

Calculation of broadbill swordfish Recommended Biological Commercial Catch in 2023

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1 Executive Summary

This report updates the Recommended Biological Commercial Catch (RBCC) for broadbill swordfish (*Xiphias gladius*), under the modified Harvest Strategy 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 recent Total Allowable Catch (TAC). The four year moving average abundance index from 2019–2022 (the key input to the Harvest Strategy) remains slightly below the lower edge of the buffer zone of the Harvest Control Rule. However, an accepted modification to the original Harvest Strategy accounting for catches well below RBCC is currently in place. Under this modified Harvest Strategy, there is no decrease in RBCC compared to the recent TAC because the predicted level of undercatch in 2024 is below the original RBCC by enough of a margin that the modified RBCC is set equal to recent TAC levels. In addition, observed catch-per-unit-effort is well within the range simulated in the Management Strategy Evaluation work, so no Exceptional Circumstances are identified at the moment. As such, a RBCC of 1,047 tonnes is recommended for the 2024 fishing season.

2 Background

The AFMA Commission adopted the Harvest Strategy (HS) for broadbill swordfish following a MSE under the direction of the Tropical Tuna Resource Assessment Group (TTRAG) and the Tropical Tuna Management Advisory Committee (TTMAC) (Hillary, 2020). Recently, a modification to the broadbill swordfish HS was developed under TTRAG and TTMAC's advice (Hillary, 2022) to account for unprecedented low levels of catch well below the Total Allowable Catch (TAC) over recent years due to the COVID pandemic. This report updates the RBCC for broadbill swordfish for 2024 as required under the yearly agreed cycle for the Harvest Strategy. It includes:

1. A summary of the modified Harvest Control Rule (HCR)
2. The Recommended Biological Commercial Catch (RBCC) calculated using the modified Harvest Strategy
3. A brief consideration of potential 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 ('prime') standardised catch-per-unit-effort (CPUE) index—to calculate a scalar multiplier (on the 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 was presented to TTRAG 38 (Tremblay-Boyer et al., 2023). In the Harvest Strategy a four year mean (i.e., from 2019–2022) was selected as the reference mean index to use as 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 (Hillary 2022;

