2005 BLACK TERN POPULATION SURVEY AND OTHER MARSHBIRD MONITORING ACTIVITIES IN VERMONT

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ABSTRACT

2005 BLACK TERN POPULATION SURVEY AND MARSH BIRD MONITORING ACTIVITIES IN VERMONT

As part of ongoing research into the status of Vermont's marshbirds, a statewide census of the Black Tern (***Chlidonias niger***) nesting population was undertaken again in the year 2005. The Black Tern nesting population was found to be approximately 103 pairs in 2005, the highest number since this study was initiated in 1990. The high number of nesting pairs is encouraging, but again in 2005, all Black Tern nesting in Vermont was found at the north end of Lake Champlain within the Missisquoi National Wildlife Refuge (NWR). Artificial nest platforms and perches of various designs were erected within the nearby Mud Creek Wildlife Management Area in an effort to entice Black Terns to nest at this marsh, with no success.

Monitoring of selected marshes in Vermont for other marshbirds (Pied-billed Grebe, Least Bittern, American Bittern, Virginia Rail, Sora, Common Moorhen, and American Coot) was also continued in 2005. Twelve marshbird routes situated in emergent marshes within state Wildlife Management Areas, Missisquoi NWR, or in marshes designated as "Important Bird Areas" were surveyed by volunteers. Virginia Rail is still the most common and abundant marshbird 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 marshbird population trends within the marshes of Vermont, and to investigate the effect of water level and marsh vegetation management on marshbird numbers. Relationships between various marshbird nesting patterns are discussed and recommendations are made for management activities which could benefit the Black Tern nesting population.

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INTRODUCTION

The Black Tern (***Chlidonias niger***) is a colonial nesting marshbird which is currently on the Vermont endangered species list due to its declining numbers. In order to better understand the biology and population status of this species, statewide censuses of the Vermont Black Tern nesting population have been made since 1990. The Vermont Black Tern nesting population has been hovering at 50-100 pairs since the start of this study in 1990, probably down from about 300 pairs in the 1970s, although this latter number is not well documented. It is unknown if this apparent population decline is related to nesting activity in Vermont, or problems on wintering areas.

In 2005 the entire Vermont Black Tern breeding population was concentrated within the Missisquoi National Wildlife Refuge in Swanton, VT, in the northern part of the Champlain Valley. The Vermont breeding range of this species has gradually constricted since about 1996, when nesting still occurred at Little Otter Creek in Ferrisburg, Dead Creek WMA in Addison, and South Bay WMA in Coventry. As recently as 1998, Black Terns nested in eight different, discrete nesting colonies, in 2005 there were only four colonies.

Black Terns nested in relatively large numbers at Mud Creek WMA in Alburg in the 1990's but the numbers gradually declined until only one pair nested in 2002 and 2003, and none in 2004. This marsh is an impounded wetland which the VDFW manages for waterfowl and which they would like to manage for a stable Black Tern nesting population. Because the marsh is a recent Black Tern colony site and it is near to Missisquoi NWR, the VDFW and the author decided to try to lure terns back to this marsh by lowering the water level to encourage emergent vegetation, and put out nest platforms for Black Terns to nest on. Various sizes and styles of nest platforms were deployed in the wetland in the hopes of having something which would be attractive to terns.

In addition to the above Black Tern census work, the author continued to coordinate, in cooperation with Audubon Vermont, volunteer marshbird surveys of selected marshes in Vermont in 2005. As in previous years, the following bird species were selected for monitoring: 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 and are of conservation concern 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 started reporting it.

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 May 20 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 Black Tern census work was undertaken by the author.

MARSHBIRD CENSUS

The four marshbird survey routes created in 1996: Charcoal Creek at Missisquoi National Wildlife Refuge in Swanton VT, Mud Creek at Mud Creek Wildlife Management Area (WMA) in Alburg VT, Route 17 at Dead Creek WMA in Addison, VT, and Brilyea at Dead Creek WMA were all surveyed again in 2005 (see Figures 1-4 for site locations). Of the routes created after 1996, eight were surveyed successfully during the summer of 2005. These routes, their locations, and year that surveys began are as follows: Long Marsh (1998), Goose Bay (1998), and Dead Creek (1998) at MNWR in Swanton, VT (see Figure 1), South Bay WMA (1998) in Coventry, VT (see Figure 5), Little Otter Creek (1999) in Ferrisburgh, VT (see Figure 7), West Rutland Marsh (2001) in West Rutland, VT (Figure 8), Herrick's Cove (1999) in Rockingham, VT (Figure 10), and Panton Rd. (2002) in Panton, VT (Figure 11). Locations of existing routes which were not surveyed successfully in 2005 are depicted in Figure 1 (Cranberry Pool at MNWR in Swanton, VT), Figure 6 (Sandbar WMA in Milton, VT), Figure 9 (Lake Bomoseen in Hubbardton, VT), and Figure 12 (Berlin Pond in Berlin, VT).

These survey routes were set up and surveyed according to the Marshbird 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 at 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 is reported. This semi-circle is referred to as a survey plot. Each route was surveyed twice at least ten days apart during the month of June. 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. The American Coot, while quite rare in Vermont, will at times respond to the tape, and are reported periodically by surveyors.

NEST PLATFORMS

Black Terns nest in emergent marshes on exposed mud, old muskrat structures, or floating mats of vegetation. The marsh at Mud Creek is a large marsh with dense cattails surrounding a central pool of open water, when kept at full pool, the open water is deep enough that emergent vegetation and exposed mud do not appear until late in the Black Tern nesting season, if at all. Therefore, when Black Terns are

looking for nesting sites in May, there is generally little suitable substrate. In discussions with the wildlife managers of VDFW, it was decided that we would try to make the area more suitable to Black Terns by lowering the water level in the impounded area in May to try to encourage emergent growth earlier in the summer. Beaver activity makes this difficult, but in 2005 the new "beaver baffle" helped to keep the water level down a bit.

Nest platforms were constructed of various sizes and shapes with the twin goals of giving terns alternatives, and trying to optimize a stable, biodegradable design. The latter goal is intended to ensure that even if platforms can't be retrieved at the end of the summer, they won't contribute lasting contamination of the area. All floating platforms were anchored into place using 7' wooden garden stakes. The various designs were as follows:

- Two hay bales secured together with twine and anchored with a stake between the two into the mud.
- 40" x 40" frame made of 2" x 4"s in a square, with wire fencing attached to the top.
- 3' x 5' section of picket fence, with two 4' 2" x 4"s nailed on as "pontoons"
- 4' x 5' section of picket fence, with two 5' cedar posts nailed on as "pontoons", and two 5' 2" x 4"s on top as walls to hold nest substrate in place.

RESULTS AND DISCUSSION

BLACK TERN CENSUS

Based on the results of the 2005 Black Tern census, it is estimated that there were 103 Black Tern pairs nesting in Vermont in 2005 (see Table 1). The only documented nesting in 2005 was within the Missisquoi National Wildlife Refuge at the northern end of Lake Champlain. No terns were found nesting in the southern half of Lake Champlain or on Lake Memphremagog or even within the Mud Creek Wildlife Management Area (WMA) near the Missisquoi NWR. Mud Creek Wildlife Management Area in Alburg was, as recently as 1995, one of the major nesting areas in Vermont for this species. The Missisquoi NWR is, fortunately, the largest wetland complex in Vermont, with large amounts of a wide variety of wetland habitats and it continues to support a healthy population of Black Terns, with major concentrations in 2005 at Long Marsh, Cranberry Pool, and Charcoal Creek North.

Previous reports in this series have speculated on a possible negative relationship between Lake Champlain lake levels and Black Tern nesting numbers. This relationship did not hold up in 2005. Based on the predictive equation in last year's report, with a 2005 May lake level of about 98', there should have been about 70 nesting pairs in 2005. The record high number of terns this year cannot be explained based on this hypothesis. Even if this relationship was true in the past, it may be that it no longer holds true because the nesting area has become so restricted in Vermont in recent years. Even if the general relationship doesn't hold true, it is most probably true that impoundments such as Cranberry Pool would have suitable nest substrate even when other areas don't due to high water. So I believe it is important to make sure that Cranberry Pool is available for nesting during wetter than normal years. If a drawdown is necessary it should be timed to coincide with a normal or slightly dry year.

NEST PLATFORMS

As can be seen in Table 1, Black Terns did not nest at Mud Creek WMA, where nest platforms were put out in 2005. Two terns were observed flying over the marsh on May 24, but they didn't land or

feed as far as I could tell. For a nest platform to be suitable for Black Terns it must have nest substrate (exposed mud) and nest making material (dead vegetation) in the immediate area. All nest platforms put out in 2005 were covered with mud and/or rotting vegetation in addition to dead vegetation which could be used for nest building. This technique has been used successfully by the author at both Goose Bay (MNWR) and South Bay (South Bay WMA) Black Tern nesting colonies. Unfortunately, it was not possible to keep the nest material from washing off the platforms at Mud Creek WMA in 2005. Presumably this is due to the lack of emergent vegetation in the area of the nest platforms. The wide expanses of open water at Mud Creek, even in protected coves, enabled large waves to build up at times. At other marshes where nest platforms were used successfully, the platforms were placed within extensive beds of emergent vegetation, primarily burreed and bulrush. This vegetation served to act as a wind and wave break to protect the platforms, even if the vegetation wasn't dense enough to provide nesting habitat itself.

