

## **2014 Project Abstract**

For the Period Ending June 30, 2016

**PROJECT TITLE:** Contaminants in Minnesota's Loons and Pelicans-Phase 2

**PROJECT MANAGER:** Carrol Henderson

**AFFILIATION:** Minnesota Department of Natural Resources

**MAILING ADDRESS:** Department of Resources, 500 Lafayette Road

**CITY/STATE/ZIP:** St. Paul, MN 55155

**PHONE:** (651) 259-5104

**E-MAIL:** Carrol.henderson@state.mn.us

**WEBSITE:** www.mndnr.gov

**FUNDING SOURCE:** Environment and Natural Resources Trust Fund

**LEGAL CITATION:** M.L. 2014, Chp. 226, Sec. 2, Subd. 05g

**APPROPRIATION AMOUNT:** \$ 260,000

### **Overall Project Outcomes and Results**

The Deepwater Horizon oil spill in 2011 released about five million gallons of crude oil into the Gulf of Mexico and subsequent deposition of up to one million gallons of "dispersant". Both are carcinogenic and threaten the health of Common Loons and American White Pelicans that nest in Minnesota and winter in the Gulf of Mexico.

Minnesota has the largest populations of Common Loons and American White Pelicans in the continental US. We have a stewardship responsibility to preserve healthy populations of those species.

This project documented the threat posed to loons and pelicans by the Deepwater Horizon oil spill. Loon research involved satellite telemetry and internal transmitters to monitor migration and wintering movements, geolocators on leg bands to study diving behavior, and sampling of blood, feathers, tissues, and eggs for contaminants. Pelican research involved analyses of eggs and shed bill knobs. Collection of pelican migration with cell tower transmitters was not successful.

Radiotelemetry revealed juvenile loons wintering in the Gulf where contaminants occurred. In summer they traveled along the Atlantic seaboard to Quebec and northern Manitoba their first two years. This information is new to science.

Sublethal petroleum contaminant levels were present in pelican eggs (46.3%), bill knobs (78.4%), loon eggs (17.9%) and blood (35.0%), loon feathers (14.3%) and fat (31.8%). Dispersant contamination was found in pelican bill knobs (37.0%) and eggs (43.5%). Those contaminants could affect survivability, behavior, reproduction, or chick survival. Loon population levels appear stable. Pelicans declined from 2012 to 2015 but the cause does not appear related to the oil spill.

The federal Oil Pollution Act of 1990 will allow the State of Minnesota to obtain remediation funds from BP to pay for recovery efforts for conservation of loons and pelicans. The DNR is awaiting guidelines to apply for remediation funds.

**Project Results Use and Dissemination:** This LCCMR project has generated an enormous amount of media and public attention, especially for the work related to loons and the potential impact of the Deepwater Horizon oil spill on loons. There have been numerous presentations to conservation groups, garden clubs, bird clubs, civic groups, and statewide media coverage.

Recent media coverage has included:

1. Loon research. A look at new loon research at a time when Minnesota stands to share in BP Oil Spill settlement money to benefit the state bird. Photo gallery by Aaron Lavinsky. Star Tribune. Sept. 3, 2016.
2. Minnesota on Cusp of a New Era of Loon Conservation. Star Tribune. Tony Kennedy. Sept. 4, 2016.
3. Gulf oil spill residue found in Minnesota loons. Greg Vandegrift, KARE-TV. Sept. 27, 2016.
4. Loon Study. Frequently asked questions. USGS. Upper Midwest Environmental Sciences Center. Website.
5. Loons and the gulf oil spill. MN DNR website. Nongame Wildlife Program.



# Environment and Natural Resources Trust Fund (ENRTF)

## M.L. 2014 Work Plan-FINAL REPORT

---

**FINAL REPORT: Date of Report:** November .3, 2016  
**Date of Next Status Update Report:** N/A  
**Date of Work Plan Approval:** June 4, 2014  
**Project Completion Date:** June 30, 2016.  
**Does this submission include an amendment request?** no

---

**PROJECT TITLE: Contaminants in Minnesota's Loons and Pelicans-Phase 2**

**Project Manager:** Carrol Henderson  
**Organization:** Minnesota Department of Natural Resources  
**Mailing Address:** Nongame Wildlife Program, Box 25, Division of Ecological and Water Resources, Department of Natural Resources, 500 Lafayette Road.  
**City/State/Zip Code:** St. Paul, MN 55155  
**Telephone Number:** (651) 259-5104  
**Email Address:** carrol.henderson@state.mn.us  
**Web Address:** www.mndnr.gov

---

**Location: Statewide**

---

<b>Total ENRTF Project Budget:</b>	<b>ENRTF Appropriation:</b>	<b>\$260,000</b>
	<b>Amount Spent:</b>	<b>\$249,261</b>
	<b>Balance:</b>	<b>\$ 10,739</b>

---

**Legal Citation:** M.L. 2014, Chp. 226, Sec. 2, Subd. 05g

**Appropriation Language:**

\$260,000 the second year is from the trust fund to the commissioner of natural resources to continue to assess the potential impact of petroleum, dispersants, and heavy metal contaminants from the Deepwater Horizon oil spill in the Gulf of Mexico on the wintering habitat of Minnesota's common loons and white pelicans using radiotelemetry, geolocators, and contaminant analysis.

## **I. PROJECT TITLE: Contaminants in Minnesota's Loons and Pelicans-Phase 2**

**II. PROJECT STATEMENT:** Since April 2010, the Deepwater Horizon oil spill has taken on significant dimensions because of direct mortality and possible long term impacts on Minnesota-origin Common loons and American white pelicans. Petroleum contaminants (PAH) and toxic dispersants (DOSS) released into the Gulf of Mexico cause continuing exposure to loons and pelicans that winter in the Gulf of Mexico. PAH stands for Polycyclic Aromatic Hydrocarbons. They are petroleum contaminants that are carcinogenic, mutagenic, and teratogenic. DOSS stands for Dioctyl Sodium Sulfosuccinate. Known commercially as "Corexit", from 800,000 to 1,000,000 gallons were dispersed onto oil slicks in the Gulf. It did not break down the oil. It only made it sink. DOSS is reported by the Environmental Protection Agency to cause respiratory, nervous system, liver, kidney, and blood disorders. It is carcinogenic and causes hormone disruption.

Minnesota has the largest breeding population of both loons (12,000 adult loons in the state) and white pelicans (22,000 breeding pairs which nest primarily on islands of Marsh Lake near Appleton in Swift County). This presents a national stewardship responsibility to look after the long term health of and survival of those populations.

Loons hatched in Minnesota in the summers of 2008 and 2009 were in the Gulf when the oil spill occurred, and young pelicans hatched in 2009 were also present in the Gulf when the oil spill occurred. Subadult loons do not return to Minnesota until the beginning of their third year, and they typically do not begin breeding until their fifth year. Young American white pelicans do not return to Minnesota until spring of their second year. The Deepwater Horizon oil spill caused the death of approximately 200 Common loons and continuing contamination may be affecting their long term survival and reproduction. This study is directed at learning the extent of those long term damages.

ENRTF funding in 2011 provided three years of field studies in which telemetry showed that, in addition to the impacts on juvenile loons, adult loons from Minnesota subsequently migrated to winter in the area affected by the oil spill. Analyses of loon and pelican blood, tissue, egg, and bill knob samples revealed that a significant percentage of loons and pelicans from Minnesota had picked up both oil and dispersant contaminants in the Gulf. This may be causing long term sublethal impacts including reproductive failure, population declines, or reduced longevity in these long-lived species. Five activities are proposed over the next two years to continue assessing pollutant levels, migration patterns, and population trends for loons and white pelicans.

This information will be used by the US Fish and Wildlife Service for settlement of damages incurred by wildlife including Minnesota loons and pelicans in accordance with the Natural Resources Damage and Restoration (NRDAR) process under the Oil Pollution Act to reimburse states for the loss of wildlife due to oil spills. This data and other information previously gathered in this ENRTF study will likely result in a significant settlement to the State of Minnesota for damages to loons and pelicans, with the proceeds to be used for future loon and waterbird restoration and management purposes over a 15 year period.

## **III. PROJECT STATUS UPDATES:**

**Project Status as of November 15, 2014:** Phase II of our project to assess the potential impact of the Deepwater Horizon oil spill on Minnesota-origin loons and white pelicans is continuing on schedule. We ordered the 15 satellite transmitters needed for our tracking of juvenile loons. Our crew from the USGS successfully captured 15 loons in mid-to late summer and implanted the transmitters, attached geolocators to those loons, and collected blood samples and feather samples from each loon. Three juvenile loons died in their natal areas in late summer due to miscellaneous mortality causes. The transmitters were retrieved and will be reused next year when three more loons will be captured and outfitted with the transmitters. The remaining 12 loons are now "on the air" and can be tracked by Googling "USGS, loon tracking." Two loons migrated from Minnesota on October 7 and 31, and the remaining loons migrated from the state from November 7 to 14. Seven loons are now in the Gulf of

Mexico ranging from offshore areas of Texas to southern Florida. Five loons are still en route to the Gulf and are in lakes and reservoirs of Kentucky, Tennessee, and Indiana.

A total of 125 loon blood samples has been analyzed for mercury, lead, selenium, aluminum, and cadmium to determine if there are other factors that could be affecting the survival or reproduction of the state's loon population. Mercury was found in all loon blood samples and selenium was found in 119 blood samples. Lead was found in two blood samples and aluminum was found in two samples. No cadmium was found in any samples. The results of this testing will now be peer reviewed by Bruce Monson of the Minnesota Pollution Control Agency to compare the selenium and mercury background levels in the lakes where the loons were captured and determine the extent to which those metals were present at levels detrimental to the health of the loons. Contracts with North Dakota State University, the University of Minnesota, and the University of Connecticut have been completed and the work identified in those contracts will commence in the coming winter and spring. The contract with Audubon Minnesota will be negotiated in January of 2015 for the telemetry work on American White Pelicans.

**Project Status as of April 15, 2015, including amendment request:** This project is proceeding on schedule and as planned, with a couple minor exceptions. Samples of loon eggs, feathers, blood, and fatty tissues are being analyzed at the University of Connecticut and 50 pelican eggs will also be tested before June 30, 2015. Plans are proceeding for Audubon Minnesota to place transmitters on 15 white pelicans this summer and they will monitor their movements over the next two years. The statewide pelican survey will be carried out by the University of Minnesota as planned to compare the statewide numbers with those found in 2010. An amendment relating to the pelican telemetry activity is included at the end of this report. We have been notified by the US Fish and Wildlife Service that according to the terms of the Deepwater Horizon settlement terms that are being negotiated with BP, information that has been gathered from the LCCMR loon and pelican studies have been and are being incorporated into their database and evaluations of the effects of the Deepwater Horizon oil spill on Minnesota's loons and pelicans. It is likely at this point that the State of Minnesota/ Nongame Wildlife Program could be receiving three to four allocations of remediation funds, primarily for loon restoration, over the next 15 years, with the first payment of about \$5.5 million dollars by late in 2016. A loon conservation plan has been developed for use of those funds including shoreline easements to protect and enhance loon nesting habitat with shoreline restoration, provide loon nesting rafts in cooperation with lake associations where current nesting sites have a history of failure, and reactivate the statewide "Get the Lead Out" program to promote the use of nontoxic fishing tackle (jigs and sinkers) in cooperation with the MN Pollution Control Agency.

**Amendment Request (04/15/15):** The cost anticipated for purchase of 15 loon satellite transmitters under Activity 5 "Equipment/supplies" increased from \$41,350 to \$47,292-an increase of \$ 5942. That budget shortfall was met by moving \$2042 from Activity 1, \$1500 from Activity 4, and including \$2400 from the existing balance in Activity 5.

Within Activity 4, Mark Martell, the bird conservation director of Audubon Minnesota, obtained \$41,750 in matching funds to acquire 15 cell tower transmitters for this project. Initially we budgeted \$12,000 to acquire 4 satellite transmitters. With \$10,500 originally budgeted for transmitter acquisition, we will purchase two years of cell phone tracking service from cell phone service provider that will cover the data acquisition services to acquire movement data from the pelicans. The difference between the \$12,000 originally budgeted for satellite transmitter acquisition, \$1500, was moved to Activity 5 for the acquisition of the loon satellite transmitters. **Amendment Approved: 05/12/2015**

**Project Status as of November 15, 2015:** This project has continued to meet its goals for the projected loon research relating to satellite telemetry, placement and recovery of geolocators, and obtaining blood, unhatched eggs, feathers, and carcass fat and blood samples for analysis of PAH and DOSS contamination. The USGS has delivered a proposed settlement for the damages caused by the Deepwater Horizon oil spill which include a total of \$70,000,000 for damages to North American common loon and northern gannet populations. Early in 2016 it will be necessary to propose terms for a 15-year conservation plan for Minnesota for loon restoration based on the guidelines provided by the USFWS.

White pelican cell tower telemetry research continues with five birds on the air and another ten scheduled for capture and outfitting with transmitters in April of 2016. This information will also be provided to the USFWS related to terms of remediation from the Deepwater Horizon oil spill but it does not appear that the white pelican impacts will be significant in comparison to the amounts proposed for loon conservation. The statewide pelican survey done in 2015 will provide an important baseline to compare pelican numbers with the results obtained from a comparable count done in 2011.

**Project Status as of April 15, 2016:** We have made significant progress over the past year in our research on both loons and pelicans. The one remaining effort on pelicans will involve capture and marking of 10 pelicans with cell tower transmitters in May and then tracking their movement and migratory activities. Loons currently on the air will continue to be monitored to learn their migratory behavior as subadults moving between the Gulf of Mexico and the Atlantic coastal areas offshore from eastern Canada until they finally reach maturity at the age of three and return to Minnesota. Three refurbished satellite transmitters will be placed in juvenile loons this summer, and loons carrying geolocators will be retrapped in May and June to recover the data on movements and diving behavior. Blood and feather samples will also be collected to monitor their contamination levels of PAH and DOSS. All of this data will be shared with the US Fish and Wildlife Service to be used in development of the remediation plan for loon conservation efforts in Minnesota. We should receive more direction on that by May of 2016.

**Project Status as of September 15, 2016:** Our field research and survey work on common loons and American white pelicans has been wrapping up this year with filing of the final reports for the statewide American white pelican survey and the analyses of the pelican eggs and bill knobs for petroleum and dispersant contaminants. Both reports are attached here in their respective sections and highlights are summarized in the updates for September 15 in those respective accounts. The radiotelemetry study of the pelicans is still proceeding in the collaborative project with Audubon Minnesota and will be finished as of next June 30, 2017. There appears to be some issues with the either durability of the cell tower transmitters being employed or with the attachments used for the transmitters so Audubon Minnesota is in touch with the manufacturer to identify the problem and resolve the issues involved.

The juvenile loons outfitted with satellite transmitters in 2014 and 2015 have revealed significant new information about their movements, and unfortunately, their high mortality rates as juveniles. Fifteen of the 22 loons marked have died, the radio contact from five loons has been lost, and two loons are still alive- one from 2014 and one from 2015. The two-year-old loon hatched in 2014 is summering in northern Manitoba and the one-year old loon hatched in 2015 is summering in the Atlantic ocean offshore from South Carolina.

**Overall Project Outcomes and Results:** All aspects of our common loon research involving radiotelemetry, contaminant sampling for PAH, DOSS, and heavy metals, determination of migration patterns, and use of geocator technology to determine diving patterns has been successfully completed as planned and described in the above six-month updates. Collection of white pelican eggs and bill knobs was also completed as planned and they were sampled for PAH and DOSS contaminants. This research definitely demonstrated that a significant number of both loons and pelicans were picking up contaminants in their Gulf of Mexico wintering areas. This information will soon be incorporated into a remediation workplan for submission to the US Fish and Wildlife Service for use of BP funds to carry out 5 to 15 years of loon and pelican conservation and management work in Minnesota.

