# The Common Loon

## Population Status and Fall Migration in Minnesota

Minnesota Ornithologists' Union
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A Survey of Common Loons on Small Lakes in Central Minnesota
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*Peder H. Svingen*

The Minnesota Ornithologists' Union

Minneapolis, Minnesota
September 2000


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# An Estimate of Minnesota's Summer Population of Adult Common Loons

*Excerpted from*

**Minnesota Department of Natural Resources**
**Biological Report No. 37, April 1991**

Paul I. V. Strong and Richard J. Baker

*LoonWatch and the Minnesota Department of Natural Resources' Nongame Wildlife Program conducted Minnesota's first statewide population estimate of Common Loons using volunteers in 1989. More than 600 volunteers and biologists searched for loons on 723 lakes greater than or equal to 10 acres, from the ground, water, and air. The calculated estimate was 11,626 adult Common Loons with a 95% confidence interval of 1,272 (10.9%). Surveyors reported at least one adult loon on 49.5% of the sample lakes. Lakes with loons tended to occur more often in west-central, north-central, and northeastern parts of the state. Occupancy rates were greatest on lakes in the 150–499 acre size class, with nearly two-thirds of the lakes harboring loons.*

The Common Loon (*Gavia immer*) in Minnesota has been well studied (Olson and Marshall 1952, McIntyre 1975, Titus and VanDruff 1981, Eberhardt 1984). Surveys of portions of the state's summer population have been conducted (McIntyre 1978, 1988a, Hirsch and Henderson 1980, Mooty and Goodermote 1985, Reiser 1988, Valley 1987, Mathisen 1988, Mooty and Perry 1988). Hands *et al.* (1989) summarized the status of the Common Loon in Minnesota. However, this apparently large summer population has not been estimated using statistically valid techniques. Hirsch and Henderson (1980), utilizing a non-random sample, estimated the summer adult population at 10,700. This suggested that Minnesota may harbor one-half to two-thirds of the summer Common Loon population in the lower 48 United States.

Even though the state's summer loon population has never been estimated with accuracy, some data suggest that the population has decreased over the past century and that populations in some parts of the state may still be declining. Historically, the Common Loon nested throughout Minnesota (Roberts 1932); its breeding range at the turn of the century extended into northeastern Iowa (Palmer 1962). Hirsch and Henderson (1980) found Common Loons in 40 counties north of the Minnesota River in 1980. In a 15-year interval survey conducted in 1971 and 1986, McIntyre (1988a), also using a non-random sample, reported a smaller proportion of lakes with territorial loons in 1986. In a lake by lake comparison, she found nearly eight times as many lakes with less versus more utilization by Common Loons.

Sigurd Olson Environmental Institute (SOEI) and the Minnesota Department of Natural Resources' (MDNR) Nongame Wildlife Program began planning in 1988 for a statewide survey of the summer adult Common Loon population in 1989. This report details the methodology and results of the survey.

## Methodology

*Establishing the Sample.* Common Loons have recent occupation histories in 41 northern and central counties (Hirsch and Henderson 1980). Anecdotal but also consistent reports from additional south-central counties (MDNR unpubl. data) suggested establishment of a sample area that included most counties north of the Minnesota River.

Based on surveys of Common Loons in Wisconsin (Olson 1986) and Michigan (Dahmer and Robinson 1985, Heitman and Robinson 1985, Robinson *et al.* 1986), and a recent study of Common Loon use of small lakes in north-central Minnesota (Perry 1987), we decided to limit the survey to lakes greater than or equal to 10 acres. Lakes smaller than 25 acres are sometimes thought unsuitable for use by Common Loons, but Perry's (1987) study reported substantial use of lakes in this size class.

Olson (1986) suggested that volunteers could be used to survey lakes for loons, but stated that their ability to do so was impaired on lakes greater than or equal to 500 acres. Accordingly, we divided the sample into two parts: one conducted by volunteers on lakes smaller than 500 acres and one conducted by professional wildlife biologists on lakes greater than or equal to 500 acres. We further divided the subsample of lakes smaller than 500 acres into three classes, based on the mean number of loons seen on lakes of various size classes in Wisconsin (Olson 1986): 10–49 acres (one loon per lake), 50–149 acres (two loons per lake), and 150–499 acres (more than two loons per lake). For the three smaller size classes, we decided that a sample of 650 lakes (approximately 5% of the total number of Minnesota lakes in these size classes) would be adequate for statistical analysis. We added 1% more to bring the total to 780 lakes, not only to accommodate a surplus of volunteers, but also to account for volunteer attrition that was expected to occur. Olson (1986) had reported that approximately 20% of the volunteers in Wisconsin failed to complete the survey.

