

Pasteurellosis among breeding Eiders *Somateria mollissima* in The Netherlands

C. SWENNEN and Th. SMIT



A section of the Eider colony on Vlieland lost a significant proportion of its breeding females through pasteurellosis in May 1984. The nesting density and, especially, the age composition in this section were still affected five years after the incident.

Avian pasteurellosis, also known under the common names of avian cholera or fowl cholera, is a contagious disease of birds caused by the bacterium *Pasteurella multocida*. The disease has resulted in heavy losses in domestic poultry for 200 years (Rosen 1971).

In wild waterfowl, mortality by pasteurellosis was first diagnosed at Lake Nakuru in Kenya in 1940 (Hudson 1959), then in the USA in 1944 (Quortrup *et al.* 1946), and The Netherlands in 1945 (van der Hurk 1946). From 1977 till 1980, high mortality by pasteurellosis was seen in winter populations of waterfowl in several Dutch lakes (Mullié *et al.* 1979, 1980, Smit unpublished). In the United States, pasteurellosis now ranks with botulism and lead poisoning as major causes of waterfowl mortality. Acute infections are common and can result in death 6-12 h after exposure. Chronic infections, with longer incubation times, also occur (Friend *et al.* 1987).

In this paper an outbreak of pasteurellosis among breeding Common Eiders *Somateria mollissima* on the Island of Vlieland ($\pm 53^\circ\text{N}$, 5°E) will be described.

Case history

As part of a long-term research project, samples of breeding Eiders have been caught and ringed yearly on the island of Vlieland (Swennen 1988). In 1984, trapping operations were conducted in the periods 2-3, 8-19 and 28-30 May. The same sites were visited and 107, 183 and 190 nests were checked in each of these periods. During the second visit, on 10 May, one female Eider was found dead on a nest containing five eggs in the section "Bomenland Zuid". No special attention was paid to this case, although a dead

female Eider on a nest had not been seen since the Telodrin pollution incident in the 1960s (Koeman *et al.* 1972). However, in the same section of the colony, four females were found dead on or in the immediate surroundings of their nest during the third visit on 28 May. Therefore, the following day the whole colony was searched for dead Eiders. In total, a further 18 dead females was found on or near nests and seven adult females and one adult male Eider together with a Herring Gull *Larus argentatus* were found dead near one of the two freshwater ponds on the borderline between the saltmarsh and the dunes of "Bomenland Zuid". No dead or diseased Eiders were observed in any other part of the colony. This ruled out a general poisoning via their marine food, as happened in the 1960s (Koeman *et al.* 1972).

None of the dead birds had visible wounds, or dangerous levels of ectoparasites. Their plumage was intact and clean. Down was missing between the feathers of the breasts of all the females, indicative of incubating birds. About half had rings and had been ringed or checked as breeding in the same section of the colony in previous years. Obviously, they had died suddenly while sitting on their clutch (Fig. 1) or walking to or from the drinking pond. All dead birds were removed, but the following day another nine females were found dead near the pond and six others on their nests.

As no cause of death could be determined in the field, nine female Eiders and two water samples were shipped to the Central Veterinary Institute (CDI). At the same time, the pool, which was considered the possible source of contamination, was filled with sand and a new pool was dug out nearby. After that no recent corpses were seen, but several old ones were



Figure 1. A female Eider that has died of pasteurellosis while incubating (photo Th. Mulder).

found on hidden nests and along the seashore.

At the CDI, the bodies were submitted to the standard laboratory techniques for *post-mortem* examinations, such as X-ray, bacteriological, virological, histological, parasitological and toxicological examination. At necropsy, no specific signs were found. The alimentary tract was empty, except for bits of sand. Botulism tests were negative and bacteriological examinations were positive for *Pasteurella multocida* in all nine birds. The bacteria were isolated on blood-agar slants from the liver, heart and kidney of fresh dead bodies. The first identification was performed by staining with methylene-blue and Gram's dyes. Afterwards the *Pasteurella* was submitted to sugar fermentation-tests and agar-gel precipitation tests. Out of two birds,

Pasteurella and an erysipeloid were isolated. The isolated *Pasteurella* was identified as *P. multocida* Heddleston type 1 by serological examination according to Heddleston (1972). No pathogenic bacteria were isolated from the water samples.

