Monitoring of Breeding Common Loons: West Branch of the Penobscot River Area - 2006

(Report BRI 2007-11)

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Executive Summary

We report results from Common Loon (*Gavia immer*) survey efforts on all lakes with suitable breeding habitat on the West Branch of the Penobscot River. This monitoring effort is supported through a cooperative agreement between the U. S. Fish and Wildlife Service (USFWS) and the Forest Society of Maine. This agreement was developed to monitor loons on 329,000 acres protected through fee acquisitions and conservation easements, in part, with funds received from the USFWS, acting for and on behalf of the Trustees of the North Cape Oil Spill. A total of 13 lakes encompassing 33 potential loon territories were surveyed in the summer of 2006 to determine the number of territorial pairs and breeding success of loons. Thirty-two territorial pairs were recorded with 16 of these pairs nesting. A total of seven chicks hatched with four surviving to fledge. High rates of occupancy by loon pairs in the West Branch of the Penobscot River may reflect: (1) high habitat quality and (2) stable breeding populations. Overall productivity in the West Branch however was low in comparison to other regional loon populations. Long-term data will help to determine the sustainability of the population.

Introduction

The Common Loon (*Gavia immer*) is a prominent symbol of Maine's North Woods. Documented anthropogenic impacts at the individual and population level have caused public concern and subsequently have set policies by lake associations, local governing bodies, as well as state and federal governments. Although Maine's breeding loon population is robust and estimated at 1,400 pairs (Evers 2000) major stressors to the state's population requires vigilance. These stressors include both the availability of methylmercury (MeHg) in freshwater environments (Evers et al. 1998, Evers 2000) and oil spills in marine environments (NOAA 1999).

On 19 January 1996, an oil spill off the Rhode Island coast was estimated to have killed 400 loons (NOAA 1999). Models based on population dynamics of color-marked individuals (Evers 2001) indicated approximately 3,900 loon-years lost. Since on-site replacement of this injury was deemed logistically impractical, mitigation efforts focused on the purchase of shoreline breeding habitat in New England. Monies paid by the responsible party for the loon-years lost were administered through the U.S. Fish and Wildlife Service (USFWS). In an effort to identify the highest quality loon breeding habitat, BioDiversity Research Institute (BRI) was contracted to survey target areas to identify loon territories and evaluate habitat quality. Purchase priority would then be given to the highest quality shoreline habitat.

Protection of loon breeding habitat at a landscape level is critical to maintaining the integrity of populations and avoiding increased patchiness of suitable habitat. Although the modeling of source-sink habitats is currently being investigated for the Northeast's loon metapopulation, multiple stressors at play can cause local negative population growth. Pulliam (1988) argued that species in spatially heterogeneous environments can maintain large sink populations in an evolutionary stable manner. The restrictive dispersal abilities of breeding loons (an average of two km for adult males, Evers 2001) however, combined with chronic breeding ground stressors (e.g., MeHg availability) and unpredictable but frequent wintering area stressors (e.g., marine oil spills) produces enough uncertainty that sink populations need to be minimized.

Loon surveys were therefore conducted to record the number of territorial loon pairs and document chick survivorship in order to determine loon breeding habitat quality. Data from these surveys will provide a foundation for identifying areas high quality loon habitat that should be prioritized for conservation.

Study Area

The project area consists of 13 wilderness lakes encompassing 33 potential loon territories (Figure 1). All 13 lakes are located in the West Branch Region of Piscataquis and Somerset Counties, Maine. Lakes in the project area ranged in size from the 75,451 acre Moosehead Lake to 66 acres on Dingley Pond.

Methods

From mid-May to mid-August 2006, BRI conducted ground and aerial surveys for territorial loon pairs on lakes bordered by lands protected by the West Branch project. The presence of territorial loon pairs, nesting success, chick survivorship, and habitat conditions were documented using standardized methodologies.

Ground Survey Field Methods

Survey methods were consistent with those reported in Evers (2000). All known territories and surrounding areas were surveyed on the project lakes using 10X binoculars and a 15-45X spotting scope. A 15-foot canoe with a 4 hp four-stroke engine was used on moderate- and large-sized lakes. Kayaks and canoes were used on lakes with limited or no road access. Lakes with difficult access were reached on foot guided by a Garmin® GPS and orienteering.

Every effort was made to gather information from the greatest distance possible from the loons to minimize impacts on nesting and brooding activities. Since nesting evidence may be obscured by vegetation, it was often necessary to search for the presence/absence of nest evidence by foot. Searches were conducted by walking the perimeter of the available nesting habitat in loon territories.

Loon territories were delineated according to observed territorial behavior by a loon pair such as close physical association, defensive posturing and calling along borders. Defined territories were defended and used for feeding, nesting and chick rearing for a minimum of four weeks. Territories were used as a unit of reference in describing loon breeding activity and rates.

Nesting pairs **(NP)** were defined as those laying at least one egg while a ***successful nesting pairs*** **(SNP)** hatched at least one chick. A nest categorized as a "fail" included evidence as to the cause of the failure if it could be reported with certainty. Causes of failure include:

Avian predation: characterized by a small hole in the egg.
Mammalian predation: characterized by smashed eggs/eggshells, tracks around nest, and/or scat.
Water level rise: increase in lake level causing nest floods. Eggs washed off nests, or eggs still in nest, chilled in standing water.
Water level fall: decrease in lake level causing eggs to be stranded in unreachable nests.
Human disturbance: human intrusion, human related activities.
Loon disturbance: loon intrusion.
Never hatched: loons remaining on nest past normal incubation times (27-30 days).
Unknown: cause unknown.

Chicks hatched **(H)** were recorded as those that hatched completely out of their eggs, not necessarily departing from the nest. ***Chicks surviving*** **(CS)** were defined as those surviving past eight weeks of age.

Aerial Survey Field Methods

Due to limited road access in certain areas of the West Branch Region, floatplanes were used to reach water bodies not easily ground surveyed during the 2006 season. Aerial surveys were conducted by experienced observers in small fixed-wing aircraft that could decrease speed to approximately 70 m/hr (116 km/hr) and maintain an altitude to 500 ft (60 m) or less, if necessary.

Each territory was circled at low altitude for a minimum of two minutes, or until information was gathered. Territories with known chicks were searched with multiple passes. Surveys were conducted on days with light wind to improve visibility of loons on the water. Although diving birds can be easily missed, in calm conditions loons are readily observed.

While ground surveys provide the best insight on nesting attempts and reasons for nest failure, aerial surveys provide an efficient and confident technique for determining territorial pair occupancy, chicks, and non-breeding adults.

Defining Reproductive Success

Reproductive success is evaluated according to four parameters: nesting frequency, hatching success, chick survivorship and overall productivity. Nesting frequency is defined as the number of nesting pairs per total territorial pairs. This measure indicates the percent of the total potential breeding population that attempts to reproduce each season. The rate of success by these pairs, or hatching success, is measured through the number of chicks hatched by these pairs. Chick survivorship is defined as the number of chicks surviving or fledged divided by the number of chicks hatched. Overall productivity is a combination of the prior three parameters and measured through fledged young per territorial pair.

Qualitative Territory Summary 2006

In addition to reporting productivity data in a quantitative form, territory-specific information is summarized to provide additional qualitative data collected during the field season. West Branch loon territories are presented alphabetically below. Quantitative data about these territories is found in Appendix 1. Territorial and nest site maps are included in Figures 2-14 in the appendices.

Baker Lake
A territorial loon pair occupied Baker Lake. No nesting attempts were observed.

Big Grenier Pond
A territorial loon pair occupied Big Grenier Pond. No nesting attempts were observed.

Canada Falls Lake - Allen Brook
A territorial loon pair occupied the Allen Brook territory on Canada Falls Lake. No nesting attempts were observed.

Canada Falls Lake – Cunningham Brook
A territorial loon pair occupied the Cunningham Brook territory in 2006. The pair were incubating by mid-June but the nest failed in early July for unknown reasons. The pair was last seen on 8/3.

Canada Falls Lake - Dam
A territorial loon pair occupied the Dam territory and began nesting in early July. One chick was confirmed as hatched and was last observed on 8/3. The chick was not observed on the final aerial survey of 8/16.

Canada Falls Lake - Narrows
A territorial loon pair occupied the Narrows territory on this lake. No nesting attempts were observed

Canada Falls Lake – North Ironbound
A territorial loon pair occupied the North Ironbound territory and did not attempt to nest.

Canada Falls Lake - South Branch Penobscot
A territorial loon occupied this territory and began nesting in June. The nest failed from unknown causes. The pair was last observed together during the last aerial survey of 8/16.

Canada Falls Lake - South East Arm
A territorial loon pair occupied the Southeast Arm territory. By June the pair was nesting on the south end of a floating bog mat facing the river. The nest failed in mid-July; the cause of the failure could not be determined. The pair was observed on the last aerial survey of 8/16.

Canada Falls Lake – South Ironbound
A territorial loon pair occupied the South Ironbound territory and did not attempt to nest.

Cheney Pond
A territorial loon pair occupied Cheney Pond and did not attempt to nest.

Dingley Pond
A territorial loon pair occupied Dingley Pond and began nesting in early July on the north island. The nest was found predated in late July. The pair was observed during the last aerial survey of 8/16.