The nest platforms were placed in two protected coves at the north end of the open water of Mud Creek WMA. Even though these were somewhat protected coves, if the wind was from a particular direction the waves could build up enough to wash the debris off the platforms. Possible solutions include: finding a more sheltered location for the platforms, develop some method to successfully encourage more emergent growth, or modify the platform design to be more stable. The final design made in 2005 might prove to be workable. It was much more substantive and stable than previous designs. It consisted of a piece of picket fence as the platform, with two pontoons made of five foot cedar posts to raise it out of the water somewhat, and a frame on top made of 2 x 4's to keep the nest material from washing off as easily. Another concept which might be used to create suitable nest substrate would be to cut off pieces of cattail mat (maybe 10' x 10'), anchor them in the open water with posts driven into the mud, and kill or chop down the cattail to create exposed debris/mud. This would create a larger and therefore more stable nest substrate than could be built easily, it would be similar to natural nesting sites, and totally biodegradable.

If it were possible to encourage more early growth of emergent vegetation at Mud Creek then any nest platforms put out would be more protected from wave action. Until some method is developed to make the nesting habitat more conducive to terns at Mud Creek, then nest platforms cannot be a real solution. Currently there is a large expanse of dense cattail mat around the periphery of the central pool of open water. Neither habitat is preferred by Black Terns, the open water has no nest substrate, and the cattails are mostly too dense. Therefore the open water needs to be made more suitable for early emergent growth, or the cattails need to be made less dense, with patches of mud.

Mud Creek WMA is the best area available for expanding Black Tern nesting beyond the immediate area of Missisquoi NWR. If a management strategy can be developed which attracts terns back to this marsh, it would be the first step in the long term goal of recovering this species from the Vermont endangered species list.

MARSHBIRD SURVEYS

Twelve marshbird routes were surveyed successfully in 2005. Data from a total of 71stations are included in this year's results. Summary data for the mean number of each species per station are listed in Table 2 for the Vermont Wildlife Management Areas, Table 3 for Missisquoi National Wildlife Refuge and Table 4 for Vermont Important Bird Areas.

Several general observations can be made from these data. First, as in previous years, it is clear that the Virginia Rail is the most common and abundant marshbird detected by this survey. The Common

of marshbird numbers within the three original Wildlife Management Area survey routes: Brilyea and Route 17 within Dead Creek WMA and Mud Creek WMA. The number listed is a sum of the maximum number of individuals detected on a given day, in each marsh, by year. The most common species, Virginia Rail and Common Moorhen, both seem to have undergone a severe decline over the past ten years, while it is possible that Sora are on the increase.

The Common Moorhen numbers from 1996 and 1997 within these Wildlife Management Areas seem to be quite different from the later years (see Table 5). It may be that the large numbers detected in 1996 and 1997 don't correspond to the pre-1996 norm from which the population has declined, but are actually a temporary population explosion of moorhens at these marshes in response to the 'cookie cutter' vegetation management undertaken at all three of these marshes in early 1996. There was a large amount of floating, dead, chopped up vegetation present in 1996, due to the 'cookie cutter', which was solid enough for the moorhens to walk on and probably supplied abundant invertebrates and succulent roots to eat. It may be that moorhen, and Virginia Rail as well, were attracted to the temporary increase in habitat or food supply created by the 'cookie cutter'. Unfortunately, without pre-cookie cutter data for these marshes there is no way to know.

Looking at the marshbird data overall, the same trends in marshbird numbers were seen in 2005 as in previous years. Each marsh seems to have its own cohort of marsh species, which doesn't vary greatly year-to-year. By combining all of the data from all the marshes and years it is possible to make some general comparisons of the preferences of the various marshbirds for the marshes surveyed. Table 6 combines all of the data to give mean numbers of individuals per station for each marsh. The overall mean for each species is listed at the bottom, the values in **bold** are those marshes greater than the mean for that species, and the underlined value shows the marsh with the highest density for each species. It can be seen that no one marsh is obviously better than the rest, each species has preferences for different marshes. For instance, Mud Creek has the highest overall density of Virginia Rail and Least Bittern, but no Sora had been detected there until 2005. On the other hand, it is clear that some marshes have a greater diversity of marshbirds. It also appears that some marshes are either very good habitat or very poor habitat for Pied-billed Grebe, not many marshes are intermediate.

CONCLUSIONS

For the sixth year in a row, the entire Vermont Black Tern nesting population was concentrated at the north end of Lake Champlain, now restricted only to Missisquoi NWR. The 2005 estimated breeding population of 103 pairs is the highest number recorded since this study was initiated in 1990. Because of the restricted nesting area, the marsh at Charcoal Creek North takes on an ever greater importance. This marsh seems to be the only site in Vermont which has suitable nesting habitat under most water level conditions. Any alteration of this marsh, as proposed as part of the Route 78 reconstruction, must be undertaken with extreme care.

The impoundments at Mud Creek and Cranberry Pool also 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, and ability to manage the vegetation if appropriate. Because this species is concentrated in such a small area, a single adverse weather event could virtually eliminate nesting for a year, especially if Cranberry Pool is unavailable due to periodic draining. Again, it appears extremely important that Cranberry Pool not be drained during high water years because it may be the only area with suitable nest substrate.

Management activities which I believe should be seriously considered for this species include:

Cranberry Pool:

1) Do not drain Cranberry Pool for management purposes if the Lake Champlain lake level is above 98' on June 1. When the lake level is high, this marsh is used extensively for nesting. Draining after July 15 at the earliest or after terns have completed nesting would be acceptable. On those years when Cranberry Pool is drained, it might be advisable to concentrate efforts on putting nest platforms (see #4 below) in protected marshes where managers would like to see terns nesting
2) Drop water level to desired level by late May and do whatever possible to keep it constant until July 1, including not letting it rise, whenever environmental conditions permit.
3) Supplement perches with posts, logs, and possibly downed trees.
4) Experiment further with artificial nest platforms.

Mud Creek:

1) Drop water level one to two feet in May and hold it constant thru June, if weather permits.
2) Supplement perches with posts, logs, and possibly downed trees.
3) Experiment with artificial nest platforms if #1 above encourages emergent growth by early June.

Charcoal Creek South

1) Supplement perches with posts and logs.

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TABLE 1. VERMONT BLACK TERN POPULATION DATA, 1990-2005.

COLONY (POPULATION)	NUMBER OF BREEDING PAIRS															
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Charcoal Creek N. (Missisquoi)	15	24	22	15*	31	14	10	17	21	24	22	26	35	31	28	52
Charcoal Creek S. (Missisquoi)	5	13	11	2*	2	12	0	3	15	10	5	0	0	0	0	4
Cranberry Pool (Missisquoi)	17	6	5	5	13	0	0	5	4	8	11	11	14	23	25	19
Big Marsh (Missisquoi)	**	0	0	15	1*	**	16	17	19	33	10	0	1	0	1	0
Goose Bay (Missisquoi)	**	**	13	6	1*	7	0	0	0	10	0	0	0	2	0	0
Gander Bay (Missisquoi)	0	**	0	**	**	6	**	0	0	0	0	0	0	0	0	0
Mud Creek WMA (Missisquoi)	**	7	24	20*	15*	17*	8*	5*	8*	3	5	6	1	1	0	0
First Creek (Missisquoi)	**	**	**	**	**	**	**	6	**	0	1	2	0	0	0	**
Long Marsh (Missisquoi)	**	**	0	**	**	0	**	**	5	9	9	8	15	10	12	28
South Bay WMA (Memophremagog)	4	4	4	**	2	5	3	5	3	3	0	0	0	0	0	0
Panton Road N. (Dead Creek)	1	2	1	2*	0	3	0	0	0	0	0	0	0	0	0	0
Panton Road S.(Dead Creek)	0	4	3	**	0	0	0	0	0	0	0	0	0	0	0	0
Route 17 N(Dead Creek).	6	0	0	**	5	0	3	0	0	0	0	0	0	0	0	0
Route 17 S.(Dead Creek)	5	0	0	**	2	0	0	0	0	0	0	0	0	0	0	0
West Road(Dead Creek)	0	2	4	**	0	0	0	0	0	0	0	0	0	0	0	0
Little Otter Creek(Dead Creek)	6	9	8	**	2	0	4	1	2	0	0	0	0	0	0	0
TOTAL	**59**	**71**	**95**	**	**74**	**64**	**44**	**59**	**77**	**100**	**63**	**53**	**66**	**67**	**66**	**103**
MISSISQUOI POPULATION	37	50	75	63	63	56	34	53	72	97	63	53	66	67	66	103
MEMPHREMAGOG POPULATION	4	4	4	**	2	5	3	5	3	3	0	0	0	0	0	0
DEAD CREEK POPULATION	18	17	16	**	9	3	7	1	2	0	0	0	0	0	0	0

