EARTHJUSTICE

September 14, 2021

Via E-filing

Ms. Lisa Felice
Michigan Public Service Commission
7109 W. Saginaw Hwy.
P. O. Box 30221
Lansing, MI 48909

RE: MPSC Case No. U-20763

Dear Ms. Felice:

The following are attached for paperless electronic filing:

- Direct Testimony and Exhibits of Dr. Alec R. Lindsay on behalf of Bay Mills Indian Community
- Proof of Service

Sincerely,

Christopher R. Clark

Christopher R. Clark
cclark@earthjustice.org

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R. 792.10447, or the Grant of other Appropriate Relief	U-20763 ALJ Dennis Mack

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TESTIMONY OF DR. ALEC R. LINDSAY

ON BEHALF OF

BAY MILLS INDIAN COMMUNITY

September 14, 2021

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I. INTRODUCTION & QUALIFICATIONS

Q. Please state for the record your name, job title, and business address.

A. My name is Alec R. Lindsay. I am a Professor of Biology at Northern Michigan University, located at 1401 Presque Isle Avenue, Marquette, MI 49855.

Q. On whose behalf is this testimony being offered?

A. I am testifying on behalf of Bay Mills Indian Community ("BMC"). This testimony contains my independent scientific opinion. It is being provided in my individual capacity and not on behalf of my employer.

Q. Please summarize your work experience, educational background, and any awards you have received.

A. I have worked for Northern Michigan University for 19 years. I completed my undergraduate studies at the University of Wisconsin-Madison in 1994, double majoring in Zoology and Classical Humanities. I completed my graduate studies at the University of Michigan, achieving a Ph.D. in Ecology and Evolutionary Biology. I have worked in the field with birds for the past 25 plus years, including field work with loons that has taken me from Alaska to Michigan to Scotland. Along with multiple grant awards for the study of loons, I was awarded NMU's Distinguished Faculty award in 2013. In 2014 I was awarded the Michigan Distinguished Professor of the Year Award by the Michigan State Universities' President's Council. My educational background and work experience is also summarized in my CV, provided as Exhibit BMC-14.

Q. Please describe the focus of your academic research.

A. My research interests are broadly focused on studies of evolution, animal behavior and conservation, incorporating data gathered from molecular genetic methods and detailed field studies. I am interested in evolutionary theory and its application to animal behavior, molecular evolution and conservation. My research has predominantly focused on studies of genetics and behavior of Holarctic birds, but I have published additional work with students and other collaborators on varied taxa like Omura's whales, black flies, and blood parasites of wild birds.

Q. Have you testified before this Commission or as an expert in any other proceeding?

A. I have not previously testified before this Commission. I have testified as an expert in an administrative proceeding once before. That case was *Petitions of the Keweenaw Bay Indian Community, Huron Mountain Club, National Wildlife Federation, and Yellow Dog Watershed Environmental Preserve, Inc., on the permits issued to Kennecott Eagle Minerals Co.*, 2010 WL 276664 (Jan. 14, 2010) (Mich.Dept.Nat.Res.).

Q. What is the purpose of your testimony?

A. I am testifying on behalf of BMC regarding the effects of climate change on the common loon (*Gavia immer*). It is my understanding that the Commission is considering evidence regarding the effects of climate change as it considers the proposed project.

Q. What information did you review in preparing your testimony in this case?

A. In preparing my testimony in this case, I drew upon my education, research, and work experience. I am familiar with the literature addressing the impacts of climate change on many birds, including loons. In addition to my knowledge and experience, I relied upon

the literature cited below (and listed in Exhibit BMC-15) in the preparation of this testimony.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

Exhibit BMC-14: Resume (or CV) of Dr. Alec R. Lindsay

Exhibit BMC-15: References Cited in Direct Testimony of Alec R. Lindsay.

II. THE EFFECTS OF CLIMATE CHANGE WILL HARM LOONS.

Q. What bird species is the focus of your testimony?

A. Although there are five species of loons (Aves: Gaviiformes) in the world, this testimony focuses on the common loon (*Gavia immer*) - the only species of loon that breeds in Michigan and is regularly found in the Great Lakes region. Throughout this testimony I will use the terms common loons and "loons" interchangeably to refer to common loons, recognizing there are other species of loon with different biological characteristics that are not relevant to this testimony. The common loon is a large waterbird species that breeds in high latitude lakes of North America. A charismatic icon of the "northwoods," common loons are socially important for the wilderness experience of human residents and visitors, they are economically important for tourism, and they are ecologically important as top trophic-level predators in lake habitats. Much of the basic biology of loons covered below can be confirmed by the species account of Paruk et al. (2021).

Q. Please describe the typical habitat for North American common loons during the summer months.

A. Adult (>3 years old) loons use two different classes of freshwater habitats in the summer months depending on their breeding status.

