

# FEATHERED FISH: THE COMMON LOON



**Jim Paruk, Ph.D.**  
***Director, Center for Loon  
Conservation***

# OUTLINE

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- **Loon Natural History**
- **A bit of loon conservation**
- **Recent Loon Initiatives at BRI**



Sexes alike. Much to learn about their biology.



# Capture Technique



7 10 '92





- 4000 Common Loons banded
- Throughout North America





	Female	Male
<b>Bill Length (mm)</b>	84.1	87.1
<b>Bill Width (mm)</b>	13.7	14.7
<b>Bill Depth (mm)</b>	23.2	25.2





	<b>F</b>	<b>M</b>
<b>Weight (g)</b>	<b>3650</b>	<b>4450</b>

# BACKGROUND: CLINAL VARIATION\*

State	Body Mass (g)** Female-Male Averages	Tarsus (mm)*** Female-Male Averages
MN	3500, 4300	22.8, 24.8
WI	3650, 4550	23.6, 25.0
NY	4300, 5600	24.8, 26.9
NH	4700, 6000	25.0, 26.9

\*BRI database

\*\*Based on > 100 individuals for each sex

\*\*\*Based on > 50 individuals for each sex

# LOON NATURAL HISTORY

The oldest banded BRI loon is \_\_\_\_\_ years old.

- a.12
- b.15
- c.20
- d.24



Big Birds live a long time (longevity).

# LOON NATURAL HISTORY

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Big Birds have high annual survivorship

94% of all adults return each year



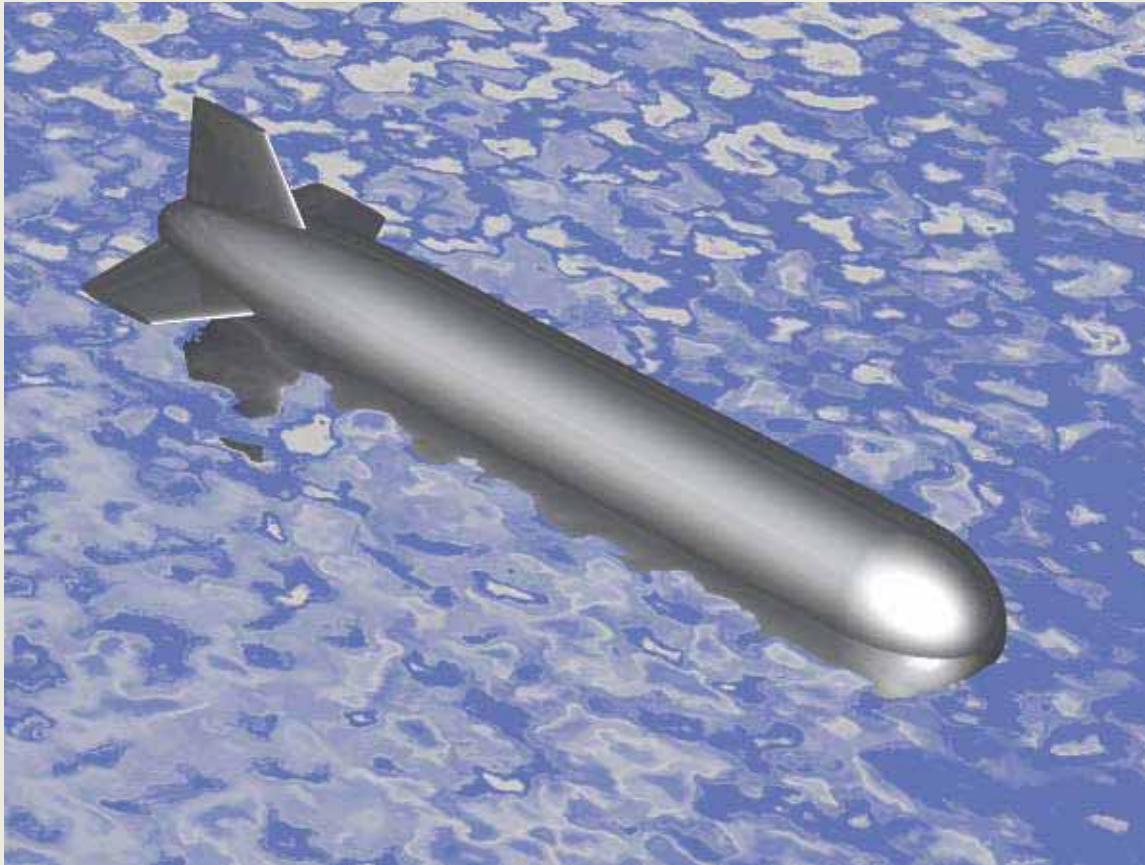
## The Loon Niche



fish- eater or piscivore (Pisces)

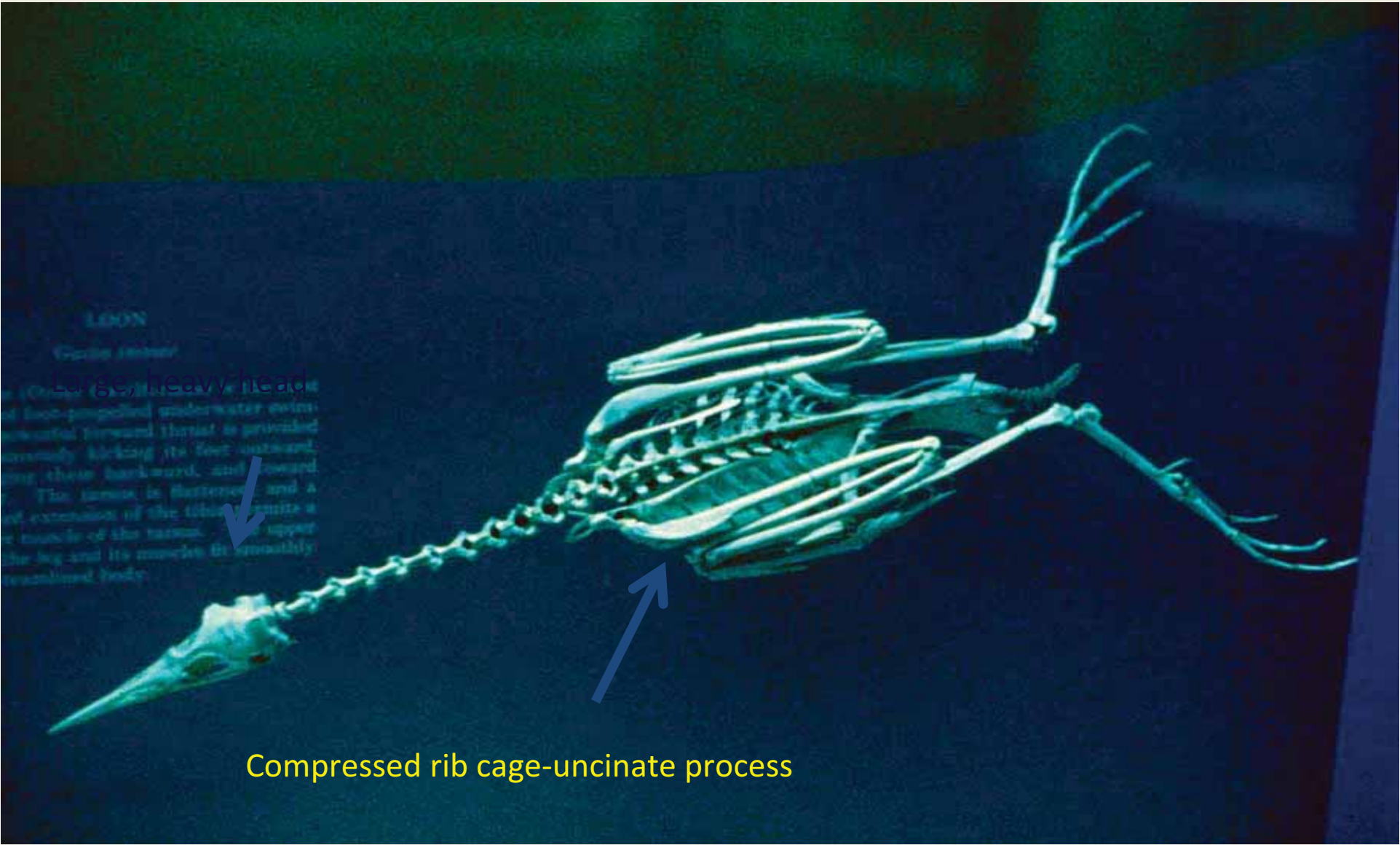
**Better be pretty darned good at catching fish!**

# Internal Anatomy



Skeleton cries out for sleekness (head to tail)  
No extra processes or points that stick out

# Internal Anatomy



LOON  
Gavia immer  
The loon is a foot-propelled underwater swimmer. Its essential forward thrust is provided by its feet, which it kicks outward, backward, and forward. The tarsus is flattened, and a long extension of the tibia permits a large muscle of the tarsus. The upper leg and its muscles fit smoothly into the body.

Compressed rib cage-uncinate process

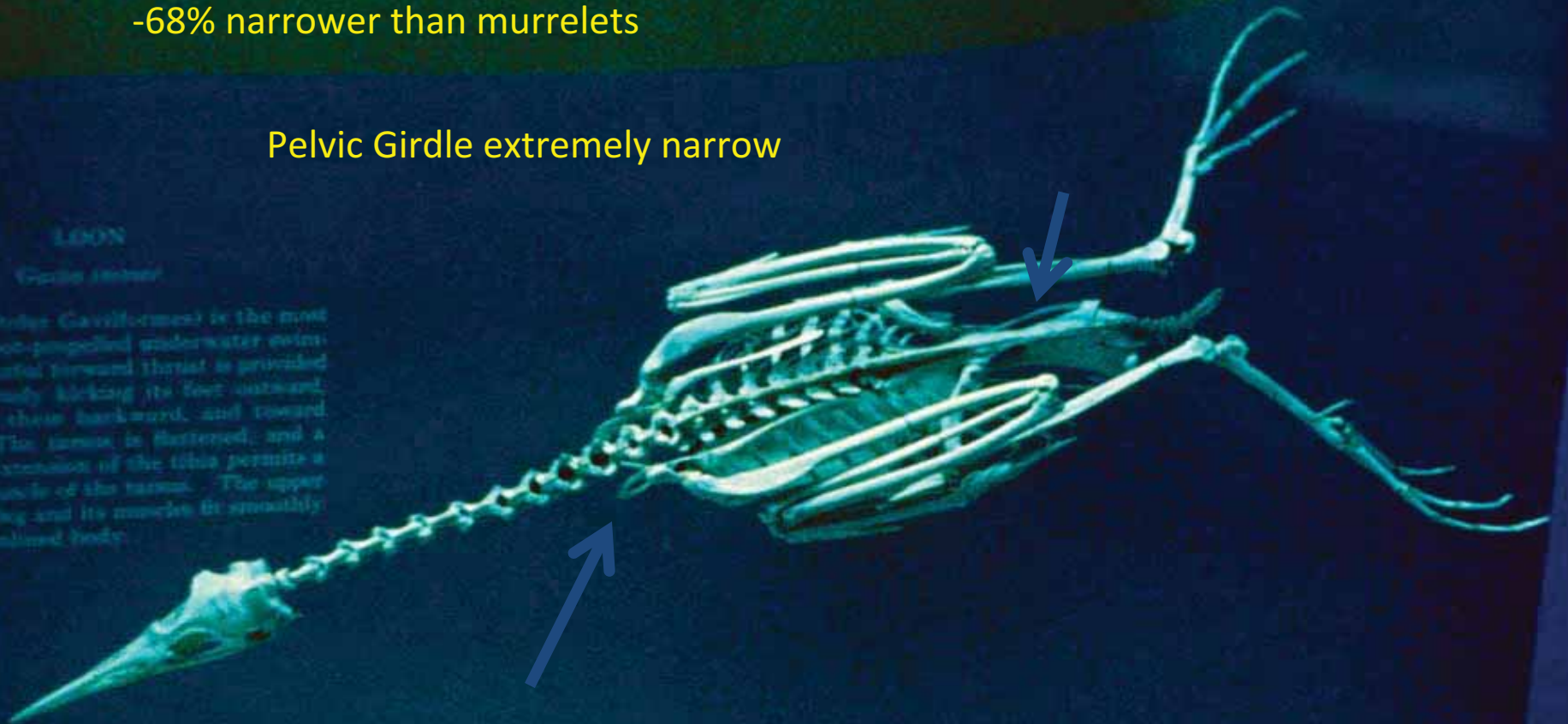
# Internal Anatomy- streamlining

- 33% narrower than grebes
- 39% narrower than murre
- 68% narrower than murrelets

Pelvic Girdle extremely narrow

LOON  
Gavia immer

(Order: Gaviiformes) is the most  
essential forward thrust is provided  
by kicking its feet outward,  
and then backward, and toward  
the body. The tarsus is flattened, and a  
great extension of the tibia permits a  
long muscle of the tarsus. The upper  
leg and its muscles fit smoothly  
underneath the body.



