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## BIRD CASUALTIES AT A CENTRAL FLORIDA POWER PLANT: 1982-1986

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**Abstract.**—A total of 2,301 birds representing 50 species was collected from 23 September 1982 through 31 December 1986 at the Crystal River Generating Facility, Citrus County, Florida. Highest mortality occurred during fall suggesting the importance of the peninsular Gulf coast for some neotropical migrants. White-eyed Vireos (*Vireo griseus*) and Red-eyed Vireos (*V. olivaceus*) accounted for 58% of the total kill. A reduction in mortality in 1985-86 may be due to reduced lighting at the base of the tall strobe-lit stacks.

The study of bird mortality at man-made structures has been a useful tool in documenting species occurrence, migration patterns, and many other facets of avian biology (Crawford 1981). In September 1982, two sizeable bird kills were reported at the Crystal River Generating Facility, Citrus County, Florida (Maehr et al. 1983). The concern over this large accident stimulated a survey to determine the regularity of these migration events. We report the findings of 4.5 years of bird casualty collections at this peninsular Gulf coast power plant.

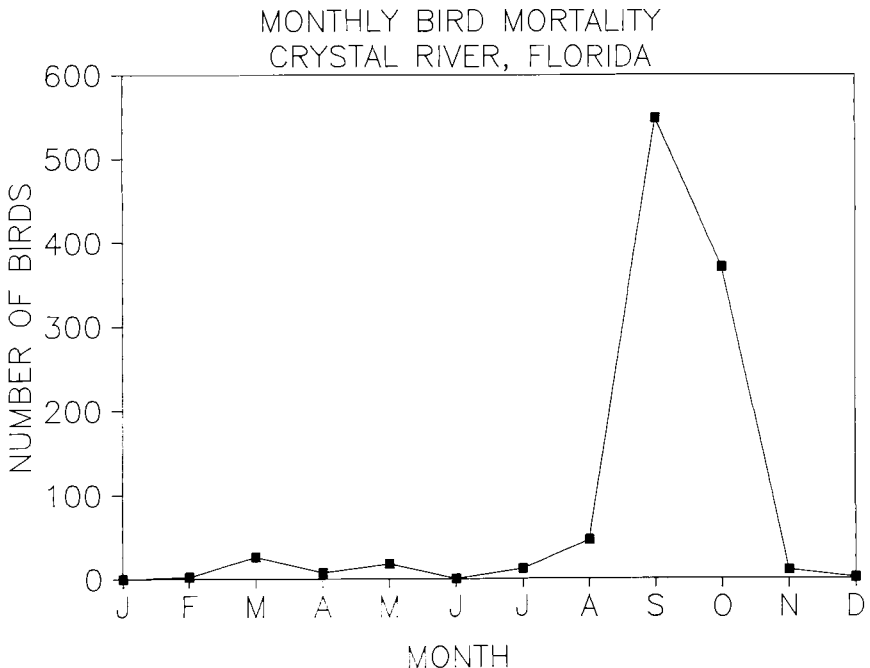
### METHODS

The Crystal River Generating Facility is dominated by two pairs of 152 m and 183 m tall chimneys. A more detailed description of the site and identification procedures can be found in Maehr et al. (1983). Birds were collected from 23 September 1982 through 31 December 1986 during searches conducted an average of five times per week between 0700 h and 0900 h, then frozen for subsequent identification. Specimens were deposited in the collection of the Florida State Museum, Gainesville, Florida. Scientific names of birds appear in Table 1. Because only 3.3 months were represented in 1982, that year's mortality figures were used only for comparisons of total species and individuals. Individual species variation was examined only with complete annual data sets (1983-1986).

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## RESULTS AND DISCUSSION

From 23 September 1982 through 31 December 1986, 2,301 birds were collected and identified at the Crystal River Generating Facility (Table 1). This total included 50 species ranging from 11 in 1986 to 37 in 1982. A peak in individual mortality was detected during September and October (Fig. 1). Similarly, number of species peaked in October but a secondary peak also occurred in April (Fig. 2). The majority of these birds were neotropical migrant species on their way to wintering grounds (Faaborg and Terborgh 1980). The temporal variation in individual and species mortality suggests a concentration of migration activity during fall and an apparent avoidance of peninsular Gulf coast Florida during spring. This is in contrast to the east coast Vehicle Assembly Building kills where spring migrants greatly outnumbered fall migrants (Taylor and Kershner 1986). The seasonal variation at Crystal River is similar in most cases to the patterns reported by Stoddard and Norris (1967) and Crawford (1974) in northwest Florida. However, exceptions to this observation were noted. The total of 988 White-eyed Vireos represents



**Figure 1. Monthly variation in bird mortality at the Crystal River Generating Facility, Citrus County, Florida, 1983-1986.**