#### **IV. PROJECT ACTIVITIES AND OUTCOMES:**

**Activity 1: Migration patterns and wintering distribution of juvenile common loons.**

**Budget: \$77,258**

**Description:** The US Geological Survey will be contracted for their biologists and a wildlife veterinarian to capture 15 juvenile loons by nightlighting in the summer of 2014. The loons will be surgically outfitted

with internal satellite transmitters and geolocators on their leg bands to monitor their subsequent migration and movements during their first two years of life. Little is known about how juvenile loons utilize the Gulf of Mexico in their first two years of life. This has become an extremely important portion of this study because it documents the wintering sites in the Gulf of Mexico that have been most directly impacted by the Deepwater Horizon oil spill. Loons will subsequently be recaptured to obtain data collected on the geolocators which includes the depths to which the loons dive while feeding.

**Summary Budget Information for Activity 1:**

**ENRTF Budget:** \$ 77,258  
**Amount Spent:** \$ 77,258  
**Balance:** \$ 0

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Capture & outfit 15 juvenile loons in 2014 with transmitters and geolocator tags and monitor loon movements and survival.	Sept. 15, 2014	\$ 64,300
2. Recover geolocator tags via carcass recovery or recapture to download data and produce final report.	Dec 1, 2016	\$ 12,958

**Activity Status as of November 15, 2014:** The US Geological Survey team captured and outfitted 15 juvenile loons with internal satellite transmitters and geolocators in central and northern Minnesota. The loons are now online and their locations can be tracked by doing a Google search on “USGS, loon tracking.” Loons included in the project were from Todd, Crow Wing, Kandiyohi, Hubbard, Becker, and St. Louis counties. Three of the juvenile loons have died last summer and 12 are still on the air. As of November 26, seven of the loons had migrated to the Gulf of Mexico and are currently offshore from Texas, Louisiana, Mississippi, and Florida. Five loons are still on lakes or reservoirs in Tennessee, Kentucky, and Indiana. Since juvenile loons have never been tracked with satellite transmitters before, this project is providing new information on their migratory and wintering behavior and on their behavior in the coming year when they are expected to stay in the Gulf of Mexico or along the Atlantic coast. This telemetry data will also help determine if juvenile loons winter in the areas that were most contaminated by the Deep Horizon oil spill. Blood and feather samples were also collected from all loons that were caught last summer so they could be tested for PAH, DOSS, and heavy metals.

**Activity Status as of April 15, 2015:** A total of seven juvenile loons implanted with satellite transmitters in 2014 subsequently died from a variety of causes, and the transmitters were recovered from five of those loons. Those transmitters are being refurbished and will be re-deployed in August of 2015 in five additional juvenile loons. In summer of 2015 additional efforts will be made to recapture loons that were previously outfitted with geolocators so their movement data can be downloaded. Most breeding loons are now back on their Minnesota nesting areas. The juvenile loons marked last year are still in the Gulf of Mexico offshore from Texas, western Florida, and in the Atlantic offshore from Georgia and are expected to stay there for another year.

**Activity Status as of November 15, 2015:** In summer of 2015 seven juvenile loons were captured and implanted with satellite transmitters and banded with geolocators to replace the seven juvenile loons that were captured 2014 but subsequently died from a variety of causes like shooting, red tide, and other accidents/injuries. The loons marked in 2014 have yielded some remarkable information. Three of the juvenile loons moved north to the Atlantic coast in April of 2015 and summered offshore from the Canadian maritime provinces of Quebec, New Brunswick, and Nova Scotia. The locations of those loons can be observed by checking “USGS, loon tracking.” Monitoring of the locations of the loons marked in 2014 and 2015 will continue, and in 2016 efforts will be made to recapture those loons and recover their geolocator data.

**Activity Status as of April 15, 2016:** Eight loons are currently online and wintering offshore from Florida (7) and Texas (1). Their locations can be observed at the USGS website by Googling “USGS, loon tracking.” Three satellite transmitters retrieved from dead loons will be refurbished and placed in

additional juvenile loons this summer. Loons captured and marked with geolocators in previous years will be recaptured in May and June to retrieve migration and diving data from the geolocators. That will complete Phase II of this study and we will then transition into the components of Phase III.

**Activity Status as of September 15, 2016:**

Satellite transmitters were implanted in 22 juvenile loons that were captured on breeding lakes in Minnesota during August 2014 and August 2015. Transmitters on 17 of these birds provided adequate location data to document movement to wintering areas. Fifteen of the radiomarked loons died and transmitter signals were lost for three birds. Carcasses of eight loons were recovered and contributing causes of death determined in seven cases. Three of the juveniles that were radiomarked in 2014 were monitored through spring 2016. These three loons summered as yearlings near the Gulf of St. Lawrence or Nova Scotia and all returned to the Gulf of Mexico for their second winter. Each loon was marked with an aluminum numbered U.S. Fish and Wildlife Service band and a unique combination of colored leg-bands to aid with future field identification of individuals. Each juvenile was also fitted with an archival geolocator tag (Model LAT 2500, Lotek Wireless Inc.). A combination of adhesive and plastic cable ties were used to affix the geolocator tag to a modified lock-on aluminum leg band. Tags were programmed to collect daily location estimates for up to two years, and to document foraging patterns (dive profiles) during fall migration and on the wintering grounds. A blood sample was collected from each loon handled and archived for contaminant residue analyses. Twenty-one of the radiomarked loons were also equipped with an archival geolocator tag. A detailed summary of capture and banding records is provided in Table 2. Movements and fates of each loon are summarized in Table 3, and maps depicting the generalized movements are provided in Figures 2-4. Of 15 apparent mortalities, carcasses of eight loons were recovered and PTTs and geolocator tags recovered from an additional three loons. Mortality and necropsy results are summarized in Table 4. Parasitic infection (in 4 cases), transmitter implant issues (2), potential red tide toxicity (2), gunshot (1), and predation (1) were among the contributing causes of death.

During spring 2016, five radiomarked loons continued to provide location data. One loon (Loon ID 1138-06650) migrated north through Lake Ontario and Lake Superior to Big Trout Lake, Ontario (latest location as of 06 June 2016). The other four loons moved northward along the Atlantic Coast and were along the Carolinas as of 08 June 2016. Loon ID 1138-06635 died on about 01 June 2016 at Bogue Sound, NC.

Table 1. Number of common loons captured, marked, and sampled in Minnesota during 2014-2015.

Year	No. loons captured	No. loons newly banded	No. loons radiomarked	No. loons geotagged	Recaptures-recoveries of geolocator-tagged adults/geotags recovered
2014	41 (13 adults; 28 juveniles)	31 (3 adults; 28 juveniles)	15 juveniles	1 adult; 15 juveniles	13/10
2015	41 (31 adults; 10 juveniles)	36 (27 adults; 9 juveniles <sup>f</sup> )	7 juveniles	24 adults; 6 juveniles	8/5

<sup>f</sup> One juvenile loon was too small to band in 2015.

Table 2. Banding records for common loons captured and banded in Minnesota during 2014, arranged by county.

Banding Status	County	Lake	Lake Territory	Latitude	Longitude	Date	Age	Sex	Loon ID/FWS Band No.	Color Band Combo		Geo-Location ID	PT ID
										Right Leg	Left Leg		
Newly Banded	Anoka	Lake George	Lake George Loon Cam	45°21'05.37" N	93°19'58.79"W	15-Jul-14	Adult	Female	1138-06630	G/S	Rs/Rs	-	-
Newly Banded	Anoka	Lake George	Lake George Loon Cam	45°21'05.37" N	93°19'58.79"W	14-Jul-14	Juv	Unk	1138-06629	Y/Ys	S/G	-	-
Newly Banded	Anoka	Lake George	Lake George Loon Cam	45°21'05.37" N	93°19'58.79"W	15-Jul-14	Juv	Unk	1138-06631	Y/Y	S/G	-	-
Newly Banded	Becker	North Tamarac	North Tamarac	46°55'39.21" N	95°40'18.98"W	21-Aug-14	Juv	Unk	1138-06649	G/G	Sgeo/S	2905	107270
Newly Banded	Becker	South Tamarac	South Tamarac	46°54'16.27" N	95°40'19.78"W	22-Aug-14	Juv	Unk	1138-06650	Rs	Sgeo/S	2913	107261
Newly Banded	Crow Wing	Clearwater Lake	Clearwater Lake West Bay	46°23'47.35" N	93°55'26.50"W	20-Aug-14	Juv	Unk	1138-06643	Gs	Sgeo/S	2910	107271
Newly Banded	Crow Wing	East Rabbit Lake	East Rabbit Lake Northwest Bay	46°31'58.23" N	93°54'54.91"W	20-Aug-14	Juv	Unk	1138-06645	R/Gs	S/Bs	-	-
Newly Banded	Crow Wing	East Rabbit Lake	East Rabbit Lake North Bay	46°32'07.79" N	93°54'29.63"W	20-Aug-14	Juv	Unk	1138-06646	Ys	Sgeo/S	2993	107273
Newly Banded	Crow Wing	East Rabbit Lake	East Rabbit Lake North Bay	46°32'07.79" N	93°54'29.63"W	20-Aug-14	Juv	Unk	1138-06647	R/G	S/Bs	-	-
Newly Banded	Crow Wing	East Rabbit Lake	East Rabbit Lake South Bay	46°31'30.64" N	93°54'28.75"W	20-Aug-14	Juv	Unk	1138-06648	Bs	Sgeo/S	2909	55480
Newly Banded	Crow Wing	Clearwater Lake	Clearwater Lake Northwest Bay	46°23'58.25" N	93°54'24.85"W	21-Aug-14	Juv	Unk	1138-06644	R/Bs	S/Bs	-	-
Newly Banded	Hubbard	Mantrap Lake	Mantrap Lake Osprey Campground	47° 4'0.54"N	94°55'57.68"W	22-Aug-14	Juv	Unk	1138-06651	G/B	Sgeo/S	2904	55491
Newly Banded	Hubbard	Mantrap Lake	Mantrap Lake Porcupine Bay	47° 4'37.40"N	94°56'33.45"W	22-Aug-14	Juv	Unk	1138-06652	G/W	Sgeo/S	2997	55490
Newly Banded	Hubbard	Mantrap Lake	Mantrap Lake Porcupine Bay	47° 4'37.40"N	94°56'33.45"W	22-Aug-14	Juv	Unk	1138-06653	R	S/Bs	-	-

Newly Banded	Kandiyohi	Long Lake	Long Lake	45°19'33.28" N	94° 51'46.15" W	18-Aug-14	Juv	Unk	1138-06634	Ys/B	S/Bs	-	-
Newly Banded	Kandiyohi	Long Lake	Long Lake	45°19'33.28" N	94° 51'46.15" W	18-Aug-14	Juv	Unk	1138-06633	G	Sgeo/S	2899	107259
Newly Banded	Kandiyohi	Point Lake	Point Lake	45°11'43.54" N	95° 1'3.78"W	18-Aug-14	Juv	Unk	1138-06632	Ys/Rs	S/Bs	-	-
Newly Banded	Kandiyohi	Monogalia	Monogalia South	45°19'40.22" N	94° 57'22.92" W	19-Aug-14	Juv	Unk	1138-06635	Y	Sgeo/S	2985	55488
Newly Banded	St. Louis	Eagles Nest Lake	Eagles Nest Lake	47°48'46.50" N	92° 4'26.38"W	23-Aug-14	Juv	Unk	1138-06655	W/Y	S/G	-	-
Newly Banded	St. Louis	Eagles Nest Lake	Eagles Nest Lake	47°48'46.50" N	92° 4'26.38"W	23-Aug-14	Juv	Unk	1138-06656	W/W	S/G	-	-
Newly Banded	St. Louis	Arrowhead Lake	Arrowhead Lake	47°40'45.95" N	92° 38'10.28" W	23-Aug-14	Adult	Male	1138-06657	S	Gs/Sgeo	2984	-

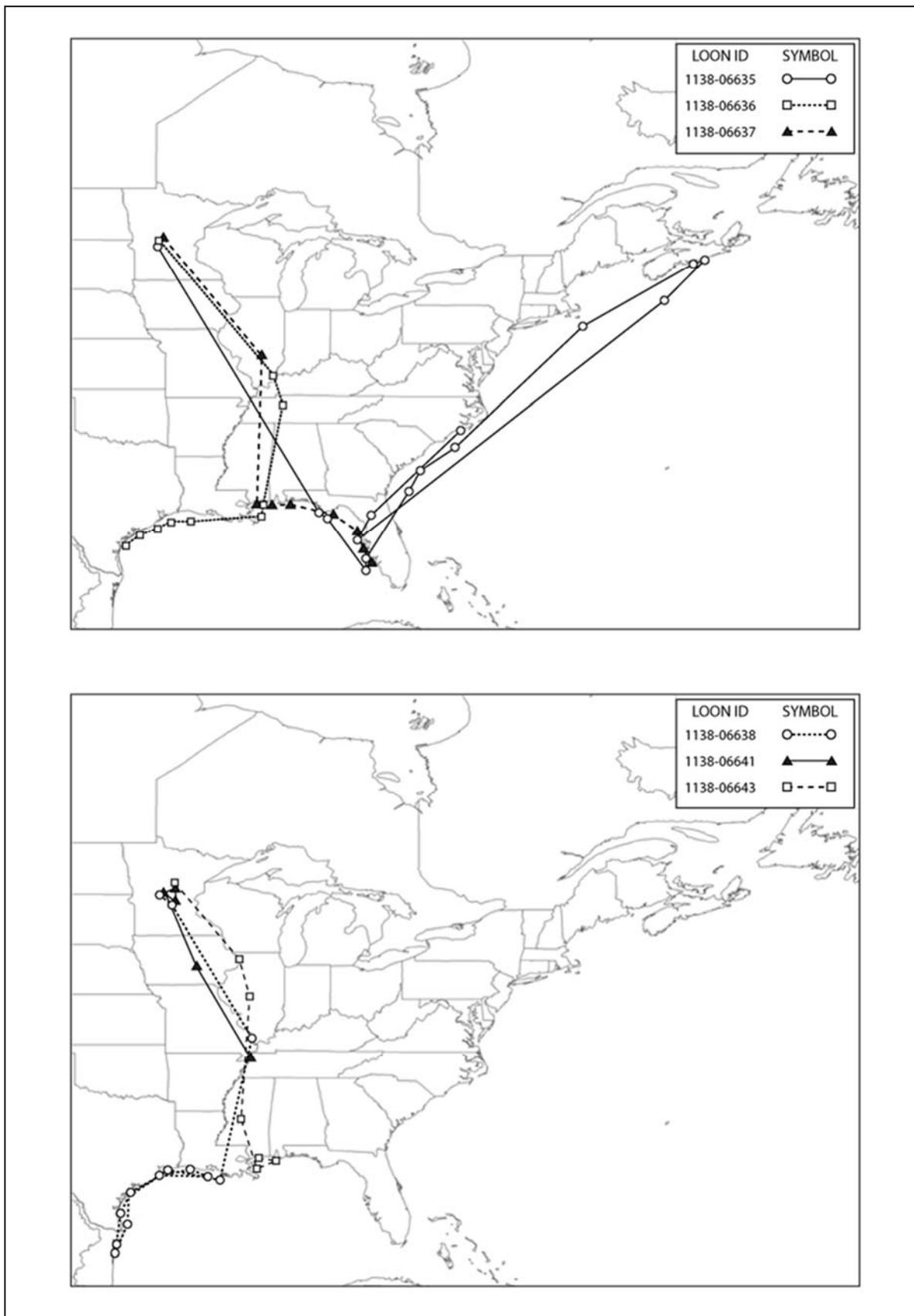
Table 3. Sequential locations and dates for juvenile common loons (*Gavia immer*) radiomarked for satellite telemetry in Minnesota, 2014.

