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### **Author**

Rand, Alison C.

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# FACTORS RESPONSIBLE FOR THE SUCCESSFUL ESTABLISHMENT OF EXOTIC AVIAN SPECIES IN SOUTHEASTERN FLORIDA

ALISON C. RAND, Marine Sciences Under Sails, P.O. Box 3994, Hollywood, Florida 33023

**ABSTRACT:** Presently southeastern Florida has at least 24 established exotic avian species from both New and Old World families. This much man-modified region of Florida is characterized by the Atlantic Coastal Ridge in Palm Beach, Broward and Dade Counties and the Florida Keys of Monroe County. Because of the draining of the Everglades to the west, the filling of the mangroves on the seaward side, and the accompanying urban-suburban sprawl, many exotic plant species have invaded the Ridge thus preparing the environment for introduced birds. The Red-whiskered Bulbul, *Pycnonotus jocosus*, illustrates this point. Most exotic avian species have appeared and colonized within the last 20 years, probably the result of a developed preconditioned environment and improvement in the transportation of exotic wildlife. Birds which have succeeded are generally those which are non-migratory, gather in communal roosts in the non-breeding season and are not obligate but generalized feeders. The exotics may be filling niches not presently filled in Florida's depauperate avifauna.

Salutations in Florida generally involve the question: "Are you a native?" So often the answer is no. Looking at the other fauna of the area as well as the flora, we see that this same answer is also true for them. Conspicuous portions of the many different habitats in southeastern Florida are composed of varying numbers of exotic species, especially birds. What are some of these avian exotics of southeastern Florida?

In 1973 Owre summarized the exotics then known in south Florida. Except for population changes, the situation remains much the same today. The Canary-winged Parakeets (*Brotogeris veriscolurus*) were noted in the late 1960's. In 1969 Ogden reported 50 roosting birds and by 1972 Shroads (1974) counted over 700 individuals. Since then the population has increased and spread north and south. Flocks of this parakeet have often been accompanied by individual Monk Parakeets (*Myiopsitta monachus*), also appearing in the late 1960's. The Red-crowned Parrot (*Amazona viridigenalis*) of Mexico is presently nesting and roosting in metropolitan Miami and Fort Lauderdale and can be seen south to Key West, 160 miles away. For at least 17 years, the Asian Rose-ringed Parakeet (*Psittacula krameri*) has been known in the same area. No less evident are the common pet Budgerigars (*Melopsittacus undulatus*).

Besides the breeding parrots, other psittacids are known to reside in the area but not yet known to be breeding successfully. Orange-fronted Parakeets (*Aratinga canicularis*), Brown-throated Parakeets (*Aratinga pertinax*), Orange-chinned Parakeets (*Brotogeris jugularis*), White-fronted Amazons (*Amazona albifrons*) and Orange-winged Amazons (*Amazona amazonica*), all Neotropical, are among those evident in the suburban areas. Most have appeared during the 1970's.

Other popular non-passerines becoming established include the pigeons and doves as well as two species of ducks. Not only is the cosmopolitan Rock Dove (*Columba livia*) found in southern Florida, but also the Inca Dove (*Scardafella inca*), the Ringed Turtle Dove (*Streptopelia* sp.) and the White-winged Dove (*Zenaida asiatica*). Near Miami's zoo are found populations of the Black-bellied Tree Duck (*Dendrocygna autumnalis*) and the West Indian Tree Duck (*Dendrocygna arborea*).

Caged birds are not restricted to the more vocal non-passerines but also the lively song birds of the world. The Red-whiskered Bulbul (*Pycnonotus jocosus*) is a case in point. A few having escaped from captivity in 1960 increased to about 250 by the winter of 1969-1970 and to 500 in 1973. The population has continued to grow and occupy a larger area. From West Palm Beach southward, the Hill Myna (*Gracula religiosa*) was found nesting in 1973 and a few even have given wolf-calls and whistles to University of Miami students. The European Starling (*Sturnus vulgaris*) began breeding in the Miami area about the same time. Since 1949 suburban Miami has become home for the Spotted-breasted Oriole (*Icterus pectoralis*) which has now spread some 150 miles north and across the Everglades to the west coast of Florida. *Thraupis virens*, the Blue-gray Tanager, started nesting activities in the early 1960's as probably did the Java Sparrow (*Padda oryzivora*). The latter were often attracted to the communal roosting assemblages of the House Sparrow (*Passer domesticus*), another exotic throughout the United States. Free-flying Brazilian Cardinals (*Paroaria coronata*) were first noted near the zoo and have subsequently spread north and south.