**Table 1. Annual mortality totals for bird species at the Crystal River Generating Facility, Citrus County, Florida, 23 September 1982-31 December 1986.<sup>1</sup>**

Species	1982	1983	1984	1985	1986	Total
Clapper Rail <i>Rallus longirostris</i>	0/1	0/1			0/1	3
Sora <i>Porzana carolina</i>	0/1					1
Black Rail <i>Laterallus jamaicensis</i>			0/1			1
Yellow-billed Cuckoo <i>Coccyzus americanus</i>	0/4	0/6	0/1	1/1	0/2	15
Yellow-bellied Sapsucker <i>Sphyrapicus varius</i>		0/2				2
Eastern Kingbird <i>Tyrannus tyrannus</i>		0/1				1
Eastern Wood Pewee <i>Contopus virens</i>			0/1			1
Acadian Flycatcher <i>Empidonax virescens</i>	0/15		0/6		0/2	23
Marsh Wren <i>Cistothorus palustris</i>			2/1	1/1	0/2	7
Sedge Wren <i>Cistothorus platensis</i>		0/2				2
Ruby-crowned Kinglet <i>Regulus calendula</i>	0/3	0/1			0/1	5
Veery <i>Catharus fuscescens</i>	0/1					1
Gray Catbird <i>Dumetella carolinensis</i>		0/5	0/5	0/11		21
White-eyed Vireo <i>Vireo griseus</i>	0/656	1/47	4/229	0/15	13/23	988
Yellow-throated Vireo <i>Vireo flavifrons</i>	0/17	0/2	0/4			23
Solitary Vireo <i>Vireo solitarius</i>	0/3			0/1		4
Red-eyed Vireo <i>Vireo olivaceus</i>	0/137	1/41	0/148	0/14	0/4	344
Prothonotary Warbler <i>Protonotaria citrea</i>			0/2			2
Tennessee Warbler <i>Vermivora peregrina</i>	0/2		0/1			3
Northern Parula <i>Parula americana</i>	0/161	0/19	3/38	1/2	3/1	228
Black-and-white Warbler <i>Mniotilta varia</i>	0/22	0/1	0/1		0/1	25
Black-throated Blue Warbler <i>Dendroica caerulescens</i>	0/1	0/1	0/3			5
Blackburnian Warbler <i>Dendroica fusca</i>	0/5			0/1		6

Table 1 (continued)

Species	1982	1983	1984	1985	1986	Total
Chestnut-sided Warbler <i>Dendroica pensylvanica</i>	0/8					8
Magnolia Warbler <i>Dendroica magnolia</i>	0/18					18
Black-throated Green Warbler <i>Dendroica virens</i>	0/1					1
Yellow-throated Warbler <i>Dendroica dominica</i>	0/1	0/2			1/0	4
Yellow-rumped Warbler <i>Dendroica coronata</i>	0/1	0/1				2
Prairie Warbler <i>Dendroica discolor</i>	0/25	1/5	0/13			44
Pine Warbler <i>Dendroica pinus</i>		0/2	0/1			3
Palm Warbler <i>Dendroica palmarum</i>	0/78	1/6	0/28	0/7		120
Yellow Warbler <i>Dendroica petechia</i>	0/1	0/1				2
Connecticut Warbler <i>Oporornis agilis</i>	0/1		0/1			2
Kentucky Warbler <i>Oporornis formosus</i>	0/5		0/2			7
Hooded Warbler <i>Wilsonia citrina</i>	0/26	0/2	0/3			31
Worm-eating Warbler <i>Helmitheros vermivorus</i>	0/3	1/0	0/3			7
Swainson's Warbler <i>Limnothlypis swainsonii</i>			0/1			1
Ovenbird <i>Seiurus aurocapillus</i>	0/14	2/2	0/8	0/1		27
Northern Waterthrush <sup>2</sup> <i>Seiurus noveboracensis</i>	0/3		0/2			5
Common Yellowthroat <i>Geothlypis trichas</i>	0/105	3/12	3/71	0/22	2/0	219
Yellow-breasted Chat <i>Icteria virens</i>	0/3		0/1			4
American Redstart <i>Setophaga ruticilla</i>	0/36	4/9	3/11	0/3		66
Indigo Bunting <i>Passerina cyanea</i>	0/2	0/1	0/2	0/5		10
Grasshopper Sparrow <i>Ammodramus savannarum</i>	0/2			0/2		4
Savannah Sparrow <i>Passerculus sandwichensis</i>	0/1					1
Swamp Sparrow <i>Melospiza georgiana</i>		0/1		0/1		2

Table 1 (continued)

Species	1982	1983	1984	1985	1986	Total
Bobolink	0/1					1
<i>Dolichonyx oryzivorus</i>						
Red-winged Blackbird			0/1			1
<i>Agelaius phoeniceus</i>						
Scarlet Tanager			0/1			1
<i>Piranga olivacea</i>						
Summer Tanager	0/1					1
<i>Piranga rubra</i>						
Number of species	0/37	8/25	6/29	3/15	4/9	50
Total individuals	1365	186	605	90	56	2301

<sup>1</sup>Spring/summer.

