

**WLF 419 - Waterfowl and Wetlands Ecology and Management**  
**Lecture 15 – Population/Harvest Surveys and Banding**  
**Next Time – North American Waterfowl Management Plan**

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Management of North American Waterfowl is one of the oldest and most evolved systems of game management. This does not mean that it is a perfect system. In the next series of lecture will explore survey methods, theories about harvest dynamics, management objectives, and the process of adaptive management for waterfowl populations.

To make the best management decisions we must know the state of the system under management, and more importantly, the response of the system to management action. Population and harvest surveys, and data from banding programs are designed to provide information about the state of the system.

We will consider sampling methods and information provided by 4 main surveys:

- Breeding Population and Habitat Survey (May Survey)
- July Production Survey (Brood Surveys )
- Winter Population Surveys
- Harvest Surveys

And Banding Programs.

**Breeding Population and Habitat Surveys**

- First survey attempts initiated in 1935 by:
  - Bureau of Biological Surveys and
  - More Game Birds in America
    - Crude survey techniques
- More formal (better design) surveys initiated in 1946
  - Ground and Aerial Surveys
- Official surveys conducted since 1955
  - Traditional Survey Area
    - US Fish and Wildlife Service and Canadian Wildlife Service

- Aerial
- Extensive
  - 3.5 million km<sup>2</sup> (1.3 million mile<sup>2</sup>)
  - Alaska, Yukon Territories, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Montana, North Dakota, and South Dakota
- Surveys 10 species of ducks (Mallard, Gadwall, American Wigeon, Green-winged Teal, Blue-winged Teal, Northern Shoveler, Northern Pintail, Redhead, Canvasback, Scaup)
- Stratified Sampling
  - 49 Strata
  - Sampling intensity varies by strata
- Transects
  - E-W
  - 0.25 miles wide
    - Pilot and observer count ducks and ponds within 0.125 miles of each side of the plane
  - up to 150 miles long
  - 18 mile segments
  - 100 mph at 150 ft
- Visibility Correction Factor (Detection Probability)
  - Double Sampling for some areas
    - Ground (Beat Outs) –
      - Prairie Canada and Northcentral U.S.
    - Helicopter
      - Northern and Eastern
  - Assume Detection Probability = 1.0
  - Spatial, temporal, and species-specific variation
- Estimates extrapolated to non-survey area
  - Sampling
    - VCF
    - Area Covered
    - Strata

