Diseases of seaducks in captivity

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For many years the Wildfowl Trust has monitored the health of its collections by carrying out post-mortem examinations. Detailed records have been kept by J. V. Beer (1959–1969), by N. A. Wood (1970–1973), and by M. J. Brown subsequently. This analysis of the accumulated records is the first of a series that will describe the cause of death in the various wildfowl groups.

There are seven genera, and 18 species, of seaducks (*Mergini*) including the eiders (Johnsgard 1960). All except one species inhabit the higher latitudes of the northern hemisphere; the rare exception, the Brazilian Merganser *Mergus octosetaceus*, has never been maintained for long in captivity. The whole group is generally difficult to keep and to persuade to breed. There are many reasons for this; seaducks are divers and animal eaters; most of them spend the winter, and some breed, on salt water; those which breed north of the arctic circle experience low levels of pathogenic organisms; and all species take at least two years to reach sexual maturity.

History in captivity

Of the eiders, only the European Eider *Somateria m. mollissima* is commonly kept and bred (London Zoo appears to have bred it for the first time in 1841). The King Eider *S. spectabilis* bred first, at Slimbridge, in 1961, and the Spectacled Eider *S. fischeri* in 1975. Steller's Eider *Polysticta stelleri* has never laid in captivity. Scoters are even more difficult to breed. The Common Scoter *Melanitta nigra* nested successfully in captivity in 1971 but the other species have never done so. The Harlequin *Histrionicus histrionicus* bred as recently as 1977. The European Goldeneye *Bucephala clangula* has been established as a breeding bird since 1909, and Barrow's Goldeneye *B. islandica* since 1937, but neither nests particularly freely in waterfowl collections. Of the sawbills, the Red-breasted Merganser *Mergus serrator* nests in the wild in Britain as far south as 53°N, and the Goosander *M. merganser* only a little farther north, so it is not surprising that they have been reared more frequently in captivity than other *Mergus* species. The Smew *M. albellus* and Bufflehead *Bucephala albeola* are, on the other hand, notoriously difficult to breed (Williams 1971), and the Hooded Merganser *M. cucullatus* is only a little easier (Lubbock 1973).

The difficulty with which these ducks are bred is, to some extent, reflected in the numbers available from the Wildfowl Trust's collections at post-mortem. For instance, eiders predominate in the records, and sawbills are commoner than scoters. However, eggs have been collected on a number of occasions from the wild, and hatched artificially, so post-mortem findings from dead downy and juvenile birds do exist, even for species that have seldom bred in captivity.

Materials

Post-mortem data from 641 seaducks dying between 1959 and 1976 have been examined. These concerned a total of 295 adults, 134 juveniles and 222 downies and, for convenience, have been divided into four groups of species (Table 1). An adult is defined as a bird that survived to its first January. A juvenile was fully feathered, but died in its first autumn or in early winter (before 1 January). A downy was any young bird not fully feathered.

Results

Seaducks generally survive for only a short time in captivity. The average age at death of adults was three years and eight months (this figure is based on the 49·5% of those examined whose age was known. Females died earlier than males at an average of only three years, while males died at four years six months. One-year-old birds constituted 24·7% of the total (in other words, a quarter never reached breeding age), and the oldest record was of a male European Goldeneye that died at 16 years.

There was a significant difference (Figure 1) between the number of males and females dying during March ($\chi^2 = 8{\cdot}2$, $P > 0{\cdot}01$), and a smaller but significant difference between the number of males and females dying during October ($\chi^2 = 4{\cdot}3$, $P > 0{\cdot}05$). Males seem to be under stress in early spring (perhaps due to competition for mates) and

again in autumn, whilst in eclipse, and more easily contract disease at these times. Females seem to be under stress during the breeding season, mortality reaching one peak in July and another in November.

At post-mortem examination a primary cause of death was assigned, and it is those conditions that are discussed below.

Tuberculosis

Avian tuberculosis was the commonest disease found in dead adults, with 34% of adult seaducks, 8% of juveniles, and one downy, found to have advanced tuberculosis at death; 49% of adult sawbills or *Mergus* species had died of this cause.

