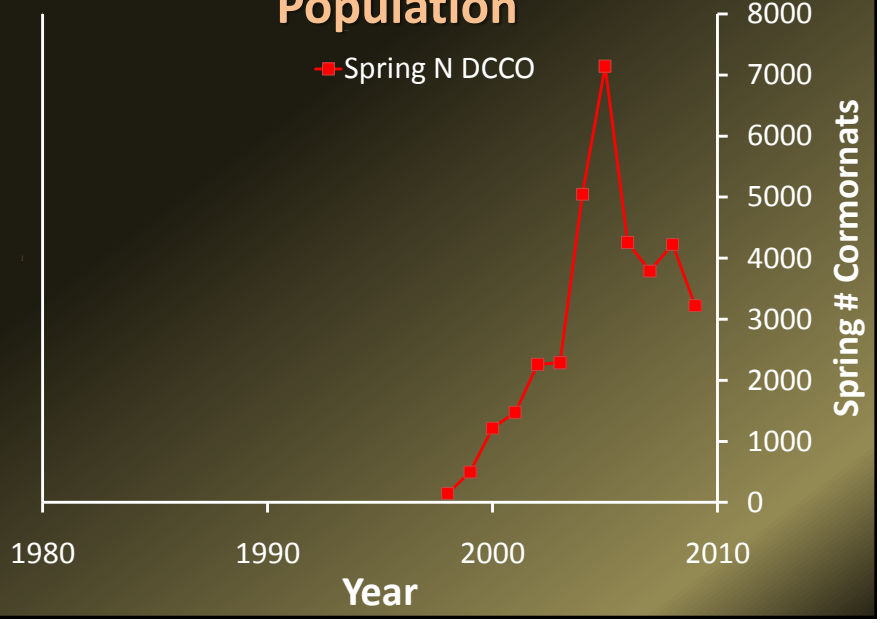
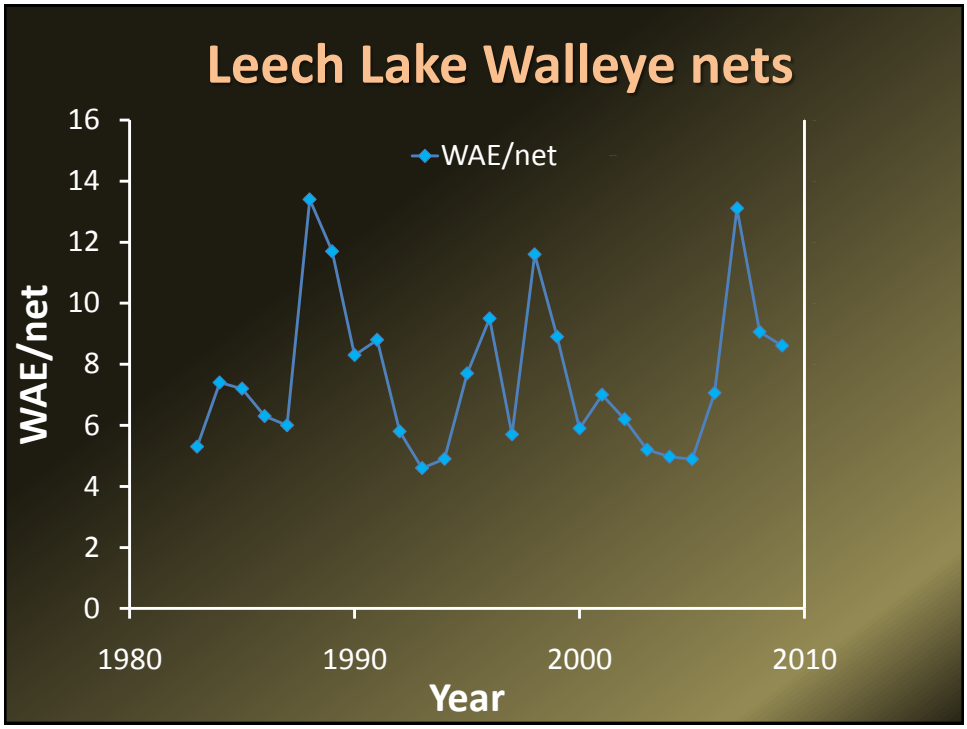
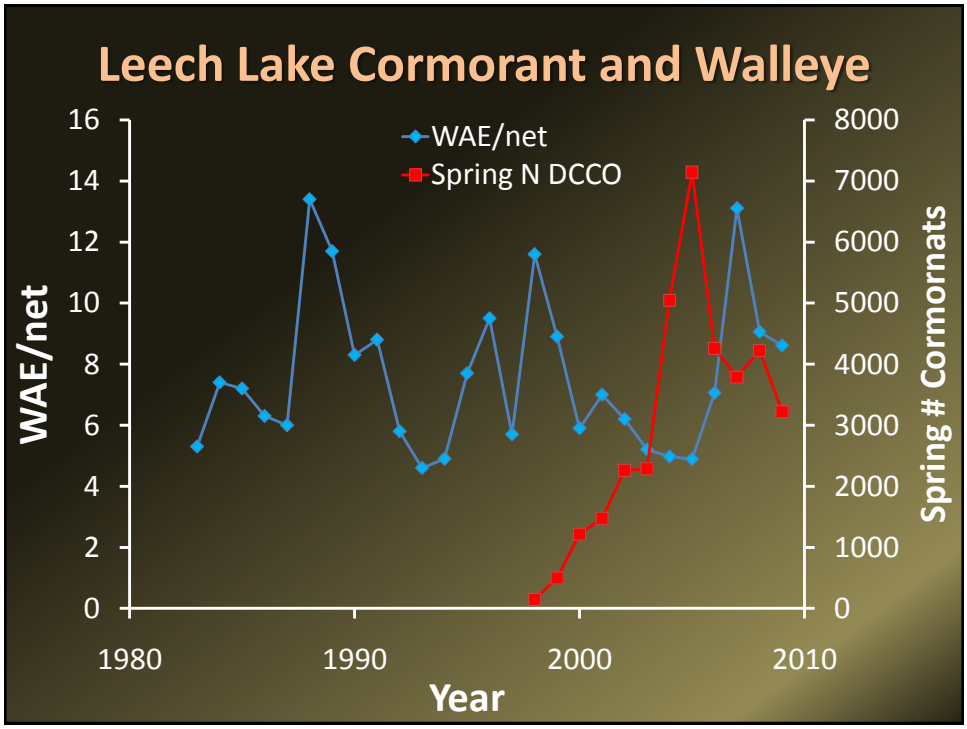
Double-Crested Cormorant Consumption Model for Leech Lake

