

**Documentation of the reproductive success of the
Common Loon on selected lakes in the
Rangeley Lakes and Eagle Lake Regions in 2004
(BRI 2005-06)**

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(BRI 2005-06)

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Executive Summary

We report results from continuing survey efforts on all lakes with suitable loon breeding habitat bordered by Pingree Forest Partnership lands (PFP). This monitoring effort is supported through a cooperative agreement between the U. S. Fish and Wildlife Service (Service) and the New England Forestry Foundation. The agreement was developed to monitor loons on PFP lands that were purchased for a conservation easement, in part, with funds received from the Service, acting for and on behalf of the Trustees of the North Cape Oil Spill. A total of 44 lakes were surveyed in the summer of 2004 for the presence of Common Loons (*Gavia immer*). In this fifth consecutive year of monitoring, we found 33 lakes supporting 43 established territorial pairs. Low rates of lake occupancy by territorial loon pairs in the Eagle Lake Region likely reflect either (1) poor habitat quality on many waterbodies and/or (2) a declining breeding population. Weekly monitoring from May through mid September confirmed nesting evidence for 18 of these territorial pairs (i.e., 42% nesting frequency). A total of 10 chicks hatched (i.e., hatching success of 0.56 chicks per nesting pair) and 5 survived to fledging age (i.e., 50% chick survivorship). Overall productivity (CS/TP) continues to be substantially lower than long-term averages reported for New Hampshire and Vermont loon populations. Low loon productivity in both monitoring regions was primarily caused by predation, abandonment from unknown causes, and water level fluctuations.

Established territorial loon pairs inhabit approximately 101 miles (162 km) of lake shoreline for the two monitoring regions (37 miles, 59 km, for the Rangeley Lakes Region and 64 miles, 102 km, for the Eagle Lake Region). The total production of fledged loon young for the past five years is 37 and is equivalent to one fledged loon per 3.7 miles (5.1 km) of protected shoreline.



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 impacted policies set 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 demands vigilance. Major stressors currently quantified as critical to Maine's breeding loon population are the availability of methylmercury (MeHg) in freshwater environments (Evers et al. 1998, Evers et al. 2000) and oil spills in marine environments (NOAA et al. 1999).

On 19 January 1996, the tank barge North Cape spilled approximately 830,000 gallons of #2 fuel oil and subsequently killed an estimated 414 loons off the Rhode Island coast (NOAA et al. 1999). Lacking the ability to directly replace the lost loons, the Trustees of the North Cape oil spill (U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and the State of Rhode Island) focused on enhancing the survival rate and/or productivity of existing loons in the wild. One method of enhancing productivity is to protect loon territories from future development by purchasing land or land development rights on shorelines of lakes with existing loon nesting territories.

In 2000, the New England Forestry Foundation protected loon-nesting habitat as part of its purchase of a large conservation easement from the Pingree family. This Pingree Forest Partnership (PFP) protected a total of 36 territorial pairs, of which 19 nested and fledged 4 chicks (Evers 2000a). The Trustees, acting by and through the U.S. Fish and Wildlife Service, provided \$500,000 towards the protection effort and up to \$200,000 to monitor the loons for five years.

As part of this monitoring effort, Biodiversity Research Institute (BRI) conducted loon productivity surveys in 2004 on a total of 44 of the 44 lakes containing PFP-protected lands in the Rangeley Lakes and Eagle Lake Regions. In addition, to appropriately evaluate ecological impacts from multiple stressors, a simplified stressor-risk rank matrix was used as an additive model (Foran and Ferenc 1999). We attempted to account for potential stressors on the breeding lakes, including shoreline development, water-based recreational activities, dam-based water level fluctuations, habitat degradation such as water clarity impacts related to increased silt loads, and increased densities of predators such as the raccoon (*Procyon lotor*) and Herring Gull (*Larus argentatus*).

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 we feel that there are multiple stressors at play that are currently causing local negative productivity rates. And, although Pulliam (1988) argued that species in spatially heterogeneous environments can maintain large sink populations in an evolutionary stable manner, we feel that loons may be an exception to this concept due to the extremely restrictive dispersal abilities of breeding loons (i.e., an average of two km for adult males, Evers 2001) combined with chronic breeding ground stressors (e.g., MeHg availability and reservoir-related water level fluctuations) and unpredictable but frequent wintering area stressors (e.g., marine oil spills) produces enough uncertainty that the chances for creating sink populations needs to be aggressively minimized to maintain a minimum viable population.

We therefore feel that the following survey monitoring program is useful for determining the population viability and status of the PFP loon subpopulation, and will provide context for our site-specific productivity measurements.

Study Areas

Rangeley Lakes Region

The Rangeley Lakes Region is a moderately populated area located in the southwestern portion of the state, just east of the NH border and southwest of the Bigelow Mountains (Figure 4). Dozens of small natural lakes are scattered among larger reservoirs such as Aziscohos, Richardson, and Mooselookmeguntic Lakes. The eight lakes bordered by PFP lands within the region vary in size from 40 acres to 16,300 acres. This region contains approximately 37 miles (59 km) of PFP-protected linear shoreline abutting loon territories.

Eagle Lake Region

The Eagle Lake region is a minimally populated area located in the north-central portion of the state, north of Millinocket (Figures 5-9). Similar to the Rangeley Lakes Region, many natural lakes exist in the region in close proximity to



larger reservoirs. There are 32 lakes bordered by PFP lands in this region, varying in size from 35 to 5,081 acres. This region contains approximately 64 miles (102 km) of PFP-protected linear shoreline abutting loon territories.

Methods

From early May to early September 2004, BioDiversity Research Institute (BRI) monitored territorial Common Loon pairs inhabiting lakes bordered by PFP land. Surveys focused on 44 lakes and were divided into two areas: 36 lakes in the Eagle Lake Region and eight lakes in the Rangeley Lakes Region. On these lakes we documented the presence of territorial loons, their reproductive activities, territory configuration, habitat conditions, as well as pressures related to human activity and predators. Non-breeding individuals were also noted. The summary of this information was then used to place lakes into 4 categories (or tiers) representing different levels of loon reproductive activity and associated survey intensity.

Ground surveys

Ground Survey Field Methods

Survey methods were consistent with those reported in Evers et al. (2000a). We surveyed all known territories and surrounding areas on survey lakes using 10X binoculars with occasional use of a 15-45X spotting scope. In the Rangeley Lakes Region, an 18-foot motorboat with a 50 hp four-stroke engine was used on Mooselookmeguntic, Richardson and occasionally Kennebago Lakes. A 15-foot canoe with a 2 hp four-stroke engine was used on moderate- and small-sized lakes with poor road access or launching facilities. We used kayaks and canoes 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 presence/absence of nest evidence by foot. We conducted searches for evidence of natural nesting attempts by walking the perimeter of the available nesting habitat in loon territories. All known historical nesting sites were checked regularly for nesting evidence. The following information presents information for lakes/territories surveyed using ground surveying methods: Territorial pairs, nesting pairs, chicks hatched, chicks surviving (fledged), nest failure cause, and non-breeders.

Causes for nest failure were assessed at each nest site based on physical evidence and professional judgment. Nest failure causes are identified and presented for each territory nesting attempt according to the following categories:

<u>Nest Failure Code</u>	<u>Nest Failure Cause</u>
AP	Avian Predation
MP	Mammalian Predation
UP	Unknown Predation
AB	Abandonment (for unknown cause)
I	Increase in water level
D	Decrease in water level
Int	Intra-specific interactions – (intruding loons)
HD	Human Disturbance
U	Unknown/unidentifiable Failure Cause

Ground Surveys – Chronology

Travel times and accessibility of lakes varied between the two regions. We ground-surveyed 32 target lakes using ground survey methods in order to confirm the presence/absence of Common Loons and document their nesting activities from 15 May to 25 September 2004. Ground surveys were conducted from 15 May to 25 September in the Rangeley Lakes Region and from 22 May to 1 October in the Eagle Lake Region. Survey periods differ in the two regions. The Eagle Lake Region surveys being later because of the late ice out and subsequent inaccessible roads from the spring thaw.



Aerial Surveys

Aerial Survey Field Methods

Due to limited road access in certain areas of the Eagle Lake Region, floatplanes were used to reach water bodies not easily surveyed using ground survey methods during the 2000-2004 seasons (no lakes in the Rangeley Lakes Region were inaccessible by roads). The planes used during our surveys were small in size and could decrease their speed to approximately 70 m/hr (116 km/hr) and an altitude to 200 ft (60 m) or less if necessary. This enabled us to circle a lake and be confident with our final evaluations of potential territorial pair presence and hatching/fledging success. Each territory was circled at low altitude for a minimum of 2 minutes, or until information was gathered. 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 (particularly when using trained observers).

Aerial Surveys – Chronology

Thirteen lakes within PFP land boundaries were only aerially surveyed in 2004. Aerial surveys of the 13 lakes that were inaccessible by roads within the Eagle Lake Region were conducted on 25 June and 22 September. Nearly all these lakes are tier 3 and tier 4 lakes. Information from lakes routinely surveyed on the ground was also opportunistically collected.

Lake & Survey Classification System

Survey lakes were monitored at varying intensities according to a classification system designed to prioritize survey efforts. Observed Common Loon territorial fidelity and reproductive activity are the foundations for this classification system. Similar survey systems have been developed and used by other organizations to survey loon populations (i.e. Loon Preservation Committee of New Hampshire Audubon). Our classification system contains four categories, or “tiers,” which are defined as follows:

Tier 1: These are lakes where breeding activity has been reliably confirmed during any one of the past three years. These lakes must be occupied by a territorial pair of loons and show some evidence of nesting activity, regardless of success or failures that ensue. Tier 1 lakes are surveyed with the highest intensity level (one survey every 7-10 days), providing that access is not limiting¹.

Tier 2: These are lakes that are occupied by a non-breeding territorial pair of loons. No evidence of current or historical nesting attempts has been discovered on these lakes. Since tier 2 lakes are the next most likely group to contain nesting activity, they are surveyed with the highest intensity level (one survey every 7-10 days), providing that access is not limiting³.

Tier 3: These are lakes that do not contain a territorial pair of loons but have supported occasional non-territorial (and therefore also non-breeding) individuals during at least one survey visit. These lakes have potential of becoming breeding lakes (Tier 1) or established loon territory lakes (Tier 2) in the future, and are surveyed 1-3 times during a season (preferably the one survey in August). These visits are likely sufficient to detect increasing fidelity of loon individuals to the lake.

Tier 4: These are lakes that have showed no loon activity or loon presence during any survey visits since 2000. These lakes are often too small, shallow, or are lacking in specific habitat requirements (e.g. water quality, prey availability) for breeding loons. However, several lakes do have the potential of moving to a different tier group in the future. The survey intensity for Tier 4 lakes is the same as for Tier 3 lakes, however, they will only occur on these lakes every other year.

Lakes in tiers 1-4 cannot be “downgraded” into a lower tier level. For example, once a lake has been classified as containing nesting loons (Tier 1), it will remain in this tier for the remainder of this monitoring effort. We have classified lakes into tier groups, rather than specific loon territories, for logistical and management reasons.

¹ Some lakes can only be surveyed aerially for logistical reasons. In these cases, survey intensities and data resolution will likely not be equal to those of ground surveys.



Determination of Habitat Quality

Productivity of loons has been related to habitat quality in several studies (e.g., Sutherland 2001). Higher quality habitats are more likely to be inhabited by more fit individuals, which, in turn, have higher productivity. We used two ranking systems as a means of determining habitat quality for all lakes containing PFP lands (Evers et al. 2000a). One was a quantitative exercise based on a simple ranking system that provided a matrix with a final index rating. All territories that contained territorial pairs of Common Loons were ranked according to the parameters defined in Appendix 5 of Evers et al. (2000a). Each territory received a ranking value for each parameter via information gathered from field surveys. These values were then summed for each territory and then divided by the number of points used in the analysis to account for parameters that lacked information. Thus, missing information did not negatively impact a territory being evaluated. This quantitative rank outline was then reviewed by the authors and integrated with their qualitative review. The qualitative ranking was based on our professional judgment of breeding habitat quality. The quantitative and qualitative aspects of this ranking exercise were then designated into three categories of breeding habitat quality: (1) high, (2) moderate, and (3) low. Territory-specific rankings from Evers et al. (2000a) have been placed into further refined categories in this report (X Low, Low, Mod-Low, Mod-High, High, X High) and have been geo-referenced in Figures 4-9. Ranks assigned in Evers et al. (2000a) in combination with the lake classification system presented in this report are currently used to prioritize survey and management efforts.

Determination of loon territories

Territories were observed until the nesting status of the pair could be determined. We also documented the behaviors exhibited by each member and mapped the location of the loons within the territory. This mapping procedure enabled us to define territory boundaries throughout the course of the season (i.e., covering pre-nesting, nesting, and post-nesting territory use by established territorial pairs). On-site observations varied in length from a few minutes to a few hours. The amount of time spent was typically related to weather conditions and loon behavioral states (e.g., if we immediately confirmed both members of a pair and one individual was incubating we would move on to the next territory). The presence of potential predators and other species of interest were recorded. BRI staff monitored known territorial loon pairs once a week for the duration of the survey (i.e., through the end of August). Lakes with no loons or non-territorial pairs were visited less often so that nesting attempts and courtship behavior on defined territories could be more closely monitored.

Mapping of territories

Each territory was mapped and PFP lands delineated in Evers et al. (2000a) using DeLorme® 3-D TopoQuads™. This program enabled us to measure the area of each territory, the amount of linear shoreline that could potentially be used for nesting, and the percentage of PFP shoreline. After each territory was mapped and defined, we created a 300-foot (90-m) buffer zone that was based on the shoreline area encompassing the loon's territory. This buffer zone provides ample area to protect nesting loons from possible encroachment. All information and measurements taken from this software program were at the highest magnification² possible.

Determining water quality

The water quality within most territories was measured for pH, apparent color, and clarity and presented in Evers et al. (2000a). Samples were taken from the center of defined loon territories. The pH was measured using digital pH meters (pHTestr 3™) and apparent color was tested with Hach® color test kits. Lake samples were measured along a color gradient to provide us with an indication of the amount of dissolved organic carbon (DOC) within each territory. These two tests enabled us to ascertain general water quality and potential relationships with elevated MeHg availability (Driscoll et al. 1995). For example, Meyer et al. (1995) found lakes with a pH < 6.3 to contain breeding adult and juvenile loons with higher blood mercury levels than lakes with a pH > 7.0. Furthermore, Meyer et al. (1998) found these low pH-high mercury lakes to significantly produce fewer fledged loons. Clarity was indicated with a secchi disk using protocols developed by the Maine Department of Environmental Protection's Volunteer Lake Monitoring Program. The disk was lowered until it was out of sight, brought back into view, then lowered again. The length from the disk to the water level was then recorded in meters. Barr (1986) and others have related loon foraging efficiency and overall habitat quality to water clarity.

² 15-1 level, DeLorme® Topo-Quads™.



Results

The following synopsis is a territory-by-territory review of loon occupancy, reproductive success, and general lake and territory information. Lakes are ordered alphabetically within tiers and by regions. We present Tier 1 and 2 lake information in a qualitative and quantitative format for each territory. Qualitative information is provided from 2004 only; further information for each territory can be found in previous reports. Tier 3 and 4 lakes are presented in a qualitative chronological format that can be used to assess long- and short-term status and trends of loon activities on water bodies. Aerial and ground surveys offer varying levels of data resolution. Because of this, data reported for a particular lake depends on 1) the survey method used (aerial, ground or both) and 2) the intensity of the survey (based on tier classification). Data are presented by lake, with multiple territories being first listed under a lakewide summary (if available). Maine's unique lake identification number (MIDAS), lake size, survey type and tier classification are presented for each lake. The percentage of each territory protected by PFP land is given for each Tier 1 & 2 territories and mapped in Evers et al. (2001a)³.

CHART CODE: TP=Territorial Pair; NP=Nesting Pair; CH=Chicks Hatched; CS=Chicks Survive; NF=Nest Failure

RANGELEY LAKES REGION

Tier 1 Lakes

Tier 1 Lakes are those lakes on which breeding activity has been reliably confirmed during any one of the past four years. These lakes must be occupied by a territorial pair of loons and show some evidence of nesting activity.

1. Big Beaver Pond - Lakewide Summary

MIDAS # 3310,

179 acres (72 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	2	0	0	0	0
2001	2	1	1	0	0
2002	2	0	0	0	0
2003	1	1	0	0	1
2004	1	0	0	0	0

2004 Productivity Summary: A single pair occupied the traditional West (Islands) territory of Big Beaver this season. A single loon and occasionally another visiting loon were observed in the East (Cabins) territory. These loons did not display territorial behavior and were considered a transitional pair rather than a territorial pair. No nesting activity was observed on either territory.

