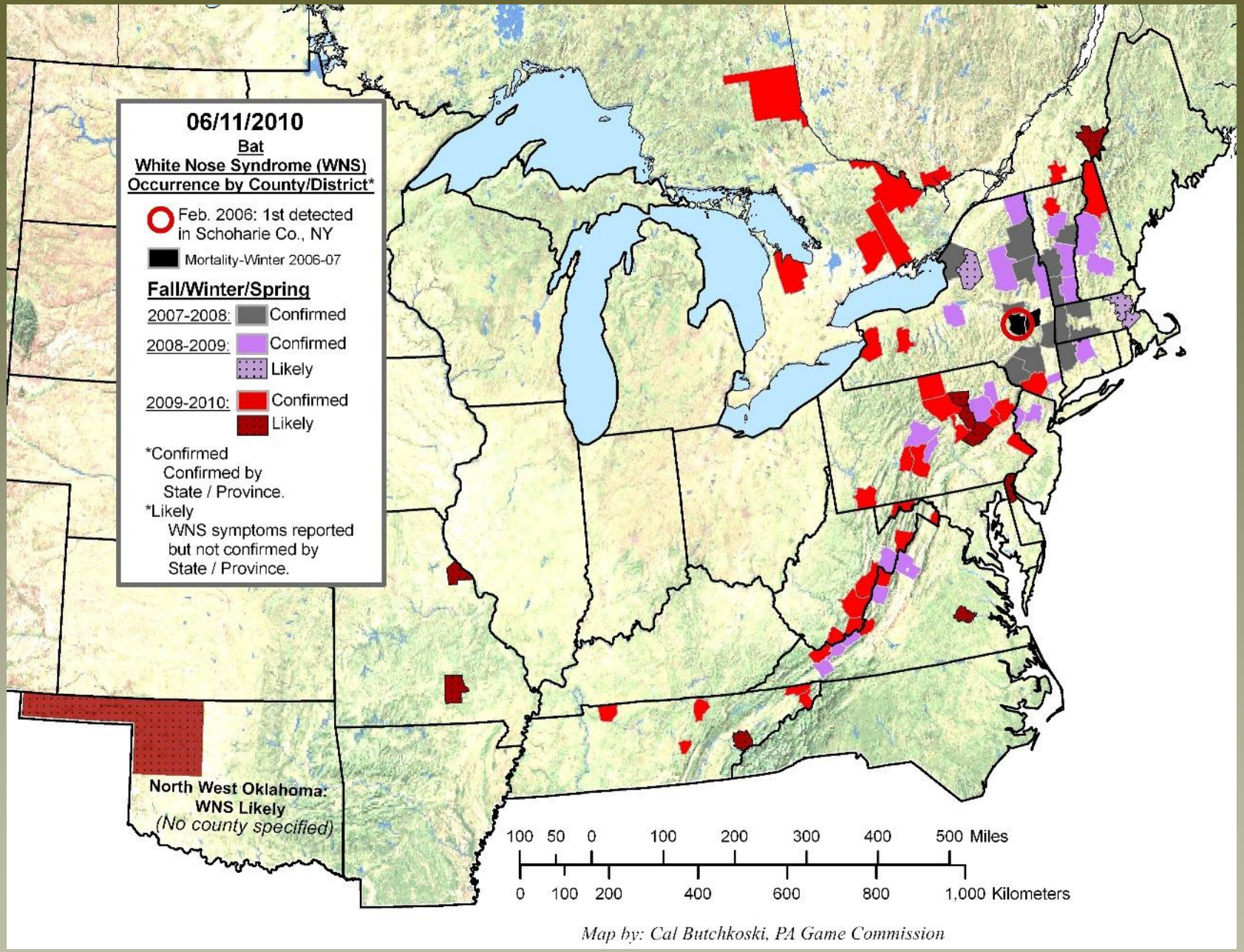
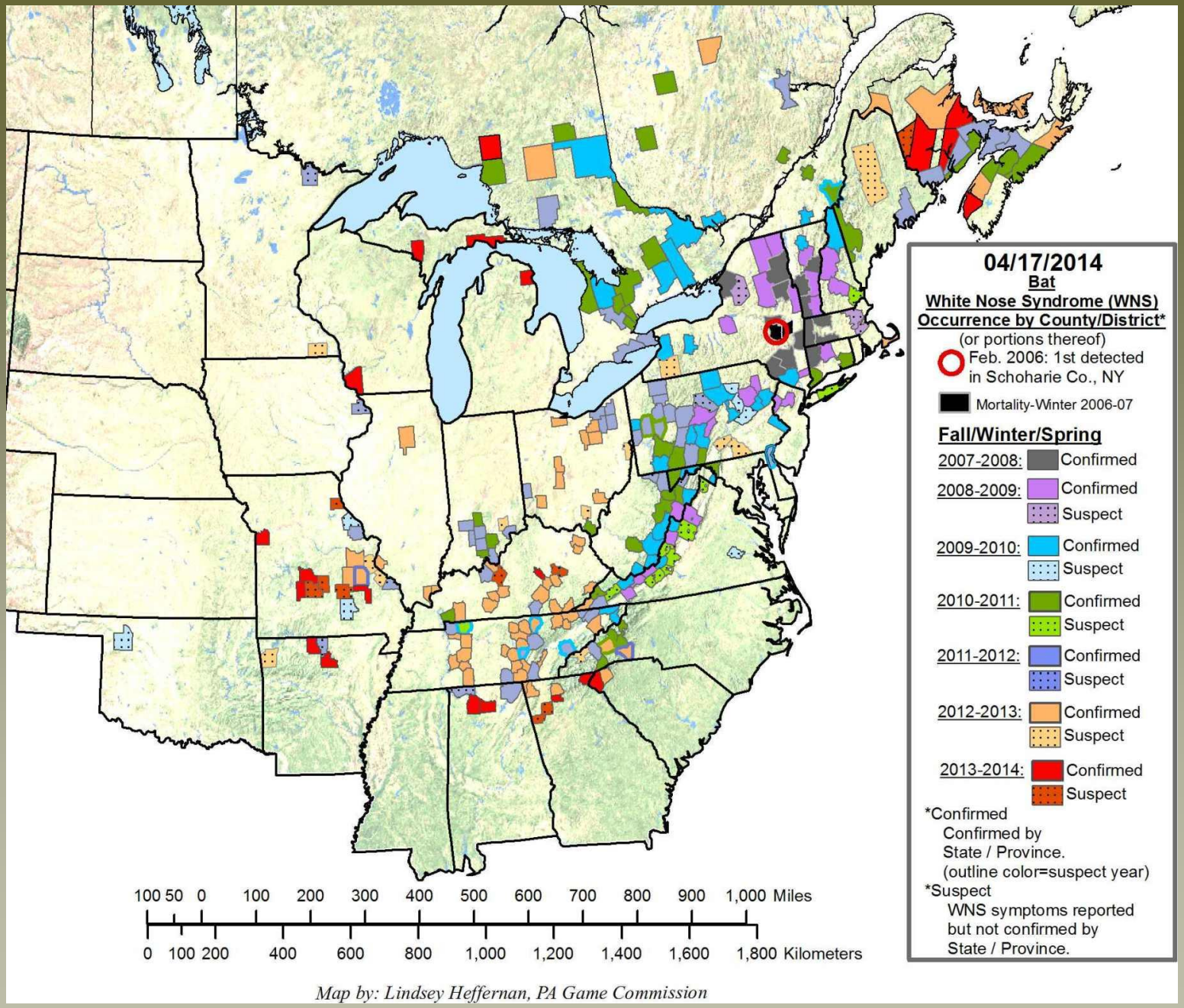
Body Condition of Bats During Staging and Swarming Periods in Mammoth Cave National Park: Before and after Arrival of White-Nose Syndrome

M. Lacki, L. Dodd, R. Toomey, S. Thomas,
Z. Couch, and B. Nichols

University of Kentucky, National Park Service,
Kentucky Division of Water & Eco-Tech Consultants

White Nose Syndrome (WNS)


06/11/2010
Bat
White Nose Syndrome (WNS)
Occurrence by County/District*
Feb. 2006: 1st detected in Schoharie Co., NY
Mortality-Winter 2006-07
Fall/Winter/Spring
2007-2008: Confirmed
2008-2009: Confirmed
Likely
2009-2010: Confirmed
Likely
*Confirmed
Confirmed by State / Province.
*Likely
WNS symptoms reported but not confirmed by State / Province.
North West Oklahoma:
WNS Likely
(No county specified)
100 50 0 100 200 300 400 500 Miles
0 100 200 400 600 800 1,000 Kilometers
Map by: Cal Butchkoski, PA Game Commission



