LOON CONSERVATION IN SOUTH CAROLINA

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DISCLAIMER/AUTHORS' NOTE

THE DATA PROVIDED IN THIS REPORT ARE SUBJECT TO FUTURE ANALYSES AND INTERPRETATIONS AND SHOULD BE NOTED AS SUCH.

LETTER TO VOLUNTEERS

Dear Volunteers,

We are extremely grateful for the support, hard work and enthusiasm each of you provided to our loon project at Lake Jocassee, South Carolina. Moreover, we appreciate your assistance and flexibility in loon capture, data entry, and meal preparation. In all, each group was dynamic and helpful beyond our expectations making the collective experience richer and more fulfilling for everyone.

We made some important strides in understanding the group dynamics of loons wintering at Lake Jocassee. Our success stemmed from the deployment of a radio transmitter and the use of photography which allowed us to identify individual loons and track their movements throughout the lake. We were able to show that loons exhibit fidelity to different parts of the lake. Initial indications suggest loons in northern part of the lake, such as Horsepasture and Toxaway creeks, and loons in the southern part of the lake, such as Howard Creek or Devil's Fork Dam, do not intermingle and remain in specific areas for the duration of the winter months. We also reobserved some previously marked loons in the same local areas of the lake where they were originally caught further supporting the notion of group stability and cohesion between and among years. This increases the likelihood that individuals in a group know each other and raises a number of questions of group members, such as 1) are they related to each other, 2) are they from the same local breeding area or different areas altogether and 3) what is their gender and age makeup?

We collected over 50 hours of behavior watching and our time activity budget data show that loons wintering on Lake Jocassee spend approximately 50% of the time foraging, 20% locomoting, 14% preening, 9% resting and 5% resting between foraging bouts. Also, loons spend 43% of the time with at least one (or more) loons, indicating a high level of sociality. Initial indications suggest solitary loons spend more time foraging than loons observed foraging in groups. This raises a number of questions, such as 1) why are some loons solitary while others more social, 2) what is the social structure of groups (gender, age) and 3) are there benefits to sociality? Increasing the number of observations in the future will likely shed light upon the social behavior of wintering loons on this freshwater reservoir.

Again, we are deeply grateful for your support, dedication and enthusiasm.

Sincerely,

Jim Paruk, Jay Mager and Brooks Wade

SUMMARY

With the use of photography and the deployment (attach) of a radio transmitter we were able to identify individual loons and track their movements throughout the lake. In addition, we reobserved some previously banded loons in the same local areas of the lake where they were originally caught. Collectively these data suggest loons at Lake Jocassee exhibit fidelity to different parts of the lake, forming separate and distinct groups that do not intermingle. Moreover, it seems that many of the loons within a group are the same individuals from year to year and likely know each other. On average, nearly half the time during an observation period an individual loon was near another loon. Lastly, solitary loons spent more time foraging than loons in a group.

GOALS, OBJECTIVES, AND RESULTS

Objective 1: Characterize and quantify the behavior of loons wintering at Lake Jocassee and compare with similar data from loons wintering in coastal Louisiana.

We made some important strides in understanding the group dynamics of loons wintering at Lake Jocassee (McIntyre 1978, Daub 1989, Ford and Gieg 1995, Evers et al. 2010, Paruk et al. 2016). A lot of our success stemmed from the deployment of two radio transmitters on loons, which allowed us to track their movements throughout the lake. We were able to show that loons exhibit fidelity to different parts of the lake. Initial indications suggest loons in northern part of the lake, such as Horsepasture and Toxaway creeks and loons in the southern part of the lake, such as Howard Creek or Devil's Fork Dam, do not intermingle and remain in specific areas for the duration of the winter months. We also reobserved some previously marked loons in the same local areas of the lake where they were originally caught further supporting the notion of group stability and cohesion between and among years. One loon we captured in 2015 was resighted each year from 2016-2018, supporting the notion that loons across North America exhibit winter site fidelity (Paruk et al. 2015). This increases the likelihood that individuals know each other and raises a number of questions, such as 1) are group members related to each other, 2) are they from the same local breeding area of different areas altogether and 3) what is the gender and age makeup of individual groups?