Comments: Big Beaver is a 179-acre (72 ha) pond in T4 R1 (Magalloway Township). Access to this pond is very limited, as there is neither a boat ramp nor an obvious trailhead leading to the pond. With owner permission, we accessed it by crossing the private property of one of the four camp owners on the pond. Both traditional loon territories are completely surrounded by PFP lands on this isolated pond. High quality nesting habitat is abundant, including two small islands and several small, protected coves. Current and historical nesting activity is evident.

³ The percentage of territory protected cannot be determined for tier 3 and 4 lakes due to the lack of loon territory fidelity on these waterbodies.



1A. Big Beaver – West (Islands)*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	1	1	0	0
2002	1	0	0	0	0
2003	1	1	0	0	1
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair was consistently observed throughout the season but did not attempt to nest. A raft was floated but never used.

Comments: This pair frequents the northwestern cove on the lake, including the island. High quality nesting habitat is abundant.

1B. Big Beaver-East (Cabins)*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	0	0	0	0	0
2004	0	0	0	0	0

2003 Productivity Summary: A single and occasional second loon was observed in the territory this season. The loons did not display territorial behavior and were therefore classified as a transitional pair.

Comments: Previous pairs frequented the area in front of the cabins and to the east. An abundance of quality nesting habitat is available.

2. Cranberry Pond*MIDAS #3314**100% territory protected**106 acres (42 ha)**Ground Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	1	1	2	1	0
2001	1	1	0	0	1 - MP
2002	1	1	1	0	1 - U
2003	1	0	0	0	0
2004	1	1	1	1	0

2004 Productivity Summary: The female banded in 2000 returned with an unbanded male this season. The pair nested and successfully hatched one chick in the beginning of July. The chick was observed on the last survey visit and likely fledged from the lake (chick was 7+ weeks of age).



Comments: Cranberry Pond is a 106-acre (42 ha) water body located in the Magalloway Plantation Township. This pond is quite difficult to access and there are no public trails. Because of public access limitations, the loons on this lake are infrequently disturbed or encountered by humans. There are only two camps on the pond, which are located on opposite shores at the south end. One camp is set back from the water, while the larger one is along the shoreline and has a dock. Residents do not currently use powered motors. Quality shoreline nesting habitat on this pond is abundant, especially in the northwestern end of the lake, which is abutted by an extensive sphagnum bog mat (this is likely linked with the low pH of 5.89 recorded on this lake). Many sections of the shoreline are rocky. There are no islands on Cranberry. PFP lands surround the entire pond.

3. Little Beaver

MIDAS #3312

100% territory protected

50 acres (20 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	2 - HD
2001	1	1	1	0	1 - UP
2002	1	0	0	0	0
2003	1	1	2	0	0
2004	1	0	0	0	0

2004 Productivity Summary: The banded pair (2003) occupied the Little Beaver territory this season, but no nesting attempts were observed.

Comments: Little Beaver is a small, 50-acre (20 ha) pond located on Fish Pond Road in the Magalloway Plantation Township. Access is limited; however there are many boats in the woods along the lake perimeter, indicating relatively frequent public use. The access road leads to Route 16, but the pond is not easily found. Lake users are relatively common and consist of local anglers. The pond has two camps, one of which is set back from the water at the west end while the other is on the southeast side.

4. Kamankeag Pond

MIDAS # 3954

100% territory protected

40 acres (16 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	2	2	0
2001	1	1	1	1	0
2002	1	1	1	0	1-I
2003	1	1	0	0	1
2004	1	1	0	0	1-UP

2004 Productivity Summary: The banded Kamankeag pair from 2001 returned to their territory and nested again this season. The pair built a nest and laid one egg on a site along the shoreline on the northwest side of the pond. Approximately two weeks into incubation, the egg was predated, but no eggshells or egg was found. The pair was last observed on August 3rd.

Comments: This 40-acre (16 ha) pond was one of the smallest occupied water bodies of those surveyed on PFP lands. Located in the Davis Township, a gate owned and operated by Seven Islands Land Company restricts access to this lake and



therefore human use/disturbance is primarily limited to members of the Kennebago Lake Association. The two private camps on the lake also have gates. We speculate that this pair uses John's Pond and the north end of Mooselookmeguntic for foraging.

5. Kennebago Lake – Lakewide Summary

MIDAS #2374

1,700 acres (680 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	3 (6)	1 (5)	0 (1)	0 (1)	1 (5)
2001	3 (6)	2 (4)	1 (4)	1 (2)	1 (2)
2002	3 (6)	0 (1)	0 (0)	0 (0)	0 (0)
2003	3 (6)	0 (1)	0 (0)	0 (0)	0 (1)
2004	3 (6)	0 (1)	0 (0)	0 (0)	0 (1)

* Numbers in parentheses represent lakewide productivity data (regardless of PFP land protection).

2004 Productivity Summary (lakewide): Six territorial pairs occupied Kennebago Lake this season, including the pairs with territories abutting PFP-lands: Blanchard Cove, Lodge, and Upper Skedaddle. None of these three target territories supported a nesting pair of loons in 2004.

Comments: Kennebago Lake is a 1,700-acre (680 ha) water body located in western Maine (T3 R4 and T3 R3). Locked gates minimize human activity. Kennebago is a deep lake, reaching depths of 116 feet (35 m). With an abundant supply of natural and stocked fish, private access, and adequate nesting areas, it provides exceptional loon habitat. A dam owned and operated by Kennebago Hydro affects water levels on the lake, creating relatively minor (<6") fluctuations throughout the season. Six loon territories were observed on Kennebago Lake during the 2000, 2001, 2002, and 2003 breeding seasons, three of which bordered PFP-land: Blanchard Cove, Lodge, and Upper Skedaddle.

5A. Kennebago - Blanchard Cove

28% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - I
2001	1	1	1	1	0
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season. Nesting activity within the Blanchard Cove territory was not observed.

Comments: The Blanchard Cove territory is located at the southern end of Kennebago Lake within Davis Township. The territory's seclusion and associated island provide high quality breeding habitat.



5B. Kennebago – Lodge*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season. Nesting was not observed.

Comments: The Lodge territory is located on the western shore of Kennebago Lake, within Davis Township. The Lodge territory has a deep cove with average nesting opportunities. The area of the loon territory also supports steady fishing pressure that may hinder nesting success. Historical nesting status prior to 2000 is unknown. The entire shoreline in this territory consists of PFP-land, however the lack of a nesting island and scarcity of mainland nesting habitat lowers the quality of this territory.

5C. Kennebago - Upper Skedaddle*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	1	0	0	1 - UP
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season. We floated a raft in the isolated cove that contained the 2001 nest site. Nesting was not observed in the territory this season.

Comments: The Upper Skedaddle territory is located along the eastern shore of Kennebago Lake, within Davis Township. Quality nesting habitat exists along the shoreline that is wholly Pingree-land. This area has minimal human activity. Traditional nesting status prior to 2000 is unknown. Except for the lack of available islands, this appears to be a high quality breeding territory.

6. Mooselookmeguntic Lake – Lakewide Summary*MIDAS #3302**16,300 acres (6,520 ha)**Ground Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	1 (20)	1 (10)	0 (1)	0 (1)	1 (18)
2001	1 (21)	0 (14)	0 (4)	0 (0)	0 (10)
2002	1 (19)	1 (12)	1 (3)	1 (3)	0 (9)
2003	1 (19)	0 (10)	0 (7)	0 (2)	0 (10)
2004	1 (20)	0 (11)	0 (12)	0 (5)	0 (5)

* Numbers in parentheses represent lakewide productivity data (regardless of PFP land protection).



2004 Productivity Summary (Lakewide): Of the 20 recognized territories on Mooselookmeguntic Lake during the 2004 season, two are within PFP lands: Cupsuptic River and Cold Brook. Rafts were again floated in both territories this season. The banded male from the Cupsuptic River territory (2000, 2001, 2002) and an unbanded female, occupied both the Cold Brook territory and the Cupsuptic River territory again in 2004. The pair was frequently observed foraging within the Cupsuptic River territory early in the season and was more frequently observed in the traditional Cold Brook territory later in the season. Nesting was not observed in either traditional territory this season.

Comments: Mooselookmeguntic Lake is a large, 16,300-acre (6,520 ha) dam-controlled reservoir, located in the western portion of Maine (T4 R2 and T4 R1) (Figure 4). Its new license by the Federal Energy Regulatory Commission for FPL Energy Maine Hydro includes management guidelines that will improve loon-breeding habitat (see introduction to Richardson Lake for a more thorough explanation). It held 20 loon territories during the breeding season in 2000, 21 in 2001, and 19 in 2002 and 2003 (BRI, unpub. data). Two of these territories border PFP-land: Cupsuptic River and Cold Brook. Although a nearby public boat launch site and highly fluctuating water levels reduce successful loon production, we feel that education signs, the abundance of available nesting habitat, and active loon management (using rafts) mandated by FERC compensate for these stressors. Water quality was not found to be a limiting factor on Mooselookmeguntic Lake.

6A. Mooselookmeguntic - Cold Brook

34% territory protected

Year	TP	NP	CH	CS	NF
2000	0	0	0	0	0
2001	0	0	0	0	0
2002	1*	1	1	1	0
2003	1*	0	0	0	0
2004	1*	0	0	0	0

* The banded male from the Cupsuptic River territory (2000, 2001) and an unbanded female occupied both the Cupsuptic River territory and the Cold Brook territory.

2004 Productivity Summary: The banded male returned with an unbanded female in 2004. The pair occupied both traditional territories of Cold Brook and Cupsuptic River. The pair was frequently observed in both areas, but did not attempt to nest.

Comments: The Cold Brook territory is located along the northwest shore of Mooselookmeguntic Lake, within T4 R2. Although the territory has been unoccupied in recent surveys, previous surveys conducted for Central Maine Power Company reported a consistent territorial pair in the area (one of the individuals was banded). The territory has ample loon nesting habitat, and two camps lie on its northwestern shore. The territory encompasses an area that is quite shallow (one meter or less), thereby restricting boating activities. We feel that this is a fairly high quality loon territory due to its territory configuration, noted minimal human disturbance and historical nesting success.

6B. Mooselookmeguntic - Cupsuptic River

82% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - U
2001	1	1	0	0	U
2002	1*	0	0	0	0
2003	1*	0	0	0	0
2004	1*	0	0	0	0

* The banded male from the Cupsuptic River territory (2000, 2001) and an unbanded female occupied both the Cupsuptic River territory and the Cold Brook territory.

2004 Productivity Summary: (See Cold Brook 2004 Productivity Summary)



Comments: The Cupsuptic River territory is located in the northeast portion of Mooselookmeguntic Lake, within Lower Cupsuptic Township. This territory consists of exceptional loon habitat. Abundant coves and vegetation, little development, and minimal human activity provide for an ideal loon territory. Historical nesting has been documented on this territory; in two of the past seven years young were produced (BRI, unpubl. data). PFP land comprises 82% of the shoreline.

7. Richardson Lake – Lakewide Summary

MIDAS #3308

7,100 acres (2,840 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	7 (13)	7 (9)	3 (6)	1 (2)	5 (7)
2001	7 (16)	3 (7)	4 (4)	1 (1)	3 (10)
2002	7 (15)	6 (11)	7 (10)	3 (4)	5 (10)
2003	7 (14)	7 (11)	10 (11)	6 (6)	4 (9)
2004	7 (15)	6 (9)	3 (5)	1 (3)	4 (8)

Figures in parentheses represent lakewide productivity data (regardless of PFP land protection).

2004 Productivity Summary (Lakewide): Fourteen territorial pairs were present on Richardson Lake this season (BRI, unpubl. data), seven of which occupied PFP-protected lands. Six of the seven (86%) pairs on PFP-lands nested, hatching a total of three chicks, and incurring four nest failures. One of the three (33%) chicks fledged from PFP-protected territories in the 2004 season.

Comments: Richardson Lake is a large, 7,100-acre (2,840 ha) reservoir, occupying three different townships, (Richardstown, Magalloway PLT, and Township C). A total of 14 established loon territories, including seven abutting PFP lands, were monitored weekly for loon activity in 2003. Richardson Lake is dam-controlled, causing the water levels to fluctuate throughout the loon's breeding season. In general, water level fluctuations are known to severely affect Common Loon nesting success. Entities that own dams on lakes in Maine are under certain legal requirements by the Federal Energy Regulatory Commission (FERC) to mitigate impacts of their water management strategies. For the past six years, FPL Energy Maine Hydro and BRI have worked together to mitigate loon reproductive impacts on nearby reservoirs, including Aziscohos Lake and Flagstaff Lake. In 2003, Richardson and Mooselookmeguntic Lakes were under a similar FERC license that stipulates the need for using artificial rafts in an effort to reduce the loss of loon nests to water level fluctuations. Six rafts, each containing an avian guard, were floated within six of the seven PFP-protected territories in 2003. Four rafts were used lakewide, all within PFP lands. Territories containing PFP lands were responsible for hatching 91% (10/11) and fledging 60% (6/10) of the young on Richardson Lake in 2003. Even with regular drawdowns, clarity is adequate for loon foraging (i.e., >1.5m), and prey abundance does not appear to be limiting. The potential for human-related impacts on productivity is high on Richardson Lake given the boat launch at Mill Brook and the large number of campsites on the lake (The Pingree family and the State of Maine Bureau of Public Lands owns all of the campsites on Richardson Lake, which are managed by South Arm Campgrounds). The sheer size of the lake, however, buffers some of this impact. Predation and intra-specific pressures are considered to be the most limiting factors on Richardson.

7A. Richardson - Beaver Islands

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - D
2001	1	1	0	0	2 - Int, U
2002	1	0	0	0	0
2003	1	1	1	0	0
2004	1	1	0	0	1-U



2004 Productivity Summary: An unbanded pair occupied the territory this year. The pair nested on the raft, which was floated in the cove of the southern most island. The pair was observed incubating one egg for at least 23 days before the egg disappeared. The cause of nest failure is unknown; there were no signs of egg or eggshells.

Comments: The Beaver Islands territory is located in the northwest portion of Richardson Lake, within T4, R1. The entire shoreline consists of PFP-land. This territory supports high quality loon habitat, including four islands and two deep, secluded coves. Human activity is moderate in this area. Occasional boaters and campers frequent the area. The two largest islands have campsites and seasonal cabins. Traditional nesting and hatching success have been documented for six of the past eight years in this territory. Intra-specific intrusions are commonly seen in this territory and may be a considerable limitation on productivity.

7B. Richardson - Carry Cove

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - AP
2001	1	1	2	1	1 - UP
2002	1	1	2	1	2 -U
2003	1	1	2	2	1 - AB
2004	1	1	2	1	0

2004 Productivity Summary: The banded pair from 2002 returned to the territory this season. The pair nested on the raft and was successful in hatching two chicks. One of the chicks disappeared at approximately 4 weeks of age. The remaining chick survived to fledge from the lake.

Comments: Carry Cove is located in the southern portion of Richardson Lake, along the west shore. The entire shoreline consists of PFP land, which contains twelve camps, two of which are easily seen from the water. The territory provides high quality nesting habitat in each of the four small coves that comprise this territory. The area is moderately developed with minimal to no boating activity. Historical nesting activity has been documented in this territory.

7C. Richardson - Cranberry Cove

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	2	2	0	0
2001	1	0	0	0	0
2002	1	1	1	0	0
2003	1	1	2	0	1 - U
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory in 2004. The pair was consistently observed near the island at the entrance of the territory but did not attempt to nest.

Comments: Cranberry Cove is located along the west shore of the upper portion of Richardson Lake (T4 R1). The territory contains no campsites or houses. Cranberry Cove provides high quality nesting habitat for loons. The cove is a large, shrubby, isolated area, with little to no human activity. Large floating sphagnum-sedge bog mats across much of the cove provide high-quality nest sites protected from mammalian predators. Due to the shallowness of the cove's entrance, it is difficult to maneuver a boat into the nesting cove, which is fully dewatered by the end of a typical seasonal drawdown. The loons



traditionally nest within a remote area of the cove and have produced young in seven of the past eight years. The entire shoreline consists of PFP-land. An active Bald Eagle nest is located across the lake from Cranberry Cove.

7D. Richardson - Fish Brook

47% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - AP
2001	1	0	0	0	0
2002	1	1	0	0	1 - UP
2003	1	1	0	0	1 - U
2004	1	1	0	0	1-I

2004 Productivity Summary: An unbanded pair occupied the territory this year. The pair nested on a natural site located on the eastern side of the mouth of Fish Brook. The nest contained two eggs and failed due to an increase in water levels during late June-early July. The raft was again floated in Fish Brook and was not used.

Comments: The Fish Brook territory is located in the northwest portion of Richardson Lake, within T4 R1. It contains two camps and no campsites. Fish Brook has high quality loon breeding habitat, including abundant nesting sites, minimal human activity, and isolated nursery coves. Approximately 47% of the territory is abutted by PFP-land.

