WETLAND BIRDS IN TURKS AND CAICOS ISLANDS II: WETLAND BIRD COMMUNITIES

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Wetlands occupy a large proportion of the land area of the Turks and Caicos Islands, a U.K. Overseas Territory in the Bahamas archipelago. Furthermore, over most of the Caicos Islands these wetlands remain effectively unaltered by human activities. In the context of rapid wetland destruction and degradation in the Caribbean region, the wetland resources of Turks and Caicos are potentially of great importance for biodiversity conservation. However, very little is known about their ecology, and the bird communities they support. A survey of wetland birds in the Caicos Islands was conducted in February - April 1999. Four main wetland types were examined: lagoons, coastal saltflats, coastal mangroves and coastal beaches. The wetland bird community comprised a large number of wintering boreal-temperate waterbirds, along with characteristic resident species of Caribbean wetlands. Overall bird numbers were rather low. Cluster analysis was used to identify two broad types of lagoon habitats: shallow salinas, with exposed mud and little flooded marginal vegetation; and deeper ponds, with flooded marginal vegetation and mangrove fringes. Bird communities differed between these two lagoon types. Two globally threatened wetland species were present: West Indian Whistling-duck (Dendrocygna arborea) and Piping Plover (Charadrius melodus).

Key Words: Caribbean wetlands, cluster analysis, Piping Plover, West Indian Whistling-duck

Caribbean wetlands have suffered high rates of destruction and degradation in recent decades (Finlayson & Moser 1991). However, in Turks & Caicos Islands, a UK Overseas Territory that forms the southern part of the Bahamas archipelago (see Hilton *et al.* 2000), substantial wetland areas remain in a largely natural state (Oldfield 1999). They are low-lying limestone islands; the Atlantic (northern) coasts are sandy or rocky, behind which is a zone of xerophytic scrub dotted with numerous, shallow, brackish-saline lagoons, frequently mangrove fringed. Towards the Caribbean shores of the islands are saltflats, which occupy more than half of the total land surface. These areas contain flashes of shallow hypersaline water, with areas of low mangrove forest interspersed with many small shallow sea-creeks.

The UK has a particular responsibility for nature conservation in its Overseas Territories. Recent reviews have indicated that these territories support a biodiversity resource that has hitherto been largely overlooked (Pienkowski 1998; Oldfield 1999), and the ornithological interest of the Turks and Caicos is under-reported (but see Buden 1987; Norton & Clarke 1989; Bradley 1995; Walsh-McGehee et al. 1998; White 1998). However, there are large-scale tourism development pressures, particularly on the uninhabited island of East Caicos (Anon 1998; Oldfield 1999). Here we describe the wetland bird communities of the Caicos Islands during February-April 1999.

The bulk of the study consisted of dawn and dusk surveys at lagoons within the xerophytic scrub habitat. Cluster analysis was used to examine the main habitat types of the lagoons, and to describe groups of wetland bird species that show similar distribution patterns. For the three remaining wetland habitats - mangroves and creeks, saltflats, and Atlantic coastal beaches - subjective descriptions of the wetland bird communities are given.

Methods

Fieldwork

The main methods used are described in Hilton *et al.* (2000). Forty-eight lagoons were visited at either dawn or dusk by one-three observers using stationary observation points. Of these lagoons, seven were completely dry, and no wetland bird counts were made. At the remaining sites, all wetland birds were recorded using look-see surveys (Bibby *et al.* 1993), during periods of 45 - 150 minutes. Two sites held no wetland birds. Bird visibility was extremely good as the sites have simple topography and almost no emergent aquatic vegetation. In this paper, species richness is measured simply as the number of species detected, without correction for unrecorded species (see Boulinier *et al.* 1998, Nichols *et al.* 1998). This potentially introduces a bias into our comparisons of species richness among different lagoon types, if there are significant differences in species detection probabilities between lagoon types. However, our study design explicitly avoided this problem by adjusting observer effort (duration of site visit) according to the species detection probability for each site. Thus site-visits were continued until no new species were being added to the species list, with longer periods being necessary to achieve this at larger or more complex sites.

