

# Wintering waterfowl in the Everglades estuaries

*A study of the numbers, composition and breeding origins of a Florida population*

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FLORIDA CONTAINS LARGE tracts of wetland habitat covering, by one 12-year old estimate, nearly 7 million hectares (Shaw and Fredine 1971). These wetlands provide wintering habitat for many types of water birds, including waterfowl. From 17 to 26% of the ducks censused in the Atlantic flyway have been reported to winter in Florida (Chamberlain 1960). Wintering waterfowl populations in Florida have declined, however, and migration schedules have been altered because of loss of habitat within the state and concurrent improvement of habitat conditions farther north (Crider 1968, Rodgers 1974, Goodwin 1979). The estuaries of Everglades National Park, at the southern tip of Florida, traditionally supported wintering waterfowl, which because of legislative policy have not been hunted since the establishment of the park in 1947. Rodgers (1974) suggested that about 15,000-25,000 ducks winter there annually, with the number using the area varying from year-to-year, primarily in response to weather and other conditions in the flyway farther north. Little is known about waterfowl in the Everglades estuary. The only previously published study was Klukas and Locke's (1970) report of fowl cholera among American Coots (*Fulca americana*) in 1967-68. There has been no systematic assessment of waterfowl use of Everglades estuaries. In this paper, we analyze the status and the seasonal and geographic distribution of waterfowl wintering in the southern and southwestern coastal areas of Florida, based on available historical data and on the results of censuses conducted over 3 years.

## METHODS

WE ANALYZED FOUR sets of data in this paper. The Coot Bay Christmas Bird Count (hereafter, CBC) provided a 31-year record (1951-1981) of waterfowl over an area of 458 km<sup>2</sup> near Flamingo, Florida (Fig. 1). Because these data are from a small area, they were affected by the vagaries of waterfowl distribution and movement along the southern Florida coast, as ducks may shift short distances into or out of the count area in response to changing water and weather conditions. However, these data, resulting from a considerable effort, probably represent a fairly accurate census of waterfowl present in the count area on a single day.

They are especially useful in locating relatively rare species. On the count, waterfowl were censused by both ground parties and by fixed-wing aircraft. Count data were not adjusted on a per party-hour basis, because information on all but the very rare species was derived from complete aerial surveys that were conducted in the same way each year.

The second source of data was the midwinter aerial waterfowl survey sponsored by the United States Fish and Wildlife Service (Larned *et al* 1980). This survey, conducted by personnel of the Fish and Wildlife Service, Florida Game and Fresh Water Fish Commission, and the National Park Service, attempts complete counts in

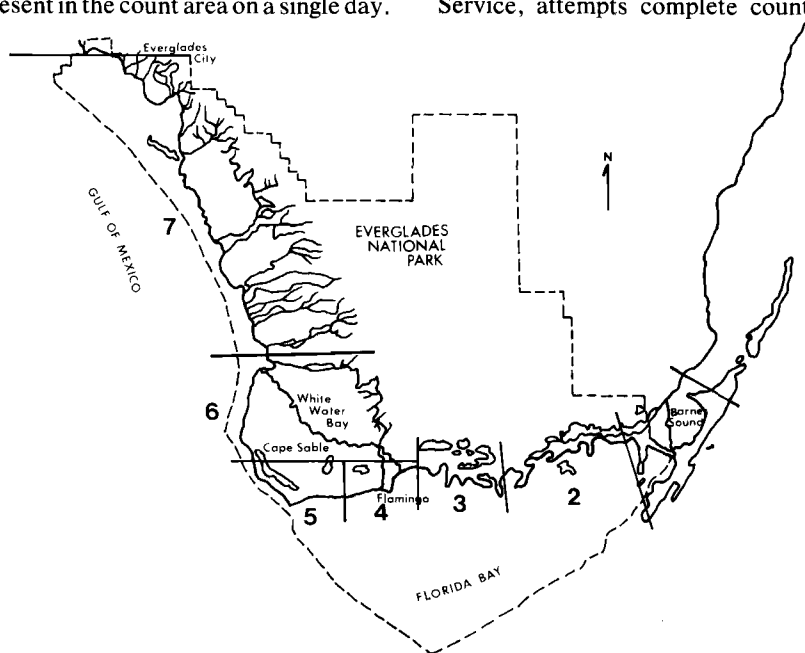


Figure 1. Map of southern Florida showing Everglades National Park and seven waterfowl census regions.

