2001 BLACK TERN POPULATION SURVEY AND OTHER MARSH BIRD MONITORING ACTIVITIES IN VERMONT

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ABSTRACT

2001 BLACK TERN POPULATION SURVEY AND MARSH BIRD MONITORING ACTIVITIES IN VERMONT

As part of ongoing research into the status of Vermont's marsh birds, a statewide census of the black tern (***Chlidonias niger***) nesting population was undertaken again in the year 2001. The black tern nesting population showed a drop from the high of 100 pairs in 1999 to only 53 pairs found in 2001. All black tern nesting in Vermont in 2001 was found at Mud Creek Wildlife Management Area in Alburg, and Missisquoi National Wildlife Refuge in Swanton. This is cause for concern because it means that all nesting is in one confined area, with no nesting at the south end of Lake Champlain or on Lake Memphremagog as in past.

A minimum estimate of at least 29 young black terns fledged from the area around Missisquoi NWR, approximately 0.5 fledglings per pair. This is not thought to be adequate to maintain the population, but the nature of the estimate makes it an absolute minimum.

In addition, the survey of selected marshes in Vermont for other marsh birds (pied-billed grebe, least bittern, American bittern, Virginia rail, sora, common moorhen, and American coot) was continued. Fifteen marsh bird routes situated in emergent marshes within state Wildlife Management Areas, Missisquoi NWR, or in marshes designated as "Important Bird Areas" were surveyed. Virginia rail is still the most common and abundant marsh bird surveyed , followed by the common moorhen, with least bittern, sora, American bittern, pied-billed grebe, and American coot being uncommon and sporadic.

These ongoing activities together have two major objectives: to look at marsh bird population trends within the marshes of Vermont, and to investigate the effect of water level and marsh vegetation changes on marsh bird numbers.

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INTRODUCTION

The black tern (***Chlidonias niger***) is a marsh nesting bird which has apparently never been very common in Vermont and is currently on the state threatened species list. In order to try to better understand the biology and population status of this species, statewide censuses of the Vermont black tern nesting population have been undertaken for the past 12 years. The black tern is a semi-colonial bird which nests in large emergent marshes, often building its nest on old muskrat lodges and feeding platforms. Because this nesting habitat is impermanent and the overall marsh vegetation varies each year depending on water level, colony locations vary from year to year. This transitory nature of nesting colony locations, makes it important to survey all potential colony sites in Vermont each year.

The Vermont black tern nesting population has been hovering at under 100 pairs for the past decade, probably down from about 300 pairs in the 1970s, although this latter number is not well documented. This apparent decline in numbers has many possible causes, only some of which may be related to nesting activity in Vermont. Because of the marsh nesting behavior of this species, and the fact that the young may leave the nest soon after hatching if disturbed, it is very difficult to get an accurate estimate of nesting success for black terns. This author and others have made various attempts to determine individual nest or colony breeding success with varying degrees of success (Shambaugh 1994). In 2001 the entire Vermont black tern breeding population was concentrated in and around the Missisquoi National Wildlife Refuge in Swanton, VT. This situation does not bode well for the future of this species in Vermont. As recently as three years ago terns were also nesting at Little Otter Creek in Ferrisburg and South Bay WMA in Coventry.

Because tern nesting was concentrated in one area in 2001, it did make possible an estimate of fledgling survival by counting the number of fledglings on staging areas on Missisquoi Bay prior to migration. This is an area where a large number of adults and fledglings congregate after abandoning nesting colonies but prior to migrating south for the winter. It is not known with certainty where these birds are from, but since there are no other nearby nesting colonies it is assumed that they are from the Vermont population. Although this is undoubtably an underestimate of the entire Vermont fledgling population, it serves as a minimum estimate of fledgling success.

In addition to the above black tern census work, the survey of selected marshes in Vermont for other marsh birds was continued in 2001. As in previous years, the following bird species were selected for monitoring in addition to the black tern: pied-billed grebe (***Podilymbus podiceps***), least bittern (***Ixobrychus exilis***), American bittern (***Botaurus lentiginosus***), Virginia rail (***Rallus limicola***), sora (***Porzana carolina***), and common moorhen (***Gallinula chloropus***). These species were selected because they are obligate, emergent marsh-nesting species. They also have limited nesting populations, or there is a limited knowledge of their breeding habitat preferences and abundance in Vermont. In addition, the American coot (***Fulica americana***) was included starting in 1999, because it is part of the monitoring methodology used for this study (McCracken et al. 1995), and several volunteers reported it.

All of the above activities have two long term objectives: to look at marsh bird population trends within certain marshes in Vermont, and to investigate the effect of water level and marsh vegetation changes on marsh bird numbers. By investigating marsh bird responses to vegetation changes this research is trying to determine habitat requirements for nongame marsh birds, investigate what habitat is created by the vegetation management undertaken, and determine what effect these management efforts have on nongame marsh bird numbers.

MATERIALS AND METHODS

BLACK TERN CENSUS

Black terns were censussed as in previous years (Shambaugh 1995). Briefly, areas where black terns have historically nested were censussed by canoe during the black tern incubation period, approximately June 1 through June 20. An estimate of nesting pairs was made by counting the number of adults flushed up from the colony while canoeing through it, then dividing by two. This estimate was verified, as much as possible without excessive disturbance, by locating actual nests. All census work was undertaken by the author except portions of MNWR which were surveyed by interns working on various bird projects in the MNWR.

MARSH BIRD CENSUS

The four marsh bird survey routes created in 1996: (Charcoal Creek at Missisquoi National Wildlife Refuge (MNWR) in Swanton VT, Mud Creek at Mud Creek WMA in Alburg VT, Route 17 at Dead Creek WMA in Addison, VT, and Brilyea at Dead Creek WMA) were all utilized again in 2001 (see Figures 1-4 for site locations). The only change to these routes was that Dave Sausville from Vermont Fish and Wildlife replaced Steve Parren surveying the Route 17 and Brilyea routes on Dead Creek WMA. The four routes created in 1998: Long Marsh, Goose Bay, and Dead Creek at MNWR in Swanton, VT (see Figure 1) and South Bay at South Bay WMA in Coventry, VT (see Figure 5 for site locations) were also continued in 2001 with the exception of station five at South Bay which was omitted. The routes created in 1999 were also continued, with the exception of Shelburne Pond: Cranberry Pool within MNWR (see Figure 1), Sandbar WMA in Milton, VT (see Figure 6), Little Otter Creek in Ferrisburgh, VT (see Figure 7), Berlin Pond in Berlin, VT (Figure 9), and Lake Bomoseen in Hubbardton, VT (Figure 10), and Herrick's Cove in Rockingham, VT (Figure 11). A new route was established at West Rutland Marsh with five stations (see Figure 8).

These survey routes were all set up and surveyed according to the Marsh Bird Monitoring Program protocol developed at the Long Point Bird Observatory, Ontario, Canada (McCraken et al. 1995) with modifications as described previously (Shambaugh 1998). Briefly, a survey route consists of between two and nine stations located at least 200 m apart. Each survey station is semi-permanently marked with either a post pounded into the mud or a metal rod pounded in the ground. Pre-recorded calls of least bittern, Virginia rail, sora, common moorhen, and pied-billed grebe are played from each survey station and responses are recorded for the next five minutes. The number of each species responding within a 100m radius semi-circle centered on the station are reported. This semi-circle is referred to as a survey plot. The American bittern was included in the survey without use of pre-recorded calls because they are loud, distinctive, and reliably detected without the use of a tape.

RESULTS AND DISCUSSION

BLACK TERN CENSUS

Based on the results of the 2001 black tern census, it is estimated that there were 53 black tern pairs nesting in Vermont in 2001. This is the second lowest population estimate since this study was initiated in 1990. Unfortunately, the black tern population continues to become more concentrated within the area of Missisquoi NWR, to the point where in 2000 and again in 2001, all nesting activity was at the north end of Lake Champlain, and all but about six pairs were within Missisquoi NWR (see Table 1 and Figure 12). Since this is the largest wetland complex in the state, Missisquoi NWR is where one would prefer black terns to concentrate if they have to be in only one area. But it means that the population is especially vulnerable to localized problems. Figure 12 groups the colonies by population area, and it can be seen that the Dead Creek and Memphremagog populations together added up to 20-30 percent of the Vermont population in the early 1990's, but that this has gradually decreased to nothing by the year 2000. For the second

year running there were no terns nesting at South Bay WMA on Lake Memphremagog. This area is about 45 mi. (75 km.) over land from the nearest known nesting area (Missisquoi NWR), so it may be difficult to re-colonize the area if terns don't return in the next year or two.

On June 6, 2001 I made a trip to Otter Creek in response to a report relayed by Steve Parren (pers. comm.) of a black tern seen in the area. The report was of a tern observed in the area near the mouth of Dead Creek, flying with nest material in its mouth. While canoeing the area I observed a black tern flying downstream over Otter Creek and it appeared to fly up Dead Creek. After continued attempts to locate an active nesting area, nothing was found. It is possible that one or several pairs of black terns nested in the area in 2001 without my being able to locate them. It probably would not have been a large colony without myself or someone else finding it. A bird observed in this area could have been nesting in wetlands near Otter Creek, Little Otter Creek, or Dead Creek.

As can be seen in Table 1 and Figure 12 the number of breeding pairs continues to fluctuate greatly from year to year. There seems to be either significant interchange between the Vermont breeding population and some other breeding area (New York, Canada, or Maine), or there must be a non-breeding population in Vermont which only breeds when the conditions are correct. Which of these, or something else, might be the case cannot be determined without extensive banding which is not planned at this time. In Figure 12 it also appears as though there may possibly be a periodicity of about six or seven years to the overall population levels, with highs in 1992 and 1999, and lows in 1996 and maybe in 2001, but the cause for this is unknown.

