Original: English

EXPLANATORY NOTE

(*submitted by the SCRS Chair*)

The SCRS has been discussing modifying the format of executive summaries and detailed reports to improve the communication with the Commission. The following document presents a draft, not yet fully approved by the SCRS, of the type of changes that are being considered. This document is presented for the information of the Commission in order to encourage feedback about the idea of shortening the executive summaries from the current versions that can be seen in the latest report of the Annual Report of the SCRS (PLE-104), to the kind of summary presented in this document. Feedback is requested not about the details contained in this document, but rather about whether the Commission is interested in:

1) Having an initial section in the SCRS Annual Report with a table of indicators summarizing the information contained for all stocks (Status summary table).

2) Having executive summaries that are 2-3 pages in length, with additional information about the stocks included as an Appendix to the SCRS Annual Report.

This document contains new text (underlined) to the current guidelines of executive summaries and detailed reports, a draft example of such initial section of SCRS Annual Report and a draft example of a shortened yellowfin tuna Executive Summary and of the additional supporting information that would be included as an Appendix of the SCRS Annual report.

REVISED PUBLICATION GUIDELINES: EXECUTIVE SUMMARIES AND DETAILED REPORTS

Effective communication of the work of the SCRS is of great importance to the Commission. The following guidelines seek to provide guidance to SCRS officers on the reports they prepare for the Commission. These guidelines seek to help in the development of comprehensive detailed reports of intersessional meetings and concise Executive Summaries. Guidelines also seek to improve communication with the Commission by preparing Executive Summaries that highlight the most relevant science for the Commission.

Rapporteurs of Species Groups are responsible for the preparation of: (1) draft Executive Summary of the Species Group; (2) final version of the Detailed Report of the Species Group; and (3) electronic record containing all of the input files, software used in the analyses, and all of the outputs of the analyses. Rapporteurs are requested to conform to deadlines and follow the appropriate format and guidelines given below.

1. Deadlines

A draft Executive Summary and adopted intersessional assessment reports should be provided to the Secretariat after the completion of a new stock assessment. Adoption of reports by the Working Group after the intersessional meetings are the sole responsibility of the Rapporteur. The Rapporteur should endeavor to complete the report as soon as possible after the intersessional meeting not to delay its publication. The electronic record (inputs/outputs) used during the stock assessment meeting should also be provided to the Secretariat immediately after the completion of the stock assessment session. Additional electronic records of analyses conducted after the stock assessment meeting should be provided to the Secretariat immediately after these analyses have been completed. Note that final adoption of the Executive Summary and the intersessional reports by the SCRS takes place at the end of the plenary session. Although the content of the intersessional reports is presented at the plenary, the plenary is not intended to review the detailed content of the report, however, any errors in such reports can be identified and corrected during the plenary.

Document type	Submitted to Secretariat by	Deadlines		Notes
		Document for distribution	Final corrections	
Executive Summary*	Rapporteur	End of Stock Assessment Session (and at least 48 h before the SCRS Plenary)	On the same day as SCRS review	Draft reviewed and adopted by the SCRS Plenary
Detailed Report**	Rapporteur	End of Stock Assessment Session***	End of SCRS Plenary***	Adopted by Species Group; **not** discussed at the SCRS Plenary, adopted by the SCRS Plenary
Electronic record of stock assessment session	Rapporteur	End of the SCRS Plenary	n/a	All of the input files, programmes used in the analyses, and all of the outputs of the analyses should be archived electronically

* Published in the Biennial Report series.

** Published in the Collective Volume series.

*** Adoption of reports completed/corrected after these deadlines is the sole responsibility of the Rapporteur, and their distribution/publication may be delayed.

2. Executive Summary of the Species Group (translated for SCRS Plenary and Biennial Report)

The Executive Summary of Species Group is the report for the sections on species stock evaluation in the SCRS Report. It contains the stock status advice for the ICCAT stocks. The Executive Summary for the SCRS

Report should be as concise as possible and follow Res. 11-14, namely by including a:

- Statement characterizing the robustness of methods applied to assess stock status and to develop the scientific advice;
- Kobe II strategy matrix indicating the probability of $B>B_{MSY}$ and $F<F_{MSY}$ for different levels of catch across multiple years;
- Kobe plot chart showing management reference points expressed as $F_{Current}$ on F_{MSY} (or a proxy) and as $B_{Current}$ on B_{MSY} (or a proxy), the estimated uncertainty around current stock status estimates and the stock status trajectory.

Additionally, the report should summarize the facts and new findings. Substantial changes to methodologies used for previous assessments should be noted. The term "the Committee" is used in Executive Summaries to refer to the SCRS Plenary and should be reserved for strong recommendations.

2.1 Format for Executive Summaries

A template/format was established in 1995, which has been revised in 2018 by the SCRS. Rapporteurs are requested to follow the appropriate format and guidelines given below. However, some flexibility may be accepted as regards those stocks for which it may not be possible to provide some of the information listed below (e.g. stocks for which data poor models are used for the provision of advice).

Executive Summary Outline	**Maximum # pages*** (2 pages)
Introduction	1/4
Summary table	1/2 (including resumed catch table)
Stock status	1/4
Outlook	1/4 + 1/4 figure (Kobe plot including)
Management recommendations	1/4 + 1/4 HCR table
Additional supporting information	**Maximum # pages*** (2 pages)
Summary table on biology aspects	1/2
Summary table on fisheries indicators	1/2 + 3 figures [Geographic distribution cumulative catch (t) by gear and year + Total annual catch by gear and flag) + CPUE indices + 1 table (Total annual catch by gear and flag]
Status of the stock (additional info)	1/2 + 2 figures (Estimates of relative abundance and fishing mortality per year from base case/combines models)
Outlook (additional info)	1/2+ 2 figures (projections of relative abundance and fishing mortality from base case/combined models)
Summary table on Effects of current regulations	1/2

* Where multiple stocks are presented in one Executive Summary, the length of the report may be expanded proportionally at the discretion of the SCRS Chairman.

2.2 Tables and figures for Executive Summaries

There will be **three tables** only in the Executive Summary: a Summary table placed at the beginning of the Executive Summary, the reported catches by year and gear and, when applicable, a third table with the estimated probabilities (%) that both the fishing mortality is below F_{MSY} and spawning stock biomass is above SSB_{MSY} derived from the base case/combined model(s) placed at the end of the Executive Summary. The Summary table will summarize the status of the resource and state what the management objective is and where the stock is in relation to that benchmark, including the Kobe plot coloring codes. There should be flexibility in the choice of the benchmark(s) used and this is best determined by the Species Group. Please see below the **headings** for the **Executive Summary SPECIES SUMMARY table:**

SPECIES SUMMARY		
Indicator		***Year (stock status)***
Maximum Sustainable Yield[1]	xxxx t (xxxx-xxxx)[3]	
Current (year) TAC	xxxx t	
Current (year) Yield[2]	xxxx t	
Yield in last year used in assessment (year)	xxxx t[4]	
B_{MSY}	xxxx (xxxx-xxxx)	**2018**
F_{MSY}	x.xx (x.xx-x.xx)	(cell to be filled with the corresponding colour quadrant key; grey if stock not assessed or status uncertain)
Relative Biomass (B_{year}/B_{MSY})	x.xx (x.x-x.xx)	
Relative Fishing Mortality (F_{year}/F_{MSY}[1])	x.xx (x.x-x.xx)	
Stock Status	Overfished: YES or NO Overfishing: YES or NO	
Management Measures in Effect	(as appropriate)	

[1] Base case/combined model: model results based on catch data from year-year.
[2] Provisional and subject to revision.
[3] Point estimate, 80% bias corrected confidence intervals are shown.
[4] As of dd mm yyyy.

Colour key	Stock overfished (B_{YEAR}/B_{MSY} <1)	Stock not overfished (B_{YEAR}/B_{MSY} ≥1)
Stock subject to overfishing (F_{YEAR}/F_{MSY} >1)		
Stock not subject to overfishing (F_{YEAR}/F_{MSY} ≤1)		
Not assessed/Uncertain		

A single standardized figure will be included, showing the stock status trajectory (Kobe plot) from the base case/combined model(s), including a pie chart representing the probabilities of stock in the different colour quadrants.

2.3 Additional supporting information

Additional supporting information can be added as an Appendix to the Executive Summaries, such as relevant biological parameters and fisheries indicators summarized in tables. Additionally, a brief description of the Stock Status (1/4 of a page), Outlook (1/4 of a page) and Effects of Current Regulation (1/4 of a page) can be added, together with relevant figures and a table. The following figures shall be included: Geographic distribution of species cumulative catch (t) by gear, in the Convention area, shown on a decadal scale; Graph of the reported catches (and TAC when applicable). Additionally the following figures shall be included whenever available: Yearly abundance indices (CPUE indices) used in the assessment; Trends in relative biomass and fishing mortality from the base case/combined model(s); Plots of the ratios of stock biomass to B_{MSY} and fishing mortality rate to F_{MSY} from the base case; Projections of the relative biomass (B/B_{MSY}) and fishing mortality (F/F_{MSY}) for the projected stock based on the base case/combined model(s) under different catch scenarios. Kobe matrices for probabilities of not overfishing and not being overfished. A table with the estimated catches by gear and flag shall also be included. All of the figures and the table must have a clear caption, which shall be standardized to the extent possible.

3. Detailed Report of the Species Group

(Original language(s) for the SCRS Plenary; text translated for the *Collective Volume of Scientific Papers* series)

The purpose of the Detailed Report is to provide a detailed record of the stock assessment session, to document the methodologies used and their assumptions, and any changes from the methodologies used in previous assessments and the rationale for the changes, as well as the results. The term "the Group" is used in Detailed Reports to refer to the participants. As this is a record of the meeting, **it should be completed and adopted by the close of the stock assessment session**. Once adopted the compilation of the report is the responsibility of the Rapporteur. Adoption of reports completed after the intersessional meetings are the sole responsibility of the Rapporteur, and their distribution by the Secretariat may be delayed.

3.1 Format for Detailed Report

The format below was established in 1995, revised in 2003, and should remain flexible. As the Detailed Report text is translated for the Collective Volume series and to prevent over-wordy documents, size limits were introduced in 2003. For consistency across species, the following format should be followed, but can vary (within the mandatory headings 1-8) for individual species:

Detailed Report Outline	***# Pages***
	(11-page max)
1. Opening, adoption of agenda and meeting arrangements	¼
2. Description of fisheries (this often contains a fleet-by-fleet description)	1*
3. State of the stocks	½*
4. Stock structure	
4.1 Catch-at-size data	½*
4.2 Catch rate data	1½*
5. Biological population parameters	½*
6. Effects of environmental factors	½*
7. Stock assessment methods	2
8. Stock assessment model results	
8.1 Synthesis of assessment results	1*
8.2 Projections	½*
8.3 Other uncertainties not considered in assessment	½*
9. Effects of current regulations	½*
10. Recommendations	
10.1 Statistics and research	½*
10.2 Management	½*
11. Other matters	½
12. Report adoption and closure	⅛
Tables**	No limit
Figures**	No limit
Appendices**	No limit

* # Pages per stock
** Not translated

For other sessions (*i.e.*, GFCM, Methods Working Group), the 11-page maximum will remain, but the headings will be at the discretion of the Chairman.

