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FLORIDA'S NON-NATIVE AVIFAUNA

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Abstract: Florida has a mild climate, diverse natural habitats, and a growing, mobile human population. Florida also hosts thousands of species of introduced plants, fish, and wildlife. A recent compilation lists 196 non-native bird species, comprising 15 orders, which have occurred in Florida. The list includes 72 species of parrots and parakeets (psittaciformes), 51 passerines, and 22 species of waterfowl (anseriformes). First sightings of newly introduced bird species in Florida increased rapidly through the 1980s, but numbers of new species detected appear to have subsided since then. Sources of introductions are often not reported, but of those that are known, most derive from intentional releases (e.g., for hunting) or escapes from private collections, parks, or zoos. Based on this list and other sources within the state, we identified 14 non-native bird species now considered to be established in Florida. We review those species in particular, and discuss impacts that they are having. We use Christmas Bird Count data to examine geographic and temporal patterns of non-native bird occurrence within the state. We identify additional non-native bird species that are emerging as potentially serious management problems in Florida, and we recommend actions for efficient, effective management of non-native bird issues.

Key Words: Christmas Bird Count, Florida, invasive species, non-native birds, population trend.

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INTRODUCTION

The house sparrow (*Passer domesticus*), a European native, has been in Florida since 1882, so non-native birds have been part of the Florida fauna for at least 125 years. Psittacines, escaped from captivity, have been flying around south Florida since the 1920s, possibly longer (Bailey 1928). The real expansion in numbers of non-native species occurred in the latter half of the 20th century, however, and was facilitated by a number of factors (Owre 1973). Natural habitats in south Florida were converted to accommodate increasing demands of the burgeoning human population for houses, businesses, and services. As the native landscape was transformed, hundreds of exotic plant species became established through horticulture or accidental release. Hundreds of thousands of exotic birds passed through the Miami airport. Many escaped there before getting to pet shops, zoos, and private exhibitors. Others were subsequently released on purpose or by accident. The mild year-round climate coupled with flora that was often identical to that found in their native range provided ideal conditions for free-flying non-native birds. Proliferation of backyard bird feeders

enhanced the favorable environment for exotic birds.

The Wild Bird Conservation Act (1992) effectively prohibited importation of most wild-caught birds. There remains, however, thriving commerce in captive-reared exotic birds to supply the ever-present demands of the pet trade. Estimates of pet bird ownership in the United States (US) vary widely, from 10 million (Wise et al. 2002) to 40 million (www.avianwelfare.org/issues/overview.htm). Thus, even if all avian imports stopped immediately, there still would exist a huge, renewable pool of non-native birds to serve as a source for new free-flying exotics.

In this paper, we review the available information on the status of non-native birds in Florida. We examine patterns and trends of non-native birds as a component of the Florida avian population, and we discuss the nature of the problems posed by this segment of the Florida avifauna. Throughout, we apply the nomenclature of Executive Order 13112 "Invasive Species" published in February 1999. Thus, an "alien species" (or exotic or non-native) is a species not native to the ecosystem under consideration. An

“invasive species” is an alien species whose introduction is likely to cause harm, either economically, environmentally, or to human health. An “introduction” is the placement of a species into an ecosystem as a result of human activity. A “native species” is one that occurs in a particular ecosystem not as a result of an introduction.

METHODS

Information Sources

We obtained information on non-native birds from 3 main sources. On its website, the Florida Fish and Wildlife Conservation Commission (FWC) lists 196 non-native bird species that have been recorded in Florida (myfwc.com/nonnatives). According to the FWC website list, just 11 of these species are considered to be established, i.e. “...confirmed breeding and apparently self-sustaining for 10 or more consecutive years.”

As of February 2007, the Florida Ornithological Society (FOS, www.fosbirds.org) recognized 498 species comprising the Florida avifauna, including 12 established exotics. The term established here means “... a stable or increasing population of that species has persisted continuously in one or more areas for at least 15 years”, and there is “little or no evidence that ongoing releases play a significant role in population maintenance”.

Finally, the compilation of breeding birds in Florida includes 165 native species, as well as 13 additional non-native species considered to be established (Woolfenden et al. 2006). Their criterion for establishment is “stable or increasing populations maintained by successful reproduction for at least 10 years up to the present”. Furthermore, there are also 29 other non-native species on this list that are breeding in Florida, but which have not yet achieved the status of “established”. This implies that a number of additional species might become established in the near future.

Assessment of Status and Potential Threat

From the 3 major sources given above, we assembled a composite list of non-native Florida bird species, and we categorized the species according to their status and evaluated the potential threat they posed to natural and to man-made resources. This was our attempt to place in perspective the relative management importance of the established, non-native bird species in the state.

We used the following categories:

- Ubiquitous, nuisance species – present throughout Florida, widespread impacts;
- Restricted range – common locally, not causing serious problems;
- Major problems – causing major ecological or monetary impact;
- Emerging threats – of concern, and still vulnerable to eradication;
- Formerly present – extirpated after once being established.

Non-native Species Trends

We estimated the proportion of non-native birds in the Florida avifauna from Christmas Bird Count (CBC) data for selected sites and years (www.audubon.org/bird/cbc/index.html). To examine the pattern across the state, we calculated the percentage of non-native birds in the most recent count (#107, December 2006-January 2007) at CBC sites within Florida, representing 15 of the 17 most populous metro areas within the state. We then examined the trends from 1970-2005 at 2 Atlantic coast CBC sites, one in south Florida (Dade County) and one in north Florida (Jacksonville).

