

## Skin disorders in bottlenose dolphins (*Tursiops truncatus*), resident in the Sado estuary, Portugal

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### Abstract

Throughout two periods, in 1986/87 and 1992/93, a systematic study was conducted of a group of bottlenose dolphins inhabiting the Sado estuary. At the end of the second study period, 85% of the long term residents showed signs of skin disorders. Forty percent of these animals show signs of the skin disorder for 6 or more years. Skin samples were not collected or analysed to date, therefore, it has been impossible to determine the cause of the skin disorders. Comparison with observations in other areas suggest that habitat degradation may play an important role when dolphins become sick and/or entire communities decline and eventually disappear. The appearance of skin disorders may indicate depressed or overworked immune systems that would normally counteract the disease. Such immune system deficiencies may be caused by stress, habitat degradation or contamination with pollutants.

### Introduction

In recent years, it has become increasingly obvious that environmental pollution and viral disorders play a role as cetacean pathogens. While much has been written about skin diseases in captive animals, reports from the wild are still scarce. Greenwood *et al.* (1974) described a variety of skin diseases in wild cetaceans, and Geraci *et al.* (1979) provided a detailed report on pox infection in wild animals.

Circular marks have been observed in many cetaceans (Greenwood *et al.*, 1974). These marks have been attributed to parasites and infections. In captivity, there appears to be a correlation between pox-like lesions and stress, environmental conditions, and the overall general health of the animal (Greenwood *et al.*, 1974; Geraci *et al.*, 1979). Other possible causes include temperature variations (Haebler & Moeller, 1993) and immunosuppressive pollutants. Recently, autoimmune viruses, such as Morbillivirus, have been considered potential

threats to dolphins as well (Lipscomb & Kennedy, 1994).

Baker (1992), who examined 81 specimens from nine cetacean species in British waters, including the bottlenose dolphin, found several cutaneous abnormalities in about two third of this mixed sample of cetaceans, including wounds or other traumatic injuries, viral infections and scars. Tattoo lesions on the skin were described, indicating a pox virus infection. These lesions are reported to be oval in shape, 0.5 to 7.0 cm long and usually orientated along the long axis of the body. They were characterised on pigmented skin by a black or grey outer line 1–3 mm wide, which was either uniform or composed of a series of spots. Inside the black line the skin was paler than the surrounding normal tissue and in the centre of larger lesions there were frequently linear longitudinal ulcers. Geraci *et al.* (1979) provided a similar description and correlated it to stress and poor health. Similar lesions have been observed in other areas and other species, such as the spotted dolphin (*Stenella frontalis*) in the Bahamas (Herzing, pers. comm.). Baker also found skin conditions that he interpreted as a herpes infection. This infection was characterised by oval shaped areas up to 6 cm long, that were paler in pigmented areas than the surrounding normal skin. Many of the animals studied were in good condition when they died, and 'except where skin disease was extensive, there was no evidence to suggest ill-health in the affected animals' (Baker, 1992). A herpes virus infection was also described for dusky dolphins (*Lagenorhynchus obscurus*) from Peru (Van Bresse *et al.*, in press). Reports on bacterial dermatitis are rare, supporting the findings of Dunn (1990), that most bacterial skin diseases are secondary, following primary viral, parasitic or traumatic insults.

Rowntree *et al.* (1994) described pox-like marks on the backs of southern right whales (*Eubalaena australis*) as concave and lighter than newly peeled skin. They ranged in size from 5–15 cm and as many as 20 such marks were reported on a single individual. They were confined to the back, a region

exposed to air when the whale breathes. In some cases these marks disappeared in 2–4 years, while in other cases they remained visible for over 4 years. The authors also found similarities with pox virus marks found in dolphins. The fact that marks only occur on the dorsal surfaces led Rowntree *et al.* (1994) to consider on the possible effects of sunlight on the virus. They speculated that a possible immune response suppression through UV-B radiation could be responsible. The increase in number of whales carrying such marks, between 1984 and 1990, may represent the spread of an infectious disease, or parallel the sharp decline in ozone seen in the late 1980s.

Thompson & Hammond (1992) reported skin diseases in live bottlenose dolphins identified during their photographic identification work in Moray Firth, Scotland. They distinguished and described three patterns of skin disorders which they considered as potentially symptomatic of disease: (1) dark lesions, (2) ring lesions and (3) de-pigmentation.

