

## EXECUTIVE SUMMARY: BIGEYE TUNA

Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resourceTABLE 1. Bigeye tuna: Status of bigeye tuna (*Thunnus obesus*) in the Indian Ocean.

Area <sup>1</sup>	Indicators		2015 stock status <sup>2</sup> determination
Indian Ocean	Catch in 2014:	100,231 t	
	Average catch 2010–2014:	102,214 t	
	MSY (1,000 t) (plausible range):	132 (98–207) <sup>3</sup>	
	F <sub>MSY</sub> (plausible range):	n.a. (n.a.–n.a.) <sup>3</sup>	
	SB <sub>MSY</sub> (1,000 t) (plausible range):	474 (295–677) <sup>3</sup>	
	F <sub>2012</sub> /F <sub>MSY</sub> (plausible range):	0.42 (0.21–0.80) <sup>3</sup>	
	SB <sub>2012</sub> /SB <sub>MSY</sub> (plausible range):	1.44 (0.87–2.22) <sup>3</sup>	
	SB <sub>2012</sub> /SB <sub>1950</sub> (plausible range):	0.40 (0.27–0.54) <sup>3</sup>	

<sup>1</sup>Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.

<sup>2</sup>The stock status refers to the most recent years' data used in the SS3 assessment.

<sup>3</sup>The point estimate is the median of the plausible models investigated in the 2013 SS3 assessment.

Colour key	Stock overfished (SB <sub>year</sub> /SB <sub>MSY</sub> < 1)	Stock not overfished (SB <sub>year</sub> /SB <sub>MSY</sub> ≥ 1)
Stock subject to overfishing (F <sub>year</sub> /F <sub>MSY</sub> > 1)		
Stock not subject to overfishing (F <sub>year</sub> /F <sub>MSY</sub> ≤ 1)		
Not assessed/Uncertain		

