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AVIAN CHOLERA IN EIDER DUCKS IN MAINE[1]

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Abstract: Outbreaks of avian cholera *(Pasteurella multocida)* occur frequently in common eiders *(Somateria mollissima dresseri)* in Maine during early summer. Studies over a seven year period show that over 90% of the loss occurred in incubating females and might be associated with their weakened condition because females do not feed during the incubation period. High nesting densities also may contribute to the losses. The exact source of *P. multocida* is unknown although carrier birds were found.

INTRODUCTION

Populations of the common eider *(Somateria mollissima dresseri)* have increased rapidly in some parts of their range during the last four decades, especially on the coast of Maine.[12] Large numbers also nest on islands in the St. Lawrence estuary of Quebec.[13] On several island colonies, nesting probably is approaching or may have reached saturation.

High densities of birds can lead to a crash decline from disease. For example, during recent years three major outbreaks of avian cholera *(Pasteurella multocida)* have been reported in northeastern eider colonies.[7,16] This study reports results of investigations of the disease over a 7-year period.

CASE HISTORIES

From 1970 to 1976, avian cholera occurred in common eiders on the Islesboro and Muscle Ridge island groups in Penobscot Bay. These islands are the major study areas on the breeding ecology of the eider, begun in 1964 by the Maine Cooperative Wildlife Research Unit. On four Islesboro islands, a total of 275-300 pairs nested annually on slightly more than 1 ha of vegetated cover. Populations of eiders on four islands of the Muscle Ridge area were estimated to average 450-475 pairs each year on about 3 ha of vegetative cover.

The general features and detailed descriptions of the flora of each of the islands in the Islesboro area were compiled by Choate[3] and Clark.[4] Bourget[1] described the island fauna. Generally the islands are small (less than 1 ha) and are covered by grasses and herbs. Great black-backed gulls *(Larus marinus)*, herring gulls *(L. argentatus)*, and double-crested cormorants *(Phalacrocorax auritus)* are the most important breeding associates of the eiders. The Muscle Ridge islands are similar in flora and fauna, although the two largest islands contain shrubs as well as herbaceous vegetation.

Common eider mortality from avian cholera in Maine was first reported in June, 1963, when a minimum of 117 nesting females were found dead in the Islesboro area.[7] No additional reports of the disease were recorded until dead

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common eiders were found on an island in the Muscle Ridge study area in Penobscot Bay on 9 June 1970. During the following two weeks 43 dead or dying birds were found; 20 were on nests or in nesting cover. All except one were adult females. Dead common eiders frequently were found in or near fresh water catch basins, tide pools and along beaches. The disease reached a peak sometime between 12 and 20 June, and then declined rather rapidly. No serious mortality occurred on nesting islands in the Islesboro area and eastern Penobscot Bay despite the fact that these eider colonies had suffered extensive losses in 1963. Moreover, these colonies are only 10 km from the infected colony in the Muscle Ridge region.

Mortality also occurred among common eider colonies in Muscongus Bay and offshore islands in 1970. A total of 513 dead common eiders were recovered on eight islands. All mortalities appeared to be caused by avian cholera. Herring gulls and great black-backed gulls also were affected by the disease. Participants in a seal collecting trip found dead eiders in Muscongus Bay the week of 14 June. One of their two captured harbor seals *(Phoca vitulina)* died during transport to New York. Type A *P. multocida* was isolated from the dead seal (W. B. Stone, pers. comm.).

In 1972, at least 24 common eiders died of avian cholera on two islands in the Islesboro study area. Dead birds were found during the latter part of June and well into July. No avian cholera was recorded on any of the Muscle Ridge islands in 1972.

Pasteurella was isolated in 1972 from a sample of water taken from a stagnant pool containing dead eiders.

The last known outbreak in Maine occurred in 1974, and as far as is known, occurred only on the Muscle Ridge islands of Penobscot Bay. The first indication of that outbreak occurred when one dead male and two dead female eiders and a few sick great black-backed gulls were found on 15 June. Additional eider and subsequent gull mortality (both herring and black-backed gulls) occurred for approximately 2 weeks. A total of 53 dead eiders were found on three islands. All but two were adult females. Many dead females were on nests or in nesting cover, but a few were near or in small stagnant pools along the periphery of the island. No losses were recorded on the Islesboro study area or on several other islands in Penobscot and Muscongus bays.

There were no reports of avian cholera in 1975. However, on 29 June, 1976, an incubating female eider that had died of avian cholera was found in the Muscle Ridge study area. No other mortality due to avian cholera was found in over 200 other eider colonies throughout the state during the 1976 and 1977 nesting seasons.