Narrow furculas (clavicle) or wish-bone, not wide  
as found in other strong flyers

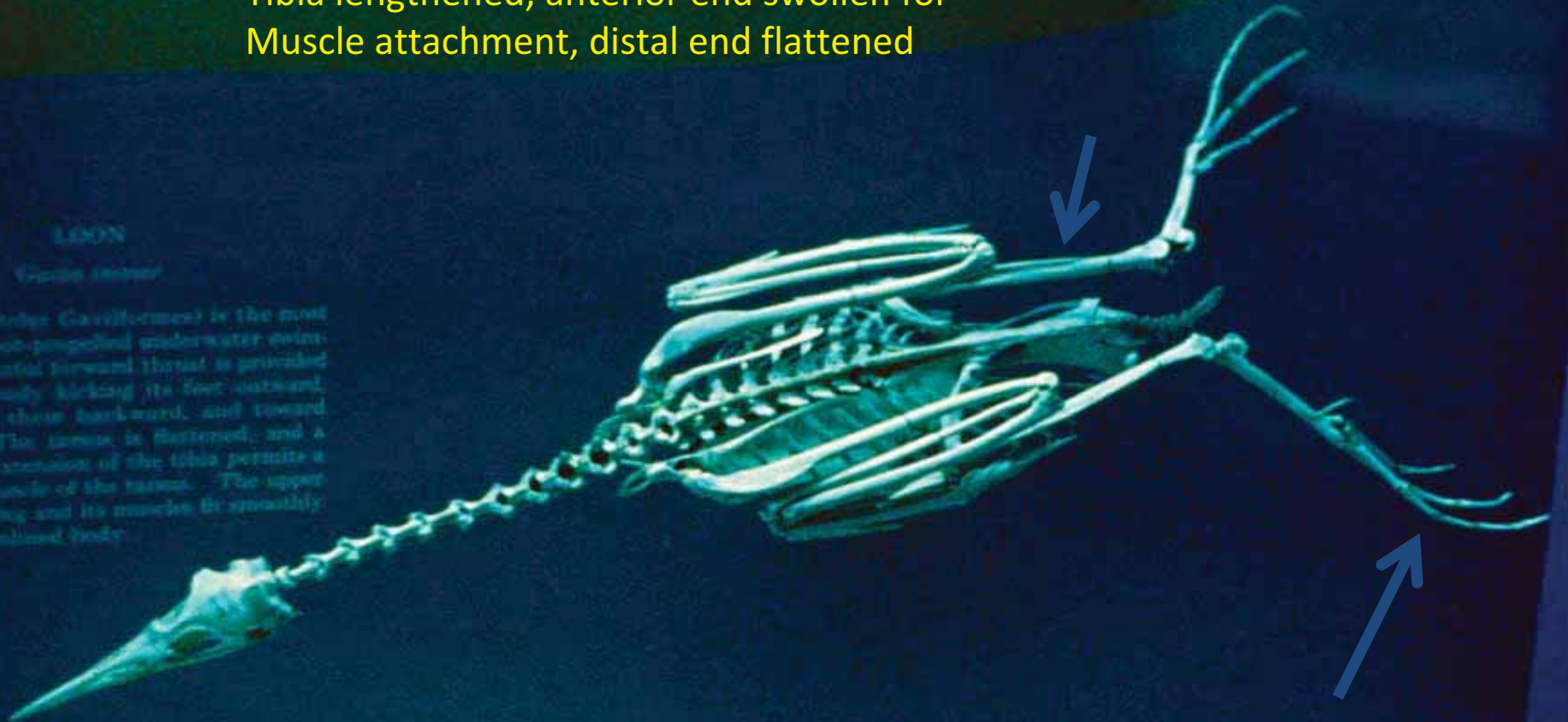


# Internal Anatomy- streamlining

Tibia lengthened, anterior end swollen for  
Muscle attachment, distal end flattened

LOON  
Gavia immer

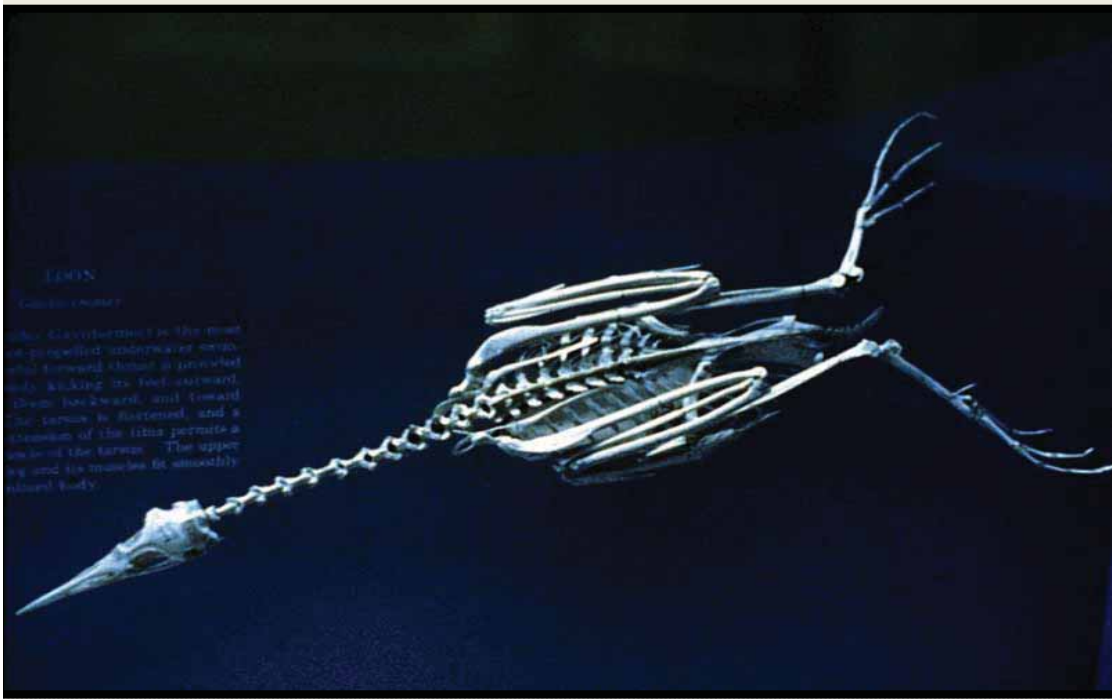
(Order: Galliformes) is the most  
of foot-propelled underwater swim-  
essential forward thrust is provided  
erely kicking its feet outward,  
ng them backward, and toward  
The tarsus is flattened, and a  
ed extension of the tibia permits a  
r muscle of the tarsus. The upper  
the leg and its muscles fit smoothly  
streamlined body.



Toes elongated, big toe reinforced

# Anatomical modifications

flattened leg bones



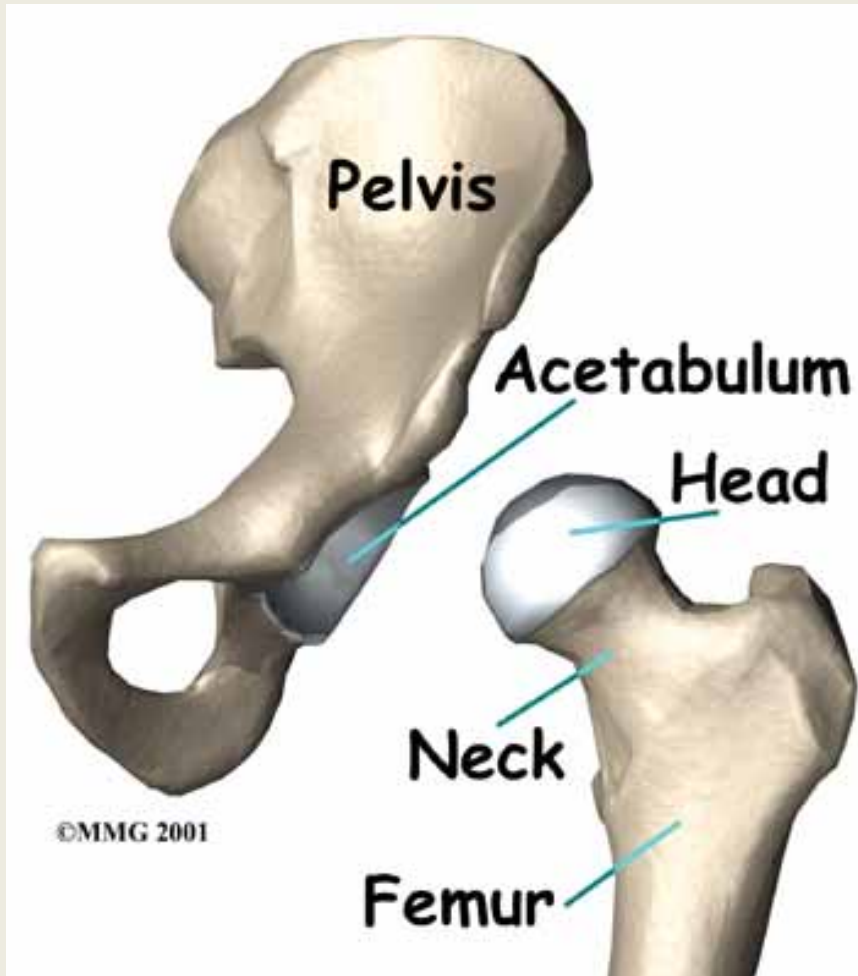
**Trade-off, clumsy on land**

**Loon, derived from Shetland Islands "loom", which  
Comes from Icelandic "lomr", or from Swedish "lom."**

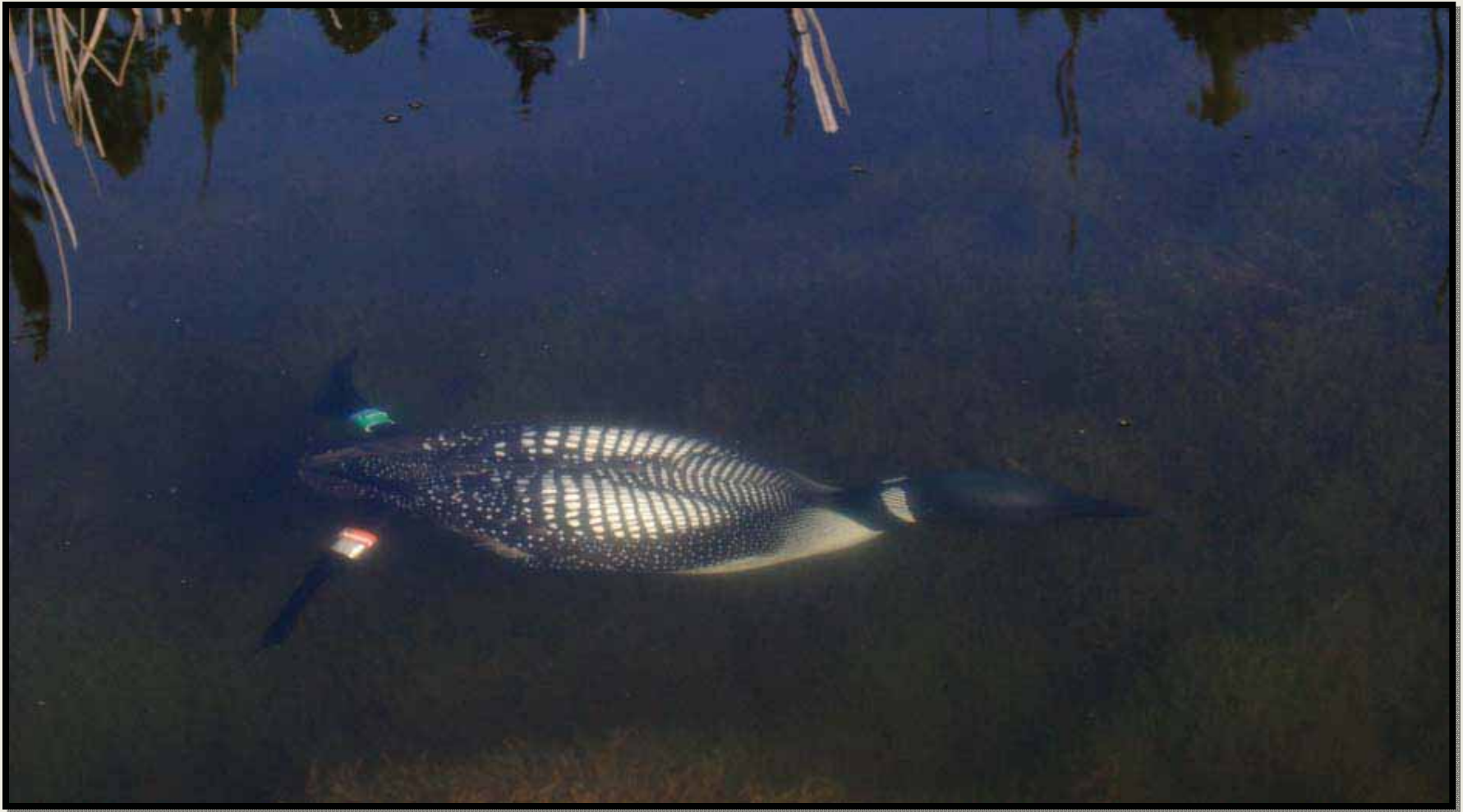




Compared to other birds, loon keel is shallow → streamlined;  
Trade-off, not a lot of space left for muscle attachment →  
difficulty in take-off.



Human Hip- leg firmly attached to hip  
Loon hip → no acetabulum. Not firmly attached. Trade-off?  
Phenomenal range of motion (like our shoulder)



Full range of motion for legs

Loons have BIG FEET!



