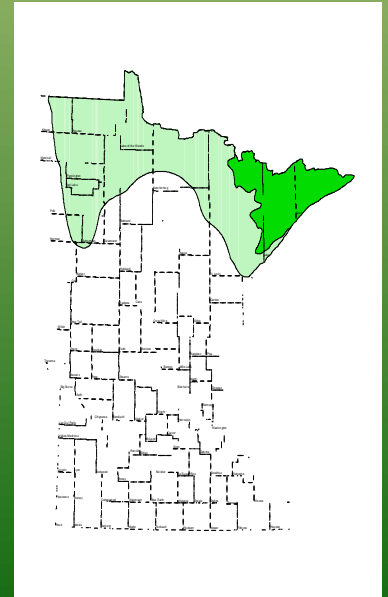
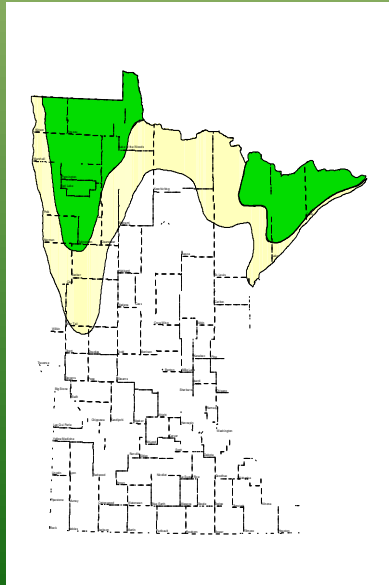
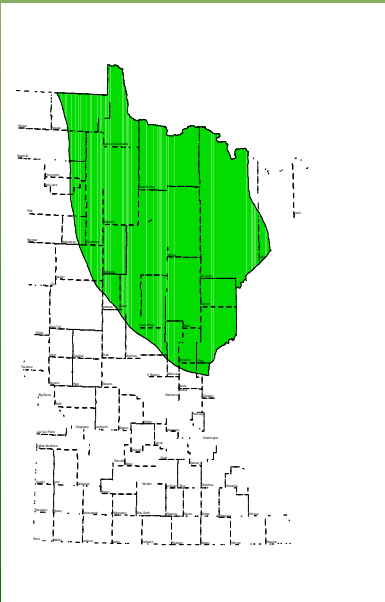


# Status and Trends of Minnesota's Moose Populations

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Northwestern Minnesota

Moose population estimate

Mid-1980s: **4,000+**

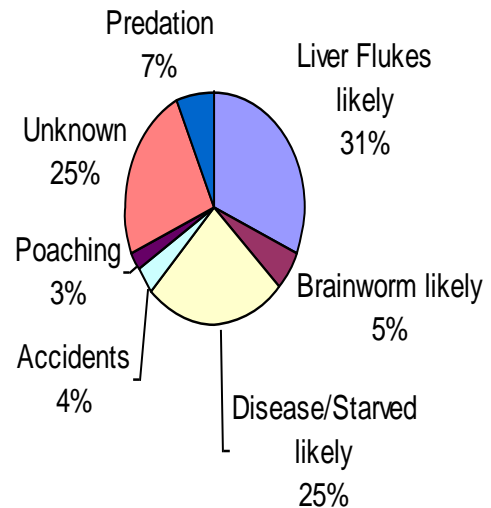
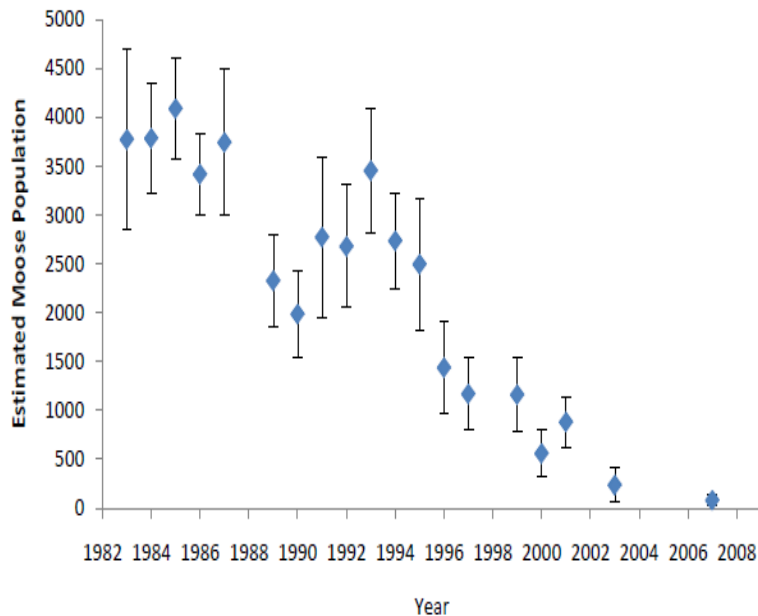
2007 : **< 100**