Map by: Lindsey Heffernan, PA Game Commission

Photo Courtesy of Marvin Moriarty, USFWS

Bat Body Condition

- Accelerated loss of body mass
- Dehydration
- Increased mortality

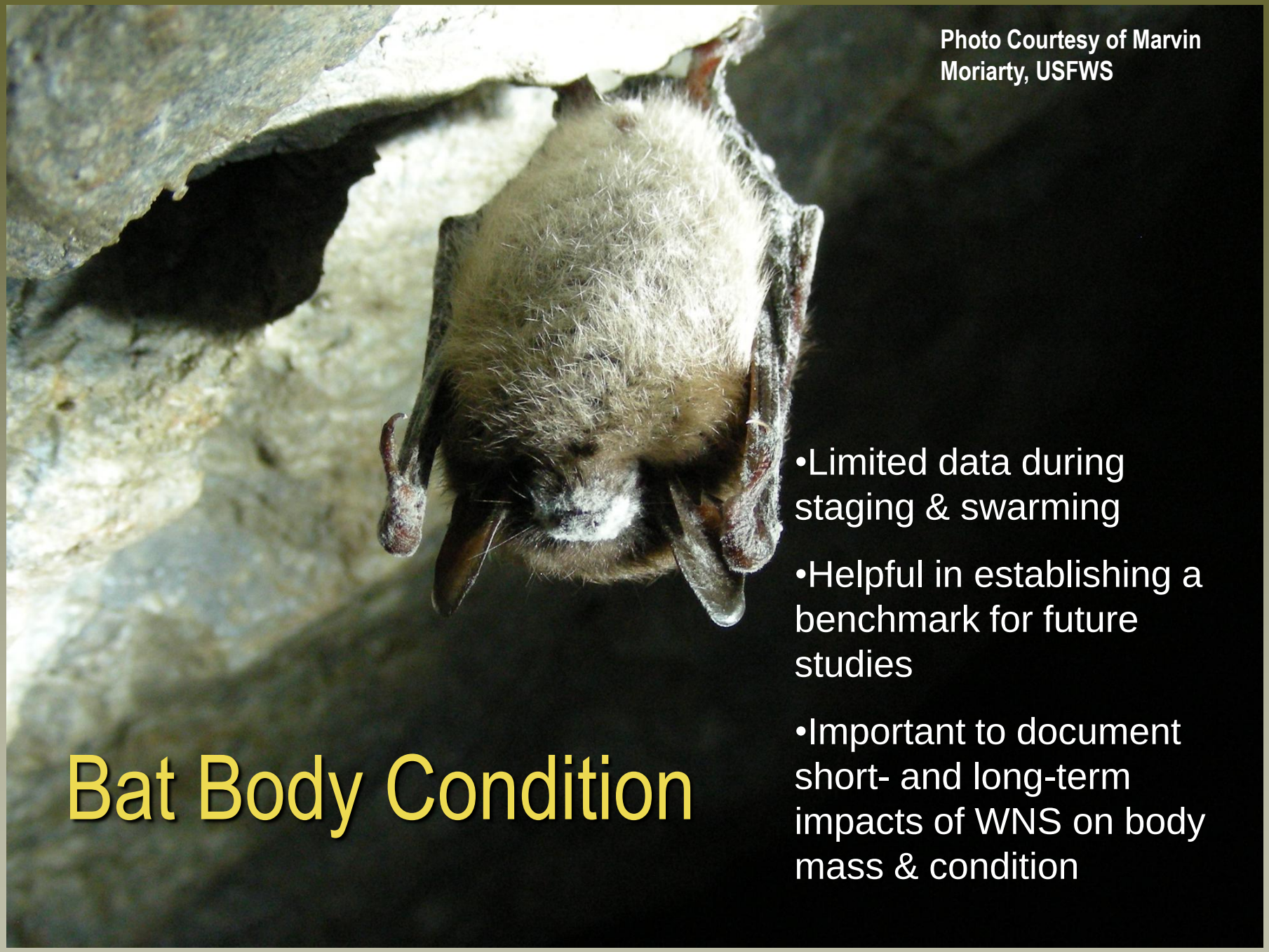


Photo Courtesy of Marvin Moriarty, USFWS

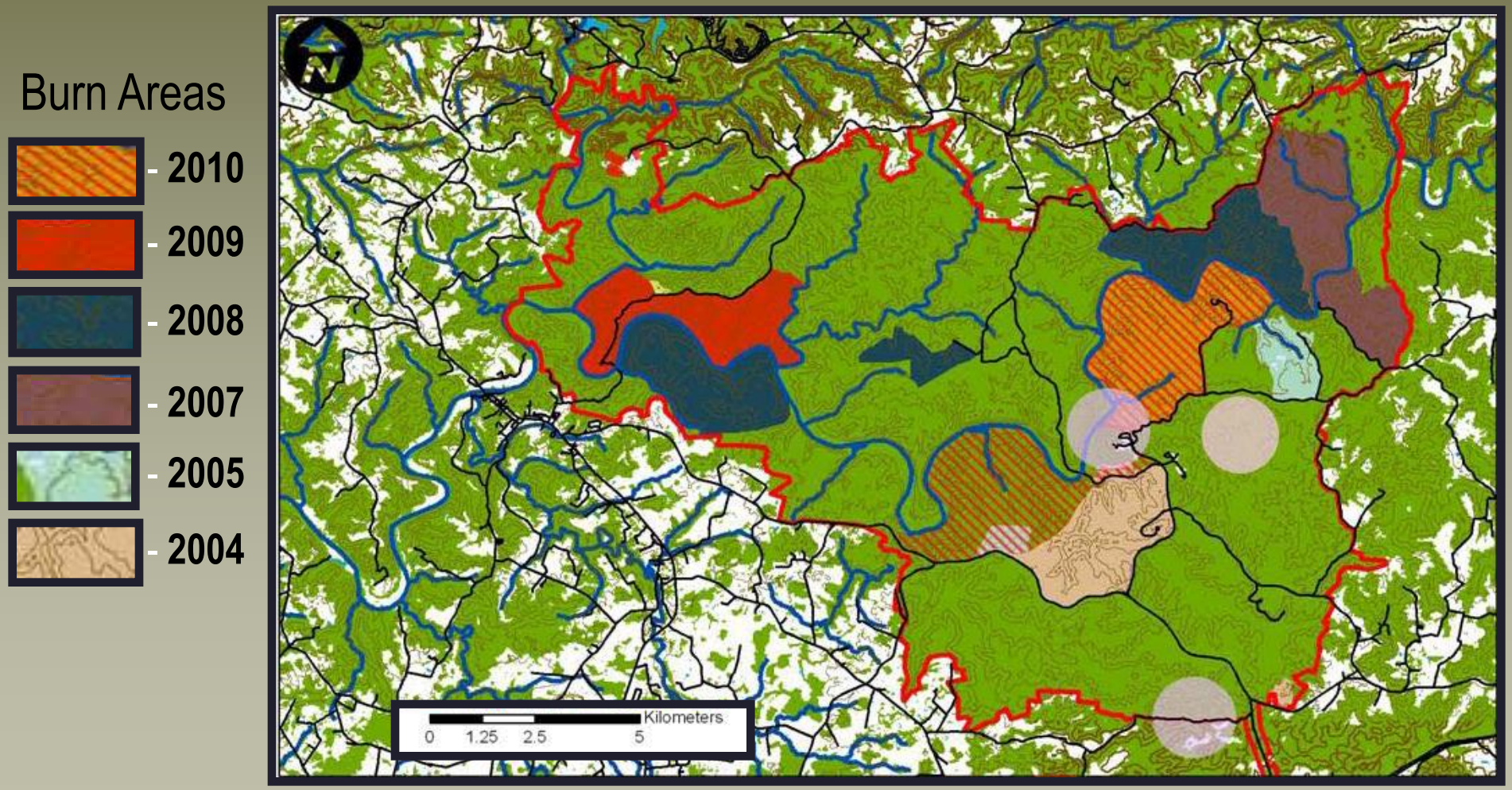
Bat Body Condition

- Limited data during staging & swarming
- Helpful in establishing a benchmark for future studies
- Important to document short- and long-term impacts of WNS on body mass & condition

