Common Eiders and Parasites – Are Parasites the Cause of Mass Mortality of Common Eiders in the Wadden Sea?

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Introduction

The high number of Common Eiders *Somateria mollissima* that died in the Wadden Sea during the winter and spring of 1999/2000 has caused a lot of debate regarding the cause of this event. Many possibilities were put forward, but also many were considered irrelevant to this particular case. Among the rejected possible causes were: oil pollution, poisoning by toxic contaminants, bacterial and viral disease, chronic stress and a reduced immune system. Three causes remain: starvation, parasites, or a combination of the two.

Two "parties" have claimed two causes of death. One party blames the shellfish fishermen for catching too much food (a.o. mussels and cockles), otherwise destined for the eiders, thus causing a situation in which the eiders starve. The other party says that there is plenty of food, but the eiders have been heavily infected with parasites and that this parasitic infection causes mass mortality. The parasite species that is particularly suspect is *Profilicollis botulus*, an acanthocephalan that lives in the intestine and has the Shore Crab *Carcinus maenas* as its intermediate host.

In the past, mortality among eiders has been regularly observed in Europe and North America. The first report was from Forsius (1931), who reported high mortality among Common Eiders in Finland, which was probably due to *Polymorphus boschadis* or *P. botulus*. Christiansen (1948) saw high mortality in eiders around the island of Bornholm, where he found eiders, which were heavily infected with acanthocephalans and were also suffering from renal coccidiosis. Grenquist (1970) mentioned another outbreak in Finland, while Persson et al. (1974) saw a high mortality (90%) of ducklings in the Stockholm Archipelago. The most important parasitic infections were Amidostomum anseris in the gizzard, and tapeworms and P. botulus in the intestine. The first report from the Dutch Wadden Sea was published by Swennen & Van den Broek (1960), where *P. botulus* was regarded as the cause of death. In the USA, Clark et al. (1958) described an epizootic among Common Eiders involving an acanthocephalid worm on the northeast coast.

In all these studies, there was no report of a lack of food, but instead, a presence of parasites was noted. In some studies, *P. botulus* was considered as the most important parasite, but in others, renal coccidiosis and amidostomosis were found to be more important.

The question therefore remains if we are dealing with mortality as a natural phenomenon that returns every year on a low to moderate level, or – in years in which certain key factors coincide – a mass mortality, or is something else going on?

Photo: *Profilicollis botulus* **collected from one Common Eider.**

Materials and Methods

Only a very limited number of eiders were available for an extensive study of parasites.

Between 1976-1991, 15 Common Eiders (or rather parts of them) were received by the Parasitology Department. These birds had been sent to the Institute within the framework of the activities of the Working Group on Bird Mortality in the Netherlands. After the dissolution of this Working Group in 1990, material for investigation only became available by accident. During the mass mortality in the winter and spring of 1999/2000, the intestines of nine eiders from the Wadden Sea were investigated for the presence of parasites. In the same period, the gizzard and intestine of two eiders from the province of Zeeland were received.

Procedures involving parasites were as follows: the content of the intestines was washed with tap water in a bucket and a dilution count of (1/100 of the volume) was made. The sample was

Table 1: Results of the parasitological investigations of 15 Common Eiders between 1976-1991. (+ = few; ++ moderate; +++ many).
Amidostomum **spp. is** *A. acutum*. **Spirurids are** *Tetrameres fissispina* **and** *Paracuaria formosensis*. **Cestodes have not yet been identified. Many trematode species/genera have been seen a.o. Microphallidae, Echinostomatidae, Heterophyidae, Psilostomatidae and Notocotylidae. Species identification is pending.**

	Gizzard (n=7)				Intestine (n=13)		
	+	++	+++		+	++	+++
Amidostomum spp.	3	3	1	*Profilicollis botulus*	1	6	1
Spirurids	2	2		Cestodes	4	1	1
				Trematodes	3	1	6
				Capillaria mergi			3