## Hydrodynamic Design to minimize drag

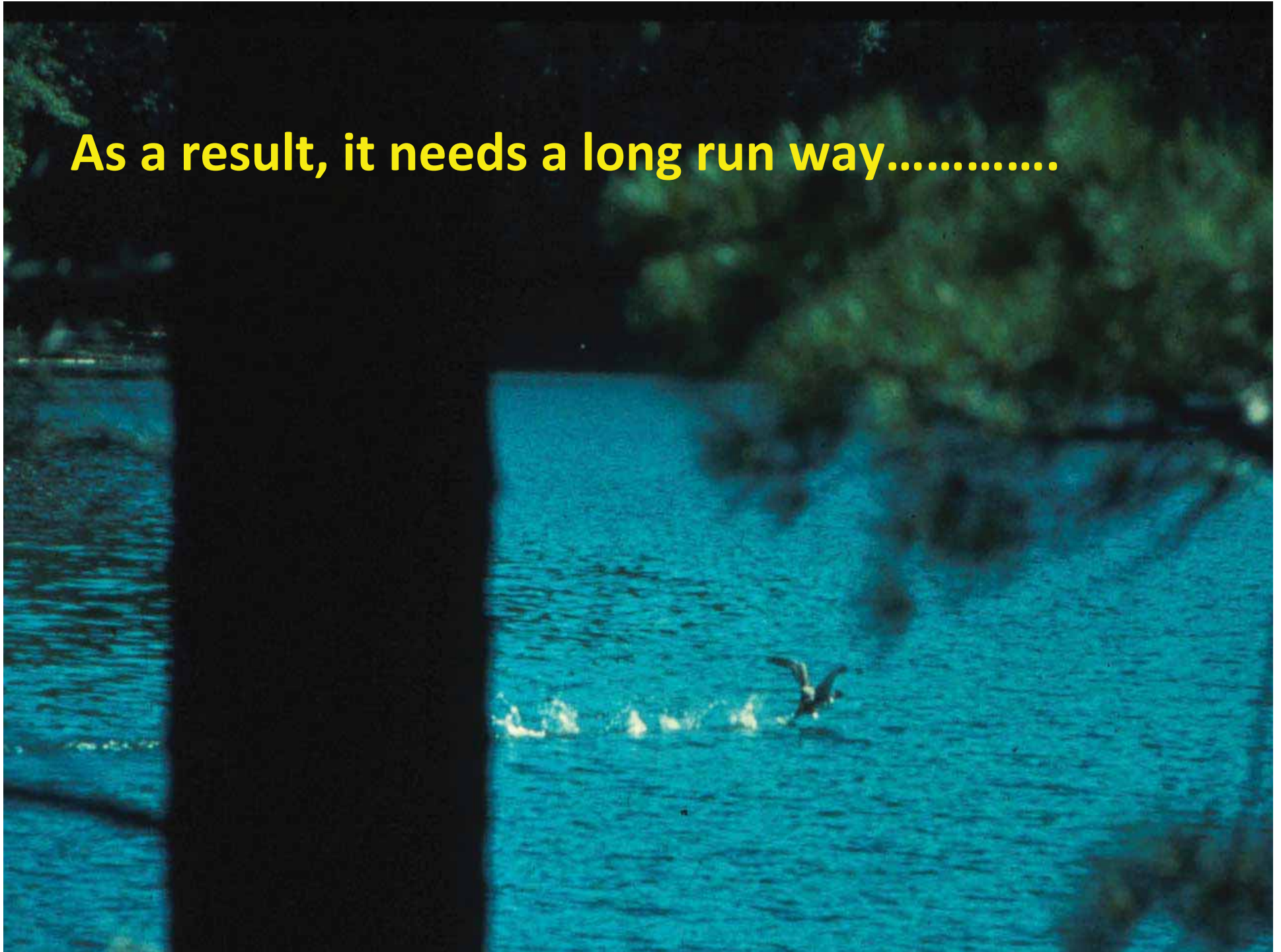
Narrow head (no crest feathers), narrow shoulders, narrow hips, short wings (trade-off)

Wings are 20% shorter for a bird its size





**As a result, it needs a long run way.....**







**Must fly rapidly to keep aloft,  
~70-75% mph (no gliding!)**

# LOON NATURAL HISTORY

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Fish are found in lakes → Loons feed on fish →  
Loons need lakes  
(competition for lakes/territories)



# LOON NATURAL HISTORY

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Not all lakes are created equally



Less competition



More competition

**Do Loons mate for life?**



# SWANS & ALBATROSSES MATE FOR LIFE

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Continuous Partnerships

## Continuous partnerships (monogamy)

### Advantages:

1. Familiarity
2. Develop coordination

### Outcome:

- a. Better reproductive success
- b. Low Annual Divorce Rate (<5%)



## Part-Time Partnerships - Puffins, kestrels, gulls

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1. Do not stay together year-round
2. Come together to breed (raise young)
3. Winter in different locales  
(reduce competition?)



### Outcome:

High Annual Divorce Rate (20-40%%)

What type of partnership do loons exhibit?



1. Part-time partnership and the “divorce” rate is relatively high (~40%)

# Why Divorce?

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- 1) One partner may desert the other
- 2) One partner may be chased away, usurper
- 3) Pre-empted by earlier arrival
- 4) “up-teen” other ideas.....

Loons appear to have allegiance to the territory, not the mate.



# The Dark Side of the Loon



**They compete aggressively for territories**





**Males die with sternal puncture wounds,  
Many outcomes fatal**

# OUTLINE

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- Loon Natural History

- **A bit on loon conservation**

- Recent Loon Initiatives (research) at Biodiversity Research Institute (BRI)

# CONSERVATION STATUS IN NORTH AMERICA

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- **~250, 000 territorial pairs (robust)**
- **Over 94% of the breeding loon population resides in Canada (National Bird of Canada)**
- **Of 6% in USA, 2% breed in AK, so only 4% entire NA population resides in lower 48 (8500-8800 pairs)**




# CONSERVATION STATUS IN UNITED STATES

Match the following: Most to least # of breeding pairs

1. A. Maine
2. B. Michigan
3. C. Minnesota
4. D. New York
5. E. Wisconsin
  
6. A. Massachusetts
7. B. Montana
8. C. New Hampshire
9. D. Vermont
10. E. Wyoming



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- A photograph of two Common Loons in a wetland habitat. One loon is on a grassy bank, and the other is in the water. The background is filled with tall, dry reeds. The text is overlaid on the image in yellow.
1. Minnesota (4500 pairs)
  2. Maine (~1700 pairs)
  3. Wisconsin (1250 pairs)
  4. Michigan (400 pairs)
  5. New York (250 pairs)

6. New Hampshire (200 pairs)
7. Montana (60 pairs)
8. Vermont (50 pairs)
9. Massachusetts (25 pairs)
10. Wyoming (22 pairs)

# CONSERVATION STATUS IN UNITED STATES

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## Statewide Trends



**Wisconsin, Vermont, New Hampshire and Massachusetts**



**New York, Maine, Montana, Alaska, Minnesota, Washington**



**Michigan, North Dakota**



# MASSACHUSETTS LOONS

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- 1 pair (1975) to 24 pairs (2004)
- Quabbin Reservoir
- Monitoring efforts established



# VERMONT LOONS

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- 12 pairs (1980)  
59 pairs (2002)
- Vermont Center for  
Ecostudies/ Vermont  
Institute of Natural  
Sciences
- Set out rafts, educate  
public (Eric Hanson)



# NEW HAMPSHIRE LOONS

- 87 pairs (1980)  
199 pairs (2002)  
>250 pairs (2010)
- Rawson Wood, founder of Loon Preservation Committee (LPC), 1975
- Set out rafts, educate public



# New Hampshire Lead Legislation

## ● 2000

- Restricted use on lakes and ponds of:
  - Sinkers 1 oz. or less
  - Jigs <1 inch along longest axis