We conducted observational behavioral sampling of Common Loons between the hours of 0700 and 1615h each day between February 13 and March 9, 2018. Sampling periods varied in duration between 1 and 4 hours. During sampling periods, we recorded the behavioral state (feeding, preening, resting, locomotion, in-between foraging, and aggression) of focal individuals as well as whether the individual was solitary (no other loon within 20 body-lengths of the focal individual) or within a group (at least one loon within 20 body lengths), and the relative distance (in loon body-lengths) the focal individual was to the nearest loon via scan sampling every two minutes. Additionally, we recorded instantaneous vocal events, noting the type (hoots, type I, II, and III wails and tremolos, and yodels) given, as well as the duration of underwater dives made by focal individuals during the sampling period.

In total, we collected over 50 hours of behavior watching from 17 loons. Our time activity budget data show 50% of the time is spent foraging, 20% locomoting, 14% preening, 9% resting and 5% resting between foraging bouts. Overall, 16 of the 17 loons spent some time within 20 "loon lengths" of another Common Loon. However, focal individuals varied in the proportion of time they spent either alone or with other Common Loons. On average, each focal individual spent 43.20 +/- 8.14% of an observation period with at least one other Common Loon; however, initial observations indicate the distribution of this behavioral phenomenon to be either exponential or bimodal, where most individuals spent most of their time (great than 70% of the time) either alone or with at least one other individual (Fig. 1).

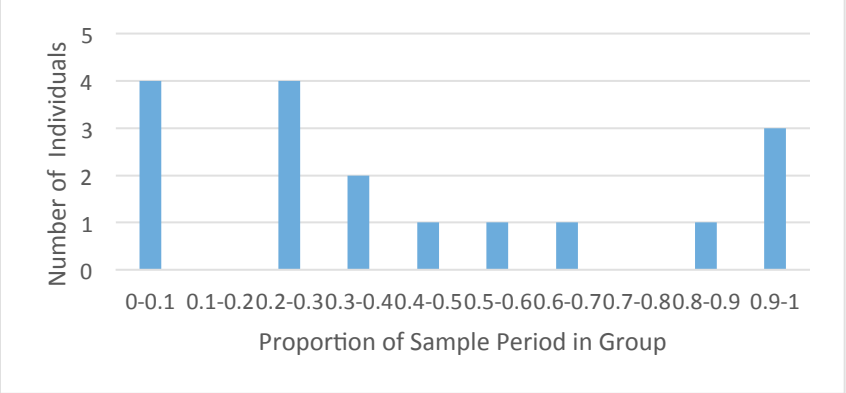

Figure 1. *Frequency histogram displaying the variation among focal Common Loons (n=17) in the proportion of sampling period they were found within a group (within 20 body lengths) of conspecifics. Initial observations indicate that individuals appear to either spend most (at least 70%) of their time either alone or with another Common Loon.*

When individuals did gather within a group, we found that for most observation periods individuals we paired with a single individual rather than with more than one individual. However, focal individuals did gather with groups as large as 18 individuals (Fig. 2).

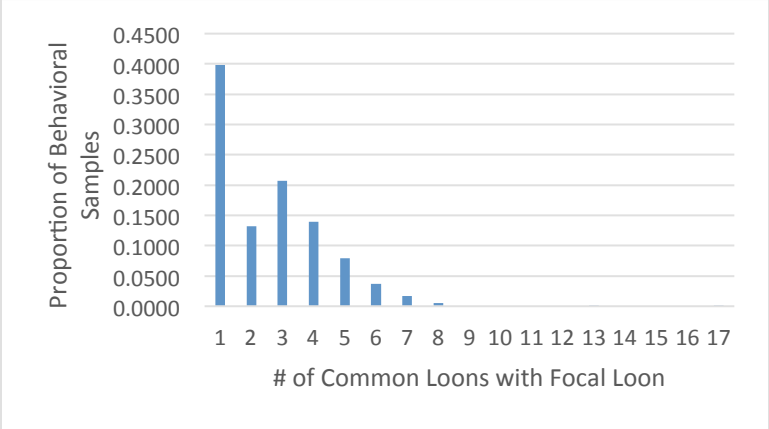

Figure 2. *Proportion of behavioral time-activity budget samples loons were engaged with other Common Loons as a group as a function of group size. For most observations when individuals were with other loons, they were with one other individual. However, individuals at times would group with as many as 17 other Common Loons.*

For 16 individuals that we observed both alone (solitary) and with another Common Loon during sampling periods, we found no significant differences in the proportion of time spent preening (paired t = 1.9339, df = 15, P = 0.07), resting (paired t = 1.2748, df = 15, P = 0.221), or locomoting (paired t = 0.6039, df = 15, P = 0.5549). However, when we combine the time spent foraging and "in between" foraging into an overall 'foraging' behavior, we found that solitary individuals spent a significantly greater proportion of their time in these this activity (paired t = 2.2828, df = 15, P = 0.0377; Fig 3). While the sample size is still low both in terms of individuals and time sampled, we are greatly intrigued by this finding, and interested in further examining the significance of these differences, and look forward to adding to this sample during the 2019 field season.