RESULTS

Non-native Species List

From the 3 sources we consulted, there was generally good agreement as to the roster of established species (Table 1; scientific names of bird species in the table are not repeated in the text). Probably the chief difference among the sources is that FOS considers the mallard and the white-winged dove to be native, and thus does not include these species on their list. Unlike the FWC and Woolfenden et al. (2006), however, the FOS considers the black-hooded parakeet to be established. The 3 sources of established exotic bird species are not independent as many of the same individual ornithologists contributed to the compilations. The 3 lists converge on a core set of 14 species that represent Florida’s established non-native avifauna which we considered in more detail.

Status and Potential Threat

Ubiquitous, nuisance species. It seems unlikely that species as well-entrenched as these could ever be eliminated from the avifauna. They are here to stay, and the best course of action is to monitor interactions so that when an unexpected impact is

Table 1. Non-native bird species considered established in Florida by various authorities: Florida Fish and Wildlife Conservation Commission (FWC), Woolfenden et al. (2006, WRC), and Florida Ornithological Society (FOS).

| Scientific Name | Common Name | FWC | WRC | FOS |
|--------------------------------|------------------------|-----|-----|-----|
| <i>Cairina moschata</i> | Muscovy duck | x | x | x |
| <i>Anas platyrhynchos</i> | Mallard | | x | |
| <i>Columba livia</i> | Rock pigeon | x | x | x |
| <i>Streptopelia decaocto</i> | Eurasian collared-dove | x | x | x |
| <i>Zenaida asiatica</i> | White-winged dove | x | x | |
| <i>Melopsittacus undulatus</i> | Budgerigar | x | x | x |
| <i>Myiopsitta monachus</i> | Monk prakeet | x | x | x |
| <i>Nandayus nenday</i> | Black-hooded parakeet | | | x |
| <i>Brotogeris versicolurus</i> | White-winged parakeet | | x | x |
| <i>Pycnonotus jocosus</i> | Red-whiskered bulbul | x | x | x |
| <i>Sturnus vulgaris</i> | European starling | x | x | x |
| <i>Icterus pectoralis</i> | Spot-breasted oriole | x | x | x |
| <i>Carpodacus mexicanus</i> | House finch | x | x | x |
| <i>Passer domesticus</i> | House sparrow | x | x | x |

detected, remedial steps can be promptly taken. These species exploit human-altered environments and seldom venture into natural habitats. What impact are these birds having? The main impacts seem to be nuisance and aesthetics, and these are principally due to the big 3 of invasive birds – European starling, house sparrow and rock pigeon. All are ubiquitous in urban/suburban areas and each has become a fixture of the bird communities. The Muscovy is rapidly becoming the waterfowl equivalent of the rock pigeon in its fecundity, frequency of occurrence, and propensity to create unsavory, possibly unhealthy, conditions.

The house sparrow, one of the most common invasive bird species in the country, is exhibiting a long, strong decline, not only in Florida but throughout the US. According to Breeding Bird Survey (BBS) trend results, the Florida population has declined 70% to 75% in the past 40 years (Sauer et al. 2005). For the house sparrow nationwide, the BBS indicates a downward trend of approximately 60% in the same time frame. In Great Britain, a similar downward trend in the house sparrow population is attributed to changes in habitat (Robinson et al. 2005).

In the US, there is some evidence that competitive interactions with the house finch are contributing to the decline of the house sparrow (Cooper et al. 2007). The Florida situation, as evidenced by BBS data, clearly shows that both

species are in the midst of trends, with the house sparrow heading down and the house finch going strongly upward (Figure 1). No cause-effect relationship has been established, however, so in Florida it is not clear how the burgeoning house finch population is affecting the house sparrow.

Many house finches carry a form of conjunctivitis that potentially could be spread to other wild bird species and to poultry (Luttrell et al. 2001, Farmer et al. 2005). The house finch frequents bird feeders and is well-suited to suburban and urban environments. As the house finch continues to expand throughout Florida, there will be increased concern for its role as carrier or reservoir of this disease.

In Florida, the Eurasian collared-dove and white-winged dove have the potential for negative impacts to native dove species. But, despite dietary overlap, there is as yet no evidence of a large-scale negative interaction with native mourning doves (*Zenaida macroura*) or any other species (Poling and Hayslette 2006). For example, the mourning dove count on the BBS continues to increase slowly and steadily even as numbers of the non-native doves increase at much faster rates and overtake the mourning dove in terms of number of birds counted (Figure 2). The Eurasian collared-dove particularly

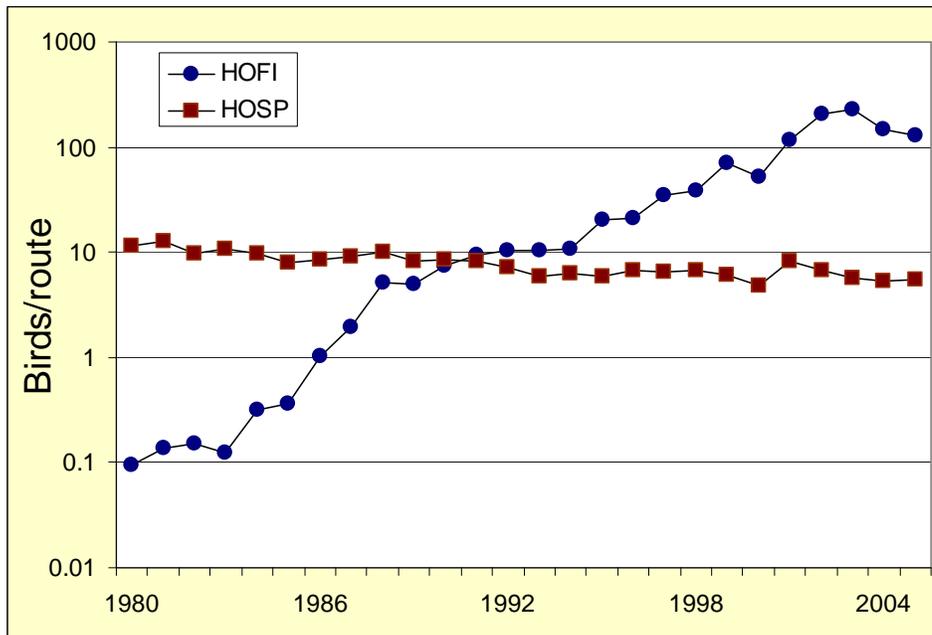


Figure 1. Recent trends in house finch (HOFI) and house sparrow (HOSP) abundance in Florida, Breeding Bird Survey data.