* estimated
** unknown

TABLE 2. VERMONT WILDLIFE MANAGENT AREA MARSH BIRD SUMMARY, 1996-2005.*

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
BRILYEA 2002 (4)	0.75	0	0	0	0	0	0
BRILYEA 2003 (4)	0	0	0	0	0	0	0
BRILYEA 2004 (4)	1	0	0.25	1.75	0	0.5	0.5
BRILYEA 2005 (4)	0.5	0.75	0	0	0	0.25	0
BRILYEA MEAN	0.725	0.475	0.025	0.45	0.025	0.075	0.075
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
ROUTE 17 2002 (8)	1.125	0	0.125	0.625	0.125	0	0
ROUTE 17 2003 (8)	1.5	0	0	0.625	0	0	0
ROUTE 17 2004 (8)	0.88	0	0	0.75	0	0.125	0.125
ROUTE 17 2005 (8)	0.625	0.25	0	0.875	0	0.125	0
ROUTE 17 MEAN	1.076	0.15	0.0125	0.3875	0.0125	0.025	0.0125
MUD CREEK 1996 (9)	2.22	1	0.11	0	0.11	0.11	0
MUD CREEK 1997 (9)	1.56	0.67	0.11	0	0.11	0	0
MUD CREEK 1998 (9)	2.125	0.44	0.22	0	0.11	0	0
MUD CREEK 1999 (9)	1.44	0.33	0.22	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
MUD CREEK 2002 (8)	1.25	0.125	0.125	0	0	0	0
MUD CREEK 2003 (8)	0.5	0.125	0.25	0	0.125	0	0
MUD CREEK 2004 (8)	0.625	0	0.25	0	0	0	0
MUD CREEK 2005 (8)	0.375	0	0.125	0.125	0	0	0
MUD CREEK MEAN	1.242	0.302	0.174	0.0125	0.0565	0.011	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
SOUTH BAY 2002 (no data)							
SOUTH BAY 2003 (6)	0.5	0.167	0	0	0.67	1.17	0
SOUTH BAY 2004 (6)	1.5	0	0	0.33	0	0.67	0
SOUTH BAY 2005 (6)	0.667	0.167	0	0.5	0.333	1.333	0
SOUTH BAY MEAN	0.705	0.048	0.128	0.167	0.191	1.067	0.104

* 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. MISSISQUOI NATIONAL WILDLIFE REFUGE MARSH BIRD SUMMARY 1996-2005*

SURVEY ROUTE (number of stations)	VIRA	COMO	LEBI	SORA	AMBI	PBGR	AMCO
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)	0.14	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)	0.55	0.375	0	0.375	0.25	0	0
CHARCOAL CREEK 2002 (8)	0	0.125	0	0	0	0.25	0
CHARCOAL CREEK 2003 (8)	0.5	0.125	0	0.25	0.125	0	0
CHARCOAL CREEK 2004 (8)	0.25	0.5	0	0.375	0.375	0.25	0
CHARCOAL CREEK 2005 (8)	0.625	0.5	0	0.625	0.375	0.25	0
CHARCOAL CREEK MEAN	**0.279**	**0.215**	**0.025**	**0.236**	**0.138**	**0.129**	**0**
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 (5)	1	0.2	0.2	0	0	0.2	0
GOOSE BAY 2002 (no data)							
GOOSE BAY 2003 (5)	0	1.2	0	0.2	0.4	0.2	0
GOOSE BAY 2004 (5)	0.4	0.4	0	0.4	0.2	1.2	0
GOOSE BAY 2005 (5)	0.2	2	0	0	0.2	1.8	0
GOOSE BAY MEAN	**0.228**	**0.986**	**0.028**	**0.114**	**0.138**	**0.881**	**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
DEAD CREEK (MNWR) 2002 (4)	0.5	0.25	0	0.25	0.5	0	0
DEAD CREEK (MNWR) 2003 (4)	0	0.2	0	0	0	0	0
DEAD CREEK (MNWR) 2004 (5)	0.4	0	0	0.2	0.2	0.2	0
DEAD CREEK (MNWR) 2005 (5)	1.2	0.4	0	0.4	0.4	0.4	0
DEAD CREEK (MNWR) MEAN	**0.562**	**0.206**	**0.025**	**0.131**	**0.238**	**0.15**	**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
LONG MARSH 2002 (5)	0	1.2	0	0.4	0	1.2	0
LONG MARSH 2003 (5)	0.6	1	0	0.2	0	0.6	0
LONG MARSH 2004 (5)	0	1.8	0	0.2	0.4	2.4	0
LONG MARSH 2005 (5)	0.6	3	0	0	0.4	1.8	0
LONG MARSH MEAN	**0.45**	**1.21**	**0.025**	**0.296**	**0.1**	**0.871**	**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
CRANBERRY POOL 2002 (no data)							
CRANBERRY POOL 2003 (5)	0	2.4	0	0	0	0.6	0
CRANBERRY POOL 2004 (5)	0	1.6	0	0	0	1	0
CRANBERRY POOL 2005 (no data)							
CRANBERRY POOL MEAN	**0.36**	**1.4**	**0**	**0.04**	**0.16**	**0.76**	**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 4. VERMONT IMPORTANT BIRD AREA MARSH BIRD SUMMARY 1999-2005*

SURVEY ROUTE (number of stations)	VIRA	COMO	LEBI	SORA	AMBI	PBGR	AMCO
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
BOMOSEEN 2002 (5)	0.6	0	0	0.2	0	0	0
BOMOSEEN 2003 (5)	1.2	0.2	0	0	0	0	0
BOMOSEEN 2004 (only one visit-not included)							
BOMOSEEN 2005 (only one visit-not included)							
BOMOSEEN MEAN	**1.16**	**0.2**	**0.04**	**0.12**	**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
SAND BAR 2002 (5)	0	0	0	0	0	0.2	0
SAND BAR 2003 (5)	0.2	0	0	0.2	0	0	0
SAND BAR 2004 (5)	0.8	0	0	0	0	0	0
SAND BAR 2005 (no data)							
SAND BAR MEAN	**0.5**	**0**	**0**	**0.033**	**0**	**0.067**	**0**
HERRICK'S COVE 1999 (7)	0.143	0	0	0.14	0.14	0	0
HERRICK'S COVE 2000 ** no data							
HERRICK'S COVE 2001 (7)	0.286	0	0	0	0	0	0
HERRICK'S COVE 2002 (7)	0.143	0	0	0	0	0	0
HERRICK'S COVE 2003 (7)	0	0	0	0	0.14	0	0
HERRICK'S COVE 2004 (7)	0	0	0	0	0	0	0
HERRICK'S COVE 2005 (7)	0	0	0	0	0	0	0
HERRICK'S COVE MEAN	**0.095**	**0**	**0**	**0.023**	**0.047**	**0**	**0**
LITTLE OTTER CREEK 1999 (7)	0.86	1.57	0.14	0.14	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
LITTLE OTTER CREEK 2002 (7)	0.43	2	0.14	0.43	0.14	0.71	0.57
LITTLE OTTER CREEK 2003 (7)	0.29	2.43	0.43	0	0.14	0.43	0
LITTLE OTTER CREEK 2004 (7)	0.86	3.29	0.296	0	0.14	0.43	0
LITTLE OTTER CREEK 2005 (7)	0.71	3.43	0.14	0	0	0.28	0
LITTLE OTTER CREEK MEAN	**0.533**	**2.2**	**0.163**	**0.101**	**0.06**	**0.509**	**0.081**
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
BERLIN POND 2002 (3)	0.33	0	0.33	0	0.33	0	0
BERLIN POND 2003 (no data)							
BERLIN POND 2004 (only one visit-not included)							
BERLIN POND 2005 (no data)							
BERLIN POND MEAN	**1.08**	**0**	**0.08**	**0**	**0.33**	**0**	**0.08**
W. RUTLAND MARSH 2001 (5)	0.6	0	0	0	0	0	0
W. RUTLAND MARSH 2002 (5)	0.8	0	0	0	0	0	0
W. RUTLAND MARSH 2003 (5)	0.6	0	0	0	0	0	0
W. RUTLAND MARSH 2004 (5)	1.4	0	0.4	0	0.4	0	0
W. RUTLAND MARSH 2005 (5)	1.2	0	0.4	0.2	0	0	0
W. RUTLAND MARSH MEAN	**0.92**	**0**	**0.16**	**0.04**	**0.08**	**0**	**0**
PANTON ROAD 2002 (3)	0.67	0	0	0	0	0	0
PANTON ROAD 2003 (3)	0.67	0	0	0.33	0.33	0	0
PANTON ROAD 2004 (3)	1	0.33	0	1	0	0	0
PANTON ROAD 2005 (3)	0.33	1	0	0	0	0	
PANTON ROAD MEAN	**0.668**	**0.332**	**0**	**0.332**	**0.082**	**0**	**0**

* Maximum number of each species detected during a single survey, 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 5. MARSHBIRD TRENDS AT DEAD CREEK WMA AND MUD CREEK WMA, 1996-2005*

YEAR	VIRA	COMO	LEBI	SORA	AMBI	PBGR
1996	37*	17	1	5	1	1
1997	25	12	1	3	1	0
1998	34	7	2	4	1	0
1999	22	4	2	2	1	0
2000	22	6	2	2	1	0
2001	20	5	1	3	0	0
2002	22	1	2	5	1	0
2003	16	1	2	5	1	0
2004	16	0	3	13	0	3
2005	10	5	1	8	0	2
MEAN	**22.4**	**5.8**	**1.7**	**5**	**0.7**	**0.6**

* Sum of the maximum individuals counted during a single survey from the three routes: Route 17, Brilyea, and Mud Creek.