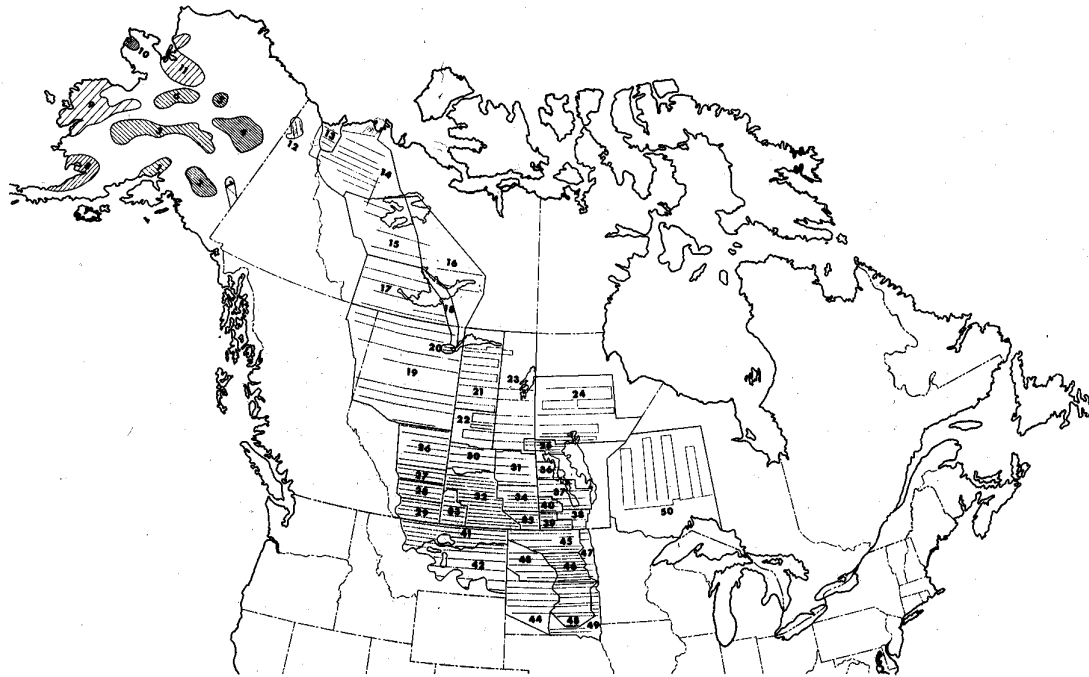


Figure 1-1. Transects and strata of annual aerial surveys of waterfowl breeding grounds by the U.S. Fish and Wildlife Service.

From Bellrose (1976)

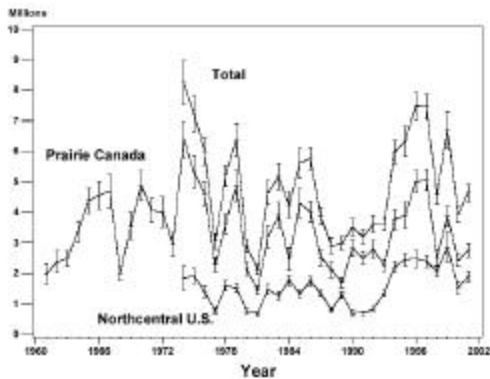


Figure 1. Number of ponds in May and 95% confidence intervals for Prairie Canada and the Northcentral U.S.

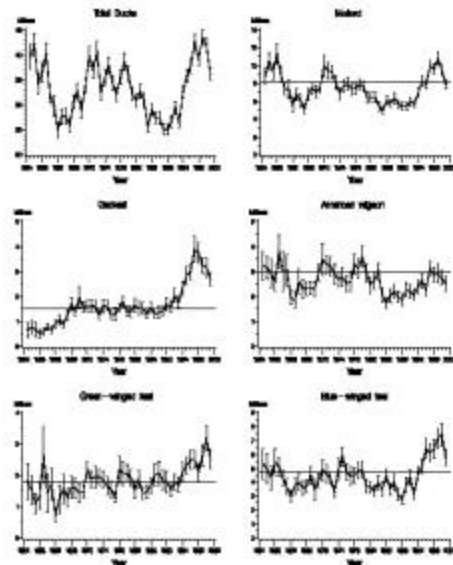


Fig. 4. Duckling population estimates, 95% confidence intervals, and 1960-1965 breeding management. The population and percent change in selected species for the 1960-1965 period are given in Table 1-1, 2-1, 3-1, 4-1, 5-1, 6-1, 7-1, 8-1, 9-1, 10-1, 11-1, 12-1, 13-1, 14-1, 15-1, 16-1, 17-1, 18-1, 19-1, 20-1, 21-1, 22-1, 23-1, 24-1, 25-1, 26-1, 27-1, 28-1, 29-1, 30-1, 31-1, 32-1, 33-1, 34-1, 35-1, 36-1, 37-1, 38-1, 39-1, 40-1, 41-1, 42-1, 43-1, 44-1, 45-1, 46-1, 47-1, 48-1, 49-1, 50-1.

