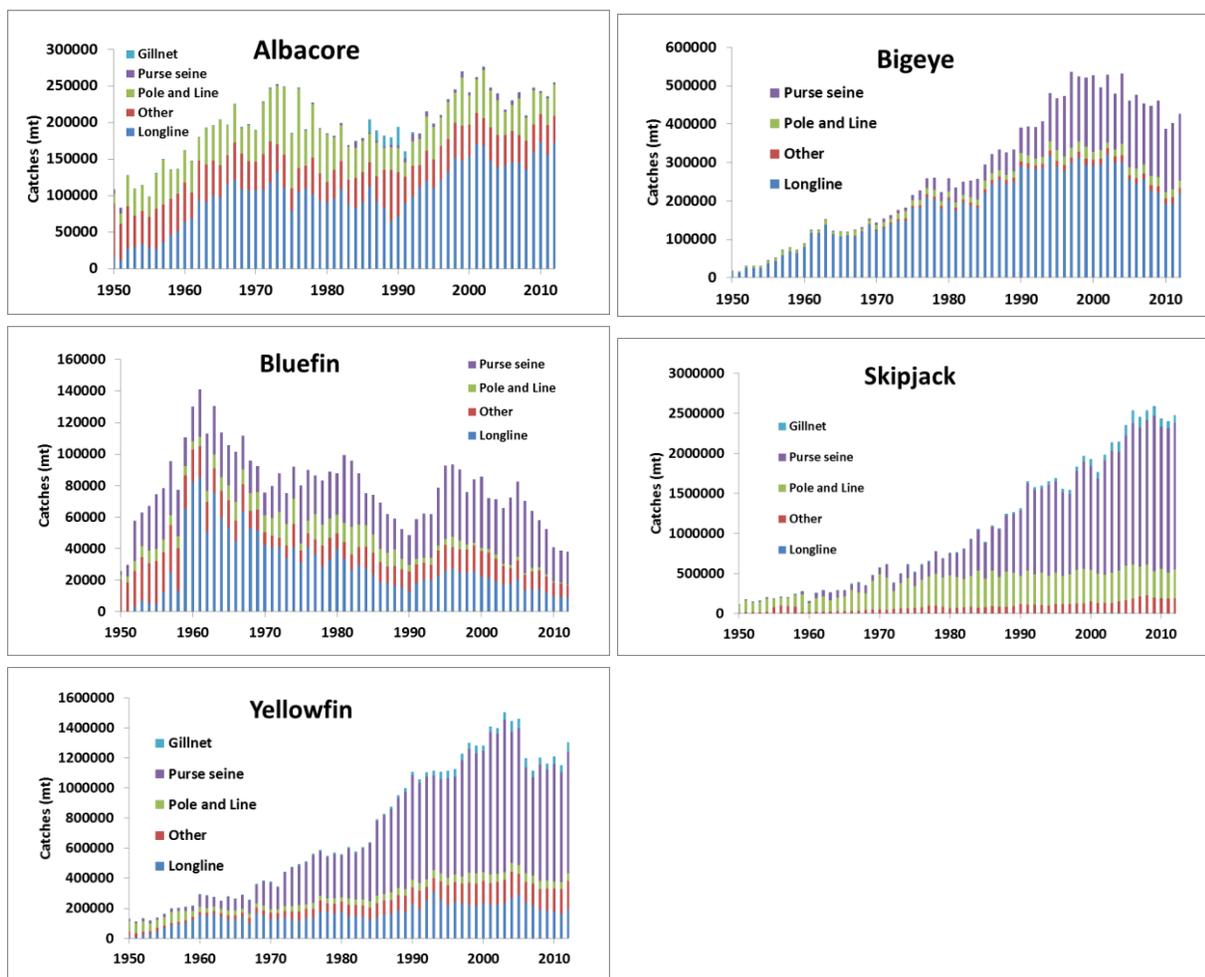


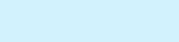
Figure Global-2. Global trends in catch (tonnes) of major commercial tunas, 1950-2012.

## Ratings methodology

For each stock, ISSF applies simple color ratings (Green, Yellow, Orange) to each of three factors. The protocol used is as follows:

1. The Chair of the ISSF Scientific Advisory Committee drafts the text based on reports from the RFMOs and assigns ratings according to the decision table below.
2. Members of the Scientific Advisory Committee review the draft and may revise the ratings to make them more precautionary (but not less), based on their knowledge of the RFMO scientific committees.
3. The Scientific Advisory Committee approves the final report with changes as in step 2, above.

Color Ratings Decision Table

STOCK ABUNDANCE		Spawning Biomass is at or above $B_{MSY}$ .
		Spawning Biomass is below $B_{MSY}$ but it has been stable or increasing*. Yellow is also used in the absence of a stock assessment.
		Spawning Biomass is below $B_{MSY}$ and it has not been stable or increasing*.
FISHING MORTALITY		F is below $F_{MSY}$ .
		F is above $F_{MSY}$ but there are adequate management measures expected to end overfishing.
		F is above $F_{MSY}$ and there are no adequate management measures to end overfishing, or the measures in place are insufficient
ENVIRONMENT		Adverse population effects on bycatch species are not expected for a given fishing gear/fishing method.
		Adverse population effects on bycatch species are expected for a given fishing gear/fishing method, but there are either management measures or research programs in place expected to mitigate these effects. In addition, there is adequate monitoring of bycatch.
		Adverse population effects on bycatch species are expected for a given fishing gear/fishing method, and there are no management measures or research programs in place expected to mitigate these effects. In addition, bycatch monitoring is inadequate.

\* As determined by the ISSF Scientific Advisory Committee based on the results of the stock assessment. Generally, a stable or increasing trend has to be observed for more than two years.

Environmental ratings are specific to different fishing methods. [Appendix I](#) provides the default ratings for major gear types.

### Additional resources

ISSF produces other reports that are complementary to this one, which are published as part of the ISSF Technical Reports series (<http://iss-foundation.org/science/technical-reports/>). Two such reports can be particularly useful in providing additional information:

"Stock Assessment 101: Current practice for tuna stocks" gives a simple introduction to concepts and terms such as  $F$ ,  $F_{MSY}$ ,  $B_{MSY}$ , Recruitment, etc., which are encountered numerous times in this report.

"Status of the world fisheries for tuna: Management of tuna stocks and fisheries" (updated annually) provides additional information about the RFMOs: How they are structured, who are their members, how are decisions made, and what management measures they have adopted that are not strictly for tuna stock management or bycatch mitigation.

## STOCKS IN THE EASTERN PACIFIC OCEAN

RFMO: Inter-American Tropical Tuna Commission (IATTC)

Last Scientific Committee (SAC) meeting: May, 2013.

Last Commission meeting: June, 2013.

Tuna stocks managed by IATTC: EPO Yellowfin, EPO Bigeye, EPO Skipjack. Also, North Pacific Albacore, South Pacific Albacore and Pacific Bluefin (also managed by WCPFC; see Stocks in the Pacific Ocean)

Data sources: The main sources of information for this section are IATTC (2013), Aires da Silva and Maunder (2012a and 2012b), and Maunder (2012).

Last update: August, 2013.

About 13 percent of the world production of tuna is from the eastern Pacific Ocean (EPO). Catches of skipjack, yellowfin and bigeye in 2012 were 550,100 tonnes, a 2% decrease from 2011. There has been a general tendency for the total catch to decline since 2003, when a record 800,000 tonnes of these three species were caught (Figure EPO-1).

Catches of albacore and Pacific bluefin also occur in the EPO. These stocks are also distributed in the western Pacific and are covered in a different section of this report, under Pacific Ocean.

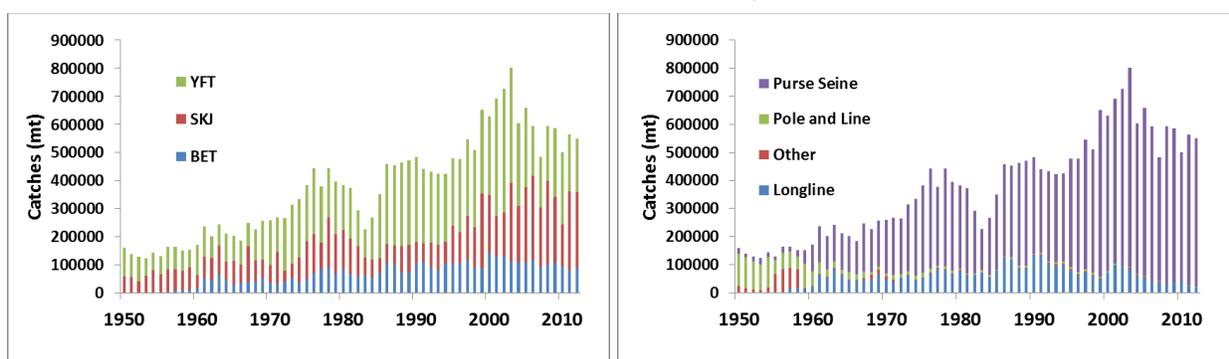


Figure EPO-1. Trends in catch (mt) of bigeye, skipjack and yellowfin in the EPO region, by species (left) and gear (right), 1950-2012.

Average catches for the five-year period 2008-2012 (559,200 tonnes) provide an indication of the recent performance of the fisheries (Figure EPO.2): Skipjack accounts for 44% of the catches in weight, followed by yellowfin (39%) and bigeye (17%). Purse-seine vessels take 91% of the total catch, followed by longline (6%).

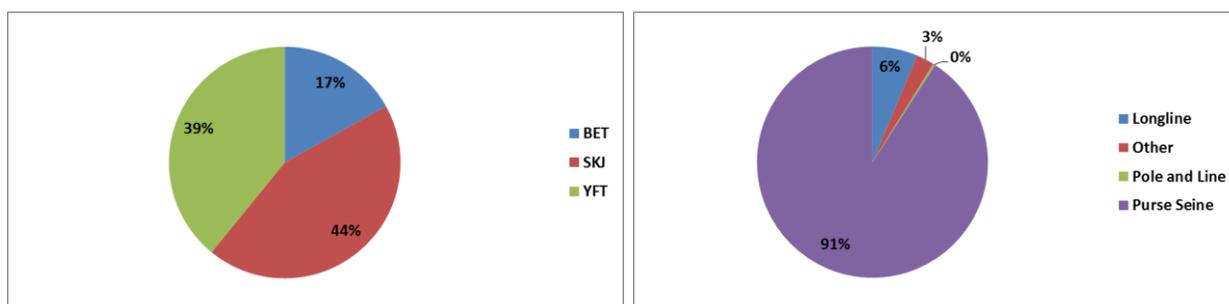


Figure EPO-2. Average 2008-2012 catches of skipjack, yellowfin and bigeye tuna in the EPO. The graph on the left shows the percentages by species, and the graph on the right shows the percentages by gear type.

## EPO Bigeye Tuna

Bigeye catches in 2012 were about 88,000 tonnes, an 8% increase from 2011. Longline fishing dominated the catches in weight until the mid-1990s. Purse seine fishing accounts for the majority of catches in recent years (71%), and longlining accounts for 29% (Figure EPO-3). Bigeye catches in the EPO by other gears are very minor.

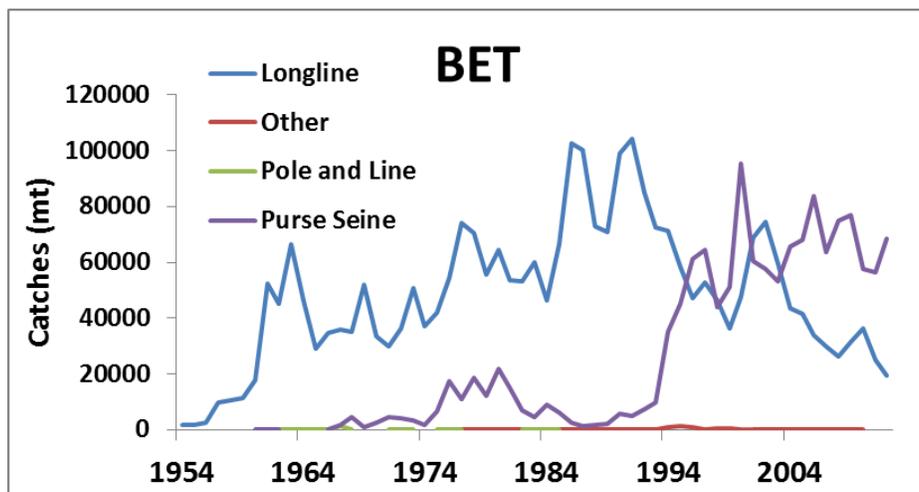


Figure EPO-3. Catches of bigeye tuna in the EPO from 1954 to 2012, by gear type.

## STOCK ASSESSMENT

In 2013, the IATTC conducted an updated assessment of the stock. This assessment made use of several new assumptions, following an external peer review of the 2010 assessment, which resulted in more optimistic results compared to previous assessments. The results of this update indicate the following (EPO-4):

1. The current ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 1.08. This indicates that the stock is not in an overfished state. Between 2005 and 2010, there was an increasing trend in biomass, subsequent to IATTC management measures initiated in 2004. However, under the current levels of fishing mortality, recent spikes in recruitment are predicted not to sustain this increasing trend.
2. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.95, indicating that overfishing was not occurring on average in the most recent three years (2010-2012).
3. The estimate of MSY is 106,700 tonnes. MSY has been reduced to about half its level in 1993, when the expansion of the floating-object fishery began, as the overall selectivity from all fleets combined shifted towards smaller individuals. Since bigeye tuna can grow to be quite large (close to 200 cm), catching them when they are small results in a loss of potential yield, i.e. the catches that could be taken by other gears that target larger individuals, such as longlining. This is known as "growth overfishing".
4. As for all stock assessments that use MSY-based reference points, the assessment of stock status is highly sensitive to the assumed relationship between spawning biomass and recruitment (the base case assessment did not assume one). The results are more pessimistic if a stock-recruitment relationship is assumed (the stock would be assessed to be overfished, and overfishing would be taking place). The results are also more pessimistic if a higher value is assumed for the average size of the older fish, if lower rates of natural mortality are assumed for adult bigeye, and if the size data from longline fisheries are given higher weight in the analyses.

The assessment estimated a strong increase in biomass between 2005 and 2010 in response to management measures, followed by a decline in biomass that could be driven by below-average recruitment levels, coinciding with La Niña events. Stock projections at the 2010-2012 average level of fishing mortality indicates that the spawning biomass will fall slightly below the MSY level and then increase. There is also concern with the excess fishing capacity of the purse seine fleet in the EPO. For these reasons, and the sensitivity of the results to various assumptions, ISSF is taking a cautious view about the status of EPO bigeye.

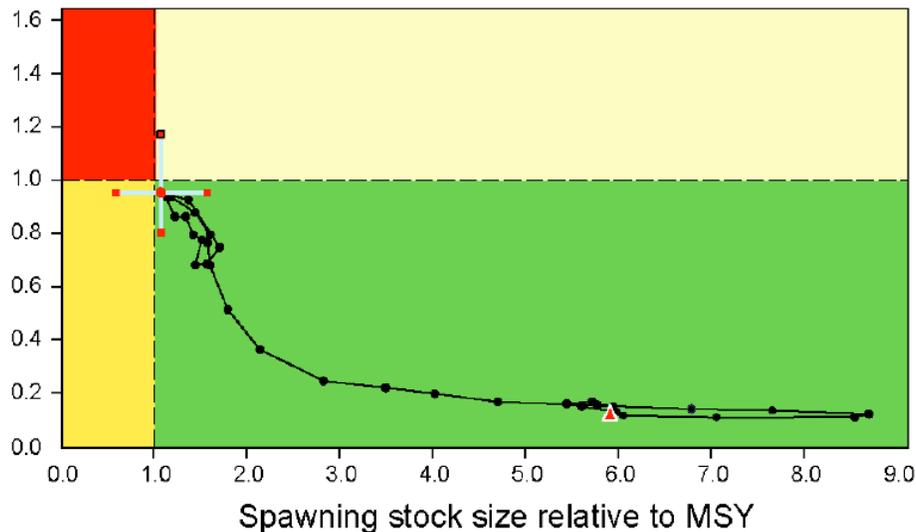


Figure EPO-4. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for bigeye tuna in the EPO. The blue cross represents relative spawning biomass in 2012 and relative fishing mortality for 2010-2012. Colors are taken from IATTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined.  $F_{MSY}$  used implicitly.

Harvest control rule: Not defined. The IATTC has requested the staff to develop options for target and limit reference points, to be considered at the 2014 Commission meeting.

The main conservation measure established by the IATTC for bigeye is Resolution C-13-01, which includes an annual fishing closure for purse seine vessels greater than 182 tons carrying capacity. This measure calls for:

1. A 62-day closure for purse seiners greater than 182 tons capacity through 2016;
2. A seasonal closure of the purse seine fishery in an area known as "El Corralito", west of the Galapagos Islands, where catch rates of small bigeye are high;
3. A full retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas;
4. Bigeye catch limits for the main longline fishing nations.

## SUMMARY

EPO BET	Estimate	Years	Notes
Recent catch	88	2012	
5-yr catch	95	2008-12	
MSY	107	2012	
F/F <sub>MSY</sub>	0.95	2010-2012	
B/B <sub>MSY</sub>	1.05	Start of 2013	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		B > B <sub>MSY</sub> . Spawning biomass is above the MSY level. Projections indicate that the stock will fall slightly below B <sub>MSY</sub> and then increase again.
FISHING MORTALITY		F < F <sub>MSY</sub> . Although the point estimate of current F is below F <sub>MSY</sub> (so it could be rated Green), it is highly unlikely that increased fishing effort will result in significantly increased sustained catches, but it will significantly reduce spawning biomass.
ENVIRONMENT		69% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks, non-target species in general). There is 100% observer coverage on large purse seiners.
		29% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). There will be 5% observer coverage on large longliners

Last Updated: August, 2013.

Changes from previous (July 2012) version: The F rating changed from Orange to Yellow and the B rating changed from Yellow to Green. In 2013, a new assessment with new methodology resulted in more optimistic results than previous assessments. Although both B and F could be rated Green, ISSF is maintaining a cautious view until the next assessment.

## EPO Yellowfin Tuna

Yellowfin catches in the EPO in 2012 were about 190,800 tonnes, a 6% decline from 2011. The main fishing gear is purse seine (97.4% of the catch), and recent catches by this gear are about 50% of the record high caught in 2002 (Figure EPO-5). Catches from longline vessels, although smaller in magnitude, have also declined substantially in recent years.

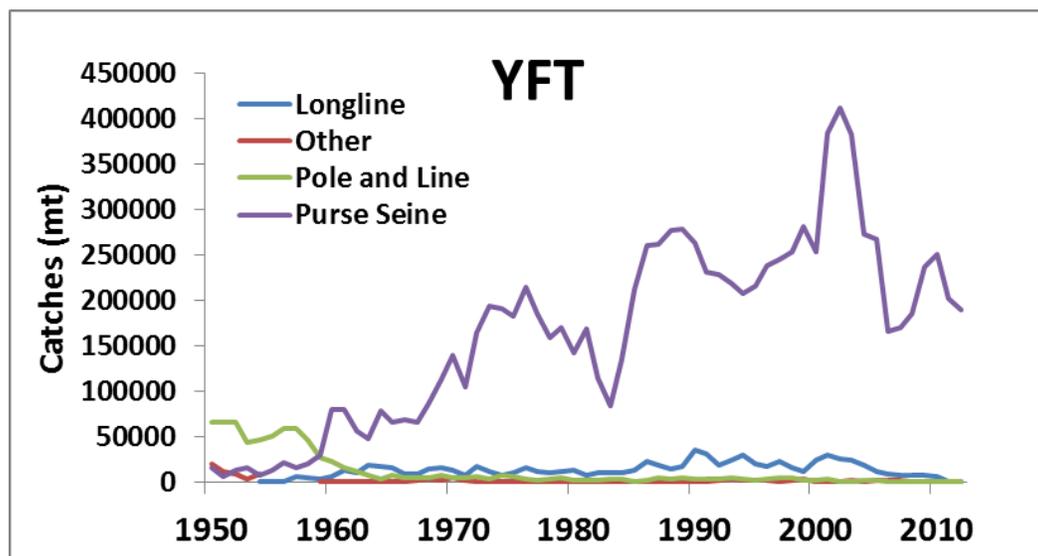


Figure EPO-5. Catches of yellowfin tuna in the EPO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The 2013 assessment used the same methodology as the previous one, with updated data. The assessment results indicated the following (Figure EPO-6):

1. The ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated to be 0.85, indicating that the stock is overfished. The level of spawning biomass is estimated to have declined in recent years due to an increase in the fishing mortality levels for middle-age yellowfin tuna since 2008. In addition, the population may have recently switched from a high to an intermediate productivity regime.
2. The ratio  $F_{\text{current}}/F_{\text{MSY}}$  is estimated to be 0.99, indicating that overfishing is not occurring.
3. MSY is estimated to be 259,000 tonnes. Increasing the average weight of the yellowfin caught could increase the MSY.
4. The assessment of stock status is highly sensitive to the assumed relationship between spawning biomass and recruitment (the base case assessment did not assume one). The results are more pessimistic if a stock-recruitment relationship is assumed. The results are also sensitive to the natural mortality assumed for adult yellowfin and the length assumed for the oldest fish.

Analyses made using the base case assessment results indicate that increasing fishing mortality would change the long-term catches only marginally, while reducing the spawning biomass considerably. Because of this, and taking into account the more pessimistic estimates of stock status obtained when a stock-recruitment relationship is assumed, ISSF believes that fishing mortality for yellowfin tuna in the EPO should not be allowed to increase.

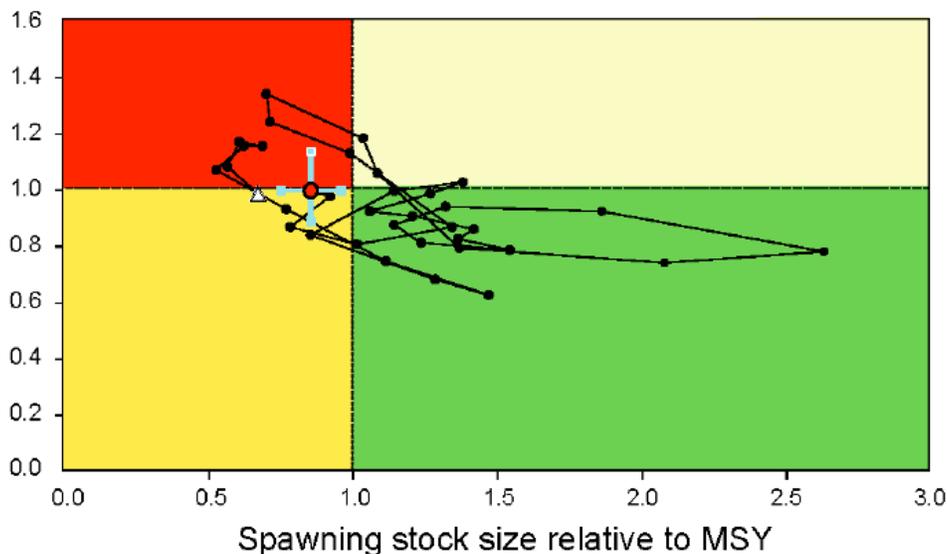


Figure EPO-6. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for yellowfin tuna in the EPO. The red dot represents relative spawning biomass in 2013 and relative fishing mortality for 2010-2012. Colors are taken from IATTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined.  $F_{MSY}$  used implicitly.