## INDIAN OCEAN STOCK – MANAGEMENT ADVICE

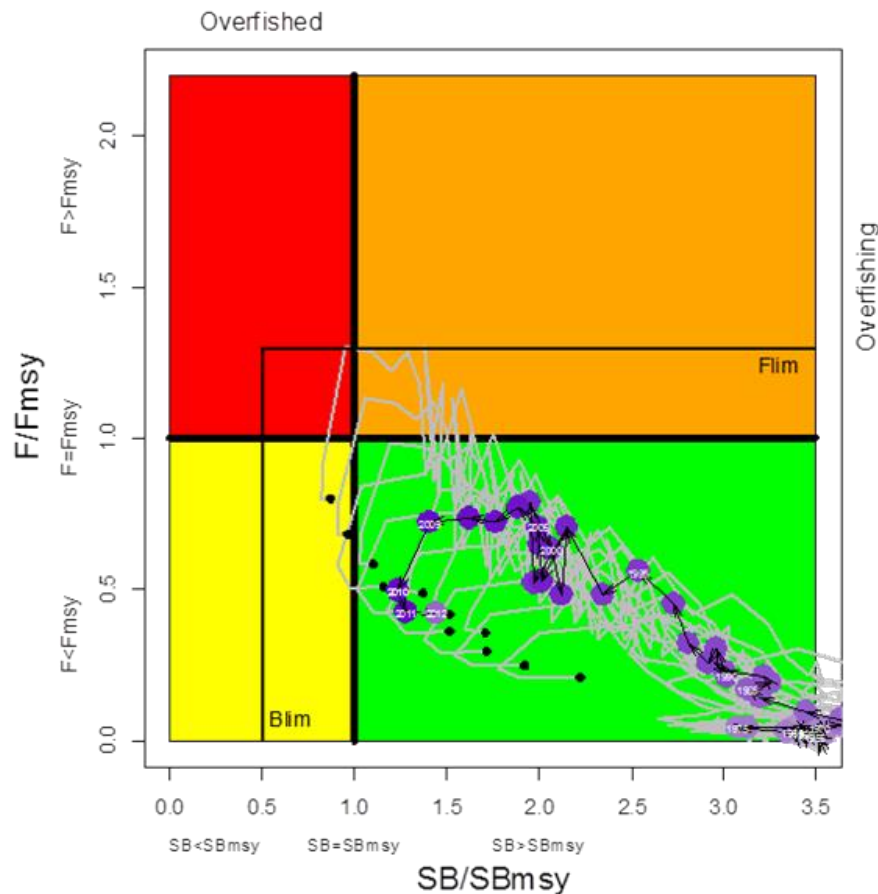
**Stock status.** No new stock assessment was carried out for bigeye tuna in 2014 or 2015, thus, stock status is determined on the basis of the 2013 SS3 assessment and other indicators presented in 2015. The 2013 stock assessment model results did not differ substantively from the previous (2010 and 2011) assessments; however, the final overall estimates of stock status differ somewhat due to the revision of the catch history and updated standardised CPUE indices. All the runs (except 2 extremes) carried out in 2013 indicate the stock is above a biomass level that would produce MSY in the long term (i.e. SB<sub>2012</sub>/SB<sub>MSY</sub> > 1) and in all runs that current fishing mortality is below the MSY-based reference level (i.e. F<sub>2012</sub>/F<sub>MSY</sub> < 1) (Table 1 and Fig. 1). The median value of MSY from the model runs investigated was 132,000 t with a range between 98,000 and 207,000 t. Current spawning stock biomass was estimated to be 40% (Table 1) of the unfished levels. Catches in 2013 (≈109,000 t) remain lower than the estimated MSY values from the 2013 stock assessments (Table 1). The average catch over the previous five years (2010–14; ≈102,000 t) also remains below the estimated MSY. In 2012 catch levels (≈120,000 t) of bigeye tuna increased markedly (≈29% over values in 2011: ≈92,000 t), but have declined to ≈102,000 t in 2014. Thus, on the weight-of-evidence available in 2015, the bigeye tuna stock is determined to be **not overfished** and is **not subject to overfishing** (Table 1).

**Outlook.** Declines in longline effort since 2007, particularly from the Japanese, Taiwan, China and Rep. of Korea longline fleets, as well as purse seine effort have lowered the pressure on the Indian Ocean bigeye tuna stock, indicating that current fishing mortality would not reduce the population to an overfished state in the near future. The Kobe strategy matrix based on all plausible model runs from SS3 in 2013 illustrates the levels of risk associated with varying catch levels over time and could be used to inform future management actions (Table 2). The SS3 projections from the 2013 assessment show that there is a low risk of exceeding MSY-based reference points by 2015 and 2022 if catches are maintained at catch levels of 115,800 t at the time of the last assessment (0% risk that B<sub>2022</sub> < B<sub>MSY</sub> and 0% risk that F<sub>2022</sub> > F<sub>MSY</sub>) (Table 2).