Again following the methodology used by Olson (1986), we selected lakes using a random cross-stratified format with two strata (lake size class and county), so that there would be equitable distribution across the range of lake sizes and across the sample area. First, we obtained the most current listing (MDNR 1968) of lakes greater than or equal to 10 acres in Minnesota and deleted all lakes in the 38 counties not included in the survey. For each remaining county, we determined the number of lakes in each size class within each county. We then calculated the number of lakes to be sampled from all three smaller size classes in each county using the formula for proportional allocation (Cochran 1977).

Using this sampling routine, we found that no lakes would be sampled within Benton, Mille Lacs, and seven additional counties (Kittson, Koochiching, Lake of the Woods, Marshall, Pennington, Red Lake, Roseau). We pooled the seven northwestern counties to obtain at least a small sampling from that region.

In order to distribute the lakes among the size classes in a manner that would reduce the variance for our final estimate, we inspected data from other surveys of Common Loons in the United States and Ontario, and summarized information on lake area and numbers of loons. Using these data, we derived a pooled estimate of the variance for each size class using another formula from Cochran (1977). These values were used to determine the number of lakes to be sampled in each size class in each county. [*Editor's Note:* See the original report for formulae and statistical analyses.]

We then selected the sample lakes by assigning a random number to each lake in the three smaller class sizes within the 49 counties to be included in the survey. We grouped the lakes within each county by size class, sorted the groups by random number, and selected the lakes.

Few data were available for surveys of lakes greater than or equal to 500 acres, but large variance in the number of loons on lakes in this size was thought to exist, so we

| | Size Class (acres) | | | | |
|---|---|---|---|---|---|
| | **10–49** | **50–149** | **150–499** | **>499** | **Total** |
| Status of Lakes in Initial 5% Sample | | | | | |
| Existing in 1989 | 204 | 159 | 196 | 126 | 685 |
| Marshy/Dry in 1989 | 43 | 26 | 21 | | 90 |
| Total | **247** | **185** | **217** | **126** | **775** |
| Status in Additional 1% Sample | | | | | |
| Existing in 1989 | 47 | 39 | 48 | | 134 |
| Marshy/Dry in 1989 | 9 | 5 | 1 | | 15 |
| Total | **56** | **44** | **49** | **0** | **149** |
| Lakes Visited (Initial 5% Sample) | | | | | |
| Existing Lakes | 142 | 128 | 161 | 126 | 557 |
| Replacements for Marshy/Dry | 31 | 24 | 17 | | 72 |
| Lakes Visited (Additional 1% Sample) | | | | | |
| Existing Lakes | 25 | 26 | 34 | | 85 |
| Replacements for Marshy/Dry | 7 | 2 | 0 | | 9 |
| Total Lakes Visited | **205** | **180** | **212** | **126** | **723** |
| Lakes Not Visited (Initial 5% Sample) | | | | | |
| Existing Lakes | 62 | 31 | 35 | | 128 |
| Replacements for Marshy/Dry | 12 | 2 | 4 | | 18 |
| Lakes Not Visited (Additional 1% Sample) | | | | | |
| Existing Lakes | 22 | 13 | 14 | | 49 |
| Replacements for Marshy/Dry | 2 | 3 | 1 | | 6 |
| Total Lakes Not Visited | **98** | **49** | **54** | **0** | **201** |

**Table 1. Distribution of lakes included in the survey. See text for explanation of Initial vs. Additional Sample, and procedure for selecting replacement lakes (n=105) for those found to be marshy or dry after the initial selection process.**

decided to sample about 20% of these lakes. From the 623 lakes greater than or equal to 500 acres in the study area, we randomly selected 126. Due to a low-level flight ban over the Boundary Waters Canoe Area (BWCA), we replaced all selected lakes within the BWCA with the nearest lake greater than or equal to 500 acres that was outside the BWCA but within the same county.