Harvest control rule: Not defined. The IATTC has requested the staff to develop options for target and limit reference points, to be considered at the 2014 Commission meeting.

The main conservation measure established by the IATTC for yellowfin is Resolution C-13-01, which includes an annual fishing closure for purse seine vessels greater than 182 tons carrying capacity. This measure calls for:

1. A 62-day closure for purse seiners greater than 182 tons capacity through 2016;
2. A seasonal closure of the purse seine fishery in an area known as "El Corralito", west of the Galapagos Islands, where catch rates of small bigeye are high;
3. A full retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas.

## SUMMARY

EPO YFT	Estimate	Years	Notes
Recent catch	191	2012	
5-yr catch	219	2008-12	
MSY	259	2011	
F/F <sub>MSY</sub>	0.99	2010-2012	
B/B <sub>MSY</sub>	0.85	Start of 2013	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		B < B <sub>MSY</sub> . Spawning biomass has been fluctuating below the MSY level.
FISHING MORTALITY		F < F <sub>MSY</sub> . Although the point estimate of current F is below F <sub>MSY</sub> (so it could be rated Green), it is highly unlikely that increased fishing effort will result in significantly increased sustained catches, but it will significantly reduce spawning biomass.
ENVIRONMENT		65% of the catch is made by purse seining on tuna-dolphin associations. Dolphin mortality is managed and closely monitored by AIDCP, with 100% observer coverage.
		16% of the catch is made by purse seining on FADs. Several bycatch mitigation measures are in place (turtles, sharks, non-target species in general). There is 100% observer coverage on large purse seiners.
		15% of the catch is made by purse seining on free schools of yellowfin.
		2% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds).

Last Updated: August, 2013.

Changes from previous (July 2012) version: Biomass rating changed from Green to Yellow due to a more pessimistic stock status estimated by the 2013 assessment.

## EPO Skipjack Tuna

In 2012, skipjack catches were about 271,300 tonnes, a 3% decrease from 2011. Skipjack catches in the EPO are notoriously variable (Figure EPO-7). Purse seine fishing dominates the catches (over 99% of the total).

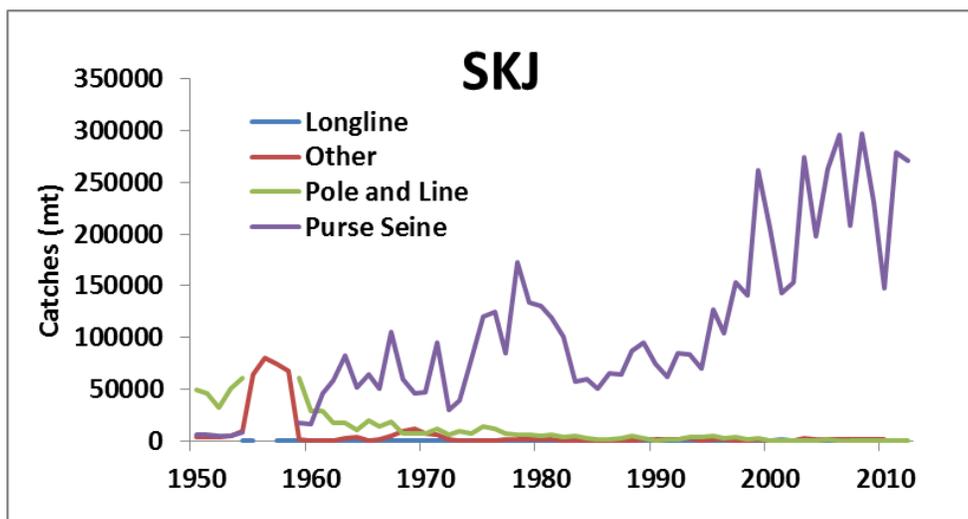


Figure EPO-7. Catches of skipjack tuna in the EPO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The last assessment for skipjack tuna was in 2012, based on four alternative types of analyses. The analyses demonstrated a high degree of uncertainty, particularly with respect to the determination of MSY reference points and biomass levels. There may also be substantial differences between regions. The analyses indicate that exploitation rates may be near the MSY level. However, there is no indication of a credible risk to the stock from overfishing.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined.  $F_{MSY}$  used implicitly.

Harvest control rule: Not defined. The IATTC has requested the staff to develop options for target and limit reference points, to be considered at the 2014 Commission meeting.

The main conservation measure established by the IATTC for skipjack is Resolution C-13-01, which includes an annual fishing closure for purse seine vessels greater than 182 tons carrying capacity. This measure calls for:

1. A 62-day closure for purse seiners greater than 182 tons capacity through 2016;
2. A seasonal closure of the purse seine fishery in an area known as "El Corralito", west of the Galapagos Islands, where catch rates of small bigeye are high;
3. A full retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas;

## SUMMARY

<b>EPO SKJ</b>	Estimate	Years	Notes
Recent catch	271	2012	
5-yr catch	246	2008-12	
MSY	N/A		
$F/F_{MSY}$	$\leq 1$		
$B/B_{MSY}$	$> 1$		
TAC	N/A		

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B > B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F \leq F_{MSY}$ .
<b>ENVIRONMENT</b>		63% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks, non-target species in general). There is 100% observer coverage on large purse seiners.
		35% of the catch is made by purse seining on free schools of skipjack.

Last Updated: August, 2013.

Changes from previous (July 2012) version: None.

## STOCKS IN THE WESTERN AND CENTRAL PACIFIC OCEAN

RFMO: Western and Central Pacific Fisheries Commission (WCPFC)

Last Scientific Committee (SAC) meeting: August, 2013

Last Commission meeting: December, 2013.

Tuna stocks managed by WCPFC: WCPO Yellowfin, WCPO Bigeye, WCPO Skipjack. Also, North Pacific Albacore, South Pacific Albacore and Pacific Bluefin (also managed by IATTC; see Stocks in the Pacific Ocean). Note also that WCPFC and IATTC have an area of overlap; WCPO catch figures reported here do not include those WCPFC Convention Area catches made in the overlap area.

Data sources: The main sources of information for this section are WCPFC (2013) and Harley et al. (2011) for catch and stock status data.

Last update: December, 2013.

About 58 percent of the world production of tuna is from the western and central Pacific Ocean (WCPO). Catches of skipjack, yellowfin, and bigeye in 2012 were 2,447,438 tonnes, a 12% increase from 2011. There has been a general tendency for the total catch to increase between 1980 and 2009 (Figure WCPO-1). This increase has been particularly pronounced for skipjack tuna.

Catches of albacore and Pacific bluefin also occur in the EPO. These stocks are also distributed in the western Pacific and are covered in a different section of this report, under Pacific Ocean.

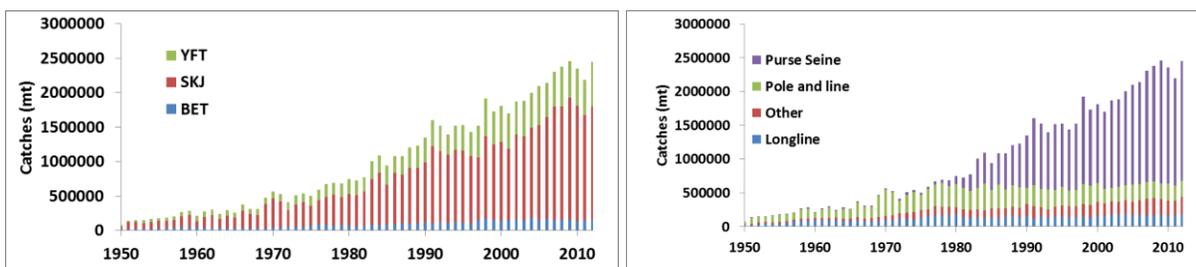


Figure WCPO-1. Trends in catch (mt) of bigeye, skipjack and yellowfin in the WCPO region, by species (left) and gear (right), 1950-2012.

Average catches for the five-year period 2008-2012 (2,376,600 tonnes) provide an indication of the recent performance of the fisheries (Figure WCPO-2): Skipjack accounts for 70% of the catches in weight, followed by yellowfin (24%) and bigeye (7%). Purse-seine vessels take 72% of the total catch, followed by pole-and-line (10%), longline (7%), and other gears.

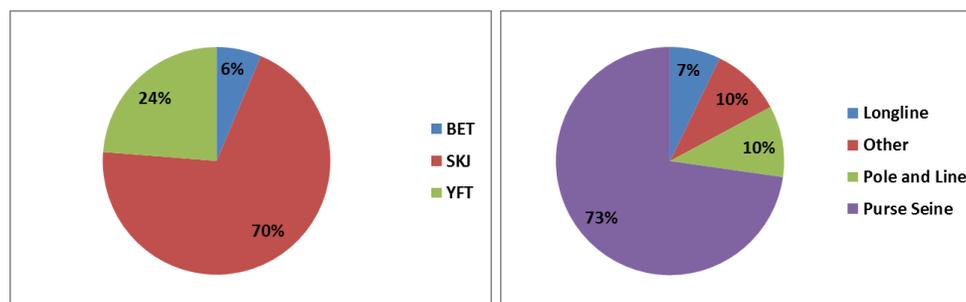


Figure WCPO-2. Average 2008-2012 catches of skipjack, yellowfin and bigeye tuna in the WCPO. The graph on the left shows the percentages by species, and the graph on the right shows the percentages by gear type.

## WCPO Bigeye Tuna

Bigeye catches in 2012 were about 156,200 tonnes, a 2% increase from 2011. The main fishing gears are longline (5-year average ~50%) and purse seine (40%) (Figure WCPO-3). Bigeye catches in the WCPO by other gears are relatively minor.

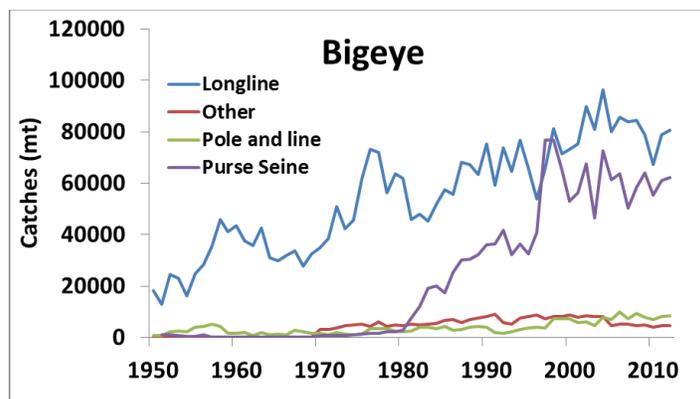


Figure WCPO-3. Catches of bigeye tuna in the WCPO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The 2011 assessment reviewed by SC7 (the 7th meeting of the WCPFC Scientific Committee) is comparable to the 2010 assessment, though there have been some changes in the base case model used to derive management advice. Notably, the new assessment uses an index of abundance based on detailed (set-by-set) Japanese longline CPUE data. In addition, the base model fixed the value of a parameter that controls the degree with which recruitment is related to stock size ("steepness") to a level that SC7 considered to be more reasonable. The updated assessment indicated the following (Figure WCPO-4):

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 1.46, indicating that overfishing is occurring. In order to reduce fishing mortality to  $F_{\text{MSY}}$ , a 32% reduction in fishing mortality is required from the 2006–2009 level. Considering historical levels of fishing mortality, a 39% reduction in fishing mortality from 2004 levels is required (consistent with the aim of CMM2008-01), and a 28% reduction from average 2001–2004 levels.
2. The ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  in the base model is estimated at 1.19. This indicates that the stock is not in an overfished state. However, other models considered plausible by SC7 estimated that  $B_{\text{current}}/B_{\text{MSY}} < 1.0$ . In particular, for a model in which MSY-based reference points were computed for the above-average recruitment period of the past 21 years, the estimate of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  was 0.61. Therefore, SC7 concluded that there is a possibility that bigeye tuna is currently in an overfished state.
3. The estimate of MSY is 76,800 tonnes. MSY has been reduced to less than half its levels prior to 1970 through harvest of small bigeye. Recent catches (2006–2009 average = 141,200 tonnes) are substantially than MSY. However, for the model in which MSY-based reference points were computed for the above-average recruitment period of the past 21 years, the estimate of MSY is considerably higher (131,400 tonnes), but still less than recent annual catches with the exception of 2010. Reducing the catch of small bigeye would increase the overall level of catches that could be obtained sustainably.

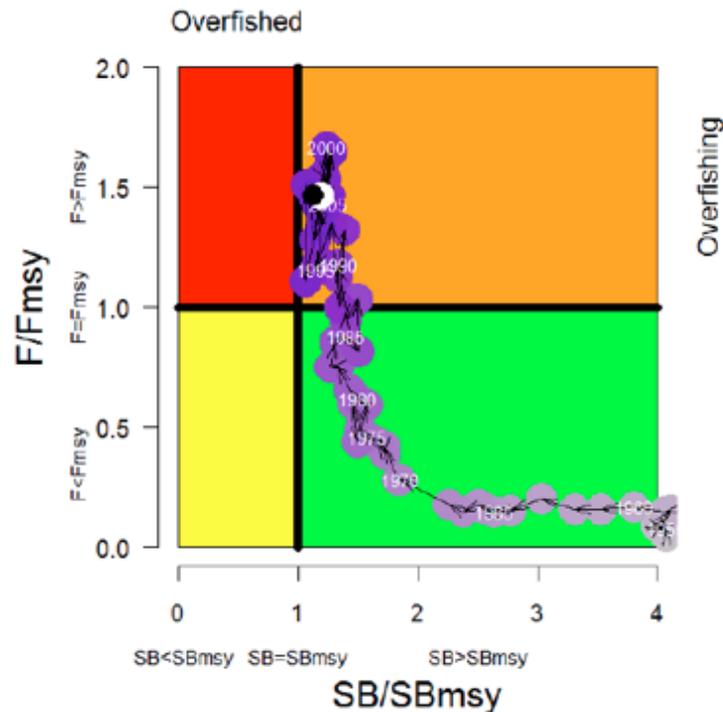


Figure WCPO-4. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for bigeye tuna in the WCPO. The white dot represents the current (2006-2009 average) level. Colors are taken from WCPFC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

**Limit reference point:** 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current environmental conditions ( $20\%SB_{current, F=0}$ ). Adopted by the Commission in 2012.

**Target reference point:** Not defined for the long term. Achieving  $F \leq F_{MSY}$  by 2017 implied as an interim target (CMM-2013-01).

**Harvest control rule:** Not defined.

The main binding conservation measure for bigeye established by the WCPFC is CMM 2013-01 which aims to reduce fishing mortality to  $F \leq F_{MSY}$  by the end of 2017. The measures call for the following in 2014-2017:

1. A 3-month closure (July through September) of fishing on FADs in EEZ waters and on the High Seas between  $20^{\circ}N$  and  $20^{\circ}S$ . VMS polling frequency is increased to 30 minutes during the closure;
2. In 2014, in addition to (1), each member shall choose between extending the FAD closure through October, or limiting the number of FAD sets to be less than the number of sets made by its vessels in a reference period specified in the CMM. In 2015 and 2016, the additional measures will be extended to either a 5-month FAD closure or stronger limits in the number of FAD sets per vessel. In 2017, a prohibition on FAD sets on the high seas will apply, except for vessels purse seine flagged to Kiribati.
3. A limitation in the number of vessel days: For PNA members, the limit in their EEZs is the 2010 level; For other coastal states with effort in their EEZs exceeding 1,000 days annually over (2006-2010), the limit is either the 2001-2004 average or the 2010 level. For non-SIDS members, purse seine effort on the high seas will be limited to levels specified in the CMM.

4. Each member shall not allow the number of fishing days in the high seas to increase above limits specified in the CMM;
5. A requirement to submit FAD management plans, including information on strategies used to implement the closure and other measures for reducing small bigeye mortality;
6. A full-retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas between 20°N and 20°S;
7. 100% Regional observer coverage for all purse seine vessels fishing on the high seas, on the high seas and in waters under the jurisdiction of one or more coastal States, or vessels fishing in waters under the jurisdiction of two or more coastal States during the same trip; all purse seiners fishing between 20N and 20S must have an observer onboard.
8. A limit between 20N and 20S in the number of purse seine and longline vessels with freezing capacity at the current level for most countries (and specifically not including Small Island Developing States);
9. Flag-specific catch limits for bigeye caught by longliners, with monthly reporting to monitor the utilization of the limits;

In addition, CMM 2009-02 provides more guidance on the FAD closure and full retention requirements.

The first comprehensive management plan adopted for tropical tunas was CMM 2008-01. This measure was amended in through CMM-2011-01 and replaced by CMM 2012-01 and CMM-2013-01 in efforts by WCPFC members to reach a compromise and not allow the fisheries to go unmanaged. Overfishing of bigeye remains a concern, and the Commission has set up a working group to draft a new CMM to be adopted in 2013.

SUMMARY

WCPO BET	Estimate	Years	Notes
Recent catch	156	2012	
5-yr catch	151	2008-12	
MSY	77	2006-09	This figure is for long-term average recruitment that is considerably below that of the past 10-20 years
F/F <sub>MSY</sub>	1.46	2006-09	
B/B <sub>MSY</sub>	1.19	2006-09	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B \geq B_{MSY}$ . The stock has been subjected to overfishing for over one decade, but has not become overfished due to higher-than-average levels of recruitment in recent years.
FISHING MORTALITY		$F > F_{MSY}$ . The WCPFC management measures in place are insufficient to end overfishing in the short term.
ENVIRONMENT		52% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		38% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks). There is 100% observer coverage on part of the purse seine fleet.
		5% of the catch is made with purse seining on free schools, with little impact on non-target species.
		5% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks.

Last Updated: March, 2013.

Changes from previous (December 2012) version: None.

## WCPO Yellowfin Tuna

Yellowfin catches in the WCPO in 2012 were about 644,500 tonnes, a 24% increase from 2011. Much of this increase may be driven by a change in Indonesian catch statistics, and probably reflects changes in reporting rather than a real increase in catch. The main fishing gear is purse seine (65% of the catch). Fifteen percent of the catches are also taken by a number of mixed gears in the Philippines and Indonesia, and 16% by longliners (Figure WCPO-5).

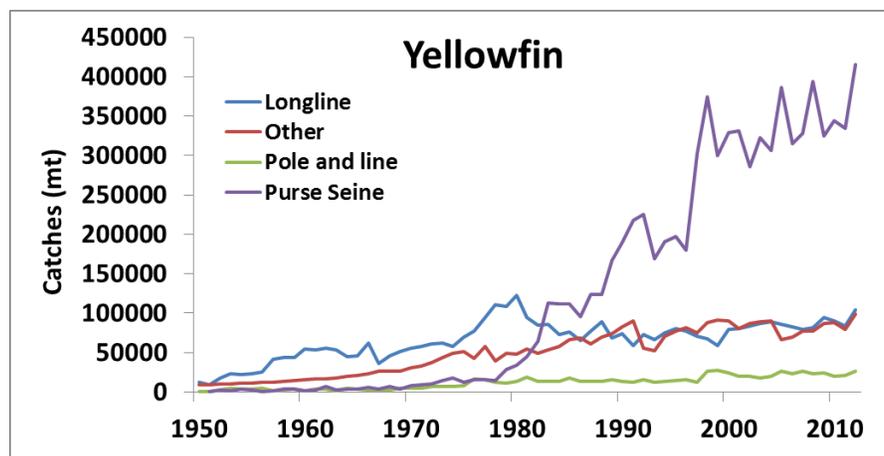


Figure WCPO-5. Catches of yellowfin tuna in the WCPO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The last yellowfin assessment was conducted in 2011 and reviewed by SC7. While the model was similar to the previous (2009) assessment, there were revisions to various data sets (e.g. longline CPUE indices, catch and size data, purse-seine catch and size data, and the modeling of the Indonesian and Philippines domestic fisheries). The results were generally more pessimistic than those from the previous assessment and indicated that (Figure WCPO-6):

1. The yellowfin stock is not in an overfished state as spawning biomass is above the  $B_{MSY}$  level ( $B_{current}/B_{MSY} = 1.47$ , range between 1.14 and 1.92).
2. The ratio  $F_{current}/F_{MSY}$  is estimated to be 0.77 (range between 0.54 and 1.15), indicating that overfishing is not occurring.
3. MSY is estimated to be 538,800 (range 432,000-645,000) tonnes.
4. The optimistic estimate of overall stock status should be tempered by the patterns estimated at a sub-regional level. The western equatorial Pacific, from which most of the catches are taken, is at least fully exploited with no potential for a substantial increase in catches to be sustainable.

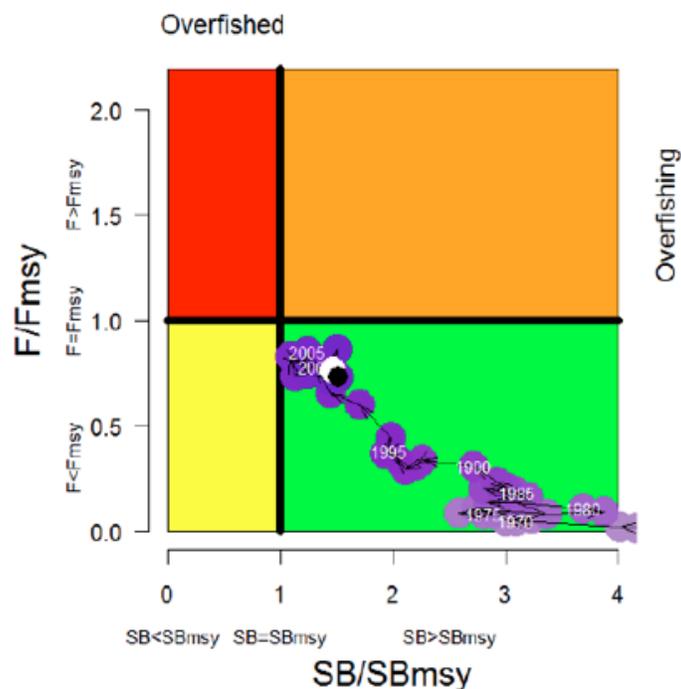


Figure WCPO-6. Temporal trend in the ratios  $B_{\text{current}}/B_{\text{MSY}}$  (x-axis) and  $F_{\text{current}}/F_{\text{MSY}}$  (y-axis) for yellowfin tuna in the WCPO, 1952-2010. The white dot represents the current (2006-2009) situation. Colors are taken from WCPFC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current environmental conditions ( $20\%SB_{\text{current}, F=0}$ ).