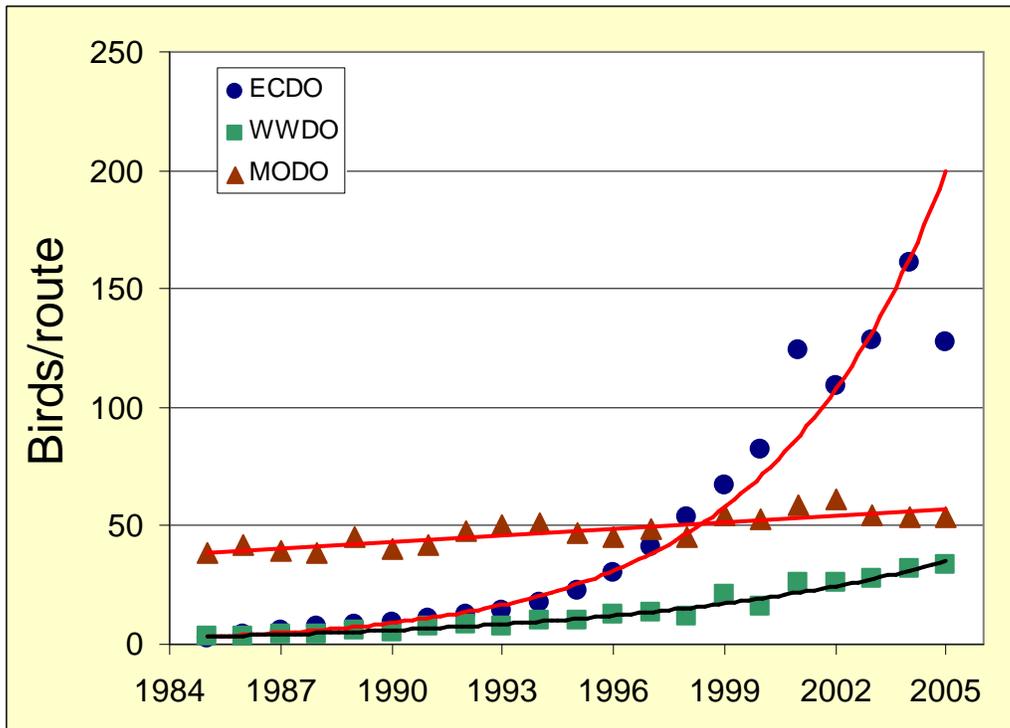


Figure 2. Recent trends in the abundance of Eurasian collared-dove (ECDO), white-winged dove (WWDO), and mourning dove (MODO) in Florida, Breeding Bird Survey.

exploits bird feeders and other human-derived sources of food. It appears to be in the midst of widespread and rapid range expansion and likely will continue to thrive in concert with expanding human activity (Romagosa and Labisky 2000).

Restricted range. There are several examples of introduced species that were once entrenched, but that subsequently declined with no overt intervention by managers or wildlife biologists (Simberloff and Gibbons 2004). In Florida, the budgerigar is a well-documented example of population boom and bust (Pranty 2001). In the 1950s and 1960s, the species was a very popular pet bird and thousands were imported annually. Invariably, some escaped or were released in west-central Florida. The birds nested in natural and man-made cavities. Many residents augmented the feral population by providing nest boxes (Pranty 2001). The Florida population peaked in the mid-1970s when several thousand budgerigars were recorded annually on the Christmas Bird Count (CBC). Throughout the late 1980s and 1990s the budgerigar population declined precipitously, and the most recent CBC yielded <50 birds (Figure 3). The reason for the demise of the feral budgerigar population in Florida is not known. Possible contributing factors include decreased availability of nest boxes, competition for nest sites, disease,

and cold winter weather (Pranty 2001).

Although not nearly as numerous as the monk parakeet, the black-hooded parakeet has exhibited a strong upward population growth trend in recent years (Pranty and Lovell 2004). This species is found mainly in the central west coast of Florida where the budgerigar formerly flourished. Like the budgerigar, the black-hooded parakeet is a cavity-nesting species, so negative interactions between the 2 species over nest sites could have contributed to the decline of the budgerigar population. At this point, there is no indication that the black-hooded parakeet is having a negative impact on any native species. Nevertheless if the positive population growth trend is maintained, possible negative consequences for native cavity-nesters could result.

The spot-breasted oriole is native to Mexico and Central America, and it has been breeding in the Miami area since 1950 (Stevenson and Anderson 1994). The species remains in south Florida, possibly constrained by inability to withstand cold winters. There has been no negative impact attributed to this species.