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

TABLE 6. MEAN NUMBER OF MARSHBIRDS PER STATION, BY MARSH 1996-2005*

MARSH (years of data)	VIRA	COMO	LEBI	SORA	AMBI	PBGR
BRILYEA (10)	**0.725**	0.475	0.025	**0.450**	0.025	0.075
ROUTE 17 (10)	**1.076**	0.150	0.013	**0.388**	0.013	0.025
MUD CREEK (10)	**1.242**	0.302	**0.174**	0.013	0.057	0.011
CHARCOAL CREEK (10)	0.279	0.215	0.025	**0.236**	**0.138**	0.129
GOOSE BAY (7)	0.228	**0.986**	0.028	0.114	**0.138**	**0.881**
DEAD CREEK (8)	0.562	0.206	0.025	0.131	**0.238**	0.150
LONG MARSH (8)	0.450	**1.210**	0.025	**0.296**	0.100	**0.871**
CRANBERRY POOL (5)	0.360	**1.400**	0.000	0.040	**0.160**	**0.760**
SOUTH BAY (7)	**0.705**	0.048	**0.128**	**0.167**	**0.191**	**1.067**
BOMOSEEN (5)	**1.160**	0.200	0.040	0.120	0.000	0.000
SAND BAR (6)	0.500	0.000	0.000	0.033	0.000	0.067
HERRICK'S COVE (6)	0.095	0.000	0.000	0.023	0.047	0.000
LITTLE OTTER CREEK (7)	0.533	**2.200**	**0.163**	0.101	0.060	**0.509**
BERLIN POND (4)	**1.080**	0.000	**0.080**	0.000	**0.330**	0.000
W. RUTLAND MARSH (5)	**0.920**	0.000	**0.160**	0.040	0.080	0.000
PANTON ROAD (4)	**0.668**	0.332	0.000	**0.332**	0.082	0.000
OVERALL MEAN	**0.661**	**0.483**	**0.055**	**0.155**	**0.104**	**0.284**

* bold numbers indicate greater than average density for that species.
** underlined indicates highest density observed for that species.

