

# The injury and subsequent healing of a serious propeller strike to a wild bottlenose dolphin (*Tursiops truncatus*) resident in cold waters off the Northumberland coast of England

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## Introduction

A solitary male bottlenose dolphin was resident close to the fishing port of Amble from April 1987 (Bloom 1991). This animal remained in a very small triangular home range of less than 0.5 km<sup>2</sup> and was rarely seen to leave that established territory. The home range was contained within Alnmouth Bay between Cocquet Island and associated shoals and the mainland. This shallow protected bay area provided good protection from gales and storms from most directions. The boundaries, as defined by the dolphin's observed movements, are the Pan Bush shoals and its navigational buoy to the north-east, the sewer outfall buoy to the south and the harbour mouth area on the westward apex of the triangle (see Figure 1).

The river Coquet is a fine salmon and sea trout river. Since these fish, by instinct, have to pass through the narrow harbour entrance to gain access to and egress from, the river estuary, they provided a regular supply of large fish that were therefore concentrated into a predictable and small forage area. This was perhaps the primary reason for this animal's prolonged residency in the Amble area. It was the dolphin's increasing interest in commercial fishing and recreational boat traffic, and later with swimmers, that brought this animal into intimate contact with people and their activities.

## Dolphin Appearance

The dolphin was estimated to be around 3.1 m in length with a heavyset build and an estimated body weight of 300–350 kg. The beak was scarred and pitted, the melon pronounced, and the eyes small and deep-set. Lower jaw and mouthline were very

pale, giving the impression that the animal had 'white cheeks' when viewed from a distance.

There were marked and deep ear creases behind both eyes, and deep crease lines under the throat. Several broken or missing teeth were observed in the lower left jaw and both sides of the upper jaw, while the remaining ones were worn and rounded.

The upper beak, melon, and blowhole areas were discoloured, giving the appearance of a blotchy skin condition. The dorsal surfaces, especially each side of the dorsal fin and tail stock, also displayed a blotchy 'camouflage' skin colouration that was associated with a dramatic variation in apparent thickness of the epidermal layers. Both hyper- and hypo-pigmentation was observed associated with these areas, as well as with old scars and partially healed lesions (see photo 1). This appearance, described as a 'moonscape' appearance has been referred to in varying degrees of seriousness by Ben Wilson (pers. comm.) and Thompson and Hammond (1992) on other *Tursiops* found in the colder waters around the U.K.

The ventral areas had an apparent irregular build up of dead skin which sloughed away unevenly. Deep scratches and rubbed areas showed up whiter than the more creamier/yellow colouration of undamaged areas of abdominal epidermis.

There were old scars evident on both dorsal and lateral areas of the body and several old rake marks low down on the right side of the tail stock. Many of these old scars were highlighted by surrounding areas of paler or darker pigmentation that further add to the unhealthy appearance. Two rake marks (one on the dorsal ridge of the tail stock and one low down on the right flank behind the genital slit area) were photographed in 1989 and were still evident in 1992 (see photo 8).

