



Diver/Loon Specialist Group

Newsletter

Volume 5 - 2006

The primary objective of the Diver-Loon Specialist Group is to facilitate communication among loon researchers, educators, and conservationists, and to develop a cooperative network of persons interested in loon preservation world-wide.

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Introduction

Welcome to Issue #5 of the Diver/Loon Specialist Group Newsletter! If you have been keeping up with our publications, you know that we have posted a newsletter approximately every other year. This one has taken longer, but we hope you will find the articles here equally as informative as our past issues.

Much has happened among North American loon organizations over the past few years. First, Joe Kerekes has recruited Ted Gostomski to be the new co-editor of this newsletter, and despite all the modern forms of communication available to us, Joe and Ted experienced difficulty in catching up to one another and fully discussing the editorial responsibilities associated with the DLSG Newsletter. (Joe's illnesses in the summer of 2005 and the spring of 2006 contributed to the delay.) Having now completed that discussion, we are ready to move forward and hopefully be timelier in our publications.

Second, the North American Loon Fund closed its doors in 2005, bringing to an end 25 years of very successful collaborative research, education, and protection of the Common Loon. Scott Sutcliffe gives a brief history of the organization in this newsletter.

The DLSG met in August 2003 during the *Limnology and Waterbirds 2003* conference held in Sackville, New Brunswick, Canada. Joe Kerekes presents topics discussed during that gathering.

Please look at the updated Directory on our website (www.briloon.org/bri/workinggroups/diver.htm). Check your entry and send any necessary corrections to the Editor.

Announcements

The articles contained in this Newsletter may be quoted as:

Name of Author(s). 2002. Title of article. (page numbers) Newsletter, Diver/Loon Specialist Group, Wetlands International. vol. 4.

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Welcome Ted!

Ted Gostomski has returned to the Gaviidae family (and other divers) after a hiatus spent working with The Nature Conservancy in southern Michigan. Ted is a former coordinator for Wisconsin's LoonWatch program and was a trustee, newsletter editor, and (briefly) executive director for the North American Loon Fund. He is currently the Northern Region Ecologist for the Wisconsin Department of Natural Resources, Endangered Resources program, where he assists with property planning, management of State Natural Areas, and permit reviews. He comes to the Diver-Loon Working Group as an assistant editor, helping Joe Kerekes to collect, edit, and write stories and articles for this newsletter.



Eighth International Conference on Mercury as a Global Pollutant

The University of Wisconsin-Madison, University of Wisconsin-LaCrosse, and the U.S. Geological Survey are hosting this year's International Conference on Mercury as a Global Pollutant, 6-11 August 2006, in Madison, Wisconsin, USA. The theme of this year's conference is "Toward Integration of Science, Policy and Socioeconomics" and will feature socioeconomic issues pertinent to public policy as well as recent scientific advances in mercury research. For more information or to register, go to www.mercury2006.org.



CONFERENCE ON
MERCURY
AS A GLOBAL
POLLUTANT

MADISON WISCONSIN
AUGUST 6-11, 2006

North American Loon Fund Closes Its Doors

By Scott Sutcliffe, Cornell Lab of Ornithology

After twenty-five years of leadership and discovery, the North American Loon Fund (NALF) closed its doors in 2005. NALF was the first national organization dedicated to the study and conservation of North America's loons. It was founded in 1979 to coordinate and promote state and provincial loon programs. Its mission of loon study, loon conservation, and public education was well received from coast to coast at a time when loon populations were in jeopardy from environmental degradation. Led by an energetic crew of volunteers and a small staff, NALF was instrumental in fostering state and provincial loon study and preservation programs, funding research and education programs, and acting as a national clearinghouse. Its dramatic recording, *Voices of the Loon*, educated and activated conservationists from coast to coast.

Since its inception, NALF was the leading source of expertise and support in fostering, funding, and guiding regional loon alliances. Twenty+ loon associations were established under NALF's guidance; untold numbers of conferences, workshops, and seminars were hosted by NALF; and \$300,000 was distributed to associations and individuals working to preserve loons in North America. NALF served as a union of state and provincial groups, galvanizing them into action.

NALF's initiatives were instrumental in turning the tide for Common Loon populations. State, regional, and provincial programs now flourish thanks to NALF's leadership. And, most important, North America's Common Loons are better understood and protected than ever before.

