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DDT and Birds

Birds played a major role in creating awareness of pollution problems. Indeed, many people consider the modern environmental movement to have started with the publication in 1962 of Rachel Carson's classic *Silent Spring*, which described the results of the misuse of DDT and other pesticides. In the fable that began that volume, she wrote: "It was a spring without voices. On the mornings that had once throbbed with the dawn chorus of robins, catbirds, doves, jays, wrens, and scores of other bird voices there was now no sound; only silence lay over the fields and woods and marsh." *Silent Spring* was heavily attacked by the pesticide industry and by narrowly trained entomologists, but its scientific foundation has stood the test of time. Misuse of pesticides is now widely recognized to threaten not only bird communities but human communities as well.

The potentially lethal impact of DDT on birds was first noted in the late 1950s when spraying to control the beetles that carry Dutch elm disease led to a slaughter of robins in Michigan and elsewhere. Researchers discovered that earthworms were accumulating the persistent pesticide and that the robins eating them were being poisoned. Other birds fell victim, too. Gradually, thanks in no small part to Carson's book, gigantic "broadcast spray" programs were brought under control.

But DDT, its breakdown products, and the other chlorinated hydrocarbon pesticides (and nonpesticide chlorinated hydrocarbons such as PCBs) posed a more insidious threat to birds. Because these poisons are persistent they tend to concentrate as they move through the feeding sequences in communities that ecologists call "food chains." For example, in most marine communities, the living weight (biomass) of fish-eating birds is less than that of the fishes they eat. However, because chlorinated hydrocarbons accumulate in fatty tissues, when a ton of contaminated fishes is turned into 200 pounds of seabirds, most of the DDT from the numerous fishes ends up in a relatively few birds. As a result, the birds have a higher level of contamination per pound than the fishes. If Peregrine Falcons feed on the seabirds, the concentration becomes higher still. With several concentrating steps in the food chain below the level of fishes (for instance, tiny aquatic plants, crustaceans, small fishes), very slight environmental contamination can be turned into a heavy pesticide load in birds at the top of the food chain. In one Long Island estuary, concentrations of less than a tenth of a part per million (PPM) of DDT in aquatic plants and plankton resulted in concentrations of 3-25 PPM in gulls, terns,

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cormorants, mergansers, herons, and ospreys. "Bioconcentration" of pesticides in birds high on food chains occurs not only because there is usually reduced biomass at each step in those chains, but also because predatory birds tend to live a long time. They may take in only a little DDT per day, but they keep most of what they get, and they live many days.

The insidious aspect of this phenomenon is that large concentrations of chlorinated hydrocarbons do not usually kill the bird outright. Rather, DDT and its relatives alter the bird's calcium metabolism in a way that results in thin eggshells. Instead of eggs, heavily DDT-infested Brown Pelicans and Bald Eagles tend to find omelets in their nests, since the eggshells are unable to support the weight of the incubating bird.

Shell-thinning resulted in the decimation of the Brown Pelican populations in much of North America and the extermination the Peregrine Falcon in the eastern United States and southeastern Canada. Shell-thinning caused lesser declines in populations of Golden and Bald Eagles and White Pelicans, among others. Similar declines took place in the British Isles. Fortunately, the cause of the breeding failures was identified in time, and the use of DDT was banned almost totally in the United States in 1972.

The reduced bird populations started to recover quickly thereafter, with species as different as ospreys and robins returning to the pre-DDT levels of breeding success in a decade or less. Furthermore, attempts to reestablish the peregrine in the eastern United States using captive-reared birds show considerable signs of success. Brown Pelican populations have now recovered to the extent that the species no longer warrants endangered status except in California.

More recent studies have uncovered another disturbing phenomena. While some birds, notably birds of prey, have been recovering from the ill effects of DDT, song birds, especially non-migratory species like the cardinal, black-capped chickadee and dark eyed junco are testing positive for higher levels of DDT and other toxic chemicals in their systems. Non migratory species have exhibited 2 to 10 times more pesticide residue including DDT than those who migrate according to studies conducted by Wesleyan University of Illinois and senior scientists at the Audubon Society. Many North American bird species are definitely in decline due to the effect of chemical residue on embryonic development. Are humans at risk? "These birds are the canaries of the coal mine and warn us of what's going on in our environment," stated the co-author of "Our Stolen Future,1996".

To date, recent studies have focused on what is happening in the populations. The next important question to be investigated is WHY? One hypothesis is that the US used far more DDT than other countries following World War II so residual concentration in the soil may be far higher than previously estimated. Another theory suggests that in tropical countries, where DDT and its derivatives are still used to combat malaria, prevailing winds tend to blow these persistent organic pollutants north to the continental U.S. In other words, the US bears the brunt of the ill effects because in warm climates where the spraying occurs the initial chemicals evaporate, but the residue travels north on prevailing wind currents.

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International treaties continue to label "persistant organic pollutants, POPs" and ban them from production and use. However, the banning of DDT and other POPs has helped to create other pesticide problems. The newer organophosphate pesticides that to a degree have replaced organochlorines, such as parathion and TEPP (tetraethyl pyrophosphate), are less persistent so they do not accumulate in food chains. They are, nonetheless, highly toxic. Parathion applied to winter wheat, for instance, killed some 1,600 waterfowl, mostly Canada Geese, in the Texas panhandle in 1981.

Furthermore, DDT has recently started to become more common in the environment again; its concentration in the tissues of starlings in Arizona and New Mexico, for example, has been increasing. While the source of that DDT is disputed, what is certain is that DDT has been shown to be present as a contaminant in the widely used toxin dicofol (a key ingredient in, among others, the pesticide Kelthane). Dicofol is a chemical formed by adding single oxygen atoms to DDT molecules. Unhappily, not all the DDT gets oxygenated, so that sometimes dicofol is contaminated with as much as 15 percent DDT.

Overall, the 2.5 million pounds of dicofol used annually in pesticides contain about 250 thousand pounds of DDT. In addition, little is known about the breakdown products of dicofol itself, which may include DDE, a breakdown product of DDT identified as the major cause of reproductive failure in several bird species. Finally, DDT itself may still be in use illegally in some areas of the United States, and migratory birds such as the Black-crowned Night Heron may be picking up DDT in their tropical wintering grounds (where DDT application is still permitted). Unhappily tropical countries are becoming dumping grounds for unsafe pesticides that are now banned in the United States. As the new century begins, the once hopeful trend may be reversing, so that DDT and other pesticides continue to hang as a heavy shadow over many bird populations. The final word on this issue may well be; Beware what you release into the natural environment because a genie once released is not easily put back in the bottle.

Citation: Ehrlich, P.R., Dobkin, D.S., and D. Wheye. 1988. The Birder's Handbook. Simon and Schuster, New York, p. 21-25.

SEE: Metallic Poisons, p. 137; Hatching, p. 233; Wintering and Conservation, p. 513; Conservation of Raptors, p. 247.