major waterfowl habitats, rather than using a statistical sampling procedure, and provides more information on distribution than absolute abundance (Fish and Wildlife Service 1981). In southern Florida, the survey was conducted using fixed-wing aircraft. Specific routes covered, altitude, observer skill, aircraft type, and areas covered varied in different years. Midwinter survey data were available to us from 1970 to 1981. The CBC provided a check on this aerial survey data.

A third source of data was banding records from the U.S. F. & W.S. bird-banding laboratory. From these data we obtained information on the origin of waterfowl reported from south Florida, at or south of latitude 27°N. Data were available from 1920 to 1981. For this analysis we divided North America into four sections. The northeast included Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Maine, Vermont, Massachusetts, New York, New Jersey, Delaware and Maryland. The Midwest included Ohio, Michigan, Wisconsin, Minnesota, Saskatchewan, Manitoba, North Dakota, South Dakota, Nebraska, Iowa, Kansas and Missouri. The southeast included North Carolina and Florida. The west included Northwest Territory, Alberta, Montana, Utah, Nevada, Colorado, Alaska, Washington, Oregon, and California.

The most useful data were derived from our extensive aerial censuses

flown in the winters of 1977-78, 1978-79, and 1979-80. In each month from November 1977 through March 1978, we censused coastal areas of southern and southwestern Florida from fixed-wing aircraft. The census covered Barnes Sound along the coast and inland lakes north of Florida Bay, Cape Sable, Whitewater Bay, and inland bays of the west coast north to Everglades City (Fig. 1). Shorelines, shallow lakes, bays, pools and coves were searched from an altitude of 50 to 100 m and all visible waterfowl were identified and numbers estimated. To analyze seasonal movements, we divided the census area into 7 regions, as shown in Figure 1. The censuses in 1977-1978 provided information on seasonality of occurrence and spatial distribution. The entire area was resurveyed in January 1979 and January 1980 to provide a year-to-year comparison. The data represent an attempt to achieve a complete census. Lacking information on the extent of bias, our best estimates of the wintering waterfowl population were the actual number of birds we counted, which probably represent a conservative population figure.

## RESULTS AND DISCUSSION

### Faunal composition

OVER THE 31 YEARS of the Coot Bay CBC, the American Coot and 22

species of ducks (scientific names in Table 1) have been identified as occurring in the Everglades estuaries (Table 1). This represents nearly half of the species of swans, geese, and ducks in the United States.

Coots have historically been the most abundant waterbirds in the Everglades estuaries (Rodgers 1974), and 6 species of ducks winter in large numbers in the area. In January 1978 over 99% of the wintering duck-population consisted of 6 species: Blue-winged Teal (41.4%), Lesser Scaup (23.6%), Pintail (18.5%), American Wigeon (9.2%), Ring-necked Duck (4.6%), and Northern Shoveler (2.5%). These species were also consistently present from one year to the next, being found on over 90% of the CBCs (Table 1). Mottled Duck, Green-winged Teal, Ruddy Duck, and Red-breasted Merganser also occurred on over 90% of the counts. Geese are rare in the Everglades estuaries; Brant and Snow Geese were observed in only 3 years and 2 years, respectively. Black Duck and Oldsquaw were seen only once. Mallard was not regularly present. Mottled Duck was most common in the freshwater Everglades. Fulvous Whistling Ducks were first observed on the count in 1960 but have been seen regularly since 1977.

### Origin of the wintering population

DATA, SPANNING OVER 60 years, exist for 419 individuals represent-

Table 1. Waterfowl observed on Coot Bay Christmas Bird Counts, 1951-1981. Summarized from Bolte and Bass (1981), Bass (1981), and Bass (in press.).