## ● 2005

- Restricted use of above tackle sizes on all freshwater

## ● 2006

- Restricted sale of above tackle sizes

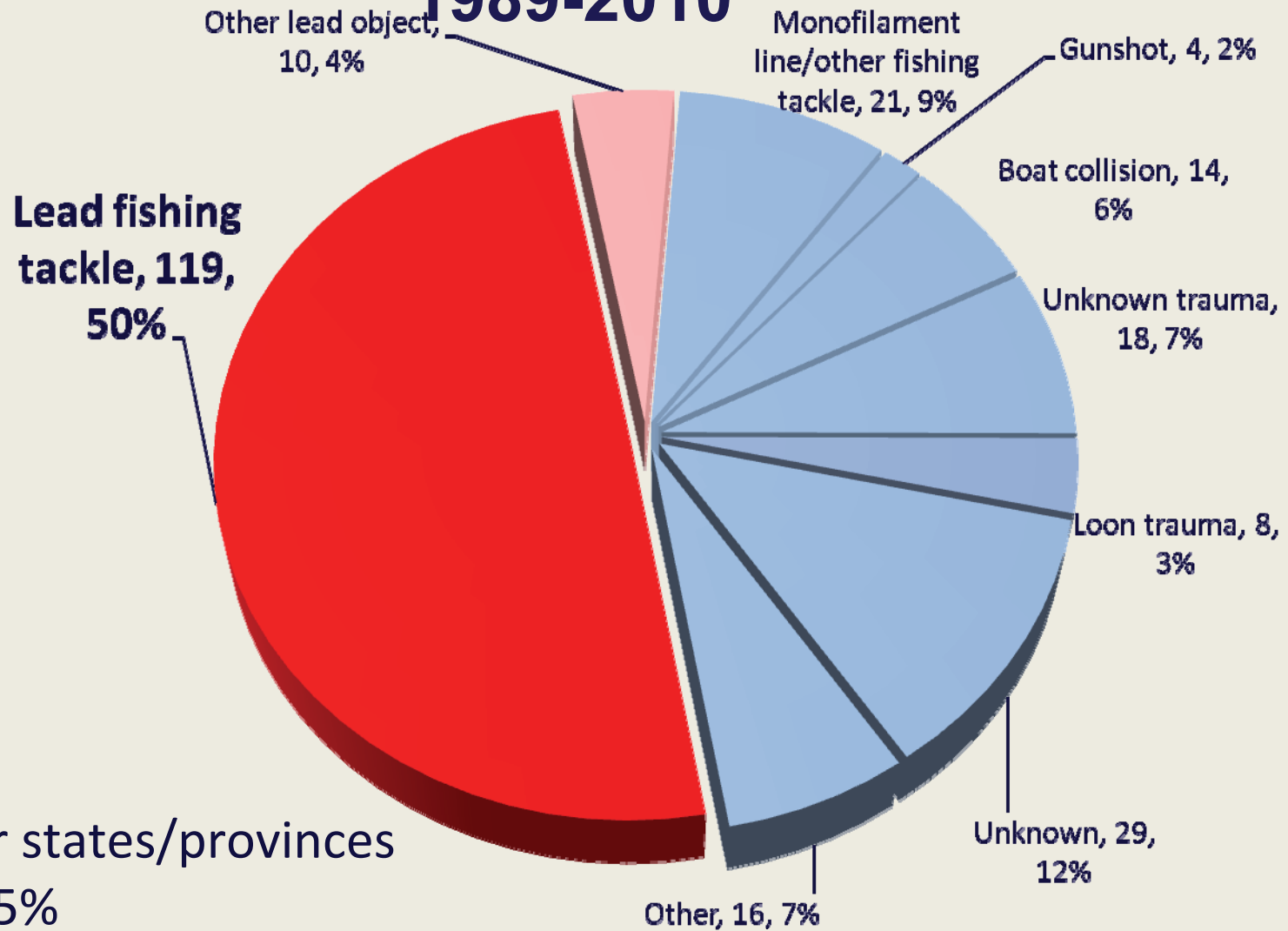
# Methods

## Radiographs and gizzard contents



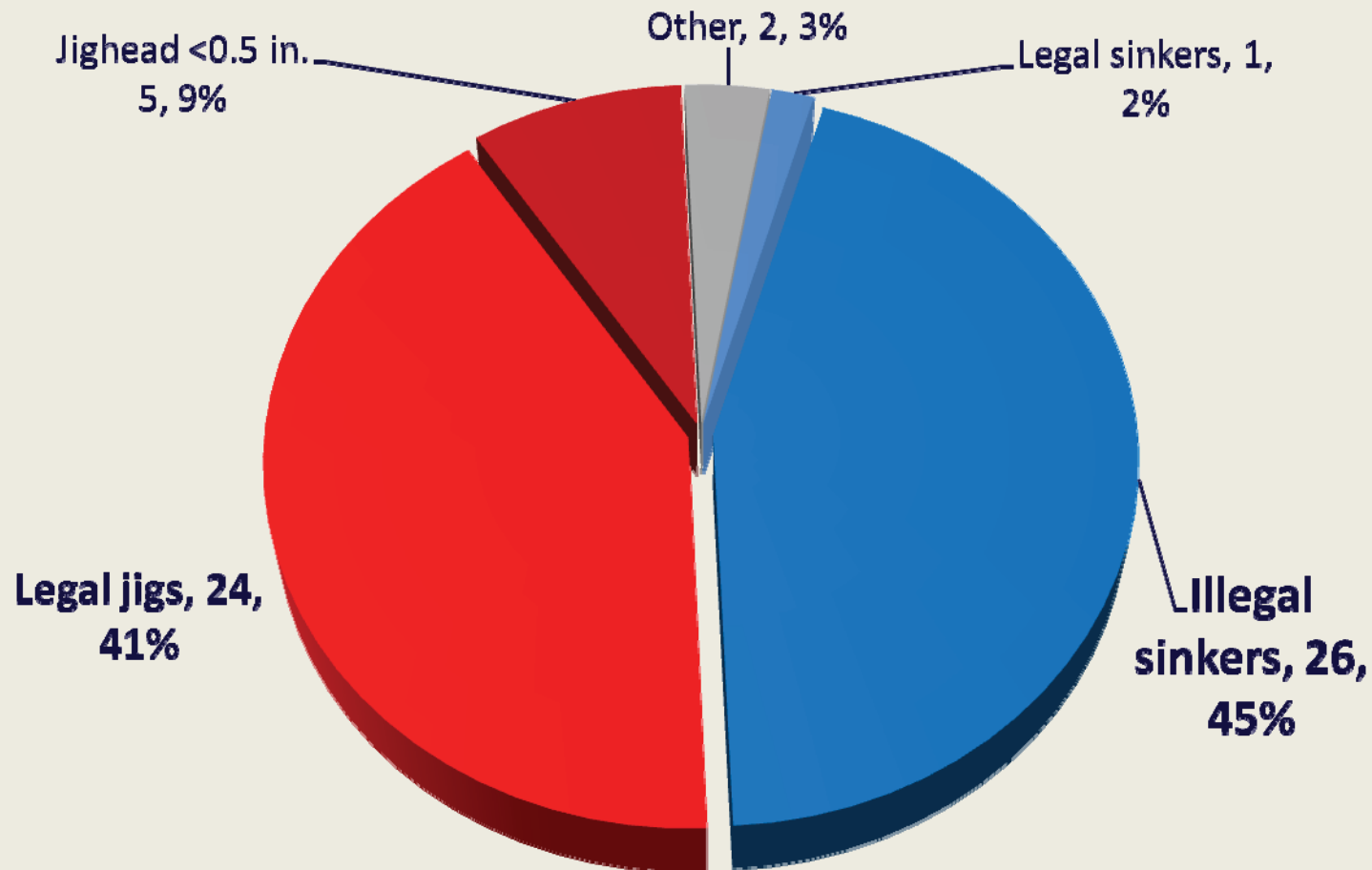


# Documented causes of mortality in NH adult loons, 1989-2010

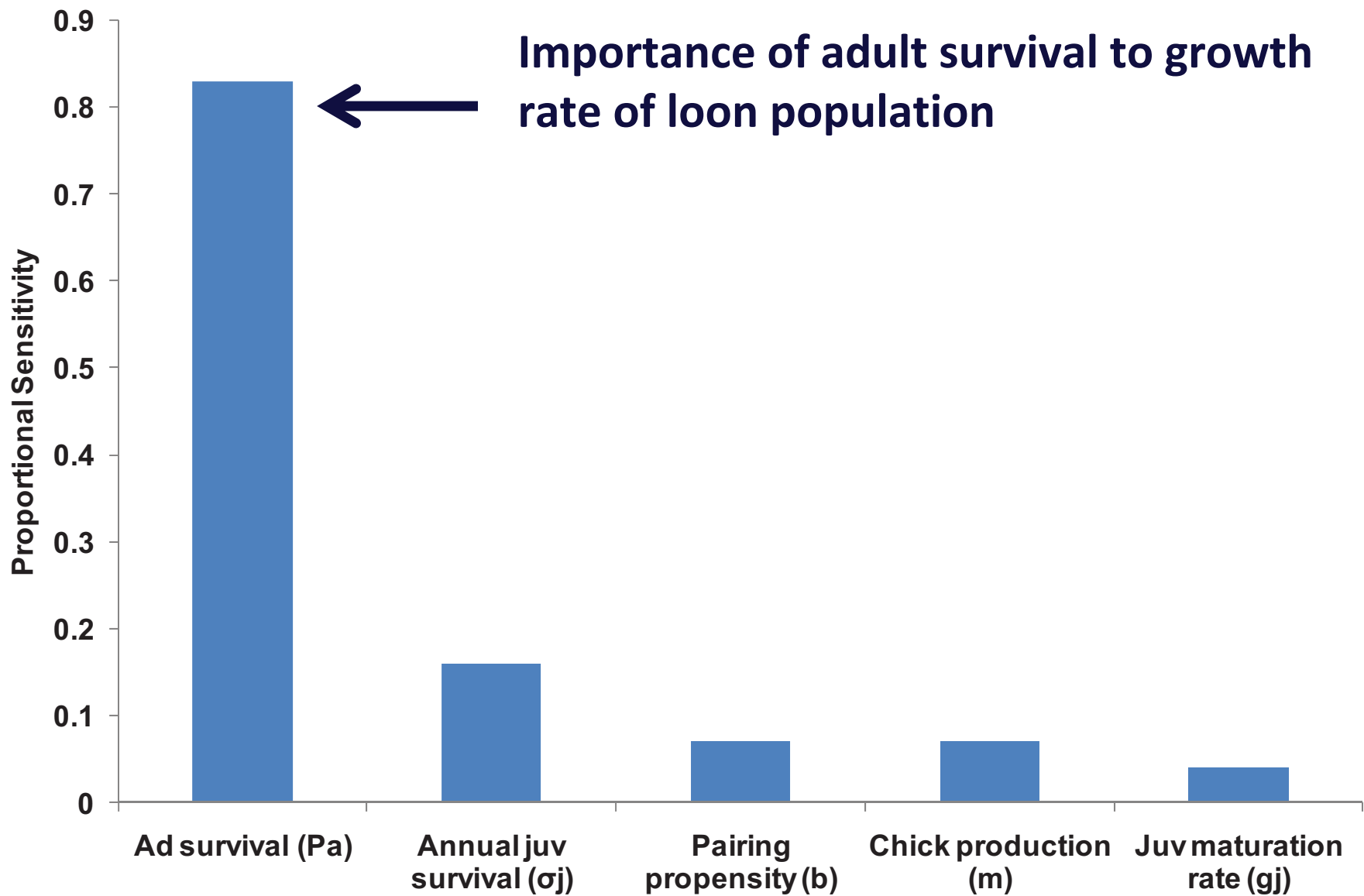


Some other states/provinces  
show 20-25%

# Types of lead objects inside loons, 2000-2010



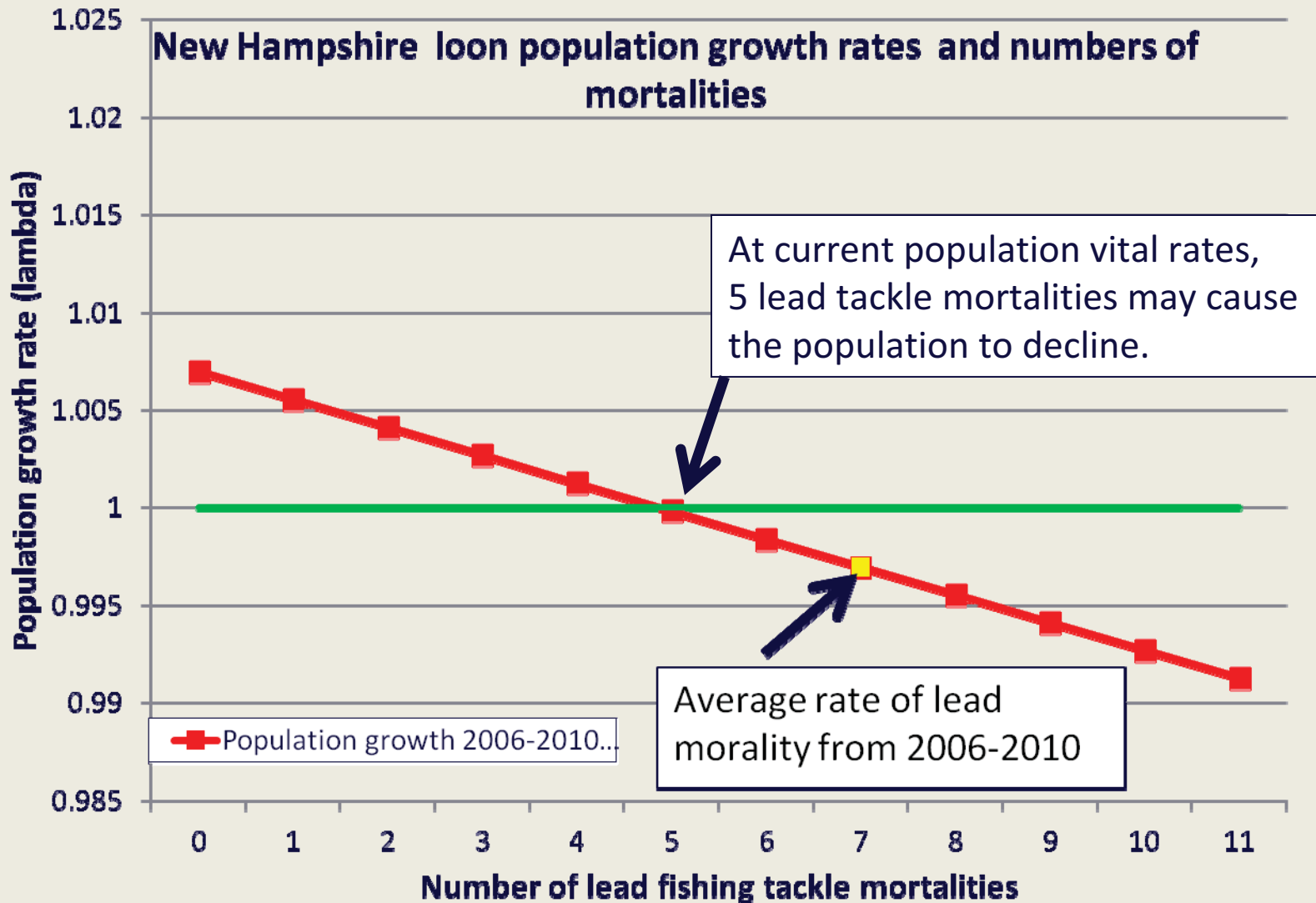
Dual problem for loons: 1) inadequate size standards for jigs  
2) lack of compliance with existing regulations (sinkers)



Proportional sensitivities of population growth rate to lower level vital rates for New Hampshire (from Gear et al. (2009), Table 3)

# Population-level impacts

## Population projections and lead tackle mortalities





**MAINE LOONS  
-APPEAR TO BE DOING WELL**

Next Era Energy manages a number of the lakes  
(FERC)







**Bill Hanson, NEE Biologist, nationally recognized for his conservation efforts**





Watermarks: water levels regulated by dams

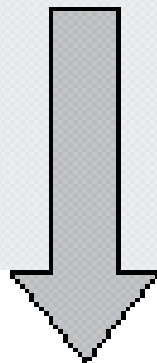
**2000- Made major rule curve change  
Namakan Lake (reservoir)**

- 1. Timing: move peak from end of June to  
first of June**
- 2. Fluctuation: from 3 m to 2 m**

**Result: Productivity increased 45%**

# Mercury Cycle

Air  
Deposition



Watershed



Humans

Birds



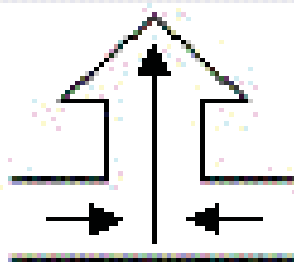
Mammals

Fish ← Invertebrates

Methylation → Algae → Plankton

Soils

Sediments



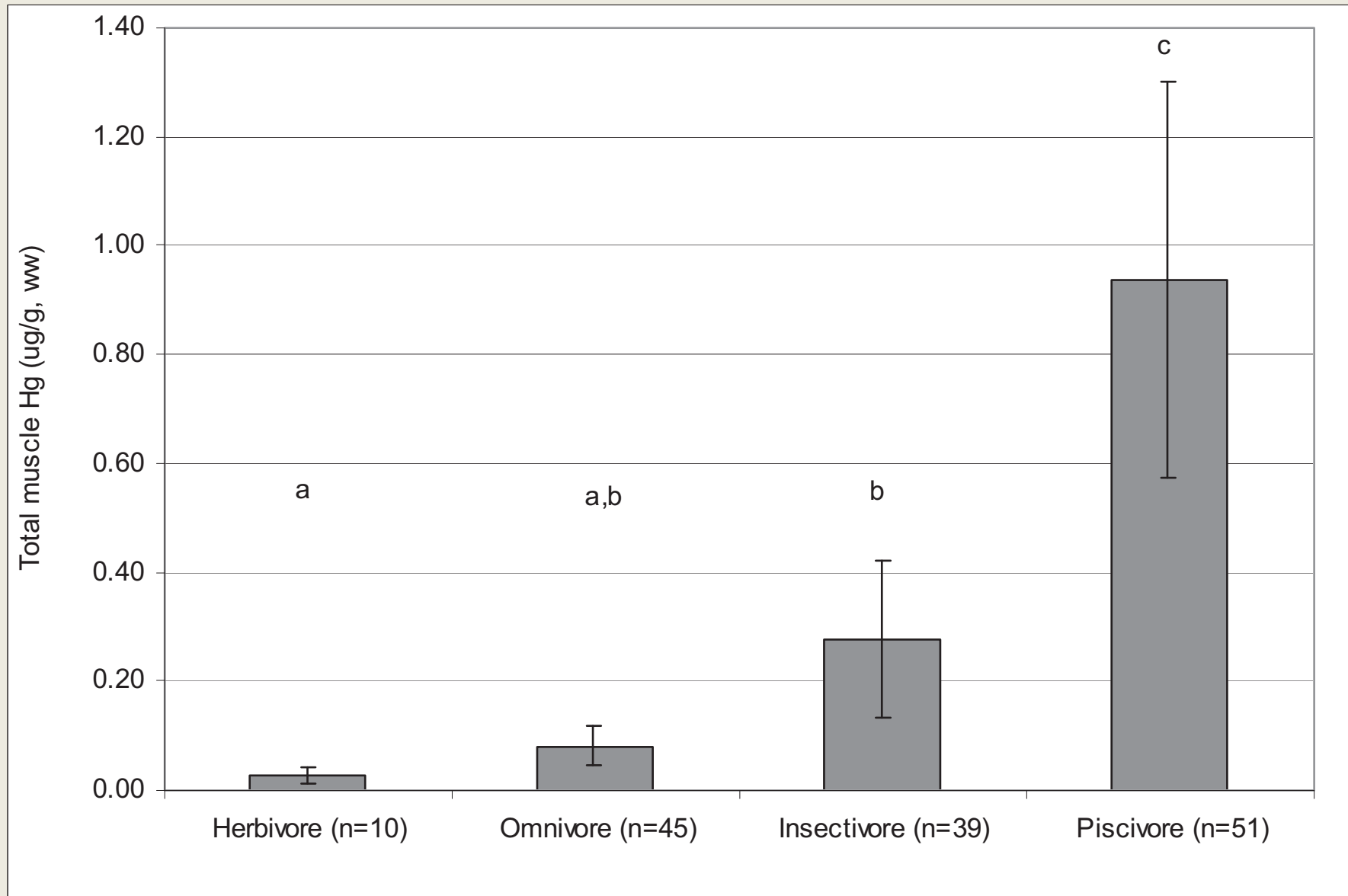
Water  
Chemistry

Hydrology

Physiognomy



# Blood mercury measured in different waterfowl foraging guilds



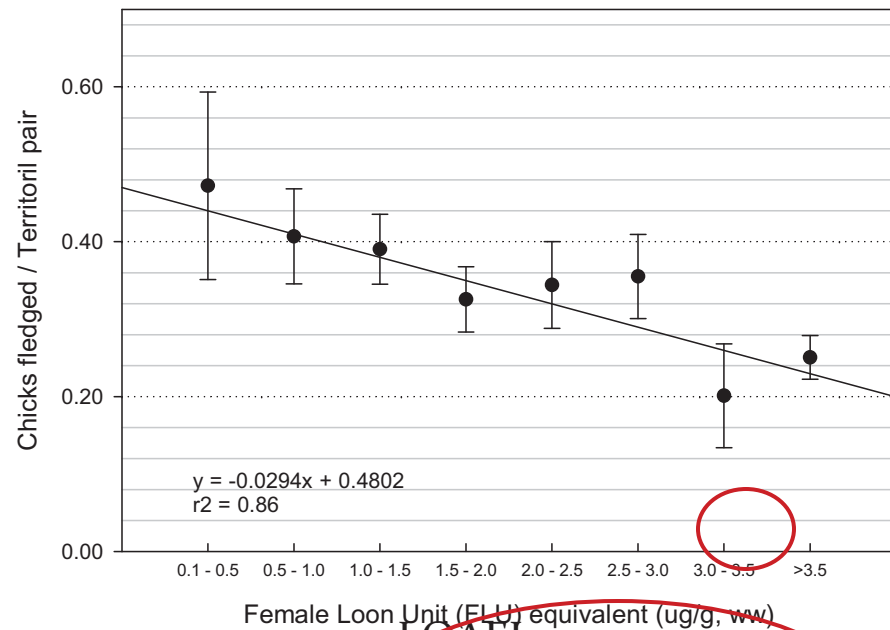
# Common Loon – reproductive effects now shown in New England



