

Prevalence of ocular anterior segment disease in captive pinnipeds

A. G. Greenwood,

International Zoo Veterinary Group, Hainsworth House,
Damems Lane, Keighley, West Yorkshire, UK

Introduction

Reviews of disease in captive pinnipeds generally give major importance to ocular disease, chiefly affecting the cornea and lens (Eriksen 1972; Hubbard 1968; Sweeney 1974; Ridgway *et al.* 1975). Some maintain that similar conditions occur extensively in the wild (Hubbard 1968; Ridgway *et al.* 1975). Conditions recognized as common, perhaps because they are apparent on cursory examination, are corneal oedema, ulceration or scarring, conjunctivitis and cataract. These conditions have been widely attributed to physical trauma, chemical and osmotic damage, high incident light, inadequate nutrition and infection (Hubbard & Poulter 1968; Bellhorn *et al.* 1977; Ridgway *et al.* 1975). More recently, proper investigation of the pathogenesis of these conditions has begun (Stoskopf *et al.* 1983).

The purpose of this investigation was to determine the real importance of pinniped ocular disease by examining a large population of captive animals held under varying conditions of management.

Materials and methods

Between June 1983 and February 1984, 126 captive pinnipeds of 7 species were examined for evidence of anterior segment ocular disease. The examinations were carried out in 26 European zoos and marine-lands within the author's veterinary practice. The status of each animal was recorded only once, on the first occasion during this period on which it was seen, whether or not it was under treatment for or had a subsequent episode of ocular disease. Examination was limited to direct inspection in daylight or with a pen light from as close as possible. Most animals could be examined very closely with patience and, where under-water viewing of animals was possible, some were examined in water through glass. Details of the exhibit were noted, including approximate latitude, pool salinity, use of chlorination and whether the animals were indoors or outdoors.

Results

Of the 126 animals examined, 28 (22.2%) were affected with some form of ocular disease.

Conditions detected by the methods of examination used are recorded in Table 1. Several animals had more than one condition. Unilateral blepharospasm, without any visible lesion occurred in a Cape fur seal (*Arctocephalus pusillus*) and was reported to occur seasonally in summer. The corneal opacities recorded in many species represent either generalized corneal oedema, corneal ulceration or scars. Chronic keratitis, which was recognized as heavy vascularization of the cornea covering most or all of the surface, was seen unilaterally together with chronic conjunctivitis, in a Southern elephant seal (*Mirounga leonina*) and in a grey seal (*Halichoerus grypus*) and bilaterally in a California sea lion (*Zalophus californianus*). Bilateral cataract of long-standing was seen in a California sea lion (over 20 years old), two common seals (*Phoca vitulina*) and a Southern elephant seal, and of recent onset in a Southern fur seal (*Arctocephalus tropicalis*). Fixed dilated pupils were seen in a grey seal which had developed total blindness of sudden onset, and the

Table 1. Ocular conditions in 22 pinnipeds

Conditions	Number of individuals affected
Blepharospasm (unilateral)	1
Chronic conjunctivitis	1
Corneal opacity (various)	12
Chronic keratitis (pannus)	3 (1 bilateral)
Cataract (bilateral)	5
Fixed dilated pupil (unilateral)	1
Fixed dilated pupils (bilateral)	1
Depigmented iris	6
Strabismus (unilateral)	2
Atrophy of globe	1

Table 2. Species of pinnipeds examined

	Number Examined	Number Affected	Percentage Affected
<i>Otariidae</i>			
South American Sea Lion (<i>Otaria flavescens</i>)	48	8	16.7
California Sea Lion (<i>Zalophus californianus</i>)	35	8	22.9
Cape Fur Seal (<i>Arctocephalus pusillus</i>)	13	2	15.4
Southern Fur Seal (<i>Arctocephalus australis</i>)	5	2	40.0
<i>Phocidae</i>			
Common Seal (<i>Phoca vitulina</i>)	12	2	16.7
Grey Seal (<i>Halichoerus grypus</i>)	7	2	28.6
Southern Elephant Seal (<i>Mirounga leonina</i>)	6	4	66.7