A cooperative project between:
Minnesota Department of Natural Resources,
Leech Lake Reservation Division of Resources Management,
& the University of Minnesota

Leech Lake Spring Cormorant Population



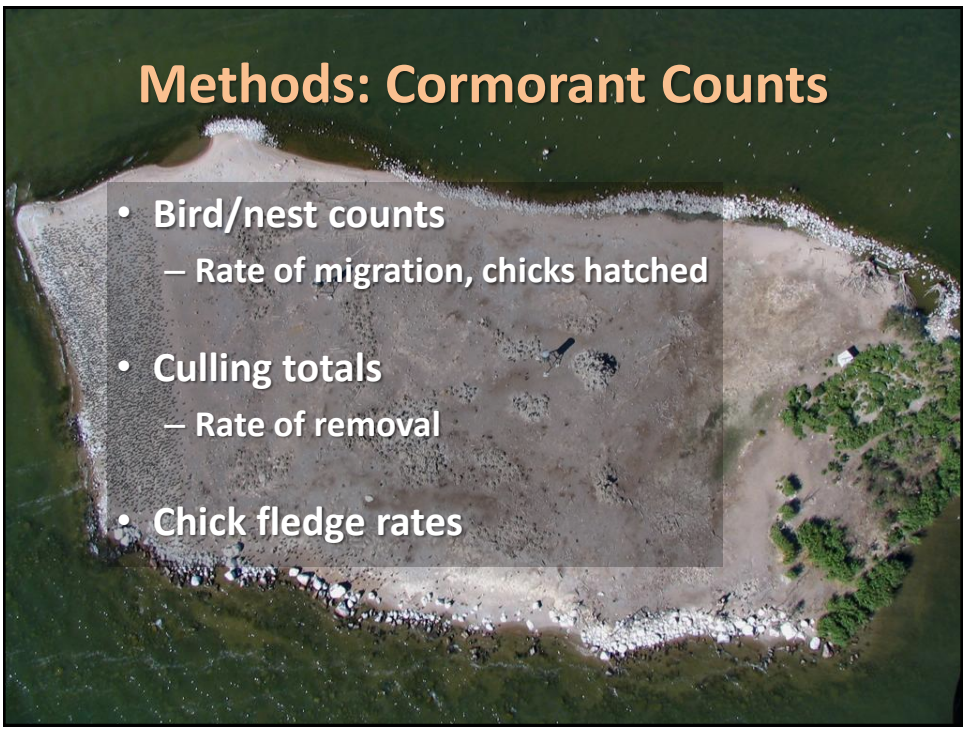

Leech Lake Walleye nets
WAE/net
16
14
12
10
8
6
4
2
0
1980
1990
2000
2010
Year


Leech Lake Cormorant and Walleye
WAE/net
Spring N DCCO
16
14
12
10
8
6
4
2
0
8000
7000
6000
5000
4000
3000
2000
1000
0
1980
1990
2000
2010
Year
Spring # Cormornats

Objectives

- Estimate total fish & walleye consumption by cormorants
- Compare culling scenarios
- Incorporate findings into DNR's updated Leech Lake walleye management plan

Methods: Cormorant Counts



- **Bird/nest counts**
  - **Rate of migration, chicks hatched**
- **Culling totals**
  - **Rate of removal**
- **Chick fledge rates**

Methods: Diet

- Diets collected 2005-2007
  - Culled adults & chick regurgitants
- Composition (number & mass)
  - Species or lowest taxa (eg. shiners)
  - Age (walleye only)
- Season
  - 15 Apr – 15 Jun (spring migrate & pre-chick)
  - 16 Jun – 15 Aug (chicks)
  - 16 Aug – 15 Oct (post-fledge & fall migrate)

Conceptual model

- Weekly intervals
  - Total bird days
  - Consumption rates for bird class (adults and chick)

Every week:

Adults  × Adult consumption rate (lb/day) = Pounds of fish consumed by adults in 1 week

+

Chicks  × Chick consumption rate (lb/day) = Pounds of fish consumed by chicks in 1 week

