

**2000
Mooselookmeguntic Lake Common Loon Population
Survey
and Management Plan**

(Report BRI 2001-04)

(Upper Dam Project)



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INTRODUCTION

ABOUT THE STUDY SITE

Mooselookmeguntic Lake is a 16,300- acre (6,520 ha) reservoir found in Adamstown, Rangeley, Rangeley Plantation, and Richardstown, Maine (Figure 1). These townships lie in the northwest portion of Maine. The reservoir is managed by FPL Energy Maine Hydro (FPL), through Upper Dam, located in Richardstown, Maine. Mooselookmeguntic Lake is fed mostly by Rangeley Stream, and the Kennebago and Cupsuptic rivers. The reservoir drains through Upper Dam, into Richardson Lake.

HISTORY AND PURPOSE OF STUDY

Due to the significant water level fluctuations on reservoirs during the nesting season, the Common Loon (*Gavia immer*) has been identified by the U.S. Fish and Wildlife Service, and other natural resource trustees, as a species to be evaluated in connection with the Federal Energy Regulatory Commission (FERC) licensing of certain reservoir projects. The Union Water Power Company obtained a FERC license and initiated a study to evaluate Common Loon populations, productivity, and the related effects of water level management in 1995 (Fair 1995). The following report summarizes BioDiversity Research Institute's Mooselookmeguntic Lake survey efforts in 2000 and outlines a proposed management plan for the 2001 common loon's breeding season.

PROJECT OBJECTIVES

1.
 - a. To determine whether artificial nesting islands are necessary and feasible on Mooselookmeguntic Lake, and to identify a specific site for each.
 - b. To survey Mooselookmeguntic Lake's loon population and to determine the number of non-breeding and breeding loons, territorial and nesting pairs, nest sites, and chicks hatched.
 - c. To determine overall productivity of the Mooselookmeguntic Lake loon population through late summer surveys and historical records.
 - d. To assess the placement need of artificial nesting islands based on biological necessity and availability of sites for proper placement.
2. To establish a long-term loon management and monitoring project on Mooselookmeguntic Lake. We will monitor site-specific nesting activities and factors affecting the productivity of the Common Loon population on Mooselookmeguntic Lake. Emphasis is placed upon monitoring the effects of current water level management practices and the effectiveness of artificial nesting islands, as well as monitoring and quantifying the impact of human and animal disturbances on loon productivity
3. To construct full recommendations for an implementation plan for the manufacture, placement, and maintenance of artificial nesting islands determined necessary.
4. To extend chick monitoring into the late fall to document chick survivorship, and fledge times.
5. To evaluate between-year territory fidelity, mate fidelity, territorial persistence, estimated adult minimum survivorship and natal site fidelity, for all banded loons on Mooselookmeguntic Lake.

PROPOSED METHODS

1. POPULATION AND NESTING SURVEYS

In 2000, surveys were conducted on Mooselookmeguntic Lake starting on May 3 and ending on August 28 to establish territory boundaries and confirm the presence/absence of Common Loons and document their nesting activities (Table 1). The bulk of the survey effort was concentrated on the Common Loon nesting onset and hatching period from May through July. Survey methods were consistent with those reported by Fair (1995), with a few changes to address objectives 4 and 5. We surveyed all known territories and surrounding areas on Mooselookmeguntic Lake from an 18' boat using 10X binoculars and occasionally a 15-45X spotting scope. Every effort was made to gather information from the greatest distance possible in 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 performed searches for evidence of natural nesting attempts by walking the perimeter of the available nesting habitat in loon territories. All known historical nesting sites previously reported by Jeff Fair and Bill Hanson were checked regularly for nesting evidence both above and below the waterline in response to fluctuating water levels. These surveying methods continue in the 2001 season.

Table 1: Lake Survey visit record for Mooselookmeguntic Lake, 2000

Month	Visit dates*
May	4, 16
June	1, 13, 26
July	19, 30
August	7, 29

TOTAL: 9 visits

*Only includes data when lake-wide surveys were made. Territory by territory checks were commonly made outside of these visits.

2. SURVEYING FOR MARKED INDIVIDUALS

Surveying for marked individuals will help us achieve objective 5. From 1996-2000, 9 adults and 4 juvenile Common Loons had been captured (using a night-lighting technique developed by Evers (2001)) and uniquely color marked on Mooselookmeguntic Lake. Each captured individual was custom fitted in the field with one or two bands on each leg (one USFWS band plus 1-3 color bands per bird). These color bands are visible both above and below the water with binoculars and/or a spotting scope. We opportunistically identified marked individual loons to track site and mate fidelity (Objective 5) of the Mooselookmeguntic Lake loon population. We recorded the color combination thought to be seen in the field, and later referenced a color banded loon ID list to confirm the

individual(s) observed. We also recorded the location and general behavior of both banded and unbanded individuals at the time of observation.

3. ABANDONED EGG COLLECTION

We will collect abandoned Common Loon eggs whenever possible to archive for future contaminant analysis, which may provide insight into causes of nest failure.

Loon eggs will not be collected unless abandonment or failure can be confirmed beyond a reasonable doubt. We will attempt to immediately collect abandoned eggs before they are predated or destroyed. When uncertainty exists in the determination of the absolute abandonment of the eggs by the adults, we will gently pencil an "X" on the "upside" surface of the egg(s) in question. Eggs will be checked no less than 24 hours later and those that had not been rolled will be considered unviable and will be collected, and placed in a labeled plastic bag, and frozen for future egg analysis.

4. LOON NESTING ACTIVITIES IN RELATION TO WATER LEVEL FLUCTUATIONS

Reservoir operations attempt to capture and store water including sudden precipitation events such as thunderstorms. Because of this, water levels often increase during and immediately after rain events. Since loons tend to nest adjacent to the water's edge, these increases are the most common cause of nest failures on natural sites for reservoirs, and many times for natural lakes. (DeSorbo and Evers 2000). Research in New Hampshire and elsewhere has shown that water level increases of over 0.5 feet or decreases of over 1.0 feet during the 28-day incubation period are likely to cause nest failure through flooding or necessary abandonment (Fair 1995).