TRENDS IN DUCK BREEDING POPULATIONS, 1955-2001

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- Eastern Surveys
  - Initiated in 1980's because traditional surveys areas were not useful in thick forest areas
  - 1.8 km<sup>2</sup> (0.7 miles<sup>2</sup>)
  - Ontario, Quebec, Labrador, Newfoundland, Nova Scotia, Prince



Figure 2. Townships and strata for areas of the Breeding Waterfowl and Habitat Survey

Edward  
Island, New  
Brunswick,  
New York  
and Maine

## July Productions Surveys

- Aerial
  - Number, age, and size of broods
  - Ponds
  - Pairs
- Traditional survey area (strata 20-49 and 75-77)
- No visibility correction
  - Index, not estimate
- Fall Flight
  - Mallards and all ducks
  - Adaptive Harvest Management Models

## Goose Surveys

- Breeding, Migration, and Winter Surveys
- 30 population of geese recognized
- Wide spread

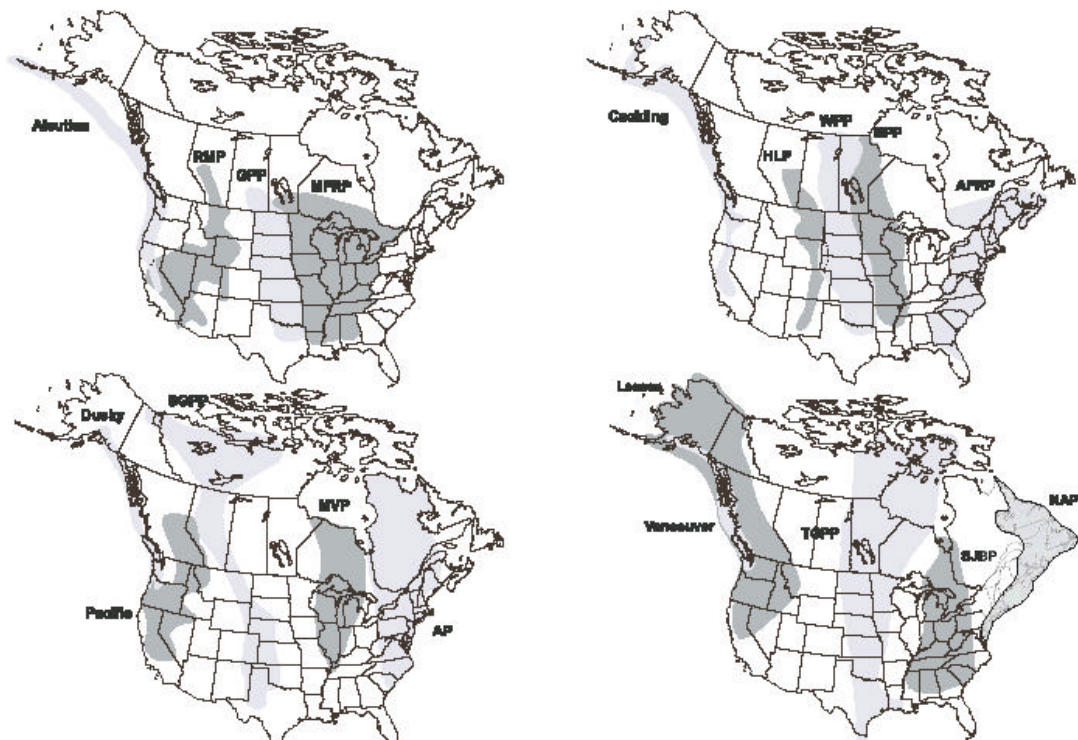


Fig. 3. Approximate ranges of Canada goose populations in North America. Population names are abbreviated as in text.



Fig. 1. Important Arctic and sub-arctic nesting areas of North American geese.

