Twenty Four Years of Common Loon Research in Wisconsin

Mike Meyer, WDNR Science Services, Rhinelander

Photo courtesy Michele Woodford

Research Partners

Kevin Kenow, USGS
La Crosse, WI

Dave Evers,
Biodiversity Research
Institute, Gorham, ME

Walter Piper,
Chapman University

Erica LeMoine
LoonWatch, Ashland

Migration Studies of Wisconsin Common Loons

Kevin Kenow and Colleagues, USGS UMESC, La Crosse, WI
Mike Meyer, WDNR Science Services, Woodruff

Photo courtesy Paul Leuders

Fine-resolution location

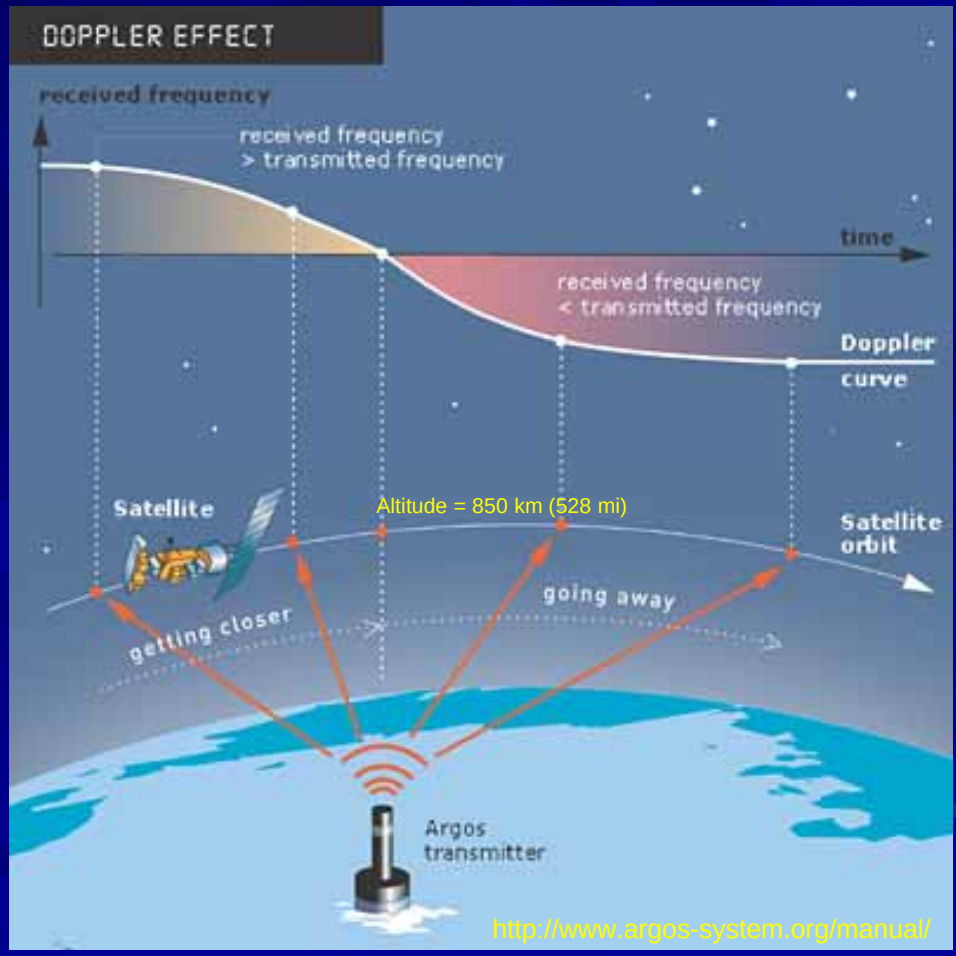
- Implantable satellite transmitters (Microwave Telemetry model PTT-100) in 10 adult male loons used to provide fine resolution (e.g., <250 m accuracy) location data
  - Abdominal implant with exteriorized antenna
  - 64 grams (~1.5% of BW) volume = 32 cc
- 1,500 hours, duty cycles:
  - Breeding- 8 hrs on:72 hrs off
  - Fall migration- 8on:24off
  - Wintering- 6on:96off
  - Spring migration- 8on:24off
  - 8on:96off thru Oct 2011

Tracking loons via satellite

- Satellite transmitters available for birds in early 1980s - 170 g
- Argos receiver onboard NOAA polar-orbiting satellites
- Transmitter needs to emit a strong and stable signal as the location is computed on the basis of Doppler effect measurement
- Backpack harness and bib collar not acceptable to common loons

- **2010 = 10 satellite transmitters implants**

- **2011 = 21 satellite transmitter implants**



Common Loon Migration St...

www.umesc.usgs.gov/terrestrial/migratory_birds/loons/migrations.html

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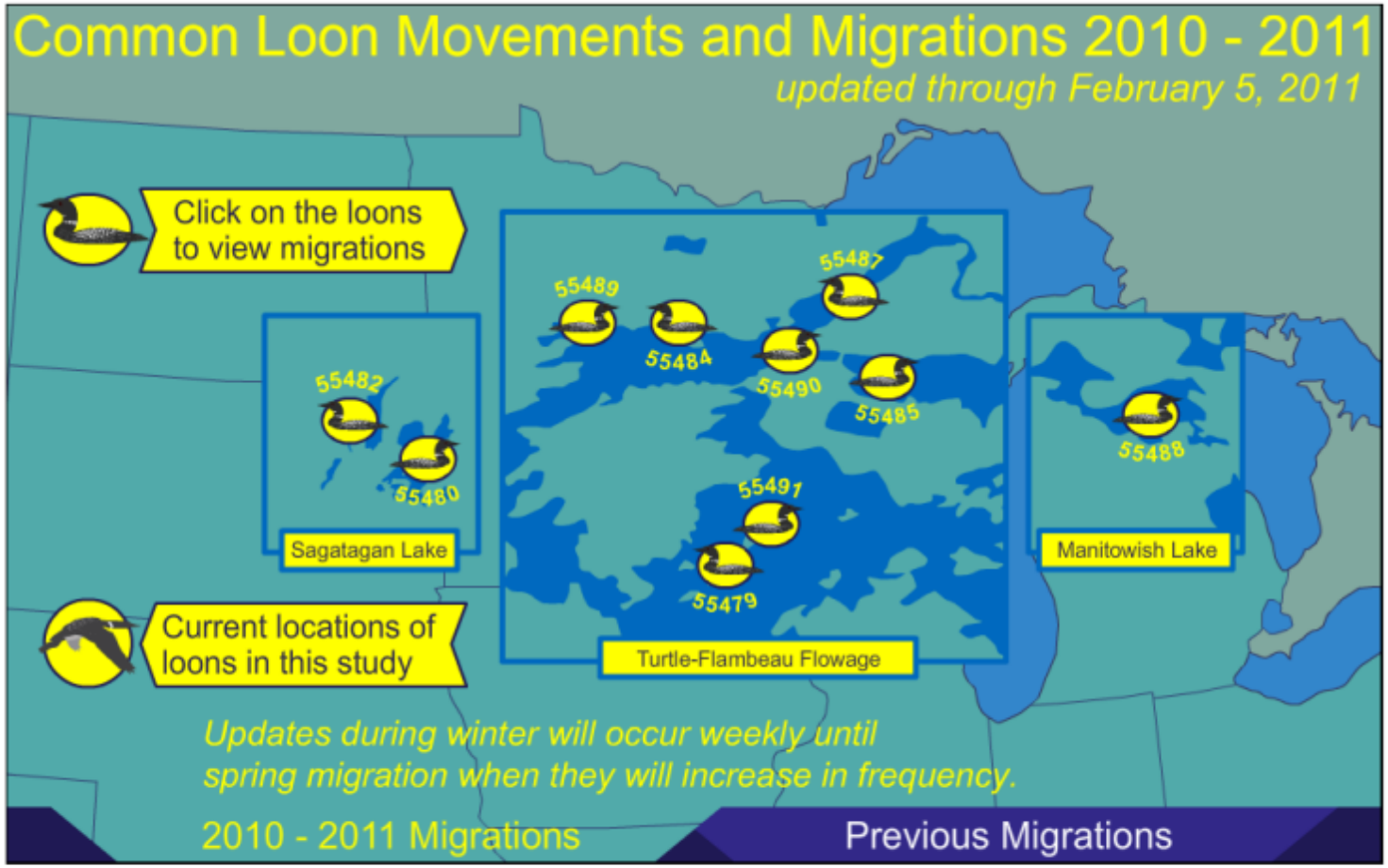
Common Loon Movements and Migrations 2010 - 2011

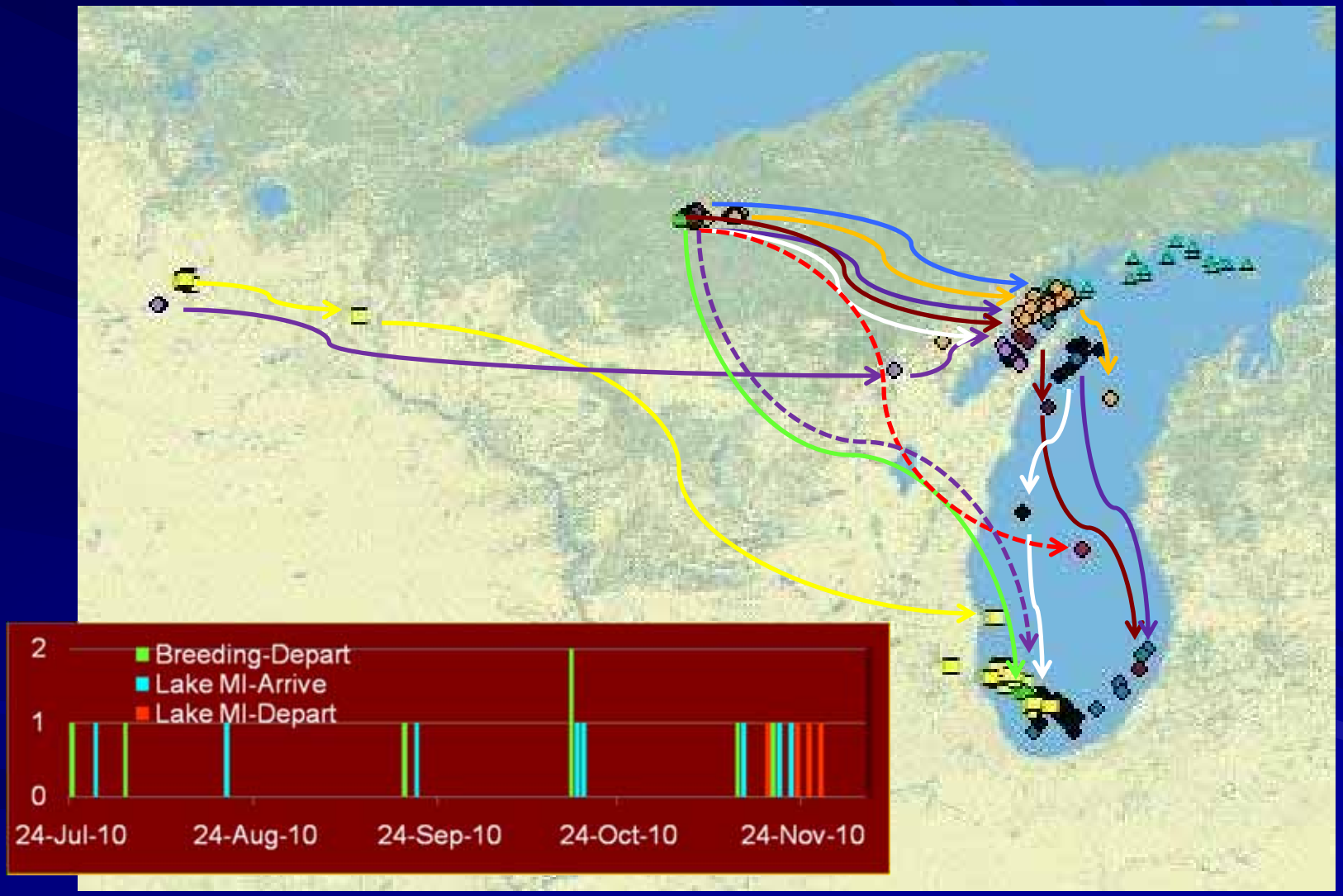
updated through February 5, 2011



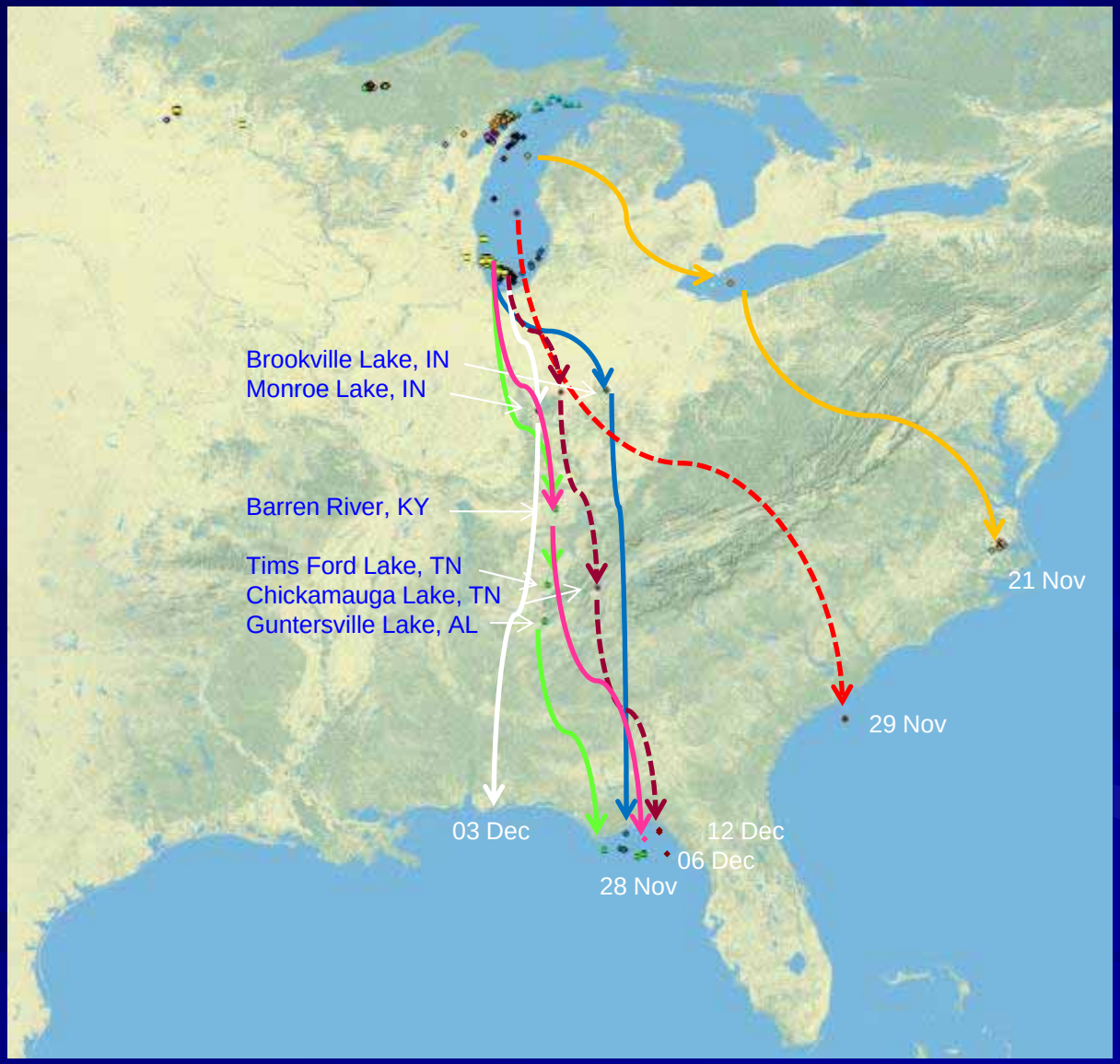
Contact Kevin Kenow with questions and comments about UMESC's loon migration studies.

- ***Learn more*** about UMESC's loon migration studies.
- Summary graphic of the 2003-6 migrations in the Northeastern U.S.