=

Weekly cormorant consumption

Conceptual model

- Culling: Weekly intervals

Adults

Adult nesting pairs

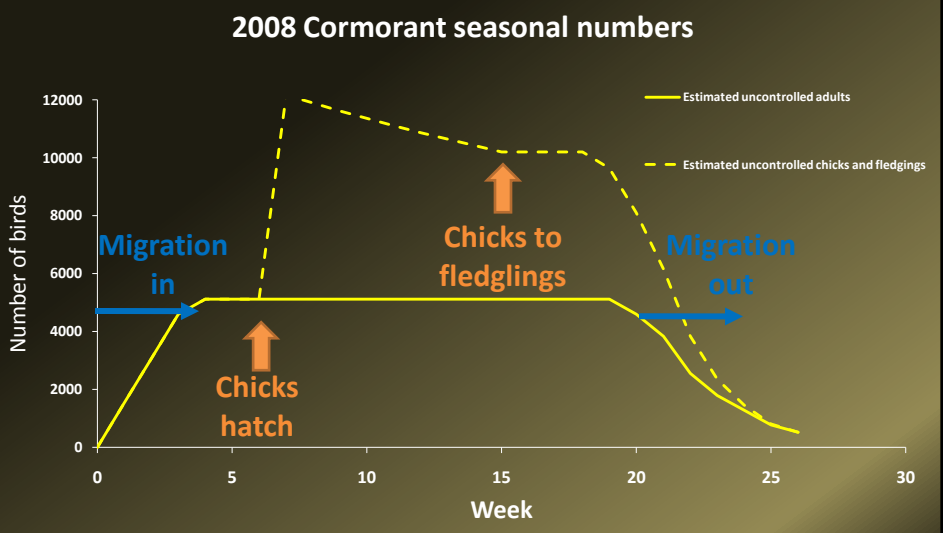
Migrants

Juveniles

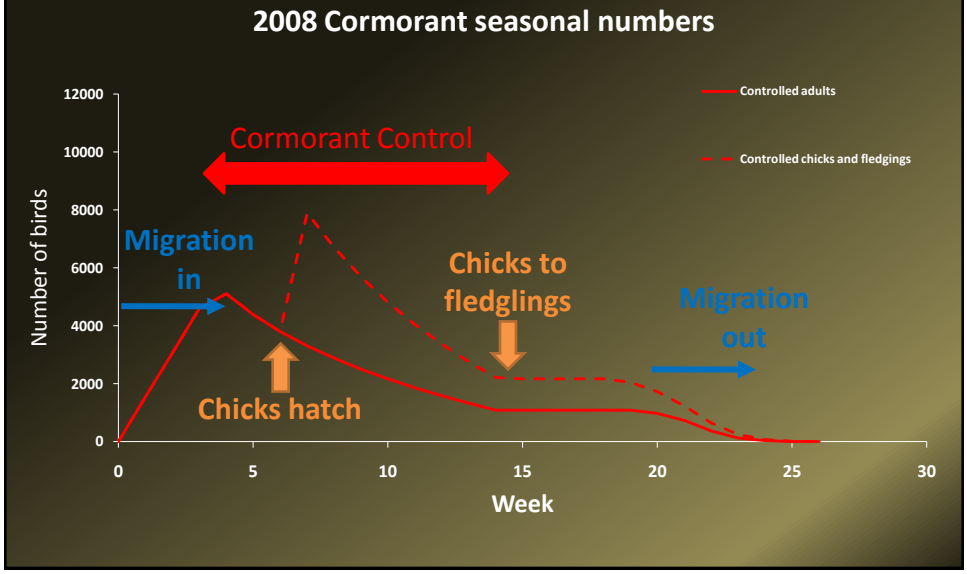
Chicks

Fledged chicks

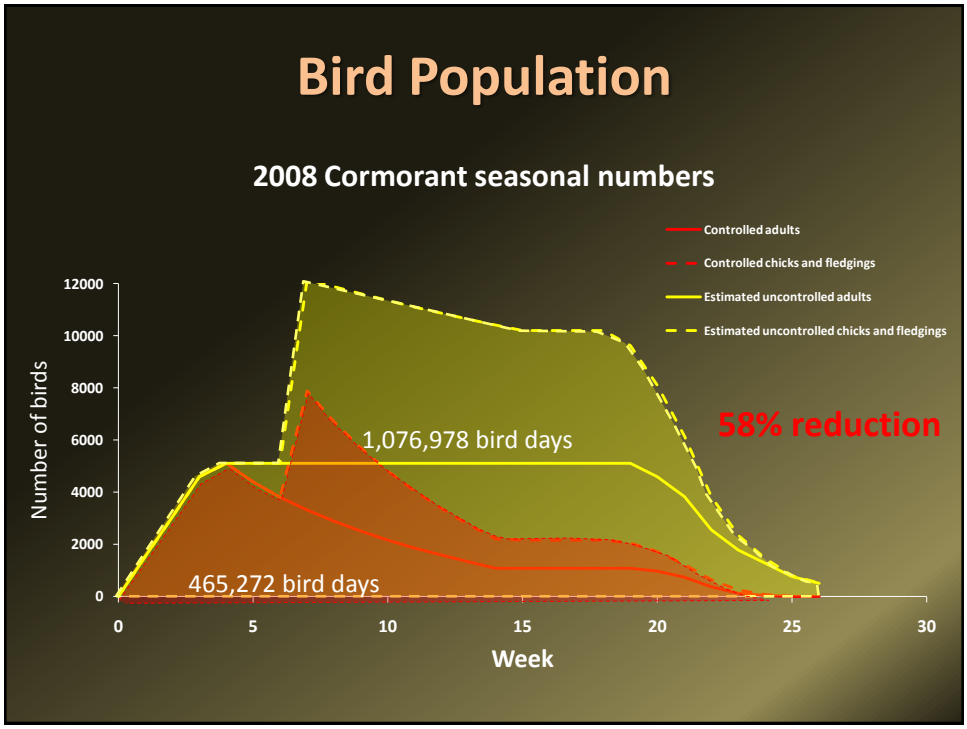
Bird Population Without Control

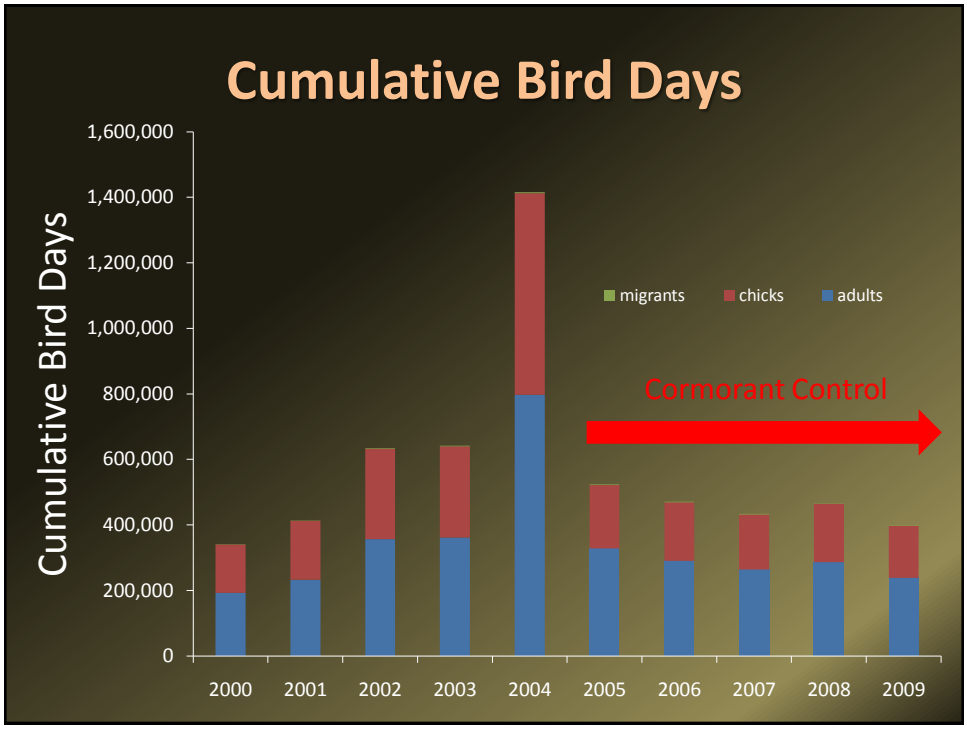


Bird Population With Control



Bird Population





Consumption

- Varies by season and bird size
  - Adults, juveniles, and migrants
  - Chicks
- Goktepe (2008) estimated rates for Leech Lake (2005-2007)