The red-whiskered bulbul is native to China and southeast Asia and is specifically named on the Federal Injurious Species List (50CFR 16.12). It was first noted in the Kendall area of Miami-Dade

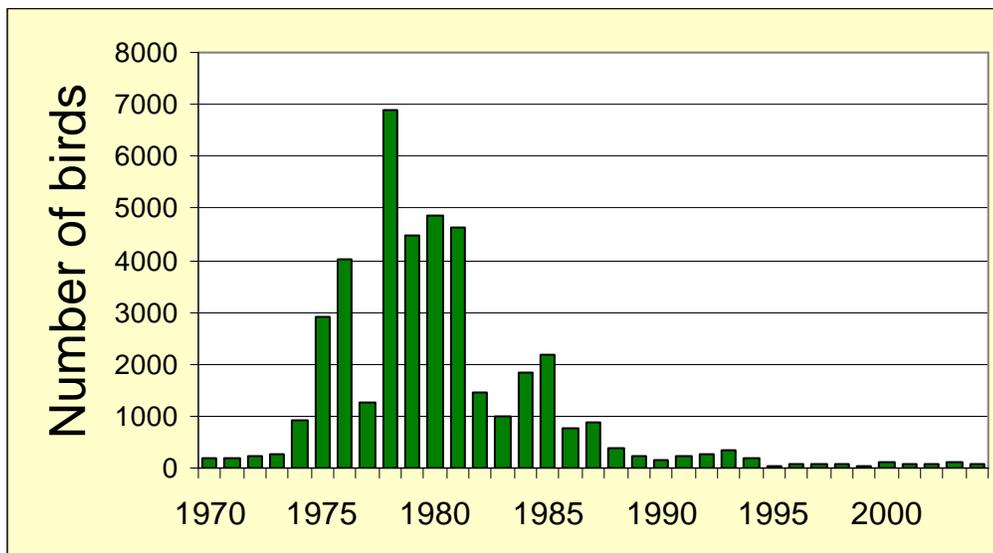


Figure 3. Number of budgerigars recorded on Christmas Bird Counts in Florida, through December 2005.

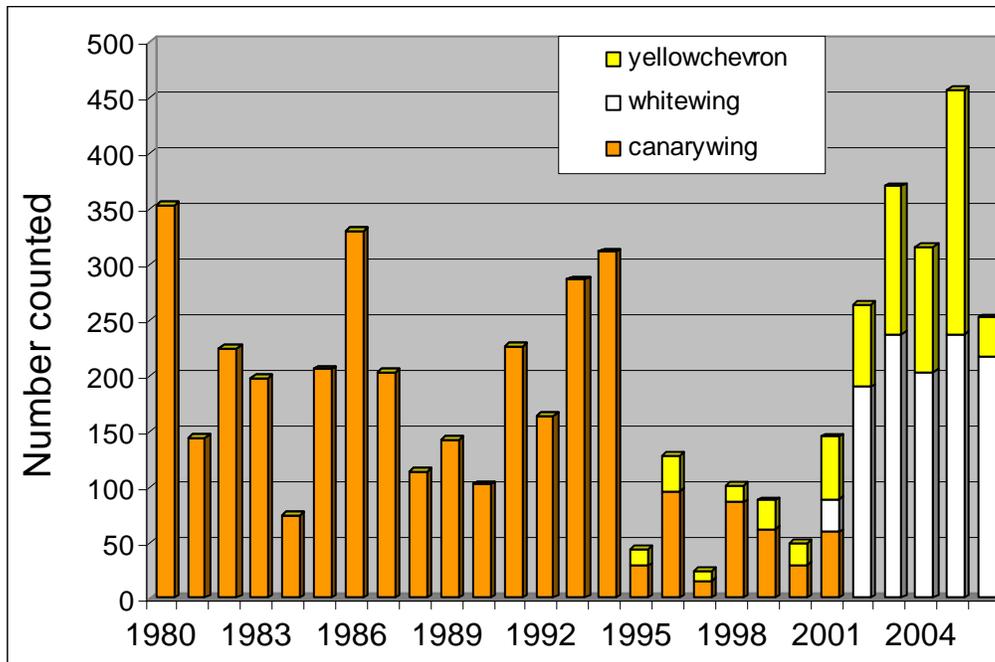


Figure 4. Number of *Brotogetis* parakeets recorded on Christmas Bird Counts in Florida, through December 2005.

County in the early 1960s and has persisted there where it exploits abundant exotic vegetation for nesting, roosting, and feeding (Carleton and Owre 1975). It has not expanded outside of Miami-Dade County.

The white-winged parakeet was formerly considered conspecific with the yellow-chevroned parakeet (*Brotogetis chiriri*), and, collectively, they were known as canary-winged parakeets (Brightsmith 1999). Because of possible nomenclatural confusion, and because the species are difficult to tell apart in the field, and because they are known to hybridize in Florida (Pranty and Epps 2002), we combined the *Brotogetis* data from CBC records for this paper. These records indicate that over the past 25 years there has been little net change in the size of the *Brotogetis* parakeet population in Florida other than lower numbers in 1995-2001 (Figure 4).

Major problems. The mallard occurs naturally in Florida in the winter, so technically it is not an exotic species. But the mallard is not a native breeding species in the state. All of the breeding seems to have been traced to domesticated birds that escaped or were released from farms, bird parks, or zoos. According to Stevenson and Anderson (1994, p. 113), "...it is possible that all summer and breeding reports have involved escaped (introduced) individuals or their

descendants." Currently, mallards are breeding all over the state. The major impact of the mallard is through its propensity to breed with native species, particularly the mottled duck (*Anas fulvigula*). This genetic introgression is, in effect, causing the mottled duck to be extirpated in Florida. According to some authors, hybridization with the feral mallards "...is possibly the single greatest threat to the future of the mottled duck as a unique species" (Moorman and Gray 1994). Recognition of the problem is the first step in addressing it, but in this case it might already be too late to stop. The FWC estimates that more than 12,000 mallards are purchased statewide from feed-and-seed stores annually, and these form an ongoing pool of potential releases. It is unlawful to release mallards, but that does not stop people from continuing to release these birds on local ponds, lakes and canals for aesthetic reasons. Domesticated mallards occur year-round throughout Florida at city and county parks, apartment and condominium complexes, and in other urban and suburban areas. Feral mallards also have spread from developed areas into rural habitats.

