FAO species YFT – Atlantic Yellowfin Tuna (Thunnus albacares)

Introduction

A stock assessment was conducted for yellowfin tuna in 2024 (ICCAT, 2024), using data through 2022, applying an age structured model, Stock Synthesis. Management advice (Kobe Matrices) was developed using constant catch projections at 0 t, and 100,000 to 150,000 t. The uncertainty was characterized using the 80% confidence intervals from 4,000 Monte Carlo iterations on the most influential fixed parameters, natural mortality (M) and steepness (h). A summary of the stock status is provided below (**Table 1**). **Table 2** provides estimated catches and discards by gear, for the period 1999-2023. The Kobe Phase Plot and uncertainty of current status estimates is summarized in **Figure 1**. **Table 3** provides estimated probabilities (%) that both the fishing mortality will below F_{MSY} and spawning stock biomass will be above SSB_{MSY} in future years under different constant catch scenarios.

Table 1. Species summary table.

Indicator		***Stock Status in 2022***
Maximum Sustainable Yield[1]	121,661 t (107,485-188,456)[3]	2022
Current (2023) TAC	110,000 t	
Current (2023) Yield[2]	139,529 t	
Relative Biomass (SSB_{2022}/SSB_{MSY}[1]) if applicable	1.37 (0.91-2.15)	
Relative Fishing Mortality ($F_{2020\text{-}2022}/F_{MSY}$[1])	0.89 (0.40-1.46)	
Stock Status	Overfished: NO (81% probability)[4] Overfishing: NO (58% probability)[4]	
Management Measures in Effect (Rec. 17-01, Rec. 22-01) - No fishing with natural or artificial floating objects from 1 January to 13 March 2023, throughout the Convention area. Prohibited to deploy drifting FADs during a period of 15 days prior to the start of the closure period - TAC of 110,000 t (since Rec. 11-01) - Specific authorization to fish for tropical tunas for vessels 20 meters or greater - Prohibition of discarding from purse seine - Specific limits on FADs, non-entangling FADs required		

[1] Median of 4,000 Monte Carlo iterations of the Stock Synthesis base case
[2] Provisional and subject to revision as of 26 September 2024.
[3] Median and 80% confidence intervals are shown
[4] As estimated from the Kobe plot probability in each quadrant

Table 2. Estimated catches and discards of Atlantic yellowfin tuna by gear, for the period 1999-2023.

YFT-Table 1. Estimated catches (t) of Yellowfin tuna (Thunnus albacares) by gear and year (1994-2023)
YFT-Tableau 1. Prises estimées (t) de Albacore (Thunnus albacares) par et année (1994-2023)
YFT-Tabla 1. Capturas estimadas (t) de Rabil (Thunnus albacares) por arte y año (1994-2023)

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TOTAL		172763	154552	148697	136653	144076	134165	131964	152905	136464	123236	119574	105091	105912	102844	111874	117915	117424	113186	114389	107007	115698	129859	150311	136863	135914	136213	153913	122367	149098	139529
Landings	Bait boat	22590	18687	15810	16804	19591	21808	16584	19522	17407	13720	19379	13407	15187	15099	10342	10080	10741	14531	10328	8350	9872	9983	11100	8710	8016	7676	7180	6463	8566	6513
	Longline	27080	25322	26589	21985	25812	26670	27266	23079	17793	19394	29705	25393	22723	29545	22342	22097	20051	18964	19006	16398	14475	14362	17989	16292	16261	17644	16110	13551	16790	26043
	Other surf.	7282	6745	6946	6339	5578	6481	7274	7128	5478	8911	7891	7176	8655	5547	2987	3261	3727	3951	6510	11213	14134	16068	19559	23043	19392	16814	26503	19077	24590	19564
	Purse seine	112752	101289	98539	90030	91607	77257	78789	102789	95465	79905	61064	58061	58595	51812	75189	81045	81886	74131	76665	69711	75813	88138	100133	87885	91203	93061	108958	82225	97637	86070
Landings(FP)	Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
	Purse seine	3059	2509	813	1495	1488	1781	2051	387	321	1305	1535	1054	747	836	1008	1423	1012	1601	1872	1332	1401	1168	1528	867	991	992	1116	1005	1459	1298
Discards	Bait boat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Longline	0	0	0	0	0	167	0	0	0	0	0	0	5	6	5	9	8	9	8	3	3	3	3	4	11	9	25	26	26	33
	Other surf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Purse seine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137	0	63	40	17	20	19	25	2

