SPiCt model for anchovy 9a South

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Abstract

An SPiCt model has been fitted to anchovy 9a South data using catches biomass time series and PELAGO and ECOCADIZ survey indexes, available until 2020, testing different model features. Results of different scenarios will be presented and also a comparison with the current model used as basis for the assessment which is a Gadget model.

1. Model Description

SPiCt model fits an stochastic surplus production model in continuous time incorporating dynamics in both biomass and fisheries and observation error of both catches and biomass indices. The model has a general state-space form that can contain process and observation-error as well as state-space models that assume error-free catches (Pedersen and Berg, 2017).

The general SPiCT model description and all the options available can be found in Pedersen and Berg (2017), as well as a user guide available at `https://github.com/mawp/spict/raw/master/spict/vignettes/vignette.pdf`.

2. Data and priors

Quarterly catches time series from 1989 to the second quarter of 2019. For the first two quarters of year 2019, provisional catches estimations of Spanish (until May 27th) purse-seine fleet were used and catches for June were estimated as the 37% of January to May catches based on historical records from 2009 to 2018. There were not any catches for Portuguese purse-seine in these two quarters. ECOCADIZ and PELAGO acoustic survey biomass indexes were provided at the exact time of the year when the surveys were carried out.For ECOCADIZ that corresponds to March of 2004 and 2006, April of 2007, 2009, 2010, 2014-2018, and May of 2013, and for

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PELAGO to February of 1998, 2000-2002 and April of 2005-2010, 2013-2019. Data summary is presented in Figure 1.

Priors for parameters were set to default.

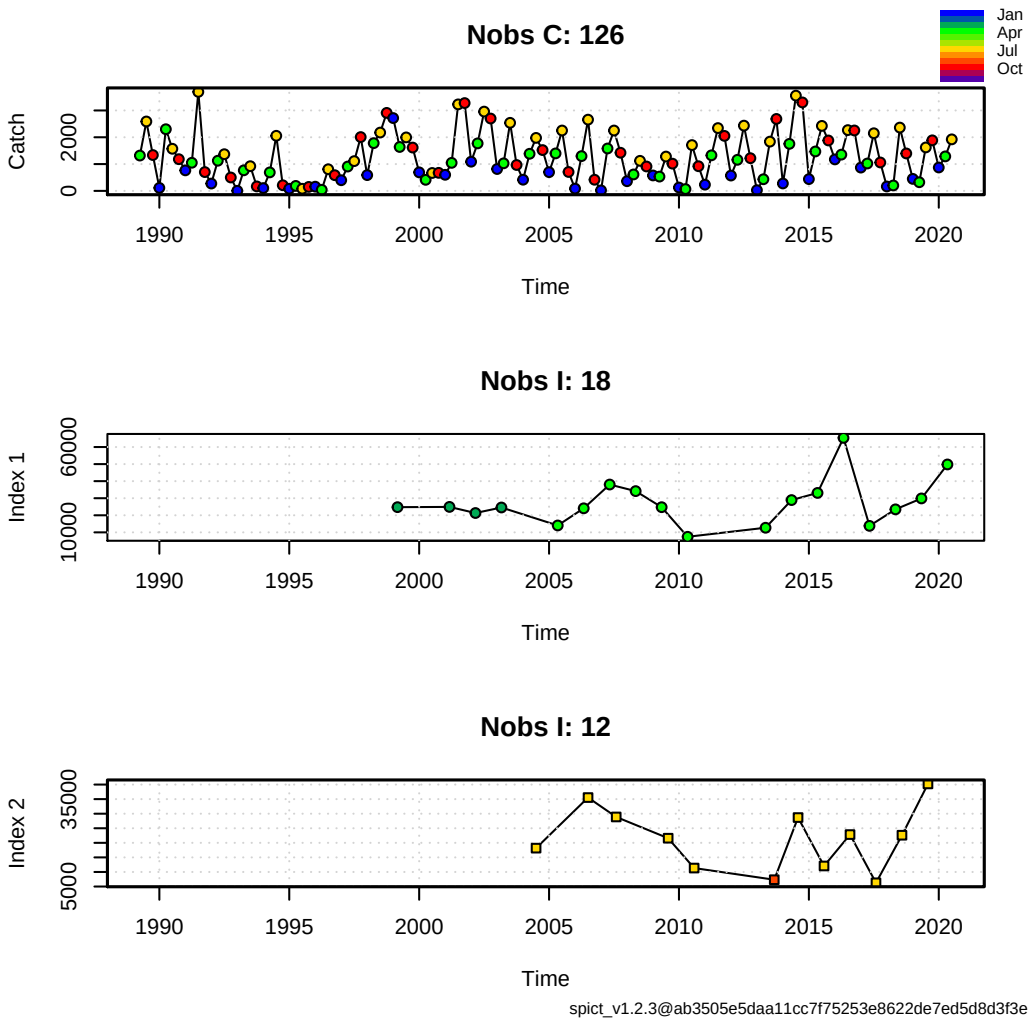

Figure 1: Summary of data used for the SPiCt model

3. Scenarios

Four different scenarios were tested, the first one with no seasonal productivity, the second one assuming seasonal productivity, the third one with no seasonal productivity and with time-varying growth and the last one with no seasonal productivity, no time-varying growth and with the data restricted to the 1999-2019 period where there is a more stable length distribution pattern.

