AVIAN USE OF DITCHED AND UNDITCHED SALT MARSHES IN SOUTHEASTERN NEW ENGLAND: A PRELIMINARY REPORT[1]

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INTRODUCTION

Widespread ditching of salt marshes to eliminate breeding sites of the salt marsh mosquito (Aedes sollicitans) reached a peak throughout the Northeast during the 1930's when Federal funds for relief labor became available. By 1938, approximately 90% of the original area of tidal wetlands between Maine and Virginia had been altered (Bourn and Cottam 1950). In Rhode Island, roughly one-half of the state's 1500 ha of salt marsh was ditched (MacConnell 1974). Ditching had practically stopped in this state by 1939 because of dwindling Federal funds, a lack of labor to maintain ditches already dug and growing concern over the impacts of ditching on the natural values of marshes (Office of Entomology and Plant Industry 1939).

Parallel or grid ditching, which was the usual method in the 1930's, is now viewed as totally unnecessary and often ineffective (Ferrigno 1970). Today, most mosquito control experts favor the "open marsh water management" (OMWM) system developed in New Jersey (Ferrigno and Jobbins 1968). However, while OMWM techniques are used in two Rhode Island towns (Boyes and Capotosto 1980, Marques 1980) and on Cape Cod (pers. comm., O.W. Doane, Cape Cod Mosquito Control Project, Hyannis, Mass., 16 September 1981), most New England dis-

[1]This paper is the result of research sponsored by the NOAA Office of Sea Grant, U.S. Department of Commerce, under Grant No. NA79AA-D-00096.

tricts have neither the manpower nor the equipment to conduct an OMWM program as it is done in New Jersey. Mosquito control for most districts simply involves cleaning debris and sediment from the ditches dug in the 1930's. Table 1 gives some indication of the extent of this effort in Massachusetts, Connecticut and Rhode Island. In effect, then, parallel ditching is still being practiced in the Northeast.

Despite the magnitude of the mosquito ditching effort in this region, the impacts on salt marsh biota remain poorly known. No detailed, quantitative studies of such effects have ever been published in New England, and research outside of the region has been limited. Burger et al (1978) summarized the research relating to the effects of ditching on salt marsh birds. Most studies have addressed breeding species such as the clapper rail (Rallus longirostris), the herring gull (Larus argentatus) and the laughing gull (Larus atricilla) which do not breed extensively in New England marshes. Only Florschutz (1959), working in Delaware, attempted to determine the effects on the entire bird community. Burger et al (1978) specifically noted the lack of data on red-winged blackbirds (Agelaius phoeniceus) and marsh sparrows (Ammospiza spp.), which breed in abundance on some New England marshes, and waterfowl which use these marshes throughout the year.

The following pages present preliminary data from a research project designed to: (1) systematically identify the key features of southeastern New England salt marshes that determine their value as avian habitat in all seasons, and (2) explain how ditching affects these features and the birds that depend upon them.

Table 1. Magnitude of current and proposed mosquito ditching maintenance programs in southern New England salt marshes.

Location	Length of Ditch Cleaned (km)	
	1979-81	1982-92
MASSACHUSETTS		
Barnstable County	256	853
Bristol County	62	61
Essex County	30	-
Plymouth County	28	457
RHODE ISLAND		
Barrington	<1	1
North Kingstown	2	-
CONNECTICUT	229	914

METHODS

Six study areas, ranging in size from 11.5 to 31.0 ha, were selected along the northern and eastern borders of the Narragansett Bay estuary in Rhode Island and Massachusetts. Three of the salt marshes are parallel-ditched at intervals ranging from 30 m to 100 m, two lack ditches entirely, and one is unditched except for a small area where OMWM has been practiced since 1976. For the purposes of this project, all of the latter three marshes are considered unditched. All sites are bordered primarily by deciduous forest and open water, with smaller areas of agricultural land and low density residential development at some sites. Human use of all marshes is minimal, except during the waterfowl hunting season.