Migration of Radiomarked Common Loons in 2010



Migration of Radiomarked Common Loons in 2010



Common Loon Migration Study

www.umesc.usgs.gov/terrestrial/migratory_birds/loons/migrations.html

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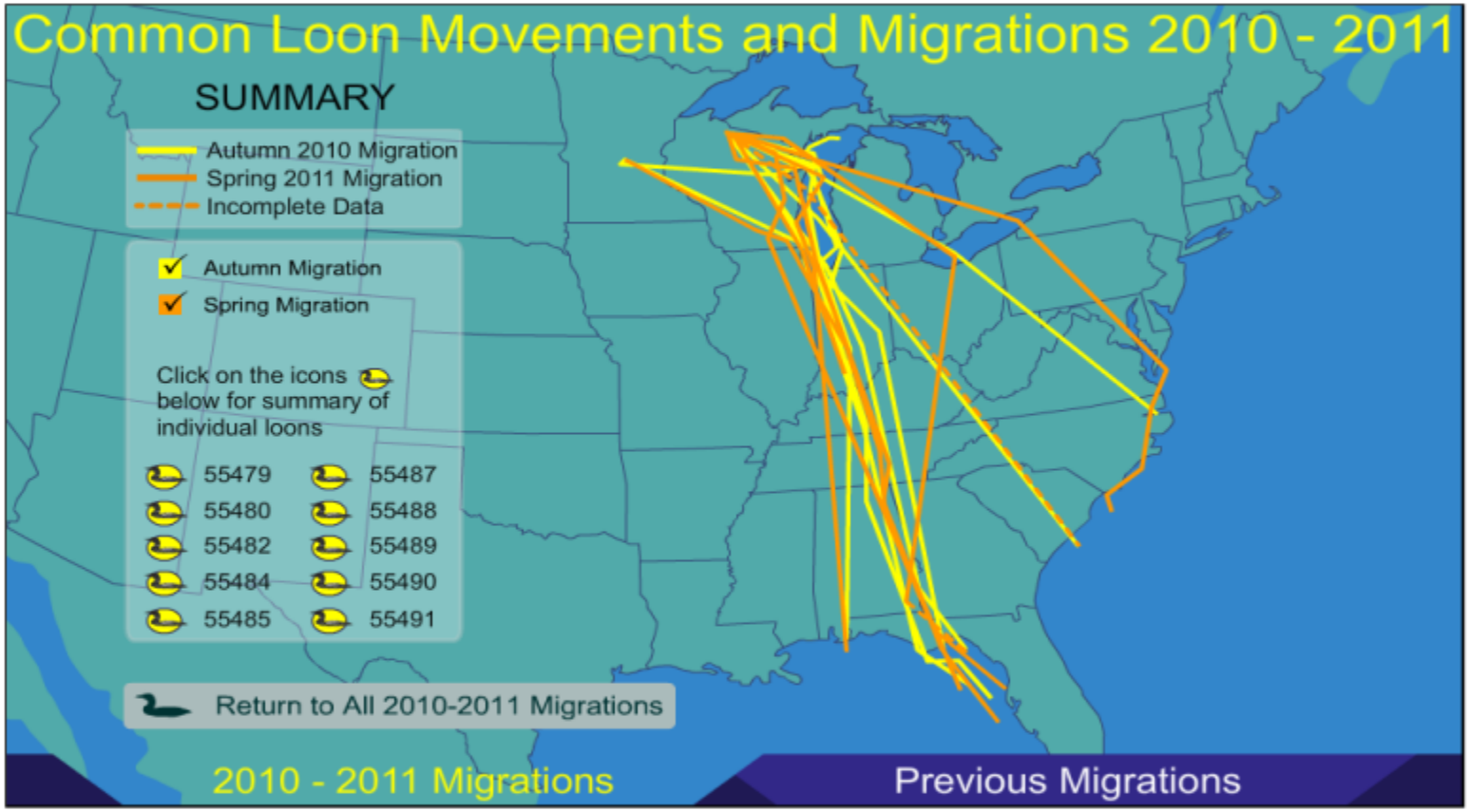
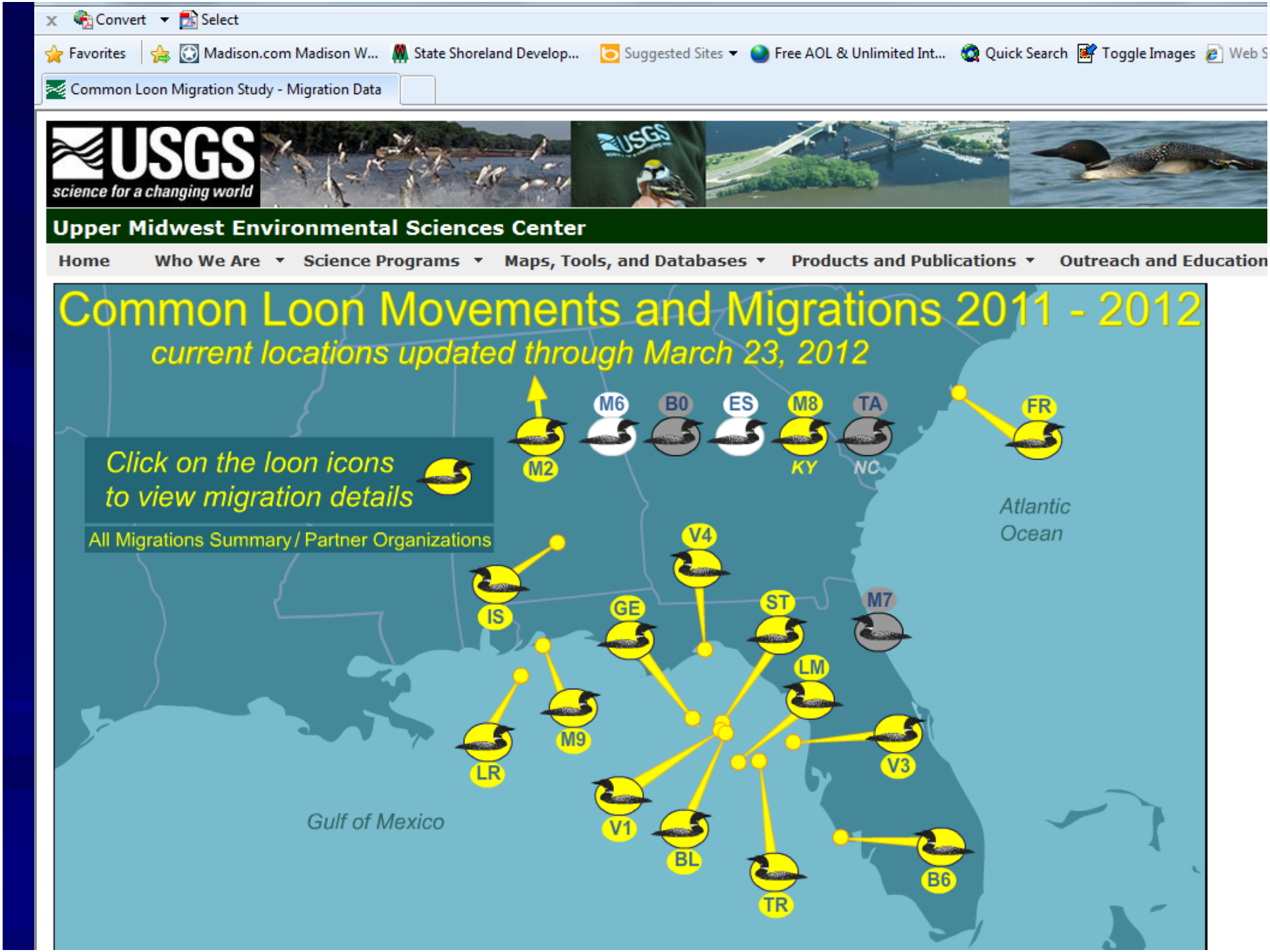


Contact Kevin Kenow with questions and comments about UMESC's loon migration studies.

- ***Learn more*** about the current study.
- ***Learn more*** about UMESC's loon migration studies.
- ***Summary graphic*** of the 2003-6 migrations in the Northeastern U.S.
- ***Alternative content:*** the content in the Flash file above is also available in standard HTML.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Common Loon Movements and Migrations 2011 - 2012
current locations updated through March 23, 2012
Click on the loon icons
to view migration details
All Migrations Summary / Partner Organizations
M2
M6
B0
ES
M8
KY
TA
NC
FR
Atlantic
Ocean
V4
IS
GE
ST
M7
LM
M9
LR
V3
V1
BL
TR
B6
Gulf of Mexico

http://www.umesc.usgs.gov/terrestrial/migratory_birds/loons/migrations.html

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Common Loon Migration Study - Migration Data

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Common Loon Movements and Migrations 2011 - 2012

Loon M2 (107272)

Indiana (in flight)

Status: Migrating

PLAY ANIMATION

March 22, 2012

Loon locations

500 mi.

2011-12 Migrations | 2010-11 Migrations | Previous Migrations

Contact Kevin Kenow with questions and comments about UMESC's loon migration studies

Contact Kevin Kenow with questions and comments about UMESC's loon migration studies.

Wintering Ground Threat - Impact of BP Gulf Oil Spill (April 20, 2010) on Upper Midwest Common Loons

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Video about USGS loon research in the Upper Midwest: Unraveling Mysteries of the Common Loon

Link to previous loon migrations.

Juvenile Loon Migration Data:

Loon ID	Last updated
55479	Mar. 5, 2015
55480	Mar. 6, 2015
55484	Jan. 4, 2015
55487	Nov. 22, 2014
55488	Feb. 26, 2015
55489	Mar. 6, 2015
55491	Nov. 25, 2014
107261	Mar. 4, 2015
107262	Mar. 6, 2015
107263	Dec. 12, 2014
107266	Feb. 2, 2015
107267	Feb. 23, 2015
107268	Mar. 6, 2015
107271	Dec. 22, 2014
107273	Feb. 15, 2015

locations through March 6, 2015

click upon loon locations for details

Wisconsin Loon Population Assessment

Wisconsin Department of Natural Resources
USGS UMESC, LaCrosse, WI
University of Wisconsin - Madison

Photo credit: Doug Killian

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This research is funded by U.S. EPA - Science To Achieve Results (STAR) Program
Grant # R82-905


WS 5307 FK
MERCURY
THE GOOD
THE BAD
THE
LUCKY!
MIKE'S
2005
RECORD
BREAKING
LOON CREW
143 LOONS


red-stripe ("Rs")
red ("R")
orange ("O")
orange-dot ("Od")
yellow ("Y")
white ("W")
taupe-stripe ("Ts")
mint ("M")
mint-burgundy ("Mb")
green ("G")
green-stripe ("Gs")
blue ("B")
blue-stripe ("Bs")
white-periwinkle ("Wp")
copper-cream ("Cc")
copper ("C")
auric-red ("Ar")
pink ("P")
iceberg ("I")

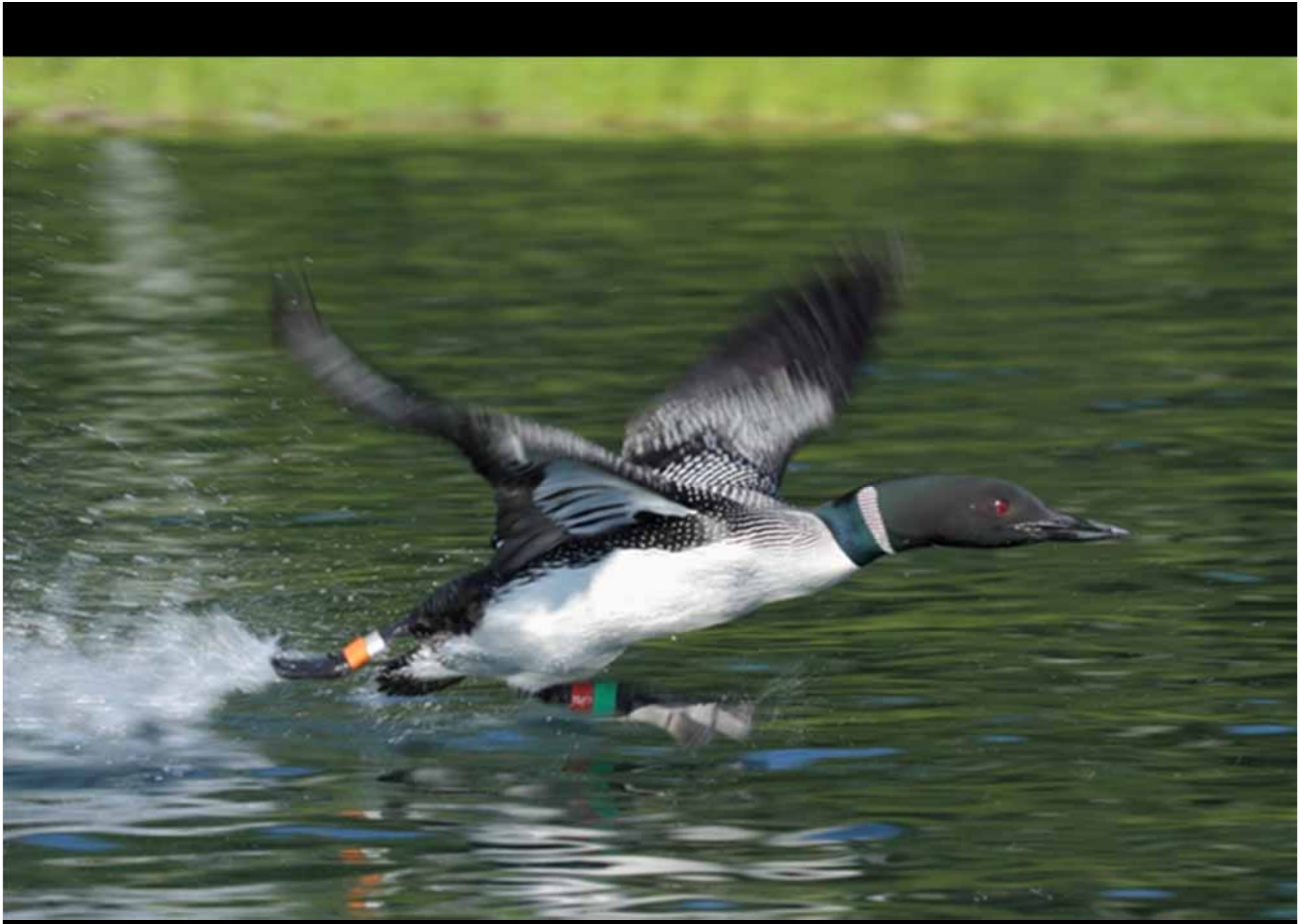
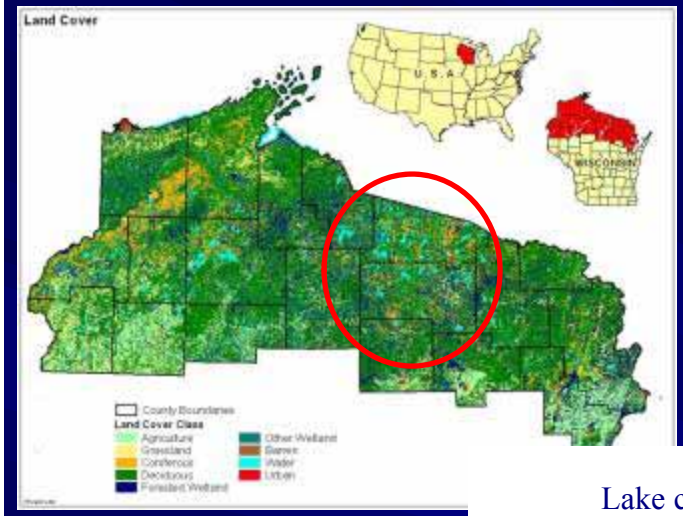
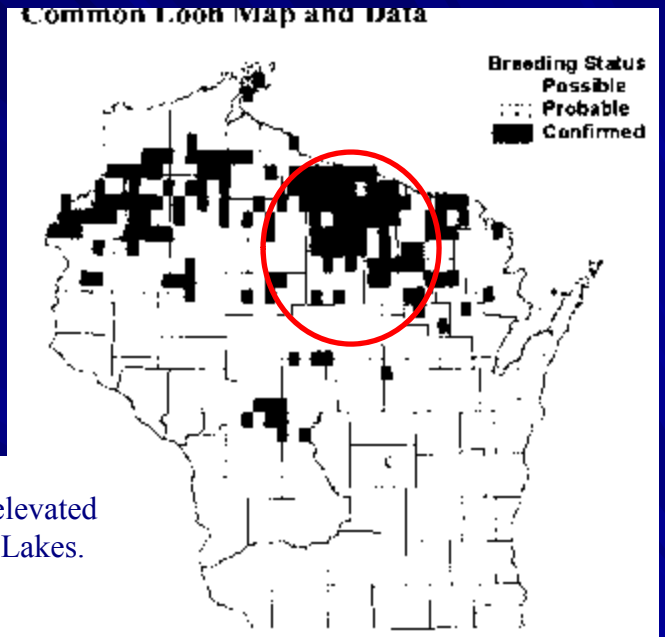


