

Marine Stewardship Council (MSC) Expedited Audit Report

French Polynesia albacore and yellowfin longline fishery

On behalf of

Direction des Ressources Marines (DRM)

Prepared by

Control Union (UK) Limited

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Contents

CON	CONTENTS						
QA	1A1						
GLO	SSARY						
1	Execu	JTIVE	SUMMARY2				
2	Repo	RT DE	TAILS				
2.1		Surv	eillance information3				
3	Васк	GROU	IND1				
3.1		Vers	ion details1				
3.2		Unit	(s) of Assessment (UoA)1				
3.3		Reas	on for expedited audit2				
3.4		Prin	ciple 1: Eastern Pacific Ocean yellowfin2				
3.4.1 Back 3.4.2 Catc		Back Catcl	ground				
3.	4.3	Key l	ow trophic Level species				
4	Resu	LTS	5				
4.1		Reso	coring Performance Indicators7				
5	Refer	RENCE	s9				
6 APPENDICE		NDICE	s				
APPENDIX 1		1	EVALUATION PROCESSES AND TECHNIQUES				
Appendix 1.1		1.1	Site visits and stakeholder participation13				
APPENDIX 2		2	STAKEHOLDER INPUT				
APPENDIX 3		3	REVISED SURVEILLANCE PROGRAM				
APPENDIX 4		4	HARMONISED FISHERY ASSESSMENTS				
APPENDIX 5		5	PRINCIPLE 1 PERFORMANCE INDICATOR SCORES AND RATIONALES				

QA

Role	Signature and date
Originator:	C. Sieben – 6 th Oct 2020
Reviewer:	H. Jones – 7 th Oct 2020
Approver:	T. Tsuzaki – 13 th Oct 2020



Glossary

Term/acronym	Definition
ВЕТ	Bigeye tuna
САВ	Conformity Assessment Body
ССМ	WCPFC Commission Members, Cooperating non-Members, and participating Territories
DRM	Directorate of Marine Resources (French Polynesia)
EPO	Eastern Pacific Ocean
F, F _{MSY}	Fishing mortality, F resulting in Maximum Sustainable Yield
F _{lim}	Fishing mortality limit reference point
Fcurrent	Average fishing mortality at age
G	Generation Time
HCR	Harvest Control Rule
IATTC	Inter-American Tropical Tuna Commission
LRP	Limit Reference Point
LTL	Low Trophic Level (species)
м	Natural mortality
MEC	ME Certification Ltd
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
PCR	Public Certification Report
PI	Performance Indicator (of the MSC Standard)
PRI	Point of Recruitment Impairment
SAC	Scientific Advisory Committee (IATTC)
S, S _{MSY}	Spawning Biomass that results from fishing at maximum sustainable yield
Slim	Spawning Biomass limit reference point
SG	Scoring Guidepost
ТАС	Total Allowable Catch
TRP	Target Reference Point
UoA	Unit of Assessment
UoC	Unit of Certification
YFT	Yellowfin tuna



1 Executive Summary

The French Polynesia albacore and yellowfin longline fishery was certified on the 19th June 2018. The initial assessment team consisted of Dr Jo Gascoigne (Team Leader, Principle 1), Chrissie Sieben (Principle 2) and Dr. Charles Daxboeck (Principle 3). The initial assessment was conducted in accordance with the MSC Fisheries Certification Requirements v2.0.

The year 1 surveillance audit for this fishery was completed in March 2020; however the Covid-19 pandemic led to delays in the IATTC calendar and Eastern Pacific yellowfin tuna benchmarking, which the CAB determined could have implications on the scoring of Principle 1 Performance Indicators for this stock. An expedited Principle 1 audit on Eastern Pacific yellowfin tuna was therefore launched on the 15th July 2020. The expedited audit team consisted of Dr. Jo Gascoigne (Principle 1 expert) and Chrissie Sieben (Team Leader) and the audit was carried out remotely. Details of the meetings held are provided further on in this report. A harmonisation meeting with CABs involved with overlapping fisheries also took place on the 3rd September 2020.

The audit team confirms that this fishery continues to conform to the MSC Principles and Criteria for sustainable fishing. The existing condition on 1.2.2 (Harvest control Rules) has been lifted. No new conditions or recommendations were raised against Principle 1.

The audit team recommends that this fishery should remain certified.



2 Report Details

2.1 Surveillance information

1	Fishery name					
French	French Polynesia albacore and yellowfin longline fishery					
2	Surveillance level and type					
Expedit remotel	ed audit on Prir y.	nciple 1 for Eastern Pacific yellowfin (<i>Thunnus albacares</i>). This audit was conducted				
3	Surveillance n	umber				
1st Surv	eillance					
2nd Sur	veillance					
3rd Surv	veillance					
4th Surv	veillance					
Other (e	expedited etc)	x				
4	Team leader					
Name		Chrissie Sieben				
Areas respor	of nsibility	Team Leader				
Competency criteria (Annex PC)		Chrissie Sieben has a Master's Degree in Marine Environmental Protection which she obtained at the University of Wales, Bangor, and specialises in marine and fisheries ecology, marine environmental impact assessments and sustainable fisheries. She was the MSC fisheries scheme manager at ME Certification Ltd (which later became CU Pesca) up until December 2018. Previous to joining MEC, she worked as a fisheries consultant and marine ecologist on UK-based and international projects. Chrissie is now an independent assessor with over eight years' experience with the MSC certification requirements and has acted as team leader and P2 assessor on a range of preassessments, surveillance audits and full assessments of demersal and pelagic fisheries in the Atlantic, Mediterranean, Indian Ocean, Southern Ocean and Pacific. She also regularly participates in MSC training sessions and workshops. Chrissie speaks fluent French and Dutch in addition to English. Chrissie meets all Fishery Team Leader Qualification and Competency Criteria (Table PC1) and the following Table PC 3 competency criteria: 3. Fishing impacts on aquatic ecosystems; 6 Understanding of the CoC Standard and CoC Certification Requirements. Chrissie has successfully completed the MSC online training on the application of the Risk-Based Framework (RBF), FCRv2.0 and FCPv2.1. She is also obtained her qualification as a lead auditor for ISO 19011				



fishery	No conflict of interest has been identified for this fishery		
On-site or off-site Off-site			
5 Proposed team members			
Name Dr Jo Gascoigne			
Areas of responsibility Principle 1			
Competency criteria (Annex PC) Dr Gascoigne is a former research lecturer in marine biology at Bangor Univer- Wales and a shellfisheries and tuna fisheries expert, with over 25 years' experies working in the fisheries sector. In addition to numerous pre-assessments, Gascoigne has considerable experience with tuna fisheries in the MSC program On 20 May 2016 a variation request was granted by MSC, qualifying Dr Gascoign Principle 1 (P1) assessor for tuna fisheries. Dr Gascoigne has been involved as ex- and lead auditor in over 15 MSC pre-assessments and full assessments. Dr Gasco has also completed the required Fishery Team Leader MSC training modules for V2.0 Fisheries Certification Requirements meeting Table PC2. With her exten experience and knowledge of on tuna fisheries she also meets PC3 criterion Gascoigne speaks fluent French, the common language spoken by the Client Gr and stakeholders	ity, nce Dr ne. ert gne the sive Dr oup		
Conflict of interestNo conflict of interest has been identified for this fisheryin relation to thisfishery			
On-site or off-site Off-site			

6 Audit/review time and location

The expedited audit was launched on the 15th July 2020; the audit took place remotely.

7 Assessment and review activities

During the audit, CU UK communicated with the client and relevant stakeholders and used any available up to date information to assess and review:

- Any changes to the scientific base of information such as stock assessments and its impact on Eastern Pacific yellowfin Principle 1 scoring;
- A review of the current conditions on Principle 1 for this stock;
- Harmonization with overlapping fisheries in the MSC programme;
- Any other significant changes in relation to this stock.