(last State survey in the NW)

# Northwestern MN Moose Population

Population crash – >4,000 moose in the 1980's,  
by the 1990's, things started to change.....

- Stopped hunting in 1997
- Habitat management efforts
- Radiocollared (VHF) adult mortality study
  - Climate change correlation
  - Health related (liver flukes and brainworm)



## Additional research findings:

1. Low mean annual survival of ad (0.79) and yrl (0.64), but high calf survival (0.66)
2. Low pregnancy rates (48%)
3. Annual pop. growth rate related negatively to mean summer temperature



Murray et al. (2006): study period 1995-2000



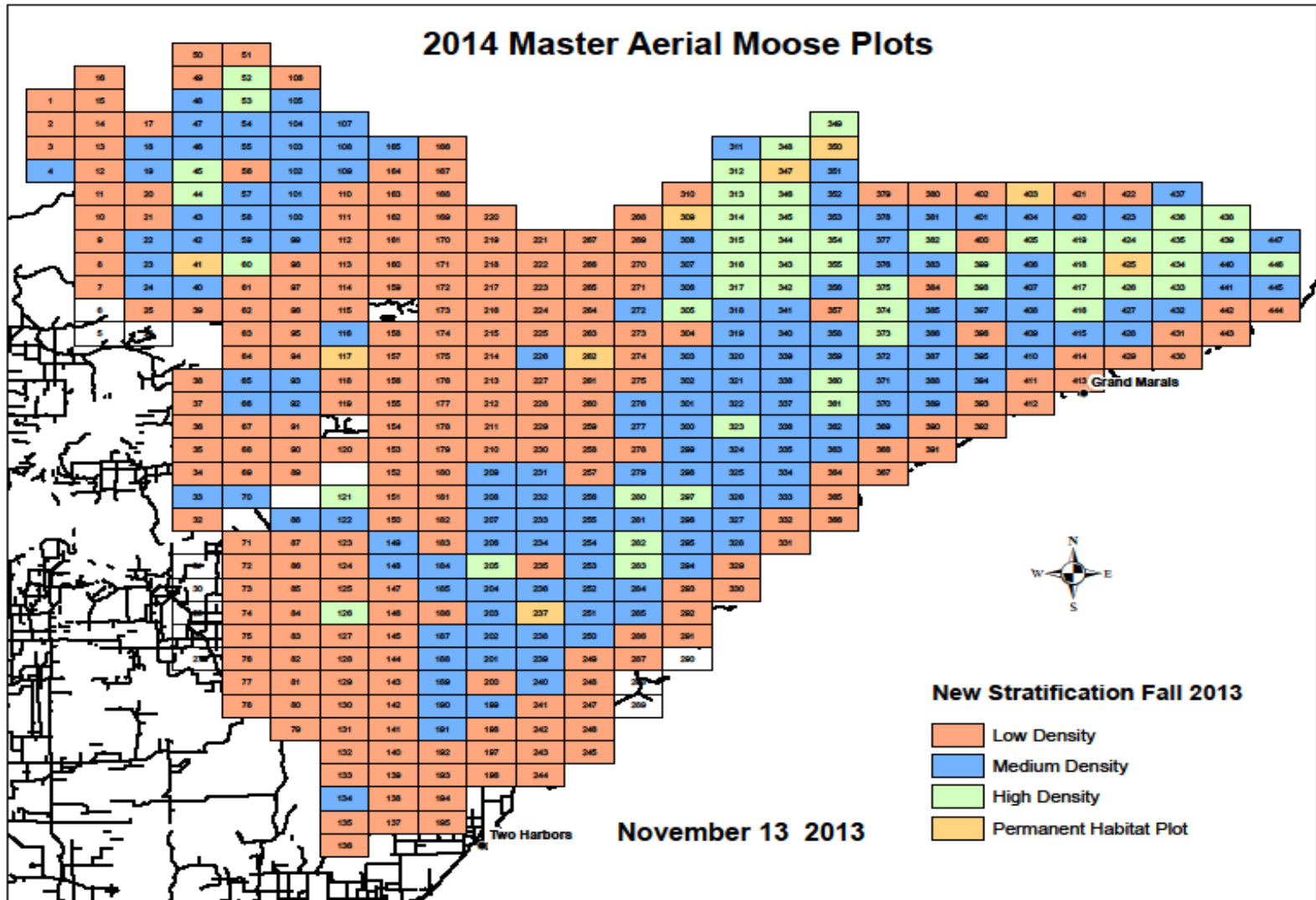
Northeastern Minnesota  
January 2014

Pop. estimate: 4,350    Calves:cow: 0.44

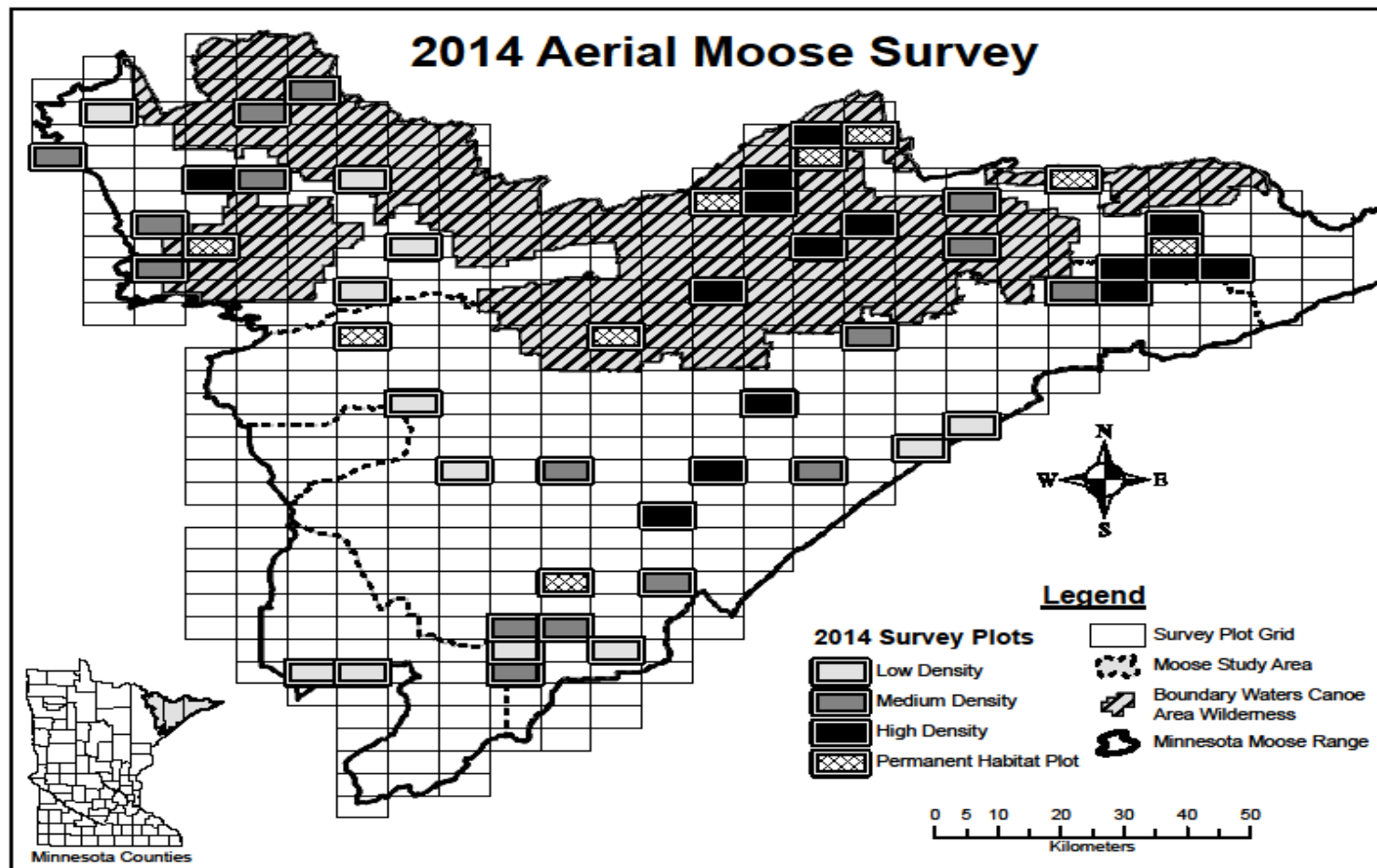