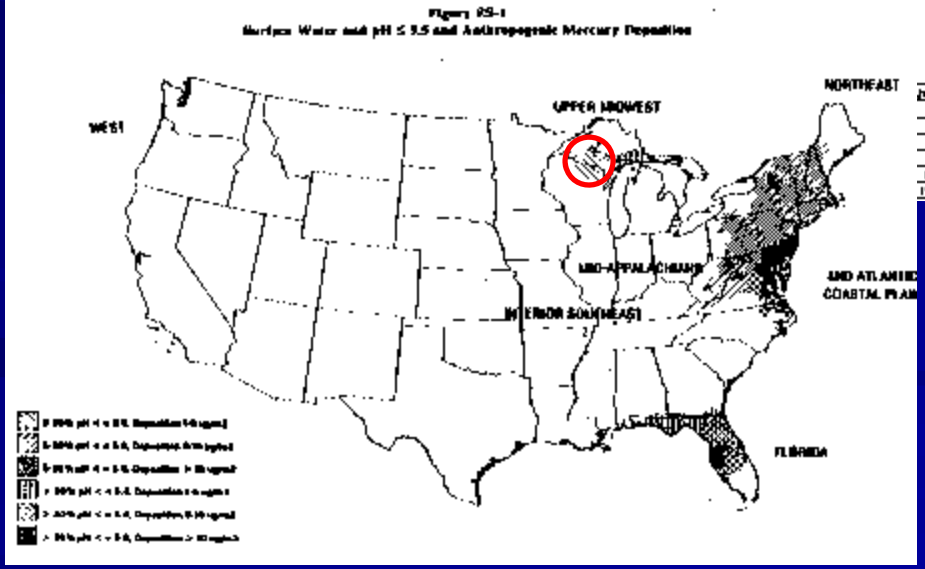
Photo – Matt Erlandson

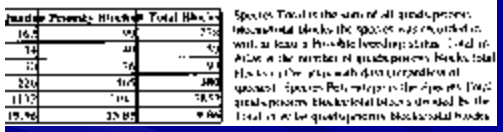
Risk Assessment Region





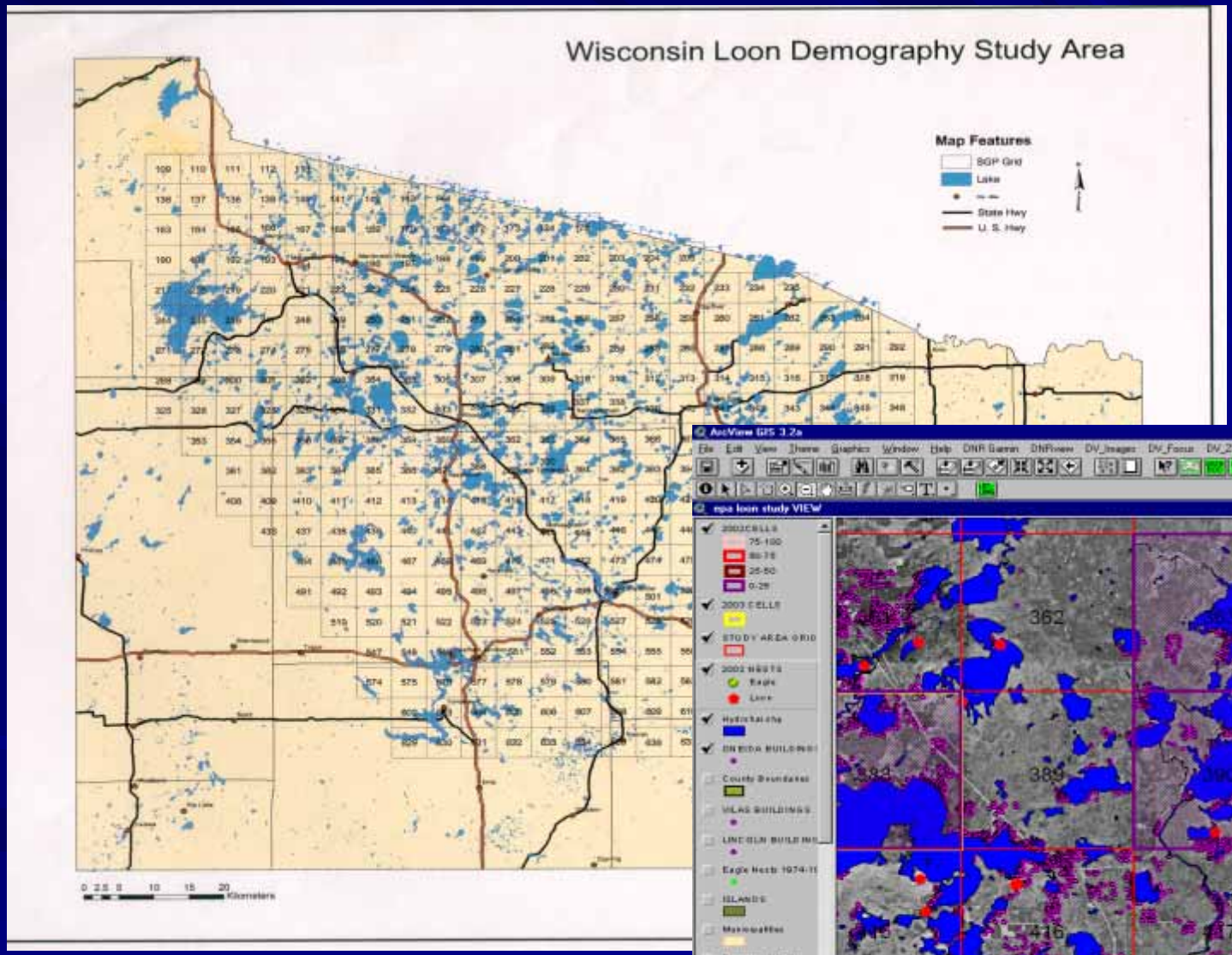
Lake chemistry and Hg deposition rates favor elevated MeHg in fish in some northcentral Wisconsin Lakes.



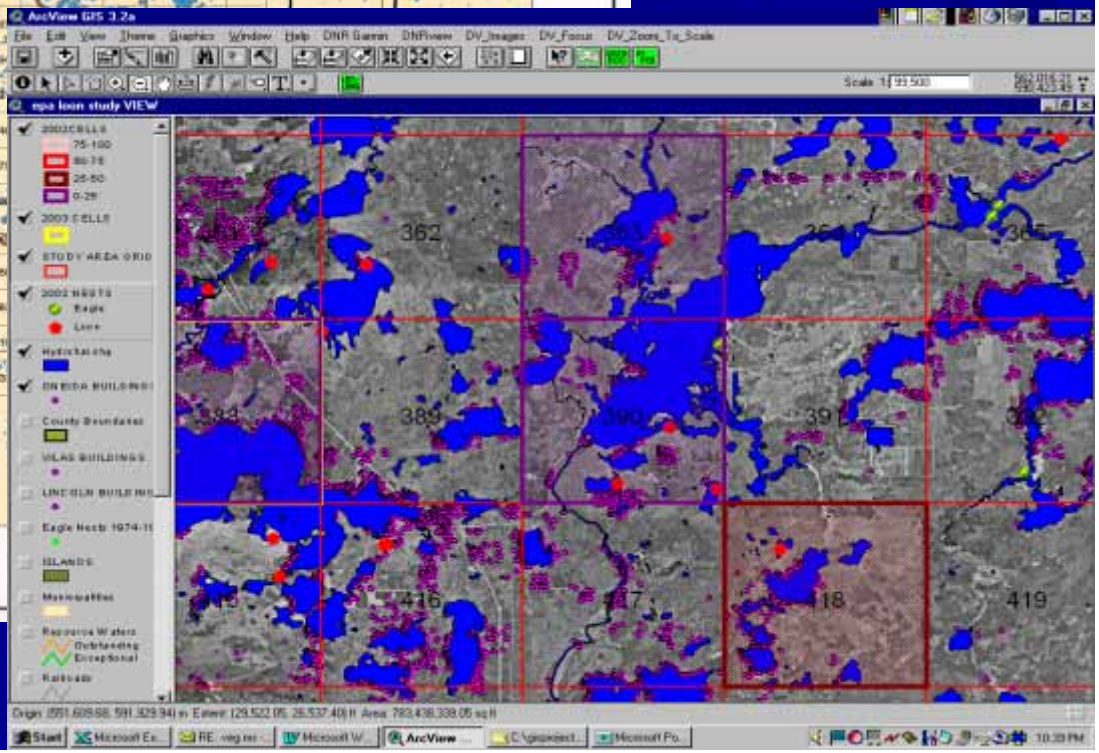


Site/scale

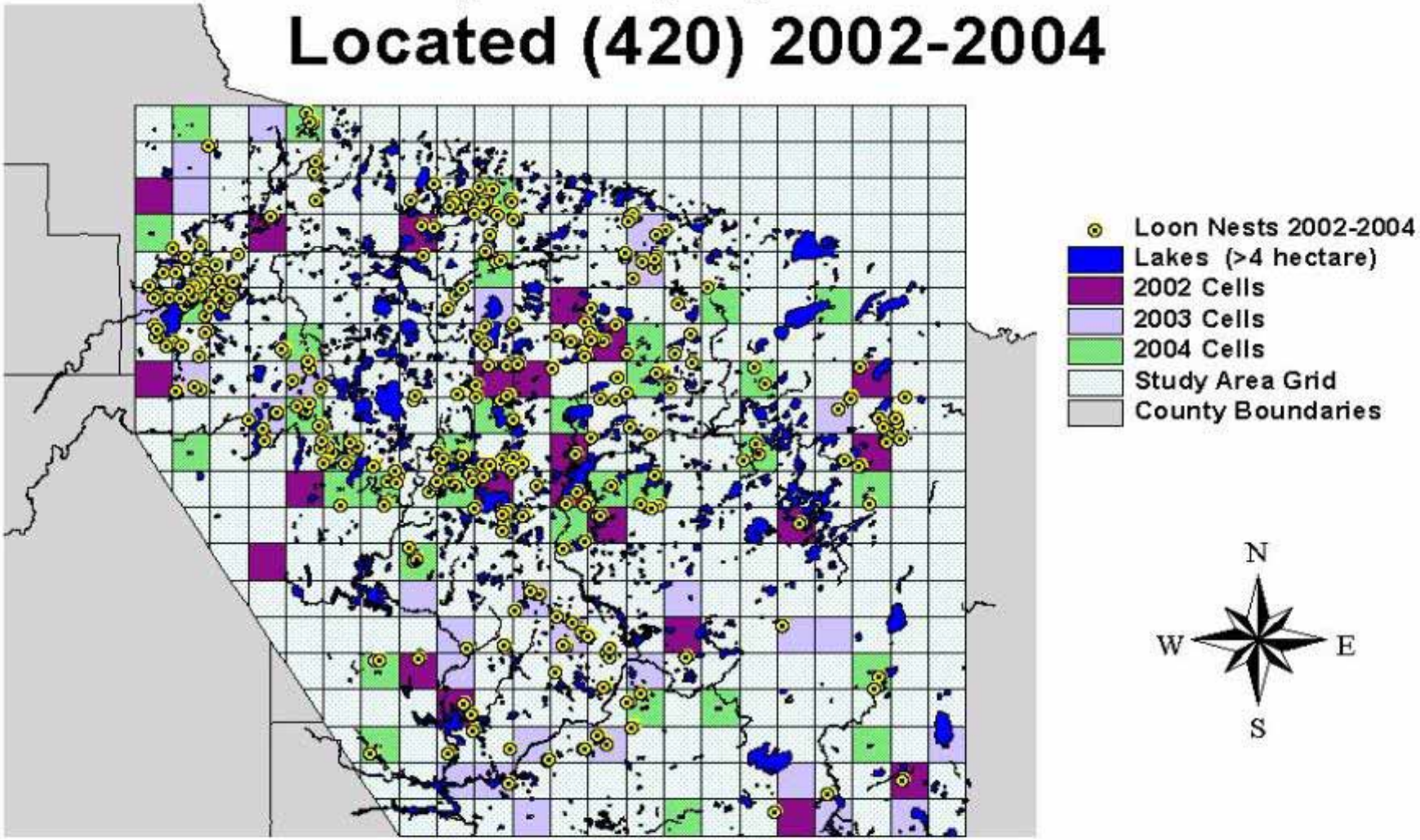
Objective 1) LOON POPULATION ESTIMATE



- Dual Frame Quadrat Sampling Technique. Haines and Pollock. 1998. *Environmental and Ecological Statistics* 5,245-256.



Cells Sampled (90) & Loon Nests Located (420) 2002-2004



Adult Survival Rate – Re-observations of >1600 Wisconsin adult loons individually color-marked 1991 - 2011

Adult Survival Rate - Program MARK

Analysis based on 734 adult loons captured and individually color-marked 1991 - 2001 in Wisconsin and New England

Co-Investigators

M. Mitro USEPA/WDNR, D. Evers BioDiversity, M. Meyer WDNR

Weekly lake surveys document presence of territorial adults and floaters, nest attempts, and chick survival