Site selection was not random, so no attempt is made to use counts at this sample of wetlands to extrapolate bird numbers over the whole territory.

A few line transects were conducted on

the saltflats and through the mangrove/creek habitat (see Hilton *et al.* 2000). However, these transects were insufficient to allow estimation of bird densities. Thus the records made during these transects are combined with incidental observations to give qualitative descriptions of bird communities for these wetland habitats.

Cluster Analysis

Agglomerative hierarchical cluster analysis was used in SPSS Version 7.5 (Norusis 1994) to determine whether species formed coherent groups by their pattern of presence and absence at lagoons. This procedure begins with each species as a separate cluster, and proceeds by combining the two most similar clusters at each step until all species are combined in one cluster. The choice of which number of clusters best describes the patterns in the data is based on (1) visual inspection of dendrograms that depict the step-wise joining of clusters and (2) measures (co-efficients) of the similarity of clusters that are joined. Each successive step combines progressively less similar clusters. When the coefficient becomes large, the clusters that are being joined are very dissimilar.

Of the 53 wetland bird species recorded at lagoons, we selected 29 species for analysis that were recorded from four or more lagoons, and that were predominantly resident or winter visitors rather than passage migrants. Passage migrants were not included because the study period spanned pre-migration and migration periods for some species. For each of the 39 lagoons where birds were present, each species was scored as present or absent. The cluster analysis used 'average linkage between groups' to define species clusters. 'Pattern difference' dissimilarity measures were used on the binary presence/absence data.

The same procedure to define clusters of lagoons with similar habitat characteristics was used. For each lagoon five habitat variables was scored on a 0 - 2 scale: (1) area of the site, (2) extent of flooded marginal vegetation, (3) extent of mangrove fringe/islands, (4) extent of exposed mud, (5) maximum depth (see **Table 1**). 'Squared Euclidean Difference' was used to define the dissimilarity of clusters.

Results and Discussion

Lagoons

A high proportion of the lagoons had low species richness and held low numbers of birds (**Figures 1a, 1b**). Almost two thirds of the lagoons visited held fewer than 50 wetland birds and half held less than 20 birds.

Cluster analysis revealed two main habitat types (**Figure 2**). Cluster 1 contains 10 sites that had moderately or extensively flooded margins, moderate or extensive mangrove areas, and were moderately deep or deep. These sites are referred to as 'pond-type' sites (local people refer to such wetlands as ponds). Cluster 2 has sites that lacked flooded margins, had moderate or no mangrove areas, and were mostly shallow; these are referred to as 'salina-type' sites. A five-cluster solution is also apparent from the dendrogram, in which the first cluster splits into two, and the second cluster splits into three, mainly on the basis of site size.

Figure 3 shows the distribution among the two main lagoon types of the more widespread species. The relative number of sites of each type in which the birds occur

Table 1. Habitat characteristics of 39 lagoons in the Caicos Islands, February - April 1999, and the criteria used to define them. The scores were used to identify groups of sites with similar habitat characteristics using cluster analysis.

		Score		
		0	1	2
Criteria for score	Extent of flooded margins	None (28)	Moderate (7)	Extensive (4)
	Maximum depth	<0.3m (13)	0.3-0.6m (15)	>0.6m (11)
	Extent of mangroves	None (14)	Moderate (15)	Extensive (10)
	Area	0-10 ha (12)	11-100 ha (18)	>100 ha (9)
	Extent of exposed mud	None (9)	Moderate (17)	Extensive (13)

shows the extent to which they are specialists on a particular lagoon-type. Black-bellied Plover *Pluvialis squatarola,* Least Sandpiper *Calidris minutilla*, Greater Yellowlegs *Tringa melanoleuca* and Greater Flamingo *Phoenicopterus ruber* are strong salina specialists; more surprisingly so is Osprey *Pandion haliaetus*. Pond specialists include American Coot *Fulica americana*, Blue-winged Teal *Anas discors*, Great Blue Heron *Ardea herodias*, and to a lesser extent White-cheeked Pintail *Anas bahamensis*, Green Heron *Butorides striatus* and Tricoloured Heron *Egretta tricolor*.