Finally, we located randomly selected lakes smaller than 500 acres on county highway maps, or on topographic maps if they did not appear on the county maps. Many lakes that were absent on both maps were apparently dry or marshy. We replaced these lakes with the closest lake in the same county and size class (Table 1).

*Volunteer Recruitment.* [*Editor's Note:* See the original publication for a detailed description of volunteer recruitment and assignment. Information packets, maps, forms for recording data, and instructions for conducting the survey were sent by mail. Volunteers were not trained. Report forms were inspected for unusual data and errors. Volunteers who did not return the report forms were not contacted.]

*The Aerial Component.* We assigned lakes greater than or equal to 500 acres to MDNR nongame wildlife biologists, other MDNR regional staff, and the LoonWatch coordinator. All flight surveyors received specific instructions. We instructed them to fly at 75–90 mph, 100–300 feet above the lake, and to circumnavigate the lake about 300 feet from the shoreline. Flight surveyors flew one or more additional passes to cover re-

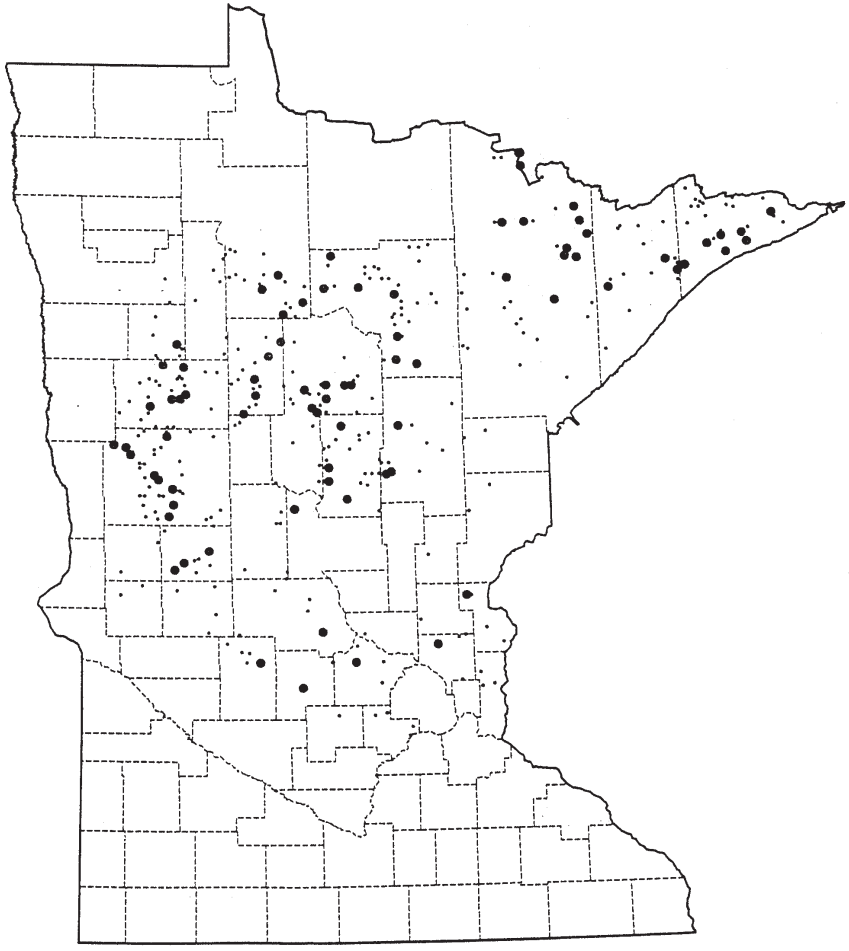

**Figure 1. Lakes on which at least one adult Common Loon was seen during survey. Map legend: • = 10–499 acres, ● = 500+ acres.**

maining areas of the lake, particularly lakes with open water basins and/or islands. Because visibility decreases on choppy water, flights were aborted if the wind was greater than or equal to 5 mph at the time of departure, or if conditions worsened during the flight. For consistency among flights and for optimal viewing conditions, surveyors were instructed to conduct flight surveys between 5:00 and 9:00 A.M. CST, with some latitude allowed. Surveyors counted adult loons and recorded their locations on maps. All flight surveys were done 17–24 July 1989.