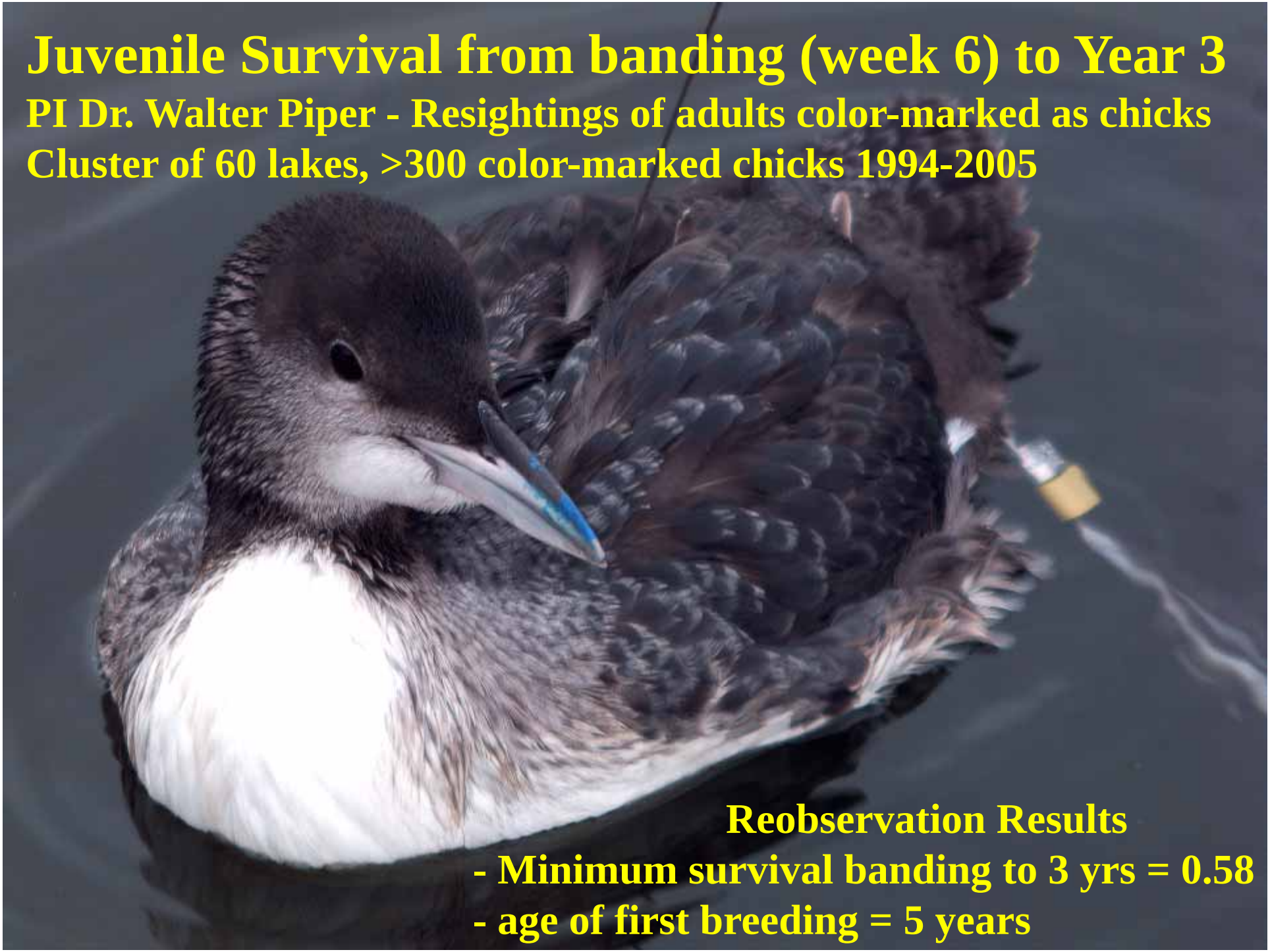
Nest Monitoring

Proportion nesting

Clutch size

Nest Success

Chick Survival to Banding



Juvenile Survival from banding (week 6) to Year 3

PI Dr. Walter Piper - Resightings of adults color-marked as chicks

Cluster of 60 lakes, >300 color-marked chicks 1994-2005

Reobservation Results

- Minimum survival banding to 3 yrs = 0.58

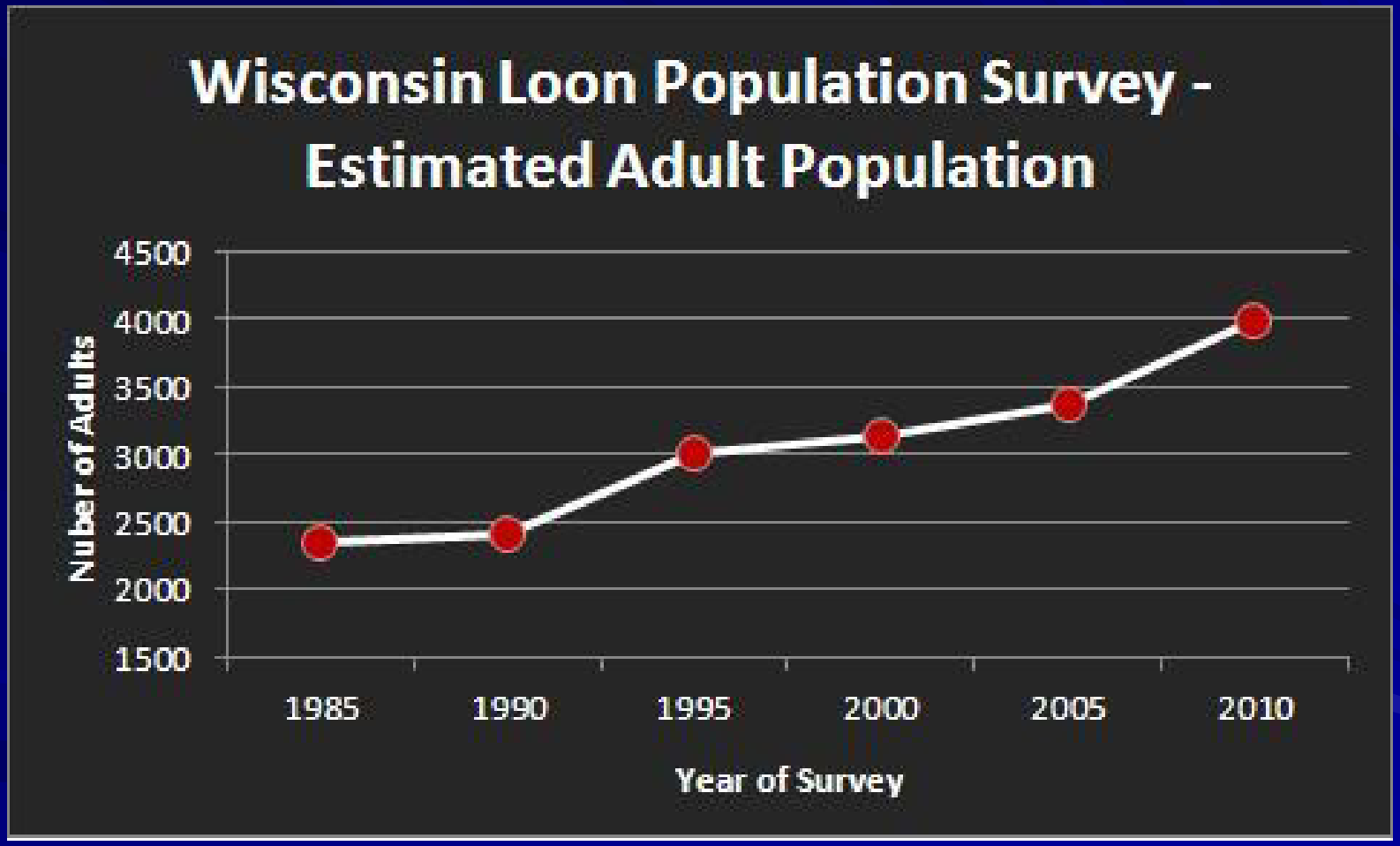
- age of first breeding = 5 years

2003 Wisconsin Loon Population Estimate for Risk Assessment Region

	Total Adults	Breeding Pairs	Floaters
Estimate	1194	463	269
SD	123	54	49

- 80% WI adult loon population paired
- 20% Floaters/Intruders

LoonWatch Population Estimates of Adult Common Loons in Wisconsin



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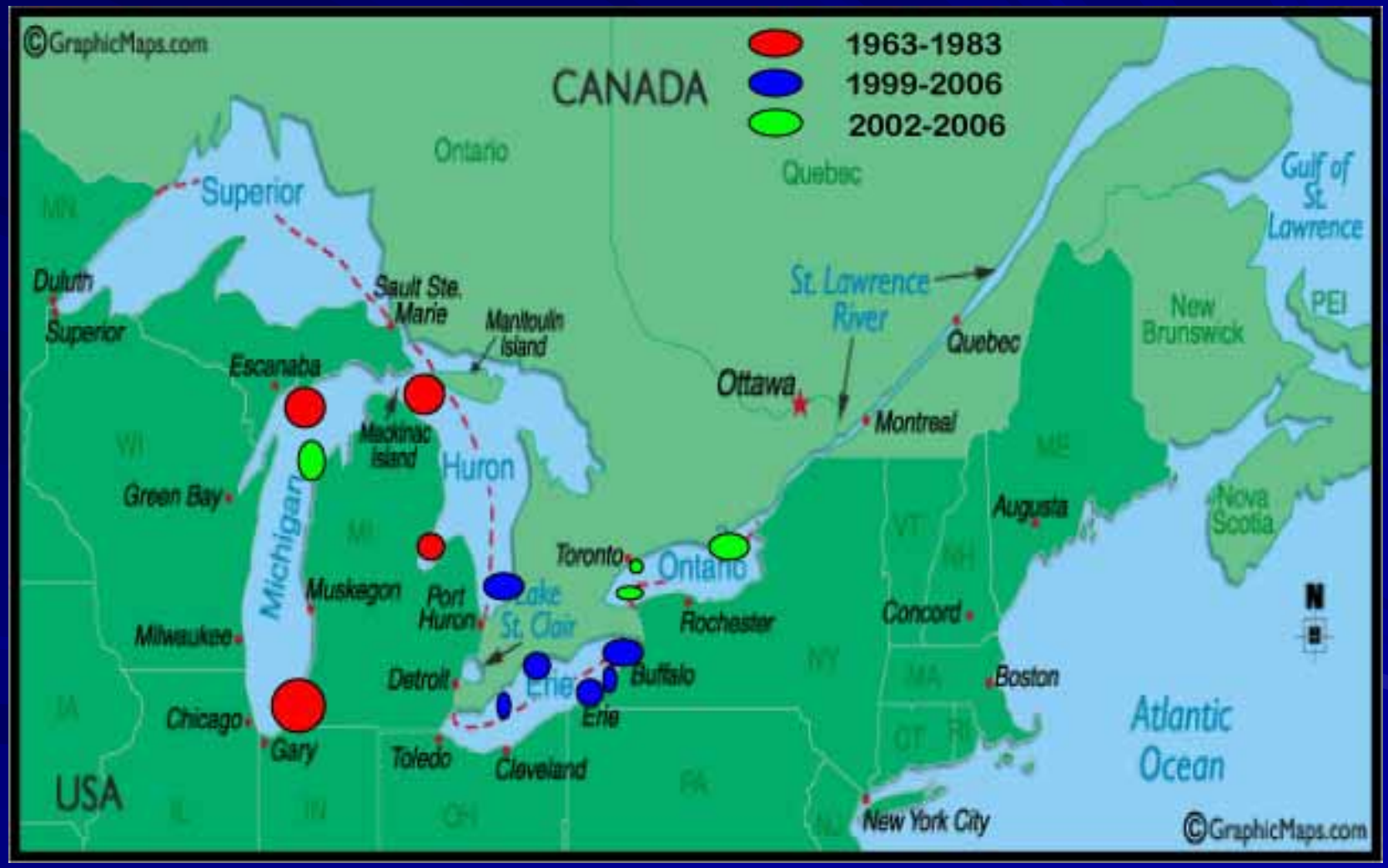
Great Lakes RESTORATION

Migration Ecology of Common Loons and Exposure to Avian Botulism in the Great Lakes

Botulism outbreaks since 1963.

(Graphic courtesy of Pennsylvania Sea Grant)



Preliminary 2007 Great Lakes Carcass Count = 6982

Courtesy M. Jankowski USGS

Top 5 Species collected by Great Lake

Courtesy M. Jankowski USGS

Lake Michigan (3491)

- **Common loon (622)**
  - BOT E confirmed by NWHC
- Double-crested cormorant (581)
- Long-tailed duck (545)
- Ring-billed gull (448)
- Horned grebe (351)

Lake Huron (44)

- **Common loon (23)**
  - Bot E confirmed
- Red-necked grebe (5)
- Double crested cormorant (1)
- White-winged scoter (# not available)
- Long-tailed duck (# not available)

Lake Erie (1694)

- Ring-billed gull (972)
- **Common loon (685)**
  - BOT E confirmed by NWHC
- Herring gull (13)
- White-winged scoter (8)
- Great black-backed gull (5)

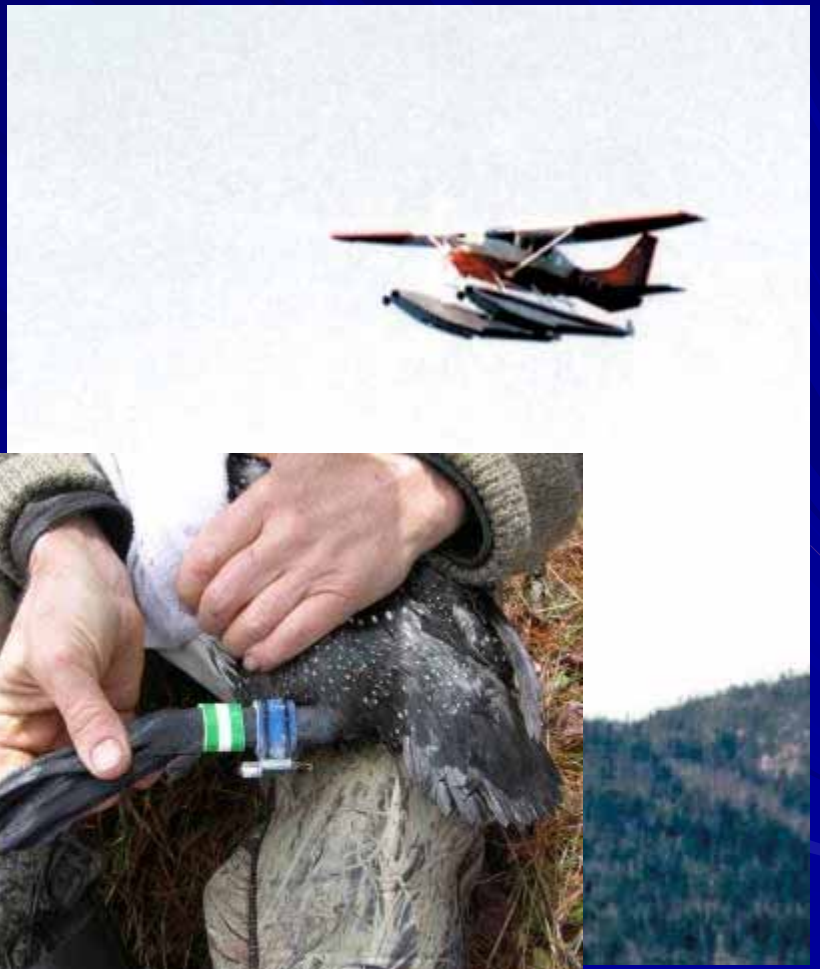
Lake Ontario (1753 so far)

- Ring-billed gull (942)
  - BOT E confirmed by CCWHC
- Caspian tern (309)
- Double-crested cormorant (162)
- Long-tailed duck (128)
  - BOT E confirmed by CCWHC
- **Common loon (128)**

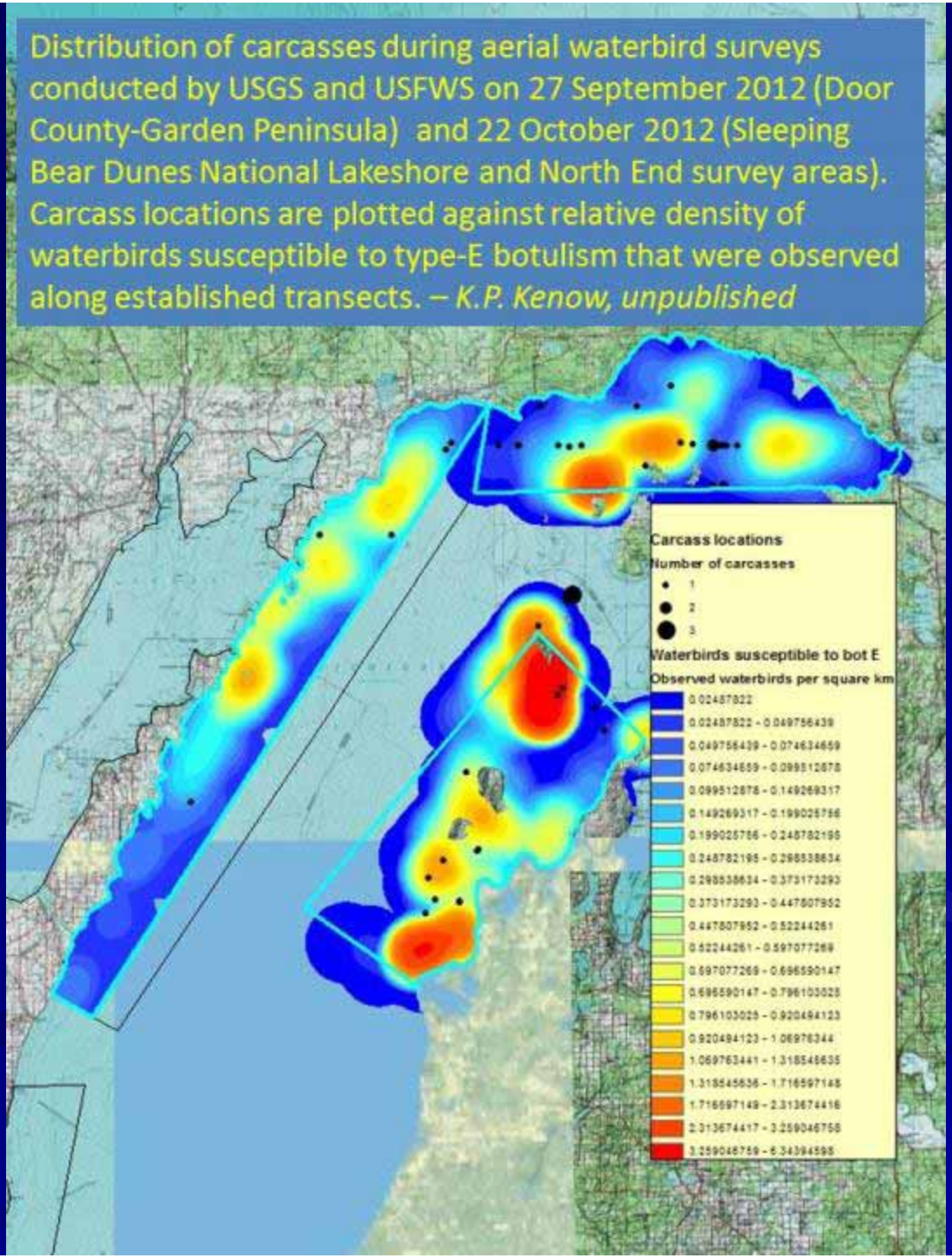
Objective

Document the fall distribution and foraging patterns of sentinel waterbirds …

- via low-level, systematic aerial surveys
- by tracking migration movements coupled with foraging depth profiles of common loons equipped with archival geo-locator tags and/or satellite transmitters.