A. Recent findings from a 10-year study indicate sig. relationship between increasing Hg levels and:

1. Physiological changes
2. Abnormal behavior
3. Survival
4. Reproductive success

B. Some areas of the Northeast contain population sinks because of Hg – detecting this is difficult



LOAELS

Blood = 3.0 ppm (ww)

Feather = 40 ppm (fw)

Egg = 1.3 ppm (ww)

# OUTLINE

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- **Loon Natural History**
- **Brief Loon Conservation**
- **Recent Loon Initiatives at BRI**



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MARQUIL  
empirewire.com

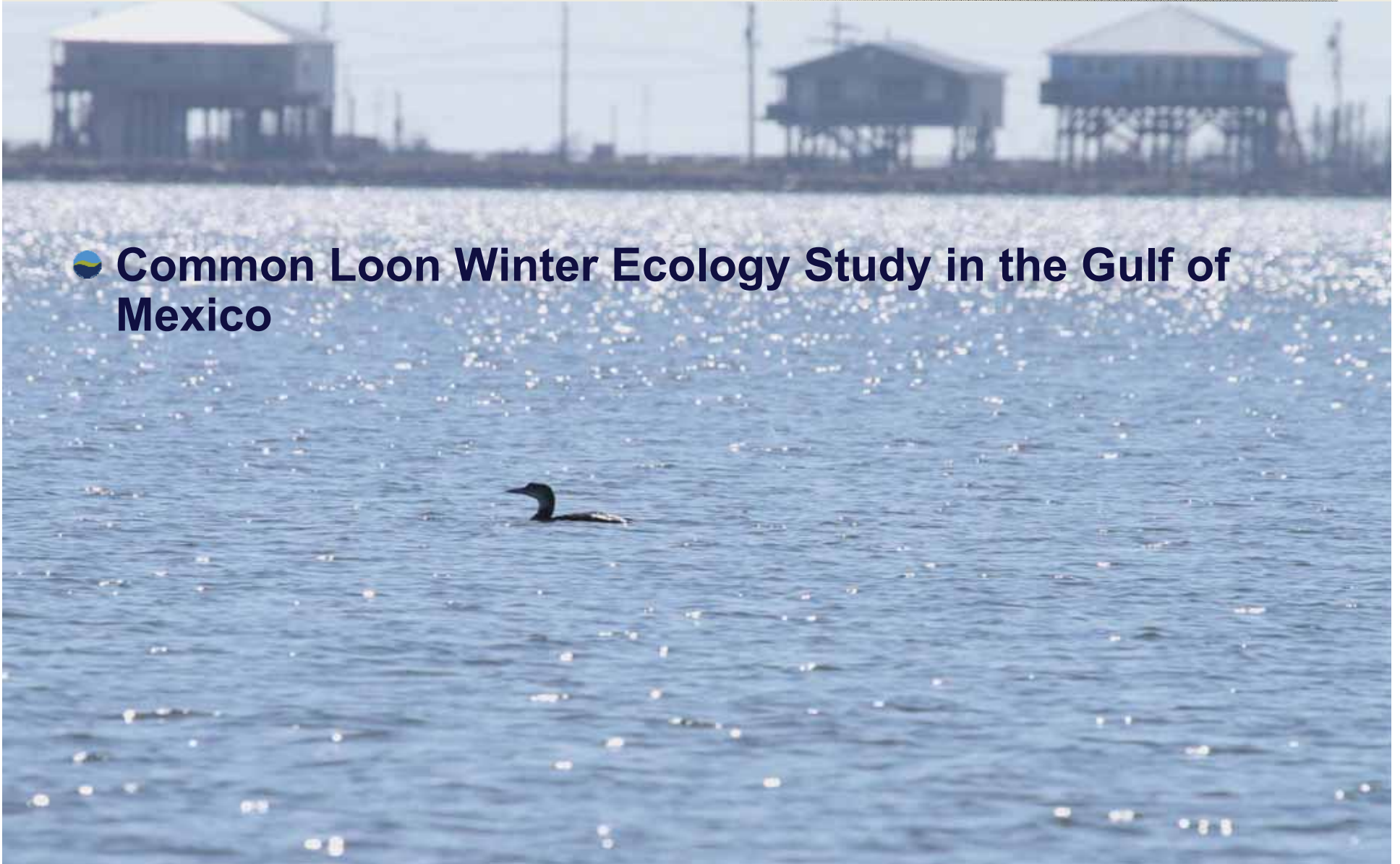


Science to study loon migration

# CENTER FOR LOON CONSERVATION INITIATIVE #1

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- **Common Loon Winter Ecology Study in the Gulf of Mexico**

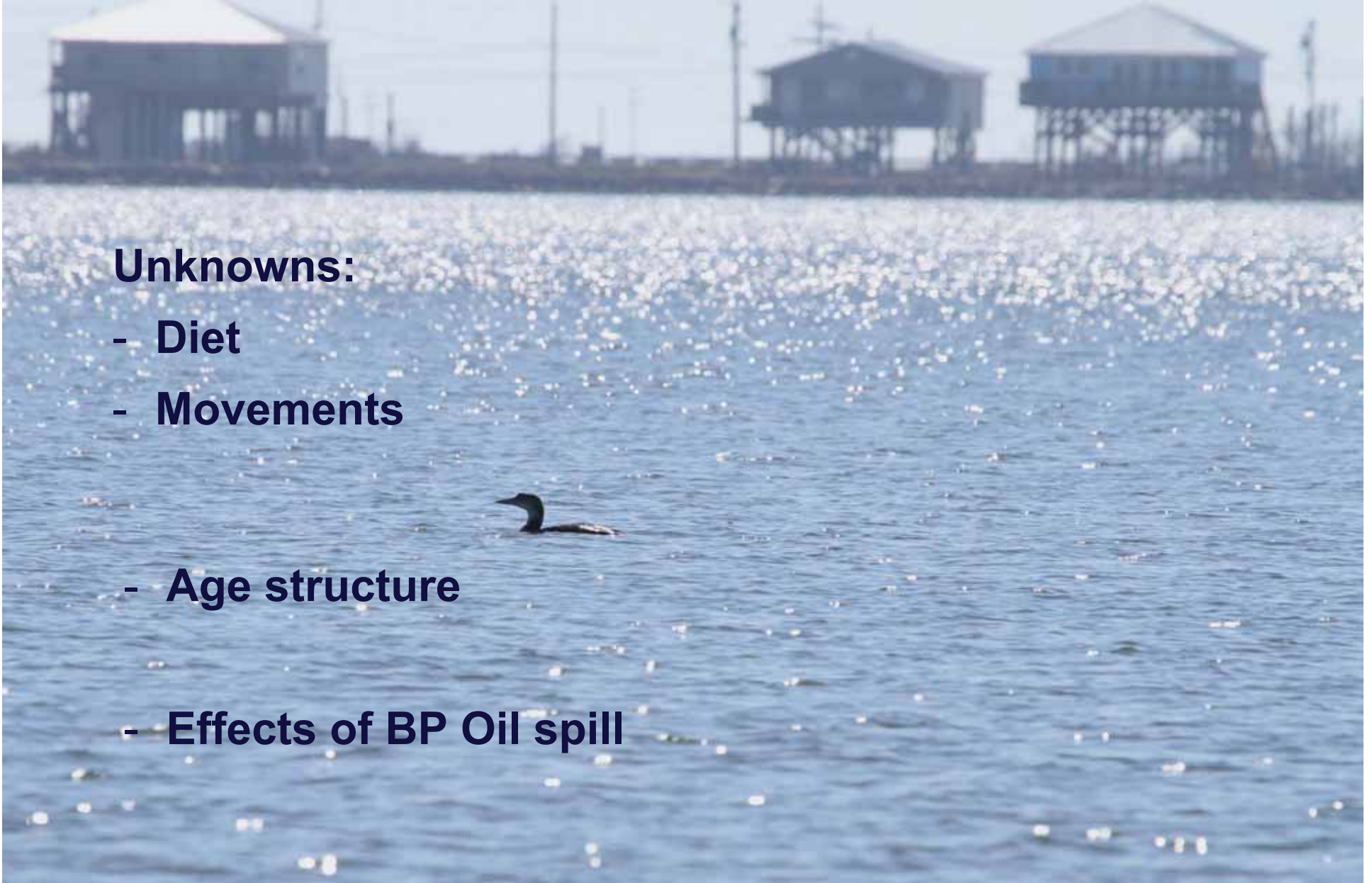


# CENTER FOR LOON CONSERVATION

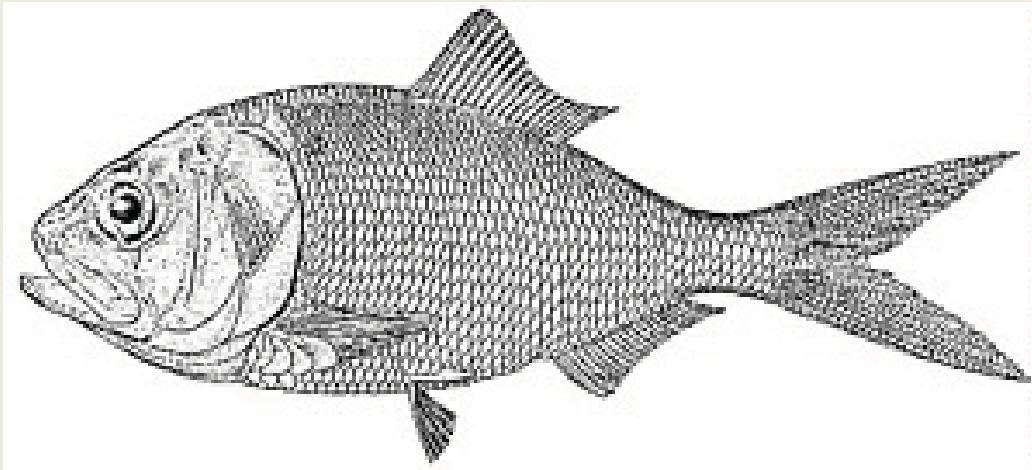
## INITIATIVES #2

### Unknowns:

- Diet
- Movements
- Age structure
- Effects of BP Oil spill







Very large head

Filter 4-8 gal/minute

Planktivores

Gulf Menhaden (*Brevoortia patronus*)





Largest Fishery in Gulf

Forms enormous schools

Many fish depend on them

Gulf Menhaden

## **AND LOONS JOIN THEM FLOCK-FEEDING ON MENHADEN**

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**One flock > 700 loons!**

BRI interested in Migration Routes/Breeding Grounds



# SPRING MIGRATION

Arrives at Breeding Lake,  
North-east Saskatchewan,  
Day 52  
Total Trip: 2,309 miles