3 Background

3.1 Version details

Table 1. Fisheries programme documents versions

Document	Version number
MSC Fisheries Certification Process	Version 2.1 ¹
MSC Fisheries Standard	Version 2.01
MSC General Certification Requirements	Version 2.4.1
MSC Reporting Template	Version 2.01

3.2 Unit(s) of Assessment (UoA)

Control Union (CU UK) confirms that the fishery remains within in the scope of the MSC Fisheries Standard (7.4 of the MSC Fisheries Certification Process v2.1):

- The target species is not an amphibian, reptile, bird or mammal;
- The fishery does not use poisons or explosives;
- The fishery is not conducted under a controversial unilateral exemption to an international agreement;
- The client or client group does not include an entity that has been successfully prosecuted for a forced or child labour violation in the last 2 years;
- The fishery has in place a mechanism for resolving disputes, and disputes do not overwhelm the fishery;
- The fishery is not an enhanced fishery as per the MSC FCP 7.4.6; and
- The fishery is not an introduced species-based fishery as per the MSC FCP 7.4.7.

CU UK confirms that the client group has submitted the completed 'Certificate Holder Forced and Child Labour Policies, Practices and Measures Template' prior to the start of this assessment.

The current Units of Assessment (UoAs) are given in Table 2; this expedited audit applies to UoA 3 (Eastern Pacific Ocean yellowfin) only.

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Species	UoA1: Albacore tuna (<i>Thunnus alalunga</i>) UoA2 and 3: Yellowfin tuna (<i>Thunnus albacares</i>)
Stock	UoA1: South Pacific albacore, UoA2: Western Central Pacific Ocean yellowfin UoA3: Eastern Pacific Ocean yellowfin

¹ Following the publication of the MSC Guidance for MSC Fisheries CABs relating to the Covid-19 Derogation on the 17th of April 2020, Section 2.1. states that: "CAB shall follow FCP v2.2 clause 7.29.1. to trigger an expedited audit from the 17 April 2020 until 25 September 2020" - (https://www.msc.org/docs/default-source/default-document-library/for-business/programdocuments/chain-of-custody-supporting-documents/msc-covid-19-guidance-for-cabs---fisheries.pdf).



Geographical range of fishery	French Polynesia Exclusive Economic Zone		
Harvest method / gear	Pelagic longline		
Client group	French Polynesia (DRM) licensed vessels fishing in the EEZ of French Polynesia for albacore and yellowfin using pelagic longline		
Other eligible fishers	None		

3.3 Reason for expedited audit

The year 1 surveillance audit for this fishery was completed in March 2020 (Sieben and Daxboeck, 2020). The surveillance audit took into account the latest available information on the Eastern Pacific Ocean yellowfin (EPO YFT) stock, including the stock assessment update released by Minte-Vera et al. (2019). At the time, the decision was made by the CAB not to rescore Principle 1 for this stock on the basis of this latest update (see Sieben and Daxboeck (2020) for details), particularly as a benchmarking was scheduled to take place in May 2020, with new management recommendations to the Commission to be made in July 2020. However, the planned IATTC Scientific Advisory Committee meeting (foreseen for May 2020) was postponed to an undisclosed later date due to the Covid-19 pandemic. It was therefore not clear to what extent management action was being taken in response to the uncertainty identified in the latest stock assessment update (Minte-Vera et al., 2019), which the CAB determined could have implications on the scoring of Principle 1 Performance Indicators. For this reason, an expedited P1 audit on EPO YFT was launched on the 15th July 2020.

In June 2020, the IATTC released drafts of a new benchmark assessment of the yellowfin tuna fishery (Minte-Vera et al., 2020), together with a risk analysis report (Aires-da-Silva et al., 2020). The latter, incorporating the results from the assessments of both yellowfin and bigeye tunas into a decision-making framework that led to the presentation of recommendations in a dedicated document (IATTC, 2020). Although the three documents were available only as drafts at the time the expedited audit was launched, the IATTC's staff indicated that the main results would not be changed and that only editorial work was conducted before the final versions (Aires-da-Silva, pers. comm.). Therefore, even though it is uncertain whether the staff's recommendation would become policy in IATTC Resolutions (they first need to be adopted by the SAC, and later presented as proposals and accepted in the plenary), issues raised in the 2019 stock assessment (Minte-Vera et al., 2019), and uncertainties identified in the external review (Cass-Calay et al., 2019) were addressed in the new benchmark assessment.

Following the launching of the expedited audit, the final versions of the benchmark assessment (Minte-Vera et al., 2020) and the management recommendations document (IATTC, 2020) were issued on the 23rd September and 4th August 2020. A variation request was therefore submitted by the CAB and approved by MSC to delay submission of this expedited audit report so that these latest developments could be considered in the re-scoring of Principle 1.

3.4 Principle 1: Eastern Pacific Ocean yellowfin

3.4.1 Background

IATTC have suffered from problems with their stock assessments since 2018, when the bigeye assessment was not considered robust enough to provide scientific advice; the same occurred with the yellowfin assessment in 2019 (Minte-Vera et al., 2019). IATTC put in place a plan for external



review and benchmarking of their stock assessments, to be implemented during 2019 and 2020 (IATTC, 2019a). Despite the Covid-19 pandemic, this workplan has now been successfully completed. An external review of the yellowfin stock assessment was published in December 2019 (Cass-Calay et al., 2019), with a validated benchmark assessment for yellowfin published in September 2020 (Minte-Vera et al., 2020).

The major changes from the previous assessment structure were as follows:

- The assessment incorporates 12 reference models instead of a single 'best case' model.
- Instead of assuming no Stock-Recruit (SR) relationship based on empirical analysis of biomass and recruitment information, the assessment evaluates four steepness assumptions (0.7, 0.8, 0.9, 1) within each model (i.e. 48 models in total).
- Within each model, the assessment addresses the major sources of error identified in external review, i.e. high sensitivity to new data from the longline abundance index, inconsistency between longline and purse seine indices and poor fits to length composition data, as well as the issue of steepness previously mentioned.
- Fishery definitions and their selectivity functions were reviewed and revised.

It was found that the conclusions of a given model depended strongly on assumptions about steepness, as well as growth, purse seine selectivity and the assumed relationship between abundance indices and population size. The results of the models were combined in a risk analysis which was used to provide management advice (Aires-da-Silva et al., 2020). This concludes that combining all the models there is a 12% probability of the stock being overfished (S<S_{MSY}) and a 9% probability of overfishing (F>F_{MSY}), with a negligible probability that either of the limit reference points (S_{lim} and F_{lim}) are exceeded.

The harvest strategy and harvest control rule (HCR) for EPO yellowfin are unchanged from previous audits. The HCR is applied via a timed closure of the purse seine fishery, based on the assessment that shows highest risk of overexploitation – in this case it is bigeye, since the yellowfin stock is most likely healthy. The conclusions of the bigeye assessment remain problematic in terms of their interpretation (a bimodal distribution of model results) but the scientific advice concludes that retaining the status quo (i.e. a 72-day closure) is appropriate in the short term.

3.4.2 Catch

In 2018, 1,263 tonnes of yellowfin were caught by the UoA fleet, with approximately 80% coming from the eastern side of the yellowfin stock boundary (150°W) as was the case during the initial assessment (Gascoigne et al., 2018). The UoA catch levels thus correspond to approximately 0.53% of the Eastern Pacific stock (IATTC, 2019b).

The total allowable catch (TAC) and landings data are shown in **Error! Reference source not found.**. EPO YFT is not managed via TAC.

Table 3. TAC and Landings data for Eastern	n Pacific yellowfin (EPO YFT). Source: DRM
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TAC	Year	2018	Amount	N/a
UoA share of TAC	Year	2018	Amount	N/a
UoC share of total TAC	Year	2018	Amount	N/a



Total green weight catch (EPO YFT, estimated at 80% of total	Year (most recent)	2018	Amount	1,010 t
YFT catch)	Year (second most recent)	2017	Amount	1,109 t

3.4.3 Key Low trophic Level species

Yellowfin tuna are not a low trophic level species (trophic level of 4.4 according to FishBase (2020)).



4 Results

This fishery was certified by ME Certification (MEC) (now CU UK) on the 18th June 2018 with 9 conditions although none in relation to the EPO YFT stock. During the Year 1 surveillance, one new condition was raised in relation to EPO YFT as summarised below. Following Principle 1 rescoring at this audit, all performance indicators meet SG80 and this condition was therefore closed.

