Yield per recruit analysis for the red blackspot seabream (*Pagellus bogaraveo*) stock from the Azores (ICES area Xa2).

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Summary

Red seabream is the most important commercial species of the Azores. This paper has the objective to assess the red seabream stock from the Azores through length base yield per recruit in order to define long term management objectives. Input data was revise and effects of constant or variable natural mortality (M) by length analysed. Results show that YPR is virtually asymptotic for any option of M which the maximum is not possible to attain except for low level of M=0.2. For any option of M the current F exceeds the target level except for very high values of M. Similar values to base case (constant M=0.2) hypothesis are estimated for optimal fishing mortality from YPR analysis when using a dependent length profile for M , but with a reduction of about 50% on all stock characteristics. Assessment results suggests that the stock is overexploited having considerable advantages on the reduction of fishing mortality or a combination of this recommendation with an increase of the hook size. Potential bias related with the sex change (Protandric hermaphrodite) is discussed. Stock status is also discussed in the context of the multispecies, multigear and multiarea characteristics of the Azorean deep-water hook and line fishery.

Introduction

The red black spot seabream (*Pagellus bogaraveo*) is considered a relatively slow growing species (Krug, 1994). It is a typical protandric hermaphrodite species, male to female type (Krug, 1994). Blackspot seabream has been exploited in the Azores, at least since the XVI century as part of the demersal fishery. The Azorean demersal fishery is a multispecies and multigear fishery where *P. bogaraveo* is considered the target species (Diogo et al., 2015; ICES, 2014). The stock from the Azores, ICES area X, is considered by ICES as a management unit for the assessment (ICES, 2012). This stock has no management objectives defined because the uncertainty on the assessment, being precautionary managed based on trends of abundance indices and landings (ICES, 2014). The objective is to assess the red seabream stock from the Azores through yield per recruit analysis in order to define long term management objectives. Input data was revise and effects of some parameters analyse, particularly the natural mortality.

Materials and methods

Length base yield per recruit formulation (Thompson and Bell type) was used in this study. Two basic hypotheses were assumed for the analysis: Hypotheses 1 consist on runs assuming natural mortality constant for all lengths and hypotheses 2 by dependent length natural mortality (different M by length). The analysis was performed in the three stages: 1) The base case is considered the analysis for the current situation (F= 0,4; M=0,2; Lc= 30cm) (hypotheses 1), 2) Analysis of the effect of changing the value(s) of natural mortality as input, 3) Exploitation pattern correspond to the analysis of long term effects of changing the level of fishing mortality (F) for different selectivity’s (lengths of first capture (Lc)) adopting input values according results of 1) and 2).
Results and discussion

Maximum YPR was not attained or occurs at high F. At low F levels, up to 0.2 (corresponding to FO.1) sustainable Y/R are predicted to occur over a range of length of first capture (Lc). Since, the current F is much higher than this level there is a strong concern about the state of the stock because it indicate overexploitation. The stock at the current fishing mortality is considered unsustainable (B=30%; SSB= 13% of the pristine level) (Fig. 1A). Similar values to base case hypothesis are estimated for optimal fishing mortality from YPR analysis when using a different mortality by length, but with a reduction of about 50% on all stock characteristics (Y, B, SSB) (Fig. 1B). A 60% reduction on the current fishing mortality is required at long term to maintain the stock at the F0.1 reference point, with a benefit of increasing SSB about 190%.

Yield per recruit results for Pagellus bogaraveo from the Azores were similar to the results obtained for other areas and species, such as the Bay of Biscay (Lorance, 2010), some reef species (Buxton, 1992) and species with similar population structure (Molloy et al., 2007). YPR increase vary rapidly at low values of F over most of Lc above which YPR is asymptotic while females spawning biomass decrease very fast. However, red seabream is a protandric hermaphrodite (male-first sex change type) and independent of the sex change rule the stock are always predicted to be sensitive to the size-selective fishing. Although the sex-ratio and maturation have been considered in the modelling, the sex change is not explicitly modelled which can introduce bias in the predictions (Molloy et al., 2007). Management measures should be introduced in order to increase the females spawning biomass in the stock of ICES area X. To address long term management objectives to fishing we propose the F0.1 as a target reference point (maintaining SSB around 30% of the unfished level).

References