SUMMER USE OF TWO CENTRAL FLORIDA PHOSPHATE SETTLING PONDS BY FLORIDA DUCKS[1]

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Abstract: Night-light capture rates for flightless juvenile and adult Florida ducks (*Anas fulvigula fulvigula*) were used to assess the possible significance of phosphatic clay settling areas as post breeding habitat. Capture rate was significantly below ($P < 0.05$) that documented for brackish water areas on the Merritt Island NWR, but was similar ($P > 0.05$) to the capture rate for brackish water habitat on Florida's Gulf Coast and fresh water habitat in Southeast and Central Florida. Analysis of the esophageal contents of ten actively feeding specimens collected during the study suggest the ample availability of invertebrate food items believed essential in the satisfaction of protein requirements of laying hens and ducklings. Other aspects of nesting and post nesting ecology and management implications are discussed.

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The Florida duck (*Anas fulvigula fulvigula*) is a year-round resident of the southern two-thirds of peninsular Florida and an important game species throughout much of its range (Chamberlain 1960). Although wetlands habitat is extremely abundant within the state, large scale elimination of or deterioration in the quality of habitat within the species' range has resulted from the construction of flood control projects (Goodrick and Milleson 1974, Montalbano et al. 1979a), and agricultural (Sincock et al. 1964) and urban development (Marshall 1968). Observations of extensive winter use by resident and migratory ducks (Montalbano et al. 1978, Montalbano et al. 1979b) and summer use by Florida ducks of phosphatic clay settling ponds suggested that these areas might be important as brood rearing and molting habitat. This report documents and assesses the significance of this use.

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STUDY AREAS

Clay settling ponds are used extensively in Florida's Central Land Pebble phosphate mining district (portions of Hardee, Hillsborough, Manatee, and Polk counties) for the retention and settling of clay slurries generated in the processing of phosphate ores. Development typically begins with the construction of a retaining levee and a system of water control structures around a complex of old mine cuts and adjacent piles of overburden removed during mining. Herbaceous vegetation is established on retaining levees following construction to facilitate levee stabilization. Slurry is then pumped into the impoundments. As clays settle, excess water is decanted from the system using the water

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control structures. Periodically all standing water is removed to accelerate settling. During these drawdowns, emergent vegetation that has volunteered on substrates proliferates rapidly. Irregularities in substrate deposits resulting from the formation of surface drainage channels and concentration of sediments near inflow points frequently develop a mosaic of emergent vegetation, open channels, and open depressions (Montalbano et al. 1978).

Two settling areas in Polk County, Florida were selected based on observed usage by Florida ducks, accessibility, and willingness of landowners to cooperate in the project. The Agrico Payne Creek Site (261 ha) and the Borden Teneroc Site (219 ha) are typical of recently active settling ponds in this area. Both contained extensive stands of emergent vegetation; predominantly cattail (*Typha* sp.) and primrose willow (*Ludwigia* spp.) interspersed with areas of open water over slurry substrates. An obvious difference between the two sites was the dominance of open water areas on the Borden Teneroc Site by the exotic submerged aquatic plant hydrilla (*Hydrilla verticillata*).

METHODS

Florida duck broods, accompanying females, and adults in various stages of molt were captured during 1976, 1977, and 1978 using night-light techniques described and used by La Hart (1970) and Fogarty and La Hart (1971) in Florida duck capture efforts during 1969 and 1970. Birds were sexed and aged using a combination of cloacal examination and plumage characteristics described by Kortright (1967:31-35). Catch per hour of capture effort was computed for comparison (Student's t-test) with data reported by Fogarty and La Hart (1971) and D. E. La Hart (personal communication) for the capture effort conducted in 1969 and 1970.

Ten Florida ducks were collected in Polk County phosphate settling ponds during the period April 9, 1976—September 15, 1976. Food habits were analyzed in an effort to better understand summer use of settling ponds by this species (Martin et al. 1951, Swanson and Bartonek 1970, Korschgen 1971). An effort was made to collect only actively feeding ducks. While conditions did not always permit observation of feeding activity for at least 10 minutes (Krapu 1974a, 1974b, Swanson et al. 1974a), all ducks were believed to be actively feeding immediately prior to collection. Specimens were promptly retrieved with a trained retriever dog, and an 80 percent ethyl alcohol solution immediately introduced into esophagi to minimize post-mortem digestion (Swanson and Bartonek 1970). Food items were identified and volumes determined by fluid displacement. Results are presented as percent frequency of occurrence and aggregate percent (mean of volumetric percentages) to minimize bias and insure equal weight for all specimens in results (Swanson et al. 1974b).