Figures 13-15 illustrate a possible relationship between Lake Champlain lake levels and the number of black terns nesting in Vermont. The lake level values which are utilized are arrived at by averaging the May 15 - May 31 lake levels measured in Burlington, Vermont. This is the time period when black terns are most probably searching out prospective nesting areas in Vermont (Shambaugh, pers. observ.). Figure 13 shows an apparent negative relationship between lake levels and the overall Vermont population, while Figure 14 selects only those colonies sites under the direct influence of fluctuating Lake Champlain levels. The negative relationship in Figure 14 is stronger than that shown in Figure 13, with an r^2 of 0.43 vs. 0.33. This relationship raises the possibility that as lake levels get too high, the terns cannot find suitable nesting sites and either don't breed or move on to other nesting areas away from Lake Champlain. Figure 15 shows that as water levels increase, the percent of black terns nesting in impoundments (Cranberry Pool, Mud Creek, and the Route 17 N. and S. sites) tends to increase. A combination of factors would interact during high water years to discourage black tern nesting. Black terns are very late nesters in Vermont (generally starting nesting in early June) because they have to wait for emergent vegetation growth to progress far enough or lake level to drop enough for nest substrate to become available. So when vegetation growth is delayed by high water levels, it may not leave sufficient time for the birds to successfully raise a brood, or at least not re-nest if the first fails. It is possible that if suitable nesting habitat isn't found within a reasonable time (maybe mid-June), then the birds will loose the urge to nest and spend the season as non-breeders, either on Lake Champlain or elsewhere.

BLACK TERN FLEDGLING COUNT PROJECT

An attempt was made in 2001 to estimate the number of fledglings produced in the area of Missisquoi National Wildlife Refuge by counting the number of fledglings on staging areas in Missisquoi Bay in August, after nesting colonies have been abandoned, but prior to migration. Two days, 8/4/01 and 8/11/01, were spent observing and counting terns on Missisquoi Bay at the mouth of Dead Creek, MNWR. This is a major staging area for black terns, common terns, and gulls on calm days in early to mid August. Best estimates for the number of fledglings present during the two days were 25 and 29 fledglings respectively. If one uses 29 fledglings as a minimum estimate of the number of fledglings produced in Vermont from the 53 pairs found in 2001, then each pair produced about 0.55 fledglings. If one assumes the 29 fledglings came only from MNWR and not Mud Creek WMA then an estimated 0.62 fledglings per pair were produced in 2001. Either way at least 0.5 fledglings per pair were probably produced by the Vermont black tern population in 2001. If this is an accurate approximation of the reproductive success of Vermont's terns then it is probably not adequate to sustain the population. Unfortunately, it is not possible to determine if this number of fledglings is a large or small percentage of the true total fledgling population.

MARSH BIRD SURVEYS

Fifteen marsh bird routes were surveyed in 2001 with a total of 89 stations. Shelburne Pond was not surveyed in 2001, but a new marsh route was added at West Rutland Marsh. The marsh bird monitoring routes investigated are situated in emergent marshes within state Wildlife Management Areas, Missisquoi NWR, or in marshes designated as "Important Bird Areas"(IBAs) by Audubon Vermont. IBAs are areas selected by a scientific panel as being especially important for the continued well-being of Vermonts birds. Table 2 lists the mean number of each marsh species detected per station in each marsh. Several observations can be made from these data. First, as in previous years, it is the case that the Virginia rail is the most common and abundant marsh bird detected by this survey. The common moorhen is also quite common, but the other species are only found sporadically. In general, the same trends in marsh bird numbers were seen in 2001 as in previous years. Each marsh seems to have it's own cohort of marsh species, which doesn't vary greatly year-to-year. The few differences which stand out are probably due to the low lake levels in 2001. For instance, Goose Bay, on Missisquoi Bay, typically does not have good Virginia rail habitat but it apparently did in 2001. Another difference which stands out is the large number of common moorhen in Cranberry Pool, it is possible the moorhens moved into Cranberry Pool because of the low water in the surrounding areas, but this is just speculation. One observation which has been made in previous years and continues this year is the gradual decline in the number of common moorhen at Mud Creek WMA. In 1996 there were ten moorhen detected at this marsh, in 2001 only one. This trend is most pronounced in the moorhen, but it is present in all species surveyed. I believe this may be a response to deteriorating habitat at the south end of this marsh, but I can't verify this at this time.

Table 3 totals up the number of individuals observed at each marsh in 2001, while Table 4 lists the number of stations where each species was detected. As with Table 2, these demonstrate that the Virginia rail and common moorhen are both widespread and common. Pied-billed grebe were also fairly numerous, but more localized with 18 detected at 12 stations. Least bittern, sora, and American bittern were each observed only occasionally, and never more than one at a station, while American coot was only found at one station in 2001. Of all these species, the least bittern and American coot are the least common, and a more detailed search for these species at some point might be useful.

CONCLUSIONS

For the second year in a row, the entire Vermont black tern nesting population was concentrated at the north end of Lake Champlain at Mud Creek WMA and Missisquoi NWR. The estimated breeding population of 53 pairs was the second lowest since this study was initiated in 1990. The black tern now meets the criteria for listing as a state endangered species and this maybe should be considered if this species does not re-colonize other nesting areas in the next year or two. Because of the restricted nesting area and the highly variable lake levels the impoundments at Mud Creek and Cranberry Pool become very important to the survival of this species in Vermont. These impounded areas are critical because they can act as refugia during very high (and maybe low) water years on Lake Champlain. Other reasons for their importance include: ability to vary the water level or hold it constant, isolation from human disturbance, ability to manage the vegetation if appropriate. There may be things we can do to encourage black terns to nest and nest successfully in these marshes. If so we should make the attempt while we still have birds nesting there.

The marsh bird surveys continue, with six years of data at the four original sites. The most striking observation from this data is the gradual decline in marsh birds at Mud Creek WMA. Observations indicate that the south end of the marsh, just north of the old rail bed, has become much more densely populated with cattails. In addition, the rest of the edge between open water and cattail mat seems to be more abrupt, with less of a transition and therefore less diverse habitat. The causes for these observations are unknown, but some of it is certainly simply the shifting cattail mats. Whether the cookie cutter activity in 1996 had any influence is unknown.

Proposed activities for 2002 include:

- Continue statewide black tern survey
- Continue marsh bird surveys
- Continue black tern fledgling count at staging area as in 2001
- Arrange a flight over areas where cookie cutter was used in 1996 to look for lasting effects, to assess Mud Creek vegetation patterns, and to photograph black tern nesting colonies.

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TABLE 1. VERMONT BLACK TERN POPULATION DATA, 1990-2001.

COLONY (POPULATION)	NUMBER OF BREEDING PAIRS											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Charcoal Creek N. (Missisquoi)	15	24	22	15*	31	14	10	17	21	24	22	26
Charcoal Creek S. (Missisquoi)	5	13	11	2*	2	12	0	3	15	10	5	0
Cranberry Pool (Missisquoi)	17	6	5	5	13	0	0	5	4	8	11	11
Big Marsh (Missisquoi)	unknown	0	0	15	1*	unknown	16	17	19	33	10	0
Goose Bay (Missisquoi)	unknown	unknown	13	6	1*	7	0	0	0	10	0	0
Gander Bay (Missisquoi)	0	unknown	0	unknown	unknown	6	unknown	0	0	0	0	0
Mud Creek WMA (Missisquoi)	unknown	7	24	20*	15*	17*	8*	5*	8*	3	5	6
First Creek (Missisquoi)	unknown	unknown	unknown	unknown	unknown	unknown	unknown	6	unknown	0	1	2
Long Marsh (Missisquoi)	unknown	unknown	0	unknown	unknown	0	unknown	unknown	5	9	9	8
South Bay WMA (Memophremagog)	4	4	4	unknown	2	5	3	5	3	3	0	0
Panton Road N. (Dead Creek)	1	2	1	2*	0	3	0	0	0	0	0	0
Panton Road S.(Dead Creek)	0	4	3	unknown	0	0	0	0	0	0	0	0
Route 17 N(Dead Creek).	6	0	0	unknown	5	0	3	0	0	0	0	0
Route 17 S.(Dead Creek)	5	0	0	unknown	2	0	0	0	0	0	0	0
West Road(Dead Creek)	0	2	4	unknown	0	0	0	0	0	0	0	0
Little Otter Creek(Dead Creek)	6	9	8	unknown	2	0	4	1	2	0	0	0
TOTAL	**59**	**71**	**95**	**unknown**	**74**	**64**	**44**	**59**	**77**	**100**	**63**	53
MISSISQUOI POPULATION	37	50	75	63	63	56	34	53	72	97	63	53
MEMPHREMAGOG POPULATION	4	4	4	unknown	2	5	3	5	3	3	0	0
DEAD CREEK POPULATION	18	17	16	unknown	9	3	7	1	2	0	0	0