Dark lesions were observed on many animals and were characterised as distinct from natural pigmentation, patchy in distribution and sometimes located in a reticulate pattern around normal skin. They found this general appearance to be similar to the descriptions of cutaneous candidiasis, described for captive cetaceans, where areas of skin colonised by *Candida sp.* appear darkened (Dunn *et al.*, 1977). On one animal the lesions were more widespread and included skin eruptions, but Thompson & Hammond (1992) could not determine whether this might represent an advanced state of the dark lesions. Ring lesions were usually grey in colour and varied in diameter from an estimated 1–5 cm. They compared this pattern to similar lesions reported for wild and captive bottlenose dolphins known to result from a pox virus infection. De-pigmentation was observed on several dolphins, consisting of blotchy areas. On one animal, this pattern remained visible for at least one year.

Their study shows that disruptions in normal skin patterns can be determined through photographic identification and can be monitored through the analysis of photographs taken over several years.

Here we present the evidence of skin disorders based on the analysis of more than 10 000 photographs taken in the course of the study of the behaviour and social ecology of a resident population. Further details of the results from this study can be found in Harzen (1989, 1995), Harzen & d.Santos (1992) and Harzen & Brunnick (1995). A total of 53 individuals have been identified since 1981, of which only 25 have been observed in both 1986/86 and 1992/93.

## Methods

Photographs to identify individual dolphins (Würsig & Würsig, 1977; Würsig & Jefferson, 1990) were made exclusively from the boat. Photographs were taken with motor driven cameras and lenses of 200 to 600 mm. We usually used 100, 200 and 400 ASA Kodak slide film, but occasionally black and white negative film was utilised as well.

The animals were primarily identified using natural markings on the trailing and/or leading edge of the dorsal fin. Other fin and body features, including anomalies of the skin were also considered.

When this study began in 1986 a total of 26 dolphins had been identified (d.Santos & Lacerda, 1987). Each fin observed was subsequently compared to those registered in the catalogue and either matched or named as a new animal. The entire set of more than 10 000 photographs taken was then re-analysed for evidence of visible skin disorders.

## Results

Photographic evidence suggests that dolphins in the Sado estuary suffer from at least one, and possibly several, skin disorders. At the end of the second study period, December 1993, 85% of the long term residents showed signs of skin disorders. Although determining pathology or a specific diagnosis is impossible without skin samples, some insights and observations are possible from the photographic documentation. Signs of infection were documented from 1986 to the present. Of the 25 animals observed in both study periods, 21 (85%) exhibited skin disorders in 1992/93. Ten (40%) of these showed signs previously, many dating as far back as 1986.

### *A description of the disorders*

The most commonly observed form of disorder is large patches of discoloration found on all parts of the dolphin's body. The large patches are apparently made up of clusters of small spots. The small spots can be dark or light. The patches can change from black to white, light to dark, and can be distinct or massed. Generally, the patches appear to contrast the natural body coloration, i.e. light on dark skin and dark on light skin. Some samples, however, show an increase in natural skin coloration in the patches, mostly darker on dark skin. The coloration of the patches and the extent of the infection in the patches can change in a matter of weeks from subtle to extreme discoloration. It is unclear if the coloration changes are indicative of advanced stages of infection, remission, or other factors (Figs 1 and 2).



**Figure 1.** Large patches of discoloration most commonly observed [Sup, October 1993].



**Figure 2.** Patches of discoloration in high density on the forehead and around the blowhole [Tal, October 1993].

Although the lesions have been observed in the same location on the animal's body, some animals show obvious progression of the disorder over time. There is also evidence of periods of *bloom*, where the patches are more distinct than at other times.

These bloom periods can begin quickly and enter remission in short order (Figs 3–7).

Even during apparently long periods of remission or partial remission, the animal still exhibits scarring from the disorder. Scar tissue is noticed



**Figure 3.** Dorsal fin and trunk show patches of light and dark discoloration [Hub, August 1987].



**Figure 4.** General discoloration progressed from previously infected areas. Possible cyst like textures on the trunk, large patches below the dorsal fin [Hub, June 1992].

as a discoloration in the infected areas. These areas may maintain the shape of the infection patches or in cases of extreme infection may appear as a general discoloration over large areas of the body.

