

Primer on Population Dynamics of Common Loons  
(Gavia immer)  
in the Upper Peninsula, Michigan.

*(BRI 2000-04)*



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## Introduction

Data on population dynamics of Common Loons (*Gavia immer*) are incomplete. For example, our knowledge of dispersal, survivorship, longevity, and age of first breeding are still largely speculative. It is only recently, as a result of a long-term study of marked individuals initiated by David Evers in 1987, that it has become possible to track the breeding performance, return rates of adults and juveniles, and data relevant to measure lifetime reproductive success for individual Common Loons. Studies that establish patterns concerning lifetime reproductive success for Common Loons and other birds are vital for long-term conservation initiatives (Newton 1992). For over a decade Common Loons at Seney National Wildlife Refuge in Michigan's Eastern Upper Peninsula have been intensely monitored and studied. This report chronicles the 1999 monitoring efforts, details off-site surveys for refuge banded loons and summarizes these results.

## Adults Banded as Juveniles (ABJs), a primer

In the spring of 1992 an adult male Common Loon arrived at Seney National Wildlife Refuge after a five-year absence. Hatched upon G pool in 1987, he had been one of nine juveniles to fledge from Seney that season. In the summer of his return he divided his time between several pools otherwise ignored by the breeding population of Seney's loons. The following season he again returned, and on a territory adjacent to his natal pool paired with his first female. He did not nest that year, nor in the three subsequent years during which he was observed, sometimes alone, sometimes paired. He meandered between a set of pools with no historical records of loon nesting. In 1997, following the failure of a nest on E-east pool, he displaced the male of that territory and immediately paired with the resident female. His new mate had occupied E-east for the past seven years, and this new territory carried one of the highest rates of chick productivity on the refuge. Upon returning to E-east the following spring he and his partner nested, and shortly thereafter hatched one chick. The G pool juvenile of 1987 was a first-time father at the age of eleven.

## Population Ecology

Located in the eastern-central portion of Michigan's Upper Peninsula, Seney NWR harbors 21 shallow (<2.5 m) artificially-controlled pools ranging in size from 27 to 900 acres. Since banding activities commenced in 1987 fifteen of these pools have served as territories for nesting common loon pairs. From the start the accessibility these sites has been assured by the logistical ease with which they can be visited (serviceable roads connect all refuge pools) and the unwavering support and assistance of refuge personnel. This has inspired absolute confidence in statistics such as territorial occupancy and reproductive success, and as the percentage of banded adult loons within the Seney system has steadily increased (from 26% in 1989 to 75% in 1997) so too has the resolution of data concerning survivorship, longevity, site fidelity, and mate switching.

Predictably, this increase has coincided with a commensurate magnification in observational efforts. In 1999, as during the previous two years, this monitoring spanned the uninterrupted length of the season, from the ice-off arrival of the first adults in mid-April to the autumn migration of the last fledged juveniles in mid-September. Using 7x35 binoculars and a 20-60x spotting scope, all territorial pools were checked at least twice weekly, with substantially

higher visitation (often twice daily) occurring during spring courtship, May-June nesting, and August post-reproductive gathering. In July three new adults and eight chicks were banded during night capture, bringing to 26 and 58 the respective totals since color-marking was initiated. Twenty of these adults were present during the 1999 field season, and collectively accounted for 80% of the resident population. The eight banded chicks represented all juveniles who fledged from Seney this autumn, and all save one of the hatchlings. Of the twelve territories established on refuge this spring, eleven featured nesting pairs, and six produced successful clutches. Residency and productivity details for all 1999 territories are summarized below.

#### A pool

For the third consecutive season the banded resident pair bred unsuccessfully. The female, captured on E-west in 1996 before moving to A pool the following spring, was rarely evidenced on territory after the late-June nest failure. The male, originally banded upon B pool north in 1992, has fledged only one chick over the last seven years.