All captive wildfowl may contract tuberculosis, but seaduck seem to have very little resistance. Nevertheless, it predominately affected older birds: of the 55 adults whose age was known, death occurred on average at 4½ years, 25 females averaging 4 years,

Table 1. The number of seaducks dying in Wildfowl Trust collections, 1959–1976

	Ad ♂	Ad ♀	Total	Juv ♂	Juv ♀	Total	Downy ♂	Downy ♀	Total
Eiders *Somateria & Polysticta*	64	60	124	22	38	60	25	24	49
Scoters *Melanitta*	9	13	22	3	3	6	4	4	8
Goldeneyes *Histrionicus Clangula & Bucephala*	45	24	69	16	17	33	37	37	74
Sawbills *Mergus*	42	38	80	16	19	35	41	50	91
Totals	160	135	295	57	77	134	107	115	222

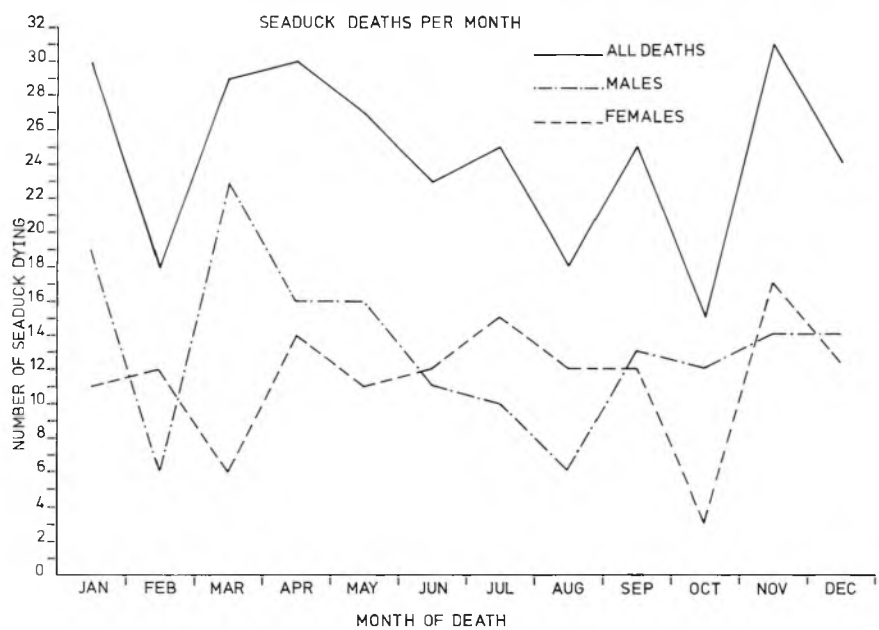

Figure 1. Numbers of male and female seaducks dying per month in Wildfowl Trust collections, 1959–1976.

and 30 males averaging 5 years. This is almost one year later than the overall age at death.

The bacteria *Mycobacterium avium* usually invade the liver and spleen, sometimes the gut and lungs, forming multiple lesions. They are spread in the droppings of infected birds, and in contaminated food and water. Wild birds also spread the infection, especially gulls (Laridae), doves (Columbidae). Pheasant *Phasianus colchicus* and Starlings *Sturnus vulgaris*, and wild eiders seem to die of the disease fairly frequently (Garden 1961; MacDonald 1965).

Mycobacterium avium is very resistant to disinfection and can remain viable for three years in the soil; it is therefore very difficult to eradicate the contamination from a waterfowl collection. The only recommended procedure is exposure to the ultra-violet in sunshine rays, and keeping pens unshaded. This is obviously not completely compatible with good husbandry, since breeding may depend upon a cover of vegetation in the summer when disinfection from the sun's rays has its greatest potential. As yet, no effective vaccine against avian tuberculosis has been produced. Work is being done on the possibility of testing for the presence of progressive avian tuberculosis in live waterfowl. Preliminary results are encouraging (M. J. Brown pers. com.). The advantage of regular testing, thus giving the opportunity for eliminating diseased specimens from a collection before they can contaminate their pens heavily, is obvious.

