Eledone cirrhosa and SPICT or why it is not easy to assess a short lived cephalopod species

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INTRODUCTION

Although some cephalopods have had always commercial value and others started to increase in value in recent years, unlike European Atlantic stocks of many commercially important finfish and crustaceans, they are not routinely assessed and no specific management measures are applied to fleets catching cephalopods, with the exception of some regional harvest control rules for artisanal fleets. Among the species that has been gaining importance in landings is the horned octopus, *Eledone cirrhosa*. This octopus represents an important bycatch for several North Spanish otter trawl fisheries, appearing in landings but also in discards. Like other cephalopods, *E. cirrhosa* is a short-lived and fast growing species, and previous studies showed that its abundance varies in relation to physical and environmental conditions. As a first step towards its possible future inclusion in the ICES annual assessment system, a simple assessment model has been tested in the ICES Working Group on Cephalopod Fisheries and Life History (WGCEPH).

MATERIAL & METHODS

Assessment model: A Stochastic Surplus Production model in Continuous Time (**SPiCT**) (Pedersen & Berg, 2017)) was used. The package (version 1.2.8) is available on GitHub (https://github.com/DTUAqua/spict)

Input data:

- Spanish total landings in ICES divisions 8c and 9a for the period 2000-2019.
- Abundance index (kg/hauls) from Spanish IBTS GroundFish Research survey, DEMERSALES for the period 2000-2019.
- Abundance index (tons/fishing sequence) from a commercial bottom trawl fleet (LPUE_LCGOTBDEF) of a Spanish port in the area, period 2009-2019.

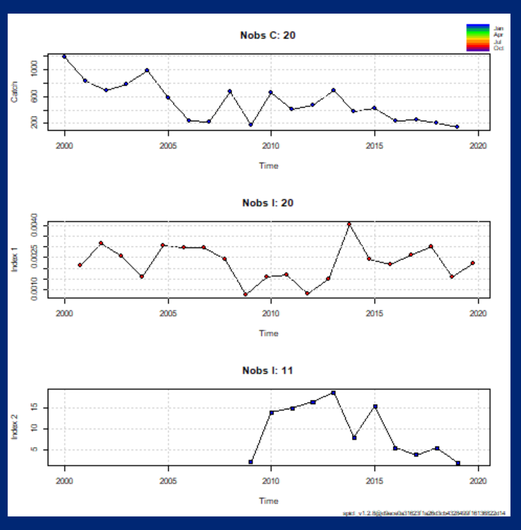


Figure 1: input data.

RESULTS & DISCUSSION

Settings

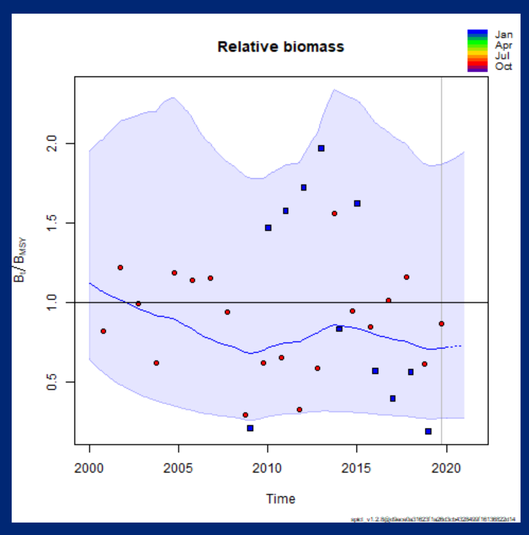
The chosen model converged with the settings of symmetric productive curve (BMSY/K=0.5) and set priors for the ratio between biomass in the initial year relative to K, mean of log(0.5) and sd of 0.2.

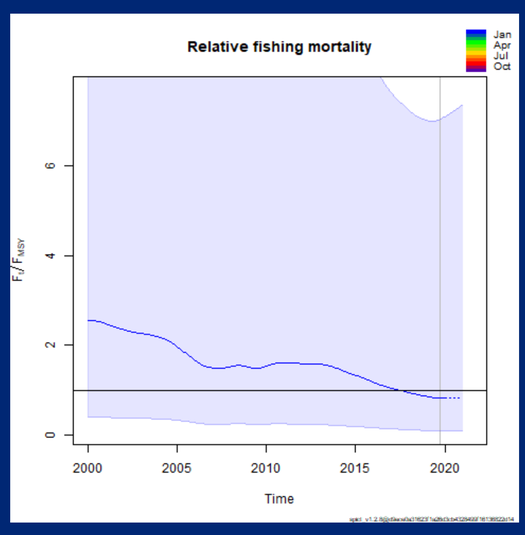
Outputs parameters

α	β	n	r	K	sdb
2.78 [0.69-11.25]	2.03 [0.53-7.76]	2 (fixed)	0.08 [0.00-8.84]	20,353 [483-858,096]	0.15 [0.04-0.53]