Weekly lake levels for Mooselookmeguntic Lake during four nesting seasons (1997-2000) are shown in Appendix 4. Mooselookmeguntic Lake's water level is controlled by a hydro dam, and therefore fluctuates greatly throughout the loon's breeding season. Appendix 4 shows that from 1997-2000, water levels fluctuated dramatically throughout the loon's nesting period (late-May to early July). In 2000, a comprehensive productivity survey of Mooselookmeguntic Lake was conducted to establish loon territory size, occupancy, and reproductive success. Nesting periods on Mooselookmeguntic Lake ranged from May 17 to July 6. Water levels decreased dramatically from late May throughout the remainder of the breeding loon's breeding season (Appendix 4). These water level changes and others could potentially have a negative effect on overall loon productivity for Mooselookmeguntic Lake.

Other factors affecting loon productivity related to water level fluctuations are: 1) the abandonment of young (less than five weeks old) due to a greater number of unsuccessful pairs which temporarily leave their territories and may interfere with nesting of brooding of other pairs, 2) later hatch dates due to later nesting or reneating, both of which are

likely on lakes with greater water level fluctuations, and 3) a reduction in nesting because traditional sites are more often under water or difficult to approach (Fair 1995).

5. IMPLEMENTING RAFTS AS A MANAGEMENT TOOL

Implementing artificial nesting islands (rafts) has proven to be an effective management tool for Common Loons nesting on large reservoirs. Long-term studies have been conducted on Aziscohos and Flagstaff Lake (hydro-dam controlled reservoirs) comparing the productivity between natural nesting sites and raft sites, among Common Loons. Over a 14-year study (1986 to 2000), Aziscohos Lake produced an average of 0.36 chicks per territory from natural sites compared to 0.82 chicks hatched per territory from rafts (DeSorbo and Evers 2000). From 1993 to 2000, Flagstaff Lake produced an average of 0.35 chicks per territory from natural sites, compared to 1.02 chicks per territory from raft sites (Yates et al. 2000).

Management Considerations for Artificial Nesting Islands

Rafts are most successful in situations where loons have established territories and nested. Pairs that exhibit repeated nest failures are prime candidates for this type of management assistance. Although one past study indicated rafts were not useful for (1) encouraging occupancy of new areas by potential breeding pairs or (2) enticing non-breeding pairs to nest (McIntyre 1975), recent evidence from our studies and those of biologists with FPL Energy Maine Hydro strongly indicate otherwise.

Proper placement of rafts is crucial for successful nesting pairs. Rafts should be placed in an area that is sheltered from the wind (turbulent waters) and from human disturbances. Placing a raft in an inadequate area poses a greater risk of nest failure. If a territory does not contain a suitable area to place a raft, one should not be instituted (Fair 1995).

Avian Guards

Avian predation of loon nests (natural and raft sites) has been documented on numerous occasions. Jeff Fair reported avian depredation for 3 of 7 loon nests on Aziscohos Lake in 1987 and 1988. The frequency of nest failures from avian predation necessitated preventative management. The implementation of avian guards was established and was proven to be effective. From 1987 to 1992, no fully covered raft failed due to avian predation in 18 instances (Fair 1992).

We will continue the practice of attaching (using staple-nails) avian guards made of metal fencing and camouflage mesh (Cabella's® CAT order # HK22-0081-168 phone # 1-800-237-4444) to all rafts as was initiated by Jeff Fair in 1988 (Fair 1988, Fair 1992) (Appendix 3). Burlap camouflage mesh was also occasionally used and was determined to be adequate for single-season use (Appendix 3). Avian guards are effective in lessening raft visibility and nest exposure from aerial predators and human lake users,

which decreases flushing events and disturbances to nesting loons. Avian guards may therefore increase incubation time and hatching success of raft nesting loons. Guards will be covered with camouflage mesh material, which will be removed at the end of the season to avoid further degradation.

Signs

Human disturbance on nesting loons frequently attributes to nest failures among these large, heavily used reservoirs. Many of these disturbances are unintentional and would likely be avoided by placing informational signs both at the launch sites and at some nesting/brooding areas where deemed necessary. FPL biologists occasionally distribute signs (“Loon Nesting Area Please Keep Away”) for use in protecting these areas from human disturbances. The decision of whether or not to place a sign in a territory is often a difficult one based on their variable effectiveness as management tools. The character of and type of lake users as well as the configuration of the territory and location of nest site will influence their efficacy. Sign placements will be based on previous reports’ recommendations, knowledge of typical lake use patterns and previous site-specific nest failure history. Signs will not be implemented before nesting activity had been found (and therefore will not be used for territorial pairs which do not attempt nesting), and should be taken down after nesting and/or brooding activities cease. They should also not be implemented in cases where it’s determined that their cost (potentially attracting attention to a nest site) outweighs the benefit (notifying unsuspecting lake users to stay away) (DeSorbo and Evers 2000).

6. EXPLANATION OF THE RANKING PROCESS FOR THE QUALITATIVE AND QUANTITATIVE EVALUATION OF TERRITORIES

Two ranking exercises by the authors provide context for prioritizing the overall demand for the implementation of rafts in each loon territories. One was a quantitative exercise based on a simple ranking system that provided a matrix with a final index rating (Appendix 1). All the territories that supported a pair of Common Loons in the 2000 season were ranked according to the parameters in Appendix 1. They received a ranking value for each parameter via information gathered from field surveys conducted by Jeff Fair, FPL, and BioDiversity Research Institute from 1995 to 2000. These values were summed for each territory and then divided by the number of points used in the analysis.