Breeding birds: When adult loons return to the higher latitudes of North America each spring, they are predominantly seeking habitats that are suitable for breeding. Loons breed on large (>24ha), clearwater lakes that tend to have irregular shorelines and an ample fish prey-base. Breeding lakes preferably have islands, which serve as prime sites for their ground-built nest. Breeding loon pairs (pairs are socially and genetically monogamous) will routinely defend whole lakes as their breeding territory, although large lakes with abundant fish may support multiple pairs. Loon pairs on multi-pair lakes will "parcel" out the lake into defensible regions. Territorial pairs can also defend multiple lakes as a single territory, especially when lakes are small and the nesting lake has a small prey-base. Breeding loon pairs rarely nest on Great Lake shorelines, presumably due to the damaging effects of large waves on their near-shore nests. The cases where loons breed on the waters of the Great Lakes are nearly always restricted to protected bays or inlets, like those found on Isle Royale in Lake Superior.

"Floater" birds: When adult loons do not secure suitable habitat for nesting with a mate, they predominantly become "floater" birds that do not defend territories, and instead spend time on multiple water bodies. The home range of "floater" loons is thus considerably larger than the typical home range of territorial breeding loons and the quality of habitats used by "floater" loons is more varied. During the breeding season, "floater" loons can be found on large inland lakes, on lakes with heavier human development, and on Great Lakes shorelines. Loons rarely are found on rivers during the breeding season (they use rivers

more frequently while migrating). Periodically, "floater" loons will intrude on the territories of breeding pairs, usually resulting in aggressive interactions between territory holders and intruders.

Q. Please describe the migration process for North American common loons.

A. On a most basic level, loons fly north to their breeding regions in the spring and south to their wintering regions in the autumn. Loons are fast fliers (120km/hr) and when flying over land have been observed migrating at an altitude of 1500-2700m above sea level (when over water, loons typically fly lower). Migration is inherently difficult to study, because birds in flight are hard to track in large numbers. Still, data from migration count sites, genetic analyses, and satellite telemetry provide an increasingly clear picture of the routes and timing of migration. The particulars of flight paths and timing vary with different populations, and even within populations there can be some variability. For instance, some loons that breed in northern Minnesota fly east to their wintering grounds in the mid-Atlantic, while other loons that breed in the same region fly south to winter in the Gulf of Mexico.

***Vernal Migration**:* Generally, in March or April, once the molt of flight feathers is complete (see below), loons will begin their journey northward. In the Great Lakes region, where we know arguably the most about loon migration, loons fly north typically following ice-out as it moves north with the warming weather. Breeding pairs will often appear on territorial lakes within 24-48 hours of open patches of water appearing on the lake. The pressure to "stake-out" territory leaves little room for deviation, so spring migration is fairly stereotyped and individual birds tend to follow the same routes each spring.

Autumnal migration: Loon pairs that were successful breeders usually stay on their breeding territory for the 14-15 weeks it takes to successfully raise 1-2 loon chicks. As the developing loon chicks get closer to fledging, adults may start to wander from the territory. Eventually they fly off the breeding lake, leaving their now self-sufficient offspring behind. Usually within 7-14 days the offspring will also leave their natal lake territory. Adults migrate independent of each other and of their chicks. Migrating birds will fly hundreds of kilometers in a single day, stopping periodically on larger bodies of water to forage and rest. Recent genetic analysis (Larison et al., 2021) and satellite-telemetry data (Kenow et al., 2021) show that the Great Lakes are an important stopover site for migrating loons, including those that breed as far away as the province of Alberta and Quebec. Loons can remain on their stopover sites for days or weeks before continuing their journey southward to their final overwintering waters.

Q. Please describe the typical habitat for North American common loons during the winter months.

A. During the winter months, adult common loons go through a complete and synchronous replacement of their flight feathers ("molt"), rendering them flightless for 4-6 weeks. As such, loons require habitats that have ample prey-base to sustain them over long periods of time while flightless. Thus, most loons spend their winter months on the nearshore or offshore coastlines of North America where water is relatively clear, the prey-base is ample, and the depth is less than 35m. Some birds will overwinter on large reservoirs (typically in the southern United States) or on large slow-moving rivers of warmer climates (i.e. the Columbia River). Loons rarely overwinter on the Great Lakes. Hatch-year loons

(<3yrs) migrate to these same types of habitats after fledging and remain in those habitats until they reach sexual maturity (>3yrs).

Q. During which time of year are common loons found in Michigan?

A. Common loons are among the earliest migratory waterbirds observed in Michigan, being regularly sighted on the Great Lakes in late March and early April. Breeding takes place on inland lakes in Michigan from April to October. During autumn migration birds can be commonly seen in Michigan into October and November. Loons are rarely seen in Michigan from December-February, and if they are seen it is almost always on the Great Lakes.

Q. Has climate change already affected common loons?

A. Yes. One study of a population of breeding loons (Bianchini et al., 2020) found that in the last 38 years loon productivity declined in Ontario, and attributed that decline to "climate change-induced stress, acting through multiple interacting pathways." As to changes in loon migration, data collected over the last 30 years at Whitefish Point Bird Observatory ("WPBO") on Lake Superior demonstrate that:

- loons are migrating north earlier in the spring (Figure 1)
- numbers of migrating loons are declining in the spring (Figure 2)
- loons are migrating south later in the fall (Figure 3)

[*N.B.* The three figures included below were generated using compiled data collected from WPBO over 30 years. These data were used with permission from WPBO and Michigan

Audubon. Raw data are shared for this testimony, but should not be used without express permission of Michigan Audubon and A. R. Lindsay.]