Target reference point: Not defined.

Harvest control rule: Not defined.

The main binding conservation measure for yellowfin established by the WCPFC is CMM 2013-01. The measures call for the following in 2014-2017:

1. A 3-month closure (July through September) of fishing on FADs in EEZ waters and on the High Seas between 20°N and 20°S. VMS polling frequency is increased to 30 minutes during the closure;
2. In 2014, addition to (1), each member shall choose between extending the FAD closure through October, or limiting the number of FAD sets to be less than the number of sets made by its vessels in a reference period specified in the CMM. In 2015 and 2016, the additional measures will be extended to either a 5-month FAD closure or stronger limits in the number of FAD sets per vessel. In 2017, a prohibition on FAD sets on the high seas will apply, except for vessels purse seine flagged to Kiribati.
3. A limitation in the number of vessel days: For PNA members, the limit in their EEZs is the 2010 level; For other coastal states with effort in their EEZs exceeding 1,000 days annually over (2006-2010), the limit is either the 2001-2004 average or the 2010 level. For non-SIDS members, purse seine effort on the high seas will be limited to levels specified in the CMM.
4. Each member shall not allow the number of fishing days in the high seas to increase above limits specified in the CMM;
5. Each member shall not allow its catch of yellowfin to increase;

6. A requirement to submit FAD management plans, including information on strategies used to implement the closure and other measures for reducing small bigeye mortality;
7. A full-retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas between 20°N and 20°S;
8. 100% Regional observer coverage for all purse seine vessels fishing on the high seas, on the high seas and in waters under the jurisdiction of one or more coastal States, or vessels fishing in waters under the jurisdiction of two or more coastal States during the same trip; all purse seiners fishing between 20N and 20S must have an observer onboard.
9. A limit between 20N and 20S in the number of purse seine and longline vessels with freezing capacity at the current level for most countries;

In addition, CMM 2009-02 provides more guidance on the FAD closure and full retention requirements. In 2011, SC7 concluded that the CMM is achieving its objective of limiting overall fishing mortality on WCPO yellowfin to sustainable levels. However, considering that the western equatorial region is estimated to be fully exploited, the SC recommended that there be no increase in fishing mortality in this region.

## S U M M A R Y

WCPO YFT	Estimate	Years	Notes
Recent catch	644	2012	
5-yr catch	562	2008-12	
MSY	539	2006-09	
F/F <sub>MSY</sub>	0.77	2006-09	
B/B <sub>MSY</sub>	1.47	2006-09	
TAC	N/A		

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B > B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F < F_{MSY}$ . Although the overall estimate of current F is well below $F_{MSY}$ , this is not the case in the western equatorial region (where over 80% of the catch is taken). Due to heavy fishing effort in this region, there is little or no room for increased fishing pressure on the stock overall.
<b>ENVIRONMENT</b>		36% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks). There is 100% observer coverage on part of the purse seine fleet.
		35% of the catch is made with purse seining on free schools, with little impact on non-target species.
		15% of the catch is made by other gears such as gillnets, with unknown impacts on non-target stocks.
		16% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.

Last Updated: March, 2013.

Changes from previous (December 2012) version: None.

## WCPO Skipjack Tuna

The WCPO Skipjack stock supports the largest tuna fishery in the world, accounting for 36% of world-wide tuna landings. Catches in 2012 were 1,646,800 tonnes, an 8% increase from 2011. Purse seining, which accounts for 79% of the catches, increased steadily for three decades. In contrast, pole-and-line fishing (about 13%) has been declining steadily (Figure WCPO-7).

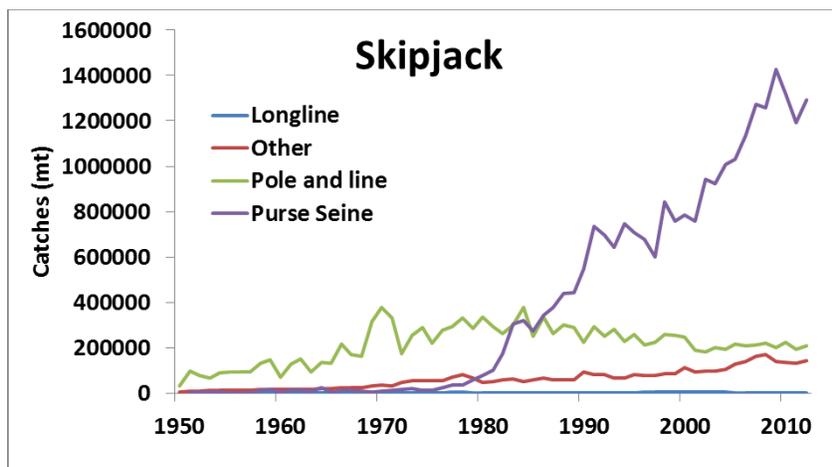


Figure WCPO-7. Catches of skipjack tuna in the WCPO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The 2011 assessment incorporated improved data sets and a number of different assumptions compared to the previous (2010) assessment. The updated assessment gave similar results to the previous one, and indicated the following (Figure WCPO-8):

1. Fishing mortality rates tended to be higher during the last decade than for the preceding period. The ratio  $F_{\text{current}}/F_{\text{MSY}}$  is estimated to be 0.37, indicating that the stock is moderately exploited and overfishing is not occurring.
2. The stock is not in an overfished state as spawning biomass is above the  $B_{\text{MSY}}$  level ( $B_{\text{current}}/B_{\text{MSY}} = 2.94$ ).
3. MSY is estimated to be 1.5 (range 1.3-1.8) million tonnes. The recent recruitment level has been higher than average, and using this recent level to calculate maximum sustainable catches would result in higher potential yield.

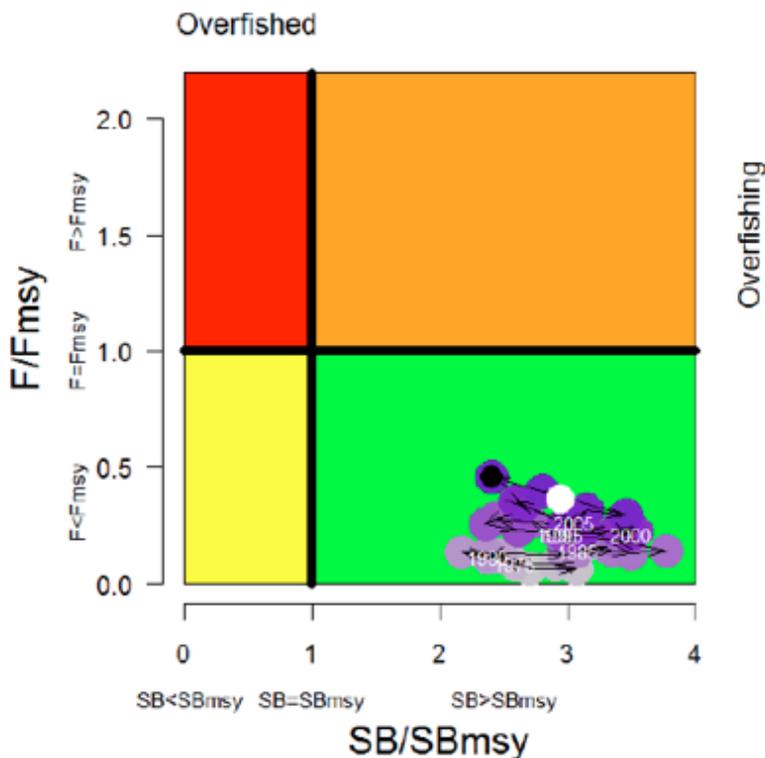


Figure WCPO-8. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for skipjack tuna in the WCPO. Colors are taken from WCPFC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

**Limit reference point:** 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current environmental conditions ( $20\%SB_{current, F=0}$ ).

**Target reference point:** Not defined.

**Harvest control rule:** Not defined.

The main binding conservation measure for skipjack established by the WCPFC is CMM 2013-01. The measures call for the following in 2014-2017:

1. A 3-month closure (July through September) of fishing on FADs in EEZ waters and on the High Seas between 20°N and 20°S. VMS polling frequency is increased to 30 minutes during the closure;
2. In 2014, addition to (1), each member shall choose between extending the FAD closure through October, or limiting the number of FAD sets to be less than the number of sets made by its vessels in a reference period specified in the CMM. In 2015 and 2016, the additional measures will be extended to either a 5-month FAD closure or stronger limits in the number of FAD sets per vessel. In 2017, a prohibition on FAD sets on the high seas will apply, except for vessels purse seine flagged to Kiribati.
3. A limitation in the number of vessel days: For PNA members, the limit in their EEZs is the 2010 level; For other coastal states with effort in their EEZs exceeding 1,000 days annually over (2006-2010), the limit is either the 2001-2004 average or the 2010 level. For non-SIDS members, purse seine effort on the high seas will be limited to levels specified in the CMM.

4. Each member shall not allow the number of fishing days in the high seas to increase above limits specified in the CMM;
5. A requirement to submit FAD management plans, including information on strategies used to implement the closure and other measures for reducing small bigeye mortality;
6. A full-retention requirement for all purse seine vessels regarding bigeye, skipjack and yellowfin tunas between 20°N and 20°S;
7. 100% Regional observer coverage for all purse seine vessels fishing on the high seas, on the high seas and in waters under the jurisdiction of one or more coastal States, or vessels fishing in waters under the jurisdiction of two or more coastal States during the same trip; all purse seiners fishing between 20N and 20S must have an observer onboard.
8. A limit between 20N and 20S in the number of purse seine and longline vessels with freezing capacity at the current level for most countries.

In addition, CMM 2009-02 provides more guidance on the FAD closure and full retention requirements.

SC7 noted that, if recent fishing patterns continue, catch and catch rates are likely to decline. For this reason, it recommended that the Commission consider developing limits on fishing for skipjack to limit the declines in catch rate associated with further declines in biomass.

## SUMMARY

WCPO SKJ	Estimate	Years	Notes
Recent catch	1647	2012	
5-yr catch	1652	2008-2012	
MSY	1503	2006-2009	
F/F <sub>MSY</sub>	0.37	2006-2009	
B/B <sub>MSY</sub>	2.94	2006-2009	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B > B_{MSY}$ .
FISHING MORTALITY		$F \leq F_{MSY}$ .
ENVIRONMENT		56% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks). There is 100% observer coverage on part of the purse seine fleet.
		30% of the catch is made with purse seining on free schools, with little impact on non-target species.
		13% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks.
		9% of the catch is made by other gears such as gillnets, with unknown impacts on non-target stocks.

Last Updated: March, 2013.

Changes from previous (December 2012) version: None.

## PACIFIC-WIDE STOCKS

RFMOs: Western and Central Pacific Fisheries Commission (WCPFC) and Inter-American Tropical Tuna Commission (IATTC)

Last Scientific Committee meetings:

- WCPFC: August, 2012
- IATTC: May, 2013
- ISC: July 2013

Last Commission meeting:

- WCPFC: December, 2013
- IATTC: June, 2013

Three of the major commercial tunas with Pacific-wide distributions are warranted treatment as Pacific-wide stocks due to their scales of movement between the WCPO and the EPO: North Pacific albacore, South Pacific albacore and Pacific bluefin. The responsibility for their management is shared between IATTC and WCPFC. In terms of stock assessments, the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) evaluates North Pacific albacore and Pacific bluefin; the SPC evaluates South Pacific albacore.

Data sources: The main sources of information for this section are WCPFC (2013), ISC (2013) and Harley et al. (2011) for catch and stock status data. Information available publicly from ISC is often limited or difficult to find.

Last update: August, 2013.

## PO North Pacific Albacore

North Pacific albacore catches in 2012 were about 80,200 tonnes, a similar figure to that of 2011. The main fishing gears are longline (41%) and pole-and-line (33%), followed by trolling (25%) (Figure PO-3). Catches by longlining have shown a decreasing trend since 1997.

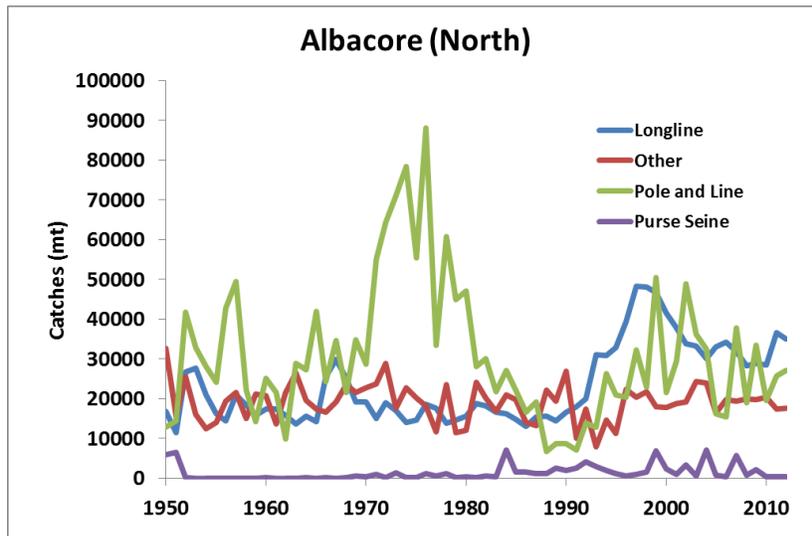


Figure PO-3. Catches of albacore tuna in the North PO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The most recent assessment of north Pacific albacore was in 2011, using data through 2009 (ISC 2011). The assessment indicated that recent levels of fishing mortality have declined relative to the last (2006) assessment and concluded that:

1. The stock is not in an overfished state.
2. Fishing mortality is lower than many commonly-used reference points that are used as proxies for  $F_{MSY}$ .
3. Increasing  $F$  beyond 2006-2008 levels will not result in proportional increases in yield.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined.

Harvest control rule: Not defined.

The main binding conservation measure for North Pacific albacore established by the WCPFC is CMM 2005-03 which called for members not to increase fishing effort directed at North Albacore beyond the "current level". Similarly, in the IATTC, Resolution C-05-02 called for members not to increase fishing effort directed at North Albacore beyond the "current level". IATTC Resolution C-13-03 supplements C-05-02 and requires the reporting of fishing vessel information for 2007-2012.

S U M M A R Y

<b>PO ALB-N</b>	Estimate	Years	Notes
Recent catch	80	2012	
5-yr catch	76	2008-12	
MSY	N/A		
F/F <sub>MSY</sub>	I <		
B/B <sub>MSY</sub>	> I		
TAC	N/A		

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B > B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F \leq F_{MSY}$ . Although the point estimate of current F is below various $F_{MSY}$ proxies (so it could be rated Green), it is highly unlikely that increased fishing effort will result in significantly increased sustained catches, but it will significantly reduce spawning biomass. Both IATTC and WCPFC have measures in place to limit fishing effort or fishing capacity targeted on this stock.
<b>ENVIRONMENT</b>		41% of the catch is made by longlining. Several bycatch mitigation measures are in place (turtles, sharks, sea birds).
		33% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish species.
		25% of the catch is made by trolling, with little impact on non-target species.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## PO South Pacific Albacore

South Pacific albacore extends beyond the WCPFC Convention Area. However, the stock is assessed by WCPFC for the area of the Pacific south of the Equator and between 140°E and 110°W. South Pacific albacore catches in 2012 were about 87,400 tonnes, a 21% increase from 2011. The main fishing gear is longline, accounting for 96% of the catch. Relatively minor amounts are taken by other gears like trolling (Figure PO-4).

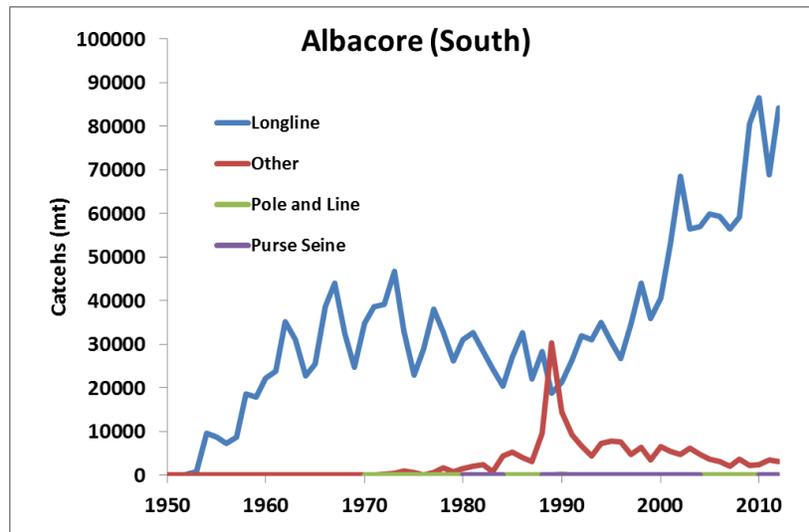


Figure PO-4. Catches of albacore tuna in the South PO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The last assessment was conducted by SC8 (WCPFC) in 2012 using similar methods to the previous (2011) assessment. However, there were substantial revisions made to some of the longline data and biological parameters. The assessment results were similar to those in 2011 and indicated the following:(Figure PO-5):

1. The estimated ratio  $F_{current}/F_{MSY}$  in 2009-2011 is 0.21, indicating that overfishing is not occurring. However, given the recent expansion of the fishery and recent declines in exploitable biomass available to longline fisheries, and given the importance of maintaining catch rates, SC8 recommended that longline fishing mortality be reduced if the Commission wishes to maintain economically viable catch rates.
2. The estimated ratio of spawning biomass  $B_{current}/B_{MSY}$  in 2011 is 2.6. This indicates that the stock is not in an overfished state. However, the stock's biomass may be approaching an unprofitably low level.
3. The estimate of MSY is 99,000 tonnes (the median across a large number of plausible model runs).

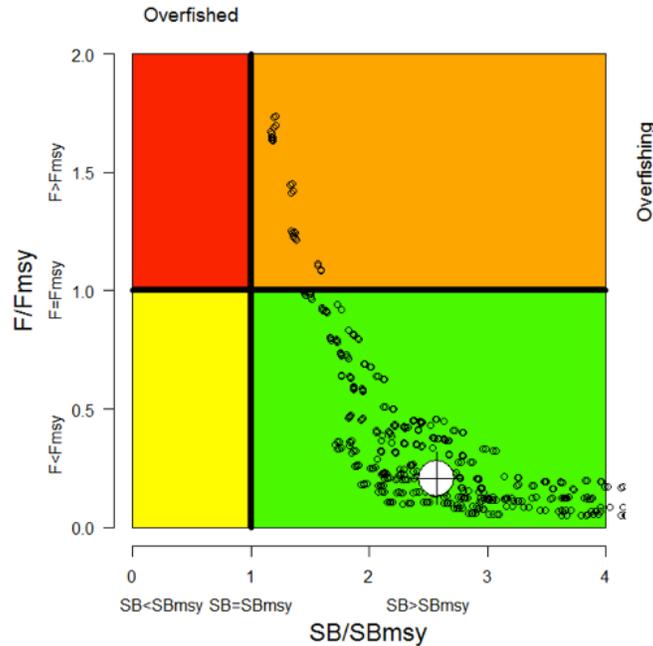


Figure PO-5. Ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for albacore tuna in the South Pacific Ocean. The white dot represents the median and the spread of points represents the uncertainty in the estimated ratios. Colors are taken from WCPFC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: (WCPFC) 20% of the equilibrium spawning biomass that would be expected in the absence of fishing under current environmental conditions ( $20\%SB_{current, F=0}$ ).

Target reference point: Not defined.

Harvest control rule: Not defined.

The main binding conservation measure for south Pacific albacore established by the WCPFC is CMM 2010-05 which aims to limit fishing mortality by establishing a cap on the number of vessels by each Commission member, with some exemptions for small island developing states. This capacity limitation is for the number of vessels not to increase over the 2005 level, or the 2001-2004 average.

## SUMMARY

<b>PO ALB-S</b>	Estimate	Years	Notes
Recent catch	87	2012	
5-yr catch	79	2008-12	
MSY	99	2011	
F/F <sub>MSY</sub>	0.21	2008-10	
B/B <sub>MSY</sub>	2.6	2011	
TAC	N/A		

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B > B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F < F_{MSY}$ .
<b>ENVIRONMENT</b>		96% of the catch is made by longlining. Several bycatch mitigation measures are in place (turtles, sharks, sea birds)
		4% of the catch is made by trolling, with little impact on non-target species.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## PO Pacific Bluefin Tuna

Reported Pacific bluefin catches in 2012 were about 15,200 tonnes, a 13% decrease from 2011. Most of the catch (80%) occurs in the western Pacific. About 65% of the Pacific-wide catch is made by purse seine fisheries, followed by a variety of gears such as coastal set nets and troll (17%) and longline (9%). (Figure PO-6).

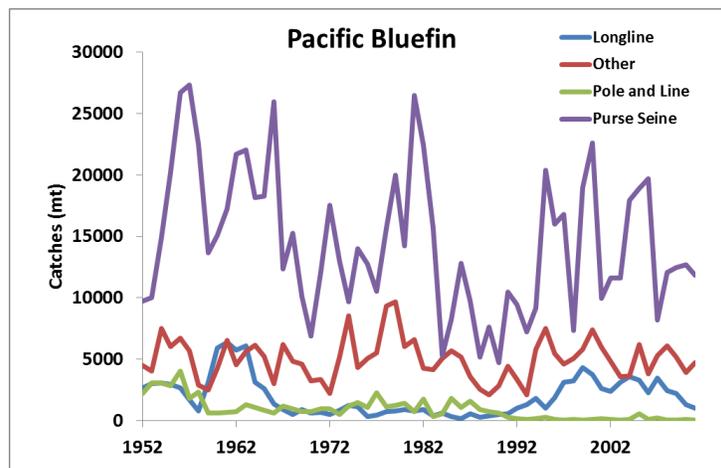


Figure PO-6. Catches of Pacific bluefin tuna from 1952 to 2012, by gear type.

## STOCK ASSESSMENT

A full stock assessment was carried out by the Pacific Bluefin Working Group of the ISC in 2012 (ISC, 2013). The results indicate that (Figure PO-7):

1. The stock is heavily overfished. The spawning stock biomass has been declining for over ten years and for 2010 it is estimated to be 3.6% of the unfished level, and at or near the historically-lowest level.
2. Fishing mortality is estimated to be substantially higher than reference levels that are often used as proxies for  $F_{MSY}$  (e.g.,  $F$  is about two times greater than  $F_{max}$ ).

