Oceans & Atmosphere
www.csiro.au

Calculation of Broadbill Swordfish Recommended Biological Commercial Catch in 2022

R. Hillary, L. Tremblay-Boyer, A. Williams

13 September 2022

CSIRO Oceans & Atmosphere
Battery Point, Hobart 7000, Tasmania, Australia.

Citation

Hillary, R., Tremblay-Boyer, L. and Williams, A. (2022). Calculation of Broadbill Swordfish Recommended Biological Commercial Catch in 2022. Working paper presented to the 36th meeting of the Tropical Tuna Resource Assessment Group held 13 September 2022, Maroochydore.

Acknowledgement

This work was undertaken as part of the project "Data management, assessment and implementation of the harvest strategies for Australia's tropical tuna fisheries" funded by the Australian Fisheries Management Authority and CSIRO.

Contents

1 Executive Summary

Given the recently modified Harvest Strategy for Broadbill Swordfish (*Xiphias gladius*), a Recommended Biological Commercial Catch (RBCC) is calculated for this species. Application of the harvest strategy for 2023 results in a calculated RBCC of 1,047 tonnes, i.e., **no change** from the previous Total Allowable Catch (TAC). The four year moving average abundance index from 2018–2021 (the key input to the harvest strategy) is still below the lower edge of the buffer zone. The reason no decrease in RBCC has occurred is because of the modification to the original Harvest Strategy that takes explicit account of the fact that current catches are well below RBCC. The fact that the current low catches are further below the unmodified RBCC than the RBCC is below the current TAC means no actual reduction in the overall TAC is required. Given the previously identified Exceptional Circumstance (catches well below TACs) is now accounted for in the Harvest Strategy itself, and observed catch-per-unit-effort is well within the range simulated in the Management Strategy Evaluation work, we therefore recommend a RBCC of 1,047 tonnes for the 2023 fishing season.

2 Background

The AFMA Commission adopted the Harvest Strategy for Broadbill Swordfish which was developed under the direction of the TTRAG and TTMAC over the last few years. Given unprecedented low levels of catch well below the Total Allowable Catch (TAC) over the last couple of years during the COVID pandemic, a modification to the Broadbill Swordfish HS was developed within TTRAG and TTMAC. Given the annual agreed cycle for this Harvest Strategy, a TAC for Broadbill Swordfish is required for 2022 and this paper details:

1. A reminder of the modified Harvest Control Rule (HCR)
2. The standardised catch-per-unit-effort (CPUE) index used in the HCR
3. The Recommended Biological Commercial Catch (RBCC) calculated using the modified Harvest Strategy
4. A brief consideration of a potential invocation of Exceptional Circumstances

3 Broadbill Swordfish Harvest Strategy

The HCR used in the Broadbill Swordfish Harvest Strategy can be seen in Figure 1. A single recent-average abundance index is used (the sub-adult standardised CPUE index) to calculate a scalar multiplier (on y-axis of Figure 1) which is applied to the current TAC to get the new proposed RBCC.

The CPUE index used in the Broadbill Swordfish harvest strategy is the previously agreed sub-adult standardised CPUE index—specifically the index which was presented at the previous TTRAG [1]. In the Harvest Strategy a 4 year mean (i.e. from 2018–2021) was designed as the reference mean index to be used as an input to the HCR. The RBCC scalar is then calculated subject to the constraint that the relative change in RBCC cannot exceed 10% in either direction (up or down). In addition to this constraint, the modified harvest strategy accounts, when relevant, for the amount of undercatch by the fleet (i.e., a catch deficit below the actual RBCC). In the event the original HS recommends a decrease in the RBCC, the following rules apply: (a) if

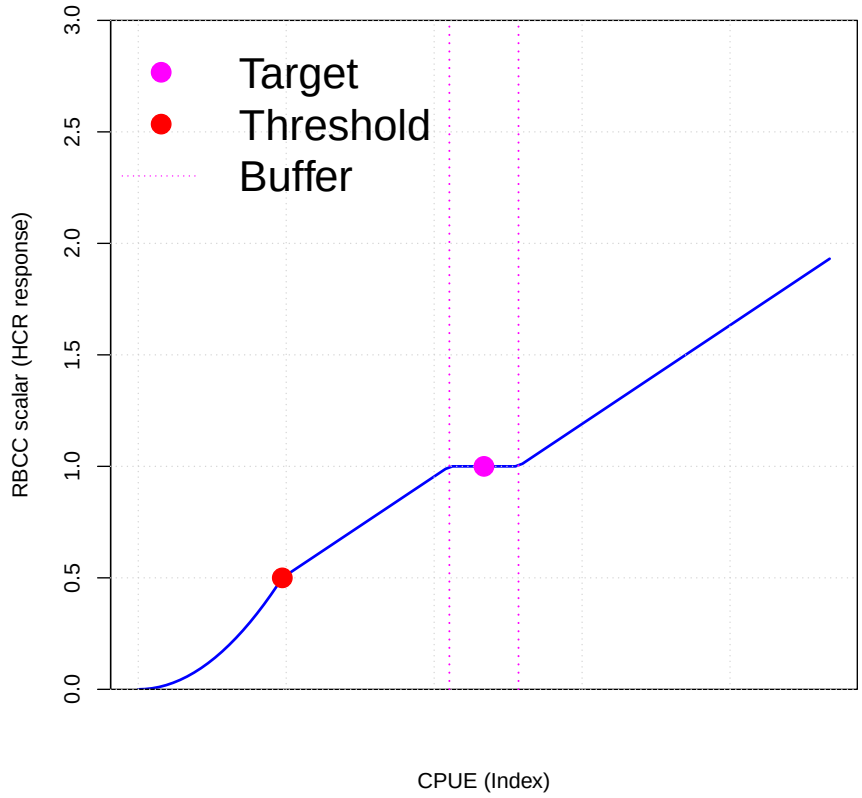

Figure 1: *General functional form of the Broadbill Swordfish Harvest Strategy.*

current catches are further below the RBCC than the RBCC is below the current TAC, *no change* is recommended; (b) if current catches are not further below the RBCC than it is below the TAC, the residual difference is discounted from the TAC reduction; (c) if the RBCC is below current catches then the full TAC decrease is applied. No alterations are made in the event of a TAC increase.