  - Daily adult consumption rate is 17-28% of body weight*

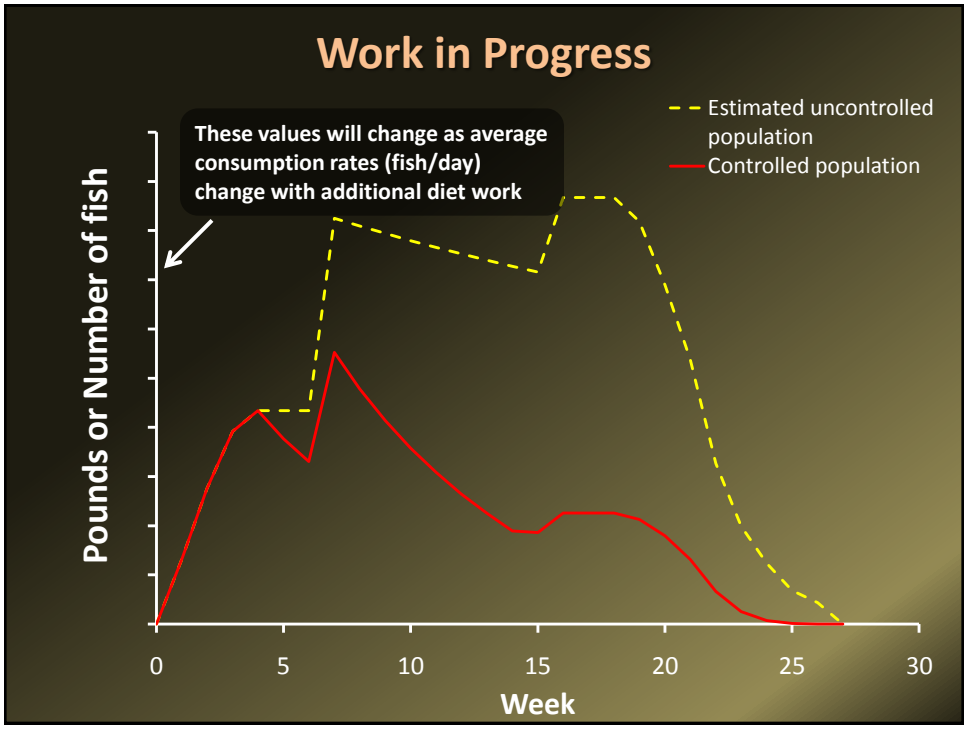
* Subject to change upon further diet collection and analysis

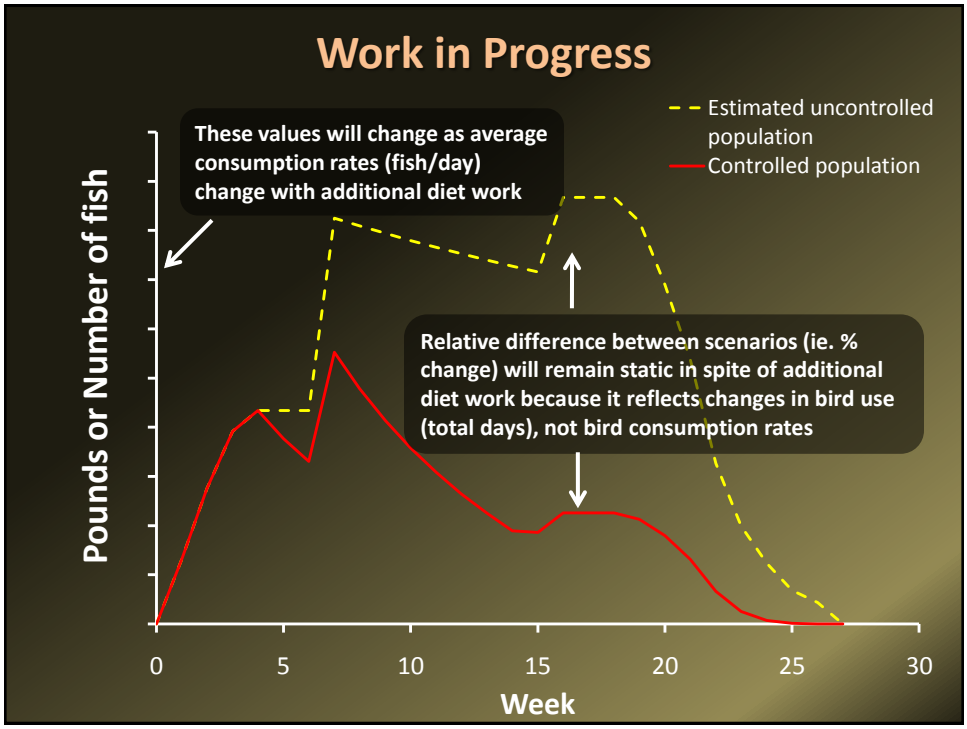
Adult Consumption Rates

Author	Location	Bird Size (lbs)	Total Fish (lbs/bird/day)	% Body Wt.
Goktepe (2008)	Leech Lake, MN	5.29	1.49	28
Glahn & Brugger (1995)	Mississippi Delta USA	4.36	1.09	25
Fowle (1997)	Lake Champlain, VT	4.94	1.03	21
Herbert & Morrison (2003)	Lake Erie, OH	4.19	0.71	17
Seefelt (2005)	Lake Michigan, MI	4.41	1.21	27
Rudstam et al. (2005)	Lake Oneida, NY	5.03	1.01	20