In July of 2004, NALF trustees decided the timing was right for NALF to close its doors. It had accomplished what it set out to do; effective loon research and conservation programs now rest with strong state, provincial, and regional programs—NALF's mission has been embraced by over twenty independent organizations.

In closing NALF, its Trustees voted to create the *North American Loon Research Endowment*, managed by the Sigurd Olson Environmental Institute of Northland College. The endowment will fund the *Sigurd T. Olson Loon Research Award*, an annual award that will enhance our understanding and management of loon populations.

In closing, the dedication and hard work of NALF volunteers, staff, trustees, and affiliates have contributed immeasurably to our understanding of Common Loons and to their preservation. NALF's mission will live on through its strong affiliates and, with everyone's help, North America's loons will live on forever.



The North American Loon Research Endowment

By Amber Roth, LoonWatch Coordinator, Sigurd Olson Environmental Institute

In 1985, LoonWatch established the Sigurd T. Olson Loon Research Award. The Award was named in honor of wildlife biologist, Sigurd T. Olson, son of the Institute's namesake, Sigurd F. Olson, in recognition of his early contributions to our understanding of loons. His 1952 paper co-authored with William H. Marshall, "The Common Loon in Minnesota," continues to be cited as one of the premier baseline reports on the natural history of the species.

The Loon Research Award provides funding for original research that leads to better understanding and management of loon populations across North America. Since its inception, the Loon Research Award has provided nearly \$30,000 to projects in Minnesota, Wisconsin, Michigan, Massachusetts, and Alaska. Sigurd T. Olson Loon Research Award funding has provided critical support for small but important projects that have allowed researchers to increase their understanding of loon nocturnal vocal behavior, impacts of human disturbance on loons and causes of loon mortality. The Award has also assisted in the establishment of projects that are now long-term and/or continent-wide studies. Please see the LoonWatch website at www.northland.edu/loonwatch to view the award history and the many projects supported by this award.

Mark Pokras, Tufts School of Veterinary Medicine, received the 2006 Sigurd T. Olson Loon Research Award for his project titled, *Learning from Loons: Lead Poisoning and its Threats to Wildlife and Human Health*. Mark proposes to write a book to educate the public about the perils of lead poisoning in loons and other wildlife and to encourage efforts that reduce lead in the environment. If you are interested in submitting a proposal for the 2007 award, contact LoonWatch at loonwatch@northland.edu, or call (715) 682-1223. Submission guidelines are available upon request and the deadline for proposal submission will likely be around mid-December 2006.

Funds for the Loon Research Award were initially generated through the hosting of an annual Wisconsin Loon Banquet. Since the mid-1990s, individual donors with an interest in loon research and management have supported the fund. In 2005, the remaining cash assets from the North American Loon Fund were transferred to LoonWatch to create the North American Loon Research Endowment. To support the Loon Research Award, you can make a tax deductible gift and designate your contribution to the endowment. Send your contribution to: LoonWatch, 1411 Ellis Avenue, Ashland, WI 54806-3999, USA.

LoonWatch is a program of the Sigurd Olson Environmental Institute at Northland College in Ashland, Wisconsin, USA.



Abstracts (related to Gavidae) from the 4th Conference of the Working Group on Aquatic Birds – International Society of Limnology (SIL)

“Limnology and Waterbirds 2003”

Sackville, New Brunswick, Canada – August 3-7, 2003

Compiled by Joe Kerekes

MERCURY BIOMAGNIFICATION AND STABLE CARBON AND NITROGEN ISOTOPES IN YELLOW PERCH AND COMMON LOONS IN EASTERN CANADIAN LAKES.