In the summer of 1980, a grid system was laid out in each area by driving oak stakes into the soil at 30-m intervals from perpendicular baselines established with a transit. Cover maps showing various plant communities, permanent ponds, mosquito ditches, creeks and upland islands were prepared from 1:2400-scale false-color infrared aerial transparencies taken of the study areas in October of 1980. The grids were superimposed on these maps so that data could be accurately ploted in the field. The length of ditches and tidal creeks in each marsh was measured directly from the aerial transparencies, and the number of ponds within various size classes was determined. Areas of the plant communities will be measured also, so that data on avian use can be correlated with the relative abundance of the various habitat types in each marsh. The major types referred to in this paper are:

1. Permanent Ponds - Ponds, usually 0.3 to 0.8 m deep, which contain water at all times. Most support the submergent plant, Ruppia maritima, as well as surface mats of algae during the summer.

2. Tidal Water - Open water which is present in tidal creeks, ponds and ditches during only part of the tidal cycle.
3. Mud Flats - Unvegetated, muddy areas which lie exposed in creeks, ditches or ponds during part of each tidal cycle. The same area may be regarded as tidal water or mud flats, depending upon the tidal stage when observations are made.
4. Tall Form of Spartina alterniflora - The vegetated portion of the marsh where the substrate is flooded and exposed during every tidal cycle. The only vascular plant present is S. alterniflora, a coarse grass which stands 1-2 m tall at maturity. This community occurs along the margins of creeks and ditches below the level of mean high tide.
5. Short Form of Spartina alterniflora - Stands of S. alterniflora which occur near the level of mean high tide, either as isolated patches within high marsh or around the edges of permanent ponds. S. alterniflora ranges in height from 0.2 to 0.8 m; Distichlis spicata and Salicornia europaea may be present also. This poorly drained community may have surface water for several days or almost continually.
6. High Marsh - The nearly level zone above mean high water which is covered by Spartina patens, Distichlis spicata, Juncus gerardi, Salicornia europaea, scattered short S. alterniflora and scattered forbs. Plants are fine textured and average less than 0.4 m in height at maturity.

7. Iva frutescens - A shrub community found at the highest elevations on some marshes. Iva occurs at the upland edge of the marsh or along mosquito ditches where mounds of spoil persist. Shrubs are normally 1.0-1.3 m tall.

Bird censusing began in December 1980 and will continue for 2 full years. Large birds such as herons, gulls, terns and waterfowl are censused from observation platforms strategically located in trees along the upland edge of each marsh. During the winter (Dec-Feb) and summer (Jun-Aug), platform censuses are conducted biweekly; they are done weekly during the spring (Mar-May) and fall (Sep-Nov) when birds are migrating. Shorebirds and songbirds are censused while the observer traverses the entire study area along transects that are 60 m wide and 60 m apart. One-half of the marsh is sampled during each census by walking every other strip; the intervening strips are walked on the following census. Transect censuses are run biweekly throughout the year. For each bird observed during a cnesus, the bird species, habitat type, height and type of perch and activity are recorded. The location of each bird is plotted on the grid map. The same observer conducts all 40 platform censuses and 28 transect censuses in each year.

Breeding ecology studies began in the spring of 1981. The territories of singing male red-winged blackbirds, seaside sparrows (Ammospiza maritima) and marsh wrens (Cistothorus palustris) were delineated by plotting the locations of singing males and noting the movement of birds between songposts, nest sites and foraging areas. Nests of these and other species were located by searching preferred habitat types, systematically traversing the entire marsh and flushing incubating females, and observing the movements of adults to and from active nests. In order to facilitate the recognition of individu-

al seaside sparrows and sharp-tailed sparrows (Ammospiza caudacuta) in marshes where populations of these species were especially dense, we captured birds in mist nests and placed an aluminum Fish and Wildlife Service band on one leg and a distinctive combination of three colored, plastic bands on the other leg of each bird.