One manifestation of the skin disorder is obvious by what appears to be a series of cyst-like bumps over the infected area. The extent of the infection over the body is unknown, but it has been observed on the trunk of some animals. The cysts appear to



**Figure 5.** Patches of discoloration appear raised below the dorsal fin [Hub, October 1992].



**Figure 6.** Obvious cluster of white spots in the centre of dark patch [Hub, May 1993].

leave scars of general discoloration and disturbance in texture of the skin and can reappear repeatedly over time (Figs 8 and 9). At least one animal has been tracked over two years with this problem.

Another skin disturbance observed in this study is characterised by distinct white spots that remain

over time. These scars are consistent and can be used as identification markers. It is unclear whether these scars result from encounters with predators or injury, or are disease orientated (Figs 10 and 11).

Another manifestation of the skin disorder is small white spots that are scattered over the trunk



**Figure 7.** Dark patches are considerably darker than in Figure 4 [Hub, October 1993].



**Figure 8.** Cyst-like bumps on trunk below dorsal fin [Gor, May 1993].

of the animal (Fig. 12). It is unclear if the infection spreads to the extremities. It is also unknown, whether this is an early stage of the previously described dermal disorder, or a specific and unique malady.

#### **Discussion**

The fact, that a relatively large number of animals show signs of skin disorder for six and more years suggests that it is not (immediately) fatal.



**Figure 9.** General discoloration and disturbance in texture of the skin in the area below the dorsal fin. Same area previously covered with cyst-like bumps [Gor, End of September 1993].



**Figure 10.** White scar tissue on saddle and peduncle areas [Gor, October 1988]. Photo provided by M. d.Santos.

Because no skin sample could be collected or analysed, it has been impossible to determine the cause of the skin disorder. Hence, the microbiological nature and pathology of the disorder

remains speculative. The observed skin disorders do, however, match the description for pox and herpes virus infection provided by Baker (1992).



**Figure 11.** Same white scar tissue on the saddle and peduncle areas. General discoloration due to possible long term dermal infection [Gor, July 1993].



**Figure 12.** Small white spots generally scattered over the trunk and saddle area [Lis, July 1993].

The reasons for the bloom periods are unclear, but may signify seasonal changes in water temperature and salinity or periods of environmental, physical, and/or mental stress for the individual. Skin disorders, including pox and herpes virus' have

been associated with periods of stress in marine mammals (Geraci *et al.*, 1979; Van Bresseem *et al.*, in press). Pollutants, i.e. heavy metals and organochlorines, which have already been linked to reproductive abnormalities, reduced testosterone levels,

and survival rates in dolphins (Subramanian *et al.*, 1987), may also be contributing factors.

Comparison with observations in other areas suggest that habitat degradation may play an important role when dolphins become sick and/or entire communities decline and eventually disappear (Gaskin, 1982; Geraci, 1989; Cockcroft *et al.*, 1989; Kuehl *et al.*, 1991). One of the most pressing problems in many estuaries, including the Sado, is excessive nutrient enrichment, or eutrophication. Nutrients, essential for the plant growth that forms the base of the food web, and thus influences the production of fish and shellfish, can in excess have highly damaging effects, such as partial or complete removal of dissolved oxygen from the water column, occasional deadly algae blooms, reduced populations of fish and shellfish, and dieback of important seagrass nursery ground habitats (Baden *et al.*, 1990; Cederwall & Elmgren, 1990; Hansson & Rudstam, 1990; Smayda, 1992; Rosenberg *et al.*, 1990). This may lead to a damage of the entire food web, affecting all organisms for whom the Sado estuary is a primary nursery and feeding ground, including the dolphins (Harzen, 1995). The drastic consequences of such developments became obvious in Lisbon, about 40 km north of Setúbal, where the river Tejo meets the ocean in a wide estuary. More than twenty years ago, a community of bottlenose dolphins inhabited these waters and were seen every day by people crossing the estuary in ferry boats. The slow and continuous deterioration of their habitat most likely led to the disappearance of these dolphins.

More research on skin disorders of dolphins, in particular their microbiology, is needed to determine their causes, virulence, and impact on long-term survival. Combined with a detailed study of the processes and effects taking place in complex estuarine ecosystems, such research may provide useful clues to the general health of free ranging dolphins and their habitat.

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