*Data Compilation and Analysis.* All data were entered in a data management software program and carefully inspected for errors in transfer. Data on weather conditions, time spent conducting the survey, and methods of observation were summarized.

| | Size Class (acres) | | | | |
|---|---|---|---|---|---|
| | **10–49** | **50–149** | **150–499** | **>499** | **Total** |
| One | 26 | 28 | 68 | 32 | 154 |
| Two | 32 | 54 | 74 | 0* | 160 |
| Three | 5 | 2 | 16 | 12 | 35 |
| Four | 1 | 3 | 8 | 7 | 19 |
| Five | 3 | 1 | 3 | 5 | 12 |
| Six | 0 | 3 | 5 | 3 | 8 |
| Seven | 0 | 0 | 2 | 0 | 2 |
| Eight | 0 | 0 | 2 | 0 | 2 |
| | **67** | **91** | **178** | **59** | **395** |

**Table 2. Number of sample lakes in each size class with groups of one to eight loons. *Observers in airplanes (lakes >499 acres) were instructed to report groups of three or more loons.**

Within each lake size class we totaled the number of adult loons and calculated a sample mean and variance. We then estimated the number of adult loons in each size class using another formula. The total estimate was a sum of the estimates for the four class sizes. We calculated the variance of the estimate using the formula for stratified random sampling (Cochran 1977). [*Editor's Note:* See the original publication for formulae and statistical analyses.] Observers were asked to record the number of groups of loons and the size of the largest group. If these data were absent, the lake was left out of group size analysis.

## Results

*Rate of Reporting.* We received data for 723 lakes (Table 1). Volunteers submitted data for 597 (74.8%) of the 798 assigned lakes smaller than 500 acres. All 126 of the lakes greater than or equal to 500 acres were surveyed. Lakes for which no forms were submitted tended to be small and in remote areas.

*Occupancy Rates by Geography and Lake Size.* Surveyors reported at least one adult loon on 358 (49.5%) of the 723 lakes. There appeared to be geographic differences between lakes with loons present (Fig. 1) vs. lakes without loons (Fig. 2). Lakes with loons present tended to occur more often in west-central, north-central, and northeastern parts of the study area. Occupancy rates varied by size class, ranging from nearly one-third of the lakes 10–49 acres to nearly two-thirds of the lakes over 149 acres (Fig. 3). Loons were absent from most of the lakes in the southern part of the study area. Occupancy rates varied greatly by size class within counties also, but generally reflected the trend of greater occupancy in the northern parts of the study area, except for the extreme northwest. [*Editor's Note:* See the original publication for more graphics depicting occupancy rates by lake size class and by county.] Observers did not spot loons on any of the survey lakes in nine counties: Dakota, Hennepin, Lake of the Woods, Marshall, Mille Lacs, Ramsey, Scott, Stevens, and Swift.

The total number of Common Loons counted on individual lakes ranged from zero to 27. The most frequent numbers of loons seen were zero, one, or two, across all size classes. Large numbers were seen most often on lakes greater than or equal to 150 acres. The probability of observing zero loons was highest in the smaller size classes. There was great variation in numbers of loons seen in all lake size classes. The mean number of loons per lake ranged from one-half on the 10–49 acre lakes to nearly three loons on lakes greater than or equal to 500 acres.

*Group Size.* Observers were able to determine the size of 395 groups of loons (Table 2). Group size ranged from one to eight. Most loons were seen singly (39%) or in pairs (41%). The number of groups of one and two loons was nearly equal in the 10–49 acre and 150–499 acre size classes. However, there were nearly twice as many groups of two in the 50–149 acre class. No groups of two loons were reported on lakes greater than or equal to 500 acres, because we asked for group size only for groups of more than two loons in that size class.