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

FIGURE 1.MISSISQUOI NWR MARSH BIRD STATIONS

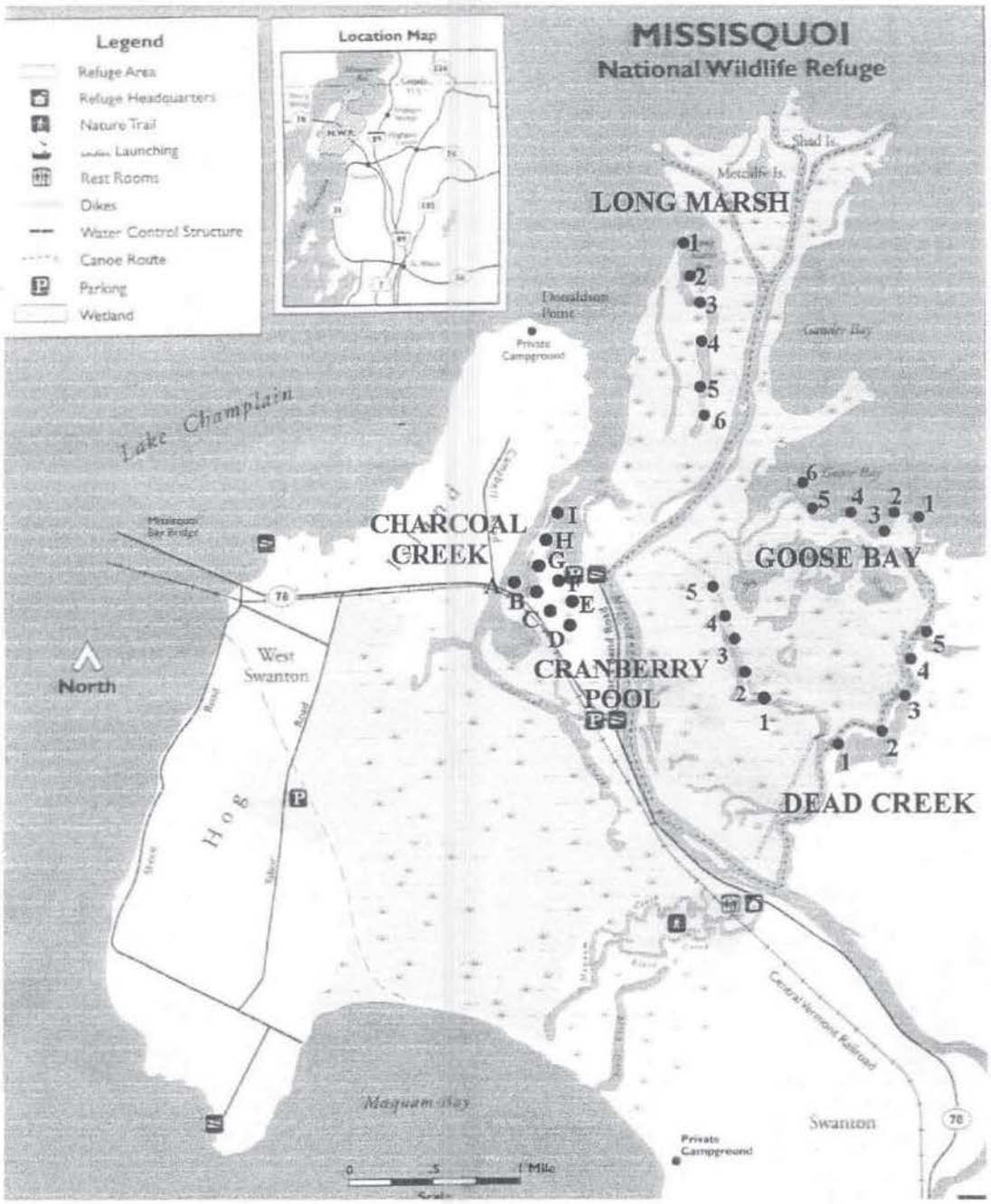

FIGURE 2. MUD CREEK MARSH BIRD STATIONS

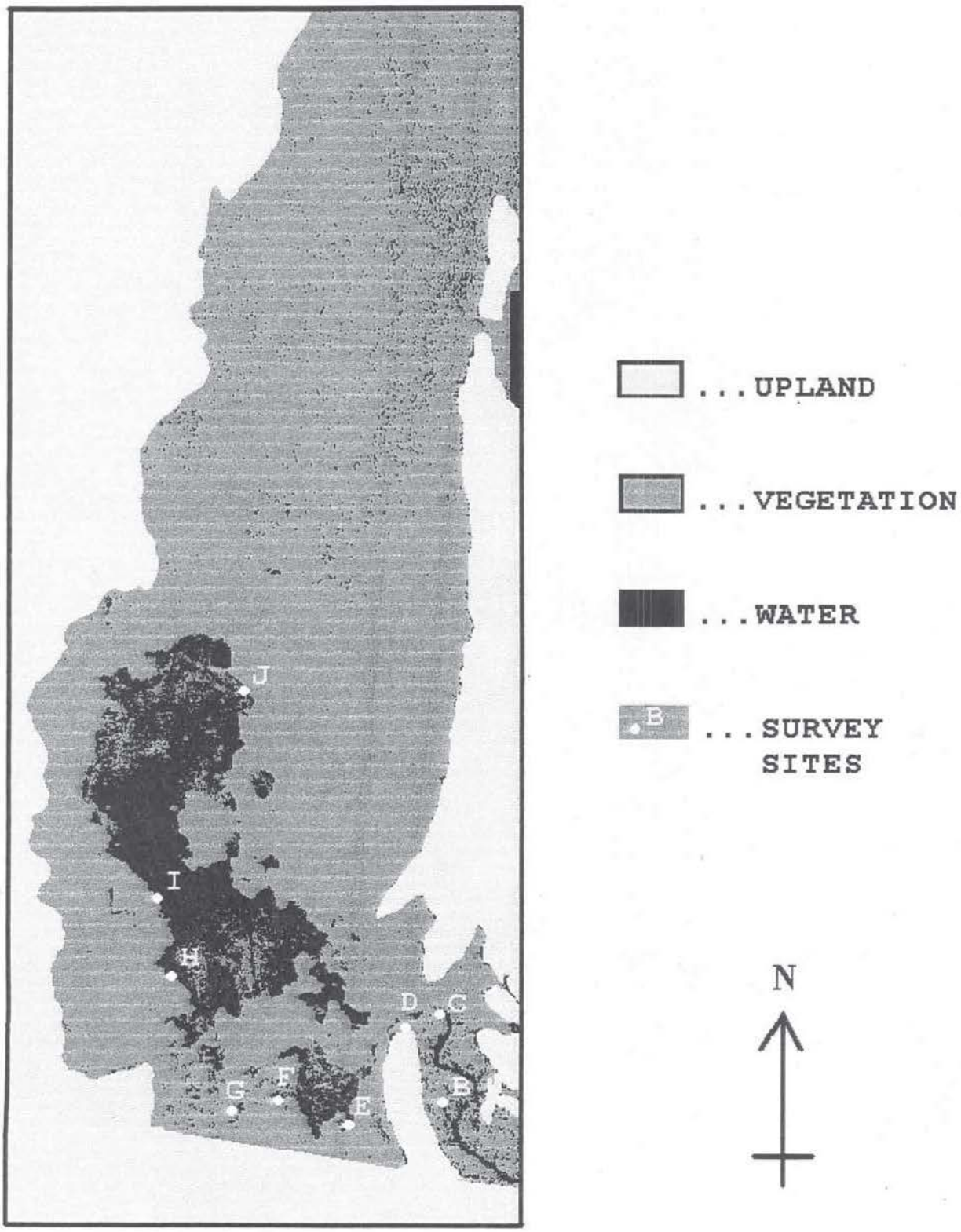

FIGURE 3. DEAD CREEK MARSH BIRD STATIONS

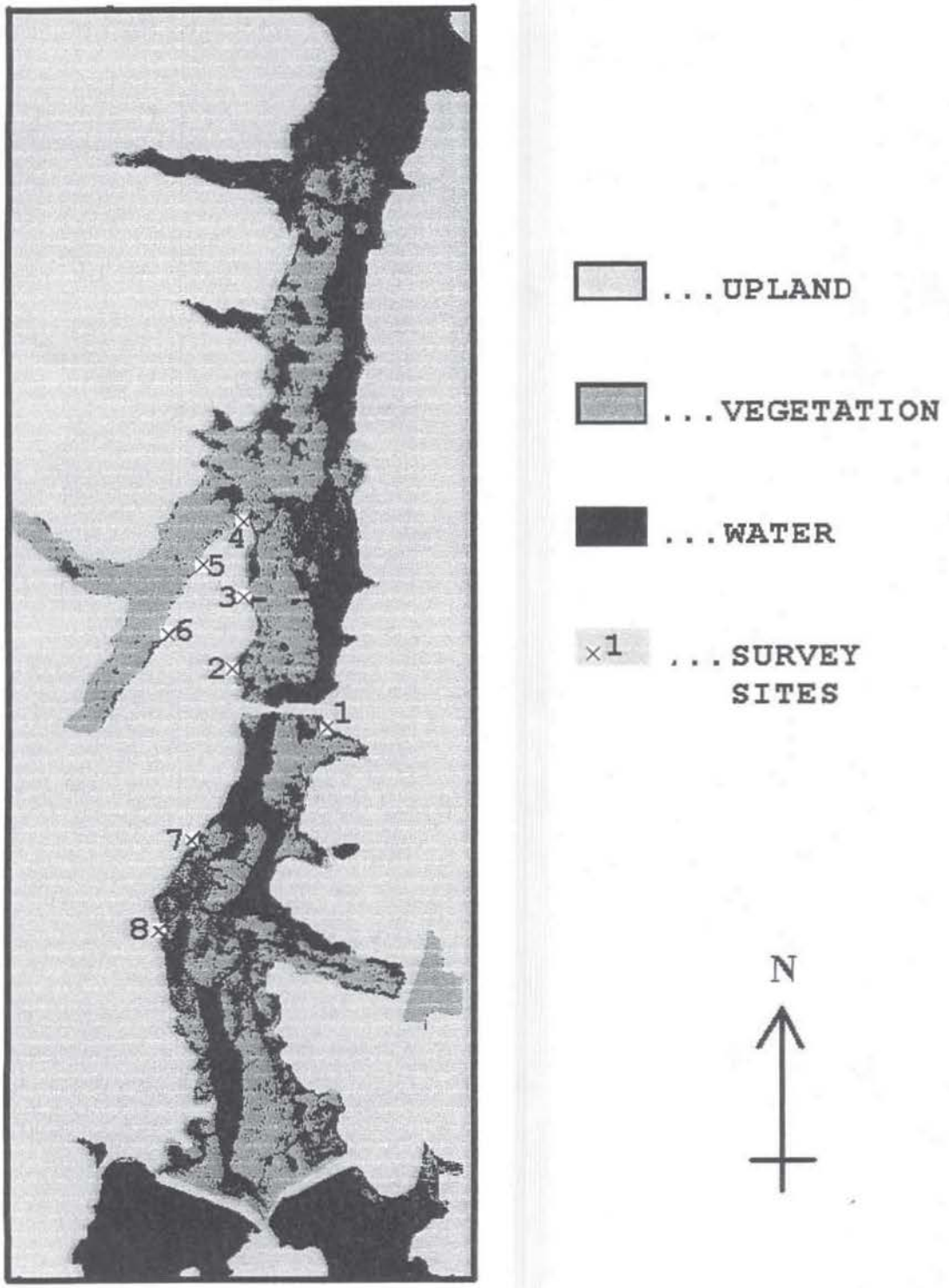

FIGURE 4. BRILYEA MARSH BIRD STATIONS

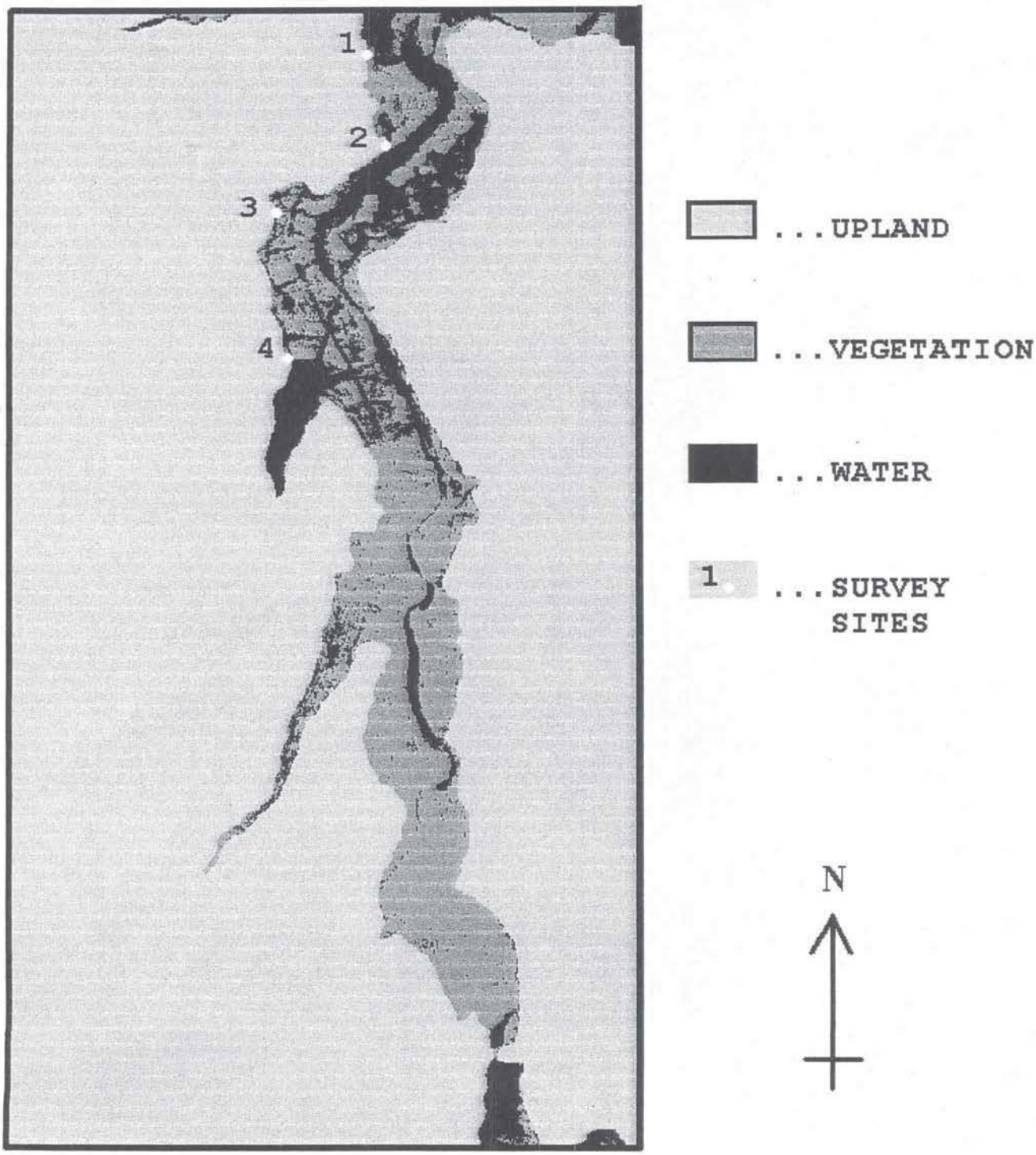

FIGURE 5. SOUTH BAY WMA MARSH BIRD STATIONS.

