DDT + PCB

PESTICIDES AND WILDLIFE

Editor's Note: This is a speech given at a Symposium on Pesticides and Environmental Health in March at Montgomery.

By JAMES E. KEELER
Research Biologist
Game and Fish Division

THE TERM, "chlorinated hydrocarbons," first became widely used in wildlife circles in Alabama during the Fire Ant Eradication Program of 1957-58. Prior to that time, limited use of powerful pesticides had not attracted the attention of the majority of conservationists simply because few dead wildlife specimens were found that could be directly attributed to pesticide poisoning.

As man leaves the destructive 1960's, he carries a tremendous load of chlorinated hydrocarbons with him. His suitcase is packed with such TNT as DDT, aldrin, dieldrin, endrin, and heptachlor. A small space was still available so this was packed with organic phosphates.

With such a deadly arsenal of pesticides facing every living thing in the world, one can only speculate as to what the 1970's will bring. Man awakens slowly and even then he hesitates to admit his mistakes. How do you tell that to the eagles, the pelicans and the peregrine falcons which are rapidly being decimated from our environment?

Pesticide Levels

Since 1962, much work has been accomplished on the effects of pesticides on wildlife, both in the field and in laboratories. Even with more sophisticated techniques, it still remains difficult to ascertain just how much DDT or other chlorinated hydrocarbons it takes to kill a quail, a deer, or a robin. A multitude of laboratory tests have been conducted on certain species of birds and mammals where controlled amounts of a certain pesticide have been fed to each animal only to have about six of the 10 die, two others exhibit traumatic symptoms and perhaps two others to exhibit no symptoms at all. Due to the differences in the physiology of the individual animal, minimum lethal dosages of pesticides are very difficult to determine.

Of great concern to wildlife biologists are the animals that survive high dosages of pesticides. Studies have shown drastic changes in reproduction and also pronounced behavioral changes in certain birds and mammals carrying large doses of chlorinated hydrocarbons.

An example of how pesticide levels can increase in animals at the top of the food chain would be the study conducted at Clear Lake, Calif. DDD was applied to Clear Lake to a level of .07 ppm (20 parts per billion) of water for nuisance midge control. Thirteen months later, analyses showed the residue levels were 10 ppm in plankton, 903 ppm in the fat of plankton-eating fish, 2690 ppm in the fat of carnivorous fish, and 2134 ppm in the fat of fish-eating birds, most of which had died. This represents a 100,000 fold increase in fish-eating birds over levels in the lake water.

Other Examples Cited

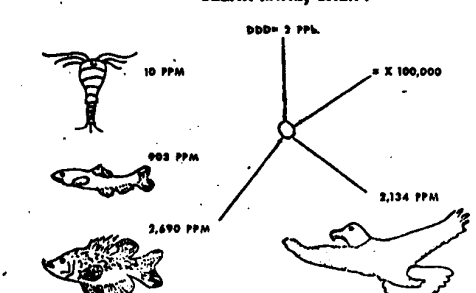
Other examples of pesticides in wildlife are as follows:

1. Dieldrin in big game mammals of South Dakota exceeds the zero tolerance for dieldrin in meats set by the U. S. Government.
2. Brain tissues of dead robins on areas sprayed with DDT for Dutch elm disease have contained as much as 240 ppm of DDT residues.
3. A 10-acre area in Autauga County, was treated with heptachlor at the rate of two pounds of undiluted technical grade chemical per acre as a part of the Fire Ant Eradication Program. Seven days after application, three quail, six rabbits, three opossums, one raccoon, one barred owl, 10 cardinals, 20 sparrows, two blue jays, one mockingbird and one white-footed mouse were found dead or dying. In Wilcox County, a total of 180 animals of 24 species were found dead or dying during a seven week period after application.

Important To Hunters, Fishermen

Pesticide residues in game species are important to hunters and fishermen. A national survey conducted in 1960 showed that two of every five persons in the United States went hunting or fishing, or both, and spent $3.9 billion annually. The average consumption of game per individual in the U. S. is 2.7 pounds per year.

Earthworms, which constitute the main food of many birds such as woodcocks and robins, show a resistance to all except very heavy doses of pesticides. Earthworms from 67 fields of 14 crop types in eight states concentrated or-



MONS 086721

ganochlorines to an average of nine times the concentration of the surrounding soil.

Recently, polychlorinated biphenyls have been discovered in wildlife samples. These PCB's are industrial pollutants and, like insecticides, are widely distributed in wildlife from Great Britain, Sweden, and North America. PCB's have interferred with the determination of other compounds and have caused a re-evaluation of the original findings, especially the readings on DDT and its metabolites.

Pesticide Effects On Reproduction

Laboratory tests show that DDT and dieldrin can pass from mother to offspring through the placenta in mice, dogs, rabbits and man. They are also found in the eggs of birds.

