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Book Reviews

An Examination of a Worldwide Disaster

Peregrine Falcon Populations. Their Biology and Decline. A conference, Madison, Wis., 1965. JOSEPH J. HICKEY, Ed. University of Wisconsin Press, Madison, 1969. xviii + 446 pp., illus. $22.50.

This book might well be a classic—the handwriting on the wall for all mankind. Although it is specifically concerned with the biology of the peregrine falcon and its raptor relatives, it could foretell our own fate if the contamination of our environment continues at the present rate.

During the years 1950 to 1965, a population crash of peregrine falcons occurred in North America and parts of Europe that amounted to an ecological disaster. In this species evolution has produced the perfect raptor, majestic in appearance, unrivaled in speed of wing, and almost worldwide in distribution—the prize of falconers from medieval times to the present and a bird that continues to excite the admiration of all who know it. Now the peregrine seems to be faced with extirpation over much of its former range if not with actual extinction.

The book seeks to explain what is happening. To achieve this end an imposing array of European and North American experts, representing all facets of avian biology, were assembled at the University of Wisconsin to crystallize and evaluate all hypotheses that might account for the phenomenon that is taking place before our very eyes. Since by the early 1960's peregrine populations had catastrophically declined on two continents, and since other raptors were also mysteriously and rapidly decreasing, the organizers of the conference appropriately concluded that no time should be lost in seeking out the causes. The conferees sought to examine a wide variety of adverse factors—diseases, parasites, predators, human harassment, and environmental contaminants, particularly pesticides. They did so with a remarkable degree of objectivity. In the final analysis, the book expresses the conclusion that the decline of the peregrine falcon could not be attributed exclusively to any one factor but that the concentration of chlorinated hydrocarbons by raptors that eat fish and birds is the only hypothesis that adequately explains the simultaneous population failure of so many species on both sides of the Atlantic Ocean.

At the time of the conference, 29 August to 1 September 1965, the peregrine populations of Alaska and the Canadian Arctic seemed unaffected, but recent studies have shown that they too are not immune. High levels of insecticides have been found in these birds, apparently as a result of concentrations picked up on the populations' wintering grounds south of the wilderness in which they breed. One drastic change that seemingly affects several populations of birds that show high concentrations of insecticides is a reduction in eggshell thickness that results in egg breakage and egg eating by the parents. The phenomenon is associated with a general failure to lay eggs, decreased numbers of eggs, disinclination to renest, and reduced viability of the young. The timing of these events coincides with the general introduction of DDT or its metabolites. The ecological case against the organochlorine insecticides is especially incriminating now that there is experimental proof that these insecticides stimulate the hydroxylation of steroids. A breakdown of sex hormones took place in birds subjected to 1-week diets in which the concentration of DDT was as low as 10 parts per million and that of dieldrin was 2 ppm. Since these are the hormones that regulate the metabolism of calcium in the reproductive cycle of birds, the mechanism producing the recent breeding failures is strongly indicated. Another mechanism, one that has been suggested to the reviewer, may be the inhibition by the pesticides of carbonic anhydrase, an enzyme involved in calcium regulation. Central nervous system effects of the organochlorines on reproduction are difficult to identify, as was argued at the Wisconsin conference, but with concentrations of DDT complex exceeding 300 ppm in the fat of Arctic peregrines, as has recently been shown, it seems possible that raptors live precariously near a lethal threshold and that these compounds in periods of stress might be transferred to the central nervous system and thereby produce adult mortality.

It is, however, the metabolite DDE that has gradually taken on increasing significance in the reproductive failure of raptorial birds in the last two decades. This compound was reported in the fat of bald eagles to have run as high as 2800 ppm. And adult Arctic peregrines studied in 1968 averaged about 414 ppm in Alaska and 284 ppm (wet weight) in Canada. However, improved analytical techniques have recently disclosed that previously reported levels of *p,p'*-DDT and *p,p'*-TDE, as determined by electron-capture gas chromatography, may in fact be polychlorobiphenyls—a group of industrial pollutants that do not break down in the environment. The effect of these contaminants on birds is unknown. It has been reported that DDE can induce the production of hepatic microsomal enzymes, and concentrations of DDE in the eggs of American herring gulls were found to be inversely proportional to eggshell thickness at American colonies of this species sampled in 1967.

The persistence of DDE in the world's environments and its concentrations at the tops of certain ecosystems is a phenomenon that binds peregrine falcons, Scottish golden eagles, sparrow hawks, American ospreys, and bald eagles together in a process of physiological deterioration. The report of the Wisconsin conference could well be the requiem of one or all of the species in question.

It has been said that man has never been known to avoid catastrophe—he devotes all his energies to recovering from one catastrophe or another. What must be produced to awaken our populace to our environmental pollution and contamination! As beneficial to mankind as insecticides have proved to be, we cannot justify on any biological or humanistic ground their indiscriminate use. Man, like the peregrine, is at the top of a food chain.

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