

## CONSERVATION SECTION

### A CONSIDERATION OF THE EXOTIC AVIFAUNA OF SOUTHEASTERN FLORIDA

OSCAR T. OWRE

Walking catfish, poison toads and giant, garden-devouring snails—which have given Florida a surprising new dimension in publicity—are but part of a large and diversified exotic fauna now in accelerating recruitment. Birds form a conspicuous part of this fauna. Invasion by exotic animals is not, of course, unique to Florida. Surprise and misunderstanding exist, however, as to why these exotics have appeared so suddenly and in such numbers. Confusion and indecision prevail as to what, if anything, can or should be done about the situation.

To appreciate this exotic avifauna, one should examine aspects of the ecology and demography of southeastern Florida, particularly as these relate to the *Atlantic Coastal Ridge*, a narrow, somewhat elevated strip of land which extends from north of Palm Beach to south of Homestead. The ridge forms the eastern rim of the Everglades basin; on its seaward margin lie the mangrove swamps and beaches bordering the Atlantic. In 1930 the ridge was still in considerable part covered with pseudoclimax pineland and climax tropical hammock. Drainage of the Everglades was being accelerated and dredging and filling had been begun in the mangroves. The three counties which straddle the ridge (Palm Beach, Broward, and Dade) plus Monroe County which includes the Florida Keys to the south, contained in 1930 (Bur. Census, 1932) but 228,000 human inhabitants. Forty years later (Bur. Census, 1971) this population had grown to 2,289,000! The natural plant communities had all but been replaced by an urban-suburban sprawl which now covers the ridge along most of its more than 100 mile length. The ecology of the ridge—to express it mildly—had become a “disturbed” one. It is, of course, well recognized that disturbed ecological situations are more easily invaded by at least some types of exotic organisms. A number of factors contributing to this disturbed ecology are of particular significance with respect to invasion by an exotic avifauna.

Zeal displayed by those who would bring exotic animals to their lands appears to have been far outmatched by those engrossed with plant introductions. In Florida the introduction of exotic plants has been no haphazard affair. Within the U.S. Department of Agriculture's plant introduction centers, one of which was established in southern Dade County, David Fairchild (1943:viii) noted that “thousands of species and varieties of tropical trees and plants are growing.” Fairchild (and others) undertook far-ranging expeditions to search for tropical plants “to be distributed to plant lovers through these introduction gardens.” He referred (1947:56) to millions of Australian cajeput trees (*Melaleuca leucodendron*) being grown near Ft. Lauderdale for landscape gardeners. Appropriately enough, Fairchild (1947) entitled a book of reminiscences about his collecting activities “The World Grows Round My Door” (his residence being Coconut Grove, a suburb of Miami).

In development of the vast suburban areas of southeastern Florida, it has been general practice to scarify the land; eventual landscaping has been almost exclusively with exotic plants. (Nurseries seldom stock species of native trees and shrubs.) Exotic plants, usually species popular for their showy flowers and ornamental or edible fruit, have largely replaced the native flora of the *Atlantic Coastal Ridge*. Even the native shade trees have

been ignored and, among other kinds of trees affording much shade, numerous species of exotic *Ficus* (in place of two native species of *Ficus*) now line endless miles of suburbia's roadsides. Over wide expanses of southeastern Florida native plants are almost entirely lacking.

Some successful invaders have been described as "preadapted" to a new environment (Allee et al., 1949). Southeastern Florida, one might well say, has been "preconditioned" to a surprising extent for exotic invasion. Thus Carleton (1971) found the Red-whiskered Bulbul (*Pycnonotus jocosus*), introduced from India, roosting in exotic trees native to India, feeding to some extent upon the same fruit the species is known to consume in India and even building nests with plant materials the species has been reported to construct nests with in India.

It should be stressed that the flora of southeastern Florida now contains elements of the world's tropics. Virtually any exotic tropical bird will find aspects of the landscape which are "familiar" to it. Moreover, any former seasonality in flowering and fruiting imparted by the native flora has been much modified, some plants from somewhere now furnishing fruits, seeds, and nectar at every season.

