

Skin disease in wild cetaceans from British waters

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Eighty-one dead cetaceans of a variety of species and from British waters were examined for evidence of skin disease and 69% were found to be affected. The most common conditions were wounds and other traumatic injuries, viral infections (predominantly pox) and a variety of scars. Some previously undescribed conditions of uncertain etiology were also recorded.

Introduction

In the course of photo-identification work and on cetacean watching cruises in U.K. waters, cutaneous lesions on porpoises and dolphins have been frequently noted (Bloom, 1991; Thompson and Hammond, 1992; S. Meyer, pers comm). These authors hypothesised that the lesions might be associated with pollution and were a cause for concern. Cutaneous disease has been reported as common in wild cetaceans elsewhere in the world (e.g. Greenwood *et al.*, 1974).

Much has been written about skin diseases in captive cetaceans, but relatively little about its occurrence in wild animals. Thompson and Hammond (1992) attempted to identify diseases in live wild bottle-nosed dolphins seen during photo-identification work and provisionally identified dolphin pox on some of their animals. The only other paper giving details of this infection in wild animals is by Geraci *et al.* (1979). Cutaneous herpes infection has been described in belugas (*Delphinapterus leucas* by Martineau *et al.* (1988), Barr *et al.* (1988) and Barr *et al.* (1989). Clausen and Andersen (1988) briefly described a fungal disease of the skin of free-living porpoises. A variety of bacterial infections of the skin have been described by Howard *et al.* (1983) but it is not clear from the text whether any of these were wild animals. A variety of skin diseases in wild cetaceans were described by Greenwood *et al.* (1974).

The opportunity arose to undertake pathological investigations on porpoises, dolphins and whales stranded, or washed up dead on the coast of the U.K. or caught in fishing gear. The pathology of the cutaneous diseases found was studied and the results are presented here. Details of the internal pathology

of most of these animals has been given elsewhere (Baker and Martin, 1992; Baker, 1992).

Materials and methods

Details of the 81 animals involved in the survey are given in Tables 1 and 2; the majority (66) were porpoises, which came from all round the British coast. The dolphins and whales were from the Irish Sea, most from South Wales; the fin whale, which stranded on the North Sea coast, was the only exception. Sixteen animals were accidentally caught and killed in fishing gear. Nearly all the animals were examined between late 1989 and the end of 1991. The fin whale and the minke whale were examined on the beach; 4 animals were examined at other laboratories and samples were sent to the author. The other specimens were transported to the University of Liverpool Veterinary Field Station or to the Sea Mammal Research Unit, Natural Environment Research Council, Cambridge, where post-mortem examinations were carried out using a standard protocol. The sex of the animals was recorded and on length and weight they were divided into neonates, juveniles and adults. The corpses were examined for skin lesions and details of any present were recorded. With the exception of wounds and scars, samples of the lesions were taken and preserved in formalin prior to processing by routine methods for histological examination. The sections were routinely stained with haematoxylin and eosin with the use of special stains when required. The identification of the layers of the skin follows the criteria of Geraci *et al.* (1979).

Results

The skin of eighty-one of the animals recovered was substantially intact. Forty nine of these animals had skin lesions, 32 did not (Tables 1 and 2). As would be expected, neonates were rarely affected. The ratio of animals with and without lesions was approximately the same in both juveniles and adults and both sexes were equally represented.

A summary of the conditions and diseases found on the skin of the affected animals is given in Table 3.

Table 1. Cetaceans with no skin lesions

Species	No. % of all animals*	Males	Females	Neonates	Juveniles	Adults
Porpoises	26	13	13	10	7	9
(<i>Phocoena phocoena</i>)	32%					
Common dolphins	2	1	1			2
(<i>Delphinus delphis</i>)	2%					
Striped dolphin	2	2				2
(<i>Stenella coeruleoalba</i>)	2%					
Risso's dolphin	1		1	1		
(<i>Grampus griseus</i>)	1%					
Bottle-nosed dolphin	1		1			1
(<i>Tursiops truncatus</i>)	1%					

*to nearest 1%

Table 2. Cetaceans with skin lesions

Species	No. % of all animals*	Males	Females	Neonates	Juveniles	Adults
Porpoise	34	21	13	2	12	20
(<i>Phocoena phocoena</i>)	42%					
Common dolphin	7	1	6		1	6
(<i>Delphinus delphis</i>)	9%					
Striped dolphin	3	3			1	2
(<i>Stenella coeruleoalba</i>)	4%					
Long finned pilot whale	1		1			1
(<i>Globocephala melaena</i>)	1%					
White beaked dolphin	1		1			1
(<i>Lagenorhynchus albirostris</i>)	1%					
Bottle-nosed dolphin	1		1			1
(<i>Tursiops truncatus</i>)	1%					
Minke whale	1		1			1
(<i>Balaenoptera acutorostrata</i>)	1%				1	
Fin whale	1		1			
(<i>Balaenoptera physalus</i>)	1%					