**Management advice.** If catch remains below the estimated MSY levels, then immediate management measures are not required. However, continued monitoring and improvement in data collection, reporting and analysis is required to reduce the uncertainty in assessments.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** The median value of MSY from the model runs investigated was 132,000 t with a range between 98,000 and 207,000 t (range expressed as the different runs of SS3 done in 2013 using steepness values of 0.7, 0.8 and 0.9; different natural mortality values; and catchability increase for longline CPUE) (see Table 1 for further description). Current stock size is above  $SB_{MSY}$  and predicted to increase on the short term. Catches at the level of 132,000 t have a low probability of reducing the stock below  $SB_{MSY}$  in the short term (3–5 years) and medium term (10 years). Therefore, the annual catches of bigeye tuna should not exceed the median value of MSY. However, for lower productivity model options, catches at the median MSY level will reduce stock biomass over the long-term (10–15 years).
- **Interim reference points:** Noting that the Commission has agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
  - **Fishing mortality:** Current fishing mortality is considered to be below the interim target reference point of  $F_{MSY}$ , and therefore below the interim limit reference point of  $1.4 * F_{MSY}$  (Fig. 1).
  - **Biomass:** Current spawning biomass is considered to be above the interim target reference point of  $SB_{MSY}$ , and therefore above the interim limit reference point of  $0.4 * SB_{MSY}$  (Fig. 1).
- **Main fishing gear** (Average catch 2011–14): Longline  $\approx 56.0\%$  (frozen  $\approx 43.5\%$ , fresh  $\approx 12.5\%$ ); Purse seine  $\approx 21.2\%$  (FAD associated school  $\approx 16.1\%$ ; free swimming school  $\approx 5.1\%$ ); Line other  $\approx 9.6\%$ ; Other  $\approx 6.8\%$ .
- **Main fleets** (Average catch 2011–14): Indonesia  $\approx 27\%$ ; Taiwan, China  $\approx 22\%$ ; European Union  $\approx 16\%$  (EU, Spain:  $\approx 10\%$ ; EU, France:  $\approx 6\%$ ); Seychelles  $\approx 11$ ; Japan  $\approx 5\%$ ; All other fleets  $\approx 19\%$ .



**Fig. 1.** Bigeye tuna: SS3 Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of 12 plausible model options included in the formulation of the final management advice (grey lines with the black point representing the terminal year of 2012). The trajectory of the median of the 12 plausible model options (purple points) is also presented. The biomass ( $B_{lim}$ ) and fishing mortality limit ( $F_{lim}$ ) reference points are also presented.

**Table 2.** Bigeye tuna: 2013 SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of weighted distribution of models violating the MSY-based reference points for five constant catch projections (2012 catch level,  $\pm 10\%$ ,  $\pm 20\%$ ,  $\pm 30\%$  and  $\pm 40\%$ ) projected for 3 and 10 years. Note: from the 2013 stock assessment using catch estimates at that time.

Reference point and projection timeframe	Alternative catch projections (relative to the average catch level for 2012) and probability (%) of violating MSY-based target reference points ( $SB_{\text{targ}} = SB_{\text{MSY}}$ ; $F_{\text{targ}} = F_{\text{MSY}}$ )								
	60% (69,480 t)	70% (81,060 t)	80% (92,640 t)	90% (104,220 t)	100% (115,800 t)	110% (127,400 t)	120% (139,000 t)	130% (150,500 t)	140% (162,100 t)
SB <sub>2015</sub> < SB <sub>MSY</sub>	n.a.	n.a.	n.a.	n.a.	0	0	0	0	0
F <sub>2015</sub> > F <sub>MSY</sub>	n.a.	n.a.	n.a.	n.a.	0	0	0	8	17
SB <sub>2022</sub> < SB <sub>MSY</sub>	n.a.	n.a.	n.a.	n.a.	0	0	8	17	25
F <sub>2022</sub> > F <sub>MSY</sub>	n.a.	n.a.	n.a.	n.a.	0	0	8	17	25
Reference point and projection timeframe	Alternative catch projections (relative to the average catch level for 2012) and probability (%) of violating MSY-based limit reference points ( $SB_{\text{lim}} = 0.5 SB_{\text{MSY}}$ ; $F_{\text{lim}} = 1.3 F_{\text{MSY}}$ )								
	60% (69,480 t)	70% (81,060 t)	80% (92,640 t)	90% (104,220 t)	100% (115,800 t)	110% (127,400 t)	120% (139,000 t)	130% (150,500 t)	140% (162,100 t)
SB <sub>2016</sub> < SB <sub>Lim</sub>	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
F <sub>2016</sub> > F <sub>Lim</sub>	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SB <sub>2023</sub> < SB <sub>Lim</sub>	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
F <sub>2023</sub> > F <sub>Lim</sub>	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.