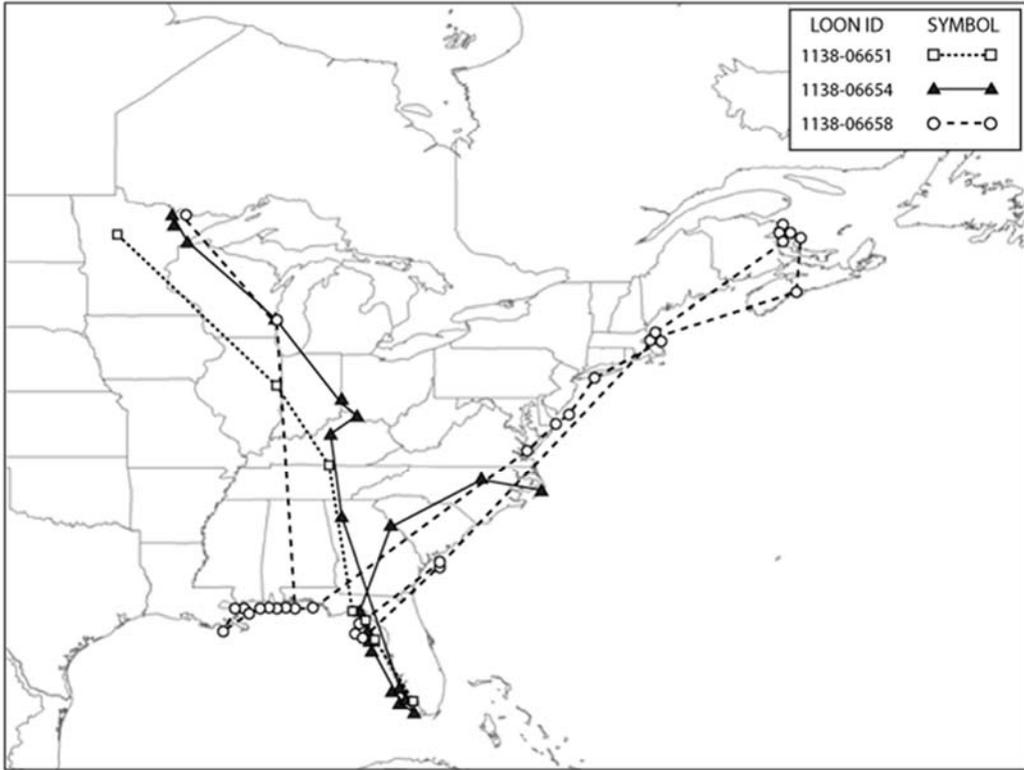
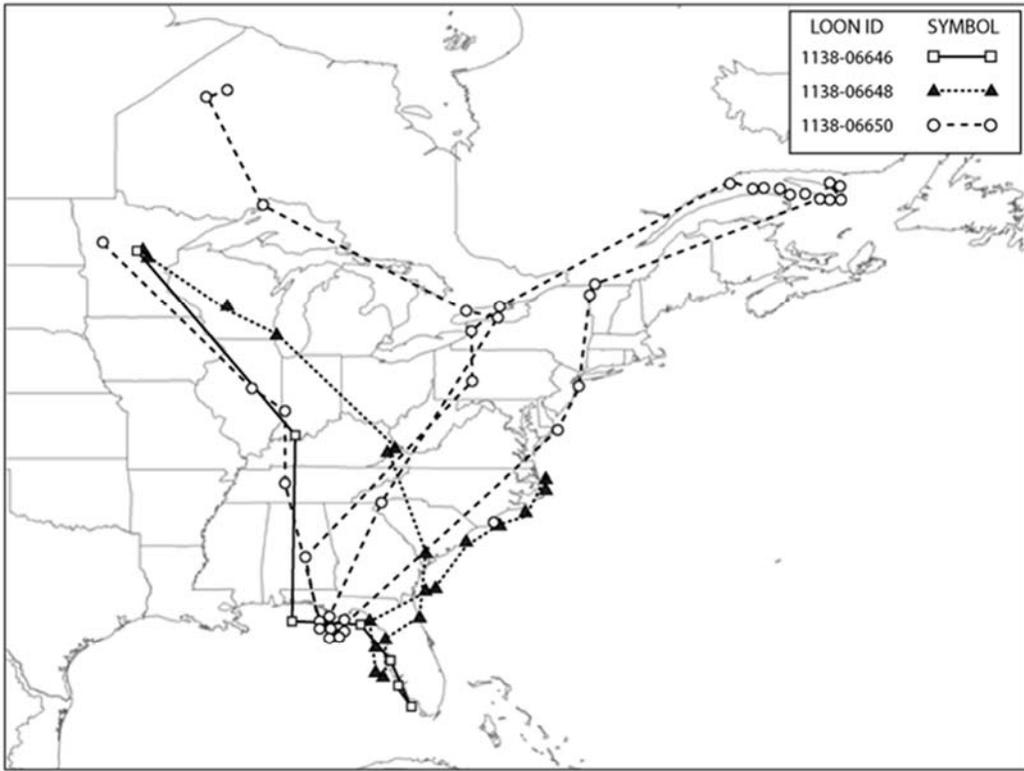
Loon ID (FWS #)	PTT ID	Breeding lake/territory	Fall staging areas	Wintering area	Subsequent locations
1138-06633	107259	18 Aug 14 – 04 Sep 14 ( <i>died</i> ) (Long Lake, Kandiyohi Co.)			
1138-06635	55488	19 Aug 14 – 11 Oct 14 (Monogalia South, Kandiyohi Co.)	13 Oct 14 – 11 Nov 14 (George Lake, MN; Nest Lake, MN)	14 Nov 14 – 23 Mar 15 (Gulf of Mexico, FL)	06 Apr 15 – 21 May 15 (Atlantic Ocean: GA, SC, NC, DE, MA) 31 May 15 – 01 Nov 15 (Atlantic Ocean, Nova Scotia) 06 Dec 15 – 17 Apr 16 (Gulf of Mexico, FL) 17 Apr 16 (in flight across FL) 01 Jun 16 ( <i>died</i> ) (Bogue Sound, NC)
1138-06636	55479	19 Aug 14 – 18 Oct 14 (Little Birch South Narrows, Stearns Co.; minor trip to Big Birch Lake, Todd Co., MN)	20 Oct 14 – 27 Nov 14 (Sylvia Lake, Big Birch Lake, Hartnette Lake, MN; Ohio River, KY; Cross Creeks NWR, KY; Lake Barkley, Cumberland River, TN)	28 Nov 14 – 24 May 15 ( <i>died</i> ) (Gulf of Mexico: MS, LA, TX; Freeport Harbour, TX; Powderhorn Lake, TX; Aransas Bay, TX)	
1138-06637	55484	19 Aug 14 – 05 Nov 14)	05 Nov 14 – 11 Nov 14 (Sylvia Lake, MN)	13 Nov 14 – 08 Jan 15 ( <i>lost signal</i> )	

		(Little Birch Narrows, Todd Co.)		(Gulf of Mexico: MS, AL, FL; Bon Secour Bay, AL; Pine Island Sound, FL)	
1138-06638	55489	19 Aug 14 – 08 Nov 14 (Little Birch Northeast Bay, Todd Co.; minor trips to Latimer and Swan Lakes, MN)	09 Nov 14 – 12 Nov 14 (French Lake, MN; Buffalo Lake, MN; Mississippi River, MO;	13 Nov 14 – 30 Apr 14 ( <i>died</i> ) (Gulf of Mexico: LA, TX, Mexico; Galveston Bay, TX; Moses Lake, TX; Dickinson Bayou, TX; Aransas Bay, TX; Laguna Madre, Mexico)	
1138-06641	55487	20 Aug 14 – 27 Sep 14 (Big Birch South, Todd Co.)	04 Oct 14 – 21 Nov 14 ( <i>died</i> ) (Big Swan Lake, Schafer Lake, Hennessy Lake, MN; Lake Ponderosa, IA; Mississippi River, AR; Everett Lake, TN)		
<b>Loon ID (FWS #)</b>	<b>PTT ID</b>	<b>Breeding lake/territory</b>	<b>Fall staging areas</b>	<b>Wintering area</b>	<b>Subsequent locations</b>
1138-06643	107271	20 Aug 14 – 07 Oct 14 (Clearwater West Bay, Crow Wing Co.)	10 Oct 14 – 30 Oct 14 (UMR Pool 13, IL; Springfield Lake, IL; Ross R Barnett Reservoir, MS)	31 Oct 14 – 22 Dec 14 ( <i>died</i> ) (Gulf of Mexico: MS, AL; Mississippi Sound, MS)	
1138-06646	107273	20 Aug 14 – 02 Oct 14 (East Rabbit North Bay, Crow Wing Co.)	05 Oct 14 – 04 Dec 14 (Cedar Lake, Sunset Lake, MN; Ohio River, KY)	07 Dec 14 – 22 Apr 15 ( <i>signal lost</i> ) (Gulf of Mexico, FL; Tampa Bay, FL; Charlotte Harbor, FL; Pine Island Sound, FL)	
1138-06648	55480	20 Aug 14 – 21 Oct 14 (East Rabbit South Bay, Crow Wing Co.)	22 Oct 14 – 29 Nov 14 (Arco Mine, Mahnomen No. 2 Mine, Blackhoof Lake, Feigh Mine, Menomin Lake, Louise Mine, Huntington Mine, MN; Wisconsin River, WI; Lake MI; Fishtrap Lake, KY; Atlantic Ocean, GA)	02 Dec 14 – 14 Apr 15 (Gulf of Mexico, FL)	17 Apr 15 – 23 Jun 15 ( <i>died</i> ) (Atlantic Ocean: GA, SC, NC)
1138-06649	107270	21 Aug 14 – 01 Sep 14 ( <i>died</i> ) (North Tamarac, Becker Co.)			
1138-06650	107261	21 Aug 14 – 08 Sep 14 (South Tamarac, Becker Co.)	11 Sep 14 – 12 Nov 14 (Cotton Lake, Detroit Lake, Big Cormorant Lake, Sallie Lake, MN; Lake Clinton, IL; Dugger Strip Mine, IN)	15 Nov 14 – 14 Apr 15 (Gulf of Mexico, FL)	17 Apr 15 – 22 May 15 (Cooters Pond, AL; Williams Run Reservoir, PA; Lake Erie; Lake Ontario) 25 May 15 – 13 Sep 15 (Gulf of St. Lawrence, Quebec) 17 Sep 15 – 02 Dec 15 (Lake Champlain: NY, VT, Quebec; Atlantic Ocean: NJ, MD, NC) 09 Dec 15 – 22 Apr 16 (Gulf of Mexico, FL)

					26 Apr 16 – 13 Jun 16 (Lake Jocassee, SC; Lake Ontario: NY, Ontario; Lake Superior, Ontario; Makoop Lake and Big Trout Lake Ontario)
1138-06651	55491	22 Aug 14 – 07 Nov 14 (Mantrap Osprey Campground, Hubbard Co.)	08 Nov 14 – 10 Nov 14 (Middle Fork Vermilion River, IL; Dale Hollow Lake, TN)	11 Nov 14 – 25 Nov 14 ( <i>died</i> ) (Gulf of Mexico, FL)	
1138-06652	55490	22 Aug 14 – 13 Sep 14 ( <i>died</i> ) (Mantrap Porcupine Bay, Hubbard Co.)			
1138-06654	107262	23 Aug 14 – 01 Oct 14 (Arrowhead, St. Louis Co.)	04 Oct 14 – 08 Dec 14 (Esquagama Lake, Vermillion Lake, MN; Lake Superior; Lake Michigan; Acton Lake, OH; Ohio River, KY; Taylorsville Lake, KY; Allatoona Lake, GA)	09 Dec 14 – 11 May 15 (Gulf of Mexico, FL; Rodgers River Bay, FL; Whitewater Bay, FL)	15 May 15 – 03 Aug 15 ( <i>died</i> ) (Pamlico Sound, NC)
1138-06658	107268	24 Aug 14 – 31 Oct 14 (Shagawa, St. Louis Co.)	01 Nov 14 (Lake Michigan)	02 Nov 14 – 03 May 15 (Escambia Bay, FL; Bon Secour Bay, AL; Gulf of Mexico, AL; Lake Borgne, LA; Lake Laurier, LA; Caminada Bay, LA; Little Lake, LA; Mississippi Sound, LA; Bay Boudreau, LA; Gulf of Mexico, MS; Gulf of Mexico, FL)	10 May 15 – 07 Jun 15 (Chesapeake Bay, VA; Atlantic Ocean, NJ; Hingham Bay, MA; Cape Cod Bay, MA) 10 Jun 15 – 26 Sep 15 (Gulf of St. Lawrence, New Brunswick) 29 Sep 15 – 07 Dec 15 (St. Margaret's Bay, Nova Scotia; Gulf of Maine, ME; Atlantic Ocean, MA; Massachusetts Bay, MA; Atlantic Ocean, SC; Atlantic Ocean, FL) 10 Dec 15 – 17 May 16 (Gulf of Mexico, FL) 28 May 16 (Atlantic Ocean, SC)

Figure 2. Generalized movements of juvenile common loons radiomarked in Minnesota during August 2014.







Interim report\_MN  
juvenile loon moveme

**Final Report Summary:** This telemetry study was the first ever migration and wintering study on juvenile loons using internally implanted satellite transmitters that could locate each loon's location to within 250 meters. This radiotelemetry effort was successfully completed with on 22 loons. The research resulted in dramatic new information about movements of juvenile loons and also verified that they wintered in areas where petroleum contaminants and dispersants would have settled to the bottom of the Gulf of Mexico. When juvenile loons leave Minnesota they generally migrate south/southeast directly to the Gulf of Mexico without a stopover in Lake Michigan as adult loons do. We thought they spent the next two years in the Gulf before returning to Minnesota at the beginning of their third year.

However, in the spring of their first year they migrated northeast diagonally across the southeastern US to the Atlantic and to Lake Erie. Some summered along the Atlantic seaboard and several went all the way to Atlantic waters offshore from Nova Scotia, New Brunswick, and the the Gulf of St. Lawrence near Quebec. This had never been documented before. The loons, now subadults, returned to the Gulf of Mexico for their second winter season. Mortality for these loons was high for a number of reasons including toxic red tides in the Gulf of Mexico, being shot by goose hunters, and injuries incurred in flight. Seven of the 15 juvenile loons died in their first year.

Two surviving second-year subadults again migrated north in the spring of 2016. One summered off the coast of South Carolina and the other summered in a Manitoba lake several hundred miles north of Minnesota. We have discerned absolutely no pattern to the migratory destinations of these subadult loons. The signal has now faded for the South Carolina loon, and the remaining loon that summered in Manitoba is now on a lake in northwestern Vermont. It is expected to return to the Gulf of Mexico in the next month and return to Minnesota in the spring of 2017. All of this new knowledge adds significantly to our information on survival and migration ecology of loons while also documenting that the subadults were being annually exposed each winter to the residual contaminants that remain in the Gulf of Mexico.

We learned that juvenile loons return to the Gulf of Mexico each year after summering in northern regions ranging from the Atlantic coast offshore from the Carolinas northward to the Gulf of St. Lawrence in Quebec, and even into northern Manitoba. Each winter they would be potentially exposed to contamination in the Gulf of Mexico from the Deepwater Horizon oil spill. This was the first study of its kind that looked at the movement and migration behavior of subadult loons.