Condition number	Condition	Performance Indicator (PI)	Status	PI original score	Pl revised score
10	Evidence will be presented to the CAB that the tools used to implement HCRs for EPO yellowfin are appropriate and effective in achieving the exploitation levels required under the HCRs.	1.2.2	Opened at Year 1	75	80

Table 4. Summar	y of conditions	on Eastern	Pacific	yellowfin
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Table 5. Condition 10	Harvest control	rules – Eastern	Pacific vel	lowfin)

Performance Indicator	1.2.2
Score	75
Justification	The main tool is a seasonal closure which is used to restrict effort, based on the level of F- mult for whichever of the two stocks it is lowest. Trends in both bigeye and yellowfin S provide some evidence that the HCR is effective; SG60 is met. For yellowfin, F is at the target level (F-mult=0.99). For bigeye, however, F-mult is estimated to be too low, which IATTC scientists believe is due to problems with the stock assessment. A review of the assessment is underway, and the current closure should be sufficiently precautionary for the meantime, but for the moment we do not have good evidence that the tools are achieving an appropriate level of exploitation (F) for bigeye. This is relevant for yellowfin, on the basis that the tools apply to both stocks, so the same situation could arise for yellowfin in other circumstances – i.e. there is concern that the tool to reduce effort may not be applied when required by the HCR.
	Furthermore, the sensitivity analysis for yellowfin that included a stock-recruitment relationship with a steepness of 0.75 estimated the SBR required to support the MSY to be 0.35, compared to 0.27 for the base case assessment, and results in an estimate of S below the MSY level. If there is a stock recruitment relationship, which is a common assumption in many other tuna stock assessments, then effort would have to be reduced significantly. SG80 is not met.
Condition	Evidence will be presented to the CAB that the tools used to implement HCRs for EPO yellowfin are appropriate and effective in achieving the exploitation levels required under the HCRs.
Milestones	Year 1 (2020) – Year 3 (2022): the client should provide evidence that it is actively working to ensure that well defined harvest control rules taking into account the main uncertainties are in place for EPO yellowfin and that these are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached. This evidence will include a summary of the actions taken by the client and other relevant parties to achieve this outcome. (Score 60).



	Year 4 (2023): HCR adopted. (Score: 80)
	Year 1 (2020)- year 3 (2022):
	Given that French Polynesia is part of France's delegation at IATTC meetings, DRM will be proactive and coordinate before and during IATTC meetings with France's head of delegation and other delegations who have fisheries with the same MSC conditions as DRM, MSC and other stakeholders in order to obtain the appropriate progress in the commission's work regarding HCR for EPO YFT.
	DRM will also coordinate with France's head of delegation to make statements at IATTC meetings to make sure the progress made by the Commission is aligned with the given milestones.
Client Action Plan	At the MSC annual surveillance audit in 2020, 2021, 2022, information will be provided to the CAB regarding the actions taken by DRM and other relevant parties during the year, to ensure that well defined harvest control rules taking into account the main uncertainties are in place for EPO yellowfin and that these are consistent with the harvest strategy and to ensure that the exploitation rate is reduced as limit reference points are approached.
	Year 4 (2023): DRM will be proactive and coordinate before and during IATTC meetings with France's head of delegation and other delegations in order to get their support for the adoption of appropriate HCR for EPO YFT.
	At the MSC annual surveillance audit in 2023, information will be provided to the CAB that the HCR has been adopted by IATTC
Consultation on condition	No consultation is required since IATTC have already expressed their intention of undertaking this process (see rationale) and the client for this fishery is the French Polynesia government itself (the DRM)
Progress on Condition (Year 1)	N/a – this condition was raised during the Year 1 surveillance audit.
Progress on Condition (Expedited audit)	Until 2019, the main tools used to implement the HCR were the F multiplier and the temporal closure as a form of effort control. As demonstrated mainly by the estimates of status of the YFT stock in recent years, the tools have shown to be effective in achieving the exploitation levels required under the HCR. Regarding the old approach, the IATTC staff concluded that the "measures established in Resolution C-13-01 have had the intended effect of reducing the fishing mortality of bigeye and yellowfin to a level not exceeding the MSY" (IATTC, 2015). In the new risk-based framework, there is not sufficient evidence yet that the way closure length is being recommended will have the expected effect. However, given the past history and the structure of the risk analysis, it is expected that better handling of uncertainties, better accounting for biological and fishery factors, will lead to more robust decisions, making the tools effective to achieve the exploitation levels required under the HCR. Because
	the new approach has not been fully applied to the next fishing season, it is not possible to ascertain that the evidence is clear regarding the efficiency of the tools, therefore the fishery meets SG60 and SG80 but not SG100.
Status	Closed
Additional information	N/a



4.1 Rescoring Performance Indicators

Rescoring was carried out for Principle 1 (EPO YFT), as summarised in the following tables. See Appendix 5 for the rescoring rationales.

Table 6. Principle level scores. Revised scores are shown in red.

Principle	Score UoA3 (EPO YFT)
Principle 1 – Target Species	91.7
Principle 2 – Ecosystem Impacts	86.3
Principle 3 – Management System	84.0

Table 7. Performance Indicator scores. Revised scores are shown in red.

Princi- ple	Component	Wt	Performance Indicator (PI)		Wt	Score
	Outcomo	0.22	1.1.1	Stock status	0.5	100
	Outcome	0.55	1.1.2	Stock rebuilding	0.5	N/a
000			1.2.1	Harvest strategy	0.25	95
One	Managamant	0.67	1.2.2	Harvest control rules & tools	0.25	80
	Management	0.67	1.2.3	Information & monitoring	0.25	80
			1.2.4	Assessment of stock status	0.25	95
			2.1.1	Outcome	0.33	90
	Primary species	0.2	2.1.2	Management strategy	0.33	85
			2.1.3	Information/Monitoring	0.33	95
	Secondary species	0.2	2.2.1	Outcome	0.33	90
			2.2.2	Management strategy	0.33	90
			2.2.3	Information/Monitoring	0.33	95
	ETP species	0.2	2.3.1	Outcome	0.33	75
Two			2.3.2	Management strategy	0.33	75
			2.3.3	Information strategy	0.33	60
			2.4.1	Outcome	0.33	100
	Habitats	0.2	2.4.2	Management strategy	0.33	95
			2.4.3	Information	0.33	85
		0.2	2.5.1	Outcome	0.33	80
	Ecosystem		2.5.2	Management	0.33	85
			2.5.3	Information	0.33	95
	Governance	0.5	3.1.1	Legal &/or customary framework	0.33	85
Three	and policy	0.5	3.1.2	Consultation, roles & responsibilities	0.33	85



Princi- ple	Component	Wt	Performance Indicator (PI)		Wt	Score
			3.1.3	Long term objectives	0.33	90
	Fishery specific management system	0.5	3.2.1	Fishery specific objectives	0.25	60
			3.2.2	Decision making processes	0.25	85
			3.2.3	Compliance & enforcement	0.25	100
			3.2.4	Monitoring & management performance evaluation	0.25	80



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6 Appendices



Appendix 1 Evaluation processes and techniques

Appendix 1.1 Site visits and stakeholder participation

The expedited audit was launched on the 15th July 2020. Due to reduced availability during the holiday period, the client opening meeting was held on the 4th August via Skype, attended by the team leader and client representative Marie Soehnlen. Stakeholders were notified of the expedited audit on the 15th July 2020 via the MSC website and via email. No submissions were received.

This fishery overlaps with other fisheries in the MSC programme. Harmonisation discussions therefore took place with the individuals listed in Table 8 (also see Appendix 4).

Note that this expedited audit took place simultaneously with the Year 1 surveillance audit and Principle 1 rescoring of the Northeastern Tropical Pacific Purse Seine yellowfin and skipjack tuna (PAST) fishery. This fishery's MSC certificate is also managed by CU UK, with Rob Blyth-Skyrme as Team Leader and Carlos Alvarez as Principle 1 expert. Meetings with IATTC representatives were held in the context of the PAST surveillance with close communication taking place with the expedited audit team for the French Polynesia fishery. The relevant PAST surveillance audit participants are therefore also listed in the below table.

