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The influence of tidal cycle on the fine-scale behaviour of bottlenose dolphins using the outer southern Moray Firth coastline



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Introduction

Along the southern coastline of the outer Moray Firth in northeast Scotland (57°41'N, 2°00'W) (Figure 1), bottlenose dolphins (*Tursiops truncatus*) exhibit a consistent spatial distribution throughout the summer and autumn months (Robinson *et al.*, 2007). Whilst the occurrence of animals is relatively predictable along this coastline, however, their movements and behaviour appear to be highly flexible, yet few studies have explored the effects of tidal cycle on distribution patterns and behaviour in this region to date. Although bottlenose dolphins are amongst the best studied cetacean species in the region, much remains unknown about their ecology with respect to tidal phases and tide cycles in this location.

Since 1997, the Cetacean Research & Rescue Unit has studied the bottlenose dolphin community utilising the outer southern Moray Firth and has examined the social behaviour (Eisfeld & Robinson, 2004), range patterns (Robinson *et al.*, 2007), and habitat use (Culloch & Robinson, 2008) of these animals. Information from these studies has increased our present understanding of the dynamics of this northeast dolphin population, but ongoing fine-scale studies in the region remain essential for their local management and protection.

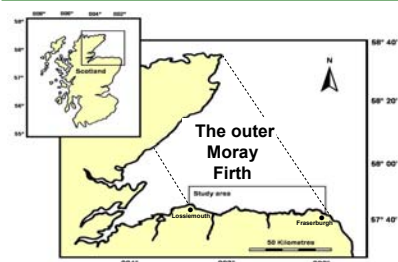


Fig. 1. Map of the Moray Firth in north east Scotland showing the position of the study area between Lossiemouth and Fraserburgh, along the southern coastline of the outer firth region.

Methods

Data were collected during dedicated boat surveys between May and October 2001 to 2007. The surveys were conducted along an 83km length of coastline comprising the southern outer Moray Firth (lying between the ports of Lossiemouth and Fraserburgh) using rigid inflatable boats in Beaufort sea states ≤ 4 . During encounters, the group behaviour of animals was recorded as travelling, foraging, feeding and/or resting accordingly. Tide Plotter (Belfield Software, UK) was subsequently used to determine the tidal state (i.e. neap or spring tide) and stage of the tidal flow (i.e. rising, falling, high or low) for each of the encounters respectively.

The behaviours observed in this study were both states and events. States are long behaviours of measurable duration, whilst events are brief behaviours (see Mann *et al.* 1999). In studying behaviour, it is important to have details of how observers define behaviour. The definitions used for observations made in this study are given below.

Results

- ❖ From 146 encounters, 37% occurred in the rising (flood) tide, 31% on the falling (ebb) tide, 22% on the high tide and just 10% on the low tide.
- ❖ Travelling was the most commonly observed behaviour for each of the tidal stages (Figure 2), whilst milling was the least common.
- ❖ The majority of travelling groups (75%) showed considerable overlap in their activities, with travelling being frequently accompanied by simultaneous feeding and/or foraging behaviours, particularly in the ebb and flood tidal phases.
- ❖ Foraging and feeding activities were observed most commonly during low and flood water periods. Resting behaviour was observed most frequently during slack water periods (Figure 2).

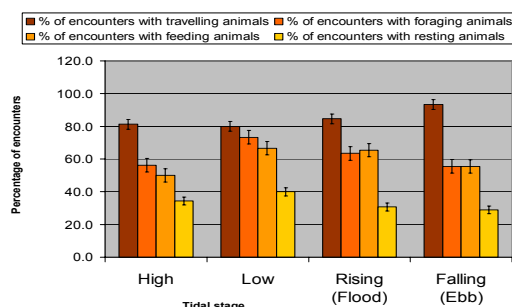


Fig. 2. Percentage of encounters with animals and the behaviour observed during high, low, rising and falling tidal states.



TRAVELLING:

Animals engaged in persistent directional movement, occasional porpoising and/or bow-riding



FORAGING/FEEDING:

Animals observed in any effort to capture and consume prey, evidenced by prey pursuit/fish tossing



RESTING:

Animals observed at the surface but showing no surface behaviour, usually slow movements.

Discussion

The results from this study support the hypothesis that bottlenose dolphin groups exploit local tidal currents. This exploitation may help animals to conserve energy and enhance resource gain and prey capture. This use of prevailing environmental conditions may be significant when considering the high percentage of calves recorded in groups encountered along the Moray Firth coastline, and the importance of the outer southern Firth as a summer calving/nursery area for this northern dolphin community (Culloch & Robinson, 2008). Previous studies of cetacean species in the Moray Firth have shown that the distribution, habitat preferences and behaviour of bottlenose dolphins can be closely linked to environmental factors (Robinson *et al.*, 2007). This study shows that tidal state also appears to be an important determinant for foraging behaviour, and thus related to fitness gain and reproductive success. These results, combined with those of Robinson *et al.* (2007) and Culloch & Robinson (2008) may therefore have important implications for management, as the area of coastline studied lies out with the currently designated Special Area of Conservation (SAC).

Literature Cited:

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