Black Tern Nesting,
Missisquoi National Wildlife Refuge, 2009-2014

Background:

Black tern breeding pair surveys have been conducted in Vermont every year since 1990, except during 2006. Initially, there were 3 separate nesting populations of black terns at: (1) Dead Creek (Panton Road, Route 17, West Road, and Little Otter Creek), (2) Memphremagog (South Bay WMA), and (3) Missisquoi (Mud Creek WMA and Missisquoi NWR). Nesting at Dead Creek was observed for the last time in 1998, and at Memphremagog, nesting was last observed in 1999. Of the 3 populations, Missisquoi always had the most (63-97%) nesting pairs, followed by Dead Creek (2-31%), and then Memphremagog (3-8%).

For the Missisquoi population, Missisquoi NWR held the majority (70-99%) of black tern breeding pairs with Mud Creek WPA holding 1-32%. In both 2002 and 2003, only one pair of nesting black terns was observed at Mud Creek WPA. Since 2004, all of Vermont's endangered breeding black terns have nested at Missisquoi NWR.

Surveys:

During 2009-2014, the staff of Missisquoi NWR observed and monitored the annual nesting activity of state-endangered black terns throughout the refuge. Black terns usually arrive at the refuge sometime in early- to mid-May. Black tern activity was observed by boat, from May to August, to determine: the numbers of black tern breeding pairs, where they are located on the refuge, and the onset and progression of nesting.

During the peak (usually the last week of May to the first or second week in June) of black tern nesting, all refuge wetlands were systematically and thoroughly surveyed using a shallow-water Go-Devil boat, a motorized canoe, or a kayak, depending on the habitat conditions and water levels. The high count method of surveying nesting black terns, recommended by Fred Servello, University of Maine, was used. Since black terns are semi-colonial and build either floating nests near vegetation, or sparse nests on hummocks, a boat is needed to slowly move throughout each wetland, in order to flush and count nesting terns in or near these areas.

Each time nesting black terns were flushed, the highest count of individuals was recorded. Only terns that were vocalizing, circling, or displaying other nesting behaviors, were counted; birds that flew by or appeared to be feeding were not counted. After all navigable areas in a wetland were traversed, and all groupings of nesting black terns were flushed, high counts were summed to determine the total number of nesting black terns in a given wetland. Habitat conditions (high/low water levels; amount of vegetation), area of wetland covered, effort (scouting beforehand as well as doing surveys), and timing of surveys, are all factors that may impact the number of nesting black terns observed and counted in a given year.

Table 1. Dates and observers of black tern high count surveys Missisquoi National Wildlife Refuge, 2009 to 2014.

Survey Dates	Observers
June 5-11, 2009	Joe Bertrand, Judy Sefchick Edwards, volunteer
May 25-June 8, 2010	Joe Bertrand, Judy Sefchick Edwards
May 31-June 6, 2011	J. Eddy Edwards, Joe Bertrand, Judy Sefchick Edwards
May 31-June 14, 2012	Joe Bertrand, Judy Sefchick Edwards
May 30-June 10, 2013	J. Eddy Edwards, Joe Bertrand, Judy Sefchick Edwards
June 4-10, 2014	Joe Bertrand, Judy Sefchick Edwards

Black terns usually complete their nesting activities around July 15. Afterwards, fledglings and adults leave the nesting areas to congregate in Missisquoi Bay before their August migration. Post-season fledgling counts were done by boat in mid- to late-July, to determine if refuge wetlands produced black tern fledglings.

Table 2. Dates and observers of fledgling surveys Missisquoi National Wildlife Refuge, 2009 to 2014.

Survey Dates	Observers
July 20-30, 2009	Judy Sefchick Edwards, volunteer
July 14-20, 2010	Joe Bertrand, Judy Sefchick Edwards, volunteer
July 13-27, 2011	Joe Bertrand, Judy Sefchick Edwards, volunteer
July 16-27, 2012	Joe Bertrand, Judy Sefchick Edwards
July 17-22, 2013	J. Eddy Edwards, Joe Bertrand, Judy Sefchick Edwards
July 16-22, 2014	Joe Bertrand, Judy Sefchick Edwards

Number of Breeding Pairs:

Although the observed number of black tern breeding pairs changes from year to year, a small, and relatively stable, population of black terns continued to nest in Vermont by using Missisquoi NWR wetlands. During recent (2009-2014) years, an average of 119 (range 77-157) black tern breeding pairs was observed at the refuge per year (Appendix A). Within this timeframe, the greatest numbers of breeding pairs (157 and 137) were found in 2010 and 2012, respectively, and the lowest numbers (77 and 95) were found in 2011 and 2014, respectively.

Interestingly, during this timeframe, the highest numbers of breeding black terns were observed in years when Lake Champlain water levels were at their lowest during late May and early June (Appendix B). During these years, the birds were observed to be more evenly distributed in Big Marsh Slough, Cranberry Pool, Long Marsh Channel, and Cabot/Clark Marsh, which may have made them easier to survey and count.