Key Considerations

- Total bird-days has strongest influence on total consumption
  - Fish eaten (lbs or number) = bird-days * consumption rate (fish/day)
- Further analysis & diet collection will change the average rate at which fish are eaten. In turn, point estimates of pounds/number of fish consumed (Y-axis of following figures) will also change.
- Relative comparisons (% differences) between control scenarios will remain static because the same fish consumption rate is used when making these comparisons – these reflect bird use, not consumption rates

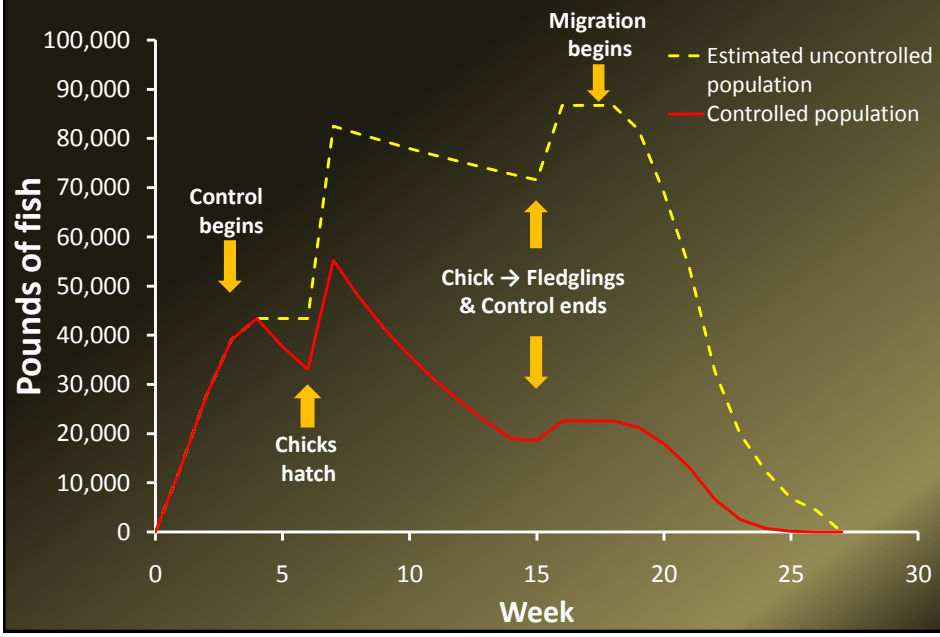

Work in Progress
These values will change as average consumption rates (fish/day) change with additional diet work
Estimated uncontrolled population
Controlled population
Pounds or Number of fish
0
5
10
15
20
25
30
Week


Work in Progress
These values will change as average consumption rates (fish/day) change with additional diet work
Estimated uncontrolled population
Controlled population
Relative difference between scenarios (ie. % change) will remain static in spite of additional diet work because it reflects changes in bird use (total days), not bird consumption rates
Pounds or Number of fish
0
5
10
15
20
25
30
Week

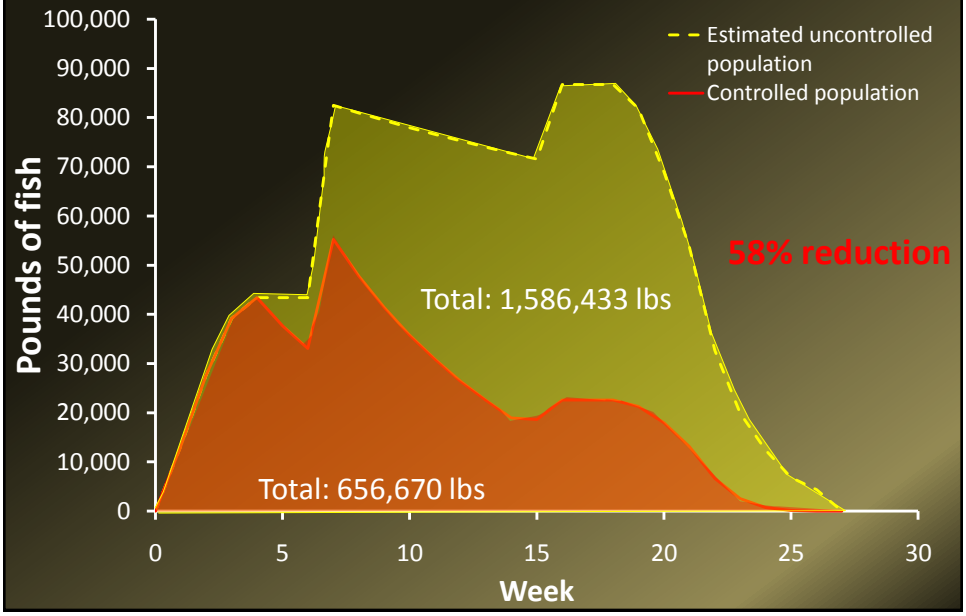
Key Considerations

- Why will consumption estimates change with more study?
- Wide range in forage scenarios from year-to-year reflected in diets
  - Total consumption influenced by energy content of forage
    - Lots of cisco in 2006 diets led to lower total fish consumption because cisco have higher energy value (calories) than other species – birds ate less to meet day-to-day calorie requirements
  - Species-specific consumption rates varies with
    - Year-to-year changes in abundance for a given species
    - Abundance of other prey items could buffer predation on a particular species or age group (ie. how many options are available)