4 TAC calculation

The mean sub-adult standardised CPUE for the years 2018–2021 (correctly rescaled by the mean of the 1998–2018 index used in the MSE work) was 0.63. This is *below* the lower buffer of 0.8 in the HCR, which means a decrease in the RBCC will result. For reference, the "tuned" target CPUE (the longer-term target CPUE the Harvest Strategy tries to attain) is almost twice that of the current average value.

The actual value of the RBCC multiplier is 0.9 (the maximum 10% permitted). If not for the maximum change constraint the reduction would have been a factor of 0.72 as can be seen in Figure 2. Figure 2 details a graphical summary of the actual adopted HCR used for Broadbill Swordfish, as well as the location of the current mean CPUE and the associated proposed RBCC multiplier. However, because current catches are further below the initial RBCC than it is below the current TAC, the recommended RBCC is 1,047 tonnes (no change).

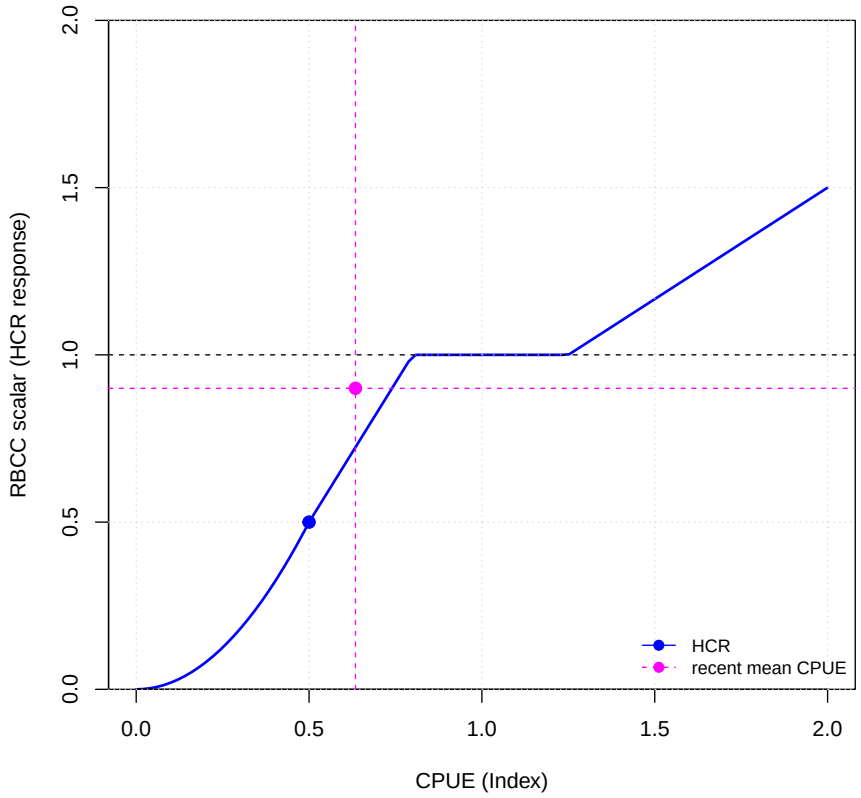

Figure 2: *Adopted HCR for Broadbill Swordfish (blue) and the observed mean recent sub-adult standardised CPUE and the associated RBCC multiplier (magenta).*

5 Exceptional Circumstances

The consideration of Exceptional Circumstances (EC) is an important part of the full MSE-tested Harvest Strategy process which, in essence, consists of asking:

1. Are the current conditions (data, fishery, other relevant parameters) meaningfully different to what we simulated, hypothesised, and assumed when testing?
2. If so, does action need to be taken?

The Harvest Strategy was tested conditional on the assumption that the future we simulated actually comes to pass in terms of the data and other factors that we see when implementing the HS in reality. If conditions appear outside of that range we cannot say that the HS is robust to those conditions as they have not been tested against. The previously discussed metarules process is how we deal with unforeseen events via a pragmatic process. It does not try and codify rules for all eventualities; it simply states that if EC are triggered, the relevant group (TTRAG in this case) will discuss what, if anything, needs to be done.

The most recent CPUE data falls well within the bounds of that simulated in the updated MSE work [2]. The previously identified Exceptional Circumstance (catches well below the TAC and in excess of the level tested in the original MSE) have been included explicitly in the modified Harvest Strategy. Given the 2021 assessment [3] we see no obvious major shift in either the

biological or stock status understanding for this population. We therefore recommend that no Exceptional Circumstances have been identified and the calculated RBCC can be recommended for consideration.

References

[1] Tremblay-Boyer, L., and Williams, A. (2022) Standardised CPUE indices for the target species in the Eastern Tuna and Billfish fishery - 1998 to 2021. *TTRAG, July, 2022*

[2] Hillary, R.M. (2022) Evaluation of proposed modification to Swordfish Harvest Strategy. *TTRAG, July, 2022*

[3] Ducharme-Barth, N., Castillo-Jordan, C., Hampton, J., Williams, P., Pilling, G., Hamer, P. (2021) Stock assessment of southwest Pacific swordfish. *WCPFC: SC17-SA-WP-04*.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

YOUR CSIRO

Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.