7E. Richardson - Halfmoon Cove

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	2 - MP
2001	1	1	2	1	0
2002	1	1	2	2	1 - U
2003	1	1	1	0	1 - AB
2004	1	1	1	0	0

2004 Productivity Summary: The banded pair from 2002 returned to the Halfmoon territory this season. The pair nested on the raft and successfully hatched the single egg in mid-July. The chick was never observed but eggshell fragments and an egg membrane were found at the nest site, indicating a successful hatch. The chick appeared to have hatched and quickly disappeared.

Comments: Halfmoon Cove is located in the middle portion of Richardson Lake, along the west shoreline (T4 R1). There are two campsites (owned by the Pingree family and managed by the South Arm campground) within the territory, but no camps. This territory is a series of four small coves, with adequate nesting habitat along much of the shoreline. The shoreline consists entirely of PFP land. Halfmoon Cove provides high quality nesting habitat for loons although predation pressure over the past few years appears to be significant. High use of the two campsites in the northern end of the territory may increase human disturbance and predation pressure on this pair.



7F. Richardson - Narrows*53% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	1	0	0	1-U
2003	1	1	2	2	0
2004	1	1	0	0	2 – UP,AB

2004 Productivity Summary: The banded pair from 2003 returned to the territory this season. The pair attempted two nests on the raft, both resulting in nest failure. One egg was laid during the first nest attempt and appeared to have been predated. Eggshells and egg contents were found in the nest. One egg was laid during the second nest attempt and was later found abandoned in the nest. The reason for abandonment is unknown.

Comments: The Narrows territory is located in the southern portion of the lake, found in T4 R1. The territory contains two camps and four campsites. The entire west shore is comprised of PFP-land. With the addition of a raft floated within the secluded cove along the west shore, the Narrows territory supports adequate nesting habitat. However, much of the territory is comprised of a narrow stretch that sustains heavy boating activity throughout the loon's breeding season.

7G. Richardson - Rocky Cove*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	1	1	1	0
2001	1	0	0	0	0
2002	1	1	2	0	0
2003	1	1	2	2	0
2004	1	1	0	0	1- UP

2004 Productivity Summary: A banded female (originally banded in the Beaver Island Territory in 1996) and an unbanded male occupied the territory this year. The pair nested on a raft, laying two eggs in early June. The nest attempt failed approximately two weeks into incubation. It appears the nest was predated. One whole egg and a large piece of eggshell from the second egg were found in several feet of water below the raft. It appears one egg was predated and the second egg knocked out of the nest. The pair did not attempt to reneest.

Comments: The Rocky Cove territory is located on the northwestern shoreline of Richardson Lake, within T4 R1. The territory contains no campsites or houses. The entire shoreline is PFP-land. This territory consists of one large, rocky cove, with very little human activity (because of the rocky substrate) and no development. Traditional nesting has been documented in this territory in four of the past seven years.



8. C Pond

MIDAS #3278,

100% territory protected

173 acres (69 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	1	1	1	0
2003	1	1	2	2	0
2004	1	0	0	0	0

2004 Productivity Summary: The banded male (2003) and an unbanded female occupied this territory for the season. No nesting attempts were observed. There were two intruder birds present for the entire season and water levels were extremely high during the nesting season, which could have prevented nesting.

Comments: C Pond is a 173-acre (69 ha) pond located in the C Township (T4 R1); it is entirely surrounded by PFP lands. The pond has an abundance of quality nesting habitat - from sandy beaches found throughout the pond to marshy hummock habitat at the west end. The eastern end has a rocky shoreline and is quite shallow. There are no islands. The gate on Mountain Brook, which is owned and operated by Seven Islands, restricts access. There are several camps on the pond; however it appears nesting habitat is minimally disturbed. For the last few years, there has been a pair of nesting Peregrine Falcons (*Falco peregrinus*) on C Bluff, the large rock face that overshadows the eastern end of the pond. We consider C Pond as providing high quality nesting habitat for loons, largely because of the lack of development and private access.

EAGLE LAKE REGION**Tier 1 Lakes****9. Caucomgomoc Lake – Lakewide Summary**

MIDAS # 4012

5,081 acres (2,007 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	2	2	1	0	1 -D
2001	2	0	0	0	0
2002	2	1	0	0	2 - AP
2003	2	1	0	0	1 - UP
2004	2	0	0	0	0

2004 Productivity Summary (Lakewide Summary): Both pairs (East and West) returned to their respective territories during the 2004 season, with neither pair attempting to nest. Both pairs occupied the territories throughout the season but no nesting was observed. A raft was floated in each territory this season and neither was used.

Comments: Caucomgomoc Lake, located in the southern portion of T7 R15 and T7 R14, containing two territorial pairs of loons. These pairs are designated as Caucomgomoc-East and Caucomgomoc-West. There is a campground in the West territory, which in the past has had substantial use. This lake is dam-controlled and the associated two-foot (<1m) drawdowns may limit nesting success. The Caucomgomoc Lake dam (currently owned and operated by Brascan) is currently under FERC review, which will likely influence water level management and loon productivity on the lake in the future. Potential predators on Caucomgomoc Lake are deemed high, with a pair of resident Bald Eagles, Herring Gulls and raccoons present.



9A. Caucomgomoc –East*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 -D
2001	1	0	0	0	0
2002	1	1	0	0	2- AP
2003	1	1	0	0	1 - UP
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the East territory this season. The pair was consistently occupied in the territory throughout the season but did not attempt to nest. Excellent nesting sites are available on the islands but heavy camping activity may deter nesting activities. A raft was floated in this territory for the season.

Comments: Water quality and nesting habitat in this territory appear to be suitable; island nest sites also limit mammalian predation.

9B. Caucomgomoc – West*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	1	1	0	0
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the West territory this season. The pair was consistently occupied in the territory throughout the season but did not attempt to nest. Excellent nesting sites are available on the islands but heavy camping activity may deter nesting activities. A raft was floated in this territory for the season.

Comments: Islands existing in the territory support adequate nesting locations, providing the water level remains constant. A popular campsite and public boat launch near the nest provides increased potential for human disturbance. Human disturbance was considered to be a potential limiting factor for nesting activities this season.

10. Chandler Pond*MIDAS # 2834**63% territory protected**125 acres (50ha)**Aerial Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	1	1	2	0	0
2001	1	0	0	0	0
2002	1	1	0	0	1-U
2003	-	-	-	-	-
2004	1	0	0	0	0

2004 Productivity Summary: A territorial pair occupied Chandler Pond in 2004. Two aerial surveys were conducted on 25 June and 22 September. A pair was observed for each survey and did not produce any chicks.



Comments: This is a narrow 125-acre (50 ha) pond located on the border of T7 R10 and T8 R10, with the northwest section of the pond abutting PFP land. It does not contain any nesting islands. Access to the pond is difficult and lacks a public boat launching facility.

11. Cliff Lake (not including Twin Lake) – Lakewide Summary

MIDAS# 2780

406 acres (162 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	2	0	0	0	0
2001	1	0	0	0	0
2002	2	2	1	1	1-U
2003	2	0	0	0	0
2004	2	2	0	0	2-UP

2004 Productivity Summary (Lakewide): Two unbanded territorial pairs occupied Cliff Lake in 2004. A pair occupied each traditional territory (North and South). Both pairs attempted to nest this season and failed but never renested. A raft was floated in the North territory for the first time this season and was not used.

Comments: Cliff Lake is a 406-acre (162 ha) lake located in T9 R12. It contained two territorial pairs of loons in 2003. A peninsula near the middle of the lake separates the two documented territories. With a maximum depth of 65 feet (19.6 m), Cliff Lake has the volume to support a large prey base for feeding loons. Development consists of two cabins, a frequented public boat launch, and a campsite at its southeastern tip. Cliff Lake does experience a fair amount of human activity through fishing, boating activities, and camping. Overall, Cliff Lake supports suitable habitat for Common Loons.

11A. Cliff-North

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	0	0	0	0	0
2002	1	1	1	1	0
2003	1	0	0	0	0
2004	1	1	0	0	1-UP

2004 productivity Summary: An unbanded territorial pair occupied Cliff Pond-North this season. The pair nested in early June, laying two eggs in a nest located on an island. The eggs disappeared in mid-June but there was no evidence of predation or human disturbance. The pair did not attempt a second nest.

Comments: Adequate nesting habitat exists among the islands and along the shoreline of this territory.



11B. Cliff- South*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	0	0	0	0	0
2002	1	1	0	0	1-U
2003	1	0	0	0	0
2004	1	1	0	0	1-UP

2004 Productivity Summary: An unbanded territorial pair occupied Cliff Pond-South this season. The pair nested in early July, laying one egg in a nest located on an island. The egg disappeared in early August and there was no evidence of predation or human disturbance. The pair did not attempt a second nest.

Comments: The South territory contains suitable habitat for breeding loons. Frequent use of the territories campsite and public boat launch could be a deterrent to loon nesting activities.

12. Daggett Pond*MIDAS# 4006**461 acres (184 ha)**Ground Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	0	-	-	-	-
2001	0	-	-	-	-
2002	0	-	-	-	-
2003	1	1	1	1	0
2004	1	1	0	0	1-UP

2004 Productivity Summary: An unbanded pair occupied Dagget Pond in 2004. Transitional pairs of loons were observed in 2001 and 2002, but this is the second year a pair established a territory. The pair nested on a natural hummock and laid two eggs during the first week of July. Both eggs disappeared in mid July and there was no evidence of predation or human disturbance. The pair did not attempt a second nest.

Comments: Daggett Pond is a 461-acre (184 ha) waterbody located in T7 R14. It contains suitable water depth, but avian predation is a potential limiting factor for loon productivity because of an active Bald Eagle nest nearby. Transitional loon pairs were observed in 2001 and 2002. Due the presence of a territorial pair and their overall reproductive success in 2003, Dagget Pond was moved from a tier 3 to a tier 1 lake.

13. Little Shallow*MIDAS# 2868**100% territory protected**308 acres (123 ha)**Ground Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	1	1	1	0
2003	1	1	0	0	1 - UP
2004	1	1	2	2	0



2004 Productivity Summary: An unbanded territorial pair occupied Little Shallow Pond this season. The pair nested in late June, laying two eggs in a nest located on the only existing island. The pair successfully hatched two chicks during the middle of July. Both of the chicks were observed on the last survey visit conducted on 26 August, and therefore presumably fledged from the lake (chick 4 weeks of age upon last survey visit).

Comments: Little Shallow is 308-acre (123 ha) lake located in the eastern section of T7 R14, and has limited public access. A small trail leading to its northern end is the most obvious access point and appears to be rarely used by people. A large nesting island and emergent vegetation along the shoreline provides ample suitable nesting/breeding habitat for Common Loons.

14. Loon Lake (attached to Big Hurd)

MIDAS #4024

37% territory protected

1,140 acres, (505 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 -D
2001	1	1	0	0	1 -D
2002	1	1	0	0	1- AP
2003	1	1	2	1	0
2004	1	0	0	0	0

2004 Productivity Summary: The banded pair (2003) returned and occupied this territory for the season. No nesting attempts were observed. There were three intruder birds present for the entire season and water levels were extremely high during the nesting season, which could have prevented nesting.

Comments: Loon Lake is located in T6 R15, between Big Hurd and Caucomgomoc Lake. Its southwest side borders PFP land. Public access and human development on Loon Lake are both limited. The lake does not contain a public boat launch. The Loon Lake dam was inoperative during the 2001 and 2002 seasons (the dam gates were welded open), resulting in a continuous drawdown throughout the season. This lake would provide high quality loon breeding habitat, but the fluctuations in water levels makes nest sites highly susceptible to predation and abandonment.

15. Lower Hudson

MIDAS# 1954

100% territory protected

108 acres (43 ha)

Aerial Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	1	0	0
2001	1	1	-	1	0
2002	1	1	1	1	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: A territorial pair occupied Lower Hudson Pond in 2003. Two aerial surveys were conducted on 25 June and 22 September. A pair was observed for each survey and did not produce any chicks.

Comments: Lower Hudson Pond is a 108-acre (43 ha) pond, located in the northern section of T10 R10. It does not have any islands, but adequate nesting habitat exists on the west end of the pond. Access is highly limited due to the absence of a public boat launch and the limited development (one primitive campsite and one hunting/fishing camp) on the pond.



16. Mile Pond

MIDAS# 2982

100% territory protected

66 acres, (26 ha)

Aerial Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	-	-	0	-
2001	1	-	-	0	-
2002	1	0	0	0	0
2003	1	1	-	1	-
2004	1	0	0	0	0

2004 Productivity Summary: A territorial pair occupied Mile Pond in 2004. Two aerial surveys were conducted on 25 June and 22 September. A pair was observed for each survey and did not produce any chicks.

Comments: This 66-acre (26 ha) pond is located in T8 R14. The pond is not accessible by roads and contains no human development. Due to the presence of a territorial pair in four consecutive years and a chick produced in 2003, we have moved Mile Pond from a tier 2 to a tier 1 lake.

17. Mooseleuk Lake – Lakewide Summary

MIDAS#1990

422 acres (169 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	2	1	0	0	1 – AP
2001	1	0	0	0	0
2002	2	0	0	0	0
2003	1	1	0	0	2 – U, AB
2004	2	2	3	0	0

2004 Productivity Summary: A pair occupied the west end of the lake this season. A second pair was present this year in the west end. Each pair nested once, both hatching chicks but no chicks fledged from the lake. A raft was floated in the East territory this season.

Comments: Mooseleuk Lake (422 acres, 169 ha) is located in T10 R9. Road access to this lake is one of the most difficult in the region; therefore public access and development are limited. Heavy rains can flood streams and make access extremely difficult. There is a North Maine Woods campsite and a single commercial sporting camp at the south end of the lake. Also, a previously existing log camp is currently being rebuilt on the commercial lease, which is near the North Maine Woods campsite.

17A. Mooseleuk-East

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1-AP
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	1	1	0	0	2 – U, AB
2004	1	1	2	0	0



2004 Productivity Summary: An unbanded pair occupied the traditional East territory this season. The pair built a natural nest among a marshy section of the territory and laid two eggs during the middle of June. The pair successfully hatched two chicks during the middle of July, but none survived to fledge. A raft was floated in this territory for this season and was not used.

Comments: The historical (2000) loon nest site was located on the eastern side of the only island on the lake. In 2003, the pair nested among the abundant mud hummocks, sheltered by emergent vegetation.

17B. Mooseleuk-West

100% territory protected

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	0	0	0	0	0
2002	1	0	0	0	0
2003	0	0	0	0	0
2004	1	1	1	0	0

2004 Productivity Summary: An unbanded pair occupied the traditional West territory this season. The pair built a natural nest among a marshy section of the territory and laid one egg during the middle of June. The pair successfully hatched one chick during the middle of July, but it did not survive to fledge.

Comments: The western shoreline of the territory, consisting of emergent vegetation and mud hummocks, provides suitable nesting habitat for loons. However, unlike the East territory, the West territory lacks a nesting island, which may limit loon productivity.

18. Munsungan Lake – Lakewide

MIDAS# 4180

1,414 acres (566 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	2	0	0	0	0
2001	2	1	0	0	1
2002	2	1	0	0	1-U
2003	2	1	1	0	0
2004	2	0	0	0	0

2004 Productivity Summary: Munsungan Lake contained two territorial pairs in 2004. An unbanded pair occupied the traditional Munsungan territory and did not attempt to nest. A second unbanded pair occupied the traditional Little Munsungan territory and did not attempt to nest. A raft was floated in each territory this season and neither was used.

Comments: Located in the northeast section of T8 R10, the majority of this 1,414-acre (566 ha) lake is bordered by PFP land; exceptions are the northern tip of Munsungan and the eastern section of Little Munsungan. It has no islands, two campsites (on the east/Little Munsungan end) and several boat launch sites. The size of this lake indicates that it is capable of sustaining two or three territorial pairs.



18A. Munsungan – Munsungan*100% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	1	0	0	1 – UP
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season and did not attempt to nest. A raft was floated in the territory this season.

Comments: The Munsungan territory was located at the northern end of Munsungan Lake. The northern section of this territory was outside PFP lands, however historical nest sites were reported on the southwestern side within PFP-lands. Munsungan Lake is one of the deepest in the region, reaching maximum water depths of 122 feet (37m). Fishing activity is frequent in the Chase Lake outlet for deepwater salmon and brook trout.

18B. Munsungan – Little Munsungan*38% territory protected*

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	1	0	0	1-U
2003	1	1	1	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season and did not attempt to nest. A raft was floated in the territory this season.

Comments: Suitable natural loon nesting habitat is limited in the Little Munsungan territory. The lack of islands and marshy hummocks exposes nests to avian and mammalian predation. The most suitable natural nesting habitat in this territory consists of a marshy cove located in the northwestern section of the territory.

19. Poland Ponds*MIDAS# 2994**490 acres (196 ha)**Ground Survey, Tier 1*

Year	TP	NP	CH	CS	NF
2000	0	-	-	-	-
2001	0	-	-	-	-
2002	0	-	-	-	-
2003	1	1	0	0	1 – UP
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season and did not attempt to nest.

