MARSH BIRDS OF THE CONNECTICUT RIVER ESTUARY: A 20-YEAR PERSPECTIVE

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Abstract.- This study reports the summer distribution of marsh birds of the lower Connecticut River for the 1994 breeding season. It compares findings with similar observations made between 1974 and 1987, and serves as a 20-year update on the first 1974 surveys. In addition, habitat change over the 20-year interval is qualitatively assessed, and preliminary date are presented that examine the use of cattail and invasive reed habitats by selected marsh bird species. In 1994, I found 21 marsh-breeding species and 24 marsh-using species at the Connecticut River marshes. During the study period, populations of species like the American Black Duck, Sharp-tailed Sparrow, Red-winged Blackbird, Herring Gull, and Bank Swallow declined, whereas species like the Mute Swan, Canada Goose, Willet, Great Blue Heron, and Osprey increased. Moreover, species like Blue-winged Teal, Common Moorhen, and Black-crowned Night Heron that were summer residents in 1974 were absent in 1994. Most notable among habitat changes that have occurred in the Connecticut River marshes were contraction of salt meadow patches at transitional marshes, progressive replacement of cattails by reeds at Great Island, Upper Island, Ragged Rock Creek, Ayer's Point, and Lord's Cove, dying back of *Iva frutescens* at Great Island and Black Hall River, a small increase in cattail cover at Wetherfield Meadows, expansion of cover by *Lythrum salicaria*, and late growth by vegetation at freshwater marshes during years of heavy June flooding. Data on use of cattail and invasive reed habitats suggested that certain species like the Least Bittern, Marsh Wren and Red-winged Blackbird used reeds extensively, but particularly the Virginia Rail most frequently occupied cattail habitats.

This study reports the summer distribution of marsh birds of the lower Connecticut River for the 1994 breeding season. It compares findings with similar observations made between 1974 and 1987, and serves as a 20-year update on the first surveys. It examines also changes in habitats that have occurred during this period, and provides preliminary data on use by marsh birds of cattail habitats versus invasive reed communities. The data reported here provide a rare look at long-term changes in bird populations and distributions. Examining community changes such as these provide insights into the dynamics of the system.

Previous investigators of the Connecticut River avifauna include Clark (1884, 1897), who described the nest of the Black Rail (*Laterallus jamaicensis*), and Poulson (1969), who studied the physiology of the Seaside (*Ammodramus maritima*) and Sharp-tailed (*A. caudacuta*) sparrows. Ames and Mersereau (1964), Ames (1966), Wiemeyer et al. (1975), Spitzer (1977), Spitzer et al. (1978), and Spitzer and Poole (1980) studied nesting Ospreys (*Pandion haliaetus*), and Peterson (1969) briefly discussed population changes of raptorial and fish-eating birds of the river. More recently, Craig (1990) described the historic distributions of marsh birds in this system.

The most complete analysis of avian community ecology in the Connecticut River system is that by Craig and Beal (1992). In this study, species richness of marsh breeders was found to be most closely associated with marsh size, although richness of marsh-using species (species that feed in marshes but nest elsewhere) was most closely associated with proximity to additional marsh habitat. In comparing species richness of series of small vs. a single large marsh, small marshes were found to hold similar numbers of species to the large site, but the large marsh accumulated rarer species.

METHODS

STUDY AREAS

The gradient in physical and vegetative features of the Connecticut River system has been described previously (Craig 1990). Briefly, a vegetation gradient parallels that of tidal amplitude and salinity. From the river mouth upstream, principal plant associations include 1) rank intertidal cordgrass marshes of *Spartina alterniflora* and *Scirpus robustus* (low salt marsh), 2) shortgrass salt meadows composed largely of *Spartina patens, Distichlis spicata*, and *Juncus gerardi*, only occasionally inundated by tides (high salt marsh), 3) strong-stemmed Narrow-leaved Cattail and/or Common Reed (*Typha angustifolia, Phragmites australis*, respectively) marshes, 4) relatively soft-stemmed River Bulrush-Tuckahoe-Water Horsetail (*Scirpus fluviatilis, Pe1tandra virginica, Equisetum fluviatile,* respectively) marshes, and 5) floating-leaved Pickerelweed-Bullhead Lily (*Pontederia cordata, Nuphar variegatum,* respectively) associations. Additional more subtle habitat subdivisions can be identified (Metzler and Damman 1985).

The 14 marshes studied here ranged from tidal salt marshes near the river mouth to nontidal freshwater marshes 52 km upriver (Fig. 1). Four principal marsh types were represented among these (1) salt marshes, containing predominantly high and low salt marsh; (2) transitional marshes, containing high and low salt marsh and cattail-reed habitats; (3) brackish cattail marshes, containing cattail-reed and low salt marsh; and (4) freshwater marshes, containing softstem bulrush and floating-leaved habitats. Habitats of the sites are as follows (Table 1):

Great Island.- Most of this marsh is dominated by salt meadow grasses. In areas inundated daily by tides taller cord grasses (*Spartina alterniflora, S. pectinata*) and bulrushes (*Scirpus robustus, S. maritimus*) predominate. In drier areas and particularly at the island's upriver end a mixture of Black Grass (*Juncus gerardi*), bulrushes (*Scirpus pungens, S. americanus*), reeds and cattails occurs. High Tide Bush (*Iva frutescens*) is scattered throughout, but is particularly common along mosquito ditches.

Black Hall River.- Vegetationally similar to Great Island, this marsh differs primarily in having limited cover by reeds and cattails and in having two small islands of largely pure *S. alterniflora.* These latter areas are unusual in their lack of mosquito ditches.

