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DIELDRIN AND ENDRIN RESIDUES IN FULVOUS WHISTLING-DUCKS IN TEXAS IN 1983

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Fulvous Whistling-Ducks (*Dendrocygna bicolor*) that nest in rice fields along the Gulf Coast of southeastern Texas suffered a major population decline in the late 1960s. This decline was attributed to mortality from dieldrin (a derivative of aldrin) or aldrin (Flickinger and King 1972). Although registered for insect control in newly planted rice fields, aldrin may have been used as an avicide and applied at illegal rates. Numbers of Fulvous Whistling-Ducks increased in the early 1970s after aldrin treatment of rice seed was voluntarily discontinued in some nesting habitats (Flickinger et al. 1977, 1980). In 1974 the U.S. Environmental Protection Agency cancelled the use of aldrin as a treatment for rice seed; however, Fulvous Whistling-Duck populations have not recovered to the numbers estimated for Texas in the early 1950s (Singleton 1953).

Concurrently, numbers of Fulvous Whistling-Ducks declined during the 1960s on their wintering grounds in Mexico; a large 5 state area extending from Veracruz on the Gulf Coast southward to the Pacific Coast (Flickinger et al. 1973). However, the literature contains no information on possible contamination of this species in Mexico. This study was begun in Texas to determine if Fulvous Whistling-Ducks continue to carry harmful levels of organochlorine contaminants and if the species is exposed to contaminants in Texas or Mexico. We determined concentrations of organochlorine insecticides in carcasses of adult Fulvous Whistling-Ducks immediately after spring arrival in Texas and in juveniles before they departed for Mexico in the fall.

METHODS

In spring 1983, adult Fulvous Whistling-Ducks were collected by shooting on a small reservoir in southern Wharton County between 22 April and 3 May, shortly after the birds arrived from their wintering grounds. Southern Wharton County is a traditional early spring concentration and nesting area in the southwestern end of the Texas rice belt. In July, levees along rice fields were searched for nesting ducks to facilitate collection of juveniles. Sixteen juveniles from flightless to fledgling

stages were collected from six broods by shooting and by hand at 3 reservoirs near rice fields in Wharton, Colorado, and Jefferson counties from 31 August to 11 September 1983.

All ducks were weighed and skinned. Feet, bills, wingtips, and gastrointestinal tracts were removed. Gastrointestinal tracts were examined for food content. Each carcass was analyzed at the Patuxent Wildlife Research Center, Laurel, Maryland for a series of organochlorine contaminants: p,p'-DDT, p,p'-DDD, p,p'-DDE, dieldrin, endrin, heptachlor epoxide, oxychlordane, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor, toxaphene, and polychlorinated biphenyls (PCBs). We used the analytical method of Cromartie et al. (1975) as modified by Kaiser et al. (1980).

Residues were identified and quantified by electron-capture, gas-liquid chromatography (GLC) using a 1.8 m 1.5/1.95% SP-2250/SP-2401 column. Residues in 13 percent of the samples were confirmed with a Finnigan model 4000 GLC/mass spectrometer. For comparison, average percent recovery in fortified Mallard (*Anas platyrhynchos*) tissues ranged from 76–104%. Residues were not adjusted for percent recovery. The lower limit of reportable residues was 0.1 ppm for pesticides and 0.5 ppm for PCBs.

In calculating geometric means, a value of one-half the lower limit of quantification was used for samples in which residues were not detected. Following an initial 2-way analysis of variance (ANOVA), the Bonferroni multiple comparison method was used to test for significant ($P \leq 0.05$) differences in log-transformed carcass residues among years and between adult males and females. The antilogs (geometric means) are presented in Table 1.

RESULTS

The arrival of Fulvous Whistling-Ducks in the Texas nesting area in spring 1983 coincided with the planting and flooding of rice fields, which began in the Wharton County study area about 12 April. Planting continued through 3 May when 447 adult Fulvous Whistling-Ducks were counted in nearby rice fields. Seven of 15 collected adults (47%) had rice in their gastrointestinal tracts and the carcasses of 5 of the 7 (71%) contained dieldrin residues ($\bar{x}$ = 0.65 ppm, range 0.11–1.9 ppm). In comparison only 2 of 8 (25%) ducks without rice in their gastrointestinal tracts contained dieldrin in their carcasses ($\bar{x}$ = 3.2 ppm, range 2.0–4.3 ppm). There were no significant differences in geometric means of dieldrin concentrations between males (0.09 ppm, range 0–0.7 ppm; n = 7) and females (0.34 ppm, range 0–4.3 ppm; n = 8) shot in 1983 or between males (0.4 ppm, range 0.1–1.6 ppm; n = 2) and females (0.23 ppm, range 0–1.3 ppm; n = 4) shot in 1967 or between males (6.35 ppm, range 2.0–16.0 ppm; n = 3) and females (1.25 ppm, range 0.5–3.1 ppm; n = 2) found dead in 1960–1969.

The geometric mean for dieldrin residues in adults (sexes combined) shot in 1983 was not significantly different from the mean for adults shot

in 1967 (Table 1). However, the former was significantly lower than the mean for adults found dead in the 1960s. Because of the larger standard error associated with the mean for dieldrin residues in adults shot in 1967, that mean was not statistically different from the mean for those found dead in the 1960s.