Name	Position	Type of consultation	
Marie SOEHNLEN	Offshore Fisheries Project Manager, DRM	Provision of information during the site visit	
Carlos Alvarez	Principle 1 assessor, Northeastern Tropical Pacific Purse Seine yellowfin and skipjack tuna fishery (CU UK fishery)	Harmonisation	
Rob Blyth-Skyrme	Team Leader, Northeastern Tropical Pacific Purse Seine yellowfin and skipjack tuna fishery (CU UK fishery)	Harmonisation	
Guillermo Compean	IATTC - IATTC Director		
Alexandre Aires-da-Silva	IATTC - Coordinator of Scientific Research	Participation in PAST Year 1 surveillance audit and Principle 1 rescoring, carried out by CU UK in parallel with this expedited audit.	
Mark Maunder	IATTC - Head of Stock assessment program		
Carolina Minte-Vera	IATTC - Senior Stock assessment scientist		
Juan Valero	IATTC - MSE Coordinator		
Cleridy Lennert-Cody	IATTC - Senior scientists, statistician		
Gerard DiNardo	Principle 1 assessor, Eastern Pacific Ocean tropical tuna - purse seine (TUNACONS) fishery (SCS fishery)	Harmonisation	
Kevin McLoughlin	Principle 1 assessor, AGAC four oceans Integral Purse Seine Tropical Tuna Fishery (Eastern Pacific Ocean)	Harmonisation	
Karola Kirchner	Principle 1 assessor, AGAC four oceans Integral Purse Seine Tropical Tuna Fishery (Eastern Pacific Ocean)	Harmonisation	

Table 8. List of attendees at the remote site visit.



Jo Akroyd	Team leader, AGAC four oceans Integral Purse Seine Tropical Tuna Fishery (Eastern Pacific Ocean)	Harmonisation
Jo Gascoigne	Principle 1 assessor, this fishery	Assessor
Chrissie Sieben	Team leader, this fishery	Assessor



Appendix 2 Stakeholder Input

No formal stakeholder submissions were received.



Appendix 3 Revised Surveillance Program

The surveillance programme remains at level 6 as per Gascoigne et al. (2018).



Appendix 4 Harmonised fishery assessments

The Eastern Pacific Ocean yellowfin stock overlaps with the following fisheries in the MSC programme:

Table 9. Overlapping fisheries

Fishery name	САВ	Certification status and date	P1 Performance Indicators to harmonise
Northeastern Tropical Pacific Purse Seine yellowfin and skipjack tuna fishery	СU UK	Certified since 7 Sept 2017	All
AGAC four oceans Integral Purse Seine Tropical Tuna Fishery	Lloyds Register	ACDR published 21 August 2020	All
Eastern Pacific Ocean tropical tuna - purse seine (TUNACONS) fishery	SCS	ACDR published 2 October 2020	All

Table 10. Overlapping fisheries

Supporting information				
A harmonisation meeting on EPO YFT scoring was held on the 3 rd September 2020 individuals:) between the following			
Carlos Alvarez: Principle 1 assessor, represented CU UK Rob Blyth-Skyrme: Team leader, represented CU UK Hugh Jones: Project manager represented CU UK Mathias Deleau: Project manager represented CU UK Gerard DiNardo: Principle 1 assessor, represented SCS Kevin McLoughlin: Principle 1 assessor, represented Lloyds Register Karola Kirchner: Principle 1 assessor, represented Lloyds Register Jo Akroyd: Team leader, represented Lloyds Register Close communication between this fishery's assessors and Carlos Alvarez and Rok that all views were represented at the meeting. Following discussions, consensus that no material differences in scoring were identified.	o Blyth-Skyrme ensured was reached to the extent			
Was either FCP v2.1 Annex PB1.3.3.4 or PB1.3.4.5 applied when harmonising?	No, see above, consensus was reached following the harmonisation meeting to the extent that no material differences in scoring were identified.			
Date of harmonisation meeting 03/09/2020				
If applicable, describe the meeting outcome				
Agreement found among teams, there are no scoring differences.				



Appendix 5 Principle 1 Performance Indicator scores and rationales

Scoring table 1. PI 1.1.1 – Stock status

PI 1.1.1		The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing				
Scoring Issue		SG 60	SG 80	SG 100		
а	Stock statu	ock status relative to recruitment impairment				
	Guide post	It is likely that the stock is above the point where recruitment would be impaired (PRI).	It is highly likely that the stock is above the PRI.	There is a high degree of certainty that the stock is above the PRI.		
	Met?	Yes	Yes	Yes		

Rationale

Version 2.0 of the MSC Fisheries Standard requires that the status of the target stock of a fishery must be likely above the point where recruitment would be impaired (PRI) to reach the SG60 level. At the SG80 level, the stock must be highly likely above the PRI. To reach the SG100 level, the stock is expected to be above PRI with a high degree of certainty. In these definitions, likely means greater than or equal to the 70th percentile of a distribution, highly likely means greater than or equal to the 95th percentile. In this SI, it is understood that *impairment* means "lacking full functional or structural integrity" as defined by the Merriam Webster dictionary, or according to the Cambridge Dictionary, "damaged in a way that makes something less effective". Under these definitions, departure from the recruitment produced by an unexploited stock does not represent impairment, otherwise, any reduction in biomass would constitute a state of recruitment impairment. The PRI is understood therefore, as a state in which spawners are in such low numbers, such that this condition causes them to be unsuccessful to mate and/or produce viable offspring.

IATTC proposed that a LRP "should be based on biological grounds to protect a stock from serious, slowly reversible or irreversible fishing impacts". To represent this idea, it is proposed that, considering fishing reduces recruitment from a baseline unfished state, reference points can be constructed from recruitment related quantities. It was recognized however, that it would be difficult to estimate the actual biomass level where recruitment would be so low that could lead the stock to collapse, therefore, the procedure calculated a limit biomass depletion level requiring assumptions about reduction in recruitment and about the steepness parameter in the Beverton-Holt stock-recruitment relationship. If conservative assumptions are made about the reduction in recruitment and steepness, they should correspond to a depletion that would be a limit of acceptable reduction in biomass to prevent problems in recruitment leading to stock collapse. It was proposed that a reduction (r) of 50% in recruitment could unlikely cause the stock to collapse and a steepness (h) of 0.75 was proposed as it has been used as an extreme unlikely value for YFT in sensitivity analyses. Other RFMOs use a range



of assumptions regarding *h*, with 0.8 as their mid-range most often used value, and their low choice varying from 0.6 to 0.7 (Kolody et al., 2019). The resulting depletion in stock abundance from the virgin spawning biomass (*S*₀) under such assumptions is calculated as

$$d = \frac{S_{actual}}{S_0} = \frac{0.2r(1-h)}{0.8h - r(h-0.2)}$$

With r = 0.5 and h = 0.75, the limit level of spawning biomass depletion is d = 0.077

It is noted that a depletion level of 0.077 is lower than the MSC default PRI of 0.2 relative to B_0 . The assessment team is not using the MSC default despite being lower than the default because the Guidance in GSA2.2.3.1 indicates that such values (MSC default PRI) should be adopted "in the case where neither B_{MSY} nor the PRI are analytically determined,", and that "in the case where either B_{MSY} or the PRI are analytically determined, those values should be used as the reference points for measuring stock status unless additional precaution is sought". As previously described, the IATTC LRP was derived from biological considerations about recruitment and making conservative assumptions about what level of depletion could cause the stock to collapse. In this sense, the IATTC LRP can be considered to be above the biomass at the PRI and therefore, the team has no reason to seek additional precaution.

