Black Duck Conservation:
Increasing Carrying Capacity

Easton, MD

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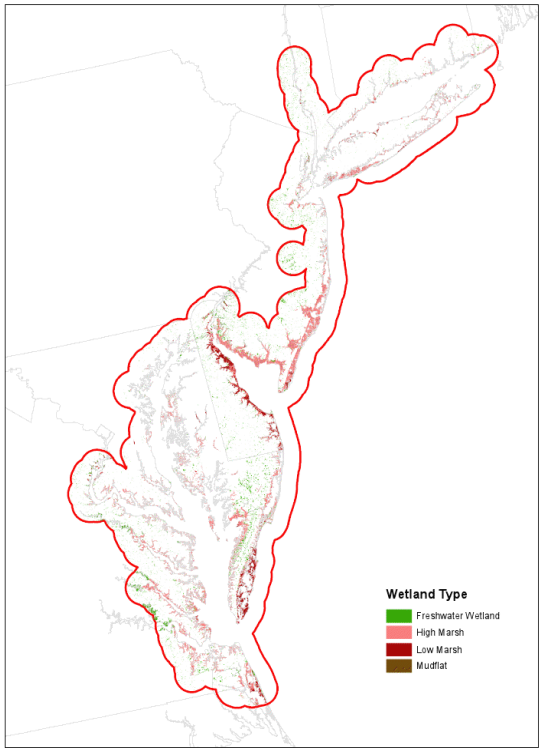
John Coluccy, Tim Jones, and Pat Devers

Increasing Carrying Capacity



Outline

- Acknowledgements
- Introduction and background
- Methods and Results
- Discussion

Acknowledgements

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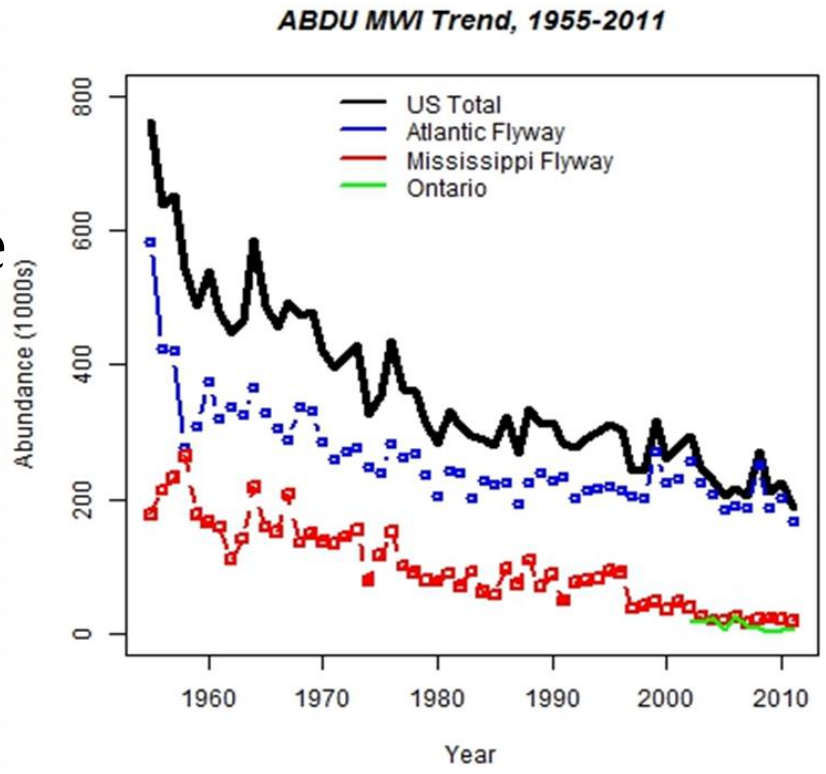
Introduction and Background

- Historically most abundant duck in E. NA.
  - *"The bread and butter duck of the northeast"*
  - *"The gold standard of the eastern wildfowler"*
  - *"The pride of the salt marsh"*
- Rapid and sustained decline in abundance
- 1986 NAWMP