RESULTS AN DISCUSSION

Nine nights involving 24.8 hours of trapping effort resulted in the capture of 91 Florida ducks, a capture rate of 3.7 ducks per hour. Comparison using the Student's t-test indicated that capture rates were similar for the trap sites ($P > 0.05$, $n=9$), averaging 4.3 birds per hour for 6.5 hours of effort on the Borden Teneroc Site, and 3.5 birds per hour for 18.3 hours of effort on the Agrico Payne Creek Site. Forty-three (47%) of the birds captured were immatures, 46 (51%) were adults, and 2 were inadvertently released prior to determination of sex and age. Initially, all birds captured were assumed to be flightless. As capture efforts progressed, it became apparent that some were capable of flight. Thereafter, all birds were carefully examined to determine flight capability. Nineteen (73%) of 26 immatures examined had not attained flight capability. Twenty-nine (94%) of 31 adult birds examined were not capable of sustained flight. Eighteen (62%) of the flightless adults were in molt, 8 (28%) had not yet molted, and 3 (10%) had new primaries and secondaries fully grown, but were not yet capable of sustained flight.

Catch rate in phosphate settling ponds was significantly lower ($P < 0.05$, $n=22$) than the 9.8 birds per hour reported for coastal habitat on the Merritt Island NWR during 1969 (D. E. La Hart personal communication), and substantially below the 9.3 and 12.0 birds per hour reported by Fogarty and La Hart (1971:192) for the Merritt Island NWR during 1969 and 1970 respectively. No statistical comparison was attempted for the catch rates reported by Fogarty and La Hart (1971) since they did not use a format that permitted calculation of variability in nightly catch rates. Catch rate in phosphate settling ponds was similar ($P > 0.05$, $n=15$) to the 4.8 birds per hour reported for three brackish water habitats on Florida's Gulf Coast (D. E. La Hart personal communication), and similar ($P > 0.05$, $n=18$) to the 3.4 birds per hour reported for fresh water habitat on the Loxahatchee NWR and the Upper Kissimmee chain of lakes in Central Florida (D. E. La Hart, personal communication).

In spite of efforts to collect actively feeding birds, 4 of the 10 birds collected did not contain measurable quantities of food in esophagi and are excluded from the presentation. Swanson et al. (1974a) reported that 8 of 115 blue winged teal (*Anas discors*) contained no esophageal foods even though they appeared to be actively feeding for at least 10 minutes prior to collection.

Animal foods averaged 60.8 $\pm$ 38.8 percent of the food items with Diptera and Coleoptera constituting 92.4 percent of the animal material (Table 1). Midges (predominantly larvae) and predacious diving beetle larvae were the two most common individual food items.

A considerable body of evidence suggests that the seasonal appearance and abundance of animal foods is an important stimulus to the initiation of nesting in several species of prairie nesting puddle ducks (Krapu 1974a, 1974b, Krapu and Swanson 1975, Swanson et al. 1974a). A marked increase in the consumption of invertebrate foods by pintails (*Anas acuta)* (Krapu 1974a), gadwalls *(Anas strepera)* (Serie and Swanson 1976), and blue winged teal hens (Swanson et al. 1974a) occurred concurrent with the onset of the nesting season and is believed related to an increased protein demand by hens during reproduction (Krapu and Swanson 1975). Beckwith and Hosford (1955) suggested that a similar shift in Florida duck food consumption occurs during the summer months. The high rates of consumption of midge larvae reported here is consistent with the findings of Montalbano et al. (1978) in suggesting the ready availability of this food item in settling pond substrates. Such an abundant source of invertebrate protein is also an important requisite for brood rearing habitat (Bellrose 1976:259. Leitch 1964). La Hart and Cornwell (1970) indicated that Florida duck broods relied heavily upon aquatic invertebrates.