Upper Island.- The vegetation of Upper Island consists of patches of salt meadow grass and black grass. Stands of cattails and reeds are extensive, and in areas inundated daily by tides cordgrasses and bulrushes are common. The vegetation may be thought of as transitional between salt meadow and cattail

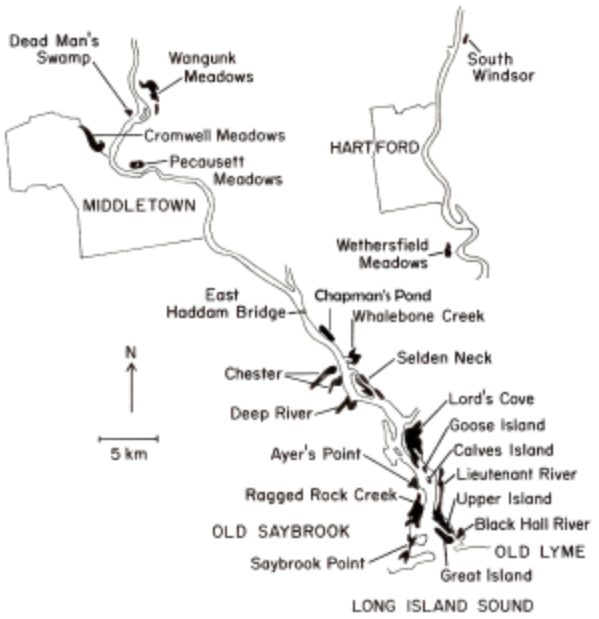

Fig. 1. Selected marshes of the Connecticut River.

marshes.

Ragged Rock Creek.- This marsh is vegetationally similar to Upper Island. As at Upper and Great Island several small oak copses occur on rocky outcrops, and similarly to all marshes near the river mouth, Ragged Rock Creek is bordered by extensive tidal flats. In 1974 a landfill, now closed, operated at the site's southern end.

Ayer's (Ferry) Point.- This marsh was dominated by cattails even into the 1990s, although at present reeds have encroached over much of the area. Along large creeks cordgrasses form a fringe, and small patches of short sedges (*Carex* spp., *Eleocharis smallii*) occur along the upland border.

Lord's Cove.- This marsh was largely dominated by cattails although at present reeds are encroaching over much of the area. Along creek edges cordgrasses predominate, particularly at Goose Island, which is here considered part of the Lord's Cove complex. In shallow water near creeks, bulrushes (*Scirus fluviatilis, S. validus*) occur; and along the western border cattails and reeds merge with a damp switchgrass-sedge (*Panicum virgatum, Eleocharis smallii*, respectively) meadow. An extensive tidal flat is present at the southern end and, as all sites discussed thus far, numerous tidal creeks dissect the marsh.

Deep River (*Pratt & Post Coves*).- These marshes are each dissected by major creeks vegetated along their deepwater portions by Pickerelweed, Bullhead Lily and Wild Rice (*Zizania aquatica*). Shallower areas are vegetated by River Bulrush (*S. fluviatilis*), Tuckahoe, Calamus (*Acorus calamus*) and Tussock Sedge (*Carex stricta*), cattail and reed. Mudflats are

TABLE 1. Summary of habitat features of the Connecticut River marshes.

	Type	Tides	Salinity	km from river mouth
Great Island (GI)[a]	salt marsh	yes	high	0.1
Black Hall River (BH)	salt marsh	yes	high	0.8
Upper Island (UI)	transitional	yes	moderate	1.3
Ragged Rock Creek (RR)	transitional	yes	moderate	2.6
Ayer's Point (AP)	brackish	yes	low	5.4
Lord's Cove (LC)	brackish	yes	low	6.0
Deep River (DR)	freshwater	yes	none	14.5
Whalebone Creek (WC)	freshwater	yes	none	17.5
Chapman's Pond (CP)	freshwater	yes	none	18.0
Pecausett Meadows (PM)	freshwater	yes	none	40.0
Cromwell Meadows (CM)	freshwater	yes	none	42.5
Dead Man's Swamp (DM)	freshwater	no	none	45.0
Wangunk Meadows (WM)	freshwater	no	none	47.5
Wethersfield Meadows (WM)	freshwater	no	none	52.0

[a]Abbreviations of marsh names used in subsequent tables in parentheses.

exposed along the creek borders at low tide.

Whalebone Creek.- Much of this marsh is submerged over one meter at high tide. Pickerelweed, Bullhead Lily, and Wild Rice cover these deepwater portions, but shallower areas are vegetated by River Bulrush, Tuckahoe, Calamus, and small patches of cattail. Creeks divide the marsh, and extensive mudflats are exposed at low tide.

Chapman's Pond.- Much as at other tidal freshwater marshes, River Bulrush, Tuckahoe, Tussock Sedge, Calamus, cattail, and reed are common plant species. At low tide, areas of mudflat fringe a central pond and major tidal creeks.

Pecausett Meadows.- This site has Pickerelweed bordering a pond that occupies the marsh center, but in shallower water (under one meter) covering much of the marsh, mixtures of River Bulrush, Water Horsetail, Tussock Sedge, Calamus, and Tuckahoe occur. As at all freshwater marshes, Sensitive Fern (*Onoclea sensibilis*) is particularly abundant in drier areas. There was formerly an operating landfill on the site's northern border.

Cromwell Meadows.- Known in the 19th century as the Little River Marshes, this site is vegetated by a mixture of River Bulrush, Tuckahoe, Calamus, and Water Horsetail. Smaller areas of cattail occur. In areas bordering creeks, Pickerelweed, Wild Rice, and Bullhead Lily predominate. Much of the marsh has standing water at high tide, but the portion known as Round Meadow is covered daily by approximately 0.5 to 1 m of water. Round Meadow also differs in having a boggy, quaking surface in spots. Some mud is exposed along creeks at low tide, and a landfill once occupied the western border of the site.

Dead Man's Swamp.- Even though adjacent to the Connecticut River, this marsh is not directly influenced by tides. River Bulrush, Tuckahoe, and Water Horsetail dominate much of it, but several extensive cattail stands also occur. The water depth is mostly over 1 m, and it has a quaking surface that cannot be negotiated on foot.

Wangunk Meadows.- Much of this nontidal, freshwater marsh has water averaging > 0.5 m deep. Consequently, the most common plant species are those that prefer deeper water, like Tuckahoe, Bullhead Lily, Pickerelweed, Water Smartweed (*Polygonum* spp.), Mannagrass (*G1yceria acutifolia*), and Burreed (*Sparganium* spp.). Water Horsetail, River Bulrush, and Reed Canary Grass (*Phalaris arundinacea*) are common in shallower areas.