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Mercury is known to biomagnify in aquatic foodwebs in freshwater lakes. Breeding Common Loons (*Gavia immer*) in eastern Canada can be exposed to reproductively toxic concentrations of mercury in their fish prey. We assessed the biomagnification of mercury in juvenile and adult Common Loons, and their preferred prey: yellow perch (*Perca flavescens*). Two size classes of yellow perch (mean fork length: 8.8 and 17.5 cm) were collected from lakes in Kejimikujik National Park (KNP), Nova Scotia. Total mercury and stable carbon and nitrogen isotope ratios were determined in composite whole-fish samples. Total mercury concentrations and stable isotope ratios were measured in blood samples from juvenile and adult loons captured on lakes in KNP and southern New Brunswick. Geometric mean mercury concentrations were 0.15 and 0.38 ug/g (wet wt.) for small and large yellow perch, and were 0.43 and 2.7 ug/g (wet wt.) for juvenile and adult common loons, respectively. Log-transformed mercury concentrations and body masses, and stable nitrogen isotope ratios for perch and loons were positively correlated. Juvenile loons and large yellow perch had similar mercury levels and stable nitrogen isotope ratios, indicating similar trophic status despite their 22-fold difference in mean body mass.

ASSESSMENT OF MERCURY EXPOSURE AND EFFECTS IN COMMON LOON IN QUEBEC.

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³ Biodiversity Research Institute, Falmouth, Maine, USA.

Results from recent studies indicate an increase of mercury in the environment and its accumulation in aquatic food webs. For these reasons, the Canadian Wildlife Service (CWS) and the Canadian National Park Service initiated this study, which is part of the North American Common Loon Biomonitoring Program, to document the mercury contamination in loons in Québec and determine whether loons are exposed to mercury concentrations in prey fish sufficiently high to impair their reproduction and survival. Monitoring of loon reproduction, measure of lake pH and fish sampling for mercury analysis were conducted on 24 lakes in Mauricie and Laurentides regions during summers from 1997 to 2002. Reproductive success was assessed and loons were captured at night and banded. Collection of feathers and blood was done to measure mercury and various biological parameters as biomarkers. The mean levels of Hg in loons are within normal range of samples from north-east of North America. However, one quarter (25 %) of the loons sampled have mercury levels in blood or feathers higher to threshold levels of risk for their health, reproduction or survival. This study will help to determine the risk level and potential effects on the loon population in Québec and contribute to the North America-wide picture of the effects of mercury on this species and in decision making on pollution abatement.

EVIDENCE FOR FACULTATIVE BROOD REDUCTION IN RED-THROATED, PACIFIC, AND YELLOW-BILLED LOONS.

Earnst, S.L.

U.S. Geological Survey, Boise, Idaho, USA.

Six years of data on 3 sympatrically breeding loon species in northern Alaska are used to investigate whether patterns of chick mortality were consistent with adaptive brood reduction. During 1995-2000, Red-throated, Pacific, and Yellow-billed Loon nests and broods were monitored weekly from early incubation through 6 weeks post-hatch (total nests per species = 318, 387, and 83, respectively). In each of the 3 species, nearly all pairs produced 2 eggs (76%, 79%, and 88%, respectively) but few were able to raise 2 young (17%, 4%, and 12%, respectively). Over 700 hours of time budgets indicated that chicks were dependent on parental feeding through at least 6 weeks post-hatch. Results are consistent with adaptive brood reduction. First, the daily individual chick mortality rate was brood-size dependent, with rates nearly 3 times higher in 2-chick broods than 1-chick broods. Second, the timing of most mortality during the first 2 weeks post-hatch, observations of chicks growing increasingly weaker, and the recovery of dead chicks indicate that mortality was primarily due to starvation rather than predation. Third, one chick per brood had an initial competitive advantage because of a 1-3 day hatching asynchrony and an initial egg size asymmetry, with the largest egg being laid first. Fourth, this initial advantage was reinforced by parental behaviour of feeding the nearest chick, which was almost always the larger and stronger chick. The smallest chick died in each of 20 cases of single-chick loss in marked broods.

YELLOW-BILLED LOON HABITAT PREFERENCES IN NORTHERN ALASKA.

Earnst, S.L.¹, and R. Platte².

¹ U.S. Geological Survey, Boise, Idaho, USA.

² U.S. Fish and Wildlife Service, Anchorage, Alaska, USA.