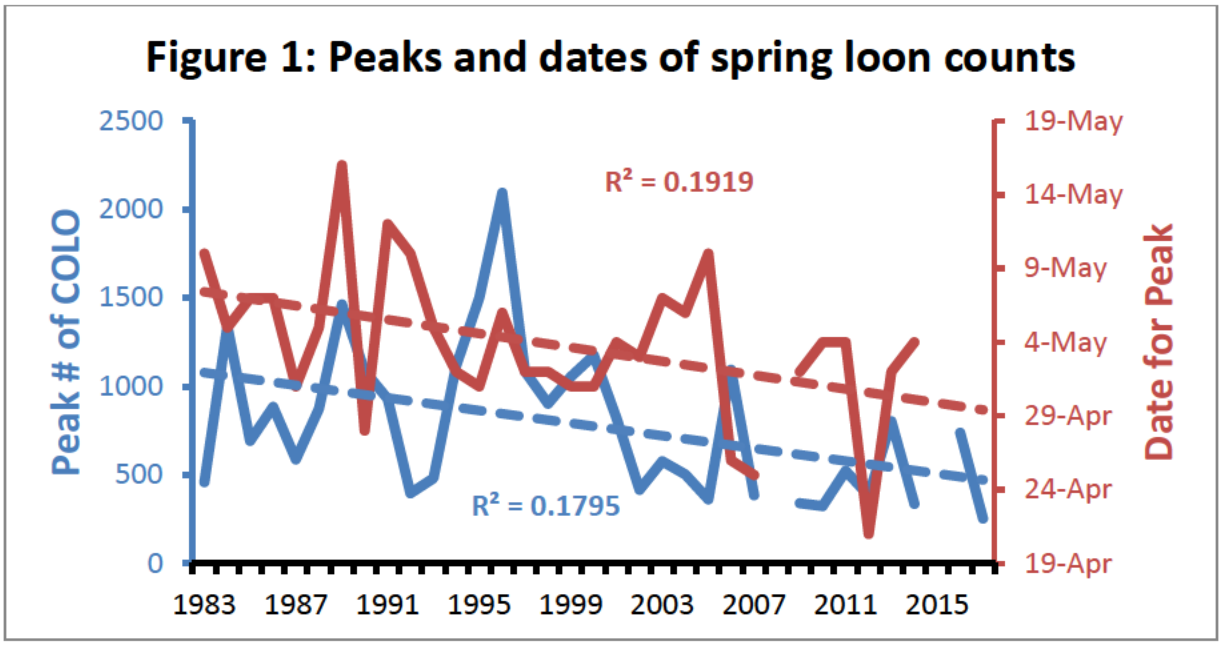

Figure 1. This graph shows the peak number of loons that migrated past WPBO waterbird counters each spring over 30 years, and the dates that those peak counts occurred. The declines in both peak number of loons and the date of the peaks (earlier over the period) were significant.