<sup>2</sup>In Maehr et al. (1983) Northern Waterthrush was mislabeled as Louisiana Waterthrush (*S. motacilla*).

over 70% of the 25-year total for Leon County, Florida (Crawford 1981). Most of these vireos were collected at Crystal River during the fall (Fig. 3), whereas the species is encountered more frequently in northwest Florida during the spring. The relatively low numbers of White-eyed Vireos reported by Crawford (1981) and Taylor and Kershner (1986) in the fall suggests that the peninsular west coast may be an important migration corridor for this species. Stoddard and Norris (1967) found Red-eyed Vireos exhibited distinct migration peaks in spring and fall while we noted high numbers only during the fall (Fig. 3).

Mortality patterns similar to northwest Florida were noted for Northern Parula, Palm Warbler, Common Yellowthroat, and American Redstart (Fig. 3). Taylor and Anderson's (1973) and Taylor and Kershner's (1986) relatively low numbers of Red-eyed and White-eyed vireos and extremely high numbers of Common Yellowthroat, Ovenbird, and Black-throated Blue Warbler suggests, at least for these autumn migrants, geographically distinct movement patterns. Ours and the above study are similar in having relatively few (<20/year) Yellow-rumped Warblers despite their abundance in Florida during winter. Stoddard and Norris (1967) reported an annual average of nearly 180 per year at the WCTV tower in Leon County, Florida. Seasonal mortality patterns similar to east central Florida were observed for Yellow-billed Cuckoo, Gray Catbird, Black-and-white Warbler, Prairie Warbler, Northern Parula, American Redstart, and Ovenbird. Opposing patterns were noted for Common Yellowthroat, Red-eyed Vireo, and Yellow-throated Vireo. Palm Warblers appeared in greater numbers during fall at Crystal River than in east-central Florida.

The bird casualties probably represent only a fraction of the total occurring during the study period. Without daily collections and predator control, a large proportion of the kill may have been taken by scavengers. Stoddard and Norris (1967) believed more than 50% of 4000 to 7000 birds killed on 8 October 1955 at the WCTV tower in northwest Florida were consumed by predators. We suspect the same was true during our study where scavenging probably was in effect long before the large kills at Crystal River in 1982. This may explain the fast rate at which we observed bird carcasses being removed by Ring-billed Gulls (*Larus delawarensis*). An additional amount undoubtedly was consumed by mammalian opportunists (i.e. raccoon [*Procyon lotor*], house cat [*Felis catus*]). Nonetheless, the consistency of sampling probably reflects true patterns in bird mortality.

Probably few options exist for reducing mortality at the Crystal River facility, although the conditions for safe passage of migrants probably is better now than it was in 1982. Throughout our study the stacks were illuminated with strobe lights which are thought to be less attractive than colored safety lights (Quilliam 1981, Taylor 1981). However, from

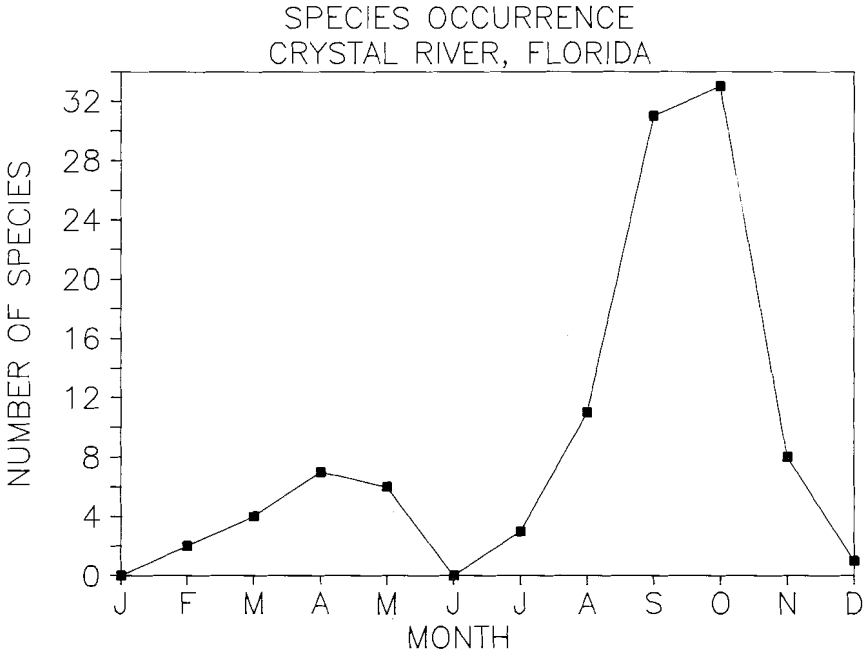


Figure 2. Monthly variation in species frequency of occurrence at the Crystal River Generating Facility, Citrus County, Florida, 1983-1986.

