



Earthwatch 2015 Annual Field Report

Loons and the Gulf of Mexico Oil Spill

Jim Paruk, PhD

Period Covered by this report: May 30, 2014 -May 31, 2015



Dear Earthwatch Volunteers,

Why is it important to continue long-term monitoring of wildlife health after an environmental disaster? After the Exxon Valdez oil spill, biologists still observed adverse health and population level impacts on breeding birds 10-20 years after the event. One can make the case that a similar pattern might occur in the Gulf of Mexico after the Deepwater Horizon Oil Spill.

I am therefore grateful that, with your help, we have been able to monitor the health and condition of Common Loons wintering in Barataria Bay, Louisiana, one of the key areas that was oiled by the Deepwater Horizon Oil Spill of April 2010. We have also been able to investigate and study the winter behavior and ecology of this iconic bird of the northwoods. Similarly, we are grateful for the opportunity to investigate the health of Brown Pelicans that coexist in the same area as the loons. How are the loons (and pelicans) doing? Well, our 2015 results reaffirm the importance and our need to be monitoring the health of both of these iconic birds in the Gulf of Mexico!

More than half of the loons and pelicans had moderately high Polycyclic Aromatic Hydrocarbons (PAH) levels. PAHs are among the most widespread organic pollutants found in the air, soil and water. They occur naturally in coal, crude oil and gasoline and can be released into the air during incomplete burning or inadvertent release of fossil fuels. PAHs are toxic to wildlife and humans, they are mutagenic, tumorigenic (tend to produce tumors), and carcinogenic. Last year, most of the loons and pelicans had low PAH levels. So, something is still going on in this region and with continued efforts and support, we hope to get a better understanding of what that "something" is.

On behalf of Hannah and Kristin, I can't thank you enough for your time and contributions to the project, especially those volunteers who returned for a 3rd straight year!

Sincerely,

Jim Paruk

Top highlight from the past season -

Why is it important to continue long-term monitoring of wildlife health after an environmental disaster? After the Exxon Valdez oil spill, biologists still observed adverse health and population level impacts on breeding birds 10-20 years after the event. One can make the case that a similar pattern might occur in the Gulf of Mexico after the Deepwater Horizon Oil Spill. In 2015, five years after the Deepwater Horizon Oil Spill, more than half (54%) of the loons, and 75% of the pelicans we caught had moderately high PAH levels. This was a different pattern than what we observed in 2014, where none of the loons had elevated PAH levels, and only 15% of the pelicans did. Our 2015 PAH results were more similar to what we observed in 2013, where 62% of the loons had moderately high to high PAH levels. The bottom line-it is important for us to keep monitoring and studying the loons and pelicans in Barataria Bay, Louisiana!

Reporting against research objectives

Objective 1. Determine the level of PAH in the circulatory system of loons (and pelicans).

Background. Polycyclic Aromatic Hydrocarbons (PAHs) are among the most widespread organic pollutants found in the air, soil and water. They occur naturally in coal, crude oil and gasoline and can be released into the air during incomplete burning or inadvertent release of fossil fuels. Consequently, there are background levels of PAHs in any environment. PAHs are toxic to wildlife and humans, they are mutagenic, tumorigenic (tend to produce tumors), and carcinogenic. In addition, they cause a range of health effects including liver damage, anemia, weight loss, gut damage, and immune suppression. PAHs range from light (naphthalene) to heavy (Indenol(1, 2, 3-c-d)pyrene) and heavy PAHs are more toxic than light PAHs, though lightweight ones tend to be more carcinogenic.

We tested for the parent (or total) PAHs as recommended by the Environmental Protection Agency (16 different ones, in parts per billion, ppb). PAHs are non-soluble compounds that circulate through the body and can move through food chains, although they do not biomagnify like DDT. Blood (plasma) samples are ideal for assessing petroleum exposure because they represent that which is circulating to target organs and causing toxic effects. Blood sampling is relatively noninvasive (from the leg) and can be repeated easily to monitor contamination over time. Total (parent) PAHs can come from a variety of sources, including air, soil and water, so their detection in wintering loons off the coast of Louisiana does not mean that some, or all, of it can be linked to the Deepwater Horizon Oil Spill.