This quantitative rank was then reviewed by the authors and integrated with their qualitative review. The qualitative ranking was based on our professional judgment of the territory characteristics. The quantitative and qualitative aspects of this ranking exercise were then designated into two categories of raft necessity for 2001 management: 1) highly recommended (2) not recommended. These final rank designations follow each territory in the Qualitative Territory Summary. The final rankings were important in prioritizing our recommendations.

SURVEY SUMMARY AND DISCUSSION

A total of 40 paired adult common loons held territories on Mooselookmeguntic Lake during the breeding season of 2000. Five non-breeding common loons (including one individual in alternate plumage) were occasionally seen on the lake as well. Non-breeding loons frequently use large water bodies such as Mooselookmeguntic Lake, as common foraging areas.

A total of 20 territorial pairs were recorded on Mooselookmeguntic Lake during the 2000 breeding season. Of these, 10 nested (1 territory renested), one successfully hatched two chicks, of which one fledged (Table 2). The approximate territorial boundaries are illustrated in Figure 1. These territories were previously documented and identified through Jeff Fair's survey of the lake in 1995. To maintain consistency, the names of the 20 territories remained that of which were designated by Fair (1995). The territories are referred to as follows:

Cupsuptic River
Cold Brook
Birch Island
Northeast Cupsuptic
Blueberry Island
Oquosoc
Nursery
Lunch Island
Shelter Island
Farrington Island
Brandy Point
Sandy Cove
Dam
Dollar Island
Richardstown
North Student's Island
Student's Island
East Toothaker
South Toothaker
Bemis

TABLE 2: Common Loon Productivity and Nesting Summary (2000).

20 Territorial Pairs
10 Nesting Pairs
11 Nesting Attempts
1 Renest
1 Successful Pairs
2 Chicks Hatched from all territories
1 Chick Fledged from all territories
10 Nest Failures
1 Nest Failure due to mammalian predation
1 Nest Failure due to avian predation

2 Nest Failure due to unknown predation
1 Nest Failure due to increase in water level
5 Nest Failures due to unknown abandonment

7. MOOSELOOKMEGUNTIC QUALITATIVE PRODUCTIVITY SUMMARY (2000)

We present productivity information for the Mooselookmeguntic loon population for the 2000 season. Below, we summarize overall lake-wide productivity, nest failures and renests. Territory-specific productivity data is summarized in the Qualitative Territory Summary (Territory maps can be found in the Maps section and Figure 1).

Cupsuptic River

The traditional Cold Brook male, captured and banded in 1996, switched territories in 2000 and mated with an unbanded female. The pair nested twice, failing in both attempts from unknown causes. The first nest was discovered on 6 July along the southeast side of a large island, located at the northern end of the territory, with no sign of eggs or eggshell fragments. The second nest was constructed on a small strip of grassland in the southern end of the territory. This nest was discovered on 19 July. After 35 known days of incubation, the loons abandoned the nest (loon incubation is 28 \pm 2 days). One egg was collected from the nest. The reason for nest abandonment is likely related to water level drawdowns. This nest was more than 20 feet (6m) from the water's edge and was very visible to boaters, which that may have led to frequent incubation vacancies.



Figure 2: Cupsuptic River territory renest site, 2000

Cold Brook

An unbanded pair established a territory in Cold Brook this season. The traditional male shifted to the Cupsuptic River territory in 2000. This is the first season since 1996 (year of initial capture) that the banded male did not return to this territory. A female was also captured in 1996, but has not been re-observed since then. The mate switch experienced on this territory likely impacted nesting behavior in the 2000 breeding season (Evers, unpubl. data).

Birch Island

The Birch Island territory supported a pair of unbanded adults during the 2000 breeding season. A nest was discovered on the west side of a small island on 6 July. The nest site consisted of a small scrape nest along the sandy island shoreline. The nest failed from an unknown cause between 7/20 – 7/30. Neither eggs nor eggshells were recovered. The nest may have been abandoned due to human disturbances. This area supports heavy camping and boating pressure throughout the loon's breeding season.

Northeast Cupsuptic

An unbanded territorial pair of loons occupied the Northeast Cupsuptic territory during the 2000 breeding season. The pair was consistently observed in the territory but evidence of nesting was not confirmed.

Blueberry Island

The Blueberry Island territory supported an unbanded nesting pair of loons during the 2000 breeding season. The pair was first confirmed incubating on 26 June. The nest site consisted of a hummock located among a sheltered cove on the south side of a small island (just north of Blueberry Island). Two chicks were successfully hatched on 13 July, one chick surviving to fledge (last confirmed on 29 August) and the other disappearing between 7/19 and 8/29 (chicks were not observed on 7/30 and 8/7 visits). Both the male and female were captured and banded in July and August of 2000.

Oquossoc

The Oquossoc pair (both unbanded) constructed a nest upon a small strip of grassland. The pair was first confirmed incubating on 26 June. During a 6 July survey, no adult loons were seen on the nest upon arrival. An immature Bald Eagle (*Haliaeetus leucocephalus*) was seen flying from a perch located above the loon's nest site. Shortly after the eagle's departure, an adult loon appeared and hesitantly (i.e., swam in front of the nest site for about 10 minutes) began incubation. We suspect that the loon was flushed from the nest due to the presence of the eagle. The nest later failed between 7/7 – 7/19, most likely from predation (unknown if mammalian or avian). A small amount of eggshell fragments was collected near the nest site.

Nursery

A territorial pair of unbanded loons was occasionally observed within the Nursery territory. Evidence of nesting was not confirmed.

Lunch Island

The Lunch Island territory supported a territorial pair of unbanded loons. The pair was observed on multiple visits but evidence of nesting was never confirmed. A nest from a previous year was found along the western shoreline of Lunch Island.