Comments: Poland Pond is a 490-acre (196 ha) lake containing a single island. Poland Pond's extremely shallow water depth may be a limiting factor for breeding loons. Due to the presence of a nesting pair of loons in 2003, Poland Pond was changed from a tier 3 to a tier 1 lake.



20. Rowe Pond

MIDAS# 4002

100% territory protected

250 acres (100 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	0	0	1 - AP
2001	1	1	0	0	1 - D
2002	1	1	0	0	1 - D
2003	1	1	0	0	1 - AB
2004	1	1	0	0	1 - AP

2004 productivity Summary: An unbanded pair occupied Rowe Pond this season. The pair nested naturally on a small island during the end of May to the beginning of June. One egg was laid and was lost to avian predation. The pair did not attempt to renest. A raft was floated on Rowe Pond this season and was not used.

Comments: Rowe Pond is located on the northern end of Caucomgomoc Lake, in T7 R15. Attached to Caucomgomoc Lake by a narrow gap, Rowe Pond is affected by the Caucomgomoc dam. The Rowe Pond pair has access to suitable nesting habitat among the many islands and emergent vegetation along the shoreline. A single campsite exists on Rowe Pond. With the exception of significant water level drawdowns, Rowe Pond contains suitable nesting habitat for loons.

21. Second South Branch - Russell Pond

MIDAS# 2988

100% territory protected

66 acres (26 ha)

Aerial Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	0	0	0	0	0
2001	0	0	0	0	0
2002	1	1	1	1	0
2003	0	0	0	0	0
2004	1	0	0	0	0

2004 productivity Summary: A territorial pair occupied Russell Pond in 2004. Two aerial surveys were conducted on 25 June and 22 September. A pair was observed for each survey and did not produce any chicks.

Comments: Second South Branch, Russell Pond is a small, shallow lake in the Russell Pond complex, located in T8 R14 (others being Lower Russell, First South Branch Russell Pond, Middle Russell Pond, and Upper Russell Pond). It is a 66-acre (26 ha) pond, abutted by wetland habitat on roughly half of its shoreline. A newly established pair successfully produced one chick during the 2002 season. This lake was upgraded from a tier 3 to a tier 1 lake in 2002 and should remain a tier 1 for the 2004 season.



22. Shallow Lake

MIDAS# 2876

100% territory protected

1,110 acres (444 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	1	2	0	0
2001	1	0	0	0	0
2002	1	1	0	0	1
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded pair occupied the territory this season and did not attempt to nest.

Comments: Shallow Lake contains seemingly high quality nesting habitat for 1-2 territorial pairs. Difficult access substantially decreases the potential for human disturbances. There are many bog mats that are highly suitable for loon nesting/breeding.

23. Spider Lake

MIDAS# 2758

10% protected

890 acres (356 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	0	0	0	0	0
2001	1	1	2	1	0
2002	1	1	0	0	1-UP
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: One banded pair and two unbanded pairs occupied territories on Spider Lake in 2004. Only one of the pairs established a territory within conservation land. This pair did not attempt to nest.

Comments: Spider Lake is a deep lake, located in T9 R11. It contains adequate nesting habitat among its several islands and backwater areas. This large 890-acre (356 ha) lake contains an active campground and public boat launch, with several other hunting/fishing camps on shoreline locations. A nesting pair of Bald Eagles was observed on Spider Lake the past two seasons.



24. Twin Lake (attached to Cliff Lake)

MIDAS# 2780

157 acres (62 ha)

Ground Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	0	-	-	-	-
2001	-	-	-	-	-
2002	0	-	-	-	-
2003	1	1	0	0	1 – U
2004	0	0	0	0	0

2004 Productivity Summary: No loons occupied this territory this season.

Comments: Twin Lake is a 157-acre (62 ha) waterbody located in T9 R12, connected to Cliff Lake. Until the presence of a nesting loon pair in 2003, shallow water depths were thought to be a limiting factor for breeding loons. Twin Lake has been changed from a tier 4 to a tier 1 lake.

25. Upper Ellis

MIDAS# 2992

100% territory protected

163 acres (65 ha)

Aerial Survey, Tier 1

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	1	2	2	0
2002	1	1	1	0	0
2003	1	1	-	1	-
2004	1	1	-	1	-

2004 Productivity Summary: An unbanded territorial pair occupied Upper Ellis Pond in 2003. Monitoring consisted of two aerial surveys conducted on 25 June and 22 September. Upon the 22 September survey, the pair was observed with a chick. Due to aerial surveys we were unable to determine the number of nesting attempts or the total number of hatched chicks, only overall productivity.

Comments: Upper Ellis Pond is a 163-acre (65 ha) pond, located in T7 R14. It contains several islands, which support adequate loon nesting habitat. Public access is highly restricted due to the absence of a public boat ramp as well as the lack of a road/trail leading to the water.



Tier 2 Lakes**26. Big Hurd (attached to Loon Lake)**

MIDAS# 4014

100% territory protected

250 acres (100 ha)

Ground Survey, Tier 2

Year	TP	NP	CH	CS	NF
2000	0	0	0	0	0
2001	0	0	0	0	0
2002	1	0	0	0	0
2003	0	0	0	0	0
2004	1	1	0	0	2 – D, D

2004 Productivity Summary: An unbanded pair occupied the territory this season. The pair nested in the same place twice on an island. Both nests failed due to a decrease in water levels. The first nest had two, which were collected for Hg analysis, and second nest had one egg, which was collected for Hg analysis.

Comments: Big Hurd is a 250-acre (100 ha) pond located in T6 R15, attached to Loon Lake (MIDAS # 4024). It contains several small islands and abundant wetland habitat, which could be adequate for nesting. Water level fluctuations occur on Big Hurd because of the Loon Lake dam, and may limit productivity or interfere with the onset of loon nesting activity. The Loon Lake dam was inoperative during the 2001 and 2002 seasons (the dam gates were welded open), resulting in a continuous drawdown throughout the season. This territory was formerly a tier 3 lake and was upgraded to a tier 2 lake in 2002.

27. Lower Ellis

MIDAS# 2870

77 acres (31 ha)

Aerial Survey, Tier 2

Year	TP	NP	CH	CS	NF
2000	0	0	0	0	-
2001	0	0	0	0	-
2002	1	-	-	0	-
2003	1	-	-	0	-
2004	1	1	0	0	1 – UP

2004 Productivity Summary: An unbanded pair occupied Lower Ellis this season. The pair nested and laid two eggs in July but failed due to unknown predation. The pair did not attempt to re-nest.

Comments: Lower Ellis is a 77-acre (31 ha) lake located in T7 R14. The lake contains several islands, which support adequate loon nesting habitat. Lower Ellis' extremely shallow water depth maybe a limiting factor for loon productivity. This lake was upgraded from a tier 3 to a tier 2 due to the presence of a pair of loons in 2002.



28. Narrow Pond

MIDAS# 2976

100% territory protected

151 acres (60 ha)

Ground Survey, Tier 2

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	1	0	0	0	0
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded territorial pair occupied Narrow Pond in 2004. The pair did not attempt to nest this season.

Comments: This 151-acre (60 ha) pond is located northwest of Allagash Lake, in T8 R14. Narrow Pond is extremely shallow, reaching a maximum depth of only six feet (2 m). Minimal water depth and the narrow lake configuration are likely limiting factors of reproductive success for this territory. The mouth and backwaters of Narrow Pond provide fair nesting habitat, however, these areas are exposed to human disturbance.

29. Round Pond

MIDAS# 4004

100% territory protected

375 acres (150 ha)

Tier 1

Year	TP	NP	CH	CS	NF
2000	1	0	0	0	0
2001	1	0	0	0	0
2002	1	0	0	0	0
2003	-	-	-	-	-
2004	1	0	0	0	0

2004 Productivity Summary: An unbanded territorial pair occupied Round Pond in 2004. The pair did not attempt to nest this season.

Comments: Round Pond (375 acres, 150 ha), is located in T7 R14. It contains a single sporting camp, and two campsites. This pond does not contain a public boat ramp. Round Pond contains suitable nesting islands along its eastern side, and highly suitable habitat in the backwater areas, where the 2002 nest was located. Avian species known to predate loon nests (Herring Gulls and Common Ravens), as well as a pair of Bald Eagles were observed on the pond this season. Water quality on Round Pond does not appear to be a limiting factor in loon productivity in this territory. On 8 July, six adult loons were observed near the two campsites.

Tier 3 Lakes

Tier 3 lakes are those that were found to inconsistently or rarely support loon individuals. Although loons have been observed on these lakes, the individuals seen are not defending the waterbody as their territory and do not display territorial behaviors. There are three main reasons for the absence of loons on a lake: 1) inadequate depth can be an indication of lake volume and hence poor prey availability, 2) winter oxygen deficits can cause fish kills that deplete the prey base; 3) poor water clarity with turbidity values greater than 22 NTUs can severely impair foraging success (BRI, unpubl. data). Lastly, the lake or pond can be too small (<75 feet wide) to physically permit efficient access by loons (McIntyre 1988). The loons observed on these lakes



were likely either sub-adults of 3-7 years of age that do not defend defined territories (Evers et al. 2000b), or loons that were visiting satellite lakes to supplement their prey base (Piper et al. 1997).

30. Bear Pond

MIDAS# 4018

138 acres (55 ha)

Aerial Survey, Tier 3

Year	TP	Non-Br
2000	-	-
2001	1	2
2002	0	0
2003	0	0
2004	0	0

2004 Productivity Summary: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: Bear Pond is a 138-acre (55 ha) pond located in T6 R15 (west of Loon Lake), and is fed by a very small stream. Bear Pond does not contain public access or human development. Moderate amounts of marshy shoreline support adequate loon nesting habitat.

31. Clarkson Pond

MIDAS# 2854

35 acres (14 ha)

Aerial Survey, Tier 3

Year	TP	Non-Br
2000	0	0
2001	0	2
2002	0	0
2003	0	0
2004	0	0

2004 Productivity Summary: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: Clarkson Pond is a 35-acre (14 ha) pond located in T9 R13. This small waterbody does not contain any islands. It has moderate water depth, and does not contain a public boat ramp. Clarkson Pond is likely too small to support breeding Common Loons.

32. Echo Lake

MIDAS# 2766

115 acres (46 ha)

Aerial Survey, Tier 3

Year	TP	Non-Br
2000	0	0
2001	-	-
2002	0	1
2003	-	-
2004	0	0

2004 Productivity Summary: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.



Comments: Echo Pond was added to surveys late in the 2000 season. It is a 115-acre (46 ha) pond located in T9 R11, and can be accessed through Libby's fishing camp. The pond has no islands and has similar habitat to other nearby lakes such as Chandler and Narrow. Echo is rumored to have been unproductive in the past, which is likely due to the fact that it is too shallow to maintain a suitable prey base for loons.

33. First South Branch - Russell Pond

MIDAS# 2978

40 acres (16 ha)

Aerial Survey, Tier 3

Year	TP	Non-Br
2000	0	0
2001	-	-
2002	0	0
2003	0	2
2004	0	1

2004 Productivity Summary: One loon was observed during two aerial surveys conducted on 25 June and 22 September.

Comments: First South Branch (Russell Pond) is a small, shallow lake in the Russell Pond complex, located in T8 R14 (others being Lower Russell, Second South Branch Russell, Middle Russell, and Upper Russell). It is 40 acres (16 ha) and is abutted by wetland habitat on roughly half of its shoreline. Individuals seen on this pond are likely to be frequenting other ponds in the area. Water depth is seen as the most limiting factor for supporting breeding loons activity. First South Branch was moved from a tier 4 to a tier 3 lake due to the presence of two loons observed in 2003.

34. Ross Lake (Chemquasabanticook)

MIDAS# 1888

2,892 acres (1156 ha)

Aerial Survey, Tier 3

Year	TP	Non-Br
2000	0	1
2001	-	-
2002	0	6
2003	2	0
2004	2	0

2004 Productivity Summary: Four adult loons were observed during an aerial survey conducted on 25 June and 22 September. The loons appeared to be two distinctive pairs, a pair occupying each end of the lake.

Comments: Ross Lake is a 2892-acre (1156 ha) lake (also called Chemquasabanticook) located in T10 R15 and T9 R15. There are no islands on the lake. Based on its size, we would estimate that Ross Lake is large enough to support at least four territorial pairs.



35. Soper Pond

MIDAS# 2782

246 acres (98 ha)

Ground Survey, Tier 3

Year	TP	Non-Br
2000	0	0
2001	0	2
2002	0	0
2003	0	1
2004	0	0

2004 Productivity Summary: No loons were observed on Soper Pond this season.

Comments: Soper Pond is a 246-acre (98 ha) pond located in the Soper Mountain Township, adjacent to Cliff Lake. It has two small islands and a public boat launch that is trailer accessible.

Tier 4 Lakes**36. Grass Pond**

MIDAS# 2778

50 acres (20 ha)

Aerial Survey, Tier 4

2000: No loons were found on Grass during the single aerial survey on 18 August.

2001: Grass Pond was not surveyed in 2001.

2002: No loons were observed during an aerial survey conducted on 16 August.

2003: No loons were observed during two aerial surveys conducted on 22 June and 19 August.

2004: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: Grass Pond is a 50-acre (20 ha) pond located in T9 R12. Access by road is difficult, and mostly contains marginal shallow and marshy habitat for loons.

37. Leadbetter Pond

MIDAS# 2764

98 acres (39 ha)

Ground Survey, Tier 4

2000: No loons were found during any of six ground surveys in 2000.

2001: Leadbetter Pond was not surveyed in 2001.

2002: No loons were observed during an aerial survey conducted on 16 August. Two Canada Geese and three Black Ducks were observed on the pond.

2003: No loons were observed during two ground surveys conducted on 15 May and 26 May.

2004: No loons were observed during two ground surveys conducted on 17 June and 17 July.

Comments: Leadbetter Pond is an extremely shallow, 98-acre (39 ha) pond located in T9 R11. It is likely that is too shallow to maintain a suitable prey base for Common Loons.



38. Lower LaPomkeag*MIDAS# 3010**91 acres (36 ha)**Aerial Survey, Tier 4*

2000: No loons were found during the single late survey on 24 August.

2001: Lower LaPomkeag was not surveyed in 2001.

2002: No loons were observed during an aerial survey conducted on 16 August.

2003: Lower LaPomkeag was not surveyed in 2003.

2004: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: Lower LaPomkeag is a shallow 91-acre pond located in T8 R7. It is likely that it is too shallow to maintain a suitable prey base for Common Loons.

39. Mountain Pond*MIDAS # 1956**70 acres (28 ha)**Aerial Survey, Tier 4*

2000: No loons were observed on the single aerial survey conducted during the 2000 season (18 August).

2001: No loons were observed on Mountain Pond during two aerial surveys (30 May and 20 June) in the 2001 season.

2002: Mountain Pond was not surveyed in the 2002 season.

2003: No loons were observed during two aerial surveys conducted on 22 June and 19 August.

2004: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: Mountain Pond is a 70-acre (28 ha) lake located in T10, R10. It contains a small island and some marshy habitat that could be adequate for loon nesting activity. Mountain Pond could be a possible satellite lake for Lower Hudson.

40. McPherson Pond*MIDAS # 1992**77 acres (31 ha)**Aerial Survey, Tier 4*

2000: No loons were observed on McPherson Pond in the single aerial survey conducted in 2000 (18 August).

2001: No loons were observed on McPherson Pond in either of two aerial surveys (30 May and 20 June) in 2001.

2002: McPherson Pond was not surveyed in the 2002 season.

2003: No loons observed during two aerial surveys conducted on 22 June and 19 August.

2004: Loons were not observed during two aerial surveys conducted on 25 June and 22 September.

Comments: McPherson Pond is a 77-acre (31 ha) waterbody located in T10, R10. McPherson could be a possible satellite lake for Lower Hudson.



Productivity Summary

We surveyed a total of 44 of the 44 lakes bordered by PFP lands, in both the Rangeley Lakes (all eight of the potential lakes were surveyed) and Eagle Lake (all 36 of the potential lakes were surveyed). Regions in the 2004 season (Table 1)⁴. Based on our 2000-2004 survey efforts, it appears that 75% (33/44) of the PFP-bordered lakes contained loon pairs (Appendix 1). In 2004, of the 44 lakes surveyed, we found 43 territorial loon pairs on 33 lakes. Of the 43 territorial pairs monitored, 18 attempted nesting at least once and produced 10 chicks. Five chicks survived to at least seven weeks of age, yielding a 50% chick survival rate for the two areas combined.

The 2000-04 surveys indicate that all eight lakes in the Rangeley Lakes Region contained established territorial loon pairs (100%), while 26 of the 36 (72%) ponds in the Eagle Lake Region currently contain territorial pairs. Many of the remaining 10 lakes without loon pairs were considered to have poor habitat quality because of their size (four were under 60 acres) or depths (six were considered too shallow to maintain a suitable prey base).