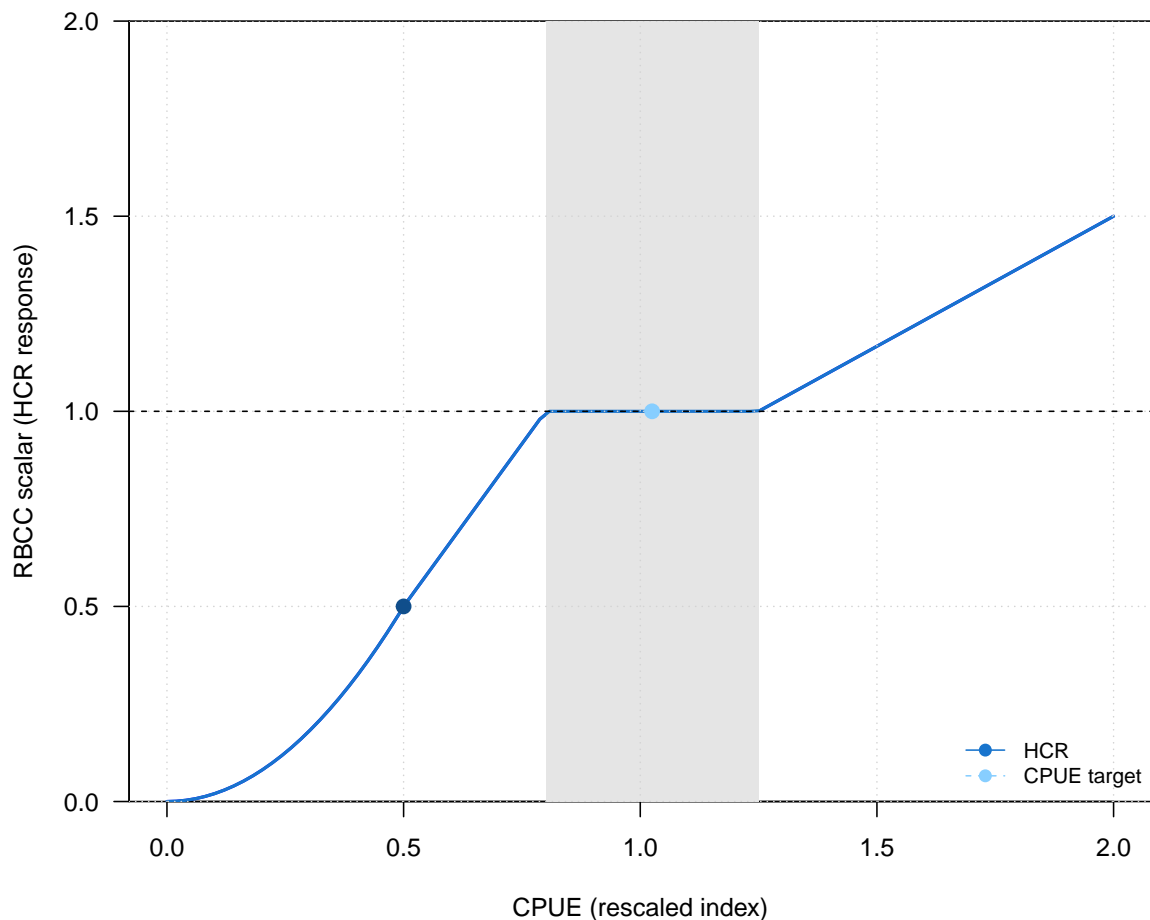


Figure 1: General functional form of the broadbill swordfish Harvest Strategy.

Figure 2) accounts for the amount of undercatch¹ by the fleet in the recent period as follows:

- In the event the original HS recommends a decrease in the RBCC, the following rules apply:
 - (a) if current catches are below the RBCC, the difference (i.e. the predicted undercatch) is added to the RBCC *up to a maximum of the difference between the recent TAC and the RBCC* (i.e. the the modified RBCC is not allowed to exceed the recent TAC);
 - (b) if the RBCC is below current catches, then the full RBCC decrease is applied.
- In the event the original HS recommends an increase in the RBCC, no modifications are made to the RBCC.

¹where undercatch is defined as a catch deficit below the TAC.

4 RBCC calculation

The mean sub-adult standardised CPUE for the years 2019–2022 (correctly rescaled by the mean of the 1998–2018 index used in the original MSE work, Hillary 2020) was 0.772. This is slightly *below* the lower limit of the buffer of 0.8 in the HCR, which means a decrease in the RBCC should result. Of note, this is an improvement in scalar value from previous iterations of the HS (e.g. Hillary et al., 2022), reflecting recent increases in the sub-adult standardised CPUE index.

The resulting prescribed reduction in RBCC from the standardised CPUE alone is a scalar of 0.953 (Figure 3). This scalar is within the 10% maximum change constraint, so should normally be applied as is to the previous TAC. However, under the modified HS, current catches (723t) are below the original RBCC (998t) by a level greater than the difference between the RBCC and the recent TAC of 1,047t, so the recommended RBCC is set to the recent TAC (1,047 tonnes, no change) (see also Figure 2).

5 Exceptional Circumstances

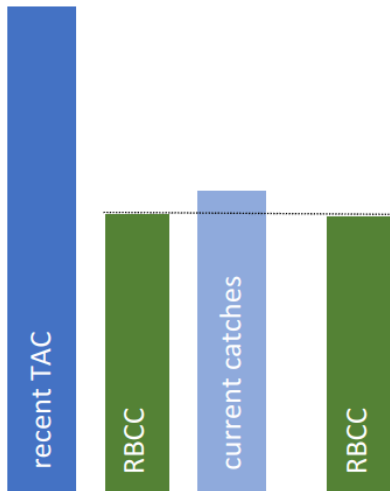
The consideration of Exceptional Circumstances is an important component of the MSE-tested Harvest Strategy process. It consists of asking, for every HS cycle:

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

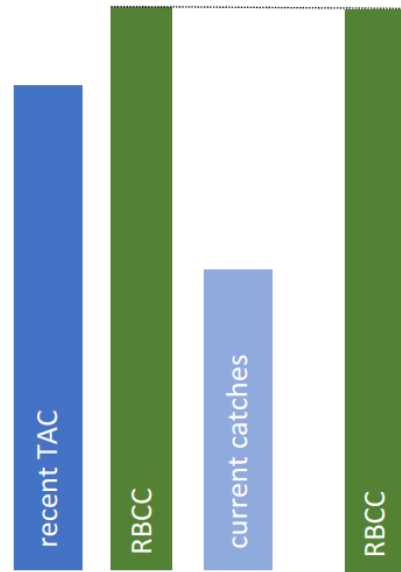
The Harvest Strategy was tested conditional on the assumption that simulations reflect future conditions in terms of the data, stock status and other factors that eventuate when the HS is actually implemented. If unforeseen conditions appear outside of the simulated range, the HS might not be robust to those conditions as they have not been tested against as part of the simulations. The metarules process outlines the procedure for unforeseen conditions. For this stock, the relevant group (i.e., TTRAG) will agree on possible solutions should Exceptional Circumstances be invoked.

For the current year, the most recent CPUE data falls well within the bounds of that simulated in the updated MSE work (Hillary, 2022). 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 (Hillary, 2022). Given no updates to the 2021 assessment (Ducharme-Barth et al., 2021), there is no obvious major shift in either the biological or stock status understanding for this population. Given no Exceptional Circumstances have been identified, it is recommended that the calculated RBCC under the modified HS be used for setting the 2024 TAC.

Unchanged RBCC

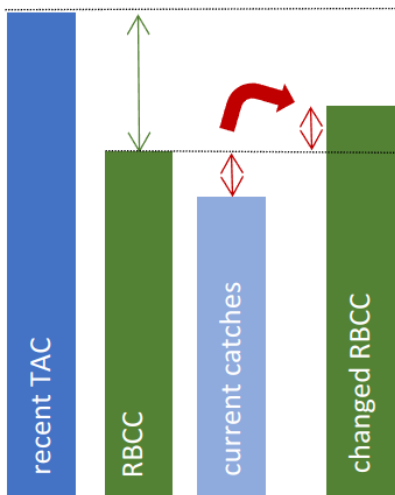


If the **RBCC < current catches**, the RBCC stays unchanged

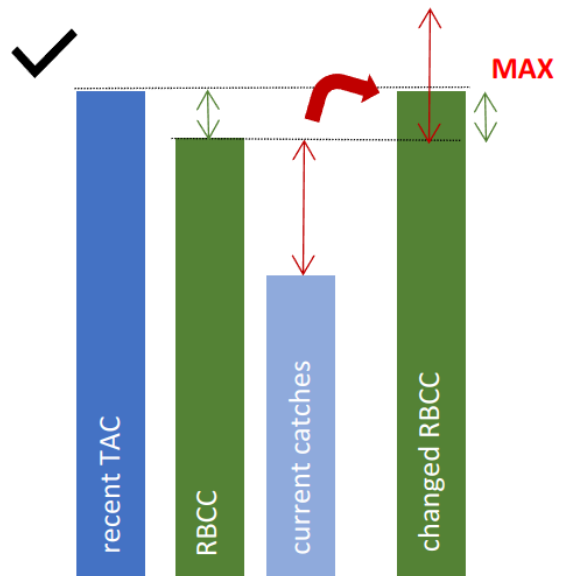


If the **RBCC > recent TAC**, the RBCC stays unchanged

Changed RBCC



If the **RBCC < recent TAC** BUT greater than current catches, the **predicted undercatch** is added to the RBCC...