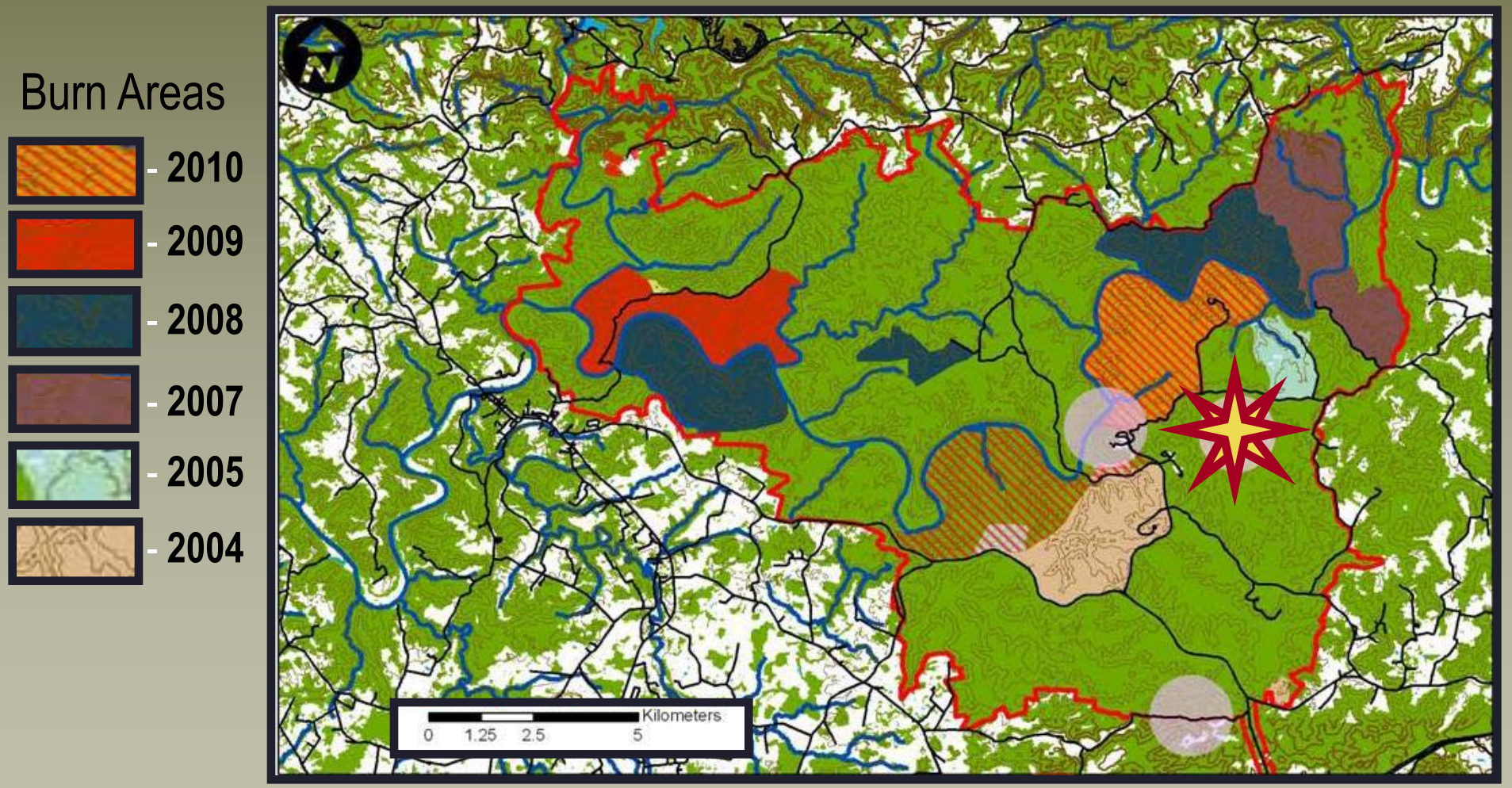
Objectives

- To investigate temporal trends in body condition of bats during staging & swarming periods.
- To evaluate these patterns in association with the arrival of WNS to the MACA cave ecosystems.
- To evaluate these patterns in combination with fire associated, temporal trends in bat activity and insect abundance across the Park.

Mammoth Cave National Park

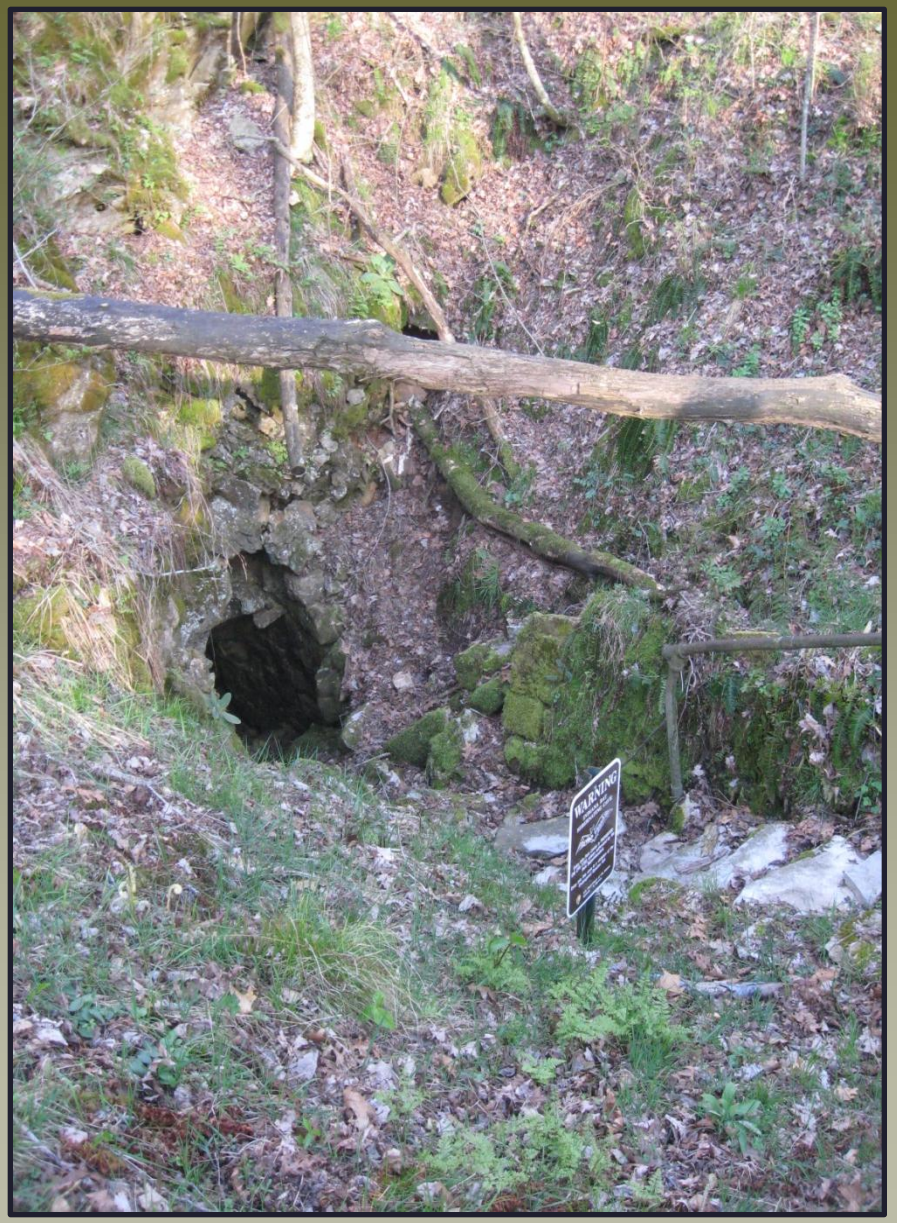


Mammoth Cave National Park



Colossal Cave

- Portion of Mammoth Cave system receiving commercial use in late 1800's
- Artificial entrance (for tours)



Colossal Cave

- Portion of Mammoth Cave system receiving commercial use in late 1800's
- Artificial entrance (for tours)
- Hibernaculum
  - "Priority 2" for *M. sodalis*
  - Also *M. lucifugus*
  - Not suspected to be swarming site for tree bats

Methods – Harp Trapping

WARNING
Caves Closed

Sampling Dates

Staging:

- 2011
  - 6 Apr, 12 Apr & 28 Apr
- 2012
  - 5 Apr, 18 Apr & 2 May
- 2013
  - 5 Apr, 21 Apr & 12 May

Swarming:

- 2011
  - 23 Aug, 13 Sep & 21 Sep
- 2012
  - 21 Aug, 4 Sep & 19 Sep
- 2013
  - 21 Aug, 13 Sep & 25 Sep

All methods comply with USFWS WNS protocols and with UK IACUC approval.