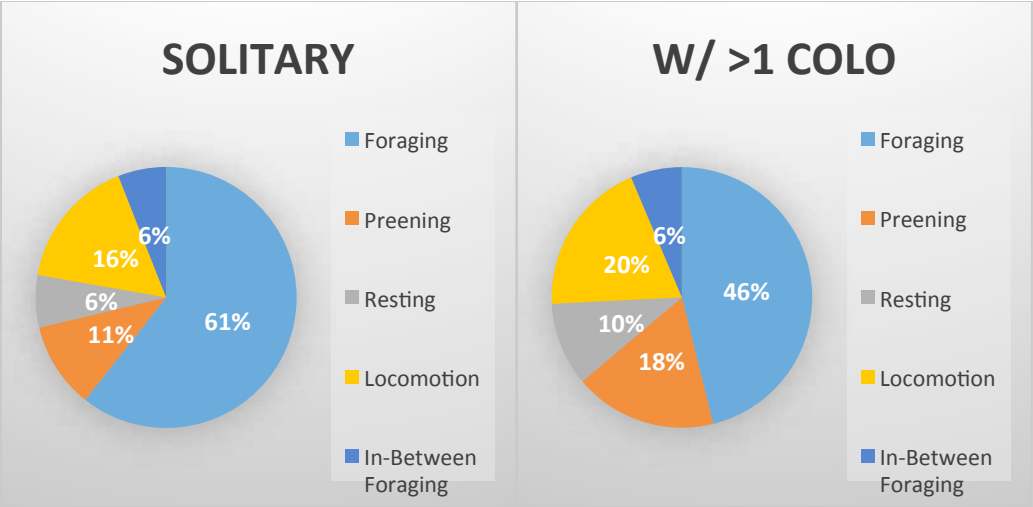

Figure 3. *Proportion of time-activity budget samples that 16 Common Loons on Lake Jocassee were engaged in various behavioral states while solitary (left) or as a member of a group (<20 body lengths to the nearest Common Loon; right).*

In combination with the differences among individuals who spend most of their time living solitarily or with a group of individuals, these results may portend that different loons may adopt different behavioral strategies (solitary vs. group) while residing on wintering lakes, and consequently adjust their times dedicated to different behavioral activities (Schoener 1971, Cairns 1987). In turn, this leads to questions regarding the adaptive costs and benefits of living solitarily and as a group during the non-breeding season. For example, individuals spending their wintering season living within a group may benefit from the reduced time spent foraging (perhaps benefitting from more eyes searching for, finding, and together catching prey), and it may benefit participants by allowing more time for swimming (locomotion) or preening, which may provide additional benefits to individuals. These findings necessitate additional behavioral observations during the upcoming field season.

Lastly, we have found that loon density varies across the lake (2-14 loons/mile). We suspect this variation has to do with the presence or absence of a large river/creek. The rivers and creeks are both spawning and preferred feeding locations of baitfish, such as blue-back herring (*Alosa aestivalis*) and shad (*Dorosoma petenense*; Clupeidea; Johnson 1971). Rivers dump nutrients into the lake, which then support a growing plankton community that baitfish (and small gamefish) feed on. Loons prefer to feed on baitfish because they lack spines, are easy to school, and are of the right size class (3-7inches) to swallow hole, with minimal effort. As such, loons are more prevalent in areas of the lake where baitfish are common. In these hotspots, loons were more likely to be in groups than in the central section of the lake, with its lack of river mouths and paucity of baitfish.

Objective 2: Compare health and condition of loons wintering at Lake Jocassee (LJ), a freshwater environment, to loons wintering in a marine environment, coastal LA.