The Yellow-billed Loon is a Species of Conservation Concern in the U.S. due to its small population size and specific habitat requirements. During 1998-2000, intensive aerial surveys were flown to document Yellow-billed Loon habitat preferences and build a model that would predict the probability of loon presence based on lake characteristics obtained from GIS sources. We flew a total of 21 plots, each 102 km² (32 km x 3.2 km), circling all lakes greater than 10 ha. Plots were placed systematically between the Colville and Meade Rivers, from the northern coast to the southern extent of wetlands. In total, we surveyed over 700 lakes, and recorded 213 loons in approximately 23.3 hours of actual survey time. The following preliminary results are based on 13 of the 21 plots; the remainder are being added. In the logistic regression model, lake area, lake depth (coded as freezing to the bottom or not as determined by synthetic aperture radar data), connectivity (coded as within 100 m of a stream or not), and the proportion of shoreline in aquatic or flooded vegetation (a measure of the degree to which the shoreline is low and gently sloping) were significant predictors. Distances to a river or to the coast were not significant predictors. The value of this model is that it can be extrapolated, based on available GIS data, to all of northern Alaska. The disadvantage is that GIS parameters are imperfect surrogates for important biological parameters such as fish availability.

MEASURING THE QUALITY OF BREEDING HABITAT FOR THE COMMON LOON.

Evers, D.C.¹, and K.M. Taylor².

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² Loon Preservation Committee, P.O. 604, Moultonborough, New Hampshire 03254, USA.

Anthropogenic stressors on lakes can degrade breeding habitat for the Common Loon (*Gavia immer*). Stressors causing impacts at the individual and population level have been documented in many parts of the loon's breeding range. In some cases, local governing bodies, as well as state and federal governments have

subsequently set policies. To appropriately evaluate and quantify the ecological impacts from multiple stressors, we developed a simplified stressor-risk ranking matrix. This model accounts for major stressors to breeding loons and is validated with long-term, standardized productivity databases. Measured stressors include shoreline development, water-based recreational activities, ingestion potential of lead, risk to atmospheric deposition of toxins including mercury, lake acidity, dam-based water level fluctuations, prey availability, direct habitat degradation such as water clarity, and avian and mammalian predation. Although birds in spatially heterogeneous environments can maintain large sink populations in an evolutionary stable manner, we feel that the extremely restrictive dispersal abilities of breeding loons (<2 km) combined with chronic breeding ground stressors (e.g., mercury and acid rain) and unpredictable but frequent winter stressors (e.g., marine oil spills) produces enough population level uncertainty that cumulative stressors need to be quantified in many areas of the loon's breeding range. Identification of high quality loon breeding habitat is critical to maintain breeding population integrity, avoid increased habitat patchiness, and prioritize conservation-oriented actions.

FEEDING BEHAVIOUR AND MODELED ENERGETIC INTAKE OF COMMON LOON ADULTS AND CHICKS ON SMALL BOREAL LAKES WITH AND WITHOUT FISH.

Gingras, B.A., and C.A. Paszkowski.

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We examined the behaviour of Common Loons (*Gavia immer*) breeding on small, shallow lakes in central Alberta, Canada that were naturally fishless or contained only small-bodied fishes (minnow lake). For both lake types, adults spent > 90% of their time on their territory and >50% of their time foraging. Adult loons on fishless lakes dove more frequently, but dives were of shorter duration than loons on lakes with fish. On two intensively studied fishless lakes, adults fed chicks macroinvertebrates, particularly leeches, whereas on a focal minnow lake, fish made up >70% of prey items delivered by adults. Chicks >36 days of age on a minnow lake spent >50% of their time foraging for themselves; even older chicks on fishless lakes were highly dependent on provisioning by adults for food. Models based on observed foraging patterns indicated that prey size was a better predictor of success in meeting energetic requirements than was feeding behaviour (e.g., dive rate, dive success). For most models, estimated energetic intake was higher for loons on minnow lakes than on fishless lakes. Our behavioural observations and model results are consistent with survey results that indicate that Common Loons frequently establish territories on small lakes in central Alberta, but that chicks hatched on lakes completely lacking fish fledge only if sufficient large invertebrates are available.

STATUS AND TRENDS OF LOONS BREEDING IN ALASKA, 1977-2002.

Groves, D.J.¹, S.L. Earnst², B. Conant³, J.I. Hodges³, R.J. King³, J.G. King³, W. Larned³, E. Mallek³, R. Platte³, and R.A. Stehn³.

¹U.S. Fish and Wildlife Service, Juneau, Alaska, USA.

²U.S. Geological Survey, Boise, Idaho, USA.