3.2 Tables and figures for Detailed Report (not translated for the Collective Volume series)

Tables and figures are placed after the text. They should be drafted clearly, with the knowledge that they may be reduced in the final version for the Collective Volume.

Titles of tables should be placed above the table, whereas figure captions should be placed below the figure. If possible, the source of the tables and figures (*i.e.*, the document from which they were taken) should be indicated in parentheses, unless the figures and tables were created by the Group.

All tables and figures should be numbered in consecutive order.

3.3 Appendices for Detailed Report (not translated for the Collective Volume series)

The Appendices will be placed after the text, tables and figures. The Agenda, List of Participants and List of Documents will be the first 3 Appendices. Additional appendices may be added, in exceptional circumstances, and may contain more detailed aspects of the analyses.

4. SCRS Plenary meeting report

The purpose of the SCRS Report is to provide to the Commission the management advice derived from the stock assessment session(s), to respond to questions from the Commission, inform on the activities carried out throughout the year and propose the work plan for the forthcoming year. It is therefore important that the Commission is provided with an Executive Summary of the SCRS report, particularly summarising the Management Advice and the Status for the species under the ICCAT mandate. Other recommendations from the SCRS shall also be summarized in the Executive Summary of the SCRS report, as well as the work plan timetable. These summaries shall be included immediately after the Table of Contents of the report, in a standardized format as follows:

List of acronyms

ACAP	Agreement on the Conservation of Albatrosses and Petrels
aFAD	Anchored fish aggregating device
ALB	Albacore
ALB SG	Albacore Species Group
ASPIC	A Stock-Production Model Incorporating Covariates
Atl-ALB	Atlantic Albacore
Atl-SWO	Atlantic Swordfish
B	Biomass (total)
BB	Baitboat
BET	Bigeye tuna

Status summary for tuna and tuna-like species

Stock/ Species	Most recent indicators		2011	2012	2013	2014	2015	Advice to the Commission
Stock Species (*Species name*)	MSY (80% CI):	xx,xxx t (xx,xxx - xx,xxx)						.....
	Current (2014) TAC:	xx,xxx t						
	Current (2014) Yield:	xx,xxx t						
	B_{MSY} (80% CI)	xx,xxx t (xx,xxx - xx,xxx)						
	F_{MSY} (80% CI)	xx,xxx t (xx,xxx - xx,xxx)						
	B_{year}/B_{MSY}	x.xx (x.xx - x.xx)						
	F_{year}/F_{MSY}	x.xx (x.xx - x.xx)						

Note: The cells corresponding to the last five previous years shall be coloured according to the stock status colour key.

5. Electronic record of stock assessment session

All of the input files, programmes used in the analyses, and all of the outputs of the analyses should be archived electronically. This will ensure the repeatability of the stock assessment. If the version of the programs used for the assessment analyses is recorded, its contents can be examined in the future. This will improve the accountability of the SCRS and allow all scientists access to the programs and outputs. This will also enable scientists to use state-of-the-art programs that may still be undocumented. However, as a courtesy to other scientists, every effort should be made by participating scientists to provide documentation for their programs so that it may be included in the ICCAT assessment program catalogue.

The master copies of all electronic files will remain with the Secretariat.

6. General notes on formats

Please use examples from the recent Biennial Reports and Collective Volume series as general guidelines. Please note the following:

Software:	Please prepare in MSWord. Paper: A4
Font:	Final documents should be in Cambria 10.
Margins:	2.5 cm r, l, t, b and 1.5 cm headers, 2 cm footers.
Font for Tables (data and text):	Calibri 10
Paragraphs:	Insert a space between paragraphs (ICCAT no longer uses paragraph indents).
Tonnes:	Metric tonne is abbreviated as "t" (no longer MT).

EXAMPLE OF NEW EXECUTIVE SUMMARY (YFT – YELLOWFIN TUNA)

A stock assessment was conducted for yellowfin tuna in 2016, applying three age-structured models and a non-equilibrium production model to the available catch data through 2014. Management advice was developed using a joint distribution of the results of seven models (ASPIC Cluster 1; ASPM-Clusters 1 and 2, VPA Clusters 1 and 2, SS Clusters 1 and 2) which were weighted equally. A detailed summary of the state of knowledge on yellowfin tuna can be found in document (SCRS/2016/207). A summary of the stock status is provided below (**Table 1**). **Table 2** provides estimated catches by gear, for the period 1990-2014. The Kobe Phase Plot and summary of current status estimates is summarized in **Figure 1**. **Table 3** provides estimated probabilities (%) that both the fishing mortality is below F_{MSY} and spawning stock biomass is above SSB_{MSY}.

Table 1. Atlantic yellowfin tuna (*Thunnus albacares*) summary table.

ATLANTIC YELLOWFIN TUNA SUMMARY		
Indicator		***2016 stock status***
Maximum Sustainable Yield[1]	126,304 t (119,100 - 151,255 t)[1]	
Current (2014) TAC	110,000 t	
Current (2015) Yield[2]	110,300 t	
Yield in last year used in assessment (2014)	108,910 t	
B_{MSY}	N/A	
F_{MSY}	N/A	
Relative Biomass (B_{2011}/B_{MSY})	0.95 (0.71-1.36)[1]	
Relative Fishing Mortality (F_{2011}/F_{MSY}[1])	0.77 (0.53-1.05)[1]	
Stock Status	Overfished: YES Overfishing: NO	
Management Measures in Effect	[Rec. 14-01]: Time-area closure for FAD associated surface fishing TAC of 110,000 t Specific authorization to fish for vessels 20 meters or greater Limits of number of LL and/or PS boats for a number of fleets [Rec. 15-01: Same as [14-01], except Revised time-area closure for FAD associated surface fishing Specific limits on FADs, non-entangling FADs required	

NOTE: $F_{current(2014)}$ refers to F_{2014} in the case of ASPIC, ASPM and SS, and the geometric mean of F across 2011-2013 in the case of VPA. Relative biomass is calculated in terms of spawning stock biomass in the case of ASPM, SS and VPA and in total biomass in the case of ASPIC.

[1] Median (10^{th}-90^{th} percentiles) from joint distribution of age-structured and production model bootstrap outcomes considered.

Color key	Stock overfished (B_{year}/B_{MSY} <1)	Stock not overfished (B_{year}/B_{MSY} ≥1)
Stock subject to overfishing (F_{year}/F_{MSY} >1)		
Stock not subject to overfishing (F_{year}/F_{MSY} ≤1)		
Not assessed/Uncertain		

Table 2. Estimated catches of Atlantic yellowfin tuna by gear, for the period 1990-2014.

				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TOTAL				193604	167523	163770	163451	173744	154588	149152	137375	144496	136325	132154	153455	134427	122448	119445	101745	104659	95963	106716	113438	108981	102783	104528	97269	96988
	ATE			160873	130626	126058	124706	125530	119314	116096	105034	113576	105615	96531	113132	104767	97467	88207	75677	76388	71795	88593	94661	88187	85105	84678	77790	82109
	ATW			32731	36897	37712	38745	48215	35274	33056	32341	30919	30710	35623	40323	29660	24982	31238	26068	28272	24167	18123	18777	20794	17678	19851	19479	14879
Landings	ATE		Bait boat	19648	17693	15095	18471	15652	13496	11365	12695	14265	16729	10022	14034	11145	9967	14639	9725	12490	7044	7253	7424	6879	9118	6297	4731	6176
			Longline	10253	9082	6518	8537	14638	13723	14236	10483	13872	13561	11369	7570	5869	9183	11537	7317	7234	13437	8562	7385	5544	6602	5510	5659	5283
			Other surf.	2175	3748	2450	2122	2030	1989	2065	2136	1674	1580	2424	2074	1624	2309	2699	2152	2988	2534	1693	3012	1890	1397	1964	2941	1450
			Purse seine	127673	97182	99532	92130	90151	87597	87616	78225	82278	71964	70664	89068	85808	74702	57797	55429	52928	47944	70077	75417	72006	64966	69034	63126	67798
	ATW		Bait boat	4718	5359	6276	6383	7094	5297	4560	4275	5511	5364	6753	5315	6009	3764	4868	3867	2695	2304	886	1331	1436	2311	1108	1403	493
			Longline	18963	14100	17336	12129	11790	11185	11882	11554	11671	13326	15760	14872	11921	10166	16019	14449	14249	13557	13192	12782	13038	10677	12558	12308	8384
			Other surf.	2250	3024	2741	4152	9719	12454	5830	4801	4581	5330	5241	7027	3763	6445	7134	5118	6880	5959	1973	3285	3590	2425	2885	2130	3418
			Purse seine	6800	14414	11359	16081	19612	6338	10784	11710	9157	6523	7870	13108	7966	4607	3217	2634	4442	2341	2067	1370	2722	2256	3292	3635	2581
Landings (FP)	ATE		Purse seine	1124	2921	2463	3447	3059	2509	813	1495	1488	1781	2051	387	321	1305	1534	1054	747	836	1008	1423	1869	3021	1872	1332	1401
			Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0
	ATW		Longline	0	0	0	0	0	0	0	0	0	167	0	0	0	0	0	0	5	6	5	9	8	9	7	3	3
			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

Stock status

A full stock assessment was conducted for yellowfin tuna in 2016, applying three age-structured models and a non-equilibrium production model to the available catch data through 2014. Models used to develop management advice considered two primary sources of scientific uncertainty, the use of index clusters that reflect two disparate hypotheses regarding trends in abundance of yellowfin tuna, and alternative model structures as implemented using four model platforms. Surplus production models that used Cluster 2 indices did not converge and were not considered. Management advice was developed using a joint distribution of the results of seven models (ASPIC Cluster 1; ASPM-Clusters 1 and 2, VPA Clusters 1 and 2, SS Clusters 1 and 2) which were weighted equally. Additional uncertainties in growth, age-slicing, mortality, index selection and data weighting were explored in sensitivity runs.

When the uncertainty around the point estimates from all models is taken into account, there was an estimated 45.5% chance that the stock was healthy (not overfished and overfishing not occurring) in 2014, a 41.2% probability that the stock was overfished, but not experiencing overfishing, and a 13.3% chance that the stock was both overfished and undergoing overfishing (**Figure 1**).