* estimated

TABLE 2. MEAN MARSH BIRDS PER SURVEY STATION.*

SURVEY ROUTE (number of stations)	VIRA	COMO	LEBI	SORA	AMBI	PBGR	AMCO
BRILYEA 1996 (4)	0.75	1.5	0	1	0	0	0
BRILYEA 1997 (4)	0.75	1.5	0	0.75	0	0	0
BRILYEA 1998 (4)	0.75	0	0	0	0	0	0
BRILYEA 1999 (4)	1	0.25	0	0.5	0.25	0	0
BRILYEA 2000 (4)	0.75	0.75	0	0.25	0	0	0.25
BRILYEA 2001 (4)	1	0	0	0.25	0	0	0
ROUTE 17 1996 (8)	1.75	0.25	0	0.125	0	0	0
ROUTE 17 1997 (8)	1	0	0	0	0	0	0
ROUTE 17 1998 (8)	1.5	0.375	0	0.5	0	0	0
ROUTE 17 1999 (8)	0.625	0	0	0	0	0	0
ROUTE 17 2000 (8)	0.75	0.125	0	0.125	0	0	0
ROUTE 17 2001 (8)	1	0.5	0	0.25	0	0	0
MUD CREEK 1996 (9)	2.5	1.125	0.125	0	0.125	0.125	0
MUD CREEK 1997 (9)	1.75	0.75	0.125	0	0.125	0	0
MUD CREEK 1998 (9)	2.125	0.5	0.25	0	0.125	0	0
MUD CREEK 1999 (9)	1.44	0.33	0.222	0	0	0	0
MUD CREEK 2000 (9)	1.44	0.22	0.22	0	0.11	0	0
MUD CREEK 2001 (9)	0.89	0.11	0.11	0	0	0	0
CHARCOAL CREEK 1996 (8)	0	0	0	0	0	0	0
CHARCOAL CREEK 1997 (8)	0	0	0.125	0	0	0.125	0
CHARCOAL CREEK 1998 (7)	0.286	0.286	0	0.143	0.143	0.286	0
CHARCOAL CREEK 1999 (7)	0.125	0.125	0.125	0.375	0	0.125	0
CHARCOAL CREEK 2000 (9)	0.44	0.11	0	0.22	0.11	0	0
CHARCOAL CREEK 2001 (9)	0.625	0.375	0	0.375	0.25	0	0
SOUTH BAY 1998 (6)	0	0	0.5	0.17	0	0.5	0
SOUTH BAY 1999 (5)	0.6	0	0.4	0	0	0.8	0.4
SOUTH BAY 2000 (6)	1.17	0	0	0.17	0.17	1.67	0
SOUTH BAY 2001 (6)	0.5	0	0	0	0.17	1.33	0.33
GOOSE BAY 1998 (6)	0	1	0	0	0.17	0.5	0
GOOSE BAY 1999 (6)	0	0.5	0	0	0	0.667	0
GOOSE BAY 2000 (5)	0	1.6	0	0.2	0	1.6	0
GOOSE BAY 2001 (6)	1.2	0.2	0.2	0	0	0.2	0
DEAD CREEK (MNWR) 1998 (5)	0.2	0.2	0	0	0	0	0
DEAD CREEK (MNWR) 1999 (5)	0.8	0.2	0	0	0.8	0	0
DEAD CREEK (MNWR) 2000 (5)	1.2	0.4	0	0.2	0	0.6	0
DEAD CREEK (MNWR) 2001 (5)	0.2	0	0.2	0	0	0	0
LONG MARSH 1998 (6)	0	1.7	0	0.17	0	0.17	0
LONG MARSH 1999 (5)	1	0.2	0	0.4	0	0.2	0
LONG MARSH 2000 (5)	0.6	0.2	0.2	0.8	0	0.6	0
LONG MARSH 2001 (5)	0.8	0.6	0	0.2	0	0	0
CRANBERRY POOL 1999 (5)	1.4	0.6	0	0	0.6	0.6	0
CRANBERRY POOL 2000 (5)	0.4	0.2	0	0.2	0	0.4	0
CRANBERRY POOL 2001 (5)	0	2.2	0	0	0.2	1.2	0
BOMOSEEN 1999 (5)	1.6	0.2	0	0	0	0	0
BOMOSEEN 2000 (5)	0.8	0.4	0	0.2	0	0	0
BOMOSEEN 2001 (5)	1.6	0.2	0.2	0.2	0	0	0
SAND BAR 1999 (5)	0.4	0	0	0	0	0.2	0
SAND BAR 2000 (5)	1.2	0	0	0	0	0	0
SAND BAR 2001 (5)	0.4	0	0	0	0	0	0
HERRICK'S COVE 1999 (7)	0.143	0	0	0.143	0.143	0	0
HERRICK'S COVE 2000 ** no data							
HERRICK'S COVE 2001 (7)	0.286	0	0	0	0	0	0
LITTLE OTTER CREEK 1999 (7)	0.857	1.57	0.143	0.143	0	0.714	0
LITTLE OTTER CREEK 2000 (7)	0.29	0.86	0	0	0	0.57	0
LITTLE OTTER CREEK 2001 (7)	0.29	1.86	0	0.14	0	0.43	0
BERLIN POND 1999 (3)	1.33	0	0	0	0	0	0.333
BERLIN POND 2000 (3)	1.67	0	0	0	0.33	0	0
BERLIN POND 2001 (3)	1	0	0	0	0.67	0	0
SHELBURNE POND 1999 (2)	1.5	0	0	0	0	0	0
SHELBURNE POND 2000 (2)	1	0	0	0.5	0	0	0
SHELBURNE POND ** no data							
W. RUTLAND MARSH 2001 (5)	0.6	0	0	0	0	0	0

* Maximum number of each species detected during a single survey in a given year, divided by the number of stations within that survey.

VIRA = Virginia rail COMO = common moorhen LEBI = least bittern SORA = sora
AMBI = American bittern PBGR = pie-billed grebe AMCO = American coot

TABLE 3. NUMBER OF INDIVIDUALS OBSERVED PER MARSH, 2001*.

SURVEY ROUTE (number of stations)	VIRA	COMO	LEBI	SORA	AMBI	PBGR	AMCO
BRILYEA (4)	4	0	0	1	0	0	0
ROUTE 17 (8)	8	4	0	2	0	0	0
MUD CREEK (9)	8	1	1	0	0	0	0
CHARCOAL CREEK (9)	5	3	0	3	2	0	0
SOUTH BAY (6)	3	0	0	0	1	8	2
GOOSE BAY (6)	6	1	1	0	0	1	0
DEAD CREEK (MNWR) (5)	1	0	1	0	0	0	0
LONG MARSH (5)	4	3	0	1	0	0	0
CRANBERRY POOL (5)	0	11	0	0	1	6	0
BOMOSEEN (5)	8	1	1	1	0	0	0
SAND BAR (5)	2	0	0	0	0	0	0
HERRICK'S COVE (7)	2	0	0	0	0	0	0
LITTLE OTTER CREEK (7)	2	13	0	1	0	3	0
BERLIN POND (3)	3	0	0	0	2	0	0
W. RUTLAND MARSH (5)	3	0	0	0	0	0	0
TOTAL (89)	**56**	**37**	**4**	**9**	**6**	**18**	**2**

* Maximum number of each species detected during a single survey

VIRA = Virginia rail COMO = common moorhen LEBI = least bittern SORA = sora
AMBI = American bittern PBGR = pie-billed grebe AMCO = American coot

TABLE 4. NUMBER OF STATIONS WHERE SPECIES OBSERVED, 2001*.

SURVEY ROUTE (number of stations)	VIRA	COMO	LEBI	SORA	AMBI	PBGR	AMCO
BRILYEA (4)	4	0	0	1	0	0	0
ROUTE 17 (8)	6	2	0	2	0	0	0
MUD CREEK (9)	6	1	1	0	0	0	0
CHARCOAL CREEK (9)	3	2	0	3	2	0	0
SOUTH BAY (6)	2	0	0	0	1	5	1
GOOSE BAY (6)	5	1	1	0	0	1	0
DEAD CREEK (MNWR) (5)	1	0	1	0	0	0	0
LONG MARSH (5)	4	2	0	1	0	0	0
CRANBERRY POOL (5)	0	5	0	0	1	3	0
BOMOSEEN (5)	5	1	1	1	0	0	0
SAND BAR (5)	2	0	0	0	0	0	0
HERRICK'S COVE (7)	2	0	0	0	0	0	0
LITTLE OTTER CREEK (7)	1	7	0	1	0	3	0
BERLIN POND (3)	2	0	0	0	2	0	0
W. RUTLAND MARSH (5)	3	0	0	0	0	0	0
TOTAL (89)	**46**	**21**	**4**	**9**	**6**	**12**	**1**

* Number stations where each species detected during a single survey

VIRA = Virginia rail COMO = common moorhen LEBI = least bittern SORA = sora
AMBI = American bittern PBGR = pie-billed grebe AMCO = American coot