We had an extremely difficult time catching loons and caught only two individuals. Over time, we believe the loons may have learned to elude capture by night-lighting. In nearly every case, they simply dive the minute the light shines in their general vicinity (this was not the case catching loons in the Gulf of Mexico). We suspect the reason for this difference is likely due to the lack of boat traffic (at night) and shoreline development (few lights on the lake) on LJ compared to Louisiana (LA). In addition, because of the colder water temperatures at LJ compared to LA, it is harder to obtain blood and thus had to rely on simply obtaining feathers, which is limiting compared to information we could have obtained had we successfully obtained blood. Both of the loons we caught were adults, had full stomachs and were in good condition. They weighed 3850 and 4840 grams, respectively. It is likely the lighter bird is female and the larger one, male.

Objective 3: Compare isotopic signatures of Common Loons wintering in freshwater (Lake Jocassee) and marine (coastal Louisiana) environments

We are unable to determine stable isotope values at this point in time because the only tissue we could obtain from loons is feathers, and unfortunately it is necessary to obtain 1-2ml of blood.

Objective 4: Educate boaters, local schoolchildren, and members of the community about the importance of loons as a bioindicator and the importance of wildlife research, including the proposed research conducted on Lake Jocassee.

Brooks Wade (and Jocassee Lake Tours) have been instrumental in educating several hundred tourists and local citizens about our research on wintering loons at Lake Jocassee. They have educated them them on their importance as a bioindicator of a healthy ecosystem. In addition, they have shown some of colored banded loons to them, furthering our connection with the local citizens.

PROJECT IMPACTS

1. Increasing Scientific Knowledge

a) Total citizen science research hours

- Time spent in training: 4-5hr/first day, then 1hr additional. Each volunteer trained for ~6hrs/week.
- Data Entry: each volunteer on average, 1.5hrs/week
- # of hours each volunteers collects data: 14hrs week (we spend a fair amount of time boating to our locations)
- Transportation from one behavioral observation point to the next (~2hr/day)

b) Peer-reviewed publications

None. We are developing a manuscript entitled, "Lake Jocassee serves as in important wintering location for Common Loons."

c) Non-peer reviewed publications:

- Jocassee Journal, Fall, 2017, Department of Natural Resources, several thousand readers, feature article on our loon work at Lake Jocassee.
- Seneca Journal, February 2017, feature article on our loon work at Lake Jocassee.
- Blue Wall Weekly, personal blog by Jocassee Lake Tours, gives a weekly account of our loon work throughout the winter. It goes out to 2,000 members weekly who open it and read it.

d) Books and book chapters

None.

e) Presentations:

Indicate if this was an invited paper, panel presentation, keynote speech, plenary address, or other.

- Paruk, Lecturer, Winter Ecology of the Common Loon, St. Joseph's College, September, 2018.
- Paruk, Lecturer, The Deepwater Horizon Oil Spill and its Impacts on Wintering Loons, St. Joseph's College, December, 2017.
- Wade, Brooks and Kay, Lecture, The Loons of Lake Jocassee, Foothills Trail Association Conference, 100 members in the group, November 2017.
- Wade, Brooks and Kay. Lecture. The Loons of Lake Jocassee, Master Naturalist Association, conduct advance training, 3-day program, on loon behavior and our study. December 2017.

2. Mentoring

a) Graduate students

Student Name	Graduate Degree	Project Title	Anticipated Year of Completion

However, Paruk has involved an undergraduate student, Garreth Logan, at St. Joseph's College in the research project.

b) Community outreach

Name of school, organization, or group	Education level	Participants local or non-local	Details on contributions/ activities
Master Naturalist Program	Post B.S.	Local and non-local	Creates environmental leaders
Tours	Variable	Non-local	Environmental awareness

3. Partnerships

Partner	Support Type(s)[1]	Years of Association (e.g. 2006-present)
Friends of Lake Jocassee	Financial	2014
Master Naturalist Association	Financial	2015
Carolina Bird Association	Financial	2015

[1.] Support type options: funding, data, logistics, permits, technical support, collaboration, academic support, cultural support, other (define)

4. Contributions to management plans or policies

Plan/Policy Name	Type[2]	Level of Impact[3]	New or Existing?	Primary goal of plan/policy[4]	Stage of plan/policy[5]	Description of Contribution

[2.] Type options: agenda, convention, development plan, management plan, policy, or other (define)

[3.] Level of impact options: local, regional, national, international

[4.] Primary goal options: cultural conservation, land conservation, species conservation, natural resource conservation, other

[5.] Stage of plan/policy options: proposed, in progress, adopted, other (define)

5. Conserving natural and sociocultural capital

a) Conservation of taxa

i. List any focal study species that you did not list in your most recent proposal

Species	Common name	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source

ii. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.