The Pacific bluefin catch is dominated by recruits (age 0) and juveniles (ages 1 to 3). Preliminary data indicate an unusually low catch of age-0 bluefin in 2012, while longline catch rates continue to decline. This may imply lower recruitment, which would adversely affect projected stock rebuilding and increase the risk of SSB falling below its historical lowest level observed. In 2013, the ISC recommended further reductions in fishing mortality, especially for juvenile fish.

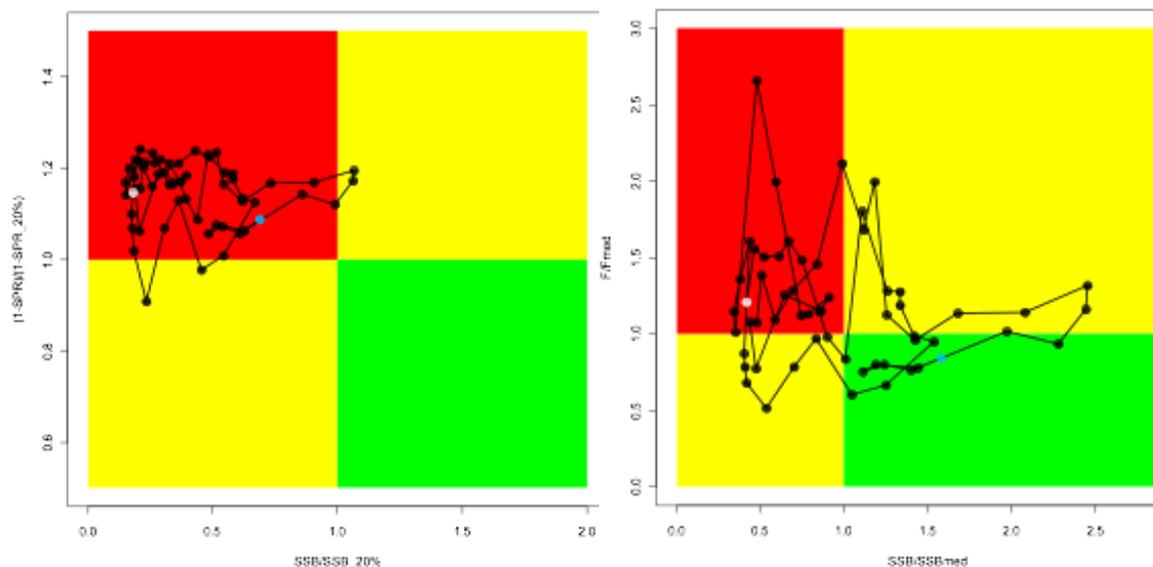


Figure PO-7. Temporal trend in the ratios  $B_{current}/B_{ref}$  (x-axis) and  $F_{current}/F_{ref}$  (y-axis) for Pacific bluefin tuna. The plot on the right uses  $F_{med}$  as the reference point and the plot on the left uses 20%SPR. Note that neither ISC or WCPFC or IATTC have adopted reference points for Pacific bluefin.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined.

Harvest control rule: Not defined.

WCPFC CMM 2013-09 has an interim objective of not allowing fishing mortality to increase from the current level. It limits total fishing effort during 2014 by vessels fishing for Pacific bluefin tuna north of 20°N to below the 2002-2004 levels. Members are also required to reduce juvenile (ages 0-3) catches below the 2002-2004 levels by at least 15%. IATTC Resolution C-13-02 limits commercial catches to 5,000 tons in 2014.

## SUMMARY

<b>PO-PBF</b>	Estimate	Years	Notes
Recent catch	15	2012	
5-yr catch	18	2008-12	
MSY	N/A		
F/F <sub>MSY</sub>	N/A		F/F <sub>max</sub> = 2.1 for 2007-2009
B/B <sub>MSY</sub>	N/A		
TAC	5	2014	IATTC area

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		B < B <sub>MSY</sub> was not estimated by ISC. However, B is 3.6% of the unfished level and at or near the historically-low level.
<b>FISHING MORTALITY</b>		F relative to F <sub>MSY</sub> was not estimated by ISC. However, F is substantially higher than all proxies used as proxies for F <sub>MSY</sub> .
<b>ENVIRONMENT</b>		61% of the catch is made by purse seining on free schools.
		9% of the catch is made by longlining.
		11% of the catch is made by trolling.
		8% of the catch is made by set nets

Last Updated: August, 2013.

Changes from previous (December 2012) version: Biomass rating changed from Yellow to Orange given that the 2012 ISC assessment found that the stock is heavily depleted.

## STOCKS IN THE ATLANTIC OCEAN

RFMO: International Commission for the Conservation of Atlantic Tunas (ICCAT)

Last Scientific Committee (SCRS) meeting: October, 2013

Last Commission meeting: November, 2013.

Tuna stocks managed by ICCAT: AO Yellowfin, AO Bigeye, Eastern AO Skipjack, Western AO skipjack, North AO Albacore, South AO Albacore, Mediterranean Albacore, Western AO bluefin, Eastern AO bluefin.

Data sources: The main sources of information for this section ICCAT (2013).

Last update: December, 2013.

About 10 percent of the world production of tuna is from Atlantic Ocean (AO) stocks. Catches of skipjack, yellowfin, bigeye, albacore and bluefin in 2012 were 478,000 tons, a 4% increase from 2011. There was a general tendency for the total catch to decline since the mid-1990s, followed by small increases since 2009 (Figure AO-1).

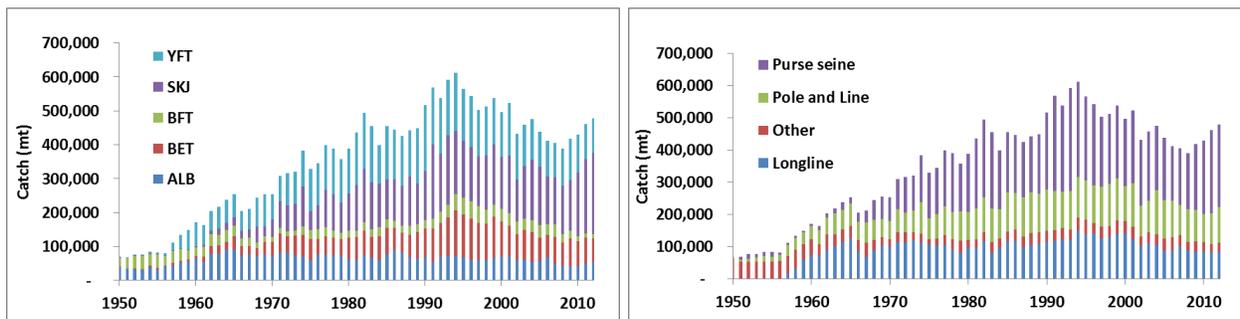


Figure AO-1. Trends in catch (mt) of bigeye, skipjack, yellowfin, albacore and bluefin in the AO region, by species (left) and gear (right), 1950-2012.

Average catches for the five-year period 2008-2012 (434,800 tonnes) provide an indication of the recent performance of the fisheries (Figure AO.2): Skipjack accounts for 43% of the catches in weight, followed by yellowfin (25%), bigeye (17%), albacore (10%), and bluefin (4%). Purse-seine vessels take 51% of the total catch, followed by pole-and-line (some of which operate jointly with purse seiners, 23%), longline (19%) and other gears (7%).

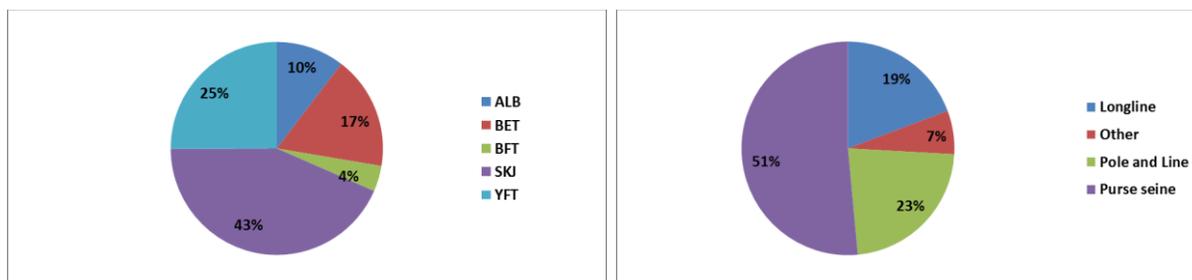


Figure AO-2. Average 2008-2012 catches of skipjack, yellowfin, bigeye, albacore and bluefin tuna in the AO. The graph on the left shows the percentages by species, and the graph on the right shows the percentages by gear type.

## AO Bigeye Tuna

Atlantic bigeye catches in 2012 were about 70,500 tonnes, a 9% decrease from 2011. Catches by longline, the main fishing gear (55% of the catch), declined sharply between 1999 and 2006, but they have been stable during the last few years. Purse seine and pole-and-line vessels account for about 29% and 16% of the catches, respectively (Figure AO-3).

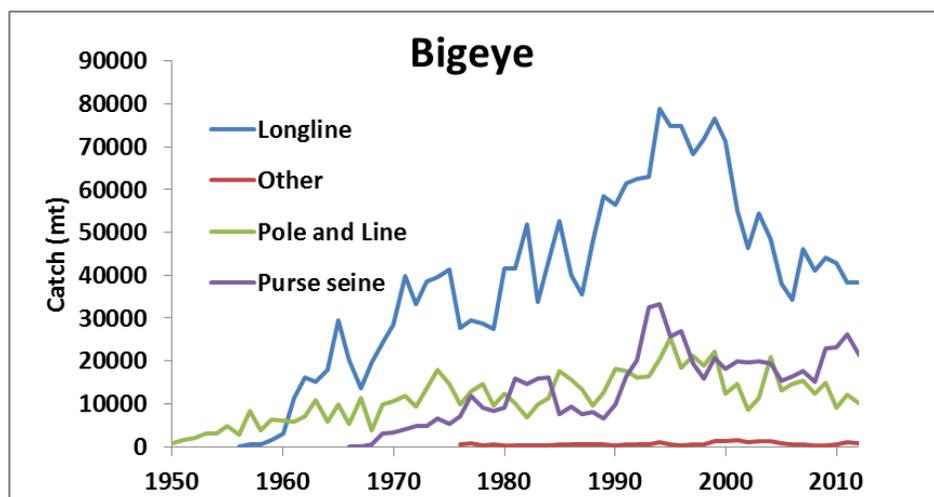


Figure AO-3. Catches of bigeye tuna in the AO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The last (2010) assessment conducted by SCRS (ICCAT Standing Committee on Research and Statistics) gave somewhat more optimistic results than the 2007 assessment. The following conclusions were reached by SCRS, based on combining several model-data sets: (Figure AO-4):

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  in 2009 is estimated at 0.95, indicating that overfishing is not occurring. However, there is uncertainty in this estimate. Estimates of  $F_{\text{current}}/F_{\text{MSY}}$  from the model runs considered plausible ranged from 0.65 to 1.55.
2. The ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  in 2009 is estimated at 1.01. This indicates that the stock is not in an overfished state. There is also uncertainty in this estimate. Estimates of  $B_{\text{current}}/B_{\text{MSY}}$  from the model runs considered plausible ranged from 0.72 to 1.34.
3. The estimate of MSY is 92,000 tonnes (range: 79,000 to 102,000 tonnes). MSY has been reduced considerably through harvest of small bigeye. Current catches (78,700 tonnes) are below MSY.

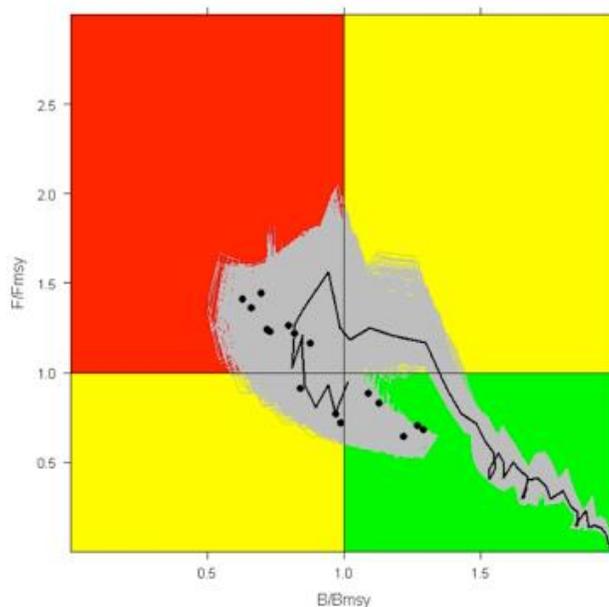


Figure AO-4. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for bigeye tuna in the AO. The shaded area represents the 80% confidence limits for the historical trajectory (1950-2009) and the solid line represents the median estimated from several models. Points depict structural uncertainty in current status from various other models. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

The main binding conservation measure established by ICCAT for bigeye is Recommendation 11-01, which amended several previous Recommendations. This 2012-2015 management plan calls for:

1. A Total Allowable Catch of 85,000 tonnes, with catch limits given to ICCAT members. The measure includes detailed provisions for countries to be penalized with lower quotas if their limits are exceeded;
2. A capacity limitation (country-specific) for the number of longline and purse seine vessels over 20 m in length;
3. The establishment of a record of vessels actively fishing for bigeye;
4. A two-month prohibition of fishing on floating objects in an area off West Africa, with 100% observer coverage during this time/area closure;
5. Annual submission of FAD management plans by countries with purse seine and baitboat (pole-and-line) fisheries;

While a TAC of 85,000 tonnes is specified, consistent with SCRS advice, the permissible catch under [11-01] exceeds 85,000 tonnes by a noticeable amount due to catch allowance made for CPCs not included in the allocation table. There is concern that fishing capacity remains high, and is probably growing due to longline and purse seine vessels moving from the IO into the AO due to piracy.

## SUMMARY

AO BET	Estimate	Years	Notes
Recent catch	71	2012	
5-yr catch	75	2008-12	
MSY	92	2009	Range: 79-102
$F/F_{MSY}$	0.95	2009	Range: 0.65-1.55
$B/B_{MSY}$	1.01	2009	Range: 0.72-1.34
TAC	85	2012-2015	

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B \approx B_{MSY}$ .
FISHING MORTALITY		$F \approx F_{MSY}$ . The 2011 catch was below the TAC. Recommendation 2011-01 includes catch limits and fishing capacity limitations.
ENVIRONMENT		55% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		35% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).
		16% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks. Some of the baitboats in the Gulf of Guinea fish together with the purse seiners, thus becoming like a single fleet.
		6% of the catch is made with purse seining on free schools, with little impact on non-target species.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## AO Yellowfin Tuna

Yellowfin catches in 2012 were about 101,400 tonnes, a 2% decrease from 2011. The main fishing gear is purse seining (about 68% of the catch) (Figure AO-5). Purse seine catches have shown a general decrease since the early 1990s, with two high peaks in 2001 and 2009. About 18% of the catch is made by longlining and 10% by pole-and-line vessels.

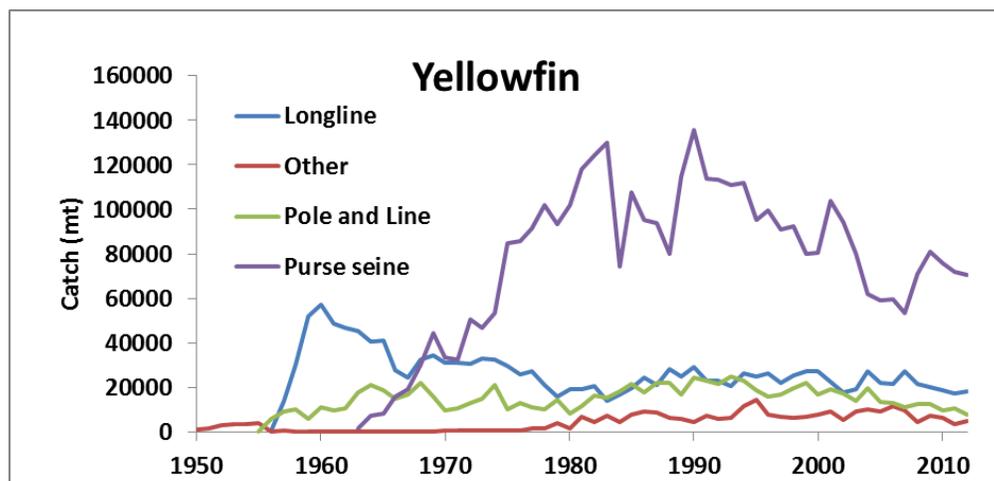


Figure AO-5. Catches of yellowfin tuna in the AO from 1950 to 2011, by gear type.

## STOCK ASSESSMENT

The most recent full assessment of yellowfin tuna was carried out by SCRS in 2011. The SCRS advice is based on averaging the results from two types of models. These results are somewhat more pessimistic than those of the previous (2007) assessment and indicate that (Figure AO-6):

1. The (2010) ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.87 (range 0.68-1.40), indicating that overfishing is not occurring.
2. The (2010) ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 0.85 (range 0.61-1.12). This indicates that the stock in 2006 is in an overfished state. However, the SCRS notes that the two types of models used show conflicting trends in the last few years: An increasing trend in biomass with one model, and a decreasing one with the other.
3. The estimate of MSY is 144,600 tonnes (range 114,200-155,100). MSY is lower than in previous decades because the overall fishery selectivity has shifted towards smaller yellowfin, mainly through fishing on FADs. Current catch (100,400 t) is below MSY.

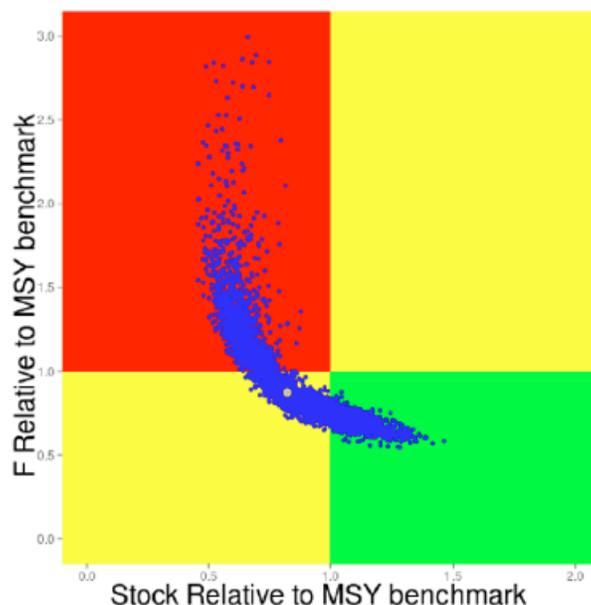


Figure AO-6. 2010 ratio of  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for yellowfin tuna in the AO. The gray point is the combined estimate from two types of models. The blue array of points reflects bootstrap estimates of uncertainty. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

The main binding conservation measure established by ICCAT for yellowfin is Recommendation 11-01, which amended several previous Recommendations. This 2012-2015 management plan calls for:

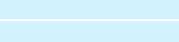
1. An overall TAC of 110,000 tonnes (unallocated by country);
2. The establishment of a record of vessels actively fishing for yellowfin;
3. A two-month prohibition of fishing on floating objects in an area off West Africa, with 100% observer coverage during this time/area closure;
4. Annual submission of FAD management plans by countries with purse seine and baitboat fisheries.

The TAC adopted by ICCAT is consistent with the advice provided by SCRS. While recent catches have been below the TAC, there is concern that fishing pressure on the stock could increase in the near future with the recent movement of purse seine and longline vessels from the IO into the AO due to piracy. This situation should be monitored closely.

## SUMMARY

AO YFT	Estimate	Years	Notes
Recent catch	101	2012	
5-yr catch	109	2008-12	
MSY	145	2010	Range: 131-147
F/F <sub>MSY</sub>	0.86	2010	
B/B <sub>MSY</sub>	0.96	2010	
TAC	110		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B < B_{MSY}$ in 2010. Recent trends in spawning biomass are uncertain because the two assessment models used give conflicting results (one increasing and one declining).
FISHING MORTALITY		$F < F_{MSY}$ . Although the point estimate of current F is below $F_{MSY}$ (and thus it could be rated Green), it is highly unlikely that increased fishing effort will result in significantly increased sustained catches, but it will
ENVIRONMENT		69% of the catch is made with purse seining on free schools, with little impact on non-target species
		18% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		10% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks. Some of the baitboats in the Gulf of Guinea fish together with the purse seiners, thus becoming like a single fleet.
		13% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## AO Eastern Skipjack Tuna

There are two (eastern and western) skipjack stocks in the Atlantic. Skipjack catches in the eastern Atlantic Ocean in 2012 were about 207,500 tonnes, a historical maximum, and an 11% increase from 2011. Purse seine (73%) and pole-and-line (24%) dominate the catches (Figure AO-7). The purse seine catches had been decreasing from the early 1990s to 2009, but increased substantially since then; catches by other gears have remained stable.

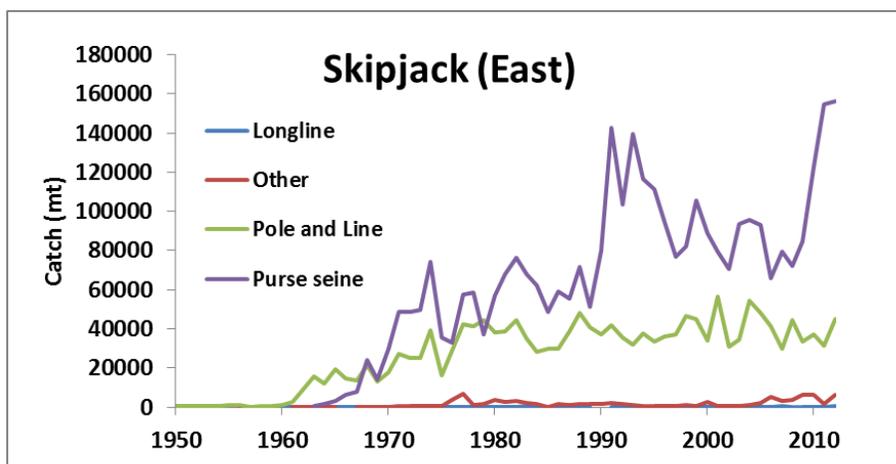


Figure AO-7. Catches of skipjack tuna in the Eastern AO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The stock was assessed by SCRS in 2008, using data up to 2006. Different models were used, and the results were characterized by high uncertainty. The SCRS concluded that overfishing is not occurring and the stock is not overfished (Figure AO-8).