- Examples
  - Habitat Conditions
    - Ice instead of water

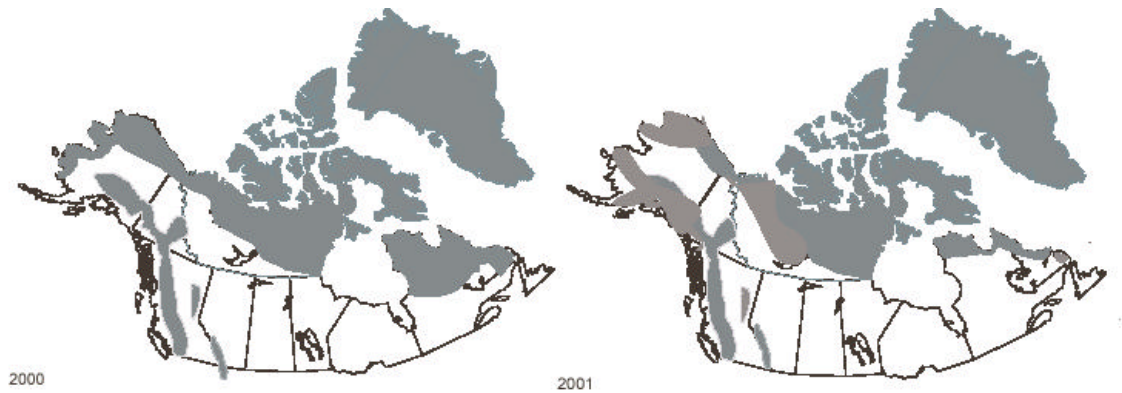


Fig. 2. The extent of snow and ice cover in North America for 3-5 June, 2000 and 3 June, 2001. The figures were produced from reports prepared by the National Oceanic and Atmospheric Administration.

- Atlantic Population Canada
  - Aerial Breeding Survey

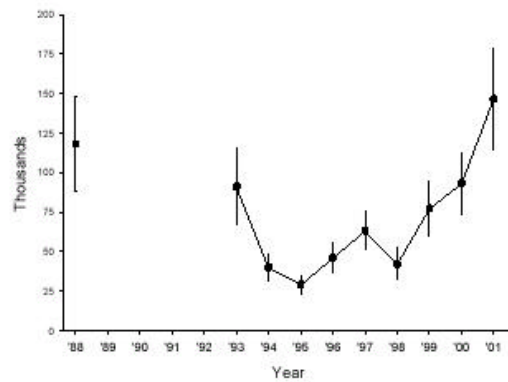


Fig. 4. Estimated number of breeding pairs (and 95% confidence intervals) of Atlantic Population Canada Geese in northern Quebec.

- Light Geese at Queen Maud Gulf
  - Snow and Ross
  - Periodic Photo Inventories
  - Annual Ground Surveys at Karrak Lake

- Emperor Geese
  - Spring Survey on Staging Area

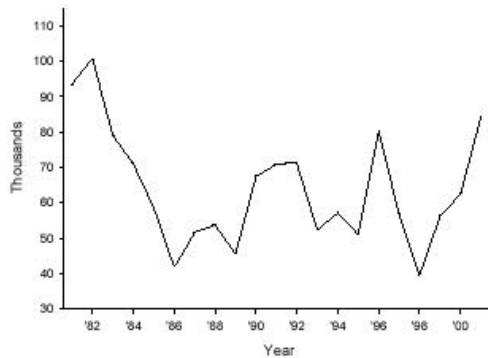


Fig. 26. Approximate range of the Emperor geese, and eastern and western swan populations in North America.

Fig. 25. Estimated numbers of emperor geese present during May surveys.

## Winter Population Surveys

- Mid-winter Survey
  - December and January since 1930's
  - Aerial
  - Ducks, geese, and swans
  - Main survey for most geese and swans
    - Prefer breeding population surveys
  - Index
  - Distribution

## Special Surveys

## Harvest Surveys

- 2 part survey
  - Mail Questionnaire of Hunters (Federal Duck Stamps)
    - 1952
    - Stratified Random Sample
    - Non-respondent survey
      - Self-selected sample
    - Hunting Activity, Birds Killed and Crippled
  - Parts Collection Survey
    - 1961
    - Stratified Random Sample

- Collect wings from ducks and tails from geese
  - Wing Bee
    - Species, Age, and Sex
  - What can you conclude from Age Ratios alone?
- Harvest Information Program (HIP)
    - Improved estimates of waterfowl harvest
    - Other Migratory Species (Doves and Woodcock)