Wethersfield Meadows.- This site, with standing water 0.5 to 1 m deep, is not influenced by tides. Most of it is vegetated by River Bulrush, Tuckahoe, Calamus and Water Horsetail. Several cattail stands occur, and Reed Canary Grass is abundant in shallow water. Several small areas of open water occur, and Black Willows (*Salix nigra*) are scattered through the marsh.

Temporal habitat change.- I qualitatively assessed vegetation distribution in marsh habitats on summer aerial photos taken in 1968 and 1986. I also visually compared sites in 1994 with photo stations established in 1974. From these observations, I drew conclusions about gross changes in marsh vegetation over a 20-year period.

These descriptions of habitats apply to the marshes only during the nesting season. By late summer, vegetation is taller and water levels are usually lower at freshwater sites. Moreover, Wild Rice and several other species that are inconspicuous in early summer assume dominance by late summer.

BIRD SURVEYS

I studied marsh bird distributions from mid-May to mid-July, 1994 (the breeding season). I visited each site once at the height of the breeding season (to mid-June), and again briefly during the fledging period (July). During each visit, I recorded all species of birds encountered while I crossed the marsh on foot or by boat. I did not attempt to quantify rigorously the abundance of species but, similar to Christmas Bird Count procedures (Drennan 1981), I counted all individuals of species encountered. As in 1974, during the first set of surveys I also counted all individuals of abundant species during two hours, beginning between 05:30 and 06:00 EDT. Marsh species were divided into those that were: 1) breeders- species that spent their entire day in marshes, nesting there and using marsh vegetation, creeks, or tidal flats, and 2) users- species that used marshes or associated creeks and flats primarily for feeding, but which nested elsewhere.

To gain some perspective about population trends

and habitat affinities, I examined standardized count data using methods similar to those used for Christmas Bird Counts (Bock and Root 1991). For relatively common species I computed birds observed/l0 or 100 hr at each site. For less common or strongly flocking species, I computed birds/year, birds/site, birds/marsh type and sites occupied/species. To gain insights into populations and habitat affinities of abundant species, I used data from two-hour counts. I also compared counts from 1974 with those for 1994.

For selected species, I gathered preliminary data on use of cattail vs. invasive reed habitats by recording at transitional and brackish marshes the habitat I first encountered birds occupying. Although such a procedure did not provide information on habitat use vs. availability, it gave an initial indication of use of these two habitats.

RESULTS AND DISCUSSION

In 1994, I found 21 marsh-breeding species and 24 marsh-using species at the Connecticut River marshes (Table 2). The distributions, populations, and habitat affinities of marsh species are summarized below. Several species present in 1974 were absent in 1994; the status of these species is also discussed.

BREEDERS

Pied-billed Grebe (*Podilymbus podiceps*).- I encountered only one individual in 1974: a calling bird at Dead Man's Swamp (Table 2). I have not encountered individuals since. The species is known historically as a rare breeder (Craig 1990).

American Bittern (*Botaurus lentiginosus*).- I encountered only one individual in 1994: a calling bird at Dead Man's Swamp (Table 2), where the species has occurred consistently since 1974. It has remained a rare breeder throughout the 20 y study period, and has shown no consistent population trend. I found 1.6 birds/100 hr in 1974 (n = 246 hr), 2.5/100 h in 1983-4 (n = 121.8 h), 1.9/100 h in 1986-7 (n = 161.8 hr), and 0.8/100 h in 1994 (n = 123 hr).

Tate and Tate (1982), among others, have noted that American Bittern populations were declining. Peterson (1969) noted that they formerly bred near the mouth of the Connecticut River, but had since disappeared, probably because of pesticide pollution. They have declined as breeders in Connecticut (Craig 1979).

Least Bittern (*Ixobrychus exilis*).- The Least Bittern was present at all marsh types, but showed no clear population trend since 1974. As noted by Craig (1990), it occurred most commonly in brackish marshes (Table 3). Known historically as an infrequent Connecticut resident (Craig 1990), it has been described as a rare breeder by Zeranski and Baptist (1990).

Mute Swan (*Cygnus olor*).- Feral birds, largely confined to brackish portions of the river in 1974, had increased numbers in freshwater marshes by 1994. However, the greatest densities remained in sheltered coves near Upper Island and Lord's Cove. Populations increased after 1974, when I estimated 83 adults to be present, compared with 201 tallied in 1983-4, 199 in 1986-7, and 193 in 1994. Mute Swans have been established in the Northeast possibly since 1875, and several dozen were present in Connecticut by 1950 (Palmer 1962). They expanded their range throughout Connecticut during the 20th century (Zeranski and Baptist 1990).

Canada Goose (*Branta canadensis*).- Feral birds were less restricted to brackish portions of the river than in 1974, although the largest concentration remained near Lord's Cove. Population size showed no clear trend until the present survey, when I counted 136. Some of these birds were apparently full grown juveniles, although numbers of adults clearly were greater than previously recorded. In 1974 I found 39 adults, in 1983-4 45 adults, and in 1986-7 32 adults. Current nesters have become established from captive stock (Bagg and Eliot 1937), and the species

TABLE 2. Occurrence of summering birds at the Connecticut River marshes in 1994.