³U.S. Fish and Wildlife Service, Anchorage, Alaska, USA.

In northern Alaska, loons have been monitored by one annual aerial survey begun in 1986, and a second begun in 1992 and flown at twice the intensity over a subset of the area. Elsewhere in Alaska, loons have been monitored reliably on a third survey since 1977. Survey areas cover most of the loon nesting habitats in Alaska. Breeding population trends and minimum population size estimates will be presented for Red-throated Loons, Pacific Loons, Common Loons, and Yellow-billed Loons. For example, for the Yellow-billed Loon, which is the rarest species, the current 6-year average breeding population size estimate in northern Alaska, adjusted by a visibility correction factor, is 2,407 individuals (95% confidence interval of 1,286 - 3,528), and the entire Alaska population is only 3,187 individuals. Most of the population occurs between the Colville and Meade Rivers, with 84% occurring within 15% of the area. There is no evidence of a long-term population trend since 1986 (annual change = -1.2%, P = 0.56). However, a significant short-term decline has occurred since 1992 (annual change = -7.8% for one survey and -3.4% for both

surveys combined). Similarly, when observer effects are minimized by using data from only the pilot, both surveys indicate marginally significant short-term declines. For Yellow-billed Loons, but not the other loon species, the two individual surveys have relatively low power to detect a decline of interest (here considered to be a 3.4% annual decline), but when the two trends are combined, power is 62%.

MONITORING THE COMMON LOON POPULATION ON 16 LAKES IN KEJIMKUJIK NATIONAL PARK.

Hope, P.

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The Common Loon (*Gavia immer*) population was monitored from 1996 to 2001 to determine its status and trends on 16 lakes in Kejimikujik National Park, Nova Scotia. The 16 study lakes vary from 25.7 to 246 hectares in area and are very shallow. The lakes are oligotrophic with very low total phosphorus and conductance and pHs between 4.79 and 5.9. The loon monitoring combined data gathered from intensive loon watch days involving many volunteers, plus public observations and repeated surveys by National Park staff. Most surveys were carried out from early June until late August with some follow-up monitoring of chicks into the fall. During the six year period from 16 to 18 territorial pairs of common loons inhabited the study lakes. Observations showed from 9 to 11 pairs of loons bred each year and produced between 5 and 10 broods from which 4 to 15 loon chicks survived until mid August. This level of reproductive success is comparable with that reported in New Hampshire, USA. The characteristics of the most productive lakes are defined while some of the factors limiting reproduction are outlined.

HABITAT USE BY BREEDING LOONS IN ATLANTIC CANADA.

Kerekes, J.

Canadian Wildlife Service, Dartmouth, Nova Scotia, Canada.

The breeding Common Loon populations are monitored where they occur in the National Parks in the Atlantic Region (Kejimikujik, Cape Breton Highlands, Fundy, Terra Nova, Gros Morne) and in the Experimental Ponds Area in Newfoundland. The monitoring effort goes back to 1982 in Kejimikujik N. P. while it commenced in 1997 in Terra Nova, Gros Morne National Parks. The lakes ranged from oligotrophic to ultra-oligotrophic. Overall, the adult population remained stable, with considerable year to year variation in reproductive success. The data indicated that nutrients (phosphorus) through fish production controlled the lake size that is required to breeding success. In oligotrophic lakes 40 ha were required to support a chick to fledging while in ultra-oligotrophic lakes 120 ha or several smaller lakes were needed as a territory to raise chicks. Smaller lakes 20 ha or less, close to the sea or large lakes where adults could fly to feed were able to support chicks to fledging (Fundy, Terra Nova). In spite of the apparent abundance of lakes of different sizes, the number of breeding loons is very rare in Gros Morne National Park in Western Newfoundland. The reason for this is unknown.

THE DYNAMICS AND BEHAVIOUR OF WINTERING LOON POPULATIONS OCCUPYING MORRO BAY, CALIFORNIA.