The benchmark assessment of 2020 (Minte-Vera et al., 2020) used a comparative approach in which several different models were used to build a risk matrix. This approach represents a departure of the "best assessment" model concept so that alternative hypotheses can be explored to formally incorporate uncertainty in the management advice for decision making. The risk analysis based on the stock assessment (Aires-da-Silva et al., 2020) estimated current status both in terms of spawning biomass and fishing mortality, relative to the target and limit reference points. These quantities were obtained as a weighted average of the point estimates of each ratio for each alternative model. The probability of exceeding the reference points is obtained from the cumulative probability of each ratio. The risk assessment presented a table with the probability that *S*_{CURRENT} is below *S*_{LIMIT} and *F*_{current} is above *F*_{limit} for all alternative models investigated in the stock assessment. In all cases there is zero probability that the limit reference points are exceeded, which allows the fishery to meet the requirements of this SI at SG60, SG80 and SG100.

b	Stock statu	Stock status in relation to achievement of Maximum Sustainable Yield (MSY)					
	Guide post		The stock is at or fluctuating around a level consistent with MSY.	There is a high degree of certainty that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years.			
	Met?		Yes	Yes			

Rationale



Scoring Issue b requires at the SG80 level that the stock is fluctuating around a level consistent with MSY, whereas, at the SG100 level, there must be a high degree of certainty that the stock has been fluctuating around that level or has been above that level over recent years. The Guidance indicates in GSA2.2.2 that the concept of fluctuation around the B_{MSY} level pretends to acknowledge fluctuations influenced by the biology of the species, therefore, short-term fluctuations may be observed.

The results of the risk analysis (Aires-da-Silva et al., 2020) indicate that the expected and median values of the combined distributions for F_{curr}/F_{MSY} were 0.67 and 0.65 respectively with a probability of 0.09 that the ratio is greater than 1. The expected and median estimated value of S_{curr}/S_{MSY} were 1.57 and 1.58 respectively with a probability of 0.12 that the ratio is lower than 1.

The Guidance of the MSC Fisheries Standard in GSA2.2.2 presents examples of cases where a fishery may meet the requirements at SG80 and SG100. An example that applies to the stock of YFT in the EPO, indicates that a fishery can meet SG80 if "there is an instantaneous estimate of current stock status that is not less than 90% B_{MSY} "; therefore as the probability that ($B_{CURRENT} < B_{MSY}$) is 0.12, SG80 is met. A score of 100 may be achieved if "A recent series of estimates of stock size that has a mean or median over the last two generation times that is not less than 90% B_{MSY} ". The current estimated median is 57% above B_{MSY} . Following MSC definition of generation time as G ~ 1/M + A_{m50} , with M = 0.5 (approximately the adult female natural mortality in Minte-Vera et al. (2020)) and A_{m50} = 2 years (approximately from the length at 50% maturity estimated by Cole (1980) and the age-length relationship in Fig. 5 of Hampton and Fournier (2001)), generation time of YFT is assumed 4 years. If the current biomass is 57% above B_{MSY} , looking at the trends in biomass in Figure 1 it follows that the median biomass in the last 8 years, cannot be under 90% B_{MSY} , therefore meeting SG80 and SG100.





Figure 1. Spawning biomass ratios (SBRs) for yellowfin tuna in the EPO, 1985-2019. The solid lines represent the maximum likelihood estimates for four values of the steepness parameter (h), and the shaded areas the approximate 95% confidence intervals around those estimates. The red dashed horizontal line (at 0.077) identifies the SBR at SLIMIT. From Minte-Vera et al. (2020). Model descriptions given in Table 3 in Minte-Vera et al. (2020).

References

Cole (1980), Minte-Vera et al. (2020), Aires-da-Silva et al. (2020), Hampton and Fournier (2001) and Kolody et al. (2019)



QA: 2846R08G



Reference point used in scoring stock relative to PRI (SIa)	$\begin{array}{ll} B_{\text{LIMIT}} & 0.01\\ F_{\text{LIMIT}} & & \\ p\left[\left(B_{\text{CURRENT}}/ B_{\text{LIMIT}}\right) < 1\right] & \leq 0. \end{array}$	7	p that (B _{CURRENT} / B _{LIMIT}) < 1 is zero. p that (F _{CURRENT} / F _{LIMIT}) > 1 is zero.
Reference point used in scoring stock relative to MSY (SIb)	B _{MSY} F _{MSY}		p that (B _{CURRENT} < B _{MSY}) is 0.12 p that (F _{CURRENT} < F _{MSY}) is 0.91
Overall Performance I	ndicator score	100	
Condition number (if r	elevant)	N/a	



Scoring table 2. PI 1.1.2 – Stock rebuilding

PI 1.1.2 Where the stock is reduced, there is evid		Where the stock is reduced, there is evidence	of stock rebuilding within a specified time	eframe
Scoring Issue		SG 60	SG 80	SG 100
а	Rebuilding	timeframes		
	Guide post	A rebuilding timeframe is specified for the stock that is the shorter of 20 years or 2 times its generation time . For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.		The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the stock.
	Met?	N/a		N/a

Rationale

Stock rebuilding is not triggered. Not applicable.

b	Rebuilding	evaluation		
	Guide post	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within the specified timeframe.	There is evidence that the rebuilding strategies are rebuilding stocks, or it is likely based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.	There is strong evidence that the rebuilding strategies are rebuilding stocks, or it is highly likely based on simulation modelling, exploitation rates or previous performance that they will be able to rebuild the stock within the specified timeframe.
	Met?	N/a	N/a	N/a

Rationale



Stock rebuilding is not triggered. Not applicable.

References	
N/a	
Overall Performance Indicator score	N/a
Condition number (if relevant)	N/a



Scoring table 3. PI 1.2.1 – Harvest strategy

PI 1.2.1		There is a robust and precautionary harvest strategy in place			
Scoring Issue		SG 60	SG 80	SG 100	
а	Harvest str	ategy design			
	Guide post	The harvest strategy is expected to achieve stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving stock management objectives reflected in PI 1.1.1 SG80.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in PI 1.1.1 SG80.	
	Met?	Yes	Yes	Yes	

Rationale

MSC defines a harvest strategy as 'the combination of monitoring, stock assessment, harvest control rules and management actions, which may include an MP or an MP (implicit) and be tested by MSE' (MSC – MSCI Vocabulary v1.1).

This SI evaluates the design of the harvest strategy which is expected to include the harvest control rules, the information and monitoring systems and stock assessment procedures. To achieve SG80, these elements must work together to achieve the objectives defined in PI 1.1.1, allowing the management system to be responsive to the state of the stock. At the SG100, the strategy must have been designed to achieve the objectives in PI 1.1.1.

The Antigua Convention defined that the Commission shall adopt measures to "maintain or restore the populations of harvested species at levels of abundance which can produce the maximum sustainable yield" (IATTC, 2003)). Consistently, the Commission adopted the control rule such that "if fishing mortality exceeds the level corresponding to MSY, it be reduced to that level" (IATTC, 2014). To implement this rule, the Antigua Convention established that this could be achieved "through the setting of the total allowable catch of such fish stocks as the Commission may decide and/or the total allowable level of fishing capacity and/or level of fishing effort for the Convention Area as a whole". Also, the same Article VII of the Convention indicates that measures must be based on the best available scientific evidence.

These provisions set the foundations to develop the IATTC harvest strategy. By design, stock assessments are conducted estimating stock status relative to reference points. Until 2019, the result of the stock assessment estimated fishing mortality rate F relative to the rate producing MSY (F_{MSY}), combined in a management parameter known as the "F multiplier". This parameter was used to make management decisions such that, if current fishing mortality was higher than F_{MSY}, fishing effort was adjusted by increasing the length of the closure season (IATTC, 2007). This approach has been substituted by a two-step process to first conduct a stock assessment using multiple models representing possible states of nature (Minte-Vera et al., 2020), and a risk analysis which includes a decision analysis (Aires-da-Silva et al., 2020). This shift allows for formal



implementation of improved definitions of the control rule which now have probabilistic considerations as defined in Resolution C-16-02 (IATTC, 2016); better accounting of different types of uncertainties that have been identified; and to provide decision makers with more appropriate tools to understand the different scenarios under which stock status is being estimated.

The IATTC research program collects supervised off-loading records and additional data to provide the basic inputs for assessment models that have been developed over a long period of time, supplemented by data collected through the purse seine fishery observer programme which has 100% coverage.

The harvest strategy is implemented by applying the HCR in a way that, the aim is to keep F from exceeding "the best estimate of the rate corresponding to the maximum sustainable yield (F_{MSY}) for the species that requires the strictest management" (IATTC, 2016). This concept implies that YFT, BET and skipjack are linked by identification of the stock that is in greatest need of protection, defining conservation actions for that stock and implementing the same management measures equally to all three species. At time of the present audit, the IATTC staff has proposed additional measures to limit purse seine sets on objects, but the 2020 SAC meeting was postponed and has not taken place given the situation with the Covid-19 pandemic. The approach taken to managing YFT will be reviewed in light of any changes at forthcoming audits.