Why should all these exotics have appeared within the last 20 years? What factors have allowed these birds to become, at least seemingly, established? Will these introduced birds become a pest like some of the others we have heard about at this conference?

First, comments about the ecology and demography of southeastern Florida are in order. Southeastern Florida is considered to be the eastern portion of the land extending south from Lake Okeechobee including Palm Beach, Broward, Dade and Monroe counties. A narrow, elevated strip, known as the Atlantic Coastal Ridge, with the Everglades to the west and mangroves and beaches on the seaward side, characterizes this section running from north of Palm Beach to south of Homestead. Mangrove communities continue below the ridge to Key West in Monroe County. Here the temperate and tropical zones intermingle allowing for pineland and tropical hardwood hammock development through at least 1930. Since then much of the Everglades have been drained and the mangrove habitat filled.

Colonization by exotics is often facilitated in man-modified regions (Elton 1958). Changes in the ecology of southeastern Florida have probably been as rapid and as profound as any generated by man in the United States. The increase in human population, by 1970 some ten times that of 1930 in these four counties (Bur. Census 1932, 1971), and the accompanying urban-suburban sprawl which now covers almost the entire Ridge are remarkable. The natural ecological communities of the Atlantic Coastal Ridge are largely gone, while the flora of remaining open spaces is largely exotic. Sturrock and Menninger (1946) estimated the number of species of exotic trees and shrubs established in southeastern Florida at more than 1000.

The adaptations of zoochorous plants that make them attractive to birds (Snow 1971) delight landscapers. Urban and suburban southeastern Florida are now extensively planted with exotic fruiting plants. Showy flowering (often nectar-containing) exotic trees and exotic shade trees which line boulevards and shelter parks and yards are widely planted. Fruit trees have been planted by both home gardeners and commercial growers. The "Gold Coast" has become a botanical garden representative of the world's tropics. Flowering and fruiting plants provide variety and abundance of food for birds and have masked any seasonality of flowering or fruiting characteristic of the native flora. At every season throughout the year, some species are in fruit or flower.

Let us look at the life history study of the Red-whiskered Bulbul in Florida to get a better understanding of the exotic avian situation.

This bird belongs to an Old World family, the Pycnonotidae, which contains about 100 species and has an essentially tropical distribution. Pycnonotus jocosus, native to India, Burma and portions of Asia to the south and east, is commonly found in agricultural areas, in villages and about gardens. Because of its good nature and attractive song, it makes a popular cagebird. Escape from captivity seems inevitable and P. jocosus is now established in Mauritius, Australia, Sumatra and at three locations in the United States - Florida, California and Hawaii.

Bulbuls have been observed consuming some insects and other arthropods, although the mainstay of their diet consists of berries and fruit (Austin 1961). Flower parts, nectar, seedlings and growing shoots are also consumed. This species damages fruits of various types in India (Baker 1922) and Australia (Chaffer 1933; Barrett 1947). Because of this fact, concerns arose when the bulbul population in South Miami began to increase.

A morphological study of this bulbul indicates that the bird cannot manipulate objects which are too large. They use a median ridge on the inside of the rhinotheca to break up or scrape objects between their mandibles. It therefore appears that drupes, berries, small syconia and other fruits easily mouthed are a principal food source. Included would be the ubiquitous Brazilian peppertree (Schinus terebinthifolius), an introduced species from South America widely disseminated by birds. Important also are the syconia of the fig trees (Ficus spp.), two of which are native species and 19 are exotic species. Of the several Asian fig species (Barrett 1951) planted in Miami, the two from India are fed upon both in Miami and India (Carleton and Owre 1975; Hume 1889).

Lantana drupes, considered a favorite food of the Indian population, are taken in Dade County also. A total of 24 exotic plant species are known to be consumed by the Red-whiskered Bulbul in this area. It was found that captive bulbuls readily ate the four native fruits they were offered, including wild coffee (Psychotria undata), Florida holly or Dahoon (Ilex cassine), French mulberry (Callicarpa americana) and Virginia creeper (Parthenocissus quinquefolia).