Dole Pond
A territorial loon pair occupied Dole Pond and did not attempt to nest.

Foley Pond
A territorial loon pair occupied Foley Pond and did not attempt to nest.

Frost Pond
A territorial loon pair occupied Frost Pond and were nesting by early June on a hummock. Two chicks hatched in July and were both surviving as of the last aerial survey of 8/16.

Long Pond - Dam
A territorial loon pair occupied the Dam territory on Long Pond. The pair were observed nesting on a hummock by mid-June. By late June the nest was found abandoned; the cause of the nest failure could not be determined. The pair was observed during the last aerial survey of 8/16.

Long Pond - Middle
A territorial loon pair occupied the Middle territory on Long Pond. No nesting attempts were observed.

Long Pond - South
A territorial loon pair occupied the South territory on Long Pond this season. The pair were observed incubating two eggs in early July. The nest failed from mammalian predation. The pair was last observed on 8/3.

Moosehead Lake - Bigney Cove
A territorial loon pair occupied the Bigney Cove territory on Moosehead Lake and did not attempt to nest.

Moosehead Lake - Northwest Cove
A territorial loon pair occupied the Northwest Cove territory and began nesting in late June. One chick hatched in July and was observed during the last aerial survey of 8/16.

Moosehead Lake - Seboomook Island
A territorial loon pair occupied the Seboomook Island territory and did not attempt to nest.

Penobscot Lake - Dam
A territorial loon pair occupied the Dam territory on Penobscot Lake and were observed incubating two eggs on a rocky peninsula by mid-June. The nest failed from predation. The last lake survey recorded the pair on territory.

Penobscot Lake - Islands
A territorial loon pair occupied the Islands territory and were observed nesting by late June. The nest failed due to an unknown predator. The pair was last observed during the aerial survey of 8/16.

Penobscot Lake - North End
A territorial loon pair occupied the North End territory and were observed nesting by early June. By late June the nest had failed due to mammalian predation. The pair did not attempt to renest and were observed together during the last lake survey.

Seboomook Lake - Beaver Brook
A territorial loon pair occupied the Beaver Brook territory on Seboomook Lake and were incubating two eggs on a bog mat by late June. Two chicks hatched in mid- July but were not observed during the last aerial survey of 8/16.
Seboomook Lake - Dam
A territorial loon pair occupied the Dam territory on this lake and did not attempt to nest.

Seboomook Lake - East Islands
A territorial loon pair occupied the East Islands territory and did not attempt to nest.

Seboomook Lake - Gulliver Brook
A territorial loon pair occupied the Gulliver Brook territory this season. The pair were observed nesting on an island in June but the nest was predated by a mammal by mid-July. The pair did not renest but remained on territory together.

Seboomook Lake - Logan Brook
A territorial loon pair occupied the Logan Brook territory and were nesting on a hummock at the mouth of Logan Brook by early July. The nest had failed by mid-July; the cause of this failure could not be determined. No other nesting attempts were observed. The pair were together as of the final lake survey.

Seboomook Lake - Nulhedus Stream
A territorial loon pair occupied the Nulhedus Stream territory this season. The pair incubated two eggs on a small gravel island in close proximity to a gull nest. One chick hatched and the second egg was abandoned. Both the pair and surviving chick were observed during the last aerial survey 8/16.

Seboomook Lake - Pittston Farm
A single loon was observed in the Pittston Farm territory this season.

Seboomook Lake - West Islands
A territorial loon pair occupied the West Islands territory and did not attempt to nest.

Wellman Pond
A territorial loon pair occupied Wellman Pond this season. No nesting attempts were observed.

Results and Discussion

Summary of overall reproductive success

In 2006, 32 territorial loons pairs were recorded on 13 lakes for the West Branch region (Table 1). Sixteen of these pairs nested with no renests recorded region wide (Table 1). Five of the 16 nesting pairs were successful in hatching seven chicks with four confirmed as surviving during the August aerial survey. This yielded a nesting frequency of 50% (16/32), hatching success of 31% (5/16) and a 57% (4/7) chick survival rate.

Lake-wide productivity for the West Branch Region was 13% (4/32) fledged young per territorial pair. Population models developed by BRI in conjunction with the U.S. Environmental Protection Agency and USFWS indicate that a long-term average of 48% fledged young per territorial pair is needed for a sustainable loon population.

TABLE 1: Common Loon Productivity and Nesting Summary for all lakes surveyed (2006).

32 Territorial Pairs (TP)
16 Nesting Pairs (NP)
16 Nesting Attempts (NA)
0 Re-nests (R)
5 Successful Nesting Pairs (SNP)
7 Chicks Hatched (CH)
4 Chicks Surviving (CS)
11 Nest Failures (NF)
- 3 (27%) nest failures due to unknown predation
- 3 (27%) nest failure due to mammal predation
- 5 (45%) nest failure due to unknown reasons

There were a total of 11 nest failures documented in the West Branch Region in 2006 (Table 1). In total, 68% (11/16) of the attempted nests failed. Six nest failures were attributed to predation, three from mammalian predators and three nest depredations were from unknown predators. The cause of five nest failures (45%) could not be determined.

TABLE 2. Summary of Overall Reproductive Success for the West Branch Region and Downeast Lakes in 2006 In Comparison to Rangeley Lakes Region, Eagle Lake/Allagash Region, New Hampshire and Vermont Long-term Data.

Region	Number of Lakes Surveyed	Number of Lakes with Loon Pairs	TP[1]	NP[1]	CH[1]	CS[1]	NP/ TP	CH/ NP	CS/ CH	CS/ TP
West Branch 2006	13	13	32	16	7	4	0.44	0.44	0.57	0.13
Downeast Lakes 2006	46	34	75	33	21	10	0.44	0.64	0.48	0.13
Rangeley Lakes 2000-2004	8	8	85	50	44	22	0.59	0.88	0.50	0.26
Eagle Lake/ Allagash Region 2000-2004	24-36	14-25	107	48	29	15	0.45	0.60	0.52	0.31
New Hampshire 1976-2000	44-135	n/a	3,650	3277	2440	1847	0.68 +/- 0.06	0.99 +/- 0.13	0.77 +/- 0.06	0.52 +/- 0.09
Vermont 1981-2000	n/a	7-36	428	305	374	315	0.70 +/- 0.09	1.2 +/- 0.20	0.85 +/- 0.05	0.84 +/- 0.16

Comparison of the West Branch Region Results with Other Areas

Loon reproductive success in the West Branch Region is similar to those found in the Downeast Lakes area and those in northern and western Maine. Results from Maine, however, continue to represent deviations from regional loon populations as recorded in New Hampshire and Vermont (Table 2).

Some of the differences in loon reproductive success between Maine (West Branch and the Downeast Lakes Region, northern and western Maine), and New Hampshire and Vermont may be due to the following characteristics of lakes in Maine as compared with New Hampshire and Vermont:

(1) low primary productivity and therefore lower fish biomass,
(2) frequent and irregular water level fluctuations,
(3) shoreline nesting habitats of marginal quality, and
(4) potential anthropogenic stressors including MeHg availability, recreational fishing and boating, and changes in fish composition related to reduced movements because of dams (Evers 2007).

Summary of Survey Results, 2001, 2004-2006

Table 3 below summarizes data compiled from the 2004 – 2006 loon surveys in the West Branch Region. In 2001, initial survey efforts recorded 30 territorial pairs with 11 chicks surviving. Although this survey did not record all current parameters, data represented for this year provides a foundation for the current standardized effort. For each lake, the annual number of territorial pairs observed, nesting pairs, chicks

hatched and surviving is presented, along with averages across years.

While nesting frequency in 2006 (50%) surpassed that recorded in the previous year (38%), hatching success has dropped from a high of 1.31 CH/NP in 2004 to 0.44 CH/NP in 2006. Chick survivorship decreased 14% from 2004-2005. High water and rain in June caused many loon nests to fail regionally. Maine Audubon reported the second-lowest number of loon chicks from their 23-year survey of Maine lakes. The heavy precipitation may have been a factor in low hatching success in the West Branch Region in 2006. According to Evers (2007), approximately 0.48 chicks surviving per pair is needed for a self-sustaining population. Overall productivity continues to decline well below recommended values and presents the most concern. Data collected from 2004-2006 represent only three breeding seasons, however and may not accurately represent the stability of the loon population in this region.

TABLE 3. Summary of Loon Survey Results, 2004-2006

Region	***# lakes surveyed***	***# lakes with loon pairs***	***TP***	***NP***	***CH***	***CS***	***NP/ TP***	***CH/ NP***	***CS/ CH***	***CS/ TP***
2004 West Branch	13	13	30	13	17	12	0.43	1.31	0.71	0.40
2005 West Branch	13	13	32	12	7	5	0.38	50.58	0.71	0.16
2006 West Branch	13	13	32	16	7	4	0.50	0.44	0.57	0.13
Average+/-sd	*13*	*13*	*31 +/- 1*	*14 +/- 2*	*10 +/- 16*	*7 +/- 4*	*0.44 +/- 0.06*	*0.78 +/- 0.47*	*0.66 +/- 0.08*	*0.23 +/- 0.15*

Recommendations

1. Use rafts on Canada Falls and Seboomook lakes to compensate for low productivity rates until water levels can be stabilized.