4. Results

4.1. Scenario 1

Most important outputs for scenario 1 are displayed in figure 2. This scenario assumes no seasonal productivity, no time-varying growth and uses the whole data set available. Diagnostics are displayed in figure 3 and the following is the results summary:

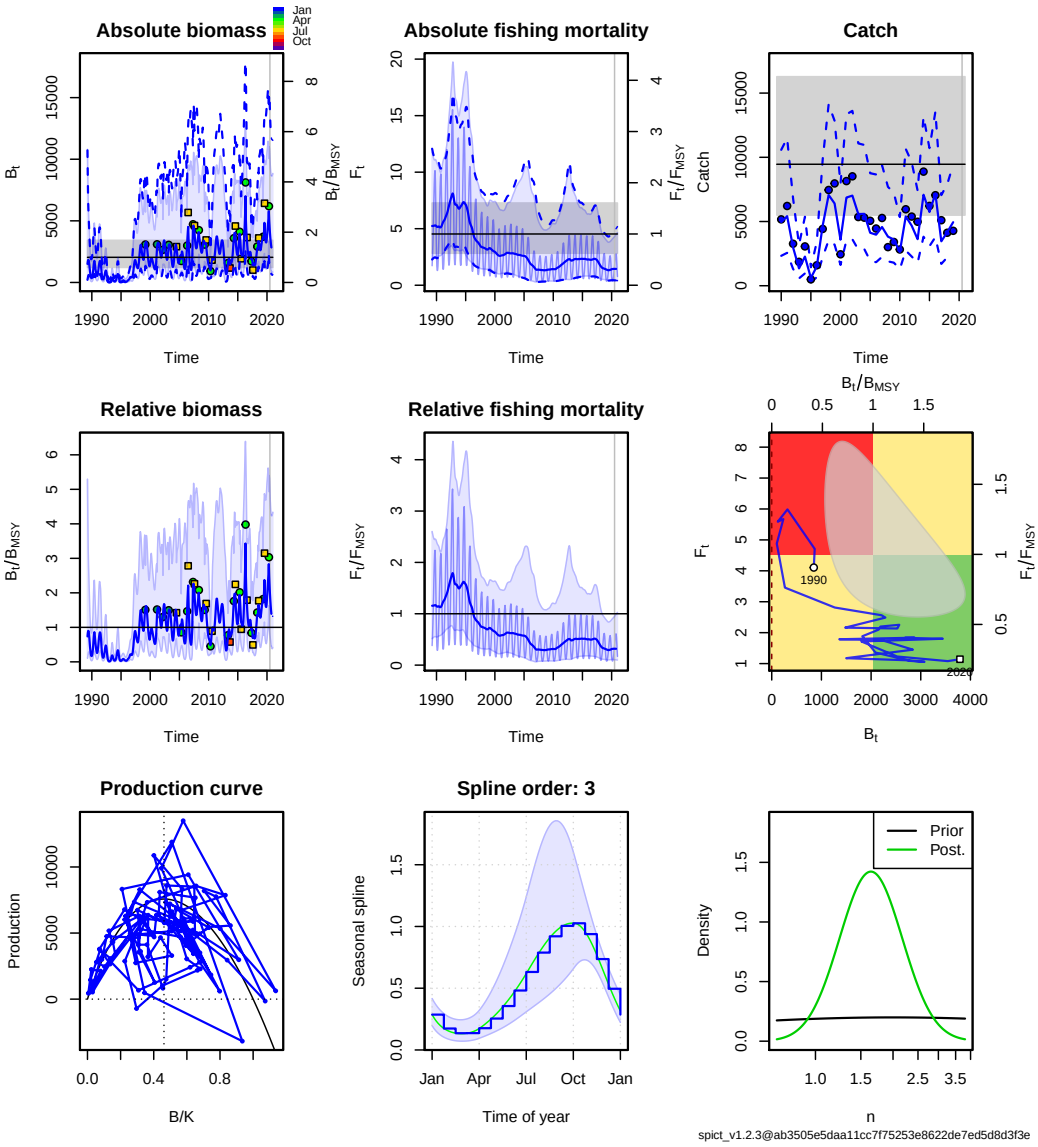

Figure 2: Summary of SPiCt results for scenario 1

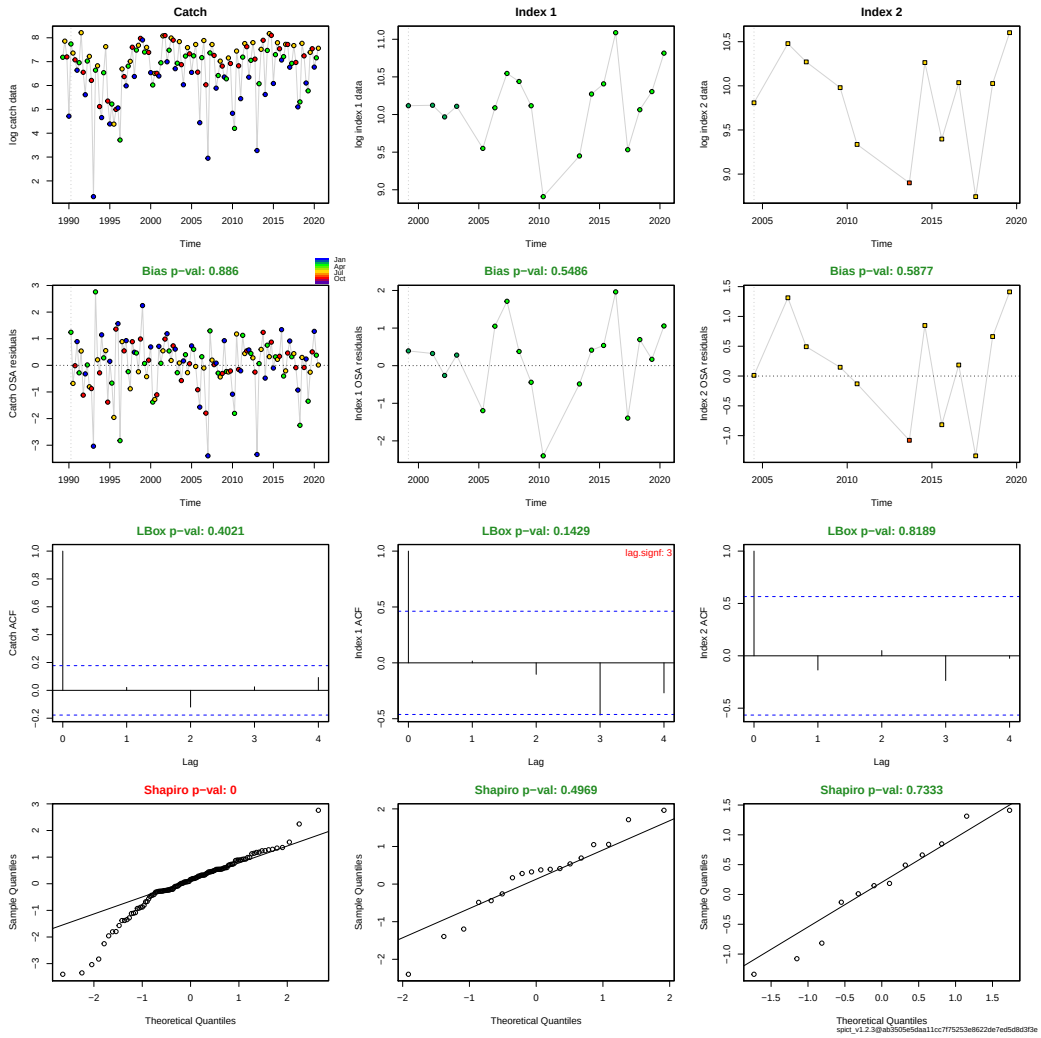

Figure 3: Summary of SPiCt diagnostics for scenario 1

4.2. Scenario 2

