

## Postmortem evidence of interactions of bottlenose dolphins (*Tursiops truncatus*) with other dolphin species in south-west England

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**Reports of violent interactions between bottlenose dolphins (*Tursiops truncatus*) and harbour porpoises (*Phocoena phocoena*) in the coastal waters of the UK are well documented. Examination of stranded cetaceans by the Cornwall Wildlife Trust Marine Strandings Network and the UK Cetacean Strandings Investigation Programme has indicated that seven animals, of four other species, found stranded in south-west England, had pathology consistent with bottlenose dolphin interaction, including two juvenile and two adult common dolphins (*Delphinus delphis*), one juvenile pilot whale (*Globicephala melas*), one juvenile Risso's dolphin (*Grampus griseus*) and one adult striped dolphin (*Stenella coeruleoalba*). Although recorded traumatic lesions were often not as severe as those found in harbour porpoises, it is probable that the interactions did contribute to stranding and/or death in all four of the juvenile animals examined. Furthermore, analysis of photographs taken before establishment of the Marine Strandings Network revealed rake (teeth) marks consistent with bottlenose dolphin interaction on one stranded common dolphin in 1992. A number of causes have been suggested for these interactions in harbour porpoises stranded in**

**the UK and it is possible that any combination of these factors may also be implicated in the cases described in this report.**

REPORTS of violent and often fatal interactions between bottlenose dolphins (*Tursiops truncatus*) and harbour porpoises (*Phocoena phocoena*) in the coastal waters of the UK are documented in the literature (Ross and Wilson 1996, Jepson and Baker 1998). Published reports to date have been largely confined to areas with resident bottlenose dolphin populations such as the Moray Firth in Scotland and Cardigan Bay in Wales. Since 2001, however, it has become clear that interactions between bottlenose dolphins and harbour porpoises are also occurring outside of these areas (Wilson and others 2004, Jepson 2005). Infanticide has also been recorded within bottlenose dolphin groups in Scotland (Patterson and others 1998). This paper reports that, since 2001, skin wounds and injuries consistent with negative and sometimes fatal interactions with bottlenose dolphins have been detected in cetacean species other than harbour porpoises found stranded in south-west England.

### Materials and methods

In Cornwall, external examinations of stranded cetaceans have been carried out by trained volunteers from the Cornwall Wildlife Trust Marine Strandings Network since 2004 and, before this time, by a volunteer network linked to the Cornwall Biological Records Unit. Those considered in suitable condition for postmortem examination are retrieved for detailed postmortem examination using standard protocols (Law and others 2006) as part of the Defra-funded UK Cetacean Strandings Investigation Programme (CSIP). The majority of these are carried out at the Veterinary Laboratories Agency (VLA) – Truro. In Devon, stranded cetaceans are initially examined primarily by trained volunteers of the Devon Wildlife Trust and Brixham Seawatch, and any considered suitable generally undergo postmortem examination at the Institute of Zoology, London, again under the aegis of the CSIP. In this study, a full postmortem examination was carried out on almost all animals with the one exception being an adult common dolphin (*Delphinus delphis*), which underwent external examination only by Cornwall Wildlife Trust Marine Strandings Network volunteers.

### Results

Skin wounds or scars suspected of being caused by the teeth of bottlenose dolphins ('rake marks') were found in four juveniles and three adults of four species of dolphin other than the bottlenose dolphin (Table 1). In all cases, parallel wounds or scars were present on the integument, the spacing of which was at or near the intertooth distances (10.97 to

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**TABLE 1: Summary of rake marks and other pathological findings in four dolphin species stranded in south-west England with evidence of negative interactions with bottlenose dolphins (*Tursiops truncatus*)**