Species	IUCN Red List category	Local/regional conservation status	Local/regional conservation status source	Description of contribution	Resulting effect[6]

[6.] Resulting effect options: decreased competition, improved habitat for species, range increased, population increase, improved population structure, increased breeding success, maintained/enhanced genetic diversity, other

b) Conservation of ecosystems

In the past year, has your project helped conserve or restore habitats? If so, please describe below.

Habitat type	Habitat significance[7]	Description of contribution	Resulting effect[8]

[7.] Habitat significance options: nursery, breeding ground, feeding site, corridor, migration path, refuge, winter range, summer range, spring range, fall range or other (define)

[8.] Resulting effect options: extent maintained, condition achieved, restored, expanded, improved connectivity or resilience

c) Ecosystem services

Indicate which ecosystem service categories you are **directly studying** in your Earthwatch research and provide further details in the box below.

☐Food and water

☐Flood and disease control

☐Spiritual, recreational, and cultural benefits

☐Nutrient cycling

Details:

d) Conservation of cultural heritage

Provide details on intangible or tangible cultural heritage components that your project has conserved or restored in the past year.

Cultural heritage component[9]	Description of contribution	Resulting effect

[9.] Cultural heritage component options: traditional agriculture, artifacts, building(s), hunting ground or kill site, traditional ecological knowledge and practices, monument(s), oral traditions and history, spiritual site, traditional subsistence living

RESEARCH PLAN UPDATES

Report any changes in your research since your last proposal/annual report. For any 'yes' answers, provide details on the change in the 'Details' box. This section will not be published online.

1) Have you added a new research site or has your research site location changed? ☐ **Yes** ☒ **No**
2) Has the protected area status of your research site changed? ☐ **Yes** ☒ **No**
3) Has the conservation status of a species you study changed? ☐ **Yes** ☒ **No**
4) Have there been any changes in project scientists or field crew? ☐ **Yes** ☒ **No**

Details – provide more information for any 'yes' answers

5) Provide details on any changes to your objectives, volunteer tasks, or methods, include reason for the change.

ACKNOWLEDGEMENTS

Zach Maddox and Kay Wade from Jocassee Lake Tours both assisted and contributed to the project's success. Their competency, warm smiles and positive attitudes were greatly appreciated. Alex Dalton, from Biodiversity Research Institute, offered technical expertise and assistance in catching loons. From Earthwatch, we thank Kyle Hutton who serves as the expeditions Project Manager. Lastly, Jim Paruk is grateful for his colleagues at St. Joseph's College who filled in for him when he was away conducting this research.

LITERATURE CITED

- Cairns, D. K. 1987. Seabirds as indicators of marine food supplies. Biological Oceanography 5: 261-271.
- Daub, B. C. 1989. Behavior of Common Loons in winter. Journal of Field Ornithology 60: 305-311.
- Evers, D. C., J. D. Paruk, J. W. McIntyre and J. F. Barr. 2010. Common Loon (*Gavia immer*), The Birds of North America. Number 313.
- Ford, T. B. and J. Gieg. 1995. Winter behavior of the Common Loon. Journal of Field Ornithology 66: 22-29.
- Johnson, J. E. 1971. Maturity and Fecundity of Threadfin Shad, *Dorosoma petenense*, in Central Arizona Reservoirs. Transactions of the American Fisheries Society.100: 74–85.
- McIntyre, J. W. 1978. Wintering behavior of Common Loons. Auk 95: 396-403.
- Paruk, J.D., M. Chickering, D. Long, IV, H. Uher-Koch, A. East, E. A. Adams, K. A. Kovach, D.C. Evers. 2015. Winter site fidelity in Common Loons across North America. The Condor: Ornithological Applications 117:485-493.
- Paruk, J.D., E. M. Adams, H. Uher-Koch, K. A. Kovach, D. Long, IV, C. Perkins, N. Schoch and D. C. Evers. 2016. Polycyclic aromatic hydrocarbons in blood related to lower body mass in Common Loons. The Science of the Total Environment 565:360-368.
- Schoener, T. W. 1971. Theory of feeding strategies. Annual Review in Ecology and Systematics 2: 369-404.