Aspergillosis

Of the birds examined, 17% of adults, 31% of juveniles and 27% of downies were found to have died of advanced aspergillosis. Eiders seems especially susceptible, with 30% of the adults, 47% of the juveniles and 47% of the downies affected. Figure 2 shows the incidence of aspergillosis in adult eiders month by month; two peaks are apparent, one in spring and another in autumn.

Aspergillosis is caused by the fungus *Aspergillus fumigatus*. A widespread disease of all birds and many mammals, it is commonly encountered in wild and captive waterfowl. The fungus grows readily on damp foodstuffs and rotting vegetation such as hay and straw, and large numbers of microscopic airborne spores are produced, particularly in the damp days of October. These spores may become pathogenic when they are inhaled into the respiratory tract, and give rise to large spore-producing plaques in the lungs and air sacs; it is the toxin produced by these fungal growths that often kills the affected bird.

Waterbirds in captivity seem much more susceptible to aspergillosis than do land

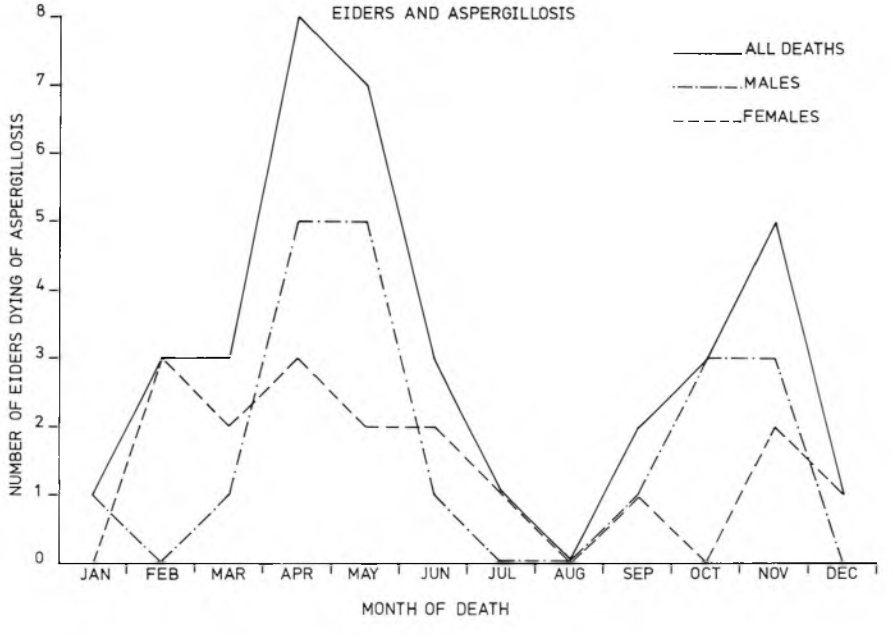

Figure 2. Numbers of male and female eiders dying per month of Aspergillosis in Wildfowl Trust collections, 1959–1976.

birds; penguins (Spheniscidae), pelicans (Pelecanidae), flamingos (Phoenicopteridae), divers (Gaviidae), petrels (Hydrobatidae) and some shore birds (Charadriiformes) are especially susceptible. Dathe (1962) pointed out that all seabirds have salt extracting nasal glands that atrophy when the birds are kept on fresh water, and he suggested that this renders them more prone to airborne infections. Kaben & Schwarg (1970) also suggested that the salty nasal secretion of marine birds protects them to a large degree from invasion by *Aspergillus*.

Treatment has up to now been unsatisfactory, partly because diagnosis is difficult. Prevention consists of the removal of mouldy and dusty food, straw, grass cuttings, nesting materials, old sacks, etc. (Beer 1959). The regular fumigation of nesting boxes, incubators, and rearing houses will also help to kill any spores that remain.