Species (identification number)	Age class, sex and body length	Location, month and year of stranding	Nature and distribution of rake marks	Significant pathological findings/cause of death
Common dolphin ( <i>Delphinus delphis</i> ) (SW2001/5)	Juvenile male, 1.19 m	Near Bigbury, south Devon, January 2001	11 mm spaced, fresh, full skin thickness rake marks on right tail fluke and caudal peduncle	Hypostatic pulmonary congestion, suspect live stranding
Pilot whale ( <i>Globicephala melas</i> ) (SW2001/238)	Juvenile female, 1.78 m	Dawlish Warren, south Devon October 2001	11 mm spaced, fresh, full and partial skin thickness rake marks on left tail fluke, tail stock and right side of head. 'Three-cornered' 2 to 3 mm wide puncture wounds randomly distributed on head and body	Live stranding, maternally dependent, euthanased
Common dolphin ( <i>Delphinus delphis</i> ) (SW2005/4)	Adult male, 2.23 m	Near Lands End, Cornwall, January 2005	10 to 11 mm spaced, fresh, full and partial skin thickness rake marks on left tail fluke	Subcutaneous and intralubber haemorrhage over head, pressure mark in integument of thorax
Striped dolphin ( <i>Stenella coeruleoalba</i> ) (SW2008/9)	Adult male, 2.25 m	Lizard Peninsula, Cornwall, January 2008	13 mm spaced, healed rake marks (scars) on right lateral tail stock. 5 to 6 mm spaced rake marks on right and left flanks	Live stranding, mandibular fracture, euthanased
Common dolphin ( <i>Delphinus delphis</i> ) (C2008/39)	Adult male, 2.30 m	Near Port Isaac, Cornwall, May 2008	11 to 12 mm spaced fresh, full skin thickness rake marks on dorsal, right and left side of tail stock	Postmortem examination not undertaken
Risso's dolphin ( <i>Grampus griseus</i> ) (SW2008/159)	Juvenile female, 2.07 m	St Agnes, Isles of Scilly, August 2008	9 to 11 (predominantly 11) mm spaced, fresh, full and partial skin thickness rake marks on head, thorax, flanks, dorsal fin, tail stock and tail flukes. Approximately one quarter of body surface affected	Malnutrition, hepatic lipidosis, haemorrhage in intercostal muscles and overlying external oblique muscles on left thorax
Common dolphin ( <i>Delphinus delphis</i> ) (SW2008/189)	Juvenile male, 1.63 m	Near Porthleven, Cornwall, October 2008	11 to 14 mm spaced, fresh full and also partial skin thickness rake marks on pectoral fins, left flank, dorsal midline, tail stock and tail flukes. Approximately one third of body surface affected	Suspect live stranding, mandibular and maxillary fractures, haemorrhage in subcutaneous fascia of head and right thorax, temporalis, trapezius, iliopsoas, right caudal intercostal and external oblique muscles, proximal cervical spinal cord and pleural cavity, tearing of left iliopsoas muscle, proximal shaft fractures of left 7th, 8th and 10th to 13th ribs. <i>Brucella ceti</i> isolated from cerebrospinal fluid

12.32 mm) recorded for this species by Ross and Wilson (1996). In three cases, one pilot whale (*Globicephala melas*), one striped dolphin (*Stenella coeruleoalba*) and one Risso's dolphin (*Grampus griseus*), the wounds/scars had a 'three-cornered' skin puncture at one end or an acute change in direction, also consistent with bottlenose dolphin rake marks seen on harbour porpoises (Ross and Wilson 1996). The spacing of the wounds or scars did not match the intertooth spacing of other species sighted in the coastal waters of south-west England for which intertooth distances are available (Table 2). The pilot whale is the only species sighted for which there are no intertooth distance data; this species has intertooth distances considerably larger than bottlenose dolphins. Pilot whales have tooth spacing similar to that of killer whales (Lockyer and Morris 1985) and Ross and Wilson (1996) report an intertooth distance for the latter of 28.64 to 35.1 mm.

## Discussion

Although the trauma associated with bottlenose dolphin interactions in the present cases was not as severe as that observed in many harbour porpoises, it is likely that the interactions contributed to the stranding and death of the four juvenile animals examined.

There is circumstantial evidence that the common dolphin (SW2001/5) and pilot whale (SW2001/238) that live-stranded on the south Devon coast in 2001 had been interacting with bottlenose dolphins before stranding. The carcass of the common dolphin was found near to where a common dolphin calf had been seen previously, close to shore, with one or more bottlenose dolphins. The pilot whale was found initially in shallow water just offshore, where it was supported and shepherded out to sea by rescuers and then observed swimming towards a number of unidentified cetaceans. The animal re-stranded the following day and was subsequently euthanased.