Results. We caught 13 Common Loons and 8 Brown Pelicans during the 2015 field season and had their tissues analyzed for polycyclic aromatic hydrocarbons (or PAHs). The data summarized below meets our first objective.

More than half (54%, 7/13) of the loons, and 75% (6/8) of the pelicans (had moderately high to high PAH levels (>30ppb). We observed both an increase in frequency and an increase in concentrations in blood PAH for loons between last year and this year. The frequency increased from 0% to 54% and the concentrations increased from 0.0ppb to 48.4 (range: 30.6-163.5ppb). Feather PAH frequencies and concentrations for Brown Pelicans increased from 15% to 75%, and concentrations increased from 46.3 ppb to 58.3 (range: 48.0-99.4ppb).

Objective 2. Determine the diet of wintering loons

We have summarized our carbon-nitrogen and sulfur isotope testing over the last 3 winters, completing and fulfilling our second objective. Dr. Sam Wainwright, at the U.S. Coast Guard Academy, has been my colleague in this endeavor. He analyzed 50 Common Loon blood samples for carbon, nitrogen and sulfur isotopes to assist us in understanding what the birds might be feeding on, and where. Results show distinct isotopic differences between blood samples from loons collected in different geographic areas, suggesting that not only do Common Loons collected in different areas have different diets, but also they appear to show some degree of site (or habitat) fidelity. Prey organisms showed clear isotopic differences between mollusks (mussels and oysters), fish (menhaden), and crustaceans (mud crabs and blue crabs). Based on C vs. N isotope plots, Common Loons and Brown Pelicans showed similar diets of organisms at the same trophic level as mud crabs and menhaden. However, sulfur isotopes revealed differences between the diets of these avian species, suggesting different prey and/or foraging habitats.

Objective 3. Quantify behavior of wintering loons

This aspect of the project is winding down and we hope to put a manuscript out within the next year summarizing our results. In 2015, loons were in low abundance in the study area, and reasons for this remain unclear. In addition, loons were rarely observed from shore, where in years past, we would be able to collect behavioral data from shore consistently. Loons spent most of their diurnal hours foraging (64.6%). They also spent a significant amount of time preening (19.6%) and resting (14.8%). Compared to loons in the summer, winter loons appear to spend more time foraging and preening. This is likely because they do not need to defend territories and interact with other loons and instead can focus more on somatic activities, instead of social ones.

Research Impacts

1. Contributions to conventions, agendas, policies, management plans

International: I spoke at the International Journal of Waterbirds (Waterbird Society) in August, 2015, and am giving a talk on my loon work in the Gulf of Mexico. Researchers from around North America and Europe will be in attendance, and so will learn about our research.

National or Regional: We had a paper accepted in the journal “*The Condor*” on winter-site fidelity in the Common Loon Across North America. This is an important piece of information about loons that was unknown until our investigation.

Local: We have partnered with Louisiana State University to continue to do monitoring work in the Gulf of Mexico.

2. Developing Environmental Leaders

In February, I attended an international conference on the Deepwater Horizon Oil Spill Event in Houston, Texas. I presented my research to a local consortium of researchers. Then, in March, I presented my research on PAHs in wintering loons at the New England States Loon Working Group, in Holderness, New Hampshire. This was a 2-day seminar on loon conservation and research. There were roughly 50 attendees at the conference. This past August (2015), I presented my research at the Waterbird Society annual meeting. My Gulf research on loons is also linked to our website at www.briloon.org.