Shelter Island

The Shelter Island pair nested on a small island located northwest of Shelter Island. An adult loon was first confirmed incubating the small bowl nest on 13 June. Nest failure from an unknown cause (neither eggs nor eggshells were recovered) occurred between 6/14 and 6/26. The traditional male (captured and banded in 1996) was confirmed on this territory with an unbanded female.

Farrington Island

The Farrington Island pair established itself in the 2000 breeding season. The unbanded territorial pair was consistently observed near Farrington Island. Evidence of nesting was not found for the 2000 season.

Brandy Point

The Brandy Point territory supported an unbanded pair of nesting loons during the 2000 breeding season. A nest with two eggs was discovered on 14 June. Due to the increase of water levels on Mooselookmeguntic Lake during this time period, the nest and two eggs were completely surrounded by water. In an effort to save the nest from flooding, the eggs and nest were moved about 10 feet towards the shoreline and placed among protected and suitable loon nesting habitat. The nest later failed, most likely from an increase in water levels, between 6/14 and 6/26. The pair remained on territory throughout the 2000 breeding season, but never re-nested.

Sandy Cove

An unbanded territorial pair was consistently observed within the Sandy Cove territory during the 2000 breeding season. Evidence of nesting was not confirmed.

Dam

The Dam territory contained an unbanded territorial pair throughout the 2000 breeding season. Evidence of nesting was not confirmed.

Dollar Island

The unbanded Dollar Island pair was frequently observed within the territory. Evidence of nesting was not confirmed.

Richardstown

The Richardstown pair nested upon a grassy shoal that became exposed during the month of June. A small bowl nest containing one egg was discovered on 10 July. The nest was saturated by increasing water levels and appeared to be on the verge of abandonment (Figure 3). The pair swam alongside the nest site, but remained off the nest. In an effort to prevent the nest from flooding, the nest and egg was moved inland from the waterline about two feet. The nest was abandoned between 7/10 and 7/12. A 7/12 survey visit revealed that the nest and egg had washed away. The nest was most likely abandoned from an increase in water levels.



Figure 3: Richardstown territory nest site, 2000

North Student's Island

An unbanded territorial pair occupied the North Student's Island territory during the 2000 breeding season. Evidence of nesting was never observed.

Student's Island

The traditional banded female (captured and banded in 1996) returned and paired with an unbanded male. The Student's Island pair constructed a nest upon a small grassy island located south of Student's Island. The nest containing two eggs was discovered on 10 July. Oddly, this nest site was among an active Herring Gull (*Larus argentatus*) colony, a documented predator of loon eggs. The nest later failed between 7/10 and 7/23, most likely from avian predation. On 24 July, eggshell fragments were collected near the nest, as well as a whole egg found several feet from the nest, submerged in the lake (the whole egg most likely rolled out of the nest and into the water).

East Toothaker

Two nests were constructed by the unbanded East Toothaker pair, during the 2000 breeding season. On 14 June the pair was observed building the first nest among the tall grassy shoreline of a small cove located southwest of East Toothaker Island. Upon a follow-up survey visit on 10 July, a second nest was found at the northern end of East Toothaker Island. The nest consisted of a small indentation in the sandy soil. It appeared that the nest had been predated, small eggshell fragments were found near the nest. Eggs were never found at the first nest site.

South Toothaker

The unbanded South Toothaker pair constructed a nest upon a small island located at the southern end of Toothaker Island. The nest was discovered on 10 July. Albumen covered the eggshells, indicating that the nest had recently failed, most likely from mammalian predation.

Bemis

Traditionally, a banded pair of loons occupies the Bemis territory (pair captured and banded in 1996). However, the 2000 Bemis pair consisted of an unbanded male and female. This pair was observed on territory consistently, but evidence of nesting was never confirmed.

8. QUALITATIVE TERRITORY SUMMARY FOR PLACEMENT OF RAFTS

Reporting productivity data in a quantitative summarized form often inadvertently overlooks some important details. We report territory-specific information here in a qualitative descriptive format to minimize this potential loss of information. All territories and other areas of interest are listed from north to south. Map numbers are also given, which display locations of historical nest sites and potential areas for raft placement (Evers, DeSorbo, Savoy, Nelson 2000).

The following synopsis is a territory-by-territory review of known productivity history for the 20 territories on Mooselookmeguntic Lake. The overall evaluation of each territory is based on the information in Appendix 1.

Cupsuptic River

Nesting has been observed in the Cupsuptic River territory during the 1996 and 2000 breeding seasons. Chicks were not produced during those seasons. The territory supports abundant island nesting habitat. We feel a raft should not be placed in the Cupsuptic River territory for the 2001 breeding season; although once we better understand human disturbance patterns we will be able to recommend a raft site. **(Quantitative Ranking: = 0.66) (Qualitative Ranking: Not recommended)**

Cold Brook

The Cold Brook pair successfully hatched chicks during the 1996 breeding season, however nesting has not been documented since. The area best suited for nesting lies within the mouth of Cold Brook, located at the northern end of the territory. Due to the steep banks formed by decreasing water levels, the nesting success of the Cold Brook pair is heavily dependant on the stability of Mooselookmeguntic's water levels. We feel the placement of a raft within the Cold Brook territory will have a positive affect on nesting success. **(Quantitative Ranking: = 0.55) (Qualitative Ranking: Highly recommended)**

Birch Island

The Birch Island territory contains three large islands, adequate for nesting. The Birch Island pair nested among one of these islands during the 2000 breeding season. Due to the availability of nesting habitat, we feel it is not necessary to place a raft within the Birch Island territory. **(Quantitative Ranking: = 0.55) (Qualitative Ranking: Not recommended)**

Northeast Cupsuptic

The Northeast Cupsuptic territory has not been documented as supporting a nesting pair. Adequate nesting habitat exists along the northeast shoreline of the territory. Taking in account the availability of nesting habitat and the absence of nesting within the Northeast Cupsuptic territory, we feel the placement of a raft here is not necessary. **(Quantitative Ranking: = 0.11) (Qualitative Ranking: Not recommended)**