The frequency and percent cover of all plant species located within a 4-m^2 circular plot centered on each nest were recorded for all nests of each bird species. The density of each plant species located in a 0.125-m^2 circular area directly surrounding each nest will be determined through stem counts. The distance from each nest to the nearest boundary between habitat types was measured in the field as well. Nests of passerine birds were checked weekly, whenever possible, to gather information on nest success and the length of various phases of the breeding cycle.

RESULTS

Avian Richness and Density

At this writing, the first winter, spring and summer censuses have been completed. A total of 2144 birds were observed during these first three seasons. Table 2 shows that the variety of birds seen (species richness) in unditched marshes daily or seasonally was consistently greater than that for the ditched marshes. The difference was smallest during the winter and greatest during the spring when more than twice as many species were observed in the unditched areas. The total number of birds observed per day per unit area during the spring and summer was nearly 3 times as great for unditched marshes. During the winter, avian densities were generally low in both types of marshes.

Table 2. Avian richness and density in ditched and unditched New England salt marshes from winter through summer of 1981.[1]

Season	Ditched (n=3)				Unditched (n=3)			
	n	Total spp.	Spp./day	Birds/day/ 100 ha	n	Total spp.	Spp./day	Birds/day/ 100 ha
Winter	133	7	2.1	41.7	80	11	3.0	26.0
Spring	151	13	3.9	35.1	620	31	11.5	111.5
Summer	251	21	9.3	120.6	909	32	14.9	301.4

[1]Waterfowl, waders, gulls and terns were censused biweekly in winter (Dec-Feb) and summer (June-Aug) and weekly in spring (Mar-May); shorebirds and songbirds were censused biweekly in all seasons.

The five major groups of birds observed on the marshes were waterfowl; waders (herons, egrets and ibises); gulls and terns; shorebirds and songbirds. During the spring and summer, the number of species observed in each of these groups in unditched marshes was the same as, or greater than, the number observed in ditched marshes (Table 3). The differences during the winter were less dramatic. During the spring and summer, all groups of birds were more numerous in the unditched marshes.

Seven species of birds nested in the unditched marshes, and all but one of these (the common tern, Sterna hirundo) nested in the ditched marshes as well (Table 4). The density for most breeding species was considerably greater in the unditched marshes, however. One hundred eighty-seven nests were discovered, including 38 in ditched marshes and 149 in the unditched areas. Red-winged blackbirds, seaside sparrows and marsh wrens were far more abundant in the unditched marshes. Sharp-tailed sparrows had the highest density of any breeding species, 34.5 females per 100 ha in ditched marshes and 53.4 females per 100 ha in unditched marshes. Redwings and sharptails accounted for 75% of the nesting females in the unditched areas, while sharptails alone comprised 71% of the breeding females at the ditched sites.

Habitat Use

Tables 5 and 6 present the number of species and density of birds in all of the groups observed in each of the six major habitat types during the spring and summer. In both seasons, the greatest numbers of waterfowl, waders, gulls, terns and shorebirds were seen in the permanent ponds of the unditched marshes. Shorebirds also made extensive use of mud flats in the unditched marshes during

Table 3. Species richness and density data for bird groups censused in ditched and unditched New England salt marshes in 1981.[1]

Season	Group	Ditched (n=3)			Unditched (n=3)		
		Species	n	Birds/day/ 100 ha	Species	n	Birds/day/ 100 ha
Winter	Waterfowl	1	117	33.9	4	32	6.8
	Waders	1	1	0.3	0	-	-
	Gulls, Terns	1	4	1.2	1	5	1.1
	Shorebirds	1	1	0.6	0	-	-
	Songbirds	3	10	2.9	4	43	18.2
Spring	Waterfowl	4	108	16.9	9	363	41.4
	Waders	1	4	0.6	4	81	9.2
	Gull, Terns	1	12	1.9	4	44	5.0
	Shorebirds	2	2	1.2	5	30	12.7
	Songbirds	5	25	14.5	5	102	43.2
Summer	Waterfowl	2	4	1.2	2	87	18.4
	Waders	5	80	23.2	7	276	58.5
	Gulls, Terns	2	2	0.6	4	33	7.0
	Shorebirds	6	13	7.5	9	109	46.2
	Songbirds	4	152	88.1	4	404	171.3

[1]Waterfowl, waders, gulls and terns were censused biweekly in winter (Dec-Feb) and summer (June-Aug) and weekly in spring (Mar-May); shorebirds and songbirds were censused biweekly in all seasons.