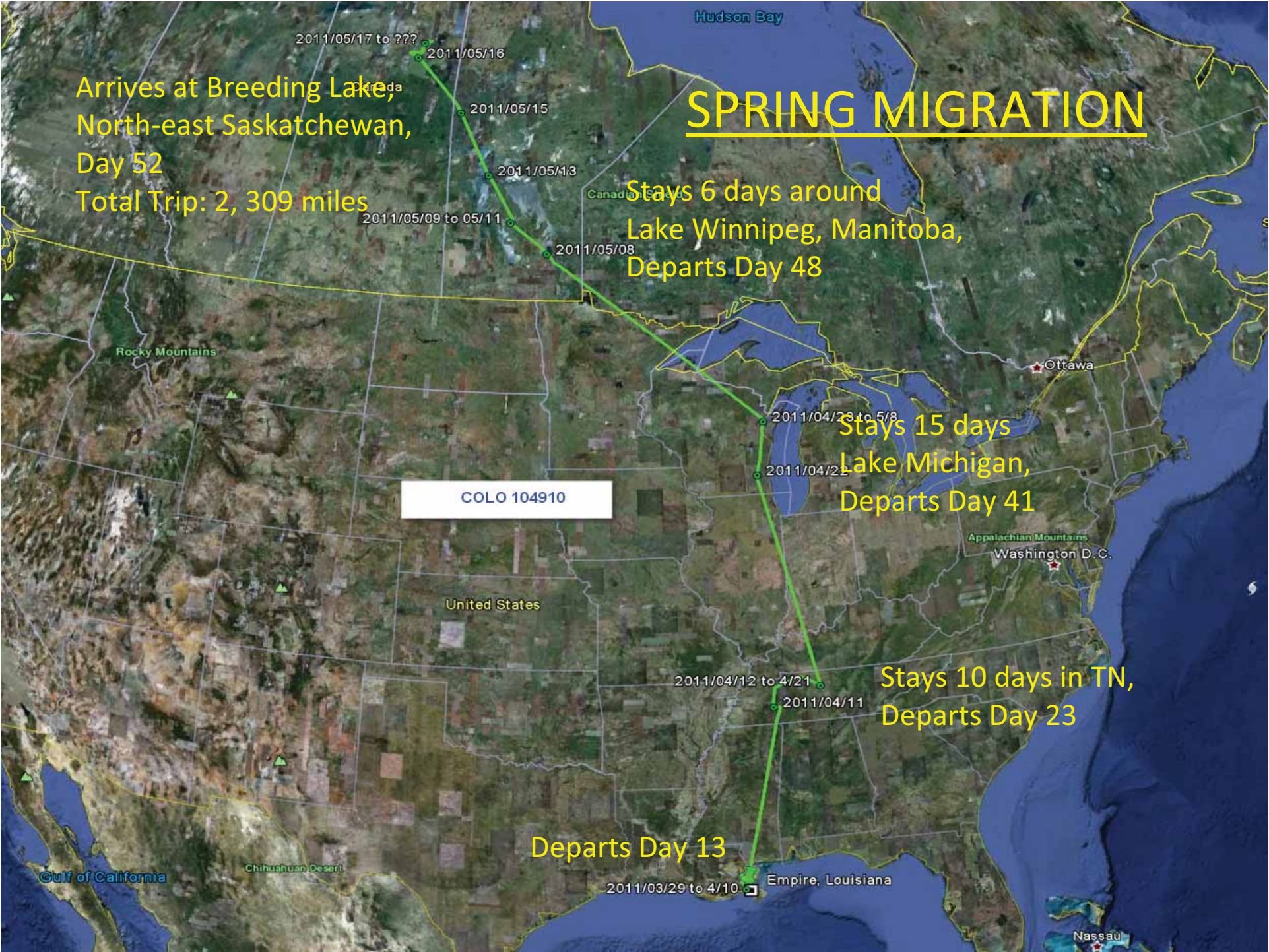
Stays 6 days around  
Lake Winnipeg, Manitoba,  
Departs Day 48

Stays 15 days  
Lake Michigan,  
Departs Day 41

Stays 10 days in TN,  
Departs Day 23

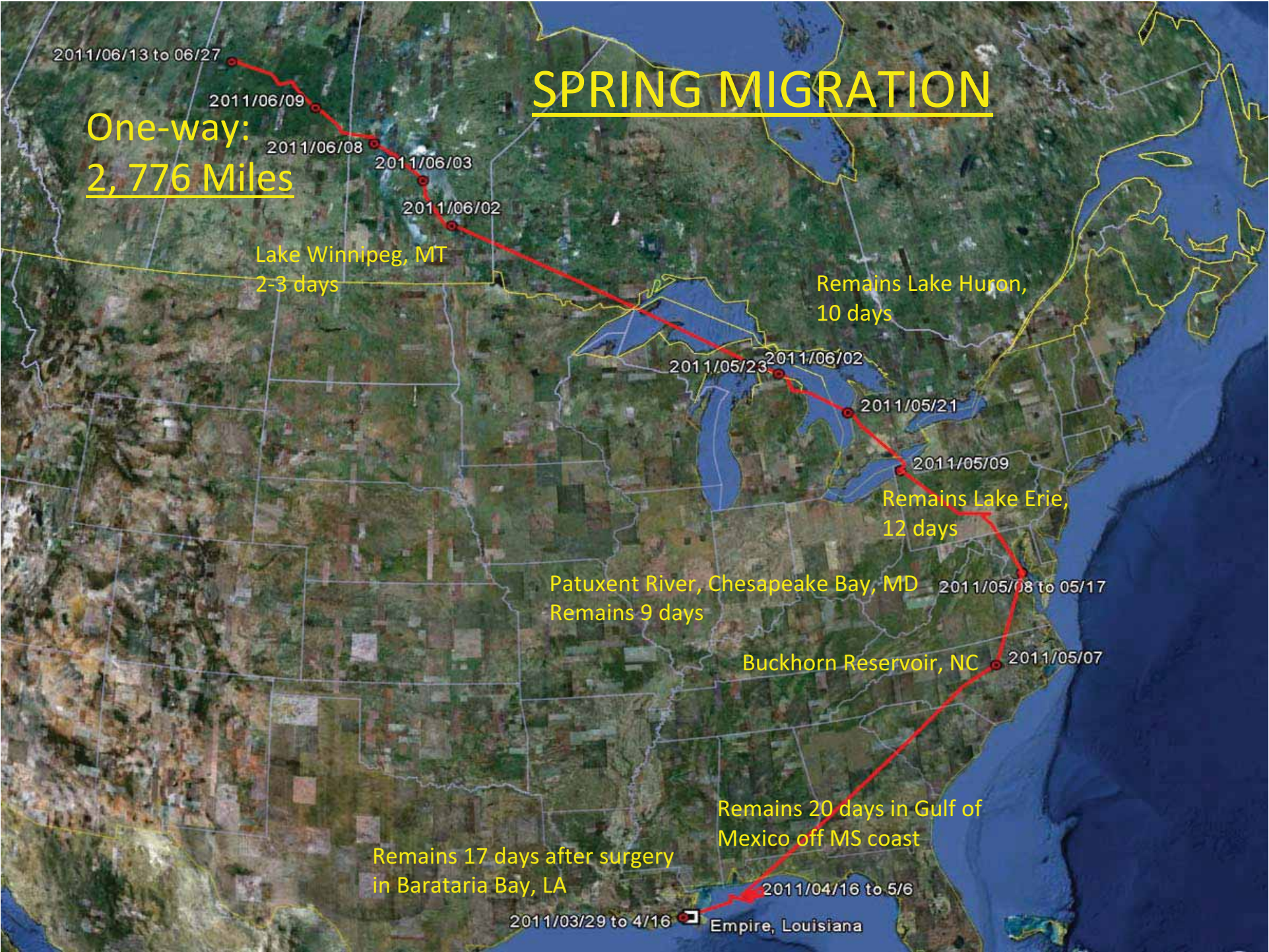
Departs Day 13

COLO 104910



# SPRING MIGRATION

One-way:  
2, 776 Miles



Lake Winnipeg, MT  
2-3 days

Remains Lake Huron,  
10 days

Remains Lake Erie,  
12 days

Remains 17 days after surgery  
in Barataria Bay, LA

Remains 20 days in Gulf of Mexico  
off MS coast

# SURPRISING RESULTS

1. Both birds ended up in Saskatchewan, not the Midwest.
2. It was known that birds in Saskatchewan winter off Pacific coast of North America.
3. New migratory pathway?
4. Potential mixing of Western and Central breeding loon populations



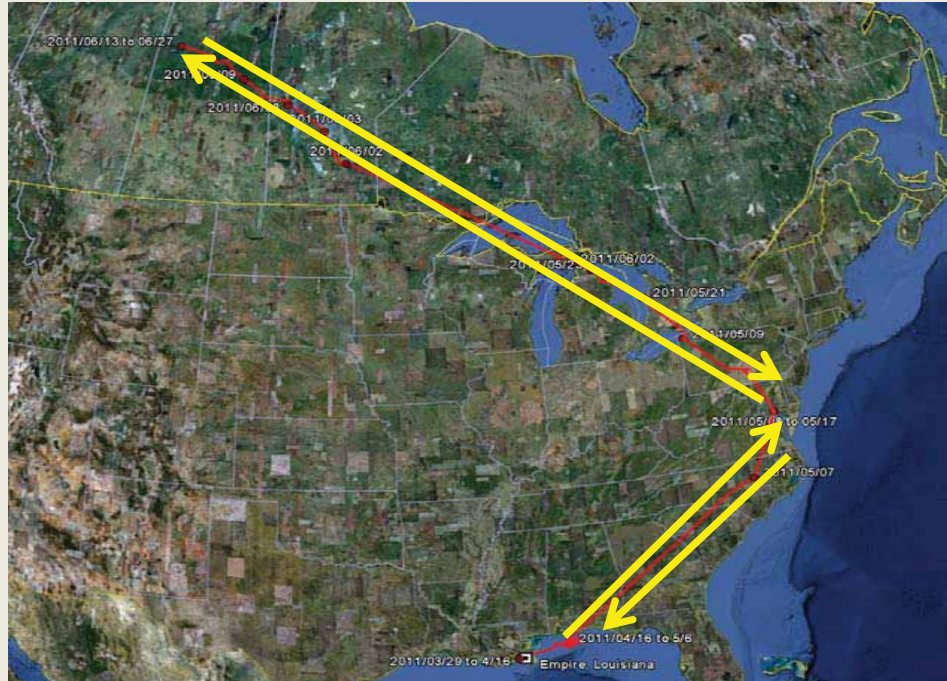




# SURPRISING RESULTS

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Female flew all the way east to Chesapeake Bay, why?



- It is unknown where first-year birds hang out
- It is possible they spend time on ocean, or bays, such as Chesapeake....so, they went to a familiar place
- adult birds may simply retrace their migratory pathway used as younger birds.

# CENTER FOR LOON CONSERVATION INITIATIVE #2

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- Yellow-billed Loons  
(candidate species for federal listing)
- One of top 10 rarest birds in NA
- < 1000 pairs in AK