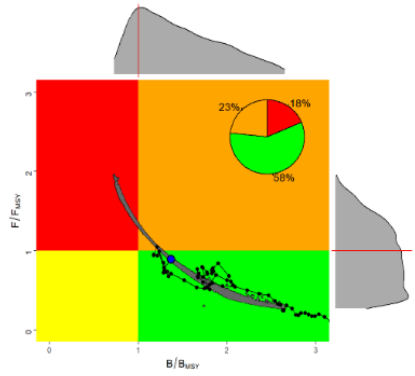

Figure 1. Kobe plot for the Atlantic yellowfin tuna stock status in 2022, estimated during the 2024 yellowfin stock assessment (ICCAT, 2024). Gray dots are the 4,000 Stock Synthesis model runs; the blue circle is the median of these runs and marginal histograms represent the distribution of either SSB/SSB_{MSY} or F/F_{MSY}. The black line indicates the stock status trajectory starting in 1958. The inserted pie indicates the probability of the stock being within each Kobe color quadrant.

Outlook

In summary, 2022 stock biomass was estimated to be about 37% above B_{MSY} (not overfished) and fishing mortality rates were about 11% below F_{MSY} (no overfishing). Projections conducted in 2024 considered a number of constant catch scenarios. In most cases, catches less than 125,000 t led to, or maintained, a healthy stock status through 2034.

Management recommendation

The results from 4,000 Monte Carlo iterations of the Stock Synthesis base model were summarized to produce estimated probabilities of achieving the Convention objectives ($B>B_{MSY}$, $F<F_{MSY}$) for a given level of constant catch, for each year up to 2034 (**Table 3**). The Committee reiterated concern that current catch levels, averaging nearly 140,000 t over the last 5 years, are expected to result in overfishing and lead to an overfished status if they continue. Furthermore, given that the TAC has been exceeded continuously by substantial amounts, existing conservation and management measures appear to be insufficient to limit harvest. The Committee recommends that the Commission establish a mechanism to ensure that the catches of YFT do not exceed any adopted TAC. The Commission should also be aware that increased harvests on FADs could have negative consequences for yellowfin and bigeye tuna, as well as other by-catch species[1]. Should the Commission wish to increase long-term sustainable yield, the Committee continues to recommend that effective measures be found to catches associated with floating objects (FOBS) and other fishing mortality of small yellowfin tuna.

Table 3. Kobe II matrices giving the joint probability that: a) $F<F_{MSY}$; b) $B>B_{MSY}$; and c) both $F<F_{MSY}$, $B>B_{MSY}$ and the joint probability of $F<F_{MSY}$ and $B>B_{MSY}$, for given years, for various constant catch levels based on model results.

a) Probability that $F<F_{MSY}$

Catch	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0kt	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
100kt	92%	91%	90%	89%	89%	89%	88%	88%	88%	88%
105kt	90%	89%	87%	86%	85%	85%	84%	83%	83%	82%
110kt	88%	86%	84%	82%	81%	80%	79%	77%	76%	75%
115kt	86%	83%	81%	79%	76%	74%	72%	70%	68%	67%
120kt	83%	80%	77%	74%	71%	67%	65%	63%	62%	61%
125kt	81%	77%	73%	69%	65%	62%	60%	58%	56%	55%
130kt	78%	74%	68%	64%	60%	57%	55%	53%	51%	49%
135kt	75%	70%	64%	60%	56%	53%	50%	48%	46%	44%
140kt	71%	66%	61%	56%	51%	48%	45%	44%	42%	41%
145kt	68%	63%	57%	52%	48%	44%	42%	41%	39%	38%
150kt	65%	60%	54%	48%	44%	42%	39%	38%	36%	35%
155kt	62%	56%	51%	45%	42%	39%	37%	35%	34%	33%
160kt	60%	54%	47%	43%	39%	36%	34%	33%	31%	30%