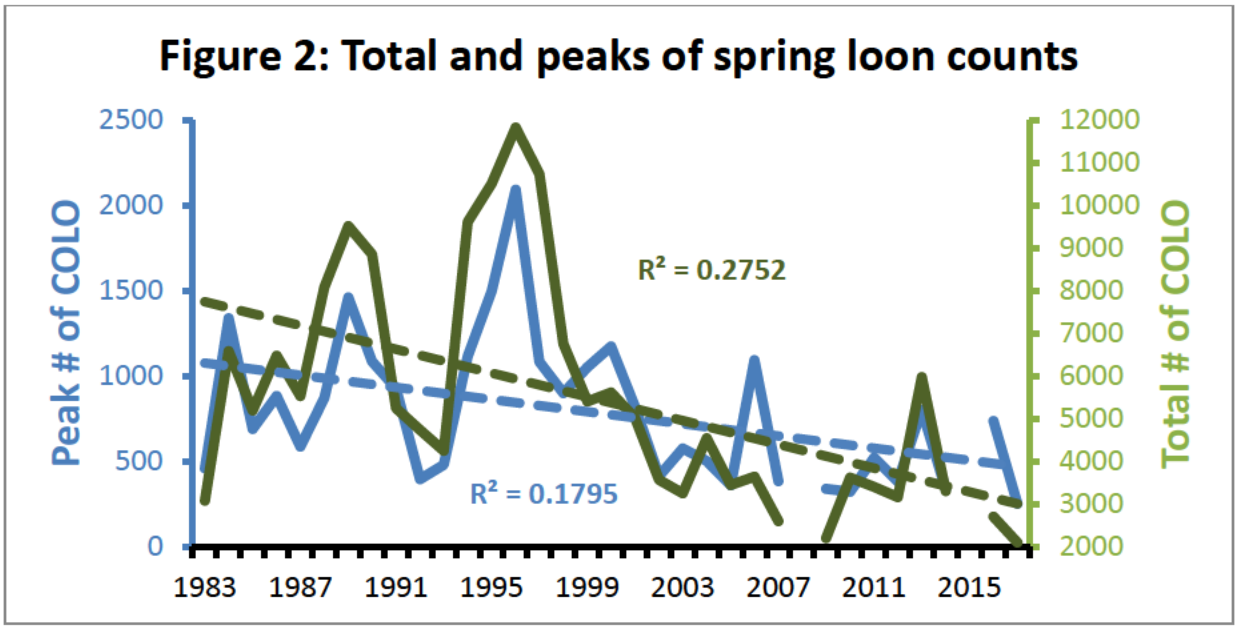

Figure 2. This graph shows the peak and total number of loons that migrated past WPBO waterbird counters each spring over 30 years. The declines in both peak number of loons and the total number of loons over the period were significant.

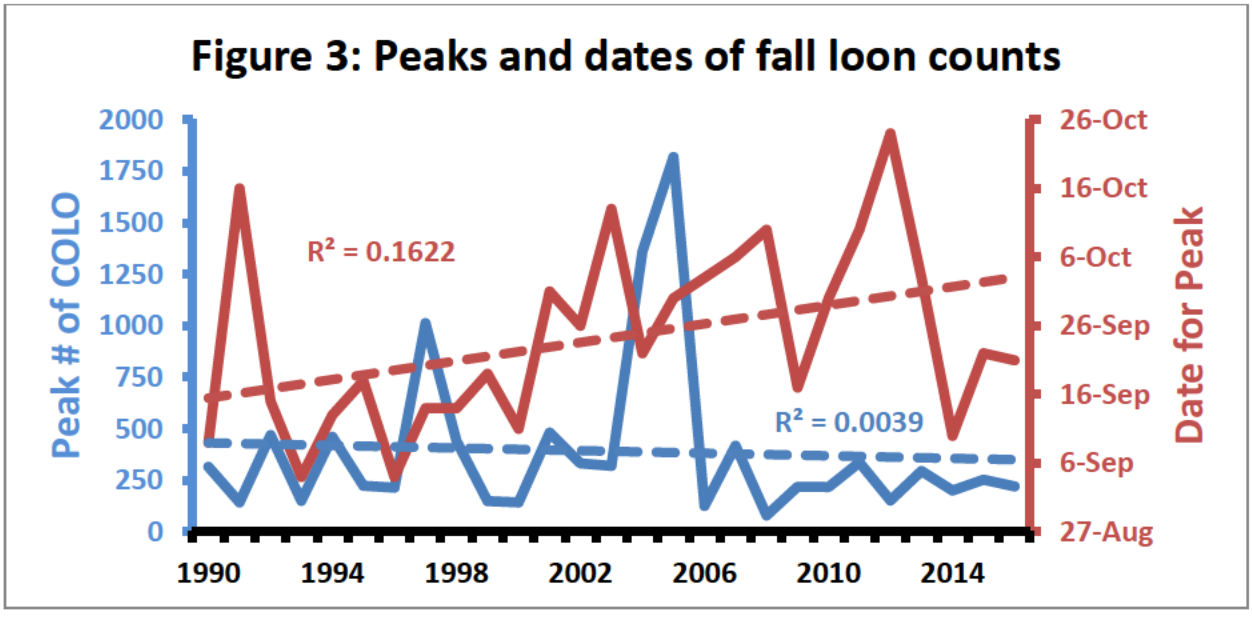

Figure 3. This graph shows the peak number of loons that migrated past WPBO waterbird counters each autumn over 30 years, and the dates that those peak counts occurred. Neither

the peak numbers nor total numbers of loons significantly declined across years, but the peaks did occur significantly later across the period.

Q. What are your primary concerns about climate change and its effects on common loons?

A. I am concerned about the impact of climate change on loons. My primary concerns are the loss of breeding habitats in Michigan associated with the overall loss of breeding range of loons, and the direct loss of individuals due to more frequent and intense botulism type E outbreaks than have been experienced in the past.

Q. How will climate change impact common loon breeding habitats?

A. It is projected that climate change will alter water levels in both the Great Lakes (Angel & Kunkel, 2010; Hayhoe et al., 2010) and inland breeding lakes (Magnuson et al., 1997), and also change the total number of ice-free days in many inland breeding lakes (Mishra et al., 2011). Changing water levels in loon habitats are of significant importance to loons, since loons are not merely waterbirds, they are water-bound birds. Many other species of birds that are considered "waterbirds" (mallard, great blue heron, herring gull, etc.) are dependent on water, but will spend longer periods in terrestrial habitats. Like penguins or puffins, loons are among the most aquatic of birds. Unless they are flying (or sick or injured), loons will only set their webbed feet onto land to copulate (very brief) or to nest. Unlike nearly all other waterbirds, loons cannot effectively stand on land. Once a chick hatches from an egg it will enter the water within 48 hours and it will likely not go onto land again until it is an adult, paired with a mate, and ready to nest. Emphasizing the water-

dependence of loons is important because the fundamental way climate change will affect loons is through climate-induced changes in lakes and coastal oceans (lake temperatures, lake levels, ice-out, hydrological cycles, coastal food webs, etc.).