Bulls:cow: 1.24

# Minnesota's annual aerial moose survey method

## Consistency and standardization



# Minnesota's annual aerial moose survey method



# Minnesota's annual aerial moose survey method



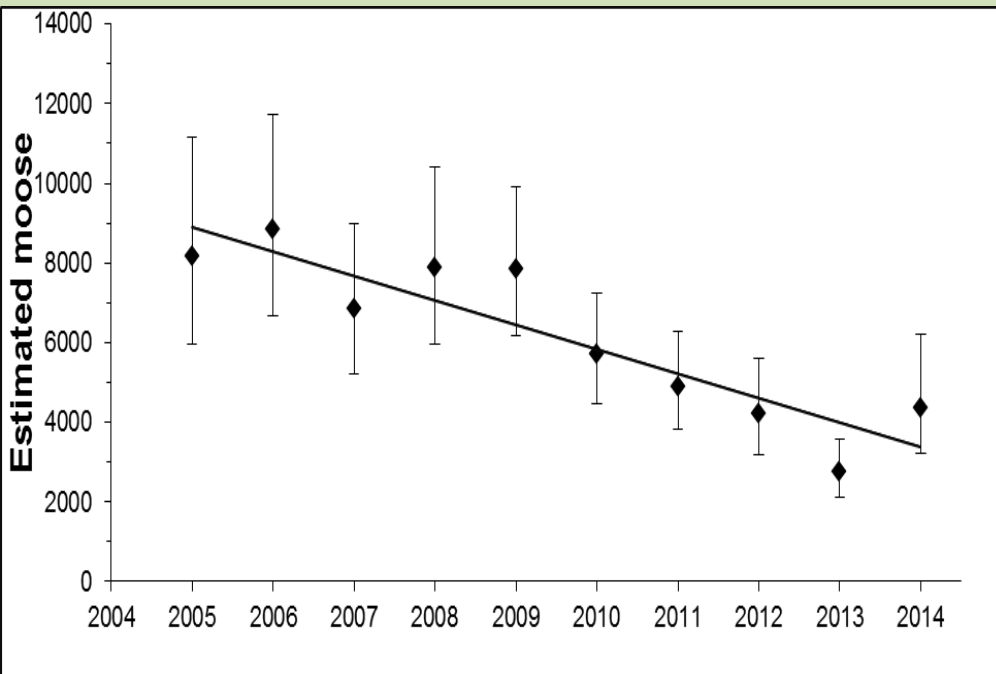


# Minnesota's annual aerial moose survey method

2004 – detection probabilities are estimated using a Sightability Model (Giudice et al. 2012)