The development of commercial aviation took place as the human population of the *Atlantic Coastal Ridge* exploded. Birds are popular pets. Most Northern Hemisphere countries of the Temperate Zone no longer allow commercialization of their avifaunas. Many of the world's tropical countries do. Tropical birds attract the imagination. Cargo flights originating in the tropics now could transport caged animals with rapidity and therefore minimal mortality to almost any point on the planet. What was more logical than to bring flights destined for North America to southeastern Florida where, in a tropical milieu, the animals could be held until wholesaled and redistributed? Importers established themselves in and about Miami. Some enterprising dealers transformed their holding areas into show places for tourists, thus earning additional return on their investments. The area rapidly became an important center for the traffic in exotic tropical vertebrates. In 1971 more than half a million cage birds (excluding canaries and parrots), more than one million reptiles, and approximately 30 million fish were passed through the Miami Port of Entry (U.S. Dept. Interior, 1972)!

Southern Florida's salubrious climate merits stressing at this point in discussion. The climate entices citizens out-of-doors and encourages outside activities. Zoos, tourist attractions, establishments of some animal importers, the back yard aviaries which dot suburbia, and the bird cages which swing in a myriad of patios—these have but open sky above them.

Thus, the ecological "stage" came to be set for the airborne faunal lift which began moving to southern Florida with accelerating tempo: plane-loads of monkeys and mynas, toucans and hornbills, ocelots and kinkajous, parrots from South America, Africa and southern Asia, tropical fish by the millions, caymans and chameleons, lizards and tortoises. "Tell us what you want and we'll get it for you" was a stock phrase of the animal importer.

Now the "how" of the exotics escaping into the landscape. However small the percentage may be, *some* fraction of any number of imported animals, particularly of volant species, would seem bound to find freedom in some manner or other. Consider the Canary-winged Parakeet (*Brotogeris versicolurus*). Between 1968 and 1970, 123,721 of these were imported into the United States (Clapp and Banks, 1973). To anyone who has kept parrots in captivity, their escape is an ever present possibility. And escape they do. Is it unrealistic to consider such a small percentage as one-half of one percent as likely to be freed by accident and/or by the deliberate intent of persons tired of caring for their charges or even desiring to see them free? The fraction itself is a small one. Such a fraction of

123,721 birds is large enough—more than six hundred—to account for the fact that the birds are free-flying in many areas of the United States where they have been widely sold. Of course, this entire caged population was not imported through Miami—but large numbers were. Pet shops and department stores found the bird a popular item throughout the Miami area. (One store clerk made the comment that some of his previous customers came back for replacements of Canary-wings which had escaped [C. R. Robins, pers. comm., 1973]). That captive birds have indeed escaped is attested to by the fact that of Canary-wings which we at the University of Miami have live-trapped, some, by their behavior, attested to an obvious history of captivity.

There are those who persist unconvinced as to the manner by which the exotic species now establishing themselves in Florida have arrived. To assume that species which are traditionally non-migratory have, at the same time as a wide spectrum of other species, migrated from tropical areas of the world on vectors to an ocean-surrounded peninsula in the north Caribbean is hardly credulous. True, the Cattle Egret (*Bubulcus ibis*) and the Fulvous Tree Duck (*Dendrocygna bicolor*) have invaded the peninsula “on their own.” But these species represent taxa known for peregrinations or migratory habits. In the case of the majority of the exotic species now loose in Florida, one has but to inspect existing data on importations (e.g., Clapp and Banks, 1973). In almost every case the species are those which have been commercially trafficked. But let us move on to inventory of this exotic avifauna.