Q. Will climate change reduce the abundance of common loons in Michigan?

Yes. Climate change will drastically reduce the abundance of, and may even eliminate, common loons in Michigan. With a 3°C global temperature change by 2080, common loons will be extirpated from Michigan and have an anticipated breeding range loss of 97% within the lower 48 states and a nearly 30% loss of population across their entire range (Bateman et al., 2020). Studies of hydrological dynamics of lakes under climate change scenarios predict increased warming of lake surface water and changes in lake levels due to alterations of evapotranspiration from lake surfaces. Although some models have predicted dramatic losses of Great Lakes water levels (Angel & Kunkel, 2010; Hayhoe et al., 2010), more parameterized models show less of a decline in lake levels, but still warn of more dramatic fluctuations in water levels (MacKay & Seglenieks, 2013; Music et al., 2015). In smaller lakes of Michigan where loons breed, this will result in losses of lake volumes due to less ice-cover which leads to increased evaporation (Magnuson et al., 1997; Mishra et al., 2011). As lake volumes decrease, their salinities and nutrient (and contaminant) concentrations will change, leading to shifts in species compositions that will affect the trophic webs in which loons are embedded (Collingsworth et al., 2017; Magnuson et al., 1997; Murdoch et al., 2000; Noyes et al., 2009). These changes are predicted to occur on the Great Lakes (Hayhoe et al., 2010) and on smaller inland breeding lakes of the Great Lakes region (Magnuson et al., 1997). A recent study (Saunders et al.,

2021) demonstrated that the North Atlantic Oscillation (NAO) generates climatic variation that correlates with diminished loon productivity and survival, and the authors show that "...the steepest declines [in the loon population] were projected under positive NAO trends, as anticipated with ongoing climate change."

Q. What is botulism type E and how has it affected loons?

A. In the autumn, loons that migrate through the Great Lakes face an additional danger - being poisoned by botulism type E. Botulism type E outbreaks in the Great Lakes have killed an estimated 100,000 waterbirds in the last 50 years, with an estimated 10,000+ common loons being killed in the Great Lakes over that period (Chipault et al., 2015; USGS, Web Informatics and Mapping (WIM), online). Botulism type E is a neurotoxin produced by a strain of the naturally occurring bacterial species, *Clostridium botulinum*. There are seven different strains of *C. botulinum*, and the toxins produced by these strains tend to occur in different environments and affect different types of organisms. While botulism types A, B, E, and F have been associated with cases of human botulism, botulism types C and E are primarily associated with outbreaks in wild birds (Rocke & Friend, 1999). In the last 30 years nearly all of the botulism-killed birds on the Great Lakes have been associated with botulism type E (Chipault et al., 2015; Lafrancois et al., 2011; Princé et al., 2018). The spores of *C. botulinum* are quite ubiquitous in the environment (Espelund & Klaveness, 2014; Pérez-Fuentetaja et al., 2006).

Q. How will climate change impacts make common loons more susceptible to botulism outbreaks?

A. Climate change will alter limnological (temperature, stratification) and ecological (algal growth and decomposition) conditions in lakes such that the conditions will encourage the growth of the anerobic bacteria that produce the botulism toxin. The limnological and ecological interactions that lead to loons (and some other waterbirds) ingesting and being killed by the toxin are still being delineated, but it is clear that the invasive zebra and quagga mussels (*Dreissena* spp.), the invasive round goby (*Neogobius melanostomus*), and native *Cladophora* sp. algae are all players in this phenomenon (Essian et al., 2016; Kenow et al., 2018; Lafrancois et al., 2011; Pennuto et al., 2012; Tozer & Beck, 2019). Botulism type E outbreaks do not occur every autumn, but are more likely to occur in those years when the water is unusually warm, anoxic, and unmixed (Lafrancois et al., 2011). Models of climate change in the Great Lakes predict that surface temperatures will warm, lake levels will likely decline, and mixing will be diminished (Trumpickas et al., 2009). The analysis of Lafrancois et al. (2011) indicates that those conditions will lead to an increase in the incidence of botulism outbreaks, potentially killing thousands of more loons in each outbreak.

Q. Does that complete your testimony?

A. Yes.

EXHIBIT BMC-14

Alec R. Lindsay, Ph.D.
Curriculum Vitae

Address: Department of Biology
Northern Michigan University
Marquette, MI 49855-5341
Telephone: 906-227-1834
E-Mail: alindsay@nmu.edu
Website: https://sites.google.com/view/alecrlindsay/home

EDUCATION

2002	Ph.D., Department of Ecology and Evolutionary Biology, University of Michigan
1994	B.S., Double Major: Zoology and Classical Humanities, University of Wisconsin-Madison