Outbreaks of aspergillosis are frequently associated with stressful conditions for the birds, such as new pens, new feeding regimes, transport, nest defence and parental demands.

Candidiasis

Just 2% of adults (a total of five birds) and a single juvenile were found to have serious candidiasis. Candidiasis or moniliasis is caused by a yeast-type fungus *Candida albicans*. It is very infectious, but is uncommon in wildfowl and rarely a primary cause of death. The typically thickened, cream-coloured lesions are found in the mucous membranes of the mouth and oesophagus. The surrounding tissue may also be inflamed. The disease is probably transmitted by food and water contaminated by the fungus; *Candida* is also known to live on grass blades.

Treatment consists of spraying the food with formic acid once a day, with a 6% solution or three times daily with a 2% solution (Wood 1968). The acid should not be used in bright sunshine or in high temperatures because it tends to evaporate. Formic acid has a low toxicity at the recommended concentrations.

Renal disease

Renal disease was found in 18% of adults, 20% of juveniles and 10% of downies. Kidney problems are found amongst captive seaducks of all ages and exist in several forms. Little is known about the causes, though a high protein 'unbalanced' diet may be associated with renal malfunction (Humphreys 1973). It is a common misconception that seaducks take a high protein diet in the wild. Eiders eat whole mussels, and mergansers take whole fish including the relatively indigestible shells, bones, scales, gut and gut contents. Ungutted sprats, for instance, contain only about 15% protein (Murray & Burt 1969). Seaducks often find commercial pellets intended for trout and dogs particularly palatable, but these foods should not be fed as a sole diet (Kear 1976).

Impactions

Some 3% of all adult seaducks, 17% of juveniles and 4% of downies had impactions either of the gizzard or proventriculus. Diseased and weak birds are prone to gizzard impactions due to inefficient working of the musculature. In the sawbills, however, the problem is of a different nature. Twelve juvenile Red-breasted Mergansers, out of 23 examined, had gizzard impactions, caused by bits of wood or string and, in one case, part of a fan-belt! Some of the sticks were over 5 cm long and 2·5 cm thick. These either caused severe inflammation, or physically blocked the entrance to the stomach, so that the animal starved to death.

Red-breasted Mergansers in the wild have been found with sticks and pieces of bark in their gizzards (Aass 1956). In one study, where 41 birds were shot for examination of the gut contents, over half contained sticks, bark and coarse plants as well as fish. It is not unknown for wild sawbills to die after choking on fish that are too large (Wick & Roger 1957) one wild Goosander died after swallowing a fish hook and steel wire (Robertson 1969). Captive sawbills, especially juveniles, are apt to play with sticks, and sometimes to swallow them. The tendency is probably increased by 'boredom', and live fish introduced to the ponds may alleviate the problem. Running water also helps to prevent a build-up of woody debris and, incidentally, provides a healthy environment for any fish that are present.

Enteritis

The incidence of enteritis was 6% of adults, 6% of juveniles and 7% of downies. It was usually recognised by the presence of blood in the gut. Enteritis in waterfowl downies and juveniles is a common cause of death as they do not have much resistance to bacterial or viral infections. On the other hand, in adult birds, enteritis is often secondary to stress, or to weakness from a primary disease that lowers resistance to infection.

The contamination of food may be important in causing the condition, and rodent-

proof silos and grain hoppers are recommended.

Amyloid disease

Only 4% of dead adults and one juvenile were found to have amyloid disease. This chronic disease, of uncertain aetiology, is often found in adult wildfowl. Healthy birds have some amyloid tissues present in the liver and other organs that can increase when the bird is under stress, or is weakened by other disease. A large increase in amyloidosis causes gross lesions in the liver which may become enlarged and pale.

Cardiac diseases

Just 2% of adults, one juvenile and one downy died of cardiac disease. The five adult deaths, except for that of one female European Eider, were all caused by cardiac failure. Apart from a year-old female Goosander, their ages were not known. The juvenile Goldeneye and the downy Smew both had pericarditis, a condition that is not necessarily caused by malfunction of the heart, but may be due to bacterial infection or to other debilitating conditions.

