OUTLINE OF AN ALTERNATIVE PROJECTION APPROACH TO EVALUATE RECENT CONSERVATION MEASURES RECOMMENDED BY ICCAT TO REDUCE MORTALITY FOR NORTH ATLANTIC SHORTFIN MAKO

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SUMMARY

An alternative projection approach may be useful to evaluate the effectiveness of recent conservation measures recommended by ICCAT to reduce North Atlantic shortfin mako shark mortality in association with ICCAT Fisheries. An outline of an alternative projection approach is presented which combines output from an uncertainty grid of multiple Stock Synthesis model sensitivity runs with forward projection using a software package (FLasher) developed for the Fisheries Library in R (FLR).

RÉSUMÉ

Il pourrait s'avérer utile d'élaborer une approche alternative de projection afin d'évaluer l'efficacité des mesures récentes de conservation recommandées par l'ICCAT visant à réduire la mortalité du requin-taupe bleu de l'Atlantique Nord capturé en association avec les pêcheries de l'ICCAT. Ce document présente un aperçu de l'approche alternative de projection qui combine les résultats d'une grille d'incertitudes de scénarios de sensibilité du modèle Stock Synthesis avec une projection vers l'avant au moyen d'un progiciel (Flasher) mis au point pour la Fisheries Library dans R (FLR).

RESUMEN

Un enfoque de proyección alternativo podría resultar útil para evaluar la eficacia de las recientes medidas de conservación recomendadas por ICCAT para reducir la mortalidad de los ejemplares de marrajo dientuso del Atlántico norte capturados en asociación con pesquerías de ICCAT. Se presenta un resumen del enfoque de proyección alternativo que combina los resultados de una matriz de incertidumbre para múltiples ensayos de sensibilidad del modelo Stock Synthesis con proyecciones hacia adelante que utilizan el paquete de software (FLasher) desarrollado para la Fisheries Library en R (FLR).

KEYWORDS

Projections, Shark fisheries, Pelagic fisheries, Shortfin mako shark

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Background

At its 2017 annual Commission meeting, ICCAT recommended several conservation measures intended to reduce North Atlantic shortfin mako shark mortality in association with ICCAT Fisheries. The commission also tasked the SCRS by 2019 with reviewing the effectiveness of the measures. Since it is unlikely that sufficient data will be available by 2019 to conduct a new stock assessment, projections based upon the 2017 assessment may be useful to determine the probability based on simulated results that measures contained in the ICCAT recommendation are expected to prevent the population from decreasing further, stop overfishing and begin to rebuild the stock by 2019.

In 2018, ICCAT held a series of workshops to build capacity of the ICCAT SCRS scientific community in the Management Strategy Evaluation (MSE) process. Programming methods introduced and evaluated at the workshops included the use of Stock Synthesis as an operating model and forward projection using a software package (FLasher) developed for the Fisheries Library in R (FLR; http://www.flr-project.org/FLasher/; Available 7/4/2018).

The FLR software packages may also be useful for projections. An alternative projection approach is outlined here for future evaluation which uses the software package (FLasher) to implement an uncertainty grid of multiple Stock Synthesis model sensitivity runs with forward projection. An example of the approach is outlined for two uncertainty grids and two recent conservation measures recommended by ICCAT.

Methods

Step 1. Identify recent conservation measures recommended by ICCAT to reduce North Atlantic shortfin mako mortality (https://www.iccat.int/Documents/Recs/compendiopdf-e/2017-08-e.pdf; Accessed 7/2/2018).

Step 2. Identify examples of conservation measures for use in forward projection:

a) Retention of shortfin mako if dead when brought along side for taking on board the vessel; or
b) Retention of shortfin mako of a minimum size of at least 180 cm fork length for males and of at least 210 cm fork length for females.

Step 3. Implement alternative projection approach using the software package (FLasher).

Outline:

1. Develop an example of an operating model in Stock Synthesis (e.g., Anon. 2017),
2. Implement an uncertainty grid for the operating model (**Tables 1 and 2**),
3. Implement selected examples of conservation measures in forward projection (**Table 3 and Figure 1**),
4. Combine projection model output and evaluate the range of uncertainty in results.

Table 1. Example Uncertainty Grid #1 includes 12 Stock Synthesis model sensitivity runs (3X2X2) developed from the range of uncertainty evaluated for the Stock Synthesis model using the Beverton-Holt (BH) stock recruit relationship (Anon. 2017).

Parameter	*Value-1*	*Value-2*	*Value-3*
BH-steepness	0.3	0.345	0.4
Selectivity	Double-Normal	Logistic	
Catch start yr.	1950	1971	

Table 2. Example Uncertainty Grid #2 includes 16 Stock Synthesis model sensitivity runs (4X2X2) developed from the range of uncertainty evaluated for the Stock Synthesis model using the Low Fecundity Stock Recruit (LFSR) relationship (Anon. 2017).

Parameter	*Value-1*	*Value-2*	*Value-3*	*Value-4*
LFSR-Beta	0.642	1	2	3
Selectivity	Double-Normal	Logistic		
Catch start yr.	1950	1971		

Table 3. Example implementation for use in forward projection of a conservation measure to limit retention of shortfin mako if dead when brought along side for taking on board the vessel (assumed for this example to be applied to the average catch 2013-2015 used in the Stock Synthesis model; Anon. 2017).