Focus on problem

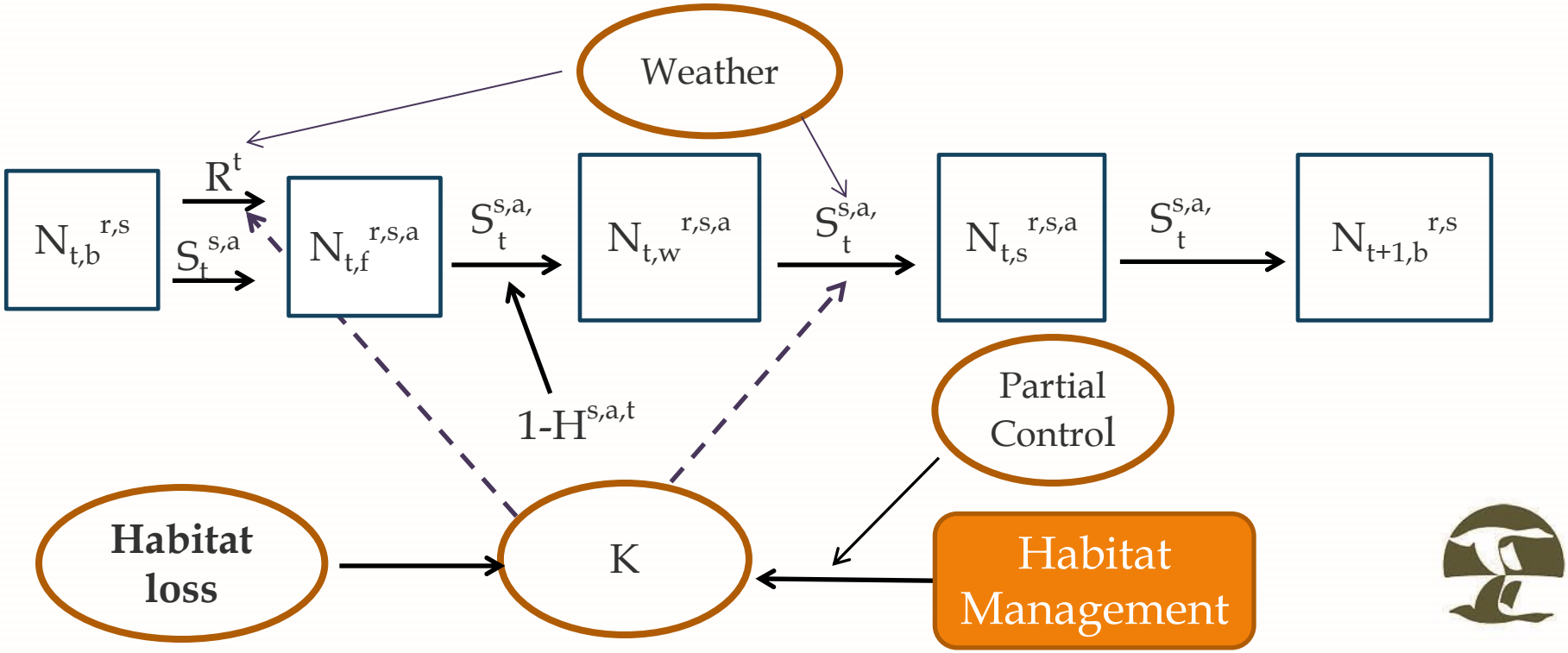
Given a budget, what is the most effective allocation of habitat throughout the annual range to achieve the NAWMP population goal and increase our understanding of black duck limiting factors?

Approach is scalable – so we can address same question in the CBWS.

The problem is framed as a resource (i.e., $) allocation issue.

Conceptual Model:

1. D-D reproduction related to breeding grounds
2. D-D survival related to wintering grounds
3. D-D reproduction related to wintering grounds
4. D-D changes in transition probabilities



Strategy Going Forward

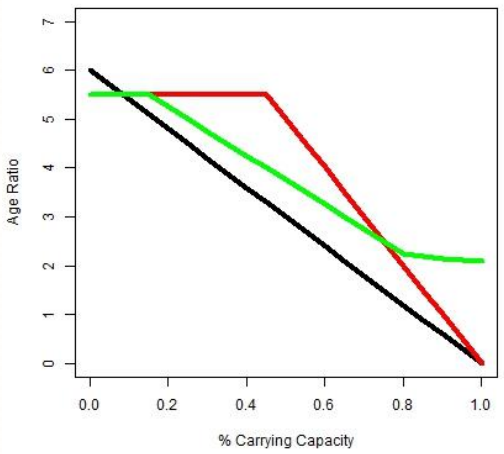
$$R_t^{i,\cdot} = R * (1 - \frac{N_t^{\cdot,j}}{K^{\cdot,j}}))$$