Figure 4 shows the pattern of species clusters by presence/absence at lagoons. The dendrogram suggests that there is not a highly structured set of discrete species clusters. Instead, each step of the procedure tended to produce a small gain in coefficient, implying that the distribution patterns of species among lagoons varied along a continuum.

These broad patterns were used to define three species-groups for further analysis of distribution patterns.

Cluster 1

Largely piscivorous species (13 species): herons, egrets and spoonbill, Brown Pelican *Pelecanus occidentalis*, Belted Kingfisher *Ceryle alcon* and Pied-billed Grebe *Podilymbus podiceps*, plus Spotted Sandpiper *Actitis macularia*, and Black-necked Stilt *Himantopus mexicanus*.

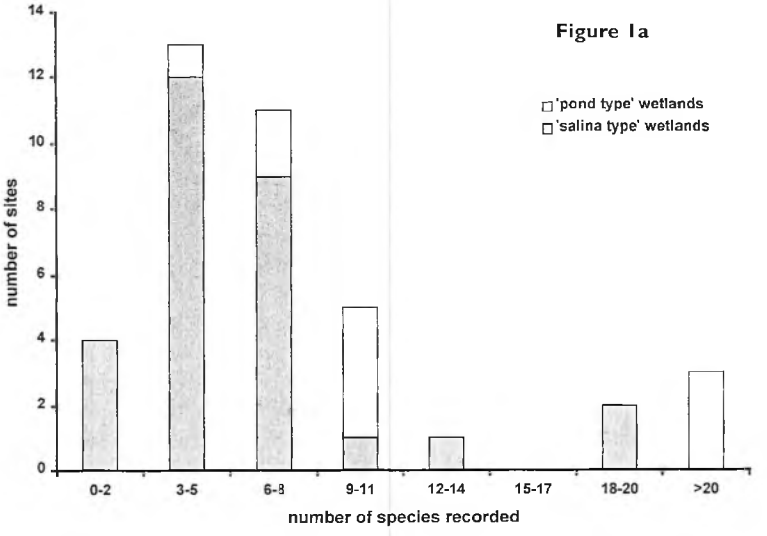
Cluster 2

Swimming and diving species (5 species): American Coot, Common Moorhen *Gallinula chloropus*, White-cheeked Pintail, Blue-winged Teal, and Least Grebe *Tachybaptus dominicus*.

Cluster 3

Coastal waders (4 species): Ruddy Turnstone *Arenaria interpres*, Sanderling *Calidris alba*, Least Sandpiper and Black-bellied Plover.

Note that these groups are defined heuristically with the intention of identifying some habitat associations of three guilds that show relatively well-defined clustering. They do not represent the outcome of a formal selection procedure, and do not include all species.



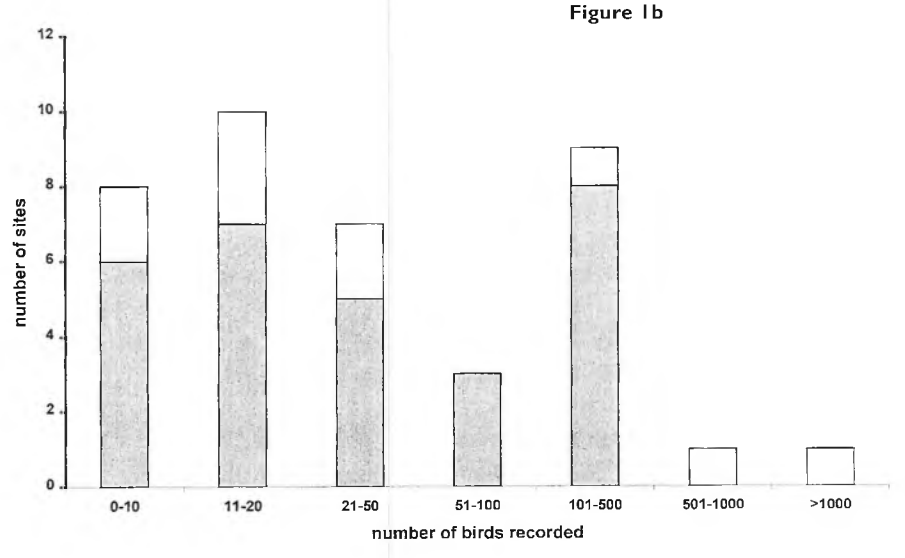


Figure 1. Frequency distribution of (a) wetland bird species richness at lagoon sites in Turks and Caicos, and (b) number of wetland birds at lagoon sites in Turks and Caicos (n=41 lagoons).

