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Violent interactions between bottlenose dolphins and harbour porpoises

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SUMMARY

The majority (63 %) of harbour porpoises stranded around the Moray Firth, Scotland, died from trauma characterized by multiple skeletal fractures and damaged internal organs. Surface injuries consisted of skin cuts resembling the teeth marks inflicted by one cetacean on another. The spacings between these matched those between teeth in bottlenose dolphins, of which there is a population in the Moray Firth. Four violent dolphin–porpoise interactions have been witnessed. Reasons for these interactions are unknown and similar documented examples between other mammals are extremely rare. These findings challenge the benign image of bottlenose dolphins and provide a hitherto unrecorded cause of mortality in porpoises.

1. INTRODUCTION

Since 1991, SAC Veterinary Services have conducted post-mortem examinations of suitably fresh cetaceans found stranded on the Scottish coast to obtain life history information and to document disease. Harbour porpoises (*Phocoena phocoena*), which are common around Scotland (Evans 1980), were the most frequently stranded species comprising 47 % of cetacean strandings between 1991 and 1993 (SAC Veterinary Services, unpublished data). During this period, 105 harbour porpoises were subjected to post-mortem examination. A total of 42 porpoises, all but two from the Moray Firth, exhibited multiple, internal, antemortem injuries characterized by extensive bruising and haemorrhage in the subcutis and underlying musculature, particularly over the head, dorsum, upper chest wall and flank. The subcutaneous blubber layer was frequently torn at depth suggesting that the skin and blubber had been driven inward with force

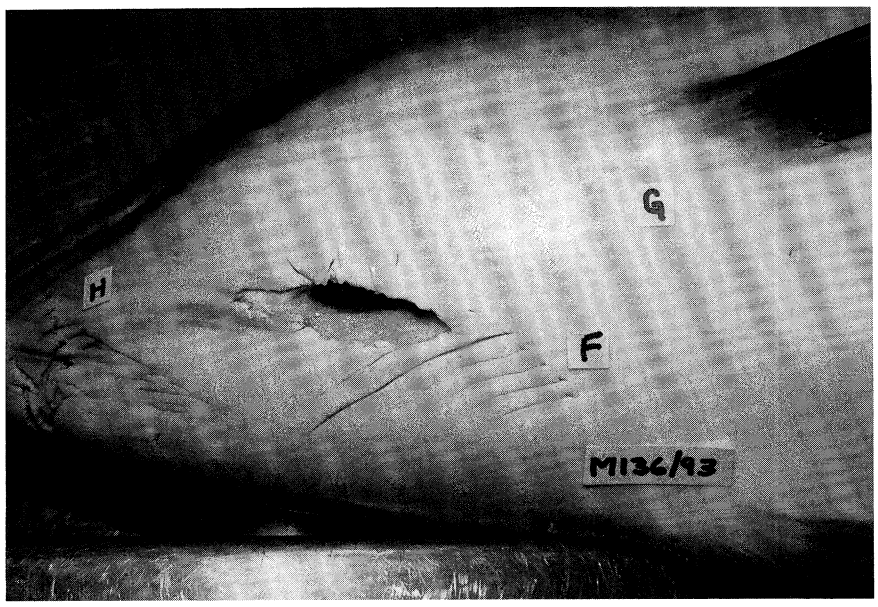

Figure 1. Skin lesions on a harbour porpoise. A typical series of parallel skin cuts (*F*), each commencing as a three-cornered tear. The larger, transverse, irregularly edged wound is post-mortem damage probably inflicted by a carrion feeding bird.

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Table 1. *Inter-tooth distances for cetaceans known to occur in the North Sea compared with surface wounds on harbour porpoise carcasses*

species	mean inter-tooth distance/mm	95% Confidence interval	*n*
harbour porpoise (*Phocoena phocoena*)	3.61	3.36 to 3.87	4
common dolphin (*Delphinus delphis*)	4.71	4.46 to 4.95	8
striped dolphin (*Stenella coeruleoalba*)	5.34	-	1
white-beaked dolphin (*Lagenorhynchus albirostris*)	6.87	6.26 to 7.48	5
bottlenose dolphin (*Tursiops truncatus*)	11.60	10.97 to 12.32	6
Risso's dolphin (*Grampus griseus*)	16.48	15.28 to 17.67	6
killer whale (*Orcinus orca*)	31.88	28.64 to 35.1	2
inter-cut distances from lesions on eight harbour porpoise carcasses	11.56	10.66 to 12.47	77[a]

[a] As each set of parallel cuts on a porpoise carcass could have come from a different source each was considered as a separate sample.