⁴ Several Tier 4 Lakes in the Eagle Lake Region will be surveyed every other year as outlined in the Methods - Lake & Survey Classification System section. Two tier 1, one tier 3, and 1 tier 4 lakes were not surveyed in 2003.



Table 1. Summary of overall reproductive success¹ for Eagle Lake and Rangeley Lakes Regions, 2000-2004.

Region	# lakes surveyed	# lakes with loon pairs	TP	NP	SNP	CH	CS	NP/TP	⁵ SNP/NP	CH/NP	CS/NP	CS/TP	CS/CH
Rangeley 2000	8	8	17	11	4	6	4	65%	36%	0.54	0.36	0.23	67%
Rangeley 2001*	8	8	17	10	7	9	3	59%	70%	0.90	0.30	0.18	33%
Rangeley 2002	8	8	17	10	8	11	5	59%	80%	1.1	0.50	0.29	45%
Rangeley 2003	8	8	17	11	8	14	8	65%	73%	1.3	0.73	0.47	57%
Rangeley 2004	8	8	17	8	3	4	2	47%	38%	0.5	0.25	0.12	50%
Rangeley 00-04	40 lake-years	40 lake-years	85	50	30	44	22	59%	60%	0.88	0.44	0.26	50%
Eagle 2000	29	14	18	8	4	7	0	44%	50%	0.88	0.00	0.00	0%
Eagle 2001	24	16	18	6	3	5	4	33%	50%	0.83	0.66	0.22	80%
Eagle 2002	30	18	22	13	5	5	4	59%	38%	0.38	0.31	0.18	80%
Eagle 2003	28	19	23	11	5	6	4	48%	45%	0.55	0.36	0.17	67%
Eagle 2004	36	25	26	10	4	6	3	39%	40%	0.6	0.3	0.12	50%
Eagle 00-04	147 lake-years	92 lake-years	107	48	21	29	15	45%	44%	0.6	0.31	0.14	52%

* PFP land was determined not to abut Pond-in-the-River after the final numbers were tallied in 2000. Subsequently, the number of lakes surveyed, the number of lakes with loon pairs, TP, NP/TP, and CS/TP now reflect this change in Table 1 and 2.

¹ Nesting frequency=NP/TP; Percent Nesting Success=SNP/NP; Hatching success=CH/NP; Chick survival per nesting pair=CS/NP and per territorial pair (overall productivity)=CS/TP; Chick survival=CS/CH. Individual territory productivity details are given in Appendix 1 (for tier 1 & 2 lakes only)

Rangeley Lakes Region: 2004

Most of the productivity parameters (NP, CH, CS) in the 2004 season decreased slightly in the Rangeley Lakes Region vs. those found in 2000, 2001, 2002, and 2003 (Table 1). Of the 8 lakes surveyed this season, all contained loon pairs, totaling 17 territorial and 8 nesting pairs. The 4 chicks hatched and 2 surviving to > 7 weeks of age, was a significant decrease from all of the previous seasons. The nesting frequency in 2004 (NP/TP) decreased by 18% (47%) from 2003 and equaled the lowest level observed during the 5-year monitoring period. All five individual years, as well as the 5-year mean (47%) for nesting frequency, tend to be lower than the NH statewide comparison of 68% +/-6% (Taylor and Vogel 2000) and the VT comparison of 70% +/-9% (Hanson et. al 2001) (Table 2). Percent nesting success (SNP/NP) in 2004 (38%) decreased from levels reported in levels reported in all years except 2000 (36%), and is significantly lower the 5-year average of 52%. The 2004 percent nesting success (38%) is lower the NH statewide average of 65% (+/- 21%) and lower than the VT comparison of 74% (+/- 10%). The number of chicks hatched per nesting pair (CH/NP) has also decreased from 0.54 reported in 2000, 0.90 in 2001, to 1.1 in 2002, to 1.3 in 2003, to 0.5 in 2004. Hatching success in 2004 (0.5) is lower than the Rangeley Lake Region 5-year average (0.88) and is lower than the NH and VT comparisons (NH = 0.99 +/-0.13; VT = 1.2 +/- 0.2). The majority of measures related to chick survival (CS/NP and CS/TP) in the Rangeley Lakes Region decreased to study-long lows in 2004.

⁵ Percent nesting success for the Eagle Lake Region in 2000 has been changed from 63% (as presented in Evers et. al 2000a) to 50% in Table 1 due to findings that Caucomgomoc East did not hatch a chick but failed in 2000. Thus, SNPs for 2000 in the Eagle Lake Region = 4.



CS/NP in 2004 was 0.25, and is significantly lower than the 5-year mean (0.44). However, CS/NP in 2004 is lower than NH and VT comparisons of 0.76 ± 0.11 and 1.01 ± 0.18 , respectively. Overall productivity (CS/TP) in 2004 (0.12) decreased dramatically from each of the four previous seasons and is significantly lower than the 5-year average (0.26). In comparison to the NH and VT statewide averages (0.52 ± 0.09 and 0.84 ± 0.16), productivity in the Rangeley Lakes Region was lower in 2004. Chick survival in 2004 (50%) increased from 33% in 2001, 45% in 2002, but was lower than the 67% and 57% reported in 2000 and 2003, respectively. Chick survival in 2004 is the same as the 5-year average (50%) but is significantly lower than the NH and VT statewide means for chick survival ($77 \pm 6\%$; $85 \pm 5\%$), respectively.



Table 2. Summary of overall reproductive success for yearly combined PFP Regions, with long-term NH and VT population mean comparisons*.

Region	# of lakes surveyed	# of lakes with loon pairs	TP	NP	SNP	CH	CS	NP/TP	SNP/NP	CH/NP	CS/NP	CS/TP	CS/CH
Total 2000	37	22	35	19	8	13	4	54%	42%	0.68	0.21	0.11	31%
Total 2001	32	24	35	16	10	14	7	46%	63%	0.88	0.44	0.20	50%
Total 2002	38	26	39	23	13	16	9	59%	57%	0.70	0.39	0.23	56%
Total 2003	36	27	40	22	13	20	12	55%	59%	0.91	0.55	0.30	60%
Total 2004	44	33	43	18	7	10	5	42%	39%	0.56	0.28	0.12	50%
Total 2000-2004	187	132	192	98	51	73	37	51%	52%	0.75	0.38	0.19	51%
NH⁶ 1976-2000	44-135	n/a	3,650	327 7	1604	244 0	1847	68 +/-6%	65 +/- 21%	0.99 +/-	0.76 +/-	0.52 +/-	77 +/-
VT 1981-2000	n/a	7-36	428	305	234	374	315	70 +/- 9%	74 +/- 10%	1.2 +/-	1.01 +/-	0.84 +/-	85 +/- 5%

* Nesting frequency=NP/TP; Percent Nesting Success=SNP/NP; Hatching success=CH/NP; Chick survival per nesting pair=CS/NP and per territorial pair (overall productivity)=CS/TP; Chick survival=CS/CH. Individual territory productivity details are given in Appendix 1 (for tier 1 & 2 lakes only).

Eagle Lake Region: 2004

Thirty-six of the 36 target lakes were surveyed in 2004⁷. The 2000-2004 findings indicate that 62% (92/147) of PFP lakes in the Eagle Lake region contained territorial loon pairs. Twenty-five of the 36 lakes surveyed in 2004 (69%) contained territorial loon pairs, totaling 26 territorial and 10 nesting pairs in the region. The total number of territorial pairs found in the Eagle Lake region increased, from 18 found in both the 2000 and 2001, 22 in 2002, to 23 in 2003, and 26 pairs observed in 2004. This increase reflects our better understanding of certain lakes' dynamics. During the initial two years of observations, a few of the lakes within the Eagle Lake Region supported non-breeding loons, which were consistently observed during surveys. These non-breeding loons have established themselves as territorial pairs. Six chicks hatched in the region, three of which survived to fledge (> 7 weeks of age). The nesting frequency in 2004 (39%) was lower than all years except 2001 (33%). The 2004 nesting frequency is slightly lower than the 5-year average (45%). All five individual years are lower than the NH statewide comparison of 68 +/-6% (Taylor and Vogel 2000) and the VT comparison of 70 +/-9% (Table 2). Percent nesting success (SNP/NP) in 2004 (40%) increased from 2002 (38%) and was slightly lower than percentage reported during the 2000, 2001(50%), and 2003 (45%) seasons. Nesting success in 2004 matched the 5-year average (0.6). The NH statewide average for percent nesting success is higher, but quite variable (65% +/-21%), while the VT statewide average is 74 +/-10%. The number of chicks hatched per nesting pair (0.6) increased from 2002 (0.38) and 2003 (0.55) but was significantly lower

⁶ In order to include standard deviations, calculations for data columns 8-13 for NH (Taylor and Vogel 2000) and VT (Hanson et. al. 2001) rows are performed on original data not presented in Table 1. Thus, calculations from data in columns 3-7 will result in slightly different figures than those presented in columns 8-13. VT sample sizes: TP, NP, SNP, CH, CS, CH/NP, CS/TP, CS/CH (n=17 years); NP/TP, SNP/NP, CS/NP (n=21 years). NH sample sizes: n=25 years for all parameters. Data in 2000-02 summary rows and NH & VT comparison rows represent territory-years.

⁷ Several Tier 4 Lakes in the Eagle Lake Region will be surveyed every other year as outlined in the Methods - Lake & Survey Classification System section. Two tier 1, one tier 3, and 1 tier 4 lakes were not surveyed in 2003.



than the levels reported in 2000 and 2001 (0.88), (0.83); all five of these levels are lower than the statewide averages for NH (0.99 +/- 0.13) and VT (1.2 +/- 0.2). Productivity parameters related to chick survival (CS/NP and CS/TP) in 2004 decreased slightly from 2003 parameters. Chicks surviving per nesting pair decreased from 0.31 in 2002 to 0.36 in 2003 and is lower than the 5-year average (0.31). Overall productivity (CS/TP) continued to decrease since the first year of monitoring in 2000. Both of these measures are lower than comparison figures for the NH (0.76 +/- 0.11 CS/NP; 0.52 +/- 0.09 CS/TP) and the VT populations (1.01 +/- 0.18 CS/NP; 0.84 +/- 0.16 CS/TP). Percent chick survival (50%) decreased from each of the previous three seasons (80% in 2002 and 2001 and 67% in 2003). The chick survival rate observed in 2004 is lower than the 5-year average (52%) and is lower than the NH average (77% +/- 6%) and lower than the VT average (85 +/- 5%).

PFP Regional Comparisons

The Eagle Lakes Region produced 60% (6/10) of all chicks hatched in both regions combined, and 60% (3/5) of all chicks fledged from PFP lands in 2004 (Table 1). The Rangeley Lake Region, therefore, produced 40% (4/10) of the total number of chicks hatched, and 40% (2/5) of the chicks fledged from PFP lands in both regions.

A comparison of the two areas indicates that all of the mean (2000-04) reproductive parameters, except chick survival, are higher in the Rangeley Lakes Region than in the Eagle Lake Region. All reproductive parameters, except nesting frequency, observed in 2004 are also higher in the Eagle Lake Region. All reproductive parameters, with the exception chick survival, have shown annual decreases since monitoring began in 2000. In comparison, most reproductive parameters (SNP/NP, CS/TP, and CS/CH) in the Rangeley Lake Region have increased following the 2000 season, except 2004. Nesting frequency in the Rangeley Lakes Region increased from 59% observed in 2001 and 2002, to 65% in 2003 and matched the frequency in 2000, and in 2004 was at an all time low (47%). Nesting frequency in the Eagle Lake Region in 2004 (39%) was lower than frequencies observed in 2000 (44%), 2003 (48%), and 2002 (59%), but increased from 2001 (33%). While nesting frequency (NP/TP) and percent nesting success (SNP/NP) in the Rangeley Lakes Region were 47% and 38%, respectively, Eagle Lake Region figures were 39% and 40%. Percent nesting success in the Rangeley Lakes Region decreased from 2001-03, but is slightly higher than levels reported in 2000. The percent nesting success in 2004 (38%) is significantly lower than the 5-year mean of 60%. In comparison, the percent nesting success in the Eagle Lake Region in 2004 (40%) is lower than percentages observed in 2000 and 2001 (50%) and increased slightly from 2002 (38%). The nesting frequency (45%) and nesting success (44%) is similar to the 5-year means of 47% and 45%, respectively. Five-year means for nesting frequency and percent nesting success was higher in the Rangeley Lakes Region than in the Eagle Lake Region (NP/TP = 59% vs. 45%) and (SNP/NP = 60% vs. 44%). Measures of chicks hatched per nesting pair (CH/NP) and chicks surviving per territorial pair (CS/TP) were considerably higher in the Rangeley Lakes Region than in the Eagle Lake Region in 2004. CH/NP has decreased for the first time in four years within the Rangeley Lakes Region (0.54 in 2000, 0.90 in 2001, 1.1 in 2002, 1.3 in 2003, and 0.5 in 2004), while unstable within the Eagle Lake Region (0.88 in 2000, 0.83 in 2001, 0.38 in 2002, 0.55 in 2003 and 0.5 in 2004). CH/NP in 2004 is lower than the 5-year mean for the Rangeley Lakes Region (0.5 vs. 0.88), and is stable in the Eagle Lake Region (0.6 vs. 0.6). Levels of CS/NP and CS/TP within the Rangeley Lakes Region were lower in 2004, than the levels reported during the previous four seasons. Percent chick survival in 2004 (50%) was higher than the levels found in the 2001 (33%), and 2002 (45%) seasons and lower than the levels reported in 2000 (67%) and 2003 (57%). In comparison, CS/NP slightly decreased within the Eagle Lake Region in 2004 while CS/TP continued to decrease since 2001. Besides the 0% chick survival reported in 2000, CS/TP in 2003 decreased significantly from 80% reported in 2001 and 2002. Five-year means for CS/NP and CS/TP were higher in the Rangeley Lakes Region than in the Eagle Lake Region (0.44 vs. 0.31) and (0.26 vs. 0.14). The 2004 percent chick survival (CS/CH) for the Eagle Lake Region was 50%, while the Rangeley Lakes Region has the same survival rate of 50%. The five-year mean shows a slightly higher chick survival rate within the Eagle Lake Region (52%), than in the Rangeley Lakes Region (50%). However, both regions remain significantly lower than comparison populations in NH (77 +/- 6%) and VT (85 +/- 5%) (Table 2). Seasonal fluctuations in many productivity parameters emphasize the need for multiple-year analysis in order to obtain representative productivity means in both regions.

Summary of nest failures

The 8 pairs that nested in the Rangeley Lakes Region in 2004 attempted to nest a total of 9 times (there was one re-nest attempt). Six of these 9 attempts (67%) resulted in nest failure (Table 3). The leading cause of nest failures within the Rangeley Lakes Region was reported as unknown predation (50%). One nest failure (17%) was reported as undetermined cause of nest failure and one nest attempt (17%) resulted in failure from abandonment due to unknown causes.

The ten pairs that nested in the Eagle Lake Region attempted to nest a total of eleven times (one re-nest attempt). There were seven nest failures in 2004, three (43%) of which were documented as predation from an unknown source. Two nest



failures (29%) were caused by a decrease in water levels, while the remaining failures (1) were caused by avian predation (14%).

The total number of nest failures for the Rangeley Lakes Region in 2004 (6) decreased from most of the previous three years: 2003, (6), 2002, (7), 2001 (6) and 2000 (11). Nest failures within the Eagle Lake Region in 2004 (7) stayed the same as 2003 (7) and, decreased slightly from 2002 (9) and were higher than levels reported in 2001 (3) and 2000 (4). The fluctuations in the number of nest failures within the Eagle Lake Region from 2000-2004 appears to be directly related to the number of nesting attempts; 8 found in 2000, 6 found in 2001, 15 found in 2002, 12 found in 2003, and 11 reported in 2004. Fifty percent of the attempted nests failed during the 2000 and 2001 seasons, 68% in 2002, 58% in 2003, and 65% in 2004. One of the nest failures (17%) in the Rangeley Lakes Region was documented as abandonment from an unknown cause. We speculate that this one nest failure may have been caused from high densities of black flies. Nest abandonment among incubating Common Loons, due to the swarming behavior of black flies has been documented in the Great Lakes Region (BRI unpubl. data). One nest failure was attributed to water level fluctuations in the Rangeley Lakes Region in 2004, reflecting an increase in the implementation of rafts and subsequent use by nesting loons. Eight rafts in nine loon territories abutting PFP lands (on Richardson and Mooselookmeguntic Lake) were floated in 2004 within the Rangeley Lakes Region. The purpose by FPL Energy Maine Hydro is to decrease the impacts of water level fluctuations on loon productivity. Five of these rafts were used, producing 30% of the hatched and 20% of the fledged young in the Rangeley Lakes Region. Egg predation continues to be the most common cause of nest failure in the Eagle Lake Region. While documented water level fluctuations were responsible only 29% of all failures in 2004, lowering water levels regularly place loon nests at greater danger to predation. As more nesting loons in the Eagle Lake Region begin to use rafts we expect the number of nest failures to decrease.