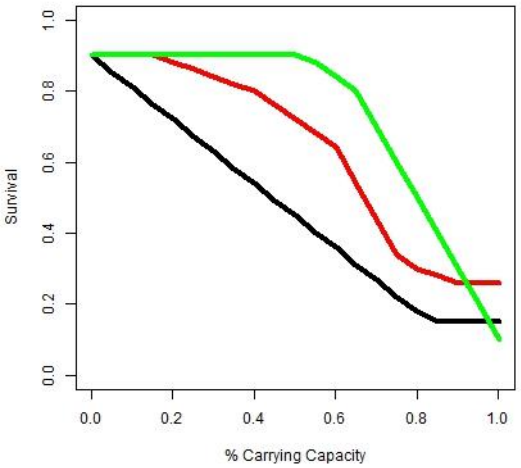
$$R_t^{i,\cdot} = R * (1 - \frac{D_t^{\cdot,j}}{E^{\cdot,j}}))$$

$$S_{a,s,t}^{\cdot,j} = S * (1 - \frac{N_t^{\cdot,j}}{K^{\cdot,j}}))$$

$$S_{a,s,t}^{\cdot,j} = S_{a,s} * (1 - \frac{D_t^{\cdot,j}}{E^{\cdot,j}}))$$

Assume **winter K** is limited by energy (bio-energetics model)





Methods

Estimating K: energetic capacity (E)

- Standardized & Replicated field studies

- 5 wetland types
  - FW, HM, LM, MF, ST

- Core samples & net sweeps

- Food habits samples

- Est. TME

Site	*Years*
Coastal, CT	*2007-2010*
Long Island, NY	*2004-2006*
Coastal, NJ	*2006-2009*
Eastern Shore, VA	*2006-2009*

Methods

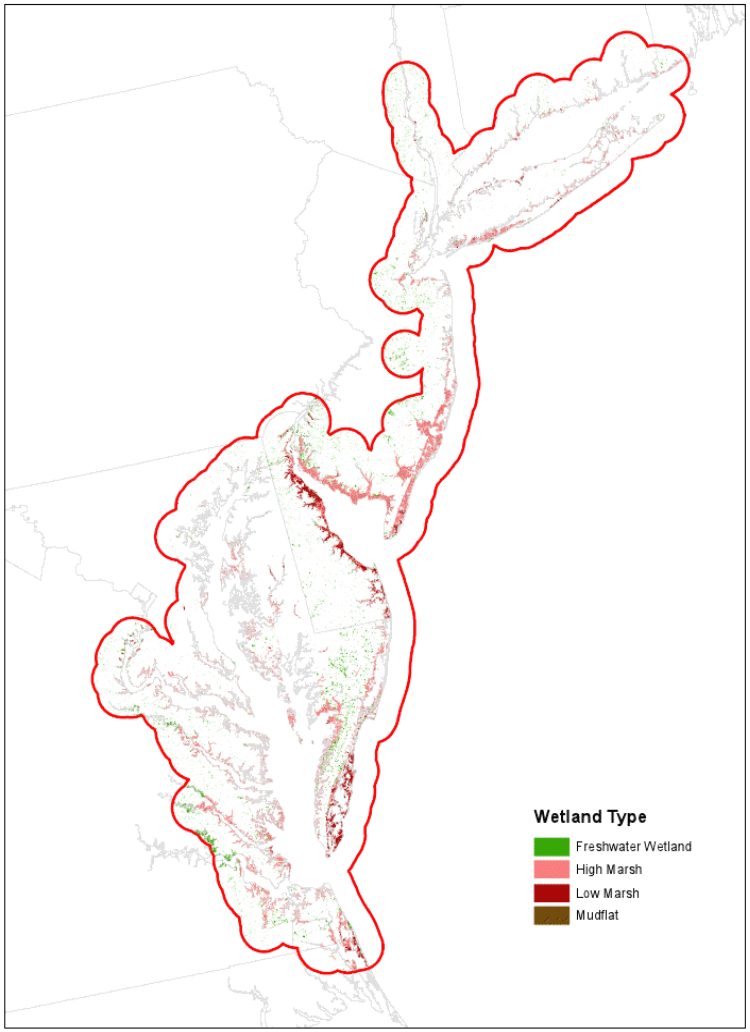
Estimating K: energetic capacity (E)