Upper photo courtesy of Joe Johnson

Assessing
Body Condition
• Forearm (0.01 mm)
• Weight (0.01 gram)
• Body Condition Index =
Weight/Forearm (g/mm)

Banding

Assessing Wing Damage

Score = 0; no damage (membrane intact, no wing scarring)

Score = 1; light damage (membrane intact, < 50% of wing de-pigmented)

Score = 2; moderate damage (necrotic tissue, flaking of forearm skin, > 50% of wing de-pigmented or splotching)

Score = 3; heavy damage (receding plagiopatagium, isolated holes ≥ 0.5 cm in diameter in membranes)

Wing Damage Score = 2

Wing Damage Score = 3

Overall Capture Metrics

- 1092 bats captured and processed
- Totals by year
  - 2011 (n = 420)
  - 2012 (n = 370)
  - 2013 (n = 302)
- Totals by season
  - Staging (n = 485)
  - Swarming (n = 607)
- Average number processed per trap session (Mean = 61 bats)
- Number of species captured (n = 8)

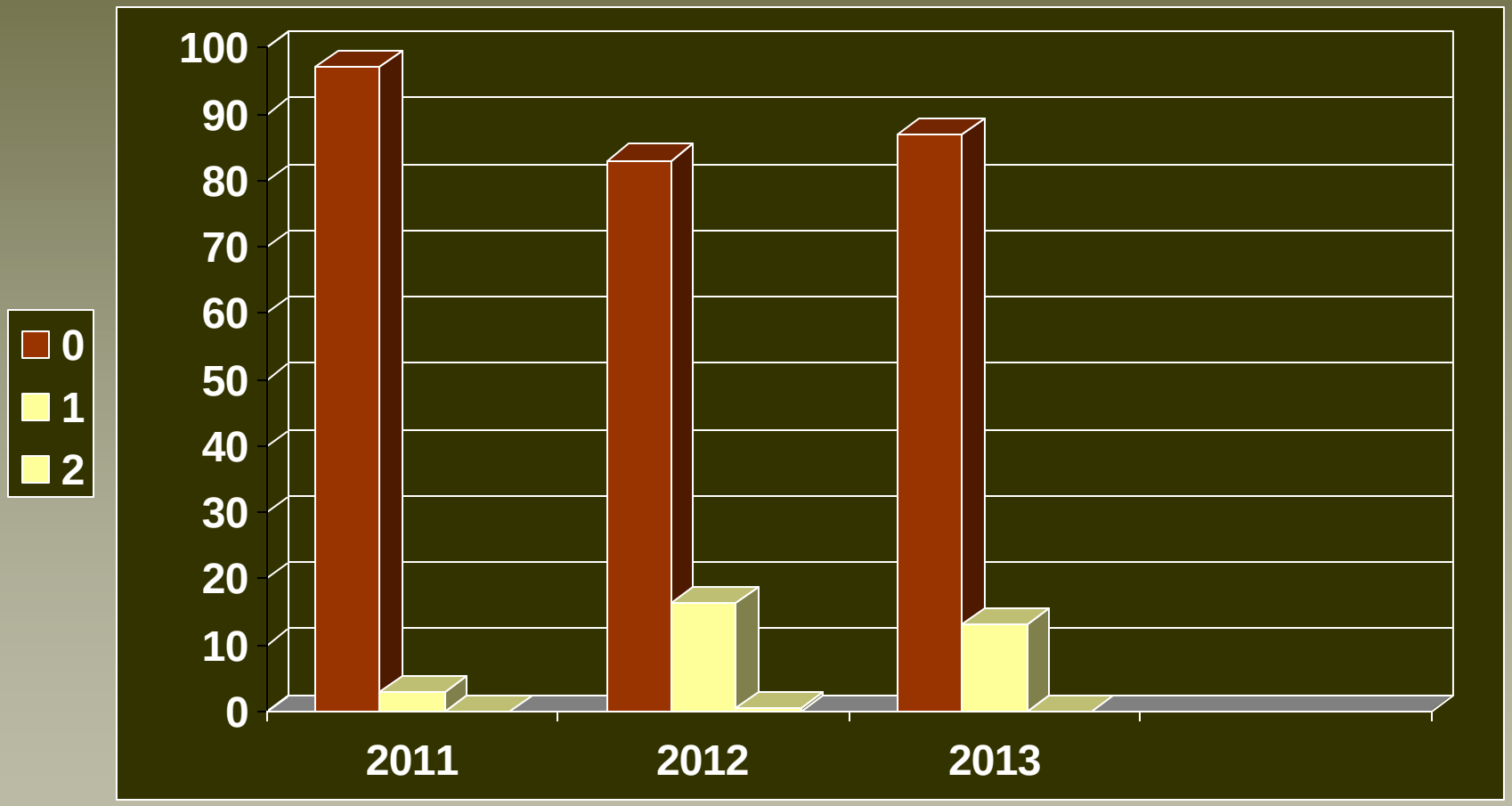
Totals for Species Captured

- *Perimyotis subflavus* **(n = 495)**
- *Myotis septentrionalis* **(n = 418)**
- *Myotis lucifugus* **(n = 73)**
- *Myotis sodalis* **(n = 56)**
- *Myotis leibii* **(n = 17)**
- *Eptesicus fuscus* **(n = 4)**
- *Corynorhinus rafinesquii* **(n = 2)**
- *Lasiurus borealis* **(n = 2)**

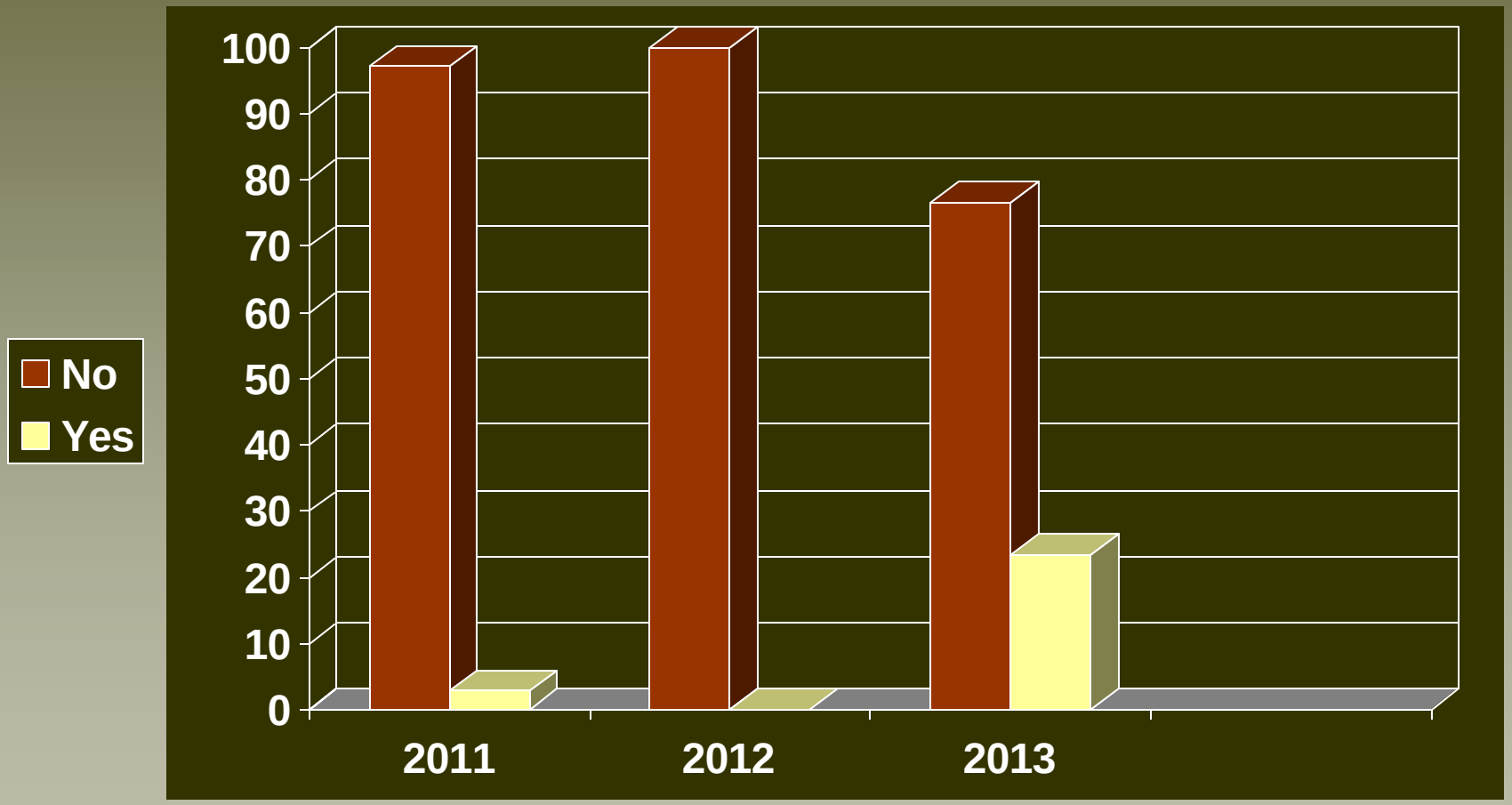
Sex Ratios of Species Captured

- *Perimyotis subflavus* **(2.67 males/female)**
- *Myotis septentrionalis* **(3.64 males/female)**
- *Myotis lucifugus* **(4.21 males/female)**
- *Myotis sodalis* **(6.0 males/female)**
- *Myotis leibii* **(4.67 males/female)**
- *Eptesicus fuscus* **(3 males/female)**
- *C. rafinesquii* **(2 males)**
- *Lasiurus borealis* **(1 male/female)**