Recoveries of ringed female Eiders found dead along the coast between 10 May and 10 June (Table 1) indicate a remarkably higher mortality only among the birds breeding in "Bomenland Zuid" compared to the other years (Likelihood ratio test, $G = 20.824$, $P < 0.001$; Cohen kappa 0.668 ± 0.115).

From the numbers of dead birds found, it was estimated that 80-100 females had died during the epizootic. The empty places were occupied gradually by new breeding birds in the follow-

Table 1. Recoveries of ringed female Eiders from known breeding sites found dead between 10 May and 15 June.

Breeding site	1982	1983	Years 1984	1985	1986
on Vlieland					
Bomenland Zuid	1	0	21	1	2
Elsewhere	4	1	3	6	4

ing seasons, but the distribution and the local abundance in this part of the colony has remained affected for several years. The age composition in this segment of the colony has been affected even longer. During an inspection in 1989, 54% of the breeding females in "Bomenland Zuid" appeared to have been ringed after 1984, against only 25% in the other parts (Table 2). The differences are statistically significant (Likelihood ratio test, $G = 17.143$; $P < 0.001$; Cohen kappa 0.064 ± 0.0182); the composition of the ring-age between the sections of the colony was not significantly different in the years before 1984.

Table 2. Ring age of female Eiders in Bomenland Zuid compared to other sections of the Vlieland colony in 1989.

Breeding site	Ringed	
	before 1984	after 1984
Bomenland Zuid	23	27
Other sections	412	138

Discussion

The long-lasting effect of the mortality on the age composition of females in the colony is caused by the high annual survival rate (Coulson 1984), and the high degree of nest site fidelity of female Eiders (Swennen 1990). Such difference in age composition may have an effect on clutch size (Marshall 1967) and mean laying date (Baillie & Milne 1982) between different sections of the same colony.

Acute pasteurellosis, with a high mortality in wild birds, had so far occurred in The Netherlands only in overcrowded areas such as blow-holes in the ice during winter. Severe outbreaks in summer are rare, probably because of lower densities of waterbird populations and a better condition of the birds. High mortality in wild waterfowl has never been caused by serological types other than Heddleston 1. In poultry and mammals, besides type 1, 12 serotypes or combinations of serotypes have been isolated.

Most victims died of an acute bacteraemia (bacteria occurring in blood) between 24 and 48 hours after infection. Infected birds sometimes crashed during flight, suggesting intoxication. After 1980, smaller outbreaks occurred involving Herring Gulls and Great Black-backed Gulls *L. marinus*. From January till March 1984, chronic pasteurellosis was diagnosed in these gulls, characterized by pericarditis and peritonitis. Chronically diseased birds and latent carriers act as a source of infection for a long time. Initial infection can be caused by contacts with carriers or contaminated scratches and bite-wounds from predators (Smit *et al.* 1980).

This was the first record in The Netherlands of an infection in May. It is also the first record in The Netherlands of an infection primarily involving Eiders. The cause of infection in this case is not clear. However, Reed & Cousneau (1967) described two epidemics in a breeding population of 4000 Eiders at Ile Blanche, Quebec, with a mortality of 25% in 1964 and 17% in 1966. Similar outbreaks of pasteurellosis have occurred frequently in Common Eiders in Maine during early summer (Korschgen *et al.* 1978). In all cases, stagnant waterpools were present which were used by the females. All happened around hatching time when the females are under stress, having lost about 50% of their initial weight within a few weeks (Korschgen 1977, Swennen 1981). An additional stress factor may be the increasing pollution of the marine environment with PCB, since Friend & Trainer (1970) found that PCB makes ducks more susceptible to infectious agents.

In Maine, all remaining Eiders and gulls were destroyed and all carcasses, eggs and nests were burned, while waterholes were disinfected with a cresylic compound in the hope that infection could be eradicated (Gershman *et al.* 1964). No special measures have been taken for controlling the disease among wild birds in The Netherlands, except for filling up the small drinking pond and making a new one on Vlieland. On Ile Blanche, no actions were undertaken at all and mortality ended within a few weeks, as happened in the Dutch cases.