Table 4. Breeding bird densities and nests discovered in ditched and unditched New England salt marshes in 1981.

Species	Ditched (49.3 ha)			Undiched (67.4 ha)		
	Nests	Pairs	Pairs/100 ha	Nests	Pairs	Pairs/100 ha
Black Duck	1	1	2.0	5	3	4.5
Mallard	2	2	4.1	2	1	1.5
Common Tern	0	0	-	3	3	4.5
Marsh Wren	10	1	2.0	25	5	7.4
R-w Blackbird	1	1	2.0	60	31[a]	46.0
Sharp-t Sparrow	24	17[a]	34.5[a]	50	36[a]	53.4
Seaside Sparrow	0	2	4.1	4	10	14.8
Total	38	24	48.7	149	89	132.1

[a]Based on breeding females.

Table 5. Habitat used by birds censused in ditched and unditched New England salt marshes in spring, 1981.[1]

Treatment/ Group	Perm. Ponds		Tidal Water[3]		Mud Flats		Tall S. alt.		Short S. alt.		High Marsh[4]	
	Spp.	Density[2]	Spp.	Density	Spp.	Density	Spp.	Density	Spp.	Density	Spp.	Density
DITCHED												
Waterfowl	1	0.3	3	14.5	0	-	1	0.3	0	-	2	1.7
Waders	0	-	0	-	1	0.6	0	-	0	-	0	-
Gulls,Terns	0	-	1	0.3	1	0.3	1	0.6	0	-	1	0.6
Shorebirds	0	-	0	-	0	-	0	-	0	-	1	1.2
Songbirds	0	-	0	-	0	-	3	3.5	0	-	5	11.1
UNDITCHED												
Waterfowl	9	32.0	5	10.0	0	-	1	0.1	0	-	0	-
Waders	3	5.4	1	0.2	2	0.5	2	1.3	3	1.1	2	0.8
Gulls,Terns	4	4.1	0	-	1	0.3	1	0.1	0	-	1	0.5
Shorebirds	4	7.6	0	-	4	3.4	1	0.4	1	0.8	1	0.4
Songbirds	0	-	0	-	0	-	2	3.4	4	28.8	4	11.0

[1]First 3 groups censused weekly; last 2 groups censused biweekly.

[2]Expressed as birds/day/100 ha.

[3]Includes water present in ponds, creeks and ditches for only part of the tidal cycle.

[4]Includes areas dominated by *Spartina patens*, *Distichlis spicata*, *Juncus gerardi*, *Salicornia europaea*, *Iva frutescens* or a combination of these species.

Table 6. Habitat used by birds censused in ditched and unditched New England salt marshes in summer, 1981.[1]

Treatment/ Group	Perm. Ponds		Tidal Water[3]		Mud Flats		Tall S. alt.		Short S. alt.		High Marsh[4]	
	Spp.	Density[2]	Spp.	Density	Spp.	Density	Spp.	Density	Spp.	Density	Spp.	Density
DITCHED												
Waterfowl	1	0.9	1	0.3	0	-	0	-	0	-	0	-
Waders	1	0.3	1	13.3	1	0.9	3	3.2	0	-	3	5.5
Gulls,Terns	0	-	1	0.3	0	-	0	-	0	-	1	0.3
Shorebirds	0	-	0	-	4	5.2	1	0.6	0	-	3	1.7
Songbirds	0	-	0	-	1	0.6	4	36.5	2	13.3	3	37.7
UNDITCHED												
Waterfowl	2	18.0	4	0.4	0	-	0	-	0	-	0	-
Waders	7	47.5	1	1.7	4	2.5	4	2.5	1	0.8	4	3.4
Gulls,Terns	4	5.9	0	-	0	-	1	0.4	0	-	1	0.6
Shorebirds	4	24.6	0	-	9	20.8	1	0.4	0	-	1	0.4
Songbirds	2	1.3	0	-	1	0.4	4	42.0	3	92.0	3	35.6

[1]All bird groups censused biweekly.