The team recognizes that the harvest strategy was designed to meet the fundamental requirements of the Antigua Convention and that specific components have been developed sequentially, from defining reference points, building the harvest control rule, and constantly improving the stock assessments. The evidence shows that the elements of the strategy have worked together and that is being responsive to stock status, the strategy is currently designed to avoid the stock to reach or exceed LRP and keep the stock at or fluctuating around MSY. This meets the requirements at SG60, SG80 and SG100.

b	Harvest str	ategy evaluation		
	Guide post	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Yes	Yes	No

Rationale

This SI requires at the SG60 level that the strategy is likely to work based on prior experience or plausible argument, whereas at SG80, even if not fully tested, evidence exists that it is achieving its objectives.

The evidence indicates that the Harvest Strategy conducts stock assessments, using the results to present management advice making the strategy responsive to the state of the system. The strategy operates by adjusting effort (closure length) based on the evaluated species resulting in the assessment with the greatest need of protection. The



strategy assumes associations to specific types of fishery are maintained (e.g. SKJ and BET sets on floating objects), to assure that for any particular effort applied to all fishing types, all other species will be equally protected.

As evidenced by the results of the 2019 assessment (Minte-Vera et al., 2019), certain issues led to uncertainties large enough to prevent useful management advice to be provided. An external review suggested changes to the entire assessment model leading to an all new approach to assess stock status and to provide management advice. Results of the revised stock assessment indicate that although the strategy has not been fully tested, it appears to be achieving its objectives.

A full management strategy evaluation has not been conducted for YFT but testing of the harvest strategy is being conducted in an application of the management strategy evaluation (MSE) on BET.

The harvest strategy can be viewed as having worked effectively for many years as the stock has been shown to be around the biomass producing MSY at least for the last two generations. The control rule has evolved from a simple form to a probabilistic specification while the main control tool is to reduce effort by reducing the length of the fishing season. In 2015, the staff concluded that "measures established in Resolution C-13-01 have had the intended effect of reducing fishing mortality of bigeye and yellowfin tuna to a level not exceeding the MSY" (IATTC, 2015).

The team concludes that evidence exists that the harvest strategy is achieving its objectives (maintain the stock at MSY (IATTC, 2003)), but additional testing is required; as such, the fishery meets the requirements at SG60 and SG80 but not at SG100.

С	Harvest str	rategy monitoring	
	Guide	Monitoring is in place that is expected to	
	post	determine whether the harvest strategy is working.	
	Met?	Yes	

Rationale

There is a considerable amount of data that is being collected that informs various aspects of the harvest strategy. Full observer coverage of purse seine vessels, supervised offloading records, vessel logbooks and additional data gathering such as from canneries provide the basic inputs for the stock assessment. Additionally, since 2000, the port-sampling program for collecting length-composition data has also provided information on species composition. Longline catch data are reported annually to the IATTC by Members and Cooperating non-Members (CPCs), pursuant to Resolution C-03-05 on data provision. IATTC databases include data on the spatial and temporal distributions of longline catches of yellowfin in the EPO by the fleets of distant-water CPCs (China, Chinese Taipei, France (French Polynesia), Japan, Korea, Vanuatu) and coastal CPCs (principally Mexico and the United States) (Minte-Vera et al., 2020). The results of the assessment include specific outputs that establish the status of the stock in relation to reference points such that it can be determined whether the harvest strategy is working. SG60 is met.



d	Harvest str	Harvest strategy review				
	Guide		The harvest strategy is periodically reviewed			
	post		and improved as necessary.			
	Met?		Yes			

Rationale

IATTC has been going through a process for some years of reviewing, evaluating and adjusting the harvest strategy to arrive at the current point; for example, stock assessment methodologies have changed, and quite a bit of work has gone into defining appropriate reference points and harvest control rules. Examples of a search for appropriate reference points and control rules are in: Maunder (2012), Maunder and Deriso (2007, 2013, 2014). Changes in stock assessment methodologies to improve estimation of parameters can be followed in: Aires-da-Silva et al. (2020), Cass-Calay et al. (2019), IATTC (2000, 2020), Maunder and Aires-da-Silva (2010), Maunder and Watters (2001), Maunder and Watters (2003), Minte-Vera et al. (2020).

Resolution C-16-02 provides a comprehensive road map for the evaluation of harvest control rule for the tropical tunas (yellowfin, bigeye and skipjack). Although the Commission has used as an operational harvest control rule (HCR) which limits fishing mortality (F) to levels that do not exceed the level corresponding to the maximum sustainable yield (MSY), the Commission recognised in Resolution C-17-02 that target reference points should also include the level of biomass as well as F if the long-term sustainable exploitation of the fish stocks, with the best possible catches, is to be achieved. Therefore the Commission, during its 87th annual meeting, adopted interim limit and target reference points for yellowfin tuna and bigeye tuna and appropriate limit reference points related to the maximum values of fishing mortality or the minimum values of biomass, which should not be exceeded, are to be evaluated following the recommendations of the IATTC scientific staff (Maunder and Deriso, 2016) that the appropriateness of the operational HCR currently used with regard to the limit reference points has not been investigated in depth. Therefore, a more comprehensive management strategy evaluation (MSE) is to be conducted to evaluate the HCR; and alternative HCRs will be considered that include hard and soft limit reference points, that use reference points based on biomass, and that establish well-defined scientific management recommendations in the case that the reference points are exceeded. Maunder et al. (2016) outlines current and future research on management strategy evaluation (MSE) for tunas and related species in the EPO. There is ample evidence documenting the efforts to improve the performance of the harvest strategy with constant reviews and analyses. The fishery meets the requirements at SG100.

e	Shark finni	Shark finning					
	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.			
	Met?	N/a	N/a	N/a			



Rationale

The target species is not a shark; this scoring issue is not relevant.

f	Review of a	alternative measures		
	Guide post	There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock.	There is a regular review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate.	There is a biennial review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate.
	Met?	N/a	N/a	N/a

Rationale

There is no unwanted catch of yellowfin in this fishery. Based on the most recent Part 1 report submitted by French Polynesia to the WCPFC (DRM, 2020), yellowfin discards in the longline fishery amounted to 4%. This scoring issue is therefore not relevant.

References

Aires-da-Silva et al. (2020), Cass-Calay et al. (2019), IATTC (2000, 2015, 2020), Maunder and Aires-da-Silva (2010), Maunder and Watters (2001), Maunder and Watters (2003), Minte-Vera et al. (2020), DRM (2020), Maunder et al. (2016), Maunder and Deriso (2016), Maunder (2012), Maunder and Deriso (2007, 2013, 2014), Minte-Vera et al. (2019).

Overall Performance Indicator score	95
Condition number (if relevant)	N/a



Scoring table 4. PI 1.2.2 – Harvest control rules and tools

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place			
Scoring	lssue	SG 60	SG 80	SG 100	
а	HCRs design and application				
	Guide post	Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock fluctuating at or above a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, most of the time.	
	Met?	Yes	Yes	No	

Rationale

At the SG80 level, well defined harvest control rules need to be in place, ensuring that the exploitation rate is reduced as the PRI is approached; additionally, it is expected that the rule will keep the stock fluctuating around or above a level consistent with MSY. At the SG100 level, it is expected that the stock will be maintained at or above this level most of the time, as per SA2.5.4, meaning that, "where simulation testing is available", the stock is maintained at or above MSY at least 70% of the time.

I) The Harvest Control Rule is well defined

In 2014 the IATTC adopted the simple rule that "if fishing mortality exceeds the level corresponding to MSY, it be reduced to that level" (IATTC, 2014). At that point, the rule became explicitly defined or agreed (if *F*>*F*_{MSY} it will be returned to *F*_{MSY}), quantitative, and measurable, and was therefore considered well-defined. This HCR was further developed and expressed in probabilistic ways such that measures for the purse-seine fishery:

- a) "Shall attempt to prevent the fishing mortality rate (F) from exceeding the best estimate of the rate corresponding to the maximum sustainable yield (F_{MSY}) for the species that requires the strictest management".
- b) "If the probability that *F* will exceed the limit reference point (*F*_{LIMIT}) is greater than 10%, as soon as is practical management measures shall be established that have a probability of at least 50% of reducing *F* to the target level (*F*_{MSY}) or less, and a probability of less than 10% that *F* will exceed *F*_{LIMIT}".