Pond-type sites tended to have higher species richness of wetland birds (**Figure 1**, Mann-Whitney U=76.0, *P*=0.025). Species richness of cluster 1 and cluster 2 species was higher at pond-type sites than at salina-type sites (Mann-Whitney U=51, *P*=0.002 and U=91, *P*=0.05 respectively). Species richness of cluster 3 species showed the reverse pattern, with a tendency for higher richness at salina-type sites than at pond-type sites (Mann-Whitney U=88.5, *P*=0.057).

These analyses show some similarities to those of Halse *et al.* (1993) for south-west Australian wetlands. The wetlands in the Australian study formed clusters largely on the basis of salinity, depth and density of vegetation. While all the wetlands in our study were saline, there was a comparable distinction between the deeper, more vegetated 'pond' type wetlands and the shallow, unvegetated 'salina' types. In both studies, a cluster of largely piscivorous birds - especially Ciconiiformes - was apparent, as was a cluster of predominantly swimming birds, especially Anatidae. In both studies, these groups tended to avoid shallow, hypersaline wetlands. Similarly both studies found a smaller cluster of species that were apparently specialised on 'salina' type wetlands. The Australian study had a group of species confined to well-vegetated, brackish or fresh wetlands - whereas this guild was absent in our study, due to a lack of wetlands of this type. In the present study, wetland bird guilds were not so clearly defined as in the comparable studies of Halse *et al.* (1993), and Pöysä (1983) (who worked in a boreal landscape). This may reflect greater homogeneity of wetland type in the present study, or lower levels of habitat-specialisation among the species present.

Sandy beaches

Fourteen kilometres of this habitat was walked on East Caicos, and incidental sightings were made elsewhere. Brown Pelicans and Ospreys were common. The wading bird community consisted of Piping Plover *Charadrius melodus*, Snowy Plover *Charadrius alexandrinus*, Wilson's Plover *Charadrius wilsonia*, Ruddy Turnstone and American Oystercatcher *Haematopus palliatus*.

Saltflats

During the present study the avifauna of this extensive habitat was very poor, both in species richness and in bird density. On East Caicos 20km of walking transect using a 400m-wide belt produced: two Reddish Egrets *Egretta rufescens*, three Black-bellied Plovers, two Ruddy Turnstones, one Greater Yellowlegs and two Semipalmated Plovers *Charadrius semipalmatus*. During the present study much of the saltflat habitat was dry, and the shallow flashes of water that remained lacked visible plant or invertebrate life. The saltflats, covering over half of the land area of the Caicos Islands, are potentially an important wetland. The seasonal use of them by birds needs to be more firmly established: bird densities were apparently orders of magnitude higher in this habitat during October and November 1998, when water levels were much higher (M. Pienkowski and S. Cross, verbally).

Coastal mangroves and creeks

This habitat held relatively high densities of herons and egrets, most notably Green Heron, Great Blue Heron, Yellow-crowned Night Heron *Nyctanassa violacea*, and Reddish Egret, along with Belted Kingfisher and Osprey. An 8km transect through a