The Carolina Parakeet is gone from Florida's skies. Parrots, however, are represented as never before. Almost 300,000 psittacids were imported into the United States in the years 1968–1970 (Clapp and Banks, 1973). Figures are lacking for the proportion of these which came through south Florida's ports of entry. The numbers, however, have not been inconsiderable. Additional birds have been raised locally in captivity. Parrots are favorite birds for public exhibits as well as for home and garden. Free in the landscape of year-round summer the birds apparently experience little difficulty in finding adequate fruits, seeds and greens as well as provender from multitudes of feeding stations which are kept constantly supplied.<sup>1</sup>

The abundant Canary-winged Parakeet has been previously mentioned. Free-flying birds were noted in the late 1960's, 50 being counted in a roost in South Miami in 1969 (Ogden, 1969:652). The birds were then reported from Upper Matecumbe Key and from the western side of the Everglades (Stevenson, 1971:570). A few were seen in Ft. Lauderdale in 1970 (George, 1971); flocks of 40 to 50 were being seen there during the spring of 1973 (C. E. Timmer, pers. comm.). The species is currently under study by Ms. Crystal Shroads, graduate student of the University of Miami. In December 1972 a winter roost of the birds in Coconut Grove contained very nearly 700 individuals (Shroads, pers. comm.). Birds in immature plumage were evident in this assemblage. Of the 15 or so nests in Miami now (May of 1973) being monitored, it is noteworthy that all of them are in exotic species of palms, burrowed into the frass of decaying leaf stalks which surrounds the trunks. The large, noisy flocks of the birds and their depredations of mangos and

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<sup>1</sup> The significance of feeding stations in establishment of exotic species can hardly be underestimated. The abundance of the stations in suburbia and the constancy of food supplies they afford have no doubt contributed materially to successful invasions by some species. Carleton (1971:31) writing of the Red-whiskered Bulbul, discussed what might well be described as symbiotic *mutualism*. Humans attracted the bulbuls with all manner of carefully prepared foods—cake, bread soaked in sugar solutions and “mushes, polentas and purees,” as well as various fruits, etc. The feeding station operators benefited by: the notoriety and distinction of having attracted crowds of bird watchers, some from remote and interesting places; and aesthetic satisfaction.

other fruits grown in suburbia have occasioned much local comment as well as some consternation.

The Red-crowned Parrot (*Amazona viridigenalis*), native to Mexico, is the most abundant of the amazons now present in southeastern Florida. These have been reported from the Florida Keys (Robertson, 1972:54) and are commonly seen throughout metropolitan Miami and in Ft. Lauderdale. In November 1972 the author counted 32 in a flock feeding in casuarina trees (exotic to Florida) on the University of Miami campus and he is at present (May 1973) observing a nest with two eggs, this within a hollow casuarina tree on the same campus.

The Rose-ringed Parakeet (*Psittacula krameri*), native to southern Asia, is establishing itself in suburban north Dade County (Ogden, 1972:848). Adults, often with accompanying immatures, frequent feeding stations. According to Mrs. J. Hunsinger (pers. comm.), who has numbers of the birds coming to her feeding shelves, there is reason to believe that the population has been present in this area for a considerable time, possibly more than 10 years. University of Miami collections contain skins of two immature birds of this population, one just past fledging. Field observations indicate that the subspecies *P. k. manillensis*, the race of peninsular India, is representative of the local birds.

Monk Parakeets (*Myiopsitta monachus*) have been breeding in the Miami area since at least 1969 (Mrs. M. Jacobs, pers. comm.). The birds are now being seen throughout a wide area (Ogden, 1972:848). Individual birds are frequently seen accompanying the flocks of Canary-winged Parakeets, even visiting feeding stations with them. Two lodges (nests) were constructed on the Miami campus during the fall of 1972 (Both were eventually destroyed, one by rock-throwing youngsters, the other from unknown factors).

Budgerigars (*Melopsittacus undulatus*), as would be predicted, are widespread in southern Florida. One should read of the deliberate manner in which a prosperous colony, the individuals of which have spread throughout a wide area, was established near St. Petersburg (Anonymous, 1963). The freed birds were regarded as a *tourist attraction!*

This is far from a complete list of parrots enjoying freedom in Florida. Among those species presently evident in Dade County but not yet known to be breeding successfully are the following.

The Orange-fronted Parakeet (*Aratinga canicularis*), of Central America, is reported from throughout the Miami area and from northward along the *Atlantic Coastal Ridge* (Ogden, 1972:848). A male killed by an automobile (South Miami, 11 March 1973), was reported to have been one of a pair; this bird (UMRC #7319) was found to have considerably enlarged testes, those of a breeding or near-breeding bird.