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Loon populations using Morro Bay, California, USA were monitored weekly over an eight-month period, fall to spring. A brief summary of wintering loon ecology is given, and the study area introduced. The key objectives of the study were to quantitatively describe the loon species composition within the bay over the period, and to identify the areas within the bay having the highest and lowest occupational frequencies for a given species, age, and tidal condition. By abundance, it was determined that common loons consistently and prominently outranked all other species throughout the study period and throughout all areas of the bay. Slower fall population infiltration and rapid spring egress of adult loons were noted, with a sustained

population of immature loons remaining, thus following expected seasonal migration patterns. All species uniformly occupied the bay, with no area significantly preferred by any one species. Relationships between the sections of the bay used, date, tidal activity, food abundance, loon age, and other variables and anomalies are investigated. Overall, the northwestern portion of the bay closest to the entrance was most heavily occupied by all species, while the southeastern portion of the bay farthest from the entrance was the least occupied. At high tide, the central and northwestern portion of the bay experienced significantly higher use by common loons, while adjacent areas and the entrance channel were avoided during high tides and favoured during ebb tides. Food concentrations and currents influenced by the tides appeared to dictate this activity. The far northwestern portion of the bay was consistently favored by immature common loons, mainly due to repeated engagement in social rafting at that particular location during evenings. Hypotheses, interpretations, and conclusions about the dynamics of the loon populations that occupy Morro Bay, and the effectiveness of the study, are supplied and discussed.

SIXTEEN YEARS OF MONITORING OF COMMON LOON POPULATION IN LA MAURICIE NATIONAL PARK, QUÉBEC.

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² Canadian Wildlife Service, Environment Canada, Québec Region.

Since 1987, the status and breeding success of the common loon population of La Mauricie National Park (536 km²) has been monitored. Two aerial censuses are conducted annually on all lakes exceeding 3 ha (n=76) and ground counts are also executed during the breeding season. Since 1987, the number of territorial pairs is fairly stable (25, 2 avg; 18-32). The number of breeding pairs (14, 4 avg; 11-20) and the number of egg per nest remained stable (1, 79 avg). The nesting success has slowly declined with a significantly decrease of 15% (69% to 54% avg; 1987-94: 95-02). The reproductive success (number of young surviving to six weeks of age) has significantly decreased (15, 1 to 10.8 avg; 1987-94: 95-02). This decrease cannot be related only to the nesting success, other factors are involved such as acidification and mercury exposure. The human disturbance is excluded because this decrease is also observed on lakes not used by visitors. The lakes used for breeding (n=32), compared to all other lakes used by loons (n=42), are large, deep, irregularly shaped with islands, and have a low trophic level (oligotrophic) and a low alkalinity. Occasionally, small lakes (7-10 ha) are used for breeding. The reproductive success (1987 to 2002) was significantly lower for smaller lakes (<25 ha), lakes with low pH (<5, 5) and alkalinity (<2 mg/l) and those with higher levels of human presence (>15 person-years/ha). Three large lakes abandoned for loon reproduction (1980-1996) were reused since 1997 with a high success. This success can be associated with the decrease in the number of fisherman-day on these lakes (2500 to 450). Many actions have been taken by the park to reduce conflicts between visitors and loons. Since 1997, lead sinkers have also been prohibited. The water quality and fish population are being monitored in order to better document effects of acid precipitation, human disturbance and other factors on breeding loons. This monitoring program was also integrated with an assessment of mercury exposure and effects in Common Loon in Quebec with the Canadian Wildlife Service.

CHANGES IN LOON AND GREBE POPULATIONS IN THE LOWER MATANUSKA-SUSITNA VALLEY, ALASKA.

Mills, T.K.

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Common Loons (*Gavia immer*), Pacific Loons (*G. pacifica*), and Red-necked Grebes (*Podiceps grisegena*) breeding on lakes in the Matanuska-Susitna Valley (Mat-Su Valley) of Alaska may be impacted by increasing human settlement and disturbance associated with the use of lakes for recreation. To address concerns over the susceptibility of loons and grebes to rising anthropogenic pressures, I compared changes in loon and grebe lake occupancy and productivity to changes in the human population and settlement

patterns from years 1987 to 1999. There has been both a temporal and spatial shift in the population distribution of Common Loons, Pacific Loons, and Red-necked Grebes in the Mat-Su Valley since 1987. Significantly ($P=0.0003$) fewer lakes had any specie of loon or grebe present in 1999 compared to 1987 while productivity remained stable. There has also been a spatial shift in lake occupancy by loons and grebes from the southwest to the northwest region of the study area. Most of the lakes that are no longer used by breeding loons and grebes have been located in an area that has also experienced the most human growth. Such changes in lake occupancy may be indicative of declining loon and grebe populations or may reflect large-scale emigration due to the loss of suitable nesting habitat from shoreline development and human recreational disturbance.