## **Activity 2: Loon and pelican tissue contaminants analysis.**

**Budget: \$ 84,013**

**Description:** The North Dakota State University Dept. of Biology will be contracted to collect 50 eggs from the American white pelican colony breeding at Marsh Lake in 2014 and 2015. The U of Connecticut will be contracted to analyze the eggs for PAH and DOSS to determine if petroleum contaminant concentrations are declining from 2011 levels.

Contract with the U of Connecticut to analyze loon feather samples collected by the US Geological Survey biologists for both PAH and DOSS contaminants to verify high levels of PAH and DOSS detected in blood

samples from the same loons. The U of Connecticut will analyze blood samples taken from live loons captured by the USGS in the course of placing or recovering geolocators and satellite transmitters by the USGS field staff. They will also analyze blood and fatty tissue samples of loons found dead in Minnesota for PAH and DOSS.

This analysis will be carried out by the Center for Environmental Sciences and Engineering at the University of Connecticut because that facility has been doing the analysis of PAH and DOSS samples in wildlife contaminated by the Deep Horizon oil spill for federal agencies and research institutions. It is important that the results obtained for Minnesota’s loons and pelicans to be consistent with the results obtained with other samples from the oil spill to strengthen the evidence that will be necessary to present for federal litigation related to upcoming NRDAR proceedings. The U of Connecticut also has access to original samples of oil spilled during the Deep Horizon incident so that unique PAH and DOSS features found in MN can be matched to the “fingerprint” characteristics of the oil spill petroleum and dispersant. That is why a Minnesota-based firm was not identified to carry out this analysis.

Additional analysis will be carried out to determine levels of heavy metal contaminants in 125 loon blood samples. This specialized analysis of heavy metals in loon blood samples will be carried out by Frontier Global Sciences, Inc. They specialize in comprehensive biological assessment of heavy metals in wildlife blood and tissues. They offer a superior level of detection and accuracy compared other labs that do such testing including those in Minnesota. This assessment will broaden our understanding of additional environmental contaminants, like mercury or lead which can pose a long-term threat to the health of Minnesota’s loon population.

**Summary Budget Information for Activity 2:**

**ENRTF Budget:** \$ 84,013  
**Amount Spent:** \$ 84,013  
**Balance:** \$ 0

**Activity Completion Date:**

Outcome	Completion Date	Budget
1. Collect 50 pelican eggs at selected Minnesota colony sites.	Sept. 15, 2015	\$ 8,000
2. Analyze 50 pelican eggs for PAH and DOSS concentrations and provide summary of results to MN DNR and USGS.	June 30, 2015	\$ 15,000
3. Prepare summary report of findings on all contaminants found in pelican eggs and bill knobs from 2011 through 2015 .	Dec 31, 2015	\$ 8,000
4. Analyze 26 loon feather samples for PAH and DOSS and provide summary of results to MN DNR and USGS.	June 30, 2015	\$ 7,800
5. Analyze up to 45 blood samples taken from live loons captured by USGS field staff and provide summary of results to MN DNR and USGS.	June 30, 2015	\$ 13,350
6. Analyze 34 blood and fatty tissue samples from dead loons and eggs from Minnesota and provide summary of results to MN DNR and USGS.	June 30, 2015	\$ 10,000
7. Analyze 125 blood samples for heavy metals and provide results to MN DNR and USGS.	June 30, 2015	\$ 20,293
8. Direct and necessary services/DNR	June 30, 2015	\$ 1,570

**Activity Status as of November 15, 2014:** Dead loons and unhatched loon eggs found in Minnesota in the summer of 2014 and loon blood and feather samples collected by USGS biologists have been forwarded to the University of Connecticut of this activity .

Item 7 of this activity has been completed with the analysis of 125 loon blood samples for heavy metals including mercury, lead, selenium, cadmium, and aluminum. Lead was found in two samples, aluminum was found in two samples, and no cadmium was found in any samples. Bruce Nomson of the Minnesota

Pollution Control Agency to obtain an assessment of the levels of cadmium and mercury found in the loons.

**SELENIUM:** Selenium was found in 119 of 125 samples. The concentrations identified in the samples, measured as milligrams per kilogram, were as follows:

Selenium	
<u>Concentration</u>	<u>#</u>
0.01-0.50:	5
0.51-1.00:	67
1.01-1.50:	26
1.51-2.00:	10
2.01-2.50:	3
2.51-3.00:	5
<u>3.01-3.50:</u>	<u>3</u>
	119

**MERCURY:** Mercury concentrations were found in 124 loon blood samples. The concentrations, measured as nanograms per kilogram, were as follows:

Mercury	
<u>Concentration</u>	<u>#</u>
10-500:	59
501-1000:	37
1001-1400:	13
1401-1800:	10
1801-2200:	4 Lake George (Anoka Co.), Crow River (2), Monongalia (Kandiyohi County)
2260:	1 Arrowhead Lake (St. Louis County)

Loon researcher Kevin Kenow has reviewed the results and commented mercury levels are lower in Minnesota than in Wisconsin. He found that the median blood mercury concentration from adult loons in northern WI was 1230 ng/g and for adult Minnesota loons it was 775 ng/g. In Wisconsin the 75th percentile was 1800 ng/g and for Minnesota it was 1250 ng/g. The maximum concentration of mercury detected by the USGS in northern Wisconsin was 5620 ng/g and in central Wisconsin highest record in the state at was encountered at 7300 ng/g. In contrast, the highest level detected in Minnesota was 2260 ng/g.

**Activity Status as of April 15, 2015:** All remaining samples of loon blood, feathers, eggs, and fatty tissues collected through the summer of 2014 have been submitted to the University of Connecticut and are being analyzed for PAH and DOSS contaminants. The results have not yet become available but will be completed by June 30 of 2015. The last 50 pelican eggs collected through the summer of 2014 will also be analyzed for PAH and DOSS by June 30, 2015.

**Activity Status as of November 15, 2015:**

**White Pelicans:** A total of 40 white pelican eggs from Marsh Lake were collected in summers of 2013 (5), 2014 (15), and 2015 (20) for analysis of both PAH and DOSS. A total of 4 of the 40 eggs had PAH contamination. All of those four had Anthracene present in concentrations ranging from 59.7 ppb to 87.2 ng/g (ppb), with a mean of 70.8 ng/g (ppb). One egg, collected in 2014) out of 40 had a concentration of 112.1 ng/g (ppb) of DOSS present.

## PAH CONTAMINATION IN PELICAN EGGS

<b>YEAR</b>	<b># specimens</b>	<b>per cent</b>	<b>concentration</b>	<b>PAH type</b>
<b>2013</b>	1/5	20.0%	75.4 ng/g	Anthracene
<b>2014</b>	2/15	13.0%	59.7, 60.8 ng/g	Anthracene
<b>2015</b>	1/20	20.0%	87.2 ng/g	Anthracene
<b>COMPOSITE</b>	4/40	10.0%	70.8 ng/g mean,	Anthracene

**Common Loons:** Loon feathers, blood/fat, and eggs collected in the summer of 2014 were sampled for contaminants. A total of 29 unhatched loon eggs were analyzed for both PAH and DOSS. Four of the 29 eggs had PAH contamination, ranging from 59.4 ppb to 769. Ng/g (ppb), with a mean of 300.6 ng/g (ppb). No DOSS was detected in the eggs.

Sixteen loon feathers collected in the summers of 2011 through 2013 were analyzed (21 from 2011, 9 from 2012, and 5 from 2013). Four of the feathers had PAH contamination present: One from 2011-26.9 (ng/g) ppb of 3-methylphenanthrene; two feathers from 2012 contained contained 35.7 ng/g (ppb) and 30.8 ng/g (ppb) of 1,3-dimethylnaphthalene (a mean of 33.2 ng/g (ppb); and one feather from 2013 had a level of 33.5 ng/g (ppb) of 2,6-dimethylnaphthalene.

Below is a cumulative summary of PAH sampling results to date.

<b>PAH CONTAMINATION (2011-2013)</b>		
<b>SAMPLE</b>	<b># specimens</b>	<b>per cent</b>
<b>BLOOD</b>	17/48	35.0%
<b>FAT</b>	7/26	26.9%
<b>FEATHERS</b>	5/35	14.3%
<b>EGGS</b>	10/56	17.9%

A special set of 16 loon feathers were collected from the same eight loons before the oil spill (2010) and after the oil spill (six were recaptured in 2011 and two in 2013) were sampled for PAH and DOSS. These were captured in Wisconsin by USGS biologists. No comparable before and after samples were available from Minnesota.

**Pre- and post- oil spill feather samples from the same 8 loons**

<b>loon #</b>	<b>pre-spill PAH</b>	<b>post-spill PAH</b>
705	ND	<b>87.1 ng/g</b>
242	ND	<b>88.7 ng/g</b>
230	ND	<b>54.0 ng/g</b>
246	ND	<b>92.5 ng/g</b>
237	ND	<b>72.2 ng/g</b>
006	ND	ND
016	ND	ND
65	ND	ND

Blood and tissue samples were obtained from eight loons found dead in Minnesota in the summer of 2014. They were analyzed for both PAH and DOSS contamination. Two of those loons had PAH contamination. One loon and 53.9 ppb of Flouranthene and one loon had 39.1 ppb of Anthracene. None of the loons tested positive for DOSS contamination.

**Activity Status as of April 15, 2016:** Analyses of the pelican eggs and bill knobs and loon blood, eggs, and feathers have now been completed. One final report on the pelican egg and bill knob analyses will now be prepared by Dr. Mark Clark of North Dakota State University.

### Activity Status as of September 15, 2016:

Based on the preliminary findings, both petroleum-based hydrocarbons (i.e., PAH) and dispersant (i.e., DOSS) occur in the eggs of American white pelicans nesting in Minnesota. More than half of the pelican eggs analyzed had detectable concentrations of both PAH and DOSS in 2011 and 2012 (Tables 1 & 2). However since 2012, prevalence of PAH in pelican eggs from Marsh Lake has declined, with no PAH detected in eggs collected in 2015 (Table 1). Thus, American white pelicans nesting in Minnesota have been exposed to PAH and DOSS, but exposure after 2012 is declining.

Concentrations of PAH in pelican eggs from Marsh Lake were higher in 2011 and 2012 compared to eggs collected in later years (Figure 1). This indicates that pelicans nesting in Minnesota have been exposed to PAH at some point in their life cycle, but continued exposure may be declining. Based on these findings, eggs from American white pelicans nesting in Minnesota have petrogenic polycyclic aromatic hydrocarbons as well as chemicals used as petroleum dispersants. Evidence indicates that prevalence of these compounds declined significantly after 2012. To our knowledge, this study represents the only multi-year investigation of petroleum contaminants in the eggs of colonial waterbirds.

**Table 1:** Numbers of eggs for which PAH was detected or not detected by location, year and species (AWPE = American white pelican, RBGU = Ring-billed gull, GBHE = Great blue heron, CAGO = Canada goose).

Location	Year	Species	PAH detected	PAH not detected
Marsh Lake	2011	AWPE	22	5
Marsh Lake	2012	AWPE	14	2
Marsh Lake	2013	AWPE	2	5
Marsh Lake	2014	AWPE	2	13
Marsh Lake	2015	AWPE	0	19
Pigeon Lake	2011	AWPE	4	8
Swartout Lake	2011	AWPE	7	7
Marsh Lake	2012	RBGU	0	4
Marsh Lake	2014	RBGU	4	1
Marsh Lake	2015	RBGU	1	2
Marsh Lake	2015	GBHE	0	1
Marsh Lake	2015	CAGO	0	1

**Table 2:** Numbers of eggs for which DOSS was detected or not detected by location, year and species (AWPE = American white pelican, RBGU = Ring-billed gull).

Location	Year	Species	DOSS detected	DOSS not detected
Marsh Lake	2011	AWPE	15	5
Marsh Lake	2012	AWPE	0	16
Marsh Lake	2012	RBGU	0	4
Pigeon Lake	2011	AWPE	5	7
Swartout Lake	2011	AWPE	7	7

Note: The analysis for DOSS in the 2013-15 samples has not been completed.

**Table 3:** Numbers of American white pelican rhynotheca (i.e., bill knobs) for which PAH was detected or not detected by location and year collected.

Location	Year	PAH detected	PAH not detected
Marsh Lake	Pre-2011	10	0
Marsh Lake	2011	16	4
Pigeon Lake	2011	2	3
Swartout Lake	2011	1	1

**Table 4:** Numbers of American white pelican rhynotheca (i.e., bill knobs) for which DOSS was detected or not detected by location and year

Location	Year	DOSS detected	DOSS not detected
Marsh Lake	Pre-2011	4	6
Marsh Lake	2011	8	12
Pigeon Lake	2011	1	4
Swartout Lake	2011	1	1

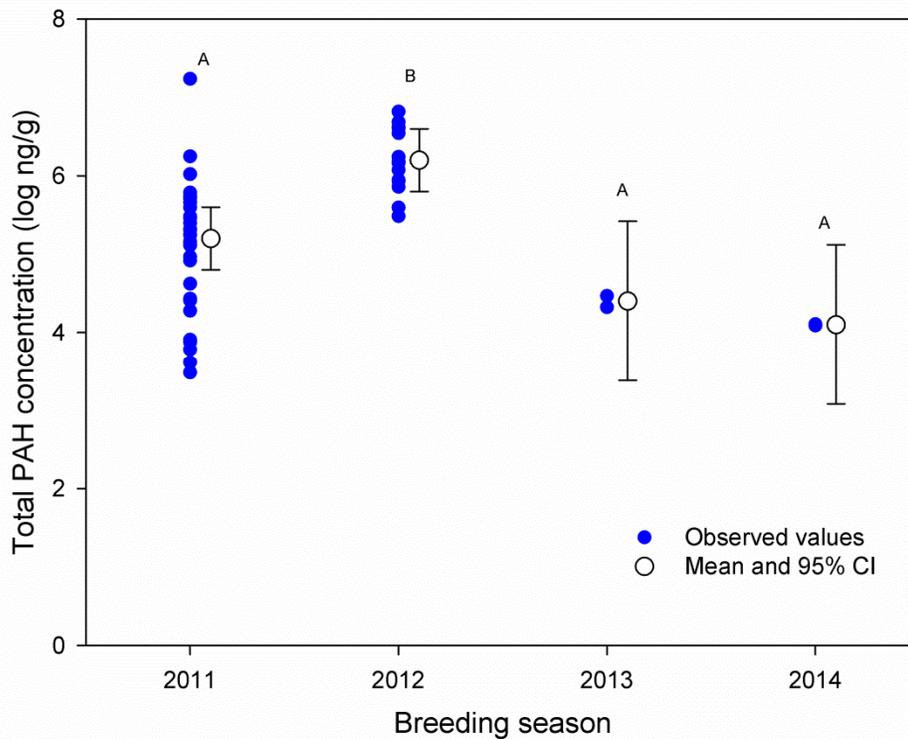


Figure 1: Log-transformed total polycyclic aromatic hydrocarbon concentrations present in the eggs of American white pelicans from Marsh Lake (blue circles) collected in 2011-2014 (blue-filled circles) along with mean concentrations (open circles, with bars indicating 95% confidence limits) for year of collection. Different letters indicate mean levels that are significantly different ( $F_{3,36} = 9.3$ ,  $p < 0.001$ ,  $r^2 = 0.30$ ). Note that detectable levels of PAH were not found in eggs collected in 2015.

Detection rates of PAH were significantly higher in pelican eggs from the 2011 and 2012 breeding seasons. Concentrations of PAH found in American white pelican eggs were significantly higher at the Marsh Lake colony in 2012.