The juvenile Risso's dolphin (SW2008/159) was found to be in a malnourished state on postmortem examination, with no evidence of recent food intake. However, the multiple rake marks (Fig 1) and

the thoracic intramuscular haemorrhage present were consistent with some of the traumatic lesions seen in harbour porpoises that had been attacked (Ross and Wilson 1996, Jepson and Baker 1998), suggesting that interaction with bottlenose dolphins may have contributed to the death of this debilitated animal.

The most severe trauma was seen in the juvenile common dolphin (SW2008/189) that stranded in October 2008. This animal was observed swimming slowly or possibly drifting offshore before stranding and it is unclear if the animal was alive at the point of stranding. With the exception of the mandibular and maxillary fractures, the traumatic lesions observed in addition to the rake marks on this animal were again consistent with lesions reported by Ross and Wilson (1996) and Jepson and Baker (1998) in attacked harbour porpoises and suggest that a negative interaction with bottlenose dolphin(s) is likely to have contributed to the death of the animal. The isolation of *Brucella ceti* from the cerebrospinal fluid of this animal may also be of significance with regard to the behaviour of this dolphin and its susceptibility to negative bottlenose dolphin interaction, as abnormal swimming behaviour has been associated with neurobrucellosis in striped dolphins (Hernández-Mora and others 2008, Davison and others 2009). Unfortunately, it was not possible to investigate this case further with histopathology.

The rake marks present on the tail stock of the adult striped dolphin (SW2008/9) were a relatively small number of healed scars and therefore appear to be incidental findings; this animal also had healed rake marks on both flanks with 5 to 6 mm spacing, consistent with interaction with members of the same species (Ross and Wilson 1996). The significance of the rake marks on the tail fluke of the adult common dolphin (SW2005/4) that stranded in January 2005 is less clear. Although the rake marks appeared fresh, other traumatic lesions and the presence of a probable rope mark over the thorax suggested that this animal may have been a victim of by catch (Kuiken and others 1994, Jepson 2005). The rake marks on the adult common dolphin (C2008/39) that stranded in May 2008 were fresh, suggesting interaction with bottlenose

**TABLE 2: Cetacean species sighted in coastal waters of Cornwall and Devon and their reported intertooth spacing**

Species	Cornwall sightings September 1991 to December 2008*	Devon sightings January 1997 to December 2008†	Reported intertooth distance (95% confidence interval‡) mm
Bottlenose dolphin ( <i>Tursiops truncatus</i> )	3117	270	10.97 to 12.32
Harbour porpoise ( <i>Phocoena phocoena</i> )	1914	759	3.36 to 3.87
Common dolphin ( <i>Delphinus delphis</i> )	682	100	4.46 to 4.95
Risso's dolphin ( <i>Grampus griseus</i> )	236	9	15.28 to 17.67
Pilot whale ( <i>Globicephala melas</i> )	90	11	No data
Striped dolphin ( <i>Stenella coeruleoalba</i> )	13	0	5.34§

\* Data from Cornwall Wildlife Trust  
† Data from Devon Biodiversity Records Centre and Seawatch Foundation; records unavailable before 1997  
‡ Data from Ross and Wilson (1996)  
§ Single measurement only

dolphins shortly before death. However, in the absence of a full post-mortem examination, it is not possible to be sure of their significance in relation to the animal's death.

Observations of negative bottlenose dolphin interactions with other dolphin species have been reported in the literature, including chasing common dolphins away from prey after emission of specific sounds (Clua and Grosvalet 2001), tail slapping and biting Atlantic spotted dolphins (*Stenella frontalis*) during sexual behaviour (Herzing and Johnson 1997) and head striking and fluke and pectoral slapping of an estuarine dolphin (*Sotalia guianensis*) calf (Wedekin and others 2004). Alonso and others (2000) reported on the presence of rake marks and internal injuries consistent with bottlenose dolphin attack in a stranded striped dolphin in Galicia, north-west Spain, which is likely to have caused the death of the animal. Some of the cases presented here provide the first published evidence that such interactions may also lead to the stranding and death of targeted dolphins in UK waters.