99fig1.tif

FIGURE 1.MISSISQUOI NWR MARSH BIRD STATIONS

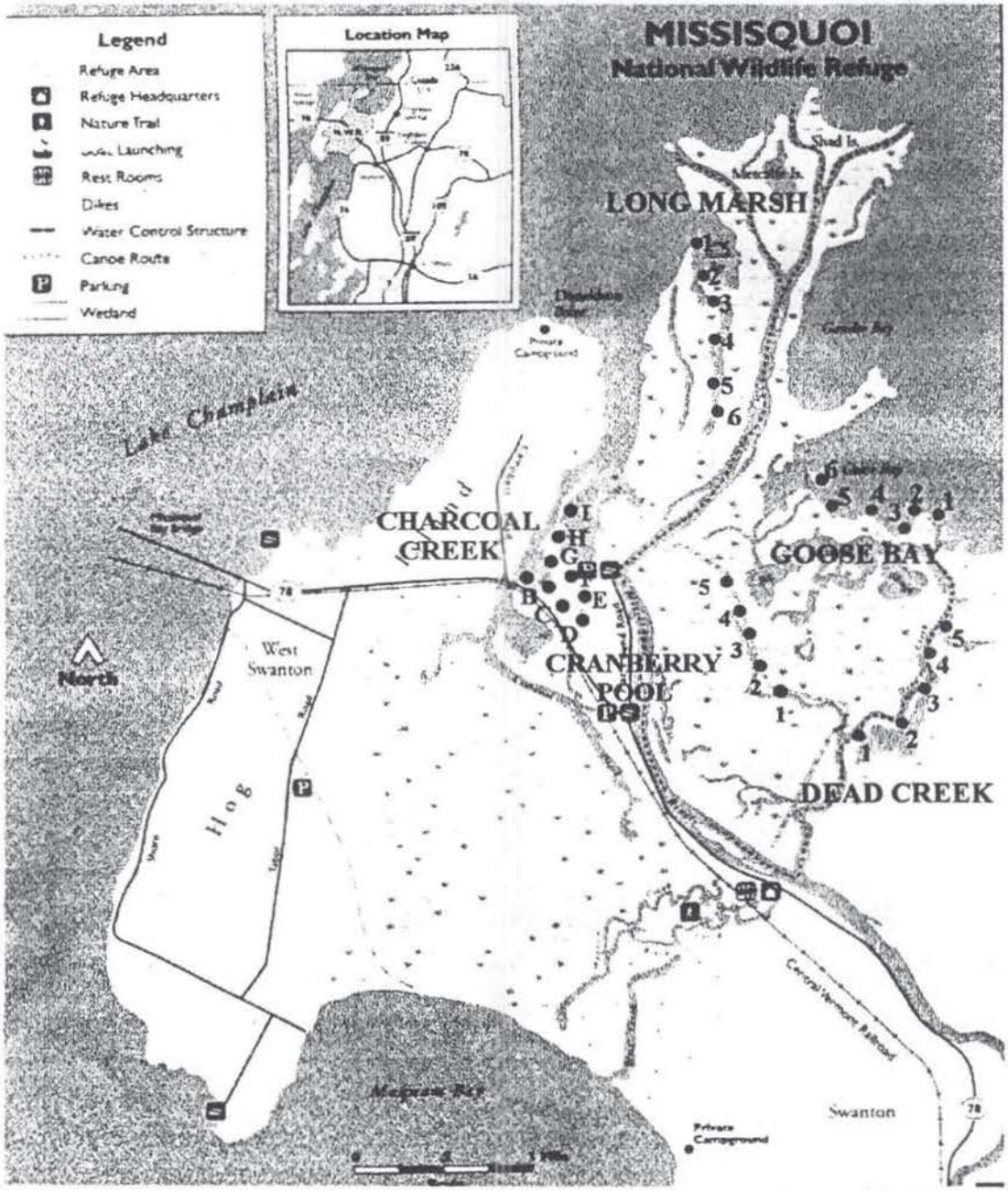


FIGURE 2. MUD CREEK MARSH BIRD STATIONS

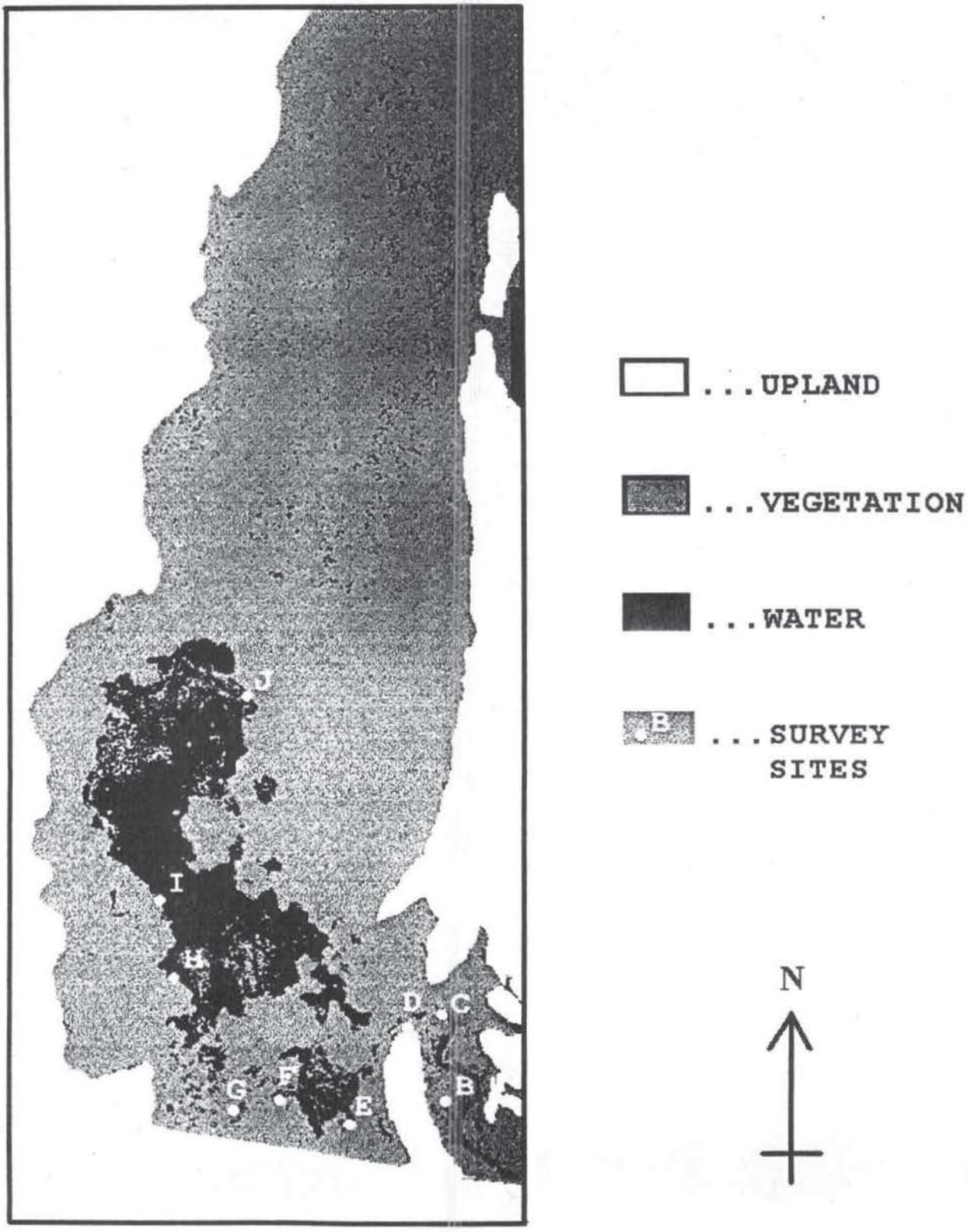


FIGURE 3. DEAD CREEK MARSH BIRD STATIONS