[2]Expressed as birds/day/100 ha.

[3]Includes water present in ponds, creeks and ditches only part of the tidal cycle.

[4]Includes areas dominated by Spartina patens, Distichlis spicata, Juncus gerardi, Salicornia europaea, Iva frutescens or combinations of these species.

the summer. Waterfowl used the tidal water habitat to a greater extent during the spring than during the summer.

Eighty-five percent of the 316 surface-feeding ducks observed in the unditched marshes during the spring were resting or feeding in permanent ponds. In the ditched marshes, only 108 ducks were counted and 86% of these rested on tidal waters. In the unditched marshes, 81% of the 216 wading birds censused during the summer were observed in permanent ponds. This group was dominated by snowy egrets (Egretta thula) and great egrets (Casmerodius albus) which foraged for minnows or rested on islands within the ponds. In the ditched marshes, only 1% of the 80 herons and egrets were seen in permanent ponds; 58% were observed wading in shallow tidal waters.

Songbirds rarely were observed outside of the vegetated portions of the marsh. During the spring and summer, they occurred in greatest numbers in the short S. alterniflora in the unditched marshes, but tall S. alterniflora and high marsh habitats were used heavily there as well. In the ditched marshes, songbirds were observed primarily in the latter two habitat types.

Red-winged blackbirds, seaside sparrows and marsh wrens nested exclusively in dense patches of S. alterniflora. The first two species preferred stands of short S. alterniflora which bordered permanent ponds. Marsh wrens selected taller stands along tidal creeks and large ditches. Of the three species, redwings showed the strongest affinity for a single habitat type. All of the 61 redwing nests were built in short S. alterniflora, and 50% of all redwings censused was in this community at the time of observation. The only redwing nest found in a ditched marsh was built in a small patch of short S. alterniflora at the head of a clogged mosquito ditch.

Seaside sparrows bred in one ditched marsh and one unditched marsh. Only four nests were found in 18 territories, but all were placed in short S. alterniflora. In the unditched marsh, 16 seaside sparrow territories were crowded into a band of short S. alterniflora surrounding a large permanent pond. In the ditched marsh, only two territories were established; one centered around the only large patch of S. alterniflora within the marsh, and the other encompassed high marsh and a small area of tall S. alterniflora located along a mosquito ditch. Seaside sparrows did not breed in any of the other marshes despite the availability of short S. alterniflora stands in some of the areas.

The difference in habitat use between ditched and unditched marshes is most striking for the sharp-tailed sparrow which bred in all six study areas (Table 7). In the unditched areas, sharptails were observed most frequently in short S. alterniflora (46% of the time), but in the ditched sites, where the short form is scarce, tall S. alterniflora (41%) and high marsh (28%) were used to a greater extent. While sharptails foraged primarily in S. alterniflora communities, only 10 (14%) of their nests were built in this vegetation; the rest were placed on the high marsh. Spartina patens, Distichlis spicata and short S. alterniflora comprised 50%, 25% and 18%, respectively, of the cover within a 4-m^2 area surrounding the 74 sharptail nests we found.