Blueberry Island

Two large islands, adequate for nesting, are located within the Blueberry Island territory. Nesting was observed among one of these islands during the 2000 breeding season. Two chicks were successfully hatched (one surviving to fledge) from this nest site. Due to the availability of nest sites and the 2000 hatching success, we feel placing a raft in the Blueberry Island territory is not necessary. **(Quantitative Ranking: = 0.88) (Qualitative Ranking: Not recommended)**

Oquossoc

Nesting within the Oquossoc territory has been observed during the 1996 and 2000 breeding seasons. Both nest sites resulted in nest failures. The Oquossoc territory consists of abundant grassy and shrubby strips of land, providing for ideal loon nesting habitat. We feel placing a raft within the Oquossoc territory is not necessary. **(Quantitative Ranking: = 0.55) (Qualitative Ranking: Not recommended)**

Nursery

Nesting has not been documented within the Nursery territory (1995-2000). Adequate nesting habitat can be found within a deep cove located at the southeastern portion of the territory. Because nesting has not been documented within the Nursery territory, we feel a raft should not be implemented. **(Quantitative Ranking: = 0.33) (Qualitative Ranking: Not recommended)**

Lunch Island

Nesting has not been confirmed within the Lunch Island territory (1995-2000). The Lunch Island territory consists of a cluster of five small islands. All of the islands support adequate nesting habitat for loons. We feel a raft is not necessary within the Lunch Island territory. **(Quantitative Ranking: = 0.33) (Qualitative Ranking: Not recommended)**

Shelter Island

The Shelter Island territory contains five small islands, all supporting adequate loon nesting habitat. Nesting has been confirmed within this territory during the 1995, 1996, and 2000 breeding seasons. Chicks were successfully hatched during the 1996 season. We feel since the Shelter Island territory contains abundant quality nesting habitat and have had nesting success in past years. Placing a raft within the territory is not necessary. **(Quantitative Ranking: = 0.66) (Qualitative Ranking: Not recommended)**

Farrington Island

The Farrington Island territory appears to be relatively new, a territorial pair first observed during the 2000 breeding season. The territory contains a large island that could adequately support a nesting pair of loons. Therefore, we feel a raft should not be placed within the Farrington Island territory. **(Quantitative Ranking: = 0.33)**
(Qualitative Ranking: Not recommended)

Brandy Point

The Brandy Point territory consists of a large jut of land containing numerous campsites, decreasing the amount of loon nesting habitat considerably. Nesting was confirmed during the 1995 and 2000 breeding seasons, both nests resulting in nest failure. We feel implementing a raft within the Brandy Point territory would positively increase nesting success. **(Quantitative Ranking: = 0.55)** **(Qualitative Ranking: Highly recommended)**

Sandy Cove

Nesting within Sandy Cove has only been documented during the 1996 breeding season. The Sandy Cove territory consists of a large, open cove providing quality nesting habitat only at the northern end (the mouth of the small stream). The majority of Sandy Cove's landscape consists of wooded shoreline, constantly exposed to wave-action from Mooselookmeguntic's characteristically rough waters. We feel the implementation of a raft at the mouth of the stream would positively affect the nesting success within the Sandy Cove territory. **(Quantitative Ranking: = 0.44)** **(Qualitative Ranking: Highly Recommended)**

Dam

Nesting within the Dam territory has not been confirmed from 1995-2000. Abundant nesting habitat exists among a couple small, shrubby islands. Since nesting has not yet been confirmed within the Dam territory, we feel a raft should not be implemented. **(Quantitative Ranking: = 0.44)** **(Qualitative Ranking: Not recommended)**

Dollar Island

The Dollar Island territory contains abundant nesting habitat among two large islands. Nesting was confirmed upon one of these islands during the 1995 breeding season. Due to the shallow and rocky waters, the Dollar Island territory supports minimal recreational activity. We feel the Dollar Island territory contains sufficient nesting habitat with little human disturbance and therefore would not recommend implementing a raft for the 2001 breeding season. **(Quantitative Ranking: = 0.44)** **(Qualitative Ranking: Not recommended)**

Richardstown

Nesting has been confirmed within the Richardstown territory during the 1995, 1996, and 2000 breeding seasons, all resulting in nest failures. Water level fluctuations greatly impact the nesting success of the loon pairs within this territory. The nest sites from each of the years listed above were all located upon a grassy patch of land which becomes exposed from decreasing water levels and is subject to flooding when water levels increase. We feel the placement of a raft would positively increase nesting success

within the Richardstown territory. (**Quantitative Ranking: = 0.55**) (**Qualitative Ranking: Highly recommended**)

North Student's Island

The North Student's Island territory has not contained a nesting pair of loons from 1995-2000. Although not confirmed, Jeff Fair felt the pair from 1995 might have nested (Fair 1995). The territory supports a secluded cove, along the eastern shoreline, with adequate nesting habitat available. The landscape of this cove changes dramatically with Mooselookmeguntic's fluctuating water levels. We feel a raft should be placed within this cove for the 2001 breeding season. (**Quantitative Ranking: = 0.33**) (**Qualitative Ranking: Highly recommended**)

Student's Island

Nesting within the Student's Island territory has been documented during the 1996 and 2000 breeding season, chicks successfully hatching in 1996. The territory contains five small islands, all heavily supporting recreational activity throughout the loon's breeding season. On the two southern-most islands, exists a Herring Gull (*Larus argentatus*) colony. The 2000 loon nest site was located on the smaller of the two islands. The nest failed due to predation, most likely from Herring Gulls (gulls have been documented as predators of loon eggs). Due to the lack of quality nesting sites caused by heavy recreational activity and the threat of nest predation from gulls, we feel placing a raft with an avian guard, within the Student's Island territory would positively increase nesting success. (**Quantitative Ranking: = 0.66**) (**Qualitative Ranking: Highly Recommended**)