*The Population Estimate.* Observers counted a total of 1,135 adult loons on the survey lakes, yielding an estimate of 11,626 adult Common Loons with a 95% confidence

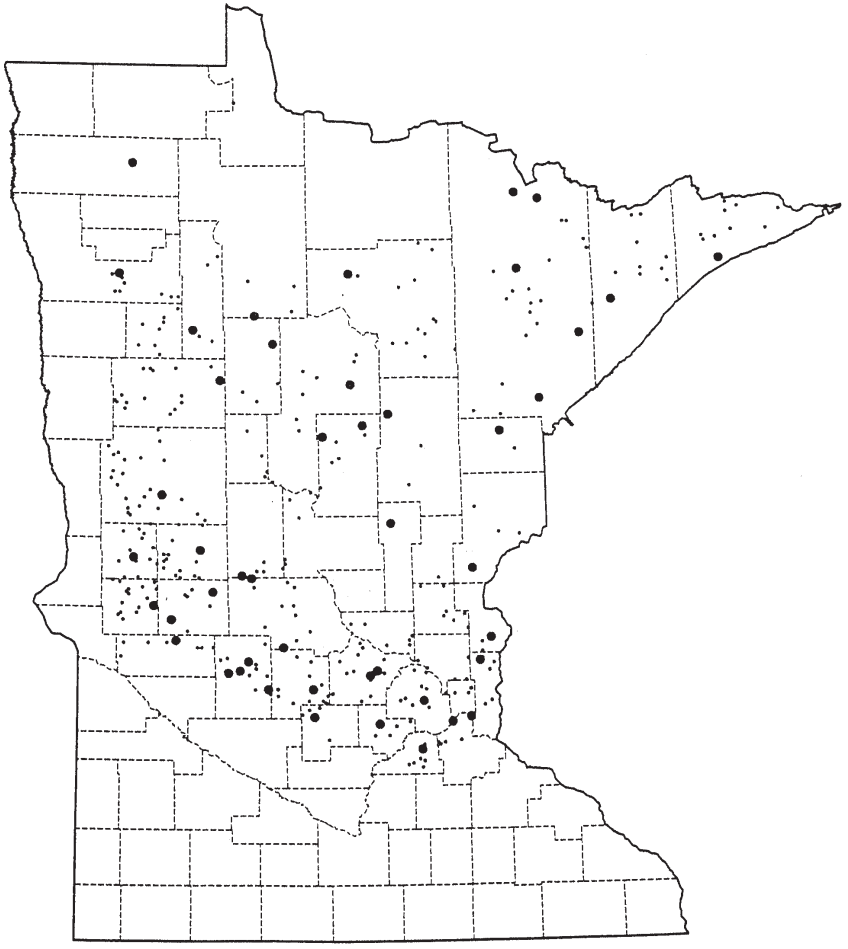

**Figure 2. Lakes on which no adult Common Loons were seen during survey. Map legend: • = 10–499 acres, ● = 500+ acres.**

interval of +/- 1,272 (10.9%). The estimated population was distributed fairly evenly across the lake size classes, although lakes in the 10–49 acre class accounted for twice as many loons as lakes greater than or equal to 500 acres (Fig. 4). All but 14 (2%) of the ground surveys were completed on 15 July 1989. The rest used one of the substitute dates.

## Discussion

*The Population Estimate.* Our estimate of about 12,000 adult Common Loons compares favorably with the estimate of 10,700 by Hirsch and Henderson (1980). It is the largest concentration of Common Loons in the lower 48 United States and accounts

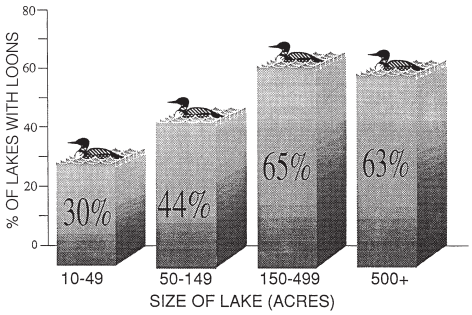


**Figure 3. Occupancy rate of lakes surveyed, by size class.**

for approximately three-quarters of the Common Loons in the Midwest, and over half of the Common Loons in the lower 48 (McIntyre 1988b:152).

Occupancy rates suggest that loons are most common in the north-central and northeastern regions of Minnesota, which correlates with the forested and lightly settled parts of the state. Low occupancy rates were primarily in southern and northwestern counties. While loons were not observed on any of the lakes in nine counties, it is likely that some Common Loons summer in these areas. A larger sample of lakes, particularly those lakes most likely to harbor loons, would be necessary to conclude that no Common Loons summer in those counties.

