Abstract

The New Jersey bald eagle (Haliaeetus leucocephalus) population has increased from near extinction in the early 1970s to 59 monitored nesting pairs in 2006. Anecdotally, nesting pairs experience reproductive failure resulting in productivity below the minimum 1.4 nesting pair rate needed to maintain the population. Environmental contaminant exposure in New Jersey bald eagles has been implicated as affecting the reproductive success, causing delayed, and decreased hatch rates (Stem et al. 1990). Eagles nesting in the Delaware Bay drainage have been monitored for blood contaminants since 1993. The present study expanded this effort to include the New Jersey bald eagle population nesting in other areas of the state that have experienced decreases in productivity. The results of this study suggest that the Delaware Bay eagle population may be experiencing reproductive impairment. Taken collectively, additional analyses of historical and contemporary blood contaminant levels and their relationship to bald eagle productivity are warranted.

Introduction

Environmental contaminants are often suspected in the slow decline of many species. The number of bald eagles (Haliaeetus leucocephalus) inhabiting the Delaware Bay drainage has variously been reported to be between 100 and 300 eagles (New Jersey Division of Fish and Wildlife, 2006). In 1994, the New Jersey Division of Fish and Wildlife began a bald eagle monitoring program in the Delaware Bay drainage. The estimated number of bald eagles in New Jersey, after Wood War II was at its peak by 1950, since 1980 has not increased, only seen nesting pair reported 1993-2006.

Eagles are one of the sentinel species that are affected by environmental contaminants and are utilized in wildlife research for this purpose (Hoffman, 1997). The New Jersey bald eagle (H. leucocephalus) inhabiting the Delaware Bay drainage has been sampled for contaminants as part of this monitoring program. This study expanded this effort to include the New Jersey bald eagle population nesting in other areas of the state that have experienced decreases in productivity.

Eaglets are highly susceptible to environmental contaminants such as organochlorine pesticides and polychlorinated biphenyls (PCBs) (Frenzel & Anthony, 1989). Exposure to these contaminants is often associated with delayed hatching and decreased productivity (Stem et al. 1990; Fraher et al. 1985). In addition, PCB levels in adult bald eagle blood have been associated with reproductive impairment, especially in females (Bowerman et al. 1999). PCB and dioxin/furan contamination levels have been associated with reproductive impairment within the Great Lakes Discipline (Kozie & Anderson, 1991). However, no studies have been conducted with comparable contaminants to assess the New Jersey bald eagle population. This study was designed to assess the blood contaminant levels of New Jersey bald eagles nesting in all areas of the state to determine the potential for reproductive impairment and to determine the condition of the New Jersey bald eagle population.

Methods

Blood was collected from 6-8 weeks old eaglets. The New Jersey Division of Fish and Wildlife and U.S. Fish and Wildlife collected blood samples from 77 eaglets nesting in New Jersey in 1993, 1994, 1995, and 1997. Blood samples were collected from the New Jersey bald eagle population nesting in areas in the Delaware Bay drainage. The New Jersey bald eagle (H. leucocephalus) population was assessed for the potential for reproductive impairment.

Blood samples were analyzed for organochlorine pesticides, PCB congeners, and dioxin/furan suite using gas chromatography/mass spectrometry (GC/MS). DDE, an important metabolite of DDT, was the predominant organochlorine pesticide present (Table 1). PCB 138 was always the dominant congener, followed by PCB 153 and PCB 180. Maximum concentrations for DDE, PCB 138, and PCB 153 were 33.3, 140, and 36.9 μg/g, respectively, for the sampled New Jersey bald eagle population. A declining PCB concentration gradient was observed between the upper and lower Delaware Bay (Figure 1).

Results

Organochlorine Pesticides

• p,p’-DDE was the predominant pesticide present (Table 1).
• Maximum p,p’-DDE concentration of 141 ng/g, 12 times the geometric mean and almost 4 times that of any other sample.
• Geometric mean of the total PCB concentration: 60.85 ng/g.
• Maximum total PCB concentration of 395 ng/g, 6 times the geometric mean and 3 times that of any other sample.
• 95% confidence interval of 48.9 to 75.7 ng/g.
• The p,p’-DDE concentration gradient was observed between the upper and lower Delaware Bay (Figure 1). The New Jersey bald eagle (H. leucocephalus) population inhabits the Delaware Bay drainage.

Non-ortho PCB congeners were present in all samples. PCBs 52, 105, and 118 were detected in all samples at levels of 1.3, 2.3, and 1.6 ng/g, respectively. The PCB concentration levels were highest in New Jersey bald eagles nesting within the Delaware Bay drainage.

Comparison of mean DDE and a PCB levels (μg/g) observed in Delaware Bay eaglets, 1993-1997.

Table 1

<table>
<thead>
<tr>
<th>PCB</th>
<th>Mean ± SD</th>
<th>Range</th>
<th>CI (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>60.85 ± 10.04</td>
<td>48.9 - 75.7</td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>15.85 ± 4.01</td>
<td>10.2 - 25.0</td>
<td></td>
</tr>
<tr>
<td>169</td>
<td>11.04 ± 2.78</td>
<td>7.8 - 14.3</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>11.28 ± 2.74</td>
<td>7.8 - 14.3</td>
<td></td>
</tr>
</tbody>
</table>

Analysis

The New Jersey bald eagle (Haliaeetus leucocephalus) population has increased from near extinction in the early 1970s to 59 monitored nesting pairs in 2006. Anecdotally, nesting pairs experience reproductive failure resulting in productivity below the minimum 1.4 nesting pair rate needed to maintain the population. Environmental contaminant exposure in New Jersey bald eagles has been implicated as affecting the reproductive success, causing delayed, and decreased hatch rates (Stem et al. 1990). Eagles nesting in the Delaware Bay drainage have been monitored for blood contaminants since 1993. The present study expanded this effort to include the New Jersey bald eagle population nesting in other areas of the state that have experienced decreases in productivity. The results of this study suggest that the Delaware Bay eagle population may be experiencing reproductive impairment. Taken collectively, additional analyses of historical and contemporary blood contaminant levels and their relationship to bald eagle productivity are warranted.

Acknowledgements

Photo: Ryan Hagerty / USFWS

Photo: Dave Menke / USFWS

Photo: Gene Nieminen / USFWS

References


Wood War II. New Jersey Division of Fish and Wildlife. 2006. Endangered and Nongame Species Program, Trenton.

Endangered Species Act has allowed the New Jersey bald eagle population to steadily increase to 59 monitored nesting pairs in 2006. However, some nesting pairs have been negatively impacted by environmental contaminants. This study was designed to assess the blood contaminant levels of New Jersey bald eagles nesting in all areas of the state to determine the potential for reproductive impairment and to determine the condition of the New Jersey bald eagle population.