Prevalence of DOSS in American white pelican eggs did not differ among colony locations in 2011, but was significantly more prevalent in 2011 compared to 2012. Concentrations of dispersant (DOSS) were detected in 27 of 66 egg samples analyzed (Table 2). DOSS was significantly more likely to be detected in pelican eggs collected in 2011 from Marsh Lake compared to eggs collected from Marsh Lake in 2012. Concentrations of PAH were detected in 29 of 37 bill knob samples analyzed. PAH concentrations in pelican bill knobs did not differ among colony locations, but were higher for knobs collected prior to 2011. Prevalence of DOSS in bill knobs from American white pelican eggs did not differ among colony locations or year collected. Concentrations of dispersant (DOSS) were detected in 14 of 37 knobs analyzed.



AWPE PAH Final  
Report 2016.docx

### Analysis of loon eggs-2015

Twenty-nine unhatched loon eggs were collected in the summer of 2014 and analyzed for a group of PAH contaminants known as alkyl-PAH. The results are as follows:

#### KEY TO ALKYL-PAHS REFERRED TO IN THE FOLLOWING TABLE:

- |                                   |                                     |
|-----------------------------------|-------------------------------------|
| PAH # 1: 2-methyl naphthalene     | PAH # 5: 2,3,5-trimethylnaphthalene |
| PAH # 2: 2,6 dimethyl naphthalene | PAH # 6: 1-methylfluorene           |
| PAH # 3: 1,3-dimethylnaphthalene  | PAH # 7: 3-methylfluorene           |
| PAH # 4: 1,5 dimethylnaphthalene  | PAH # 8: 9-methylphenanthrene       |

<b>Egg Ref. #</b>	<b>PAH # 1</b>	<b>PAH # 2</b>	<b>PAH # 3</b>	<b>PAH # 4</b>	<b>PAH # 5</b>	<b>PAH # 6</b>	<b>PAH # 7</b>	<b>PAH # 8</b>
<b>2014-01</b>	ND	<b>195.7</b>	ND	ND	ND	ND	<b>130.4</b>	ND
<b>2014-02</b>	<b>185.9</b>	ND	ND	ND	ND	ND	<b>129.8</b>	ND
<b>2014-03</b>	ND							
<b>2014-04</b>	ND	<b>193.0</b>	<b>237.9</b>	ND	ND	ND	ND	ND
<b>2014-05</b>	ND							
<b>2014-06</b>	<b>124.9</b>	ND						
<b>2014-07</b>	<b>182.8</b>	ND	ND	<b>179.8</b>	ND	ND	ND	ND

<b>2014-08</b>	ND	ND	ND	ND	<b>165.2</b>	ND	<b>136.4</b>	ND
<b>2014-09</b>	ND	<b>155.9</b>						
<b>2014-10</b>	ND	ND	ND	ND	ND	ND	<b>126.9</b>	ND
<b>2014-11</b>	ND							
<b>2014-12</b>	ND	ND	ND	ND	<b>144.2</b>	ND	ND	ND
<b>2014-13</b>	<b>172.2</b>	ND	ND	ND	<b>154.2</b>	<b>167.7</b>	ND	ND
<b>2014-14</b>	<b>150.4</b>	ND						
<b>2014-15</b>	ND	ND	ND	ND	<b>175.7</b>	<b>165.3</b>	ND	ND
<b>2014-16</b>	ND							
<b>2014-17</b>	ND	<b>207.3</b>	ND	ND	ND	<b>163.1</b>	<b>138.7</b>	ND
<b>2014-18</b>	ND							
<b>2014-19</b>	ND	<b>208.5</b>	ND	ND	ND	ND	ND	ND
<b>2014-20</b>	<b>126.8</b>	ND						
<b>2014-21</b>	ND	ND	<b>199.3</b>	ND	ND	<b>159.4</b>	ND	ND
<b>2014-22</b>	ND							
<b>2014-23</b>	<b>140.4</b>	ND						
<b>2014-24</b>	ND	ND	ND	ND	ND	<b>160.9</b>	ND	ND
<b>2014-25</b>	ND	ND	ND	ND	<b>132.5</b>	ND	ND	ND
<b>2014-26</b>	ND	ND	<b>218.8</b>	<b>189.2</b>	ND	<b>159.6</b>	ND	ND
<b>2014-27</b>	ND	ND	<b>213.8</b>	<b>213.8</b>	ND	ND	ND	ND
<b>2014-28</b>	ND							
<b>2014-29</b>	ND	ND	<b>220.7</b>	ND	<b>144.1</b>	ND	ND	ND

Contaminant analyses showed that 22 of the 29 eggs contained petroleum contaminants of the alkyl-PAH group. This summary will be used to correlate these findings with the footprint of the oil that was released by the Deepwater Horizon oil spill.

Twenty unhatched loon eggs were collected in the summer of 2015 and analyzed at the University of Connecticut. Eight of the 20 eggs showed presence of PAH compounds. None of the eggs showed presence of DOSS contamination. Eight of the eggs showed PAH contamination by five different PAH contaminants.

<b>Egg Ref. #</b>	<b>Total PAH</b>	<b>Flourene</b>	<b>Ancen- apthene</b>	<b>Anthracene</b>	<b>Flour- anthene</b>	<b>Benzo(a)- anthracene</b>
MN05	311.8	ND	ND	ND	311.8	ND
MN06	504.3	ND	ND	57.2	447.1	ND
MN08	78.9	ND	78.9	ND	ND	ND
MN10	161.1	161.1	ND	ND	ND	ND
MN16	242.0	ND	87.6	154.4	ND	ND
MN17	439.3	ND	99.1	340.1	ND	ND
MN18	73.9	ND	73.9	ND	ND	ND
MN19	1060.2	ND	ND	ND	400.2	660.0
MEAN	396.4	161.1	84.9	183.9	386.4	660.0

In addition to testing for the standard 16 PAH compounds, these eggs were analyzed for another family of eight PAH contaminants referred to as alkyl-PAH compounds. Those contaminants were found in 17 of the 20 eggs.

### KEY TO ALKYL-PAHS REFERRED TO IN THE FOLLOWING TABLE:

PAH # 1: 2-methyl naphthalene

PAH # 5: 2,3,5-trimethylnaphthalene

PAH # 2: 2,6 dimethyl naphthalene

PAH # 6: 1-methylfluorene

PAH # 3: 1,3-dimethylnaphthalene

PAH # 7: 3-methylfluorene

PAH # 4: 1,5 dimethylnaphthalene

PAH # 8: 9-methylphenanthrene

<b>Egg Ref. #</b>	<b>PAH # 1</b>	<b>PAH # 2</b>	<b>PAH # 3</b>	<b>PAH # 4</b>	<b>PAH # 5</b>	<b>PAH # 6</b>	<b>PAH # 7</b>	<b>PAH # 8</b>
<b>MN01</b>	ND	ND	ND	ND	ND	<b>226.</b>	ND	ND
<b>MN03</b>	ND	ND	ND	<b>154.9</b>	ND	ND	ND	<b>276.7</b>
<b>MN04</b>	ND	<b>257.8</b>						
<b>MN05</b>	ND	<b>140.9</b>	ND	ND	ND	ND	ND	ND
<b>MN06</b>	ND	ND	ND	ND	ND	<b>233.3</b>	ND	ND
<b>MN07</b>	ND	ND	ND	ND	ND	<b>227.2</b>	<b>265.6</b>	<b>231.7</b>
<b>-*+ MN08</b>	ND	<b>233.7</b>						
<b>MN09</b>	ND	<b>269.7</b>						

<b>MN10</b>	<b>198.7</b>	ND	ND	<b>183.7</b>	ND	ND	ND	ND
<b>MN11</b>	ND	ND	ND	ND	ND	<b>219.6</b>	ND	ND
<b>MN12</b>	ND	ND	ND	ND	ND	ND	ND	<b>241.5</b>
<b>MN13</b>	ND	ND	ND	ND	ND	ND	<b>277.8</b>	ND
<b>MN14</b>	ND	ND	ND	ND	ND	<b>227.3</b>	ND	ND
<b>MN16</b>	ND	ND	ND	<b>151.5</b>	ND	ND	ND	ND
<b>MN17</b>	ND	ND	ND	ND	ND	ND	<b>241.0</b>	ND
<b>MN18</b>	<b>184.8</b>	<b>174.4</b>	<b>171.5</b>	ND	ND	ND	<b>246.8</b>	ND
<b>MN20</b>	ND	<b>153.1</b>	<b>201.7</b>	ND	ND	ND	ND	ND

### Final Report Summary:

Our work plan called for carrying out analyses on 125 loon blood samples for heavy metals including selenium, mercury, lead, aluminum, and cadmium. Selenium was found in 119 of the 125 blood samples and mercury was found in 124 of the samples. Lead and aluminum were found in two loon samples, and cadmium was not found in any samples. Mercury was present in loons throughout the range of the loon in the state. Loon researcher Kevin Kenow has reviewed the results and commented mercury levels are lower in Minnesota than in Wisconsin. He found that that the median blood mercury concentration from adult loons in northern WI was 1230 ng/g and for adult Minnesota loons it was 775 ng/g. In Wisconsin the 75th percentile was 1800 ng/g and for Minnesota it was 1250 ng/g. The maximum concentration of mercury detected by the USGS in northern Wisconsin was 5620 ng/g and in central Wisconsin highest record in the state at was encountered at 7300 ng/g. In contrast, the highest level detected in Minnesota was 2260 ng/g. We needed to know if heavy metals like mercury may be exacerbating any negative effects caused by the oil spill but there was no apparent correlation. The low percentage of lead in the loons is a reflection that when a loon ingests lead, it causes mortality from lead poisoning soon after lead fishing jigs or sinkers are partially dissolved by the acidic content of the loon's digestive system.

This study also called for analyses of 378 samples of loon and pelican tissues. A total of 246 samples of American white pelican eggs and bill knobs were tested for PAH and DOSS contamination. PAH contamination was found in; 78.4% of the bill knobs and 46.3% of the eggs. DOSS contamination was found in 37.8% of the bill knobs and 43.5% of the eggs. The extent of contamination decreased significantly from 2011 through 2015 and neither PAH nor DOS were present in the pelican samples by 2015. This is likely a reflection that white pelicans feed at the surface and that the contaminants would have settled to the floor of the Gulf after the oil spill.

We had 308 samples of loon blood, feathers, fatty tissues, and eggs analyzed for PAH and DOSS contamination. By 2015, the DOSS contamination levels had dropped to zero but the PAH contamination continued at the same higher levels of about 35%. This is likely because this study determined that the loons were feeding on the bottom of the Gulf where the petroleum contaminants would have settled. This is extremely important data that will be shared with the USFWS to justify adequate BP remediation funds for long term loon conservation and monitoring.

**PAH CONTAMINATION IN LOON SAMPLES (2011-2015)**

<b>SAMPLE</b>	<b># specimens</b>	<b>per cent</b>
<b>BLOOD</b>	17/48	35.0%
<b>FAT</b>	14/44	31.8%
<b>FEATHERS</b>	5/35	14.3%
<b>EGGS</b>	18/76	23.7%

**Activity 3: Statewide pelican survey.**

**Budget: \$ 31,500**

**Description:** The University of Minnesota will be contracted to carry out aerial surveys to determine statewide abundance and distribution of American White Pelicans in 2014 and estimate numbers of pelican fledglings at selected Minnesota colonies. Methods will be similar to those used in assessing pelican distribution, abundance, and population change in 2011 and 2012, during which a total of 53 sites were surveyed. Reports of nest sites in the state will be solicited from natural resource professionals, and all reported and known nest sites will be visited on the ground or by aircraft during the May-June nesting period. Aerial photographs will be used to obtain nest estimates from all sites where pelicans are nesting unless visibility from the air is poor, in which case ground counts will be used. Estimates of fledgling survival will also be generated from ground counts.

Pelican surveys under this activity will be conducted by the University of Minnesota, under contract to MNDNR.

**Summary Budget Information for Activity 3:**

<b>ENRTF Budget:</b>	<b>\$</b>	<b>31,500</b>
<b>Amount Spent:</b>	<b>\$</b>	<b>31,463</b>
<b>Balance:</b>	<b>\$</b>	<b>37</b>

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Carry out statewide survey to determine location and size of all active pelican colonies.	Nov. 30, 2014	\$ 21,500
2. Prepare a final report that estimates numbers of nesting pelicans at all nesting colonies in Minnesota, analyzes statewide trends to assess if populations are increasing, stable or declining, estimates numbers of young birds at specific colonies, and determines ratio of young birds to adults as an indicator of reproductive success.	June 30, 2015	\$ 10,000

**Activity Status as of November 15, 2014:** This survey will be carried out in the summer of 2015.

**Activity Status as of April 15, 2015:** The University of Minnesota has been contracted to carry out the statewide survey of white pelicans to assess the location and size of all active pelican colonies in Minnesota. All plans are in place for the survey in the summer of 2015.

**Activity Status as of November 15, 2015:** The statewide white pelican survey was completed on schedule and the results are now being tallied. The results should be available within the next couple months.

**Activity Status as of April 15, 2016:** The statewide results for the pelican survey have been drafted and are now being reviewed and edited prior to release.

**Activity Status as of September 15, 2016:**

The final survey statewide survey of American White Pelicans was carried out in the summer of 2015 as scheduled. Twenty-four sites were visited and pelicans were found nesting on 15 locations. The four largest nesting concentrations were at Marsh Lake (3 islands) with 10,289 pairs, Lake Johanna with 1,966 pairs, Pigeon Lake with 1,512 pairs, and Minnesota Lake with 979 pairs. The total number of pairs of pelicans counted was 16,406. This was down 5,617 pairs from the count in 2012, but was comparable to the numbers estimated in 2004/2005 and 2010. The cause of the decrease is not apparent but could include higher water levels at some sites, increased mammalian predation, or perhaps movement of breeding pelicans to sites outside of Minnesota like North Dakota and Canada. While contamination from the Deepwater Horizon oil spill has been detected in pelican eggs and bill knobs, there is no direct evidence that has been the cause of this population decline. It is recommended that statewide counts of American white pelicans continue every five years to continue monitoring this species.

The pair count for American white pelicans since 2004/2005 is shown in the following table:

	<u>2004/2005</u>	<u>2010</u>	<u>2012</u>	<u>2015</u>
<b># pelican pairs</b>	15,610	15,999	22,023	16,406

The following report summarizes the surveys for pelicans. Separate funds from the DNR were also used to include a statewide population estimate for double-crested cormorants which is included in the same report.



AWPE DCCO DNR  
Report FINAL 201607

**Final Report Summary:** The statewide white pelican survey was carried out as planned. The total number of nesting pairs declined from 22,023 in 2012 to 16,406 in 2015. The reason for this decline is unclear as stated in the above report from the University of Minnesota. It is not apparent at this point that the decline is caused by petroleum and dispersant contaminants. The cause of the decrease is not apparent but could include higher water levels at some sites, increased mammalian predation, or perhaps movement of breeding pelicans to sites outside of Minnesota like North Dakota and Canada. While contamination from the Deepwater Horizon oil spill has been detected in pelican eggs and bill knobs, there is no direct evidence that has been the cause of this population decline. It is recommended that statewide counts of American white pelicans continue every five years to continue monitoring this species. The pair count for American white pelicans since 2004/2005 is shown in the following table:

	<u>2004/2005</u>	<u>2010</u>	<u>2012</u>	<u>2015</u>
<b># pelican pairs</b>	15,610	15,999	22,023	16,406

The budget came in under budget by \$37.