East Toothaker

The East Toothaker territory has supported a nesting pair of loons during the 1996 and 2000 breeding seasons. All nests have resulted in nest failure, most likely from predation. Nesting has been documented upon the only island within the territory, East Toothaker Island, and once among a grassy cove located at the southern end of the territory. These two particular spots provide the only adequate nesting habitat within the territory. The East Toothaker territory contains a relatively small stretch of rocky shoreline and a forested and rocky island. Placing a raft within the East Toothaker territory would allow for an adequate nesting location, protecting future nesting loons from predation. (**Quantitative Ranking: = 0.66**) (**Qualitative Ranking: Highly recommended**)

South Toothaker

Nesting has been observed within the South Toothaker territory during the 1999 and 2000 loon breeding seasons. Chicks were successfully hatched in 1999. The nest sites have been documented upon a small island located south of Toothaker Island. This particular area contains minimal recreational activity and provides for an ideal loon nesting territory. We feel the placement of a raft within the South Toothaker territory for the 2001 breeding season is not necessary. (**Quantitative Ranking: = 0.77**) (**Qualitative Ranking: Not recommended**)

Bemis

The Bemis territory has supported a nesting pair of loons during the 1996 and 1999 loon breeding seasons, successfully hatching chicks during those years. The Bemis territory is a marshy area containing shallow water. During years when Mooselookmeguntic's lake levels decrease, much of the territories adequate nesting habitat is lost, forcing the loons to nest in less desirable locations or to not nest at all. We feel the implementation of a raft within the Bemis territory would positively increase the pair's nesting success.

(Quantitative Ranking: = 0.55) (Qualitative Ranking: Highly recommended)

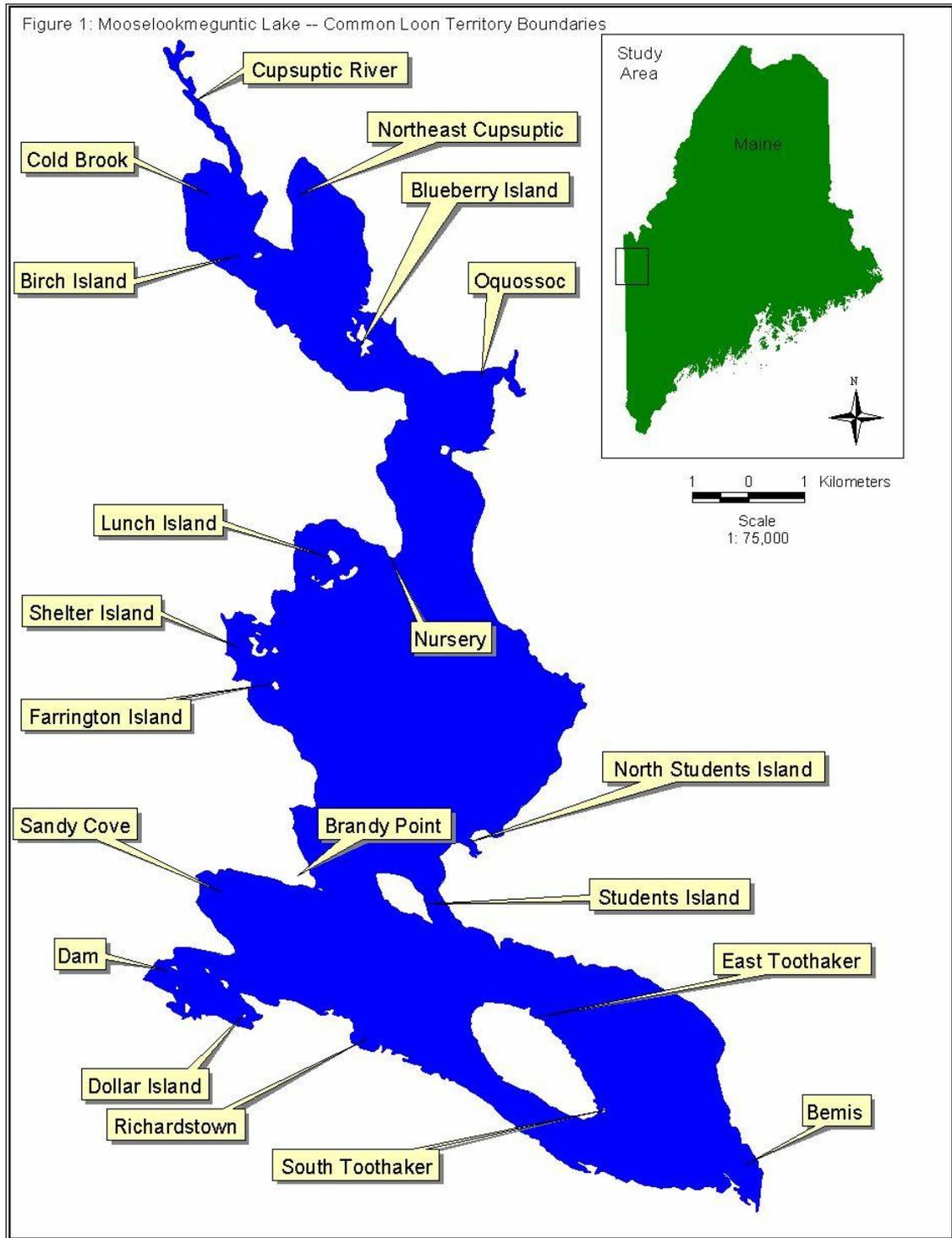
9. RECOMENDATIONS

Because of the water level fluctuation pattern on Mooselookmeguntic Lake, artificial nesting islands (rafts) will be useful for enhancing loon productivity. The following eight sites are feasible and therefore have been selected to support rafts in 2001: (Territory maps can be found in the Maps section)

