

Patterns and trends in cetacean strandings on the Galician coast and their relationship with oceanography and fishing effort.

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Summary:

Strandings provide valuable information on the presence and relative abundance of cetaceans in an area. The spatial, inter-annual and seasonal variation in the number of strandings may reflect the variability in cetacean abundance. However, this signal can be masked by other factors which are responsible both for the mortality of the dolphins and the probability that they reach the shore once they are dead. We analysed the time series of cetacean strandings in Galicia (NW Spain), available since 1990, with the aim of determining the trends and variability of strandings. We found that seasonal and inter-annual variation in the number of strandings is highly correlated with the oceanographic conditions most prevalent in each period. Moreover, a more detailed analysis of these effects should be carried out, and the use of further applicable indices (fishing effort rather than landings) may improve the explained part of the models, thus allowing us to disentangle oceanographic effects and to obtain relative seasonal and annual abundances.

Introduction:

Strandings provide valuable information on the presence and relative abundance of cetaceans in an area, and enables the collection of samples to characterise the life history, diet, contaminant burdens, and pathology from individuals and populations. Strandings also provide a minimum estimate of cetacean mortality (Peltier et al., 2014) and help to identify areas/seasons where populations could be more at risk from anthropogenic pressures. By-catch in fishing gear has been identified as the main anthropogenic threat for most cetacean populations worldwide and is also believed to be unsustainable for several cetacean populations in the study area (e.g. López et al., 2002; Fernández-Contreras et al., 2010; Goetz et al., 2013). The spatial, inter-annual and seasonal variation in the number of strandings may be a reflection of the variability in the cetacean abundance in the area but this signal can be masked by other factors implicated both in the mortality of the dolphins and the probability that they reach the shore once they are dead. There are four main factors that interact to produce the variability we observe in a stranding time series that are ultimately responsible for a floating cetacean carcass reaching the shore: cetacean population abundance, fishing effort (more apparent when proportion of by-catch is high), searching effort (that allows a stranded animal to be detected) and the oceanographic conditions (wind, currents, etc.) The aim of this work was to determine the spatial pattern and the inter-annual and seasonal trends in the stranding series of the

three most common cetacean species in the area (common and bottlenose dolphins and harbour porpoises) and to investigate the effect of the oceanography and fishing activity in this variability.

Materials and Methods:

We analysed the time series of cetacean strandings in Galicia (NW Spain), available since 1990 thanks to the work of the stranding network operated by the NGO CEMMA (Coordinadora para o Estudio dos Mamíferos Mariños). Firstly, Generalised Addictive Models (GAMs) were used to explore the spatial and temporal patterns in the data. Based on results from these models, the study area was divided in north and south and analyses were run separately for each area. GAMs were also used to investigate the potential causes (oceanography and fishing effort) for the inter-annual variation in cetacean strandings in each area separately for each species. The searching effort was considered high and constant in all areas and months as it is a highly populated area. The oceanographic variables selected were the North Atlantic Oscillation (NAO) and its seasonal components (spring, summer, etc.), the East Atlantic Index (EA), the Scandinavian Index (SCA) and the Upwelling Index (UI). In addition, the contribution of the strength and direction of the wind measured in two stations of the area were also included as a potential explanatory variable. As an indirect measure of the monthly fishing effort, we used the amounts of landings recorded in the Galician ports.

Results and Discussion:

The seasonal and inter-annual variation in the number of strandings was highly correlated with the oceanographic conditions prevalent in each period. Results showed significant effects of the oceanographic indices (NAO, EA, SCA and NAOwin) in all three cetacean species (except NAOwin in bottlenose dolphin). No significant effects of wind strength were found. Upwelling (UI) and wind direction (DirN, DirS) were shown to be highly correlated, therefore only one of the variables was included in each model. Landings, used as a proxy of fishing activity, had no significant effect in number of cetacean strandings in all cases. Our results are preliminary since more suitable indices of the fishing activity could be used (e.g. effort rather than landings).

References:

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