*to nearest 1%

Ante-mortem wounds were common, usually taking the form of lacerations, predominantly over the body and rarely on the flukes, flippers or head. The lacerations were almost all straight or slightly curved and ranged in size from less than 1 cm to 36 cm. In many cases there was evidence that these wounds were healing. A porpoise and a common dolphin had wounds which took the form of circles or parts of circles 1.5 cm across. In the dolphin there was a group of these wounds just anterior to the anogenital slit and in the porpoise there was a group of overlapping wounds between the mandibles. These circular wounds looked as though something sharp-

edged had been pressed on to the skin. Rake marks, parallel scratches or deeper wounds, produced by the teeth of other animals, were frequently seen on the common dolphins. In this species, and in one of the two affected porpoises, the spacing of the wounds suggested that the injuries had been inflicted by conspecifics. The other affected porpoise had very extensive rake marks all over the body, flippers and flukes and the 9 to 10 mm spacing of the marks indicated that they had been inflicted by another species. The fin whale had 3 parallel scars spaced about 2 cm apart across the extreme outer edges of both surfaces of the flukes. These could well have been bites and clearly

Table 3. Species of cetaceans and types of skin lesions

Lesion	P*	CD	SD	PW	WBD	BND	MW	FW
Wounds	10	1	—	—	—	—	—	—
Rake marks	2	4	2	—	1	—	—	—
Rope marks and netting	3	2	—	—	—	—	—	—
Pox	13	2	2	—	1	—	—	—
Herpes?	3	—	1	—	—	—	—	—
Other viral diseases	3	—	—	1	—	—	—	—
Bacterial dermatitis	1	1	—	—	—	1	—	1
Non-specific disease	3	—	—	—	—	—	—	—
Epidermoid cysts	2	—	—	—	—	—	—	—
Epidermal ingrowths	2	—	—	—	—	—	—	—
'Cleft' disease	4	—	—	—	—	—	—	—
Ectoparasitism	1	—	—	—	—	—	—	—
Non-specific ulcers	2	—	—	—	—	—	1	—
Scars	11	4	2	—	—	—	—	1

*P=porpoise; CD=common dolphin; SD=striped dolphin; PW=pilot whale; WBD=white beaked dolphin; BND=bottle nosed dolphin; MW=minke whale; FW=fin whale.

were not inflicted by conspecifics. Three of the porpoises showed skin marks inflicted by fishing gear in which they drowned. The skin was not broken but there were linear depressions running part-way around the bodies, one showing clearly the twists of a rope. One common dolphin had a mass of gill net around its lacerated stock. Another had two fine parallel scars completely encircling its beak suggesting that it had been caught in a fine mesh net.

Tattoo lesions on the skin indicated that pox virus infection was common, but the paisley version of this disease, consisting of irregularly circular light and dark lines, was seen in only two animals. The tattoo lesions occurred anywhere on the body but were rare on the flippers and flukes. The lesions were slightly depressed, oval, from 0.5 cm to 7 cm long and usually orientated along the long axis of the body. The number of lesions on affected animals ranged from 1 to several hundred and in a striped dolphin lesions covered an estimated 20% of the skin surface. The lesions were characterised on pigmented skin by a black or dark grey outer line 1 to 3 mm wide; this line 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 the larger lesions there were frequently linear longitudinal ulcers. In unpigmented areas the lesions were very indistinct depressions and in some animals they were only recognised when the ulcer was noted. In four animals the gross appearance of the lesions was atypical, being uniformly grey in pigmented areas and slightly raised and rough; the histological appearance was typical. The most striking feature of the histological picture was marked vacuolation of the cells of the stratum intermedium with displacement of the nucleus to form a crescent at the side of

the cell. A proportion of the cells in the stratum germinativum and stratum spinosum contained eosinophilic intracytoplasmic inclusions which caused displacement of the nucleus. Occasionally eosinophilic intranuclear inclusions were found with margination of the nuclear chromatin. In larger and probably older lesions inclusion bodies were few and in one animal were not found. There was no inflammatory reaction associated with these lesions.

Four animals had a skin condition which was probably herpes infection. The affected areas were oval and up to 6 cm long; they were rough and slightly depressed and in pigmented areas were paler than the surrounding normal skin. Histological examination showed apparently random areas of pyknosis and karyorrhexis or multifocal necrosis of the stratum spinosum. The degenerating cells contained large intranuclear acidophilic inclusion bodies and some of the epidermal cells also contained large intracytoplasmic, weakly eosinophilic, hyaline bodies. In some lesions there was a slight infiltration of the tips of the dermal papillae with mononuclear cells, mainly lymphocytes.