- Cold Brook
- Brandy Point
- Sandy Cove
- Richardstown
- North Student's Island
- Student's Island
- East Toothaker
- Bemis

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Appendix 1 : Rank of Common Loon Territories on Mooselookmeguntic Lake

	Productivity Parameters						Territory Characterization			Results
	1	2	3	4	5	6	7	8	9	10
Territories	TP	NP	CH	CS	Hist. NP	Hist. CH	Islands Av.	Devel	Activity	Quan Rank
Blueberry Island	1	1	1	1	1	1	1	1	0	0.88
South Toothaker	1	1	0	0	1	1	1	1	1	0.77
Shelter Island	1	1	0	0	1	1	1	1	0	0.66
Student's Island	1	1	0	0	1	1	1	1	0	0.66
East Toothaker	1	1	0	0	1	0	1	1	1	0.66
Cupsuptic River	1	1	0	0	1	0	1	1	1	0.66
Brandy Point	1	1	0	0	1	0	1	1	0	0.55
Cold Brook	1	0	0	0	1	1	0	1	1	0.55
Birch Island	1	1	0	0	1	0	1	1	0	0.55
Oquossoc	1	1	0	0	1	0	0	1	1	0.55
Bemis	1	0	0	0	1	1	0	1	1	0.55
Richardstown	1	1	0	0	1	0	0	1	1	0.55
Sandy Cove	1	0	0	0	1	0	0	1	1	0.44
Dollar Island	1	0	0	0	1	0	1	1	0	0.44
Dam	1	0	0	0	0	0	1	1	1	0.44
Lunch Island	1	0	0	0	0	0	1	1	0	0.33
Farrington Island	1	0	0	0	0	0	1	1	0	0.33
Nursery	1	0	0	0	0	0	0	1	1	0.33
North Student's Island	1	0	0	0	0	0	0	1	1	0.33
Northeast Cupsuptic	1	0	0	0	0	0	0	0	0	0.11
Total Mean Rank									0.52	

** See Appendix 2 for explanation of category rankings

Appendix 2: Quantitative Territory Summary Ranking Process

1. Territorial Pair (TP): The basic quantification of occupancy of a territory by a Common Loon pair from 1996 – 2000.

0 = Established pair not present

1 = Established pair present

2. Nesting Pair (NP): Categorized based on findings of nesting evidence within a territory from 1996 – 2000.

0 = No nesting evidence found

1 = Evidence of nesting found

3. Chick Hatched (CH): Categorization based on whether or not loon chicks were actually hatched from a nest, regardless of whether or not they left the nest or survived (2000).

0 = No chicks hatched

1 = Chicks hatched

4. Chick Survival (CS): Ranked based on whether or not Chicks hatched on a territory actually survived to a minimum of seven weeks old (known by change in molt) in 2000. Because of the difficulties associated with actual confirmation of the young fledging from a territory and very low mortality of chicks > 7 weeks (i.e. <5% loss), young that reach this age are assumed to have fledged.

0 = Chicks did not survive to 7 weeks of age

1 = Chicks survived to 7 weeks of age

5. Historical Nesting: Ranked based on actual findings or reports from reliable sources of historical nesting from 1996 – 2000 in a territory.

0 = Historical nesting absent

1 = Historical nesting present

6. Historical Chicks Hatched: Ranked based on actual findings or reports from reliable sources of historical chicks hatched from 1996 – 2000 in a territory.

0 = Historical chicks hatched absent

1 = Historical chicks hatched present

7. Islands Available: Loons typically choose nesting sites on islands and have higher reproductive success vs. mainland sites (McIntyre 1988). Although both sites can be successful, island nest sites have an advantage in that they limit exposure to mammalian predators. Categorization was based on whether or not islands suitable for nesting were present within each territory.

0 = No islands available for nesting within that territory

1 = At least one island suitable for nesting was present within that territory

8. Development: Shoreline development often displaces and/ or destroys loon nesting habitat, but also is a representation of human activity (which is often associated with increasing predator densities) on a water body. Although many developed lakes are productive, and, conversely, many lakes that have no development are not productive- we assume loon territories with minimal development generally create fewer potential threats to nesting loons and their chicks. Territories were ranked based on the amount of developed shoreline within their borders.

0 = Shoreline development is abundant

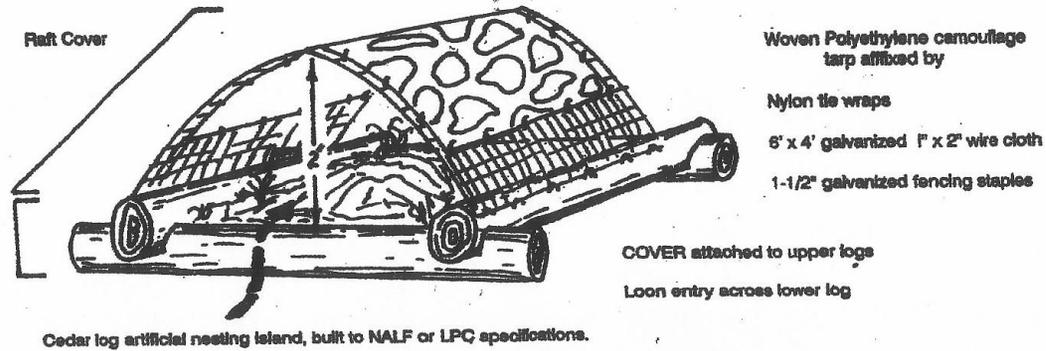
1 = Shoreline development is minimum

9. Activity: Presence or absence of a boat ramp on a water body will typically affect the level of boating activity on a lake, and therefore a loon territory. Human disturbances are often a cause for nest failure, and boats may collide with adults and/or young, risking injury or death. Increased human activity also affects loon survival due to the use of and improper disposal of fishing line and lead sinkers (Taylor and Vogel 2000). It is recognized that smaller boats such as canoes and kayaks also may disturb loons during incubation and/or brooding (Titus and VanDruff). Therefore we categorized loon territories on whether or not they contained heavy boating (i.e. motorboats, canoes, kayaks) during the 2000 season.