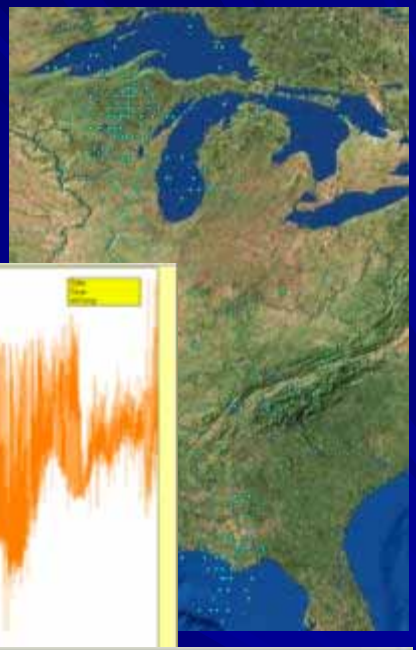


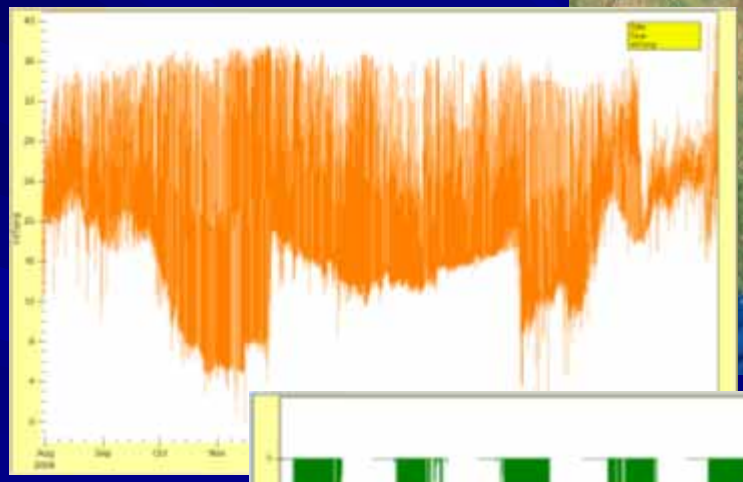
Distribution of carcasses during aerial waterbird surveys conducted by USGS and USFWS on 27 September 2012 (Door County-Garden Peninsula) and 22 October 2012 (Sleeping Bear Dunes National Lakeshore and North End survey areas). Carcass locations are plotted against relative density of waterbirds susceptible to type-E botulism that were observed along established transects. – *K.P. Kenow, unpublished*

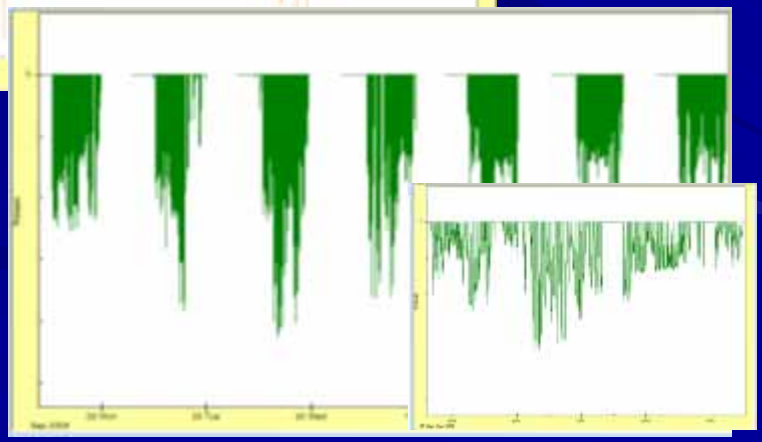


Foraging patterns

- General location and foraging depth profiles collected with Lotek light-based geolocating archival tags (model LAT 2500)
  - precision-time-stamped depth, temperature and light-based geolocation data, 512k memory
  - Programmed to collect
    - daily location estimate
    - temperature at 30 min intervals
    - pressure data at 20 sec intervals during daylight hours; Oct - Dec



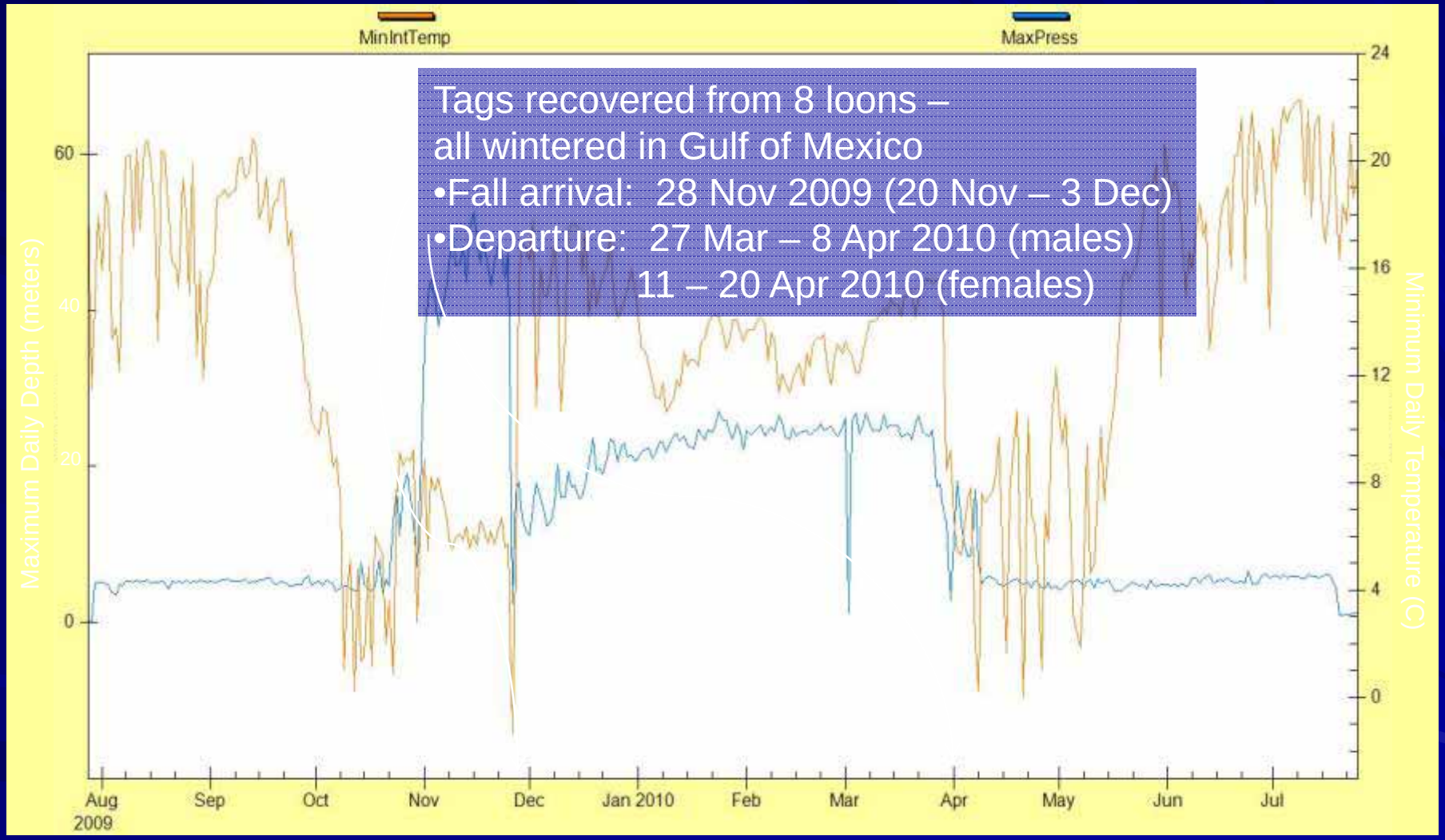




Foraging patterns

- During summer 2010
  - 18 loons marked with geolocator tags in 2009
  - of 17 loons we followed up on, all were observed back on their territories and attempted nesting in 2010.
  - recaptured 9 of 18 loons that were tagged during summer 2009

Geolocator temperature and pressure records for common loon tagged during August, 2009 in northern Wisconsin



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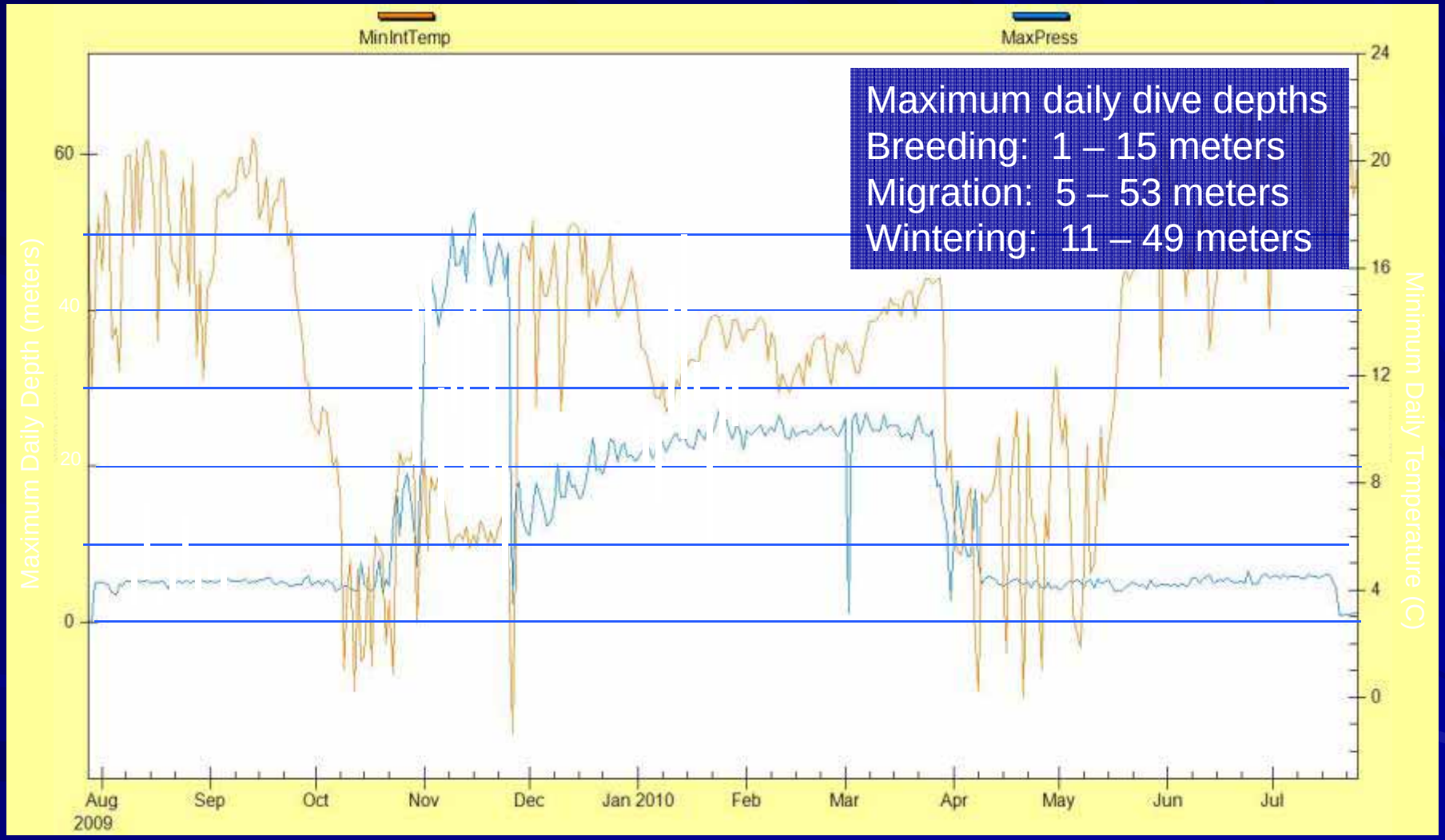
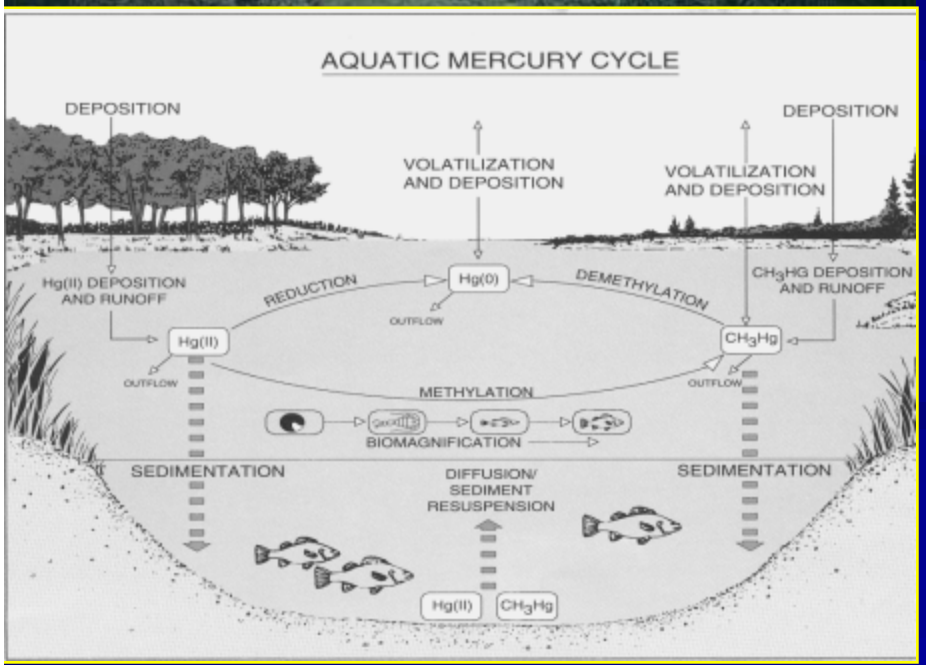
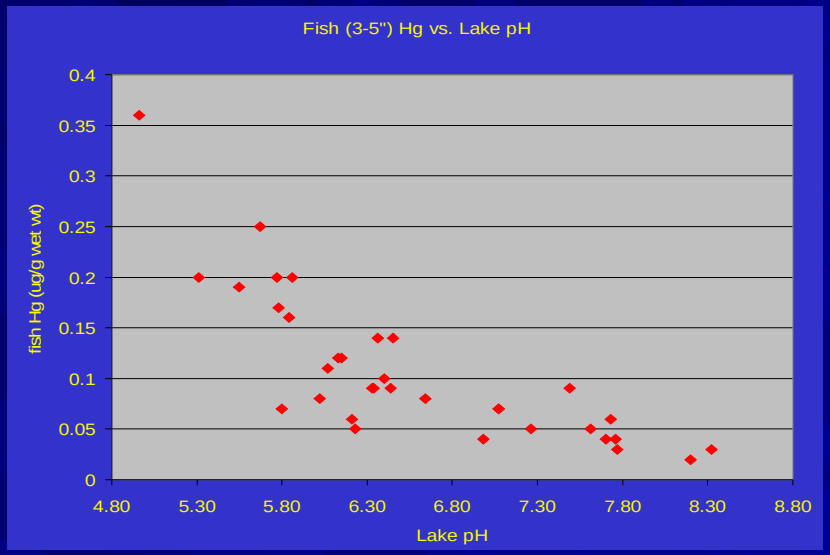
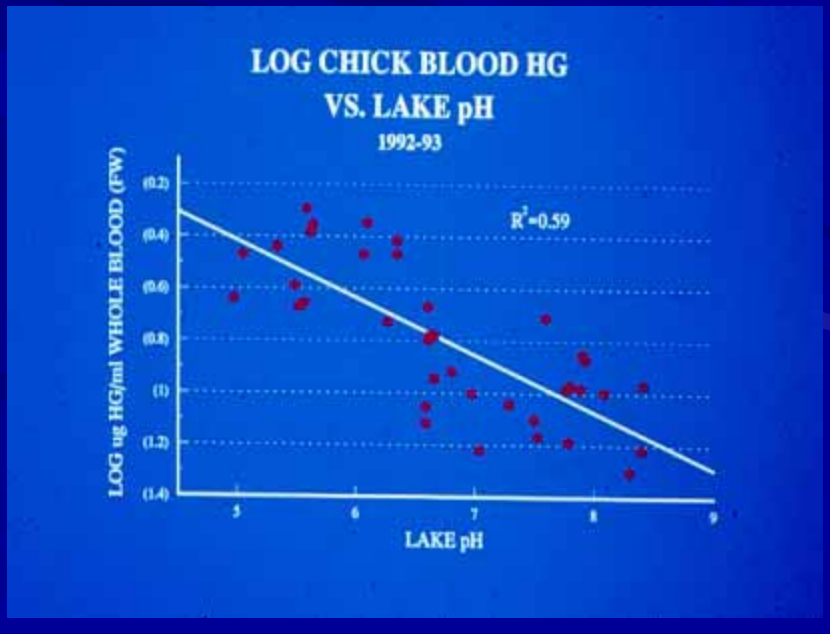