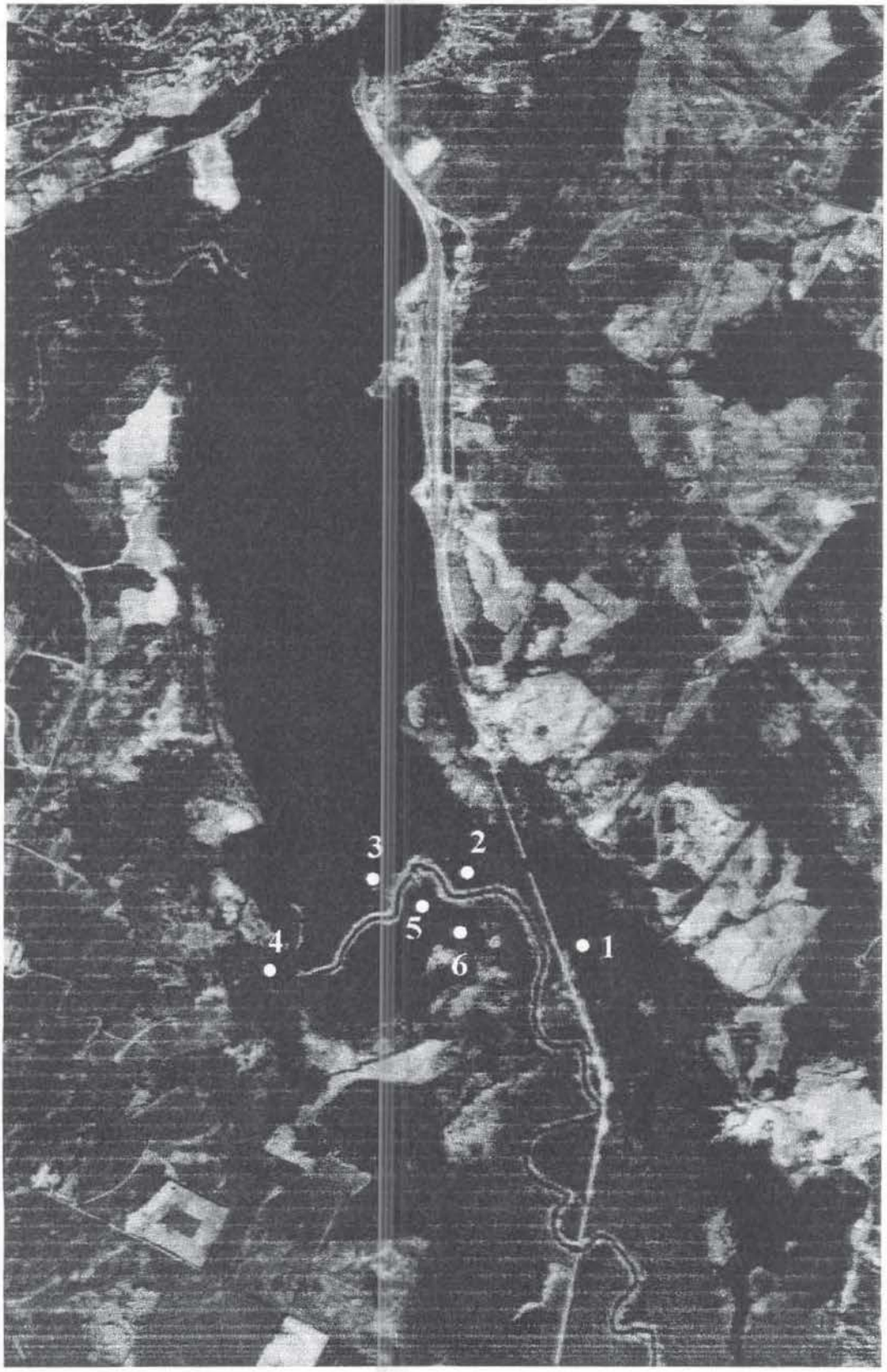

FIGURE 6. SANDBAR WMA MARSH BIRD STATIONS

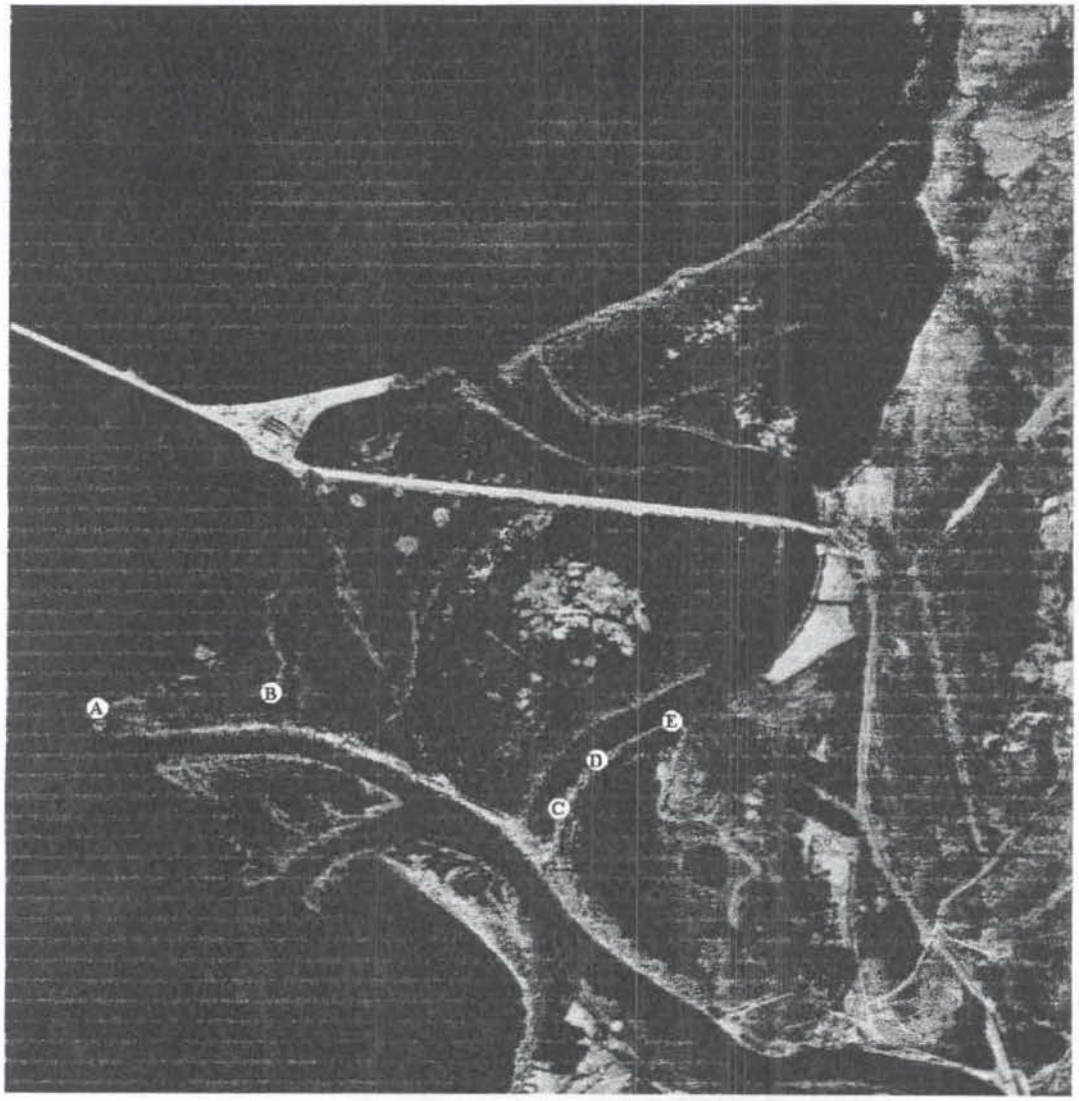

FIGURE 7. LITTLE OTTER CREEK MARSH BIRD STATIONS

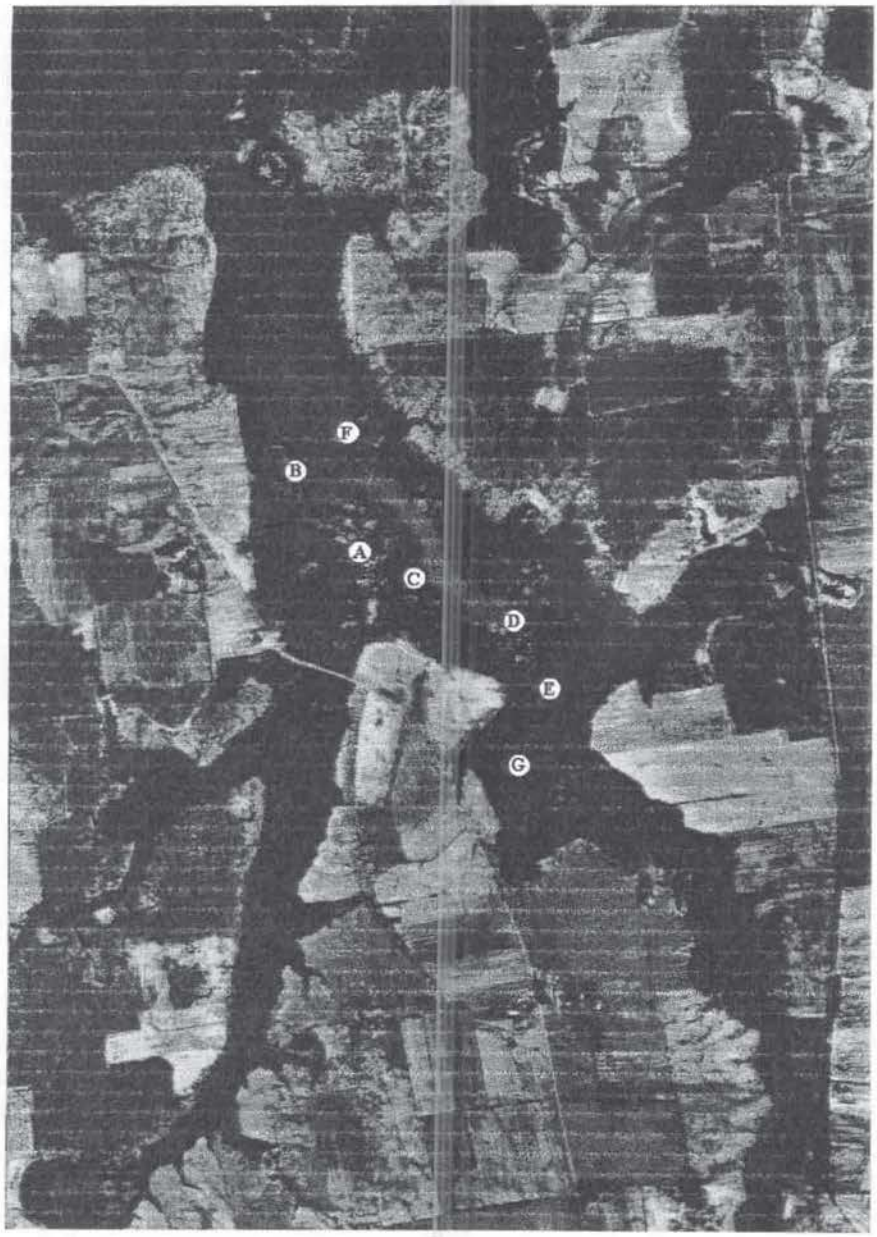

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FIGURE 