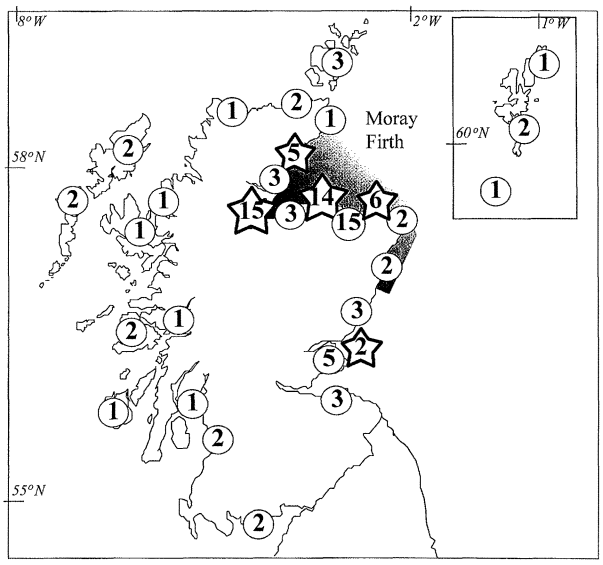

Figure 2. Strandings of harbour porpoises around the Scottish coast, 1991–1993. Stars represent stranding sites of porpoises with the characteristic patterns of injury described in the text. Circles represent porpoises which died of other causes. The number inside each symbol denotes the number of porpoises examined. The shaded area represents the known range of the bottlenose dolphin population (University of Aberdeen, unpublished data).

and speed and, in some, the blubber had separated from the underlying musculature. The rib cage was fractured in 38 animals, four of which suffered fatal perforation of adjacent lung. In 14 animals, a thoracic intervertebral joint had been dislocated with great force. In two, the dorsal spines of adjacent lumbar vertebrae were fractured at their bases and laterally displaced. Injury to abdominal organs varied from mild contusion to, in seven cases, fatal rupture of the liver capsule.

Of the internally traumatized porpoises, 36% showed no ante-mortem skin damage, but the remainder bore lesions consisting of several parallel wounds each commencing as a small three-cornered tear and continuing as a thin, shallow cut rarely deeper than the epidermis (see figure 1). Remaining parallel, the cuts could exhibit a sharp, simultaneous change in direction. In two animals, similar but healed skin injuries overlying long-standing subcutaneous bruising were also present. These marks were unlike those attributed to interaction with fisheries, for example, net or rope imprints. No part of any carcass had been removed prior to stranding and, except for fatal lung or liver rupture, the cause of death in these animals was considered to be a combination of shock and respiratory difficulty consequent to fracturing of the rib cage.

Parallel skin wounds were similar to intraspecific tooth-rakes seen on other cetaceans (McCann 1974; Lockyer & Morris 1990). The wounds on eight porpoises were further examined to identify which cetacean species might have inflicted them. The distance between each cut and the next parallel was measured either at the start of a series or at a point where they simultaneously changed direction. The inter-tooth spacings of odontocete–cetaceans present in the North Sea were measured from skulls held in the Royal Museum of Scotland. Only spacings from bottlenose dolphins (*Tursiops truncatus*) matched those on the porpoises (table 1). In the laboratory, a toothed mandible from a bottlenose dolphin skeleton was used to strike a forceful, glancing blow on a fresh unmarked porpoise carcass. Each point of tooth impact produced a small three-cornered tear before splitting the skin in the direction of travel, replicating the field-observed cuts.

Many of the traumatic injuries observed in the study appeared to be the result of high-energy blunt impact, sometimes, but not always, associated with teeth marks. Shearing of the blubber from the subcutis and fracturing of vertebral spinous processes at their bases were injuries likely to have been caused by violent torque imparted to the outer tissues of the porpoises. Of porpoises with the above patterns of skin and internal injury, 95% were found within the known range of the Moray Firth bottlenose dolphin population (figure 2). Injured porpoises were of both sexes in a ratio not significantly different from one to one (χ^2 statistic = 0.72, 1 d.f., $p = 0.4$) and were biased towards animals with body lengths of between 100 and 140 cm (figure 3). From porpoise age-length data, these animals were likely to have been between one and three years of age, i.e. juvenile or prepubertal (Lockyer 1995). In contrast,