According to the FWC, 7 to 12 percent of mottled ducks already exhibit genetic evidence of hybridization (www.myfwc.com/duck/

mottled/theproblem.htm). Because of the relatively small size of the mottled duck breeding population (estimated at 30,000-40,000), the complete hybridization could result in the extinction of the Florida mottled duck. This is a real concern because released mallards have established a track record of hybridizing and devastating local duck populations in other parts of the world. For example, in New Zealand the grey duck (*Anas superciliosa*) has become almost completely eliminated as a distinct species through hybridization with mallards released there for hunting (Braun et al. 1994). The Hawaiian duck (*Anas wyvilliana*) is a Federally-listed endangered species and genetic introgression by mallards might be the factor that seals its fate (Engilis et al. 2002). Repopulating the islands with pure-bred, captive-raised Hawaiian ducks might be possible, but only after mallards and mallard hybrids are removed.

To combat the Florida feral mallard problem, FWC is emphasizing a public information and awareness program to educate the citizens about hybridization and the laws pertaining to mallards. FWC rules stipulate that mallards cannot be possessed without a permit or released. FWC has also developed a special mallard permit program with the US Fish and Wildlife Service (USFWS) so that feral mallards can be taken during the spring and summer, outside the normal hunting season.

The monk parakeet is by far the most successful psittacine in Florida. Because of the monk parakeet's reputation as a pest species to crops in its native range in South America, early discussion of the potential impacts from the introduction and establishment of monk parakeets in the US focused on the potential of the species as a depredator of crops (Davis 1974, Neidermyer and Hickey 1977). At that time, there was no mention of the parakeet's impact on electric utility companies. Today, crop damage has not materialized as an issue except in localized situations (Tillman et al. 2001). Although crop damage by monk parakeets could still become an important issue, the most serious impact now is to electric utility companies because of power outages caused by nest-building behavior of the birds (Avery et al. 2006).

According to the CBC, the population trend for the monk parakeet was consistently upward through 2002 (Figure 5). Lately, however, the trend has been downward, but this might be only temporary. There is as yet no indication that the nests and birds removed by utility companies have negatively affected parakeet population growth.

Emerging threats. The common myna (*Acridotheres tristis*) is not yet on published lists of priority invasive Florida birds. Although it is so far restricted to local areas of south Florida, its numbers on the CBC have grown steadily (Figure 6). The myna is a serious invasive problem species in other countries (Pell and Tidemann 1997, Yap et al. 2002). Although currently in Florida its limited distribution and low population size seem to pose no serious problems, there is no way to predict future events. In view of the problems caused by mynas elsewhere, it is unwise to allow the Florida population to grow unchecked.

Two recent invasive species in particular that have caught attention of Florida biologists and managers are the purple swamphen (*Porphyrio porphyrio*) and the sacred ibis (*Threskiornis aethiopicus*). It is possible that both species escaped from the Miami Metrozoo in 1992 as a result of Hurricane Andrew. Alternatively, some might have escaped from aviculturists. Regardless, both are now showing up in natural and manmade wetlands in south Florida (Pranty et al. 2000, Herring et al 2006). It is not clear what negative consequences could result from the presence of these non-native species, but that should not be the point. While the opportunity exists to remove them from the Florida landscape, it should be done. It makes little sense to wait and study the situation to see what impacts might accrue. As management action is delayed, populations of these species will increase and spread, making it that much more difficult and expensive to implement effective corrective measures later (Simberloff 2003).

To that end, action was initiated in 2006 to limit the continued spread of the purple swamphen in south Florida. In a cooperative effort, biologists with the South Florida Water Management District (SFWMD), the USFWS, and the FWC located and removed over 800 birds during October 2006-August 2007 (Clary 2007). Retrieval efforts are scheduled to continue to remove the remainder of the introduced population.

Formerly established. In Florida, several bird species that once were considered to be established are now extirpated (Woolfenden et al. 2006). The black francolin (*Francolinus francolinus*) was introduced as a potential game bird to several parts of the state in the 1960s. The species persisted into the 1980s but ultimately disappeared and is now absent from the Florida avifauna (Stevenson and Anderson 1994).