Lead poisoning

This occurred in 5% of adults and one juvenile, and was due to the ingestion of one or more shot-gun pellets, lead fishing weights or solder. The lead is retained in the gizzard as if it were grit, and ground down so that soluble lead salts are formed by the gastric juices and absorbed into the blood. As would be expected from their special diet and feeding method, adult sawbills are not especially prone to pick up lead from the ground, and showed only one case of poisoning out of 80 dead birds examined. Eiders and Goldeneyes tend to be more susceptible because they dig more often in the soil. Lead pellets can remain in the ground indefinitely, and if an area has been used for shooting in the past, lead may be present in quantity. Adequate supplies of grit are essential for captive waterfowl, especially in areas where there is little natural grit, as on peat. Concreting pond edges also reduces the chances of birds coming across lead shot.

Treatment of infected birds is seldom successful. Removal of the pellets by washing out the gizzard, or by surgery seems impossible. Force-feeding quantities of grit and sand (on brown bread, for instance) does seem to get rid of pellets in the gizzard, and the bird may recover. Calcium disodium versenate injected into the blood stream lowers the level of soluble poison temporarily, but the injection itself is traumatic for the bird, and it will need to be repeated as long as any lead remains in the gut.

Atherosclerosis

Cases severe enough to cause death were recorded in a male European Eider of unknown age, in a female European Eider 6 years old, in a male King Eider that was 7 years old, and in a male European Goldeneye of unknown age.

Atherosclerosis is a degenerative disease of the arteries of adult birds and mammals, and seems commoner in captive than in wild animals, perhaps because of the greater age that they can achieve. Although all waterfowl species are susceptible, those leading a mainly aquatic existence and those that are animal-eaters, like the seaducks, have a relatively low incidence (Humphreys & Beer 1971). Perhaps when seaducks are living to a considerably greater age in waterfowl collections, atherosclerosis will become a more important hazard to their health.

Chilling and pneumonia

No less than 27% of downy young and 5% of juveniles had what is generally called 'chilling'. This term covers pulmonary congestion and oedema, and all pneumonia-like ailments in young birds. Pneumonia was the cause of death of 2% of adults.

Most 'chilling' deaths in young birds can be attributed to a combination of low temperatures and wet down or plumage. Underfloor as well as overhead heating of the resting area will be found useful in preventing the condition in newly-hatched birds.

Omphalitis

Omphalitis or 'infected yolk' was a fairly serious cause of mortality in downies, killing 16% of eiders, 13% of scoters, 28% of goldeneyes and 14% of the sawbills at this stage.

Infected yolk as a cause of death should not be difficult to eliminate, and preventive measures include:

1. Providing clean nesting material, and collecting eggs before they have time to be contaminated by droppings.
2. Washing hands before handling eggs, cleaning eggs, if absolutely necessary, with disinfectant 'dips', and storing on a clean substrate before incubation.
3. Regular fumigation of the incubator room and incubators.
4. Regular candling of eggs to remove 'dead-in-shells'.

5. A clean environment for the newly-hatched young. Spraying the navels of downy young with an antibiotic as they are removed from the incubator has successfully reduced the incidence of yolk sac infections in the Wildfowl Trust collections.

Useful reviews of the subject of contamination by bacteria during incubation and hatching have been published by Harry (1957, 1976).

Internal parasites

(a) Acuaria

Only 2% of adults and 6% of juveniles examined were found to have died of this parasite.

The nematode *Acuaria (Echinuria) uncinata* is a fairly widespread parasite of wildfowl. *Daphnia* the common waterflea, ingest *Acuaria* eggs which then hatch into the worm-like larval stage, and birds become infected by eating the *Daphnia*. The *Acuaria* larvae burrow deeply into the wall of the proventriculus at the entrance to the gizzard producing large tumour-like growths. Up to 2,000 worms per bird have been reported, but thirty or forty is a more usual number. The scar tissue formed by the host can completely block the gizzard/proventicular junction, and the bird dies of starvation. Susceptible wildfowl are usually dabblers that ingest large numbers of *Daphnia* at or near the surface water. Seaduck, in any case, are only vulnerable on fresh water, since *Daphnia* are not found in saline (brackish) conditions.