#### B pool South

The resident B pair, both banded, returned in mid-April and displaced to the northern end of the pool an unbanded couple who had occupied the territory in the week following ice-off. On June 16 the B-south pair hatched one chick, which survived to fledging. The female, captured in 1994, has bred successfully upon the pool every season save 1996, when her banded mate was displaced by the current B-south male following nest failure.

#### B pool North / C pool

The unbanded pair displaced from B-south in early spring re-established a second territory in the pool's northern end, marking the first time since 1993 that two pairs occupied B pool. The B-north pair appeared to feed mainly upon the adjacent C pool during nesting, and after this nest's failure in early July the pair occupied the latter pool exclusively. No interactions were observed between the two B pool pairs during the nesting period.

#### D pool

The resident female, banded in 1989, returned to the pool for the eleventh straight season. Her mate of eight years reappeared briefly before vanishing in early May; shortly thereafter his color-banded left legbone was discovered in an eagle's nest located between D and G pools (see discussion below). The deceased male was replaced by another loon with an equally well-documented history: Banded upon E-east in 1992, he was displaced to J pool in 1997, and bred there unsuccessfully the following season. Once relocating to D pool in May he immediately bred with the D female. When their nest failed in early June he was again displaced, on this occasion by an unbanded intruder. This loon, the third D pool male of 1999, held territory for the remainder of the summer.

### F pool

The E-east resident pair briefly returned to that territory in early spring before moving to the adjacent F pool, which had no recent history of loon nesting. There was no visible change in water level or wildlife activity on E-east to suggest an impetus for the territory switch, but in their absence E-east pair, which over the past decade had been one of Seney's most productive territories, went unoccupied. On F pool the pair hatched and fledged two chicks. The F male, whose life history through 1998 was documented in the introduction, is one of two loons banded as juveniles who have acquired territories at Seney as returning adults, and the only one thus far to breed successfully.

### G pool

An unbanded pair hatched two chicks on July 4, one of which died two weeks later. Subsequently both adults were captured and color-marked. The remaining juvenile survived to fledging.

### H Pool

Upon another pool with no history of recent nesting a new territory was established by an unmarked female and a banded male. The latter (along with his mate at that time) was displaced from C2 in early 1998, and subsequently went unevicenced on refuge during the rest of the season. He reappeared briefly upon M2 this spring before pairing with a new female upon H. Together they hatched one chick on June 18. Thereafter the female was banded during capture.

### A2 Pool East

The resident pair, both originally banded upon C3, has annually returned to A2-east since 1995. In 1999 they hatched one chick on June 17.

### C2 Pool

The resident male displaced the current H male in early 1998, and was banded later in the season after hatching two chicks. In 1999 he and his unmarked mate bred unsuccessfully. The old C2 female, also displaced in the spring of 1998, has since been observed only as a visitor to late-summer social gatherings in both 1998 and 1999.

### M2 Pool

The M2 male, color-marked as a chick on G pool in 1993, is the second such banded juvenile to acquire a refuge territory as a returning adult. In 1998, as a first-time nester, he bred unsuccessfully. In 1999 he and his unmarked mate evidenced no signs of nesting. M2 pool, occupied during eight seasons in the previous decade, has produced no chicks during that period.

### T2 West

The T2 female has returned every season since her capture in 1993. In 1998 she and her newly-banded mate fledged two chicks - the first documented productivity off the territory. This season their nest failed in late June.

### C3 Pool

At seven years the C3 pair continues to evince the longest current site and mate fidelity at Seney. In 1999 they hatched and fledged two chicks for the third consecutive season. Since 1987 the pool has produced 12 fledged juveniles, the highest total among refuge territories.