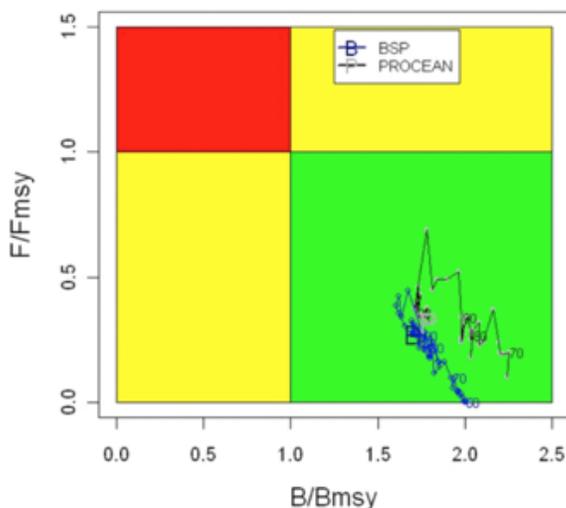


Figure AO-8. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for skipjack tuna in the eastern AO. The lines show the trends in the estimated biomass and fishing mortality ratios over time, using different assessment models. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

The time-area closure established for bigeye and yellowfin through Recommendation 11-01 also affects this skipjack stock. SCRS has recommended that catches not be allowed to exceed MSY. However, catches in 2011 and 2012 exceeded this level.

## SUMMARY

AO SKJ-E	Estimate	Years	Notes
Recent catch	208	2012	
5-yr catch	161	2008-12	
MSY	~157	2006	Range: 143-170
F/F <sub>MSY</sub>	<1		
B/B <sub>MSY</sub>	>1		
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B > B_{MSY}$
FISHING MORTALITY		$F < F_{MSY}$
ENVIRONMENT		81% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).
		24% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks. Some of the baitboats in the Gulf of Guinea fish together with the purse seiners, thus becoming like a single fleet.
		6% of the catch is made with purse seining on free schools, with little impact on non-target species.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## AO Western Skipjack Tuna

There are two (eastern and western) skipjack stocks in the Atlantic. Skipjack catches in the western Atlantic Ocean in 2012 were about 33,200 tonnes, a record high and a 3% increase from 2011. Pole-and-line fishing dominates the catches (91%), followed by purse seining (6%) (Figure AO-9). Pole and line catches have remained relatively stable (although highly variable) during the last two decades, while purse seine catches have declined.

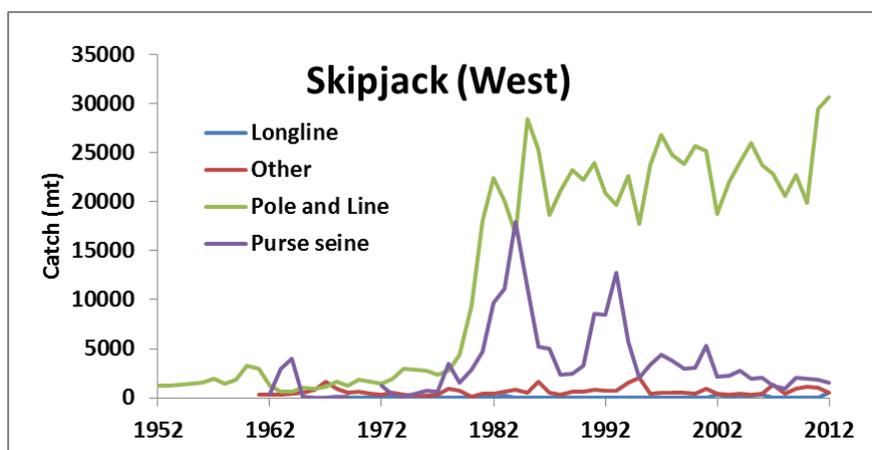


Figure AO-9. Catches of skipjack tuna in the Western AO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The stock was assessed by SCRS in 2008, using data up to 2006. Different models were used, and the results were characterized by high uncertainty. The SCRS concluded that overfishing is not occurring and the stock is not overfished (Figure AO-10).

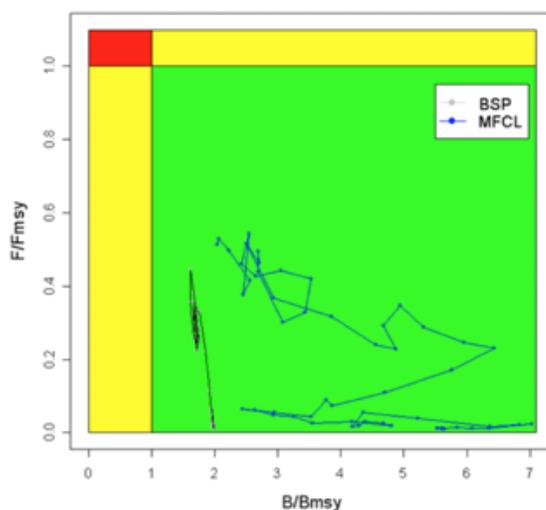


Figure AO-10. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for skipjack tuna in the western AO. The lines show the trends in the estimated biomass and fishing mortality ratios over time, using different assessment models. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

ICCAT has not adopted conservation and management measures for this stock. SCRS has recommended that catches not be allowed to exceed MSY.

## SUMMARY

<b>AO SKJ-W</b>	Estimate	Years	Notes
Recent catch	33	2012	
5-yr catch	27	2008-12	
MSY	33	2006	Range: 30-36
F/F <sub>MSY</sub>	<1		
B/B <sub>MSY</sub>	>1		
TAC	N/A		

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B > B_{MSY}$
<b>FISHING MORTALITY</b>		$F < F_{MSY}$
<b>ENVIRONMENT</b>		91% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks.
		9% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## AO Northern Albacore Tuna

There are three stocks of albacore tuna in the ICCAT Area: North Atlantic, South Atlantic and Mediterranean. Albacore catches in the North Atlantic in 2012 were about 25,900 tonnes, a 29% increase from 2011. Catches are made by a variety of fishing gears including pole-and-line (33%), troll (27%), trawl (20%) and longline (17%) (Figure AO-11).

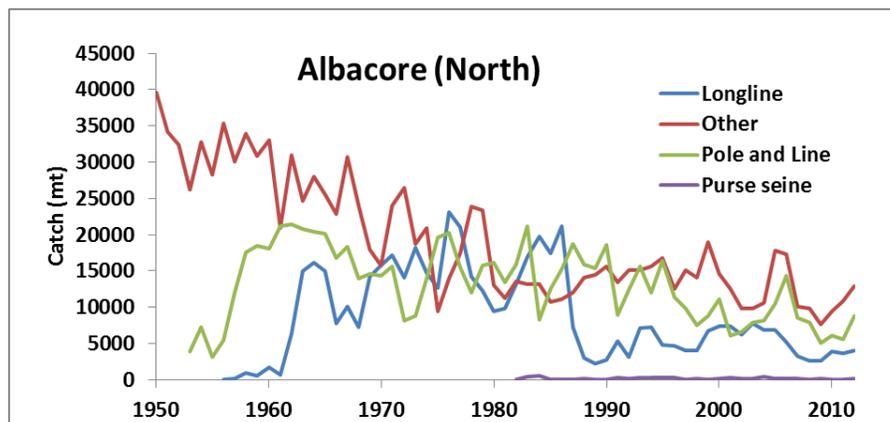


Figure AO-11. Catches of albacore tuna in the North AO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The most recent assessment for the northern stock of albacore was conducted by SCRS in 2013 using data up to 2011. The results indicate that (Figure AO-12):

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.72 (range 0.55-0.79), indicating that overfishing is not occurring.
2. The ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 0.94 (range 0.74-1.14). This indicates that the stock is in an overfished state. However, most of the assessment model runs indicate that the stock has been increasing since the mid-1990s.
3. MSY is estimated at 31,700 tonnes. Current (2012) catch is 26,000 t. Catches have been below the MSY level since 2007.

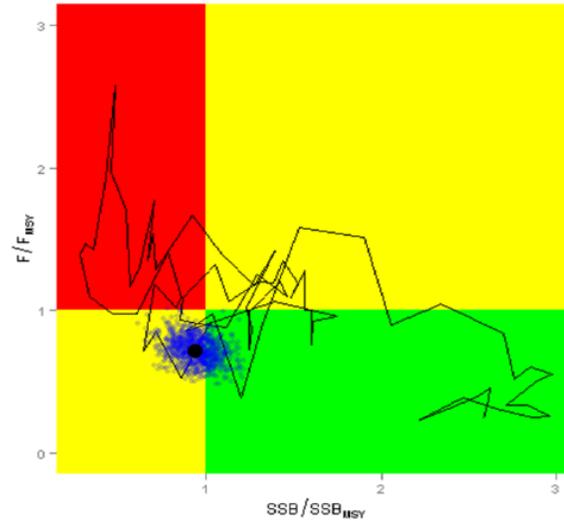


Figure AO-12. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for albacore tuna in the northern AO. The line shows the trend in the estimated biomass and fishing mortality ratios over time. The solid circle marks the 2011 ratio value and the scattered points represent uncertainty around it. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Under development (Rec. 13-05).

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Under development (Rec. 13-05). Rec. 11-13 provides a framework.

ICCAT Recommendation 98-08 limits the number of vessels targeting northern Atlantic albacore in each member country to the average level of 1993-1995.

Recommendation 13-05 established a Total Allowable TAC of 28,000 tonnes for 2014-2016, following the advice of the SCRS. However, permissible catch under [13-05] exceeds 28,000 tonnes due to catch allowance made for CPCs not included in the allocation table.

## SUMMARY

AO ALB-N	Estimate	Years	Notes
Recent catch	26	2012	
5-yr catch	20	2008-12	
MSY	29	2007	
F/F <sub>MSY</sub>	0.72	2011	Range: 0.55-0.79
B/B <sub>MSY</sub>	0.94	2009-2011	Range: 0.74-1.14
TAC	28	2014-2016	

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		B < B <sub>MSY</sub> . Most of the model runs in the 2013 assessment suggest that the stock has been increasing in recent years. If catches are kept at the TAC level, the stock is expected to rebuild by 2019.
FISHING MORTALITY		F < F <sub>MSY</sub> . There is a TAC to reduce fishing mortality that has been set following scientific advice to rebuild the stock.
ENVIRONMENT		33% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks.
		27% of the catch is made with trolling, with little impact on non-target species
		20% of the catch is made with pelagic trawling, with some impact on non-target species. Monitoring of bycatch is poor.
		17% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles). Monitoring is deficient.

Last Updated: December, 2013.

Changes from previous (December 2012) version: Following the results of the 2013 assessment, the Abundance rating has been changed from Orange to Yellow, and the F rating has been changed from Yellow to Green.

## AO Southern Albacore Tuna

There are three stocks of albacore tuna in the ICCAT Area: North Atlantic, South Atlantic and Mediterranean. Albacore catches in the South Atlantic in 2012 were about 24,600 tonnes (Figure AO-13), a 2% increase from 2011. Catches are made primarily by longline (67%) and pole-and-line (26%)

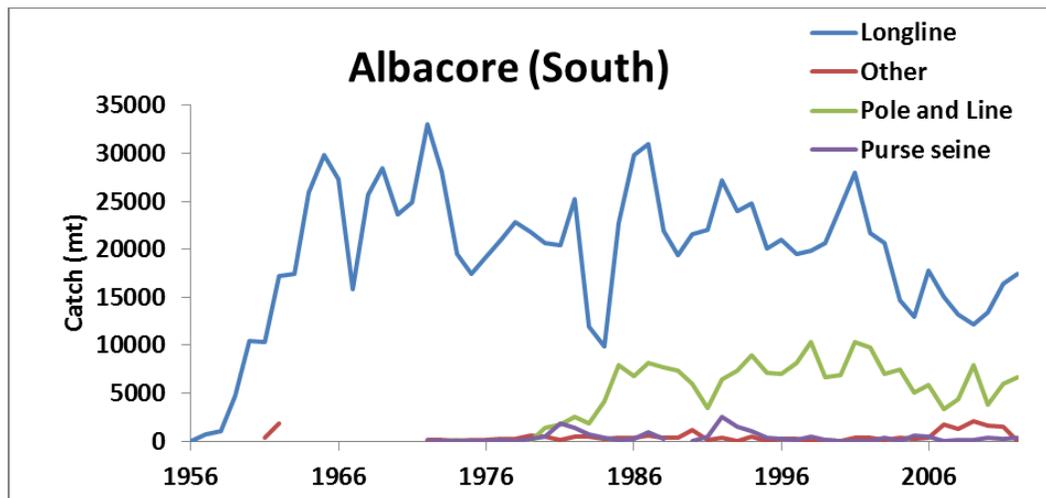


Figure AO-13. Catches of albacore tuna in the South AO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The most recent assessment for the southern stock of albacore was conducted by SCRS in 2013. The assessment used similar models to the previous (2011) one. However, fewer input data series were used after screening of the available catch rate data. The overall analysis gave slightly more optimistic results than the previous assessment. The new analyses indicate that (Figure AO-14):

1. The median ratio of  $F_{\text{current}}/F_{\text{MSY}}$  in 2011 is estimated at 1.04 (range 0.38-1.32), indicating that overfishing is occurring.
2. The ratio of biomass  $B_{\text{current}}/B_{\text{MSY}}$  in 2012 estimated at 0.92 (range 0.71-1.26). This indicates that the stock is in an overfished state.
3. MSY is estimated at 25,200 tonnes. Current (2012) catch is 24,600 t.

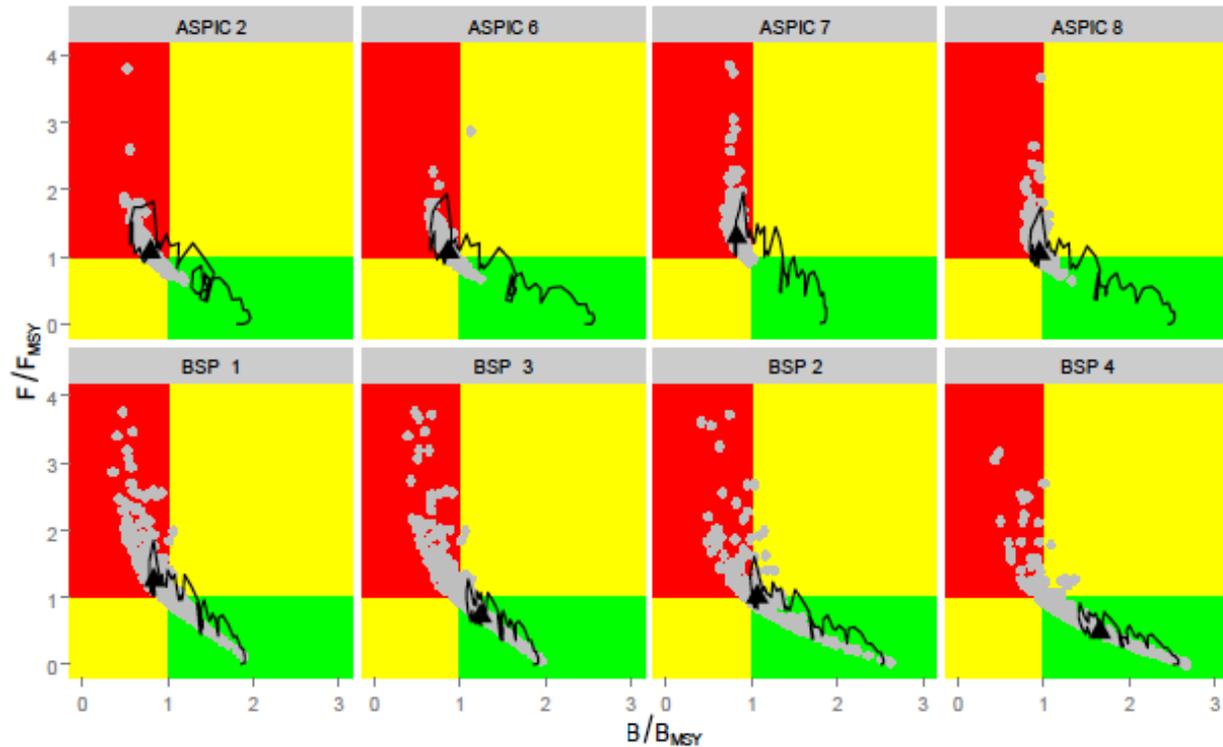


Figure AO-14. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for albacore tuna in the southern AO. The eight panels are the trajectories from eight different models that were used in combination by the SCRS to produce advice. In each plot, the scatter of points represents uncertainty around the 2011 ratios. Colors are taken from ICCAT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

Since 2011, following SCRS advice, the TAC was lowered to 24,000 tonnes (ICCAT Recommendations 11-05 and 13-06). However, permissible catch under the Rec. 13-06 exceeds 24,000 tonnes due to individual allocations. The Recommendation requires major fishing countries to improve their monitoring and reporting of catch.

## SUMMARY

<b>AO ALB-S</b>	Estimate	Years	Notes
Recent catch	25	2012	
5-yr catch	22	2008-12	
MSY	25	2011	
$F/F_{MSY}$	1.04	2011	
$B/B_{MSY}$	0.92	2012	
TAC	24	2013-2016	

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B < B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F \approx F_{MSY}$ . The overall TAC has been lowered to 24,000 t following scientific advice to allow the stock to rebuild. However, catches in 2011 and 2012 exceeded this level.
<b>ENVIRONMENT</b>		67% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		26% of the catch is made by pole-and-line fishing, with unknown impacts on baitfish stocks.

Last Updated: December, 2013.

Changes from previous (December, 2012) version: None.

## AO Mediterranean Albacore Tuna

There are three stocks of albacore tuna in the ICCAT Area: North Atlantic, South Atlantic and Mediterranean. Albacore catches in the Mediterranean in 2012 were about 2,100 tonnes, a 55% decrease from 2011. Catches are highly variable and are made primarily by longline (65%) and the remainder by other surface gears (Figure AO-15).

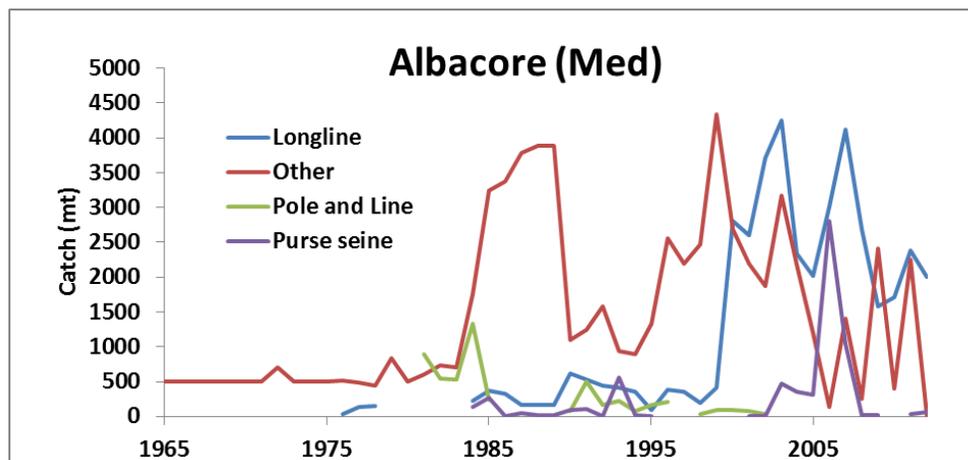


Figure AO-15. Catches of albacore tuna in the Mediterranean Sea from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The Mediterranean albacore stock was assessed for the first time in 2011. The data sets used are extremely sparse and indices of abundance are generally lacking. In addition, there is considerable uncertainty with reported catches. The SCRS concluded that:

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  in 2010 is less than or equal to 1. Therefore, overfishing is probably not occurring.
2. The ratio of  $B_{\text{current}}/B_{\text{MSY}}$  cannot be estimated with the available data. Therefore it is not known if the stock is overfished.
3. The level of MSY cannot be estimated with the available data.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined. "Green" quadrant in Kobe plot implied as target (Rec. 11-13)

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

There are no conservation and management measures for Mediterranean albacore. The 2011 SCRS recommended that the Commission adopt measures designed to limit increases in catch and fishing effort directed at Mediterranean albacore. However, the 2011 and 2012 Commission meetings did not adopt any conservation measures for the stock.

## SUMMARY

<b>AO ALB-M</b>	Estimate	Years	Notes
Recent catch	2	2012	
5-yr catch	3	2008-12	
MSY	N/A		
F/F <sub>MSY</sub>	≤1	2009	
B/B <sub>MSY</sub>	N/A		
TAC			

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		Unknown. Monitoring of basic fishery statistics is extremely poor and has made it impossible to estimate abundance in the stock assessment.
<b>FISHING MORTALITY</b>		$F \leq F_{MSY}$ . While the F level could be rated Green, there is so much uncertainty in the assessment results that a Yellow rating is given on a precautionary basis.
<b>ENVIRONMENT</b>		65% of the catch is officially reported as made by longlining. Several mitigation measures are in place (sharks, turtles). Monitoring is very deficient.
		35% of the catch is made by other surface gears, including gillnets. Monitoring is very deficient.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

## AO Eastern Atlantic and Mediterranean Bluefin Tuna

Atlantic bluefin tuna (*Thunnus thynnus*) are found in the entire North Atlantic and its adjacent seas, primarily the Mediterranean Sea. ICCAT recognizes two stocks: Western Atlantic, and eastern Atlantic and Mediterranean bluefin. There is considerable mixing between the two.

Eastern Atlantic bluefin catches have been subject to a high degree of mis-reporting between the mid-1990s and the recent past, although for the most recent few years, such mis-reported catch levels are thought to have diminished considerably. In 2012, reported catches were about 10,900 tonnes (Figure AO-16), an 11% increase from 2011. Purse seiners take 52% of the catch, followed by longline (19%), traps (15%), and a variety of surface gears, including pole-and-line, handline and trolling.