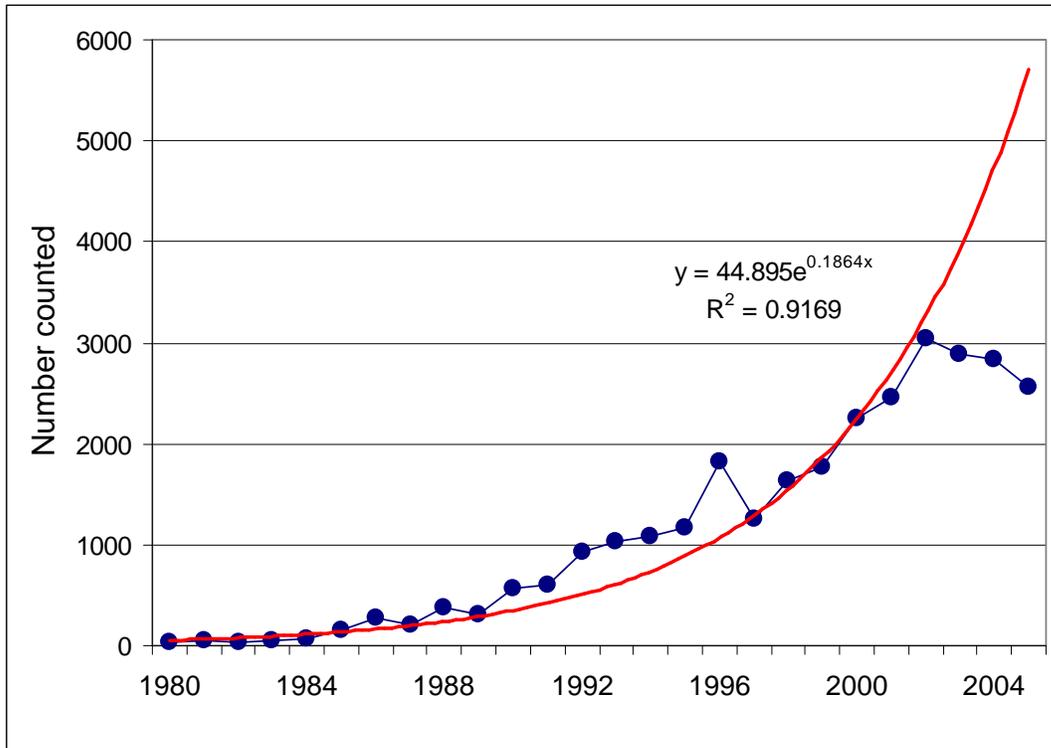


Figure 5. Monk parakeets recorded on the Christmas Bird Count in Florida, through December 2005.

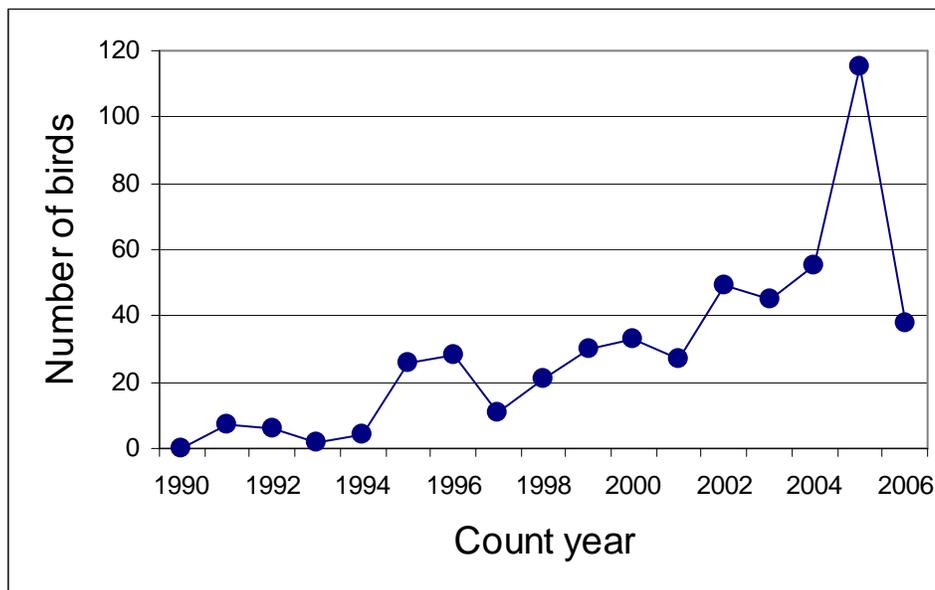


Figure 6. Common mynas recorded on Florida Christmas Bird Counts, through December 2005.

The blue-gray tanager (*Thraupis episcopus*), a common neotropical bird that feeds principally on fruit and nectar, was never very numerous in Florida. Throughout the 1960s and into the 1970s, however, it did breed in several locations in south Florida (Stevenson and Anderson 1994). There have been no reports of breeding birds for over 30 years, and new sightings are believed to be recently escaped individuals.

The Java sparrow (*Padda oryzivora*), a seed-eating species native to Indonesia, is successfully established in Hawaii, Puerto Rico, and many other places worldwide (Islam 1997). In Florida, breeding was reported in 3 counties, with the Miami-Dade County population seeming to thrive during the early 1970s (Stevenson and Anderson 1994). The last published report of the Java sparrow was in 1977, however, and the species is now considered extirpated.

No one has proffered explanations for the demise of these species following their initial

establishment as breeding birds in Florida. None was present long enough or was sufficiently abundant to draw attention as an object for study or management. Sudden inexplicable declines or local extinctions of established invasives have been noted elsewhere (Simberloff and Gibbons 2004). This illustrates the inherent difficulty in predicting the consequences of exotic bird introductions. Alternatively, establishment of these species might have been illusory, and their seeming persistence due to repeated introductions (Moulton 1985).

Non-native Species Trends in Florida

The percentage of observations that are represented by non-native birds in the most recent CBC varies considerably across the state (Figure 7). There is a strong relationship between human population size and the percentage of non-native birds in the most recent CBC for 14 of the 17 most populous metro areas in Florida (Figure 8). Except for Jacksonville, coastal areas appear to have more