Table 3. Summary of causes for nest failures within the Eagle Lake Region and Rangeley Lakes Regions, 2000-2004.*

Region	# NFs	Nest Failure Cause								
		AB	MP	AP	UP	HD	I	D	U	Int
Rangeley 2000	11		3 (27%)	2 (18%)	1 (9%)	1 (9%)	1 (9%)	1 (9%)	2 (18%)	
Rangeley 2001	6**		1 (17%)	1 (17%)	2 (33%)				1 (17%)	1 (17%)
Rangeley 2002	7	3 (43%)			1 (14%)		1 (14%)		2 (29%)	
Rangeley 2003	6	3 (50%)			1 (17%)				2 (33%)	
Rangeley 2004	6	1 (17%)			3 (50%)		1 (17%)		1 (17%)	
Eagle 2000	4			1 (25%)				3 (75%)		
Eagle 2001	3				1 (33%)			2 (66%)		
Eagle 2002	9			3 (33%)	5 (56%)			1 (11%)		
Eagle 2003	7	1 (14%)			3 (43%)			1 (14%)	2 (29%)	
Eagle 2004	7			1 (14%)	4 (57%)			2 (29%)		

* AB = abandonment from an unknown cause, MP = mammal predation, AP = avian predation, UP = unknown predation, HD = human disturbance, I = water level increase, D = water level decrease, U = unknown, Int = intra-specific intrusions.

** The total number of nest failures within the Rangeley Lakes Region in 2001 was corrected from 7 to 6, subsequently causing the percentages of nest failures to change.

Summary of overall project findings (2000-2004)

The past five seasons (2000-2004) represent 192 loon territory-years for both regions combined (35 in 2000, 35 in 2001, 39 in 2002, 43 in 2003) (Table 2). During this period, 98 of the 192 territorial pair-years nested (Table 2). Fifty-one pairs were successful, hatching a total of 73 young, 37 of which survived. The average nesting frequency (NP/TP) for the combined regions during 2000-2004 was 51% (39% in the Eagle Lake Region and 47% in the Rangeley Lakes Region). Nesting frequencies in the Eagle Lake Region are significantly lower than the NH and VT population comparisons (NH=68+/-6%; VT=70% +/-9%) while nesting frequencies in the Rangeley Lakes Region are slightly lower than NH and VT comparisons (Table 2). Percent nesting success for the regions combined in the 2000-2004 seasons was 51%, noticeably lower than the NH average (65+/-21%) and the VT average (74+/-10). The number of chicks hatched per nesting pair for the regions combined was 0.75, in comparison to NH's 0.99+/-0.13 and VT's 1.2+/-0.2. The number of chicks surviving per nesting pair was 0.38 for the regions combined. This figure represents averaged values of 2000 (0.21), 2001 (0.44), 2002 (0.39), 2003 (0.55), and



2004 (0.28). All measures of CS/NP are less than NH (0.76 ± 0.11) and VT (1.01 ± 0.18) averages. Overall productivity (CS/TP) was 0.19 for the combined regions (0.11 in 2000; 0.20 in 2001; 0.23 in 2002; 0.30 in 2003; 0.12 in 2004), substantially lower than both the NH (0.52 ± 0.09) and VT (0.84 ± 0.16) long-term population averages. Chick survival for the combined regions was 51%, also much lower than the NH ($77 \pm 6\%$) and VT ($85 \pm 5\%$) averages.

The approximately 101 miles (162 km, or 531,754 feet) protected within territorial pair-containing conservation areas from both regions, have produced 37 loon chicks in five seasons. This represents one loon chick per 3.7 miles (5.1 km) of protected shoreline.



Discussion

We conducted productivity surveys on a total of 44 of the 44 lakes containing PFP-protected lands in the Rangeley Lakes and Eagle Lake Regions in 2004. While 2000 surveys provided a benchmark for loon occupancy and productivity on those lakes, follow-up surveys during the past four seasons achieved a better estimate of the mean regional productivity and primary limitations for each identified loon territory. The five years of data are providing an improving framework from which we can evaluate habitat quality.

2004 Findings: Productivity and Nest Failures

We found 43 territorial loon pairs on 44 lakes from the 44 survey lakes containing PFP lands (91%). Twenty nesting attempts produced 10-hatched young, 5 of which survived to fledge (> 7 weeks of age). Most productivity parameters decreased significantly during the 2004 season, when compared with the 2000, 2001, 2002, and 2003 findings in the Rangeley Lakes Region. In comparison, we found most productivity parameters to fluctuate within the Eagle Lake Region. A study-wide high of territorial loon pairs (26) was observed in the Eagle Lake Region in 2004. However, overall productivity (CS/TP) and chick survival (CS/CH) rates declined from the previous three seasons in the region. All productivity parameters in 2004 increased from 2000 levels, because of no chicks fledging in the Eagle Lake Region in 2000. Occupancy of target lakes/territories remained relatively constant in the Rangeley Lakes [8 lakes/(17 territories)] while an increase was observed in the Eagle Lake Region [36 lakes (36 territories)]. Ten lakes in the Eagle Lake Region did not contain loons. The increase in the number of territorial pairs in the Eagle Lake Region is the result of three water bodies containing territorial loon pairs for the first time in 2004 (Dagget, Poland Ponds, and Twin Lake). The Rangeley Lakes Region was responsible for hatching 40% and fledging 40% of the young this season. The Eagle Lake Region, therefore, was responsible for hatching 60% and fledging 60% of the young produced from PFP lands.

Analysis of nest failures within the two regions indicates a greater total number of nest failures in the Rangeley Lakes Region in comparison to the Eagle Lake Region (36 vs. 30, 2000-2004). Fifty-seven percent (36 nest failures/63 nesting attempts, 2000-2004) of the attempted nests in the Rangeley Lakes Region failed, as well as 58% (30 nest failures/52 nesting attempts, 2000-2003) of nesting attempts in the Eagle Lake Region. Causes of nest failure are more widely distributed across categories in the Rangeley Lakes Region, however the majority of failures are due to predation (42% of all nest failures in 2000-2004 were due to predation⁸) (Table 2). Sixty percent (18/30) of the nest failures in the Eagle Lake Region (2000-2004) were caused by predation. Thirty percent (9/30) of nest failures within the Eagle Lake Region were attributed to fluctuations in water levels during the nesting season. This highlights an impact on productivity that could potentially be improved with management efforts, such as rafts. A total of eight rafts were floated on six water bodies in the Eagle Lake Region in 2004, none of which were used.

Our findings indicate a lower occupancy of Eagle Lake Region lakes by loons (100% in the Rangeley Lakes and 68% in the Eagle Lake regions) and a significantly lower nesting frequency (47% in Rangeley Lakes vs. 39% in the Eagle Lake Region) in comparison to the Rangeley Lakes Region and reference populations. We feel that these findings partially reflect differences in habitat quality related to lake size, depth, predation pressure, human disturbance and water level management. Other stressors may also be involved (e.g., contaminants, such as mercury). All measures of overall productivity [(CS/TP) single-year, 5-year means, by-region combined] are significantly lower than reference populations in NH and VT. Evaluations of habitat quality have been graphically represented for PFP protected lakes in Figures 4-9 based on territory evaluations detailed in Evers et. al (2000a).

Comparisons with other populations

Breeding loon populations reflect a mix of pairs that don't nest, experience nest failures, and succeed in hatching and fledging young. Comparisons to NH and VT statewide averages are important in order to evaluate productivity findings in both regions. Nesting frequency is lower in both regions (65% in Rangeley Lakes and 48% in the Eagle Lake Region) in comparison to the NH (68% $\pm$ 6%) and VT (70 $\pm$ 9%) means, however differences are more pronounced in the Eagle Lake Region. The Rangeley Lakes Region showed higher values for all productivity parameters except chick survival in the four years combined than the Eagle Lake population, however all were lower than NH statewide means. Most notably, overall productivity (CS/TP) in both the Rangeley Lakes Region (0.26) and the Eagle Lake Region (0.14), are substantially lower than

⁸ Because two nest failure causes deemed as unknown are likely due to predation, this figure is likely artificially low.

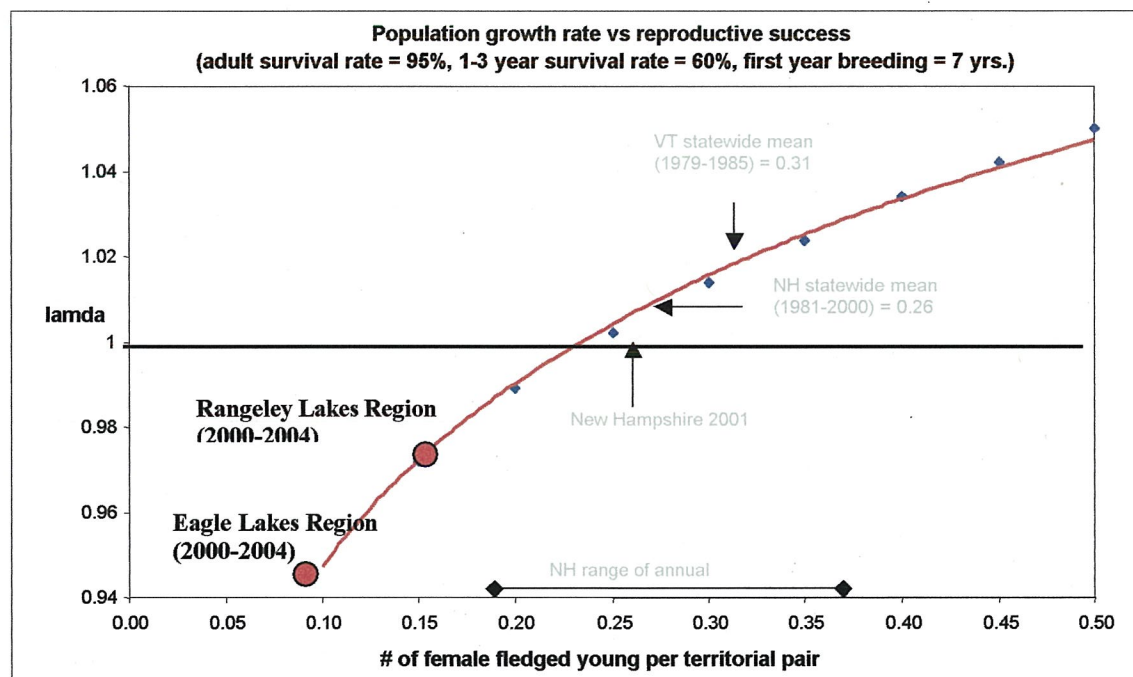


the NH mean of 0.52 ± 0.09 and the VT mean of 0.84 ± 0.16 . Percent chick survival in 2004 for the Eagle Lake Region declined from 80% reported in 2001 and 2002 and 67% in 2003 to 50% in 2004. The levels observed in 2001 and 2002 were higher than the NH statewide mean of $77 \pm 6\%$ and slightly lower than the VT statewide mean of $85 \pm 5\%$. However, the five-year mean of 52% is significantly lower than the NH and VT statewide means. Percent chick survival within the Rangeley Lakes Region has varied annually, showing survival rates of 67% in 2000, 33% in 2001, 45% in 2002, 57% in 2003, and 50% in 2004. All five years, as well as the five-year mean (50%), remain well below the NH and VT statewide means. The five-year means for percent chick survival between the two study regions reflect similar levels (50% Rangeley Lakes Region vs. 52% Eagle Lake Region). Statewide means are helpful to provide a contextual basis for productivity comparisons. It should be noted, however, that these populations are likely in varying stages of population stability. While the VT population exhibits favorable productivity and has exhibited steady growth in recent years (Hanson et. al 2001), productivity is stable or slightly declining for the NH population (Taylor and Vogel 2000).

Perspective of loon population dynamics

Loons are long-lived birds (likely 30 years or more) that on average produce 4.4 fledged young and up to 13 (modeled by using fecundity of 0.26 fledged young per female, 1-3 year annual survivorship of 55%, 3-20 year annual survivorship of 95%, and 20-30 year annual survivorship of 85%). Based on population growth models that were generated through Ramas software (Akçakaya et al. 1999), output indicates at least 0.46 fledged young per territorial pair per year (or 0.23 females per year assuming a 1:1 sex ratio) needs to be produced to maintain a lambda greater than one (Figure 3). Productivity in 2004 for both regions was 0.12, and when placed on the loon population growth curve produces a negative growth rate. However, because loons are long-lived birds, a five-year evaluation can only be contextually used.

Figure 1. Population growth rate based on demographics collected between 1991-2000 from color-marked adult and juvenile loons in New England and the Great Lakes*.



* Until recently, New Hampshire statewide population trends have been increasing at an annual rate of 4% per year. New Hampshire loon population growth is now stable (or slightly declining). Vermont statewide population trends have been increasing at a greater annual rate than documented in New Hampshire. New Hampshire and Vermont loon population trends provide the best reference for validation of this model.



Conclusions

Surveys in 2004 emphasize the importance of multiple-year productivity data collection, especially for K-selected species such as Common Loons. Seasonal variations in weather, water quality, prey abundance, predation pressure, intrusion rates, and other factors can impact overall productivity.

1. Our five-year findings show an increase in yearly occupancy of territorial loon pairs on PFP-protected lakes in the Eagle Lake Region, however overall occupancy remains low. We feel that this lower occupancy, as well as overall productivity, may reflect either (1) poor habitat quality found on many water-bodies and/or (2) a depressed breeding loon subpopulation. Population models currently project a negative population growth rate.
2. An increase in the number of territorial pairs was observed in the Eagle Lake Region during the 2004 season. The increase reflects three water bodies containing territorial loon pairs for the first time in 2004.
3. Nesting frequencies in the Eagle Lake Region continue to be lower in comparison to neighboring statewide populations. This undoubtedly impacts other important productivity parameters, such as overall productivity (CS/TP) of the subpopulations within the PFP lands.
4. A decrease in the number of chicks hatched and chicks surviving to fledge was observed in the Rangeley Lakes Region in 2004.
5. Primary limitations on loon productivity vary by region and season, however the majority of nest failures in both the Eagle Lake and Rangeley Lakes Region were caused by abandonment from an unknown cause, predation, and water level fluctuations. These abandonment's are not fully understood, but may be a result of disturbances while on the nests (i.e. human activity, predators, intruding loons).
6. Five-year estimates of overall productivity for both regions combined are poor in comparison to NH and VT statewide populations. Overall productivity within the Eagle Lake Region continued to decline for the fourth consecutive year in 2004. Although several more years of data collection are needed for improved confidence, current productivity of the loon subpopulation within PFP-protected lands produces a negative population growth rate. Due to the loon's longevity and age of sexual maturity, the impacts of poor reproductive success currently observed within the PFP regions would not effect the subpopulation for several years.
7. The number of territorial pairs observed in the Eagle Lake Region has increased by eight since 2000 (18 to 26). We feel this increase is a result of transitional pairs establishing themselves as territorial pairs and/or understanding the dynamics of the subpopulation of loons in the Eagle Lake Region.
8. Overall chick survival within the Rangeley Lakes Region continues to be significantly lower in comparison to other populations, while chick survival in the Eagle Lake Region decreased substantially from the previous three seasons.
9. The approximately 101 miles (161.6 km) protected within conservation areas containing territorial pairs from both regions have produced 37 loon chicks in five seasons. This represents one loon chick per 3.7 miles (5.1 km) of protected shoreline.



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Figure 2: Rangeley Lakes Study Area with habitat quality by loon territory and total area surveyed.