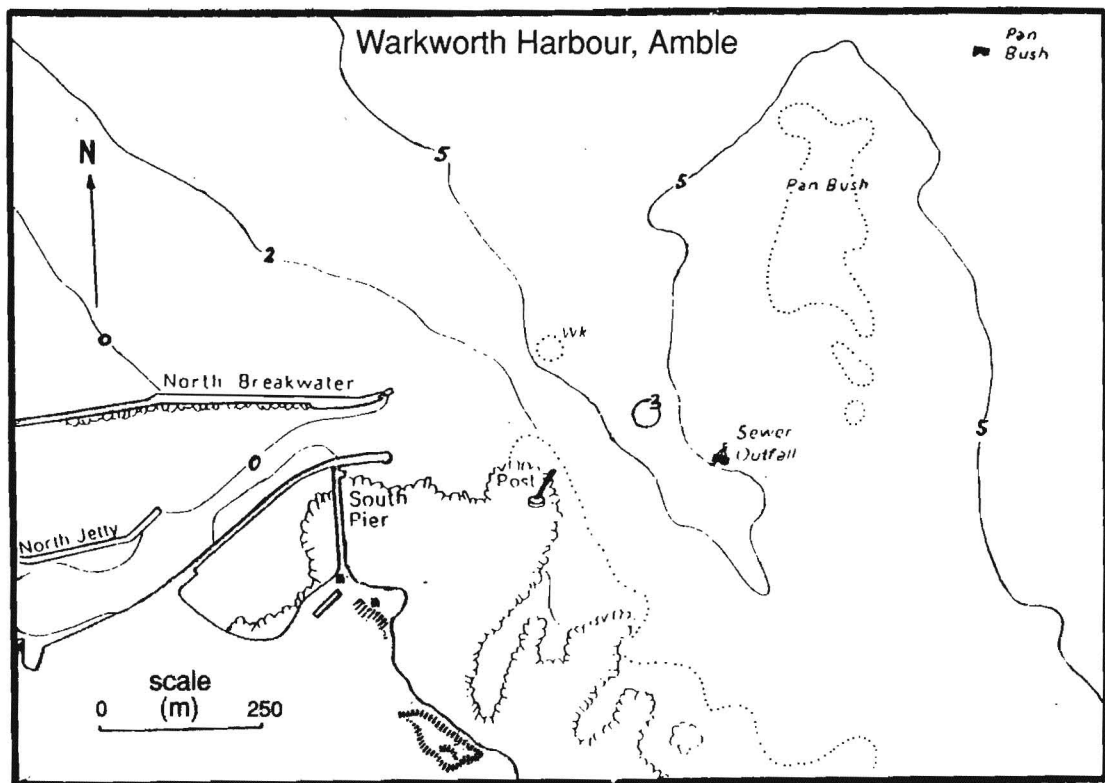


Figure 1. Warkworth Harbour, Amble.

The tail flukes, left pectoral and dorsal fins had no damage to their peripheries, but the right pectoral fin had damage to both leading and trailing edges that was caused by an entangled fishing line slowly tightening and cutting into the tissue (this line was eventually cut away by divers, once the dolphin allowed people to touch him, in August 1989).

On the extremities of the dorsal fin, especially the leading edge, there was a definite contour line where more evenly coloured skin met the more discoloured patches. This delineation had remained constant throughout the years of observation, although the 'unhealthy' side had varied in colour and texture from month to month and year to year.

#### Observations

On September 25th the dolphin suffered a major injury when a powerful twin screwed police launch that was idling in the harbour entrance went hard astern to avoid another boat coming into harbour. The skipper (Gordon Easton pers. comm.) of a sightseeing boat reported that the dolphin had been

under the stern of the launch when the boat took avoiding action and that the dolphin disappeared under the stern but surfaced, highly agitated, alongside the midships area moments later. The dolphin was observed shortly afterwards to have blood streaming from wounds on his right side. The accident happened at 17.45 and the central wound area was still oozing blood at 19.00

The following morning an inspection of the animal's right side revealed that the dolphin had suffered a serious propeller strike. The injury consisted of a series of 11 curved slash wounds running along the right side and stretching in a crescent formation from rib cage to genital slit (see photo 2).

Slash marks 2-5 were serious as the blubber layer was completely cut through and the muscle layers below exposed and penetrated. Fortunately neither the pleural cavity was breached nor any rib bones broken or damaged. Slash marks 1 and 6-11 appeared deep but were in fact only superficial cuts that exposed the blubber layer to varying depths but did not penetrate deeper. During this morning examination there was still seepage of blood, particularly when the animal's movements caused the

wound sites to gape open but by the end of the day all bleeding had apparently stopped even when the wounds gaped open.

On September 28th there were particles of sand and dirt lodged in the blubber giving the wounds a brown, grainy appearance.