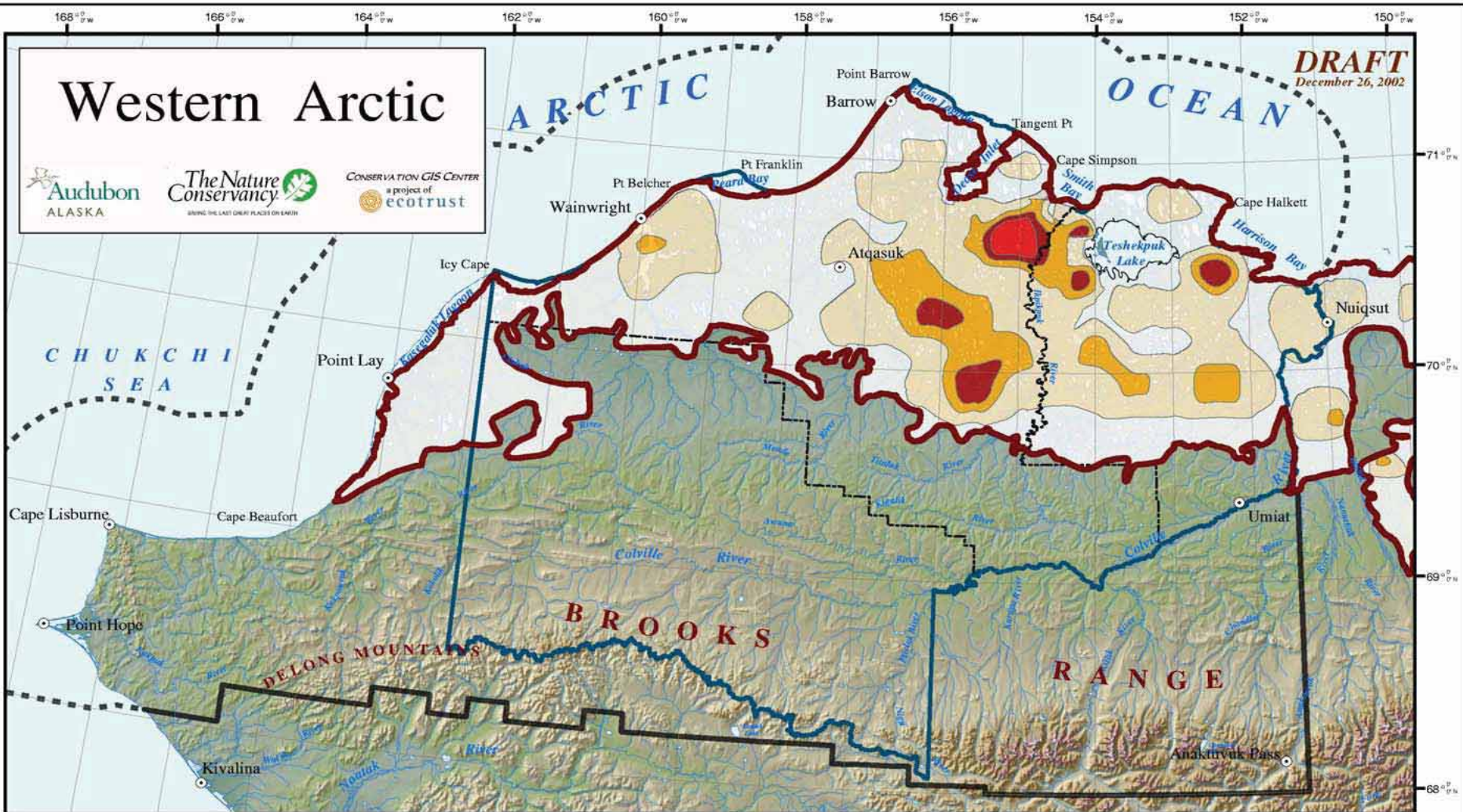


# Western Arctic



CONSERVATION GIS CENTER  
a project of  
ecotrust

**DRAFT**  
December 26, 2002



### Breeding Density of Yellow Billed Loons



Scale 1:2,810,000  
Albers Equal Area Conic Projection

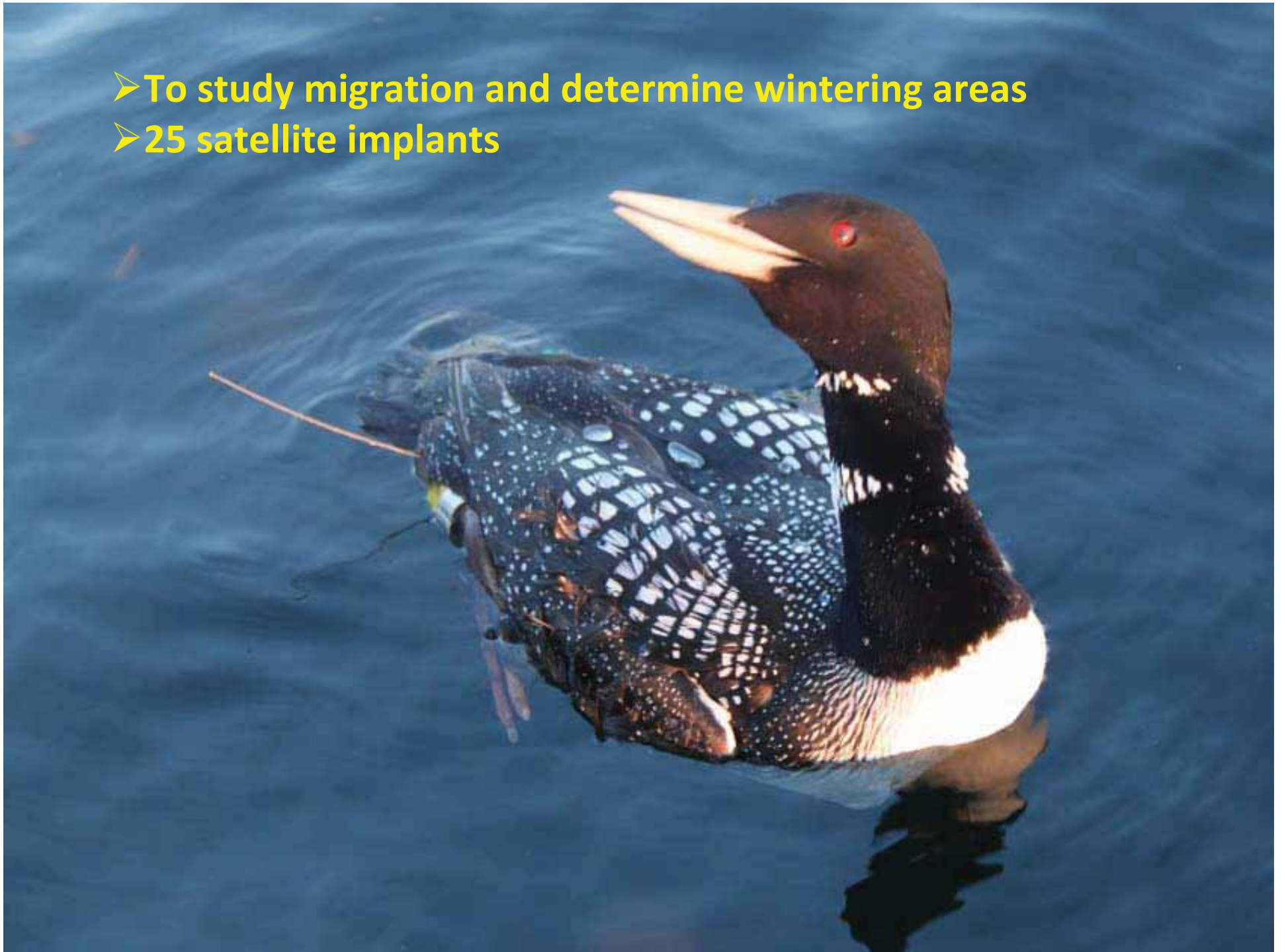






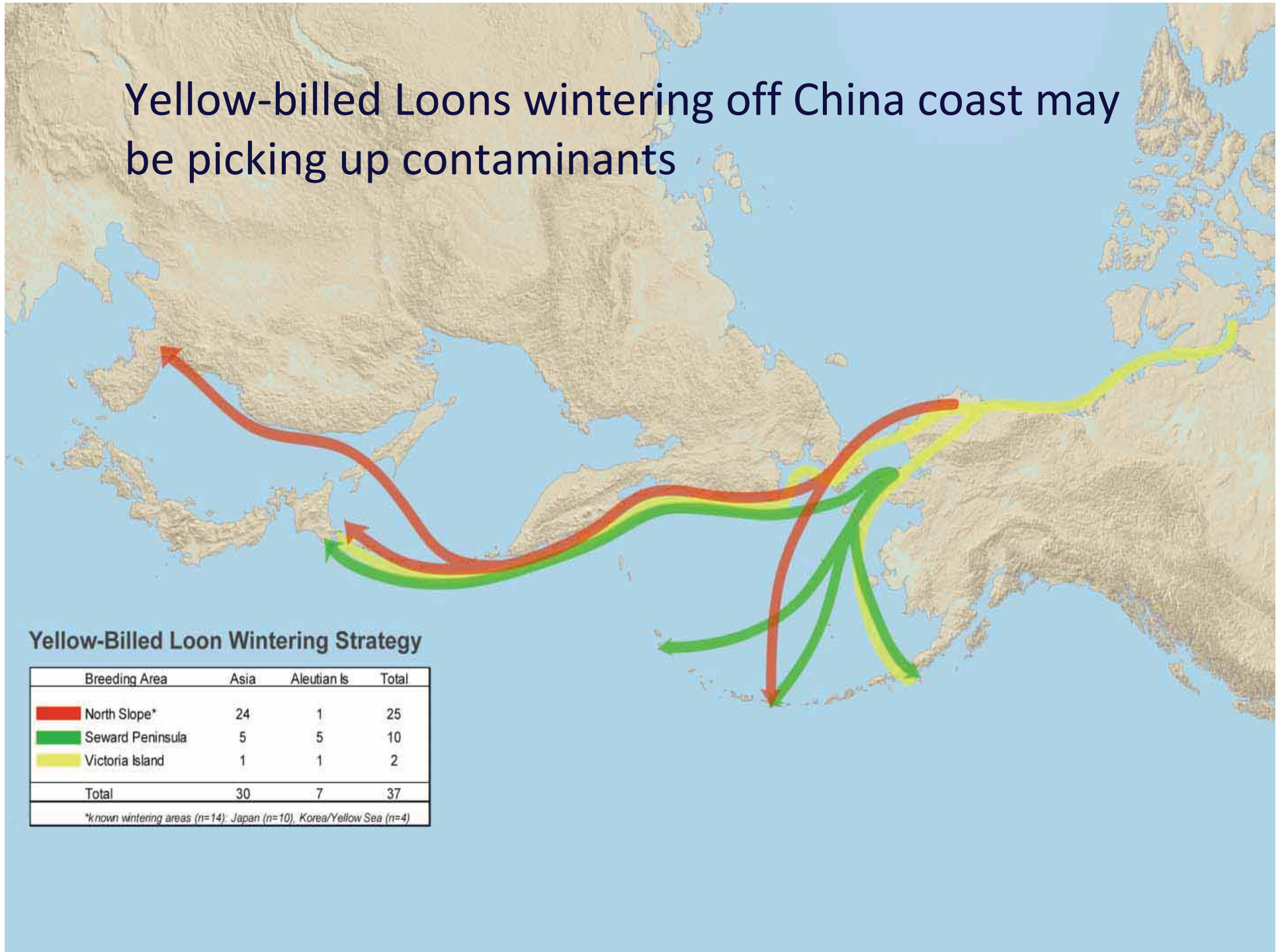


- To study migration and determine wintering areas
- 25 satellite implants





# Yellow-billed Loons wintering off China coast may be picking up contaminants



# Yellow-billed Loon

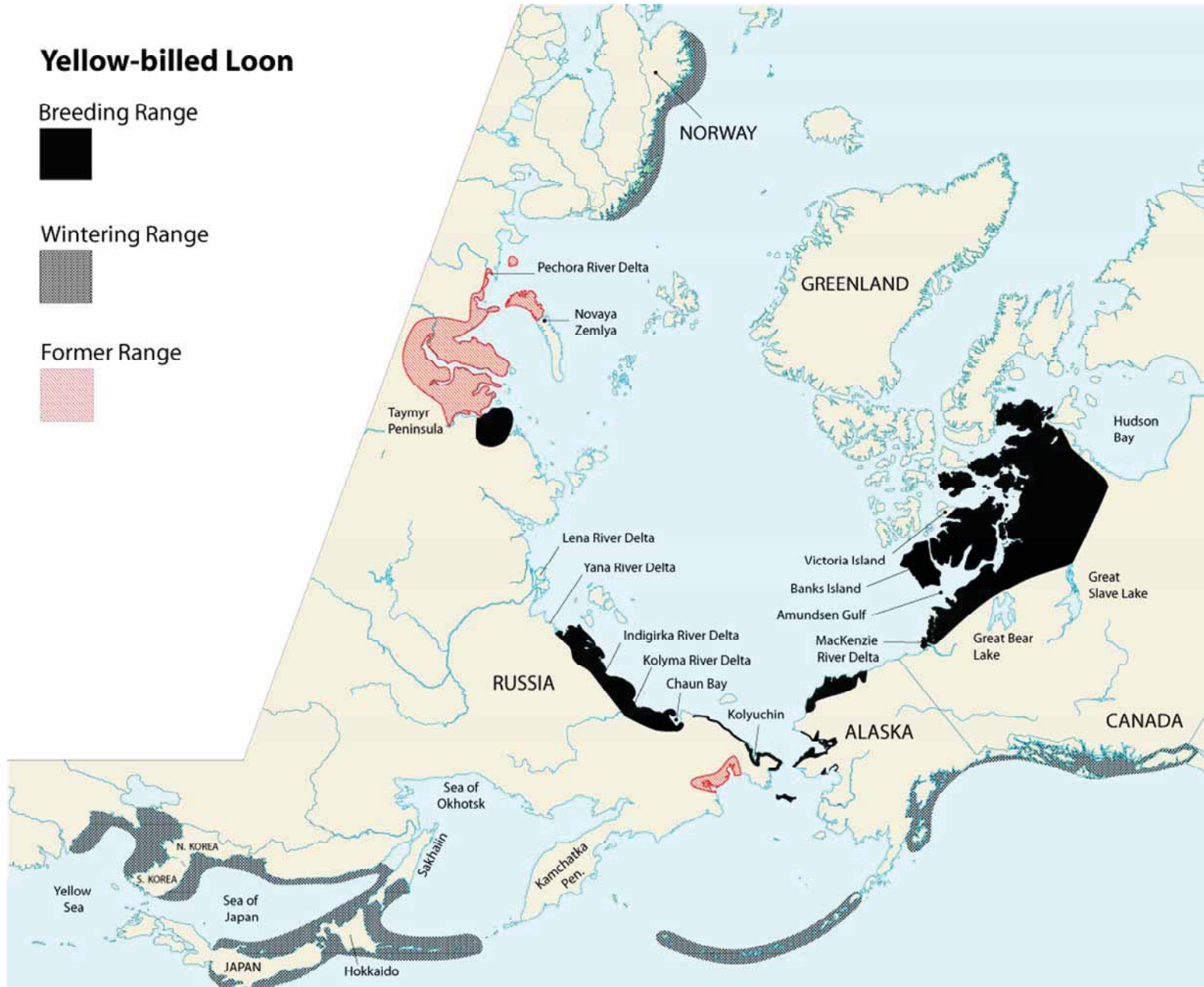
Breeding Range



Wintering Range



Former Range



A wide, flat landscape with a body of water in the middle ground and a cloudy sky above. The foreground is a mix of green and brown grasses. The water is a pale blue-grey color. The horizon is flat and distant.

## Center for Loon Conservation #2 Initiative

We've secured funding to go to Russia this summer

Gather important genetic/population data

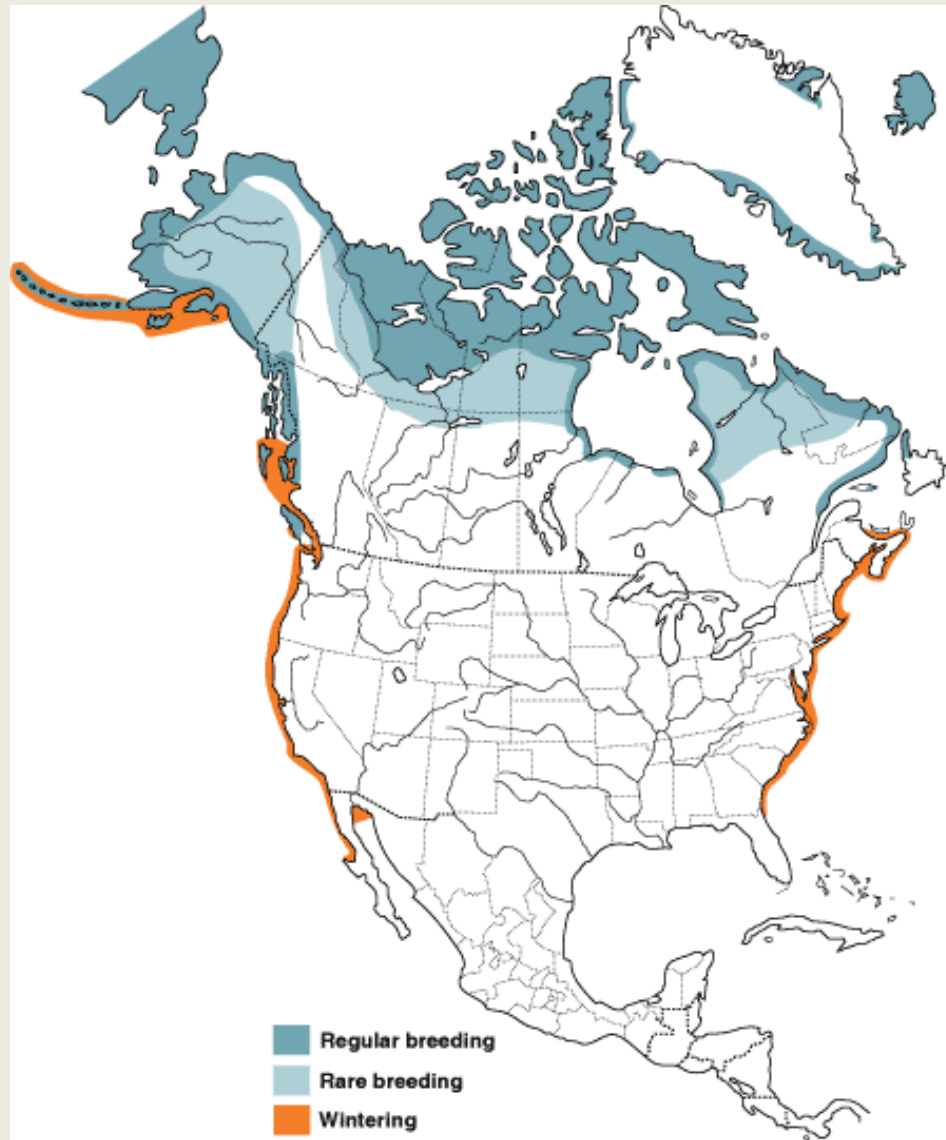
# CENTER FOR LOON CONSERVATION INITIATIVE #3