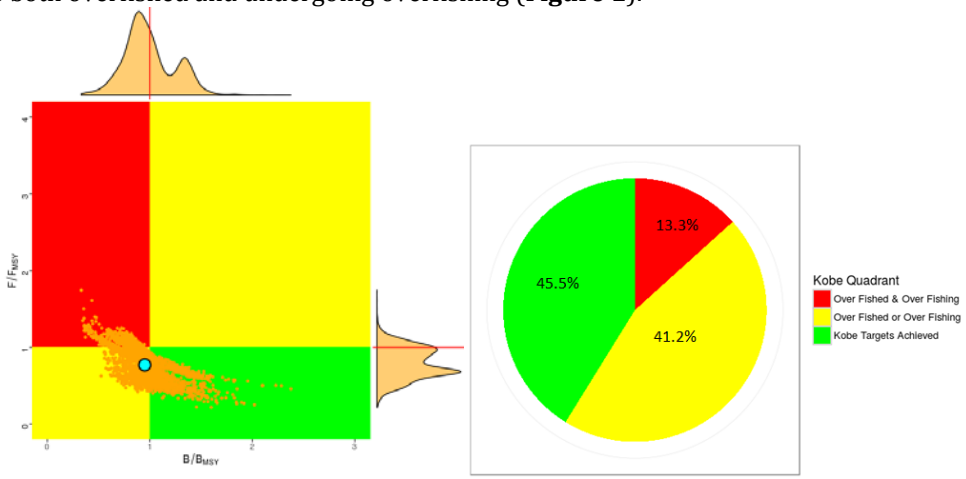


Figure 1. Kobe Phase Plot and marginal density for all models (used to develop management advice) combined (left) and summary of current status estimates for the yellowfin tuna stock based on age structured and production models making use of the catch and effort data through 2014 (right).

Outlook

In summary, 2014 stock biomass was estimated to be about 5% below B_{MSY} (overfished) and fishing mortality rates were about 23% below F_{MSY} (no overfishing). Projections conducted in 2016 considered a number of constant catch scenarios. In most cases, catches less than 120,000 t led to, or maintained a healthy stock status through 2024.

Management recommendation

The results from seven models 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 2024 (**Table 3**). Maintaining catch levels at the current TAC of 110,000 t is expected to maintain healthy stock status ($B>B_{MSY}$, $F<F_{MSY}$) through 2024 with at least 68% probability, increasing to 97% by 2024. This result is similar to the previous assessment result (2011) which indicated that catch levels of 110,000 t were expected to lead to, or maintain healthy stock status through 2017 with a at least 64% probability, and with a 77% by 2024.

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 reduce FAD-related and other fishing mortality of small yellowfin tuna.

Table 3. Kobe II matrices giving the joint probability that both $F<F_{MSY}$ and $B>B_{MSY}$, in given years, for various constant catch levels based on combined model results.

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

TAC	2017	2018	2019	2020	2021	2022	2023	2024
60,000	75%	91%	99%	99%	99%	99%	100%	100%
70,000	74%	87%	97%	99%	99%	99%	99%	99%
80,000	73%	86%	96%	99%	99%	99%	99%	99%
90,000	71%	82%	91%	97%	99%	99%	99%	99%
100,000	70%	80%	89%	92%	96%	97%	99%	99%
110,000	68%	78%	85%	90%	92%	95%	96%	97%
120,000	65%	73%	79%	78%	79%	80%	82%	82%
130,000	57%	59%	61%	61%	57%	54%	50%	48%
140,000	45%	44%	38%	33%	31%	31%	31%	30%
150,000	31%	24%	21%	20%	19%	20%	20%	20%

Note: SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 50,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.

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

EXAMPLE OF ADDITIONAL SUPPORTING INFORMATION

(to be included as an Appendix to the SCRS report)

The information below was collated from reports of the Atlantic yellowfin tuna Species Group and other sources as cited.
[…]
Table 1. Summary table on yellowfin tuna biology aspects.

Parameter	Description
Distribution range and stock structure	This species is cosmopolitan, and is distributed in open waters of tropical and subtropical areas of the three oceans. Distinct spawning areas are noted, which might imply separate stocks, or substantial heterogeneity in the distribution of yellowfin tuna. Currently, a single Atlantic stock is assumed based on information such as observed transatlantic movements indicated by conventional tagging and longline catch data. However, movement rates and timing, routes, and local residence times remain highly uncertain. In addition, some electronic tagging studies in the Atlantic as well as in other oceans suggest that there may be some degree of extended local residence times and/or site fidelity.
Feeding and habitat use	In areas where the concentration of oxygen is not a limiting factor, the distribution of yellowfin tuna in the water column is not set by the depth or the temperature, but by the relative change in water temperature with depth (Block *et al*. 1997, Brill *et al*. 1999). Yellowfin tuna generally limit incursions into depths in which the water temperature does not fall more than 8º C with respect to the temperature of the surface layer, and spend more than 90% of their time in waters with a uniform temperature of around 22º C (Brill *et al*. 1999, Brill *et al*. 2005). According to a study by Bard *et al*. (1999), the yellowfin tuna can reach depths of 350 m; however, both adult and juvenile yellowfin tuna spend most of their time in the surface layer, above 100 m. (Brill *et al*. 1999). Juvenile yellowfin tuna are mainly limited to surface waters, while larger fish form schools in surface and sub-surface waters.
Maximum size/weight and longevity	Max. weight: reaching weights of 200 kg; Longevity: believed to live up to 11 years.
Spawning and size at first maturity	Spawning: Spawning on the main fishing grounds, the equatorial zone of the Gulf of Guinea, occurs primarily from December to April. Spawning also takes place in the Gulf of Mexico, the southeastern Caribbean Sea and off Cabo Verde, although the peak spawning can occur in different months in these regions. The relative importance of the various spawning grounds is unknown. Growth: Growth rates are thought to be relatively slow initially, increasing at the time the fish leave the nursery grounds. Questions remain concerning the most appropriate growth model for Atlantic yellowfin tuna, as analyses of hard part growth increments support somewhat different growth patterns. Maturity: Size at 50% maturity was estimated at 103.9 cm fork length.
Conversion factors	Size – Weight: $W = 2.153 \times 10^{-5} * LF^{2.976}$ Caverivière (1976) Atlantic Weight – Weight: $RWT = 1.13 \times GWT$ Morita (1973) Size – Size: logLF = 1.183logLDi + 0.269 Caverivière (1976)
Other	

SWO-ATL-2. Fishery indicators

Table 2. Summary table on yellowfin tuna fisheries indicators.

Parameter	Description
Catch distribution range	Typically caught in coastal and off-shore areas in tropical and sub-tropical waters, but also from 45ºN to 45ºS, the species is available to a large number of fishing countries (**Figure YFT-1**).
Annual catches	**Table YFT-1** provides estimated catches of Atlantic yellowfin tuna by gear and flag, for the period 1990-2014. **Figure YFT-2** shows total estimated catches, by major gear, for Atlantic for the period 1950-2014.
Main fishing gears and fisheries	Yellowfin tuna are exploited by three major gears (longline, baitboat and purse seine fisheries) and by many countries throughout its range. In the eastern Atlantic, there is also an important "faux-poisson" fishery that harvests mostly small tropical tunas and other "small tunas" (**Table YFT-1**).
Discards	Discards are relatively insignificant
CPUE	Trends in standardized CPUE series by fleets are shown in **YFT-Figure 3**.

1. New Biological Information

A recent study in the eastern Atlantic Ocean further described the reproductive traits of female yellowfin tuna including, sex-ratio, size at maturity, spawning seasonality, fish condition and fecundity. Size at 50% maturity was estimated at 103.9 cm fork length when cortical alveoli were used as a maturity threshold, however a larger size at 50% maturity was estimated when more advanced oocytes were used. The conclusions of this research were incorporated in the 2016 stock assessment of yellowfin tuna.

Tagging studies of yellowfin in the Pacific and Indian Oceans suggest that natural mortality is age-specific, and higher for juveniles than for adults. Nevertheless, uncertainties remain as to the exact parameterization of the age-specific natural mortality function. As was applied for the recent bigeye tuna assessment, an age-specific natural mortality function (e.g. Lorenzen) was developed and applied to the 2016 assessment of yellowfin tuna. The most recent stock assessment does not consider sex-specific natural mortality or growth, yet there are disparities in average size by gender. Males are predominant in the catches of larger sized fish (over 145 cm), which could result if large females experience a higher natural mortality rate, perhaps as a consequence of spawning. In contrast, females are predominant in the catches of intermediate sizes (120 to 135 cm), which could result from differential growth (e.g. females having a lower asymptotic size than males). Recent results from studies in the Indian Ocean suggest a combination of the two hypotheses.

2. Fishery indicators

Yellowfin tuna have been exploited by three major gears (longline, baitboat and purse seine fisheries) and by many countries throughout its range. Detailed data are available since the 1950s (**YFT-Table 1**). Overall Atlantic catches have declined by nearly half from the peak in 1990 (193,600 t) to 108,910 t estimated for 2015 (**YFT-Figure 1)**.

In the eastern Atlantic, purse seine catches declined by over 60% between 1990 and 2007 (127,700 t to 47,900 t), but subsequently increased to 82,340 t in 2015 (**YFT-Table 1; YFT-Figure 2**). Baitboat catches have declined by 70% since 1990 to 5,910 t in 2015. Longline catches declined more than 50%to 4,330 t. In the western Atlantic, purse seine catches were as high as 25,700 t during the mid-1980s, but have since declined nearly 90%, to 1,950 t in 2015. Baitboat catches also declined 90% since a peak in 1994, and for 2015 were estimated to be below 750 t. Since 1990, longline catches have generally fluctuated between 10,000 t and 20,000 t.

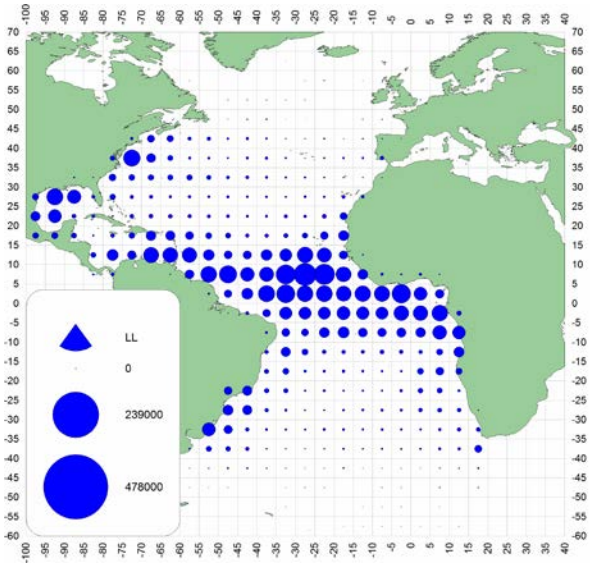
The decline in purse seine catches during 1992-2007 was in large part due to a decline in the number of European and associated fleet purse seine vessels operating in the eastern Atlantic (e.g. from 65 vessels in 1992 to 27 vessels in 2007). However, since that time, the number of purse seiners and overall fleet efficiency has increased as newer vessels with greater fishing power and carrying capacity have moved from the Indian Ocean to the Atlantic. The Committee notes that since 2013, six new purse seine vessels began operations in the Atlantic Ocean. By 2010, overall carrying capacity of the purse seine fleet had increased significantly, to about the same level as in the 1990s, and has increased by nearly 50% since. FAD based fishing has accelerated even more rapidly than free school fishing.

The Committee noted that surface fisheries for tropical tunas in the eastern Atlantic have expanded in recent years. Since 2011, significant catches of yellowfin tuna have been obtained by EU purse seiners south of 15°S off the coast of West Africa (in association with skipjack and bigeye on FADs). Another recent change is the implementation in 2012 of the strategy of fishing on floating objects off of Mauritania (north of 15°N). Catches on floating objects in this area tended to consist almost entirely of skipjack. Effort directed in this manner may therefore have a reduced impact on yellowfin tuna.