b) Probability that $B>B_{MSY}$

Catch	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0kt	93%	94%	97%	99%	100%	100%	100%	100%	100%	100%
100kt	90%	87%	86%	85%	85%	85%	85%	85%	84%	84%
105kt	89%	87%	85%	84%	83%	82%	81%	81%	80%	80%
110kt	89%	86%	84%	82%	81%	79%	78%	76%	75%	74%
115kt	89%	86%	83%	81%	78%	76%	74%	72%	69%	67%
120kt	89%	85%	82%	78%	75%	72%	69%	66%	64%	62%
125kt	89%	85%	81%	76%	72%	68%	64%	61%	59%	57%
130kt	89%	84%	80%	74%	70%	64%	60%	57%	54%	52%
135kt	88%	84%	78%	72%	66%	60%	56%	53%	50%	48%
140kt	88%	84%	77%	70%	63%	57%	53%	49%	46%	44%
145kt	88%	83%	76%	68%	59%	54%	49%	45%	43%	41%
150kt	88%	82%	74%	66%	56%	50%	46%	43%	40%	38%
155kt	87%	82%	73%	63%	54%	47%	43%	40%	38%	36%
160kt	87%	81%	72%	61%	51%	44%	41%	37%	35%	34%

c) Probability that $F<F_{MSY}$ and $B>B_{MSY}$

Catch	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
0kt	93%	94%	97%	99%	100%	100%	100%	100%	100%	100%
100kt	90%	87%	86%	85%	85%	85%	85%	85%	84%	84%
105kt	89%	87%	85%	84%	83%	82%	81%	81%	80%	80%
110kt	88%	86%	84%	82%	80%	79%	78%	76%	75%	74%
115kt	86%	83%	81%	79%	76%	74%	72%	70%	68%	66%
120kt	83%	80%	77%	74%	71%	67%	65%	63%	62%	61%
125kt	81%	77%	73%	69%	65%	62%	60%	58%	56%	55%
130kt	78%	74%	68%	64%	60%	57%	55%	53%	51%	49%
135kt	75%	70%	64%	60%	56%	53%	50%	48%	46%	44%
140kt	71%	66%	61%	56%	51%	48%	45%	44%	42%	41%
145kt	68%	63%	57%	52%	48%	44%	42%	41%	39%	38%
150kt	65%	60%	54%	48%	44%	42%	39%	38%	36%	35%
155kt	62%	56%	51%	45%	42%	39%	37%	35%	34%	33%
160kt	60%	54%	47%	43%	39%	36%	34%	33%	31%	30%

[1] Second Meeting of the Ad Hoc Working Group on FADs (*Bilbao, Spain, 14-16 March 2016*) (SCRS/2016/003).

Additional supporting information

Numerous changes have occurred in the yellowfin fisheries over time. Associated changes in the impact (i.e. overall fishing mortality) of the fleets are apparent, including the decreased impact of the longline fisheries since the 1960s, the concurrent increase of early PS fisheries, the transition from PS-free school toward FOB associated fishing beginning, around 1990, and the recent increase by a new Brazilian "vessel associated-school" handline fishery operating in the western Atlantic. These catches increased nearly nine-fold from 1,570 t in 2012 to about 14,000 t in 2023 (**Figure 2**).

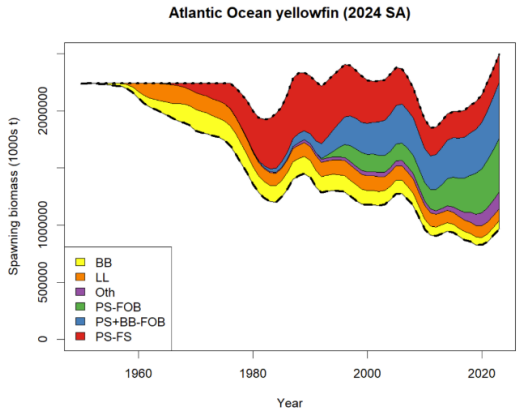

Figure 2. Impact plots represent the relative impact of each gear on the spawning biomass of the stock. Colored areas represent model predicted increases in spawning biomass when catches of each gear are eliminated from the historical catches. The estimated unfished spawning biomass (dotted line) varies with recruitment deviations. The historical SSB trajectory, estimated by the stock assessment model, is indicated with a dashed line. The codes PS FOB and PS+BB-FOB represent the purse seine fisheries operating on FOB/FADs. The code PS+BB-FOB reflects that these purse seine fleets have operated in association with baitboats (BB) in the past. The free school refers to the purse seine operations on free school banks.