Commercial fruits were of special interest in this bulbul study. Captive birds ate the small fleshy fruits of mulberries (Morus rubra) and Barbados cherries (Malpighia punicifolia). Both Indian (Baker 1922) and south Florida birds (Carleton 1971) are known to consume the Indian raspberry (Rubus albescens). The exotic loquat (Eriobotrya japonica), consumed in Asia but only sparsely so in Florida, were the largest fruits the bulbul was seen probing its bill into and eating.

Mangos (Mangifera indica), avocados and citrus fruits are very important to the economy of south Florida. It was found that because of the bulbul's morphology they did not penetrate skins of these three fruits. Captives ate readily of sliced fruits and fruits which had skins punctured by Red-bellied Woodpeckers (Centurus carolinus) but not any intact fruits. A study of P. jocosus in Hawaii finds this to be true for mature avocado (vanRiper et al. 1979).

Insect gathering provides an additional source of nutrition for these passerines. Noticeable collection of insects occurs at the roosts when bulbuls make short, vertically oriented flights. Severinghaus (1978) suggests aerial feeding is typical for many bulbuls. Insects may provide significant means for maintaining metabolism during the night and renewing energy supplies swiftly in the morning since hawking for insects is most common at both dusk and dawn. P. jocosus has also been seen hunting insects along tree trunks, and to some degree, in cobwebs and foliage. Insects attracted by flowers are a part of the bulbul's diet as well as the nectar itself.

Flocking during the nonbreeding season is characteristic of this species and individuals begin to gather in roosting assemblages during the late summer. At the start of the roosting season, the birds generally flock in trees affording far less shelter than those they roost in for the remainder of the time. It should be noted that roosting is often in exotic vegetation, i.e. fig trees (Ficus benjamina), Napier grass (Pennisetum purpurem), Acalypha hedges, mangos and exotic palms. It was from these roosting assemblages that the population size was determined.

Dissociation of roosts began near the end of January and breeding began as early as February although most roosts remained intact until the end of February. Gonadal enlargement started two months before roost abandonment.

Nesting sites in Florida are entirely within suburbs, using virtually any shrub, hedge or small tree available, thus fitting Baker's (1922) description of *Pycnonotus jocosus* as a "species of civilization". Nests are made of rootlets and grasses and appear no different from those described for Indian birds (Baker 1935; Ali and Ripley 1971) including the items used for embellishment. Nesting territories in Florida were not highly "defended" areas and thus many bulbuls may gather about a nest (Fisk 1966).

Why have we seen so many exotics in the last 20 years and not before? As previously mentioned, the population growth of this region has been outstanding. With the people have come their pets or at least their desire to own a unique pet. Birds are very popular pets. Because of the restrictions on commercialization of the North American avifauna, tropical birds have become a prime target for harvesting. Thus southeastern Florida with its tropical climate would seem a logical port of entry for such species and their associated wholesalers and distributors. The increased demand for exotics along with improved aviation transport techniques for caged animals has allowed more than a half a million cage birds (excluding canaries and parrots), more than one million reptiles and approximately 30 million fish to pass through the Miami port of entry (Owre 1973).

These factors in themselves do not necessarily account for the many escapees. The climate entices people to have back yard aviaries, to hang their bird cages and to establish commercial adventures such as zoos and other tourist attractions in out-of-door settings. Escapes do occur whether it be accidental or by some well-intentioned individual at home, at the airport handling facility or at a distribution center. The number of escapees does not have to be great because recapture in such situations is next to impossible. Also, a certain number of birds are released deliberately into the environment because they are pretty, in particular the Scarlet Ibis (*Eudocinus ruber*) and the Egyptian Goose (*Alopochen aegyptiacus*).

Many of the cage bird escapees have little or no trouble maintaining themselves once they have found freedom. The southeastern Florida environment has become "preconditioned" with its world-wide exotic tropical flora. From the feeding and nesting activities of the Red-whiskered Bulbul, one sees that the bird is "preadapted" to its new environment to the point of even using the same plant species to feed from as in India. Virtually any tropical bird will find parts of the landscape which are "familiar" to it. Besides, with the wide variety of exotic flora, there is always some plant providing fruit, seeds or nectar at any time during the year. (Owre 1973)

None of Florida's exotic avian species seem to be an obligate feeder on a single food substance. All those that are insectivorous also feed upon plant materials. The Blue-gray Tanager is both frugivorous and insectivorous. The Spotted-breasted Oriole consumes both fruit and nectar. Bulbuls have been noted taking fruit, nectar and insects. The finches eat grain and insects.