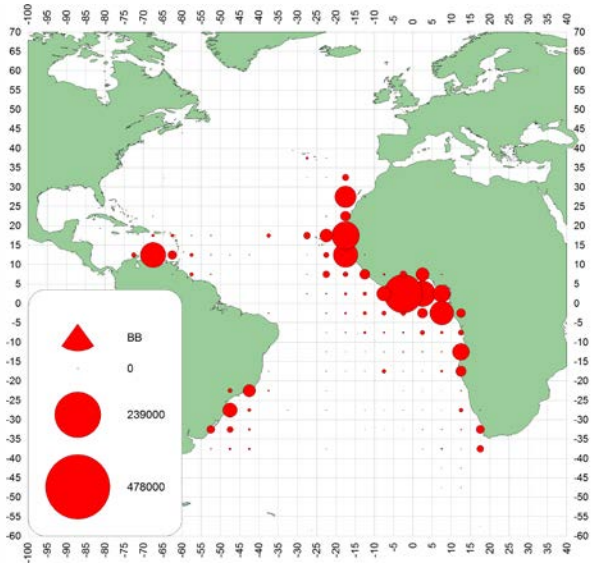
Eight longline indices were selected for use in the stock assessment. The two "clusters" represent unique hypotheses regarding trends in abundance of yellowfin tuna. Cluster 1 indices showed an initial decline, with nearly constant relative abundance since 1990, while Cluster 2 indices suggest increased abundance during the 1990s, followed by a general decline through 2014 (**YFT-Figure 3**). The two trends represent a major source of scientific uncertainty regarding the abundance of yellowfin tuna.

The average weight trends by fleet (1970-2015) are shown in **YFT-Figure 4**. The recent average weight in European purse seine catches, which represent the majority of the landings, had declined to about half of the average weight of 1990. This decline is at least in part due to changes in selectivity associated with fishing on floating objects beginning in the 1990s.

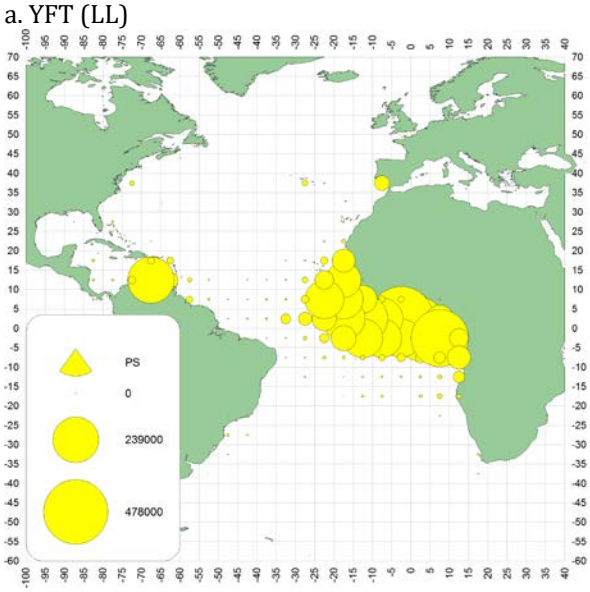
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
TOTAL				193604	167523	163770	163451	173744	154588	149152	137375	144496	136325	132154	153455	134427	122448	119445	101745	104659	95963	106716	113438	108981	102783	104528	97269	96988
	ATE			160873	130626	126058	124706	125530	119314	116096	105034	113576	105615	96531	113132	104767	97467	88207	75677	76388	71795	88593	94661	88187	85105	84678	77790	82109
	ATW			32731	36897	37712	38745	48215	35274	33056	32341	30919	30710	35623	40323	29660	24982	31238	26068	28272	24167	18123	18777	20794	17678	19851	19479	14879
Landings	ATE		Bait boat	19648	17693	15095	18471	15652	13496	11365	12695	14265	16729	10022	14034	11145	9967	14639	9725	12490	7044	7253	7424	6879	9118	6297	4731	6176
			Longline	10253	9082	6518	8537	14638	13723	14236	10483	13872	13561	11369	7570	5869	9183	11537	7317	7234	13437	8562	7385	5544	6602	5510	5659	5283
			Other surf.	2175	3748	2450	2122	2030	1989	2065	2136	1674	1580	2424	2074	1624	2309	2699	2152	2988	2534	1693	3012	1890	1397	1964	2941	1450
			Purse seine	127673	97182	99532	92130	90151	87597	87616	78225	82278	71964	70664	89068	85808	74702	57797	55429	52928	47944	70077	75417	72006	64966	69034	63126	67798
	ATW		Bait boat	4718	5359	6276	6383	7094	5297	4560	4275	5511	5364	6753	5315	6009	3764	4868	3867	2695	2304	886	1331	1436	2311	1108	1403	493
			Longline	18963	14100	17336	12129	11790	11185	11882	11554	11671	13326	15760	14872	11921	10166	16019	14449	14249	13557	13192	12782	13038	10677	12558	12308	8384
			Other surf.	2250	3024	2741	4152	9719	12454	5830	4801	4581	5330	5241	7027	3763	6445	7134	5118	6880	5959	1973	3285	3590	2425	2885	2130	3418
			Purse seine	6800	14414	11359	16081	19612	6338	10784	11710	9157	6523	7870	13108	7966	4607	3217	2634	4442	2341	2067	1370	2722	2256	3292	3635	2581
Landings(FP)	ATE		Purse seine	1124	2921	2463	3447	3059	2509	813	1495	1488	1781	2051	387	321	1305	1534	1054	747	836	1008	1423	1869	3021	1872	1332	1401
			Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0
	ATW		Longline	0	0	0	0	0	0	0	0	0	167	0	0	0	0	0	0	5	6	5	9	8	9	7	3	3
			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
Landings	ATE	CP	Angola	292	510	441	211	137	216	78	70	115	170	35	34	34	34	34	111	0	405	98	701	520	485	191	0	541
			Belize	0	0	0	0	0	1	0	3	0	0	5	0	0	0	0	0	0	0	0	405	1794	3172	5861	5207	7036
			Canada	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
			Cape Verde	2136	1932	1527	1612	1943	1908	1518	1783	1421	1663	1851	1684	1802	1868	3236	6019	5648	4568	7905	4638	5856	6002	4603	7513	4507
			China PR	0	0	0	139	156	200	124	84	71	1535	1652	586	262	1033	1030	1112	1056	1000	365	214	169	220	170	130	20
			Curaçao	0	0	0	0	0	0	3183	6082	6110	4039	5646	4945	4619	6667	4747	24	1939	1368	7351	6293	5302	4413	6792	3727	5152
			Côte d'Ivoire	0	0	0	0	0	0	0	2	0	0	673	213	99	302	565	175	482	216	626	90	470	385	1481	2077	324
			EU.España	68603	53464	49902	40403	40612	38278	34879	24550	31337	19947	24681	31105	31469	24884	21414	11795	11606	13584	24409	32793	25560	21026	18854	11878	14225
			EU.Estonia	0	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU.France	45572	34788	33964	36064	35468	29567	33819	29966	30739	31246	29789	32211	32753	32429	23949	22672	18940	11330	16115	18923	20280	22037	18506	20291	21087
			EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU.Latvia	0	255	54	16	0	55	151	223	97	25	36	72	334	334	334	334	334	0	0	0	200	143	15	0	0
			EU.Lithuania	0	332	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU.Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			EU.Poland	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
			EU.Portugal	179	328	195	128	126	231	288	176	267	177	194	4	6	4	5	16	274	865	300	990	537	452	355	335	69
			EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	21	22	1	0
			El Salvador	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
			Gabon	0	0	0	12	88	218	225	225	295	225	162	270	245	44	44	44	44	0	0	0	0	0	0	0	0
			Ghana	11988	9254	9331	13283	9984	9268	8182	15080	13222	20815	12304	23392	18100	15002	14044	13019	12897	11115	11502	11037	10457	8676	9591	8786	11652
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	2207	1588	2906	5265	3461	3736	2603	3124	2803	2949	4023	3754
			Guinea Ecuatorial	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	892	892	199	0	2	11
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	298	292	1559	1484	823
			Honduras	0	0	2	0	0	4	3	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Japan	5887	4467	2961	2627	4194	4770	4246	2733	4092	2101	2286	1550	1534	1999	5066	3088	4206	8496	5266	3563	3041	3348	3637	3843	3358
			Korea Rep.	324	259	174	169	436	453	297	101	23	94	142	3	8	209	984	95	4	303	983	381	324	20	26	97	77
			Libya	0	0	0	0	0	0	0	0	0	0	0	208	73	73	0	0	0	0	0	0	0	0	0	0	0
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	79	108	95	1940	222	102	110	110	44	272	55	137	107
			Namibia	0	0	0	0	35	14	72	69	3	147	59	165	89	139	85	135	59	28	11	1	9	90	0	6	15
			Nigeria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	3	1	0	0
			Norway	1790	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Panama	1498	7976	8338	10973	12066	13442	7713	4293	2111	1315	1103	626	1112	0	1887	6170	8557	9363	6175	5982	5048	4358	5004	3899	4587
			Philippines	0	0	0	0	0	0	0	0	126	173	86	0	50	9	68	13	30	88	53	152	89	134	5	56	0
			Russian Federation	0	3200	1862	2160	1503	2936	2696	4275	4931	4359	737	0	0	0	0	4	42	211	42	33	0	0	0	0	0
			S. Tomé e Príncipe	164	187	170	181	125	135	120	109	124	114	122	122	122	122	134	145	137	0	160	165	169	173	177	182	186
			Senegal	202	105	40	19	6	20	41	208	251	834	252	295	447	279	681	1301	1262	819	588	1279	1212	1050	1683	1247	612
			South Africa	624	52	69	266	486	183	157	116	240	320	191	342	152	298	402	1156	1187	1063	351	303	235	673	174	440	1512
			St. Vincent and Grenadines	0	0	0	0	0	0	12	129	28	255	126	75	194	56	14	0	101	209	83	74	28	0	0	0	0
			U.S.A.	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
			U.S.S.R.	3615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK.British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
			UK.Sta Helena	92	100	166	171	150	181	151	109	181	116	136	72	9	0	0	0	344	177	97	104	65	163	149	53	152
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	145	483	450	331	23	10	124	21	0
			Venezuela	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
		NCC	Chinese Taipei	2244	2163	1554	1301	3851	2681	3985	2993	3643	3389	4014	2787	3363	4946	4145	2327	860	1707	807	1180	537	1463	818	1023	902
		NCO	Benin	1	1	1	1	1	1	1	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
			Cambodia	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Cayman Islands	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
			Congo	22	17	18	17	14	13	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Cuba	798	658	653	541	238	212	257	269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Faroe Islands	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Gambia	2	16	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Georgia	0	25	22	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Mixed flags (FR+ES)	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
			NEI (ETRO)	12601	4856	10820	9800	8327	8844	9485	6514	7193	5086	5117	9942	7436	2649	2120	0	0	0	0	0	0	0	0	0	0
			NEI (Flag related)	1115	2310	1315	1157	2524	2975	3588	3368	5464	5679	3072	2038	43	466	0	0	0	0	0	0	0	0	0	0	0
			Seychelles	0	0	0	0	0	0	0	0	0	0	6	0	11	0	0	0	0	0	0	0	0	0	0	0	0
			Ukraine	0	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ATW	CP	Barbados	89	108	179	161	156	255	160	149	150	155	155	142	115	178	211	292	197	154	156	79	129	131	195	188	218
			Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143	1164	1160	940	264	42	41	38	33
			Brazil	1758	1838	4228	5131	4169	4021	2767	2705	2514	4127	6145	6239	6172	3503	6985	7223	3790	5468	2749	3313	3617	3499	2836	3316	2866
			Canada	7	29	25	71	52	174	155	100	57	22	105	125	70	73	304	240	293	276	168	53	166	50	93	74	34
			Cape Verde	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
			China PR	0	0	0	0	0	0	0	0	628	655	22	470	435	17	275	74	29	124	284	248	258	126	94	81	73
			Curaçao	170	150	160	170	155	140	130	130	130	130	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EU.España	2	1462	1314	989	7	4	36	34	46	30	171	0	0	0	0	0	1	84	81	69	27	33	32	138	155
			EU.France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122	456	712	412	358	647
			EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
			EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	60	88	179	260	115	127	92	4	2
			El Salvador	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
			FR.St Pierre et Miquelon	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
			Japan	1734	1698	1591	469	589	457	1004	806	1081	1304	1775	1141	571	755	1194	1159	437	541	986	1431	1539	1106	1024	734	465
			Korea Rep.	484	1	45	11	0	0	84	156	0	0	0	0	0	0	0	580	279	270	10	52	56	470	472	115	39
			Mexico	112	433	742	855	1093	1126	771	826	788	1283	1390	1084	1133	1313	1208	1050	938	890	956	1211	916	1174	1414	1004	1045
			Panama	2651	2249	2297	0	0	0	0	0	0	5	0	20	28	0	0	0	2804	227	153	119	2134	0	0	1995	902
			Philippines	0	0	0	0	0	0	0	0	36	106	78	12	79	145	299	230	234	151	167	0	0	0	30	72	76
			St. Vincent and Grenadines	40	48	22	65	16	43	37	35	48	38	1989	1365	1160	568	4251	0	2680	2989	2547	2274	854	963	551	352	505
			Trinidad and Tobago	304	543	4	4	120	79	183	223	213	163	112	122	125	186	224	295	459	615	520	629	788	799	931	1128	1141
			U.S.A.	5666	6914	6938	6283	8298	8131	7745	7674	5621	7567	7051	6703	5710	7695	6516	5568	7091	5529	2473	2788	2510	3010	4100	2332	2630
			UK.Bermuda	15	17	42	58	44	44	67	55	53	59	31	37	48	47	82	61	31	30	15	41	37	100	66	36	12
			UK.British Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	3	10
			UK.Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	2
			Uruguay	18	62	74	20	59	53	171	53	88	45	45	90	91	95	204	644	218	35	66	76	122	24	6	7	0
			Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	681	689	661	555	873	816	720	330	207	124	17
			Venezuela	10556	16503	13773	16663	24789	9714	13772	14671	13995	11187	11663	18651	11421	7411	5774	5097	6514	3911	3272	3198	4783	4419	4837	5050	3772
		NCC	Chinese Taipei	5221	2009	2974	2895	2809	2017	2668	1473	1685	1022	1647	2018	1296	1540	1679	1269	400	240	315	211	287	305	252	236	139
			Guyana	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
			Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1943	1829	0
		NCO	Argentina	23	34	1	0	0	0	0	0	0	0	0	0	0	0	327	327	0	0	0	5	0	0	0	0	0
			Colombia	237	92	95	2404	3418	7172	238	46	46	46	46	46	46	46	46	46	46	0	0	0	0	0	0	0	0
			Cuba	53	18	11	1	14	54	40	40	15	15	0	0	65	65	65	65	65	0	0	0	0	0	0	0	0
			Dominica	18	12	23	30	31	9	0	0	0	80	78	120	169	119	81	119	65	103	124	102	110	132	119	120	0
			Dominican Republic	0	0	0	0	0	0	0	0	89	220	226	226	226	226	226	226	226	0	0	0	0	0	0	0	0
			Grenada	530	620	595	858	385	410	523	302	484	430	403	759	593	749	460	492	502	633	756	630	673	0	0	0	0
			Jamaica	0	0	0	0	0	0	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0
			NEI (Flag related)	2985	2008	2521	1514	1880	1227	2374	2732	2875	1730	2197	773	14	112	0	0	0	0	0	0	0	0	0	0	0
			Saint Kitts and Nevis	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
			Seychelles	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Sta. Lucia	58	49	58	92	130	144	110	110	276	123	134	145	94	139	147	172	103	82	106	97	223	114	98	136	93
Landings(FP)	ATE	CP	Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	50	71	27	109	35
			Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	77	28	39	40	103	152	58	35	82	256
			Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	25	22	16	176	95	89	114	86	78
			Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	267	116	24
			EU.España	364	940	859	1149	910	559	87	384	494	733	714	0	0	335	368	142	154	67	270	279	352	358	140	146	353
			EU.France	530	982	1033	1554	1461	1074	472	658	703	832	914	344	309	672	597	244	128	33	52	203	181	344	347	129	115
			Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	35	17	32	9	34	8	12	13	19
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	0	66	20	67	95	389	876	487	461
			Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	125	177	114	99	54	101	54	163	59
			St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
		NCO	Mixed flags (EU tropical)	230	998	571	744	688	876	254	452	291	216	423	42	13	298	570	292	251	416	464	467	857	1601	0	0	0
Discards	ATE	CP	EU.France	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
			Korea Rep.	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
			South Africa	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
		NCC	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	ATW	CP	Canada	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
			Korea Rep.	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
			Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	6	5	9	8	9	7	3	3
			U.S.A.	0	0	0	0	0	0	0	0	0	167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			UK.British Virgin Islands	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
		NCC	Chinese Taipei	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