... up to a maximum value of the recent TAC

Figure 2: Illustration of the outcomes of the modified Harvest Strategy under different relative levels of recent TAC, RBCC (as prescribed by the original Harvest Strategy) and the predicted undercatch (i.e., the difference between the RBCC and current catches). The top row shows cases where the RBCC remained unchanged from the original recommendation, the bottom row shows cases where the RBCC is changed as a function of the extent of the predicted undercatch. The tick mark indicates the case applied for this year's Harvest Strategy update.

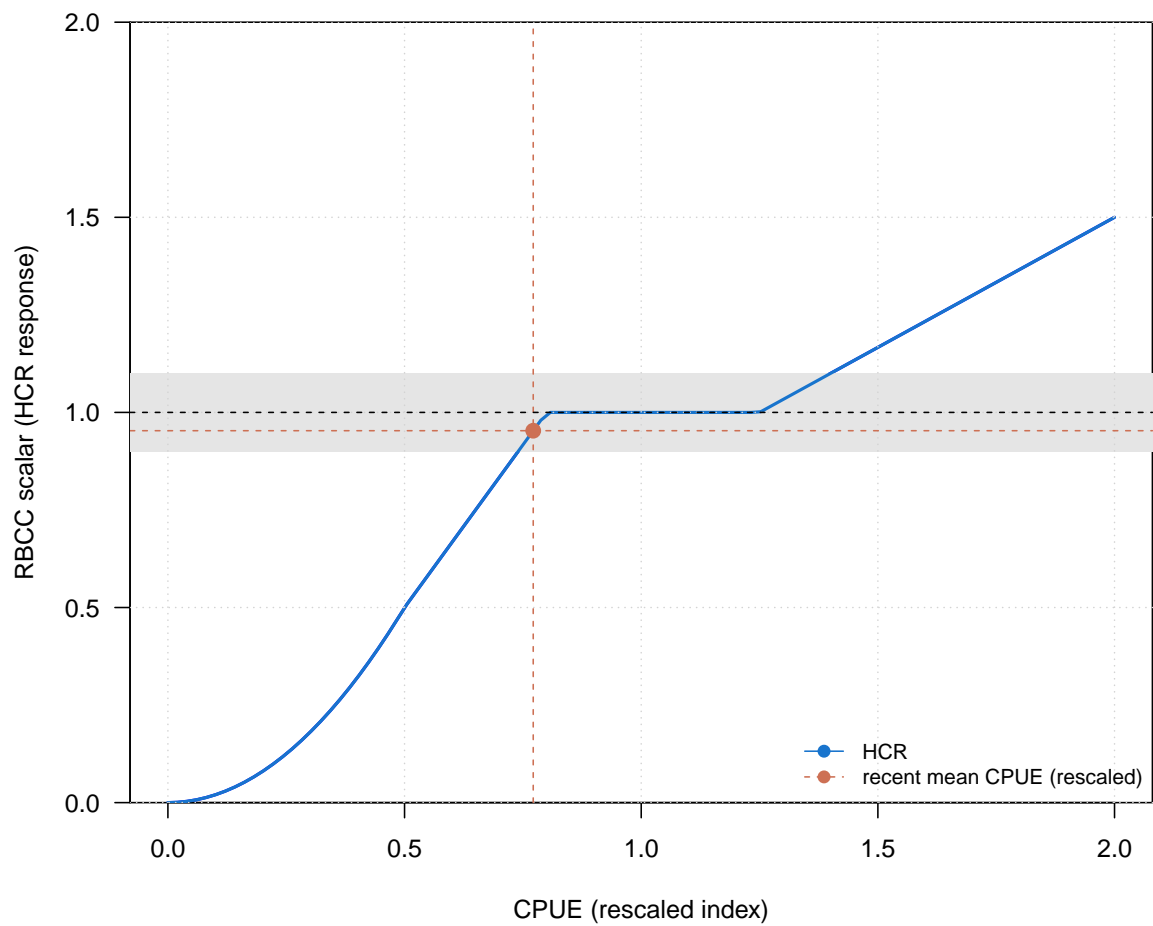


Figure 3: Adopted HCR for broadbill swordfish (blue), the observed mean recent sub-adult standardised CPUE and the associated RBCC multiplier (orange).

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