

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.

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Pesticides and Peregrines- Making the Connection

DDT, or dichloro-diphenyl-trichloro-ethane, is the best known of several pesticides first introduced in the 1940s and 1950s. It was used widely during World War II to control the spread of typhus in Europe, and also was very successful in the South Pacific where it was used for malaria control.

The chemical was also helpful in the final eradication of malaria in both the United States and Europe, although by that time the mosquito and its breeding grounds had been nearly eliminated by other methods. Because of its properties as an insecticide, farmers quickly adopted it after the war as a general-purpose agricultural spray.

The World Health Organization in 1955 initiated a program to rid the world of malaria, primarily through the application of DDT. Overall this program was highly successful, particularly in areas where there was a higher standard of living, well-established healthcare programs, and less seasonal malaria transmission. These areas included a large portion of the South Pacific, the northern portion of Australia, most of the Caribbean, Taiwan, parts of northern Africa and much of Sri Lanka and India.

However, in other areas, primarily sub-Saharan Africa, because of the lack of a good healthcare system, the continuous life-cycle of the mosquito and the development of its resistance to the pesticide, application of DDT was very limited, and other methods of control were eventually implemented.

The connection between the increased usage of DDT as an agricultural insecticide and the impacts on wildlife, particularly birds, was a detective story that took some time to resolve. The effects on birds were simultaneously noticed in both Great Britain and the United States by a handful of scientists.

In 1962, the publication of the book, *Silent Spring*, by biologist Rachel Carson, is believed by many to have been the birth of the environmental movement in the United States. The book laid out the accumulating evidence on the environmental

impacts of the spraying of large amounts of pesticides, and not surprisingly, was met with fierce criticism, particularly from the chemical industry.

Rachel Carson suggested that the widespread use of pesticides, including DDT, was a threat to wildlife, especially birds, and could cause cancer. She herself, was diagnosed with cancer in 1960, and died just two years after the book was published at the very young age of 56.

DDT had also been manufactured in Great Britain during World War II, and then used widely after the war against a variety of agricultural pests. One of its perceived benefits was its low toxicity to warm blooded animals, including humans, although there were indications of problems for both fish and, oddly, domestic cats.

It was soon discovered that treating seeds with DDT or similar chemicals, especially cereal grains, before planting, was an effective way to protect the young plants from insect pests. But this also created potential problems for large numbers of seed eating birds. And it was the connection that was discovered between high bird mortality around newly planted fields in Britain, and a declining number of peregrine falcons, which fed on birds, that led some concerned scientists to begin looking carefully at all the evidence.

This research was taking place in the early 1960s, at the same time Rachel Carson was looking into the same questions. Careful field observations and chemical analysis in Britain revealed either no eggs in peregrine nests, broken eggs, or very soft shelled eggs that didn't hatch successfully, as well as elevated levels of the breakdown products of DDT in the eggs.

As meticulous research continued, step by step, it was soon discovered that the pesticides were being biologically magnified moving up the food chain, from low levels in the soil, seeds or water, to higher levels in the peregrine's food supply, and ultimately to an accumulation in the falcon's fat tissue.

During breeding, the accumulated pesticide breakdown products led to a reduction of calcium and thinner eggshells, leading to the failure of peregrine eggs to successfully hatch. The population ultimately crashed and the peregrine falcon soon became an endangered species, in Britain and the US.