The Brown-throated Parakeet (*Aratinga pertinax*), Neotropical in distribution, is reported to have bred at Key West (Robertson, 1971:47) and there are increasing reports of the species in the Miami area.

The Orange-chinned Parakeet (*Brotogeris jugularis*), another Neotropical species, is in increasing evidence about Miami; seven were reported from the 1970 Dade County Christmas Bird Count (Bizet, 1971:282).

Orange-winged Amazons (*Amazona amazonica*) have been seen by the author on several recent occasions and there are continued reports of yellow-headed amazons of unknown species—one flock of eight such was seen by the author in Coral Gables in November 1972. That the White-fronted Amazon (*A. albifrons*) is now present in the area and may be breeding is attested by reports from John Ogden (pers. comm.) and Durban Tabb (pers. comm.).

Pigeons and doves are among the more popular birds of the aviarist. Certain species, in addition to the locally abundant Rock Dove (*Columba livia*) have gained footholds in

southern Florida. The Inca Dove (*Scardafella inca*) is known to have bred at Key West (Cunningham, 1966:414). The Ringed Turtle Dove (*Streptopelia* sp.) is apparently established at several localities, including Winter Park in Orange County (central Florida) (Robertson, 1972:54). Fisk's report (1968) of the establishment of the White-winged Dove (*Zenaida asiatica*) in Dade County merits recounting. Privately imported, in part from Venezuela, in part from Mexico, these birds were bred in captivity from 1954 to 1959 when 25 were released near Homestead. In 1968 no fewer than 200 were coming to the releaser's feeding station and the species was being seen throughout an area more than 40 square miles in extent (Ogden, 1970:674).

Other non-passerines may be in process of establishing themselves in southern Florida. The Black-bellied Tree Duck (*Dendrocygna autumnalis*), a native of southwestern United States and Central America, is nesting on Virginia Key, not far from Miami's Crandon Park Zoo which has maintained a large collection of anseriforms, this species included. In 1969 an adult and 12 downy young were seen (Ogden, 1969:652) and M. Heath (pers. comm.) observed four downy young in the same locality in November 1972. Meantime, observations of West Indian Tree Ducks (*Dendrocygna arborea*), which have also been kept at the Crandon Park Zoo, continue to be made in the Virginia Key area.

The Red-whiskered Bulbul, previously mentioned, introduces a new passeriform family (Pycnonotidae) to this Hemisphere. This species, which as a caged bird had already been carried to Australia where it is now feral, found freedom from Miami's Rare Bird Farm in 1960. Carleton (1971) studied the species in its Dade County environment. She estimated that during the first ten years of the bird's establishment in Dade County, there was an annual 30-40 percent increment to the total population! Primarily dependent upon small drupaceous fruits, berries, and sycons, the species also frequents blossoms for nectar and devours some insects. At present, of more than ordinary importance in the bulbul's diet is the drupaceous fruit of an introduced South American shrub or small tree, the Brazilian holly or Brazilian pepper (*Schinus terebinthifolius*), a plant which has spread explosively along roadsides, canal banks, and into suburban and old-field situations. In the winter of 1969-70 Carleton (op. cit.) estimated the population at slightly less than 250 and restricted to a suburban area of approximately 3.2 square miles. Slow spread of the population she attributed to the birds' apparent traditional attachment to communal roosting sites which are resorted to in winter. Indications in 1973 are that the population has continued to grow and is occupying a larger area.

The Hill Myna (*Gracula religiosa*) is another popular, widely-trafficked cage-bird. Pet shops throughout southeastern Florida stock the species. It is not surprising that free birds are being reported locally from Palm Beach County southward through Dade County (Kale, 1972:752), nesting likewise being reported at numerous locations within this area. One of a pair nesting on the University of Miami Campus (in May 1973) wolf-calls and whistles in a manner surely indicative of its having been in captivity. Little is known of the diet in southern Florida, but its diet in India emphasizes fruits and berries, particularly fruits of *Ficus* (Ali and Ripley, 1972:192). It has, interestingly, appeared in the Miami area at approximately the same time as another exotic sturnid, the European Starling (*Sturnis vulgaris*), which has only just begun breeding over much of southeastern Florida's suburbia.