2008 total pounds of fish consumed



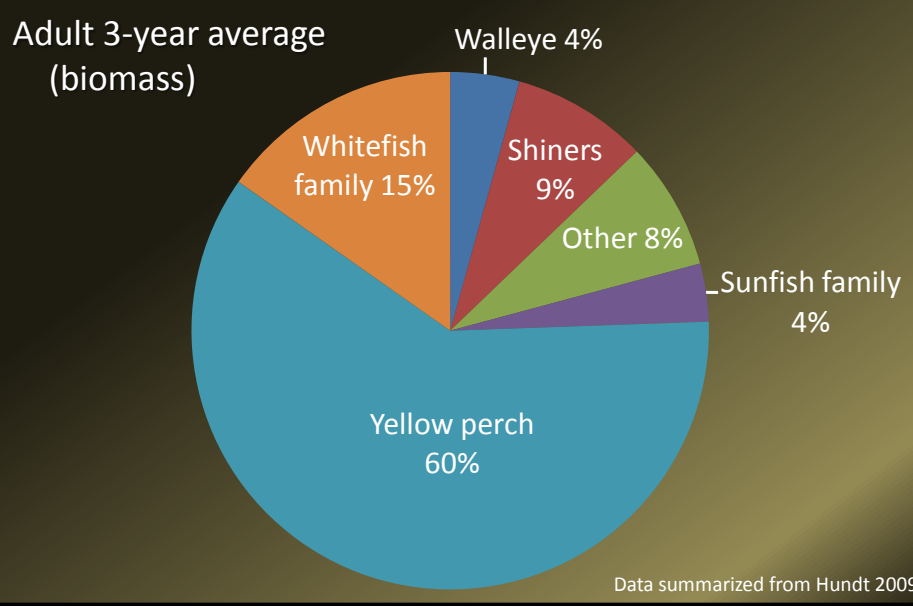
2008 total pounds of fish consumed



Cormorant diet composition

- Varies seasonally and annually
- Dominated by yellow perch (Hundt 2009)
- Some similarities to Oneida Lake (Coleman 2009)