Table 2: Helminth parasite numbers found in the intestine of 9 Common Eiders that died in the winter/spring of 1999/2000. (+ = few; ++ moderate; +++ many).
The gizzard, intestine and kidneys were investigated of the two eiders, which had been collected in the province of Zeeland in spring 2000,. The kidneys were negative for *Eimeria somateriae*. **In the two stomachs, 200 and 300** *A. acutum* **and 1700 and 400** *Streptocara crassicauda*, **were respectively present. In the intestine of one of the eiders, 82** *P. botulus*, **3700** *Himasthla* **spp., 8800** *Psilostomum* **spp., 1000** *Cryptocotyle* **spp., 4500 Microphallidae and 6600 Cestodes were found, but in the second eider, only 235** *P. botulus* **and 7600 Cestodes.**

Eider no.	*Profilicollis botulus*	Cestodes	*Capillaria mergi*	*Cryptocotyle* spp.	Other trematodes
1	200	600	1400	400	+++
3	100	400	200	900	+
4	50	300	400	-	+
5A	4000	6000	300	800	+++
5B	100	>10.000	300	4100	+++
7	100	4600	-	300	+++
9	2500	4000	1700	2500	+++
10	3000	400	700	18.000	+++
11	800	1400	-	11.000	+++

sieved (0.075 mm screen mesh) and fixed with 4% formalin in saline. Worms were counted and identified according to species, genus or a higher taxonomic unit.

When the gizzard was investigated, the horny lining was removed and parasites were manually collected under a stereomicroscope (magn. 10x).

Results

The results of the birds investigated between 1976-1991 are given in Table 1 and those of winter/spring 1999/2000 in Table 2.

Discussion

It is amazing that there is such a lack of knowledge of parasites of the Common Eider and their epidemiological patterns. The results of the few eiders that have been investigated, show that the majority of them are heavily parasitized with many parasite species present. When eiders are macroscopically investigated, it is obvious that the big, yellow/orange *P. botulus* is a focus for attention. Due to both its number and size, one has been inclined to blame this species for being the cause of death. However, those parasites that cannot be seen with the naked eye, may in fact cause more damage to the host. Members of the genus *Amidostomum* in the gizzard are well-known pathogens. It is therefore too easy to blame the acanthocephalans for causing the mass mortality. Of course, a hypothesis which states that a lack of food forces the eiders to change from eating molluscs to eating crabs and thus ingesting large numbers of parasite larvae which finally causes death, sounds logically, but is not supported by facts. Generally, the pathogenic effect in the intestine of acanthocephalans does not kill eiders, unless they are present in very large numbers and penetration of the intestinal wall occurs, leading to the possibility of peritonitis. These cases have been observed in the present epidemic (Cremers, oral communication).

It has been shown in many other animal species that heavy infections of parasites can cause a lack of appetite. If these parasitized eiders do not eat enough food due to this lack of appetite, their condition will worsen. This will ultimately lead to starvation. This shows that starvation can occur in an environment that is capable of supplying enough food. Another factor that may contribute to a reduction in food intake by eiders may be the high level of stomach infection that was found in the eiders from Zeeland. Eating molluscs and crushing them in the stomach may be painful if the stomach is highly affected. To avoid this pain resulting from eating hard shells, the diseased eiders eat an alternative softer food, such as crabs. There is an indication that the availability of digestible food plays a role. It has been shown that when eiders infested with parasites in a sanctuary were fed with easy digestible food they could gain weight and recover!

It is clear that we need much more information about the parasites and their interactions, including the patterns of larval stages and the role of immunity to parasites. This means that long term studies of parasite dynamics in eiders are needed. We also have to know what kind of pathogenic effects are caused by single and combined infections of different parasite species. Is the effect just a sum of both or is synergy involved? Studies need to be made of parasite species that use an intermediate host and also the dynamics of the larval stages in these hosts (e.g. the cystacanths of *P. botulus* in the Shore Crab). However, surveys of parasites in eiders that died of natural causes and studies of crabs are relatively easy to organize, but experimenting with infections involving single parasite species in otherwise parasite free eiders, gives rise to many difficult questions, both practical and ethical.

Conclusions

Based on the present knowledge, the following conclusions can be drawn. The mass mortality of Common Eiders in the winter and spring of 1999/2000 was caused by starvation. This starvation was caused by the inadequate food intake, which was insufficient to keep vital functions intact, despite the presence of sufficient food in their surroundings. The reason why this insufficient food intake occurred, could be found in the presence of a high numbers of parasites, which caused inappetent or otherwise prevented eating. Finally, this negative energy balance resulted in death. In some cases, intestinal perforation by parasites and peritonitis may have directly caused the host's death.

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