The Spotted-breasted Oriole (*Icterus pectoralis*) from Central America was one of the earliest introductions (1949) into suburban Miami, where the species had been sold as a cage-bird. Conspicuous by song and plumage, spread of the bird has been well noted. By 1956 the orioles were active within an area some 26 miles in north-south extent (Brookfield and Griswold, 1956). In May 1961 the bird had reached Hypoloxo Island in Broward

County (Stevenson, 1961:405). By 1962 it had spread to West Palm Beach (Stevenson, 1962:25). In 1968 sightings were made from Pine Island in Everglades National Park some 40 miles south of Miami (Robertson, 1968). In 1969 two were observed at Lake Wales, some 150 miles north of Miami (Walkinshaw and Walkinshaw, 1970:247). This species is deserving of careful study. It is now appearing, if irregularly, somewhat north of the Tropical Zone of Florida. In large part a fruit and nectar feeder, the bird presumably exploits a spectrum of fruiting and flowering plants, tropical and subtropical, which are now under suburban cultivation far northward along the peninsula. In any considerable range extension northward it may well anticipate others of the exotic species now extending their ranges. Whatever factors of the environment might be important to any further, or indeed lack of any further, range extension of the Spotted-breasted Oriole are deserving of appreciation.

The Blue-gray Tanager (*Thraupis virens*) was discovered in Hollywood (Broward County) in 1960 (Arnold, 1961). Here it was noted attracted to fruit of a large sapodilla tree (*Achras sapote*), the tree like the tanager an exotic species in Florida. Nesting was recorded in the Hollywood area in 1961 and 1962 (Paulson and Stevenson, 1962:403). A singing male was taken on the University of Miami Campus in 1964 (UMRC #4973). Ogden (1972:848), suggesting that the species was increasing, noted its continued breeding in northern sections of Dade County. In the South Miami area wild birds, three or four at a time, have been attracted to an outdoor aviary containing captives of the species (C. R. Robins, pers. comm., 1972). Insectivorous only in part, the berry-eating habits of *T. virens*, should serve the species well in its new milieu.

The Java Sparrow (*Padua oryzivora*), a favorite cage-bird in the Miami area for many years, was, according to my records, reported at feeding stations in the northern portion of Coral Gables as early as 1960. The birds are often attracted to communal roosting assemblages of the House Sparrow (*Passer domesticus*) and I first noted them at such situations in 1966. From 1968 to 1969, the numbers of the birds at one roost increased from approximately 50 to 150 (Ogden, 1969:652). No study has been made of this population which is now distributed over an area of several square miles and breeding in both residential and downtown areas. V. Brach (pers. comm., 1972) found a nest with young on a large theater building on a busy street in the center of Coral Gables. Any similarities of the niche this species occupies to that of the House Sparrow seem not to have materially impeded it in its initial stages of establishment.

The Brazilian Cardinal (*Paroaria coronata*) may well be breeding in Dade and Broward Counties. The author first noted free-flying individuals on the grounds of Crandon Zoo (Biscayne Key) in 1965. Since that time there have been scattered reports of the birds from Coconut Grove and elsewhere in Dade County. This spring the birds were reported from Ft. Lauderdale (C. E. Timmer, pers. comm., 1973).

The majority of the species just discussed have been described as "establishing themselves" or as "established"; they are species which give every indication at this time of being successful invaders. Caution should be used, however, in so describing them. First, there are many unknown factors with respect to animal invasion. Phillips (1928) commented on the number of introduced species which have demonstrated an initial local success, then, after a few years have declined in numbers and disappeared. It must also be held in mind that Florida's tropical area is small, terminating northward at about the latitude of Lake Okeechobee. North of this ecological conditions become progressively more temperate. Successful invaders of southern Florida are not gaining a foothold into a biome of continental breadth. Their ranges may well remain restricted to an area of no great geographical extent. Indeed, they may find themselves in much the same, if not

a comparable situation as species invading insular areas. The ecological precariousness of insular restriction is well recognized. It is, then, important to temper any premature confidence that these representatives of at least three great biological realms of the world have met ultimate success in adapting to the Florida's much restricted Tropical Zone.