Habitat:	Salt		Trans.		Brackish		Freshwater							
Site:	GI	BH	UI	RR	AP	LC	WC	CP	DR	PM	CM	DM	WM	WE
Breeders:														
American Bittern												x		
Least Bittern	x		x	x		x					x			x
Mute Swan	x	x	x	x	x	x	x	x	x	x		x		
Canada Goose				x	x	x			x		x	x	x	x
Wood Duck			x				x	x	x	x	x	x	x	x
Green-winged Teal														
Am. Black Duck	x	x	x			x								
Mallard	x	x	x	x	x	x	x		x	x	x	x	x	x
Gadwall	x	x	x											
Common Merganser											x			
Clapper Rail	x	x	x	x										
King Rail			x											
Virginia Rail	x		x	x	x	x	x		x	x		x		x
Willet	x	x		x										
Spotted Sandpiper						x				x	x	x		
Marsh Wren	x		x	x	x	x	x	x	x	x	x	x	x	x
Common Yellowthroat	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sharp-tailed Sparrow	x	x	x	x										
Seaside Sparrow	x	x	x	x		x								
Song Sparrow	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Swamp Sparrow	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Red-winged Blackbird	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Users:														
Double-crested Cormorant	x	x	x	x	x	x		x	x	x	x			x
Great Blue Heron						x		x		x	x	x	x	x
Great Egret	x	x	x	x		x			x					
Snowy Egret	x	x	x	x	x	x								
Little Blue Heron	x													
Tricolored Heron	x													
Green Heron	x	x	x	x	x		x		x		x	x	x	x
Glossy Ibis	x											x		
Osprey	x	x	x	x	x	x	x	x		x				
American Oystercatcher		x												
Ring-billed Gull			x			x			x					
Herring Gull	x	x	x	x	x	x	x	x	x	x	x	x		x
Great Black-backed Gull	x	x	x	x	x	x	x	x	x	x			x	
Common Tern	x	x	x	x	x	x								
Least Tern	x	x	x			x								
Belted Kingfisher	x		x	x	x	x	x	x	x	x		x	x	x
Eastern Kingbird		x	x	x	x	x	x	x	x	x	x	x	x	x
Purple Martin			x			x								
Tree Swallow	x	x	x	x	x	x	x	x	x		x	x	x	x
N. Rough-winged Swallow	x	x	x	x		x			x			x	x	
Bank Swallow			x	x						x	x		x	x
Barn Swallow	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Fish Crow	x	x	x	x		x								
Common Grackle	x	x	x	x	x	x	x	x	x	x	x	x	x	x

TABLE 3. Habitat affinities and population trends of selected species. Counts in birds/10 h; hours of observation in parentheces.

Species	Habitat				Year	
	Salt	Transitional	Brackish	Freshwater	1974	1994
Breeders:						
Least Bittern	0.6(16.0)	0.9(21.5)	2.8(18.0)	0.6(67.5)	0.9(121.8)	1.0(123.0)
Wood Duck		0.9(21.5)		7.6(67.5)	2.3(180.5)	5.0(107.0)
Am. Black Duck	10.0(16.0)	2.8(12.0)	0.6(18.0)		8.0(232.3)	1.9(123.0)
Mallard	12.5(16.0)	10.0(14.0)	14.2(12.0)	7.9(67.5)	14.0(232.3)	9.5(109.5)
Gadwall	3.1(16.0)				1.1(157.5)	0.9(55.5)
Clapper-King Rail	3.1(16.0)	2.3(21.5)			3.3(240.3)	1.8(37.5)
Virginia Rail	1.9(16.0)	2.8(21.5)	2.2(18.0)	1.9(67.5)	1.4(246.0)	2.1(123.0)
Spotted Sandpiper			0.6(18.0)	0.6(67.5)	1.4(240.3)	0.4(123.0)
Common Yellowthroat	7.5(16.0)	15.8(21.5)	20.6(18.0)	29.3(67.5)	8.1(240.3)	22.8(123.0)
Song Sparrow	14.4(16.0)	9.3(21.5)	14.4(18.0)	20.1(67.5)	9.2(240.3)	17.1(123.0)
Users:						
Double-crested Cormorant	22.5(16.0)	8.8(21.5)	7.2(18.0)	2.4(67.5)	1.8(240.3)	6.8(123.0)
Great Blue Heron			1.7(18.0)	2.5(67.5)	0.4(180.5)	1.6(123.0)
Snowy Egret	10.8(12.0)	6.4(14.0)	6.7(18.0)		3.8(149.8)	6.8(44.0)
Green Heron	2.5(16.0)	4.2(21.5)	0.6(18.0)	1.9(67.5)	2.4(240.3)	2.2(123.0)
Glossy Ibis	6.3(16.0)			0.1(67.5)	1.9(246.0)	0.9(123.0)
Common Tern	13.1(16.0)	1.4(21.5)	7.2(18.0)		2.1(149.8)	6.7(55.5)
Least Tern	8.8(16.0)	1.9(21.5)	1.7(18.0)		2.2(149.8)	1.7(55.5)
Belted Kingfisher	1.3(16.0)	3.3(21.5)	3.3(18.0)	1.9(67.5)	0.8(246.0)	2.3(123.0)
Eastern Kingbird	3.8(16.0)	1.4(21.5)	4.4(18.0)	4.0(67.5)	2.3(246.0)	3.6(123.0)
Fish Crow	3.8(16.0)	0.9(21.5)	0.6(18.0)		0.7(149.8)	1.6(55.5)
Common Grackle	16.3(16.0)	20.9(21.5)	27.2(18.0)	22.1(67.5)	6.5(246.0)	21.9(123.0)

became increasingly common as a Connecticut breeder during the 20th century (Zeranski and Baptist 1990).

Wood Duck (*Aix sponsa*).- As in 1974, the Wood Duck was primarily restricted to freshwater marshes, although in 1994 two birds occurred at the brackish Upper Island for the first time (Table 2). Populations appeared to increase by 1994 (Table 3), but much of the trend is a consequence of adding Wangunk Meadows as a study site. The species has been abundant at Wangunk Meadows since 1974, where in previous years I observed 18.6 adults/10 h (n = 21 h). Wood Ducks increased in Connecticut during the 20th century (Zeranski and Baptist 1990).

Green-winged Teal (*Anas crecca*).- Since 1974, when I found at least three individuals at brackish and freshwater marshes, I have had only one possible summer sighting of this species (1983). None were located in 1994. The Green-winged Teal has increased in the Northeast, and may occasionally breed in Connecticut (Zeranski and Baptist 1990).