3. Conservation of Taxa

Although the Common Loon and Brown Pelican are not state or federally endangered, they are at risk from the Deepwater Horizon oil spill because many winter off the coast of Louisiana. In addition, they both feed high on the food chain, and therefore are potentially vulnerable to environmental contamination. Common Loons, for example, have been identified as an important ecological indicator species. Our research will provide important data to assess the health of loons and pelicans living off the coast of Louisiana that was exposed to the Deepwater Horizon Oil Spill of 2010. There are few studies monitoring the effects of oil contamination on bird species in the local area. Our results could have important implications for local wildlife and people living in the region.

4. Conservation of Habitats

Although our research is not directly aimed at conserving habitat, it is indirectly linked to monitoring and assessing habitat quality through environmental contamination of avian piscivores inhabiting the local region. Our findings may have potential impact on the settlement and restoration funds available to the state of Louisiana from the BP Deepwater Horizon settlement that could be used for conservation of habitat.

5. Ecosystem Services

We are monitoring PAHs in Common Loons and Brown Pelicans in Barataria Bay, Louisiana and associated watercourses that were greatly impacted from the Deepwater Horizon oil spill (April, 2010) We have been studying loons in this area for five consecutive winters, and have caught a total of 98 individuals. There are few studies of wintering loons in North America and our data will provide important baseline information on the species, such as habitat use, diet and behavior. In addition, the baseline data on PAHs we are gathering is vital to study the long-term impacts of the spill in the region. It will also be valuable to local fishermen and both state and federal decision makers regarding the long-term impacts the spill will have on the local ecosystem, and directly, the people who depend on those ecosystem services.

6. Local community activities

Most of community involvement comes through interactions with local citizens at businesses (hardware, grocery, pharmacy) or at local marinas (Joshua's, Yellow Cotton). We are eager to share what we learn with them and in most cases; they are very interested in learning about our research. We have not invited local volunteers on our boats to assist in the data collection because we have space constraints on it. Our local boat captain has an extensive network and has educated local fishing and boat captains about our research and many of them survey and search for loons when they are taking clients on the water. This has been very gratifying, and also saves us a fair amount of time, which is much appreciated.

7. Scientific peer-reviewed publications

2015

J. D. Paruk, M. Chickering, D. Long, IV, H. Uher-Koch, A. East, V. Gumm, D. Poleschook, Evans, K. A. Kovach and D. C. Evers. Common Loon Winter site Fidelity across North America. The Condor (accepted). *Earthwatch acknowledged*.

J. D. Paruk, D. Long, IV, C. Perkins, H. Uher-Koch, A. East, I. Stenhouse and D. C. Evers. Patterns From Five Consecutive Years of monitoring Polycyclic Aromatic



Hydrocarbons concentrations in Common Loons wintering off coastal Louisiana. *Marine Pollution Bulletin* or *Science of the Total Environment* (near final stages of submission). *Earthwatch acknowledged*

Wainwright, S. , J. D. Paruk, D. Long, IV, and H. Uher-Koch. Diet of Common Loons wintering in the Gulf of Mexico. *Marine Ecology Progress Series* (near final stages of submission). *Earthwatch acknowledged*

8. Grey literature and other dissemination of your results

Meetings/Conferences- previously discussed.

Media: linked to our www.briloon.org

Magazine Coverage: National Audubon interviewed me a while back about my research and it will be included in an article slated to come out this summer/early fall. I was also interviewed by Theodore Barbosa, a write, who is currently working on a book on loons and environmental threats.

Anything Else

Thank you for funding my research for four years, it is much appreciated and know that a lot of positive things took place. I hope we can continue the partnership in future years.

Acknowledgements

We thank all the volunteers from Earthwatch Institute who assisted us in the data collection and Common Loon capture. They were a source of inspiration and we appreciate their long hours, dedication, and commitment to this project. We also thank our boat captain, Todd Seither, for his expertise in navigating the Gulf waters and getting us all home safely each day. In addition, we thank Chris Perkins, from the University of Connecticut environmental lab, for performing the PAH analyses.