# Northeastern Minnesota's Moose Population, 2005-2014

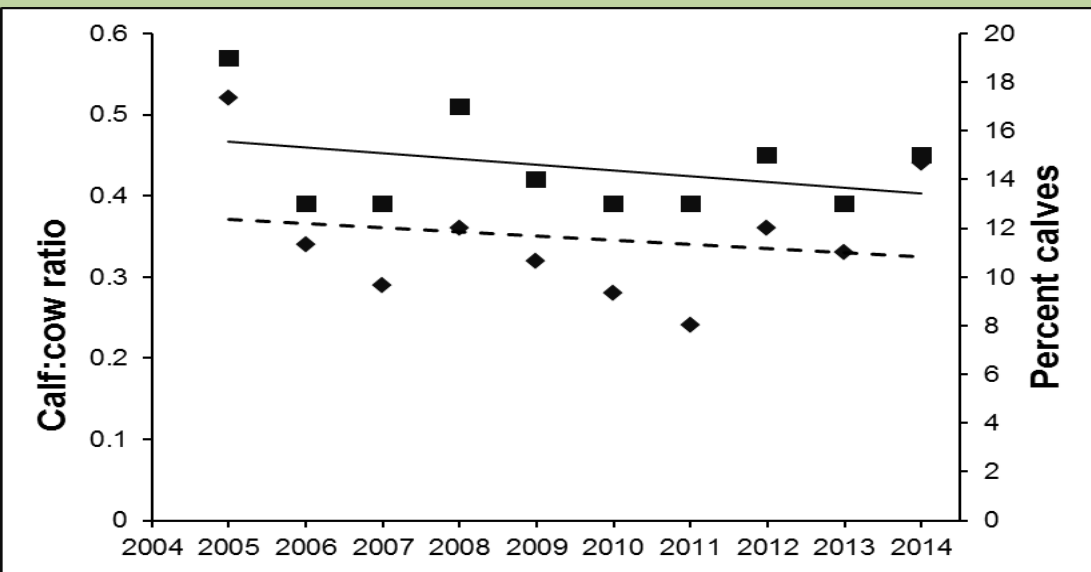


Survey	Estimate	90% Confidence Interval
2005	8,160	5,960 – 11,170
2006	8,840	6,670 – 11,710
2007	6,860	5,230 – 9,000
2008	7,890	5,970 – 10,420
2009	7,840	6,190 – 9,910
2010	5,700	4,480 – 7,250
2011	4,900	3,810 – 6,290
2012	4,230	3,190 – 5,600
2013	2,760	2,120 – 3,580
2014	4,350	3,220 – 6,210