Species	Minimum	Year	Maximum	Year	Percentage of Counts Observed
	Number		Number		
Brant ( <i>Branta bernicla</i> )	0	—	2	1971	10
Snow Goose ( <i>Anser caerulescens</i> )	0	—	1	1969	6
Fulvous Whistling Duck ( <i>Dendrocygna bicolor</i> )	0	—	46	1977	35
Mallard ( <i>Anas platyrhynchos</i> )	0	—	45	1958	61
Black Duck ( <i>Anas rubripes</i> )	0	—	11	1977	3
Mottled Duck ( <i>Anas fulvigula</i> )	2	1980	273	1960	100
Gadwall ( <i>Anas strepera</i> )	0	—	52	1973	71
Pintail ( <i>Anas acuta</i> )	7	1980	13,839	1977	100
Green-winged Teal ( <i>Anas crecca</i> )	0	1957	7,400	1967	97
Blue-winged Teal ( <i>Anas discors</i> )	50	1951	6,700	1967	97
American Wigeon ( <i>Anas americana</i> )	0	1955	1,900	1967	97
Northern Shoveler ( <i>Spatula clypeata</i> )	15	1955	1,609	1977	100
Wood Duck ( <i>Aix sponsa</i> )	0	—	4	1968	26
Redhead ( <i>Aythya americana</i> )	0	—	15	1961	58
Ring-necked Duck ( <i>Aythya collaris</i> )	0	—	5,626	1977	94
Canvasback ( <i>Aythya valisineria</i> )	0	—	1,433	1974	68
Lesser Scaup ( <i>Aythya affinis</i> )	20	1979	45,683	1952	97
Bufflehead ( <i>Bucephala albeola</i> )	0	—	25	1972	26
Oldsquaw ( <i>Clangula hyemalis</i> )	0	—	4	1977	3
Ruddy Duck ( <i>Oxyura jamaicensis</i> )	0	1972	2,504	1952	94
Hooded Merganser ( <i>Lophodytes cucullatus</i> )	0	—	50	1967	42
Red-breasted Merganser ( <i>Mergus serrator</i> )	22	1975	1,683	1960	97

ing 15 species banded on or near their breeding grounds and recovered in south Florida (Table 2). Waterfowl recovered were originally banded in all parts of North America, except the Southwest, including 35 states and provinces. Most of these species nest primarily in the Northeast or Midwest. Based on these banding returns, it was estimated that 66% of the wintering populations of these species were from the Midwest, 22% from the Northeast, 8% from the Southeast, and 4% from the West. Such totals, of course, must vary from year-to-year but it would appear, over the long-term, that most ducks wintering in south Florida are from the Midwest.

### Waterfowl population levels

TABLE 3 LISTS THE numbers of ducks and coots recorded on midwinter aerial surveys conducted in January from 1968 through 1980. The earliest complete survey of wintering waterfowl for which we have a record was conducted in the late 1960s by personnel of the Florida Game and Fresh Water Fish Commission. They censused the southwestern coast monthly from October 1967 to March 1968. In December, they found a peak population of over 7000 ducks, 97% of which were in the Cape Sable area (Rodgers 1974). A complete survey of the southern and western coast was also flown in 1968 by personnel of the U.S. F. & W.S. (Rodgers 1974) They counted about 14,000 ducks and 14,500 coots in January (Table 3).

From 1970 through 1977, not all areas were covered by the midwinter survey each year. Cape Sable was covered most consistently, probably because the survey of 1967-68 showed it to be the area used most heavily by waterfowl. Low numbers in these once per year midwinter surveys in the early 1970s may have been the result of selective coverage, which missed temporary regional accumulations of birds. This interpretation is supported by comparing midwinter survey data with those from the Coot Bay Christmas Count (Table 3) Even though both midwinter surveys and CBCs were conducted in the same month using similar aerial techniques and the count area was a subset of the survey area, in all but one year more ducks were found during the count than during the survey. In five of the seven years, more coots were found on the

Table 2. Origin of banded waterfowl recovered in south Florida.