Most important outputs for scenario 2 are displayed in figure 4. This scenario assumes a seasonal productivity, no time-varying growth and uses the whole data set available. No diagnostics are available because of the lack of convergence, nevertheless, a plot on how the model estimates the seasonal productivity pattern is presented in figure 5. The following is the results summary:

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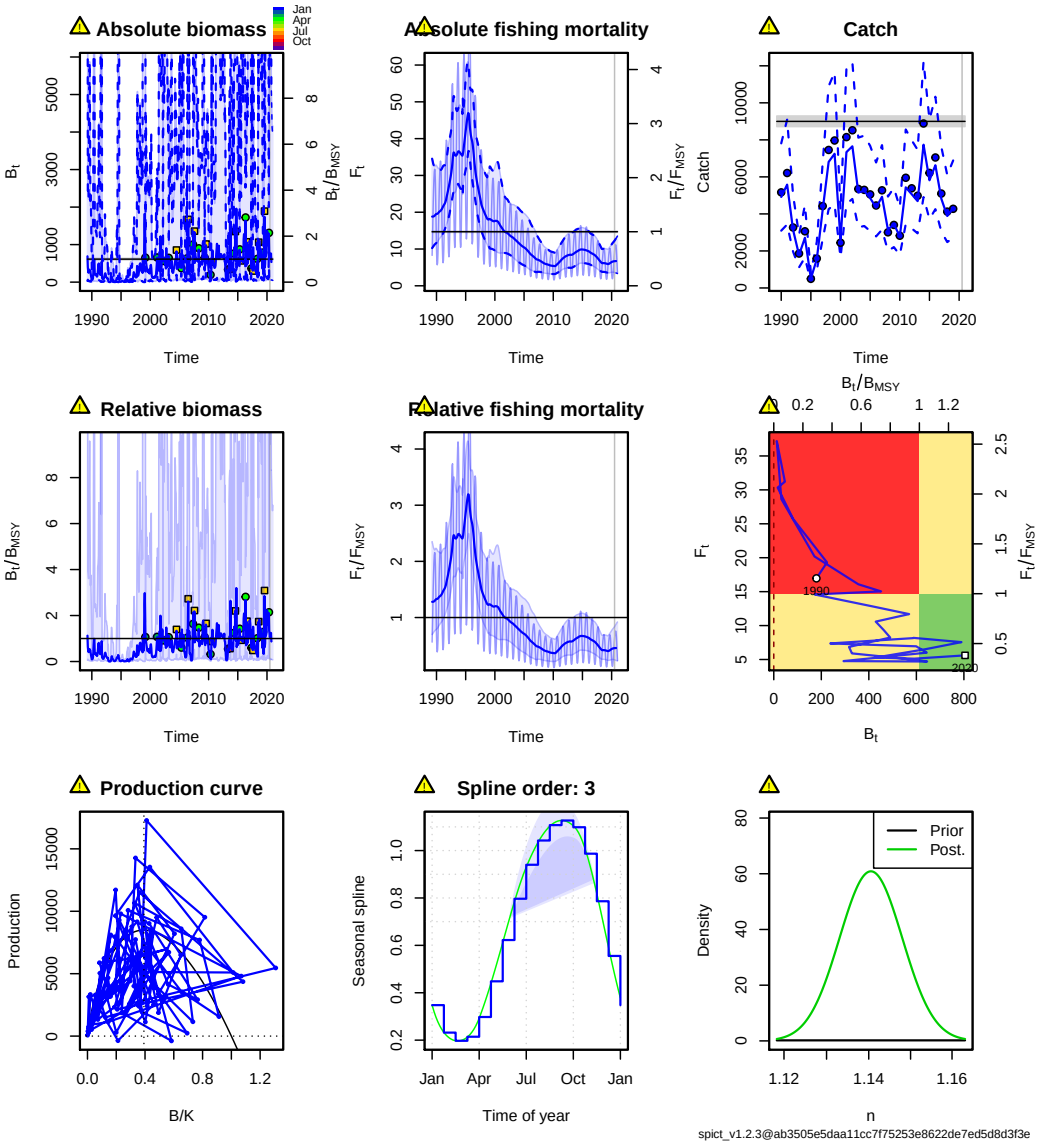