PROFESSIONAL POSITIONS & AWARDS

2014-Present	Professor, Department of Biology, Northern Michigan University
2014	Michigan Distinguished Professor of the Year Award. State Universities' President's Council
2013	Distinguished Faculty Award. Northern Michigan University.
2007-2014	Associate Professor, Department of Biology, Northern Michigan University (Tenured)
2012	Visiting Researcher, Department of Biology, Boston University
2002-2007	Assistant Professor, Department of Biology, Northern Michigan University
1996-2002	Graduate Student Instructor, Department of Biology, University of Michigan
2001	Instructor, Howard Hughes Medical Foundation/University of Michigan
2001	Research Assistantship, Genomic Diversity Laboratory, University of Michigan
2000	Research Assistantship, Division of Birds, University of Michigan Museum of Zoology

TEACHING (Undergraduate(U) and Graduate(G))	Semesters Taught:
Introductory Biology (U)	W2009, F2009, W2010, F2010, W2011, F2012, W2013, F2013, W2014, F2014, F2015, W2016, F2017, F2018, W2019, F2019
Introduction to Cell and Molecular Biology (U)	W2003, W2004, F2005, W2006, F2006, W2007, F2007
Conservation Biology (U)	W2003, F2004
Ecology of the Northern Forest (U)	F2002, F2003, S2006, F2008
Field Ornithology (U)	S2010, S2016
Genetics (U)	F2005, W2006, F2012
Evolution (U)	F2002, F2003, F2004, W2007, F2007, F2008, W2009, W2011
Hot Topics: Evolution and Intelligent Design (U)	W2006
Field Studies of Zambia (U)	S2007, S2011, S2014, S2017, S2019
Ornithology (U & G)	S2005, W2008, W2010, W2013, W2014, W2016, W2018
Systematics (G)	F2004, F2006
Seminar: Conservation Genetics (G)	W2003
Seminar: Planning and Proposing Science (G)	F2008, F2009
Teaching Assistant Training (G)	F2013, F2014, F2015

PUBLICATIONS (in print, in press or in review) - * *denotes NMU student co-authors*

Larison, Brenda, **Alec R. Lindsay**, Christen Bossu, Michael D. Sorenson, Joseph D. Kaplan, David C. Evers, James Paruk, Jeffrey M. DaCosta, Thomas B. Smith, and Kristen Ruegg. (2021) Leveraging genomics to understand threats to migratory birds. *Evolutionary Applications* 14, no. 6: 1646-1658.

Gayk, Zach*, Diana Le Duc, Jeffrey Horn, **Alec Lindsay**. (2018) Genomic Insights into Natural Selection in the Common Loon (*Gavia immer*): Evidence for Aquatic Adaptation. *BMC Evolutionary Biology* 18, no. 1 64.

Neri, Christopher M., Nova MacKentley, Zach A. Dykema*, Emily M. Bertucci*, **Alec R. Lindsay,** (2018) Different Audiolures Lead to Different Sex-biases in Capture of Northern Saw-whet Owls (*Aegolius acadicus*). Journal of Raptor Research. 52(2): 245-249

Cerchio, Salvatore, Boris Andrianantenaina, **Alec R. Lindsay**, Melinda Rekdahl, Norbert Andrianarivelo, Tahina Rasoloarijao. 2015. Omura's whales (*Balaenoptera omurai*) off northwest Madagascar: ecology, behaviour and conservation needs. Royal Society Open Science, 2, DOI: 10.1098/rsos.150301.

Debiak, Abigail L.*, Damon L. McCormick, Joseph D. Kaplan, Keren B. Tischler and **Alec R. Lindsay**. 2014. A molecular genetic assessment of sex ratios from breeding, migratory and overwintering common loons. Waterbirds 37: 6-15

Lindsay, Alec R. and C. Skye Haas*. 2013. DNA from feces and museum specimens confirms a first state record bird. University of Michigan Museum of Zoology, Occasional Papers Series. 742: 1-10

Weinandt, Meggin L.*, Michael Meyer, Mac Strand, **Alec R. Lindsay**. 2012. Cues used by the blackfly, *Simulium annulus*, for attraction to the common loon (*Gavia immer*). Journal of Vector Ecology. 37(2): 359-364

Gayk, Zachary* and **Alec R. Lindsay**. 2012. Winter Microhabitat Foraging Preferences of Sympatric Boreal and Black-capped chickadees in Michigan's Upper Peninsula. Wilson Bulletin. 124 (4): 820-824

Lindsay, Alec R. 2012. Black-Capped Chickadee. *in* Michigan Breeding Bird Atlas II. Allen Chartier, *Ed*.

Lerner, Heather R. L., Jeff A. Johnson, **Alec R. Lindsay**, Lloyd F. Kiff and David P. Mindell. 2009. It's not too late for the harpy eagle (*Harpia harpyja*): high levels of genetic diversity and differentiation can fuel conservation programs. PLoS One 4(10): e7336. doi:10.1371/journal.pone.0007336

Lindsay, Alec R. 2009. Invited Book Review of: "Ecology and Evolution of Chickadees and Titmice: an Integrated Approach" (2007, Oxford University Press, Oxford UK. Ken Otter, Editor) Wilson Bulletin. 121(4): 851-853

Lindsay, Alec R. and Jerrold L. Belant. 2008. A simple and improved PCR-based technique for white-tailed deer (*Odocoileus virginianus*) sex identification. Conservation Genetics. 9: 443-447