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- Considered for listing due to declining populations eastern North America

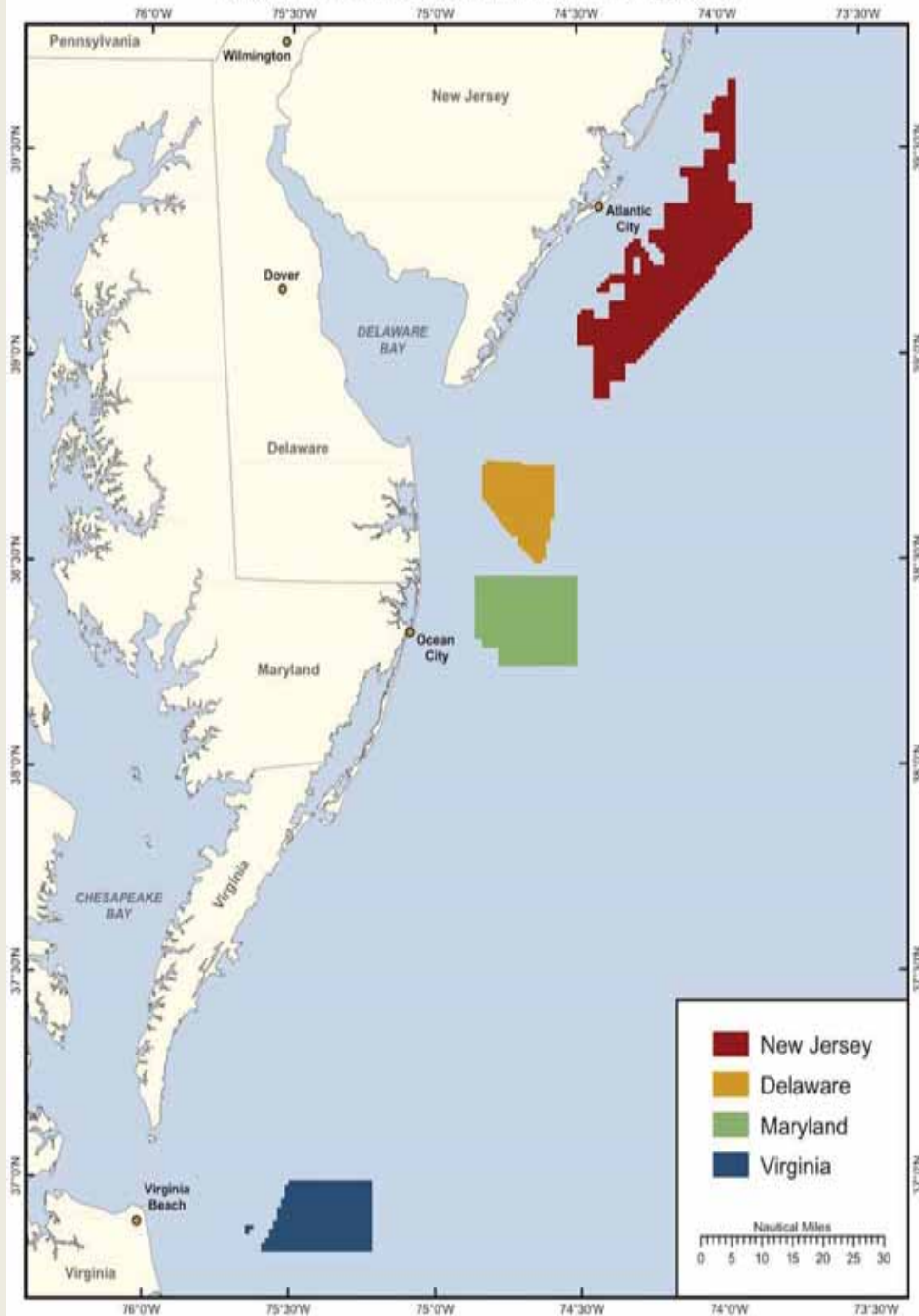


## Breeding and Wintering Range

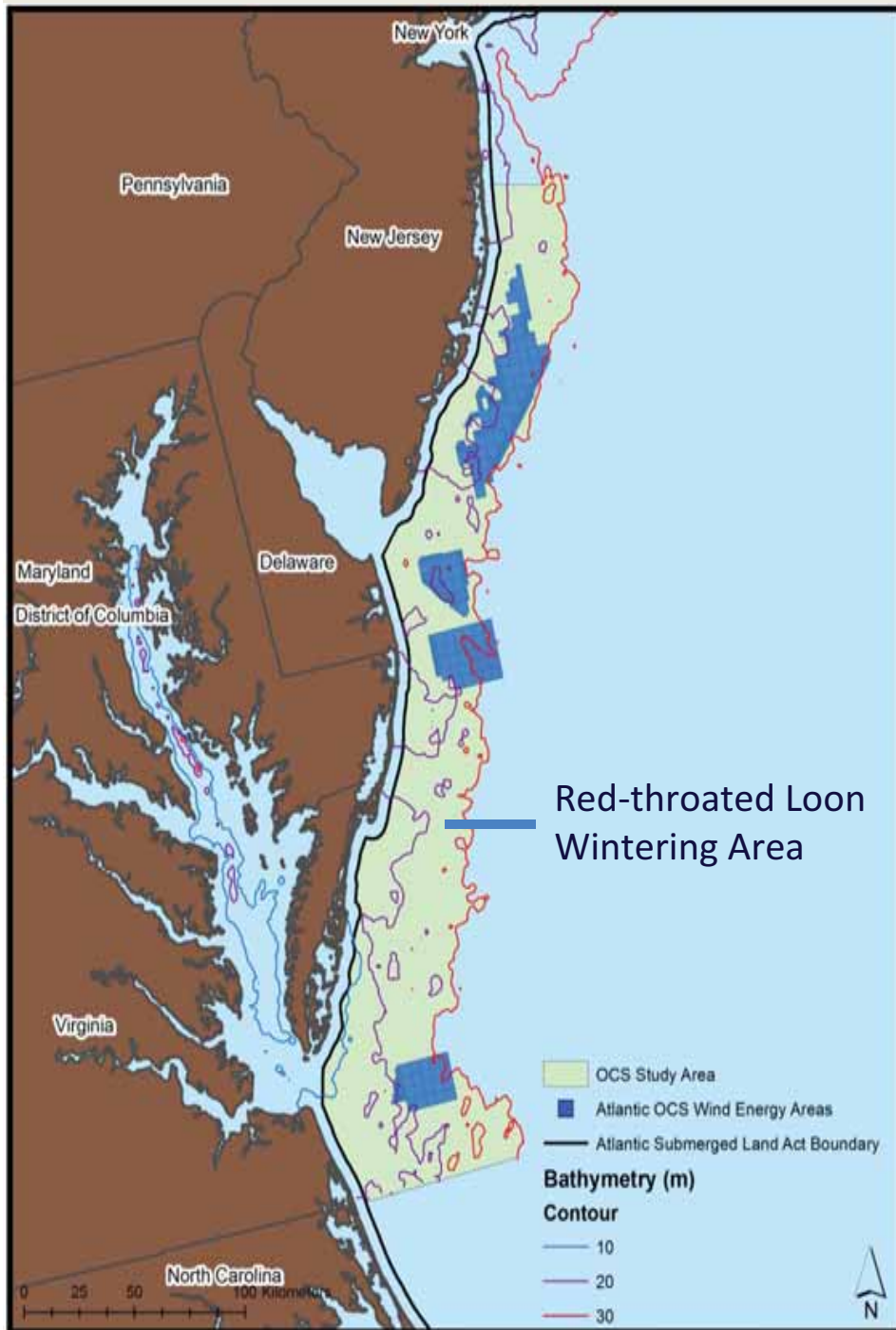


Basic (Winter) Plumage

Areas under Consideration for Wind Energy Areas



**4 colored areas have been approved for selling of leases to wind energy companies/ Windfarm for offshore development (Dept of Energy and Dept. of Interior)**



**Red-throated Loons  
overwinter offshore in  
areas slated for wind  
development**

**Is that a concern?**

**Table 2.** Score of the nine vulnerability factors and the resulting species sensitivity index (SSI) values for each of the 26 seabird species. For details see text

Bird species	Flight manoeuvrability	Flight altitude	% flying	Nocturnal flight activity	Disturbance by ship and helicopter traffic	Habitat use flexibility	Biogeographical population size	Adult survival rate	European threat and conservation status	SSI
Black-throated diver	5	2	3	1	4	4	4	3	5	44.0
Red-throated diver	5	2	2	1	4	4	5	3	5	43.3
Velvet scoter	3	1	2	3	5	4	3	2	3	27.0
Sandwich tern	1	3	5	1	2	3	4	4	4	25.0
Great cormorant	4	1	4	1	4	3	4	3	1	23.3
Common eider	4	1	2	3	3	4	2	4	1	20.4
Great crested grebe	4	2	3	2	3	4	4	1	1	19.3
Red-necked grebe	4	2	1	1	3	5	5	1	1	18.7
Great black-backed gull	2	3	2	3	2	2	4	5	2	18.3
Black tern	1	1	4	1	2	3	4	4	4	17.5
Common scoter	3	1	2	3	5	4	2	2	1	16.9
Northern gannet	3	3	3	2	2	1	4	5	3	16.5
Razorbill	4	1	1	1	3	3	2	5	2	15.8
Atlantic puffin	3	1	1	1	2	3	2	5	5	15.0
Common tern	1	2	5	1	2	3	3	4	1	15.0
Lesser black-backed gull	1	4	2	3	2	1	4	5	2	13.8
Arctic tern	1	1	5	1	2	3	3	4	1	13.3
Little gull	1	1	3	2	1	3	5	2	4	12.8
Great skua	1	3	4	1	1	2	5	4	2	12.4
Common guillemot	4	1	1	2	3	3	1	4	1	12.0
Mew gull	1	3	2	3	2	2	2	2	4	12.0
Herring gull	2	4	2	3	2	1	2	5	1	11.0
Arctic skua	1	3	5	1	1	2	4	3	1	10.0
Black-headed gull	1	5	1	2	2	2	1	3	1	7.5
Black-legged kittiwake	1	2	3	3	2	2	1	3	1	7.5
Northern fulmar	3	1	2	4	1	1	1	5	1	5.8

**Seabirds determined to be most at risk in the North Sea (Garthe and Huppopp 2004)**  
**Ibis 148: 90-109.**





There's more here than meets the eye.



Thank you!

- **Red-throated Diver (Loon) identified as a species of “highest risk” in Europe from marine wind power development**
- **Loss of habitat, particularly foraging habitat (very strong avoidance behaviors compared to most species studied)**
- **Direct mortality appears to be uncommon**

Loon Photography Credit:  
Dan Poleschook and Ginger Gumm  
Darwin Long, IV

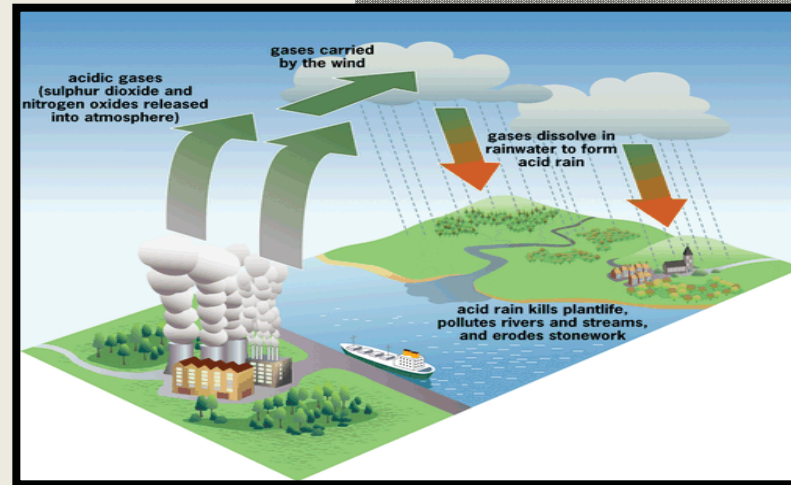


# NORTHERN RANGE: THREATS TO BREEDING POPULATIONS, CONT.

- **Human Disturbance:** shoreline development, and recreational activities



- **Acid Rain**



# EAST-WEST: MIGRATION THREATS TO THE ATLANTIC COAST, CONT.

- Botulism



- Loss of Migratory Habitat



# Common Loon Range Retraction



**Confirmed nesting: PA, IN, IL, IA, CA**

# EAST-WEST: MIGRATION THREATS TO THE ATLANTIC COAST

- Oil Spills, Atlantic Coast



- Wind Power