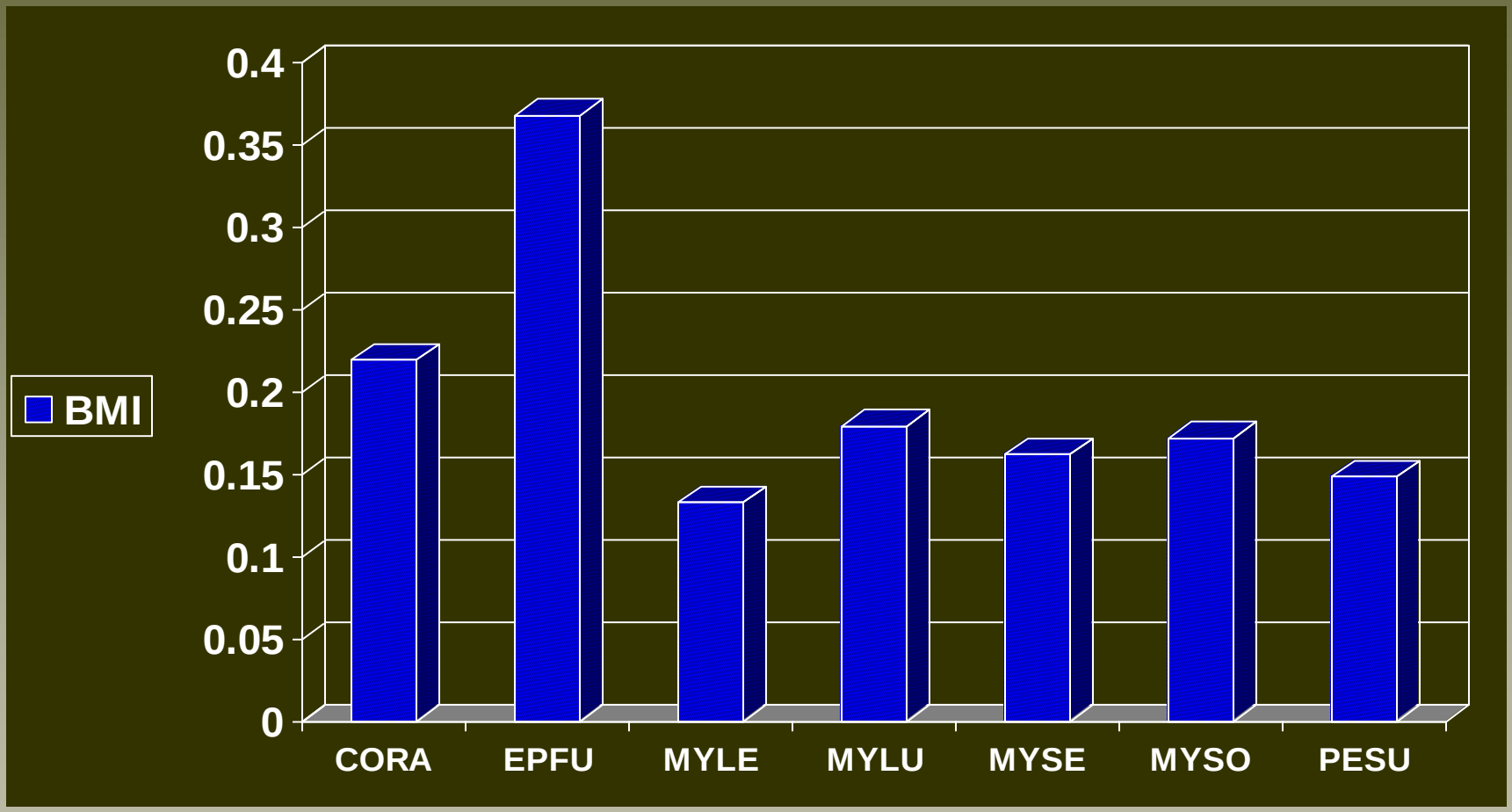
Wing Damage Index



UV Detection

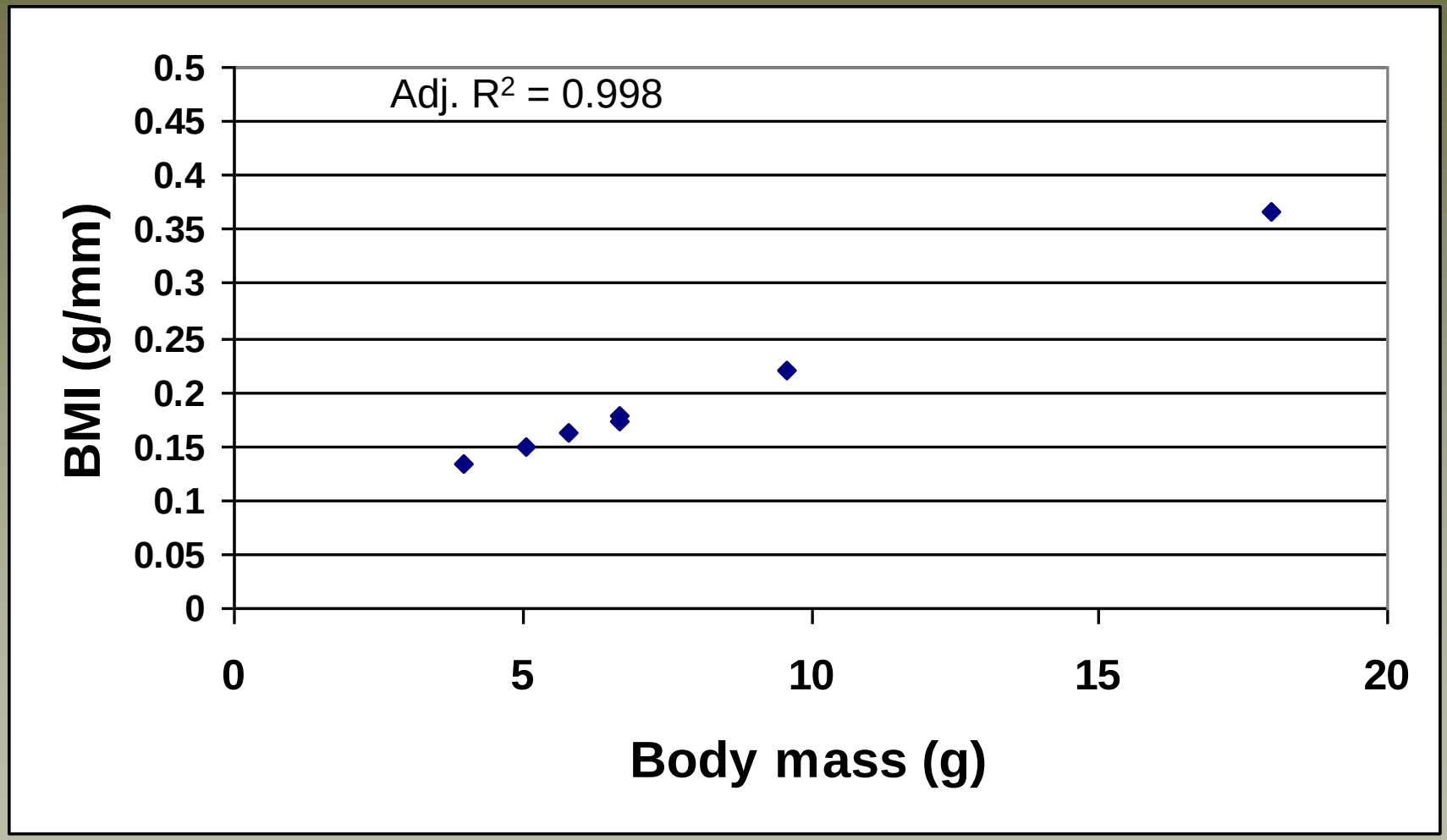


BMI (g/mm) by Species

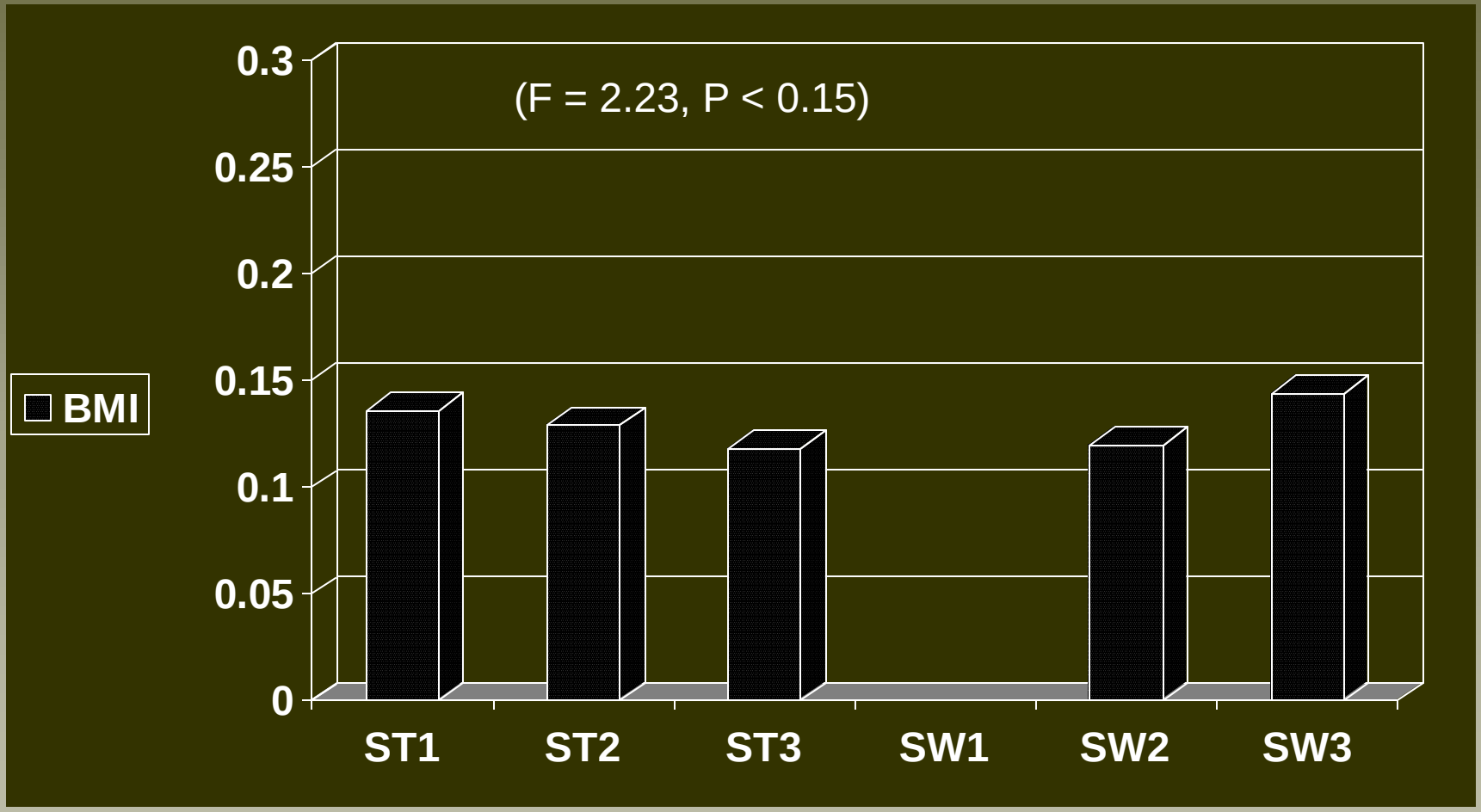


(F = 21.3, P < 0.0001)

