Precipitous declines in spectacled (Somateria fischeri) and Steller’s eider (Polysticta stelleri) populations compelled the US Fish and Wildlife Service to list both species as threatened under the Endangered Species Act. Liver and kidney tissues were collected from 115 eider carcasses consisting of 51 common eiders (Somateria mollissima), 37 king eiders (Somateria spectabilis), 16 spectacled eiders and 9 Steller’s eiders. Organochlorine residues were all or near the lower limits of analytical detection (<0.05 ppm weight) and well below toxic thresholds found in other birds. High concentrations of cadmium, copper, lead and selenium were found in eider tissues relative to other species. Interestingly, all four elements were highest in spectacled eiders, the species most rapid decline. With the exception of lead, adverse physiological responses to these contaminants have not been documented in eiders, but many of these concentrations are known to be toxic in other waterfowl. Therefore, contaminant impacts cannot be ruled out as a factor in the decline of some eider species.

INTRODUCTION

Organochlorine contaminants have been found in measurable quantities in polar ice caps (Gregor Burns 1972; Szaro 1981). Levels of chlorinated hydrocarbon contaminants have increased in the arctic environment over the past several decades. Organochlorine pollutants include the pesticides DDT, Aldrin, Dieldrin, DDE, Chlordane, Lindane, and a variety of chlorinated hydrocarbon insecticides and industrial chemicals such as toxaphene and hexachlorocyclohexane (Baker et al 1986). These contaminants are transported into the arctic environment by air and ocean currents. Organochlorines along with other elements are readily bioaccumulated by species in the food chain, particularly those at the top of the food chain such as eiders, seals, and whales. Organochlorines have been detected in the tissues of whales and dolphins from the Aleutian Islands (van Straten et al 1984), the Bering Sea (Roelofs et al 1984), the Kuril Islands (Roelofs et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986). The highest median liver concentrations were 2.9 ppm (Steller’s eider) and 1.8 ppm (common eider), similar to the 1.7 ppm in mute swans (Aythya nyroca) from Denmark (Norheim 1987). Copper concentrations in eider tissues from Alaska and arctic Russia. Median values are 3.4 ppm in eiders (Steller’s eider) and 3.8 ppm in common eiders from the United Kingdom (Hutton et al 1981). Organochlorines are detectable at levels below the toxic range in both eiders and Steller’s eiders from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

RESULTS AND DISCUSSION

Organochlorine Residues

Alcohol: Dieldrin, aldrin, DDT, heptachlor epoxide, aldrin and endosulfan; air and tempeh non-residues; vertim, endrin, dieldrin, DDE, toxaphene and DDD were not detected in any tissues. Other: p,p’-DDT, Aldrin, heptachlor epoxide, toxaphene and DDD were not detected in any of the 115 eider tissues.

Elemental Residues

Most elemental residues were found in eider tissues that were either histologically essential or seldom detected in the 115 eider tissues. Cadmium, copper, lead and mercury are a few of these that are not graphically described.

Cadmium concentrations in eiders (Figure 1)

Overall, liver (1.0 ppm) > kidney (0.6 ppm). The highest median liver concentration was 0.0 ppm (Steller’s eider) and 0.5 ppm (common eider). The highest median kidney concentration was 0.0 ppm (Steller’s eider) and 0.8 ppm (common eider). Cadmium concentrations in eider tissue concentrations were higher than those in common eiders from Denmark (Norheim 1987), but lower than those found in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981).

Comparison with literature values

Cadmium concentrations in eider tissues were lower than those in common eiders from Denmark (Norheim 1987), greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), and black guillemots (Uria lomvia) from the Barents Sea (Berlin et al 1982). Determinations of cadmium in eider tissues were similar to those from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

Selenium concentrations in eiders (Figure 2)

Overall, liver (5.0 ppm) > kidney (3.8 ppm). The highest median liver concentration was 2.9 ppm (Steller’s eider) and 0.6 ppm (common eider). The highest median kidney concentration was 1.0 ppm (Steller’s eider) and 0.7 ppm (common eider). Selenium concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), Manx shearwaters (Puffinus puffinus) from Denmark (Elvestad et al 1996), and Clapp’s gulls (Larus chloromelas) from Greenland (Fisk et al 1986). Selenium concentrations in eider tissues were lower than those found in eiders from the United Kingdom (Hutton et al 1981), but higher than those found in cetaceans from the Bering Sea (Roelofs et al 1984). Comparative studies of selenium concentrations in eider and cetacean tissues have not been done.

Comparison with literature values

Selenium concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), Manx shearwaters (Puffinus puffinus) from Denmark (Elvestad et al 1996), and Clapp’s gulls (Larus chloromelas) from Greenland (Fisk et al 1986). Selenium concentrations in eider tissues were lower than those found in eiders from the United Kingdom (Hutton et al 1981), but higher than those found in cetaceans from the Bering Sea (Roelofs et al 1984). Comparative studies of selenium concentrations in eider and cetacean tissues have not been done.

Copper concentrations in eiders (Figure 3)

Overall, liver (2.8 ppm) > kidney (1.5 ppm). The highest median liver concentration was 2.9 ppm (Steller’s eider) and 1.0 ppm (common eider). The highest median kidney concentration was 0.9 ppm (Steller’s eider) and 0.8 ppm (common eider). Copper concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), and black guillemots (Uria lomvia) from the Barents Sea (Berlin et al 1982). Determinations of copper in eider tissues were similar to those from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

Comparison with literature values

Copper concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), and black guillemots (Uria lomvia) from the Barents Sea (Berlin et al 1982). Determinations of copper in eider tissues were similar to those from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

Lead concentrations in eiders (Figure 4)

Overall, liver (23.0 ppm) > kidney (4.3 ppm). The highest median liver concentration was 110 ppm (spectacled eider) and 9.0 ppm (Steller’s eider). The highest median kidney concentration was 7.4 ppm (spectacled eider) and 5.5 ppm (Steller’s eider). Lead concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), and black guillemots (Uria lomvia) from the Barents Sea (Berlin et al 1982). Determinations of lead in eider tissues were similar to those from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

Comparison with literature values

Lead concentrations in eider tissues were lower than those in greater scaup (Aythya marila) from the United Kingdom (Hutton et al 1981), and black guillemots (Uria lomvia) from the Barents Sea (Berlin et al 1982). Determinations of lead in eider tissues were similar to those from the Bering Sea (van Straten et al 1984), the Aleutian Islands (van Straten et al 1984), and the continental shelf off the coast of Alaska (Baker et al 1986).

CONCLUSIONS

Organochlorine residues are not elevated in eiders and thus pose a minimal threat. The following elements are elevated and therefore concern: - Cadmium is elevated in spectacled eiders and potentially elevated in common and king eiders. - Copper is elevated in individual spectacled eiders, but not enough data is available from wild birds to estimate toxicity. - Lead is elevated in individual spectacled eiders but may be effectively dealt with using resource management tools. - Mercury is not elevated, thus potential setzgenic effects with selenium are probably not occurring.

Several questions remain to be answered: - Do these studies indicate the probable concentrations for Alaskan and Russian eiders? - What physiological effects, if any, might these elevated concentrations cause? - Are eiders more tolerant to these elements than other species? - Are these levels high enough to be harmful to the birds? - Are these levels high enough to be harmful to the birds? - Are these levels high enough to be harmful to the birds?