Stressor Issues - Mercury



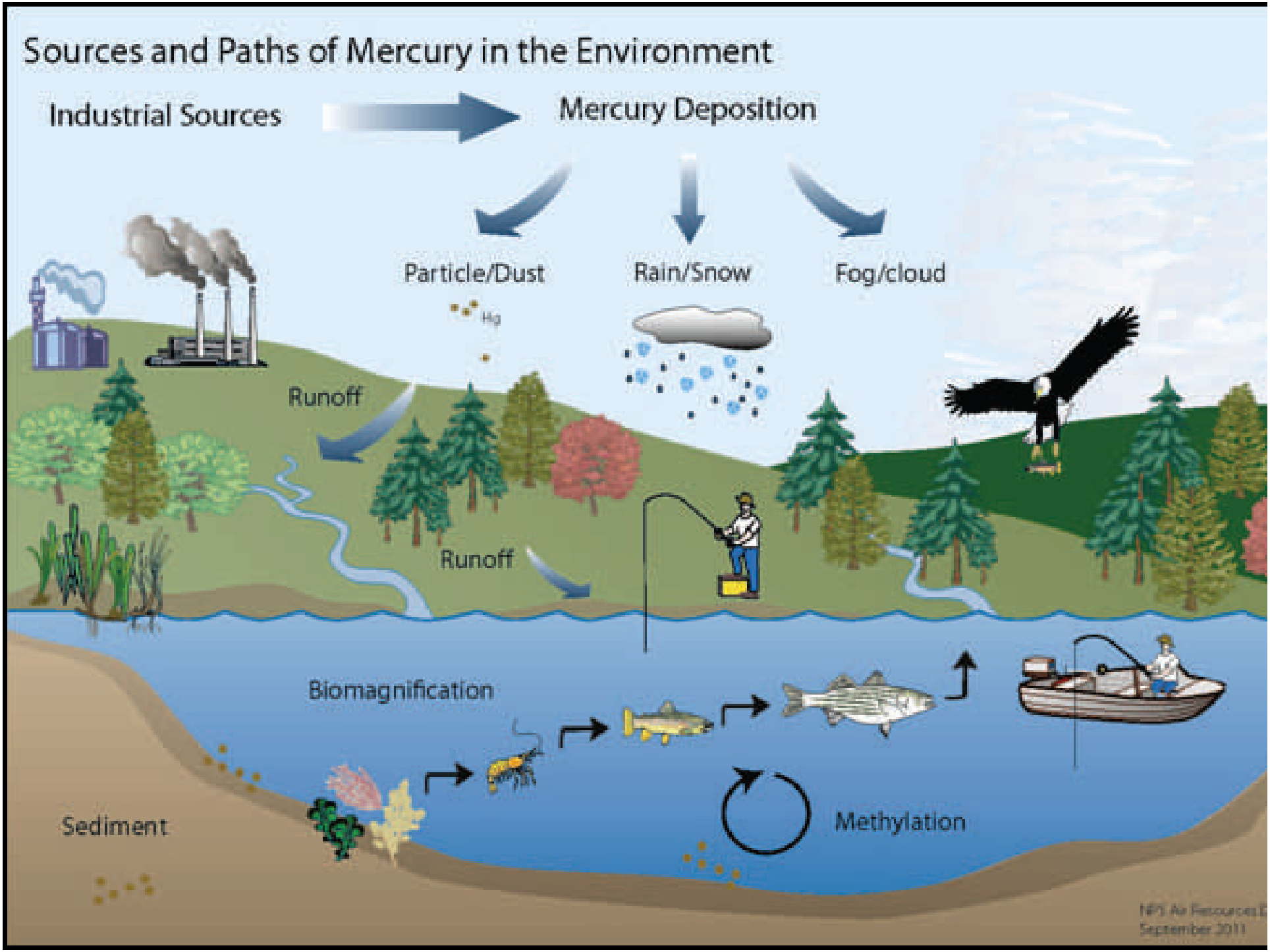




Why Common Loon?

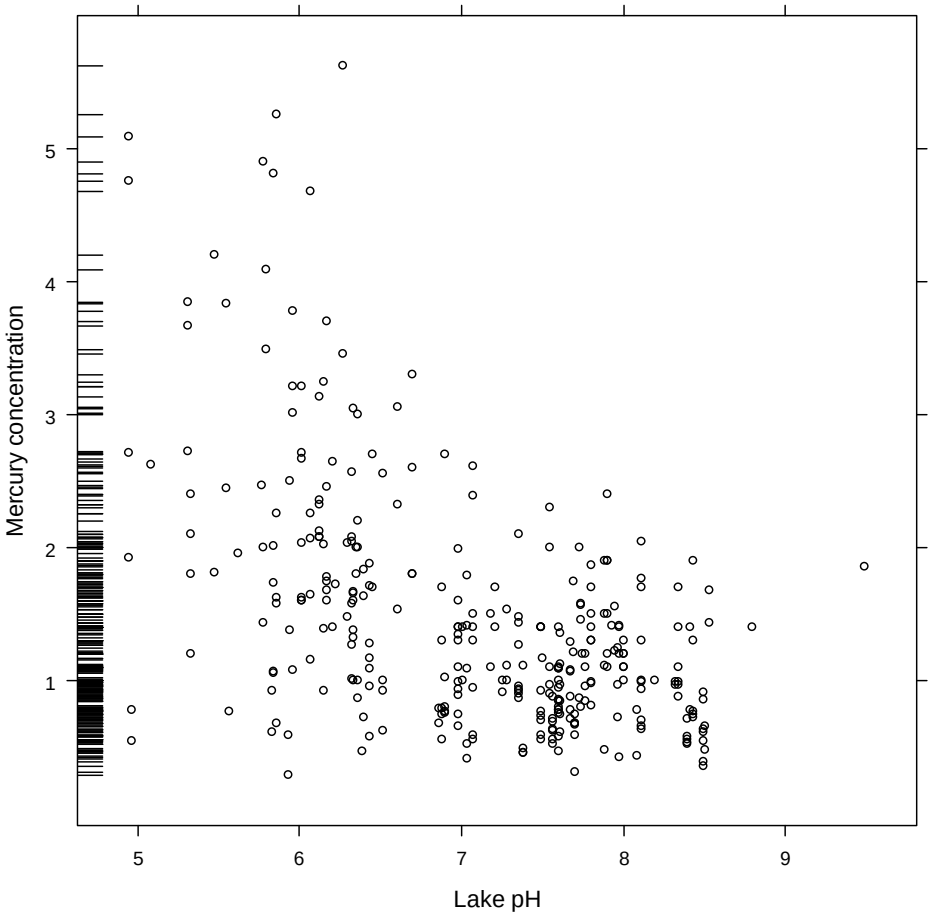
- Sensitive to effects of mercury
  - altered behavior
  - reduced reproduction
- At risk to exposure
  - high trophic level
  - long-lived
  - obligate fish-eater
  - nest on acidic lakes

Photo by Woody Hagge

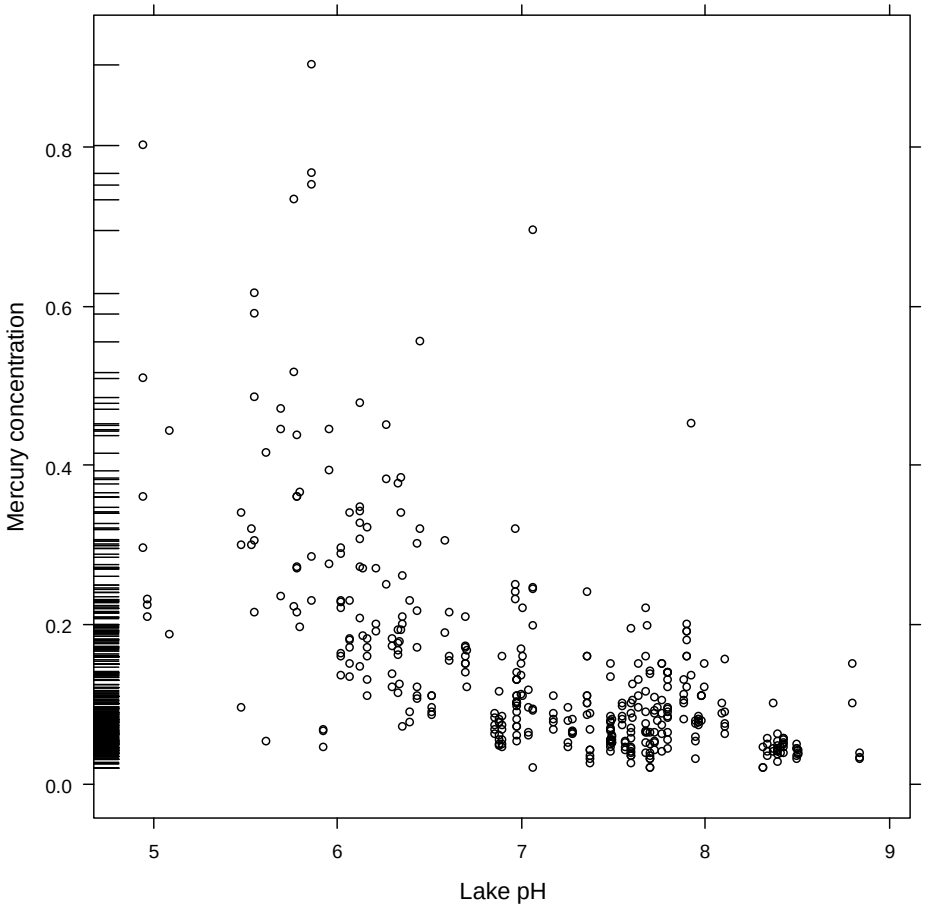

Sources and Paths of Mercury in the Environment
Industrial Sources
Mercury Deposition
Particle/Dust
Rain/Snow
Fog/cloud
Hg
Runoff
Runoff
Biomagnification
Sediment
Methylation
NPS Air Resources D
September 2011

Relationship of Loon Hg Exposure and Lake pH

Adults



Chicks



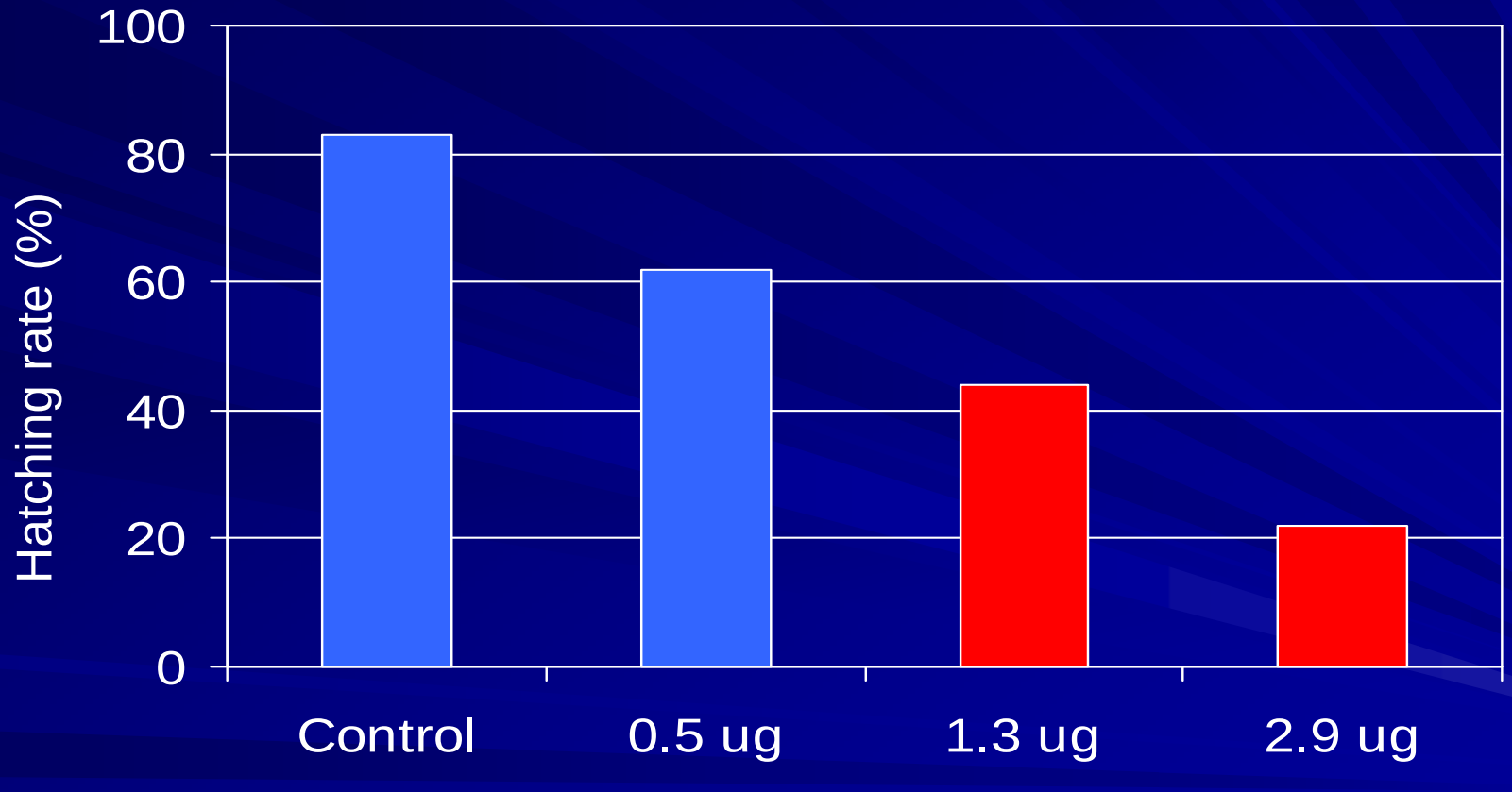
ESTABLISHING CRITICAL LIFE STAGE MERCURY TOXICITY THRESHOLDS - EGG HATCHING RATE

• Egg hatching rate was assessed in untreated eggs and in eggs injected with varying amounts of methylmercury 2005 & 2006

•Eggs injected in the field and incubated by hen until day 23 when brought to lab and hatched in incubator

USGS

Hatching rate of WI loon eggs injected with various levels of mercury 2005-2006



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Conclusions

Wisconsin Loon Population Model predicts that reducing Fish Mercury Concentrations on acidic Wisconsin lakes (pH< 6.3) to 0.1 ug mercury/g fish could result in a 1.3% increase in the Loon Population Annual Growth Rate.

Quantifying the Ecological Benefits of Mercury Emission Reductions in Wisconsin

Mike Meyer, WDNR Science Services, Rhinelander, WI
Kevin Kenow USGS UMESC, LaCrosse, WI
William Karasov, UW-Madison
Neil Burgess, Environment Canada, Mt. Pearl NF, Canada

Photo credit: Doug Killian

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Wisconsin Mercury Rule NR446

The Wisconsin Mercury Rule was adopted by the Natural Resources Board at its meeting on June 25, 2008 and supported by the state legislature October 6, 2008. The rule went into effect January 1, 2009.

Rule Summary

90% reduction of Hg emission: Under the proposed mercury rule, large coal-fired power plants must either meet a 90% mercury emission reduction or limit the concentration of mercury emissions to 0.0080 pounds of mercury per gigawatt-hour by January 1, 2015.

Mercury Reduction Projects

Environmental Retrofits at WPS

A series of emission control projects have been completed at the WPS coal-fueled power plants allowing WPS to meet stricter state and federal air quality regulatory requirements.

Mercury Reduction Project Description

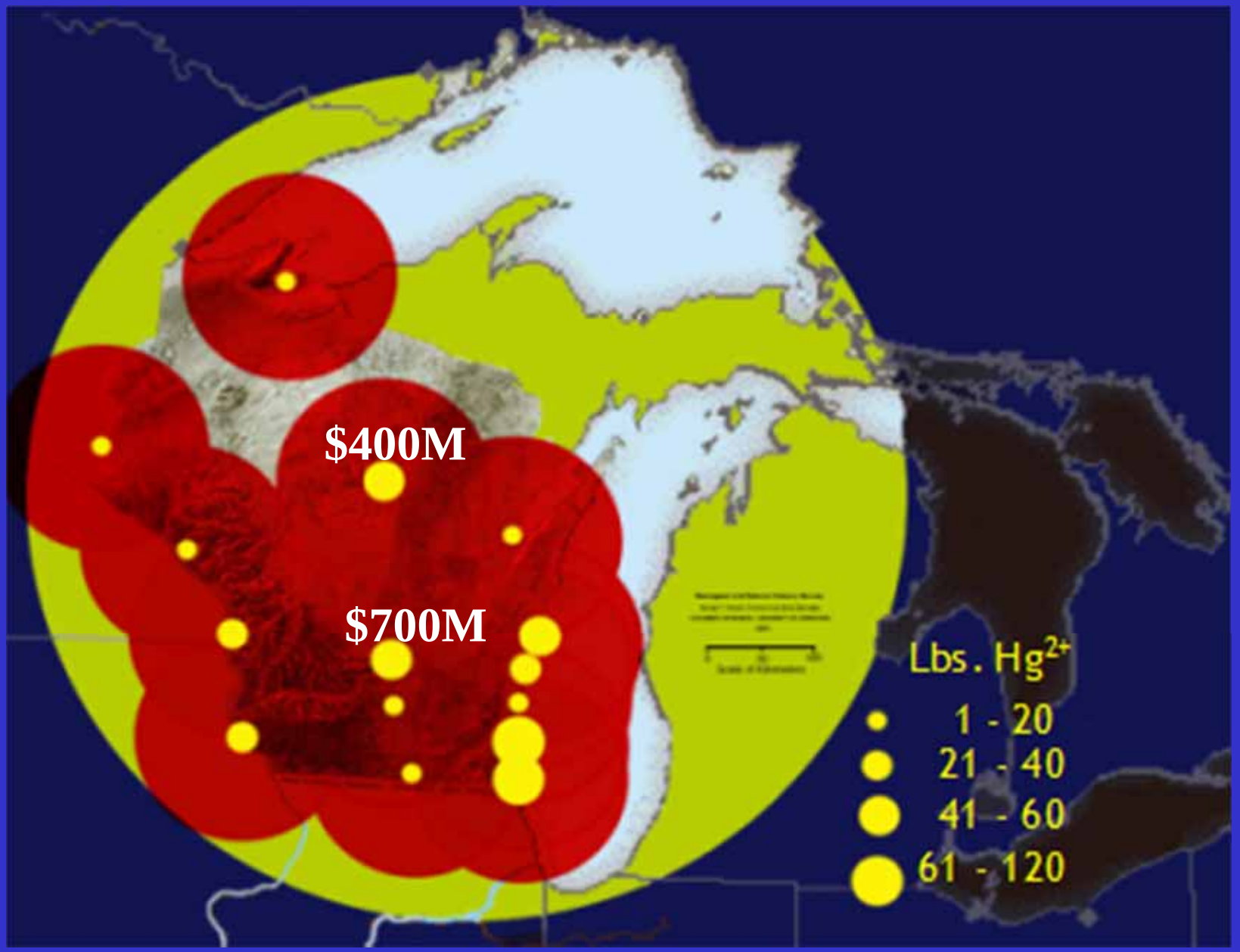
The projects consisted of installing new equipment to handle and inject dry sorbent materials into the power plant's exhaust gas. The sorbents are made of powdered activated carbon that is specially sized and chemically-treated to capture mercury, acting like a mercury-absorbing sponge. The carbon sorbent is injected into the exhaust gases upstream of existing particulate matter control equipment so that it can be separated from the exhaust before the gases reach the chimney.