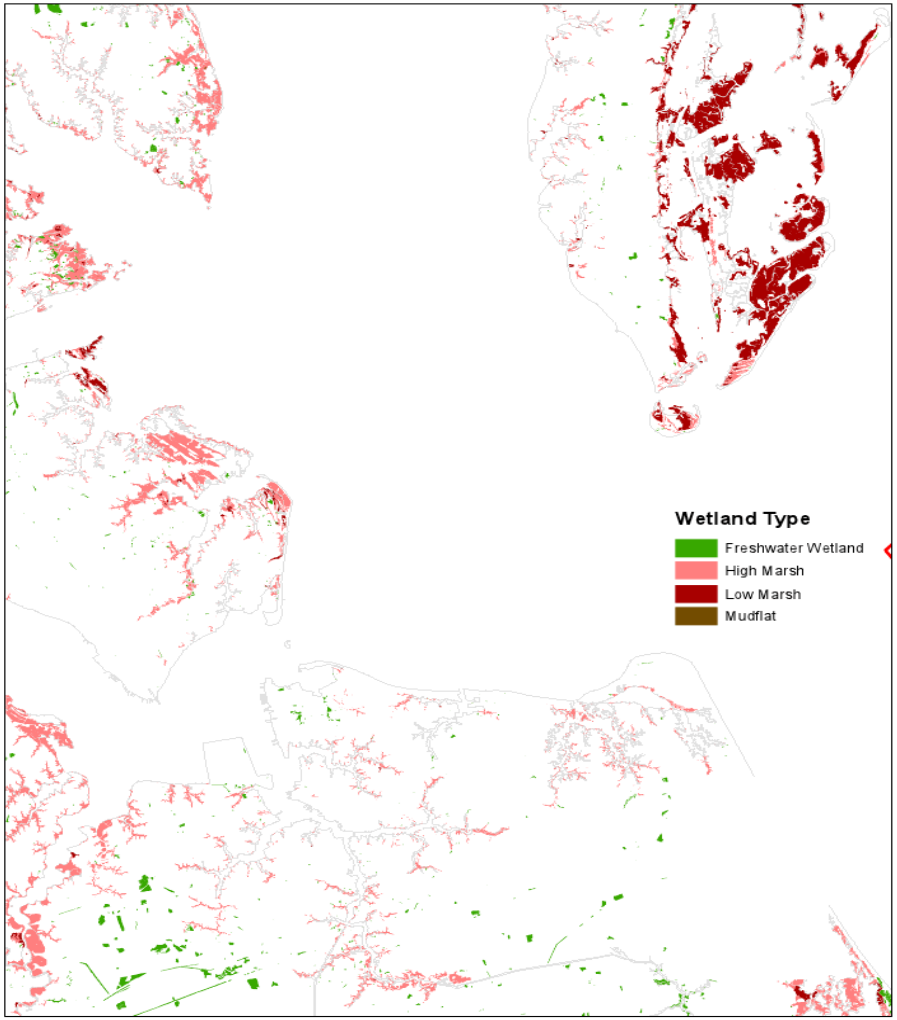
- Est. available habitat in a GIS w/ NWI data
  - Regions: CT & NY; DE & NJ; MD & VA
  - 10-mile buffer

- Assigned energetic capacity (C) by wetland type
  - FW, HM, LM, MF, ST

- Est. energetic capacity by region ($E^{.,j}$)
  - $E^{.,j} = \sum_1^h (C^h * A^h)$