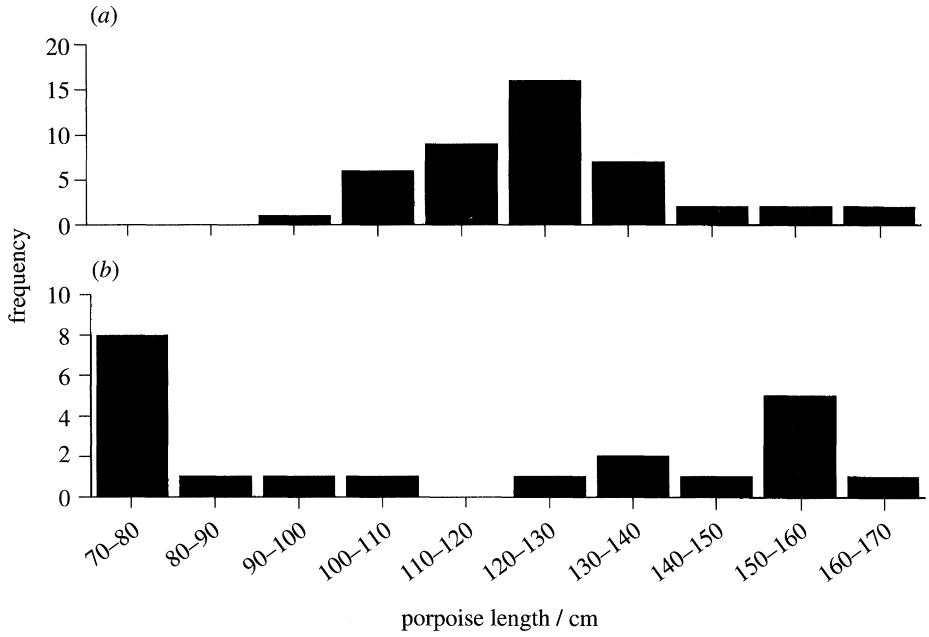

Figure 3. (*a*,*b*) Body length frequency distributions of harbour porpoises stranded in the Moray Firth (1992–1995). Porpoises that died of characteristic multiple injuries (*a*) and other causes (*b*).

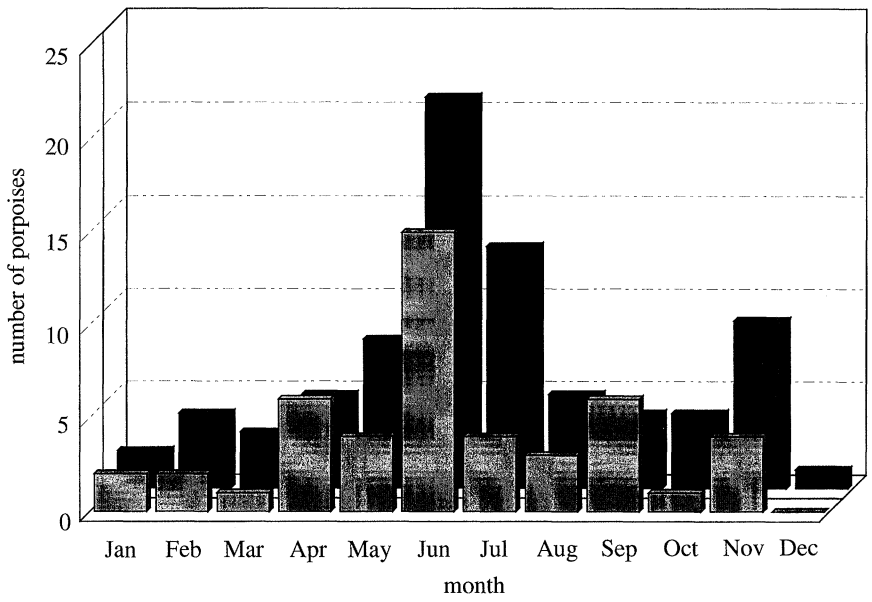

Figure 4. Seasonal distribution of porpoise strandings in the Moray Firth (1991–1993). Numbers of injured porpoises are represented by grey bars and those that died of other causes are shown with black bars.

animals which died of other causes showed a wider range of body lengths, corresponding to all age groups from neonate to adult. The total number of porpoises that stranded around the Moray Firth varied seasonally, with a peak in June (figure 4). Injured porpoises represented a relatively constant proportion of this number, such that within each month the number of injured porpoises was significantly correlated with the number that died of other causes (Spearman Rank Correlation, $t = 3.6$, 10 d.f., $p < 0.005$). No other seamammal (seal or cetacean) was found with similar patterns of injury.