	Northeast	Southeast	Midwest	West
Mallard	0	0	3	0
Black Duck	0	0	1	0
Mottled Duck	0	30	0	0
Gadwall	2	0	0	0
Pintail	2	0	11	2
Green-winged Teal	18	0	0	0
Blue-winged Teal	32	0	184	1
Unid. teal	0	0	0	1
American Wigeon	0	0	8	1
Northern Shoveler	0	0	2	0
Wood Duck	3	2	3	0
Redhead	0	0	2	0
Ring-necked Duck	30	0	56	3
Canvasback	0	0	1	0
Lesser Scaup	1	0	4	10
Hooded Merganser	6	0	0	0
Section Total	94	32	275	18

CBC than on the midwinter survey. It must be concluded that the data from the midwinter aerial surveys from 1970 through 1976 are of little use in evaluating wintering duck populations in the Everglades estuaries during this period.

Data from the CBC provide information on annual variability in the number of ducks in the count area (Table 3). From 1968 to 1981 duck counts varied over two orders of magnitude from about 400 to 40,000 birds. Coot numbers varied even more, from 30 to 20,000 birds. Differences between years probably reflect in part variability in habitat and weather conditions. The coastal marshes are usually dry in late winter, and the extent and timing of drying depend on local rainfall, which varies between years. Other local factors such as salinity patterns or food availability may also affect waterfowl numbers. The

frequency of cold weather farther north also probably influences waterfowl numbers in south Florida; after prolonged cold weather in the north the number of ducks found throughout the survey area seems to increase.

The best information on status of waterfowl in the Everglades estuary is from aerial censuses conducted during the 3 years of the present study, 1978-80 (Table 3). From these data, it would appear that the number of waterfowl wintering along the southern and southwestern Florida coast varies from 40,000 to 70,000, consisting of about equal numbers of ducks and coots (Table 3). Over the three years a minimum of about  $25,500 \pm 6700$  ( $\bar{x} \pm SD$ ) ducks and  $27,800 \pm 6100$  coots wintered along the southern and southwestern Florida coast. If the intensive surveys of 1968 provide a representative estimate

Table 3. Numbers of ducks and coots censused in the Everglades estuaries during midwinter aerial surveys in January from 1968 through 1981 and comparable numbers from the Coot Bay Christmas Bird Count.

Year	Area <sup>1</sup>	Midwinter Aerial Survey		Coot Bay CBC	
		Ducks	Am. Coot	Ducks	Am. Coot
1968	CS, SC, WC	13,900	14,500	17,134	3,600
1969	N	N	N	21,566	9,900
1970	CS	1,000	— <sup>2</sup>	10,268	1,160
1971	CS	1,000	100	12,489	20,000
1972	CS	4,300	12,000	4,040	2,030
1973	CS	1,000	—	4,521	7,208
1974	CS, SC	1,000	15,200	11,699	3,886
1975	CS	3,700	—	3,968	3,456
1976	CS, WC	9,800	12,000	38,617	930
1977	CS, SC	36,700	18,900	4,490	33
1978	CS, SC, WC	34,200	35,500	13,995	5,099
1979	CS, SC, WC	20,100	20,600	7,614	14,364
1980	CS, SC, WC	22,300	27,200	356	80
1981	CS, SC, WC	7,900	11,400	2,960	2,119

<sup>1</sup> Areas covered were CS = Cape Sable, SC = southern coast, WC = west coast (Fig. 1 for locations). N = indicates no survey data available. <sup>2</sup> Dash indicates no birds recorded.

of the waterfowl population in the late 1960s, comparison with the data available from the late 1970s suggests no decrease and possibly an increase in the numbers of waterfowl wintering in the Everglades estuary over the past decade. Montalbano's (*pers. comm.*) analysis of harvest data also suggests a slight, but not statistically significant, increase in waterfowl numbers statewide during this period.

### Seasonality

WINTERING WATERFOWL began to arrive in southern Florida in the fall and departed during the spring. By November 1977, over 7000 ducks and 7000 coots were present in the census area (Table 4). They increased to a peak of about 70,000 in January 1978. Numbers of ducks surveyed decreased by February, but coots did not decrease until March.