Table 1. Summary of the outputs parameters with corresponding confidence intervals [CI] for the best model. α the process errors of the input indices; β the observation error; n the shape of the production curve; r the intrinsic growth rate; K the carrying capacity of the stock and sdb the standard deviation of the biomass

Outputs plots





Diagnostics

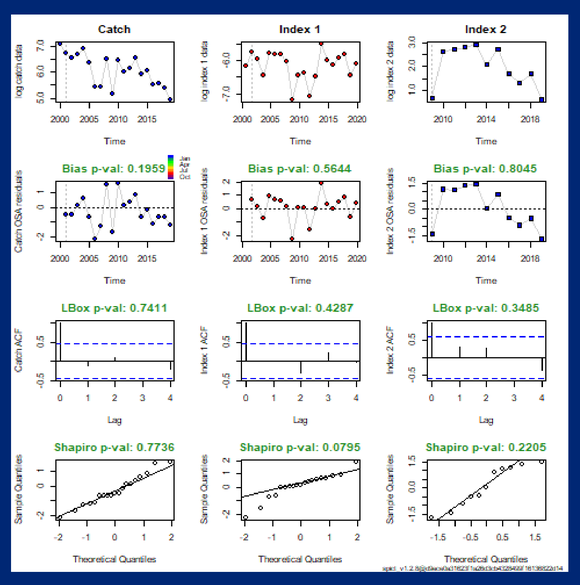


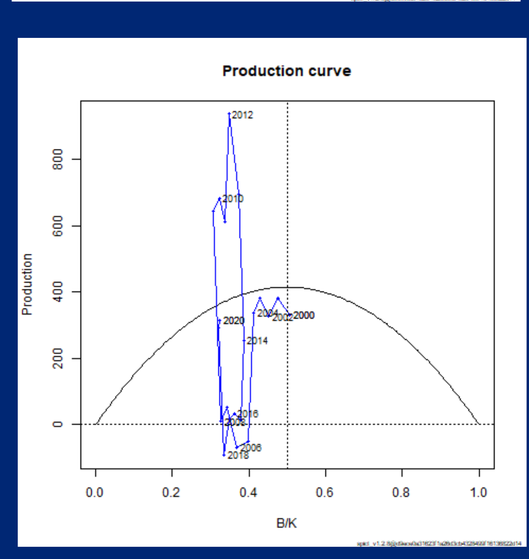
Figure 2. Diagnostics: no violation of model assumptions based on one-step-ahead residuals (bias, auto-correlation, normality).

Forecast

Forecast			
	prediction	cilow	ciupp
B_2020.00	6349.9140	191.5383	210513.5228
F_2020.00	0.0317	0.0007	1.4582
B_2020.00/Bmsy	0.7169	0.2737	1.8779
F_2020.00/Fmsy	0.8252	0.0961	7.0846
Catch_2020.00	203.0070	91.2933	451.4225
E(B_inf)	7527.9740		

Reference Points

Stochastic reference points					
Reference points	estimate	cilow	ciupp	log.est	rel.diff.Drp
Bmsys	8857.8237	439.0337	178713.0115	9.0891	-0.1066
Fmsys	0.0384	0.0004	3.6446	-3.2591	-0.1016
MSYs	336.6453	41.5968	2724.4882	5.8190	-0.2325



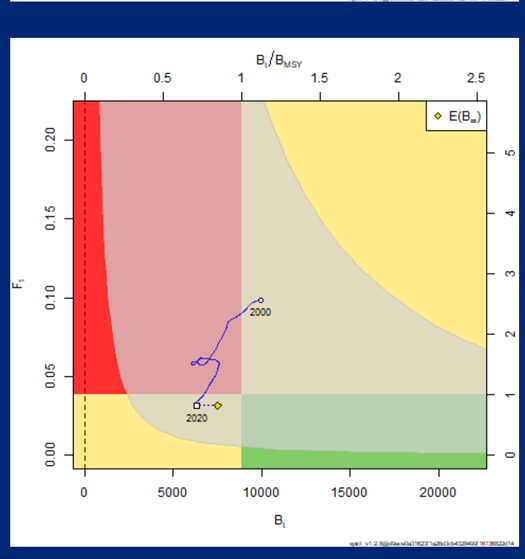


Figure 3: Outputs plots summary. Relative biomass and fishing mortality, Production curve and Kobe plot

The confidence intervals are wide for relative biomass and huge for fishing mortality. Kobe plot shows that the stock is in the area of harvest state where the biomass is low but the fishing level is good. The SPiCT model is a simplification of the dynamic process of populations. Although the residuals in this study passed all tests, the predictions are uncertain. Some improvements in the configuration of the model are needed for these short-lived species.