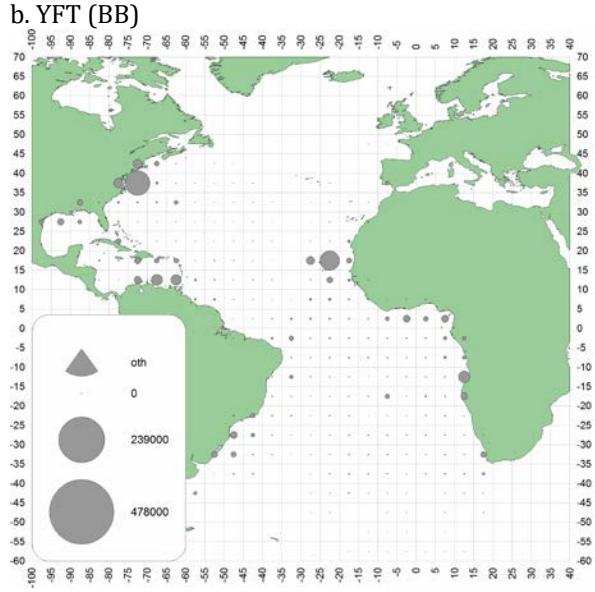
a. YFT (LL)



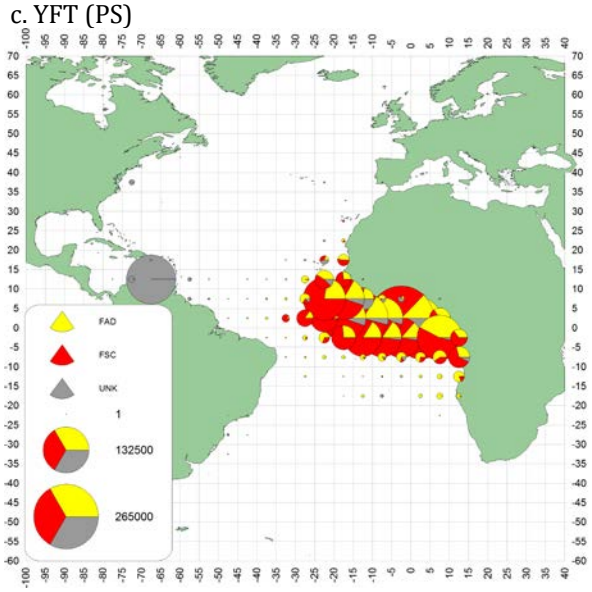
b. YFT (BB)



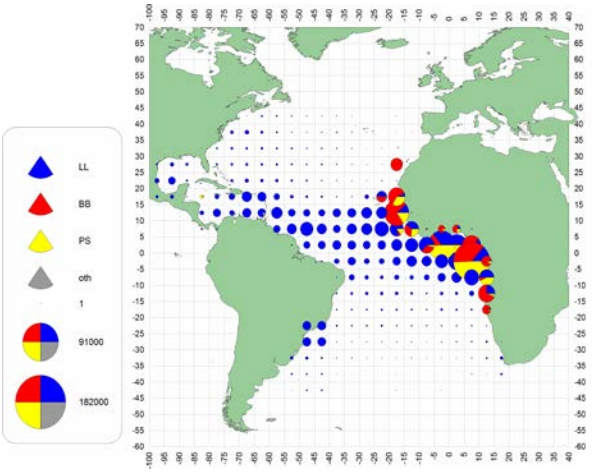
c. YFT (PS)



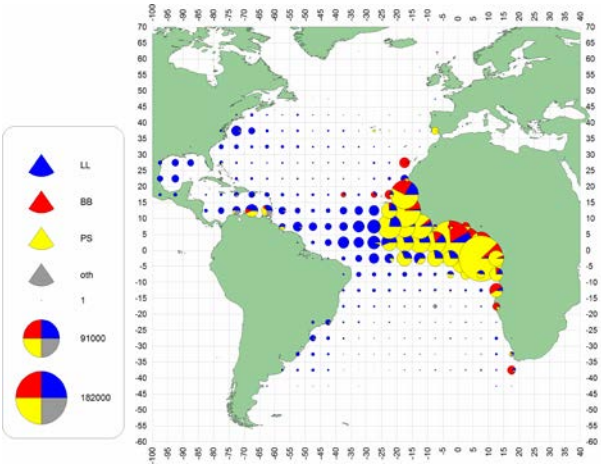
d. YFT (oth)



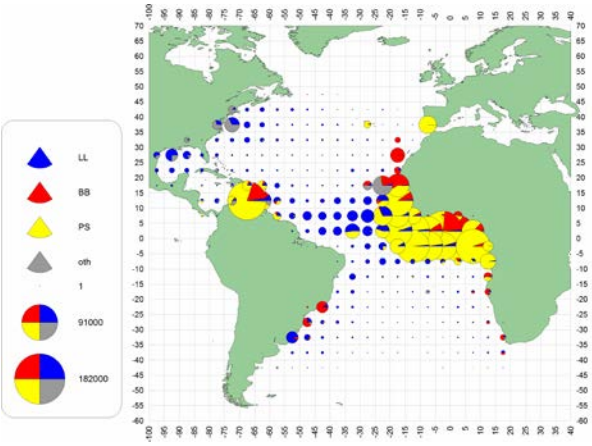
e. YFT (FAD/FREE 1991-2014)