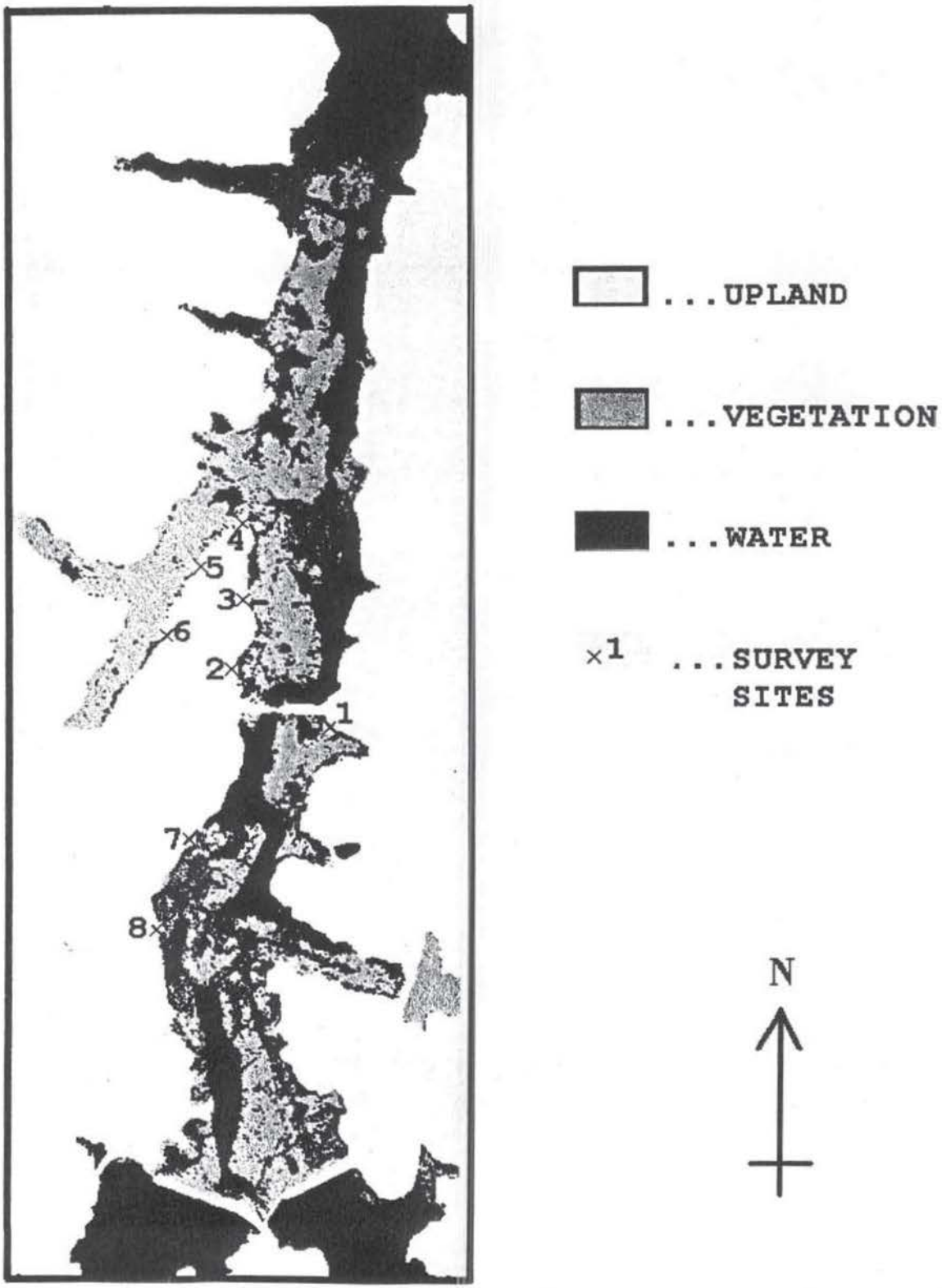
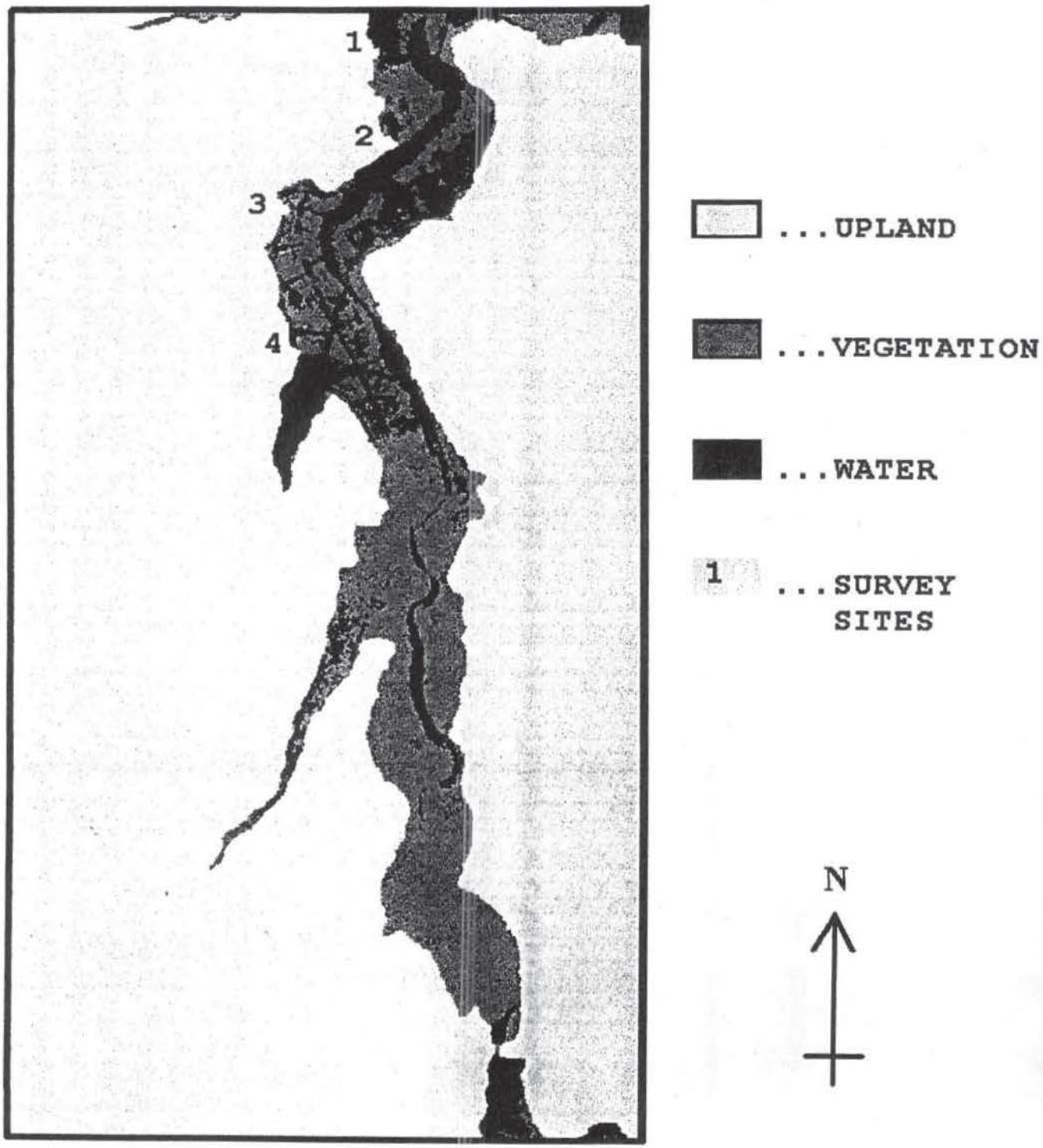
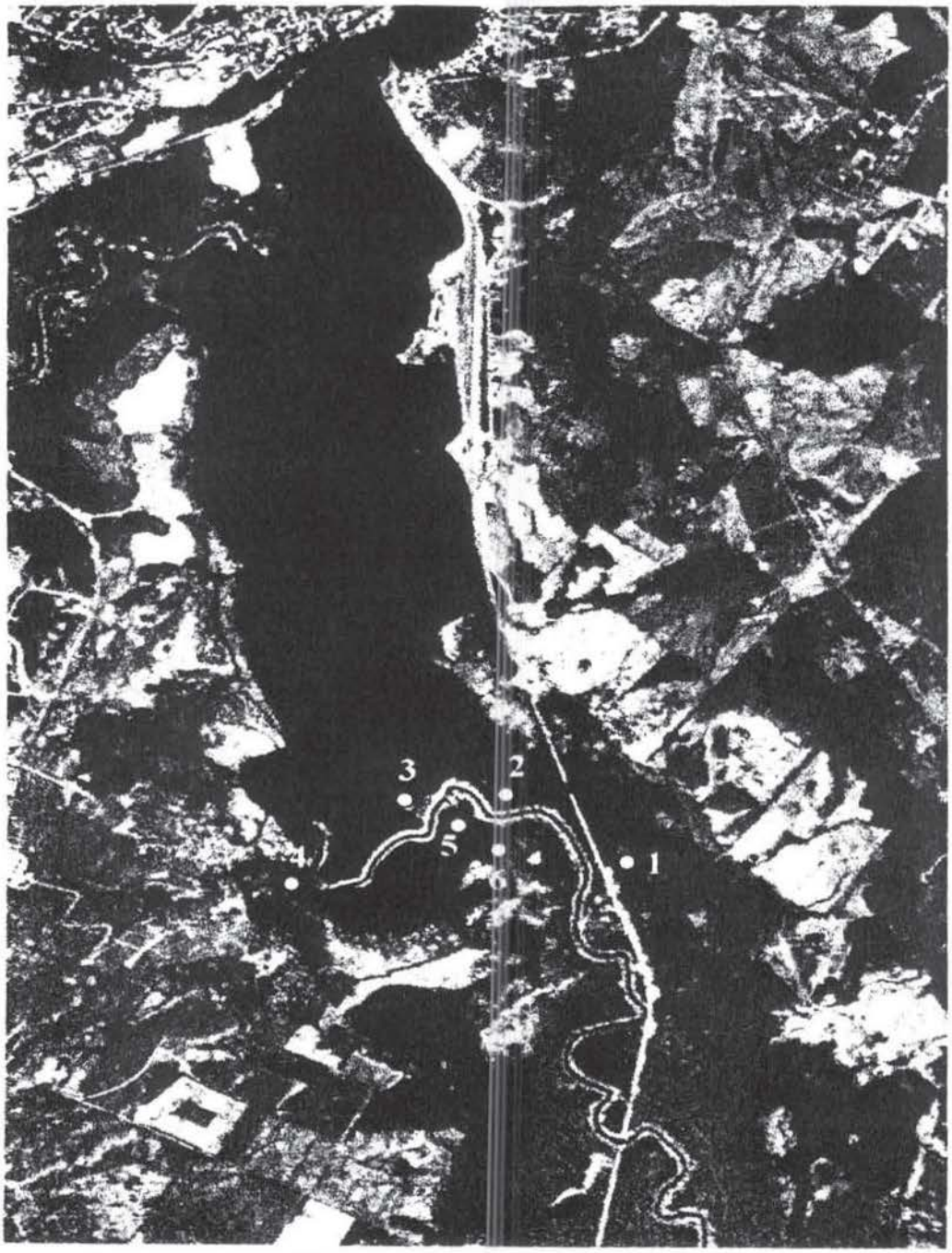


FIGURE 4. BRILYEA MARSH BIRD STATIONS



99fig5.bmp

FIGURE 5. SOUTH BAY WMA MARSH BIRD STATIONS.

