

# SPECULATION ON DDT AND ALTERED OSPREY MIGRATIONS

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This paper presents speculation that DDT and/or other chlorinated hydrocarbon pesticides reduce energy production in the major flight muscles of Ospreys (*Pandion haliaetus*) which, in turn, alter Osprey migration patterns in eastern North America. By turning to the realm of speculation, it is hoped that ornithologists interested in physiology and biochemistry will investigate the feasibility of the relationships suggested here. Although this hypothesis may be proved untenable, I think it is important to consider and investigate as many aspects of the relationships of pesticides to birds of prey (and other animals) as possible.

Before presenting this hypothesis, a review of background information concerning various aspects of Osprey reproductive biology and migration is pertinent.

## Osprey Population Fluctuations

Although a gradual, long-term decline in the numbers of nesting Ospreys has occurred along the Atlantic Coast of the United States (Bent, 1937), there is little doubt that a substantial reduction in breeding Ospreys has occurred from Maine to Chesapeake Bay within recent years (Ames, 1961, 1964, 1966; Ames and Mersereau, 1964; Emerson and Davenport, 1963; Kury, 1966; Latham, 1959; and Schmid, 1966). Emphasizing the widespread seriousness of the problem is a similar decline in nesting Ospreys in Wisconsin, Michigan and Minnesota (Ingram, 1966; Postupalsky, 1966, 1968). Curiously, the nesting Osprey population surrounding Chesapeake Bay is maintaining itself or is only slightly declining (Reese, 1965, 1968; Henny and Ogden, 1970). The nesting Osprey population in Florida Bay, Florida also is stable at the present time (Henny and Ogden, 1970). No satisfactory explanation has been provided for the stability of these latter populations.

## Hepatic Enzyme Induction

A correlating aspect of the Osprey population decline—as well as

Bald Eagles (*Haliaeetus leucocephalus*) and Peregrine Falcons (*Falco peregrinus*)—is the thin eggshell syndrome whereby DDT and its metabolites induce hepatic enzymes which alter the chemical structure of estrogen thereby altering calcium metabolism in birds of prey and certain other birds (Peakall, 1967a, 1967b; Porter and Wiemeyer, 1969; Heath, Spann and Kreitzer, 1969). Females of certain species are laying eggs with shells so reduced in thickness that they break abnormally easily during incubation (Hickey, 1969; Hickey and Anderson, 1968). The fact that species from several avian orders exhibit the thin eggshell syndrome suggests that some low trophic level species may be as susceptible to the affects of DDT and its metabolites as are many top order carnivores. Conversely, sub-lethal levels of DDT apparently do not severely affect normal rates of spermatogenesis of male Bald Eagles (Locke, Chura and Stewart, 1966).

### Increased Migration Counts

Despite the reduced populations of nesting Ospreys along the Atlantic coast, there are reports of markedly **increased** numbers of Ospreys passing Hawk Mountain in eastern Pennsylvania during the past few autumns. Nagy (1970), for example, reports a new high record of 530 Ospreys counted at Hawk Mountain during the 1969 season. These increased counts are clearly in conflict with the well documented reproductive failure of the species in the East. However, considerable difference of opinion exists regarding the emphasis, or lack of emphasis, which should be placed upon autumn hawk counts in terms of their value as general indices to hawk population trends (cf. Spofford *in* Hickey, 1969: 323-332; Broun, 1966: 16, Heintzelman, 1969: 12; and Taylor, 1970: 2-3).

### Origin of Hawk Mountain Ospreys

One of the least known aspects of Osprey (and other hawk) migrations passing Hawk Mountain Sanctuary, Bake Oven Knob and other nearby mountain lookouts during autumn is the geographic origin of these birds. What areas of North America do they come from? Are the same areas represented each year? Various suggestions have been made regarding these problems, but few data are available upon which solid conclusions can be based.

Peterson (1966:10-11) suggested that the birds are coming from unpolluted Canadian lakes and passing rapidly down the ridges to their wintering grounds in the Caribbean and elsewhere.

Heintzelman (1967:11) suggested that Ospreys may be changing their center of major nesting concentration to Canada, thereby eliminating some unfavorable ecological factor and allowing the birds

to again rear normal numbers of nestlings. DDT could be such an unfavorable ecological factor.

Banding data demonstrate that Ospreys reared along coastal New Jersey and New York do not fly inland and migrate southward along the hawk ridges of eastern Pennsylvania. Approximately 100 nestling Ospreys—banded by Joseph A. Jacobs (personal communication) and others near Avalon, New Jersey during the past few decades—have been recovered, but none from the vicinity of Hawk Mountain. The closest recovery was at Easton, Pennsylvania, approximately 45 or 50 miles to the east-northeast.

### Altered Migration Route— Reduced Energy in Flight Muscles

Another possibility is that Ospreys have recently changed their migration patterns and/or routes (Heintzelman, 1967:12) as a result of DDT and/or its metabolites. Is it possible that the birds have slightly altered the normal physiology of energy production in their major flight muscles, thereby resulting in somewhat less than normal amounts of energy being produced? If so, migrating Ospreys—which may not have been greatly dependent upon strong air currents along mountain ridges such as Hawk Mountain during years prior to the use of DDT—may be dependent to a greater extent upon the strong mountain air currents which permit the birds to glide relatively effortlessly and with a minimum of energy being exerted. An unusual dependence upon mountain air currents could result in increased numbers of Ospreys at Hawk Mountain.

Perhaps there is an indirect or direct physiological effect of DDT upon energy production in Osprey flight muscles. Avian physiologists might well find it of value to investigate the possibilities of this hypothesis. Clearly, there is an increase in the numbers of Ospreys migrating past Hawk Mountain and other mountain lookouts during recent autumns and the hypothesis suggested herein offers an interesting explanation which, if valid, will have widespread application in all species as DDT concentrates increase.

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