The three common tern nests were built on relatively dry islands of high marsh vegetation in permanent ponds within unditched marshes. Spartina patens accounted for 70%, 86% and 97% of the plant cover at these three nest sites. Mallards (Anas platyrhynchos) and black ducks, like the terns, selected nest sites near open water. All black duck nests and three of the four mallard nests were built in S. alterniflora communities; the remaining mallard nest

Table 7. Habitat used by sharp-tailed sparrows in ditched and unditched New England salt marshes in summer, 1981.[1]

Community	Ditched (n=3)		Unditched (n=3)	
	Observations	% Total	Observations	% Total
Tall *S. alt.*	50	40.7	80	31.0
Short *S. alt.*	25	20.3	120	46.5
High Marsh[2]	35	28.4	54	20.9
Iva frutescens	13	10.6	4	1.6
Total	123		258	

[1]Data gathered during biweekly transect censuses of each marsh.

[2]Includes areas dominated by *Spartina patens*, *Distichlis spicata*, *Juncus gerardi* and *Salicornia europaea* or combinations of these species.

was in high marsh vegetation. In the ditched marshes, all three duck nests were located alongside mosquito ditches. In the unditched marshes, four were on islands in permanent ponds, one was built along the edge of a pond and two were placed adjacent to a tidal creek.

DISCUSSION AND CONCLUSIONS

Our preliminary results indicate that avian richness and density vary widely between marshes and between seasons. Bird numbers were very low in all study areas during the winter of 1980-81, regardless of mosquito ditching. Since waders, gulls, terns, shorebirds and most songbirds have migrated from this region by late fall, waterfowl and a few species of songbirds represent the dominant bird groups in southeastern New England salt marshes during this season. Waterfowl use primarily permanent ponds or tidal waters, so the availability of these habitats is the principal determinant of their density in any marsh.

In the winter of 1980-81, abnormally cold weather caused ponds, tidal rivers and much of the northern end of Narragansett Bay to remain frozen for most of the season. The only habitat available to ducks in any of the study areas at this time was a tidal pond located at the end of a creek in one of the ditched marshes. The greater density of waterfowl recorded in the ditched marshes during the winter (Table 3) resulted from a single flock of black ducks which was present in this one pond during several censuses. Therefore, the difference in winter waterfowl numbers between ditched and unditched marshes is unrelated to ditching.

Table 8 presents the relative abundance of permanent ponds in the ditched and unditched marshes. The greater abundance of ponds in the unditched areas is clearly the major reason for the greater use of these marshes by waterfowl, wading birds, gulls, terns and shorebirds during the spring and summer. The tidal water present in mosquito ditches is not extensive enough to accomodate large numbers of these birds, and the depth of water in ditches varies so drastically with the tides that it is suitable foraging habitat for only short periods of time. The water level in permanent ponds is generally stable regardless of the tidal stage. Our results suggest that, although tidal waters are used by small numbers of ducks, herons and egrets, permanent ponds represent higher quality habitat.

Compared to the large number of species that use southeastern New England salt marshes at some time during the winter, spring or summer (Appendix I), the number of species that breed there is quite small. The density of all the breeding species we have encountered is directly related to the availability of open water or the short S. alterniflora community. Mallards, black ducks, common terns and red-winged blackbirds nested near open water whenever it was available and, in the first three species, there may be some preference for island nest sites as well. The value of permanent ponds for these species is clear.

The breeding density of red-winged blackbirds, seaside sparrows and sharp-tailed sparrows appears to be directly related to the abundance of short S. alterniflora on a marsh. Redwings and seaside sparrows nest only in this community and do not breed in marshes where it is scarce. Sharptails do not require short S. alterniflora for nesting, but they forage most often

Table 8. Relative abundance of permanent ponds in three ditched and three unditched New England salt marshes.

Size (ha)	Ponds/100 ha	
	Ditched	Unditched
<0.05	8	76
0.05–0.50	2	10
>0.50	0	3
Total	10	89

in this community if it is available. Although the measurements have not yet been made, it is evident that the short S. alterniflora community is far more abundant in the unditched marshes.

The breeding density of marsh wrens would seem to be regulated by the abundance of tall, robust S. alterniflora. Since the area of this community is generally small in most southeastern New England marshes, salt marsh populations of marsh wrens are probably not large anywhere in this region.