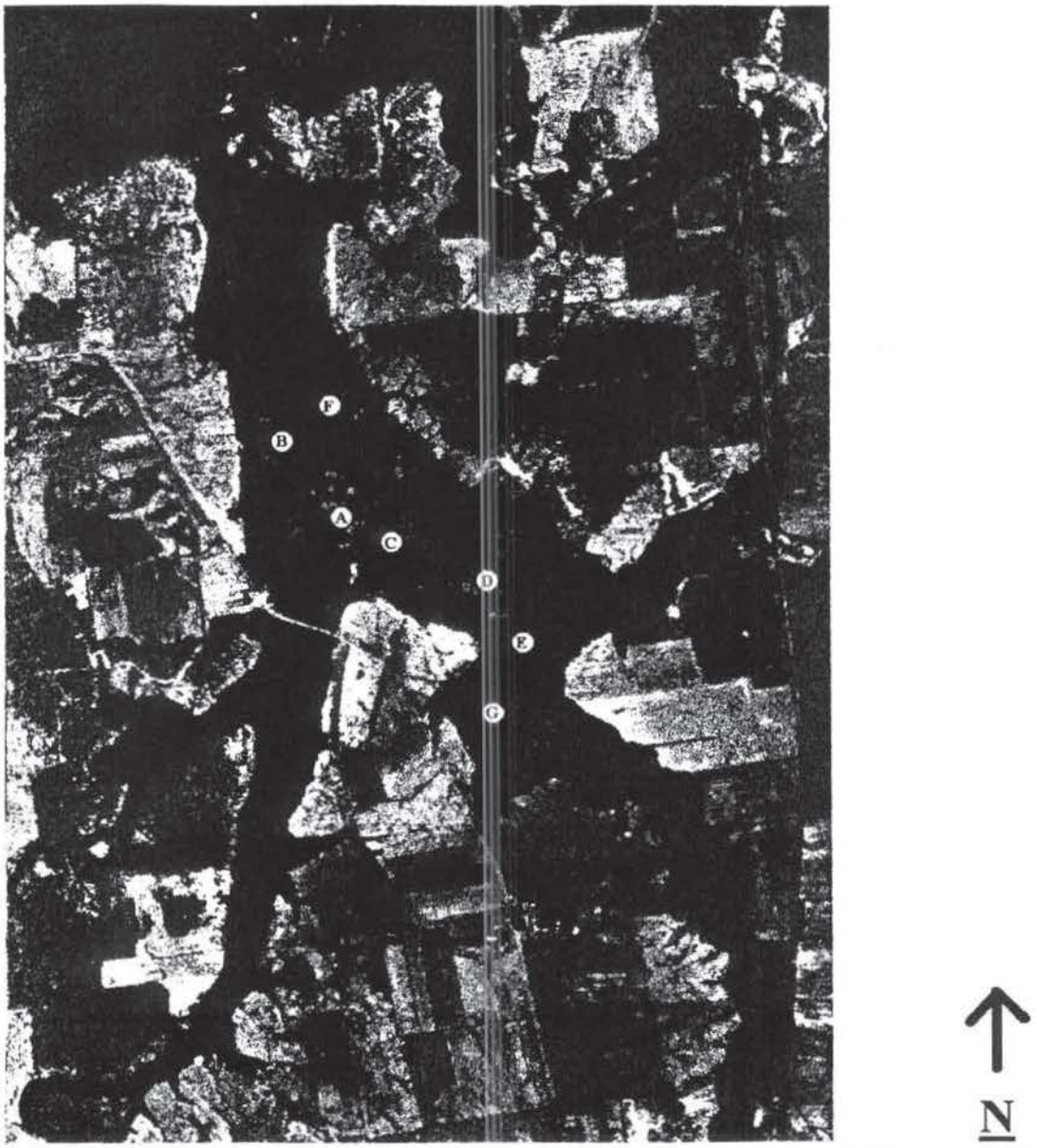


99fig6.tif

FIGURE 6. SANDBAR WMA MARSH BIRD STATIONS

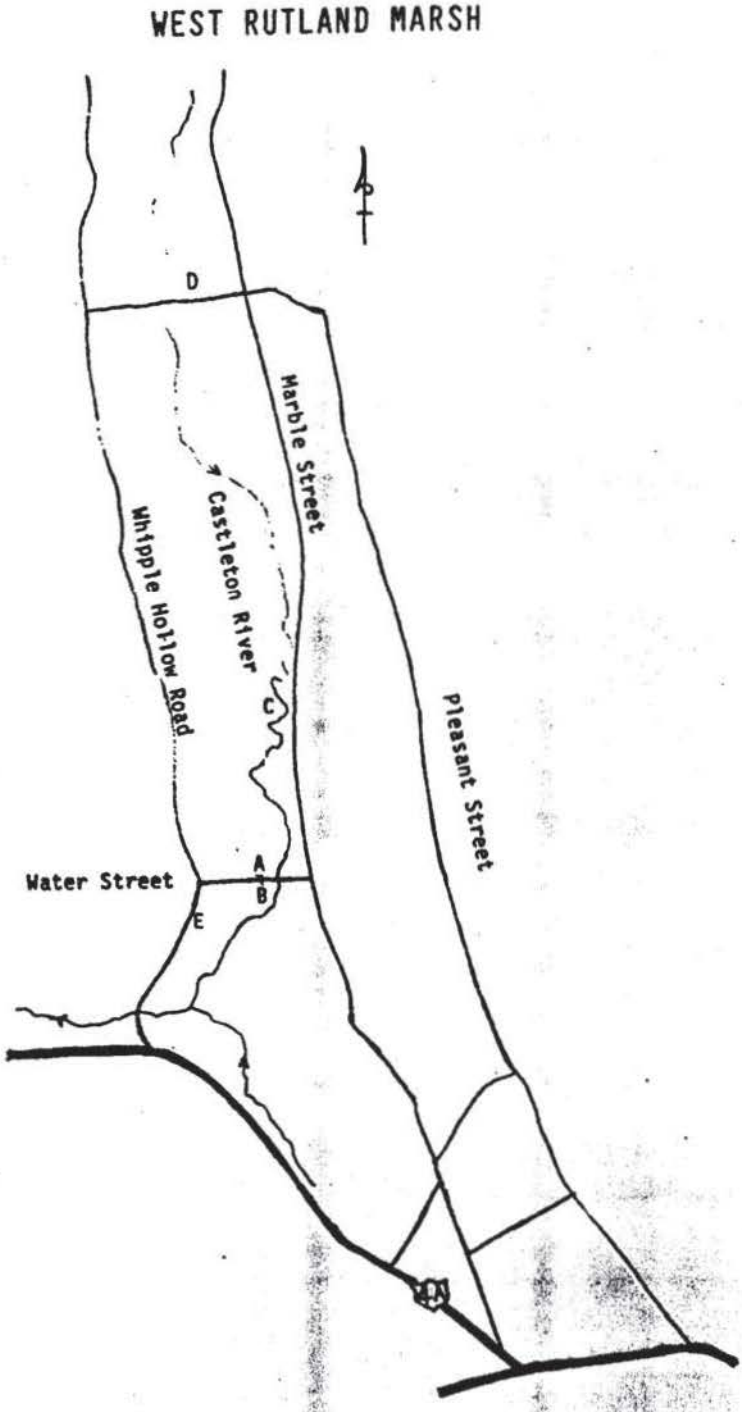
99fig7.tif

FIGURE 7. LITTLE OTTER CREEK MARSH BIRD STATIONS



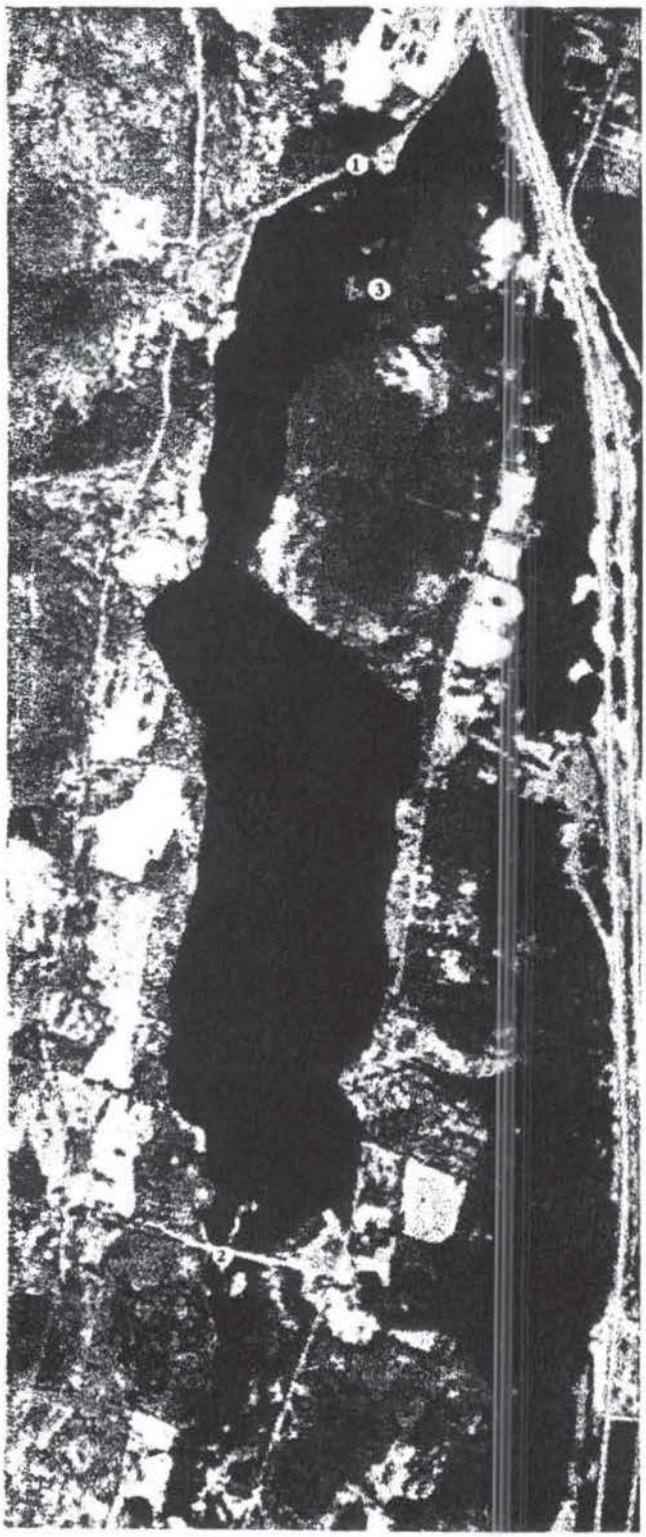
01fig8.tif

FIGURE 8. WEST RUTLAND MARSH MARSH BIRD STATIONS



99fig9.tif

FIGURE 9. BERLIN POND MARSH BIRD STATIONS



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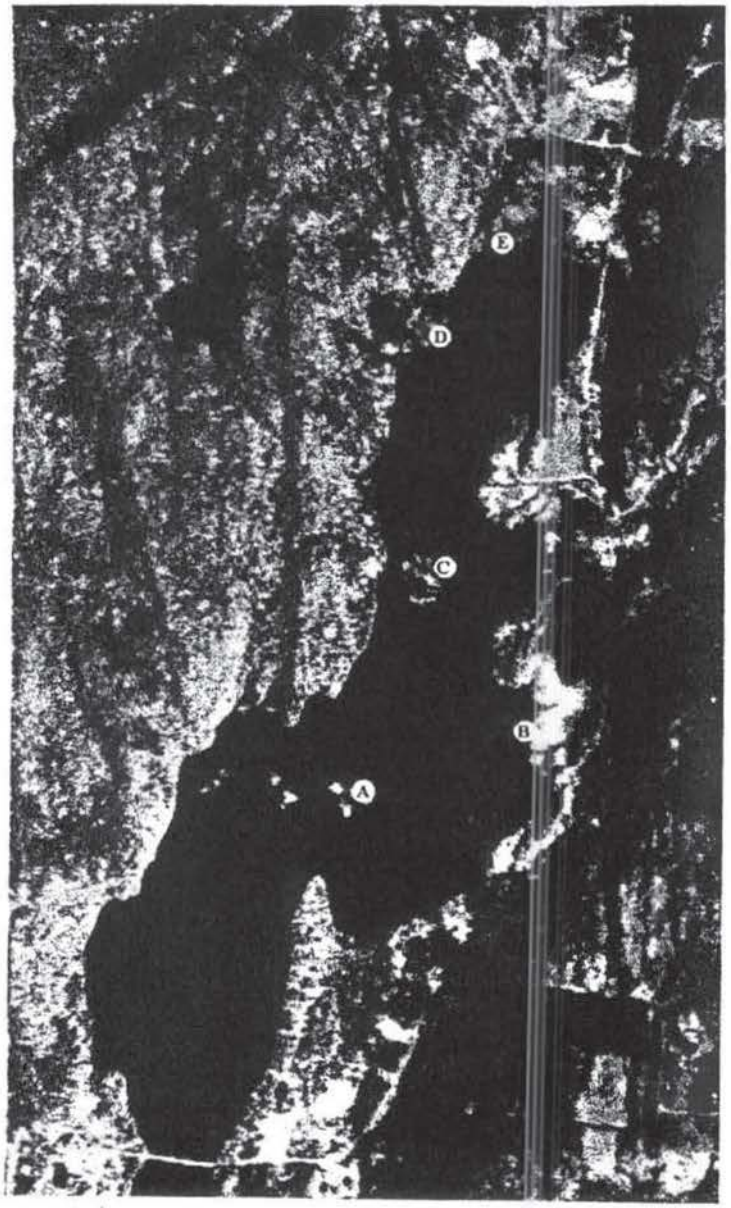
99fig10.tif