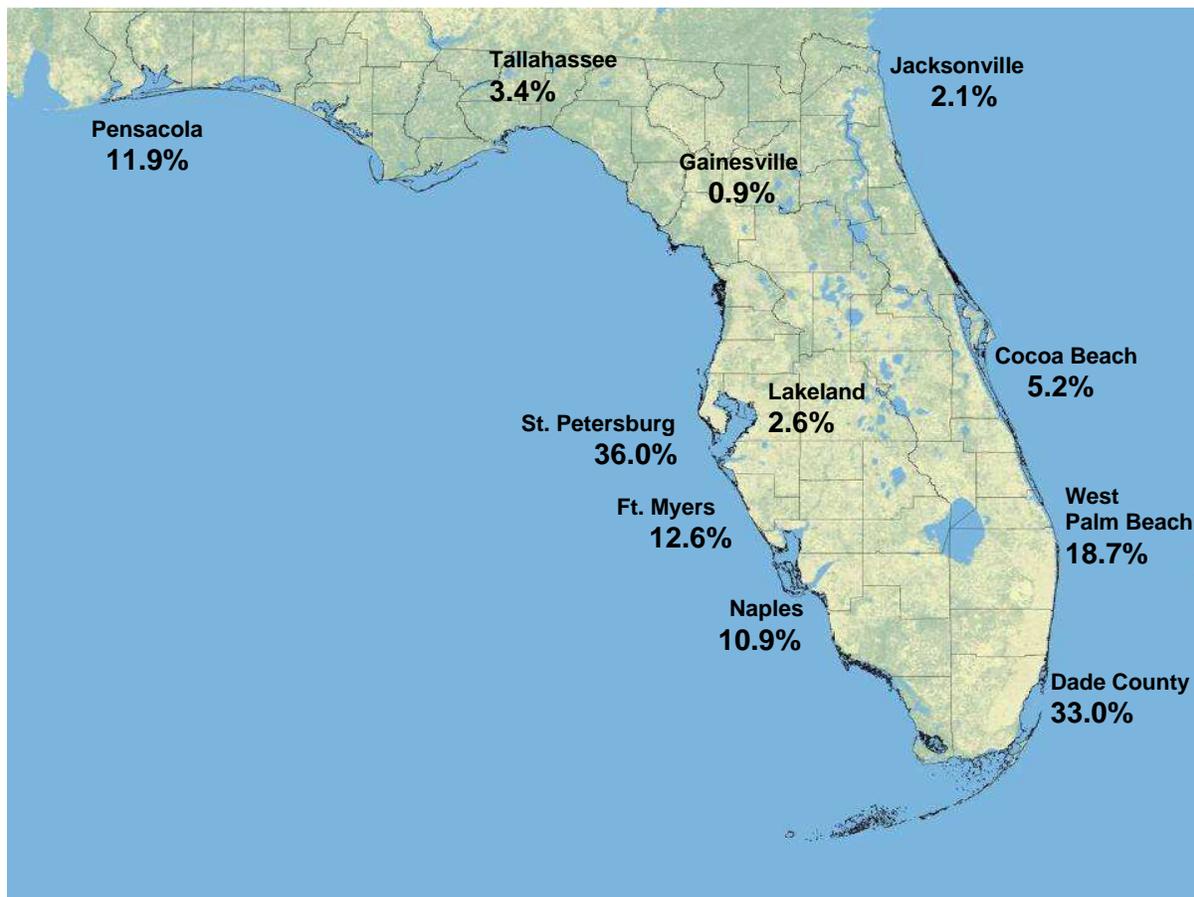


Figure 7. Percentage of non-native birds in Christmas Bird Count totals from 11 sites throughout Florida.

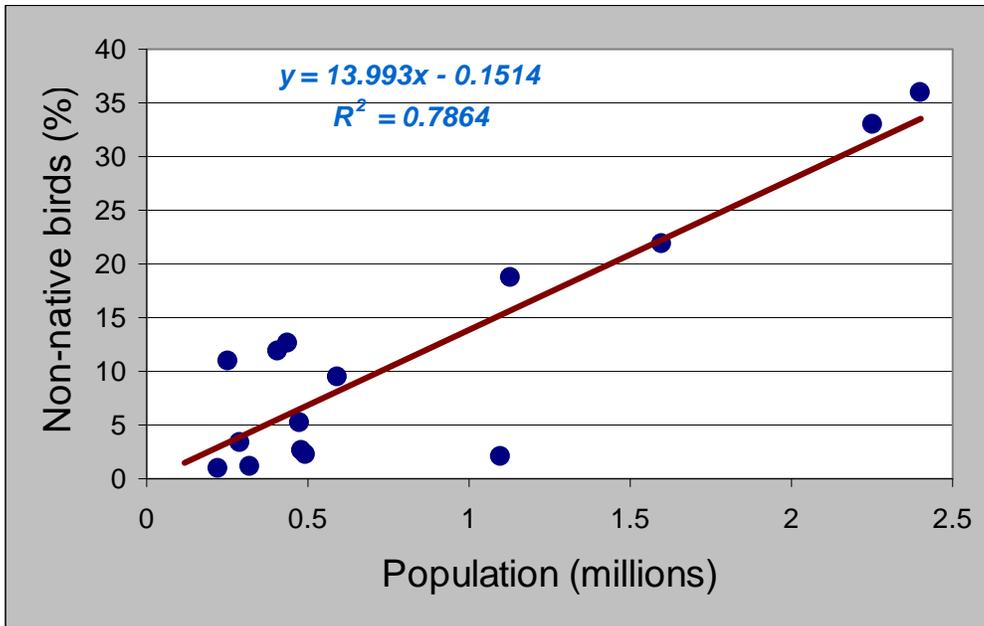


Figure 8. Percentage of non-native birds in total Christmas Bird Count increases with human population size among Florida's 14 largest metro areas.