2. Combine the West Branch dataset with other like datasets that were collected through similar efforts with the USFWS into a comprehensive report.

3. Work with local conservation groups to incorporate long-term educational and monitoring efforts of breeding loon populations using models established by the Northeast Loon Study Working Group.

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Appendix 1: Territory-Specific Productivity Summary, West Branch of the Penobscot, 2006.

Lake	Territory	Territorial Pair	Nesting Pair	Nesting Attempts	Nest Failure	Cause Nest Failure 1	Cause Nest Failure 2	Successful Nesting Pair	Chicks Hatched	Chicks Survived	Total Population (Ad+Ch
Baker Lake		1	0	0	0	~	~	0	0	0	**2**
Big Grenier Pond		1	0	0	0	~	~	0	0	0	**2**
Canada Falls Lake	Allen Brook	1	0	0	0	~	~	0	0	0	**2**
Canada Falls Lake	Cunningham Brook	1	1	1	1	UNK	~	0	0	0	**2**
Canada Falls Lake	Dam	1	1	1	0	~	~	1	1	0	**2**
Canada Falls Lake	Narrows	1	0	0	0	~	~	0	0	0	**2**
Canada Falls Lake	North Ironbound	1	0	0	0	~	~	0	0	0	**2**
Canada Falls Lake	South Branch Penobscot	1	1	1	1	UNK	~	0	0	0	**2**
Canada Falls Lake	South East Arm	1	1	1	1	UNK	~	0	0	0	**2**
Canada Falls Lake	South Ironbound	1	0	0	0	~	~	0	0	0	**2**
Cheney Pond		1	0	0	0	~	~	0	0	0	**2**
Dingley Brook		1	1	1	1	UP	~	0	0	0	**2**
Dole Pond		1	0	0	0	~	~	0	0	0	**2**
Foley Pond		1	0	0	0	~	~	0	0	0	**2**
Frost Pond		1	1	1	0	~	~	1	2	2	**4**
Long Pond	Dam	1	1	1	1	UNK	~	0	0	0	**2**
Long Pond	Middle	1	0	0	0	~	~	0	0	0	**2**
Long Pond	South	1	1	1	1	MP	~	0	0	0	**2**
Moosehead Lake	Bigney Cove	1	0	0	0	~	~	0	0	0	**2**
Moosehead Lake	Northwest Cove	1	1	1	0	~	~	1	1	1	**3**
Moosehead Lake	Seboomook Island	1	0	0	0	~	~	0	0	0	**2**
Penobscot Lake	Dam	1	1	1	1	UP	~	0	0	0	**2**
Penobscot Lake	Islands	1	1	1	1	UP	~	0	0	0	**2**
Penobscot Lake	North End	1	1	1	1	MP	~	0	0	0	**2**
Seboomook Lake	Beaver Brook	1	1	1	0	~	~	1	2	0	**2**
Seboomook Lake	Dam	1	0	0	0	~	~	0	0	0	**2**
Seboomook Lake	East Islands	1	0	0	0	~	~	0	0	0	**2**
Seboomook Lake	Gulliver Brook	1	1	1	1	MP	~	0	0	0	**2**
Seboomook Lake	Logan Brook	1	1	1	1	UNK	~	0	0	0	**2**
Seboomook Lake	Nulhedus Stream	1	1	1	0	~	~	1	1	1	**3**
Seboomook Lake	Pittston Farm	0	0	0	0	~	~	0	0	0	**0**
Seboomook Lake	West Islands	1	0	0	0	~	~	0	0	0	**2**
Wellman Brook		1	0	0	0	~	~	0	0	0	**2**
	Totals	**32**	**16**	**16**	**11**	**~**	**~**	**5**	**7**	**4**	**68**

Nest Failure Codes
AP = Avian Predation
MP = Mammalian Predation
UP = Unknown Predation
WLI = Water Level Increase
WLF = Water Level Fall
HD = Human Disturbance
LD = Loon Disturbance
NH = Never Hatched
UNK = Unknown

Figure 1. West Branch of the Penobscot Region Study Area.

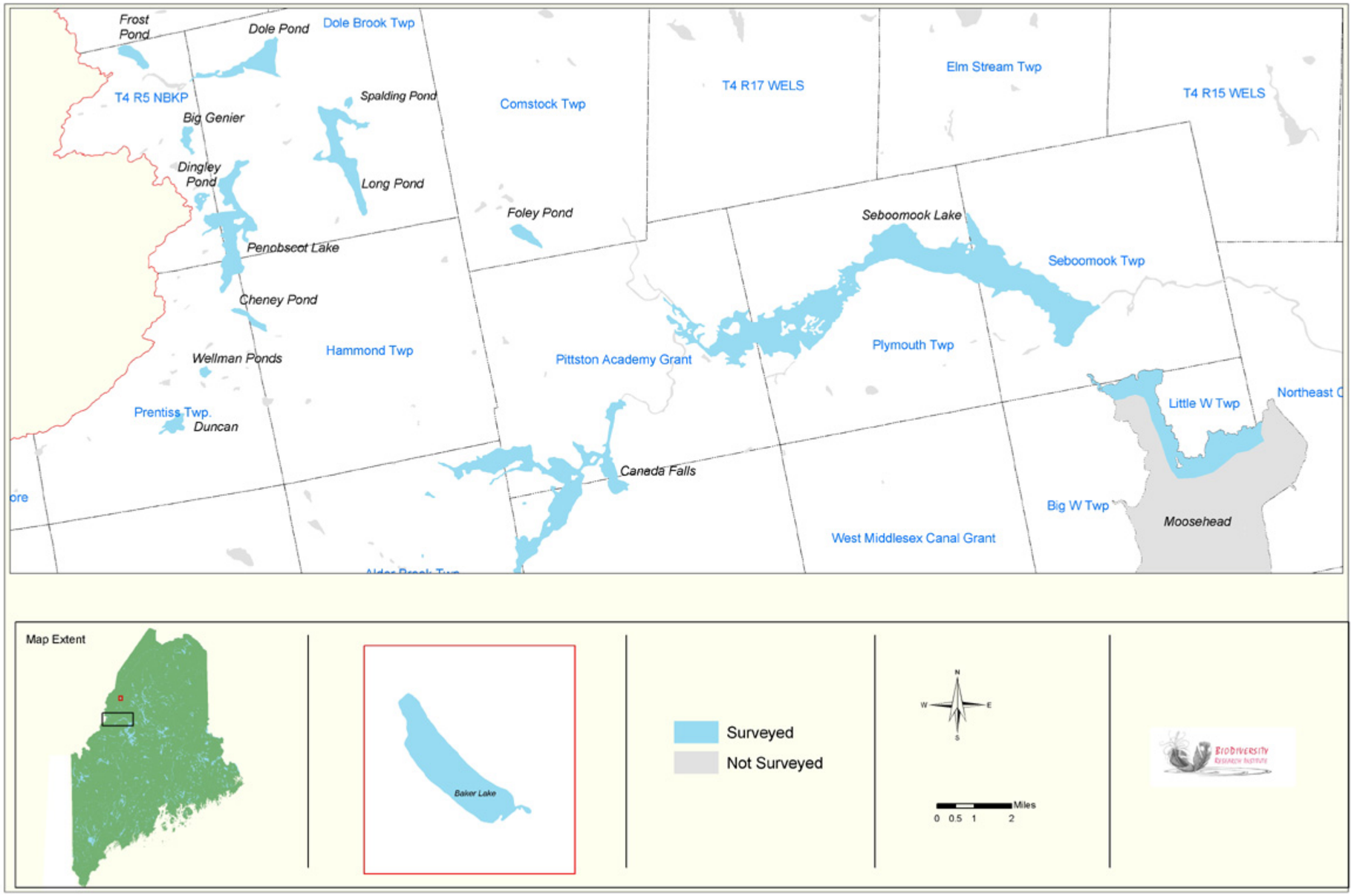

Figure 2. West Branch of the Penobscot Region Study Area. Big Grenier Pond by loon territory, total area surveyed and nest site.