The used carbon sorbent is collected and co-mingled with the fly ash. It is tested for suitability for beneficial reuse or landfill disposal. As the mercury is physically and chemically bound to the carbon sorbent it is prevented from re-emitting to the air or water.

Expected mercury reduction is in the 60 to 85 percent range using the activated carbon injection system.

These projects enable WPS to meet compliance targets according to Wisconsin Mercury Rule (NR446.)

Wisconsin Utility Mercury Emissions 1990s



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Approach

- Over each 5-year interval, sample 50 lakes with long-term data demonstrating elevated loon and fish mercury concentrations.
- Determine lake water total Hg, MeHg, and SO_4 concentrations.
- Track atmospheric deposition at NADP MDN Trout Lake (WI36) monitoring site

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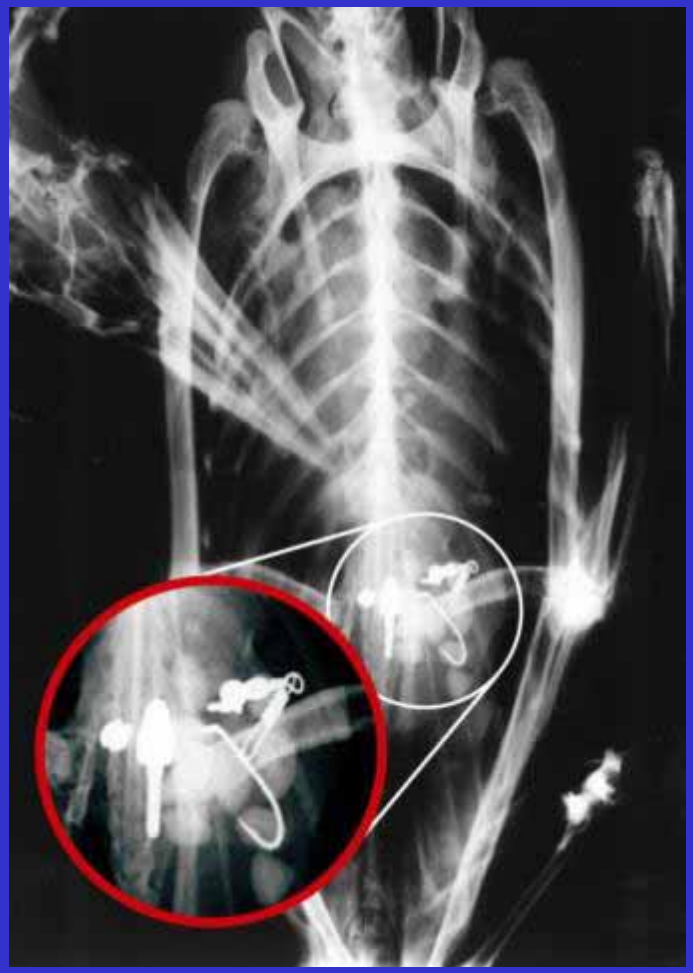
Breeding Ground Threat - Lead Fishing Tackle

- Approximately 15-20% of WI and MN loons found dead on the breeding grounds die of lead poisoning
- X-ray shows lead tackle in a loon's stomach
- We estimate that substituting alternatives for lead fishing tackle would save over 50 loons annually in Wisconsin alone.



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Stressors - Habitat alteration

Why Common Loon?

- Conspicuous ground nester - at risk to shoreland alteration
  - nests within 2-3 ft of waters edge
  - >50% of nest attempts fail
- Public highly motivated to conserve loons in Wisconsin

Photo by Doug Killian

Shoreland Management and Common Loons

- Loons infrequently use lakes with shoreland housing densities >25 buildings/km shoreline. Habitat loss, increased disturbance likely causes.

- **Protection of loon nesting habitat is critical to the long-term conservation of loons in Wisconsin!**

USGS
science for a changing world

Pilot Study - 2014

Managing the expansion of breeding common loons back into their former breeding range in Wisconsin

Kevin Kenow, Pete Boma, Luke Fara, Steve Houdek

USGS UMESC La Crosse, WI

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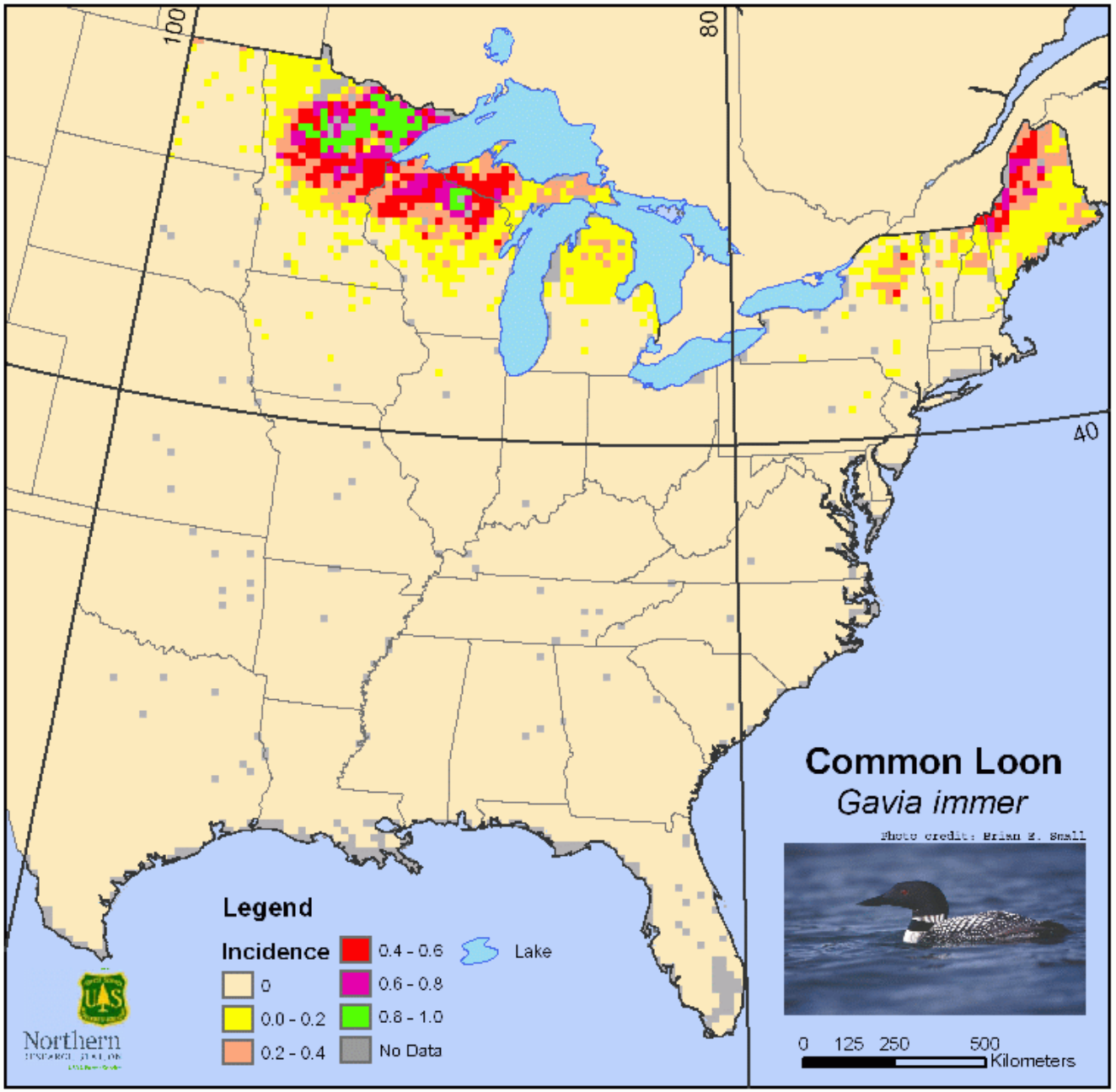
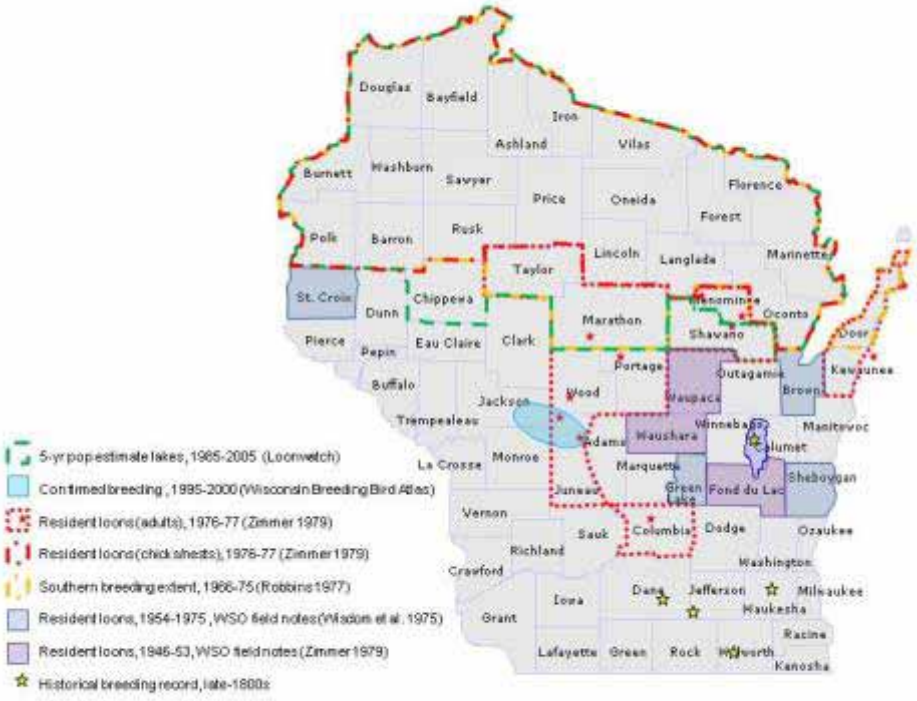
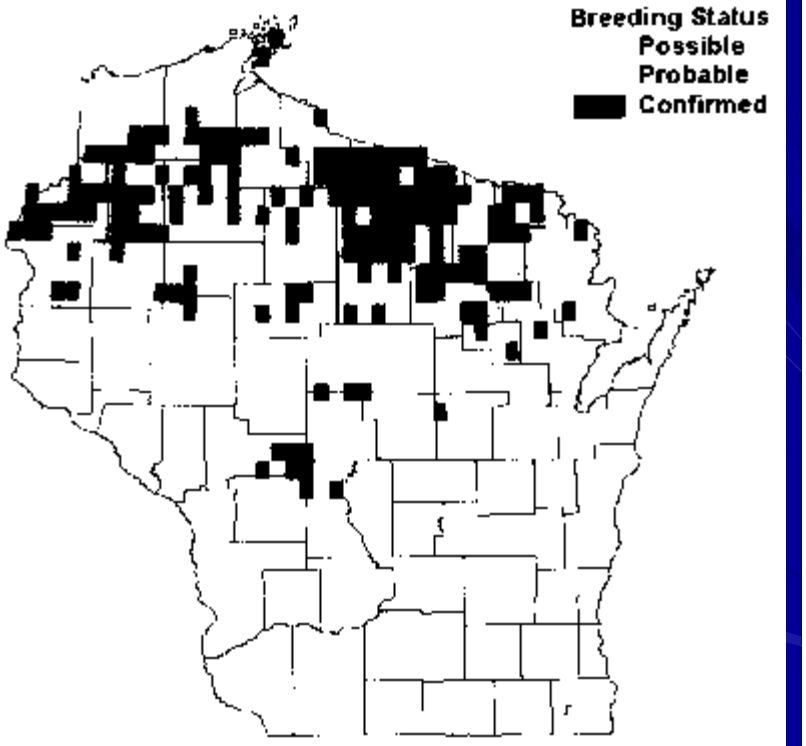

100
80
40
Common Loon
Gavia immer
Photo credit: Brian E. Small
Legend
Incidence
0
0.0 - 0.2
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8
0.8 - 1.0
No Data
Lake
0 125 250 500
Kilometers
Northern

Historical accounts and current WBBA Atlas show WI common loon breeding distribution has shifted north



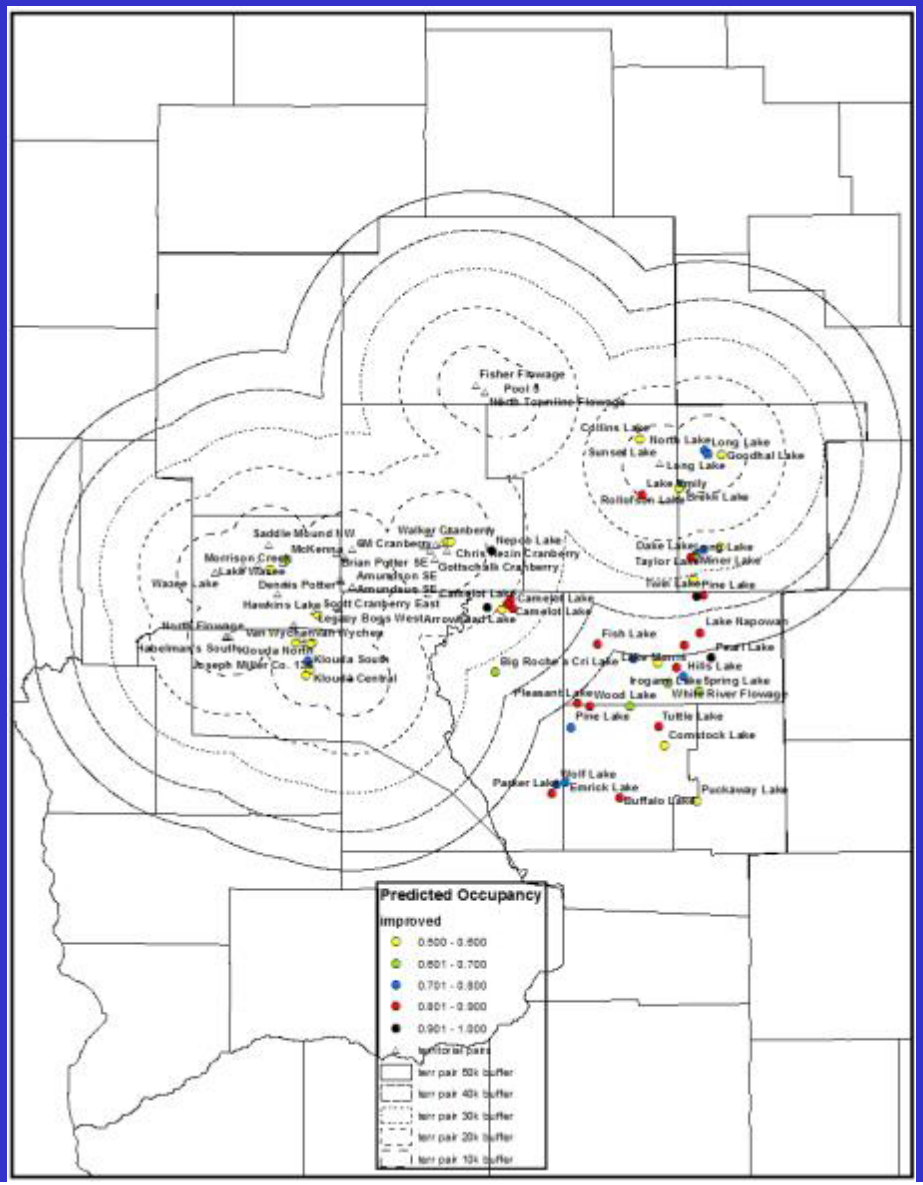
Common Loon Map and Data



Max Breeding Status	# Quads	# Priority Blocks	# Total Blocks
Confirmed	162	48	228
Probable	34	41	75
Possible	30	26	56
Species Total	226	165	359
Total in Atlas	2132	1041	3173
Species Percentage	10.96	15.85	11.31

Species Total is the sum of all quads/priority blocks/total blocks the species was recorded in with at least a Possible breeding status. Total in Atlas is the number of quads/priority blocks/total blocks in the atlas with data (regardless of species). Species Percentage is the Species Total quads/priority blocks/total blocks divided by the Total in Atlas quads/priority blocks/total blocks

Habitat Model Used to Identify Lakes for Platform Placement



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Mike Meyer, Doug Killian, Dennis Stockwell
WDNR Science Services
Rhinelander

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What Does a Loon Citizen Scientist Do?

