Will they disappear? Population Viability Analysis of a small Resident Population of Common Bottlenose Dolphins in mainland Portugal

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Introduction

The Sado Estuary, Portugal, is home to a small resident population of common bottlenose dolphins (*Tursiops truncatus*), henceforth referred to as bottlenose dolphins, Figure 1. Over the past four decades, photo ID surveys have shown that the population is declining [1] (from 42 animals in 1989 to 22 currently). Understanding the severity of this decline is paramount for effective conservation efforts to manage this population. **Here, we perform a population viability analysis (PVA) based on estimated age-based mortality and estimated fecundity, informed by 43 years of photo identification data (1981-2024).**

Fig. 1 - Scientific illustration of a bottlenose dolphin. © Miguel P. Martins.

Methodology

Photo-identification data was compiled from available literature [1,2,3] and dedicated surveys on the Sado Estuary Natural Reserve (RNES) and adjacent coastal waters, **Figure 2**. Animal births were first recorded in 1986. All individuals sighted before 1986 were considered adults and their ages were assigned as 10 years old at the time of first sighting. From 1981 until the present day, deaths were recorded. Missing individuals were treated as dead since the last year they were sighted. Age-based mortality was estimated using a Kaplan-Meier estimator, with the `survival` R package, and a competing risks Siler model with the `strandCet` R package. Additionally, mortality parameters obtained from bottlenose dolphins in Barataria Bay, and the Indian River Lagoon were used for comparison [4,5]. Fecundity was estimated by calculating a ratio between the number of available females and new calves. To account for non-reported females, sex was randomly attributed to individuals with unknown sex, assuming a 1:1 sex ratio. Custom made functions were created to simulate individual life histories in time, simulating ageing, deaths and births of new individuals. For each survival model, 1000 simulations of 200 years were run.

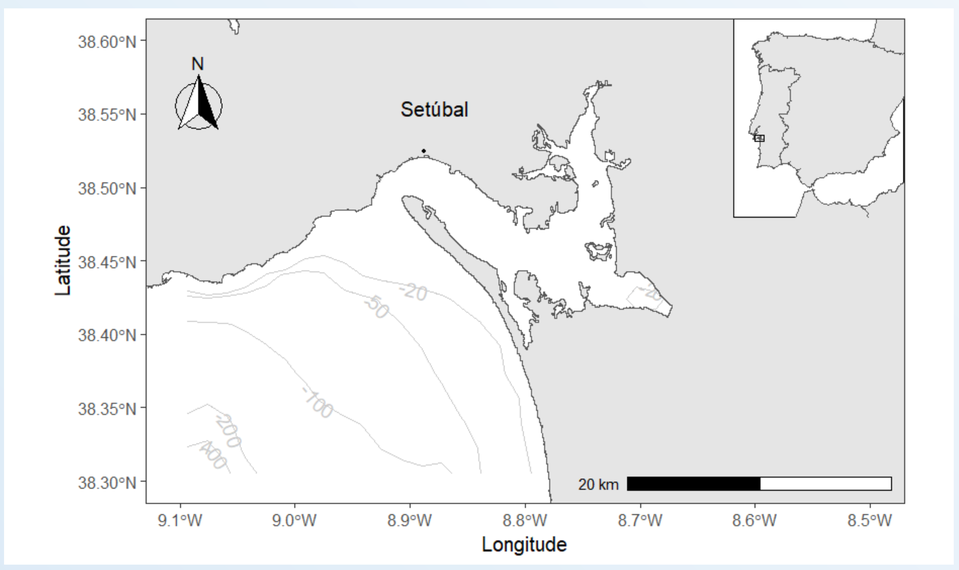

Fig. 2 – Map of the study area, the Sado Estuary Natural Reserve and adjacent waters.

Results

Estimated age-based survival curves were considerably different from other populations, predicting Sado Estuary individuals reaching higher ages than in Barataria Bay and the Indian River Lagoon, while still evidencing high mortality at a young age **Figure 3**. Simulations show that population size is expected to decrease, regardless of the survival model. When using Sado Estuary specific survival models, the expected decrease is not as steep as when using the Barataria Bay and Indian River Lagoon parameters, **Figure 4**. Still, extinction probability over the next 200 years is estimated to be 86.2% when using a Siler model and 95.7% when using the Kaplan-Meier model. Mean time to extinction is 130 years with the former survival estimator and 99 years with the latter.