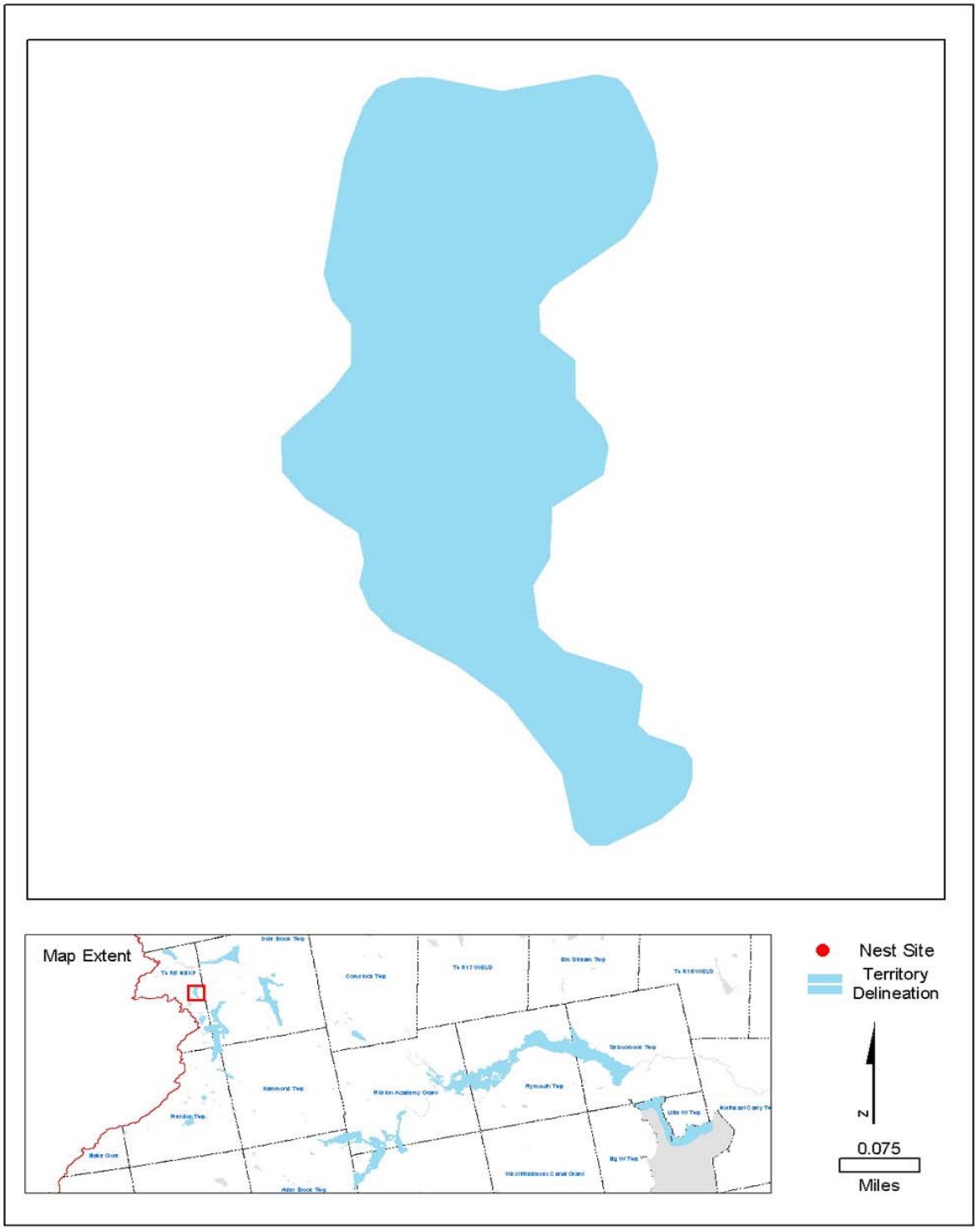

Figure 3. West Branch of the Penobscot Region Study Area. Canada Fall Lake by loon territory, total area surveyed and nest site.

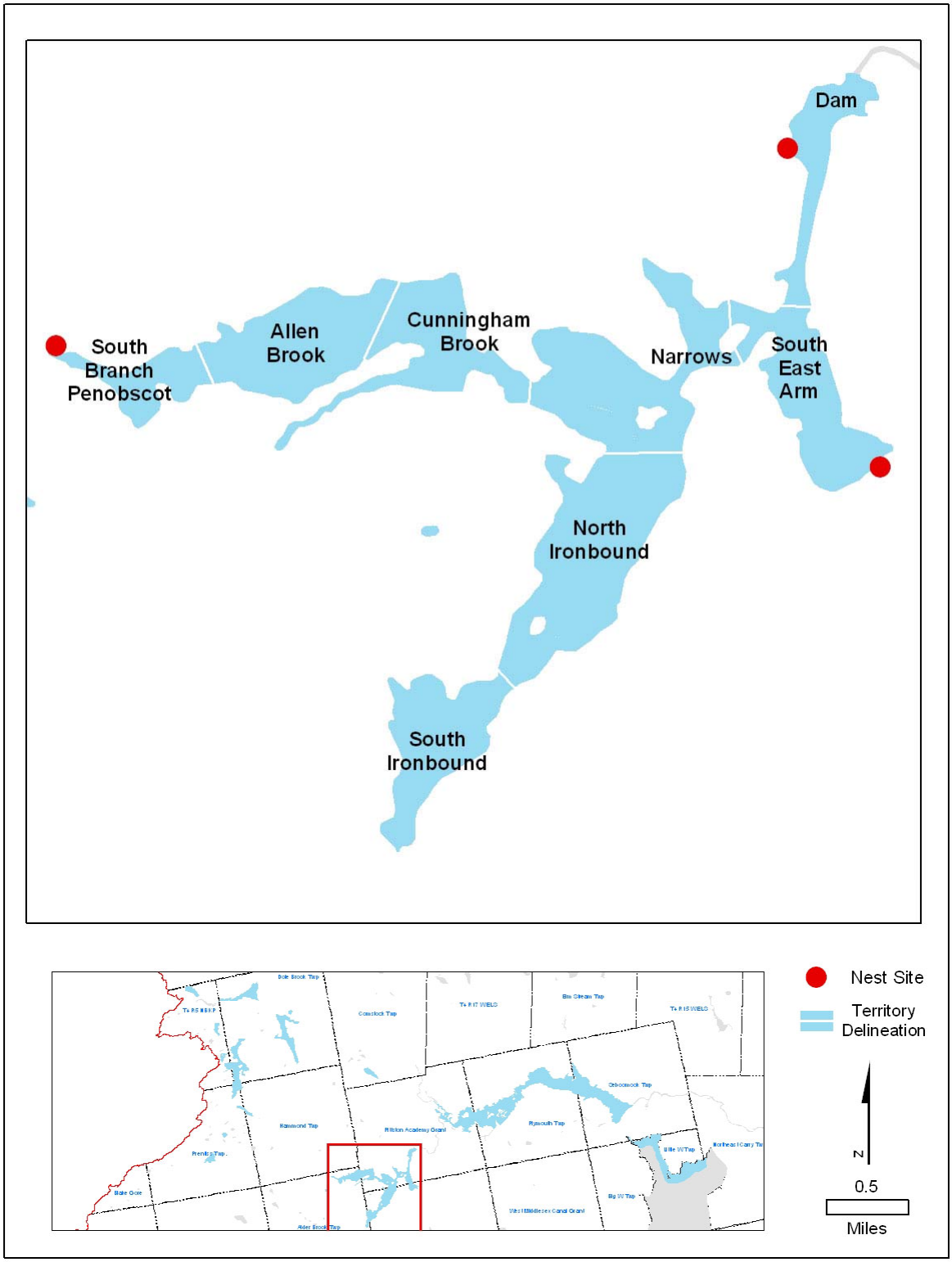

Figure 4. West Branch of the Penobscot Region Study Area. Dingley Pond by loon territory, total area surveyed and nest site.

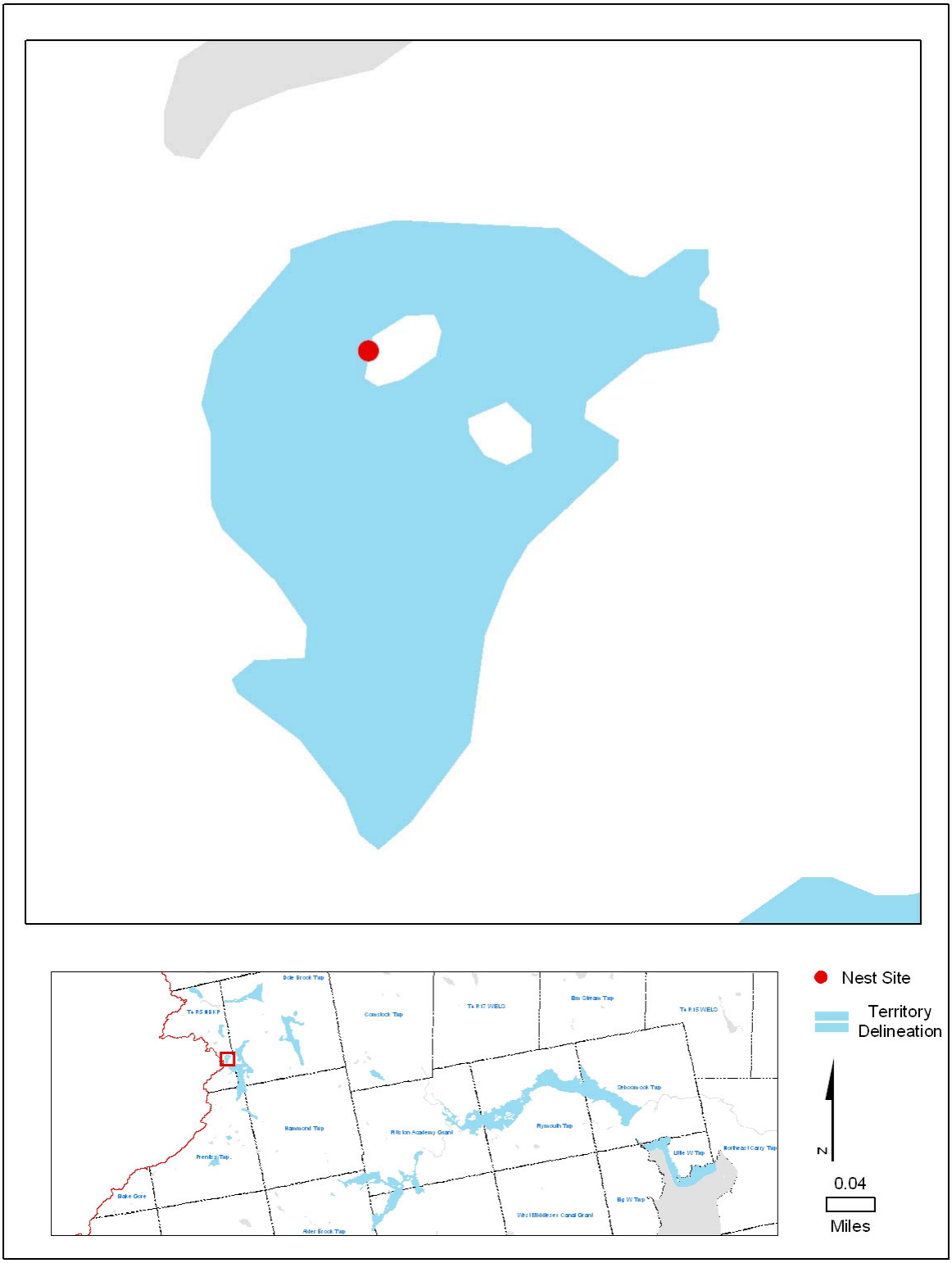

Figure 5. West Branch of the Penobscot Region Study Area. Dole Pond by loon territory, total area surveyed and nest site.

