Chapter 49

Miscellaneous Chemical Toxins

The previous chapters provide information about some of the chemical toxins that have lethal effects on wild birds. The material presented in Section 7, Chemical Toxins, is far from comprehensive because wild birds are poisoned by a wide variety of toxic substances. Also, monitoring of wild bird mortality is not yet organized so that diagnostic findings can be extended to reflect the relative impacts among the types of toxins, within populations, or among species, geographic areas, and time. The data that are available are not collectively based on random sampling, nor do specimen collection and submission follow methodical assessment methods. Instead, most data simply document individual bird poisoning events. The inherent biases in this information include the species of birds observed dead (large birds in open areas are more likely to be observed dead than small forest birds); the species of birds likely to be submitted for analysis (bald eagles are more likely to be submitted than house sparrows); collection sites (agricultural fields are more likely to be observed than urban environments); geographic area of the country; season; reasons for submissions; and other variables. Nevertheless, findings from individual events reflect the causes of mortality associated with those events and collectively identify chemical toxins that repeatedly cause bird mortalities which result in carcass collection and submission for diagnostic assessment.

The tables that follow illustrate the relative occurrence of poisoning by different types of toxic substances for wild bird carcasses evaluated at the National Wildlife Health Center during the period of 1984 through 1995. This information was compiled to reflect the relative frequency of poisoning in different groups of birds as a function of the number of years that mortality occurred, the number of multiple-death events, and the number of years that had multiple-species deaths.

As noted above, biases in collecting and submitting carcasses prevent extrapolating these data to population impacts. The specimens that were evaluated depend on submissions from field personnel who had detected avian mortality events, and, for various reasons, had sought a diagnosis of the causes of mortality. Therefore, the tables simply reflect a relative accounting of what types of toxins were found most commonly to be the cause of death of the species that were submitted for evaluation. These data are not without meaning, because they clearly identify specific causes of poisoning in various groups of wild birds.

Carbofuran stands out as a frequent cause of mortality of a variety of bird species (Table 49.1). Diazinon was the most frequently diagnosed pesticide-induced cause of mortality in waterfowl, and famphur and carbofuran had similar prominence for eagles (Tables 49.1 and 49.2). As should be expected, chlorinated hydrocarbon pesticides were not frequently determined to be the cause of wild bird mortality (Table 49.3) now that these pesticides have been replaced by organophosphates, carbamates, and other compounds. Strychnine was a frequent cause of eagle mortality among compounds used as rodenticides and repellents (Table 49.4).

More than 30 different toxic substances were diagnosed as the cause of bird mortalities in specimens submitted (Tables 49.l through 49.5). The substances included naturally occurring materials such as selenium and sodium as well as synthetic products such as insecticides, and data in the tables are limited to those substances that caused direct lethal effects. As previously noted, there are many possible impacts of chemical toxins in addition to immediate toxicity that cause illness and death; some of these impacts involve interactions with other chemical or biological agents.

Residue analyses by themselves are often insufficient determinants of cause of mortality from chemical toxins be-

Table 49.1 *Relative occurrence of carbamate-caused mortality in free-ranging birds, 1984–95.*

[Frequency of occurence: ● frequent, ● common, ● occasional, ○ infrequent or not reported]

Compound	Species						
	Eagles	Hawks	Waterfowl	Gulls/terns	Crows[1]	Songbirds	Doves
Aldicarb	●	○	○	○	●	○	○
Carbofuran	●	●	●	●	●	●	●
Methiocarb	○	○	○	○	●	○	○
Unspecified	●	○	●	○	○	●	○

[1] Includes vultures, ravens, magpies, and crows.