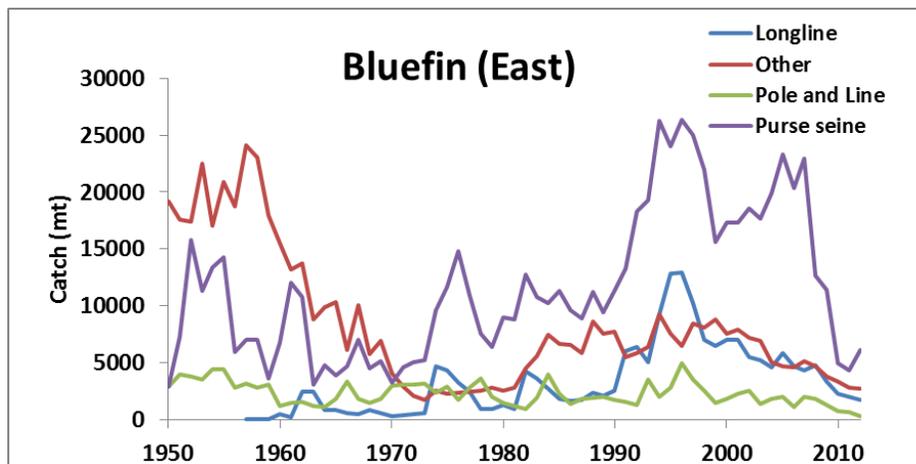


Figure AO-16. Catches of Eastern Atlantic and Mediterranean bluefin from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The eastern Atlantic bluefin tuna stock was reassessed by ICCAT's SCRS in 2012, using the same model and data types as in 2010. The stock assessment is subject to considerable uncertainties due to scarcity of CPUE data and to high levels of mis-reporting that took place primarily in the 2000s. The SCRS concluded the following (Figure AO-17):

1. The current ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 0.63-0.76 (ranging between 0.37 and 1.16 for different assumed levels of recruitment and the level of assumed mis-reporting in the past). Therefore, the stock remains in an overfished state.
2. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.36-0.70, depending on the level of assumed mis-reporting in the past. Thus, overfishing is not taking place anymore. Catches have been reduced by over 70% since 2007 due to strict limits and controls.
3. The estimate of MSY is about 30,700-35,900 tonnes (ranges between 21,500 and 74,900 tonnes, depending on the assumed recruitment level).

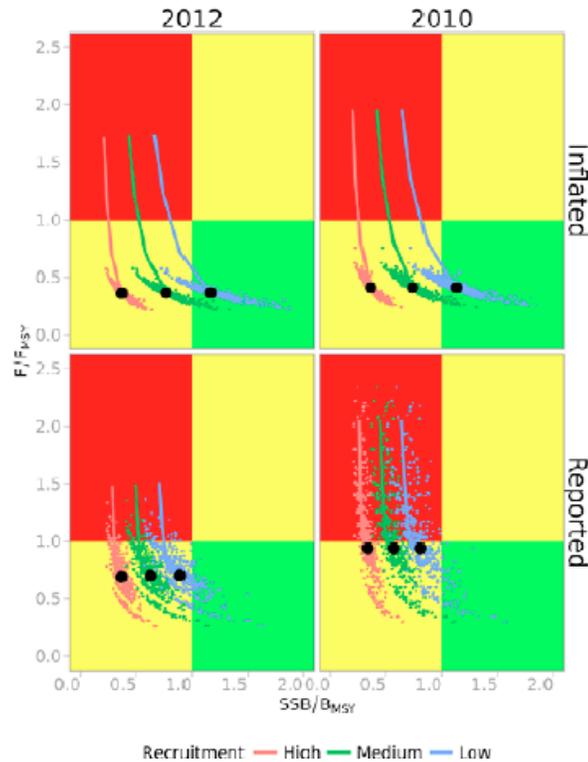


Figure AO-17. Current ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for eastern Atlantic bluefin tuna assuming inflated or reported catch (upper and lower panels) and considering low, medium and high recruitment levels (blue, green and red lines). Blue, green and red dots represent the distribution of the terminal year obtained through bootstrapping for the corresponding three recruitment levels. Left panel (2012): 2011 SSB and F relative to reference points calculated during the 2012 stock assessment. Right panel (2010): 2011 SSB and F relative to the reference points that have calculated during the 2010 stock assessment. The spread of symbols represents uncertainty in the estimate of the current ratios.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined for the long term. "Green" quadrant in Kobe plot implied as target (Rec. 11-13). Interim target is to achieve  $B_{MSY}$  through 2022 with at least 60% probability (Rec. 13-07).

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

The eastern Atlantic and Mediterranean bluefin stock has been the subject of a rebuilding program since 2006 (ICCAT Rec. 06-05), which has been amended every year in 2007-2010 and again in 2012 (Rec. 12-03). The plan aims to rebuild the stock to  $B_{MSY}$  by 2022 with at least 60% probability.

The rebuilding program (Rec. 13-07) is a very comprehensive management plan that combines multiple conservation elements with enforcement ones. The TAC for 2014 is 13,400 tonnes, in line with scientific advice. In addition to the TACs, the plan includes the following measures, among others:

1. Manages fishing capacity (including mandated capacity adjustments to make fishing capacity more commensurate with quotas) and farming capacity;
2. Establishes closed fishing seasons for longliners (six months), purse seiners (11 months), and for pole and line, pelagic trawl and sport fishing vessels (eight months each);
3. Sets minimum sizes of 8 and 30 kg, depending on the fishery;
4. Establishes records of authorized fishing vessels and authorized farming facilities;

5. Requires weekly catch reports to national agencies and monthly catch reports to ICCAT;
6. Establishes an observer program with 100% coverage for purse seiners and for transfers to cages;
7. Requires VMS on every vessel over 15 m in length, and transmissions of the VMS data to ICCAT;
8. Prohibits trade of bluefin not accompanied by valid catch documents (Rec. 09-01);
9. Establishes procedures for at-sea boarding and inspection;
10. Allows SCRS to access all MCS data from the management plan.

The multiple amendments made to the management plan since 2006 have resulted in increasingly tighter controls of the actual catches. Combined with lower quotas, fishing mortality rates have been reduced (current  $F$  is below  $F_{MSY}$ ). The SCRS projections indicated that catches above the 2012 TAC (12,900 tonnes) could allow the stock to rebuild to  $B_{MSY}$  even before the planned rebuilding date (2022) with greater than 60% probability. At its annual meeting in 2012, the Commission acted prudently in view of the uncertainty in the assessment and increased the TAC only slightly, to 13,500 tons.

## S U M M A R Y

AO BFT-E	Estimate	Years	Notes
Recent catch	10.9	2012	
5-yr catch	15.1	2008-12	
MSY	33	2010	Range: 22-75
$F/F_{MSY}$	0.7	2010	Using reported catch
$B/B_{MSY}$	0.37-0.89	2010	Using reported catch
TAC	13.4	2014	

Catches and MSY in 1000 tonnes.

<b>STOCK ABUNDANCE</b>		$B < B_{MSY}$ .
<b>FISHING MORTALITY</b>		$F < F_{MSY}$ . Fishing mortality has clearly been reduced through a TAC and strict controls.
<b>ENVIRONMENT</b>		44% of the catch is made by purse seiners that set on free schools.
		19% of the catch is made by longlining. Several mitigation measures are in place.
		13% of the catch is made by fixed traps that have minor impact on sensitive species.
		6% of the catch is made by pole-and-line fisheries that have some impact on baitfish stocks.

Last Updated: December, 2012.

Changes from previous (April 2012) version: The fishing mortality factor has been changed from Orange to Green.

## AO Western Atlantic Bluefin Tuna

Atlantic bluefin tuna are found in the entire North Atlantic and its adjacent seas, primarily the Mediterranean Sea. ICCAT recognizes two stocks: Western Atlantic, and eastern Atlantic and Mediterranean bluefin. There is considerable mixing between the two.

Western Atlantic bluefin catches in 2012 were about 1,800 tonnes, a 13% decrease from 2011. Sport gears (hand line, rod-and-reel) take 55% of the catch, followed by longline (38%) and other surface gears. Purse seine catches in recent years have been very minor (Figure AO-18).

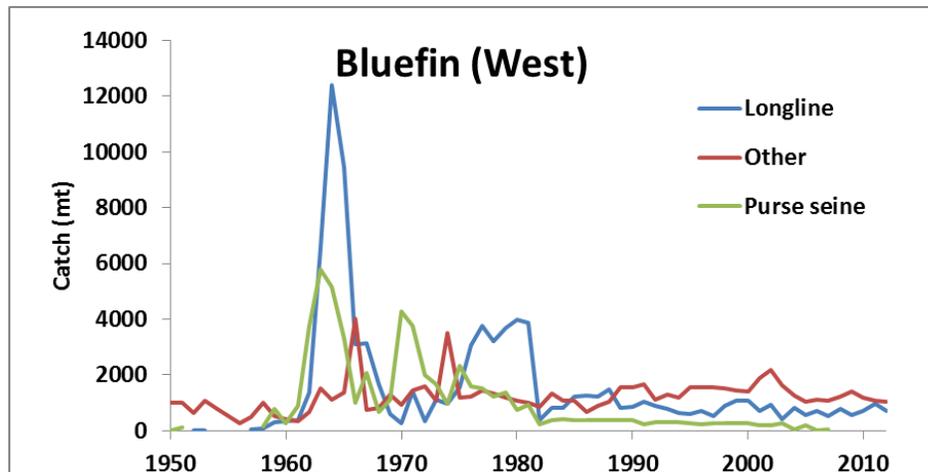


Figure AO-18. Catches of Western Atlantic bluefin tuna from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The Western Atlantic bluefin tuna stock was last assessed by ICCAT's SCRS in 2012, using the same model and data types as in 2010. The stock assessment model estimates that recruitment in the early 1970s was very high compared to the level estimated since the 1980s. The assessment also indicates spawning stock biomass was also much higher in the 1970s and earlier compared to the levels estimated since the 1980s. In calculating the status of the stock relative to MSY reference points, the SCRS considers two alternative hypothesis: One is that the high recruitment levels of the 1970s can be achieved again if the stock is allowed to rebuild substantially; the other hypothesis is that there has been a "regime shift" and environmental conditions can no longer support those high levels of recruitment, even if the stock is allowed to rebuild. These two are known as "high potential recruitment" and "low potential recruitment" hypotheses. Using these, the SCRS concluded the following (Figure AO-19):

1. The current ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 0.19 (assuming high potential recruitment) or 1.4 (assuming low potential recruitment). Thus, the stock is either severely overfished, or not overfished at all, depending on the assumed level of potential recruitment.
2. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 1.57 (assuming high potential recruitment) or 0.61 (assuming low potential recruitment). Thus, overfishing is either taking place, or not, depending on the assumed level of potential recruitment.
3. The estimate of MSY is 6,500 tonnes (assuming high potential recruitment) or 2,600 tonnes (assuming low potential recruitment).

Clearly, the status of the western Atlantic bluefin stock is highly dependent on the potential recruitment assumption. For years, the SCRS has been unable to give an idea about which of the two assumptions is more plausible. ISSF considers that SCRS should revisit this issue as a matter of priority so that it can provide unambiguous advice that is based on one of the two assumptions. Until then, given the lack of

clear indication of a regime shift, ISSF believes that it is more precautionary to assume that the high-recruitment hypothesis applies and that the stock can be rebuilt to the higher levels estimated in the 1960s and 1970s. As a result, ISSF considers that the western Atlantic bluefin stock is overfished and that overfishing is occurring.

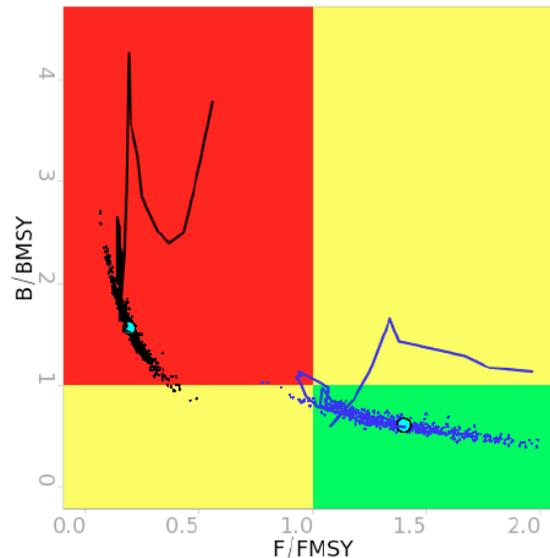


Figure AO-19. Temporal trend in the median ratios  $B_{\text{current}}/B_{\text{MSY}}$  (x-axis) and  $F_{\text{current}}/F_{\text{MSY}}$  (y-axis) for western Atlantic bluefin tuna assuming two levels of potential recruitment. The blue symbols represent uncertainty in the estimate of the current ratios.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined for the long term. "Green" quadrant in Kobe plot implied as target (Rec. 11-13). Interim target is to achieve  $B_{\text{MSY}}$  through 2018 with at least 50% probability (Rec. 13-09).

Harvest control rule: Not defined, but Rec. 11-13 provides a framework.

Western Atlantic bluefin has been the subject of a rebuilding program since 1998 (ICCAT Rec. 98-07), which has been amended in every other year since 2002. The plan aims to rebuild the stock by 2018 with at least 50% probability, mainly through TACs (the 2014 TAC is 1,750 tonnes, under Rec. 13-09, unchanged from the 2013 level). The management plan also establishes a 30-kg minimum size and prohibits directed fisheries in the Gulf of Mexico (the only known spawning area for the stock).

## SUMMARY

AO BFT-W	Estimate	Years	Notes
Recent catch	1.8	2012	
5-yr catch	1.9	2008-12	
MSY	6.5	2008-2010	
F/F <sub>MSY</sub>	1.57	2008-2010	Range: 1.2-1.9
B/B <sub>MSY</sub>	0.19	2011	Range: 0.13-0.29
TAC	1.75	2014	

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B < B_{MSY}$ . Stock biomass is very low under the "high potential recruitment" hypothesis.
FISHING MORTALITY		$F > F_{MSY}$ . According to SCRS, if the two alternative hypotheses about potential recruitment levels are combined, the current TAC will not rebuild the stock to $B_{MSY}$ by 2018 with 50% probability or greater (the year and target of ICCAT's management plan).
ENVIRONMENT		55% of the catch is made by sport fishing gears (rod-and-reel, handline) with minor amounts of bycatch.
		38% of the catch is made by longlining. Several mitigation measures are in place.

Last Updated: December, 2012.

Changes from previous (December 2011) version: None

## STOCKS IN THE INDIAN OCEAN

RFMO: Indian Ocean Tuna Commission (IOTC)

Last Scientific Committee (SAC) meeting: December, 2013

Last Commission meeting: May, 2013.

Tuna stocks managed by IOTC: IO Yellowfin, IO Bigeye, IO Skipjack, IO Albacore.

Data sources: The main sources of information for this section IOTC (2013).

Last update: March, 2013.

About 19 percent of the world production of tuna is from the Indian Ocean (IO), making this the second largest region for tuna fishing after the western and Central Pacific Ocean. Catches of skipjack, yellowfin, bigeye and albacore in 2012 were 830,100 tonnes, a 1% decline from 2011. There has been a general tendency for the total catch to decline since 2005, when a record 1.2 million tonnes were caught (Figure IO-1). Catches of southern bluefin tuna occur substantially in the IO Convention Area. This stock is covered in a different section of this report, under Southern Hemisphere.

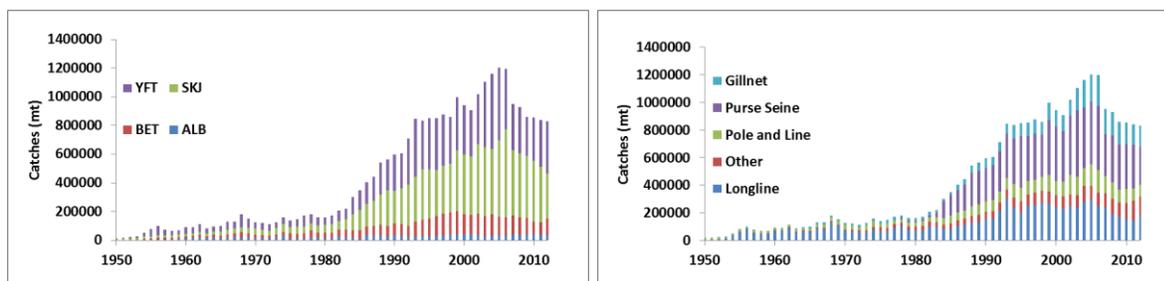


Figure IO-1. Trends in catch (mt) of bigeye, skipjack, yellowfin and albacore in the IO region, by species (left) and gear (right), 1950-2012.

Piracy in the western Indian Ocean has had an important impact in the tuna fisheries. The fishing capacity of the European purse seine fleet has decreased by 30% (in number of vessels) from the 2005-2008 average due to vessels leaving the IO to fish in other regions. Similarly, vessels from other fleets such as Japanese, Taiwanese and Korean longliners have shifted their areas of operation, sometimes to other oceans; some local fleets such as those of Kenya and Seychelles have been affected as well. Most fleets experience declines in their number of vessels between 2008 and 2011. However, the number of longline and purse seine vessels increased in 2012.

Average catches for the five-year period 2008-2012 (862,100 tonnes) provide an indication of the recent performance of the fisheries (Figure III.1.2): Skipjack accounts for 47% of the catches in weight, followed by yellowfin (37%), bigeye (12%), and albacore (4%). Purse-seine vessels take about 37% of the total catch, followed by gillnets (18%), longline (19%) and pole-and-line (11%). Gillnet fisheries are generally poorly monitored.



Figure IO-2. Average 2008-2012 catches of skipjack, yellowfin, bigeye and albacore in the IO. The graph on the left shows the percentages by species, and the graph on the right shows the percentages by gear type.

## IO Bigeye Tuna

Bigeye reported catches in 2012 were about 115,800 tonnes, a 24% increase from 2011. The main fishing gear is longline (60%). Catches by this gear have declined dramatically from a high in 2004 (Figure IO-3), due to vessels moving away from the main fishing grounds to escape piracy, but increased sharply in 2012. In contrast, catches from purse seine vessels (28%) have been relatively stable since 2000.

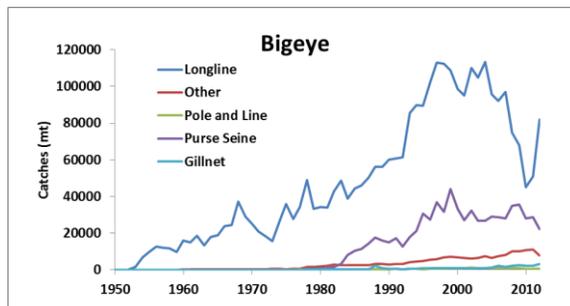


Figure IO-3. Catches of bigeye tuna in the IO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The 2013 assessment conducted by the Scientific Committee (SC15) gave similar tendencies to the 2010 and 2011 assessments in terms of average trends. The results of the new assessment indicated the following (Figure IO-4):

1. The ratio of  $F_{current}/F_{MSY}$  is estimated to be 0.42 (range: 0.21 to 0.80), indicating that overfishing is not occurring.
2. The ratio of spawning biomass  $B_{current}/B_{MSY}$  is 1.44 (range: 0.87 to 2.2), indicating that the stock is not in an overfished state.
3. The estimate of MSY is 132,000 tonnes. The 2012 catch was below this level.

Resolution 13/10 established interim limit reference points for bigeye as  $0.5B_{MSY}$  and  $1.3F_{MSY}$ . These are not being exceeded.

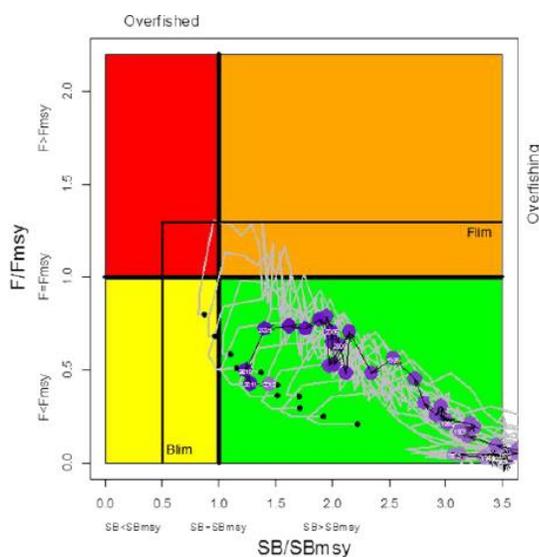


Figure IO-4. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for bigeye tuna in the IO. Purple circles represent the annual median values over time. Dots indicate uncertainty in the current status estimated from models that make different assumptions. Colors are taken from IOTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

**Limit reference point:** Interim limits of  $0.5B_{MSY}$  and  $1.3F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Target reference point:** Interim targets of  $B_{MSY}$  and  $F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Harvest control rule:** Not defined yet. Resolution 13/10 requests the SC to develop HCRs designed to maintain or restore stocks to the "Green" quadrant of the Kobe plot.

The main binding conservation measure established by the IOTC for bigeye is Resolution 12/13, which affects vessels greater than 24 m as well as smaller vessels fishing on the high seas. This measure calls for a one-month closure for purse seiners and longliners (in different months) in an area of size  $10^{\circ} \times 20^{\circ}$ . The effect of the closure in Resolution 12/13 on the status of IO tuna stocks cannot be evaluated yet, but preliminary analyses based on historical catches indicate its effect is likely to be very small. Resolution 13/11 bans discards by purse seine vessels.

## SUMMARY

IO BET	Estimate	Years	Notes
Recent catch	116	2012	
5-yr catch	108	2008-12	
MSY	132	2012	
$F/F_{MSY}$	0.42	2012	
$B/B_{MSY}$	1.44	2012	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B > B_{MSY}$ .
FISHING MORTALITY		$F < F_{MSY}$ .
ENVIRONMENT		60% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		20% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).
		5% of the catch is made with purse seining on free schools, with little impact on non-target species.
		9% of the catch is made by other gears such as gillnet. There is poor reporting by these fisheries which are thought to have substantial amounts of bycatch.

Last Updated: December, 2013.

Changes from previous (December 2012) version: None.

## IO Yellowfin Tuna

Yellowfin catches in 2012 were about 365,800 tonnes, a 12% increase from 2011. The main fishing gears for which catches have declined recently are purse seine (37% of the catch) and longline (21%) (Figure IO-5). In contrast, catches by gillnet (16%) and miscellaneous gears (21%) have become increasingly important in recent years. Catches by these gears are poorly estimated. Catches from pole-and-line vessels (5%) have been relatively stable. Overall, catches have declined by 31% from a record high of 530,000 tonnes in 2004.