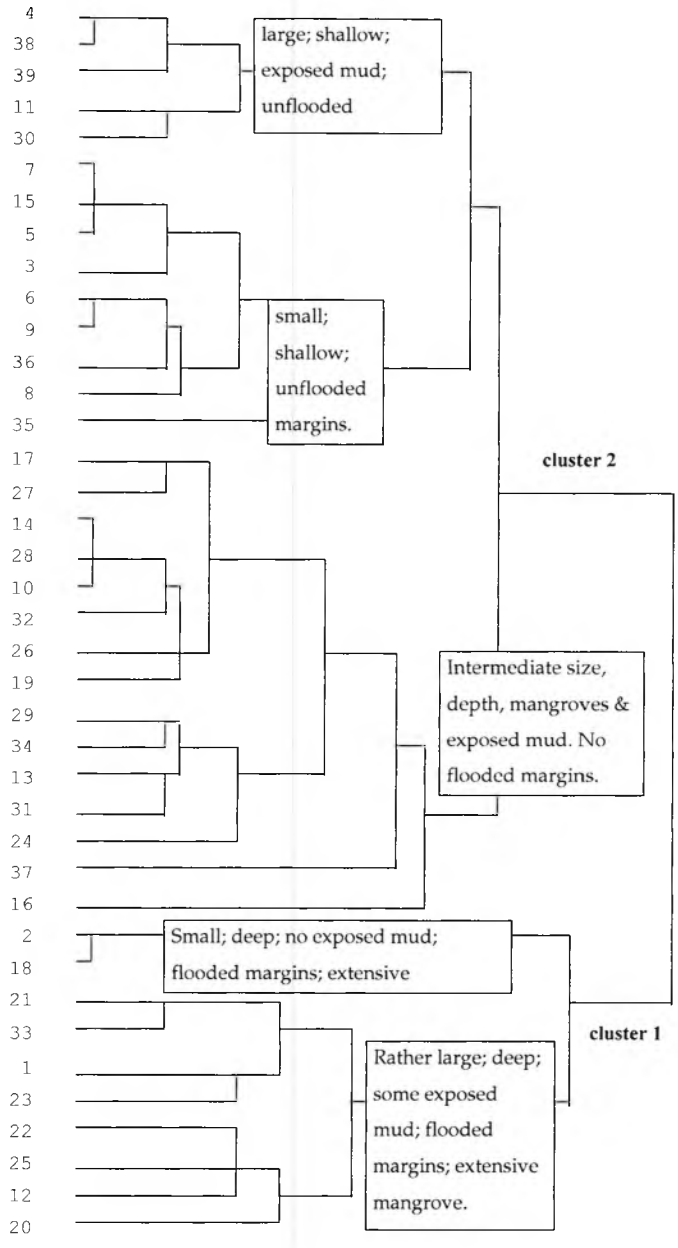


Figure 2. Cluster analysis dendrogram for 39 lagoons in the Caicos Islands. Sites are grouped by habitat features: site area; maximum depth; extent of exposed mud; extent of mangroves; extent of flooded margins. All were measured on a 0-2 scale. Cluster analysis was agglomerative, with step-wise joining of the most similar cluster. The step-wise procedure starts on the left hand side with 39 separate sites, and proceeds to the right hand site, where there is a single cluster of all sites. 'Cluster 1' and 'Cluster 2' refer to the two main clusters (pond-type and salina-type) used in subsequent analysis of bird species' distributions. Boxed text describes the habitat features that distinguish groups of sites in the five-cluster solution.

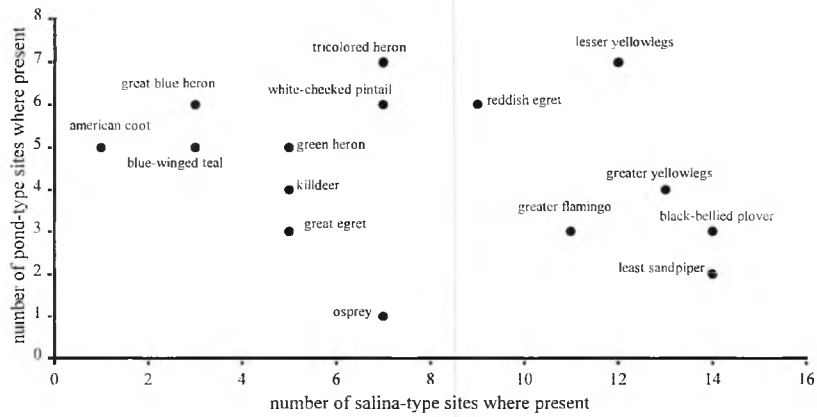


Figure 3. Distribution of common wetland bird species (occurring at ≥ 8 lagoons) among pond-type and salina-type lagoons in the Caicos Islands.