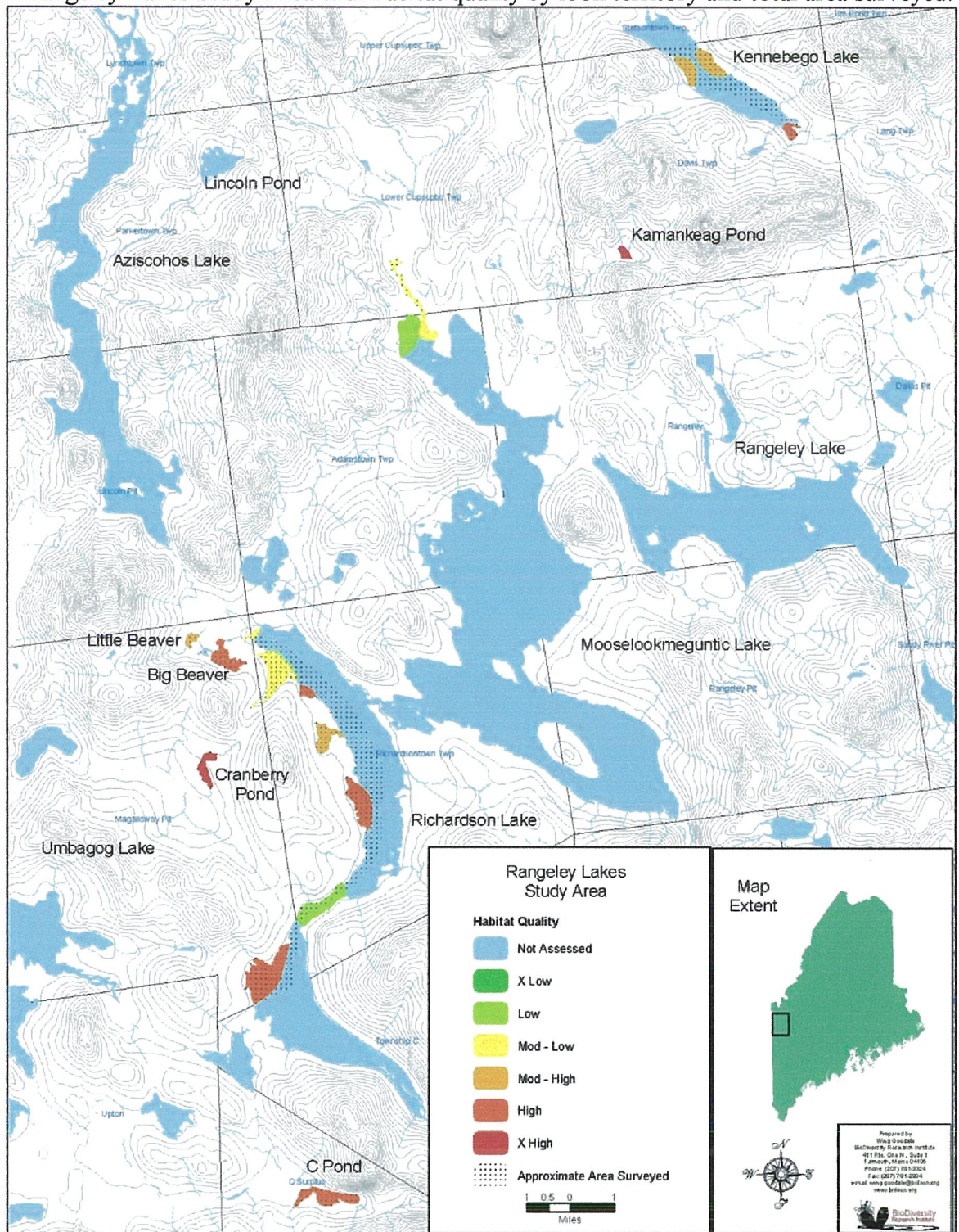


Figure 3: Eagle Lake Region Study Area with habitat quality by loon territory and total area surveyed.

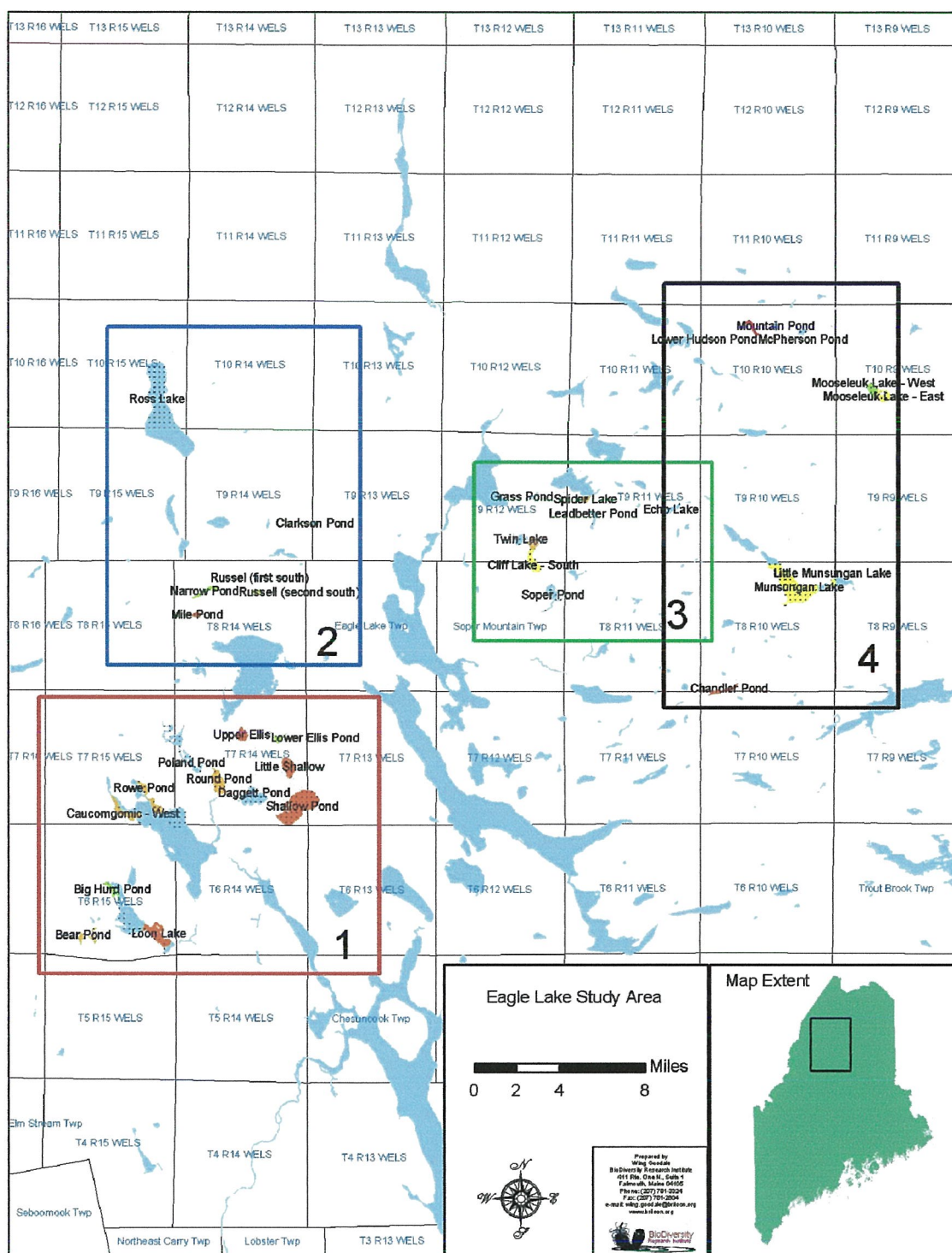


Figure 4: Eagle Lake Region Study Area. Blow-up of Caucomgomoc Lakes and surrounding water bodies with habitat quality by loon territory and total area surveyed.

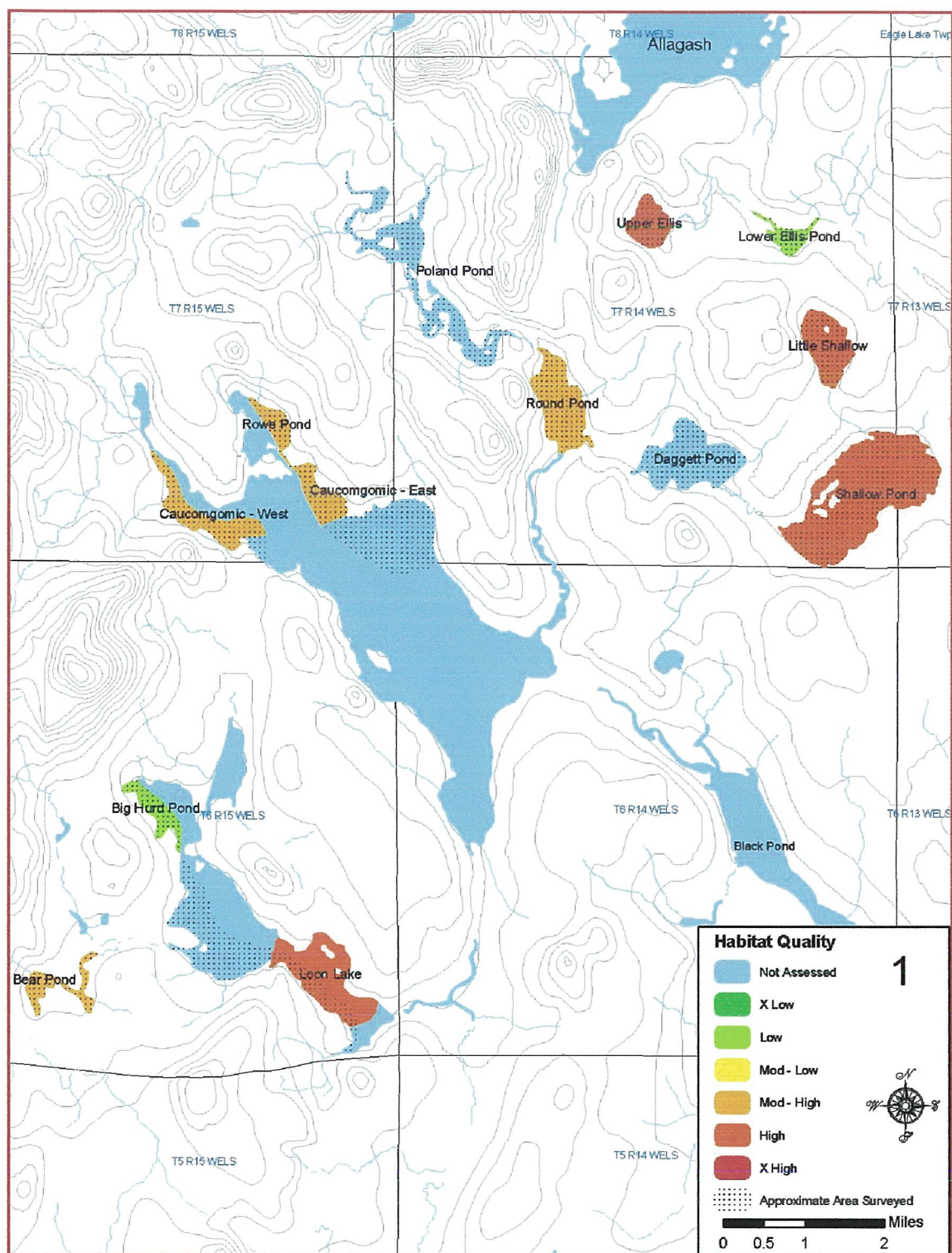


Figure 5: Eagle Lake Region Study Area. Ross Lake and surrounding water bodies with habitat quality by loon territory and total area surveyed.

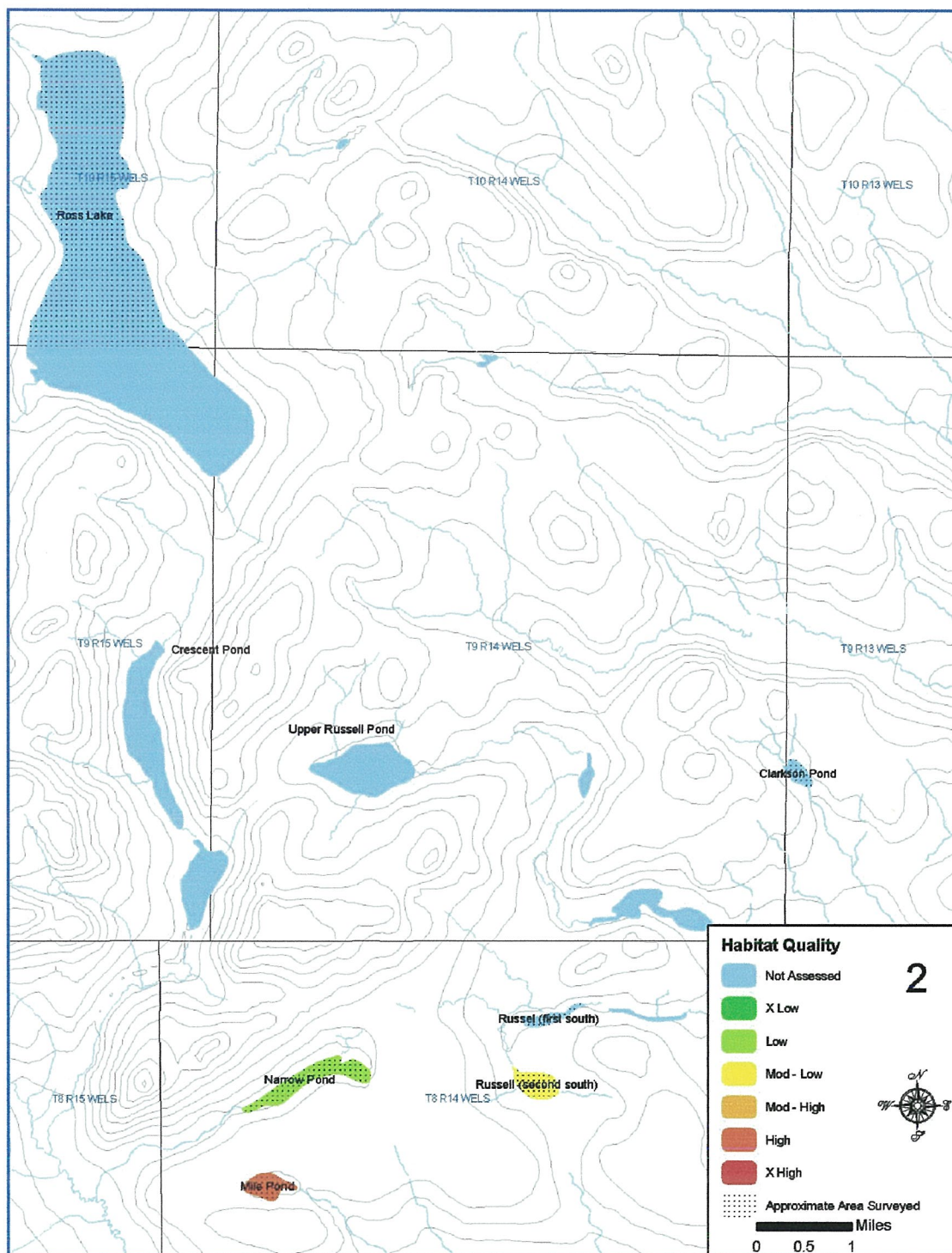


Figure 6: Eagle Lake Region Study Area. Cliff Lake and surrounding water bodies with habitat quality by loon territory and total area surveyed.