Loons were more likely to be found on lakes greater than or equal to 150 acres. However, the majority of the state's loon population apparently resides on lakes smaller than 150 acres because the vast majority of lakes are in this size class. Therefore, the importance of small lakes to the loon population should not be overlooked. The recent discovery of multi-lake Common Loon territories in Michigan's western Upper Peninsula and northeastern Wisconsin (Miller and Dring 1988), a phenomenon that occurs mostly on lakes smaller than 50 acres in close proximity to one another, suggests that occupancy rates on small lakes should be interpreted cautiously. Loon pairs may defend two to four small lakes, but their presence on only one lake at any time will lower occupancy rate estimates. The proportion of lakes actually being used by resident loons may be substantially higher.

Mean numbers of loons per lake are similar to those reported by Olson (1986) in northern Wisconsin. Few conclusions should be drawn about any correlations between lake size and mean numbers of loons observed, because the means for the two smallest size classes were greatly affected by the large numbers of lakes with zero loons. Loons were absent on over half of the sample lakes in these size classes. The aerial survey technique used on lakes greater than or equal to 500 acres almost always counts less than 75% of the actual number of loons present (Dibello *et al.* 1984). The proper interpretation of these statistics is that they represent the average number of loons one is likely to see on a lake of a given size class selected at random from all of the lakes in that size class in the survey area. [*Editor's Note:* See original publication for the sections "Dry and Replacement Lakes" and "Use of Volunteers."]

## Recommendations

The results of this survey indicate that Minnesota has a large summer Common Loon population. However, since it is the first estimate of its kind for loons in the state, it does not indicate any trend in population size, distribution, reproductive success, or habitat suitability. It would be prudent to either repeat this survey on a regular basis, or implement a monitoring program designed to detect significant changes in Minnesota's Common Loon population.

If a decision is made that repeating the survey is most desirable, we recommend that it be conducted every five years for three reasons. First, large amounts of time, effort, and funds were needed to plan and conduct the survey. It would be logistically and economically unfeasible to conduct it annually. The estimated cost associated with planning, implementing, and reporting this survey was $40,000. Second, the Common

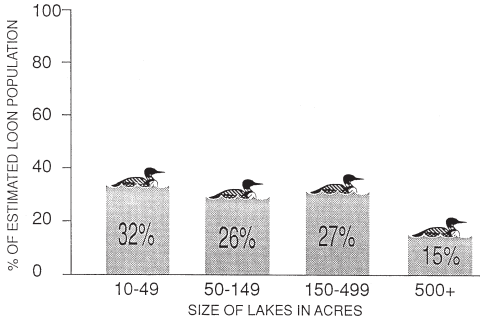


**Figure 4. Percent of estimated Common Loon population in each size class.**

Loon population is large and widely distributed, and since it is harbored on lakes surrounded by a variety of public and private lands; it is in no immediate danger of sudden decline due to changes on the breeding grounds. Third, adult loon populations probably change slowly due to low reproductive rates, recruitment, and adult mortality rate; it is therefore unlikely that short-interval surveys would be able to detect small changes in the population.

At the same time, effort should be made to assess the reproductive success of the breeding population and monitor habitat quality of important breeding lakes. Minnesota's loon population could remain nearly stationary for a number of years despite little or no reproduction. Periodic surveys of reproductive success would augment adult population data. McIntyre's (1988a) study suggested that lakeshore development and recreation on lakes may have correlated with decreases in some population parameters. Further investigation of this phenomenon seems warranted. Lastly, a survey to update the status of Minnesota's lakes should be a high priority for the near future.

## Conclusion

The methodology used in the 1989 Minnesota Loon Survey allowed a valid estimate of the state's adult summer loon population, established a list of lakes and volunteers that can be used in the future, and generated substantial positive public relations for wildlife protection in the state. The estimate of about 12,000 adult Common Loons is probably a minimum because the methodology undercounted loons on lakes larger than 500 acres and because the lake list used to establish the sample contained many lakes that were dry or marshy.

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