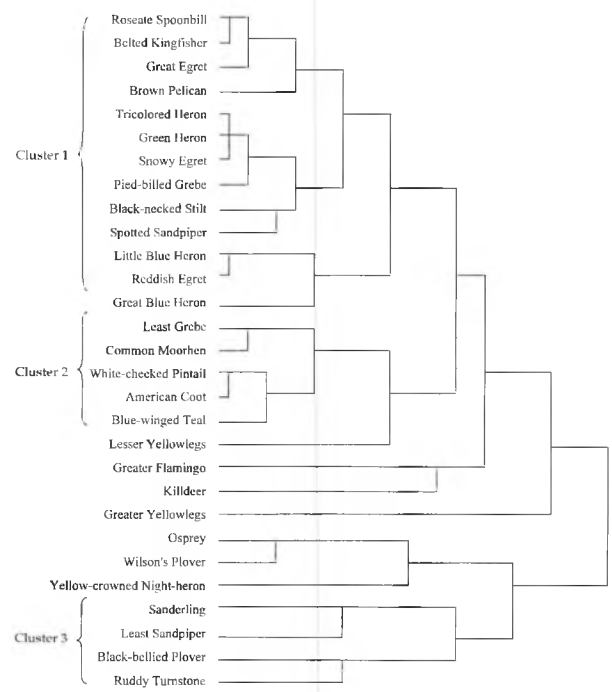


Figure 4. Cluster analysis dendrogram for wetland bird species in the Caicos Islands. Species are grouped by presence/absence patterns at 39 lagoons. Species or species-groups that are combined early in the procedure (the left hand side of the dendrogram) show particularly similar presence/absence patterns, and the groups with the most different distribution patterns are joned late in the procedure (the right hand side of the dendrogram). N=29 species that occurred at ≥ 4 lagoons, and were not passage migrants. The three clusters used for analysis of habitat use are indicated on the dendrogram (1) grouping of mainly piscivorous species; (2) grouping of ducks, rails and least grebe; (3) grouping of coastal waders.

100m-wide belt of this habitat on East Caicos produced: four Reddish Egret, seven Great Blue Heron, four Yellow-crowned Night Heron, four Green Heron, three Ospreys and three Belted Kingfisher.

Birds of global conservation concern and unusual records for the territory

West Indian Whistling-duck: see Hilton *et al.* (2000) for a full discussion of this species.

Piping Plover: Six individuals of this globally threatened species (Vulnerable, Collar *et al.* 1994) were recorded on the Atlantic coast of East Caicos between 2-9 March. The birds were found on a narrow sandy beach with low rocky outcrops, and considerable areas of tideline kelp. The count represents a small (<1%) proportion of a world population estimated at 2,668 pairs in 1996 (Plissner & Haig 2000). These records may refer to passage birds, since birds typically arrive at North American breeding sites in late March - early April (del Hoyo *et al.* 1996). It is however possible that small numbers winter in Turks and Caicos. The recent international winter census accounted for only ca.25% of the estimated wintering population (Plissner & Haig 2000), and Nichols & Baldassarre (1990) suggest that substantial numbers possibly winter at unknown sites in the Caribbean and Mexico.

Sandhill Crane *Grus canadensis* appears to be a first record for the territory, and for the Bahamas archipelago. A single individual was seen at a lagoon at Topham Pond, Middle Caicos on 17 and 18 March. The only breeding population in the Caribbean is on Cuba, where the species is rare and threatened (Raffaele *et al.*. 1998). Double-crested Cormorant *Phalacrocorax auritus*, was previously a vagrant only (single birds on Providenciales and Grand Turk, Bradley 1995; White 1998). In the present study three individuals were seen at one site. This species is expanding its range eastwards in the West Indies. Six Neotropic Cormorants *Phalacrocorax brasilianus* were recorded at three sites. These records are the first published for the Caicos Islands (Bradley 1995; White 1998) and may represent early stages in colonisation: the species' range is expanding eastwards, and there are now resident breeding populations on Cuba and Great Inagua, southern Bahamas (Raffaele *et al.* 1998). One American Bittern *Botaurus lentiginosus* was recorded; the species is previously recorded only as a vagrant on Grand Turk and Parrot Cay (White 1998). Previous to the 23 Roseate Spoonbill *Ajaia ajaja* recorded here, there have been just three records of one-two birds (Walsh-McGehee *et al.* 1998).