American Black Duck (*A. rubripes*).- Since 1974, this species has shown a classic extinction pattern of declining numbers and shrinking range. In 1974 it ranged from salt to freshwater marshes, with numbers greatest in the latter. Presently, populations approach 1974 levels only in salt marshes. Numbers were drastically lower in upriver marshes, and I found none in freshwater marshes (Table 3). Population declines have been noted throughout the East coast (Steiner 1984) a trend that has been linked to competitive replacement of Black Ducks by Mallards (Heusmann 1974, 1988).

Mallard (*A. platyrhyncos*).- As in 1974, this introduced prairie species was most common in saline portions of the river, although it was frequent throughout. It occurred about as often as the Black Duck in salt marshes, but greatly outnumbered them in other marsh types. Populations appeared to decline after 1974, but have shown relatively little change since 1983-4 (Table 3, Craig 1990). The Mallard became a common Connecticut breeder during the 20th century (Zeranski and Baptist 1990).

Blue-winged Teal (*A. discors*).- Although an uncommon but widespread summer resident in 1974, by 1994 the species was completely absent. My last definite observation of a summering bird was in 1985 (although since this study I found a pair at Deep River in 1999), when I found one bird at Great Island. The species is a rare, sporadic summer resident in Connecticut (Zeranski and Baptist 1990).

Gadwall (*A. strepera*).- In 1994 I found this species only at salt marshes (Table 2), although they previously were present from salt to brackish marshes (Craig 1990.). I also found birds in 1974 and 1987 at the freshwater South Windsor Meadows, where they have occurred sporadically since 1931 (Bagg and Eliot 1937). Since 1974, populations have appeared to fluctuate, but show no consistent trend (Table 3, Craig 1990). The species increased as a Connecticut breeder during the 20th century (Zeranski and Baptist 1990).

Common Merganser (*Mergus merganser*).- Like the Wood Duck, this species is listed here as a marsh breeder even though it nests in adjacent trees (see Craig 1990 for rationale). In 1994 I observed a single adult at Cromwell Meadows (Table 2), which was possibly a breeder although more likely a non-breeding individual. In previous years I have encountered additional summering birds along the Connecticut River, and the species may occasionally nest in the area. The Common Merganser has been a rare Connecticut breeder since at least 1962 (Craig 1979).

Northern Harrier (*Circus cyaneus*).- Although present sporadically in summer since 1974, I located no individuals of this species in 1994. Previously, the Northern Harrier has been present primarily in brackish portions of the river. Tate and Tate (1982) considered Northeastern populations threatened.

Black Rail (*Laterallus jamaicensis*).- Despite repeated searches, I was unable to locate Black Rails in 1994. I located them only in 1987, when I found calling birds at Ragged Rock Creek and Cromwell Meadows. The Black Rail is at the northern periphery of its range in Connecticut and may nest here only sporadically (Craig 1990).

Clapper Rail (*Rallus longirostris*).- The Clapper Rail inhabited salt and transitional marshes, where it was present uncommonly. Since 1974 populations of this species and the vocally indistinguishable King Rail appear to have declined (Table 3). Northeastern populations also may have declined since the 1970s (Zeranski and Baptist 1990).

King Rail (*R. elegans*).- In 1994 I confirmed the presence of the King Rail only at Upper Island, where a pair inhabiting reeds responded to playback of tape recorded calls. Since 1974, the species has been an uncommon but regularly occurring inhabitant of salt and brackish marshes. The species is near the northern periphery of its range in Connecticut, and historically has been a rare breeder here (Craig 1990).

Virginia Rail (*R. limicola*).- Unlike in previous years (Craig 1990), the Virginia Rail was relatively uncommon and difficult to find in freshwater marshes. At sites like Cromwell Meadows, where in most years I found it easily, I located none in 1994.

TABLE 4. Relative population densities of abundant species. Counts in birds/2 h.

Species	Habitat				Mean
	Salt	Trans.	Brackish	Fresh	
Breeders:					
Marsh Wren					
1974	3.1	14.3	11.9	7.0	8.6
1994	0.8	15.6	16.0	4.1	7.0
Sharp-tailed Sparrow					
1974	18.6	8.0			14.0
1994	15.5	0.3			7.9
Seaside Sparrow					
1974	8.5	2.6			6.0
1994	10.3	1.0			5.6
Swamp Sparrow					
1974		2.8	6.0	3.0	4.0
1994		8.3	5.3	4.3	5.1
Red-winged Blackbird					
1974	24.0	26.8	27.6	30.7	27.8
1994	6.8	10.0	11.5	11.0	10.3
Users:					
Herring Gull					
1974	21.3	12.8	18.1	5.3	12.4
1994	4.8	4.3	3.0	<0.1	1.8
Great Black-backed Gull					
1974	2.4	1.6	1.3		1.1
1994	2.0	1.0	0.8	<0.1	0.6
Tree Swallow					
1974	0.9	2.3	2.0	1.8	1.6
1994	1.5	1.3	1.8	1.0	1.2
Bank Swallow					
1974	0.3	2.9	2.5	0.4	1.3
1994				2.5	0.1
Barn Swallow					
1974	3.0	3.7	2.0	1.1	2.1
1994	1.5	1.3	0.5	0.5	0.8
n					
1974	16	12	20	28	76
1994	4	4	4	32	44

However, it was relatively more common in salt and transitional marshes than previously (Table 3). Overall, populations appeared down from 1986-7, and to have fluctuated since 1974.

Sora (*Porzana carolina*). - In 1994 I found no Soras on the Connecticut River despite dawn and dusk searches and making use of taped calls. Considering that Billard (1948) estimated two pairs of Soras/ha at Wethersfield Meadows, the species has clearly declined in Connecticut during this century.

Common Moorhen (*Gallinula chloropus*).- I have not found a summering Common Moorhen at the study sites since 1974, when I found a single bird at Lord's Cove. Outside this area, it occurs sporadically in summer at South Windsor Meadows. Historically, it has been a rare breeder in Connecticut (Craig 1990).

Common Snipe (*Gallinago gallinago*) - I have not found a summering Common Snipe at the study sites since 1974, when I observed a potential breeder at Wangunk Meadows. Outside the study area, I occasionally have found it summering in freshwater marshes near the Connecticut River. The species appears to have always been a rare Connecticut breeder (Craig 1990).