- c) "If the probability that the spawning biomass (*S*) is below the limit reference point (*S*_{LIMIT}) is greater than 10%, as soon as is practical management measures shall be established that have a probability of at least 50% of restoring *S* to the target level (dynamic *S*_{MSY}) or greater, and a probability of less than 10% that *S* will descend to below *S*_{LIMIT} in a period of two generations of the stock or five years, whichever is greater".
- d) "For fisheries that use gears other than purse-seine nets, the recommendations by the IATTC scientific staff on additional management measures shall be as consistent as possible with those adopted for the purse-seine fishery, while taking account of the impact of those fisheries on the species compared with that of purse-seine fishery".

With these definitions, the HCR continues to aim keeping the stock at or below F_{MSY} while at the same time, in consideration to uncertainties associated to the estimates of *S*, it will implement measures if there is a small probability that the stock is below S_{LIMIT} or is exceeding F_{LIMIT} .

II) The Harvest Control Rule is in place

Resolution C-16-02 of the IATTC has a detailed description of the control rule which was adopted by the members of the Commission. This Resolution requires that the scientific staff uses the interim limit and target reference points previously adopted as their technical basis, therefore, the HCR incorporates them in its definitions. The IATTC's decision to adopt the rule is evidence that the HCR is in now formally in place (SG80).

Additional evidence that the HCR is functional is its systematic use and implementation through temporal closures. Under the new risk based approach, the scientific staff evaluates the probability that alternative management actions would keep the stocks at the target reference point and with low probability that it would be under the LRP. The length closure satisfying these conditions is presented as the current recommendation by the staff. In recent years, the Commission has adopted the staff recommendations, therefore, based on evidence of implementation, the HCR and its main associated tool can therefore be said to be in place (SG 80) and linked to reference points, in a manner consistent with the harvest strategy.

III) The HCR reduces exploitation rate as the LRP is approached

An explicit LRP has been defined and is used in combination with the TRP by the HCR given the main mandate of the Convention. Under the current structure of the HCR, the aim is to keep *F* from exceeding "the best estimate of the rate corresponding to the maximum sustainable yield (F_{MSY}) for the species that requires the strictest management" (IATTC 2016 Resolution on the HCR). At the same time, the HCR indicates that, measures must be taken if there is a probability greater than 10% that the spawning stock is below the LRP. Under this construction, if fishing mortality is greater than the target, it will be reduced preventing the stock to approach the LRP. However, even if *F* is near *F*_{MSY}, if uncertainty is large enough to have a small probability that *S* is under the LRP, there would be measures assuring the stock to recover.

In conclusion, there is evidence that the HCR is well defined as a pre-agreed, explicit, quantitative and measurable rule. There is definitive evidence that the HCR is in place because temporal closures are defined following the demands of the rule; the HCR has been used for over a decade and because the rule itself has been formally adopted by the Commission and presented in Resolution C-16-02 (IATTC, 2016). Finally, the HCR is set relative to both the TRP and the LRP, which is safer compared with a control rule exclusively set relative to the LRP. For the large tropical tunas, YFT and BET, where the rule operates directly, this will ensure that the exploitation rate will be reduced once $F > F_{MSY}$ and/or when the probability that $S < S_{LIMIT}$ and/or $F > F_{LIMIT}$ with a probability greater than 10%.



Although the results of the stock assessment show the reconstructed population trajectory to be most of the times clearly above *S*_{MSY}, simulation testing to determine that the rule will keep the stock most of the times above the TRP has not been conducted yet, therefore, SG60 and SG80 are met for YFT but not SG100.

b	HCRs robustness to uncertainty		
	Guide	The HCRs are likely to be robust to the main	The HCRs take account of a wide range of
	post	uncertainties.	uncertainties including the ecological role of the stock, and there is evidence that the HCRs are robust to the main uncertainties.
	Met?	Yes	No

Rationale

Uncertainty in relevant parameters such as steepness in the stock recruitment relationship, asymptotic length and natural mortality has been investigated to measure the performance of the harvest strategy. Until 2019, only some sensitivity analyses in the YFT stock assessment and management strategy evaluation for BET had been conducted. Preliminary results of MSE with BET indicated that the HCR and associated reference points "works effectively to manage the stock at the MSY level" and that generally there's a less than 10% chance for the recruitment to fall under the 0.5R0 LRP (e.g. Maunder et al. (2015)).

Presently, the stock assessment and the process to prepare management advice has shifted from a best-case model analysis to a risk-based methodology where uncertainty is investigated through the development of alternative models representing competing hypotheses about the state of nature (Minte-Vera et al., 2020). The models include alternative assumptions about the biology of tunas, stock productivity, and the operation of the fishery. In doing so, uncertainty is explicitly incorporated during the estimation of stock status and when management advice is prepared. In particular, the decision-making process evaluates the impact of the different uncertainties in the assessment on the application of alternative decisions about the length of the closure period. Results of such analyses are presented as probabilities that the fishery could exceed the management reference points *F*_{MSY} and *F*_{LIMIT} (Aires-da-Silva et al., 2020).

The team recognizes that the construction and application of the HCR rule has been improving to incorporate a wider range of uncertainties and to evaluate their impact on alternative courses of action. Therefore, it is possible to say that the HCR is likely to be robust to the main uncertainties meeting the requirements of this SI at SG80. As this is a new approach and MSE is still being conducted, and because to this moment, the ecological role of the stock has not being included in the assessment process, it is considered that the fishery cannot meet the standard at SG100 yet.

c HCRs evaluation



	Guide	There is some evidence that tools used or	Available evidence indicates that the tools in	Evidence clearly shows that the tools in use are
	post	available to implement HCRs are appropriate and effective in controlling exploitation.	use are appropriate and effective in achieving the exploitation levels required under the HCRs.	effective in achieving the exploitation levels required under the HCRs.
	Met?	Yes	Yes	No

Rationale

Until 2019, the main tools used to implement the HCR were the F multiplier and the temporal closure as a form of effort control. As demonstrated mainly by the estimates of status of the YFT stock in recent years, the tools have shown to be effective in achieving the exploitation levels required under the HCR. Regarding the old approach, the IATTC staff concluded that the "measures established in Resolution C-13-01 have had the intended effect of reducing the fishing mortality of bigeye and yellowfin to a level not exceeding the MSY" (IATTC, 2015).

In the new risk-based framework, there is not sufficient evidence yet that the way closure length is being recommended will have the expected effect. However, given the past history and the structure of the risk analysis, it is expected that better handling of uncertainties, better accounting for biological and fishery factors, will lead to more robust decisions, making the tools effective to achieve the exploitation levels required under the HCR. Because the new approach has not been fully applied to the next fishing season, it is not possible to ascertain that the evidence is clear regarding the efficiency of the tools, therefore the fishery meets SG60 and SG80 but not SG100.