At this juncture in our research, it appears that the relative abundance of open water, particularly permanent ponds, and the short S. alterniflora community largely determines the species richness and density of birds in the marshes we are studying. We cannot document the changes in marsh habitats that ditching has produced because the composition of our study areas prior to ditching is unknown. However, the great disparity between ditched and unditched marshes in the relative abundance of ponds and short S. alterniflora strongly suggests that these two habitat types are effectively removed by intensive ditching. If this is true, then such ditching reduces the value of the marshes for most of the birds that would inhabit them. Our final results should allow us to suggest how current ditching programs may be modified to minimize the impact of mosquito management on birds in salt marshes, and possibly even enhance the quality of these marshes as avian habitat.

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APPENDIX I. Birds Observed on Southeastern New England Salt Marshes, December 1980-August 1981.

The following species were observed on the six study areas between 1 December 1980 and 31 August 1981. Species such as the song sparrow (Melospiza melodia) and starling (Sturnus vulgaris) that reside primarily in upland habitats, but were observed resting or feeding in the marshes, are excluded. Common and scientific names follow Peterson (1980).

Common Name	Scientific Name
Great Blue Heron	Ardea herodias
Green Heron	Butorides striatus
Little Blue Heron	Florida caerulea
Great Egret	Casmerodius albus
Snowy Egret	Egretta thula
Black-crowned Night Heron[1]	Nycticorax nycticorax
Least Bittern[1]	Ixobrychus exilis
Glossy Ibis	Plegadis falcinellus
Mute Swan	Cygnus olor
Canada Goose[1]	Branta canadensis
Mallard	Anas platyrhynchos
Black Duck	Anas rubripes
Gadwall[1]	Anas strepera
Green-winged Teal[1]	Anas crecca
American Wigeon[1]	Anas americana
Wood Duck[1]	Aix sponsa
Canvasback	Aythya valisineria
Scaup	Aythya sp.
Bufflehead[1]	Bucephala albeola
Common Merganser[1]	Mergus merganser
Red-breasted Merganser[1]	Mergus serrator
Common Shelduck[1,2]	Tadorna tadorna
Northern Harrier	Circus cyaneus
Osprey	Pandion haliaetus
Clapper Rail[1]	Rallus longirostris
Virginia Rail[1]	Rallus limicola
Semipalmated Plover[1]	Charadrius semipalmatus
Killdeer	Charadrius vociferus
Black-bellied Plover[1]	Pluvialis squatarola
Spotted Sandpiper	Actitis macularia
Willet[1]	Catoptrophorus semipalmatus

Common Name	Scientific Name
Greater Yellowlegs	Tringa melanoleuca
Lesser Yellowlegs	Tringa flavipes
White-rumped Sandpiper[1]	Calidris fuscicollis
Least Sandpiper	Calidris minutilla
Semipalmated Sandpiper	Calidris pusilla
Sanderling[1]	Calidris alba
Short-billed Dowitcher	Limnodromus griseus
Great Black-backed Gull	Larus marinus
Herring Gull	Larus argentatus
Ring-billed Gull[1]	Larus delawarensis
Laughing Gull	Larus atricilla
Common Tern	Sterna hirundo
Little Tern[1]	Sterna albifrons
Belted Kingfisher	Megaceryle alcyon
Tree Swallow	Iridoprocne bicolor
Barn Swallow	Hirundo rustica
American Crow	Corvus brachyrhynchos
Marsh Wren	Cistothorus palustris
Eastern Meadowlark	Sturnella magna
Red-winged Blackbird	Agelaius phoeniceus
Rusty Blackbird	Euphagus carolinus
Common Grackle	Quiscalus quiscula
Savannah Sparrow	Passerculus sandwichensis
Sharp-tailed Sparrow	Ammospiza caudacuta
Seaside Sparrow	Ammospiza maritima

[1]Species seen in unditched marshes only.

[2]Probable escapee from private preserve.