Other, probably viral, diseases included a porpoise with about 50 oval skin lesions 0.8 × 1.0 cm to 6 × 14 cm. These were raised and very rough and contained areas where about three-quarters of the skin thickness appeared to have been sloughed. Histologically there was necrosis of approximately the outer third of the skin with irregular areas of loss resulting in the rough appearance. In the middle of the epidermis many of the cells contained large hyaline eosinophilic bodies and smaller basophilic intracytoplasmic inclusion bodies in the stratum germinativum and stratum spinosum. The dermal papillae showed hyperaemia and oedema of their tips

and in these areas there was necrosis of the germinal cells.

Another viral disease was found in a porpoise with a small area of raised roughened skin. Histologically there was disorganisation of the lower layers of the epidermis such that the individual layers could not be identified and the cells in this area showed a marked increase in the number of mitotic figures. Many of the cells in this area contained 1 or 2 medium sized eosinophilic intranuclear inclusion bodies surrounded by a clear halo.

One porpoise showed an area of raised rough irregular skin in the edge of a partly healed laceration. Histologically there was very marked elongation of the papillae and the outer layers of the epidermis were disorganised with a patchy build-up of the external layers. The lesion was considered to be a papilloma.

The long-finned pilot whale showed very large numbers of circular lesions on the skin of the lateral and ventral body walls. These were up to 1.5 cm across, paler than the surrounding skin and felt slightly depressed. In some of the lesions there was a darker central area and a few showed central ulcers. Histologically there was ballooning of the epidermal cells close to the tips of the dermal papillae. These were oedematous, some were infiltrated with polymorphs and also some showed small haemorrhages. In the deeper layers of the epidermis there were vacuolated cells with displaced nuclei. In the stratum intermedium there were focal areas of ballooned cells with displaced crescentic nuclei, as well as larger degenerating cells with pyknotic nuclei. No inclusion bodies were seen, but the condition may be of viral etiology.

The fin whale was the only animal with a primary bacterial infection of the skin. The body of the animal showed a large number of circular lesions up to 70 cm across and it was estimated that 8–10% of the skin was affected; the head, flippers, fin and flukes were not involved. The lesions were slightly depressed, dark, with a roughened surface and surrounded by a very slightly raised rim of paler skin 2 cm wide. Histology revealed erosion and ulceration of the epidermis so that in some areas the tips of the dermal papillae were exposed. The surface of the lesions was covered with necrotic polymorphs, fibrin and some red blood cells. The whole lesion was heavily infiltrated with polymorphs and the superficial vessels were dilated and engorged. Small numbers of fine rod-shaped bacteria were present. The rim of the lesions showed disorganisation of the dermal papillae and an increase in the thickness of the deeper layers of the epidermis. Bacterial dermatitis was seen in a porpoise and a common dolphin associated with healing lacerations. The affected areas were very rough and irregular. Histologically there was a predominantly polymorph inflammation

in the dermis and ballooning of the epidermal cells. In the other case, a bottle-nosed dolphin had dermatitis which was secondary to a severe and fatal subcutaneous cellulitis.

The non-specific disease mentioned in Table 3 was characterised by round or oval areas which could be raised, level or depressed. The lesions were slightly paler than the surrounding skin in pigmented areas, and the surface of the lesions was smooth. Histologically the dermal papillae were of differing lengths and showed varying degrees of fusion and a disorganisation of the normal orderly pattern so that they ran at varying angles to the skin surface instead of the normal right-angle orientation. There was usually a mild degree of infiltration of the tips of the dermal papillae with inflammatory cells, mainly lymphocytes.

The condition listed in Table 3 as 'cleft' disease was characterised by irregularly shaped areas of extremely rough skin containing deep clefts many of which reached the blubber. Histologically there were multiple clefts at right angles to the skin surface and these ran through the full thickness of the epidermis. Between the clefts there was marked ballooning of the cells, with the exception of those in the stratum germinativum and stratum spinosum. The ballooned cells tended to rupture and merge into one another, leading to the formation of fluid filled spaces in the upper layers of the skin which in some instances also contained large numbers of polymorphs. There was marked disruption of the pattern of the papillae which ran at very varying angles to the skin surface and in two cases this disorganisation led to the formation of epidermal cysts.

The etiology of the cases of epidermal cysts not associated with 'cleft' disease, and that of the possibly related condition in which depressions in the skin overlaid areas in which groups of epidermal papillae extended deep into the dermis, is unknown, although trauma is a possibility.

One porpoise had a 3 mm diameter skin ulcer with a deep punched-out appearance. Histological examination revealed a small coiled nematode at the base of the ulcer; there was no inflammatory reaction. The minke whale had a number of parasites, identified as a *Penella* species, protruding from skin ulcers; a large number of similar ulcers probably indicated the site of attachment of others lost as the animal was rolled in the surf.