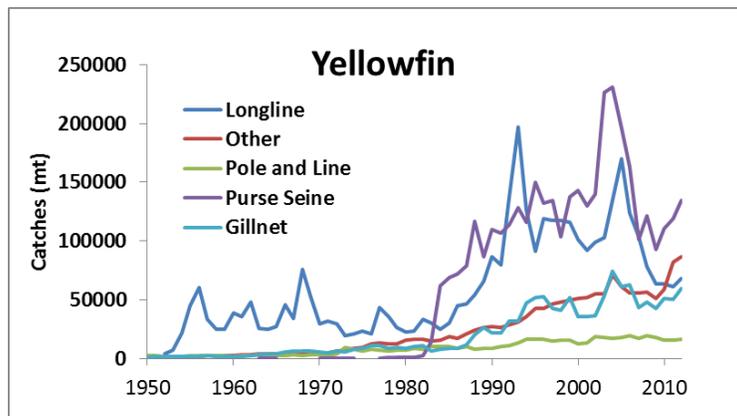


Figure IO-5. Catches of yellowfin tuna in the IO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

The 2012 updated assessment using two different models gave similar results to the 2011 assessment, indicating the following (Figure IO-6):

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.61 or 0.69 depending on the model, indicating that overfishing is not occurring. The trajectories explained by the two models differ in that one of them suggests that  $F_{\text{MSY}}$  was exceeded during the period of high catches of yellowfin tuna from 2003 to 2006, while the other model does not. However, both models estimate a similar status at the present time.
2. The stock is not in an overfished state as spawning biomass is above the  $B_{\text{MSY}}$  level ( $B_{\text{current}}/B_{\text{MSY}} = 1.24$  to  $1.35$ , depending on the model).
3. The value of  $MSY$  is estimated to be 320,000 to 344,000 tonnes depending on the model. During the period 2003-2006, catches substantially exceeded this level and the stock experienced a rapid decline. In 2012, catches exceeded  $MSY$ .

Resolution 13/10 established interim limit reference points for yellowfin as  $0.4B_{\text{MSY}}$  and  $1.4F_{\text{MSY}}$ . These are not being exceeded.

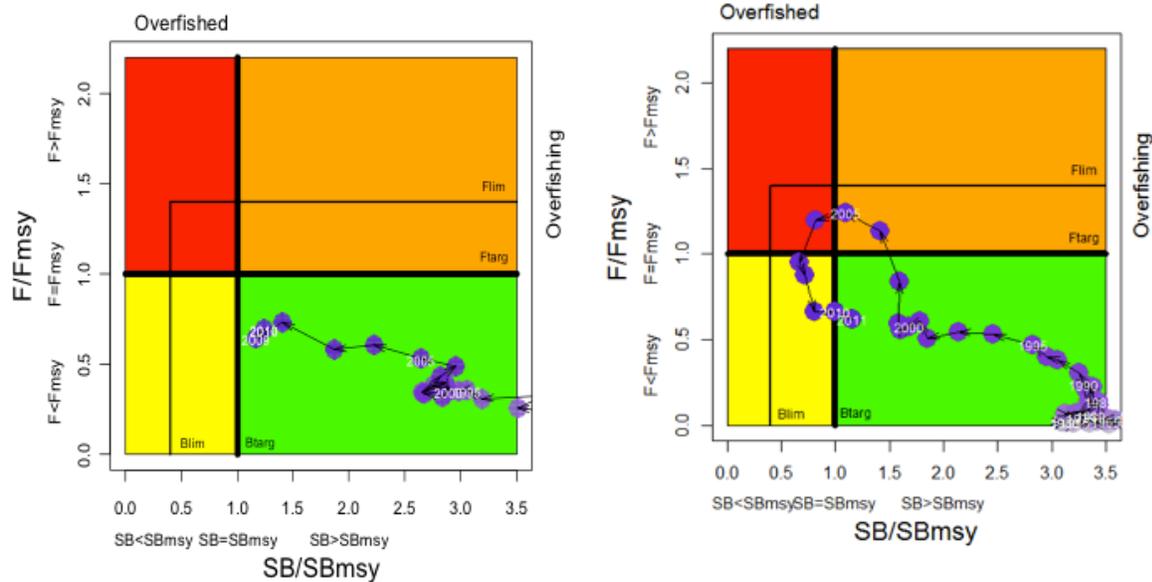


Figure IO-6. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for yellowfin tuna in the IO. The two graphs correspond to two different models (the value in the last year is very similar for both models). Colors are taken from IOTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

**Limit reference point:** Interim limits of  $0.4B_{MSY}$  and  $1.4F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Target reference point:** Interim targets of  $B_{MSY}$  and  $F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Harvest control rule:** Not defined yet. Resolution 13/10 requests the SC to develop HCRs designed to maintain or restore stocks to the "Green" quadrant of the Kobe plot.

The main binding conservation measure established by the IOTC for yellowfin is Resolution 12/13, which affects vessels greater than 24 m as well as smaller vessels fishing on the high seas. This measure calls for a one-month closure for purse seiners and longliners in an area of size  $10^{\circ} \times 20^{\circ}$ . The effect of the closure in Resolution 12/13 on the status of IO tuna stocks cannot be evaluated yet, but preliminary analyses based on historical catches indicate its effect is likely to be very small. Resolution 13/11 bans discards by purse seine vessels.

The IO yellowfin stock has been of concern because the catches in 2003-2006 substantially exceeded the MSY level. Since then, catches have decreased considerably and the 2011 SC estimated that the stock was in good health. However, this trend could be easily reversed if the piracy situation in the IO improves and fishing effort increases. In 2013 the SC once again recommended that catches not exceed 300,000 tonnes, which is at the lower end of the range of MSY estimates. The 2012 catch exceeds this level.

## SUMMARY

IO YFT	Estimate	Years	Notes
Recent catch	366	2012	
5-yr catch	317	2008-12	
MSY	320-344	2011	
$F/F_{MSY}$	0.61-0.69	2011	
$B/B_{MSY}$	1.24-1.35	2011	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B > B_{MSY}$ . The 2012 assessment indicates that the stock is in a healthy state. Declines in biomass due to intensive fishing in the mid-2000s have been halted with reduced catches. However, the 2012 catch exceeded the MSY level and stock status should be reassessed.
FISHING MORTALITY		$F < F_{MSY}$ . If fishing effort displaced because of the piracy problem returns to traditional fishing areas, an increase in F could be expected. The situation needs to be monitored closely.
ENVIRONMENT		28% of the catch is made by gillnets and handlines, which are poorly monitored. Gillnets are thought to have high bycatch rates. No mitigation measures are in place and monitoring is extremely deficient.
		21% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.
		17% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).
		17% of the catch is made with purse seining on free schools, with little impact on non-target species.
		8% of the catch is made by handlines, expected to have little impact on bycatch species.
		6% of the catch is made by trolling, expected to have little impact on bycatch species.
		4% of the catch is made by pole-and-line fishing, with small bycatch of non-target species but unknown impacts on baitfish stocks.

Last Updated: December, 2013.

Changes from previous (March 2013) version: Call for reassessment of status due to 2012 catches exceeding MSY.

## IO Skipjack Tuna

Skipjack catches in the Indian Ocean in 2012 were about 314,500 tonnes, an 18% decline from 2011. Purse seine (42%) and gillnets (26%) dominate the catches, followed by pole-and-line (20%) (Figure IO-7). Pole-and-line, purse seine and gillnet catches have been decreasing since the mid-2000s.

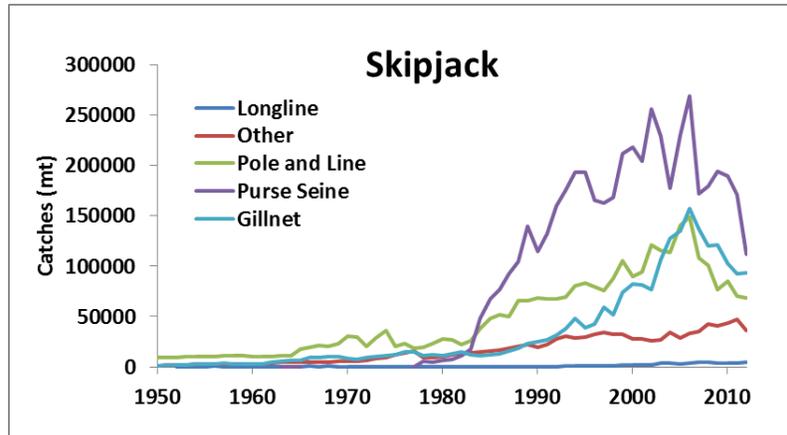


Figure IO-7. Catches of skipjack tuna in the IO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

A stock assessment of skipjack was conducted for the first time in 2011 and updated in 2012. The results indicate that (Figure IO-8):

1. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated to be less than 0.80. Therefore, overfishing is not occurring.
2. The stock is not in an overfished state as spawning biomass is above the  $B_{\text{MSY}}$  level ( $B_{\text{current}}/B_{\text{MSY}} = 1.2$ ).
3. The median estimate of MSY is estimated to be 478,000 tonnes (range: 359,000 to 598,000 t).

Recommendation 13/10 established interim limit reference points for skipjack as  $0.4B_{\text{MSY}}$  and  $1.5F_{\text{MSY}}$ . These are not being exceeded.

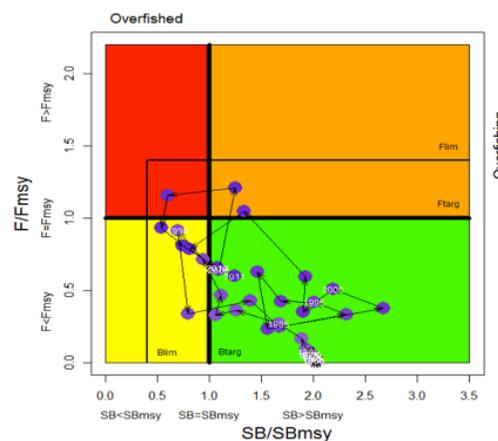


Figure IO-8. Temporal trend in the ratios  $B_{\text{current}}/B_{\text{MSY}}$  (x-axis) and  $F_{\text{current}}/F_{\text{MSY}}$  (y-axis) for skipjack tuna in the IO. Black circles indicate the median trajectory. The probability distribution contours are provided as a rough visual guide of the uncertainty in current estimates. Colors are taken from IOTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

**Limit reference point:** Interim limits of  $0.4B_{MSY}$  and  $1.5F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Target reference point:** Interim targets of  $B_{MSY}$  and  $F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

**Harvest control rule:** Not defined yet. Resolution 13/10 requests the SC to develop HCRs designed to maintain or restore stocks to the "Green" quadrant of the Kobe plot..

The main binding conservation measure established by the IOTC for skipjack (indirectly) is Resolution 12/13, which affects vessels greater than 24 m as well as smaller vessels fishing on the high seas. This measure calls for a one-month closure for purse seiners in an area of size  $10^{\circ} \times 20^{\circ}$ . The effect of the closure in Resolution 12/13 on the status of IO tuna stocks cannot be evaluated yet, but preliminary analyses based on historical catches indicate its effect is likely to be very small. Resolution 13/11 bans discards by purse seine vessels.

## SUMMARY

IO SKJ	Estimate	Years	Notes
Recent catch	315	2012	
5-yr catch	401	2008-12	
MSY	478	2011	
$F/F_{MSY}$	0.8	2011	
$B/B_{MSY}$	1.2	2011	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B < B_{MSY}$ . The stock was assessed for the first time in 2011.
FISHING MORTALITY		$F < F_{MSY}$ .
ENVIRONMENT		26% of the catch is made by gillnets, a gear expected to have high by-catch rates. No mitigation measures are in place and monitoring is extremely deficient.
		31% of the catch is made by purse seining on floating objects (including FADs). Several bycatch mitigation measures are in place (turtles, sharks).
		20% of the catch is made by pole-and-line fishing, with small bycatch of non-target species but unknown impacts on baitfish stocks.
		4% of the catch is made with purse seining on free schools, with little impact on non-target species.

Last Updated: March, 2013.

Changes from previous (December 2012) version: None.

## IO Albacore Tuna

Albacore catches in the Indian Ocean in 2012 were about 34,000 tonnes, a 1% increase from 2011. Almost all catches are made by drifting longlines (Figure IO-9).

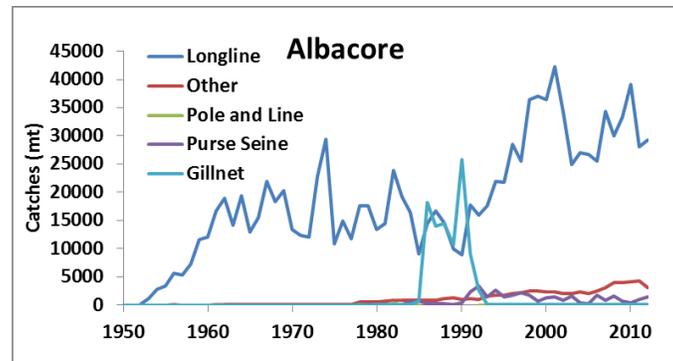


Figure IO-9. Catches of albacore tuna in the IO from 1950 to 2012, by gear type.

## STOCK ASSESSMENT

In 2012, the SC updated the assessment. The conclusions from the assessment are somewhat more optimistic than those of 2011 and indicate that (Figure IO-10):

1. The ratio of  $F_{current}/F_{MSY}$  is estimated to be 1.33 (range: 0.90 - 1.76). Therefore, overfishing is occurring. Piracy in the western tropical Indian Ocean has displaced much of the longline fishing effort to the South and East, which are traditional fishing grounds for albacore. Albacore catches in 2011 were 49% higher than in 2003.
2. The stock is not in an overfished state as spawning biomass is slightly above the  $B_{MSY}$  level ( $B_{current}/B_{MSY} = 1.05$ ; Range: 0.54-1.56).
3. The median estimate of MSY is estimated to be 33,300 tonnes (range: 31,100 to 35,600 t).

Recommendation 12/14 (non-binding) established interim limit reference points for albacore as  $0.4B_{MSY}$  and  $1.4F_{MSY}$ . Projections indicate that if catches remain the same in 2013, there is a 26% probability that the F limit reference point will be exceeded.

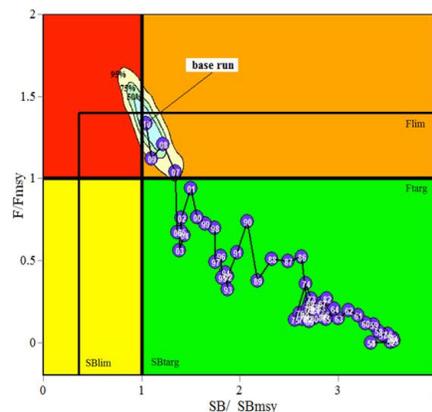


Figure IO-10. Temporal trend in the ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for albacore tuna in the IO (TB = Total biomass). Circles indicate the median trajectory and the probability distribution contours are provided as a rough visual guide of the uncertainty in current estimates. Colors are taken from IOTC reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Interim limits of  $0.4B_{MSY}$  and  $1.4F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

Target reference point: Interim targets of  $B_{MSY}$  and  $F_{MSY}$ . Resolution 13/10 requests the SC to assess and further review the adopted limits for consideration at the 2014 annual meeting.

Harvest control rule: Not defined yet. Resolution 13/09 requests the SC to develop HCRs designed to maintain or restore stocks to the "Green" quadrant of the Kobe plot.

IOTC Resolution 09/02 is a limitation of fishing capacity applicable in 2010 and 2011. It limits the number of vessels greater than 24 m fishing for albacore to the number and capacity that existed in 2007. Resolution 13/09 calls for the development of management options to be considered at the 2014 annual meeting.

The SC noted that there are considerable uncertainties in the 2011 assessment caused by data quality issues. SC14 concluded that "the available evidence indicates considerable risk to the stock status at current effort levels." While the SC did not recommend a specific catch limit or effort reduction, it is evident that IOTC needs to address the situation to end overfishing of the stock at its 2012 meeting.

## SUMMARY

IO ALB	Estimate	Years	Notes
Recent catch	34	2012	
5-yr catch	37	2008-12	
MSY	33	2010	
$F/F_{MSY}$	1.33	2010	
$B/B_{MSY}$	1.05	2010	
TAC	N/A		

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B \sim B_{MSY}$ . If overfishing continues, the stock size is expected to go below the $B_{MSY}$ level.
FISHING MORTALITY		$F > F_{MSY}$ . In addition, there is a substantial probability that the interim Limit Reference Point will be exceeded at the current catch level.
ENVIRONMENT		Almost 100% of the catch is made by longlining. Several mitigation measures are in place (sharks, turtles, sea birds). Monitoring is deficient.

Last Updated: December, 2012.

Changes from previous (April 2012) version: Abundance rating was changed from Orange to Green given the result of the 2012 assessment. Fishing mortality rating was changed from Yellow to Orange.

## SOUTHERN HEMISPHERE STOCKS

RFMO: Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

Last Scientific Committee meeting: September, 2013.

Last Commission meeting: October, 2013.

Tuna stocks managed by CCSBT: Southern bluefin tuna.

Data sources: The main sources of information for this section CCSBT (2013).

Last update: December, 2013.

### SH Southern Bluefin Tuna

Southern bluefin tuna (*Thunnus maccoyii*) is found in the southern hemisphere, mainly in waters between 30° and 50° S. The stock is assessed and managed by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). While the IATTC, ICCAT, IOTC and WCPFC have in principle a mandate to manage all tunas in their respective Convention Areas, in practice they defer to CCSBT for management of southern bluefin. Practically all of the catches are made in the IOTC, ICCAT and WCPFC convention areas (79% in the Indian Ocean, 17% in the Pacific Ocean and 4% in the Atlantic Ocean).

Southern bluefin catches in 2012 were about 10,300 tonnes, a 9% increase from 2011. Virtually all of the catches are made by longline (57%) and purse seine (44%). Current catches are nearly one-tenth of what they were at their peak, in 1961. (Figure I.2.1.1).

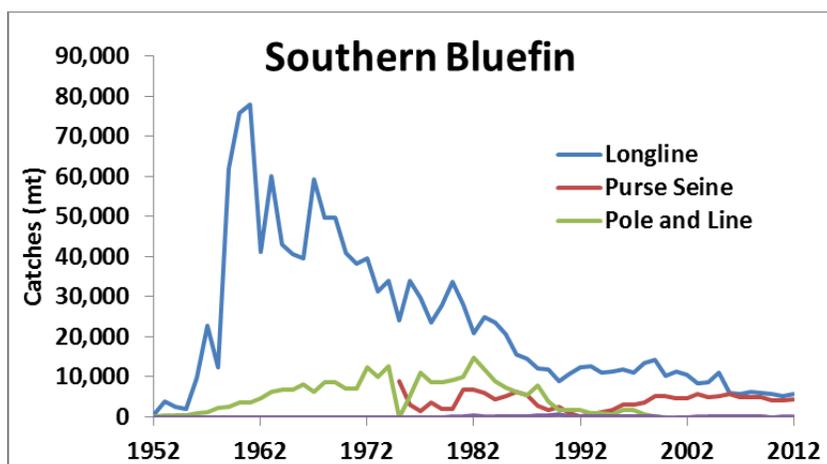


Figure SH-1. Catches of southern bluefin tuna from 1952 to 2012, by gear type.

### STOCK ASSESSMENT

Southern bluefin tuna is assessed by the Extended Scientific Committee (ESC) of the CCSBT. In 2011, the ESC indicated the following (Figure SH-2):

1. The current ratio of spawning biomass  $B_{\text{current}}/B_{\text{MSY}}$  is estimated at 0.23 (range: 0.15-0.32). This indicates that the stock is in a severely overfished state. Spawning biomass is estimated to be between 3% and 7% of the unfished level.
2. The ratio of  $F_{\text{current}}/F_{\text{MSY}}$  is estimated at 0.76 (range: 0.52-1.07), indicating that overfishing is not occurring. While overfishing was taking place in recent years, current fishing mortality has been reduced below the MSY level following reductions in overall catch.
3. The estimate of MSY is 34,500 tonnes.

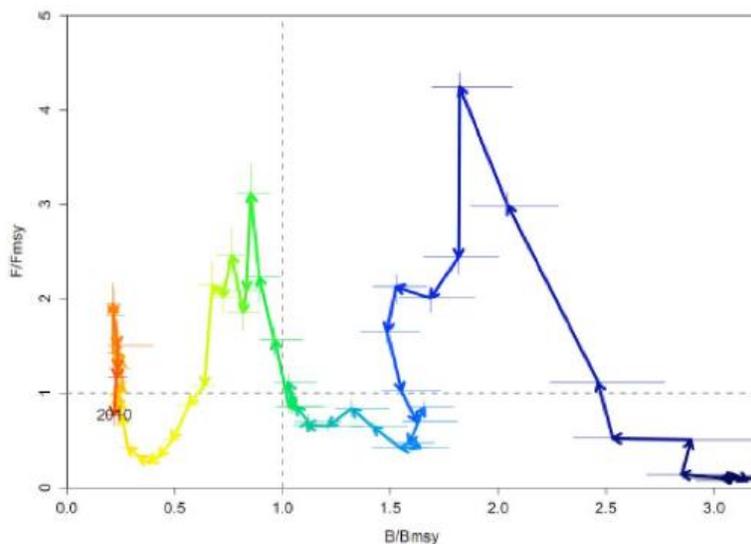


Figure SH-2. Temporal trend in the median ratios  $B_{current}/B_{MSY}$  (x-axis) and  $F_{current}/F_{MSY}$  (y-axis) for southern bluefin tuna. Vertical and horizontal lines provide an idea of the relative uncertainty in the estimates. Colors are taken from CCSBT reports and do not necessarily correspond to the colors used for ratings in the ISSF Stock Status Report.

## MANAGEMENT

Limit reference point: Not defined.

Target reference point: Not defined for the long-term. 20% of the unfished biomass (20%SSB<sub>0</sub>) is used as an interim target to be achieved with 70% probability by 2035.

Harvest control rule: Harvest rules via a TAC, that is the average catch value from two formulas designed to achieve the recovery target and tuned to juvenile surveys and CPUE. 0.7 probability of rebuilding to 20%SSB<sub>0</sub>.

Southern bluefin tuna is managed primarily through annual TACs that aim, as an interim target, to rebuild the stock to 20% of the unfished level by 2035. The TACs are set through a process known as a Management Procedure (MP), adopted in 2011, that specifies the actions to be taken depending on the outcomes of the assessment made by the ESC (in essence, a Harvest Control Rule).

TACs under the MP are set for three-year periods to maintain the stock on the planned rebuilding trajectory. The MP specifies the minimum and maximum permissible changes in TAC (either increase or decrease, depending on stock status relative to the rebuilding trajectory). The TAC for 2014 is set to 12,449 tonnes. For the three year period 2015-207, the TAC is set to 14,647 tonnes. However, the TACs for 2016 and 2017 will be confirmed at the 2014 annual meeting of CCSBT.

## SUMMARY

SBT	Estimate	Years	Notes
Recent catch	10.3	2012	
5-yr catch	10.4	2008-12	
MSY	34.5	2010	
$F/F_{MSY}$	0.76	2010	Range: 0.52-1.07
$B/B_{MSY}$	0.23	2011	Range: 0.15-0.32
TAC	12.4 and 14.6	2014 and 2015-2017	

Catches and MSY in 1000 tonnes.

STOCK ABUNDANCE		$B \ll B_{MSY}$ . Stock abundance is very low, about 5% of the unfished level.
FISHING MORTALITY		$F < F_{MSY}$ . The rating could be Green. However, overfishing was taking place in previous years and given the depleted condition of the population, a precautionary Yellow rating is given.
ENVIRONMENT		57% of the catch is made by longlining. Several mitigation measures are in place (sea birds).
		44% of the catch is made by purse seining on free schools of southern bluefin.