FIELD AND LABORATORY STUDIES

Dead eiders and gulls were taken to the University of Maine for necropsy. A few of the birds had petechial hemorrhages on the myocardium. Livers were swollen, greenish-colored, showed pinpoint necrotic lesions and some were covered by fibrinous pseudomembranes. The spleens were small and the kidneys were enlarged and mottled.

Cultures from the eiders were positive for *P. multocida*. Bacteria isolated from 10 eiders in 1974 were identified as serotype 4 that also reacted with type 12 antiserum. The isolate obtained from the dead female in 1976 was identified as serotype 3.[1] Unfortunately, the *P. multocida* isolated from eiders in 1970 was not serotyped.

[1] Serotyping was performed by Kenneth L. Heddleston, National Animal Disease Laboratory, Ames, Iowa, Zip 50010 USA.

During the course of this study, an attempt was made to find chronic carriers of *P. multocida*.[8,14,15] Birds were obtained from cooperating hunters and by special collections, under permit, at intervals during the year. Swabs from the heart, lungs, spleen, and oropharnyx were streaked on bovine blood agar plates. *Pasteurella* was detected during the winter period in one of 236 common eiders examined over the fall, winter and spring. The oropharnyx of live nesting female eiders was swabbed for culture. Only one of 357 cultures taken from eiders nesting in the Islesboro study area during 1974 and 1975 was positive for *P. multocida*. Based on the results of the sample examined, and accepting the sample as representative of the population, few common eiders harbor the bacteria as carriers.

DISCUSSION

Thus far, *P. multocida* serotypes 1 and 4 have been isolated from eiders in Maine. Heddleston *et al.*[9] reported that serotype 4 had been found only in domestic chickens, starlings *(Sturnus vulgaris)*, and evening grosbeaks *(Hesperiphona vespertina)*. Therefore, the initial source of the bacteria in eiders possibly was domestic chickens. The poultry industry is large in Maine and poultry processing and broiler houses are located adjacent to Penobscot Bay. Pieces of chicken refuse from the processing plants or refuse dumps were frequently found on the Islesboro islands in the earlier years of this study, presumably carried there by gulls.

Carter[2] found that Type A strain of *P. multocida* was the most common cause of avian cholera. Although the evidence is not conclusive because the strain was not serotyped, it is noteworthy that Type A was isolated from a harbor seal collected at the same time and place the eiders were dying.

Practically all outbreaks of cholera in free ranging wild ducks, except in eiders, have occurred while the birds are migrating or on the wintering grounds. Rosen[17] suggested that waterfowl carry the disease north to nesting grounds. However, the present study and the results of Donahue and Olson[5] have not demonstrated that a large number of birds are carriers.

Epornitics of avian cholera usually occur in populations of physiologically stressed birds. Outbreaks in Maine peak during mid- or late June when, in some years, many eiders may be still incubating eggs. Female common eiders feed little or not at all during incubation and lose up to 50% of their body weight.[11] Consequently, they are under considerable stress. Their spleens are markedly smaller during the breeding season than at other times of the year. At this time of the year, therefore, female eiders are probably more susceptible to any kind of infectious agent than at other periods. Since we have shown that the carrier state exists, such stresses might provoke an exacerbation of latent infection in a bird resulting in fulminating disease and, more importantly, a source of heavy contamination for associated susceptible (stressed) birds. This in turn could lead to an epornitic.

The timing of these outbreaks, therefore, appears to be coincident with ideal conditions for transmission. Carrier and susceptible birds, present in large numbers, are stressed severely. Birds are in extremely close contact, since nesting space is at a priority and, as has been shown, the bacteria may heavily contaminate the environment.

Pesticide contamination may be an additional stressing factor. Mortality from pesticides has been reported in common eiders in Holland.[10] Blood levels of telodrin and dieldrin in adult female eiders increased by a factor of 20 during incubation, reaching the critical level and causing mortality. Friend and Trainer[6] hypothesized that chemical pollutants were stress factors that either cause a "break" in the carriers or interact

in some manner with the host to produce overt disease. They suggest that outbreaks of avian cholera in California coincided with the widespread use of[8] insecticides. Common eiders in Maine frequently utilize more than 300 g of stored fat tissue during the reproductive process[11] and fat tissue is known to be the site of pesticide accumulation.[18] Although eiders in Maine have not been analyzed for pesticide loads, there could be a relationship between *Pasteurella* and pesticides or other environmental contaminants.

Since 1963, it is known that some island colonies of eiders in Maine have lost a significant proportion of nesting females because of mortality from avian cholera. As the eider population increases in size and number of colonies, avian cholera may become even more important as a limiting factor.

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