A small resident population of bottlenose dolphins has been reported since 1991 in the coastal waters of south-west England. This is illustrated by the Cornwall Wildlife Trust's sightings database, with 51 sightings before September 1991 and 3117 sightings since that time. The distribution of the sightings data, which includes several sightings between 1992 and 2004 of one readily recognisable, deformed individual, shows that the group moves along the south and north coasts of Cornwall, Devon and Dorset. This is further supported by sightings data from Devon Biodiversity Records Centre and Seawatch Foundation, which reveal a similar pattern of distribution. Harbour porpoises are also known to be present in the coastal waters of south-west England and, since 2001, 14 harbour porpoises have stranded dead on the coasts of Cornwall, Devon and Dorset with rake marks and musculoskeletal and/or intra-blubber trauma consistent with violent and fatal interactions with bottlenose dolphins (Jepson 2005; P. D. Jepson unpublished observations). Although predominantly an offshore species, common dolphins are sighted in the coastal waters of south-west England, so the potential for close contact between the two species is clear. Indeed, retrospective analysis of photographs taken by volunteers linked to the Cornwall Biological Records Unit revealed rake marks consistent with bottlenose dolphin interaction on a common dolphin that stranded in the Isles of Scilly in 1992 (Fig 2). These pre-date the earliest reports for bottlenose dolphin-harbour porpoise interactions in south-west England; it is possible that other earlier cases occurred, but the characteristic rake marks were not recognised at the time. Sighting and stranding reports for the other species reported are less common in south-west England, suggesting that there is less potential for close contact with bottlenose dolphins.

A number of possible causes have been postulated for bottlenose dolphin-harbour porpoise interactions (Ross and Wilson 1996). Rake

**FIG 1: Bottlenose dolphin (*Tursiops truncatus*) rake marks on the dorsal surface of a juvenile Risso's dolphin (*Grampus griseus*) stranded in the Isles of Scilly in 2008****FIG 2: Bottlenose dolphin (*Tursiops truncatus*) interaction rake marks on the tail stock of a common dolphin (*Delphinus delphis*) stranded in the Isles of Scilly in 1992**

marks consistent with intraspecific interactions have been recorded in five of eight bottlenose dolphins at postmortem examination at VLA – Truro, with probably the most extensive lesions being seen in a sub-adult male bottlenose dolphin stranded on the north Cornwall coast in December 2004 (Dawson and others 2006). In the Moray Firth, there is evidence for infanticide in this species (Patterson and others 1998) and it has been suggested that this may be an explanation for violent interspecific interactions, as bottlenose dolphin calves (less than 1.5 m) and harbour porpoises (0.74 to 1.66 m) killed by bottlenose dolphins were of approximately similar lengths (Patterson and others 1998). In this report, only the juvenile common dolphins and pilot whale were of comparable lengths to bottlenose dolphin calves. Other suggested causes for bottlenose dolphin-harbour porpoise interactions include competition for food or interference with feeding activity, protection of young or ill members of the group, play, practice fighting, sexual frustration and aberrant behaviour (Ross and Wilson 1996, Spitz and others 2006) and it is possible that any combination of these factors may also be implicated in the interactions reported here. The relatively high proportion of juveniles affected may have significance in terms of causation, although this is far from clear at present. The presence of pre-existing illness in some cases raises the possibility that aberrant behaviour in the targeted animal may attract attention or perhaps reduce their ability to flee. Injuries to porpoises consistent with violent interaction with bottlenose dolphins were first identified in Cardigan Bay, Wales in 1991 (Jepson and Baker 1998), on the east coast of Scotland in 1992 (Ross and Wilson 1996) and in south-west England in 2001 (Jepson 2005). That such interactions have now been shown to have occurred as early as 1992 in south-west England, albeit in another species, suggests that

this is unlikely to be a recently culturally transmitted behaviour that is spreading around UK coasts.