The death of the D pool male in 1999, confirmed through the discovery of his color-marked left legbone in a nearby Bald Eagle's (*Haliaeetus leucocephalus*) nest, seemingly echoes the fate of the former G pool male in the year previous: An eagle was observed eating portions of the latter bird on an island in G-pool during May of 1998, and his color-marked right legbone was eventually located at the base of the same eagle nest. In both cases the absence of any direct observation of attack allows only inference concerning the cause of death. The D male was a minimum of 13 years old at the time of his demise, and the G male at least one year his senior. Neither male evidenced a discernible change in behavior in the weeks preceding their respective deaths. Furthermore, in July of 1999 an eagle was observed diving, without success, upon both the G pool pair and their month-old chick. Previous research has showed that adult eagles hunt and kill loon chicks (Paruk et al. 1999) and do attack nesting adults (Vlietstra and Paruk 1997), but the confirmed death of adult loons from adult Eagles has not been documented. It is possible this predation on loons by eagles may be restricted or limited to the refuge because its shallow pools may limit the ability of loons to evade attacks.

The two mortalities were of considerable consequence in the context of the entire refuge population, as the departed males reflected only the sixth and seventh color-marked adult loons to exit the refuge system (through either death or disappearance) since banding began. Setting aside the obvious influence of longevity, this historical consistency seems to owe much to the singular insularity of Seney, whereby only six lakes lie within 15 km of its 21 pools. An absence of numerous unmonitored 'border' territories has seemingly elevated the probability that most movements by and displacements of Seney birds will take place on an intra-refuge level, thus engendering a high degree of holistic stability to the monitoring of a system whose inherent dynamism is underscored by Table 1. Of the twenty banded adults on territory at the end of 1999, four had changed mates during the season, and six had changed breeding pools. Cumulative totals at Seney (equaling 162 loon-seasons of observation) suggest that breeding adults will undergo pair divorce and territory relocation at annual rates of 29% and 24% respectively.

There are a formidable number of potentially enlightening statistical juxtapositions engendered by this 'closed-system' resolution. For example, comparing divorce statistics for individual loons with their productivity data offers the possibility of ultimately determining whether the duration of a pairing correlates with nesting success. Thus far, in circumstances where the length of the pair-bond is known with certainty (n=41), only 22% of first-year pairings reproduced successfully, compared with 56% for pairings of 2-4 years and 100% for those of 5-7 years. Similarly, differentiating between the cumulative productivity of specific color-marked adults and the productivity of their pools might better delineate the extent to which specific individuals or pairings affect the viability of a given territory. For

example, over thirteen years of uninterrupted occupancy C3 pool has averaged 0.92 chicks fledged per year (Table 3), while the current resident pair has averaged 1.14 chicks over the last seven of those seasons. Marked differences, or lack thereof, in values for their successors, and successors thereafter, might suggest the degree to which C3 pool owes its high productivity to inherent habitat suitability.

While the significance of these comparisons will be contingent upon a substantially lengthier period of study, some of the refuge statistics themselves offer more immediate applicability. Specifically, the productivity totals for Seney (Table 4) are potentially of broader interest given the exceedingly low levels of human disturbance ensured by limited public access (an auto tour incorporates eight Unit 1 pools) and, more significantly, the absence of any watercraft. A figure such as 0.76 fledged chicks per nesting pair (based on 103 nesting territories since 1987) reflects average success rate under conditions that, on a statewide basis, most closely approximate a 'natural' absence of human influence. The impact of human-use patterns on productivity has been the focus of a recent BioDiversity directed study on Isle Royale National Park, where Michigan's largest population (and highest density) of breeding loons fledged an average of only 0.48 chicks per nest in 1999. The findings demonstrated a strong inverse correlation between reproductive success and the proximity of canoe and kayak traffic to inland-lake nesting sites (Tischler&Kaplan in prep.). As this research seeks to partially explain the chronically low productivity at Isle Royale in terms of annual human disturbance during nesting, the potential degree of this impairment factor can theoretically be gauged by using the control of Seney's baseline figures.