Figure 4: Summary of SPiCt results for scenario 2

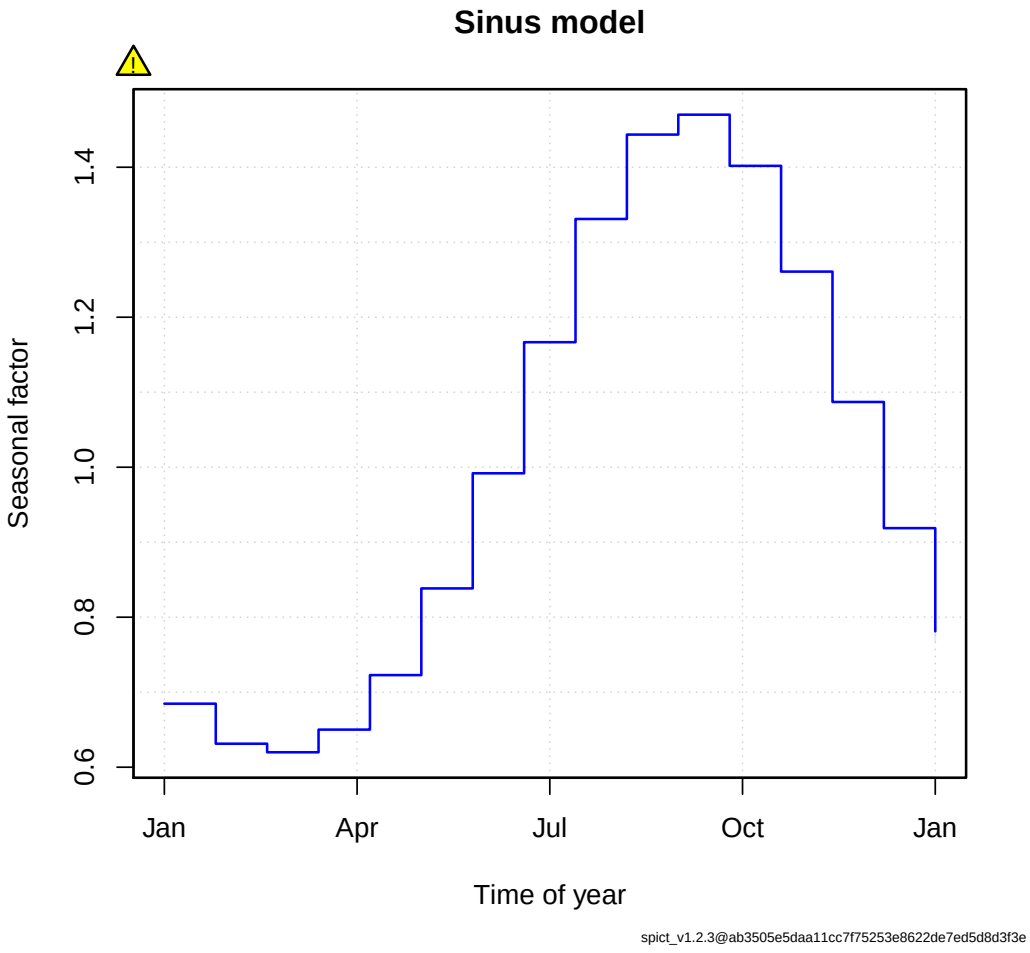

Figure 5: Estimation of the seasonal productivity pattern in scenario 2

4.3. Scenario 3

Most important outputs for scenario 3 are displayed in figure 6. This scenario assumes no seasonal productivity, time-varying growth and uses the whole data set available. Diagnostics are displayed in figure 7 and the following is the results summary:

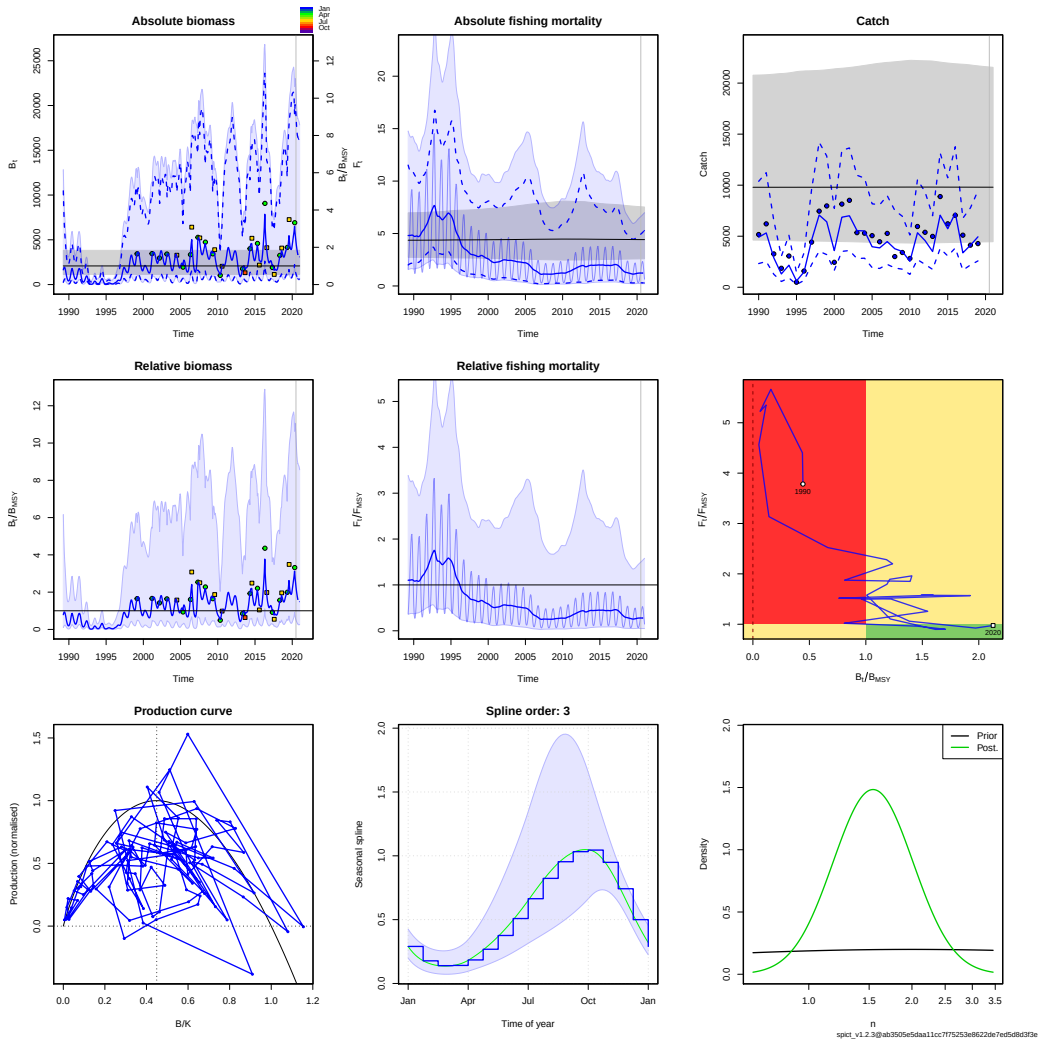

Figure 6: Summary of SPiCt results for scenario 3

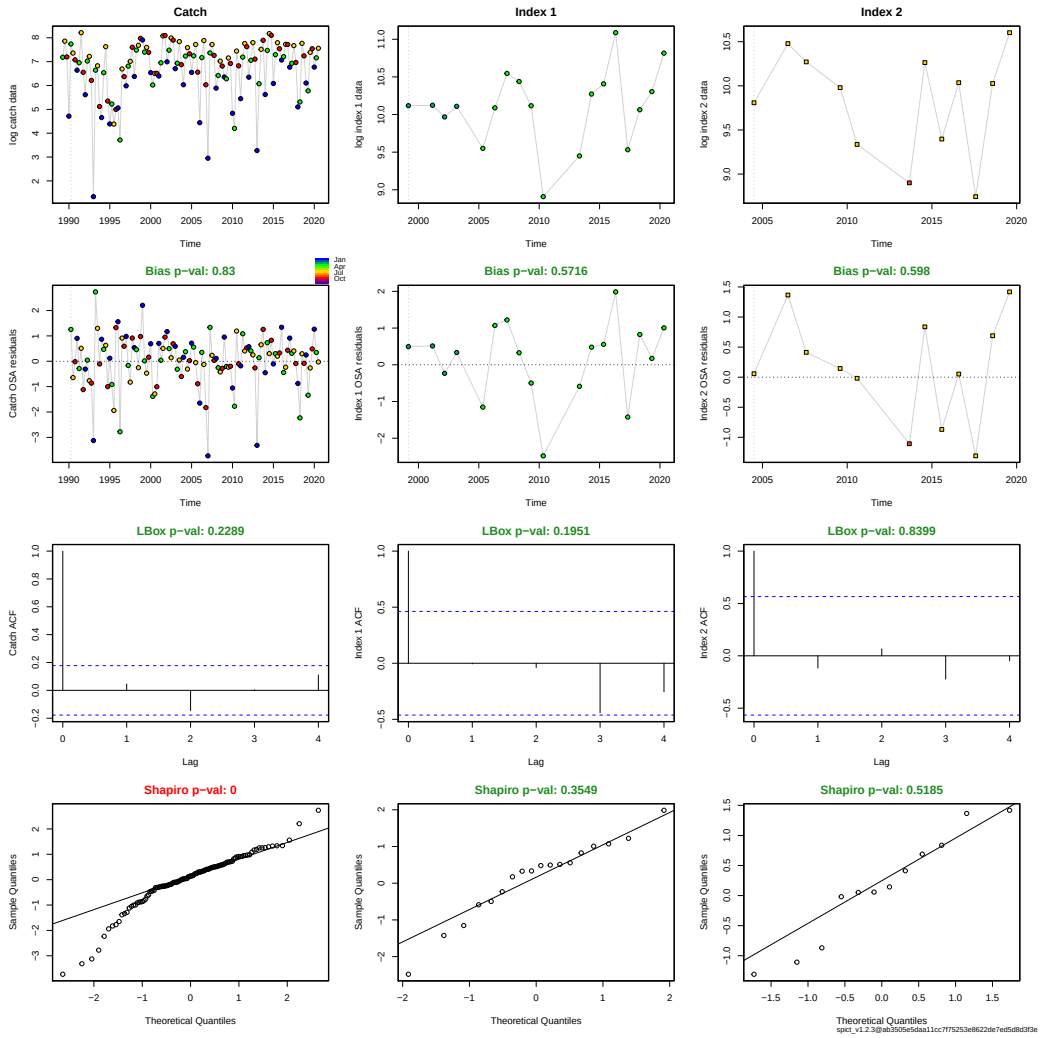

Figure 7: Summary of SPiCt diagnostics for scenario 3

4.4. Scenario 4

Most important outputs for scenario 4 are displayed in figure 8. This scenario assumes no seasonal productivity, no time-varying growth and uses a restricted dataset, with data only for the 1999-2019 period where there is a more stable length distribution pattern. Diagnostics are displayed in figure 9 and the following is the results summary:

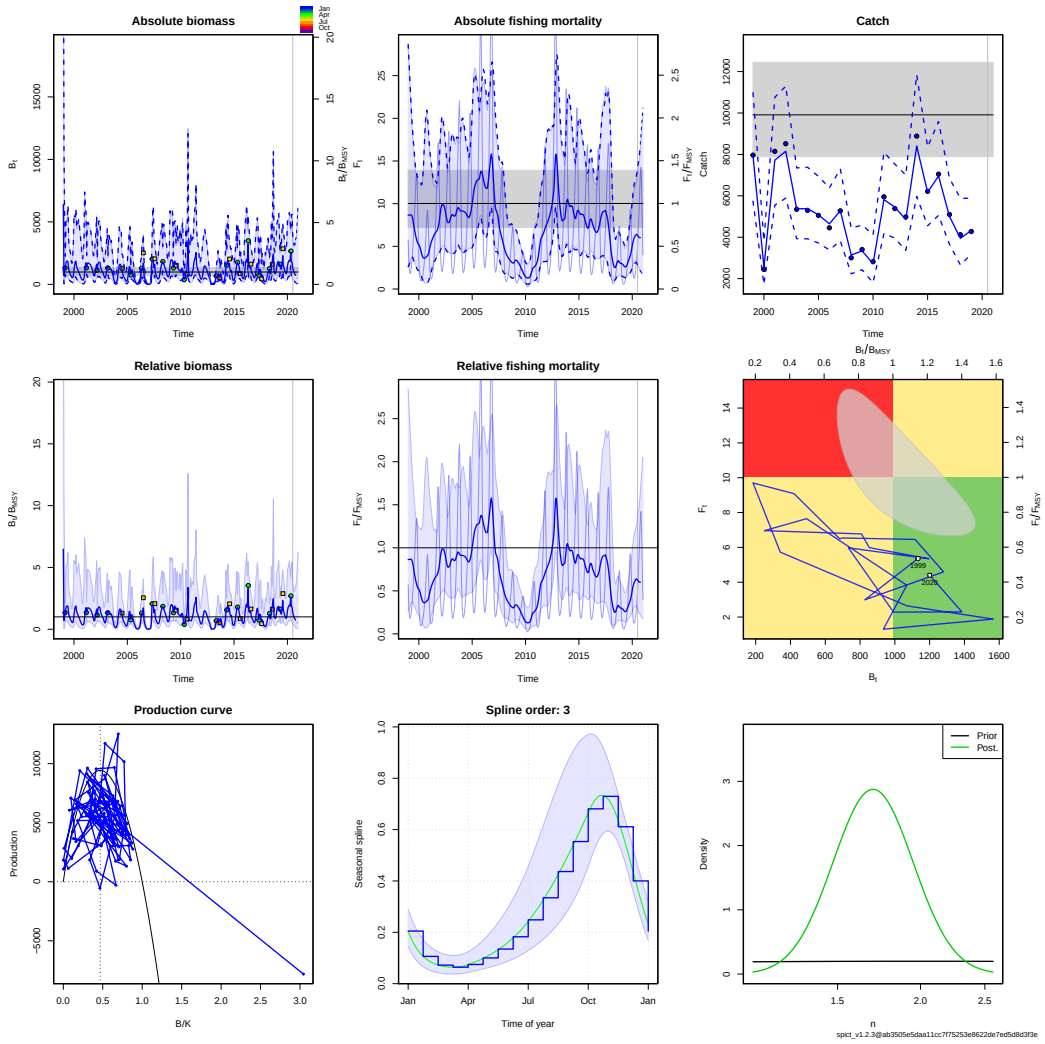

Figure 8: Summary of SPiCt results for scenario 4

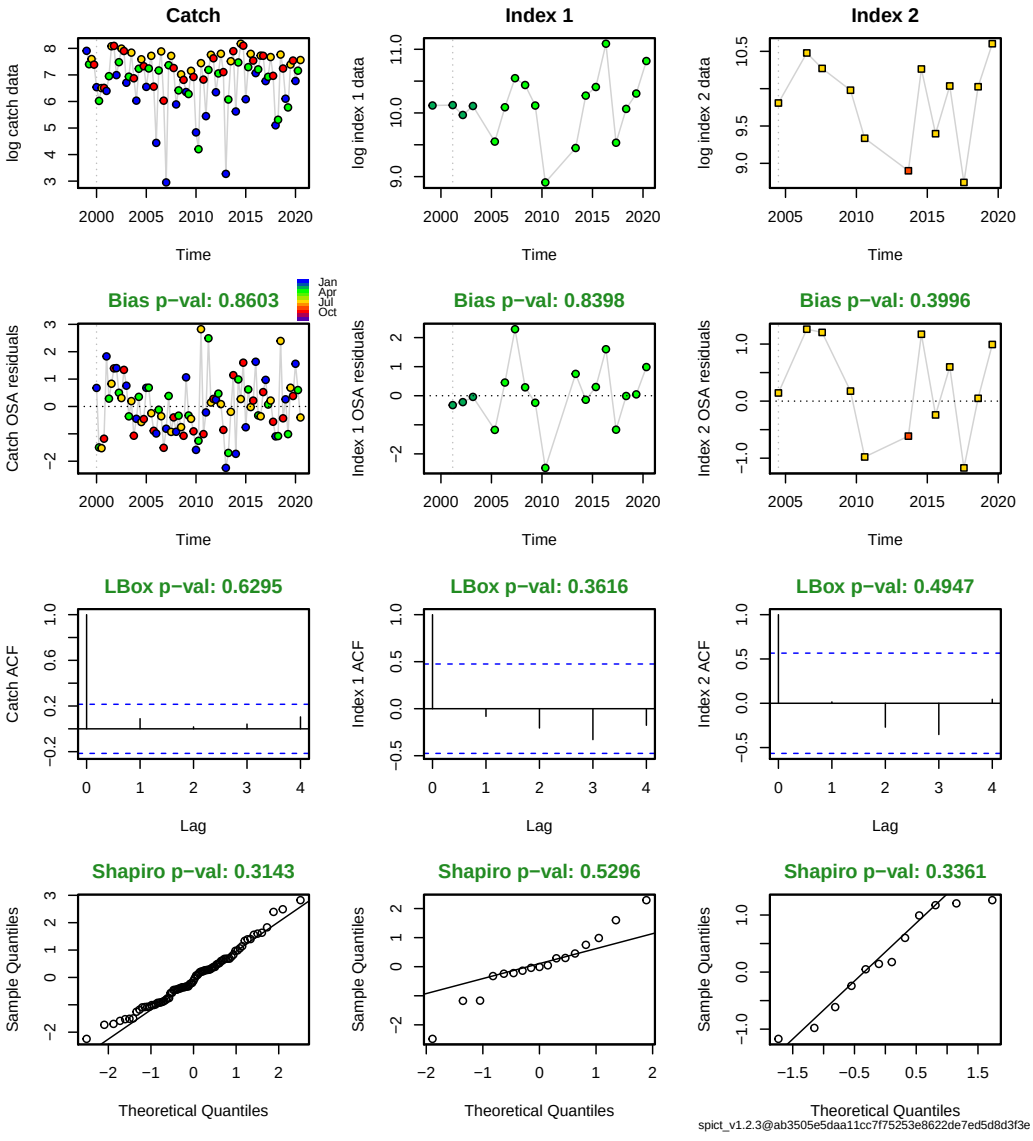

Figure 9: Summary of SPiCt diagnostics for scenario 4

5. Comparison of harvestable biomass estimation obtained in scenario 1 with harvestable biomass estimated by Gadget

Figures 10 and 11 show model comparison estimates of absolute (in tonnes) and relative harvestable biomass at the end of the second quarter, respectively. The models used for this comparison are, the SPiCt scenario 1 and the Gadget model used in the latest anchovy 9a South assessment (Rincón et al., 2020). The data used for the SPiCt scenario was also the same used in this assessment. In Figure 10 it can be observed that the two models present different trends mostly before 2005 (the year when PELAGO survey starts). A comparison between SPiCt estimates of harvestable biomass with catches time series (Figure 12) suggest that catches time series have a big influence on the SPiCT estimates.

Figure 10: Comparison of absolute harvestable biomass estimates at the end of the second quarter of each year by Spict (scenario 1) and Gadget, pink and blue lines, respectively.