Ages up to 18 years have been observed in the Gulf of Mexico, the western Atlantic and the Ascension Islands using annual otolith increment counts which were validated using 14C bomb radiocarbon and/or oxytetracycline (OTC). Tagging studies of yellowfin in the Pacific and Indian Oceans suggest that natural mortality is age-specific, and higher for juveniles than for adults. Age-specific M estimates were updated in 2024 based on new research. In the 2024 assessment, the age-specific vector of M incorporated uncertainty unlike in 2019 when a fixed vector was used for M (**Figure 3**). The maximum age assumption remains as in the previous assessment, 18 years of age.

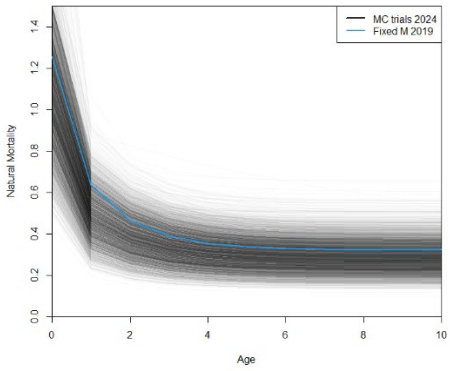

Figure 3. Age-specific natural mortality vectors used in the 2024 stock assessment (ICCAT, 2024), based on Hamel and Cope (2022) and in the previous assessment (2019) based on Then *et al.* (2015). Both were computed assuming a maximum age of 18.

Three indices of abundance were used in stock assessment model runs to develop management advice (**Figure 4**), the joint-CPC tropical Atlantic (region 2) longline index (1979-2022), the acoustic echosounder

buoy index associated with FOBs (2010-2022) and the purse seine free school index (1993-2022). Indices that reference adult biomass (the joint-LL and the purse seine free school index) have disparate trends. The joint-LL suggests the biomass of adult yellowfin tuna has remained generally stable or increased since 2019 while the purse seine free school index suggests a decline. The acoustic buoy index references juvenile yellowfin abundance in the eastern Atlantic and suggests a modest increase since 2012.

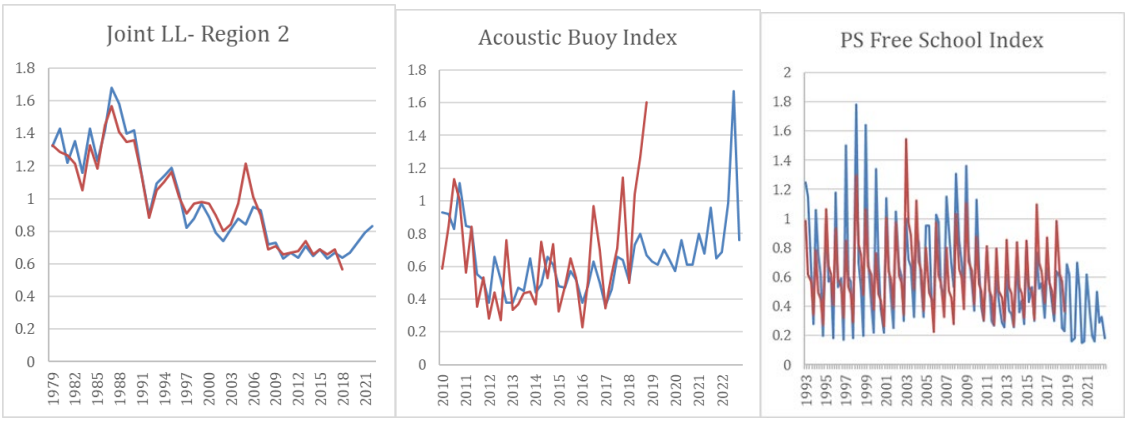

Figure 4. Standardized indices of Atlantic yellowfin tuna relative abundance fit within Stock Synthesis; the joint-CPC tropical Atlantic (region 2) longline index (1979-2022), the acoustic echosounder buoy index associated with FOBs (2010-2022) and the purse seine free school index (1993-2022). The red lines show the index used in the 2019 assessment, and the blue line shows the updated index provided for the 2024 assessment. Note: PS Free School index was estimated on a quarterly basis while the others are annual.