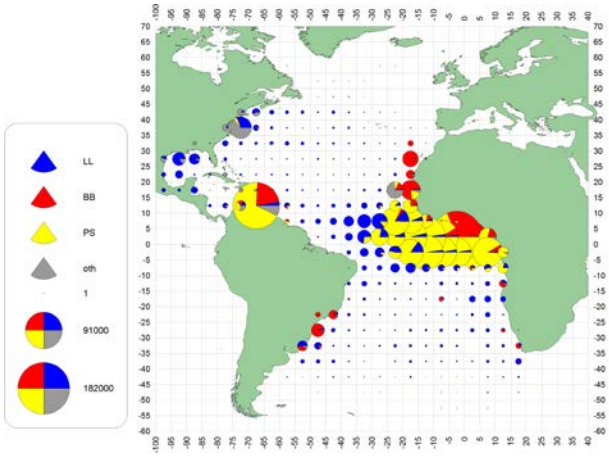
f. YFT (1960-69)



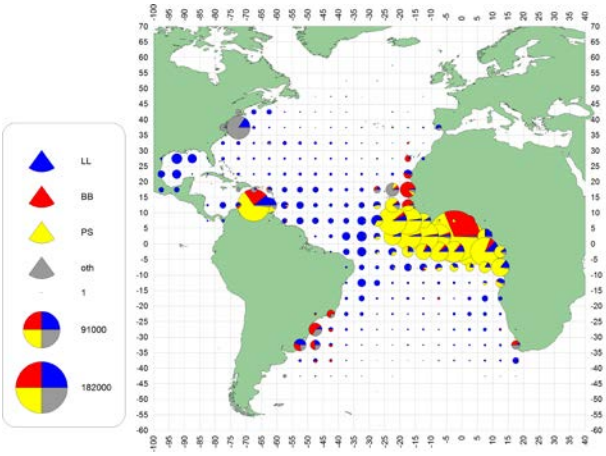
g. YFT (1970-79)



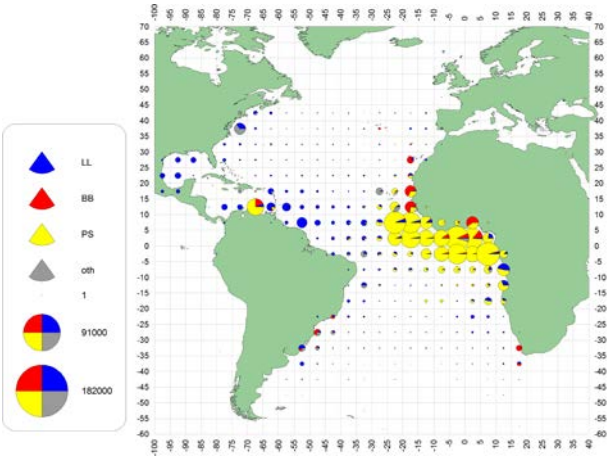
h. YFT (1980-89)



i. YFT (1990-99)

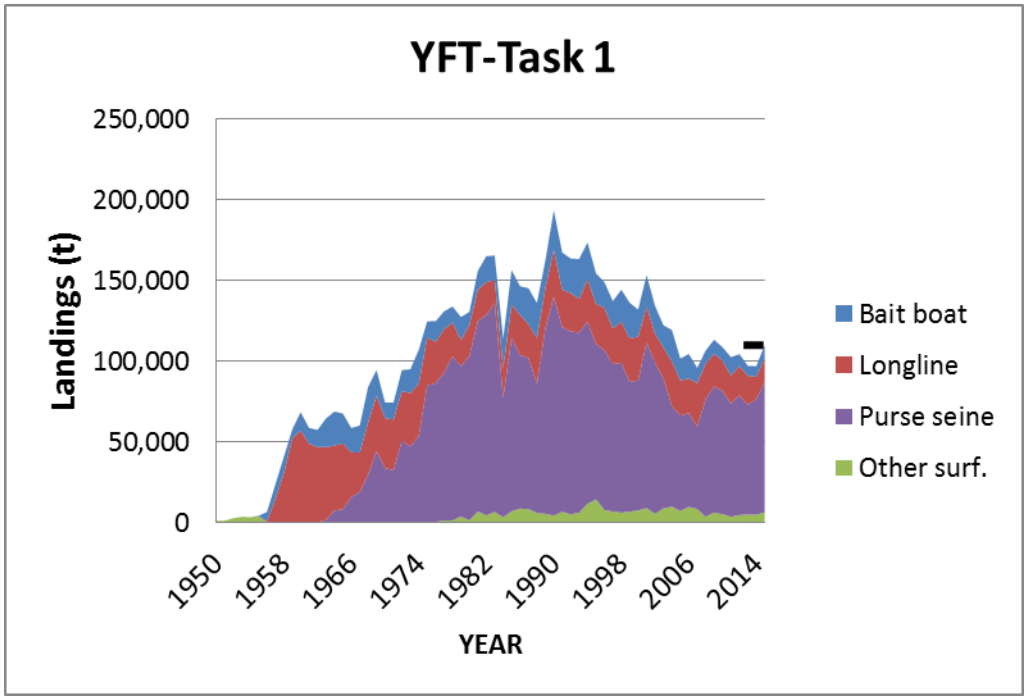


j. YFT (2000-09)

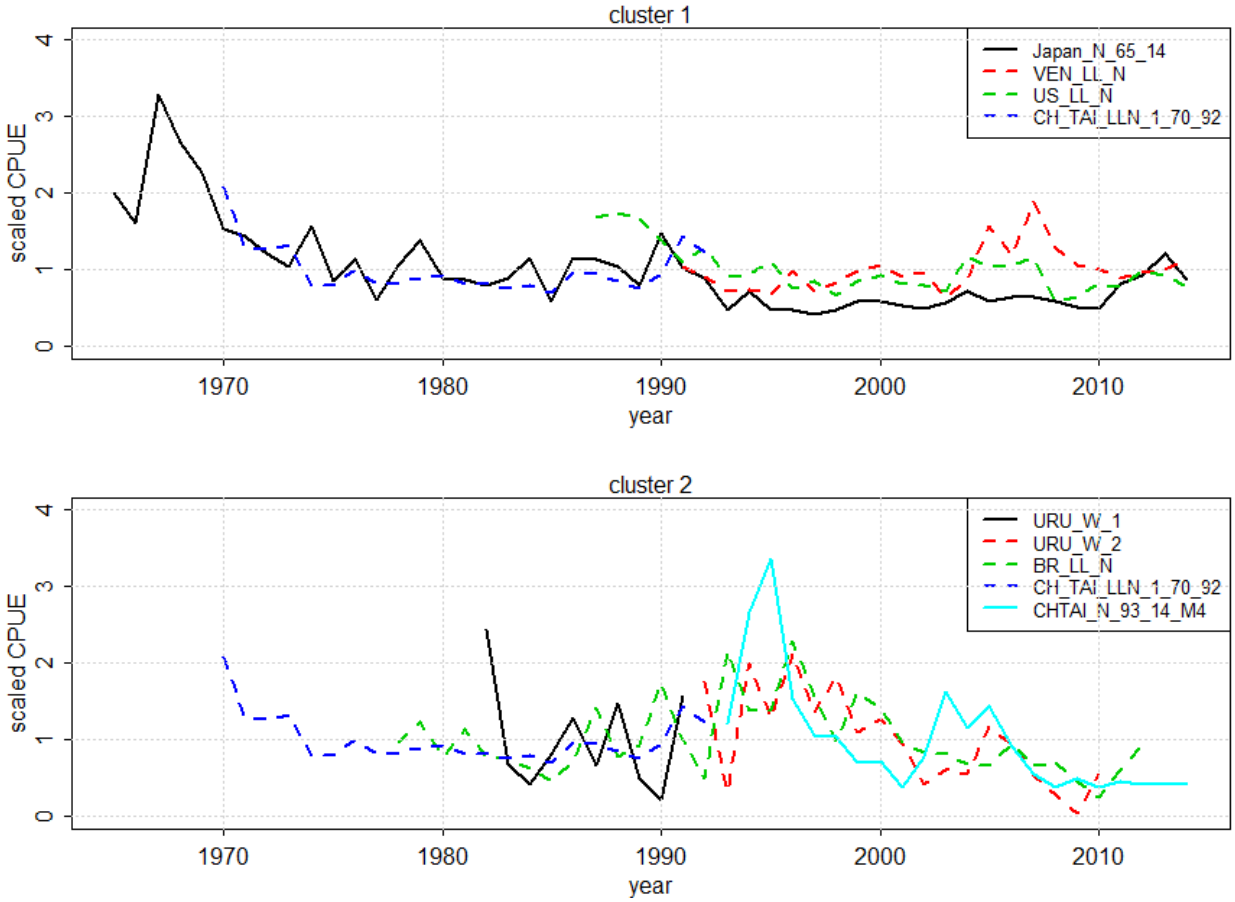


k. YFT (2010-14)

YFT-Figure 1. Geographical distribution of yellowfin tuna total catches by major gears [a-e] and by decade [f-k]. The maps are scaled to the maximum catch observed during 1960-2014. Note: the last panel (k) shows only 5 years of information. Thus, apparent changes in the size of the pie charts (in k) should not be interpreted as a reduction in catch during 2010-2014.

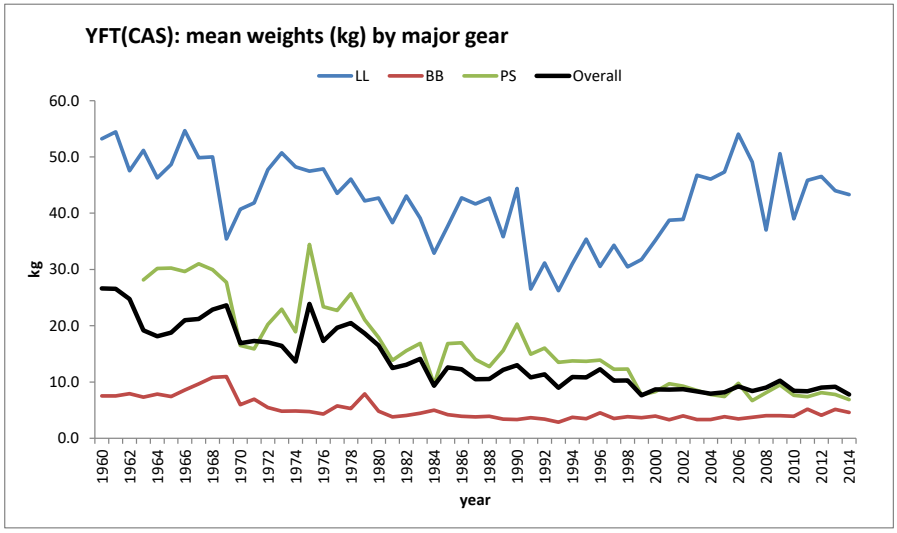


YFT-Figure 2. Estimated annual catch (t) of Atlantic yellowfin tuna by fishing gear, 1950-2015. A TAC of 110,000 t has been in place since 2012 [Rec. 14-01].