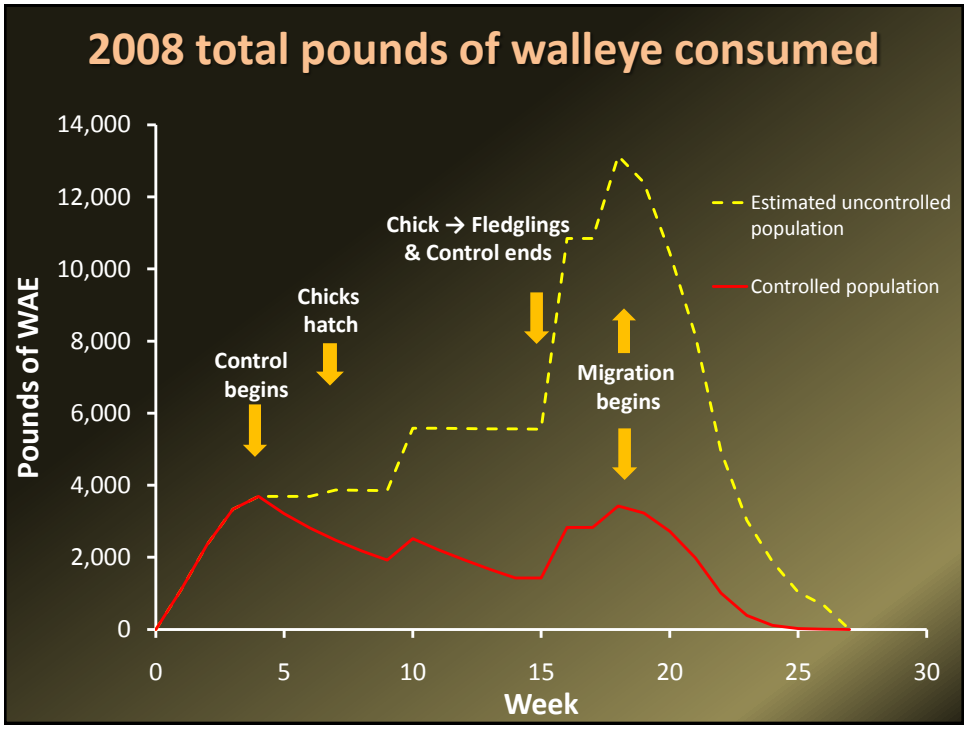
Diet composition

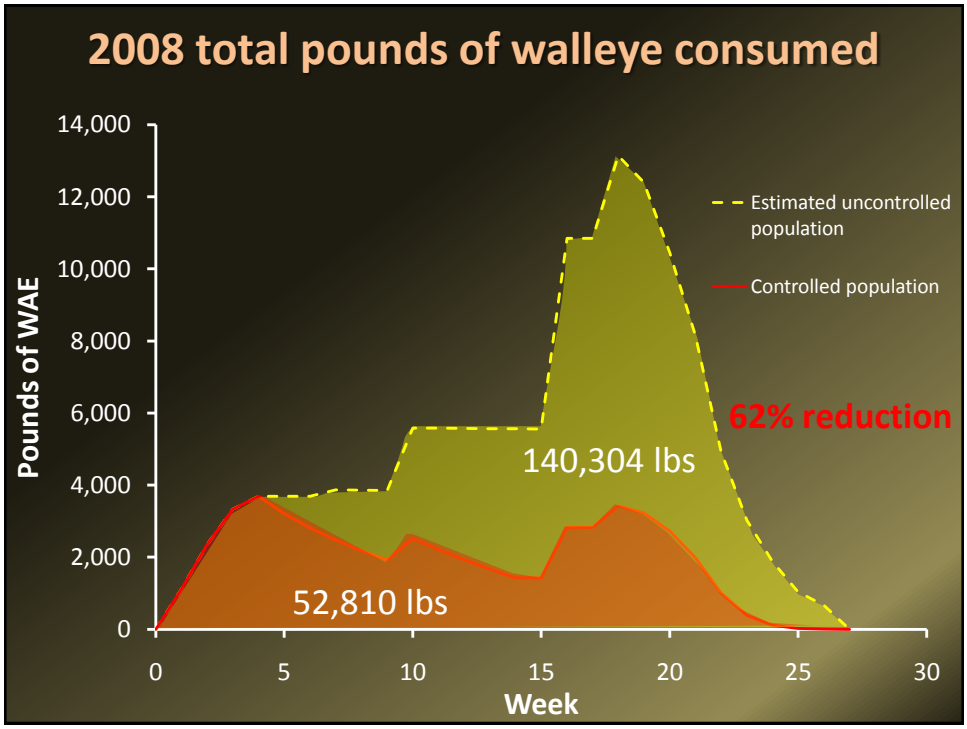


Data summarized from Hundt 2009

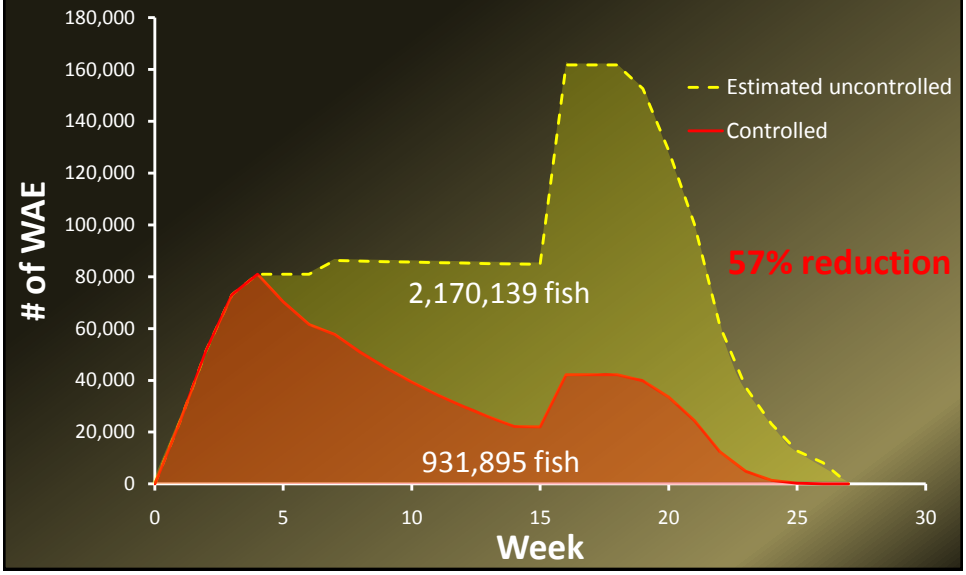
Walleye as a food item

- Varies annually and seasonally
  - Size classes available
  - Other forage species available
- Ranges between 2-8% of the total diet (Hundt 2009)


2008 total pounds of walleye consumed
Pounds of WAE
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
5
10
15
20
25
30
Week
Control begins
Chicks hatch
Chick → Fledglings & Control ends
Migration begins
Estimated uncontrolled population
Controlled population


2008 total pounds of walleye consumed
Pounds of WAE
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
5
10
15
20
25
30
Week
Estimated uncontrolled population
Controlled population
62% reduction
140,304 lbs
52,810 lbs

2008 total number of walleye consumed



What age classes are being eaten?

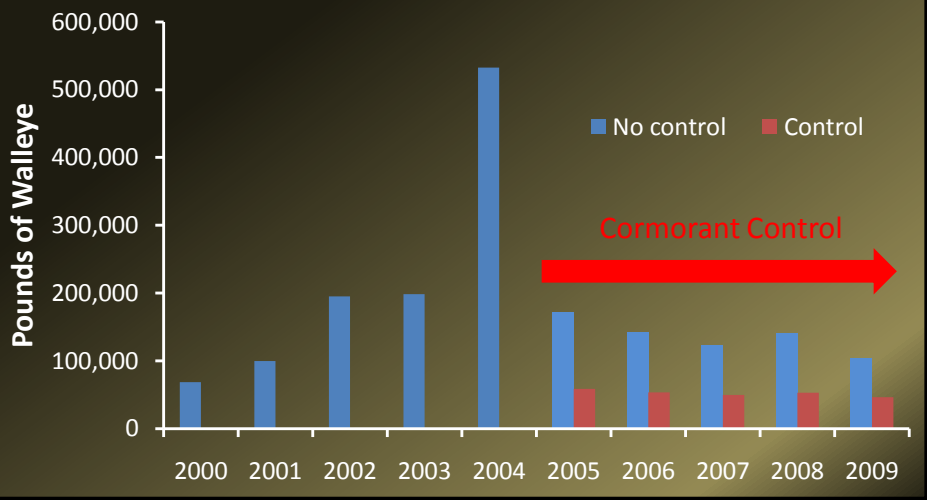
- Composition of walleye age groups eaten varies by: chick or adult, year, and season
- Averages (2005-2007; Goktepe 2008)
  - Adults
    - Age 0: 67.0%
    - Age 1: 27.7%
    - Age 2: 5.3%
  - Chicks
    - Age 0: 98.9%
    - Age 1: 1.1%
    - Age 2: 0%

Age Class Survival

Age (Spring to Spring)	Survival Rate (%)
Fry to Yearling	>2, highly variable
Yearling to Age-2	15
Age-2 to Age-3	35
Age-3 to Age-4	80

What does it mean?

- Since 2005 – Cormorant predation on Leech Lake walleye has been reduced by 55-65%



What does it mean?

- Bird predation has been reduced by 55-65%
- Timing of control can influence total bird days & total consumption
  - intensive culling rate could further reduce bird use by 15-20%
- Consumption estimates will continue to better describe long-term trends as additional diet information is collected.