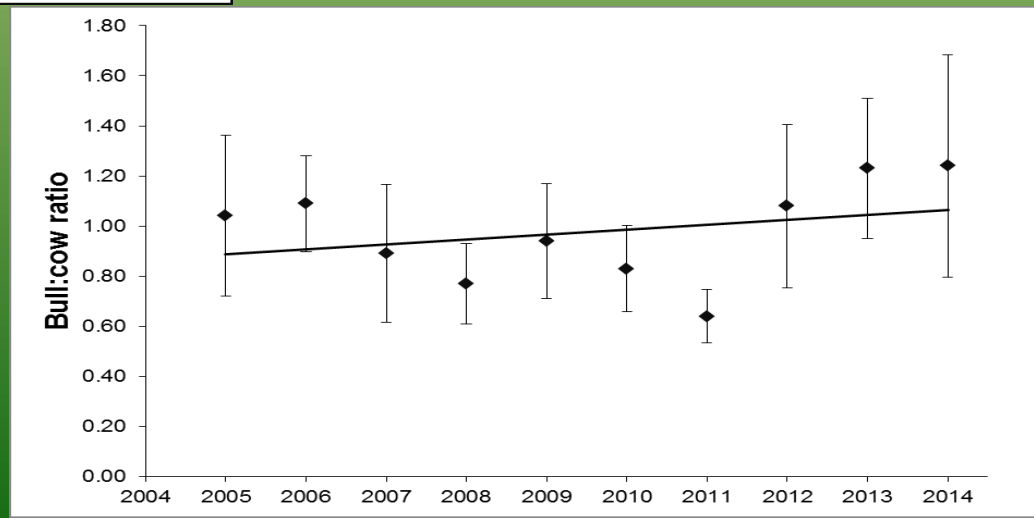
# Northeastern Minnesota's Moose Population, 2005-2014

Estimated calf:cow ratios (solid diamonds)

Percent calves (solid squares)