In late June a new adult loon banded as a juvenile (referred to as an ABJ) returned to the refuge for several days. Due to a redundancy in color band combinations its identity remained equivocal, being either that of the E-east chick of 1992 or a D pool chick from 1993. The ABJ remained alone mostly J pool and later interacted with the resident pair at G pool. The individual resurfaced in early August for a period of two weeks, when it sporadically frequented a small unoccupied arm of C pool while concurrently participating in several social gatherings upon other Seney territories.

This loon was the sixth ABJ to be re-observed on refuge; collectively the six represent 17% of all banded juveniles eligible for return as adults (Table 2). The annual rate for banded adults, cumulatively 97% since 1992, refers to all territorial birds sighted somewhere on refuge during the subsequent season, and thus reflects total survivorship more so than territorial fidelity. More generally it underscores a potential for comprehensive understanding of adult population ecology which has thus far not extended the dynamics of banded juveniles. Due to the paucity of data points (in addition to the six ABJs, two dead juveniles have been recovered on their wintering grounds) relative to total banded juveniles eligible for return (n=37 through 1999) it is unclear whether the low refuge recruitment percentage over the past decade more strongly reflects absolute survivorship figures or undocumented dispersal patterns. The latter possibility is indirectly supported by the fact that only two of the six observed ABJs, the F and M2 males, have thus far acquired refuge territories. With this potential for dispersal in mind, off-refuge lakes were incorporated in 1999 into the investigation of Seney's population dynamics.

### **Off-refuge lake survey**

Between late June and early August a total of 79 eastern Upper Peninsula lakes ranging from 10 to 77 kilometers away from Seney NWR (Figure 1) were visited with the intention of potentially locating both unreturned refuge ABJs (n=29) and missing refuge adults (n=4). Twenty-five lakes were targeted for survey, and in most instances nearby water bodies were also covered as time and logistics permitted. Using 7X35 binoculars and a 20-60X spotting scope, each lake was surveyed for 30 minutes to determine current loon occupancy. When possible, any observed loon was monitored until its banding status could be unequivocally determined.

No banded loons from Seney NWR were discovered during the off-refuge search. Although 65 of the 79 lakes were, upon inspection, subjectively classified as potential loon habitats, only 33 (51%) of these were actually occupied during surveying. Collectively they held 56 loons, 43 of whom (77%) were positively identified for banding status. Of these 40 were unbanded (93%), and three were color-marked (7%); all of the latter were loons captured during off-refuge banding efforts in previous seasons, and all were re-observed during the survey on their respective capture lakes. The 13 unconfirmed birds either took flight before their status could be verified or were rendered unobservable due to inclement weather conditions. Twenty-two loon pairs were observed with young (on 21% of occupied lakes and 11% of potential lakes).

This midsummer survey sought to avoid the potential for nest disturbance associated with earlier visitation, especially on undeveloped lakes where loon sensitivity to shoreline activity tends to be far more acute. It also aimed to avert the ambiguities and prolonged delays inherent in determining the banding status of a nesting loon pair. However, as many unsuccessful breeders tend to wander extensively following reproductive failure, this approach limited the total number of adults available for observation. While the discovery of only 56 off-refuge candidates during the course of the surveying suggests low occupancy and/or low productivity, the limitations of the search render such indications largely speculative. As the time and effort required for the off-refuge excursions seemed disproportionate to the single conclusion which was drawn from them, the results of the survey strongly suggest that any future search for ABJs should be undertaken in the context of broader investigations. For example, this pursuit might reasonably be deemed time and cost-effective when included as one aspect of a more comprehensive survey focusing upon the unequivocal determination of territorial occupancy, nesting status, and productivity for all eastern Upper Peninsula lakes.

### Conclusion

As the distribution and scope of BioDiversity Research Institute's work has grown over the past decade, the attention and commitment with which the loons of Seney National Wildlife Refuge are monitored has nonetheless remained strong. Of immeasurable assistance in this sustained effort has been the combined involvement of government agencies, refuge personnel, volunteers, and independent organizations, all of whom have implicitly recognized through their support the unique nature of the long-term study continually unfolding upon Seney's protected waters.

### Acknowledgements

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