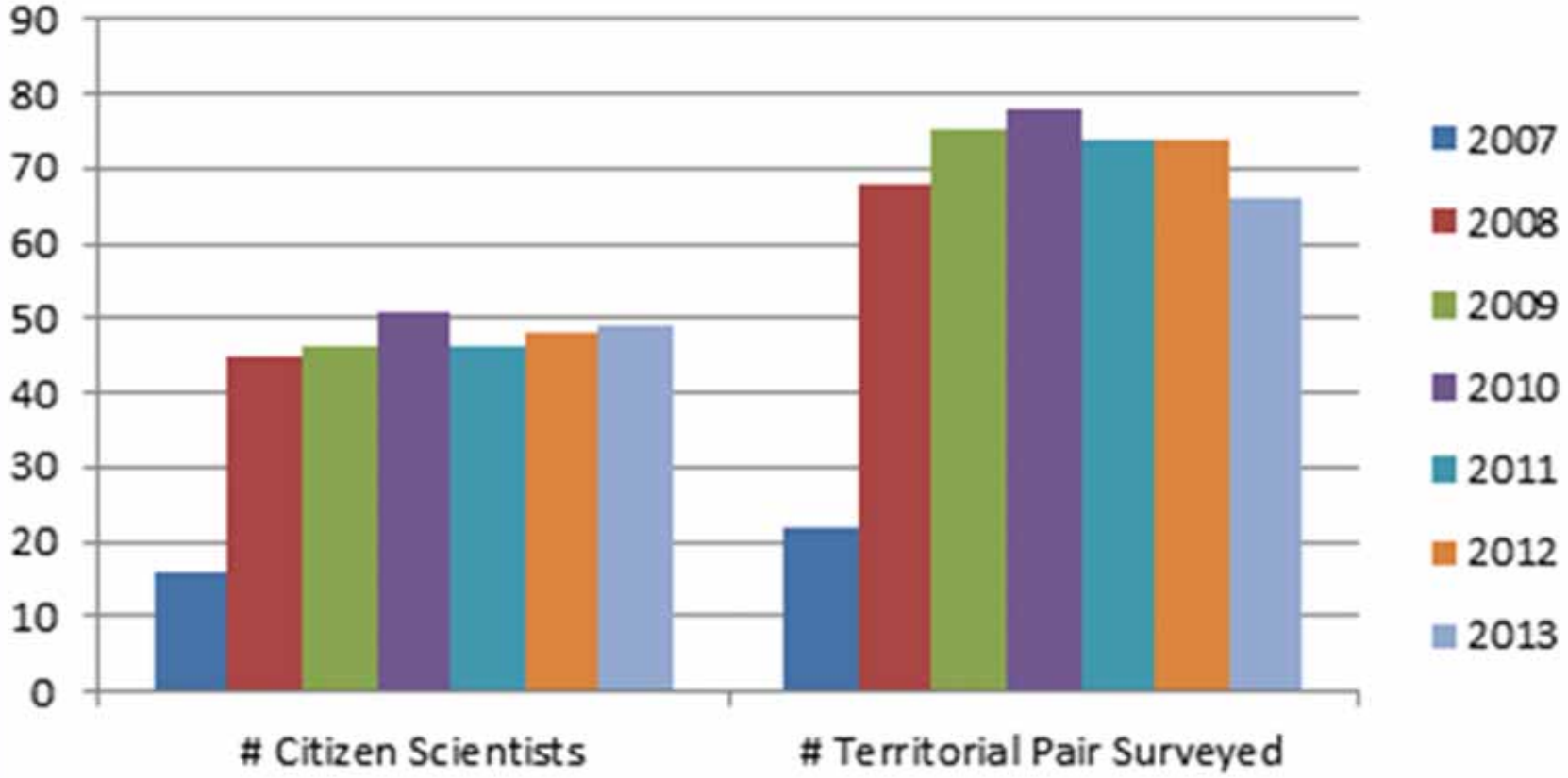
- Collect loon population data necessary to update the Wisconsin Loon Population Model
- Identify critical loon nesting habitat for conservation and management
- Assist with loon banding and lake water chemistry projects.

Weekly lake surveys document presence of territorial adults and floaters, nest attempts, and chick survival

How is this accomplished?

- Loon Citizen Scientists will survey lake(s) from May – August, ideally once weekly
- During each survey, the number of adult loons present, the nesting status, and chick survival are recorded
- Once per year, identify returning adults by identifying color leg bands when present
- Assist project staff with night banding efforts in July and early August
- Fill in appropriate data sheets and return to Project Leaders at the end of the season

Northwoods Loon Protection Program
Citizen Scientist Effort 2007-2013



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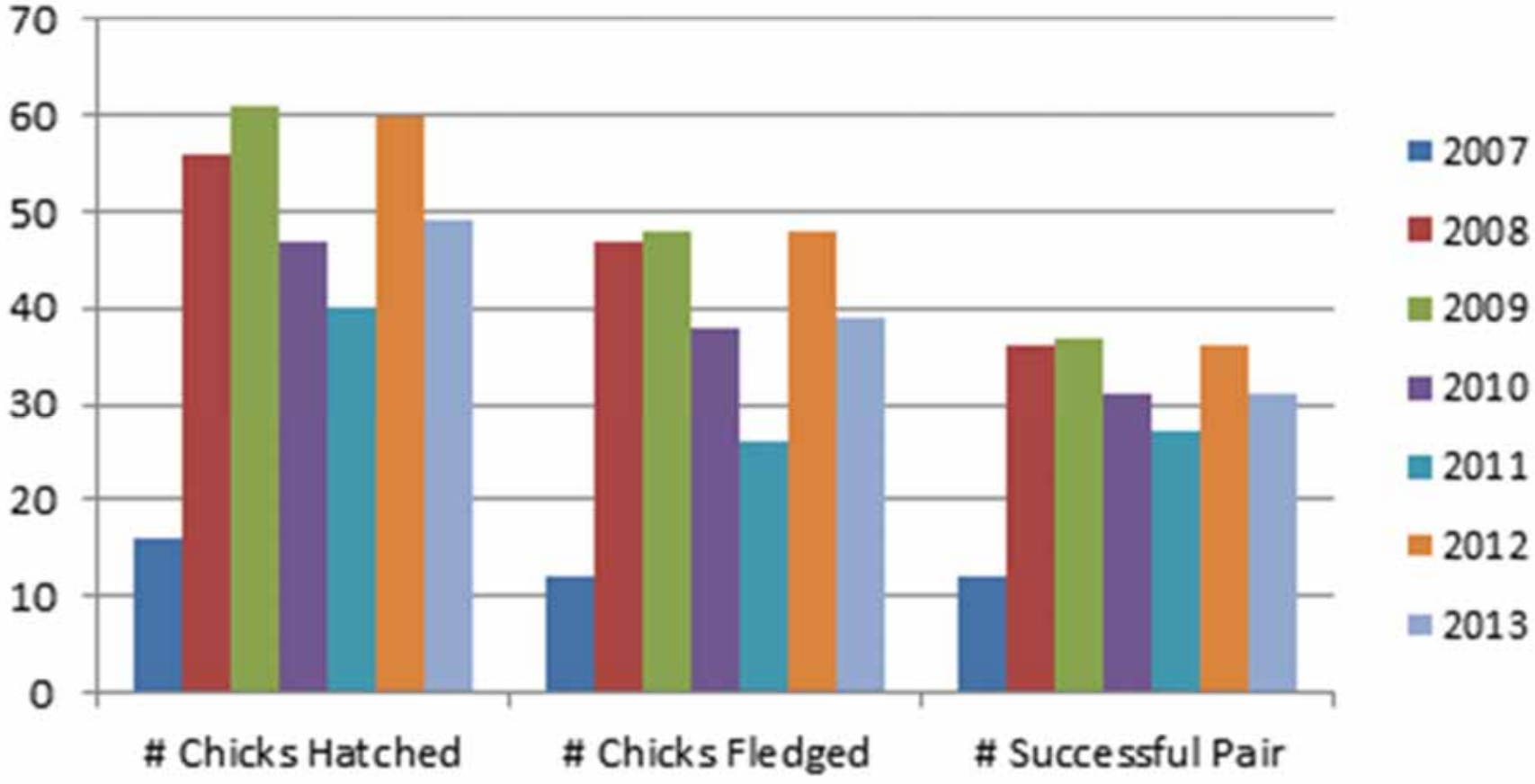
Northwoods Loon Protection Program Productivity 2007-2013



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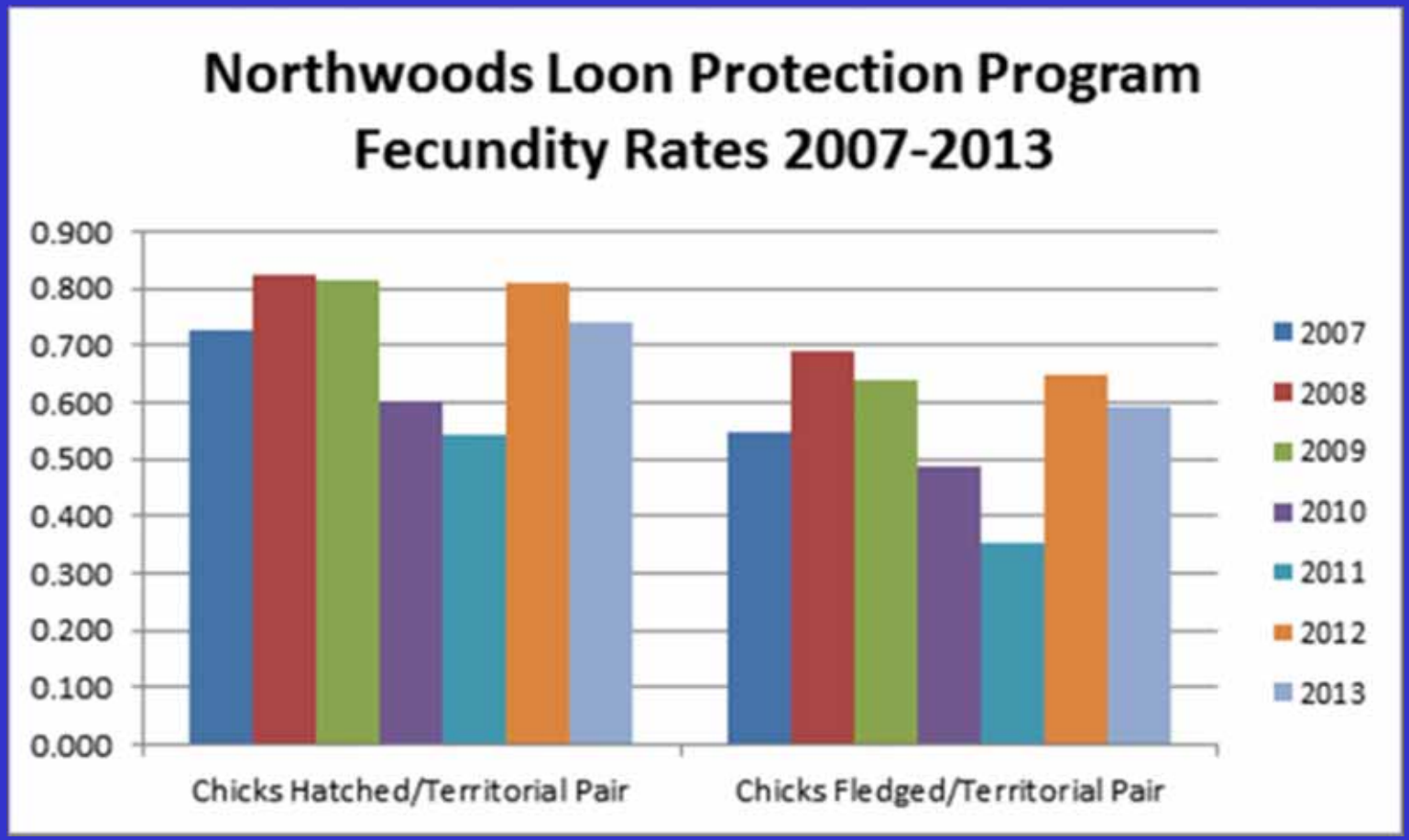

Northwoods Loon Protection Program
Fecundity Rates 2007-2013
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Chicks Hatched/Territorial Pair
Chicks Fledged/Territorial Pair
2007
2008
2009
2010
2011
2012
2013

Adult Survival Rate – Re-observations of >1500 Wisconsin adult loons individually color-marked 1991 - 2012


08/06/2008

Intangible Citizen Scientist Benefits

- Citizens participate in a State-of-the-Science Common Loon Conservation project
- Contribute data critical to natural resource policy making in northern Wisconsin
- Receive policy education via annual newsletters and spring training Workshops
- Become advocates for sound lake stewardship policies.

Volume 2, Issue 1
March 15, 2009

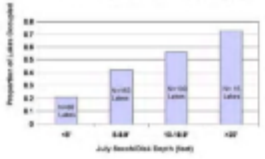
Red Eye News

New Research Grant Studies Climate Change Impact on Wisconsin Loons

NORTHWOODS LOON PROTECTION PROGRAM

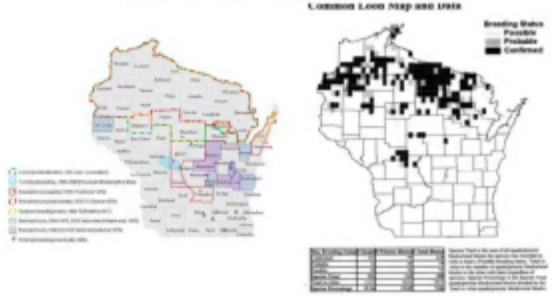
The Wisconsin Department of Natural Resources and partners at the US Geological Survey Water Center in Madison and the US Geological Survey Upper Midwest Environmental Science Center in La Crosse will begin a research study this summer to investigate whether predicted changes in Northern Wisconsin climate will result in reduced nest habitat quality of Common Loons. Loons typically select lakes for breeding that have good nesting habitat and relatively clear water. Previous work has shown that loons are less likely to be found on lakes as the secchi disk reading decline.

Proportion of Lakes with Territorial Loons Present by Water Clarity Category



USGS Hydrologists John Walker and Randy Hunt will model the potential impacts of future climate conditions on lakes within the Trout Lake watershed in Vilas County. They will investigate whether changes in temperature and precipitation could lead to changes in lake water quality in the region. WDNR Research Scientist Mike Meyer and USGS Research Scientist Kevin Kenow will be heading up crews that will be documenting loon use of lakes within the watershed and at the southern extent of their breeding range—southern and central Wisconsin. Specifically, the research crews will be identifying which lake factors (such as water clarity) nesting loons are looking for when setting up breeding territories. They will then assess whether lake models predict these factors could change under future climate conditions, potentially reducing the amount of lakes suitable for loons in Wisconsin.

Historical accounts and current WBBA Atlas show WI common loon breeding distribution has shifted north



The Wisconsin breeding loon population has shifted north over the past 100 years, it is possible that reduced lake water quality is responsible for this range reduction.. Investigators will examine whether the water quality of southern lakes abandoned by breeding loons is lower than northern lakes currently used by nesting loons. By examining the current quality of lakes once used by loons but are no longer, learning what lake factors loons are currently selecting, and modeling the future condition of lakes in northern Wisconsin under a warming climate, scientists will assess how loons may fare as lake conditions change across the region. Funding for this research project was received from the Wisconsin Focus on Energy Program.

For more information, contact Mike Meyer at WDNR Rhinelander,

Michael.Meyer@Wisconsin.gov

LOONWATCH
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Education • Monitoring • Research

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LoonWatch Mission

Engage, educate and connect students and citizens with resource professionals.

Education • Monitoring • Research