ASPECTS OF COMMON LOON (*GAVIA IMMER*) SOCIAL FLOCKING BEHAVIOUR ON THEIR BREEDING GROUNDS.

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Common Loons are asocial during courtship, incubation and early stages of chick development, but become increasingly social by mid-summer when young become more independent. These associations of individual loons have been termed social gatherings and consist primarily of stereotyped and ritualized behaviours. There are several hypotheses that attempt to explain the function of these gatherings, but little quantitative data from marked individuals exists. Field studies of two marked populations of loons found social gatherings occurred during the first three hours of sunrise and late in the afternoon, forming a distinct bimodal distribution. Individuals participating in social gatherings consisted of both sexes, successful and unsuccessful nesters, and unpaired individuals. The number of individuals participating in social gatherings increased from mid to late summer. Frequency of peering and amount of time spent underwater were positively correlated with levels of aggression. In one population, the majority of the individuals were unmarked and came from outside the marked breeding population. In this population, social gatherings were not randomly distributed across territories each year, but occurred much more frequently on territories that had undergone a divorce that season. This suggests some social gatherings occur where an established territory is open, or the pair bond unstable, allowing possible access to a new territory or mate for unmated individuals.

THE STRUCTURE OF FORAGING GUILDS OF AQUATIC BIRDS ON PRODUCTIVE BOREAL LAKES.

Paszkowski, C.A., and W.M. Tonn.

University of Alberta, Edmonton, Alberta, Canada

We surveyed 41 eutrophic lakes for breeding aquatic birds in the boreal forest of Alberta, Canada. We encountered 49 species representing five foraging guilds: diving piscivores, diving ducks, dabbling ducks, aerial piscivores, and shorebirds. All lakes contained at least three guilds and 27 lakes supported all five. Based on principal component analyses of environmental characteristics (involving morphometric, chemical, landscape, and biotic variables) and species composition (presence-absence data), randomization tests for matrix concordance found a significant relationship between lake environment and species composition for every guild except diving piscivores. Richness of each guild increased with lake size through the addition of species to a core of generalists that occurred on even the smallest lakes. Randomization tests between guilds showed that patterns of species composition were significantly concordant for eight of 10 pair-wise comparisons. Both exceptions involved the aerial piscivore guild that, in contrast to the other four guilds, was richest on lakes that were deeper, less productive, and supported populations of large-bodied fish. Overall, our results suggest that divergent avian foraging guilds respond similarly to environmental features of boreal Alberta lakes. Thus, habitat conservation strategies that protect any one guild will likely benefit others.

EFFECTS OF FOREST HARVESTING ON BUFFLEHEAD AND COMMON LOON FORAGING BEHAVIOUR.

Pierre, J.P.¹, and C.A. Paszkowski².

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We documented Bufflehead (*Bucephala albeola*) and Common Loon (*Gavia immer*) foraging behaviour on lakes in the boreal mixed-wood forest of northern Alberta, Canada, for one summer before (1996) and two summers after (1997, 1998) forest harvesting around three of eight study lakes. Each summer we recorded the duration of Bufflehead and Common Loon dives on 1-4 and 2-8 lakes, respectively. After forest harvesting, forested buffer strips 100 m-wide separated harvested areas from lakes ('harvested lakes'). 'Unharvested lakes' were surrounded by > 450 m of undisturbed forest throughout the study. There were no detectable differences in Bufflehead or Common Loon dive duration between harvested and unharvested lakes. However, the duration of Bufflehead dives differed between lakes, unrelated to forest harvesting. The duration of Bufflehead dives was significantly negatively correlated with water clarity, and non-significantly, but strongly, positively related to fish biomass. Correlations between the duration of Common Loon dives and these environmental variables were neither strong, nor significant. Thus, foraging success of buffleheads may have been affected by lake environmental conditions, but that of Common Loons may not. The ability to forage successfully in a variety of environmental conditions probably ameliorates the effects of habitat disturbances, such as forest harvesting, on aquatic birds. If birds are not affected by environmental changes, specifically those resulting from disturbances, they will not be effective as indicator organisms.