1982 through 1984, incandescent construction lights illuminated the base of the taller stacks throughout the night. Construction was completed and associated ground lighting around the taller pair of stacks was re-

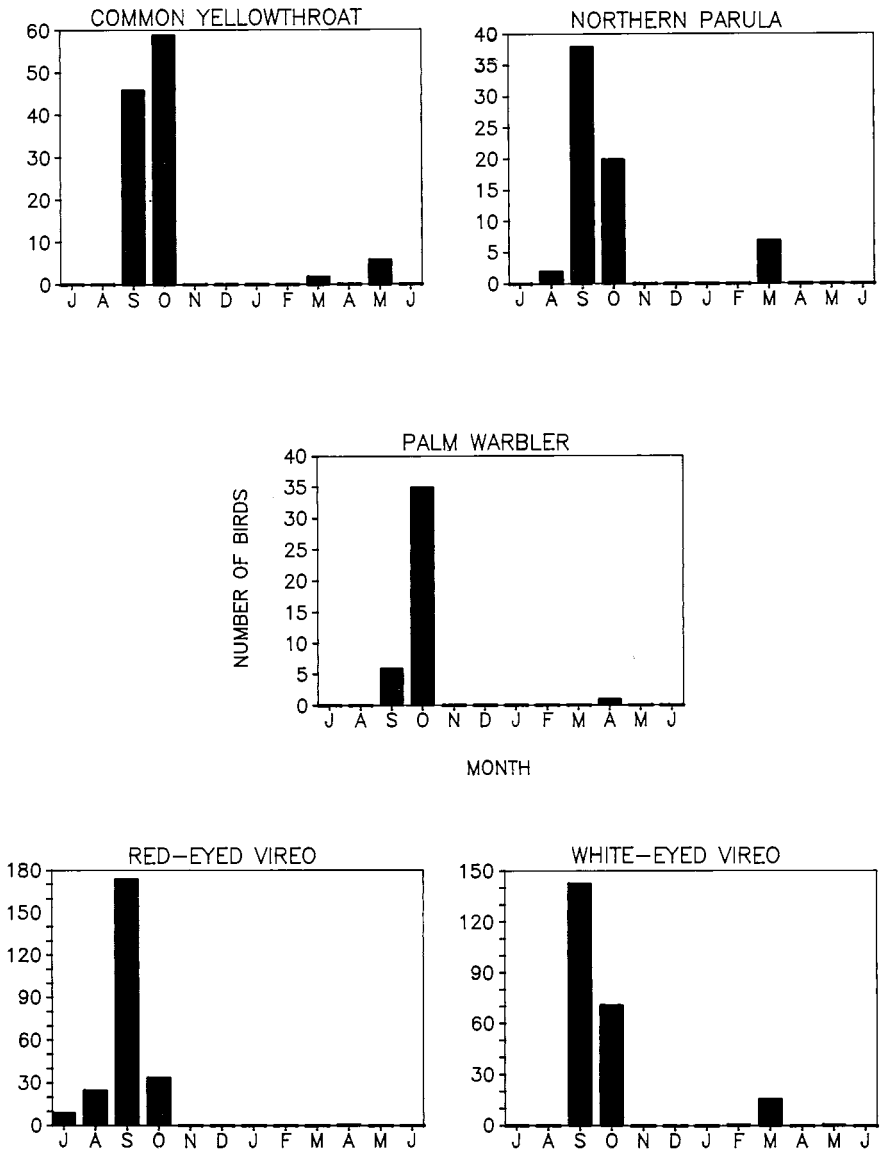


Figure 3. Monthly variation in White-eyed Vireo, Red-eyed Vireo, Northern Parula, Palm Warbler, and Common Yellowthroat mortality at the Crystal River Generating Facility, Citrus County, Florida, 1983-1986.

moved by the end of 1984, thus eliminating a potential attraction and mortality cause. These changes may explain the low numbers of birds and species recovered in 1985 and 1986.

Considerable concern exists for the conservation status of neotropical migrants in light of land use trends resulting in fragmented habitats on both breeding and wintering grounds (Terborgh 1980). However, the integrity of tropical regions may be more critical in the face of rapid deforestation and habitat fragmentation occurring there (Whitmore 1980). Nonetheless, neotropical migrants face formidable pressures at both ends of their range as well as while in transit between them. It is possible that continual losses of large numbers of individuals during migration may contribute to local breeding and wintering population declines or extirpations. However, few, if any, band recoveries are found at kill sites and, thus, it has not been possible to document site specific breeding or wintering sites of transients.

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