References			

IATTC (2014, 2015, 2016), Maunder et al. (2015), Aires-da-Silva et al. (2020), Minte-Vera et al. (2020),

Overall Performance Indicator score	80
Condition number (if relevant)	N/a



Scoring table 5. PI 1.2.3 – Information and monitoring

PI 1.2.3		Relevant information is collected to support the harvest strategy			
Scoring	Issue	SG 60	SG 80	SG 100	
а	Range of ir	nformation			
	Guide post	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.	
	Met?	Yes	Yes	No	

Rationale

There are good data available on landings, effort and size, including some operational data and some discard data. The stock assessment uses fishery data to estimate an index of abundance and its associated length composition. Thirty-eight fisheries are defined for the stock assessment of yellowfin tuna in the EPO, classified by gear (purseseine, longline, or pole-and-line), purse-seine set type (floating object, unassociated, or dolphin), unit of catch (number or weight), quarter within a year, and geographical area of operation. The information used to estimate the total purse seine catch by species comes from four main sources: in order of importance, canneries, on-board observers, vessel logbooks, and in-port sampling by IATTC staff. Longline catches are reported annually to the IATTC by Members and Cooperating non-Members (CPCs), pursuant to Resolution C-03-05 on data provision; IATTC databases include data on the spatial and temporal distributions of longline catches of yellowfin in the EPO by the fleets of distant-water CPCs (China, Chinese Taipei, France (French Polynesia), Japan, Korea, Vanuatu) and coastal CPCs (principally Mexico and the United States) (Minte-Vera et al., 2020). Although both purse-seine and longline indices of abundance are available for yellowfin in the EPO, the Minte-Vera et al. (2020) assessment includes only the purse-seine index, noting that the purse-seine fisheries, mainly associated with dolphins, account for the vast majority of EPO YFT catches, with longline catches representing a small proportion. The assessment further takes into account data on growth, natural mortality, reproductive biology and recruitment as well as yellowfin movement and stock structure. On this basis, SG60 and SG80 are met. Although the new assessment approach tries to quantify much more than previously the impact of uncertainties in information (e.g. growth, recruitment, selectivity) on the estimate of stock status, this does not mean that those uncertainties have disappeared – the range of data



b	Monitoring					
	Guide post	Stock abundance and UoA removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and UoA removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.		
	Met?	Yes	Yes	No		

Rationale

A stock assessment is conducted annually using catch and effort data as set out above. The scientists note that they have relatively high confidence in the data (which includes operational data and is based on high observer coverage in the purse seine fleet). The same data are collected across the three species which are part of the harvest strategy. The stock assessment includes detailed analysis of different types of uncertainties in the data and in the model, by using 12 different models based on different assumptions about information such as growth and selectivity, and each incorporating 4 different recruitment assumptions. On this basis, SG60 and SG80 are met. Parts of SG100 are also met, but it is hard to argue that 'all information is monitored with a high degree of certainty'; e.g. there remain data gaps in relation to the sampling of species composition and length-frequency from purse seiners, as well as data to inform assumptions about stock structure. SG100 not met in full.

C	Comprehensiveness of information					
	Guide		There is good information on all other fishery			
	post		removals from the stock.			
	Met?		Yes			

Rationale

The stock assessment covers all the main fleets; the information used to estimate the total purse seine catch by species comes from four main sources: in order of importance, canneries, on-board observers, vessel logbooks, and in-port sampling by IATTC staff. Longline catches are reported annually to the IATTC by Members and Cooperating non-Members (CPCs), pursuant to Resolution C-03-05 on data provision; IATTC databases include data on the spatial and temporal distributions of longline catches of yellowfin in the EPO by the fleets of distant-water CPCs (China, Chinese Taipei, France (French Polynesia), Japan, Korea, Vanuatu) and coastal CPCs (principally Mexico and the United States) (Minte-Vera et al., 2020). SG80 is met.



References

Minte-Vera et al. (2020)

Overall Performance Indicator score	80
Condition number (if relevant)	N/a



Scoring table 6. PI 1.2.4 – Assessment of stock status

PI 1.2.4 There is an adequate assessment of the stock status						
Scoring Issue SG 60		SG 60	SG 80	SG 100		
а	Appropriat	priateness of assessment to stock under consideration				
	Guide		The assessment is appropriate for the stock and for	The assessment takes into account the major		
	post		the harvest control rule.	species and the nature of the UoA.		
	Met?		Yes	Yes		

Rationale

Despite improvements in the stock assessment, the approach taken by the IATTC stumbled upon a series of issues that led the staff to consider an alternative way to assess stock status that was not dependent on the definition of a "best-case" model to obtain estimates of management parameters and provide advice. Some of the most important issues arose from attempts to include a new dataset from the longline fishery. Such issues were originally thought to be related to changes in the gear or operations of the longliners, however, changes in the size distribution were also present in some of the purse-seine fisheries, which were probably related to changes in selectivity or caused by model misspecification in aspects such as growth. Other issues included the spatial structure determining the degree of mixing; "inconsistencies between the indices of abundance based on CPUE from the dolphin-associated purse-seine fishery and that based on CPUE from the longline fishery; the inability of the model to fit the high values in the indices of abundance; a misfit to the composition data for the fishery that is assumed to have asymptotic selectivity" and uncertainty in the shape of the stock-recruitment relationship as pertaining to the value of the steepness parameter *h* (Minte-Vera et al., 2020).

Instead of investigating the sensitivity of the model to critical assumptions, or attempting to identify a new model addressing the problems, the external review suggested to develop a new assessment approach to incorporate a wide range of uncertainties directly into the assessment process (Cass-Calay et al., 2019).

The new approach was based on risk analysis methods using alternative model constructions that represented possible hypotheses about states of nature of biology, stock productivity and the operation of the fishery. The new approach not only allows for a better handling of uncertainty but explicitly evaluates stock status in a probabilistic way as defined by the latest version of the harvest control rule of the Commission.





The assessment was structured on the basis of the identified uncertainties in hierarchical layers represented in the figure above, which led to the definition of 48 alternative models. The assessment also ran diagnostics looking for model convergence; fit to indices of abundance; fit to length frequency data; general fit of the model; likelihood profiles and retrospective analyses.

The new approach improved what was already considered appropriate for the stock, it better fits the demands of the HCR and takes into account the major features relevant for the Unit of Assessment, including the species and the fishery. The requirements at SG80 and SG100 are met.

b	Assessmen	it approach		
	Guide	The assessment estimates stock status relative to	The assessment estimates stock status relative	
	post	generic reference points appropriate to the species category.	to reference points that are appropriate to the stock and can be estimated.	
	Met?	Yes	Yes	



Rationale

See a detailed description of how the stock is assessed relative to IATTC's reference points in PI 1.1.1 Sla. The fishery meets the requirements at SG60 and SG80.

С	Uncertainty in the assessment															
	Guide post	The assessment uncertainty.	identifies	major	sources	of	The accou	assessment Int.	takes	uncertainty	into	The unce relati way.	assessment rtainty and is ve to referenc	takes evaluat e points	into ing sto in a pro	account ck status babilistic
	Met?	Yes					Yes					Yes				

Rationale

Two of the main improvements of the new benchmark assessment are that a wider range of uncertainties are incorporated into the assessment procedure and that the stock status is now estimated in a probabilistic way consistently with the definition of the HCR and the reference points in Resolution C-16-02. Decision tables are also built to provide management advice based on the probability that, given the overall uncertainty, alternative decisions may fail to meet the management goal. The fishery meets the requirements at SG60, SG80 and SG100.



Rationale



Assessments have tested alternative hypotheses about different components of the model and even alternative models. However, results are far from being considered robust, notably in relation to the SR relationship. Although the new benchmark assessment has incorporated a wide range of uncertainties, the approach is new and requires testing, particularly with regards of issues such as the weights assigned to different assumptions. The SG100 level is not met.

е	Peer review of assessment								
	Guide	The assessment of stock status is subject to peer	The assessment has been internally and						
	post	review.	externally peer reviewed.						
	Met?	Yes	Yes						

Rationale

Results of the IATTC research are often published in peer reviewed journals, particularly those related to methodologies or the overall state of stocks and the fishery (see https://www.iattc.org/Meetings2018/IATTC93/PDFs/Docs/_English/IATTC-9306b_Staff%20research%20activities.pdf). The Commission also assembles external expert panels to peer review stock assessments and the yellowfin stock assessment has been externally peer reviewed by Martell et al. (2013). In collaboration with Scripps Institution of Oceanography and the US National Marine Fisheries Service, the IATTC founded the Center for the Advancement of Population Assessment Methodology (http://www.capamresearch.org/) to conduct research on fisheries stock assessment. Therefore, even while the latest stock assessment is too new and different to have been subject to external peer review, it is the result of input from the latest external review that led to the development of an entirely new approach to assess the stock and provide management advice. It can be considered the product of there is an extensive peer review process in place and the SG100 level is met.

References

Cass-Calay et al. (2019), Minte-Vera et al. (2020), Martell et al. (2013)

Overall Performance Indicator score	95
Condition number (if relevant)	N/a