## Banding



- Since early 1900's
  - Jack Miner
- Generally late summer banding
- About 1,000,000 birds banded annually
  - About 300,00 migratory game birds
- Banding and recovery records of migratory birds managed by the Bird Banding Laboratory in Laurel Maryland
- Why band waterfowl?
  - Monitor hunting and non-hunting sources of mortality
    - True survival probability
    - Distribution and derivation of harvest
  - Experiments
- How?
  - Band recoveries (and recaptures)

f (recovery rate) = probability that a banded bird is shot, retrieved, and has the band reported =  $Kc$

H (harvest rate) = probability that a bird is shot and retrieved

r (reporting rate) = probability that the band is reported from a banded, harvested bird

K (hunting mortality rate) = probability that a bird is lethally shot

c (retrieval rate) = probability that a lethally shot bird is retrieved

To estimate K we need to know  $H = f / r$  and K is related to H as  $K = H / c$  such that:

$$K = f / r / c$$

If we estimate K and we estimate S (true survival probability) we can estimate non-hunting mortality (E) because:

$$S = (1 - K)(1 - E)$$

Of course this requires that we know f, r, and c. How do we get these parameters.

Recovery Rate (f) = # reported / # banded

- Direct and Indirect

Retrieval Rate (c) = # shot / # retrieved

- Spy blinds

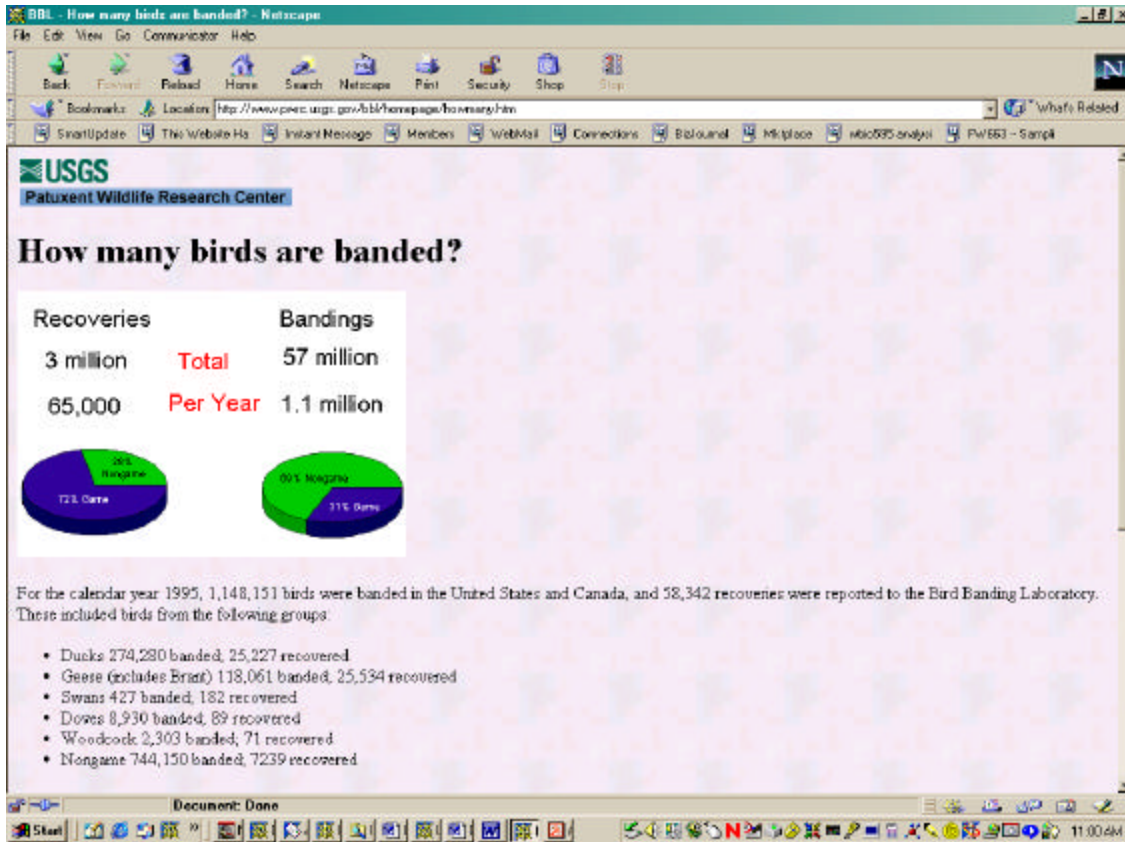
Reporting Rate (r) = # reported to BBL / # Retrieved

- Reward Banding

Reported bands are data and increase precision of our estimates. How do we increase r?