Graves, Brent M., Mac Strand, **Alec R. Lindsay**. 2006. A reassessment of sexual dimorphism in human senescence: theory, evidence and causation. American Journal of Human Biology. 18: 161-168

Lindsay, Alec R., Sandra S. Gillum, Michael W. Meyer. 2002. Differences in avian assemblages on developed and undeveloped lakes in a northern hardwood forest. Biological Conservation. 107 (1): 1-11

Lindsay, Alec R. 2002. Invited Book Review *of* "Introduction to Conservation Genetics" (2002, Cambridge University Press: R. Frankham, J. D. Ballou, D. A. Briscoe *authors*). Endangered Species Update. 19(6): 238-240

INVITED RESEARCH PRESENTATIONS (*Last 7 years*): 21 Presentations with 17 student co-authors

2019 American Ornithological Society, Anchorage, AK
2019 American Society of Mammalogists, Washington, D.C.
2019 International Giraffid Conference, Columbus, OH
2017 American Ornithological Society, East Lansing MI
2017 Inland Bird Banding Association, Kalamazoo, MI
2016 North American Ornithological Congress, Washington DC.
2014 North American Loon Symposium, Sigurd Olson Environmental Institute, Ashland, WI
2013 Gavia Workshop, Tvärminne Zoological Station, Finland
2013 Evolution 2013: SSE, SSB, ASN Joint meeting, Snowbird Utah
2012 American Ornithologist's Union, Vancouver, British Columbia, Canada
2012 Michigan Bird Conservation Initiative, Tustin Michigan

GRANTS, AWARDS & HONORS

2018 Giraffe Conservation International. Dynamics of South Luangwa Giraffe Population. *In collaboration with* Zambian Carnivore Programme. **$7100**
2017 NMU Faculty Grants. The JP Chickadee Project. **$7000**
2017 Giraffe Conservation International. Dynamics of South Luangwa Giraffe Population. *In collaboration with* Zambian Carnivore Programme. **$7100**
2015 PRIME Award: Genetic Diversity of Blue Wildebeest Populations in Zambia and Southern Africa. Co-PIs: Kate Teeter (NMU Biology), Jeff Horn (NMU-Computer Science). Collaborator: Zambian Carnivore Programme - **$20,000**
2014 Michigan Distinguished Professor of the Year Award. Michigan State Universities' President's Council
2013 Distinguished Faculty Award. Northern Michigan University.
2012 Peter White Scholar Award. Conservation Genomics of the Common Loon. - **$17,000**

2011 Visiting Researcher Award. National Science Foundation (Research Opportunity Supplement Award with Michael D. Sorenson, Boston University) – "RAD-Tag" approach for next-gen sequencing of loon genome to describe 3000+ single nucleotide polymorphism loci - **$10,352**

2009 Alec Lindsay and Patrick Brown. Developed a coordinated environmental summer program at NMU. Northern Michigan University - Wildcat Innovation Fund. **$15,000**

2006 Alec Lindsay and Jerry Belant. "Assessing non-invasive sampling techniques and conservation genetic models with white-tailed deer (*Odocoileus virginianus*)." Christine Stevens Wildlife Award. **$10,000**

2006 Alec Lindsay. Designing a simple and improved PCR-based technique for white-tailed deer (*Odocoileus virginianus*) sex identification. US-National Park Service. **$1,800**

2005 Alec Lindsay. DNA Variation, immunogenetics and mercury: genetically assessing the conservation status of common loons (*Gavia immer*). NMU Faculty Grants Program. **$6,960**

2004 Alec Lindsay. Return rates of banded common loons (*Gavia immer*) in early spring. WI-DNR. **$9,978**

2003 Alec Lindsay. Conservation genetics of common loon (*Gavia immer*) populations. NMU Faculty Grants Program. **$7,000**

PROFESSIONAL WORKSHOPS

2012 – ConGen 2012: Recent Advances in Conservation Genetics: Smithsonian Tropical Research Institute, Panama; organized by Steven J. O'Brien

2012, 2007 – Animal Diversity Web, sponsored by National Science Foundation, Stages I & II

2009 – Biodiversity Synthesis Center of the Encyclopedia of Life, Curator Synthesis Meeting

Thesis Direction (graduate)

Major advisor:

- Amy Munes: Thesis co-advisor, NMU Biology Masters Student, 2020-present
- Rachel Weisbeck: Thesis co-advisor, NMU Biology Masters Student, 2019-present
- Carly Paget: Thesis advisor, NMU Biology Masters Student, 2017-present
- Samantha Phillips: Thesis advisor, NMU Biology Masters Student, 2017-present
- Emily Griffith: Thesis co-advisor, NMU Biology Masters Student, 2019-2021
- Steph Szarmach: Thesis co-advisor, NMU Biology Masters Student, 2017-2020
- Connor Gable: Thesis advisor, NMU Biology Masters Student, 2017-2019
- James VanOrman: Thesis advisor, NMU Biology Masters Student, 2016-2019
- Katie Bjornen: Thesis advisor, NMU Biology Masters Student, 2015-2017
- Zach Gayk: Thesis advisor, NMU Biology Masters Student, 2014-2015
- Quentin Sprengelmeyer: Thesis advisor, NMU Biology Masters Student, 2012-2014
- Gary Palmer: Thesis advisor, NMU Biology Masters Student, 2010-2014
- Sayako Iwanaga: Thesis advisor, NMU Biology Masters Student, 2010-2012
- Abigail Debiak: Thesis advisor, NMU Biology Masters Student, 2010-2012
- Grant Slusher: Thesis advisor, NMU Biology Masters Student, 2007-2011
- Meggin Weinandt: Thesis advisor, NMU Biology Masters Student, 2004-2006