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APPENDIX

Wetland bird species recorded in the Caicos Islands during February - April 1999

Species		No of lagoons where present[1]	Total no of of birds recorded[2]
Pied-billed Grebe	*Podilymbus podiceps*	5	17
Least Grebe	*Techybaptus dominicus*	4	62
Brown Pelican	*Pelecanus occidentalis*	6	45
Double-crested Cormorant	*Phalacrocorax auritus*	1	3
Neotropic Cormorant	*Phalacrocorax olivaceus*	2	3
American Bittern	*Botaurus lentiginosus*	1	1
Great Blue Heron	*Ardea herodias*	9	35
Great Egret	*Egretta alba*	8	59
Snowy Egret	*Egretta thula*	6	22
Little Blue Heron	*Egretta caerulea*	3	8
Tricoloured Heron	*Egretta tricolor*	14	139
Reddish Egret	*Egretta rufescens*	15	67
Cattle Egret	*Bulbulcus ibis*	1	6
Green Heron	*Butorides striatus*	10	16
Black-crowned Night Heron	*Nycticorax nycticorax*	1	1
Yellow-crowned Night Heron	*Nyctanassa violacea*	7	11
Roseate Spoonbill	*Ajaia ajaja*	3	23
Greater Flamingo	*Phoenicopterus ruber*	14	2751
West Indian Whistling-duck	*Dencroccygna arborea*	1	2
Mallard	*Anas platyrhynchos*	1	4
White-cheeked Pintail	*Anas bahamensis*	13	281
Blue-winged Teal	*Anas discors*	8	27
American Wigeon	*Anas americana*	1	8
Lesser Scaup	*Aythya affinis*	1	1
Ruddy Duck	*Oxyura jamaicensis*	1	1
Osprey	*Pandion haliaetus*	8	12
Sora Rail	*Porzana carolina*	1	1

Clapper Rail	*Rallus longirostris*	3	7
Common Moorhen	*Gallinula chloropus*	5	18
American Coot	*Fulica americana*	6	3088
Sandhill Crane	*Grus canadensis*	1	1
Black-bellied Plover	*Pluvialis squatarola*	17	73
Snowy Plover	*Charadrius alexandrinus*	1	2
Wilson's Plover	*Charadrius wilsoni*	4	6
Piping Plover	*Charadrius melodus*	sandy beach	habitat only
Semipalmated Plover	*Charadrius semipalmatus*	1	7
Killdeer	*Charadrius vociferus*	9	28
American Oystercatcher	*Haematopus palliatus*	Sandy beach	habitat only
Black-necked Stilt	*Himantopus mexicanus*	5	198
Greater Yellowlegs	*Tringa melanoleuca*	17	128
Lesser Yellowlegs	*Tringa flavipes*	19	403
Willet	*Catoptrophus semipalmatus*	1	3
Spotted Sandpiper	*Actitis macularia*	6	15
Ruddy Turnstone	*Arenaria interpres*	6	23
Sanderling	*Calidris alba*	5	71
Semipalmated Sandpiper	*Calidris pusilla*	8	124
Western Sandpiper	*Calidris mauri*	1	1
Least Sandpiper	*Calidris minutilla*	16	405
Dunlin	*Calidris alpina*	1	2
Stilt Sandpiper	*Calidris himantopus*	1	12
Snipe	*Gallinago gallinago*	2	2
Short-billed Dowitcher	*Limnodromus griseus*	3	6
Mangrove Cuckoo	*Coccyzus minor*	3	4
Belted Kingfisher	*Ceryle alcon*	7	12
White-crowned Pigeon	*Columba leucocephala*	1	4

1: n=48 lagoons, of which seven were completely dry, and a further two had no wetland birds. Total number of lagoons for the territory = 130

2: Only includes birds recorded during the lagoon survey; birds recorded during saltflat, mangrove and beach surveys are not included.