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### References

- ALONSO, J. M., LOPÉZ, A., GONZÁLEZ, A. F. & SANTOS, M. B. (2000) Evidence of violent interactions between bottlenose dolphin (*Tursiops truncatus*) and other cetacean species in NW Spain. Proceedings of the 14th Annual Conference of the European Cetacean Society. Cork, Ireland, April 2 to 5, 2000. pp 105-106
- CLUA, E. & GROSVALET, F. (2001) Mixed-species feeding aggregation of dolphins, large tunas and seabirds in the Azores. *Aquatic Living Resources* **14**, 11-18
- DAVISON, N. J., CRANWELL, M. P., PERRETT, L. L., DAWSON, C. E., DEAVILLE, R., STUBBERFIELD, E. J., JARVIS, D. S. & JEPSON, P. D. (2009) Meningoencephalitis associated with *Brucella* species in a live-stranded striped dolphin (*Stenella coeruleoalba*) in south-west England. *Veterinary Record* **165**, 86-89
- DAWSON, C. E., PERRETT, L. L., YOUNG, E. J., DAVISON, N. J. & MONIES, R. J. (2006) Isolation of *Brucella* species from a bottlenosed dolphin (*Tursiops truncatus*). *Veterinary Record* **158**, 831-832
- HERNÁNDEZ-MORA, G., GONZÁLEZ-BARRIENTOS, R., MORALES, J.-A., CHAVES-OLARTE, E., GUZMÁN-VERRI, C., BAQUERO-CALVO, E., DE-MIGUEL, M.-J., MARÍN, C.-M., BLASCO, J.-M. & MORENO, E. (2008) Neurobrucellosis in stranded dolphins, Costa Rica. *Emerging Infectious Diseases* **14**, 1430-1433
- HERZING, D. L. & JOHNSON, C. M. (1997) Interspecific interactions between Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in the Bahamas, 1985-1995. *Aquatic Mammals* **23**, 85-99
- JEPSON, P. D. (2005) Cetacean Strandings Investigation and Co-ordination in the UK: Final report to Defra for the period 1st January 2000-31st December 2004. [http://randd.defra.gov.uk/Document.aspx?Document=WP01011\\_8244\\_FRP.pdf](http://randd.defra.gov.uk/Document.aspx?Document=WP01011_8244_FRP.pdf). Accessed September 9, 2009
- JEPSON, P. D. & BAKER, J. R. (1998) Bottlenosed dolphins (*Tursiops truncatus*) as a possible cause of acute traumatic injuries in porpoises (*Phocoena phocoena*). *Veterinary Record* **143**, 614-615
- KUIKEN, T., SIMPSON, V. R., ALLCHIN, C. R., BENNETT, P. M., CODD, G. A., HARRIS, E. A., HOWES, G. J., KENNEDY, S., KIRKWOOD, J. K., LAW, R. J., MERRETT, N. R. & PHILLIPS, S. (1994) Mass mortality of common dolphins (*Delphinus delphis*) in south west England due to incidental capture in fishing gear. *Veterinary Record* **134**, 81-89
- LAW, R. J., JEPSON, P. D., DEAVILLE, R., REID, R. J., PATTERSON, I. A. P., ALLCHIN, C. R. & JONES, B. R. (2006) Collaborative UK Marine Mammal Strandings Project: summary of contaminant data for the period 1993-2001. Science Series Technical Report. CEFAS **131** [www.cefas.co.uk/publications/techrep/tech131.pdf](http://www.cefas.co.uk/publications/techrep/tech131.pdf). Accessed July 24, 2009
- LOCKYER, C. & MORRIS, R. J. (1985) Body scars of a resident, wild bottlenosed dolphin (*Tursiops truncatus*): information on certain aspects of his behaviour. *Aquatic Mammals* **11**, 42-45
- PATTERSON, I. A. P., REID, R. J., WILSON, B., GRELLIER, K., ROSS, H. M. & THOMPSON, P. M. (1998) Evidence for infanticide in bottlenose dolphins: an explanation for violent interactions with harbour porpoises? *Proceedings of the Royal Society of London. Series B* **265**, 1167-1170
- ROSS, H. M. & WILSON, B. (1996) Violent interactions between bottlenose dolphins and harbour porpoises. *Proceedings of the Royal Society of London. Series B* **263**, 283-286
- SPITZ, J., ROUSSEAU, Y. & RIDOUX, V. (2006) Diet overlap between harbour porpoise and bottlenose dolphin: an argument in favour of interference competition for food? *Estuarine, Coastal and Shelf Science* **70**, 259-270
- WEDEKIN, L. L., DAURA-JORGE, F. G. & SIMÕES-LOPES, P. C. (2004) An aggressive interaction between bottlenose dolphins (*Tursiops truncatus*) and estuarine dolphins (*Sotalia guianensis*) in southern Brazil. *Aquatic Mammals* **30**, 391-397
- WILSON, B., REID, R. J., GRELLIER, K., THOMPSON, P. M. & HAMMOND, P. S. (2004) Considering the temporal when managing the spatial: a population range expansion impacts protected areas-based management for bottlenose dolphins. *Animal Conservation* **7**, 331-338