On October 3rd (day 8) slashes 1 and 6-11 were white and closing up without apparent infection or incorrect alignment. Wounds 2-5 however remained open with a small infection developing in the anterior side of slash 4. There was also noticeable swelling of the areas around and between the slashes that gave the whole wound area a corrugated effect (see photo 3).

On October 7th (day 12) the interior of slash wounds 2-5 were observed to be filled with loose soft tissue material suggesting the observation of the aquatic equivalent of scab formation which in turn suggests that the healing process was functioning. Bruce-Allen and Geraci (1985) observed the build up of a buffer zone of cellular material and degenerated epidermal cells in the wound site so protecting the healing areas from the water environment. This study was based on deliberate, 2 mm superficial cuts made on young Mississippi *Tursiops* held in sea-pens in Florida. These animals were younger, possibly healthier, with wounds far less serious and in much warmer ambient water temperatures but it appears the same mechanisms were at work, although over a much longer period.

On October 10th (day 15) the infection in slash 4, first observed as a greenish spot, had now developed into a yellow purulent area some 3 cms diameter. The inflammation and swelling between the slash wounds had increased to give the area an even more dramatic corrugated appearance. This swelling also had the effect of squeezing the wound edges closer together although slashes 2-5 still gaped wide during stretching (see photo 4).

On October 13th (day 18) slashes 1 and 6-11 appear almost closed up completely. Much of the swelling had gone from the areas surrounding wounds 6-11 but there were still noticeable corrugated disfigurement to the wound areas.

On October 16th (day 21) three abscesses were observed (two small hazelnut sized swellings and one walnut sized swelling sited above the two smaller) developing between slashes 3 and 4. It was this area, situated between the two deepest cuts, that had suffered the most swelling and deformation; in addition to the anterior side of slash 4 which was the site of earlier infection.

On October 22nd the two smaller abscesses had burst leaving bright red wounds; three days later (day 31) the larger, now golf-ball sized, abscess was open leaving a third raw patch some 4-5 cms in diameter.

The skin peeled away from around the other two abscess sites so that by the 27th (day 32) these areas overlapped into one large, hand sized triangle that appeared very white in colour.

On November 1st (day 37) slash wound 3 was gaping open and bright red in colour although the other serious slashes (2, 4, 5) remained white inside and appeared to be more than half closed up. The swelling and hence also the corrugation effect began to decrease during the first week of November although it was still an obvious disfigurement in January over 100 days after the injury (see photo 4).

A 2-3 mm growth band was observed forming new skin around the whole triangular margin of the abscess site. Wounds 1 and 6-11 appeared completely closed over although the wound sites were still very marked.

On November 29th (day 65) the slash and abscess sites had suffered no further infections and healing appeared to be continuing. The deep slash wounds had continued to close up from the inside so that only a thin white line of new tissue was visible and the abscess site margins continued to close (see photo 6).

By January 31st the slash wounds and the area of the abscesses were healed over with scar tissue and there were no signs of further infection. The abscess scar site remained strikingly white in the freshly healed central region but the irregular grey margin surrounding this suggested that some migration of pigmentation cells into the scar tissue was occurring (see photo 7). The slash wound area remained corrugated and disfigured by the stretched scar tissue with the original propeller blade strike sights high-lighted by a pale curved scar line associated within a recessed surrounding area of much darker pigmentation particularly on anterior side of the more serious wounds (see photos 7 and 8).

## Discussion

The overall impression of this animal's appearance, even before the propeller strike, was that of an animal with more than one severe skin disease condition. In reality this animal was probably only displaying minor, but chronic, skin problems aggravated by exposure to cold water temperatures and raw sewage.