Methods

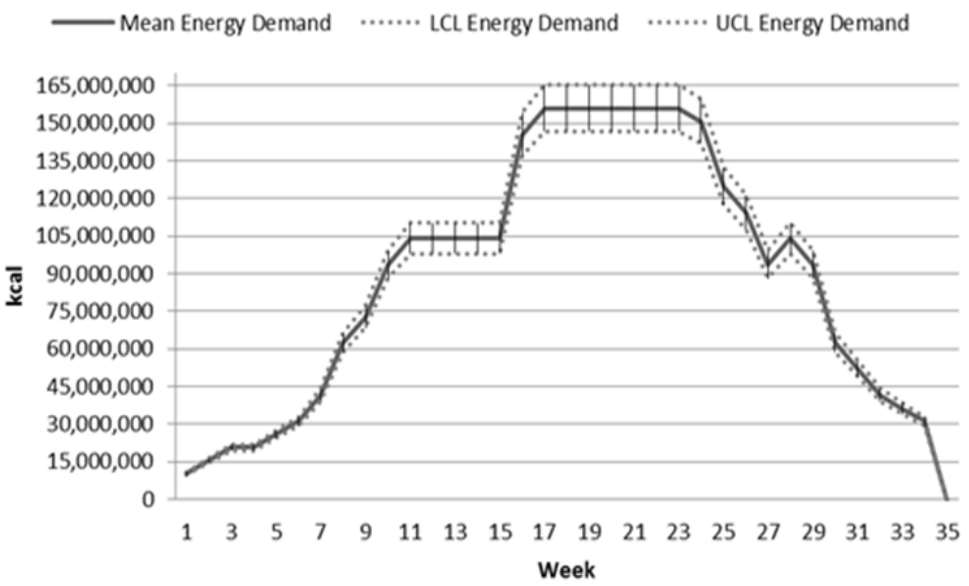

Wetland Type
Freshwater Wetland
High Marsh
Low Marsh
Mudflat


Wetland Type
Freshwater Wetland
High Marsh
Low Marsh
Mudflat

Methods

Estimating energetic demand: (D)

- Stepped down NAWMP goals
  - Continental goal = 910,000 breeding black ducks
  - County level harvest
  - Migration chronology
  - State level goals



Methods

Estimating energetic demand: (D)

- Est. daily energetic requirements (DER)
  - DER: 295 kcal/bird/day (Jones 2012)

- Popn energy demand ($D^{\cdot,j}$)
  - Days * DER = Total energy demand

Results

Table 2. Mean total energy demand and 95% confidence limits for black ducks by ACJV state.

State	Mean total energy demand (kcal)	95% confidence limit (kcal)
Connecticut	891,101,190	839,749,596 – 945,473,466
Delaware	1,781,503,584	1,678,840,666 – 1,890,205,498
Florida	39,862,760	37,565,584 – 42,295,064
Georgia	149,181,306	140,584,417 – 158,283,894
Maine	4,265,071,650	4,019,287,860 – 4,525,313,310
Maryland	4,805,842,286	4,528,895,442 – 5,099,080,120
Massachusetts	1,479,805,845	1,394,528,898 – 1,570,099,083
New Hampshire	894,056,205	842,534,322 – 948,608,787
New Jersey	3,054,410,884	2,878,393,986 – 3,240,781,718
New York	9,483,026,193	8,936,546,717 – 10,061,651,520
North Carolina	1,798,629,816	1,694,979,963 – 1,908,376,721
Pennsylvania	2,478,708,708	2,335,867,867 – 2,629,951,951
Rhode Island	309,346,293	291,519,557 – 328,221,660
South Carolina	379,473,040	357,605,102 – 402,627,328
Vermont	1,575,570,220	1,484,774,648 – 1,671,706,708
Virginia	3,616,959,010	3,408,524,084 – 3,837,654,814
West Virginia	146,111,140	137,691,176 – 155,026,396