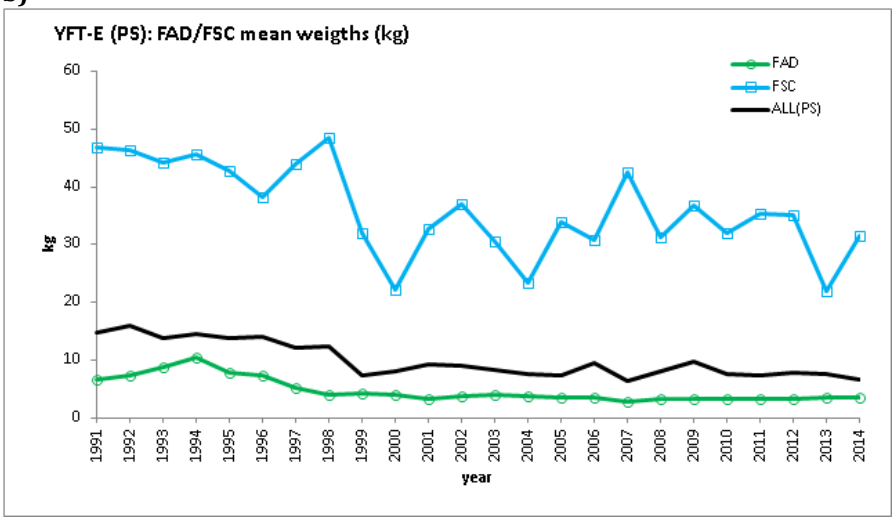


YFT-Figure 3. Yellowfin standardized catch rate trends from cluster 1 (top panel) and cluster 2 (bottom panel) indices of abundance.

a)



b)

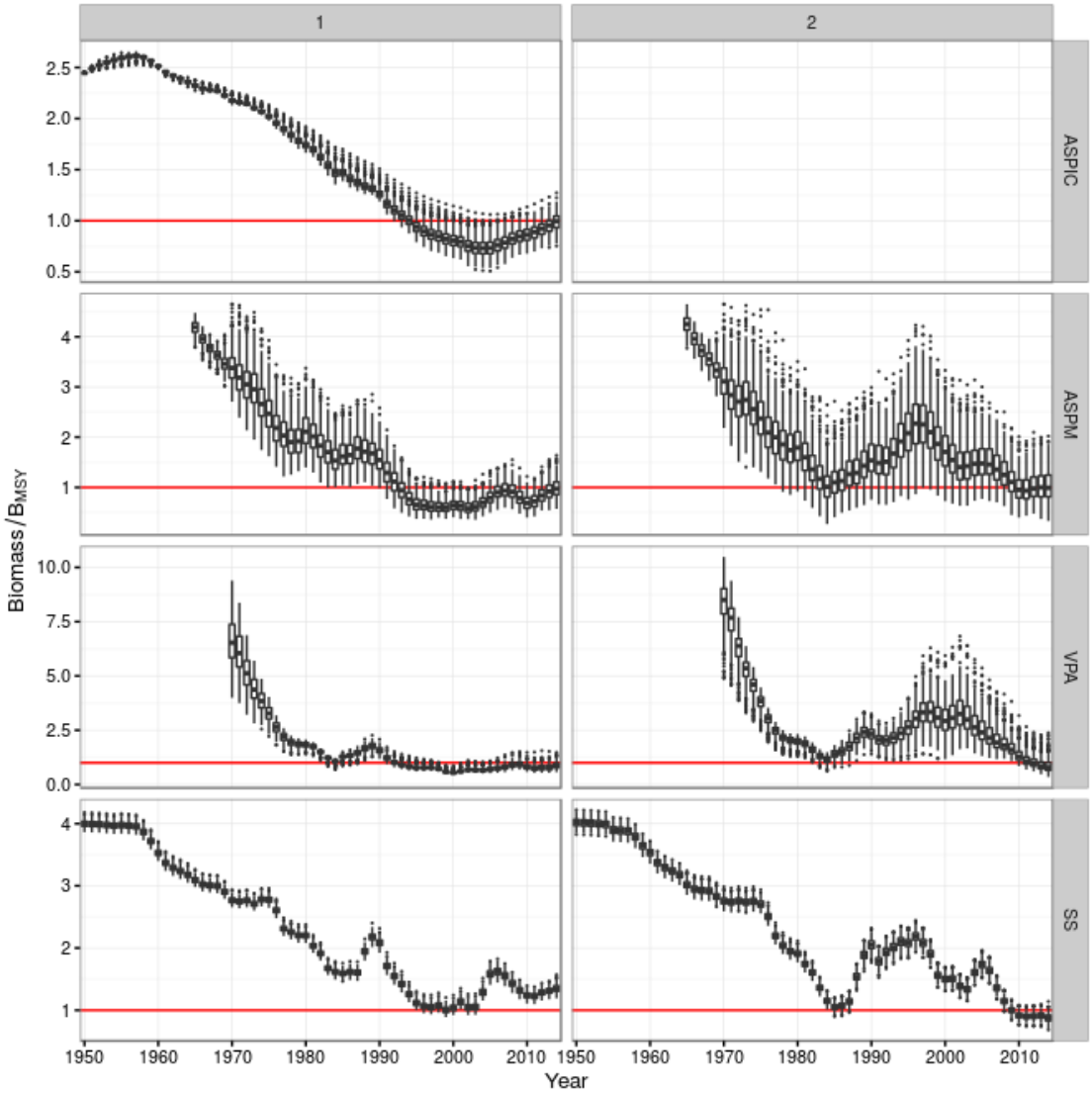


YFT-Figure 4. Trends in estimated mean weight (kg, weighted by respective catches) of yellowfin tuna: a) Overall, by major gear (1960-2014); b) Only eastern purse seine fishery (1991-2014), by operation mode (FSC: free schools; FAD: associated schools). Note: The mean weight of the baitboat fishery (panel a) reflects various baitboat fleets operating in different areas of the Atlantic Ocean.

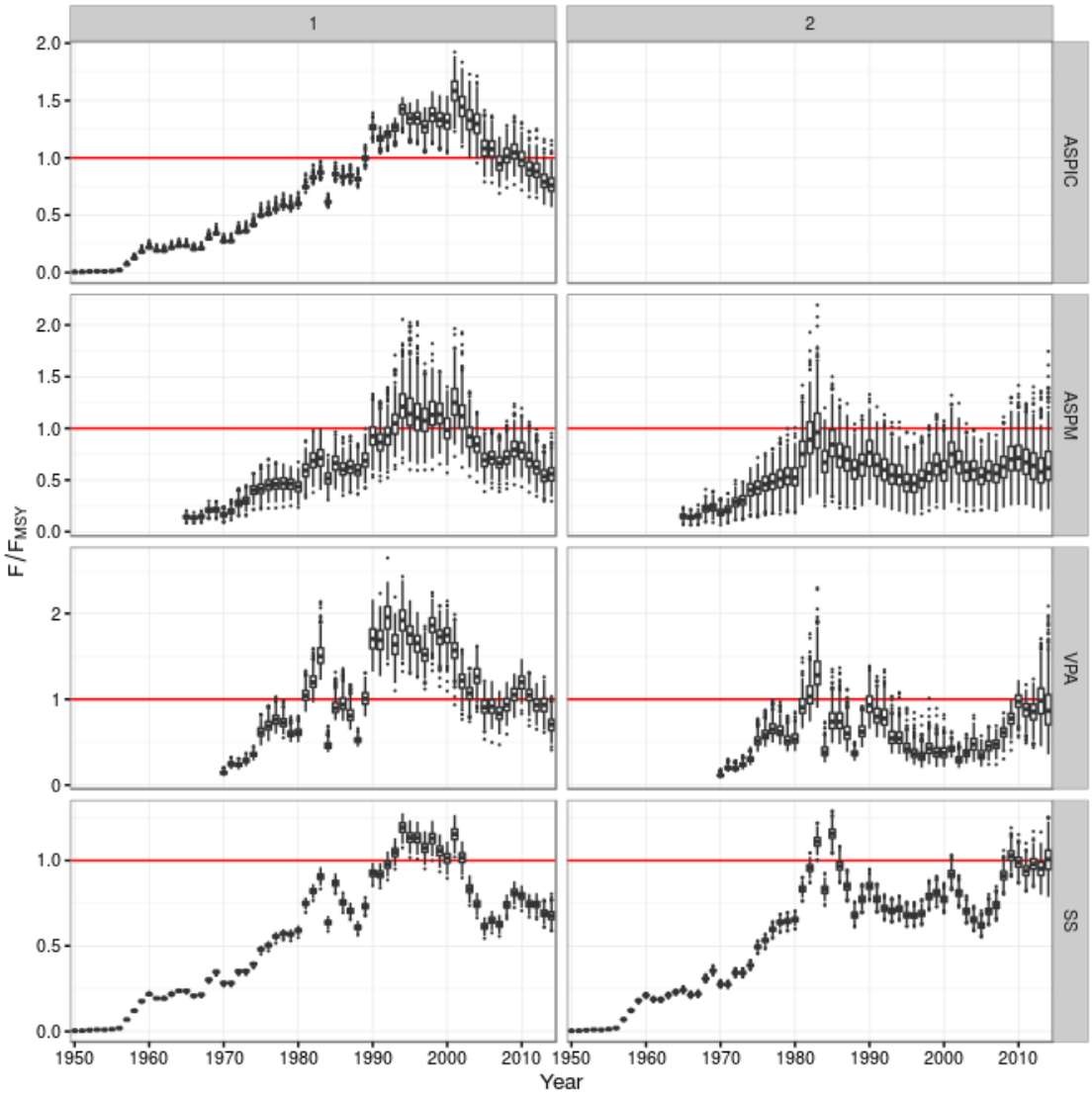
YFT-3. State of the stock

A full stock assessment was conducted for yellowfin tuna in 2016, applying three age-structured models and a non-equilibrium production model to the available catch data through 2014. Models used to develop management advice considered two primary sources of scientific uncertainty, the use of index clusters that reflect two disparate hypotheses regarding trends in abundance of yellowfin tuna, and alternative model structures as implemented using four model platforms. Trends in biomass (**YFT-Figure 5**) and fishing mortality (**YFT-Figure 6**), relative to the levels that produce MSY, were generally similar for all models used to develop management advice, although small differences in current stock status were noted (**YFT-Figures 5** and **6**). Model specific Kobe status plots (**YFT-Figure 7**), with the annual trajectories of stock status, indicate that for most models the 2014 stock status was near B_{MSY} and below F_{MSY}. Annual trajectories should be interpreted with caution because they are not adjusted for known changes in selectivity.