Certain generalizations can be made from examination of habits of the exotic species breeding and extending their ranges in southeastern Florida.

Post-breeding assemblages (in most pronounced form, communal winter roosting) are characteristic of many of the exotic species. Adults and young move into these assemblages during the summer and fall. From various social interactions inherent in such assemblages one may postulate advantage to the species. Just a pronounced tendency to flock would seem to be significant to at least some types of species "pioneering" individuals of which are in initial stages of colonizing vast new areas. Colonial habits assumedly confer increased safety from predation. Young bulbuls in the fall accompany the adults to the communal roosting sites—sites which in some cases remain the same in successive seasons. During daily activities, birds of the year outflight from the roost in company with birds already experienced in exploiting ripening food crops which become available seasonally. Opportunity for synchronization of breeding probably also occurs, bulbul roosts, for example, only breaking up at the onset of courtship. All of these factors, and probably additional ones connected with colonial habits, accrue to longevity which is important to the rapid population growth so characteristic of successful invaders. In addition to the Red-whiskered Bulbul and the various psittacids, these habits are patently characteristic of the European Starling and the House Sparrow. In the Miami area Java Sparrows are known to roost in neighboring and/or the same trees as House Sparrows.

Social habits are evidenced by others of the exotics although in lesser degree. In India the Hill Myna characteristically searches for food in groups of 5 or 6, roosting in pairs or family parties (Ali and Ripley, 1972). Haverschmidt (1968) noted that the Blue-gray Tanager is "often in flocks"; I can find no comments regarding roosting by the species. Skutch (1954:274) observed that the Spotted-breasted Oriole moved about in "small flocks" during winter—this is characteristic of these birds in Florida too. During several weeks of one winter 4 and often 5 of these orioles (possibly a family group) roosted nightly in foliage of a coconut palm in my backyard.

Among Florida's exotics there are no obligate feeders on any single category of food substances—there are, for example, no entirely insectivorous species. Psittacids feed upon a wide variety of fruit, grain, and other plant materials. Bulbuls take fruit, nectar, and insects. The Blue-gray Tanager is both frugivorous and insectivorous. The Spotted-breasted Oriole is to a large extent both a fruit and nectar feeder. The sturnids take a wide variety of food substances. The ploceids take insects in addition to granivorous materials.

With additional study of successful exotic species, numerous characteristics should become apparent which could prove useful in evaluating the potential of species as successful invaders of the various biomes.

This far from concludes the list of exotic birds which have been found free in southern Florida. The Egyptian Geese, the caracaras, lapwings, and the Spectacled Owls from South America, the Indian irenids, assorted estrildids, fringillids, and a host of additional species observed by amazed south Floridians over the past few years have lingered for varying periods of time and then have disappeared. Many may not have been adapted to the environment. Others, which might have been so adapted, were not released in numbers adequate to ensure species survival and breeding. But the supply of these exotics, it would seem, is being constantly replenished. And some from these constantly freed exotic

species, as some of those released over the past few years, *will be* released in adequate numbers and may indeed "strike it rich" in the ecological sense.

Two questions pose themselves. What, if anything, should be recommended to avert further introductions into Thomas Barbour's "Vanishing Eden"? And, what of the many species which now seem to be successful invaders—should anything at all be done about them? Let us discuss the second question first.

There are those who are enthusiastic at the parrots, the bulbuls, and the mynas in our midst.<sup>2</sup> They have a point. The numbers of native species which have adapted to suburbia are limited. The native avifauna is a depauperate one to begin with (Crook, 1969). We have, in a sense, simply speeded up colonization of the area by tropical species. In so doing we are building a tropical urban-suburban avifauna which, if nothing else, is colorful and unique.