- Advise Washington D.C.
- Write
- 1-800 number
  - solicitation
- Auxiliary Markers
  - Special Projects
  - Additional Parameters
    - Emigration

- Is banding useful for non-game birds?



Oh my facts about Banded Birds

**SUMMARY DATA ON NORTH AMERICAN BIRD BANDINGS AND ENCOUNTERS**

**PREPARED ON 10/06/99**

<b>Total Bandings Reported to BBL (1908-1998 Inclusive)*</b>	59,633,871	
<b>Total Encounters Processed (1908-1999 Inclusive)</b>	3,273,319	
<b>Retrieval File Statistics</b>	<b>Bandings</b>	<b>Encounters</b>
<b>Total Bandings/Encounters:</b>	53,714,400	3,273,319
Game Birds	18,527,976	2,417,932
Non-game Birds	35,186,424	855,387
Waterfowl	15,769,637	2,280,492
<b>Most Common Species:</b>		

Mallard	5,686,224	850,090
Mourning Dove	1,953,426	89,696
Northern Pintail	1,260,929	140,991
Canada Goose	2,428,270	568,335
Blue-winged Teal	1,318,908	60,277
Black Duck	922,305	153,261

**Game Birds:**

Ducks	12,295,873	1,540,095
Geese	3,503,010	742,648
Swans	23,569	8,012
Doves	2,256,498	102,742
Woodcock	104,257	5,542

**\*Total includes 6,010,534 Pre-1955 Non-game Birds**

**AOU 1290 - 1810 Longevity Records**

Species Number	Common Name	Age Yrs-Mos
1290	Common Merganser	13-05
1300	Red-breasted Merganser	5-05
1310	Hooded Merganser	11-03
1320	Mallard	26-04
1321	Hawaiian Duck	3-08
1322	Laysan Duck	11-10
1330	American Black Duck	26-05
1331	Mexican Duck	5-06
1340	Mottled Duck	13-05
1350	Gadwall	19-06
1360	Eurasian Wigeon	8-07
1370	American Wigeon	20-11
1390	American Green-winged Teal	20-03
1400	Blue-winged Teal	22-04
1410	Cinnamon Teal	12-11
1420	Northern Shoveler	18-07
1430	Northern Pintail	22-03
1440	Wood Duck	22-06
1460	Redhead	22-07
1470	Canvasback	22-07
1480	Greater Scaup	18-04
1490	Lesser Scaup	18-04
1500	Ring-necked Duck	20-05
1510	Common Goldeneye	15-05
1520	Barrow's Goldeneye	15-04

1530	Bufflehead	18-08
1540	Oldsquaw	15-07
1550	Harlequin Duck	8-02
1570	Steller's Eider	23-00
1590	Common Eider	22-05
1620	King Eider	18-11
1650	White-winged Scoter	15-07
1660	Surf Scoter	7-11
1670	Ruddy Duck	13-07
1690	Lesser Snow Goose (white)	26-07
1691	Lesser Snow Goose (blue)	25-06
1700	Ross' Goose	22-06
1710	Greater White-fronted Goose	25-06
1720	Canada Goose (all races)	28-05
1730	Atlantic Brant	21-07
1740	Black Brant	28-06
1751	Hawaiian Goose	17-09
1760	Emperor Goose	10-04
1770	Black-bellied Whistling-Duck	8-02
1780	Fulvous Whistling-Duck	6-06
1782	Mute Swan	26-09
1800	Whistling Swan	25-04
1810	Trumpeter Swan	23-10