**Activity 4: Pelican satellite telemetry.**

**Budget: \$ 16,800**

**Description:** Audubon Minnesota will be contracted to carry out a satellite transmitter study that will include outfitting four white pelicans from the Marsh Lake white pelican colony, Big Stone County. They will be banded and outfitted with external solar-powered cell tower transmitters in the summer of 2015 to monitor summer and winter movements related to nesting season activities, foraging behavior, and wintering locations comparable to the information collected for loons. This information will be correlated related to oil spill sites in the Gulf of Mexico. This information will help provide a more complete picture

of pelican wintering activity to supplement existing band recovery information on white pelicans. Because satellite transmitters can be tracked in real time, maps depicting the location of the radioed pelicans will be frequently updated on the internet.

**Summary Budget Information for Activity 4:**

**ENRTF Budget**     \$16,800  
**Amount Spent:**    \$ 7,650  
**Balance:**            \$ 9,140

**Activity Completion Date:**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Contract with Cellular Tracking Technologies LLC for two years to track movements of 15 white pelicans.	June 30, 2017	\$10,500
2. Capture and outfit 15 adult white pelicans with cell tower transmitters and monitor pelican movements, analyze movement patterns, and prepare final report on white pelican migration and wintering movements.	June 30, 2017	\$ 3,437

**Activity Status as of November 15, 2014:** This activity will commence in the spring and summer of 2015.

**Activity Status as of April 15, 2015:** Planning is up to date with Audubon Minnesota for capture and marking of 15 adult white pelicans at Marsh Lake near Appleton in May and June of 2015 with transmitters that will be tracked from cell towers. Audubon Minnesota has obtained about \$41,500 in matching funds to cover the cost of the 15 transmitters so the \$12,000 originally budgeted for the 4 satellite transmitters can be used to cover the cost of the tracking of the 15 pelicans.

**Activity Status as of November 15, 2015:** Cell tower transmitters were placed on five pelicans on April 24, 2015 at the pelican colony on Marsh Lake. Those pelicans are now on the air and their locations have been monitored throughout the spring and summer. The pelicans are now migrating to the Gulf of Mexico. Plans are currently underway to place the remaining transmitters on 10 more pelicans in April of 2016. The movements of the pelicans can be observed on the AudubonMN website.

**Activity Status as of April 15, 2016:** Planning is currently underway for capture and outfitting of ten additional pelicans at Marsh Lake in May of 2016. Kristin Hall of Audubon Minnesota is managing the data for the locations and migratory behavior of the five pelicans that are currently being monitored.

**Activity Status as of September 15, 2016:** On May 2<sup>nd</sup> 2016, ten American White Pelicans were trapped in the Marsh Lake (ML) colony. All 10 birds were fitted with a USFWS aluminum band, a patagial color marker and cellular transmitter. Nest abandonment was a concern based on the response of the 5 birds that were captured in 2015 (*see report dated 1 Sept 2015*). In light of these concerns, we maintained a 20 minute maximum handling time on all birds processed in the 2016 capture attempt which appears to have improved the odds of the adult pelicans remaining at the nest. Table 1, below, is a summary of potential nest abandonment for the 2016 cellular tagged American White Pelicans. In general, two of the 10 birds vacated the Marsh Lake area within 5 days of the original capture event. Another bird left the island it was captured on within 4 days of capture but then remained on the larger island colony within Marsh Lake throughout the summer. This bird may have re-nested successfully on the larger island. The remaining 7 birds stayed on the island(s) where they were originally captured, thus displaying no signs of nest abandonment related to the capture event.

Table 1. 2016 cohort of American White Pelican Capture and Nesting Overview

Cellular ID	Capture and nesting Overview	days at nest location
27234465	Remained in Marsh Lake well into June - no abandonment	60
27234580	left Marsh lake area May 8th - <b>possible abandonment</b>	5
27235140	remained at Marsh lake until last transmission date no apparent abandonment	10
27235389	Remained at Marsh Lake until May 11 (8 days post capture) then left area. Assumed failed nest yet not associated with capture.	8
27235603	remained anchored to Marsh Lake through June & into July - went back and forth to Wood Lake area regularly - no abandonment	60
27235785	Remained anchored to Marsh Lake well into June - no abandonment	60
27235900	remained at marsh lake until may 7th then left area - <b>possible abandonment</b>	4
27236171	remained in and around marsh lake until last transmission date no apparent abandonment	21
27236411	Appeared to stay on island of capture for 4 days post capture, then moved to larger island in Marsh Lake - uncertain nest abandonment - may not have established a nest prior to capture	4
27236643	Remained at nest until May 15. Relocated at Dry Wood Lake - Assumed failed nest yet not associated with capture	12

The 2016 capture was conducted by Mark Clark and Alex Rischette from North Dakota State University, John Wallenberg and Carrol Henderson from the MN DNR and Kristin Hall from Audubon MN. John and Mark worked to streamline the transmitter application method in order to reduce handling time and overall the birds appeared to move normally after the capture event. Unfortunately, there were technological issues with the cellular transmitters. In about mid-June, most of the transmitters stopped transmitting. I have discussed this issue with Cellular Tracking Technologies, the company that manufactures and maintains our data and we are working to find a solution to the problem. Andrew McGann at Cell Tech feels the scheduled time of upload may be too early in the day and not the best for when the pelicans would be in flight and therefore in cellular range. We are hoping to reconnect with the transmitters during migration and have programmed a rescheduling of the transmission timing to occur thereafter. All birds appeared to have been moving normally prior to the loss of transmission and most seem to have a good or high battery reading. If there were issues with the birds (i.e. mortality) there would have been stagnant location readings which is not the case. I have also included maps of each bird documenting their last transmissions. They are displayed below Table 2.

See Table 2 below for a summary of activity for the 10 birds tracked between 2 May 2016 and 5 Sept 2016:

Table 2. Summary of Pelican Activity - Summer 2016

Cellular ID	Location As of 9/5/2016	Days since last transmission/ Battery status
27234465	Near Forman S Dakota -	47 days, Battery Low - Last reading 20 July
27234580	Spent most of summer in Sunburg & East of Ortonville	70 days, Battery good - unknown why last transmission was Late June
27235140	13 May 2016 was date of last transmission	115 days, Battery diminishing prior to last transmission, unknown fate of bird or transmitter
27235389	In Ocheda Lake south of Worthington MN	0 days-Battery good - currently still transmitting
27235603	Tyson Lake MN South of Granite Falls MN	19 days, Battery Low prior to last transmission
27235785	N of Cyrus MN in small unnamed lake	38 days, Battery good - last reading 24 July
27235900	Buffalo Lake SE MN	76 days, Battery good, Last reading 22 June
27236171	Outside of Wilmar - still going back and forth to Marsh Lake	102 days, Battery diminishing prior to last transmission, unknown fate of bird or transmitter
27236411	South of Glenwood MN in Lake Emily 4 July 16,	64 days, Battery good - unknown why last transmission was early July
27236643	Des Moines Iowa - Sailorville Lake - appeared to be migration south	31 days, Battery good

Maps appear in the same order as the tables above, each figure includes a brief caption below the image.