8. WEST RUTLAND MARSH MARSH BIRD STATIONS

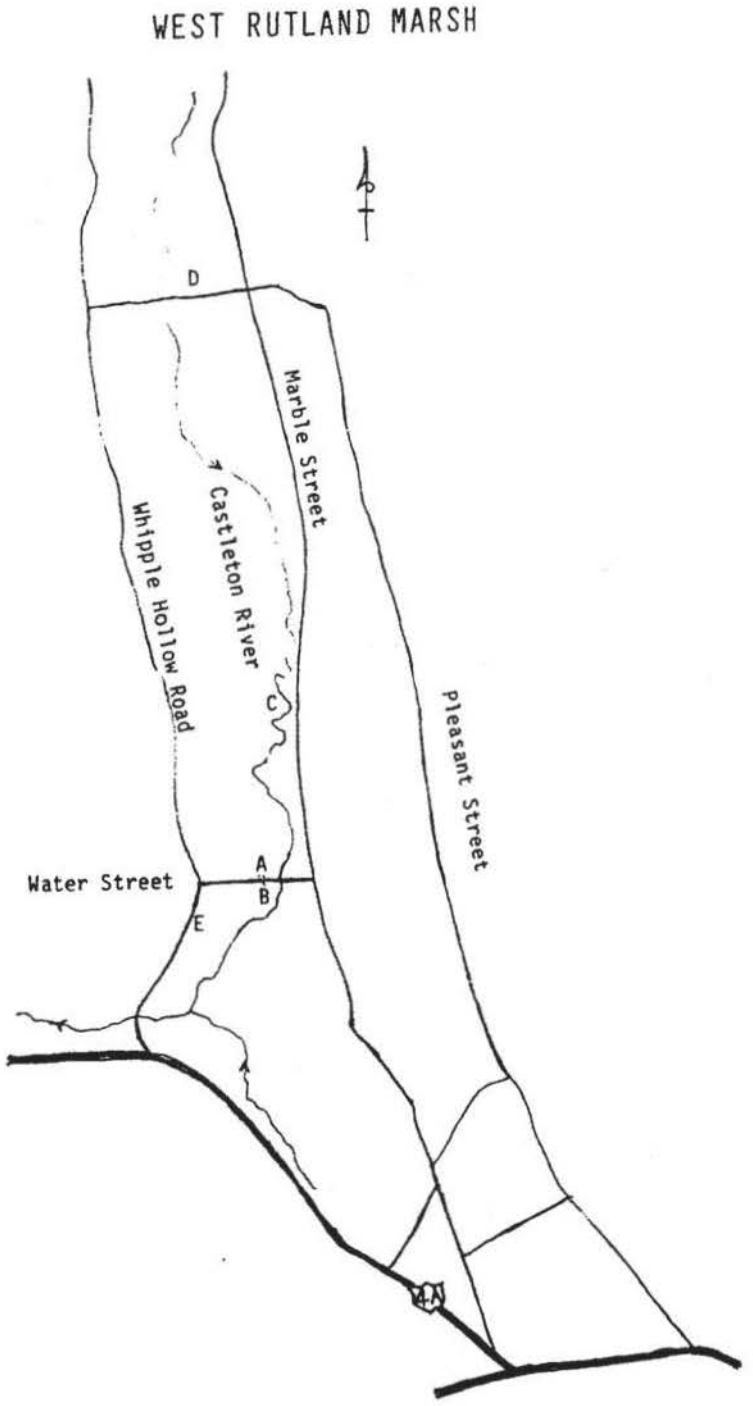

FIGURE 9. LAKE BOMOSEEN MARSH BIRD STATIONS.

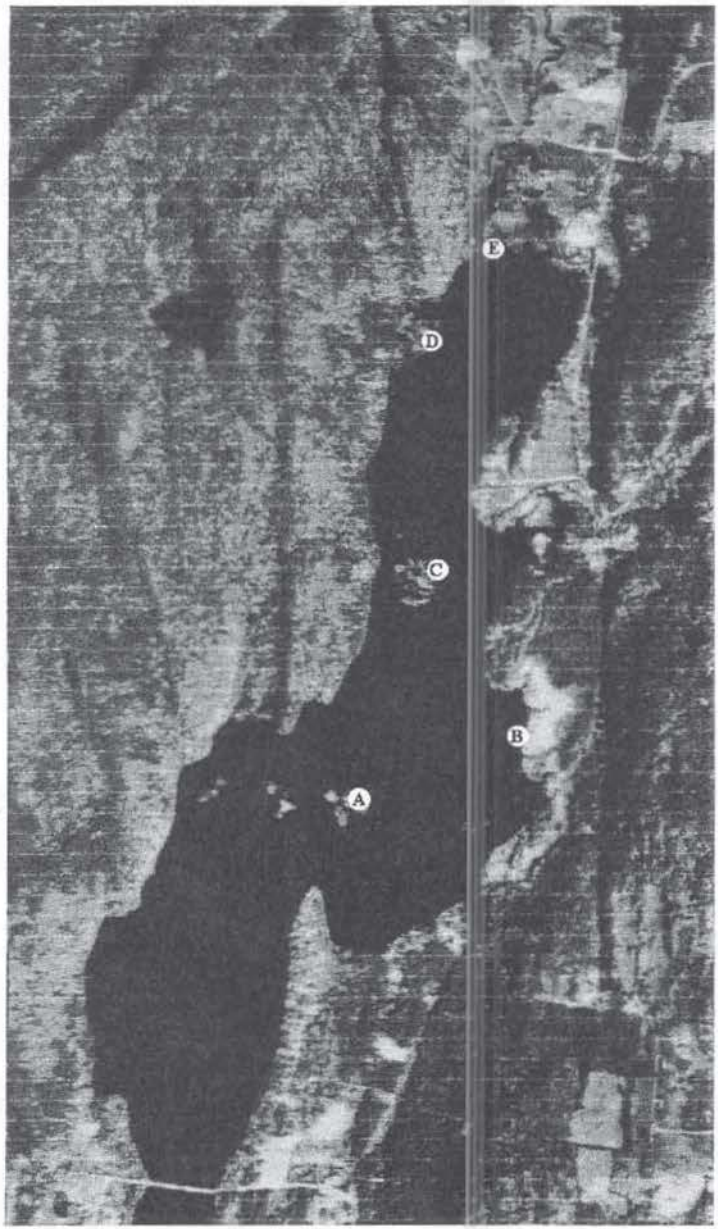

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FIGURE 10. HERRICK'S COVE MARSH BIRD STATIONS.