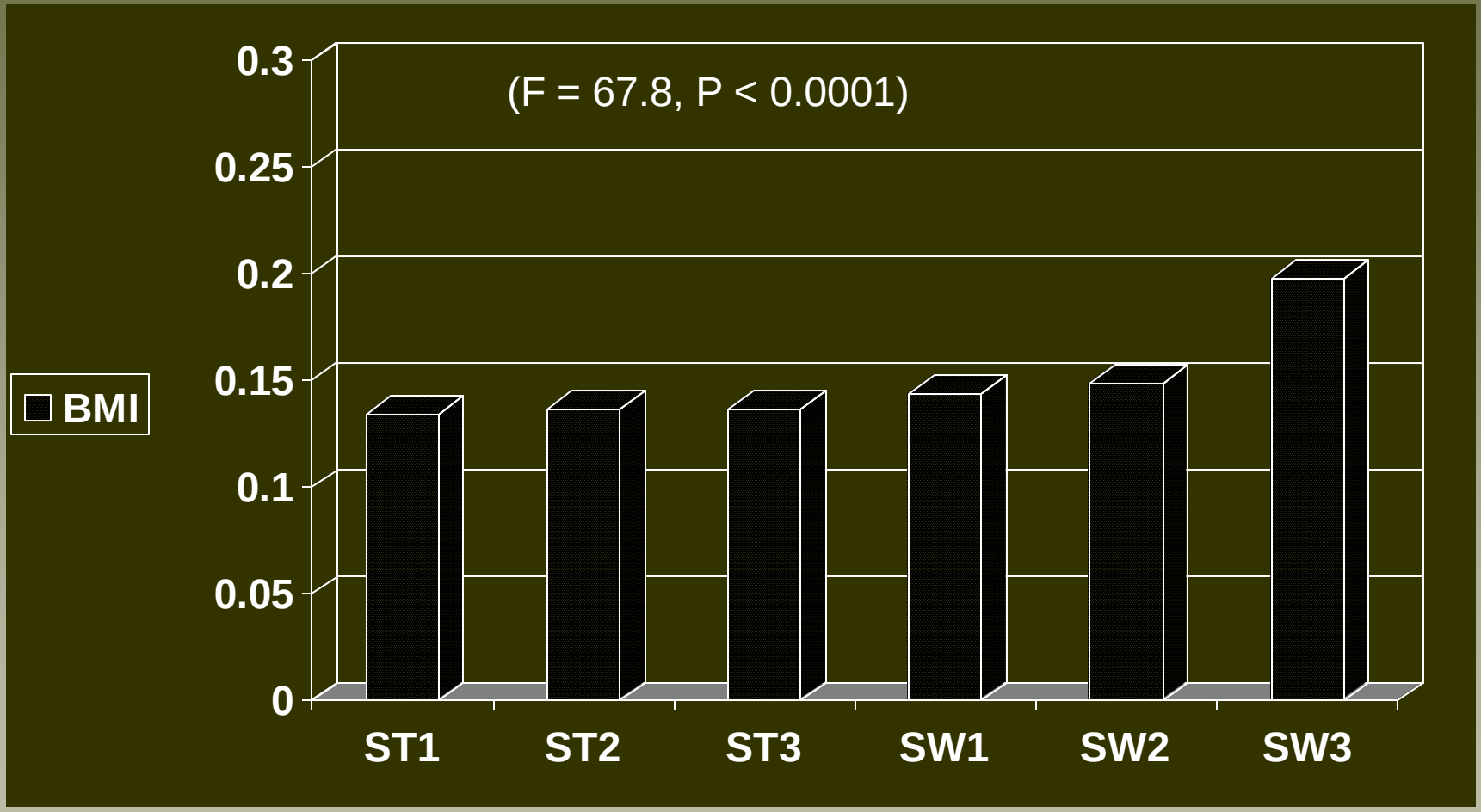
BMI by Body Mass



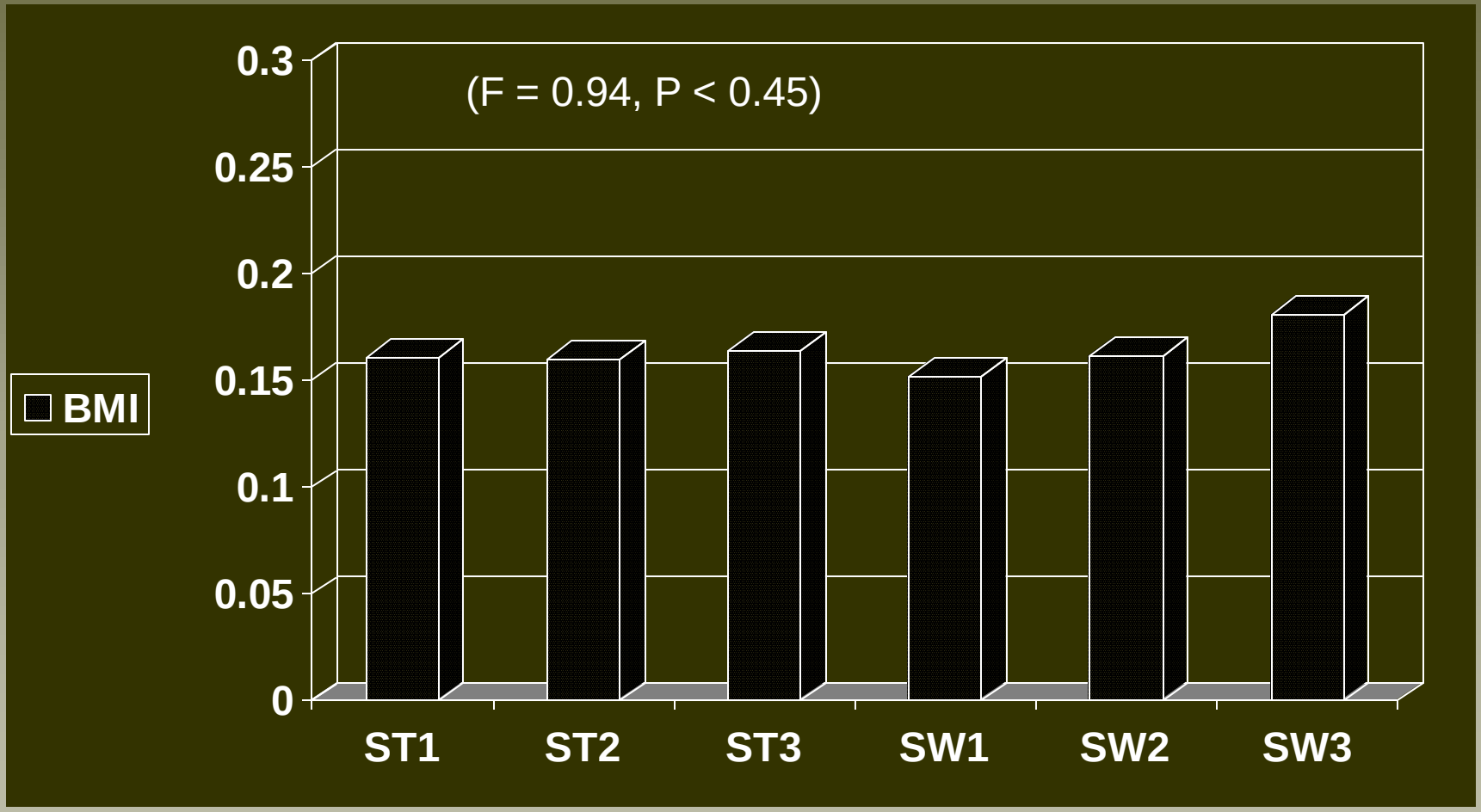
BMI for MYLE



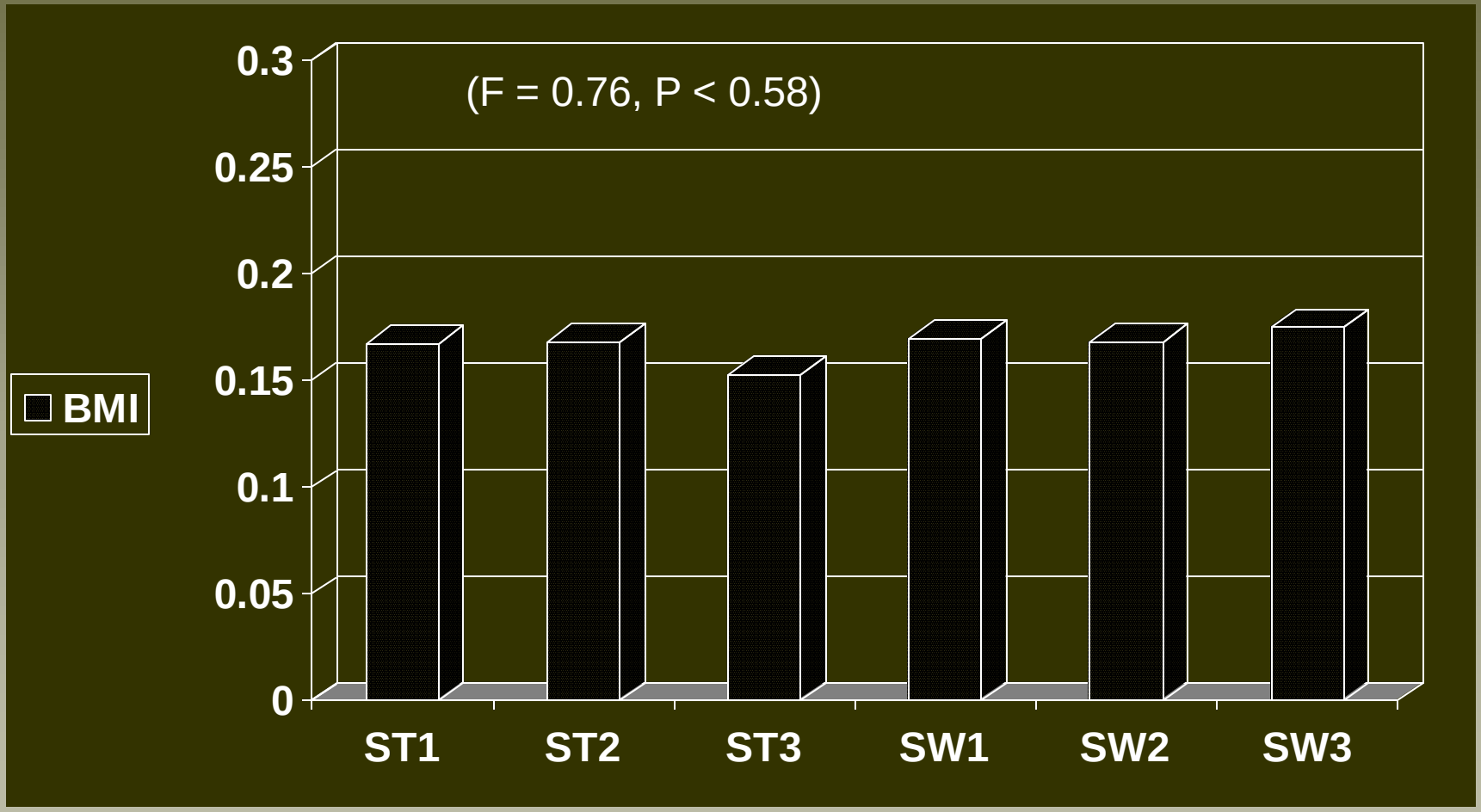
BMI for PESU



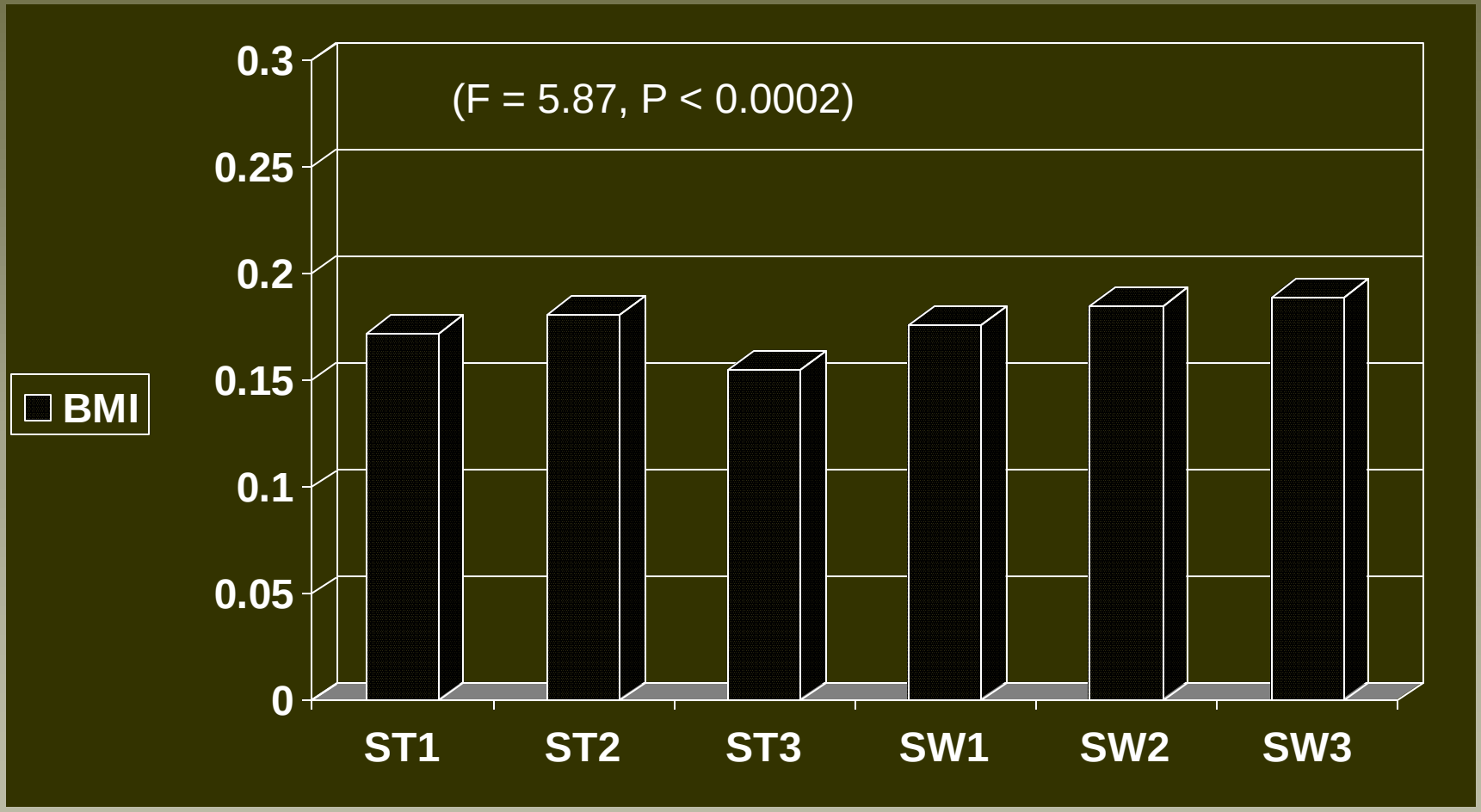
BMI for MYSE



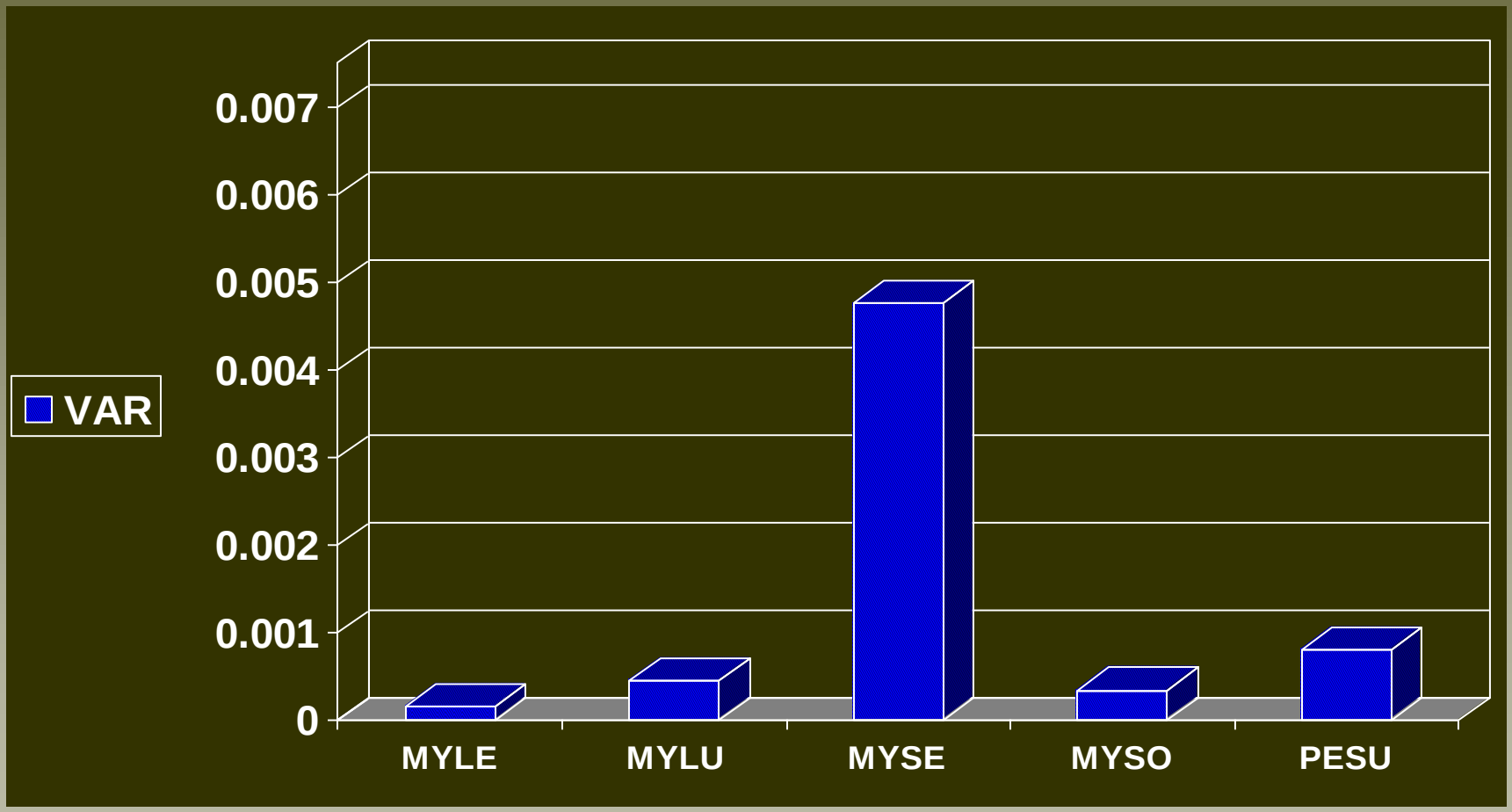
BMI for MYSO



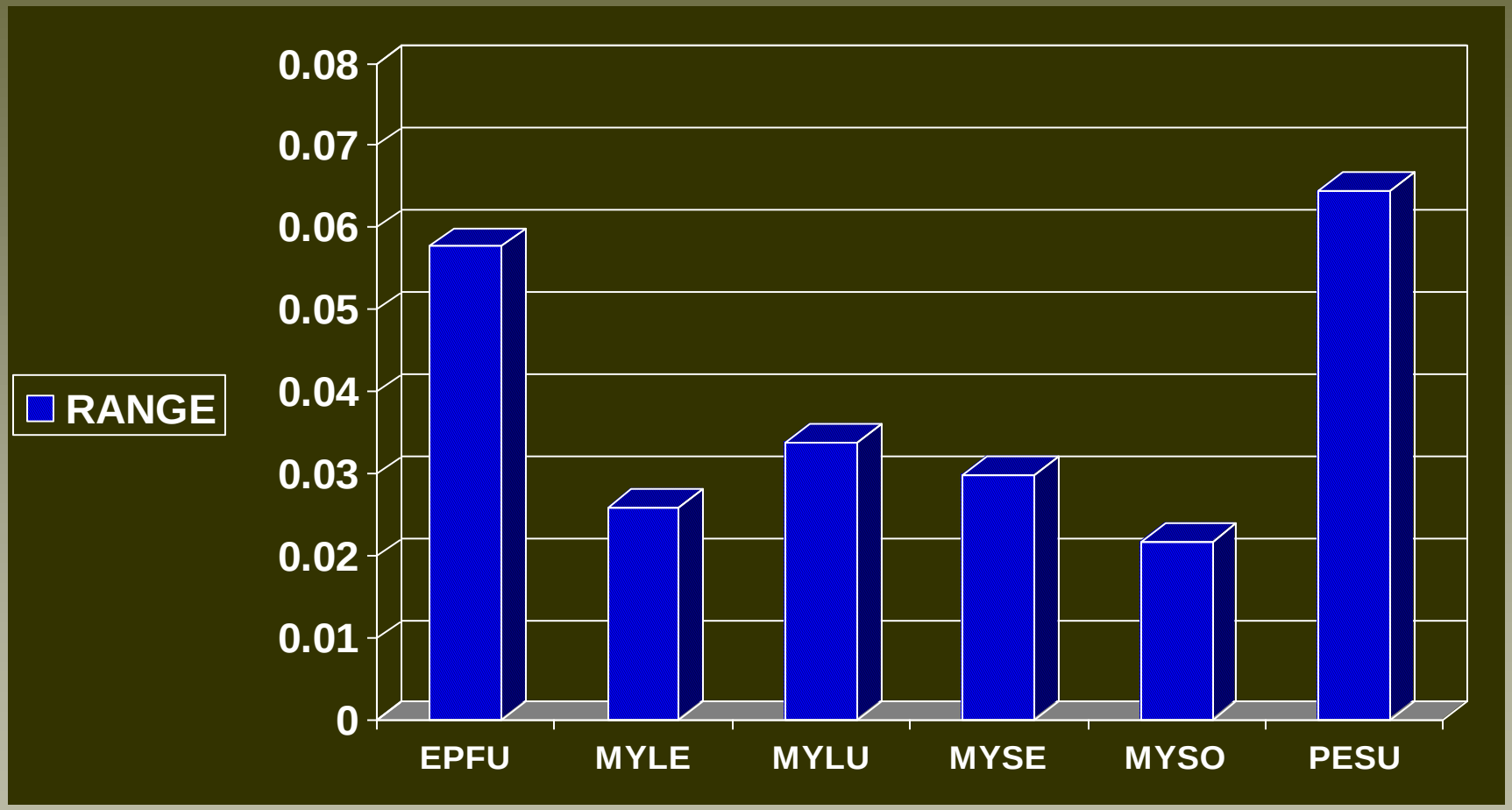
BMI for MYLU



Variance in BMI by Species



Range in Mean BMI by Species



Summary of Findings

- **BMI varied by species**
- **BMI was directly correlated with body mass**
- **BMI differed across staging and swarming periods for MYLU & PESU**
- **MYSE demonstrated the greatest overall variance in BMI, with large intra-period variability**
- **PESU (& EPFU) exhibited the largest change in BMI across sampling periods**

Implications

Photo courtesy of
Marvin Moriarty, USFWS

Acknowledgements

- USFS Northern Research Station
  - **Matt Dickinson**
  - **Nick Skowronski**
- Funding
  - **USFS Joint Fire Science**
  - **UK College of Agriculture**
- Numerous volunteers

Photo courtesy of Megan Short