

ASSESSING HISTORICAL TRENDS IN HABITAT USE AND FEEDING ECOLOGY OF THE BOTTLENOSE DOLPHIN, *TURSIOPS TRUCATUS*

1. Background

Bottlenose dolphins (BND) are ubiquitous around the UK coastlines. A greater understanding of modern and historical dietary and ecological niches of UK BND populations would support ongoing conservation measures and allow for more efficient allocation of conservation resources. There is anecdotal evidence that some populations have been forced to adapt their feeding behaviours due to habitat changes that are a result of human activities (e.g., destruction of seagrass fields through fish trawling).

The advent of steam power in the 1880's forever changed fishing practices and ocean ecology around the UK. Stable isotope ratios have been shown to represent dietary and habitat preferences in BND (e.g., offshore versus nearshore; seagrass versus sandy bottom habitats). However, many of these studies have not investigated historical records of BND. This project will investigate BND teeth from three locations around the UK (e.g., Kent, Isles of Scilly, and north Wales) to characterise modern isotopic ranges. Historical BND tooth samples from the Natural

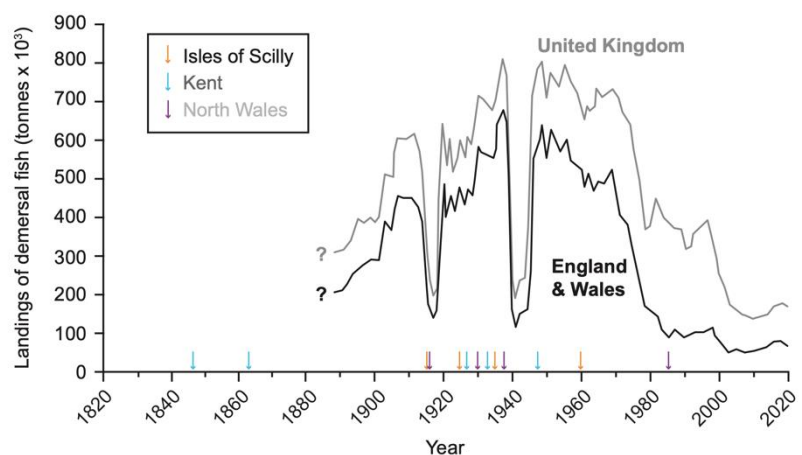
History Museum for the same areas will span from 1846 to 1986 and hence, include the pre-industrial fishing and peak industrial fishing periods (see Fig. 1).

High-resolution stable isotope profiles of historical BND teeth will provide valuable information on their diet and ecology through this time interval. Data of this kind will allow us to understand more about the ecology of BND and how they adapt to environmental pressures. Understanding these adaptations is vital to ensure current conservation measures are appropriate.

2. Aims and methods

The aim of this project is to construct high-resolution isotope profiles of modern and historical BND teeth to investigate the effect of fishing on their ecology and diet. This project will analyse a suite of BND teeth that are held in the Natural History Museum and to investigate dietary changes over the past 180 years (additional recent samples (post-2015) will also be requested

Fig. 1: BND samples (arrows) requested from the Natural History Museum for this project. The graph shows the historical records of landings of demersal fish for the UK (grey line) and just England and Wales (black line) (Thurstan *et al.*, 2010; UK Sea Fisheries Annual Statistics, 2020). CSIP will provide BND tooth samples from 2010–2020 for the three locations listed.



from the Cetacean Strandings Investigation Programme, CSIP). The objectives of the project are to answer the following questions:

- (1) What was the diet of BND before large-scale industrial fishing (pre-1880)?
- (2) Has large-scale industrial fishing affected the diet of BND around the UK south and south-east coast?
- (3) Did the BND return to a pre-1880 diet with the decline in large-scale industrial fishing and landings of demersal fish?

3. Scientific approach

Knoff et al. (2008) performed the first incremental analysis of BND teeth but only compared outer versus inner tooth variation. Since then, several studies have incorporated incremental isotopic analysis of growth-layer groups (GLGs) for carbon and nitrogen isotope ratios (e.g., Evacitas et al., 2017; Feyrer et al., 2020; Pereira et al., 2020). This study will be the first incremental study of BND teeth historically. A suite of teeth is available and specifically chosen to cover (see Fig. 1): (i) genetic differentiation of BND (Nykänen et al., 2019); (ii) the period prior to steam-powered industrial fishing exploitation (1880's); and (iii) the increases and decreases through the middle of the 20th century. The Department of Earth Sciences has excellent thin-section facilities. The manager of this facility has extensive experience in working with faunal material, through my own research projects and his previous employment where he led the training and research development of thin sectioning techniques to dental and archaeological institutions: thus, he has extensive experience in sectioning teeth and otoliths. BND samples will be prepared and analysed in a dedicated stable isotope preparation lab at Durham University. This facility has a dedicated microtome for the micro sampling of tissues.

4. Training

The student will learn how to use a range of high-precision analytical methods and instrumentation, how to integrate different data types and to understand their significance from both a scientific and historical perspective. An understanding of modern oceanography and the environmental issues surrounding fishing will also be provided. The student will be expected to produce draft manuscripts as part of their MSc by Research dissertation. Results from this study will be presented at a conference/s and to communities/groups that have a keen interest in marine science (e.g., South West Marine Ecosystems – <https://swmecosystems.co.uk>). The student will become competent in stable isotope mass spectrometry and will also become involved with other members research projects being conducted in SIBL. Visits to The Natural History Museum and fieldwork expeditions with CSIP will be seriously considered.

5. Further reading & information

[Barros et al., 2010](#) – [Evacitas et al., 2016](#) – [Evacitas et al., 2017](#) – [Feyrer et al., 2020](#) – [Hohn et al., 1989](#) – [Knoff et al., 2008](#) – [Nykänen et al., 2019](#) – [Pereira et al., 2020](#) – [Rossman et al., 2013](#) – [Thurstan et al., 2010](#)

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