0 = Activity within the territory is high

1 = Activity within the territory is low

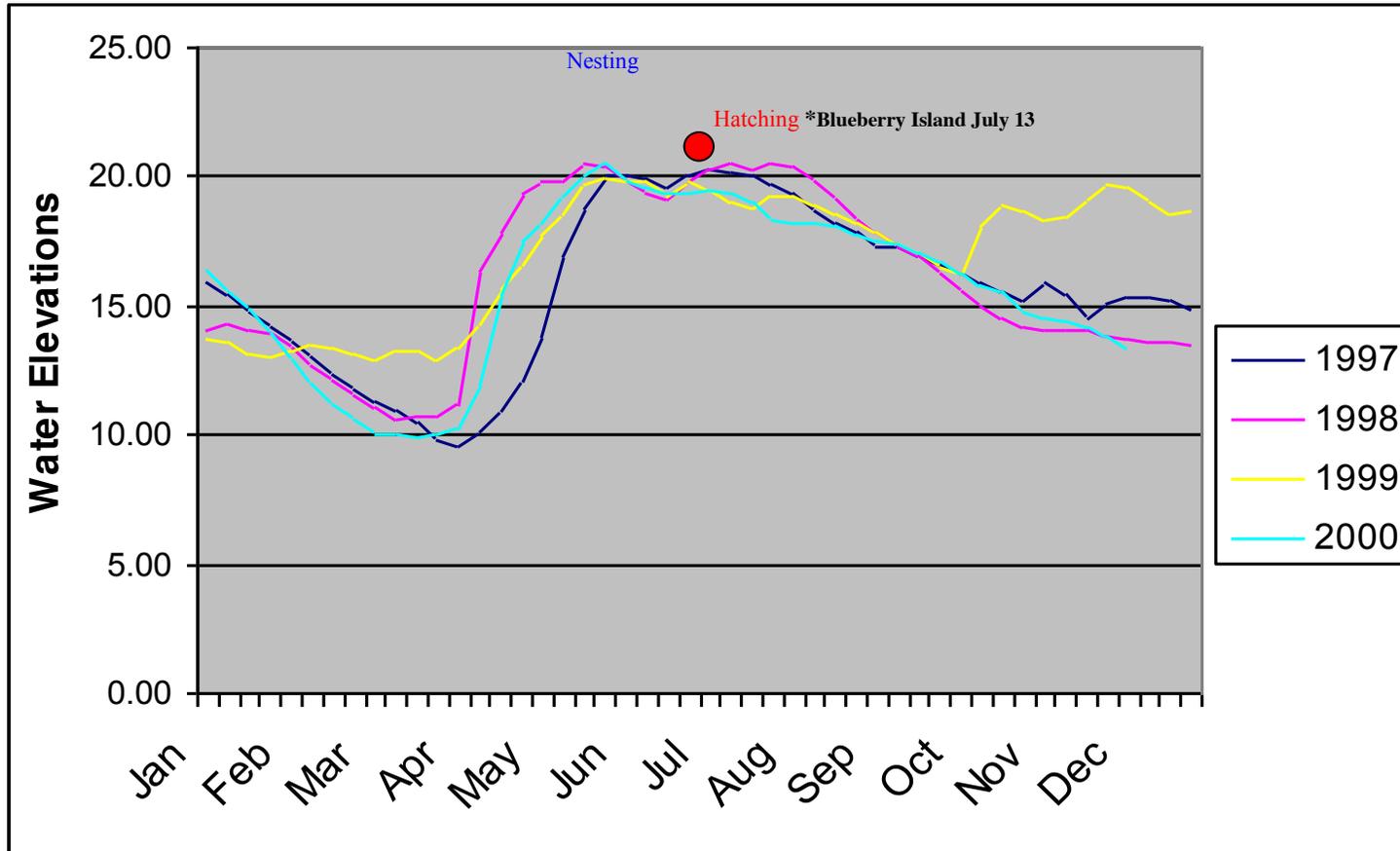
Appendix 3: Avian Guard



NOTE: The raft cover is a tool for application only in those rare cases in which loon rafts are suffering avian egg predation. ADDITION OF COVERS TO RAFTS WILL INCREASE VISIBILITY OF RAFTS AND WILL THEREFORE INCREASE THE LIKELIHOOD OF HUMAN DISTURBANCE AND RESULTANT NEST FAILURE.

Guidelines for construction and use of artificial nesting islands for common loons are available through the North American Loon and the New Hampshire Loon Preservation Committee.
J. Fair, Consulting Biologist, Box 55, N. Sandwich, NH 03259 11/82

Appendix 4: Mooselookmeguntic Daily Water Level Elevations (1997-2000)



Appendix 5: 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

Chick survival – Number of loon chicks fledged divided by the number of loon chicks hatched; often expressed (x 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

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 existed or has been monitored. Calculated by dividing the number of chicks hatched divided by the number of years during which the parameter was measured. This measure is analyzed by territory and nest site selection in Appendix 4.

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

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

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

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. On Richardson Lake during this study period, nesting season may be generally defined as May 15 – August 5.

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 (x 100) as a percentage.

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.

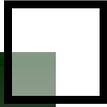
Renest – Any nest attempt by a pair subsequent to its original nest attempt on a given year.

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.



Mooselookmeguntic Lake
2000 COMMON LOON POPULATION SURVEY
SUMMARY AND MANAGEMENT PLAN



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