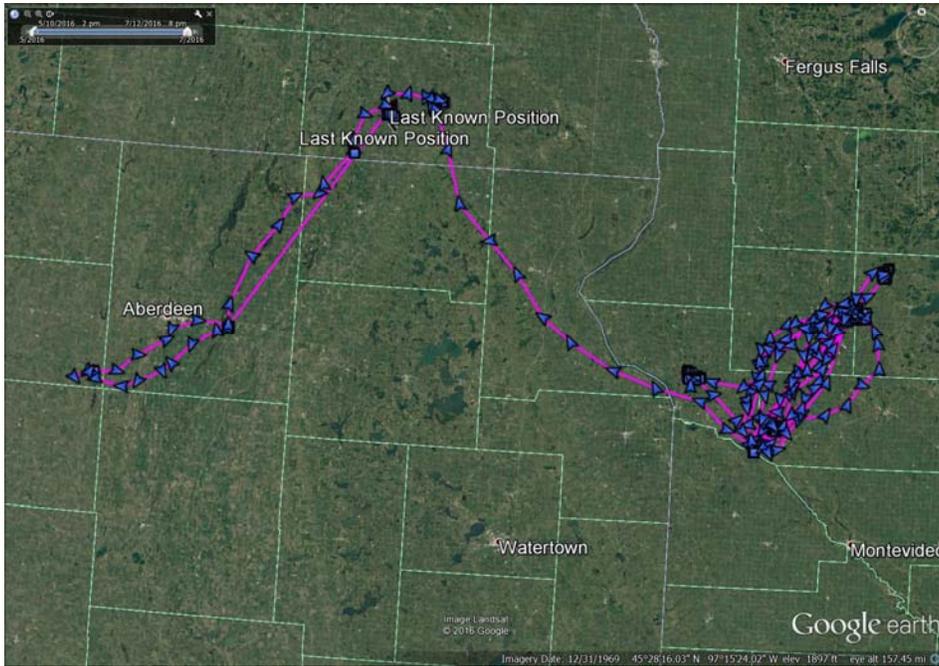


Figure 1 Pelican #4465 - all locations, last Transmission 20 July 2016

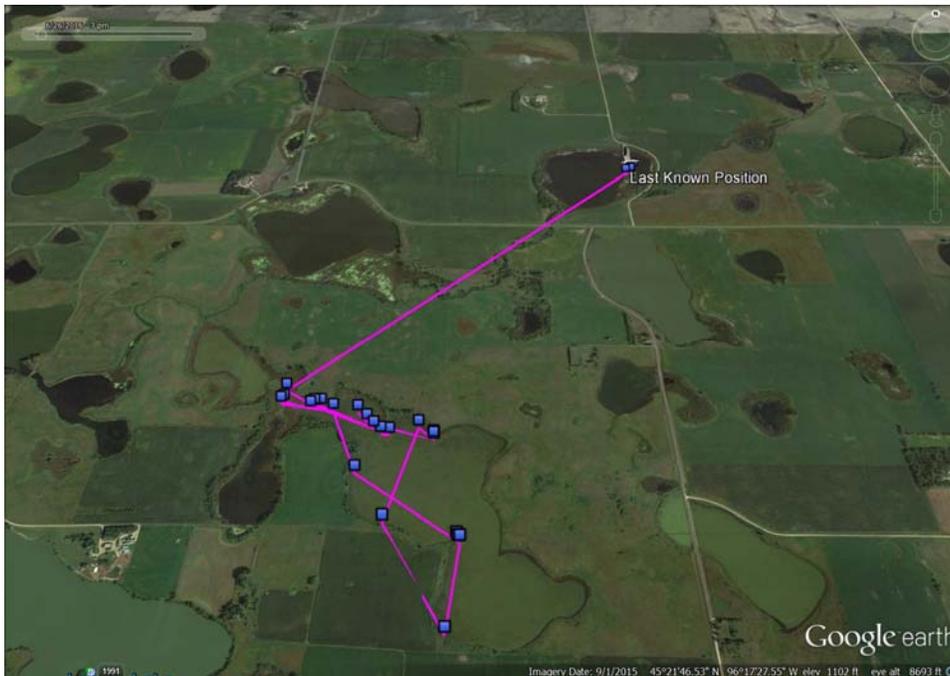


Figure 2 Pelican # 4580 - Last Transmission 26 June 2016

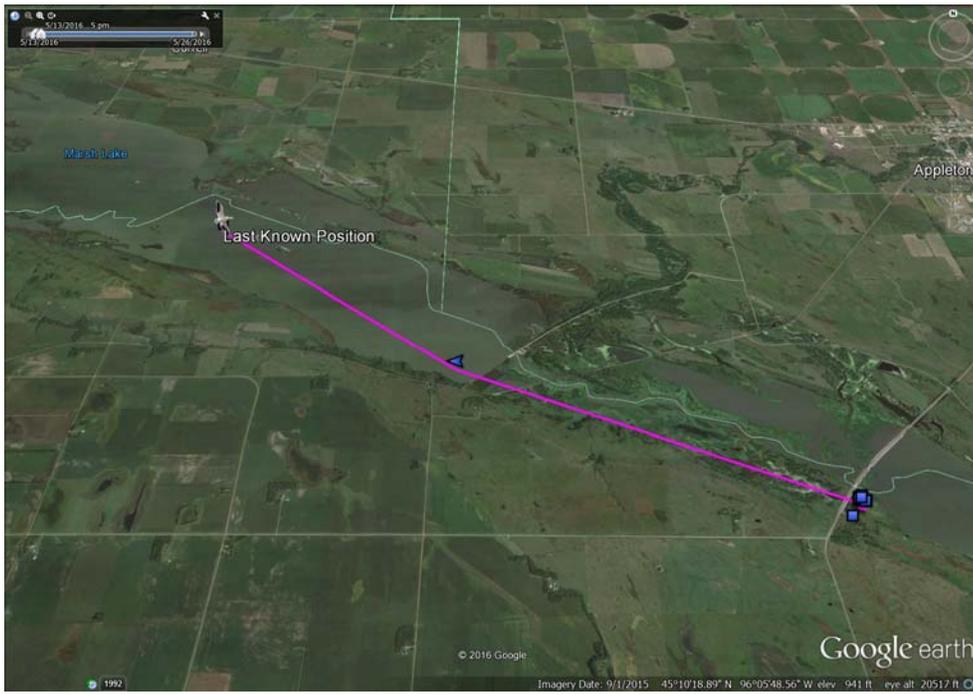


Figure 3 Pelican #5140 - Last Transmission 13 May 2016

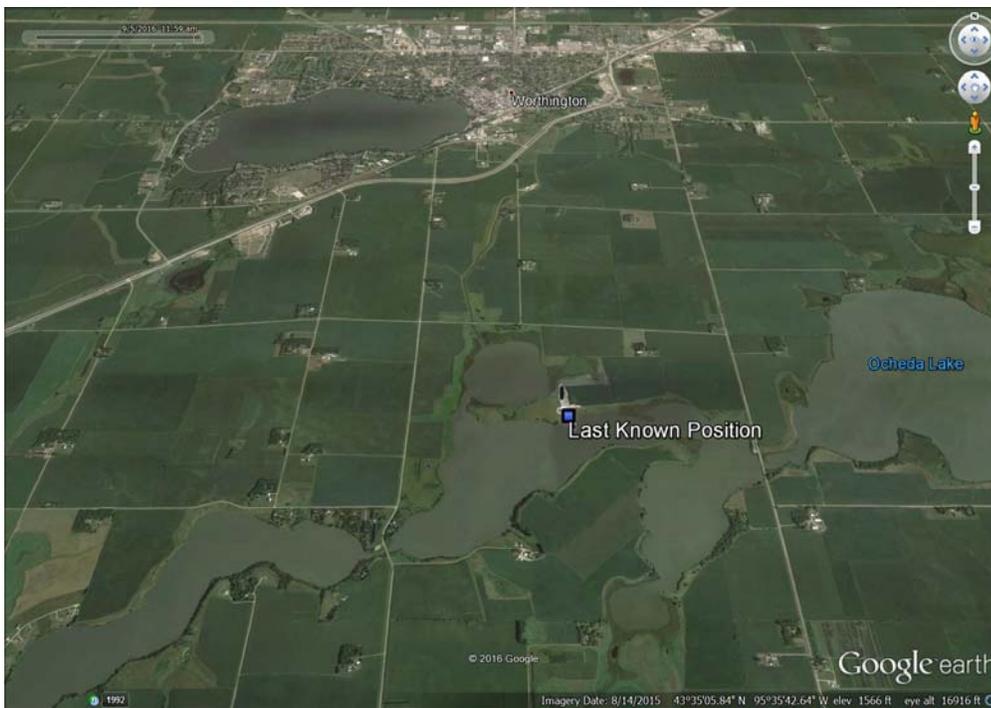


Figure 4 Pelican #5389 Still Transmission - Current location Ocheda Lake, MN

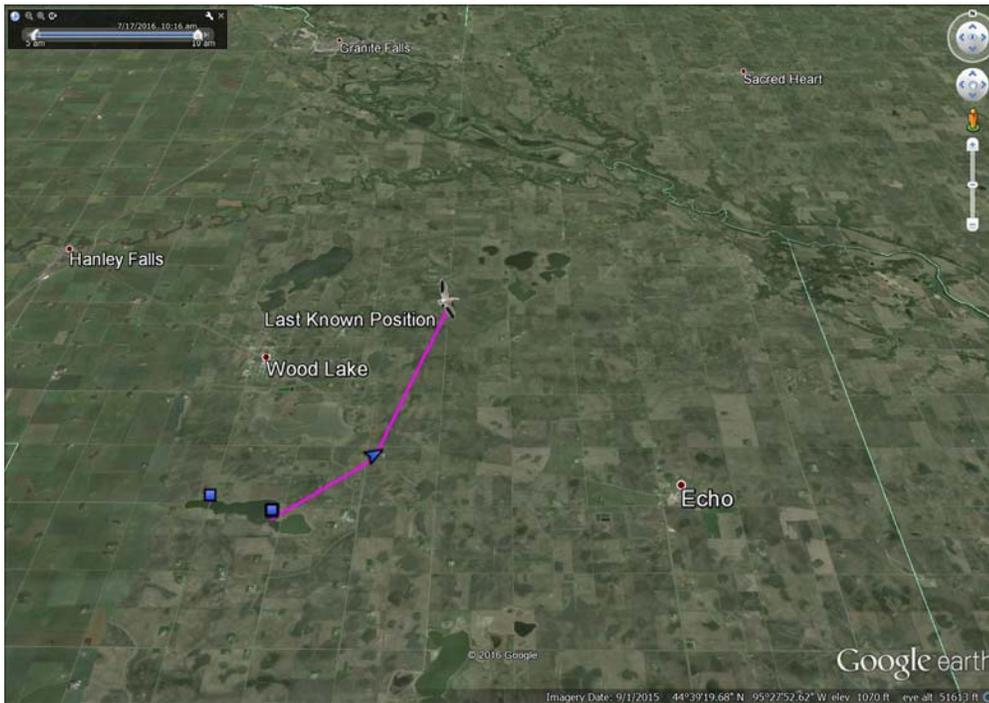


Figure 5 Pelican # 5603 - Last Transmission 17 August 2016

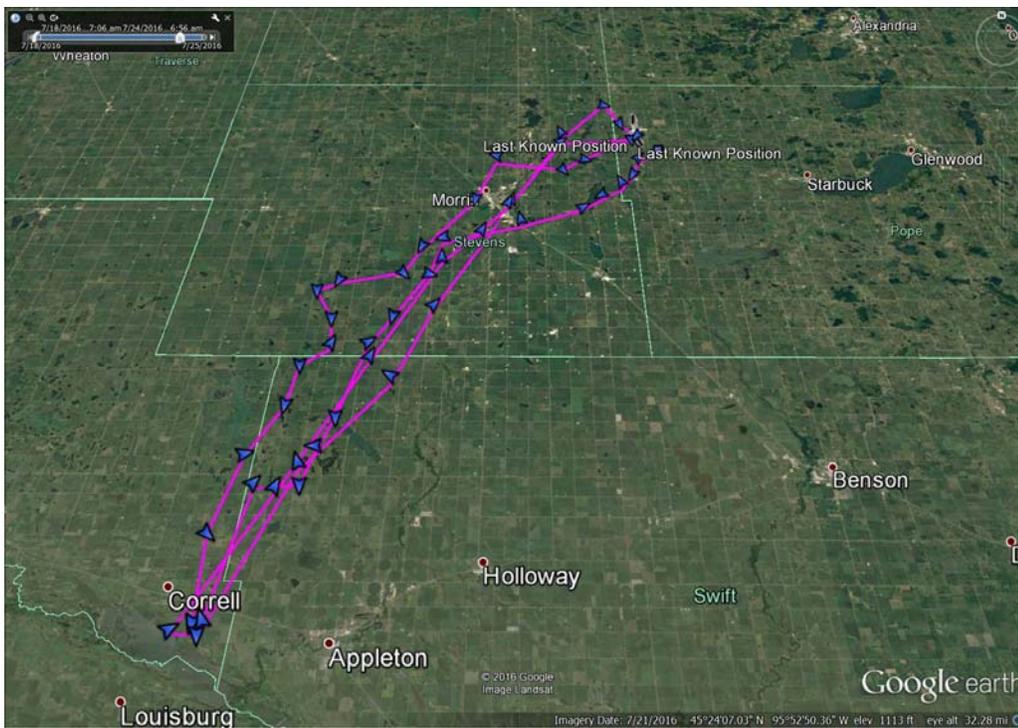


Figure 6 Pelican # 5785 Last Week of Locations -Last Transmission 24 July 2016

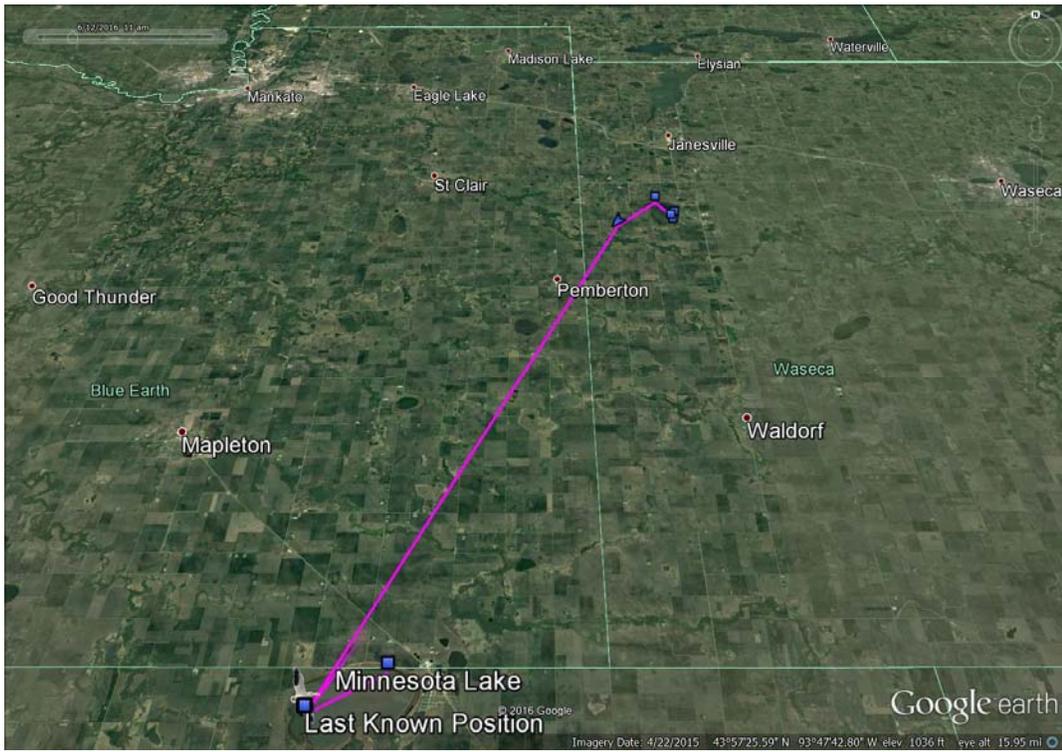


Figure 7 # 5900 Last Transmission 22 June 2016

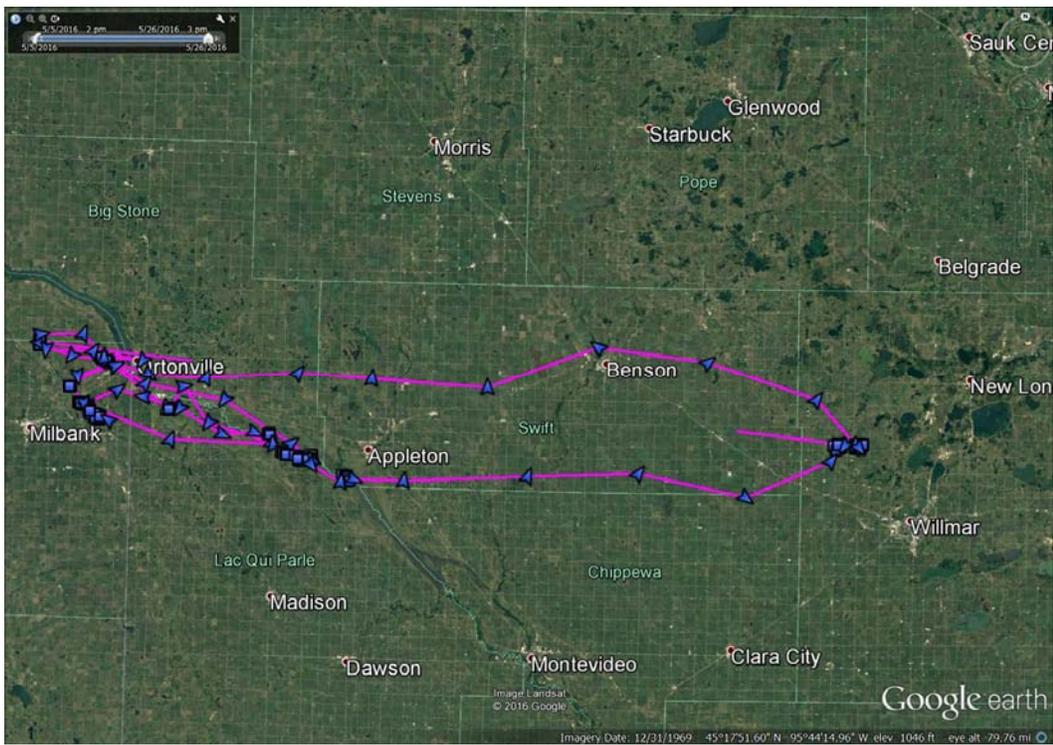


Figure 8 Pelican # 6171 Remained near Marsh Lake until last Transmissions in Late May

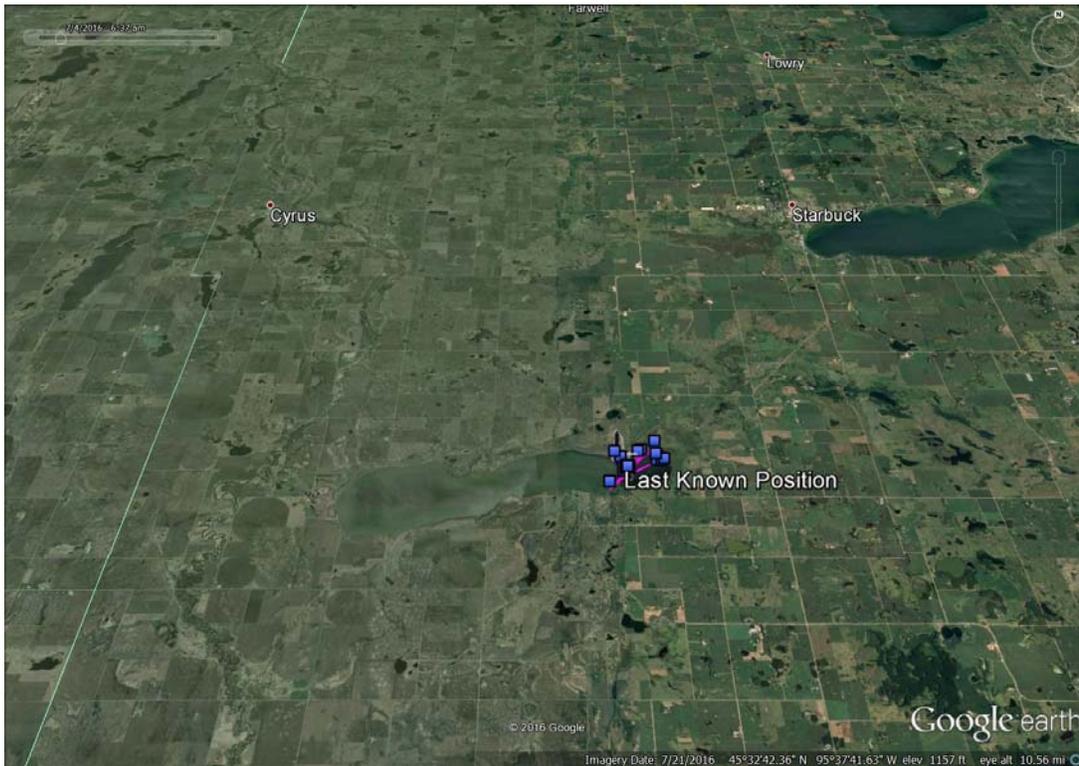


Figure 9 Pelican # 6411 Lake Emily - Last Transmission 16 July 2016

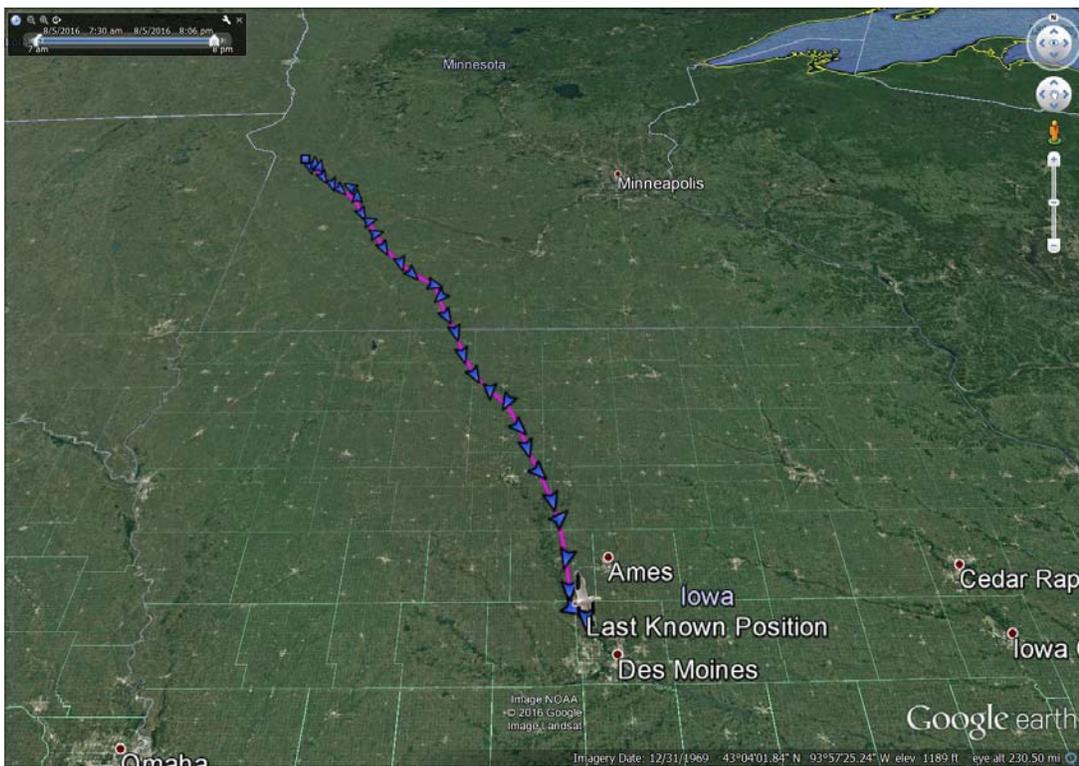


Figure 10 Pelican # 6643 - Starting Migration August 5-6 Last Transmissions Shown

**Final Report Summary:** Kristin Hall provided the last update from this project that was submitted above for September 15, but subsequently has concluded that all but one of the cell tower transmitters had failed by the end of summer and there would be no further data collected. I contacted the cell tower transmitter company, CTT technologies, and informed them of this problem and that we would not benefit from their cell tower data subscription service so we needed to cancel this effort. We will need to consult with Audubon MN and CTT technologies to learn why the transmitters failed. For this reason, money set aside for the cell tower subscription service has been cancelled so that allocation (\$6,000) reverts back to the Environment and Natural Resources Trust Fund. The additional balance of \$3,140 was due to be paid to Audubon MN for the final report for FY '17, but because of the failure of the transmitters, there will unfortunately be no new information to report for the last year of the study. The \$3,149 in the LCCMR budget allocated for AudubonMN to report on the data from the transmitters has also reverted to the Environment and Natural Resources Trust Fund. If we learn more about the reason for the failure of this type of telemetry technology, I will forward that information to the LCCMR for the failure of this portion of our project when it becomes available.