To those living outside of suburbia, to those concerned with agricultural areas and to those who have concern for the remaining areas of natural ecological communities—is there not cause for apprehension? To what extent these exotic species, once their populations have become large, may move out into the exurban areas cannot be predicted. The Starlings and the House Sparrow, for example, have very different patterns of distribution in North America. Certainly we can take some heed from habits of our exotic species within their native environments. Ali and Ripley (1969:169) described the Indian Rose-ringed Parakeet as "one of the most destructive pests of agriculture and horticulture." Bump (1971:3) described the Monk Parakeet as "one of the worst pests of agricultural crops in Argentina." Southern Florida is a major producer of winter agricultural produce for the United States. Central Florida is a major citrus production area. These parrots and other birds of our exotic menage may well prove to be "time bombs" in our midst.

May not questions be raised concerning competition exotics might afford our native species? Carleton (1971) found considerable similarity in feeding habits of the Red-whiskered Bulbul and the Mockingbird. She also called attention to the fact that the bulbul roams in flocks through the winter territories of the Mockingbird, which, as single birds, reside each upon a piece of the environment, depending upon the supply of food it contains. Tree cavities in suburban or exurban areas are obviously in limited number. What of the many hole-nesting psittacids, the two exotic sturnids and the exotic tree duck now multiplying in southern Florida? There can be no prescient answers to questions of this sort. But may it not be precarious to await the answers?

One final comment regarding arguments in defense of exotic species. Scientists are often accused of being coldly practical and of ignoring aesthetic values. Charles Elton (1958), student of animal introduction and an outstanding biologist presented argument along aesthetic lines against introductions. Must we reduce the world's biological realms, which are the planet's heritage of evolution, to a dreary sameness? Must we be denied the anticipation of first meeting the Oriental fauna in India, the Neotropical fauna in Brazil!

A second question posed itself which invited suggestion regarding regulation of the traffic in exotics. A logical expansion of this consideration involves the owning of exotics

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<sup>2</sup> The introduction of the Scarlet Ibis (*Eudocimus ruber*) into southern Florida is a case in point of the above philosophy. Zahl (1967) described the originator of the introduction as a "dedicated student of nature" who wanted to "start a colony of these dazzling scarlet birds in Florida." The original birds having inbred with the native White Ibises (*Eudocimus albus*) and the scarlet-plumaged individuals now largely gone, it has been proposed (Zahl, *op. cit.*) to introduce the species once more in order "to give our land a new and enduring touch of tropical beauty."



and their housing. These problems, if they are to be regarded as such, are, upon contemplation, so multivarious that they would appear to allow but broad approaches.

Obvious in our thinking should be concern for ecosystems beyond our immediate political borders. Ecosystems of the world are being plundered to supply the animal importers' trade. Should we condone in Neotropical countries—in the interests of a non-vital commerce and of insensitive consumers—what we have long ago become too civilized to condone in Nearctica?

It has been suggested that the only trade in exotics which should be allowed is that with birds which can be shown to have been raised in captivity. But this is not always easy to prove. And while it may stop destruction of foreign ecosystems, it will not prevent pollution of ours. Many measures have been suggested which might, in some part, alleviate invasion. Bonds could be required of those with exotic birds in their possession and fines levied for those who allow escapes. But all such measures burden bureaucracy and are but fingers in a leaky dyke.

The problem, it should be stressed, involves more than birds. Exotic plants clog our waterways. Exotic fishes are spreading along southern Florida's canals and throughout the Everglades ecosystem. The fish alone have the potential to bring great change to the aquatic communities (Lachner et al., 1970) birds obviously included. On land, invertebrates without end, amphibians, reptiles, and even mammals are producing change which is ramifying into the food webs and affecting the niches of vast numbers of organisms.

Perhaps what we need to do is take a very hard, selfish look at our native ecosystems—before what remains of them is reduced to something we cannot predict, something subverted to that we would decry. Perhaps the philosophy we need to proscribe should 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."

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- DEPARTMENT OF BIOLOGY, UNIVERSITY OF MIAMI, CORAL GABLES, FLORIDA 33124.