The 4 adults (27%) in 1983 with the highest dieldrin residues also contained low levels of endrin. Similar endrin residues were found in 2 of 6 (33%) ducks shot in 1967 and 2 of 5 (40%) found dead between 1967 and 1969 (Table 1). No other organochlorine residues were detected in 1983. Two of 6 adults in the late 1960s contained a trace (<0.1 ppm) of aldrin and 3 contained residues of DDT and its metabolites (Flickinger and King 1972).

No organochlorine residues were detected in juveniles in 1983. Whereas in 1967, 3 composite samples of flightless juveniles (10 total) from 3 broods found dead in an aldrin-treated rice field contained dieldrin, endrin (Table 1) and DDT and its derivatives. No mortality of adults or young was observed in rice fields or at reservoirs in 1983.

DISCUSSION

Although we did not demonstrate where or when the adults were exposed to dieldrin and endrin in 1983, we propose the following explanation. Robinson et al. (1967) found that the mean half-life of dieldrin in bird tissues was 47 d. Since Fulvous Whistling-Ducks migrate between the nesting area and wintering grounds in less than 47 d (Flickinger et al. 1973), adults could have arrived in the nesting area with residues acquired in Mexico. Yet, the dieldrin residues in ducks in 1983 could not have been the half-life levels, otherwise some of the ducks would have died in Mexico from the initial higher residues that would have been of similar magnitude to those in ducks found dead in Texas rice fields in the 1960s. Furthermore, White et al. (1982, 1983a,b, 1985) have shown that birds exposed to organochlorine contaminants on wintering grounds in southern Texas (between the rice country and Mexico); in Veracruz, Mexico; and in Latin America contained more DDE than dieldrin, but not much of either. Moreover, adults shot in Texas rice fields in 1983 contained no DDE. However, there has been almost continuous illegal use of aldrin during rice planting in April and May in some areas of southeastern Texas since the registration of this chemical was cancelled for rice seed treatment in 1974 (Peter Nylander, U.S. Fish and Wildlife Service Special Agent, pers. comm.). Fulvous Whistling-Ducks have wide movement patterns through the rice country (Flickinger et al. 1973) and disperse widely after their arrival in Texas. More ducks that fed on rice seed contained dieldrin residues than ducks which had not eaten rice. Ducks exposed to contaminants in Texas rice fields invariably contained more dieldrin than any other organochlorine residues (Flickinger and King 1972). We conclude that the collected adults in 1983 were probably exposed to dieldrin and endrin in some nesting areas.

TABLE 1. Dieldrin and endrin residues (ppm wet weight) in carcasses of adult and juvenile Fulvous Whistling-Ducks shot in 1983 compared to those shot and found dead in the 1960s in Texas rice fields.[a]

Age: Season, fate, and year	n	Dieldrin			Endrin		
		No. with detectable residues	$\bar{x}$[b]	(Range)	No. with detectable residues	$\bar{x}$	(Range)
Adults: Spring							
Shot 1983	15	7	0.18a[c]	(ND[d]–4.3)	4	0.08	(ND–0.18)
Shot 1967	6	5	0.27ab	(ND–1.6)	2	0.03	(ND–0.1)
Found dead 1960–1969	5	5	3.31b	(0.50–16.0)	2	0.07	(ND–0.3)
Juveniles: Summer							
Shot 1983	16	0	—	(ND)	0	—	(ND)
Found dead 1960–1969	3	3	2.96	(1.0–4.0)	3	0.16	(0.1–0.2)

[a] 1960–1969 data taken from Flickinger and King (1972). Juveniles in 1960–1969 are an average of 3 pools containing 1, 3, and 6 individuals.
[b] Geometric mean.
[c] Means sharing the same letter are not significantly different.
[d] ND = None detected at 0.1 ppm.

But, young ducks feeding only in local areas accumulated no residues indicating that not all nesting environments in Texas are contaminated.

SUMMARY

Fulvous Whistling-Ducks were collected near nesting areas in the rice fields of Texas in 1983 to determine if these birds continue to carry residue levels of organochlorine contaminants, and if the contaminants were acquired in Texas or Mexico. Adults were collected immediately after they arrived from wintering grounds and juveniles were collected in late summer before their departure to wintering grounds. Carcasses of 7 of 15 adults, some of which had been feeding in rice fields, contained residues of dieldrin in low to moderately high levels and 4 contained low levels of endrin. None of 16 flightless juveniles contained organochlorine residues. The contaminated adults were most likely exposed to aldrin or dieldrin via illegal treatment of rice seed with aldrin in some nesting areas of Texas.

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NOTES AND NEWS

North American Loon Fund Announces 1986 Grants.—In April, the North American Loon Fund, winner of a 1986 Chevron Conservation Award, approved grant requests totalling over $15,000. Each year NALF accepts grant proposals for research, management or education projects that may yield useful information for Common Loon conservation in North America. NALF raises monies through donations and the sale of loon-related items including the recording "Voices of the Loon." For further information contact: RAWSON L. WOOD, *% North American Loon Fund, Main St., Meredith, New Hampshire 03253.*