Last Updated: December, 2012.

Changes from previous (April 2012) version: None.

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## GLOSSARY AND ACRONYMS

TERM	MEANING
AIDCP	The Agreement on the International Dolphin Conservation Program
ALB	Albacore tuna, <i>Thunnus alalunga</i> .
AO	Atlantic Ocean
BET	Bigeye tuna, <i>Thunnus obesus</i> .
BFT	Atlantic bluefin tuna, <i>Thunnus thynnus</i> .
B <sub>MSY</sub>	(also "Biomass at MSY" or "MSY Biomass Level"). This is the stock size (biomass) that would result on average if FMSY was applied constantly year after year. BMSY is sometimes measured by the total biomass of the stock and sometimes by the biomass of the spawners ("spawning biomass", or SSB).
CCSBT	Commission for the Conservation of Southern Bluefin Tuna ( <a href="http://www.ccsbt.org">www.ccsbt.org</a> )
EPO	Eastern Pacific Ocean
F	Instantaneous fishing mortality rate, a measure of the intensity with which a stock is being exploited. The catch of a stock is roughly proportional to F multiplied by abundance.
FAD	Fish Aggregating Device. An inanimate object that attracts tunas and other marine life. In this report, "FAD" is used broadly for natural logs, as well as man-made objects, both anchored and drifting.
F <sub>MSY</sub>	(also "Fishing Mortality at MSY" or "MSY Fishing Mortality Level"). This is the level of fishing intensity that, if applied constantly year after year, would result in MSY.
IATTC	Inter-American Tropical Tuna Commission ( <a href="http://www.iattc.org">www.iattc.org</a> )
ICCAT	International Commission for the Conservation of Atlantic Tunas ( <a href="http://www.iccat.int">www.iccat.int</a> )
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission ( <a href="http://www.iotc.org">www.iotc.org</a> )
ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean ( <a href="http://isc.ac.affrc.go.jp">isc.ac.affrc.go.jp</a> )
MSY	The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions. (For species with fluctuating recruitment, the maximum might be obtained by taking fewer fish in some years than in others.)
PBF	Pacific bluefin tuna, <i>Thunnus orientalis</i>
PO	Pacific Ocean
RFMO	Regional Fishery Management Organization
SBT	Southern bluefin tuna, <i>Thunnus maccoyii</i>
SH	Southern hemisphere
SKJ	Skipjack tuna, <i>Katsuwonus pelamis</i>
SPC/OFPP	Secretariat of the Pacific Community (Oceanic Fisheries Programme)
SSBMSY	See BMSY.
TAC	Total Allowable Catch
WCPFC	Western and Central Pacific Fisheries Commission ( <a href="http://www.wcpfc.int">www.wcpfc.int</a> )
WCPO	Western and Central Pacific Ocean
YFT	Yellowfin tuna, <i>Thunnus albacares</i>

# APPENDIX I. BYCATCH

## Impacts by gear type

All fishing gears have some level of environmental impact, and bycatch is one of the most noticeable ones. This summary presents the overall ratings given by default to various gear types. Deviations from these color ratings may occur for individual stocks, due to advice from the ISSF Scientific Advisory Committee; these are noted for each particular stock in which deviations may occur.

This summary is presented only for non-target (non-tuna) species. Note that in some ocean regions, fishing modes such as FAD-based purse seining and pole-and-line fishing can result in high catches of small individuals of bigeye and yellowfin, which are undesirable. In this stock status report, these impacts are measured directly under the status section for these stocks.

Sources of information used for these ratings include the following: Amandè et al. (2010), Clarke and Harley (2010), FAO (2009), Gillett (2011), Gilman (2011), Harley, et al. (2011), IATTC (2012), IOTC (2005), Matsumoto and Bayliff (2008), Morizura et al. (1999), Olson (2010), Pianet et al. (2010a), Pianet et al. (2010b), SPC/OFP (2008), and SPC/OFP (2010).

### Gillnet fishing.

ORANGE

Gillnet fisheries take substantial amounts of tunas in various ocean regions, especially in the Indian Ocean. For the most part, these are poorly monitored but it is known that they tend to catch many different species at the same time. Bycatch rates of many non-target species tends to be high. Large-scale driftnets are generally prohibited on the high seas but appear to continue to be used.

Sharks. Silky, oceanic whitetip and scalloped hammerhead sharks are common in gillnet fisheries. All of these species are of concern because of their low productivity and vulnerability to overfishing.

Sea Turtles. Sea turtle bycatch is thought to be highest in gillnet fisheries compared to other gears.

Sea birds. The incidental catch of sea birds in gillnet fisheries is largely unknown.

Other finfish. Gillnet operations catch a number of other finfishes. Some of these include very productive species such as dolphinfish ("mahi-mahi") that are not of immediate concern.

to be resilient to fishing (blue shark), and others which are likely to be more vulnerable because of their low reproductive rates (e.g., porbeagle and thresher sharks).

Sea Turtles. Some turtles are also caught in longline operations as bycatch, many of which are discarded (including live releases). All RFMOs have some type of mitigation measure in place. Roughly one half, or more, of the turtles caught are alive, so the main mitigation measures aim to dehook them and release them alive.

Sea birds. Some sea birds are also caught in longline operations as bycatch, especially in higher latitudes. Most (~90%) sea birds caught are dead when brought onboard, so the best practice for mitigation is to avoid their being hooked, which is the main type of mitigation measure used by the RFMOs. Of particular concern are albatrosses and petrels.

Other finfish. After tunas and sharks, longline operations catch a number of other finfishes. Some of these include very productive species such as dolphinfish ("mahi-mahi") that are not of immediate concern. Longlining also catches marlins, some of which are estimated to be overfished.

### Handlines.

GREEN

This mode of fishing typically results in small bycatch rates.

### Longlining.

ORANGE

Sharks. Longline fisheries tend to have very high catch rates of sharks (in some areas, 30% of the longline catches are sharks). In some cases the sharks can be a target of the fishing operations, at least for parts of a trip. Sharks caught include a wide range of species, some of which are thought

### Mid-water trawling.

ORANGE

This mode of fishing has a small bycatch rate of cetaceans.

### Pole-and-line fishing.

YELLOW

There are no major concerns with the catch of vulnerable non-target species by this gear. However, the method requires the use of live baitfish (small pelagics) that are used to keep the schools of tunas attracted to the fishing vessels while they are fished. The effects of fishing on these populations is largely unknown; however, they should be managed in order to support pole and line fisheries. Gillett (2011)

notes that the amount of baitfish available in the WCPO is a limiting factor to the amount of pole and line fishing that can occur. In addition, the bait species captured are generally more fragile than temperate baitfish species.

#### Purse seining on free schools.

GREEN

This mode of fishing typically results in small bycatch rates of non-target species.

#### Purse seining on FADs.

YELLOW

Purse seining on FADs (anchored FADs, drifting FADs and natural logs) generally has bycatch rates of non-target species that are higher than those of free school sets.

Sea Turtles. The number of turtles that die in purse seine fishing operations is very small. Nevertheless, it is relatively easy to release turtles when caught alive and this is the main mitigation measures used by RFMOs.

Sharks. FAD purse seine fishing operations catch several species of sharks, some of which, based on catch trends, may have been declining in abundance in recent years, such as oceanic white tip and silky sharks. Entanglement can be a significant problem, especially if FAD designs use underwater netting materials with large mesh sizes. ISSF is advocating for RFMOs to require non-entangling designs.

Sea birds. Mortality of other sensitive species like seabirds in FAD operations is almost nonexistent.

Other finfish. FAD fishing does result in large catches of other finfish such as dolphinfish ("mahimahi"). Currently, it appears that these catches do not adversely impact the abundance of these species which are very productive and resilient to fishing. Rather, the main problem with these bycatches is one of utilization (waste), since the majority of these are discarded at sea so that the fish holding tanks can be reserved for the more valuable tunas.

#### Purse seining on tuna-dolphin associations.

GREEN

Marine mammals. In the EPO, purse-seine fishermen have learned to take advantage of the association between yellowfin schools and herds of dolphins that is prevalent in the region. Fishermen maximize their catches of yellowfin by setting their nets around these associations. Mortality of dolphins was very high early on, but the IATTC estimates that it has since the late 1980s declined by 98% after fishermen and scientists developed techniques for releasing the dolphins alive after a set, and retaining the tunas. Some scientists believe that there is an un-quantified level of mortality after the sets, caused by stress, and this remains a controversial issue. However, based on fishery-independent surveys, the abundance of most dolphin populations in the region is estimated to be either stable or increasing, while a few may be declining. The Agreement on the International Dolphin Conservation Program (AIDCP) establishes allowable dolphin mortality limits; current (2011) levels are one-fourth of that level. There is a 100%-coverage observer program in place for these operations. Catches of non-target species in these operations are very small.

#### Trolling.

GREEN

This mode of fishing typically results in very small bycatch rates of non-target species.

#### Tuna traps.

GREEN

Migrating schools of bluefin tuna have been caught by traps that are fixed near the shoreline, especially in the eastern Atlantic and Mediterranean. Most of the catch in these traps consists of scombrids, including bluefin, and up to 99% of it is utilized. There are no major bycatch issues known with this passive gear, although it occasionally catches sharks.

## RFMO bycatch mitigation and monitoring

The following is a summary of the major mitigation and monitoring measures adopted by the various tuna RFMOs.

### CCSBT

Sea birds, sharks and turtles: With only one exception, all CCSBT Members and Cooperating Non-Members are also Parties or Cooperating Parties to IOTC, WCPFC and/or ICCAT. As a consequence, any binding bycatch mitigation measure of these RFMOs is in practice binding on the CCSBT Member/Cooperating Non-Member when fishing within that Convention Area. Additionally, the non-binding Recommendation to Mitigate the Impact on Ecologically

Related Species - ERS - of Fishing for Southern Bluefin Tuna (updated 2011) strongly encourages CCSBT members to comply with mitigation measures on sea birds, sharks and sea turtles adopted by ICCAT, IOTC and WCPFC.

Sea birds. Mandatory use of Tori poles is required by all members in all southern bluefin longline fisheries South of 30°S.

Monitoring and mitigation research. CCSBT members are required to exchange information concerning new or refined

techniques to reduce incidental catch of seabirds and cooperate in developing and assessing the effectiveness of such techniques. Most CCSBT Members and Cooperating Non-Members have achieved 10% scientific observer coverage (in catch and effort) for their fisheries; the 10% level is a non-binding target.

## **IATTC**

General: Resolution 04-05 requires the release of non-target species caught in purse seine fisheries.

Sea Turtles. Resolution C-07-03 requires fishermen to release sea turtles entangled in FADs or caught in longlines and to avoid encircling them with purse seine nets. The resolution also calls for research to mitigate sea turtle bycatch, especially with gear modifications. Resolution C-13-04 calls for a transition to non-entangling FADs in purse seine fisheries.

Sharks. Resolution C-05-03 discourages shark retention and establishes a limit in the amount of shark fins that can be landed, relative to the total weight of shark bodies that must be retained. This ratio of fin-to-body-weight acts as a disincentive to target sharks because the shark carcasses occupy hold space on the vessel and have little market value. The Resolution also mandates reporting of shark catches to IATTC. Resolution C-11-10 prohibits the retention of oceanic whitetip sharks and requires the release of specimens that are alive when caught. Resolution C-13-04 calls for a transition to non-entangling FADs in purse seine fisheries.

Sea birds. The IATTC Resolution C-11-02 requires longline vessels operating in high latitudes (North of 23°N, South of 30°S and around the Galapagos Islands) to employ at least two sea bird mitigation techniques such as night setting or weighted branch lines.

Dolphins. The AIDCP establishes total per-stock and per-year limits on incidental dolphin mortality (DMLs), with a structured protocol for allocating and keeping track of DMLs (using observers). A vessel must stop setting on dolphin associations for the rest of the year once its DML has been reached.

Monitoring and mitigation research. Through the Agreement on the International Dolphin Conservation Program (AIDCP), there is 100% observer coverage on all large purse seiners (> 363 tons in carrying capacity) and lower coverage on smaller vessels. This level of observer coverage, coupled with the information from fishing logbooks, allows the IATTC to maintain a very complete accounting of the bycatch taken in purse seine fisheries in the EPO. Several IATTC Recommendations and Resolutions encourage research that could make FAD-based purse seining and longlining more species-selective. These are non-binding, however, and depend on the IATTC member nations making the necessary resources available. ISSF has a research program for bycatch mitigation in purse seine fisheries, and IATTC scientists are taking part in this program (IATTC, 2010b). Resolution C-11-08 now requires 5% scientific observer coverage for large longliners.

NOTE: Major fleets such as Japan that use longlining in the EPO reported catches of non-target species to IATTC (particularly sharks and billfishes; Matsumoto and Bayliff, 2008), and in this sense they were relatively better than longline fleets elsewhere. However, it is apparent that this level of monitoring and reporting has not been maintained.

## **ICCAT**

Sharks: Recommendations 04-10, 05-05 and 06-10 established a limit on the ratio of fin weight to total shark weight that can be retained onboard a fishing vessel, and encouraged the release of live sharks in fisheries that do not target sharks. Recommendation 07-06 limits mortality on porbeagle and North Atlantic shortfin mako. Recommendations 09-07, 10-07, 10-08 and 11-08 prohibit the retention on board of bigeye thresher, oceanic white tip, several species of hammerhead sharks, and silky sharks. All of these measures have a reporting requirement associated with them (Recommendation 12-05 requires all parties in 2013 to report on their compliance with Recs. 04-10, 07-06, 09-07, 10-08, 10-07, 11-08, and 11-15). Recommendation 10-06 prohibits the retention of shortfin mako onboard vessels flagged to countries that do not report catches for this species.

Sea Turtles. Recommendations 10-09 and 13-11 set up reporting requirements for sea turtle interactions and mandates its scientific committee to assess, by 2014, the impact of tuna fisheries on sea turtle populations. The measure has specific requirements for longline operators to be trained on appropriate handling and release of live turtles so as to maximize their survival.

Sea birds. Recommendation 07-07 required longliners operating south of 20°S to use at least two of several mitigation measures such as weighted branch lines or tori (bird-scaring) lines. The measure also required ICCAT members to collect and report data on interactions between fisheries and sea birds. Recommendation 11-09 strengthened the mitigation measures in 07-07, especially for longliners fishing south of 25°S, and in the Mediterranean.

Other finfish. Longliners and other fisheries also take Atlantic blue and white marlin as bycatch, both of which are thought to be overfished. ICCAT adopted Recommendation 06-09, later superseded by 12-04, a rebuilding plan with catch limits by country.

Monitoring and mitigation research. ICCAT has specific requirements for reporting data on sharks, sea turtles and sea birds. For the most part these are not complied with fully, but the situation is improving over time. Recommendation 10-10 requires members to have at least 5% observer coverage (for vessels over 15 m) in their national observer programs for longline, purse seine and pole-and-line fisheries. Recommendation 11-10 requires CPCs to collect and report data on bycatch and discards either through observer programs and logbooks (for vessels to which Rec. 10-10 applies) or via alternative means (for artisanal and semi-industrial fisheries). Recommendation 11-15 establishes penalties for CPCs that do not report annual catch data (including zero catches) by prohibiting them from retaining such species in the following year.

## **IOTC**

Sharks: The IOTC has adopted measures that address shark conservation concerns. Resolution 05/05 established a limit on the ratio of fin weight to total shark weight that can be retained onboard a fishing vessel, and encouraged the release of live sharks in fisheries that do not target sharks. Resolution 12/09 prohibits the retention on board of all species of thresher sharks, a group that is thought to be particularly vulnerable due to its low productivity. In addi-

tion, Resolution 12/09 requires data reporting to IOTC, especially for fisheries targeting sharks. Resolution 13/05 prohibits intentional purse seine setting on tunas associated with whale sharks. Resolution 13/06 prohibits the retention of oceanic whitetip sharks. Resolution 13/08 calls for a transition to non-entangling FADs in purse seine fisheries starting in 2014.

Sea Turtles. Resolution 12/04 (which supersedes various prior measures) requires IOTC members to mitigate sea turtle mortality and to provide data on turtle bycatch to the SC. The measure has specific requirements for longline and purse seine operators to facilitate the appropriate handling and release of live turtles. Resolution 13/08 calls for a transition to non-entangling FADs in purse seine fisheries starting in 2014.

Sea birds. Resolution 12/06 (which supersedes various prior measures) requires longliners operating south of 25°S to use at least two of several mitigation measures such as weighted branch lines or tori (bird-scaring) lines. The measure also requires IOTC members to provide data on interactions between fisheries and sea birds to the SC.

Monitoring and mitigation research. Resolution 10/04 established a regional observer program that requires at least 5% coverage for vessels over 24 m, and for smaller vessels operating in the high seas. Resolution 08/04 requires longliners greater than 24 m overall, as well as smaller longliners operating in the high seas, to have electronic logbooks and record and report data on target and non-target species to the SC. Monitoring of bycatches in the gillnet fisheries is extremely poor.

#### **WCPFC**

Sea Turtles. CMM 2008-03 instructs WCPFC members to implement the FAO (2009) guidelines for reducing sea turtle mortality, and requires longline operators to use line cutters and de-hookers to handle and promptly release sea turtles caught or entangled. The measure also requires purse seine operators to avoid setting on turtles if possible and to disentangle/release them when caught alive.

Sharks. CMM-2010-07 requires reporting of shark catches and discards by gear type and species. The measure also established a limit on the ratio of shark fins to total shark weight that can be retained onboard fishing vessels, and encourages the release of live sharks. CMM-2011-04 prohibits the retention on board of oceanic white tip sharks and CMM-13-08 does the same for silky sharks. CMM-2012-04 prohibits deliberate purse seine sets around whale sharks and requires reporting of interactions. WCPFC has initiated a research plan aimed at improving statistics and observer coverage on sharks and conducting assessments for key shark species (Clarke and Harley, 2010).

Sea birds. CMM 2012-07 requires longliners operating north of 23°N and south of 23°S to use at least two of several mitigation measures such as weighted branch lines or tori (bird-scaring) lines. The measure also encourages mitigation research to be conducted by WCPFC members.

Cetaceans. CMM-2011-03 prohibits deliberate purse seine sets around cetaceans and requires reporting of interactions. Other finfish. Striped marlin are also caught as bycatch in longline fisheries; this species is of more concern because it has been declining in abundance. The WCPFC adopted CMM 2010-01 which sets a cap on the catch of striped marlin for each member relative to historical levels.

Monitoring and mitigation research. With the exception of sharks under CMM 2009-04, reporting of bycatch species is not mandatory at WCPFC, so much of the information available comes from observer programs. The WCPFC has a Regional Observer Program that, since 2010, is intended to have 100% coverage on purse seine vessels that fish on the high seas or between two or more EEZs. As these data become available and are analyzed by the Scientific Committee, monitoring should improve. National observer programs are also run by WCPFC members, but it is not clear that all of the bycatch information collected in those programs is made available to the SC for integrated analyses. For longline fisheries, observer coverage is poor overall. Much of the information available is from bilateral EEZ access agreements in Pacific Island countries. Observer coverage for distant-water fleets is extremely low.

## APPENDIX 2. VERSION LOG

DATE	TECH REP.	CHANGES
12/2013	2013-04B	<ul style="list-style-type: none"> <li>- Updated ICCAT stock status and management</li> <li>- Updated IOTC stock status</li> <li>- Updated WCPFC stock status and management</li> <li>- Updated CCSBT management</li> </ul>
08/2013	2013-04A	<ul style="list-style-type: none"> <li>- Updated IATTC stock status</li> <li>- Updated Pacific bluefin</li> <li>- Updated IATTC management measures</li> <li>- Updated IOTC management measures</li> </ul>
04/2013	2013-04	<ul style="list-style-type: none"> <li>- Updated WCPFC catch data</li> <li>- Separated gillnet catches from "other" gears in the IO</li> <li>- Disaggregated Pacific-wide stocks</li> <li>- Added section on HCRs and Reference points for each stock</li> </ul>
12/2012	2012-04B	<ul style="list-style-type: none"> <li>- Updated ICCAT stock status and management</li> <li>- Updated WCPFC stock status and management for tropical tunas</li> <li>- Updated Pacific-wide stock status</li> <li>- Updated CCSBT status and management</li> <li>- Updated general introduction</li> <li>- Modified life-history tables (K. Schaefer review)</li> </ul>
07/2012	2012-04A	<ul style="list-style-type: none"> <li>- Updated EPO stock status</li> <li>- Updated WCPFC, IOTC and IATTC conservation measures adopted in 2012</li> <li>- Corrected F status for North Pacific albacore</li> <li>- Updated Pacific bluefin catches</li> </ul>
04/2012	2012-04	<ul style="list-style-type: none"> <li>- Added 4 bluefin stocks</li> <li>- Reformatted entire report</li> <li>- Added Exec. Summary, Glossary and Introductory sections</li> <li>- Reorganized presentation of stocks to match regions</li> </ul>
12/2011	2011-04C	<ul style="list-style-type: none"> <li>- Updated IO stock status to reflect 12/2011 IOTC SC meeting</li> <li>- Updated AO management to reflect 11/2011 ICCAT Comm. meeting</li> </ul>
11/2011	2011-04B	<ul style="list-style-type: none"> <li>- Updated AO stock status to reflect 10/2011 ICCAT SCRS meeting</li> <li>- Updated WCPO stock status to reflect 08/2011 WCPFC SC meeting</li> </ul>
08/2011	2011-04A	<ul style="list-style-type: none"> <li>- Updated EPO management to reflect 06/2011 IATTC Comm. Meeting</li> </ul> <p>Note: Doc header erroneously labeled "May" instead of "August"</p>
05/2011	2011-04	<ul style="list-style-type: none"> <li>- Updated EPO stock status to reflect 05/2011 IATTC SAC meeting</li> <li>- Added new rating factor Environment (bycatch)</li> <li>- Added more exhaustive information on RFMO resolutions</li> </ul>
02/2011	--	<ul style="list-style-type: none"> <li>- IOTC stock status update</li> </ul>
10/2010	--	<ul style="list-style-type: none"> <li>- ICCAT stock status update</li> </ul>
09/2010	--	<ul style="list-style-type: none"> <li>- WCPFC stock status update</li> </ul>
09/2010	--	<ul style="list-style-type: none"> <li>- IATTC stock status update</li> </ul>
05/2010	--	<ul style="list-style-type: none"> <li>- Updated entire report</li> <li>- Added color ratings for F and Biomass</li> </ul>
05/2009	--	<ul style="list-style-type: none"> <li>- First stock status report for 19 stocks</li> </ul>

