

Can we manage Mediterranean cephalopod stocks at MSY by 2015?

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Summary

According to the Common Fisheries Policy (CFP), there is a commitment to bring all European fish stocks to a state where they can produce at MSY by 2015 where possible, and by 2020 at the latest. Such commitment includes obviously all Mediterranean fisheries, in spite that quotas are not implemented in this area, where the management is exclusively based on technical measures. In this work, we used surplus production models to analyse the population dynamics of cuttlefish, octopus and squid during 1977-2013 and to perform medium term forecasts to estimate if these three stocks can reach the objectives established by the CFP. Results showed that these stocks were already overexploited (cuttlefish, squid) or changing to overexploitation (octopus) during late 1970s and this situation has remained up to now. Medium term forecasts indicate that these stocks will only recover from overexploitation by 2020 provided that severe measures, such as an annual 10% decrease in fishing effort, are put in force.

Introduction

Cephalopods have traditionally been considered a minor resource for European countries, except for some Mediterranean artisanal fisheries. Despite the high socio-economical importance of these resources in the Mediterranean and the increased availability of stock assessments during the last years, very few cephalopod stocks have been assessed until now. In the Balearic Islands (western Mediterranean), octopus, squid and cuttlefish are important living resources for the local fisheries. In this study, we applied surplus production models to analyse these three cephalopod stocks using a data time series from 1977 to 2013. Our main objectives were the following: 1) analyse the population dynamics during such a long time period characterized by highly contrasting levels of fishing exploitation; 2) assess the current status of each stock using MSY indicators; and 3) estimate how far are these stocks from the MSY target established by the CFP for 2015/2020.

Materials and methods

Annual time-series of landings of these stocks, along with the annual fishing activity of each individual vessel from the trawling fleet of Mallorca during 1977 to 2013, were taken from official statistics. Communications with fishermen allowed us to use the actual, not nominal (declared), engine power (in HP) for each vessel, including changes in engine power over time and the corresponding increase in HP. To analyse the temporal variation of the fishing exploitation level throughout the study period, a surplus production model was fitted to data (using the ASPIC software) for each species (Prager, 2004). In addition to the maximum sustainable yield (MSY), ASPIC estimates several benchmarks and stock status indicators such as population biomass (B), relative biomass (B/B_{MSY}) and relative fishing mortality (F/F_{MSY}); B_{MSY} and F_{MSY} stand for the B and F when stocks are exploited at their MSY. As a general consensus, the species with $B/B_{MSY} < 1$ and $F/F_{MSY} > 1$ are indicative of an overexploitation state, while $B/B_{MSY} > 1$ and $F/F_{MSY} < 1$ are indicative of an underexploitation state (Prager, 2004). In a second step, we applied medium term forecasts using the

following management scenarios and considering the period from 2014 to 2020: 1) maintaining F equal to F_{MSY} ; 2) an annual 10% reduction in F ; and 3) a linear decrease from current F to F_{MSY} .

Results and Discussion

The three stocks showed contrasting population dynamics during the time series analyzed (Fig. 1-above): fluctuating without any trend in cuttlefish, a marked decreasing trend in octopus and a notable increasing trend from the late 1990s in squid. ASPIC results showed that cuttlefish and squid were overexploited from the beginning of the time series in 1977 (relative F was above 1 and relative B below 1). However, the octopus was still changing from a state of underexploitation to overexploitation during the first years since relative B was above 1. Since then, the overexploitation state has remained in the three stocks up to present (Fig. 1-below).

The first management scenario (constant $F=F_{MSY}$; not shown) produces an important improvement in relative B from the beginning but in any species surpasses the line of 1 until 2020 (though very close in cuttlefish). The second scenario (10% reduction per year) do bring cuttlefish and octopus to underexploitation state, but not squid which has currently reached such a high F that it will need much many years to recover (Fig. 1-below). In the third scenario (linear decrease from current F to F_{MSY} ; not shown) none species reach the underexploitation state, although the situation in 2020 is somehow different in each one since cuttlefish nearly reaches it, octopus sets at 0.8 but squid just begins to recover from the high overexploitation hold during late 2010s.

As a main **conclusion**, our forecasts indicate that these stocks will only recover from overexploitation by 2020 provided that severe measures, such as the contemplated in scenario 2, are put in force.

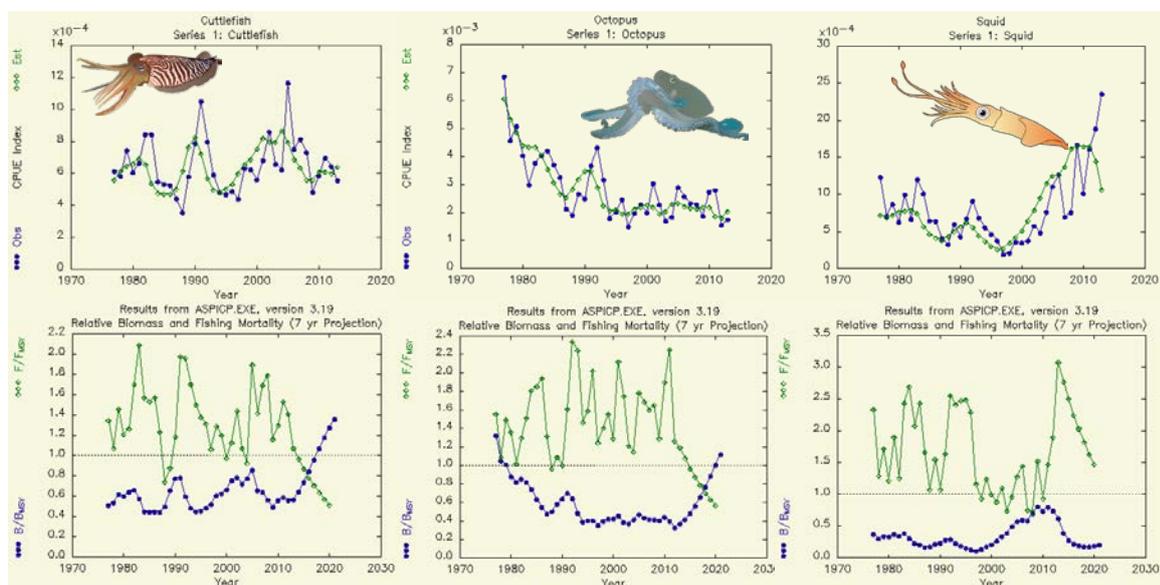


Fig. 1. Observed and estimated time series of CPUEs for cuttlefish, octopus and squid (above) and forecasts for scenario 2, an annual 10% reduction in F (below).

References

Prager, M. H. 2004. User's manual for ASPIC: a stock-production model incorporating covariates (ver. 5) and auxiliary programs. National Marine Fisheries Service, Beaufort Laboratory Document BL-2004-01: 1-27.