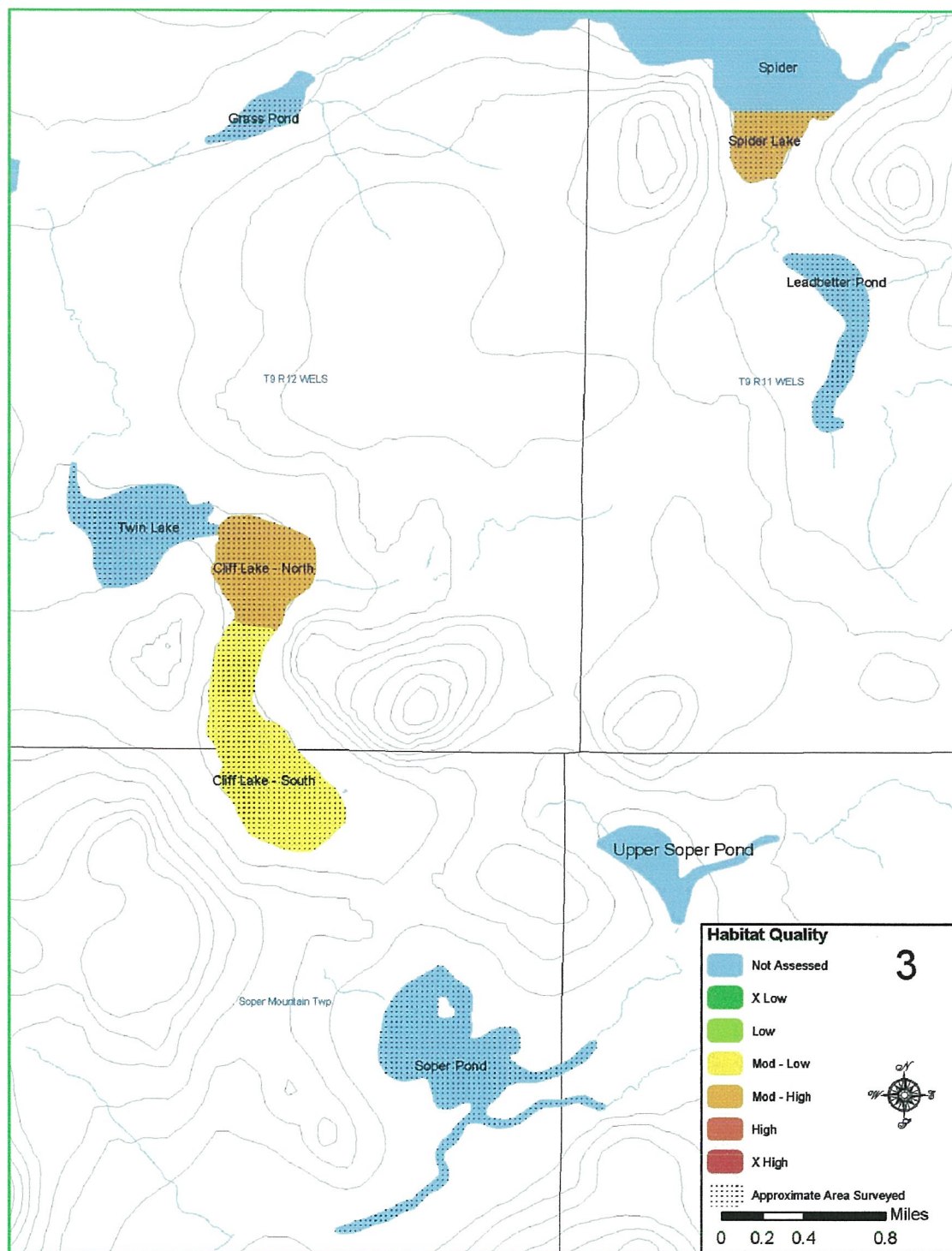
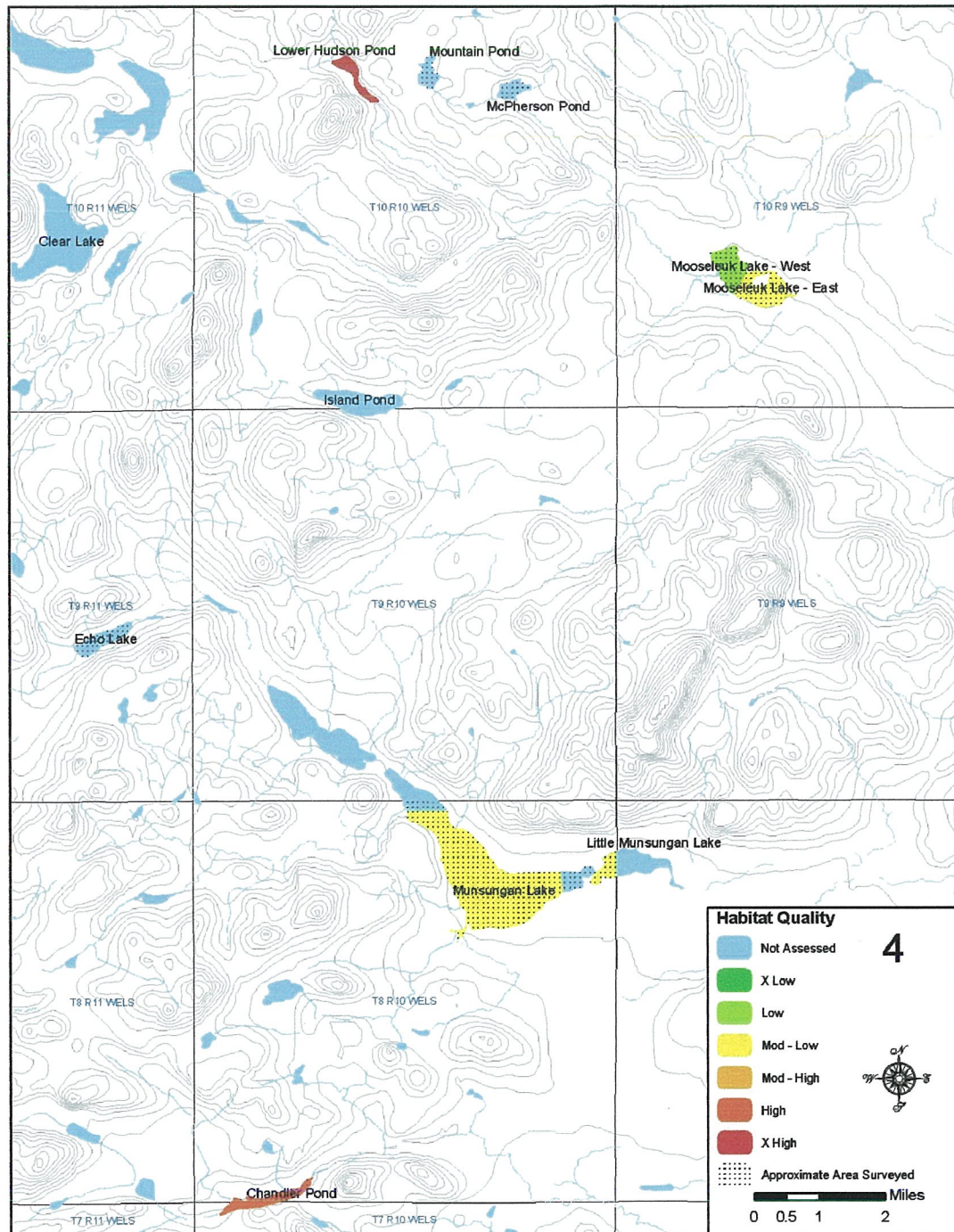


Figure 7: Eagle Lake Region Study Area: Munsungan Lake and surrounding water bodies with habitat quality by loon territory and total area surveyed.



Appendix 1. Summary of Common Loon productivity data from the Eagle Lake and Rangeley Lakes regions, 2004.

Lake Name	TP	NP	CH	CS	# NF's	nf1c	nf2c	N att	SNP	Tier
Big Beaver - East	0	0	0	0	0	~	~	0	0	1
Big Beaver - West	1	0	0	0	0	~	~	0	0	1
C Pond	1	0	0	0	0	~	~	0	0	1
Cranberry	1	1	1	1	0	~	~	1	1	1
Kemankeag	1	1	0	0	1	UP	~	1	0	1
Kennebago - Blanchard Cove	1	0	0	0	0	~	~	0	0	1
Kennebago - Lodge	1	0	0	0	0	~	~	0	0	1
Kennebago - Upper Skedaddle	1	0	0	0	0	~	~	0	0	1
Little Beaver	1	0	0	0	0	~	~	0	0	1
Mooselookmeguntic - Cold Brook	1	0	0	0	0	~	~	0	0	1
Mooselookmeguntic - Cupsuptic River	1	0	0	0	0	~	~	0	0	1
Richardson - Beaver Islands	1	1	0	0	1	U	~	1	0	1
Richardson - Carry Cove	1	1	2	1	0	~	~	1	1	1
Richardson - Cranberry Cove	1	0	0	0	0	~	~	0	0	1
Richardson - Fish Brook	1	1	0	0	1	I	~	1	0	1
Richardson - Halfmoon Cove	1	1	1	0	0	~	~	1	1	1
Richardson - Narrows	1	1	0	0	2	UP	AB	2	0	1
Richardson - Rocky Cove	1	1	0	0	1	UP	~	1	0	1
RANGELEY LAKES AREA TOTAL	17	8	4	2	6	~	~	9	3	~



Appendix 1, cont'd:

Eagle Lake Region	TP	NP	CH	CS	# NF's	nf1c	nf2c	N att	SNP	Tier
Bear	0	0	0	0	0	~	~	0	0	3
Big Hurd	1	1	0	0	2	D	D	2	0	2
Caucomgomoc - East	1	0	0	0	0	~	~	0	0	1
Caucomgomoc - West	1	0	0	0	0	~	~	0	0	1
Chandler Pond	1	0	0	0	0	~	~	0	0	1
Clarkson	0	0	0	0	0	~	~	0	0	3
Cliff - North	1	1	0	0	1	UP	~	1	0	1
Cliff - South	1	1	0	0	1	UP	~	1	0	1
Dagget	1	1	0	0	1	UP	~	1	0	1
Echo	0	0	0	0	0	~	~	0	0	3
First South Branch - Russell Pond	0	0	0	0	0	~	~	0	0	3
Grass	0	0	0	0	0	~	~	0	0	4
Leadbetter	0	0	0	0	0	~	~	0	0	4
Little Shallow	1	1	2	2	0	~	~	1	1	1
Loon	1	0	0	0	0	~	~	0	0	1
Lower Ellis	1	1	0	0	1	UP	~	1	0	2
Lower Hudson	1	0	0	0	0	~	~	0	0	1
Lower LaPomkeag	0	0	0	0	0	~	~	0	0	4
McPherson	0	0	0	0	0	~	~	0	0	4
Mile	1	0	0	0	0	~	~	0	0	1
Mooseleuk - East	1	1	2	0	0	~	~	1	1	1
Mooseleuk - West	1	1	1	0	0	~	~	1	1	1
Mountain	0	0	0	0	0	~	~	0	0	4
Munsungan - Little Munsungan	1	0	0	0	0	~	~	0	0	1
Munsungan - Munsungan	1	0	0	0	0	~	~	0	0	1
Narrow	1	0	0	0	0	~	~	0	0	2
Poland	1	0	0	0	0	~	~	0	0	1
Ross	2	0	0	0	0	~	~	0	0	3
Round	1	0	0	0	0	~	~	0	0	1
Rowe	1	1	0	0	1	AP	~	1	0	1
Second South Branch - Russell Pond	1	0	0	0	0	~	~	0	0	1
Shallow	1	0	0	0	0	~	~	0	0	1
Soper	0	0	0	0	0	~	~	0	0	3
Spider	1	0	0	0	0	~	~	0	0	1
Twin	0	0	0	0	0	~	~	0	0	1
Upper Ellis	1	1	1	1	0	~	~	1	1	1
EAGLE LAKE REGION TOTAL	26	10	6	3	7	~	~	11	4	~
BOTH REGION TOTAL	43	18	10	5	13	~	~	20	7	~



Appendix 2: Definition of Terms

Artificial nesting island – A man-made, floating platform for use as an alternate nesting site for common loons as described by the New Hampshire Loon Preservation Committee (LPC)(Fair 1989) and in some cases adapted to prevent avian egg predation through the addition of a cover described by Fair (1992). Artificial nesting islands were first developed and employed as a common loon research tool by McIntyre (1977) in a different form, later improved for management use by LPC. The term “raft” is synonymous with “artificial nesting island” in this report.

Avian guard – A camouflage mesh cover that is attached to artificial nesting islands with the intent of minimizing the visibility of the nest and eggs from avian predators and boat traffic.

Between-year territory fidelity – The return of an established territory holder to its previously occupied territory.

Breeding Adults – Established territory holders, and those with transitional territories that attempted breeding

Buffer Population – Encompasses non-territory holders and those with transitional territories that are not breeding

Chick survival – Number of loon chicks fledged divided by the number of loon chicks hatched; often expressed ($\times 100$) as a percentage.

Chicks fledged – Number of loon chicks to survive past eight weeks of age were assumed to have fledged.

Chicks hatched – Number of chicks hatched completely out of their eggs, not necessarily departing from the nest.

Established Territory – Paired adults found on territory for at least three consecutive weeks for three consecutive years

Estimated minimum survivorship – The known rate of return for adult loons during the breeding season.

Fledge rate – Number of chicks fledged divided by either the number of nesting pairs (F/NP) or territorial pairs (F/TP). Also referred to in this report as “fledging success.” F/NP is a representation of the total number of chicks fledged relative to pairs that attempted to nest, F/TP is a representation of the number of chicks fledged relative to all of the territorial pairs within a given subpopulation – including those territorial pairs that did not nest.

Hatch rate – Number of chicks hatched divided by the number of nesting pairs (H/NP) or territorial pairs (H/TP) of a given or study-area population. H/NP is a representation of the total number of chicks hatched relative to pairs that attempted to nest (also referred to as “hatching success”), H/TP is a representation of the number of chicks fledged relative to all of the territorial pairs within a given population – including those territorial pairs that did not nest. Use of hatch rates in comparisons between populations or time periods allows comparison of productivity between lakes and populations prior to effects of chick mortality.

Hatch window – The time, often expressed by a “window” of dates, when an egg(s) hatches.

Individual performance – Tracking the reproductive success of marked individuals over time.



Long-term productivity – a measure of productivity taking into consideration the number of years the territory has which the parameter was measured.

Loon – Common loon (*Gavia immer*); no other loon species nested in the study area during the report period.

Loon return-year – A measure of loon site fidelity that represents the number of years the loon group in question (M, F, or both) returned as a territorial pair to the territory from which it was originally banded. Every year a banded individual is eligible to return is a potential return-year.

Mate fidelity – The known pairing of an adult with the previous years' mate

Mate switching – The known change of mates within or between years

Multiple lake territory – Paired adults using two or more lakes during a breeding cycle to provide the required resources. Multiple-lake territories are only those that require flight to access another lake.

Natal site fidelity – the known return of an individual banded as a juvenile

Nest attempt – Presence or evidence of any loon nest constructed or scraped that contained eggs, evidence of eggs, or constructed on a site where a previous nest contained eggs; this excludes copulatory platforms and nests of uncertain origin.

Nest failure – Any nest attempt that fails to completely hatch or at least one egg.

Nest Onset – The time, often expressed as a “window” of dates, during which a nesting pair lays eggs in a nest.

Nest success – Any nest attempt in which at least one chick completely hatches from its egg.

Nesting frequency – Number of nesting pairs divided by the number of territorial pairs in a given population or study area; often expressed ($\times 100$) as a percentage. Nesting frequency is an index of the portion of a population attempting reproduction on a given year or time period.

Nesting pair (NP) – A territorial loon pair, which undertakes one or more nesting attempts on a given year. All territorial pairs are considered potential nesting pairs. Nesting pairs comprise a subset of territorial pairs.

Nesting season – That part of the year encompassing early reproductive behavior on the breeding grounds through late hatching of chicks. Nest building may begin prior to complete ice-out of aquatic systems in Maine and New Hampshire and hatches may occur as late as mid August in western Maine (Fair unpubl. Data) Nesting season varies from year to year and across latitudes and from lake to lake. Nesting season varies from year to year and across latitudes and from lake to lake.

Nesting success – The rate of nest success by pairs; number of loon pairs hatching at least one chick divided by total number of pairs exhibiting at least one nesting attempt; usually expressed ($\times 100$) as a percentage.

Non-breeding adults – Territorial and non-territory holders (e.g. floaters) that did not breed that year

Partial lake territory – Paired adults sharing a lake with other established territory holders. Common foraging areas used by non-breeding adults frequently exist.



Production – The absolute number of chicks fledged (surviving to migrate) within a given time period by a given loon population.

Productivity – The number of fledged chicks divided by the number of territorial pairs in a given population, expressed as number of chicks per territorial pair. Less thorough studies have reported productivity in terms of number of chicks (sometimes young chicks) per known nesting pair, not recognizing non-nesting and unsuccessful pairs, and chick mortality on the breeding lake. Certain ecological studies have reported loon productivity in chicks per water surface area. Productivity here reflects the total population of territorial (potential breeding) pairs, nesting frequency, nesting success, and chick survival, and is therefore a more precise and thorough reflection of the reproduction rate of the entire population.

Raft – Artificial nesting island for loons.

Raft use by loons – a raft is considered used by loons during any nesting season in which one or more nest attempts are made on that raft; may be expressed for a given study area as number of rafts exhibiting one or more nest attempts divided by number of rafts deployed that year; may be expressed ($\times 100$) as a percentage.

Renest – Any nest attempt by a pair subsequent to its original nest attempt on a given year.

Successful nest – Any nest attempt resulting in at least one chick hatching completely out of its egg, though it may never depart the nest dish.

Successful nesting pair (SNP) – A loon pair that hatches at least one loon chick completely out of its egg on a given year, regardless of failures of former nests that year.

Territorial pair (TP) – A loon pair which exhibits territorial and paired behavior including territorial defense gestures, male yodeling, and close physical association within a defined territory during the nesting season; all nesting pairs are considered territorial pairs. Not all territorial loon pairs nest every year.

Territory – An area of still water used by a bonded pair of common loons for feeding, resting, breeding, nesting, chick rearing that is behaviorally protected against incursion by most other loons (and sometimes waterfowl) for a minimum of 4 weeks. Loon breeding activities were formerly described with reference to loon pairs, about under light of new evidence of infidelity among individuals of loon pairs, the territory has become the more certain and useful unit of reference in describing loon breeding activity and rates. Territories are recognized as being either “established” or “transitional.” Long term monitoring will be necessary in order to classify a territory into one of these territory subgroups.

Territorial persistence – The tendency for territorial pair to remain present within their territory throughout the season. Measured by the length of time a pair remains on territory throughout the year.

Territory years - The number of years a territory has been surveyed. Used as the denominator of the long-term hatch rate productivity measure.

Total production – The total number of loon chicks fledged lakewide during the year of time period described; lakewide production.

Transitional territory – Paired adults found on a territory for less than three consecutive weeks and/or less than three consecutive years



Whole lake territory – One pair of adults is restricted to one lake for the entire breeding cycle. The territory may or may not encompass the entire lake, however, a second pair is not established.

