Review of: "Using mechanistic models to assess temporary closure strategies for small scale fisheries"

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1 Overview

Unfortunately, this is not an improvement over the first version that I reviewed. Authors insist on providing management advice and making statements about the status of the stock based on the smallest of evidence which is in addition very old.

I think authors need to write a new ms. with more examples of the use of Lefkovitch matrices, a new submission where the Madagascar application would be just one example. A second example from a data-rich fishery that also has open and closed seasons and where the results of Lefkovitch matrices modelling can be compared with results from data-rich applications would be very useful. A further third application of Lefkovitch matrices applied to simulated data from an operating model where the truth is known would make the ms. complete.

2 Specific issues

2.1 Title

Change 'mechanistic models' to 'Lefkovitch Matrix models' because 'mechanistic models' doesn't say anything, it's too general. Actually all stock assessment models (except CPUE standardization) are mechanistic models so saying that in the title is like saying nothing. The novelty of your work is in using those matrices, that should be in the title.

2.2 Abstract

"As overfishing remains a global issue, .."

But does it? Most fisheries in the world have not been assessed so we just don't know whether overfishing is a global issue. Perhaps the global issue is underfishing due to fear of over-conservative managers facing lack of stock assessment results? I suggest to change the sentence to "As overfishing remains a concern, ..".

"To sustain the existing population of blue octopus, our model indicates that the fishery would need to close for at least three months annually."

The authors continue to present this claim despite the fact that it is known to be a false and alarmist prediction. The fishery has evolved **for 12 years after the data used to make your prediction with much shorter closures and there has been no collapse**. Denying the facts is not a good strategy. You need to face the evidence and explain why despite your prediction the fishery has continued normally. What is so fundamentally wrong in your model or your data or both?

2.3 Introduction

L. 23-25. Mechanistic models are the bread and butter of stock assessment and fisheries research. Your audience needs no convincing in this respect. Instead, you should be convincing your audience of the advantages of using Leftkovitch matrices.

L. 86-98. You need to tone down the hype. I counted seven unjustified superlatives in these few paragraphs. Your superlatives make octopus stocks look fragile to fishing while in fact they are relatively more resilient than long-lived stock on account of their capacity to quickly bounce back from low abundance. They are more variable, not more fragile.

2.4 Materials and Methods

L. 170-172. "As there is no previous estimate of the natural death rate of this population, the Lefkovitch matrix, survivability estimates and growth rate calculations for this model also includes the influence of fishing pressure."

This seems to be false. You quote a technical report by Roa-ureta (2022) and in that report there are estimates of natural mortality rate for several years. Later you quote the report and explain why you chose not to use those estimates for natural mortality but still, you should correct this misleading sentence which is contradicted in your Discussion.

L. 175-177. "In order to parameterize this model, we use Wood's Quadratic Programming method (Caswell, 2001). Other methods required longer time

series than were available to us, were extremely sensitive to noise in the data, or simply resulted in matrices that had no reasonable biological interpretation (Caswell, 2001)."

You need to explain how Wood's Quadratic Programming work in terms of familiar terminology. It is clear that it is not likelihood maximization so it is not a statistical analysis so I guess it is a linear optimization method. Explain in sufficient detail what is the objective function, make your readers believe you've chosen the correct method for parameterization.

L. 181-183. "As all of our values calculated from the matrix fall within the known attributes of this species, we are confident that this model gave an accurate mechanistic description for this population's underlying dynamics."

You cannot determine the underlying dynamics with one year of data. Dynamics means change in time. It is impossible to determine the dynamics of a system with one time step of data. What you can do is to assume stationary behaviour, meaning that the current distribution across stages has reached equilibrium. What you may use instead of 'dynamics' is 'structure'. You can be confident that your (presumably) linear optimization gave you the true equilibrium stage structure.

Management Scenarios. The language here is too terse. E.g.: "In order to determine optimal conservation strategies, we alter the survivability of O. cyanea by different rates from 0-10% survival increase of the species." Do you alter the survivavility by steps of 1% to each of the stages, or just two levels, 0 and 10%? It seems you assume that some background survavility happening during months of fishing get reduced from 0 to 10% in months of closure. In that way you can project the matrices under different scenarios. But why only 10% as maximum increase in survivavility during months of closure? Is fishing mortality so low that only account for up to 10% less survivability?

2.5 Results

"Our analysis of different closure scenarios (Figure 5) indicates closures two months in length or shorter will be ineffective in ensuring a stable population, regardless of how much these closures decreased the death rate of the species."

So the model or the data or both are fundamentally wrong because we know for a fact that the stock has continued yielding not just stable, but growing landings since 2015 and up to 2021, under the same regime of very short (just weeks) closures at the turn of each year.

2.6 Discussion

L. 238-239. "Our calculated growth rate of -0.0184 and resulting population projection supports previous reports of overfishing at the time of data collection (Humber et al., 2006; Benbow et al., 2014)."

Your value of -0.0184 for the population growth rate is awfully close to 0 and no measure of statistical uncertainty is provided. Clearly, taking into account the sparsity of data, the standard error around that estimate must be substantial, so for all we know from you calculations, the stock might actually be increasing (instead of -0,0184 it could be +0.0184) considering statistical uncertainty. Yet you use your results to say that the stock is declining and that closures of longer than 3 months are necessary, potentially affecting the livelihoods of those fishers with not very solid data and analysis.

L. 272-276. "The overall natural mortality rate of this population has been estimated to range between from 0.0127 per week (0.0552 per month) to 0.0498 per week (0.2164 per month) (Roa-Ureta, 2022). However, this was not included in our model of fishery closures as these closures do not cover the full spatial extent of the fishery (Oliver et al.,2015), and some fishing continues during this time, meaning some fishing mortality exists during closures."

I don't understand your explanation of why those estimates are not useful to you. I read the report by Roa-Ureta and it has both natural and fishing mortality estimates per week and it explains that those estimates are valid over the whole of SW Madagascar octopus fishing grounds and that the natural mortality is the average over an annual season while fishing mortality rates are estimated by week, so your closures in time and space obviously fall within the scope of the estimates in Roa-Ureta's report. Probably you need to introduce constrains in your linear optimization method to the effect that the addition of your stage-based survival rates equal a random number that comes from the sum of natural and fishing mortality within a few standard errors of Roa-Ureta's estimates.

L. 351-353. "Similar data has been collected by Blue Ventures on this fishery since 2015 and shows there has been an improvement to this fishery since 2006, however there are still indication so that overfishing is occurring."

What are those indications? You need to named them.