The ambient water temperatures vary from 4-5°C (measured in the harbour mouth during January snow melt run off) to 11-14°C during late summer. Bacterial analysis of the water in the sewer outfall and harbour mouth areas was carried out between 1989 and 1990 and determined that although candida, salmonella, and pseudomonas sp. were never tested positive (in either the sewer outfall or the



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8

harbour mouth areas) high levels of enterobacteria were regularly recorded at the sewer buoy (up to 1100 MPN/ml) and were also *E. coli* positive in all but two of the sewer buoy samples (Bloom 1991a).

Prolonged exposure to raw sewage, with its associated high entero-bacterial levels, may slow down or impair the healing process allowing secondary infections or develop. When coupled with low water temperatures these factors exacerbate incomplete healing and cause uneven sloughing of the skin.

The superficial wounds 1 and 6-11 turned white inside the cuts after eight days and had begun to close up. By day 18 these wounds were half closed over and on day 37 were observed to be totally healed over, although the wound sites were highlighted by pale scar tissue and some residual swelling. These superficial wounds took approximately 5 weeks to close and the scars were still evident at over 22 weeks when the final observations were made.

The deeper blubber and muscle penetrating wounds 2-5 were still gaping open, although filled with loose cellular material, on day 12 with pronounced swelling and inflammation around these more serious wounds. By day 37 wounds 2, 4 and 5 were half closed up but wound 3 was observed bright red inside the wound suggesting recent further trauma to this site. By day 65 slash 4 had only a thin white line of exposed coarse, white tissue surrounded by smoother scaring. These deeper wounds took nine weeks to close up and were then completely healed over with smooth scar tissue within 18 weeks.

The abscess that appeared to develop, firstly in the anterior wall of slash 4 between days 12 and 15, eventually developed into three adjoining swellings between slash 4 and 3 by day 21. These abscesses were all open by day 31 leaving a fresh hand sized wound which had a healthy growth band around the edge of the wound within six days. Within six weeks of this fresh wound developing healthy, but nonpigmented, skin had grown inwards towards the centre of the abscess site covering two thirds of the original wound site. The texture and appearance was rough, uneven and coarse rather than the

stretched, smooth and glossy appearance associated with healed scar tissue.

After 12 weeks the abscess site had healed over completely. In addition darker, irregular areas like tendrils had developed from around the margins of the white scar and extending inwards towards the centre of the wound site indicating that some repigmentation had begun. This suggests that the non-pigmented area would eventually recede and become a much less obvious identification mark for the animal if it reappeared in a new location in the future.

Corkeron, Morris and Bryden (1987) reported, and published photographs, of serious shark attack wounds on bottlenose dolphins. Lockery and Morris (1990) also reported observations made on wound healing and scar persistence of *Tursiops truncatus* around the U.K. as well as Australia. Although propeller injuries were not discussed the latter paper set out a classification guide to the gravity of wounds.

The scale of damage and healing times of slash wounds 1 and 6-11 suggest their classification as minor wounds.

The abscess site took 2-3 months to close up completely and there remained a permanently non-pigmented scar area suggesting a deeper wound (from an internal erupting infection) classification.

Slashes 2-5 which cut into muscle in places, left some deformation and disfigurement. Healing was complete externally only after four months and these could be classified as major wounds.

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**Photo 1.** Dolphin 'moonscape' (P. Bloom, Jul 1991)

**Photo 2.** Slash wounds 2-5. Day 2. (M. Jager, Sep 1991)

**Photo 3.** Slash wounds 2-8. Day 8. (M. Jager, Oct 1991)

**Photo 4.** Slash wounds 1-5. Day 16. (P. Bloom, Oct 1991)

**Photo 5.** Slash wounds 2-5 and associated corrugation effect. Day 110. (P. Bloom, Nov 1991)

**Photo 6.** Abscess site and slashes 2-5. Day 65. (P. Bloom, Nov 1991)

**Photo 7.** Slash wounds 1-6 and abscess site. Day 128 (P. Bloom, Jan 1992)

**Photo 8.** Slash wounds 10 and 11. Day 128. (P. Bloom, Jan 1992)

in Amble during the six week period after the propeller injury.

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