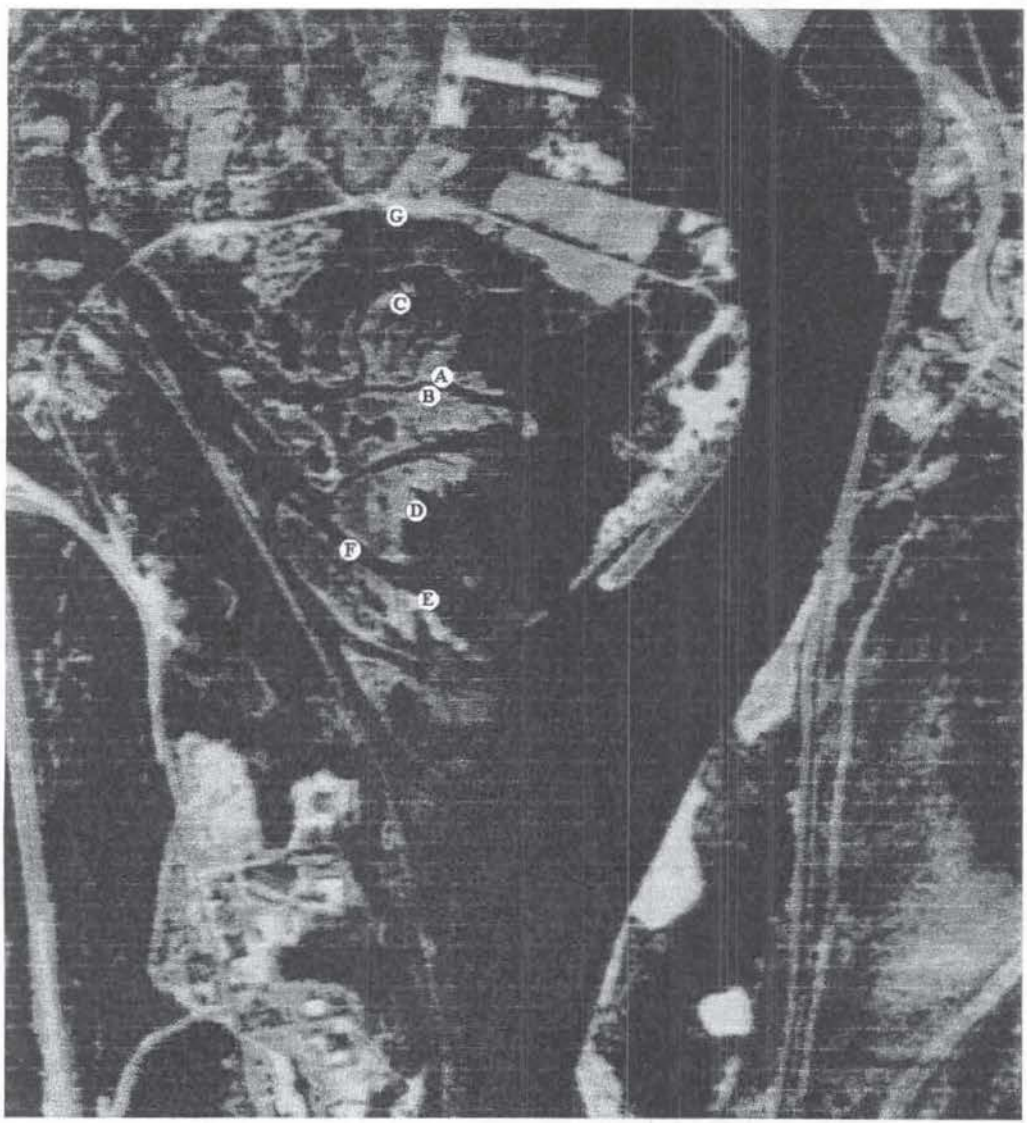

FIGURE 11. PANTON RD. MARSH BIRD STATIONS

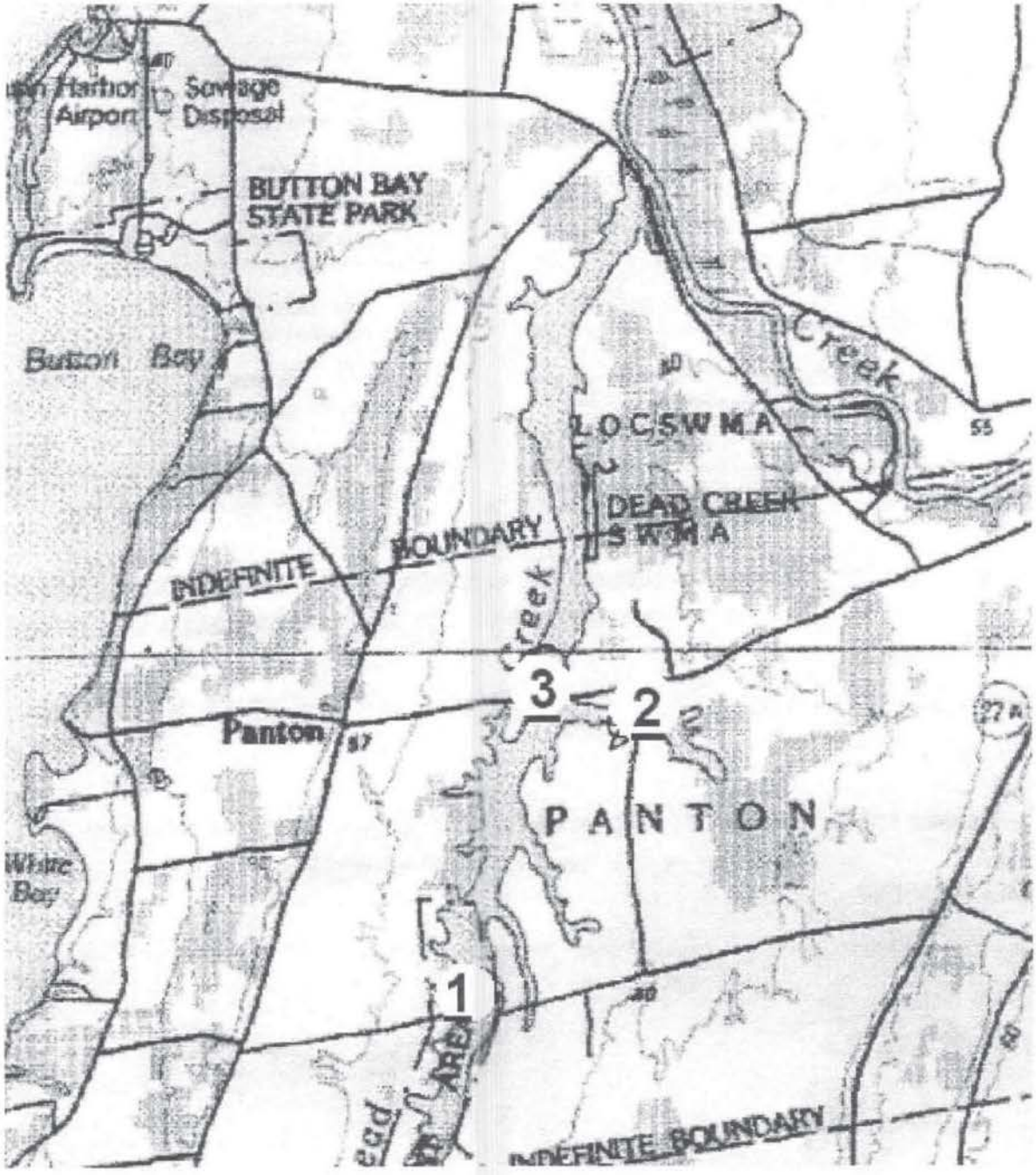

FIGURE 12. BERLIN POND MARSH BIRD STATIONS

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