Adaptive Approaches to Investigating Uncertainty

What we do know

- **Bird consumption rates on Leech higher than other studies – difference in diet collection methods?**
- **Current consumption estimates may be high**
- **Seasonality in diet composition**
- **Resident DCCO population parameters**

What is still needed

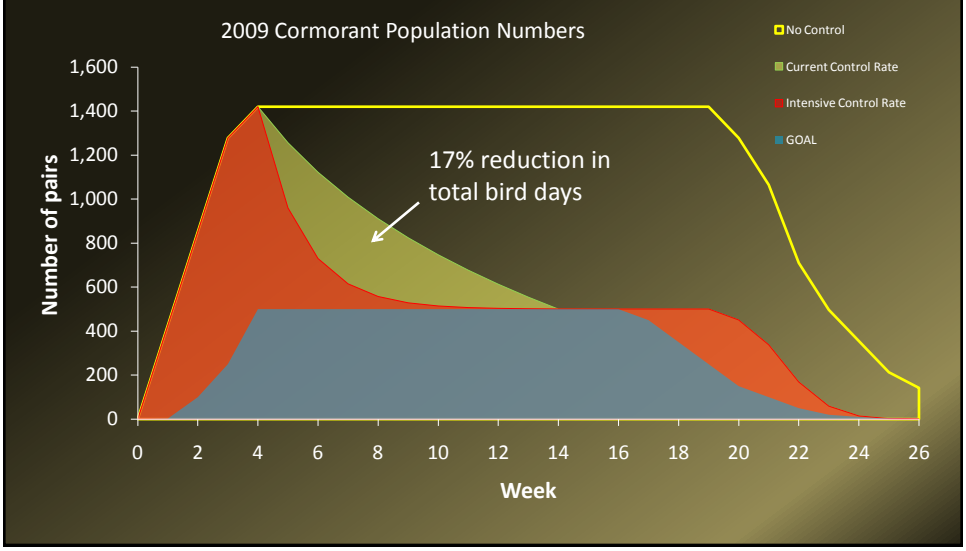
- **Diet data - consumption of a species varies with availability & size, and interacts with availability of other species (cisco, perch, trout-perch, etc.)**
- **Walleye consumption rates under different growing conditions**
- **Walleye consumption rates with below-average year classes**
- **Better methods for sampling young walleye (current DNR Research priority)**
- **Additive vs. Compensatory cormorant mortality of young walleye**

Questions on Model?

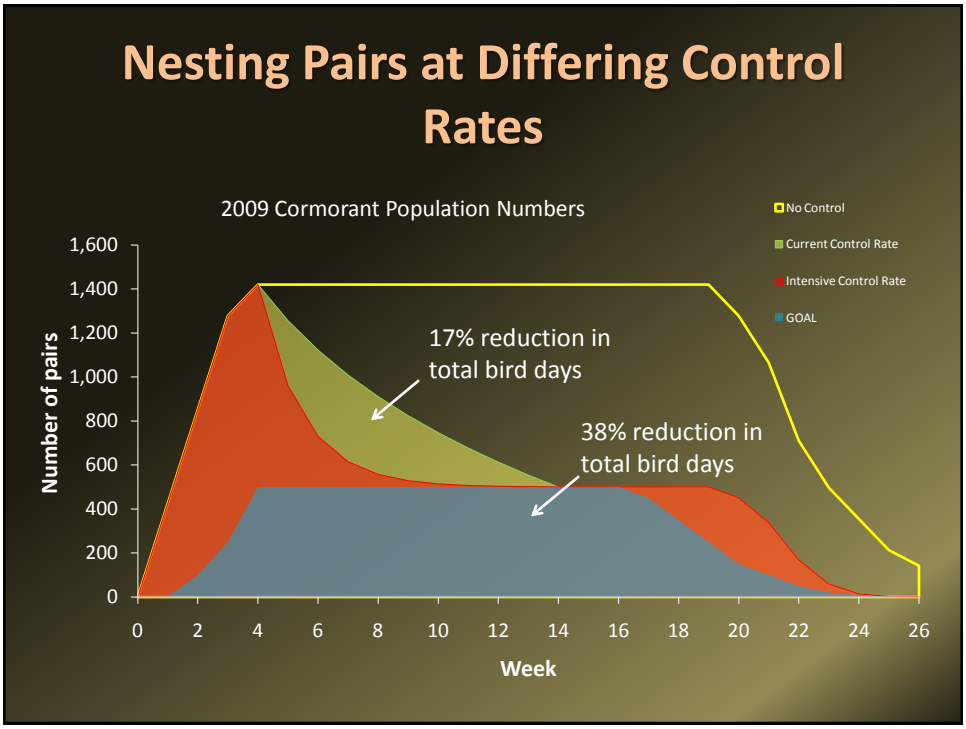
Currently…

- Strong walleye YC's suggest current target is appropriate
- Rebound in perch and walleye gill net catch rates suggest current target is appropriate
- Excellent walleye and perch fishing suggest current target is appropriate
- DRM plans to maintain current target until modeling indicates to us that we should revise it. Under present target we can reduce cormorant bird days by 15-20% below current levels
- DNR continues to monitor perch and walleye populations

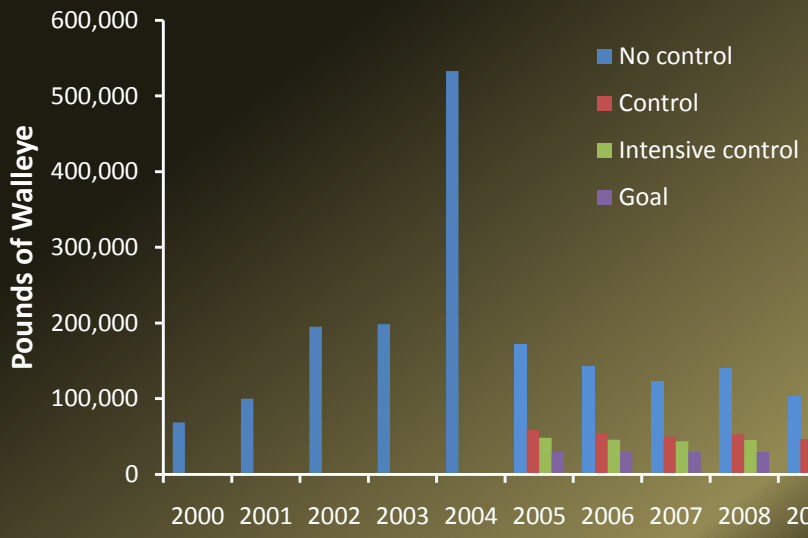
Nesting Pairs at Differing Control Rates



Nesting Pairs at Differing Control Rates



Current Control v. Intensive Control



Management Directions?

- Funding – $50,000/year for accelerated spring control
- Also need long-term research and management funding
- Control strategies - more intensive early
- Nesting habitat reduction to discourage migrants from staying
- Develop non-lethal methods of reducing cormorant numbers

Questions?