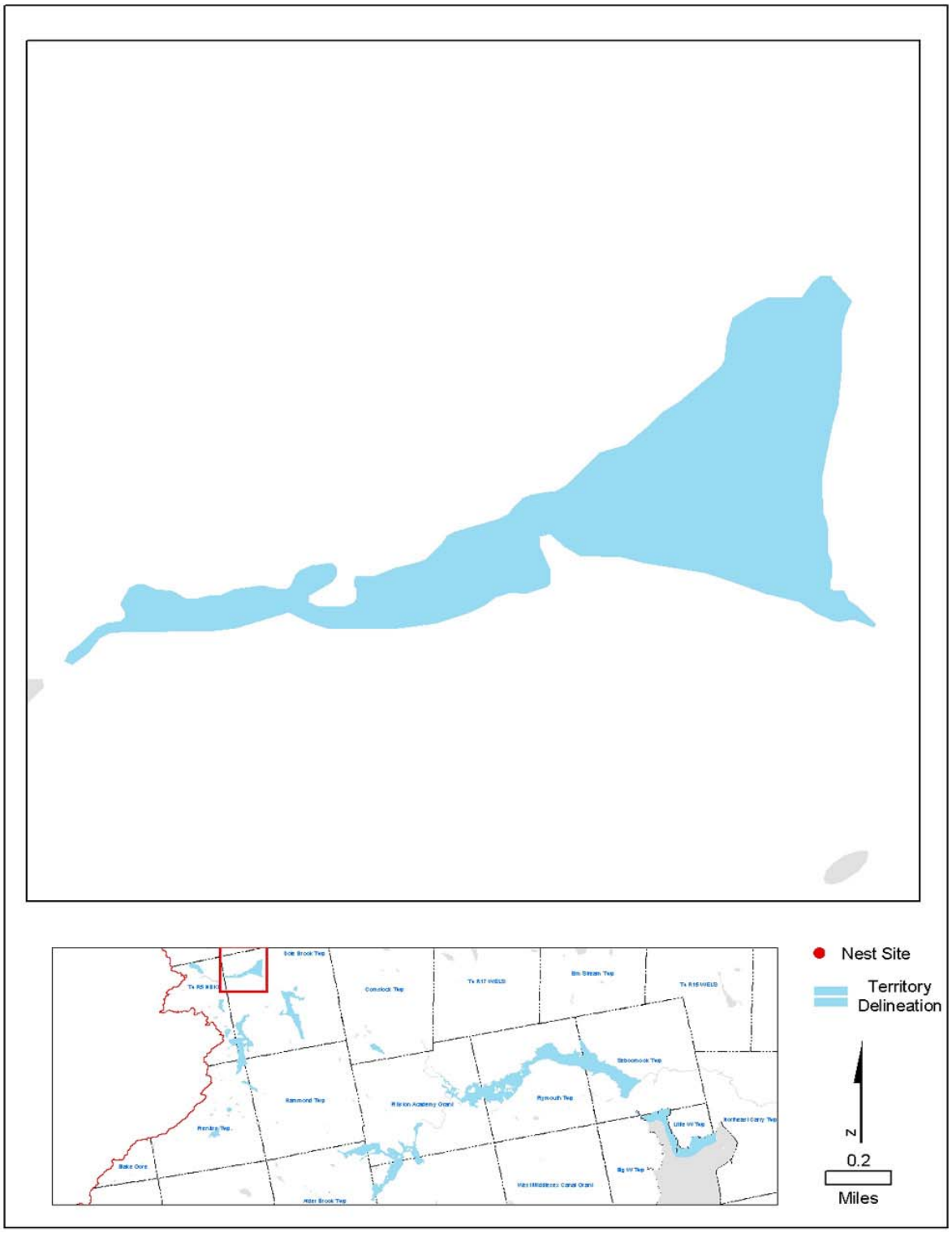

Figure 6. West Branch of the Penobscot Region Study Area. Foley Pond by loon territory, total area surveyed and nest site.

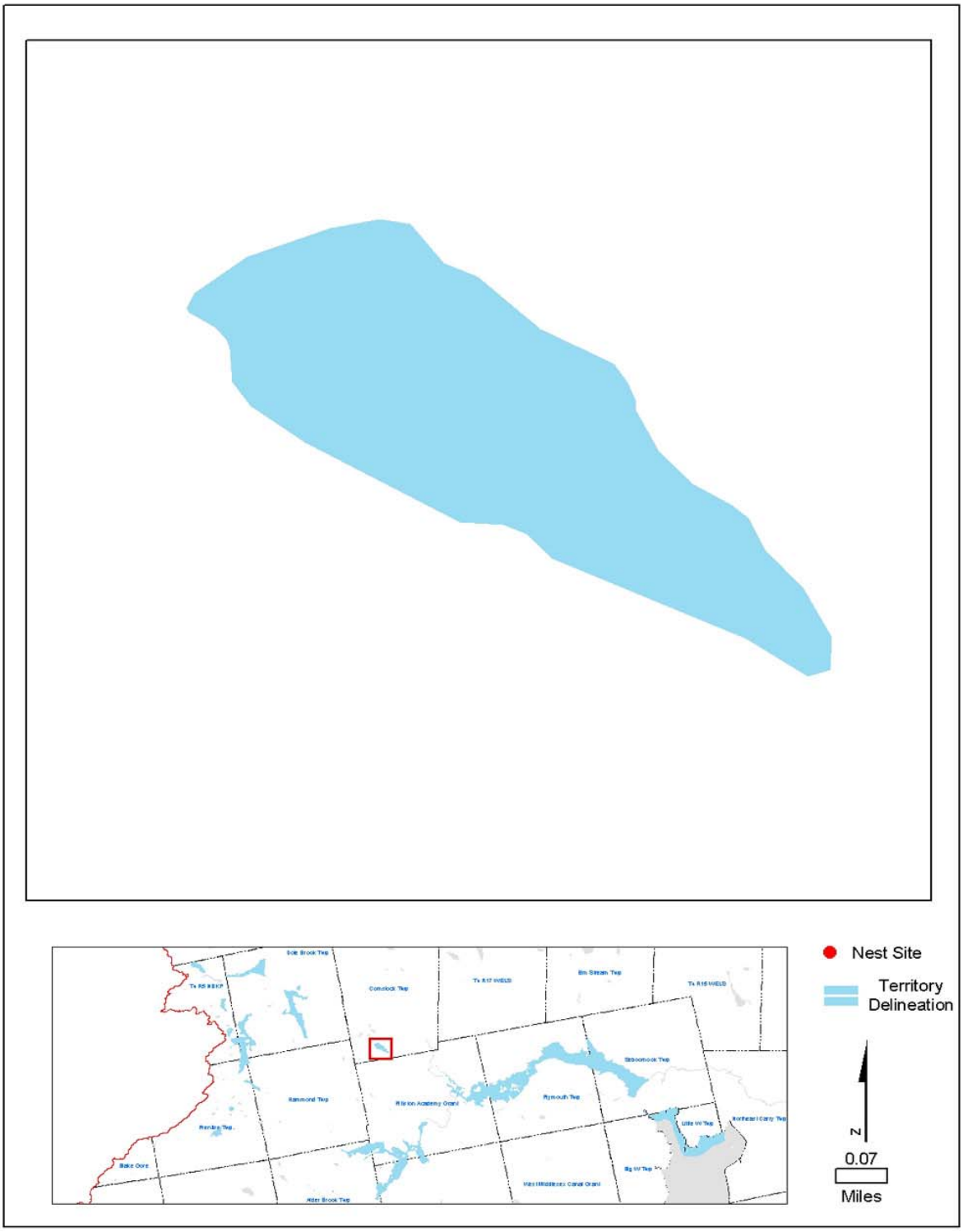

Figure 7. West Branch of the Penobscot Region Study Area. Frost Pond by loon territory, total area surveyed and nest site.