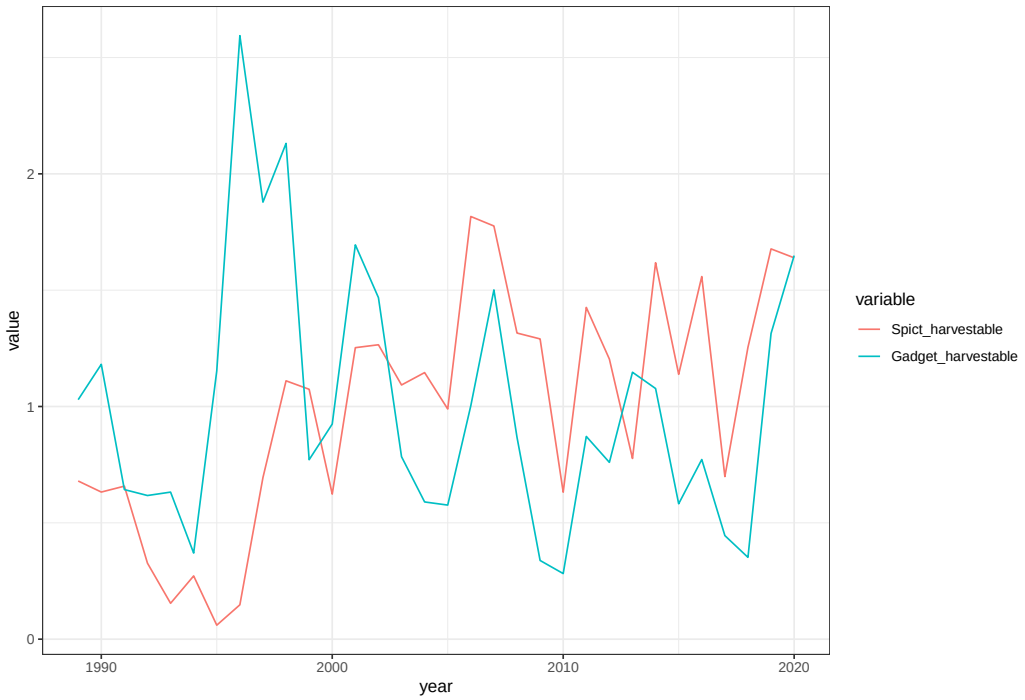

Figure 11: Comparison of relative harvestable biomass estimates at the end of the second quarter of each year by Spict (scenario 1) and Gadget, pink and blue lines, respectively.

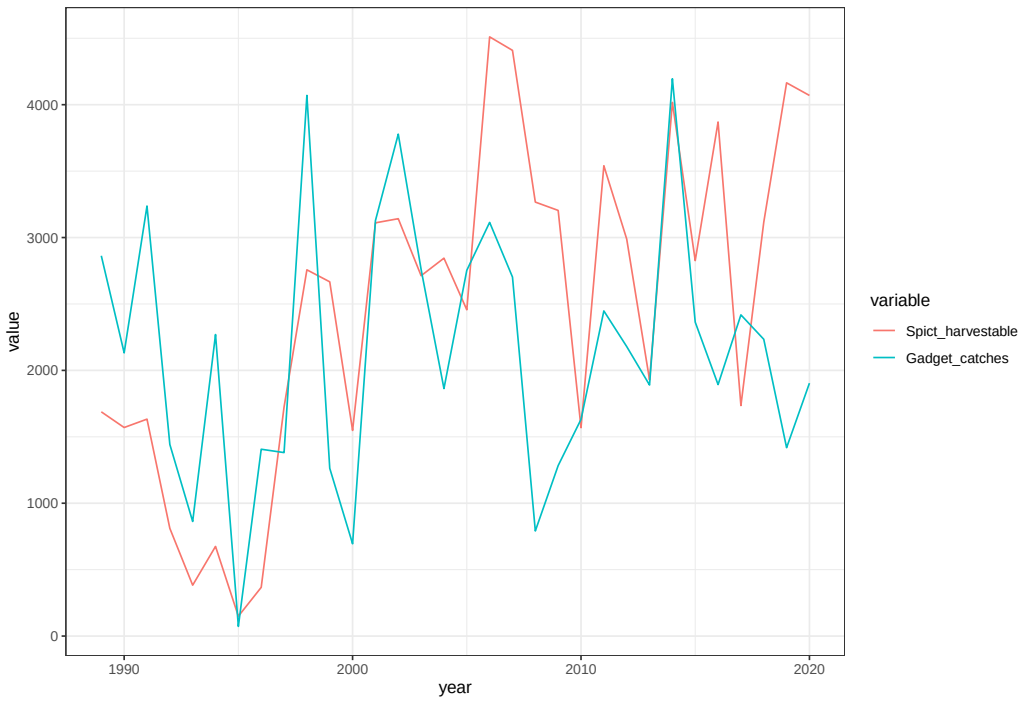

Figure 12: Comparison of absolute harvestable biomass estimates at the end of the second quarter of each year by Spict (scenario 1) and catches time series, pink and blue lines, respectively.

6. References

Pedersen, M.W., Berg, C.W., 2017. A stochastic surplus production model in continuous time. Fish and Fisheries 18, 226–243. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/faf.12174, doi:10.1111/faf.12174, arXiv:https://onlinelibrary.wiley.com/doi/pdf/10.1111/faf.12174.

Rincón, M.M., Ramos, F., Uriarte, A., Ibaibarriaga, L., Garrido, S., Silva, A., 2020. Gadget for anchovy 9a South: Model description and results to provide catch advice and reference points (WGHANSA-1 2020). Technical Report. Working Document presented to ICES WGHANSA 2020-1, available at ICES Scientific Reports. 2:41. 513 pp. http://doi.org/10.17895/ices.pub.5977. URL: https://www.researchgate.net/publication/334896165_Updated_Gadget_for_anchovy_9a_South_Model_description_and_results_to_provide_catch_advice_and_reference_points_Presented_for_ICES_WGHANSA-1_2019.