FIGURE 10. LAKE BOMOSEEN MARSH BIRD STATIONS



N

99fig11.tif

FIGURE 11. HERRICK'S COVE MARSH BIRD STATIONS

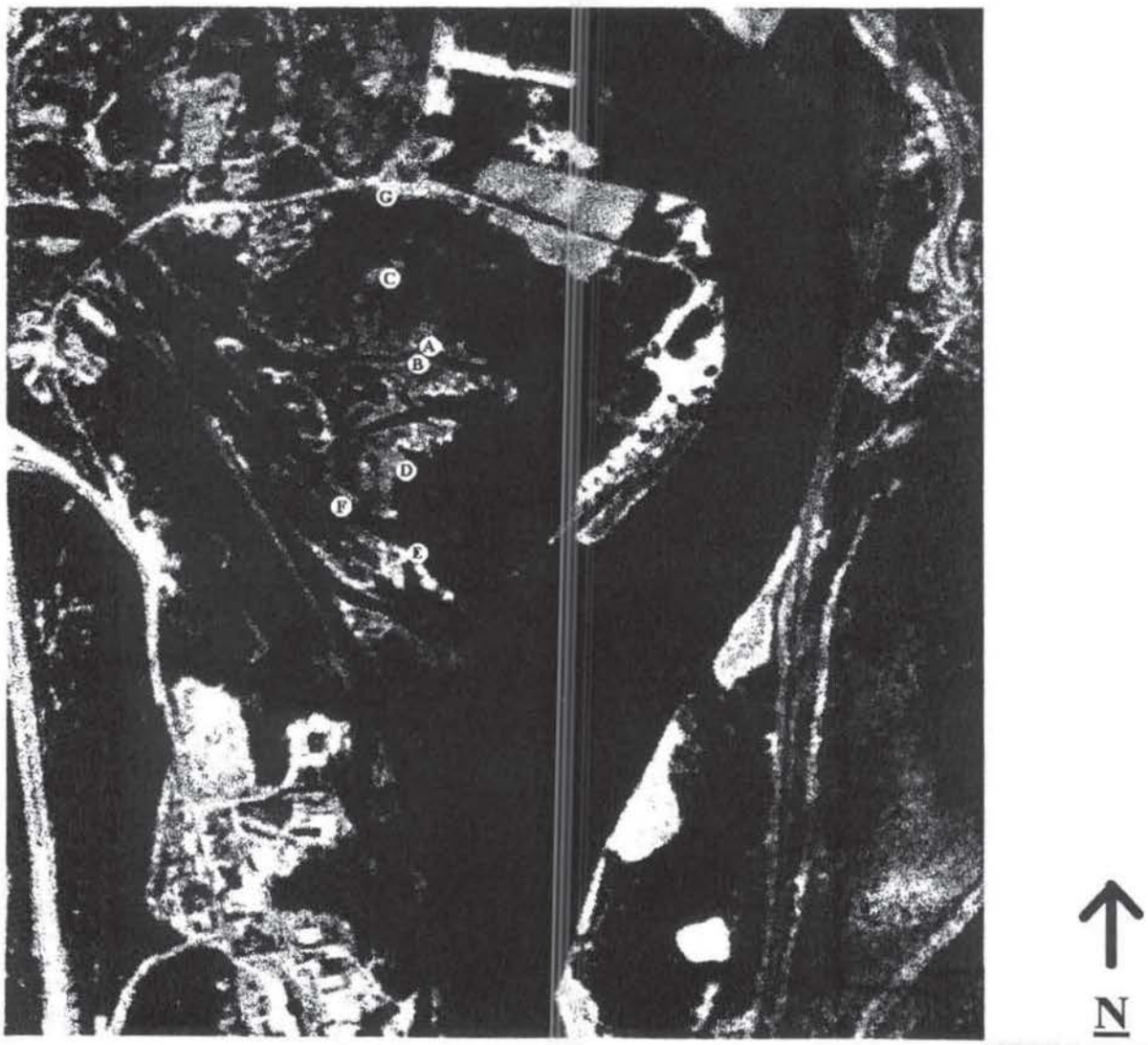


FIGURE 12. VERMONT BLACK TERN BREEDING POPULATION.

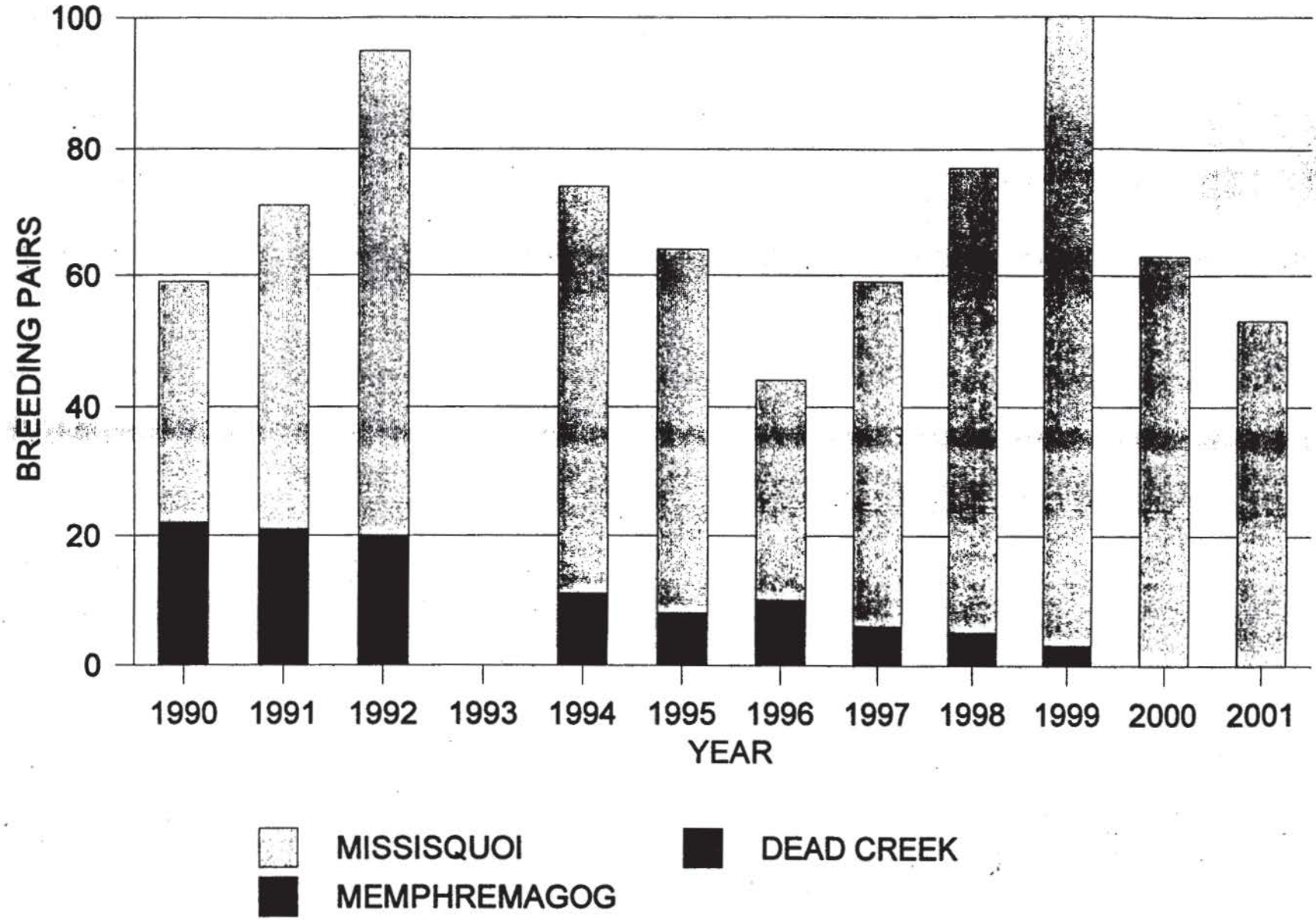
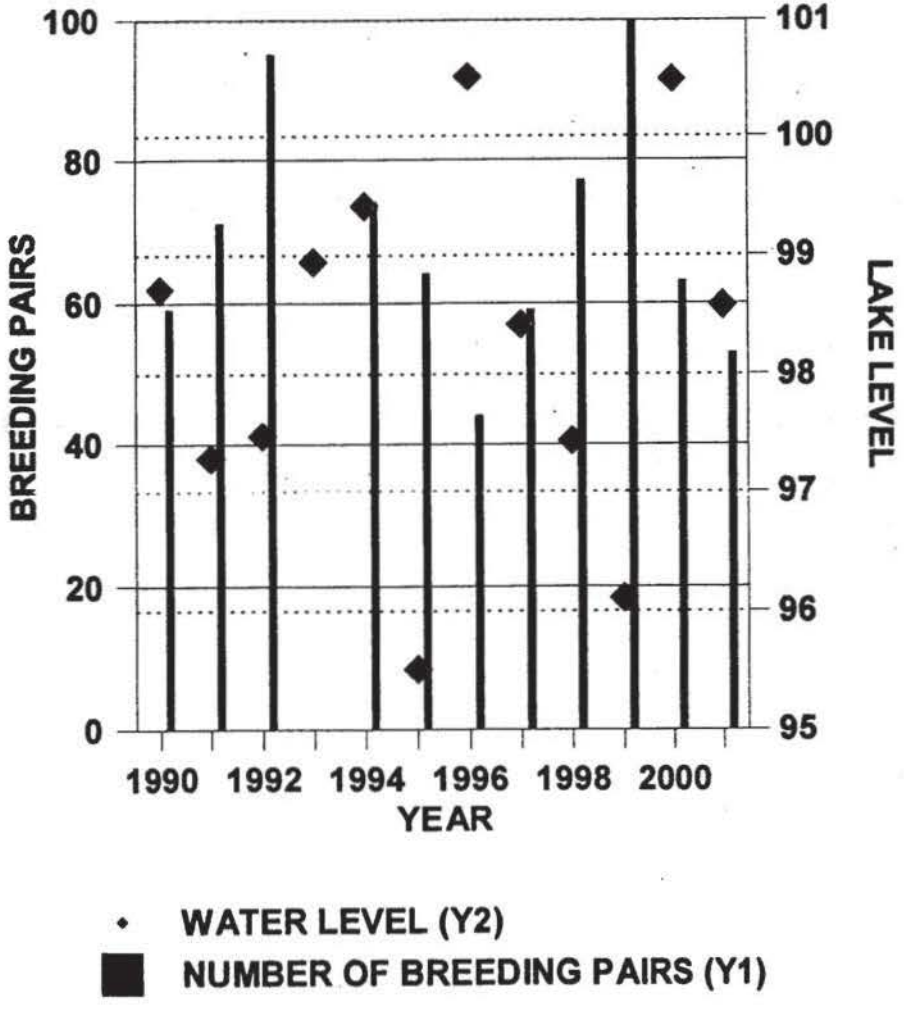