Scars were the most common skin condition seen in the survey. These varied in shape from linear through irregular to oval and circular. All those found were on pigmented areas of skin where they showed up as they were pale grey to white in colour. In the non-pigmented areas they were probably present on occasion but invisible. Very probably many represented healed lesions of the diseases mentioned above.

Discussion

Many of the animals in the survey had been dead for several days but in most the skin was remarkably well preserved; this was presumably due to very rapid post-mortem cooling of the skin in sea water which also kept the skin hydrated.

There is no information on the frequency of skin diseases in wild, free-living cetaceans although such conditions are common (Greenwood *et al.*, 1974; Thompson and Hammond, 1992). In the current survey 59% of the animals were affected and if the neonatal animals, in which skin diseases would be expected to be rare, are excluded the prevalence was 69%. It could be argued that this is not the true prevalence in the overall population, as those with these diseases are more likely to die and to become caught in fishing gear. However many of the animals were in good condition and, except where skin disease was extensive, there was no evidence to suggest that it was producing ill-health in the affected animals.

A number of the animals showed ante-mortem lacerations and other linear wounds and these included the 2 neonatal animals with skin disease. While some of the injuries could have occurred as the animals stranded, there was a likelihood that, in many cases, death had occurred at sea and the bodies had been washed ashore. In other animals the lesions showed evidence of healing, implying that these injuries occurred at sea. It is unclear exactly how such injuries happen but they might be a result of the animals foraging amongst rocks. The cause of the circular injuries seen on 2 animals is not known. They could have been caused by lampreys or ramoras although no teeth marks were seen. Presumed lamprey injuries on cetaceans have been described by many authors and a review of their work was published by Greenwood *et al.* (1974). The same authors also describe rake marks. In the present work these were more commonly seen in common dolphins than in porpoises, possibly indicating differing organisation of social groups.

Much has been written about pox infection in captive and wild cetaceans (Sweeney and Ridgway, 1975; Geraci *et al.*, 1979; Flom and Houk, 1979; Cordes, 1982; Britt and Howard, 1983; Smith *et al.*, 1983; Bossart and Dierauf, 1990). All these authors refer to the condition in dolphins and, where the species is named, bottle-nosed dolphins. In the present survey pox lesions were most frequently seen on porpoises and there do not appear to be previous reports of infection in this species. In most cases the gross lesions are identical to previous descriptions and in all cases the histological picture was as given by other authors. It is surprising that no cases were found in the survey of 149 by-catch porpoises by Clausen and Andersen (1988).

The diagnosis of the probable cases of herpes disease was based on the very marked similarity of the pathology of the lesions seen in the present survey to those of herpes diseases as seen in belugas by Martineau *et al.* (1988), Barr *et al.* (1988) and Barr *et al.* (1989). There are no published records of cutaneous herpes in other species of cetaceans. With the exception of papillomas no description of the other viral diseases seen has been found in the literature. Greenwood *et al.* (1974) and Lambertsen *et al.* (1987) described genital papillomas in male sperm whales and their descriptions of the lesions are very similar to the case described here.

Only 4 cases of bacterial dermatitis were seen in the current survey. Greenwood *et al.* (1974) state that 'primary bacterial infection of the skin in cetaceans is rare'. Dunn (1990) found that most bacterial skin diseases followed primary viral, parasitic or traumatic insults, as was the case in 2 animals in the present survey. The histological findings in the present survey were the same as those given by Howard *et al.* (1983). The etiology of the diseases listed as 'non-specific' and 'cleft' is unknown.

Scars of one sort or another were the most frequent finding in the present survey. There is a considerable literature on these and other marks sometimes found on the bodies of cetaceans, and a review of this was presented by Greenwood *et al.* (1974). They concluded that there were three etiological types of scars; groups of parallel scars caused by cetacean teeth; those caused by ectoparasites; and those caused by contact with sharp underwater objects. Perhaps there should be a fourth etiological group; namely scars produced by the healing of skin diseases.

Some diseases described by other authors were not found on the animals in the present survey. These include the areas of dark pigmentation described in bottle-nosed dolphins by Thompson and Hammond (1992) and possibly due to a candida infection, the asbestos-like spots caused by a mycotic infection seen in Danish by-catch porpoises by Clausen and Andersen (1988) and the 'target' lesions described in dolphins by Greenwood *et al.* (1974). One would have expected these as they had been seen in animals from the eastern Atlantic and the North Sea. The present survey may represent different populations to those previously investigated or the sample size may have been too small to include animals with these conditions.

In conclusion it can be seen that cutaneous abnormalities of a variety of types affect about two-thirds of a mixed sample of cetaceans from British waters; how this compares with populations elsewhere is not known.

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