Table 49.2 *Relative occurrence of organophosphorus-caused mortality in free-ranging birds, 1984–95.*

[Frequency of occurence; ● frequent, ◉ common, ◉ occasional, ○ infrequent or not reported]

	Species								
Compound	Eagles	Hawks	Owls	Waterfowl	Cranes	Shorebirds	Crows[1]	Songbirds	Doves
Chlorpyrifos	○	○	○	○	○	○	◉	○	○
Coumaphos	◉	○	○	○	○	○	○	○	○
Diazinon	○	○	○	●	○	○	◉	◉	○
Dimethoate	○	○	○	◉	○	○	○	○	○
Disulfoton	○	○	○	○	○	○	○	◉	○
Famphur	●	◉	◉	○	○	○	◉	◉	◉
Fenthion	◉	◉	◉	○	○	○	○	◉	○
Fonofos	○	○	○	◉	○	○	○	○	○
Monocrotophos	○	○	○	◉	○	○	○	◉	◉
Parathion	◉	◉	○	◉	○	◉	○	◉	○
Phorate	◉	○	○	◉	○	○	○	○	○
Terbufos	◉	○	○	○	○	○	○	◉	○
Unspecified	◉	◉	◉	○	◉	○	○	○	○

[1] Includes vultures, ravens, magpies, and crows.

Table 49.3 *Relative occurrence of chlorinated-hydrocarbon-caused mortality in free-ranging birds, 1984–95.*

[Frequency of occurence: ● frequent, ◉ common, ◉ occasional, ○ infrequent or not reported]

	Species		
Compound	Eagles	Owls	Songbirds
Dieldrin	◉	◉	◉
Heptachlor	◉	○	○

Table 49.4 *Relative occurrence of rodenticides and repellents as causes of mortality in free-ranging birds, 1984–95.*

[Frequency of occurence: ● frequent, ◉ common, ◉ occasional, ○ infrequent or not reported]

	Species				
Compound	Eagles	Hawks	Waterfowl	Crows[1]	Songbirds
Avitrol®	○	○	○	○	◉
Brodifacoum	◉	○	◉	○	○
1080	◉	○	○	○	○
Strychnine	●	◉	◉	◉	◉
Thallium	◉	○	○	○	○
Zinc phosphide	○	○	◉	○	○

[1] Includes vultures, ravens, magpies, and crows.

Table 49.5 *Relative occurrence of miscellaneous toxicants as causes of mortality in free-ranging birds, 1984–95.*

[Frequency of occurence: ● frequent, ◉ common, ◌ occasional, ○ infrequent or not reported]

Species	Compound							
	Chloride	Cyanide	Ethylene glycol	Fluorine	Hydrogen sulfide	Penta-barbitol	Selenium	Sodium
Eagles	○	◌	○	○	○	●	○	○
Hawks	○	◌	○	○	○	○	○	○
Owls	○	○	○	○	◌	○	○	○
Waterfowl	◌	◉	○	◌	○	○	◉	◉
Cranes	○	◌	○	○	○	○	○	○
Grebes	○	◌	○	○	○	○	◉	◌
Pelicans	○	○	○	○	○	○	○	◌
Gulls/terns	○	◌	○	○	○	○	○	○
Shorebirds	○	◉	○	○	○	○	○	○
Egrets[1]	○	○	○	○	○	○	◉	○
Crows[2]	○	○	◌	○	○	○	○	○
Songbirds	○	◉	○	○	○	○	○	○
Doves	○	◌	○	○	○	○	○	◌
Swallows	○	◌	○	○	○	○	○	○
Quail	○	○	○	○	◌	○	○	○

[1] Includes long-legged wading birds such as herons and egrets.
[2] Includes vultures, ravens, magpies, and crows.

cause of species variations, lack of residue for some types of compounds, and other variables. Similarly, the often-quoted 16th Century statement that, “Dosage Alone Determines Poisoning” is modified by such factors as route of exposure and other important factors.

Chemical toxins are, and will continue to be, important causes of wildlife mortality. Documentation of mortality from chemical toxins requires rigorous diagnostic work. Determination of wildlife impacts will best be accomplished through methodical monitoring programs that allow sound evaluations of changes in the status and trends of specific compounds and their impacts on wild bird populations by geographic area.

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