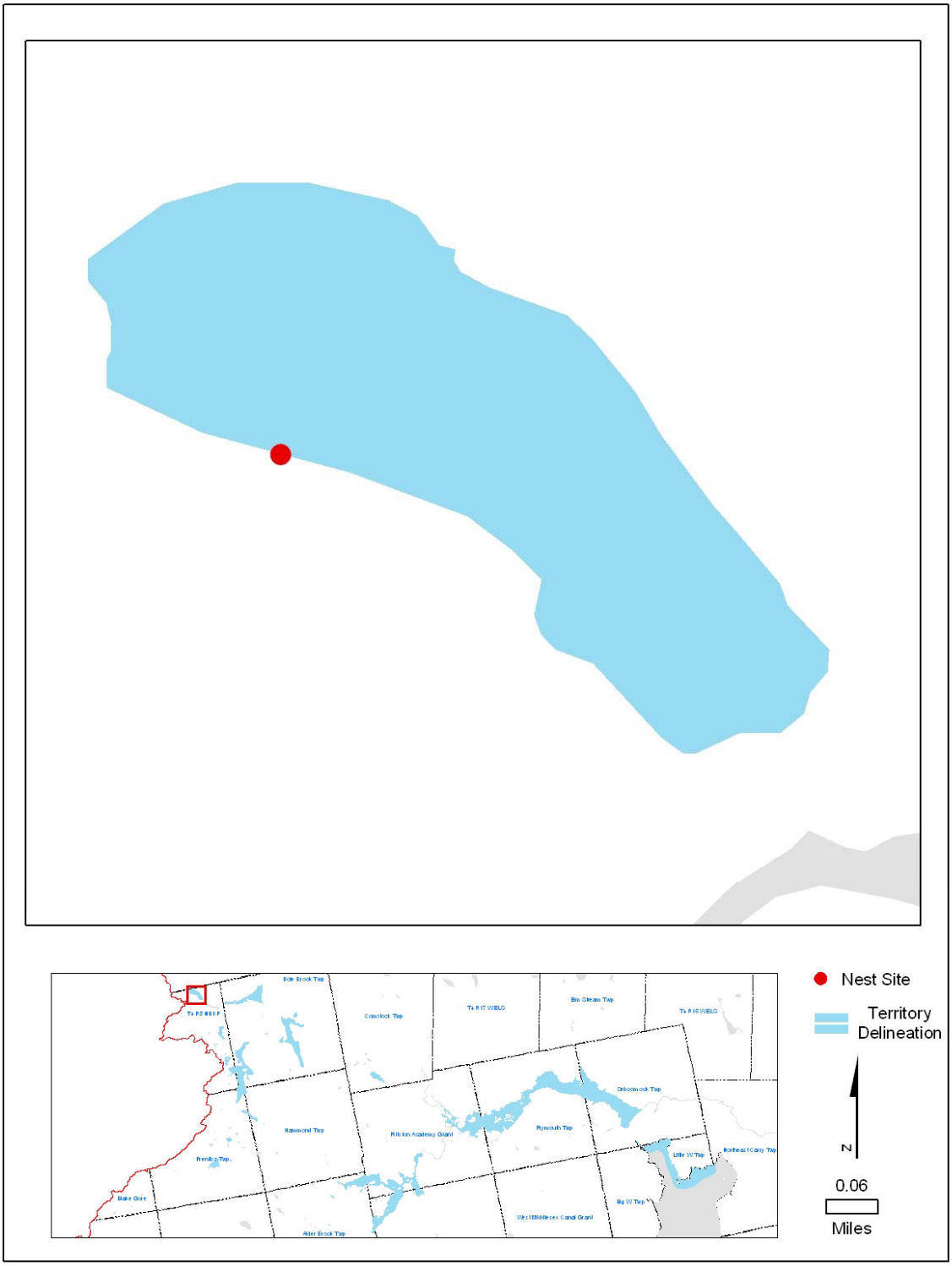

Figure 8. West Branch of the Penobscot Region Study Area. Long Pond by loon territory, total area surveyed and nest site.

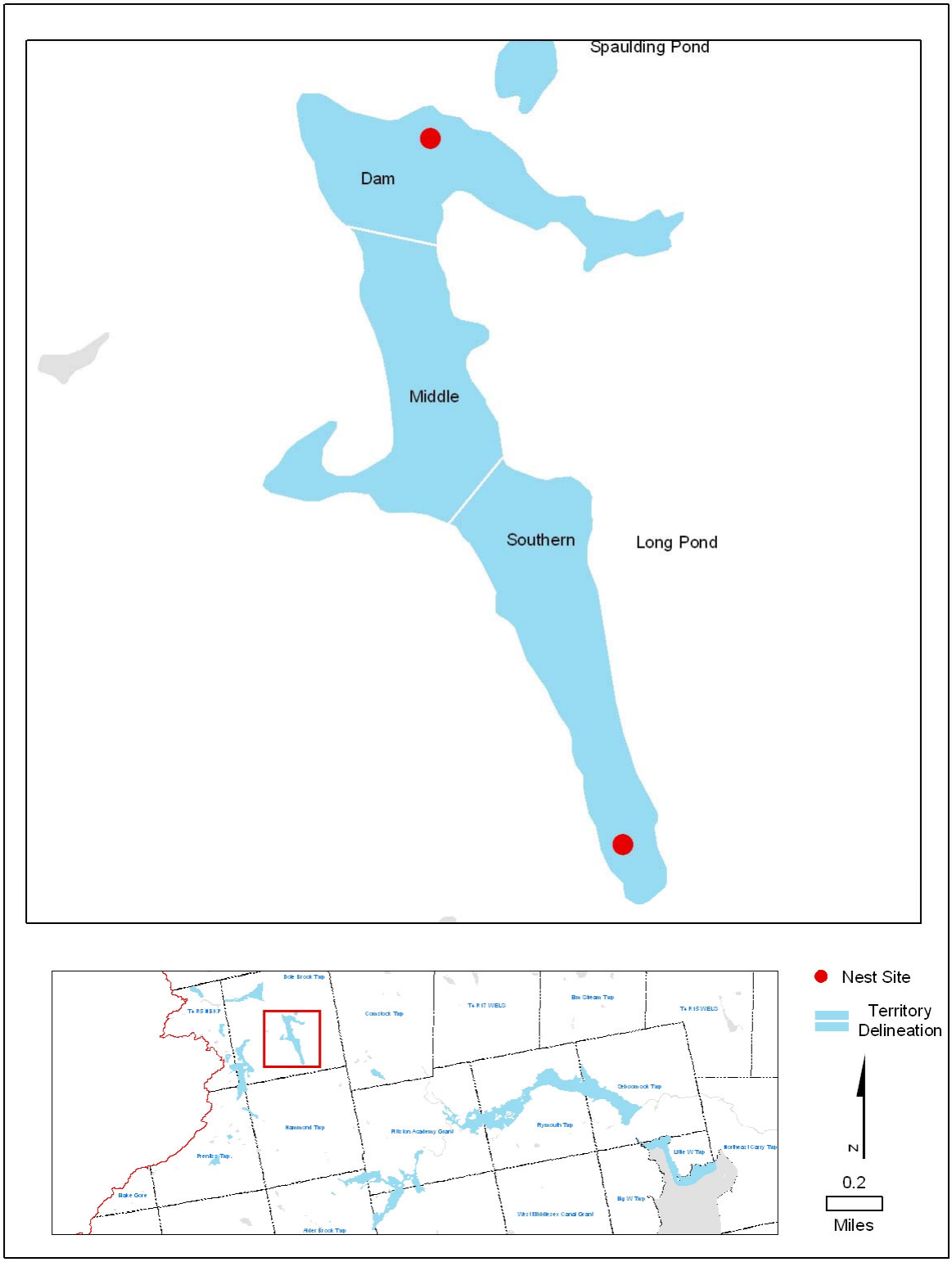

Figure 9. West Branch of the Penobscot Region Study Area. Moosehead Lake by loon territory, total area surveyed and nest site.