References

- Baillie, S.R. & Milne, H. 1982. The influence of female age on breeding in the Eider *Somateria mollissima*. *Bird Study* 29:55-66.
- Coulson, J. 1984. The population dynamics of the Eider Duck *Somateria mollissima* and evidence of extensive non-breeding by adult females. *Ibis* 126:525-543.
- Friend, M. & Trainer, D.O. 1970. Polychlorinated Biphenyl: Interaction with Duck Hepatitis Virus. *Science* 170:1314-1316.

- Friend, M., Laitman, C.J. & Kampen, R.S. 1987. Field guide to wildlife diseases I. *U.S. Fish and Wildlife Service, Res. Publ.* 167.
 - Gershman, M., Witter, J.F., Spencer, H.E. & Kalvaitis, A. 1964. Case report: epizootic of fowl cholera in the Common Eider Duck. *J. Wildl. Manage.* 28:587-589.
 - Heddleston, K.L. 1972. Avian Pasteurellosis. In: M.S. Hofstad (Ed.) *Diseases of poultry*. Pp. 219-241. Iowa State Univ. Press 6th ed. 1976.
 - Hudson, J.B. 1959. Avian Pasteurellosis in wild birds. In: A. Stableford & I. Galloway (Eds.) *Infectious diseases of animals*. Vol. 2. P. 413. Butterworth Sc. Publ., London.
 - Hurk, C.F.G.W. van den. 1946. Aantekeningen bij de epizootie van vogelcholera over Nederland in het najaar van 1945. *Tijdschr. Diergeneesk.* 71:361-362.
 - Koeman, J.H., Bothof, Th., Vries, R. de, Velzen-Blad, H. van & Vos, J.G. 1972. The impact of persistent pollutants on piscivorous and molluscivorous birds. *TNO-Nieuws* 1972:561-569.
 - Korschgen, C.E. 1977. Breeding stress of female Eiders in Maine. *J. Wildl. Manage.* 41:360-373.
 - Korschgen, C.E., Gibbs, H.C. & Mendall, H.L. 1978. Avian cholera in Eider ducks in Maine. *J. Wildl. Diseases* 14:254-258.
 - Marshall, I.K. 1967. The effect of high nesting densities on the clutch size of the Common Eider *Somateria mollissima* (L.). *J. Anim. Ecol.* 36:59.
 - Mullié, W.C., Smit, Th. & Moraal, L. 1979. Vogelcholera (Pasteurellosis) als oorzaak van sterfte onder watervogels in het Deltagebied in 1977. *Vogeljaar* 27:11-20.
 - Mullié, W.C., Smit, Th. & Moraal, L. 1980. Zwanensterfte ten gevolge van vogelcholera in het Nederlandse Deltagebied in 1979. *Watervogels* 5:142-147.
 - Reed, A. & Cousineau, J-G. 1967. Epidemics involving the Common Eider (*Somateria mollissima*) at Ile Blanche, Québec. *Naturaliste Can.* 94:327-334.
 - Rosen, M.N. 1971. Avian cholera. In: J.W. Davis *et al.* (Ed.) *Infectious and parasitic diseases of wild birds*. Pp. 59-74. Iowa State Univ. Press.
 - Smit, Th., Moraal, L.G. & Bakhuizen, Th. 1980. *Pasteurella multocida* infecties bij vogels na een kattebeet. *Tijdschr. Diergeneesk.* 105:327-329.
 - Swennen, C. 1981. Eider (*Somateria mollissima*). In: C.J. Smit & W.J. Wolff (Eds.) *Birds of the Wadden Sea*. Pp. 78-84. Balkema, Rotterdam.
 - Swennen, C. 1988. Trapping methods used for ringing Eiders in The Netherlands. *The Ring* 12:73-81.
 - Swennen, C. 1990. Dispersal and migratory movements of Eiders *Somateria mollissima* breeding in The Netherlands. *Ornis. Scand.* 21:17-27.
 - Quortrup, E.R., Queen, F.B. & Merovka, L.J. 1946. An outbreak of Pasteurellosis in wild ducks. *J. Am. Vet. Med. Ass.* 108:94-100.
- C. Swennen, Netherlands Institute for Sea Research (NIOZ), Postbox 59, 1790 AB Den Burg, Texel, The Netherlands.
Th. Smit, Central Veterinary Institute (CDI), Postbox 65, 8200 AB Lelystad, The Netherlands.