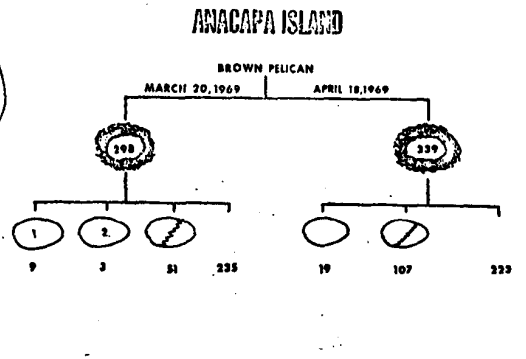
In birds, DDE appears to be the environmental pollutant most responsible for thin eggshells. DDT residues cause hormone induction in eagles and other birds which upset calcium metabolism and produce egg shells too thin to protect embryos. More specifically, DDE causes inhibition of the enzyme, carbonic anhydase, which is responsible for eggshell thickness.

The story of the brown pelican is a good example of what is happening to birds at the top of the food chain. On March 20, 1969, an expedition was sent to Anacapa Island, off California, to study pelican nesting success. Some 298 nests were counted. Intact eggs were present in only 12 nests. Nine contained a single egg and three contained two eggs. Fifty-one nests contained a single broken egg. These eggs had shells that were spongy in texture and a slight pressure produced a change in their shape. Portions of the shell were flaking, exposing the membrane. The remaining 235 nests contained no eggs. Some broken eggs were collected for analysis. One egg analyzed contained 68 ppm of DDE.

Second Colony Visited

On April 18, 1969, a second nesting colony was visited on a different part of the island and 339 nests were found. Nineteen contained intact eggs. Of the 320 nests without entire eggs, one of three had a collapsed, dehydrated egg. The reproduction at both nesting sites was a complete failure. Farther south, in the Gulf of California, reproduction in 1969 was reduced by one-third. On the Atlantic Coast, the thickness of brown pelican eggshells has been reduced by as much as 18 percent.

Since 1947, eggshells have become thinner in all of the meat-eating birds. Eggshells have decreased from 19 to 26 percent in the U. S. peregrine falcon nests. Eggshells of bald eagles have decreased 18 percent; golden eagles, nine percent; ospreys, 25 percent; and sparrow hawks from 16 to 25 percent.



Serious At Top

In the eastern half of the United States where pesticides have been more widely used, the situation has become very serious for birds at the top of the food chain. The peregrine falcon has ceased to breed in this area. The nesting success of bald eagles in the Chesapeake Bay region has decreased from 97 percent in 1936 to between nine and 23 percent during the past five years.

Studies conducted in white pelican and cormorant nesting colonies show a marked change in the behavior of these birds around their nests. Birds carrying high concentrations of DDT residues not only lay thinner eggs but exhibit a more careless attitude around their nests. This behavior, when combined with the laying of eggs with thinner shells causes many broken eggs.

Since the appearance of the white man in what is now continental United States, four birds and eight mammals have become extinct and many others are becoming rare and endangered. The major cause of extinction of these birds and mammals has been attributed to habitat destruction. All become extinct before the introduction of chlorinated hydrocarbons. It appears that another very destructive agent other than loss of habitat can now be added to man's inadvertent attempt to destroy life. This new agent is chlorinated hydrocarbons. How do you tell that to the eagles?

Reference Sources

1. MacMullan, Ralph A., 1968. The Case Against Hard Pesticides. Reprinted from Michigan Conservation. Jan.-Feb. 1968.
2. Anonymous, 1966. Fish, Wildlife and Pesticides, USDI.
3. Sticket, Lucille F., 1968. Organochlorine Pesticides in the Environment. USDI. Special Scientific Report — Wildlife No. 119. October 1968.
4. Davey, Stuart P., 1963. Effects of Chemicals on Earthworms: A Review of the Literature. USDI Special Scientific Report — Wildlife No. 74. September 1963.
5. Anderson, Daniel W., Joseph J. Hickey, Robert W. Risebrough, Donald F. Hughes and Robert E. Christensen, 1969. Significance of Chlorinated Hydrocarbon Residues to Breeding Pelicans and Cormorants. The Canadian Field-Naturalist, Vol. 83, No. 2, pp. 91-112, April-June, 1969.
6. Porter, Richard D., and Stanley N. Wiemeyer, 1969. Dieldrin and DDT: Effects on Sparrow Hawk Eggshells and Reproduction. Science, Vol. 165, pp. 199-200. July 11, 1969.
7. May 5, 1969. Conservation Foundation Newsletter.
8. Brown Pelican Newsletter, National Audubon Society July 1969.

MONS 086722