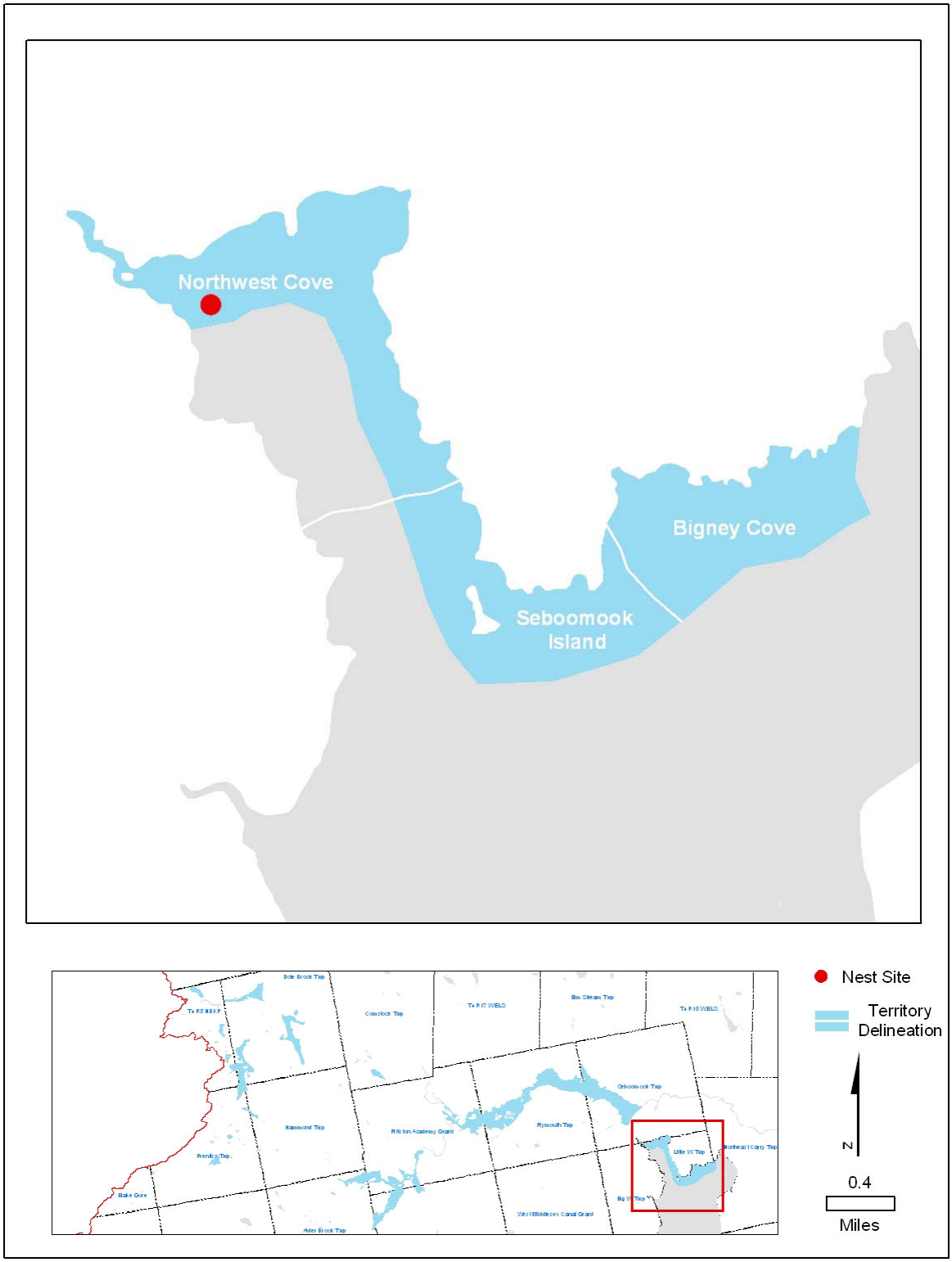

Figure 10. West Branch of the Penobscot Region Study Area. Penobscot Lake by loon territory, total area surveyed and nest site.

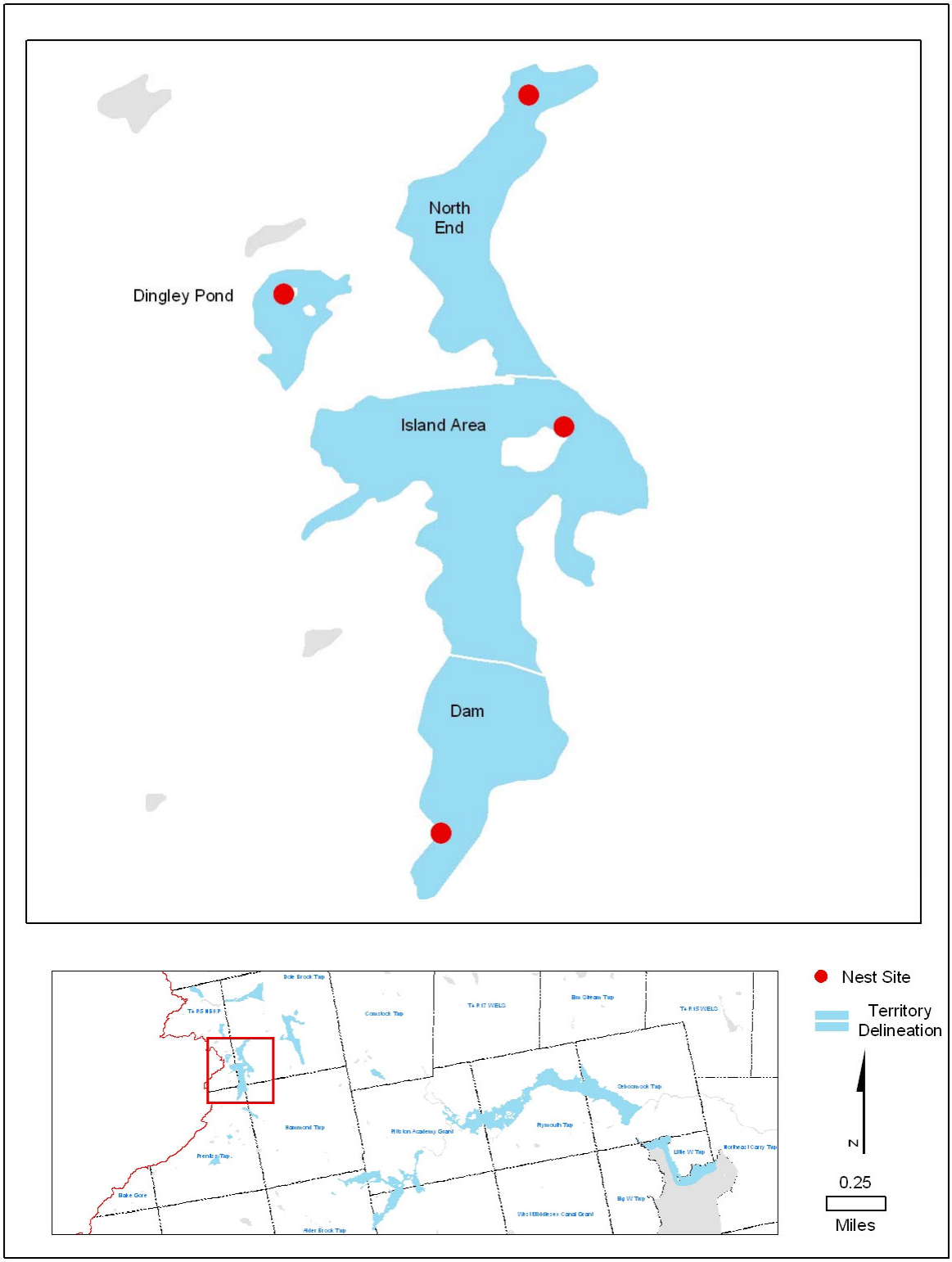

Figure 11. West Branch of the Penobscot Region Study Area. Wellman Pond by loon territory, total area surveyed and nest site.

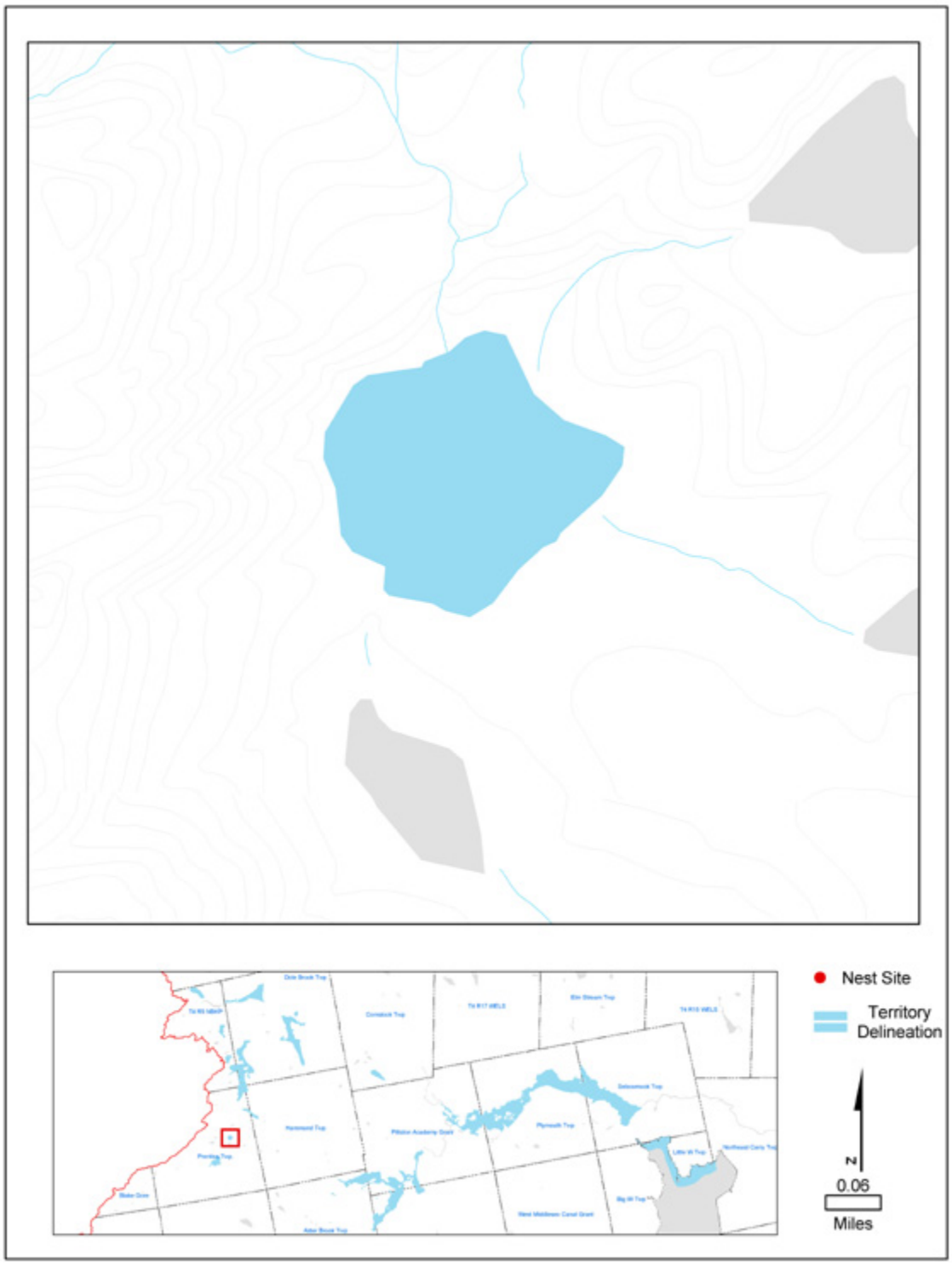

Figure 12. West Branch of the Penobscot Region Study Area. Seboomook Lake by loon territory, total area surveyed and nest site.