**Activity 5: Loon satellite transmitters and direct and necessary services**

**Budget: \$50,429**

**Description:** The DNR Nongame Wildlife Program will acquire the 15 satellite transmitters that will be used on the juvenile loons and will handle the subscription for the monitoring and downloading the satellite data received from the pelicans that are outfitted with satellite transmitters. Further description of plans for this activity can be found under Activity 1 and Activity 4.

Purchase of satellite transmitters and satellite subscription will be conducted by MNDNR.

**Summary Budget Information for Activity 5:**

**ENRTF Budget: \$ 50,429**  
**Amount Spent: \$ 48,867**  
**Balance: \$ 1,562**

**Activity Completion Date:**

**June 30, 2017**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1a.</b> Purchase 15 satellite transmitters @ \$2756.67 @ ea. for use on juvenile loons, plus sales tax.	July 10, 2014	\$ 47,292
<b>3.</b> Direct and Necessary Services (see explanation below)	N/A	\$ 3,137

**Activity Status as of November 15, 2014:** A total of 15 satellite transmitters were purchased in July of 2014 and implanted in 15 juvenile loons. When 3 loon died later in the summer, the transmitters were retrieved for future use. Current plans call for capturing three juvenile loons next summer and implanting the radios in them.

**Activity Status as of April 15, 2015:** The 15 satellite transmitters were purchased as planned in summer of 2014 and implanted in 15 juvenile loons which are now “on the air” and can be seen online by Googling “USGS, loon tracking”. A total of seven loons died, and we have recovered transmitters from five of those loons. Those transmitters are being refurbished and will be re-deployed in five new juvenile loons in early August of 2015.

**Activity Status as of November 15, 2015:** This deliverable has now been completed.

**Activity Status as of April 15, 2016:** There is one more billing due for Direct and Necessary Services.

**Activity Status as of September 15, 2016:** Billings have been completed.

**Final Report Summary:** A total of \$3137 had been budgeted to cover two years of Direct and Necessary Services for \$ 1,575 in FY '16 and \$1,562 in FY '17. However, this appropriation ended on June 30, 2016, so the balance budgeted for FY '17 (\$1,562) has reverted to the Environment and Natural Resources Trust Fund.

## **V. DISSEMINATION:**

**Description:** Results of this project will be shared via summary reports made available to the US Fish and Wildlife Service for preparation of their NRDAR court case against BP for damages to Minnesota's loon and pelican populations. News releases and postings on the Nongame Wildlife Program's facebook page will be provided as substantial conclusions are reached regarding the extent of contamination that has occurred in the state's loon and populations, and DNR staff will make themselves for interviews with the media to share the results of that work. All reports and media contacts will provide appropriate credits to the ENRTF for funding this project.

**Status as of November 15, 2014:** A story of loon capture of juvenile loons was covered by Javier Sarna of the Outdoor News in August of 2014. Additional reporting has been limited because it is known that BP has hired an agent named Brian Riley to learn of our project accomplishments and results apparently in order to provide this information this to their company's attorneys to use in litigation go discount or reduce claims of damages to Minnesota's loons and white pelicans. Mr. Riley has been contacting DNR Nongame Wildlife Program staff and asking about our work on loons without acknowledging his affiliation. According to the USFWS staff working on the NRDAR team, this NRDAR case relating to damages to Minnesota's loons and pelicans could go to court by fall of 2016.

**Status as of April 15, 2015:** We have not had any recent media coverage of this project because we are reluctant to share the project data in case it might compromise the NRDAR damage claims against BP by the US Fish and Wildlife Service. We had an inquiry from CBS news in New York City about covering this research project this week in remembrance of the Deepwater Horizon oil spill but they wanted to cover some field activities going on at present, but we did not have any field activities underway.

**Status as of November 15, 2015:** This project was featured in the Outdoors Weekend section of the Star Tribune on October 30, 2015 and I also made two presentations about this project to approximately 80 people for the Aitkin Lakes and Rivers Festival at Aitkin on June 20, to the DNR Scientific and Natural Areas Citizen's Advisory Committee on August 5, and on August 12 as part of the Chatauqua Lecture Series audience of 105 persons at Crosslake.

**Status as of April 15, 2016:** Presentations have been given at the Commissioner's Advisory Committee of the Scientific and Natural Areas program in St. Paul on the Unlimited Learning program to about 90 people at Crosby, Minnesota on March 8, 2016 and at the Department of Transportation engineers' workshop at Brainerd on March 16. Media releases on this project have been deferred until more information is known about the terms and timetables for applying for USFWS remediation funds.

**Status as of September 15, 2016.** Presentations have been given to the Cross Lake Chatauqua program in Cross Lake, to the Cullen Lake Association at Nisswa, Minnetonka Bird Club, at the Technical Training workshop for the Department of Transportation. A major story of the project by Tony Kennedy was featured on the front page of the Star Tribune on Sunday, September 4, and a major story will be aired on KARE-11 by Greg Vandegrift in late September.

**Final Report Summary:** This LCCMR project has generated an enormous amount of media and public attention, especially for the work related to loons and the potential impact of the Deepwater Horizon oil spill on loons. There have been numerous presentations to conservation groups, garden clubs, bird clubs,

civic groups, and statewide media coverage. In all of my presentations I have highlighted the support and funding provided by the Environment and Natural Resources Trust Fund. In the near future we should be receiving guidelines from the US Fish and Wildlife Service for a long term loon and pelican conservation and management plan to utilize remediation funds from BP. This could amount to at least several millions of dollars for loon habitat and management work and conservation relating to pelicans. Money could become available late in 2017. I will keep the LCCMR informed of these developments. Recent news coverage has included:

1. Loon research. A look at new loon research at a time when Minnesota stands to share in BP Oil Spill settlement money to benefit the state bird. Photo gallery by Aaron Lavinsky. Star Tribune. Sept. 3, 2016.
2. Minnesota on Cusp of a New Era of Loon Conservation. Star Tribune. Tony Kennedy. Sept. 4, 2016.
3. Gulf oil spill residue found in Minnesota loons. Greg Vandegrift, KARE-TV. Sept. 27, 2016.
4. Loon Study. Frequently asked questions. USGS. Upper Midwest Environmental Sciences Center. Website.
5. Loons and the gulf oil spill. MN DNR website. Nongame Wildlife Program. Website.

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget Overview:**

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Explanation</b>
Personnel:	\$ 0	DNR In-Kind
Professional/Technical/Service	\$ 79,300	USGS (Activity 1)
Contracts	\$ 16,000	NDSU (Activity 2)
	\$ 46,150	UConn (Activity 2)
	\$ 20,293	Frontier Global Sciences or similar (Activity 2)
	\$ 31,500	
	\$ 18,300	UMN (Activity 3)
	\$ 2,400	Audubon Minnesota (Activity 4)
		satellite subscription service (Activity 5)
Equipment/Tools/Supplies:	\$ 41,350	15 Satellite transmitters for loons (Activity 5)
Other: Direct and Necessary*	\$ 4,707	DNR-assessed Direct and Necessary services
<b>TOTAL ENRTF BUDGET:</b>	<b>\$ 260,000</b>	

**\*Explanation of Direct and Necessary assessment:** Direct and Necessary expenses include both Department Support Services (Human Resources, IT Support, Safety, Financial Support, Communications Support, Planning Support, and Procurement Support) and Division Support Services. Department Support Services are described in the agency Service Level Agreement, and is billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services (Commissioner’s Office and Regional Directors) are not assessed. Division Support Services include costs associated with Division business offices and clerical support. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisitions, and funds that are passed-thru to other entities are not assessed Direct and Necessary costs for those activities. For this work plan, all contractual activities not requiring a competitive bid (total associated cost = \$198,358) were not assessed Direct and Necessary costs.

**Explanation of Use of Classified Staff:** N/A

**Explanation of Capital Expenditures Greater Than \$5,000:** N/A

**Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: N/A**

**Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 2 (composite of staff salaries from USGS & U of MN-No DNR staff)**

**B. Other Funds:**

<b>Source of Funds</b>	<b>\$ Amount Proposed</b>	<b>\$ Amount Spent</b>	<b>Use of Other Funds</b>
<b>Non-state sources</b>			
USGS senior loon biologist salary match \$10,000	\$ 10,000	9,500	Project management, implementation and report preparation
Audubon salary match \$10,000	\$ 10,000	4,500	Project management, implementation and report preparation
Audubon match	\$41,725	\$41,725	Purchase 15 cell tower transmitters for pelicans
U of MN salary match \$17,000	\$ 17,000	\$13,250	Project management, implementation and report preparation
NDSU salary match \$10,000	\$ 10,000	\$ 10,000	Project management, implementation and report preparation
<b>State sources</b>			
DNR Nongame Wildlife Program supervisor-15% time for two years, plus travel.	\$ 30,000	\$26,200	Project management, supervision, planning, and report preparation
DNR Nongame Wildlife Program Endangered Species Coordinator- 10% time + travel	\$ 15,000	\$8,600	Project management, planning, coordination with researchers, and analysis and evaluation of research data
<b>TOTAL OTHER FUNDS:</b>	<b>\$ 133,725</b>	<b>\$ 113, 775</b>	

**VII. PROJECT STRATEGY:**

**A. Project Partners:** US Geological Survey, North Dakota State University, University of Minnesota, University of Connecticut Center for Environmental Sciences, Audubon Minnesota, Frontier Global Sciences Inc., US Fish and Wildlife Service, MN Pollution Control Agency, and DNR Nongame Wildlife Program

**B. Project Impact and Long-term Strategy:** The goal of this project is to assess the immediate and long term impacts that may affect Minnesota’s population of loons and pelicans as a result of the DeepWater Horizon oil spill that occurred in 2010. The oil spill caused direct mortality to birdlife in the Gulf of Mexico including loons and pelicans. It may also have caused long term sublethal effects that could reduce reproductive potential or longevity for these long-lived birds. This project is part of a 10-year long term strategy to quantify negative long term impacts so that this information can be used by the US Fish and Wildlife Service in developing a federal court case that according to guidelines of the Natural Resources Damages and Restoration Act which will potentially result in award of damages from

BP to the State of Minnesota over a 15 year period for restoration and management of loons and pelicans to the extent that they were affected by the oil spill.

**C. Spending History:**

<b>Funding Source</b>	<b>M.L. 2008 or FY09</b>	<b>M.L. 2009 or FY10</b>	<b>M.L. 2010 or FY11</b>	<b>M.L. 2011 or FY12-13</b>	<b>M.L. 2013 or FY14</b>
ENRTF Appropriation				\$ 250,000 ML 2011, 3p	\$260,000 ML 2014, Chp 226, Sec 2, Subd 05g

**VIII. ACQUISITION/RESTORATION LIST: N/A**

**IX. VISUAL ELEMENT or MAP(S): Attached to original proposal.**

**X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A**

**XI. RESEARCH ADDENDUM: N/A**

**XII. REPORTING REQUIREMENTS:**

This is the final report for this project.



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND																	
M.L. 2014 Project Budget																	
Project Title: Contaminants in Minnesota's Loons and Pelicans - Phase 2																	
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05g																	
Project Manager: Carrol L. Henderson																	
Organization: Minnesota Department of Natural Resources																	
M.L. 2014 ENRTF Appropriation: \$ 260,000																	
Project Length and Completion Date: 2 Years, June 30, 2016																	
Date of Report: Final Report, Nov. 4, 2016.																	
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	Activity 4 budget	Amount Spent	Activity 4 Balance	Activity 5 Budget	Amount Spent	Activity 5 Balance	TOTAL BUDGET	TOTAL BALANCE
<b>BUDGET ITEM</b>	<i>Migration patterns and wintering distribution of juvenile common loons</i>			<i>Loon and pelican contaminants analysis</i>			<i>Statewide pelican survey</i>			<i>Pelican satellite telemetry</i>			<i>Loon satellite transmitters and direct and necessary services</i>				
<b>Professional/Technical/Service Contracts</b>																	
Activity 1: Contract with US Geological Survey to capture and equip 15 juvenile loons with internal satellite transmitters and with geolocators. Monitor movements of loons and recapture loons as possible to recover geolocator data. Collect blood and feathers for contaminant analysis. Prepare final report on results. Extension of existing collaborative agreement.	\$77,258	\$77,258	\$0													\$77,258	\$0
Activity 2, Outcomes 1 and 3: Contract with the Department of Biology, North Dakota State University, to collect 50 pelican eggs in 2014 to assess current contaminat levels in white pelican eggs. Also prepare a comprehensive report on the results of contaminant analyses of eggs and bill knobs collected from 2010 through 2014. Extension of existing contract.				\$16,000	\$16,000	\$0										\$16,000	\$0
Activity 2, Outcomes 2, 4, 5, and 6: Contract with the Center for Environmental Sciences and Enginnering at the University of Connecticut for analyses of 155 samples of pelican eggs, loon blood, loon feathers, loon fatty tissues for both PAH and DOSS contamination levels. Prepare a final report on findings. Extension of existing of contract.				\$46,150	\$46,150	\$0										\$46,150	\$0
Activity 2, Outcome 7: Contract with an institution like Frontier Global Services or similar for heavy metals analysis of 125 loon blood samples. Bidding opportunities will be offered for companies that can fulfill the levels of quality control and detection levels that will be necessary to provide legal evidence in federal court proceedings related to the BP oil spill according to NRDAR guidelines. Provide a final report to the MN DNR.				\$20,293	\$20,293	\$0										\$20,293	\$0
Activity 3: Contract with the University of Minnesota, Department of Conservation Biology, to carry out a statewide aerial survey of white pelican colonies to determine statewide population numbers and do an assessment of survival of pelican chicks in those colonies. Prepare a final report on findings. Extension of existing contract.							\$31,500	\$31,463	\$37							\$31,500	\$37
Activity 4: Contract with Audubon Minnesota as a sole-source provider for carrying out a project to capture 15 white pelicans in summer of 2015 and outfit them with external cell tower transmitters to determine migration and wintering movement patterns in the Gulf of Mexico. Provide a final report to the MNDNR. Include subscription service for cell tower downloading of data.										\$16,800	\$7,650	\$9,140				\$16,800	\$9,140
<b>Equipment/Tools/Supplies</b>																	
Purchase 15 Satellite Loon_Transmitters													\$47,292	\$47,292	\$0	\$47,292	\$0
<b>Other</b>																	
DNR Direct and Necessary Services Assessment				\$1,570	\$1,570	\$0							\$3,137	\$1,575	\$1,562	\$3,145	\$1,562
<b>COLUMN TOTAL</b>	<b>\$77,258</b>	<b>\$77,258</b>	<b>\$0</b>	<b>\$84,013</b>	<b>\$84,013</b>	<b>\$0</b>	<b>\$31,500</b>	<b>\$31,463</b>	<b>\$37</b>	<b>\$16,800</b>	<b>\$7,650</b>	<b>\$9,140</b>	<b>\$50,429</b>	<b>\$48,867</b>	<b>\$1,562</b>	<b>\$260,000</b>	<b>\$10,739</b>