Conversely, when water levels were at their highest during this timeframe, the fewest breeding pairs were observed. In 2011, all-time record flooding of Lake Champlain (> 100 msl (flood stage) from mid-May to mid-June) made most refuge wetlands deep, open-water habitats that were subject to wave

action, and inhospitable to nesting terns. In 2014, water levels (99.46 – 98.08 msl) were high during the first part of the nesting season, from mid-May to mid-June. During these years, black terns were observed concentrating in atypical nesting areas, since wetlands like Cranberry Pool, Long Marsh Channel, and Cabot/Clark Marsh contained too much open water and not enough structure for nesting. Areas like the south end of Big Marsh Slough, Burton's Pothole (Youngman Brook area), and the Maquam Bog area of Patrick Marsh, that usually consist of impenetrable wetland shrub habitat when water levels are lower, gained importance for nesting terns, since the shrubs provided structure for floating nests. Unfortunately, these areas were harder to survey by boat, possibly resulting in fewer nesting pairs being counted.

Historical data (1990-2008) also show a relatively stable population of breeding black terns in Vermont, though lower numbers (53-103) of breeding pairs were reported. During this time, an average of 71 breeding pairs per year was found statewide, with an average of 58 of those pairs found on the refuge in any given year (Appendix C). Lake Champlain water level information was not compiled for the years when historic black tern data was collected, so no inferences can be made.

Recent and historical data, as well as refuge data collected pre- and post-2009, are probably not directly comparable. Historical data was not always collected in the same manner, with differences in observers, areas surveyed, effort, and methodology, over time. Increased time and effort has been spent on locating and counting nesting black terns on Missisquoi NWR since refuge staff starting doing the surveys in 2009. Also, the use of a Go-Devil boat, by refuge staff, has increased the amount of wetland area covered on the refuge, as well as the efficiency of the surveys.

The high count data reinforce the idea that each wetland should be completely and thoroughly searched for black tern breeding pairs each year during the peak of the nesting season. Dynamic weather patterns, water levels, and habitat conditions add to the uncertainty about where black terns will nest, and how they will nest (loose, scattered colonies versus larger concentrations) in any given year.

Location of Breeding Pairs:

During recent (2009-2014) years, Big Marsh Slough contained the greatest proportion (32%) of black tern breeding pairs, followed by Cabot/Clark Marsh (22%), Cranberry Pool (19%), Long Marsh Channel (17%), and then Patrick Marsh (5%). Breeding pairs were found in Burton's Pothole (Youngman Brook area), but only during the two years (2011 and 2014) when Lake Champlain water levels were at their highest. Overall, Big Marsh Slough gained in importance for nesting black terns, while Cranberry Pool, Cabot/Clark Marsh, and Long Marsh Channel seemed to decrease in importance, in high water years during this timeframe.

Historical data collected from 1990-2008 show that overall, 43% of breeding black terns on Missisquoi NWR were found in Cabot Clark Marsh, with 19% in Cranberry Pool, 13% in Big Marsh Slough, 12% in Long Marsh Channel, and 8% in Patrick Marsh. It should be noted that Long Marsh Channel was only surveyed two times between 1990 and 1997, and Big Marsh Slough was not surveyed in 1990 or 1995. Although breeding black terns were found in Goose Bay during 1992, 1993, 1994, 119, 1999, and 2003,

they comprised < 4% of the overall total during this timeframe. Gander Bay and First Creek both contributed < 1% of the breeding pairs during these years.

Overall, the data show that in most years, four or five wetlands on Missisquoi NWR provide habitat for nesting black terns. Although Lake Champlain water levels dictate habitat conditions and play the largest role in where black terns nest in any given year, the refuge seems to have enough varied habitat to support nesting terns regardless of whether water levels are high or low.

Fledgling Surveys:

Once high count surveys of breeding black terns were completed, areas with nesting terns were avoided by refuge staff until mid- to late-July, when black tern fledgling surveys were conducted. For these surveys, all wetlands were traversed by boat, with observers looking for and counting fledglings as well as adult terns. Finding fledglings can be difficult since robust emergent vegetation and lower mid-summer water levels may make some areas inaccessible. At times, surveys have been discontinued in certain wetlands due to the presence of juvenile and adult black-crowned night herons, bald eagles, raccoons, or other predators of black tern chicks.

Once fledgling and adult black terns leave the wetlands where nesting occurred, they congregate in Missisquoi Bay before their August migration. During this time, fledglings are still being fed by adults, and both like to perch on downed tree branches, sticks, or refuge buoys. Favorite congregating sites include: downed trees at the mouth of Dead Creek, downed trees along Goose Bay, southeast of Goose Bay Pool, and/or signs or refuge buoys marking the north and east refuge borders within Missisquoi Bay. Often times, counting black terns fledglings in these locations is easier and more productive than trying to locate them in nesting wetlands.

During recent years (2009-2014), 234 black tern fledglings, or an average of 39 per year, have been produced in Missisquoi NWR wetlands (Appendix D). During this timeframe, 47% of the fledglings were observed while congregating in Missisquoi Bay, and 21% were observed while congregating at the mouth of Dead Creek, so it is not possible to tell which wetlands were the most productive.