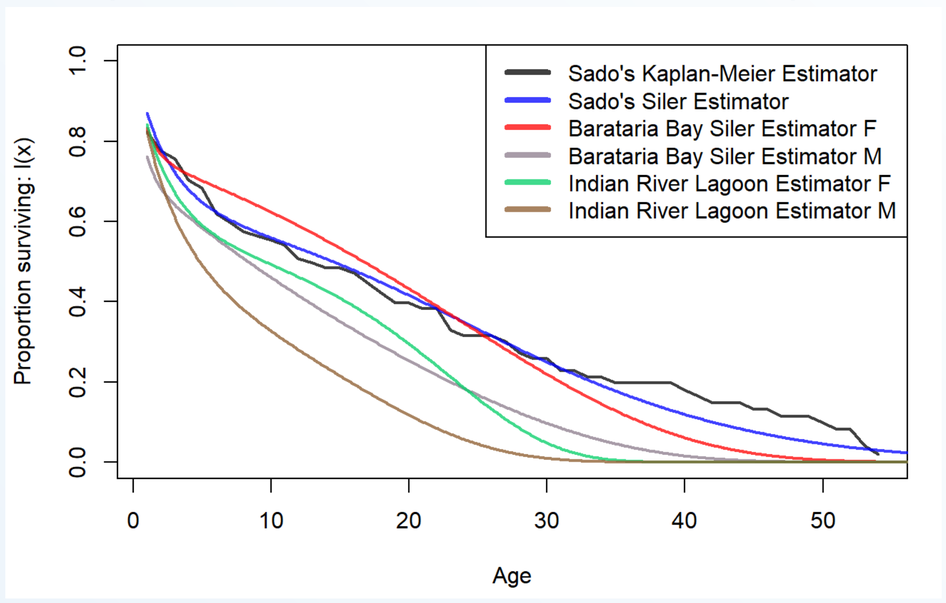

Fig. 3 – Proportion of individuals surviving, l(x), to age x.

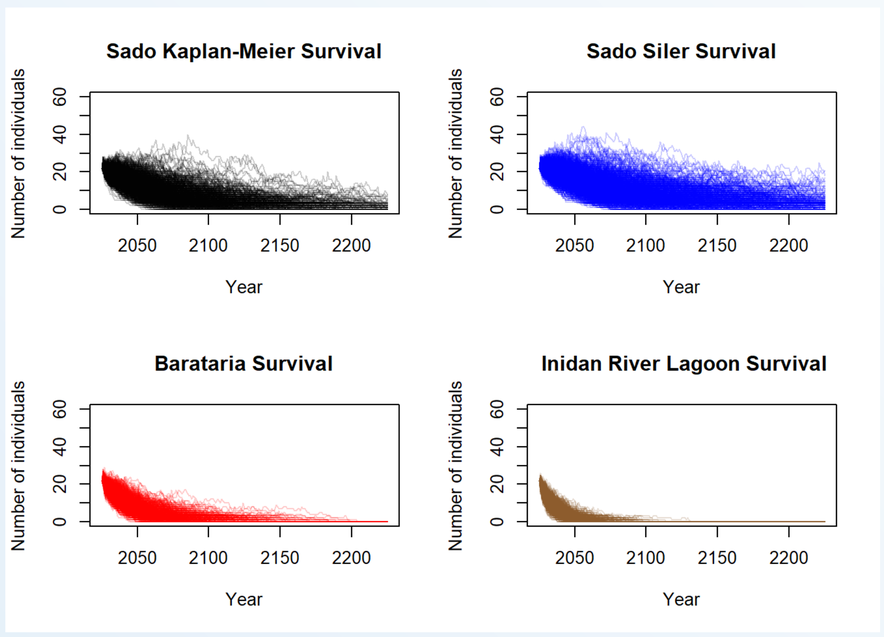

Fig. 4 – Results of PVAs. Top left: using a Sado specific Kaplan-Meier survival model; top right: using a Siler Model for the Sado population; bottom left: Barataria Bay survival parameters; bottom right: Indian River Lagoon survival parameters.

Discussion and Conclusion

Here we show how this bottlenose dolphin population is moving towards extinction, and that seems to be the case irrespective of the survival estimates considered. Currently, robust extinction times are hard to estimate as these simulations only account for age-based dolphin survival and fecundity, not incorporating increasingly significant threats like living in an estuary with large levels of human activity, chemical pollution and heavy targeting by local dolphin-watching companies, compounded by a small population size and low genetic diversity. Strong conservation measures to lessen anthropogenic impacts are urgent. Such measures will not guaranty population viability, but their lack guarantees extinction.

More info here!

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