Table 3. Effect of environmental factors on eye disease

	Indoor	Outdoor	Fresh Water	Salt Water	Chlorine	No Chlorine	Outdoor Fresh	Outdoor Salt
Total	30	96	51	75	12	114	40	55
Number Affected	7	21	14	14	4	24	9	12
% Affected	23.33	21.9	27.45	18.66	33.33	21.05	22.5	21.81

condition affected one eye of a California sea lion which also showed lateral deviation and functional blindness following traumatic proptosis of the eyeball. The other case of unilateral strabismus occurred in a California sea lion with a corneal opacity.

Depigmentation of the iris was a common bilateral defect, occurring in 4 of a group of 11 young South American sea lions (*Otaria flavescens*) and 2 California sea lions. This white discoloration of the normally brown iris was patchy in distribution, appeared to have no functional effect and was not associated with other ocular lesions. Unilateral atrophy of the globe was seen in the same Southern elephant seal as had the chronic keratitis, affecting the other eye.

Many more otariids than phocids were examined, yet the highest prevalence of defects was in phocids.

Eight of 25 phocids (32%) were affected, compared with 20 of 101 otariids (19.8%). A species breakdown of the survey is presented in Table 2. Southern fur seals and Southern elephant seals were particularly affected, although only very small numbers of these species were examined and each species was distributed between only 3 facilities (not coinciding). Least affected were Cape fur seals which were widely distributed over 7 different facilities.

The majority of animals were examined in parks between 38° and 56° latitude, extending from southern Spain to Denmark. Two South American sea lions in a Middle Eastern zoo were at 25°, but kept indoors in a controlled environment house. Animals were kept under varying conditions of housing ranging from completely undercover to completely open air without shade. Both fresh, brackish and salt water were used and pool treat-

ment involved either chlorination or regular water changes. In most cases, water quality and management were of a high standard.

The effect of various factors on the prevalence of eye disease in general is outlined in Table 3, where the percentage of animals subjected to various husbandry factors which were affected is indicated. These do not significantly differ from the overall percentage of animals affected (22.2%). No individual ocular condition, as defined in Table 1, showed any particular association with any environmental factors. Corneal opacity occurred under all combinations of circumstances and other conditions were too infrequent to analyse individually.

Discussion

Clearly there are limitations involved in this kind of study which require consideration. The survey really consists of a series of point prevalence records, presenting data amassed at many different times and places during the period of study. No attempt was made to record the incidence of new cases over the period. Consequently, the survey is biased towards the discovery of chronic or recurring lesions and will tend to underestimate the importance of transient lesions such as corneal oedema. Cataract will be quite accurately estimated as once contracted it tends to persist, as with fixed dilated pupils, strabismus and iris defects. Undoubtedly, an incidence study spread over at least one year is needed to determine the importance of corneal opacities, where every new case is recorded as it occurs in as large a population of pinnipeds as possible. Such a study might confirm the importance of various environmental and husbandry factors which at present are only implicated by impressions gained from clinical experience and limited pathological study (Ridgway *et al.* 1975; Bellhorn *et al.* 1977; Stoskopf *et al.* 1983).

Species factors are of interest. Certainly phocid seals, including elephant seals, have a higher prevalence of disease as defined by this study than do

otariids. Stoskopf *et al.* (1983) reported a disproportionate number of cataracts in *Phoca vitulina* without quoting any figures, and four of the five cases of cataract seen in this study occurred in seals, the fifth being in an aged California sea lion. All the other cases were in the same marineland. Such coincidences clearly require further investigation.

Epidemiological studies must provide the answers to questions which cannot be studied by experimentally inducing disease in such valuable animals.

The overall relevance of management factors in captivity can best be assessed by comparing populations of captive and wild specimens. Much anecdotal information exists about the frequency of ocular disease in wild pinnipeds, but no accurate surveys have been conducted. Clearly the nature of pinniped life cycles, where large groups are assembled in one place for limited time, lends itself to point prevalence studies of disease.

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