In Britain, *Daphnia* are abundant in late summer and early autumn when the pH and temperature factors are suitable. Partly for this reason, young duck are often affected by *Acuaria* and eight juveniles died between August and October. An adult female Velvet Scoter is unusual in that it died of *Acuaria* in February; presumably the bird acquired the infection in the autumn and scar tissue build-up was slow.

Although several different treatments have been tried, there is no satisfactory cure. Prevention is often easier. If the water flow through the ponds on which captive birds feed can be increased, the numbers of *Daphnia* should be substantially reduced, since waterfleas only proliferate in stagnant water (Wood 1974).

(b) Other internal parasites

Parasites other than *Acuaria* caused 2% of adult and juvenile deaths. The nematode *Cyathostoma* or its close relative *Syngamus trachea* caused the deaths of two adult European Eiders, an adult Hooded Merganser and a juvenile Goosander. These nematodes are commonly known as gapeworm and accumulate in the trachea and bronchi. Large numbers can cause broncho-pneumonia, loss of condition and eventually asphyxiation, due to the migration of worms through the lungs into the trachea. Birds can be infected directly, or via a transport host such as earthworms or slugs. Affected birds can be treated with Tetramisole administered individually by stomach tube.

Severe tapeworm infestation was found in an adult female Harlequin and an adult female Spectacled Eider. These cestodes are often present in wildfowl, but usually in insufficient quantity to harm the bird. If it is already diseased or in poor condition, then numbers can increase rapidly and cause death. Treatment is possible using a taenicide.

Serious infestations with the duck leech *Theromyzon tessulatum* were found in an adult female and a juvenile male European Eider. No less than thirty-two leeches were found in the nasal passages of the juvenile Eider, causing weakness from loss of blood and eventual asphyxiation. Leeches can also migrate into the air spaces in the skull and sometimes damage the brain. A supply of salt water helps affected birds to rid themselves of the leeches, which relax their grip in brine of high concentration, and can then be 'sneezed' out.

Theromyzon tessulatum is the only species of leech to parasitize wildfowl in Britain, but others are common in USA (Trauger & Bartonek 1977).

Probably seaduck are no more susceptible to leech infection than fresh water duck, but many seaduck such as eiders, scoters and goldeneye have enlarged nasal cavities that provide access and lodging for numbers of these parasites.

Other diseases

About 3% of adults examined were found to have died of a variety of uncommon conditions. One male and one female European Eider had cirrhosis, a female European Eider had a malignant tumour and another had a mummified and infected yolk sac. A male Common Scoter had septicaemia and a male European Goldeneye had a chronic eye infection, leading to blindness, and two female sawbills had anaemia and wet feather.

Another 3% of juveniles died of similarly rare terminal conditions: a male and female European Goldeneye had air sacculitis, a male European Goldeneye had sinusitis, and

a male sawbill had anaemia. Two European Eider downies died of anaemia and one Common Scoter downy had a severe eye infection.

Discussion

Many of the internal parasites affecting seaduck in the wild, such as *Acanthocephala* and *Coccidia* (Harrison 1955; Christiansen 1948), are absent in captive specimens because the secondary hosts (crabs, for example) do not occur. Even common freshwater parasite 'carriers' such as snails, tend to be 'eaten out' of a waterfowl collection.

Aspergillosis, renal failure and impactions of the gizzard tend to be commoner in capitve seaduck than in other groups of waterfowl. Lead poisoning, amidostomiasis (gizzard worm) and cardiac failure are comparatively rare.

In general, seaduck live short lives in captivity, and require special care if they are to survive long enough to breed.

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Summary

The results of post-mortem data for 641 seaducks dying in Wildfowl Trust collections between 1959 and 1976 are presented. The primary causes of death, of which the most important were tuberculosis, aspergillosis and renal disease, are discussed together with possible remedies.

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