FIGURE 13. BLACK TERN NUMBERS vs. LAKE LEVEL.



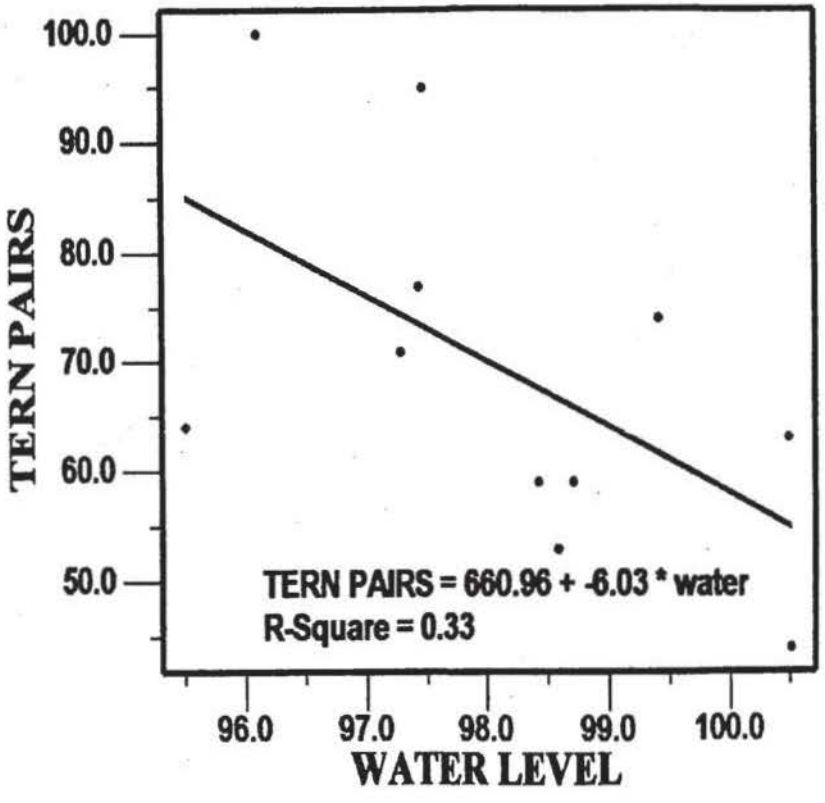
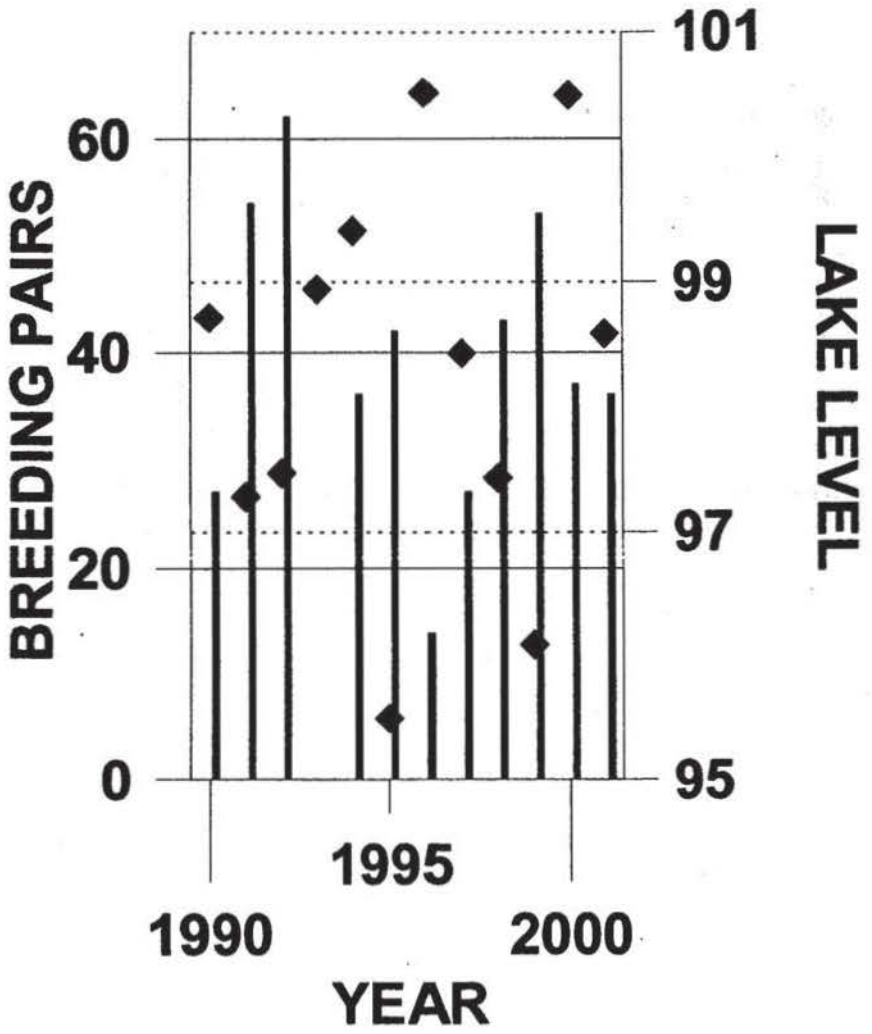


FIGURE 14. LAKESIDE BLACK TERN NESTING vs. LAKE LEVEL.



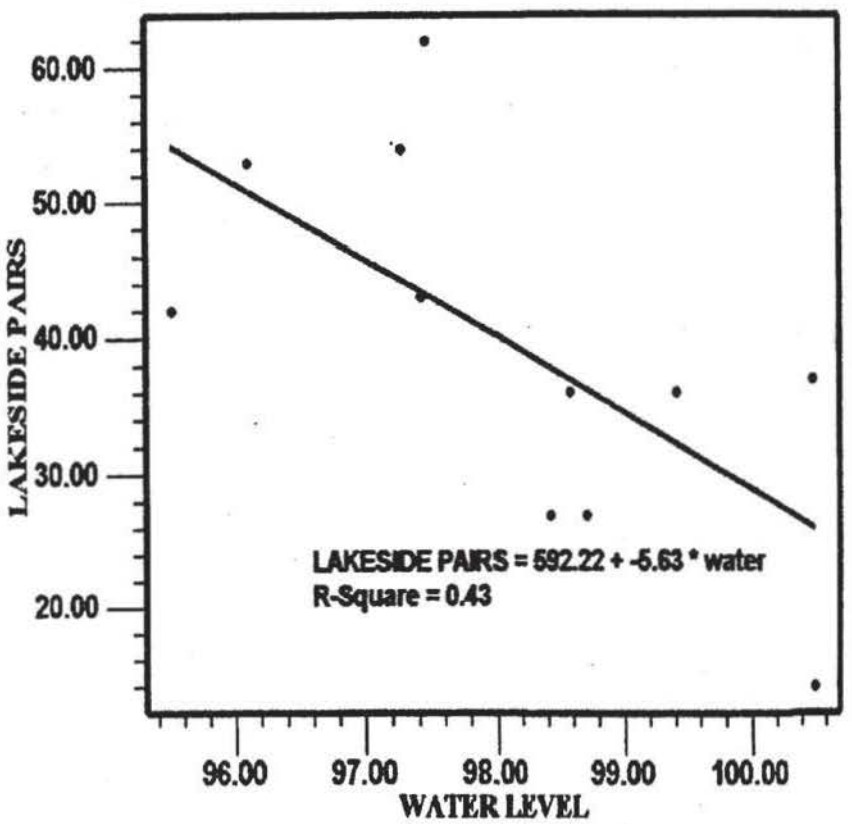


FIGURE 15. BLACK TERN NESTING IN IMPOUNDMENTS vs. LAKE LEVEL