Numbers of ducks reached their maximums at different times in different areas (Fig. 1). The upper west coast (Region 7) supported the highest numbers before January while the northern Cape Sable area (Region 6) support highest numbers after January. A similar seasonal shift in distribution has been noted along the west coast in other waterbirds such as Wood Storks (*Mycteria americana*) (Ogden *et al.* 1978) and herons (Kushlan and Frohring *in prep.*).

The Blue-winged Teal, the most abundant duck in the survey, winters in areas south of the United States in greater numbers than any other North American duck, many passing through southern Florida *enroute* (Bellrose 1976). They were the first migrant ducks to arrive in southern Florida. Montalbano (1980) found that farther north in the state teal arrive earlier, peaking in September. The second increase of teal in March (Table 3) may reflect their return migration (Bellrose 1976).

The Lesser Scaup was the most abun-

dant diving duck in the Everglades estuaries and, along with the Ring-necked, is the most abundant duck wintering in Florida (Chamberlain 1960, Goodwin *pers. comm.*). Scaup numbers remained fairly constant through the winter, from November to March (Rodgers 1974).

The Pintail winters in high numbers south of Florida in the West Indies (Bellrose 1976). Over 8000 have been reported from the Cape Sable area in the past (Rodgers 1978). Chamberlain (1960) stated that Pintail are "quite punctual" in their departure from southern Florida during mid-February. The drop in numbers in this survey from February to March supports that statement.

The American Wigeon begins arriving in southern Florida in numbers in November and maintains a fairly high and stable population from December through February (Chamberlain 1960, Bellrose 1976). Populations in the Everglades estuaries were stable in December and January.

The Ring-necked Duck has been referred to as the diving duck of freshwater habitats in Florida (Chamberlain 1960). Two important wintering areas are Lake Okeechobee (Bellrose 1976) and Loxahatchee National Wildlife Refuge. In Loxahatchee, J.E. Takekawa (*pers. comm.*) has found that Ring-necked Ducks make up from 75% to over 90% of the wintering waterfowl population. A similar situation prevails in other water conservation areas of the northern Everglades. Depending on water levels, Ring-necked Ducks may shift wintering sites among northern Everglades and Lake Okeechobee habitats in different years (Takekawa *pers. comm.*). They also have been reported to be common in the interior Everglades marsh of Everglades National Park (Rodgers 1974). However, we have not observed this to be the case in our studies there since 1975. Their occur-

rence in impounded estuarine areas such as Merritt Island National Wildlife Refuge depends on salinity conditions each year (J.L. Baker *pers. comm.*) The Ring-necked Duck arrives in Florida in November, maintains stable populations into February and declines sharply in late February and early March (Chamberlain 1960). Populations of Ring-necked Ducks wintering in the Everglades estuaries during the 1970s reflected this larger pattern.

The Northern Shoveler normally winters west of Florida (Bellrose 1976) and are the least abundant of the common dabbling ducks in Florida (Chamberlain 1960). In the current survey, populations peaked in January.

### Regional distribution

WATERFOWL DISTRIBUTION varied within the census area. The regional pattern of distribution is shown in Figure 2. Waterfowl numbers were consistently low along Barnes Sound and northeastern Florida Bay (Regions 1 and 2). Blue-winged Teal was the most common duck, but in northeast Florida Bay its numbers varied from 200 to 1100 birds in different years.

The inland lakes and shallow bights north of central Florida Bay (Region 3) consistently attracted more waterfowl than other areas. In January 1978, those habitats supported nearly 45,000 birds, including 31,000 coots. Lesser Scaup was consistently the most abundant duck in this area, followed in numbers by Blue-winged Teal. In some years, they were important habitats for American Wigeon.

The lakes and mudflats of Cape Sable (Regions 4 and 5) also had relatively high numbers of waterfowl, particularly near Flamingo (Region 4), with numbers fluctuating from year to year. For example, the number of ducks censused there varied from 11,000 in 1978 to 40 in 1979, and coots varied from 3000 in 1978 to none in 1979. The potholes, streams, rivers, and mangrove swamps of northern Cape Sable and Whitewater Bay (Region 6) usually supported few waterfowl. Lesser Scaup was the primary species using this area.