Calculation	*Value*
Average catch 2013-2015 (1000s kg)	3265
Kept-dead at vessel[a] (1000s kg)	1175
Dead after release alive[b] (1000s kg)	522
Total mortality (dead at vessel + dead after release alive) (1000s kg)	1698
Proportion of average catch (apply to F_current in projections)	0.52

[a]Kept (dead at vessel) = Observed at vessel mort (e.g. ~0.36; based on preliminary data from EU POR, Pers. Comm. R. Coelho) X average catch (2013-2015 used in 2017 NA SMA Stock Synthesis model).

[b]Dead after release alive = Released (Alive at vessel) X post release mortality estimate (e.g., ~0.25 based on preliminary data from ICCAT Shark Working Group satellite tagging study, Pers. Comm. R. Coelho).

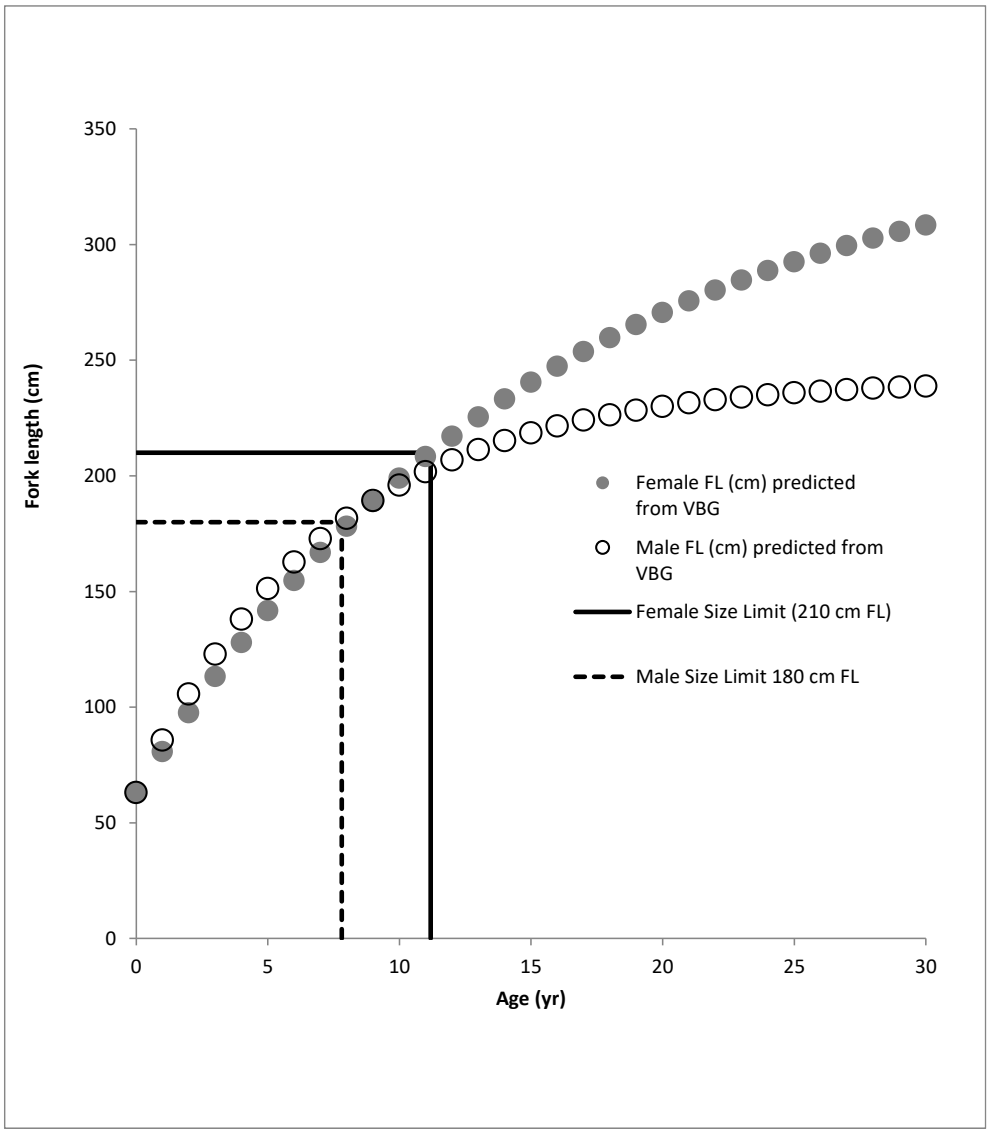

Figure 1. Example implementation for use in forward projection of a conservation measure to limit retention of shortfin mako of a minimum size of at least 180 cm fork length for males and of at least 210 cm fork length for females (assumed here to be applied to all North Atlantic fleets used in the Stock Synthesis model; Anon. 2017); convert length to age of male (180 cm FL = age 7.8 yr.) and female (201 cm FL = age 11.2 yr.) through the von Bertalanffy growth curve (VBG) used in the Stock Synthesis model; Anon. 2017); then fix selectivity in forward projections to reflect non retention of sharks below age limit.

References

Anon. 2017. Report of the 2017 Shortfin Mako Assessment Meeting (Madrid, Spain 12–16 June 2017). Collect. Vol. Sci. Pap. ICCAT, 74(4): 1465-1561.