Willet (*Catoptrophorus semipalmatus*).- Only a single summering individual occurred at Great Island in 1974, but by 1984 at least two pairs used the salt marshes, tidal creeks, and flats of Great Island. In 1994 I found birds at three marshes (Table 2) and, therefore, the species appeared to be continuing its slow increase. After disappearing in the 19th century, breeders did not return to Connecticut until 1976 (Craig 1990).

Spotted Sandpiper (*Actitus macularia*).- Compared with 1974, the Spotted Sandpiper declined, although it has fluctuated in abundance since 1974 (Craig 1990). It has been a fairly common Connecticut breeder since the 19th century (Craig 1990).

Marsh Wren (*Cistothorus palustris*).- The Marsh Wren appeared at all marsh types, but as in 1974 it was most abundant in brackish portions of the river. The species was abundant throughout this study, although perhaps slightly less so in 1994 (Table 4). It has been known as an abundant resident of

these marshes since the 19th century (Sage et al. 1913).

Common Yellowthroat (*Geothlypis trichas*). - As noted by Craig (1990), this species was increasingly common from salt to freshwater marshes. However, compared with 1974, counts were far higher (Table 3). Some of this apparent increase may be attributed to my more meticulously recording in 1994 observations of this primarily marsh edge species, although the magnitude of the change still suggests an actual population increase. The species has been known historically as a common Connecticut breeder (Craig 1990).

Sharp-tailed Sparrow (*Ammodramus caudacuta*).- Although largely restricted in habitat use to salt meadow grasses, this species was an abundant inhabitant of salt marshes (Table 2). However, it appears to have declined in them since 1974 (Table 4). Moreover, numbers declined at transitional sites, with counts averaging 33.5 birds/10 h in 1974, 0.9 birds/10 h in 1983-4, 6.0 birds/10 h in 1986-7, and 2.3 birds/10 h in 1994. The Sharp-tailed Sparrow was an abundant coastal species historically (Craig 1990).

Seaside Sparrow (*A. maritimus*).- The Seaside Sparrow followed the cordgrass fringe upriver to Lord's Cove were I have found it once previously (Goose Island; Table 2). Although less common than the Sharp-tailed Sparrow in salt marshes, it was still abundant, and its numbers appeared to have changed little overall since 1974 (Table 4). Since 1974 it has declined at transitional marshes, where I found 12.6 birds/l0 h in 1974, 4.4 birds/10 hr in 1983-4, 6.9 birds/l0 h in 1986-7, and 6.0 birds/h in 1994. The species has been a abundant coastal species historically (Craig 1990).

Song Sparrow (*Melospiza melodia*).- As noted by Craig (1990) the Song Sparrow was most common in freshwater marshes. Compared with earlier years, populations increased (Table 3). The species has been known historically as a common Connecticut breeder (Craig 1990).

Swamp Sparrow (*M. georgiana*).- This species occurred at all marsh types, and as in 1974 it reached its greatest densities in cattail-reed habitats. However, it appeared to increase at transitional marshes, probably in response to increasing coverage by cattail-reed vegetation at these sites. Primarily as a consequence of this transitional marsh increase, overall populations also showed a small but likely real increase over 1974 (Table 4). The species has been known historically as a common Connecticut breeder (Craig 1990).

Red-winged Blackbird (*Agelaius phoeniceus*).- Although still common and present at all marsh types, the Red-winged Blackbird has declined since 1974 as a breeding bird (Table 4). Where I formerly had difficulty estimating numbers of birds because of their abundance, comparatively few individuals were present in 1994. Despite this recent decline, the species has been known historically as a common Connecticut breeder (Craig 1990).

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Double-crested Cormorant (Phalacrocorax auritus).- Although only marginally a marsh bird, this inhabitant of open water occurred in decreasing numbers from saline to freshwater portions of the river Since 1974, it has increased in range and abundance in the estuary (Table 3). After largely disappearing from the Northeast in the last century, the Double-crested Cormorant steadily increased in populations during the 20th century (Zeranski and Baptist 1990).

Great Blue Heron (*Ardea herodias*).- As noted by Craig (1990), this species was most common in freshwater marshes. Counts have continued to increase since 1974

(Table 3), coinciding with a statewide increase in nesting during the same period (Zeranski and Baptist 1990).

Great Egret (*Casmerodius albus*).- Although absent in summer during 1974, the Great Egret became an irregular summer resident by 1983-4 (Craig 1990). In 1994 I made nine observations, compared with eight sightings made during previous years (Craig 1990). The increase in summer occurrence was coincident with an increase in Northeastern breeding populations (Erwin 1979).

Snowy Egret (*Egretta thula*).- As noted by Craig (1990), this species was present in decreasing numbers from salt to brackish marshes. As with the Great Egret, it has increased since 1974 (Table 3). The increase in summer occurrence was coincident with an increase in Northeastern breeding populations (Erwin 1979).

Little Blue Heron (*E. caerulea*).- As in previous years, my sole observation of this species was that of a wandering July bird (Table 2). None have occurred during the height of the breeding season during my surveys. However, if the species continues to increase as a summer resident (see Zeranski and Baptist 1990), June observations are likely.

Tricolored Heron (*E. tricolor*).- This species first appeared on summer censuses in 1983. In 1994 I found one bird at Great Island (Table 2). As with many other waders, Northeastern breeding populations are increasing (Erwin 1979).

Green Heron (*Butorides virescens*).- As noted by Craig (1990), the Green Heron was least common at brackish marshes. Populations have changed little during the study period (Table 3). As a consequence of wetland destruction, the species appears to have declined in Connecticut during the 20th century (Zeranski and Baptist 1990).

Black-crowned Night Heron (*Nycticorax nycticorax*).- Concluding a trend noted by Craig (1990), I found no birds along the Connecticut River by 1994 (although in 1999 I again found several individuals). It was formerly present commonly, with 28 birds seen flying over Great Island on 4 June 1974. Unlike many other species of waders, Northeastern breeding populations did not clearly increase during the 1970s (Erwin 1979), and populations have declined in Connecticut during the 20th century (Zeranski and Baptist 1990).