Waterfowl use of the west coast (Region 7) was variable and peaked before the January census. Depending on the year, either Blue-winged Teal or Lesser Scaup was the most abundant duck there. This region was the most difficult

Table 4. Monthly aerial censuses of ducks and coots in the Everglades estuaries, November 1977 to March 1978

	Am. Coot	All ducks	Blue- winged Teal	Lesser Scaup	Pintail	Am. Wigeon	Ring- necked Duck	N. Shoveler
November	7,230	7,210	4,730	1,180	450	430	300	10
December	22,560	16,090	1,930	6,820	1,190	4,010	2,000	130
January	35,500	34,200	14,170	6,870	6,340	3,160	1,560	840
February	36,100	12,530	620	6,820	2,680	1,800	180	300
March	10,850	4,840	2,360	1,960	50	310	0	6

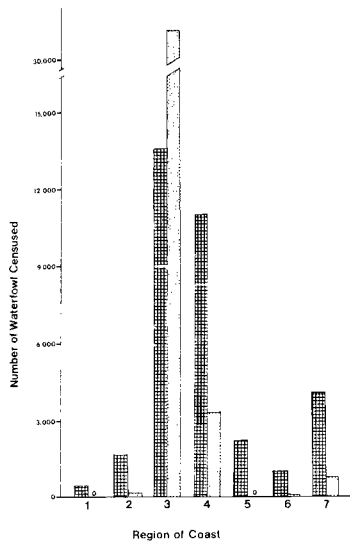


Figure 2. Number of ducks (cross-hatched) and coots (stippled) censused in January 1978 in seven regions.

to census adequately, and counts possibly underestimated the total number of waterfowl present.

#### Role of Everglades estuaries

ALTHOUGH IN SOME RECENT years at least 70,000 ducks and coots wintered in the estuaries of the Everglades, it is difficult to determine accurately how these numbers relate to the total waterfowl population of the state. Two methods usually used to compare waterfowl abundance are analysis of harvest data and analysis of survey data. Use of harvest data is probably one of the best methods of estimating populations and generating comparable indices. Rodgers (1974), for example, analyzed harvest data and found that the Everglades region, north of the park, accounted for one-fourth of the waterfowl taken by hunters in the state. Although this method has also been used on a statewide basis (Rodgers 1974, Montalbano 1980), it is inapplicable to an area protected from hunting, such as the Everglades estuaries. Comparing populations using survey data as indices of abundance must be done cautiously because it has not yet been practical to survey all waterfowl habitat in Florida. Rodgers (1974), analyzing mid-winter survey data, estimated that statewide waterfowl populations were 680,000 in 1969 and 220,000 in 1970, for a 2-year mean of 450,000 birds. Survey of the Everglades estuaries in 1968 accounted for only 6% of the number found statewide in 1969-1970.

Such estimates suggest that the Everglades estuaries do not represent the

dominant wintering area for waterfowl within the state. Fewer ducks occur in the Everglades than on areas such as St. Marks and Merritt Island National Wildlife Refuges (Goodwin 1979). In Everglades National Park, management is aimed at protection and preservation of natural ecosystems, and waterfowl wintering in the Everglades are supported without species-oriented manipulation. The ability of the Everglades estuary to provide stable habitat for wintering waterfowl is not known in any quantitative sense. Variations in water levels and salinity probably have marked effects on habitat quality. Locally, the role of hydrological and salinity regimes in maintaining waterfowl habitat merits particular attention. Although these estuaries may not have a significant effect on the continental waterfowl populations, it is probable that 70,000 ducks and coots have a substantial impact on the Everglades estuary itself. To the extent that the numbers and seasonal distribution of waterfowl in the Everglades are affected by habitat management and species oriented hunting regulations along the flyways farther north, such activities could influence the ecological impact of waterfowl in the Everglades estuaries.

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