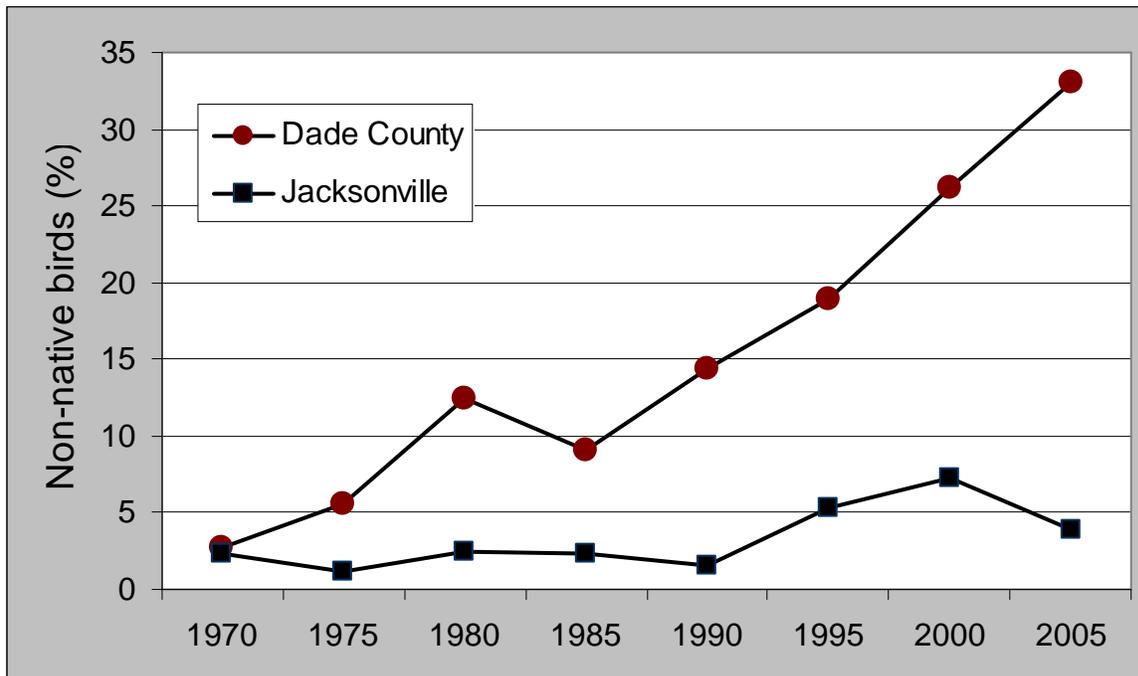


Figure 9. Percentage of non-native birds in total Christmas Bird Count remained virtually unchanged in Jacksonville, but increase steadily since 1970 at the Dade County site.

non-natives relative to inland sites. The high percentages of non-natives likely reflect the major conversions of native habitats that have taken place in those human population centers. Since 1970, the percentage of non-native birds in the annual CBC has remained roughly the same in Jacksonville, but it has steadily increased at the Dade County site (Figure 9).

DISCUSSION

Birds are released, on purpose or by accident, virtually every day in countless places throughout the world. Such events usually go unnoticed and most have no lasting impact. Occasionally, however, there are repercussions. An elusive goal has been to forecast accurately the impacts of introducing a non-native species. The study of avian introductions is not an exact science. Is there such a thing as a safe introduction?

Of the approximately 200 non-native bird species recorded in Florida, only about 5% are now considered to be established. Is it possible, retrospectively, to examine the species that are established and those that are not to determine species-specific factors which would promote establishment?

A common factor among the 14 species comprising the set of Florida's established non-native birds is that each is closely tied with human disturbance and human activity. With the possible exception of the mallard, none of the 14 species in Table 1 is established and freely living in natural biotic communities independent of human support. This suggests that a key element in the successful establishment of a non-native bird species in Florida is its capacity to coexist with human activity and to exploit opportunities created by human activity. This observation is consistent with recent, more inclusive analyses that identified human affiliation and propagule pressure as the two major correlates of invasion success (Jeschke and Strayer 2006).

Not every human-affiliated bird becomes established. In Florida, more than 70 species of psittacines have been recorded, undoubtedly the result of released or escaped cage birds. Yet, just 4 of these species are on the list of established non-native birds (Table 1). To be sure, more than 4 psittacine species are breeding and might eventually become established in Florida, but obviously human affiliation is no guarantee of long-term success for a non-native bird. Jeschke and Strayer (2006) also cite propagule pressure, the

number of individuals released and the number releases that occurred, as key to invasion success. For the majority of Florida species, propagule pressure is unknown. We can assume for the budgerigar that propagule pressure was quite substantial because of its popularity as a pet and the number of outdoor aviaries that existed during the 1970s (Pranty 2001). Still, this species flourished in Florida only briefly, and it currently seems destined for extirpation (Pranty 2001). For this non-native species, human affiliation and propagule pressure might have facilitated initial establishment, but were clearly insufficient for long-term population viability. We feel that species-specific traits are also critical to the process of establishment and persistence.

For the monk parakeet, one species-specific trait that no doubt improves its prospects for establishment is nest-building behavior. The monk parakeet is unique among psittacines in building a nest of sticks and branches rather than nesting in cavities. They use not only trees, but a number of man-made structures as nesting substrates (Avery et al. 2006). Monk parakeets are thus freed from the constraint of nest site availability which is certainly an advantage for a non-native species.

MANAGEMENT IMPLICATIONS

Becoming established is an essential aspect of the invasion process, but then becoming an invasive species (i.e., one that causes economic or ecological harm) is another matter. Our knowledge of these matters is imperfect, and therefore, we are not able to predict with any certainty the outcome of non-native species establishment. The limits of our understanding of these processes are revealed by formerly established non-native bird species that for unknown reasons are no longer present where they previously flourished (Simberloff and Gibbons 2004). Rather than risk potentially serious ecological damage, we ought to adopt a rapid response mind-set that includes zero tolerance for new free-living, non-native species. To wait and see what happens when a new free-living non-native species is detected is to risk turning a manageable problem now into an intractable one later (Simberloff 2003).

The ability to respond rapidly and effectively when a non-native species is first detected presupposes the existence of personnel and resources dedicated to this effort. Also, this approach must account for adverse public reaction that can bring well-intentioned management efforts

to a screeching halt. Within a program to manage non-native species, public education efforts to raise awareness of the detrimental impacts of non-native species are crucial. Finally, in a region like South Florida, where there are numerous land management jurisdictions, cooperation among agencies will be essential for the elimination of bureaucratic barriers that unnecessarily complicate wildlife management efforts. This cooperative approach is exemplified by recent actions of the South Florida Water Management District, the USFWS, and the Florida Fish and Wildlife Conservation Commission to eradicate purple swamphen populations (Clary 2007). Birds do not respect the land management agency boundaries. Effective implementation of programs designed to control non-native birds and other wildlife entails recognition of common objectives and willingness to commit resources to achieve them.

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