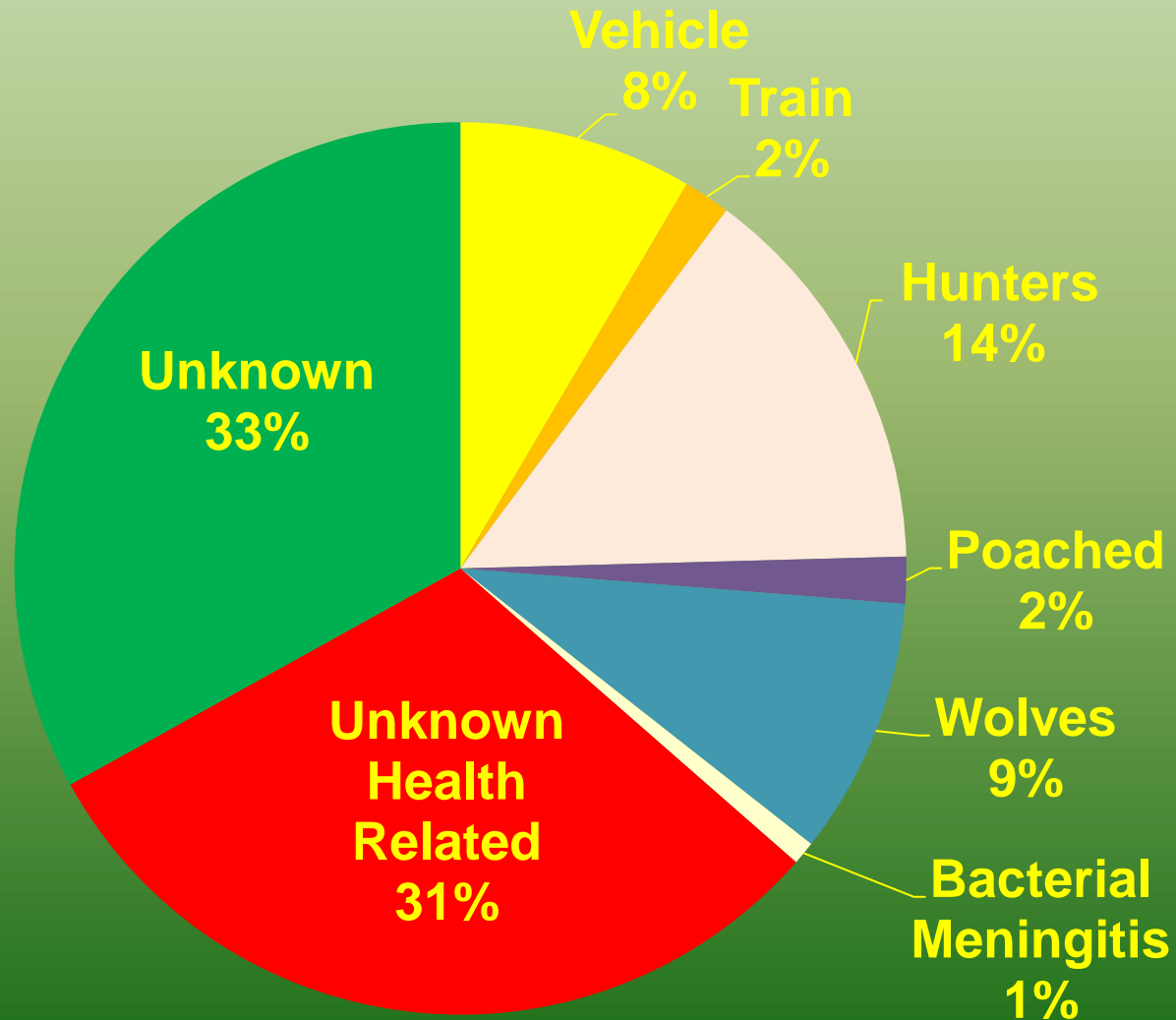


Estimated bull:cow ratios



# Northeastern Radiocollared (VHF) Moose Study Results, 2002-2008

(Lenarz et al. 2009)



# Northeastern Minnesota's Moose Population

## Additional research findings:

Lenarz et al. (2009, 2010): Study period 2002-2008

1. Models based on Jan temperatures above a critical physiological threshold were inversely correlated with subsequent adult survival
2. Explained >78% variability in spring, fall, and annual survival, and 55% for the next winter's survival
4. Mean annual adult survival rates were 0.81 (0.68-0.96)
5. No difference in male and female survival

# Research, Management, and Future of Northeastern Minnesota's Moose Population

## Aggressive research efforts studying:

1. Specific causes of adult and calf mortality relative to intrinsic and extrinsic factors, seasonal and annual survival rates relative to environmental variables, and reproductive performance
2. Nutrition and use of habitat before and after forest manipulations
3. White-tailed deer-moose interactions and potential of disease transmission
4. Thermoregulation by moose relative to behavior, habitat type, and ambient temperature
5. Wolf-moose interactions, seasonal wolf diet composition and impacts on the moose population
6. And more....

# Research, Management, and Future of Northeastern Minnesota's Moose Population

## Management efforts:

1. Ongoing annual aerial moose survey, with recent inclusion of assessments of moose use of disturbed areas in northeastern Minnesota
2. Development of Minnesota Moose Research & Management Plan
3. Cancelled the State's annual moose harvest (2013) until further notice
4. Moose listed by the State as a Species of Concern
5. Fond du Lac Indian Band, 1854 Treaty Authority, and Grand Portage Band of Chippewa cancelled moose harvests until further notice
6. Annual research/management moose meeting
7. Moose habitat inventory and development of Habitat Suitability Index (HSI)

# Research, Management, and Future of the Northeastern Minnesota's Moose Population

7. Ongoing habitat manipulation projects by the many landownerships for moose habitat improvement (including Habitat Collaborative projects)
8. Development of moose management and research websites, frequent presentations to the public and special interest groups
9. Development of a moose biennial work plan and a climate change biennial work plan (including a focus on moose)



# Acknowledgements

## Cooperating parties:

Fond du Lac Resource Management  
Division

1854 Treaty Authority

Natural Resources Research Institute, University of Minnesota-Duluth

Voyageurs National Park, U. S. National Park Service

Minnesota Deer Hunters Association, The Nature Conservancy

Grand Portage Band of Chippewa

Department of Fisheries, Wildlife, & Conservation Biology, University of Minnesota-St.  
Paul

U. S. Forest Service

U. S. Geological Survey

