Exploratory implementation of the surplus production model in continuous time (SPiCT) for common dolphinfish in the Indian Ocean

Mercedes Aramburu[1], Kim Stobberup[3], Karim Erzini[3], Margarita María Rincón[2]

1 Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz,Puerto Real, Cádiz, Spain, 2 Instituto Español de Oceanografía, Centro Oceanográfico de Cádiz, Cádiz,Spain, 3 Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Faro, Portugal.

Coryphaena hippurus. Common dolphinfish in Seychelles

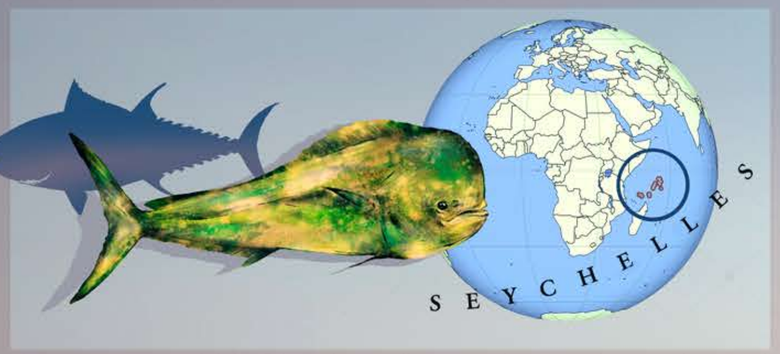

Figure 1: Common dolphinfish and tuna illustration by Mercedes Aramburu and location of study case.

The common dolphinfish is a commercial pelagic fish of importance for small-scale fisheries and fish processing sector in Seychelles, but it is also a major bycatch caught by tuna fisheries and a popular species for recreational fishers. Its exploitation rates are highly uncertained, which is a growing concern in the region, and no specific plans for the conservation of this species have been implemented yet. It is presumed that some biological characteristics of the common dolphinfish, like its rapid growth rates and early maturation could make it less susceptible to overfishing, and for this reason it could become a highly productive fishery, theoretically (Whoriskey et al, 2011).

However, other characteristics like its tendency to aggregate could make it more vulnerable than it is currently expected (Clarke et al, 2014).

Surplus production model

A Surplus Production in Continuous Time model (SPiCT; Pedersen & Berg, 2017) was implemented to obtain biomass, fishing mortality and reference point estimates by using catches of common dolphinfish by the line fleet of Seychelles from 1998 to 2017 and CPUE (commercial catch-per- unit-effort) of the longline fleet of Reunion Island from 1994 to 2017) as an abundance index. SPiCT model does not require information about the age or size structure of the stock to operate . ICES has approved using SPiCT model for stocks in categories 3 and 4, and more recently for stocks in category 1. To implement the model, the FarFish-DLMtool was used.

Main results

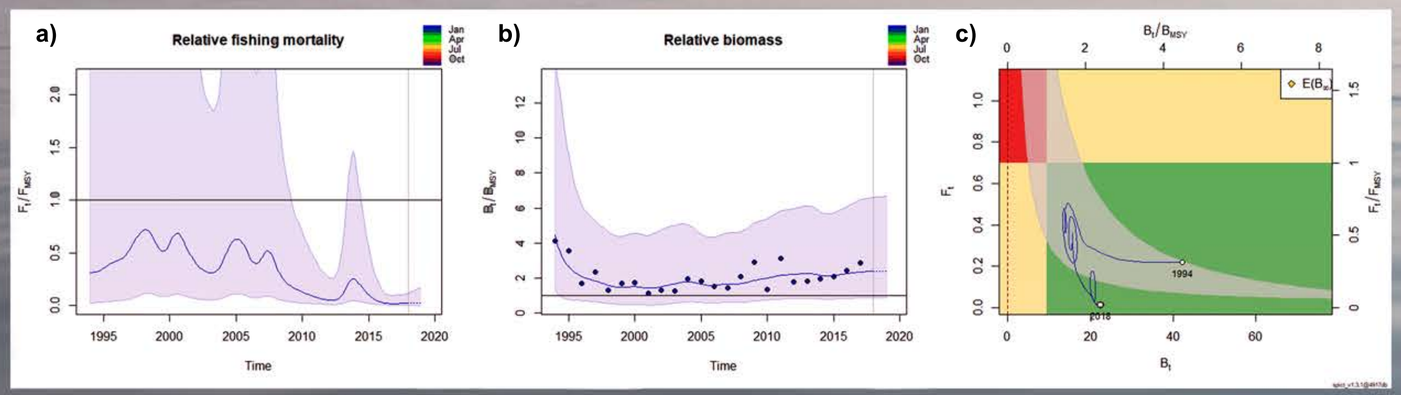

Figure 2: Relative fishing mortality (a) plot), relative biomass (b) plot) regarding F_{msy} and B_{msy} reference points respectively and Kobe plot which indicates fishery development of biomass and fishing mortality since initial year (1994).

The model estimated maximum sustainable yield (MSY) was 6.6 tones. Biomass of MSY (B_{MSY}) was 9.4 and fishing mortality rate which results in MSY (F_{MSY}) was 0.7. Figure 2 a) plot, showed estimated fishing mortality of common dolphinfish was below F_{MSY} proxy, while figure 2 b) plot, showed dolphinfish estimated biomass was greater than B_{MSY} proxy. Figure 2 c) plot, showed that the fishery has been in the green panel for the whole time series, where the risk of overfishing is considered to be very low.

Conclusions

—SPiCT model has been demonstrated to be a useful method in data limited situations and for the exploratory assessment of the common dolphinfish in Seychelles, by using only catches and at least, one abundance index, even when CPUE was extracted from the region of the nearby region of Reunion Island.

—The obtained results for common dolphinfish in this study are promising. According to model estimations, this species is being exploited sustainably in this region. Obtained results are in line with the previous work of Benjamin & Kurup (2012) about the status of common dolphinfish in the southwest coast of India.

—Possible input data inconsistencies should be evaluated and taken into account.

— More efforts should be put on the improvement of data sources, which will allow us to carry adequate assessment and progress towards a sustainable fishing.

References

Benjamin D, Kurup B. Stock assessment of Dolphinfish, Coryphaena hippurus (Linnaeus, 1758) off southwest coast of India. Journal of the Marine Biological Association of India. 2012;54(1):96. doi:10.6024/jmbai.2012.54.1.01675-12

Clarke S, Sato M, Small C, Sullivan B, Inoue Y, Ochi D. Bycatch in longline fisheries for tuna and tuna-like species: a global review of status and mitigation measures. FAO fisheries and aquaculture technical paper. 2014;588.

Pedersen MW, Berg CW. A stochastic surplus production model in continuous time. Fish and Fisheries. 2017;18(2):226-243. doi:10.1111/faf.12174

Whoriskey S, Arauz R, Baum JK. Potential impacts of emerging mahi-mahi fisheries on sea turtle and elasmobranch bycatch species. Biological Conservation. 2011;144(6):1841-1849. doi:10.1016/j.biocon.2011.03.021

Contact

Contact mercedesaramburudguez@gmail.com for more information.

Acknowledgements

I'm grateful to the European project of the Horizon 2020 program, FarFish (grant agreement No. 727891) for its collaborative work supporting sustainable and profitable European fisheries operating outside the European Union waters.