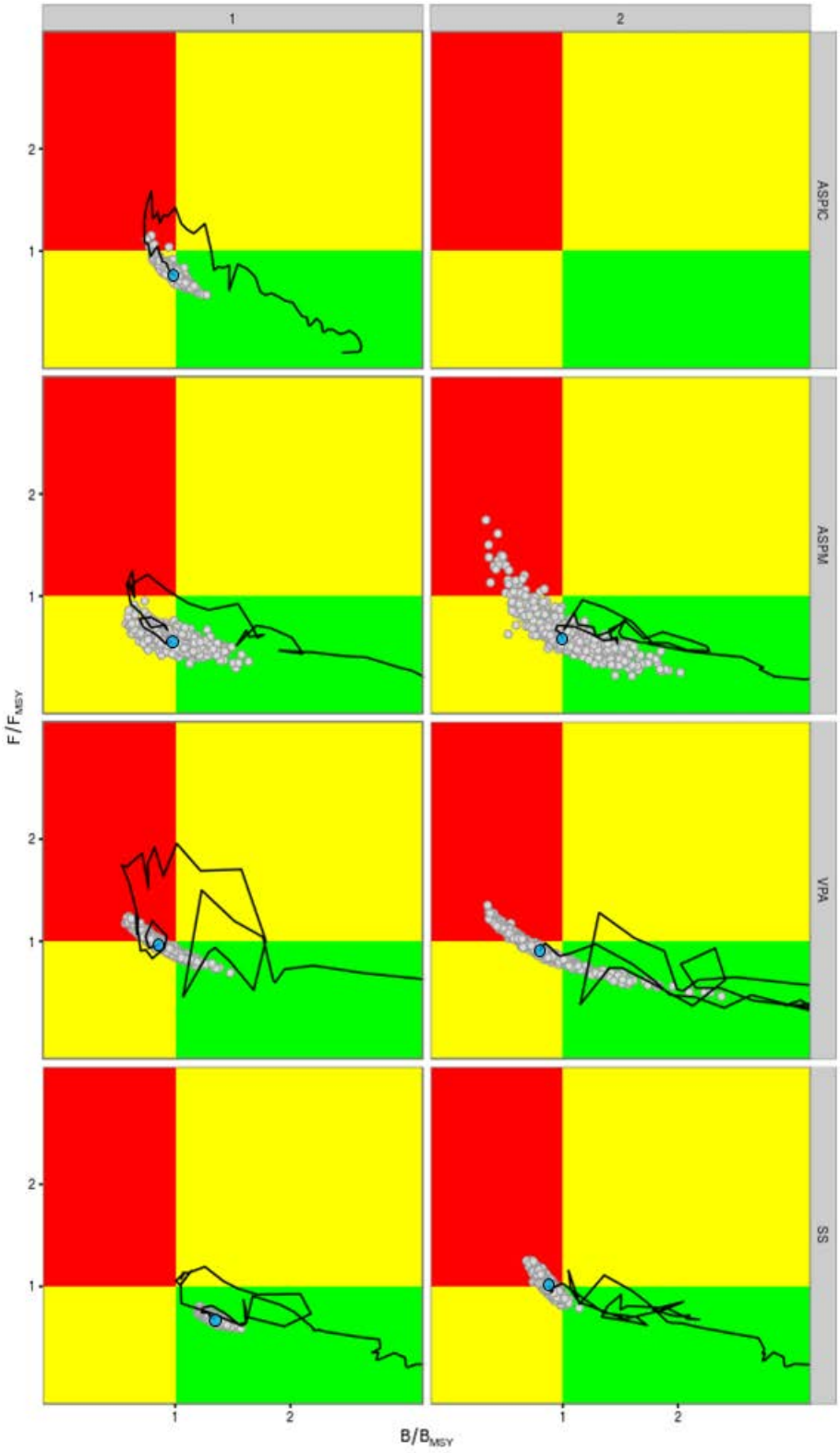
The estimated MSY (median = 126,304 t) may be below what was achieved in past decades because overall selectivity has shifted to smaller fish. The impact of this change in selectivity on estimates of MSY is clearly seen in the results from age structured models (e.g. **YFT-Figure 8**).



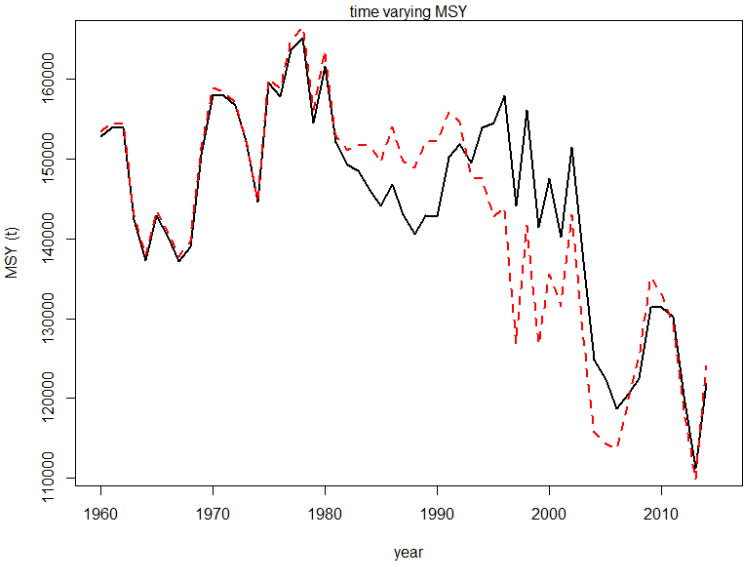
YFT-Figure 5. Trends in biomass relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points indicate the range of more extreme outcomes).



YFT-Figure 6. Trends in fishing mortality relative to the level that produces MSY (red) for the model runs used to develop management advice. Box and whisker plots indicate the uncertainty in bootstrap estimates. (Boxes indicate the annual median estimates, 25th and 75th percentiles; whiskers and points indicate the range of more extreme outcomes).



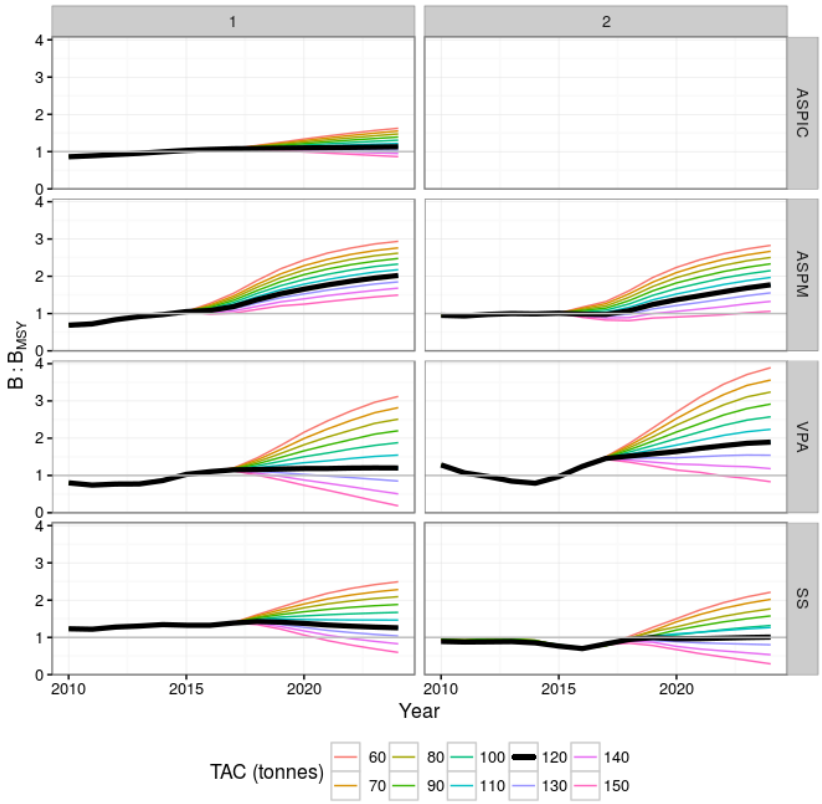
YFT-Figure 7. Kobe Status Plot for each model with 500 bootstrap estimates of the uncertainty in current stock status. The trajectories are intended to demonstrate general trends in stock status, but do not account for known changes in selectivity.



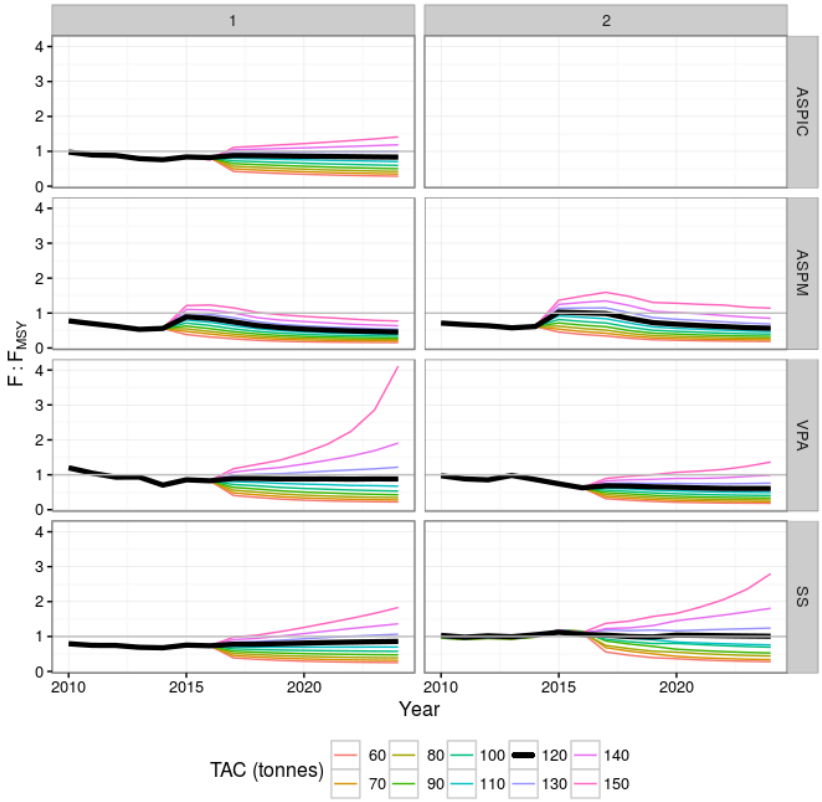
YFT-Figure 8. MSY estimated annually from an age structured stock assessment (SS) using cluster 1 and 2 indices.

4. Outlook

Projections conducted in 2016 considered a number of constant catch scenarios (**YFT-Figures 9-10**). In most cases, catches less than 120,000 t led to, or maintained a healthy stock status through 2024.



YFT-Figure 9. Median B/B_{MSY} (2010 – 2024) for projections of constant TACs of 60,000 to 150,000 t. SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 60,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.



YFT-Figure 10. Median F/F_{MSY} (2010 – 2024) for projections of constant TACs of 60,000 to 150,000 t. SS, VPA and ASPIC projections applied an assumed catch of 110,337 (2015 estimate with carry-overs) to 2015 and 2016, prior to the application of the constant TACs of 60,000 to 150,000 t in 2017-2024. Due to a software constraint, ASPM projections applied constant TACs beginning in 2015.