Graduate Committee member for over 20+ graduate students at NMU and other institutions

Research mentorship (undergraduate)

Aubrey Parsons (2002-2003)
David Hoffelder (2002-2004)
Justin Segula (2002-2004)
Nikole Goldsmith (2002-2004)
Leah Stoner (2002-2004)
Nick Squires (2002-2004)
Tom Pedersen (2002-2004)
John Elwell (2003-2004)
Stephanie Jones (2003)
Andrew Moriarity (2003-2005)
Jonelle Korhonen (2003-2004)
Mike Weirda (2003-2005)
Zeko McKenzie (2003-2007)
Ellen Lawrence (2003-2007)
Jane Stieber (2003-2005)
Steve Caird (2004-2007)
Grant Slusher (2005-2007)
Viktoria Koskenoja (2005-2007)

Julian Dupuis (2005-2009)
Sarah Hagle (2006-2009)
Kaitlyn Uren (2007-2010)
Danielle Hernandez (2007-2009)
Emily Durkin (2007-2009)
Katie Stamerjohn (2007-2009)
Kala Erickson (2007-2009)
David Pavlik (2006-2010)
Zach Gayk (2010-2012)
Brittney Dodge (2009-2012)
Chloe Apelgren (2012-2013)
Genevieve Haas (2012-2013)
Charlotte Cialek (2012-2013)
Kelsey Huisman (2012-2013)
Mariah Beaman (2012-2013)
Nicholas Vetter (2013-2014)
Dana Gilbertson (2013-2015)
Emily Bertucci (2014-2017)
Zack Dykema (2014-2017)
Abbie Persoon (2015-2018)
Alyssa Peterson (2015-2016)
Danielle Dershem (2015-2018)
Ellen Michels (2015-2018)
Ellie Ewald (2015-2017)
Eric Krause (2015-2016)
Jason Verbal (2015-2017)
Natalie Yeck (2015-2016)
Nathan Martineau (2015-2016)
Samantha Phillips (2015-2017)
Thomas Sofka (2015-2017)
Veronica Snow (2015-2017)
Zack Hancock (2015-2016)
Clara Churchill (2017-2018)
Chase Fair (2017-2018)
Joseph Kurtz (2017-present)
Kyra Brazell (2017-present)
Marissa Trombley (2017-present)
Nathan Martineau (2017-present)
Carlo Estupigan (2017-2019)
Megan Quinn (2018-present)

SERVICE

Northern Michigan University

- Chair of the Academic Senate, 2017-present
- Dean of Arts & Sciences Search Committee, 2018-2019
- Academic Senator for Biology Department, NMU Academic Senate, 2014-present
- AAUP Negotiating Team Member, 2009
- AAUP Bargaining Council Representative – Dept. of Biology, 2009-2011
- Graduate Coordinator, Department of Biology, 2009-2011
- Senate Executive Committee Member & Secretary, NMU Academic Senate, 2007-2008
- Academic Senator for Biology Department, NMU Academic Senate, 2006-2008
- Executive Committee Chair, Department of Biology, 2007-2009
- Risk Assessment and Management Committee, International Studies, 2007-2011
- Executive/Evaluation Committee, Department of Biology, 2003-2005, 2012-present
- President of Sigma Xi, NMU Chapter, 2004-2005
- Honors Board Member, 2005-2006
- Graduate Committee, Department of Biology, 2003-2005
- Seminar and Library Committee, Department of Biology 2002-2007

Michigan Audubon Society

- Chair & Executive Committee Member, March 2013-2017
- Vice Chair & Executive Committee Member, March 2012-2013
- Board of Directors, July 2011-2017

EXHIBIT BMC-15

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STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter of the Application of Enbridge Energy, Limited Partnership for the Authority to Replace and Relocate the Segment of Line 5 Crossing the Straits of Mackinac into a Tunnel Beneath the Straits of Mackinac, if Approval is Required Pursuant to 1929 PA 16; MCL 483.1 et seq. and Rule 447 of the Michigan Public Service Commission's Rules of Practice and Procedure, R 792.10447, or the Grant of other Appropriate Relief	U-20763 ALJ Dennis Mack

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PROOF OF SERVICE

On September 14, 2021, an electronic copy of *Direct Testimony of Dr. Alec R. Lindsay on behalf of Bay Mills Indian Community* was served on the following parties:

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Counsel for Michigan Environmental Council, and National Wildlife Federation	
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Date: September 14, 2021

By: Christopher R. Clark

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