Yellow-crowned Night Heron (*N. violaceus*).- Occurring only as postbreeding wanderers in 1974, by 1984 the Yellow-crowned Night Heron was an irregular summer resident. However, none appeared during 1994. Like other waders, local breeding populations have increased (Erwin 1979), and additional observations are likely.

Glossy Ibis (*Plegadis falcinellus*). - The Glossy Ibis was less common in 1994 than in 1974 (Table 3), but numbers have fluctuated during this period (Craig 1990). As in previous years, individuals appeared far upriver from more typical coastal marsh habitats (Table 2). Populations increased in the Northeast during the 20th century (Erwin 1979).

Osprey (*Pandion haliaetus*). - Only one pair of Ospreys remained at Great Island in 1974, down from over 200 pairs present near the Connecticut River in 1938 (Ames and Mersereau 1964). By 1984 I found eight nests near salt marshes and two at transitional marshes, and in 1987 I found ten nests near salt marshes, three at transitional marshes, and one being constructed at a brackish marsh (Lord's Cove). In 1994 I found 21 nests at salt marshes, two nests at transitional marshes, and three at brackish marshes. Hence, populations have grown during the study period.

Ames and Mersereau (1964) documented a 31%/y decline in Osprey populations of the Connecticut River, which they linked to

pesticide pollution. To offset the decline, Spitzer and Poole (1980) transferred eggs and nestlings from areas of low pesticide contamination to nests along Long Island.

American Oystercatcher (*Haematopus palliatus*).- My first record for this species on the Connecticut River was in June 1994, when I found four birds feeding in the mudflats adjacent to Black Hall River. The species was decimated as a Northeastern breeder in the 19th century, and began recolonizing the region during the 20th century (Zeranski and Baptist 1990).

Ring-billed Gull (*Larus delawarensis*).- Principally occurring only as a migrant in Connecticut in the early 20th century (Sage et al. 1913), in 1974 I found only two birds near marshes (at dumps). By 1983 I noted a bird away from a dump at Lord's Cove, and by 1986-7 at least five were near salt marshes, two were near transitional marshes, and several were at the dump near Cromwell Meadows. In 1994 I found a July flock of 27 birds at the transitional Upper Island, one at a brackish cattail marsh, and one at a freshwater marsh, thus suggesting that populations continue to increase.

Herring Gull (*L. argentatus*).- As noted by Craig (1990), this species generally declined in numbers from salt to freshwater marshes. Populations have declined greatly since 1974 (Table 4), apparently because several landfills along the river have closed. The Herring Gull was predominantly a winter resident in Connecticut into the early 20th century (Sage et al. 1913).

Great Black-backed Gull (*L. marinus*).- As noted by Craig (1994), this species decreased in numbers from salt to freshwater marshes. Moreover, numbers declined from 1974 to 1994 (Table 4), most likely because several landfills along the Connecticut River (Ragged Rock Creek, Pecausett Meadows, Cromwell Meadows) have closed. Before 1920, the Great Black-backed Gull was largely absent in summer from the Northeast (Bull 1964).

Common Tern (*Sterna hirundo*).- Although the Common Tern was present from salt to brackish marshes in 1974, it appeared only at salt marshes in 1983. By 1994 populations had rebounded, and it was again found to brackish marshes. Moreover, overall numbers appeared to be greater in 1994 than in 1974 (Table 3). After being decimated in the 19th century, the species increased as a breeder during the 20th century (Zeranski and Baptist 1990).

Least Tern (*S. albifrons*). - This species declined in abundance from salt to brackish marshes. I detected no change in occurrence during the study (Table 3), a trend similar to that of Connecticut breeding populations (F. Sibley pers. comm.). Populations were greatest at the river mouth (Table 3), where a nesting colony occurred at Griswold's Point. This colony was absent in 1974, but another colony was present at Hatchett's Point, Old Lyme. Terns of all species have rebounded from the plume trade of the 19th century, but are now negatively affected by loss of nesting habitat (Bull 1964, Craig 1979).

Belted Kingfisher (*Megaceryle alcyon*).- Previously, I found this species to increase in abundance from salt to freshwater marshes (Craig 1990), but during 1994 I found it most common in brackish portions of the river. Numbers appeared to increase after 1974 (Table 3). Populations are not reported to have undergone significant historical changes (Zeranski and Baptist 1990).

Eastern Kingbird (*Tyrannus tyrannus*).- Patterns noted previously for this species, that of being most abundant at freshwater marshes (Craig 1990), were not repeated in 1994. It occurred in similar numbers at all marsh types except transitional marshes, where it was relatively uncommon (Table 3). Moreover, although populations had previously appeared to decline (Craig 1990),

TABLE 5. Summary of 1974-1994 population trends of marsh birds of the Connecticut River. Historic trends are from from Craig (1990) and literature reported in this study.

Species	1974-1994	Historic
Breeders:		
Pied-billed Grebe	casual	casual
American Bittern	fluctuate	decline
Least Bittern	no trend	no trend
Mute Swan	increase	introduced
Canada Goose	increase	introduced
Wood Duck	increase	recovery
Green-winged Teal	casual	colonized
Am. Black Duck	decline	decline
Mallard	decline	introduced
Blue-winged Teal	decline	increase
Gadwall	fluctuate	increase
Common Merganser	casual	casual
Northern Harrier	casual	decline
Black Rail	casual	decline
Clapper-King Rail	decline	no trend
Virginia Rail	fluctuate	no trend
Sora	decline	decline
Common Moorhen	casual	casual
Common Snipe	casual	casual
Willet	increase	recovery
Spotted Sandpiper	fluctuate	no trend
Marsh Wren	no trend	no trend
Common Yellowthroat	increase	no trend
Sharp-tailed Sparrow	decline	no trend
Seaside Sparrow	no trend	no trend
Song Sparrow	increase	no trend
Swamp Sparrow	increase	no trend
Red-winged Blackbird	decline	no trend
Users:		
Double-crested Cormorant	increase	recovery
Great Blue Heron	increase	increase
Great Egret	increase	increase
Snowy Egret	increase	increase
Little Blue Heron	increase	increase
Tricolored Heron	increase	increase
Green-backed Heron	no trend	decline
Black-crowned Night Heron	decline	decline
Yellow-crowned Night Heron	fluctuate	increase
Glossy Ibis	fluctuate	increase
Osprey	increase	recovery
American Oystercatcher	increase	recovery
Ring-billed Gull	increase	increase
Great Black-backed Gull	decline	increase
Herring Gull	decline	increase
Common Tern	fluctuate	recovery
Least Tern	no trend	recovery
Belted Kingfisher	increase	no trend
Eastern Kingbird	fluctuate	no trend
Purple Martin	casual	decline
Tree Swallow	unclear	unclear
Rough-winged Swallow	increase	increase
Bank Swallow	decline	no trend
Barn Swallow	decline	no trend
Fish Crow	increase	increase
Common Grackle	increase	increase