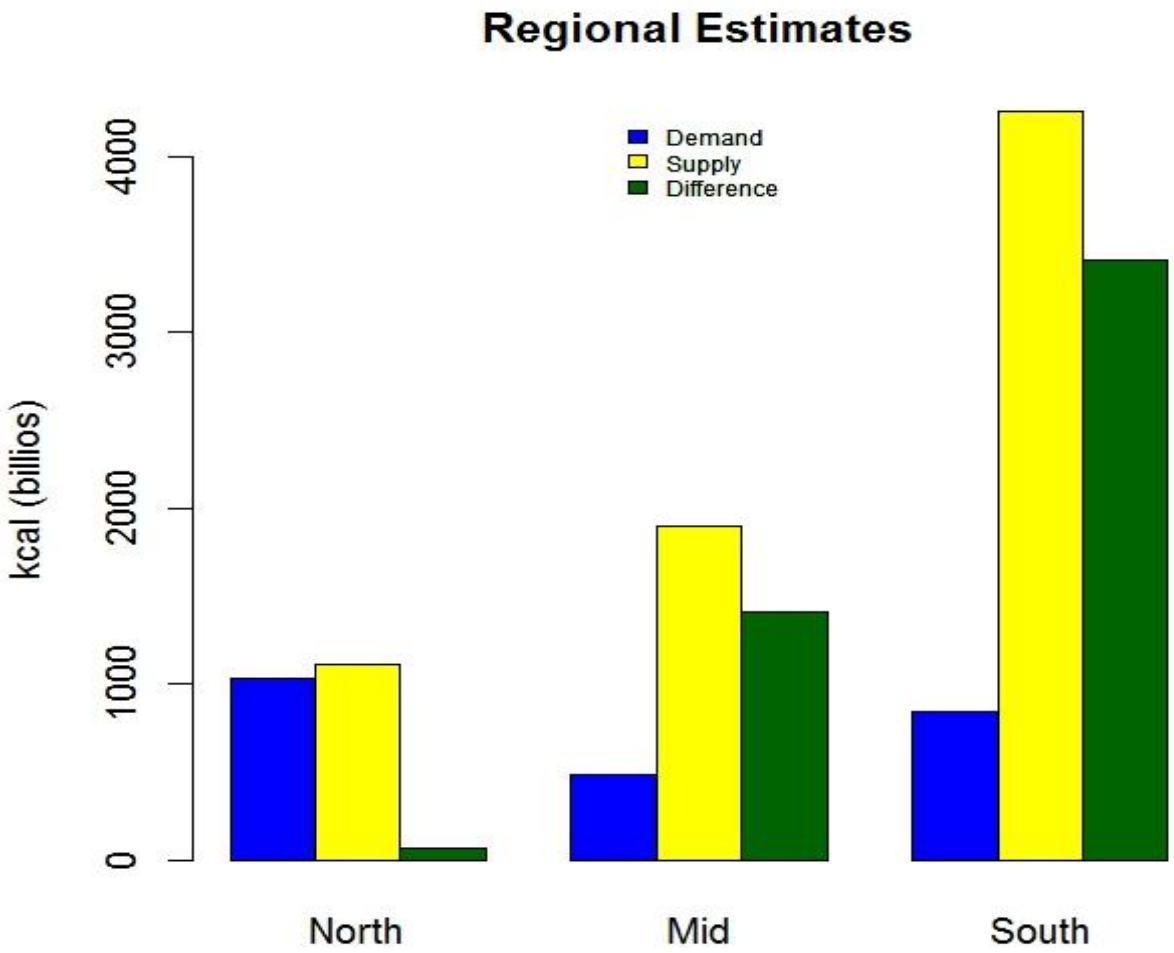
Results

Capacity: Kcals by region

- 10-mile buffer around coastal zone
- Includes small portions of RI, PA, and NC

Region	Mean Supply (Kcals)
CT & NY	11,096,229,443
NJ & DE	18,953,465,266
MD & VA	42,587,737,071

Results


Regional Estimates
Demand
Supply
Difference
kcal (billios)
0
1000
2000
3000
4000
North
Mid
South

Discussion

- Initial Conclusion:
  - Initial estimates meet NAWMP goal
  - N-S gradient in est. energetic capacity.
    - Most critical region appears to be N. Atl.
    - Rough estimates suggest enough supply in CBWS

Discussion

- Initial Conclusion: *Est. of available E biased high*
  - NWI data (i.e., avail habitat) >10 yrs old
  - ABDU may avoid some areas due to disturbance
  - Densely vegetation stands unavailable?
  - Foraging threshold (est. 15-250 kg/ha).
  - Est. RMR and behavior multipliers accurate?

Discussion

Initial Conclusion: *Est. of available E biased high*

- Haven't included estimates of variance
- Haven't accounted for weather conditions
  - Evidence of "freeze events"
- Est. do not account for competition
  - CT & NY avg ~ 80,365 total waterfowl
  - NJ & DE avg ~ 350,763 total waterfowl
  - MD & VA avg ~ 465,409 total waterfowl

Next Steps

Addressing Assumptions and Refining Estimates:

- Updating estimates of RMR and multipliers
- Assessing influence of E on survival and home range size
- Estimating avoidance and true habitat availability.
- Est. influence of habitat mgmt on E
  - Before-After-Control-Impact Studies
    - Silver Sands State Park, CT

Next Steps

Estimating habitat needs by region:

- Est. regional (*i*) habitat delivery goals for "5-year" period (C_g)
  - Estimate current Capacity (C_c)
  - Predict future rates of energy loss due to wetland loss (L_t)
  - Est. energy gained via mgmt (A_t)

$$C_g = \widehat{C_c^i} - \widehat{L_t^i} + \widehat{A_t^i}$$

Next Steps

Estimating habitat needs by region:

	Targeted Habitat Goals (ha)	
Region	Protection	Restoration
N. Breed	0-n	0-n
S. Breed	0-n	0-n
N. Atl. Winter	0-n	0-n
Mid-Atl. Winter	0-n	0-n
Interior	0-n	0-n

Thank you

Questions?