



Cardigan Bay bottlenose dolphin social and population structure

- findings from a ten-year photo ID dataset

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Introduction

The Cardigan Bay bottlenose dolphin population is the largest in the UK (Evans *et al.*, 2003). However, the level of residency and site fidelity of this population and the exchange of individuals with adjacent waters have yet to be fully revealed. The boundaries of the current SAC were based on early studies (Lewis & Evans, 1993; Arnold *et al.*, 1997). Since then, further seasonally important areas in the region have been identified.

Methods

Systematic boat- and land-based surveys were carried out from 2001-10. Standard photo-ID techniques (Wursig and Jefferson, 1990) were used. 1128 photo-identification sessions have been analyzed and 197 marked dolphins recognized within the SAC, with new individuals discovered throughout the study. Capture histories were used to calculate yearly population estimates using program CAPTURE, and the Chao (mth) model for a closed population (Chao *et al.* 1992) was applied to the data for each year. In addition, Pollock's robust design (Pollock, 1982) was applied using MARK, and the relevant abundance estimates were adjusted for the seasonal proportion of unmarked dolphins in the population. By incorporating both open and closed population models, the robust model estimates rates of temporary emigration and re-immigration in the population.

Results

Fig 1. Population Characteristics

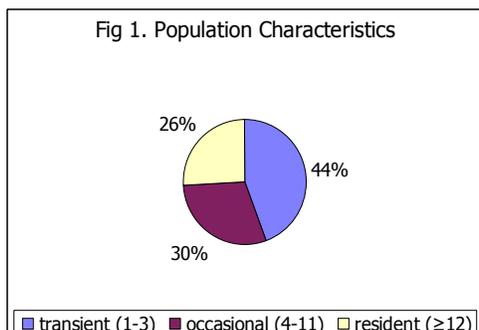


Fig 1. Sighting frequencies from Cardigan Bay SAC reveal that 26% were seen ≥ 12 times, 30% 4-11 times, and 44% 1-3 times. Along with yearly sighting frequencies (28% seen in one year only, 46% seen in 2-5 years, 26% seen > 5 years of the study), we can divide the population into resident, occasional and transient individuals.

Fig 2. Closed model Population trend 2001-10

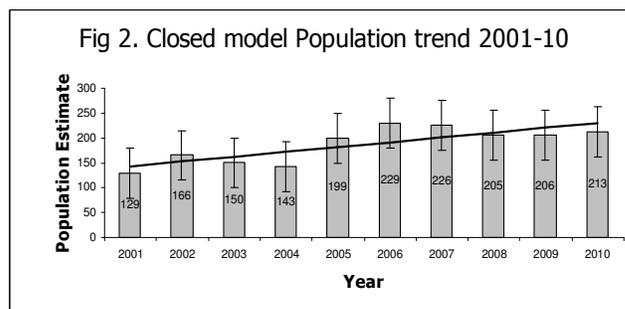
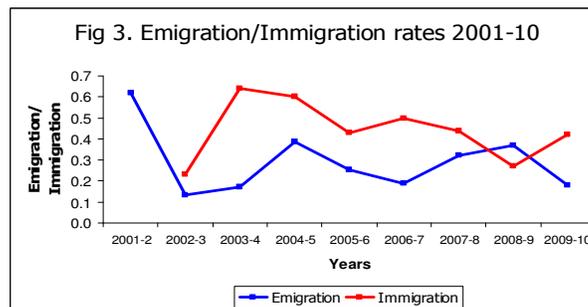


Fig 2. Population estimates for the bottlenose dolphins occupying the Cardigan Bay SAC in the years 2001-10, obtained with the mark-recapture method using a closed population model and considering the proportion of marked dolphins in each group, reveal a general growing population trend. This may be indicative of an overall increase in the wider population; alternatively, it may reflect increased usage of core habitats in Cardigan Bay as peripheral habitats are degraded.

Fig 3. The best mark-recapture fitting model revealed survival rates of 95% between years, emigration probability rates ranging from 14-62%, and immigration (likelihood that emigrated animals stayed out of the Bay) rates from 24-66%. When analyzing sighting history data from the whole of Cardigan Bay, some decline in emigration rates was observed. However, if the study area were to encompass the entire range of the overall population, then emigration should fall to near zero. Since this is not the case, we believe that we are dealing with a meta-population, showing some level of residency and site fidelity but also a consistently high number of transients and infrequent individuals. This population is probably drawn from a larger one, encompassing part, if not all, of the Irish Sea.

Fig 3. Emigration/Immigration rates 2001-10



Conclusions

After ten years of monitoring of the Cardigan Bay SAC, in which time the research area expanded to encompass all of Cardigan Bay, and the Isle of Anglesey, it is clear that further attention should be paid to extending systematic monitoring coverage to a wider area since there is likely movement in and out of the Special Area of Conservation and of Cardigan Bay entirely. Further research in the wider area will shed light on reasons for seasonal immigration/emigration such as shifts in prey availability and mating activities. It will also broaden our knowledge of population structure and social networks within the population.

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