Interactions between bottlenose dolphins and harbour porpoises were subsequently seen on four occasions in the Moray Firth. These observations took place during 3610 h of combined observation made by an amateur shore-based observer, a commercial dolphin watching operation and an ongoing dolphin research project (jointly operated by the University of Aberdeen, and the NERC's Sea-Mammal Research Unit). Twice (31/8/1993 and 24/9/1994) a single porpoise was seen fleeing and eventually escaping from a pursuing group of dolphins. On 9/4/1994 and 16/8/1994 more prolonged interactions, each lasting up to 30 min, were recorded on video. In these, two or three adult dolphins chased a single porpoise at high speed before repeatedly diving in a small area with the porpoise hidden from sight. On reappearance, the

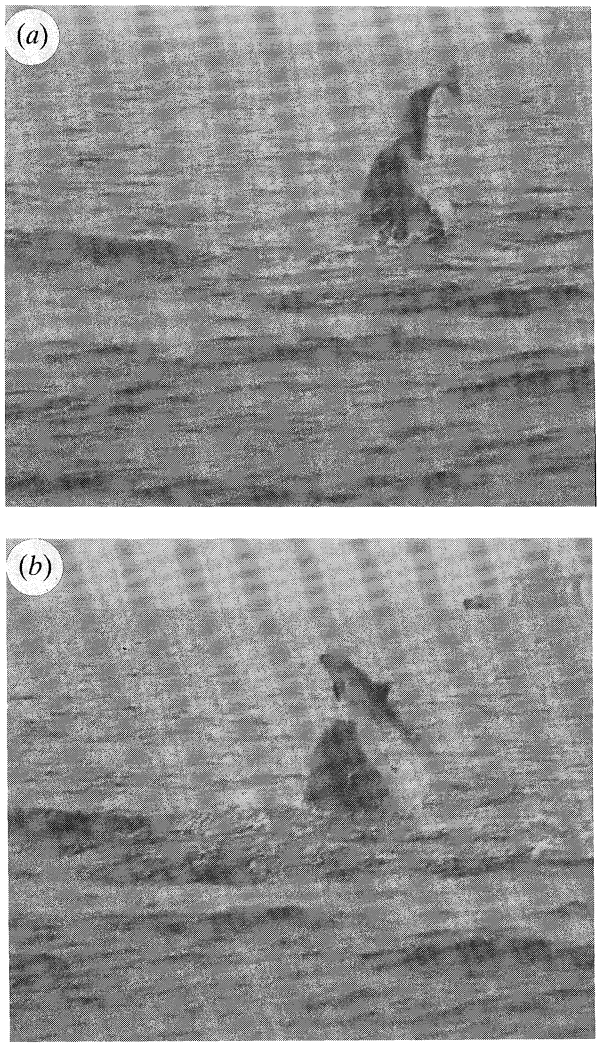

Figure 5. (*a*,*b*) A bottlenose dolphin propels a harbour porpoise clear of the water. (*a*) Lower animal has a broad beak and robust head, which together are features of a bottlenose dolphin. (*b*) Upper animal has a triangular dorsal fin, blunt head and colour pattern distinctive of a harbour porpoise. Pictures courtesy of Peter Outten and Dolphin Ecosse.

porpoise was pursued and often butted clear of the surface on the head of a dolphin (figure 5). As the interactions continued, the porpoise appeared to become increasingly sluggish until it eventually disappeared from view. The fate of the porpoises, in both cases, is unknown.

The distribution of strandings, the nature of skin and internal injuries, and the observed interactions provide evidence that bottlenose dolphins were responsible for the deaths of 42 porpoises, accounting, on the Moray Firth coast alone, for 63% of porpoise strandings. These interactions were characterized by being highly violent and non-consumptive. Evidence in two porpoises of healed injuries suggests that such interactions are not consistently fatal and, hence, may be more frequent than suggested by strandings data alone.

The reasons for these interactions are unclear. The bottlenose dolphin population is relatively small, having been estimated to consist of around 130 individuals (Wilson 1995), whereas the harbour porpoises probably belong to a large North Sea population of many thousands of individuals (Hammond *et al.* 1995). Both species in the Moray Firth frequent similar areas and therefore might compete for food or otherwise interfere with each other's feeding activity. Porpoises might be perceived as a threat to young or ill dolphins. Play, practise-fighting, sexual frustration or aberrant behaviour of a few individuals cannot be ruled out. Information is sought on whether similar interactions occur in other areas where these two species coexist. Documented examples of such behaviour between other mammals in the wild are extremely rare. One other instance occurs between lions and hyenas (Kruuk 1972). These two species compete for food and sometimes interact violently resulting in death or injury of either party. However unlike this instance, the dolphin–porpoise interactions appear to be highly asymmetric. In all observations the porpoises appeared to be the victims and seemed to be making every effort to escape from the dolphins. Our findings add an unexpected facet to the popularly perceived benign character of bottlenose dolphins and introduce a previously undocumented cause of natural mortality in harbour porpoise populations.

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