Although current waterfowl management strategies do not adequately address habitat requirements during the molt (Prince 1977), it is known that molting areas must provide abundant food and sufficiently dense cover to insure isolation (Fredrickson and Drobney 1977). The dense stands of cattail, primrose willow, and willow (*Salix* sp.) interspersed with shallow open ponds and drainage channels which commonly occur in settling areas (Montalbano et al. 1978) would seem to provide isolation, while abundant invertebrates furnish a source of readily available food (Montalbano et al. 1978).

The extensive levee system which encloses settling ponds, together with overburden islands which frequently occur within these complexes may provide suitable nesting areas. Stieglitz and Wilson (1968) reported the use of both spoil islands and mosquito impoundment levees on the Merritt Island NWR as Florida duck nesting areas. The heavy cover, including dense grasses (Sprunt 1954, Stieglitz and Wilson 1968), and brush or shrub cover (La Hart 1970, Sprunt 1954, Stieglitz and Wilson 1968) required for nesting is common on overburden islands and levees associated with settling ponds.

TABLE 1. Esophageal contents of 6 feeding Florida ducks collected on phosphate settling ponds in Polk County, Florida during April 9, 1976-August 12, 1976.

Food Item			
Scientific Name	Common Name	Percent Occurrence	Aggregate Percent
Animal		100.0	60.8
Arthropoda		100.0	60.7
Insecta	Insects	100.0	60.7
Diptera	Flies, Midges	83.3	35.0
Tendipedidae	Midges	50.0	32.0
Ephydridae	Shore flies	33.3	3.0
Coleoptera	Beetles	50.0	21.2
Dysticidae	Predacious diving beetles	33.3	15.6
Chrysomelidae	Leaf beetles	16.6	5.6
Odonata	Dragonflies	16.6	4.4
Libellulidae	Dragonflies	16.6	4.4
Hemiptera	True bugs	16.6	0.1
Corixidae	Water boatmen	16.6	0.1
Ephemeroptera	Mayflies	16.6	T
Ephemeridae	Burrowing mayflies	16.6	T
Annelida	Leeches	16.6	0.1
Plant		50.0	24.2
Leersia oryzoides	rice cutgrass	16.6	9.7
Cyperus sp.	flat sedge	16.6	5.6
Graminae	grass seeds	16.6	5.6
Echinochloa walteri	water millet	33.3	3.0
Polygonum sp.	smartweed	16.6	0.3
Unidentifiable food		66.6	14.9

T < 0.1

The presence of flightless immature birds confirms that phosphatic clay settling ponds are used for brood rearing and suggests that nesting occurs in close proximity. The occurrence of substantial numbers of molting and pre-molt flightless adults indicates that these areas may also provide important habitat during the post-breeding molt. Capture rates similar to those reported for other inland habitats suggest that certain settling ponds may have comparable value as inland breeding and molting areas for Florida ducks.

Management Implications

Increased use of mined land by certain wildlife species as a result of alteration of habitat features has been reported by Allaire (1978) and several authors (Whitmore and Hall 1978, Montalbano et al. 1978, Sandusky 1978, Uhler 1964) have discussed the potential for development of waterfowl habitat on strip mined land. The use of reclaimed coal strip mines in Illinois as breeding and brood rearing areas by mallards (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), and blue-winged teal has been documented (Sandusky 1978), and Wenner (1979) reported wood duck use of nest boxes in north Florida phosphate settling ponds. However, there is a paucity of information on the use of clay settling ponds as breeding and post-breeding areas by other waterfowl species. A female hooded merganser (*Mergus cucullatus*) accompanied by a brood was observed in a north Florida settling pond, but this was reported as an unique and unusual record (Reppening and Wester 1978). The present study appears to be the first to document significant use of phosphate settling pond habitat by breeding and molting waterfowl in central Florida.

Habitat destruction may be critical factor affecting the status of Florida duck populations. Extensive use of phosphate settling areas by breeding and molting Florida ducks suggests that these areas may partially compensate for this loss. However, clearer understanding of the ecology of phosphate settling ponds and the biology of Florida duck populations utilizing them is necessary to formulate management strategies which will sustain and optimize their value as production habitat.

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