SOUTHCENTRAL ALASKA LOON SURVEY.

Stehn, R. A., R.M. Platte, W.W. Larned, and T.K. Mills.

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Common (*Gavia immer*), Pacific (*G. pacifica*), and occasional Red-throated Loons (*G. stellata*) occupying lakes in the lower Matanuska-Susitna Valley and the northern Kenai Peninsula in south-central Alaska may be impacted by increasing human settlement and disturbance associated with the use of lakes for recreation. In May 2001, we began an aerial survey to determine the distribution, abundance, productivity, and population trend of loons in south-central Alaska. We used both a standard aerial survey sample with systematic transects and an unconventional aerial survey design and analysis procedure termed a "meandering design". One thousand Common Loons and 300 Pacific Loons were estimated for the entire survey area. Loons were found to be associated with larger size lakes; 345 lakes having 1 or more loons averaged 14.23 hectares (90% confidence interval = 1.07-189.30) compared to an average size for all 4,425 lakes in the study area of 1.38 hectares (0.08 - 22.85). When survey designs were compared, the meandering design proved advantageous for detecting loons and producing population estimates; the total distance flown was about 20% less, a slightly larger percent of the flight time was spent on transect, and more loons were observed per kilometre flown. The data gathered during surveys will establish baseline information on loon populations useful for monitoring, assessment, and management decisions.

RAPID MEASURES OF COMMON LOON (GAVIA IMMER) REPRODUCTIVE SUCCESS MAY NOT BE EFFECTIVE FOR BIOMONITORING LAKE HEALTH IN EASTERN CANADA.

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Two independent measures of Common Loon (*Gavia immer*) breeding success were used to evaluate if loon productivity could be used as an effective mechanism for biomonitoring acidification of freshwater, inland lakes in Nova Scotia. Acid stressed lakes negatively affect aquatic primary productivity and food resources, as well as increase uptake of mercury compounds by aquatic organisms. Because loons are top-level consumers, they also may be very susceptible to both of these acid related threats. No empirical support was found for a relationship between lake pH and either measure of loon productivity. After controlling for effects of lake area and year, dissolved organic carbon concentrations were negatively correlated with lake pH, which agreed with other studies done on lakes in Nova Scotia. However, despite known relations between lake acidity and mercury in Nova Scotia lakes, lakes included in our analyses may have not been unnaturally acid-stressed (at least on average) and could explain the lack of negative influences on loon productivity. Other factors not accounted for in this study, such as proximity of monitored lakes to coastal predaceous bird colonies, may negatively affect loon productivity. Thus, we conclude that use of simple indices of loon productivity, without controlling for other confounding factors, was not an effective biomonitoring technique for evaluating fresh water lake health in Nova Scotia and possibly other eastern coastal regions in North America.

TEMPORAL PATTERNS IN ONTARIO COMMON LOON BREEDING SUCCESS, 1987 – 2002.

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The common loon (*Gavia immer*) is an important and culturally popular waterbird of boreal shield lakes, many of which are sensitive to acidifying pollutants. Although loon reproductive success is known to be positively associated with lake size and pH, little is known about geographically broad scale temporal patterns in loon breeding success or temporal variation in the influence of lake attributes. We used 16 years of data (1987-2002) from the Ontario portion of the Canadian Lakes Loon Survey, a volunteer-based survey of breeding loons, to assess temporal patterns in loon breeding success and to investigate whether these patterns varied with lake acidity, surface area or degree of human disturbance. Data from approximately 1,000 lakes across central Ontario were available, with nearly half surveyed in two or more years. Successful breeding was defined for each pair of adult loons observed based on the number of chicks seen with them that were estimated to be six weeks or older (large young or LY). Two independent measures of breeding success were assigned to each lake and year combination: a) proportion successful – the proportion of all pairs observed with at least one LY, and b) proportion very successful – the proportion of successful pairs observed with at least two LY. We used logistic regression to estimate temporal effects and assess the response of breeding success to lake area, pH and indices of human disturbance. Results corroborated the importance of lake area and pH, indicated strong annual variation, and suggested the effects of the human disturbance measures may have had minimal influence beyond temporal variation.



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