in 1994 numbers were greater than in 1974 (Table 3). Populations are not reported to have undergone significant historical changes (Zeranski and Baptist 1990).

Purple Martin (*Progne subis*).- The Purple Martin occurred rarely throughout this study. I found it most often at Whalebone Creek, where it was present during four of the six years I visited the site. Of 12 birds seen, five were at transitional marshes, one was at a brackish marsh, and six were at the freshwater Whalebone Creek. The species has declined in abundance from former years as the Connecticut landscape has been altered (Craig 1979).

Tree Swallow (*Iridoprocne bicolor*).- I found it difficult to estimate swallow numbers, because their appearance varied considerably among days even at the same site. The species was generally common throughout the study, although it may have declined slightly in 1994 (Table 4). Not included in computations of abundance are early migratory flocks recorded in mid-July. The highest count recorded during the 20 years of the study, 1520, was at Lord's Cove on 15 July 1994. Populations may have increased in Connecticut during the 20th century (Zeranski and Baptist 1990).

Northern Rough-winged Swallow (*Stelgidopteryx ruficollis*).- This species was previously irregular at most marshes, occurring frequently only at Whalebone Creek. I found three in 1974, seven in 1983-4, and four in 1986-7. However, in 1994 I

found 42 (although some of these were probably early migrants), which suggested that populations had increased. The species increased in Connecticut during the 20th century (Zeranski and Baptist 1990).

Bank Swallow (*Riparia riparia*).- Although I formerly found this species regularly at all marsh types (Craig 1990), in 1994 I found it only at freshwater marshes. Compared with previous years (Craig 1990), it had declined sharply (Table 4). Populations are otherwise not reported to have undergone significant historical changes (Zeranski and Baptist 1990).

Barn Swallow (*Hirundo rustica*).- As noted by Craig (1990), the Barn Swallow appeared most common in brackish portions of the river (Table 4). However, it was less common in 1994 than in 1974. Populations are otherwise not known to have undergone significant historical changes (Zeranski and Baptist 1990).

Fish Crow (*Corvus ossifragus*).- In 1974 I found the Fish Crow only in salt marshes, but by 1994 it occurred to brackish marshes. Moreover, by 1994 it had become more common (Table 3). The species increased in Connecticut during the 20th century (Zeranski and Baptist 1990).

Common Grackle (*Quiscalus quiscula*).- Previously, I have found the Common Grackle to be most common at freshwater marshes (Craig 1990). However, in 1994 it was very common at all marsh types, and it had increased greatly since 1974 (Table 3). The species increased in Connecticut during the 20th century (Zeranski and Baptist 1990). Changes in the status of this and other marsh species are summarized in Table 5.

HABITAT CHANGE

Examination of aerial photographs, 1974 photo stations and field notes from the 1970s qualitatively demonstrated that certain types of habitat change had occurred by 1994. Most notable among these were:

1. Contraction of salt meadow patches at transitional marshes. This contraction was documented from aerial photographs and reported by Craig and Beal (1992).

2. Progressive replacement of cattails by reeds at Great Island, Upper Island, Ragged Rock Creek, Ayer's Point, and Lord's Cove. The extent of such replacement is illustrated from 1974 photo stations taken at several of the above marshes.

3. Dying back of *Iva frutescens* at Great Island and Black Hall River. In 1994 most cover by this species was gone and dead bushes were present commonly.

4. Small increase in cattail cover at Wetherfield Meadows. This increase was documented from aerial photographs and reported by Craig and Beal (1992).

5. Expansion of cover by the introduced and invasive *Lythrum salicaria* in freshwater marshes.

6. Late growth by vegetation at freshwater marshes during years of heavy June flooding (Craig 1990).

TABLE 6. Percent occurrence in cattails and reeds of selected marsh bird species. Sample sizes (*n*) are numbers of individual observations.

Species	Cattails		Reeds	
	%	*n*	%	*n*
Breeders:				
Least Bittern	12.5	1	87.5	7
King Rail		0	100.0	2
Virginia Rail	66.7	4	33.3	2
Marsh Wren	33.3	60	66.7	120
Common Yellowthroat		0	100.0	17
Swamp Sparrow	54.1	20	45.9	17
Red-winged Blackbird	27.1	16	72.9	43

AVIAN USE OF CATTAILS VS. REEDS

Of seven breeding species that I found in cattails-reeds habitats, all used reeds but two were not present in cattails (Table 6).

Relative to other species, the Virginia Rail appeared more restricted to cattails, the Swamp Sparrow appeared ubiquitous, and other species were more frequently encountered in reeds.

These assessments are based on small samples and offer only preliminary indications of habitat use. In previous years I have observed the King Rail and Common Yellowthroat in cattail habitats, although in 1994 I found both only in reeds. To thoroughly investigate habitat associations of marsh-nesting species, data are needed on habitat use vs. availability. They are needed as well on the comparative value (e.g. food availability; effectiveness as nesting substrate and cover, reproductive success) of these two habitats.

In addition to the species reported in Table 6, others such as waterfowl also may be expected to actively use both of these habitats, and swallows use them as resting perches.

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