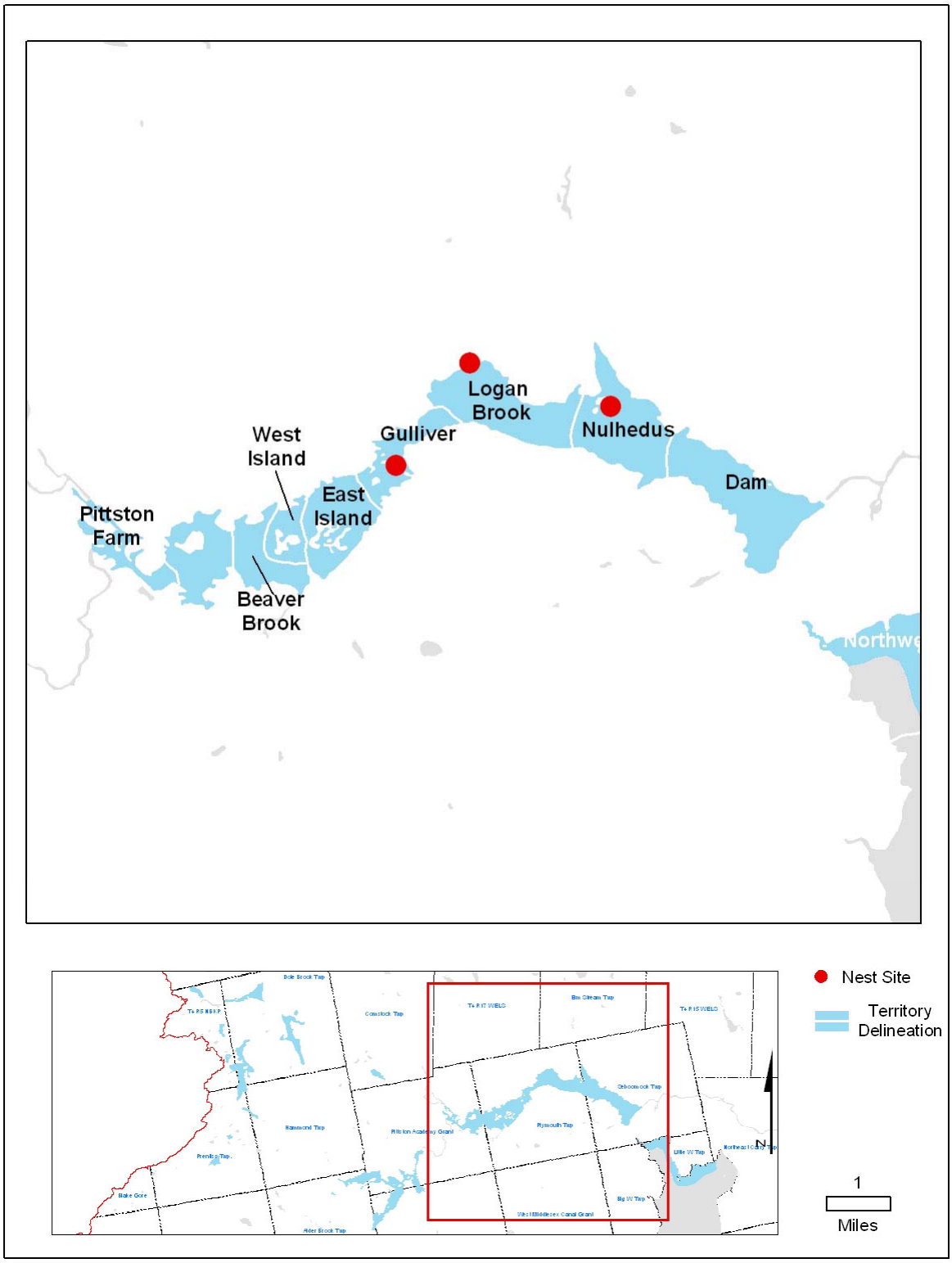

Figure 13. West Branch of the Penobscot Region Study Area. Cheney Pond by loon territory, total area surveyed and nest site.

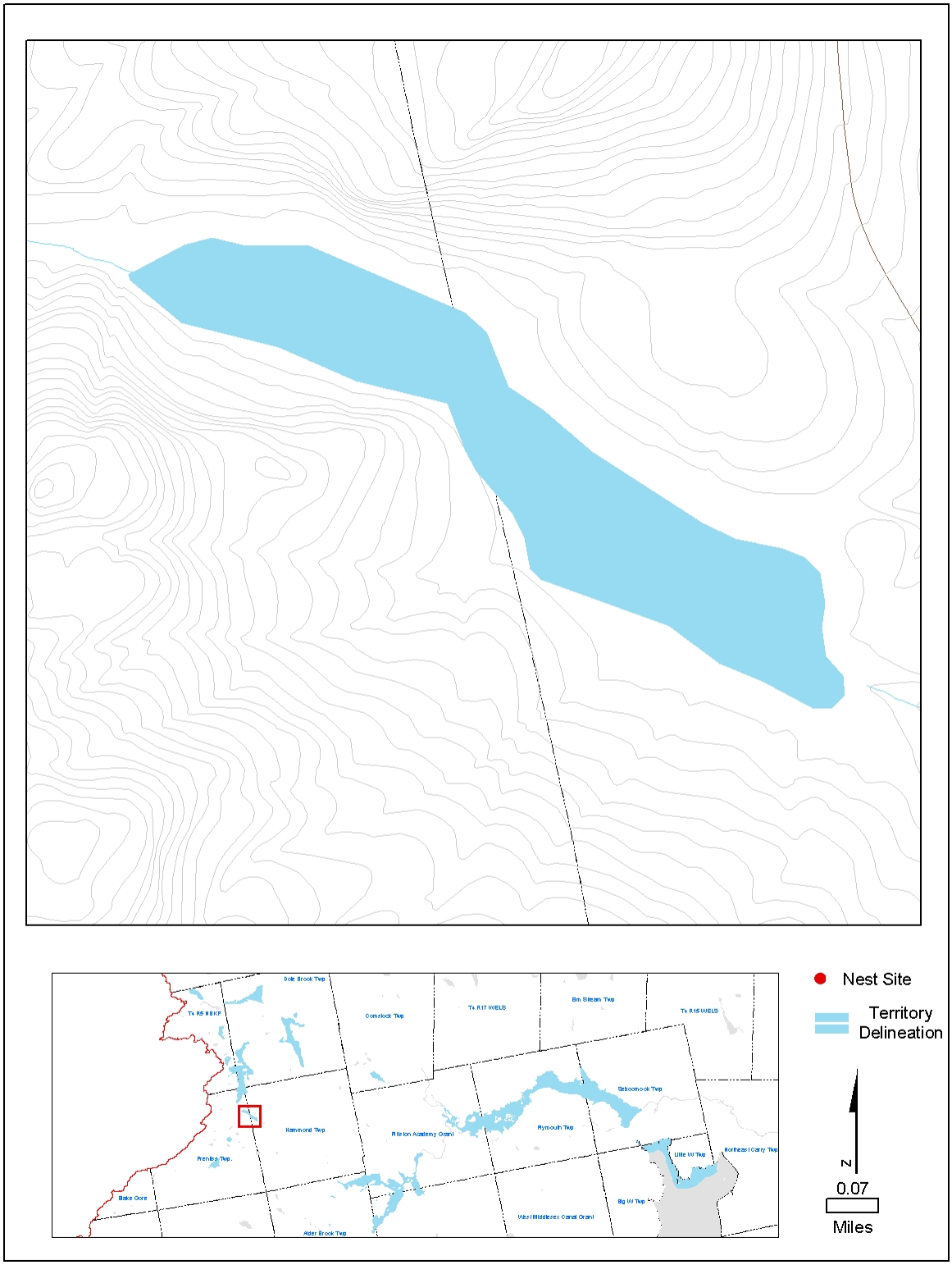

Figure 14. West Branch of the Penobscot Region Study Area. Baker Lake by loon territory, total area surveyed and nest site.