The abundance of feeding stations in suburbia with their constant supply of polentas, mushes, fruits, grains and sugar water have no doubt contributed to the successful invasion by some of these exotics. The feeding station operator often benefited as much as the escapee because it would not only bring birdwatchers from far off places to look at the exotics but also would bring aesthetic satisfaction. The success of the Red-whiskered Bulbul might be such a case.

Characteristic of many of the established exotic avian species is their habit of forming post-breeding assemblages. During the late summer and fall, adults and young move into these communal roosts. From various social interactions observed in these assemblages, one may postulate advantage to the species. Just the pronounced tendency to flock would seem to be significant to "pioneering" individuals at the initial stages of colonizing vast new areas. Secondly, there seems to be safety in numbers with regard to predators. Communal roosting sites become "information centers" between members of the species, in particular the young. During daily activity, birds of the year will accompany already experienced adults in exploiting seasonally ripening food crops. An opportunity for synchronization of breeding probably occurs. Only at the onset of courtship do bulbul roosts dissociate. These and other factors connected with colonial habits, account for longevity which is important to the rapid population growth so characteristic of successful invaders. Besides the Red-whiskered Bulbul and various psittacids, these habits are characteristic of the European Starling and the House Sparrow. In Miami, the Java Sparrows are known to roost in neighboring or the same trees as House Sparrows.

Other exotics exhibit these social habits but to a lesser degree. The Indian Hill Myna searches for foods in groups of five or six and will roost in pairs or family groups. Flocking is characteristic of the Blue-gray Tanager according to comments in the literature. The Spotted-breasted Oriole moves in "small flocks" in the winter in both its homeland and Florida. (Owre 1973)

Characteristic, too, of these exotics is that none is migratory. Generally the population is confined to a certain area and does not decline in numbers as a result of events encountered during long flights between summer and winter feeding grounds. Therefore, the population level will stay high and the transferring of local information becomes more efficient. Irregular sightings are probably of birds exploring beyond the territory ordinarily frequented by the population. Exploring of this sort, even by these relatively sedentary species, must be basic to range extensions of an invading population.

Habitats and/or niches may be vacant in certain areas due to extinction of species or to a depauperate avifauna within that region. South Florida is considered to have evolved such an avifauna because at no time as it ever been connected to a tropical environment. Tropical species have thus invaded slowly by transoceanic methods. The Spotted-breasted Oriole appears to be filling a nectar consuming niche which has only slightly been exploited in the southeastern portion of Florida by Nearctic species. The success of some of the parakeets may be due to its ability to fill a niche once occupied by the Carolina Parakeet, extinct since the early 1900's.

Phillips (1928) recognized two categories of successful invaders: those successful briefly, then dwindling in numbers and disappearing, and those succeeding permanently. Which of these two categories will exotics of southeastern Florida pattern themselves after is hard to say. Nonetheless, each species must be considered individually. Once established will they become a pest, again is open to speculation. It seems that where the bulbul occurs or has been introduced various characteristics have exhibited themselves. For example, in India and Australia they are reported to damage fruit; in Mauritius the birds are known to eat eggs and young birds; while in Florida they are known to take small fruits and some insects; fruits of various sizes and types, including some of commercial value are consumed in California; in Hawaii their potential for damage is uncertain.

In other words, each exotic avian species must be studied carefully at the points of introduction with regard to its life history characteristics, such as feeding and nesting habits. Variations do occur from area to area possibly as a result of the specific set of introduced genes, not always representative of the original population. Therefore, the exotic may become a threat to local flora and fauna in some places but not in others. If food is the primary reason to classify a bird as a pest, a thorough observation and study including stomach analysis should be done.

However, the associated problems of exotics is not linked to just birds. Exotic fish are spreading along southern Florida's canals into the Everglades ecosystem. Exotic terrestrial invertebrates, amphibians, reptiles and mammals are also producing change, thus altering food webs and affecting niches of the native organisms. We need to consider change in the trade of exotics which hopefully would stop destruction of foreign ecosystems while preventing pollution of ours. But of real importance is education of the public in this situation so they, too, may subscribe to a philosophy which might read: "You may not introduce or harbor within the \_\_\_\_\_ ecosystem of \_\_\_\_\_ any species of plant or animal which, in the opinion of the knowledgeable authorities, might, if released, compromise the ecosystem" (Owre 1973).

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