RESOURCE OVERLAP AND POTENTIAL COMPETITION BETWEEN INVASIVE RED-EARED SLIDER TURTLES AND THREATENED NATIVE RED-BELLIED TURTLES IN THE UPPER DELAWARE ESTUARY

Steven H. Pearson

and

Harold W. Avery

Six Most Important Threats to Global Biodiversity

- Habitat Degradation/Conversion
- Invasive Species
- Environmental Pollution
- Disease and Parasitism
- Over-harvesting
- Global Climate Change

Sources: Wilcove et al. (1998),Thomas et al. (2004)

Invasive vs. Naturalized & Exotic Species

Exotic Species – A species not native to a region

Naturalized Species – An exotic species that reproduces in the wild

Invasive Species – Exotic, naturalized or native species that cause ecological and economic damage

Sources: Lockwood et al. (2006), Krasney et al. (2002)

Invasive Species Interactions

Cause extinctions or population declines of native species via:

- **Predation**
  - Consumption of native species.
- **Competition**
  - Overlap for resources may decrease resource availability.
- **Habitat alteration**
  - i.e. Change in habitat structure
- **Alteration of Community Dynamics**
  - i.e. Changes in native species niches, energy flow.

Invasive Species: An Emerging Concern in the Delaware Estuary

Over 70 invasive species within estuary

- Transport vectors
  - Shipping
  - Released agricultural and pet species
- Introduction impacts
  - Ecological
  - Economic

Red-eared Slider Turtle
Trachemys scripta elegans

- Non-native species introduced worldwide including within the Delaware Estuary
  - Escaped/released pets
  - Successful reproduction world-wide
- Why is this species so
  - successful?


Kim Weimer

Sources: Lever (2003), Ernst et al. (1994), Stone (MS thesis In Prep)

Red-eared Slider Turtle Impacts on Native Species

European Pond Turtle (*Emys orbicularis*)

- Reduced time basking
- Increased mortality and body mass loss

Sources: Cadi & Joli (2003, 2004)

Red-bellied Turtle
Pseudemys rubriventris

- **PA State Threatened Species**
  - Population Declines Due to:
    - Habitat loss
    - Historic over-harvesting
    - Invasive species
- **Dietary Niche**
  - Carnivorous hatchlings
  - Omnivorous juveniles
  - Herbivorous adults
- **Habitat Preference**
  - Deep, slow moving water

Source: Ernst et al. (1993)

Red-bellied Turtles & Red-eared Slider Turtles Have Similar Ecological Requirements

	Red-bellied turtle	Red-eared slider turtle
Time of Activity	**Diurnal**	**Diurnal**
Hibernation	**Hibernates in the north but not in the south**	**Hibernates in the north but not in the south** **Inactive below 10°C** **Activity suppressed at 30°C**
Basking	**Aerial and aquatic**	**Aerial and aquatic**
Habitat: water	**Slow-moving rivers, floodplain marshes, oxbows, ponds, soft bottoms, quiet waters with basking sites and aquatic plants**	**Quiet waters with soft bottoms, basking sites and aquatic plants**
Nesting Season	**Nests from May to July peaks in June**	**Nests from April to July, peaks in May and June**
Nest Substrate	**Nests in sandy clay or loam in full sunlight**	**Nests in open, unshaded soil that is not muddy**
Hatching	**Hatch in late summer, may overwinter in nest**	**Hatch July to September may overwinter in nest**

Stone (MS thesis In Prep)

Study Objective

Determine the Potential for Competition

- **Spatial resources**
  - Habitat necessary for growth and development, reproduction and survival
- **Temporal resource use**
  - How are species separated in time
- **Dietary resources**
  - Dietary needs to maintain the growth, survival and/or reproduction of an individual

Sources: Schoener (1974), Polis & McCormick (1987)

Quantifying Resource Overlap

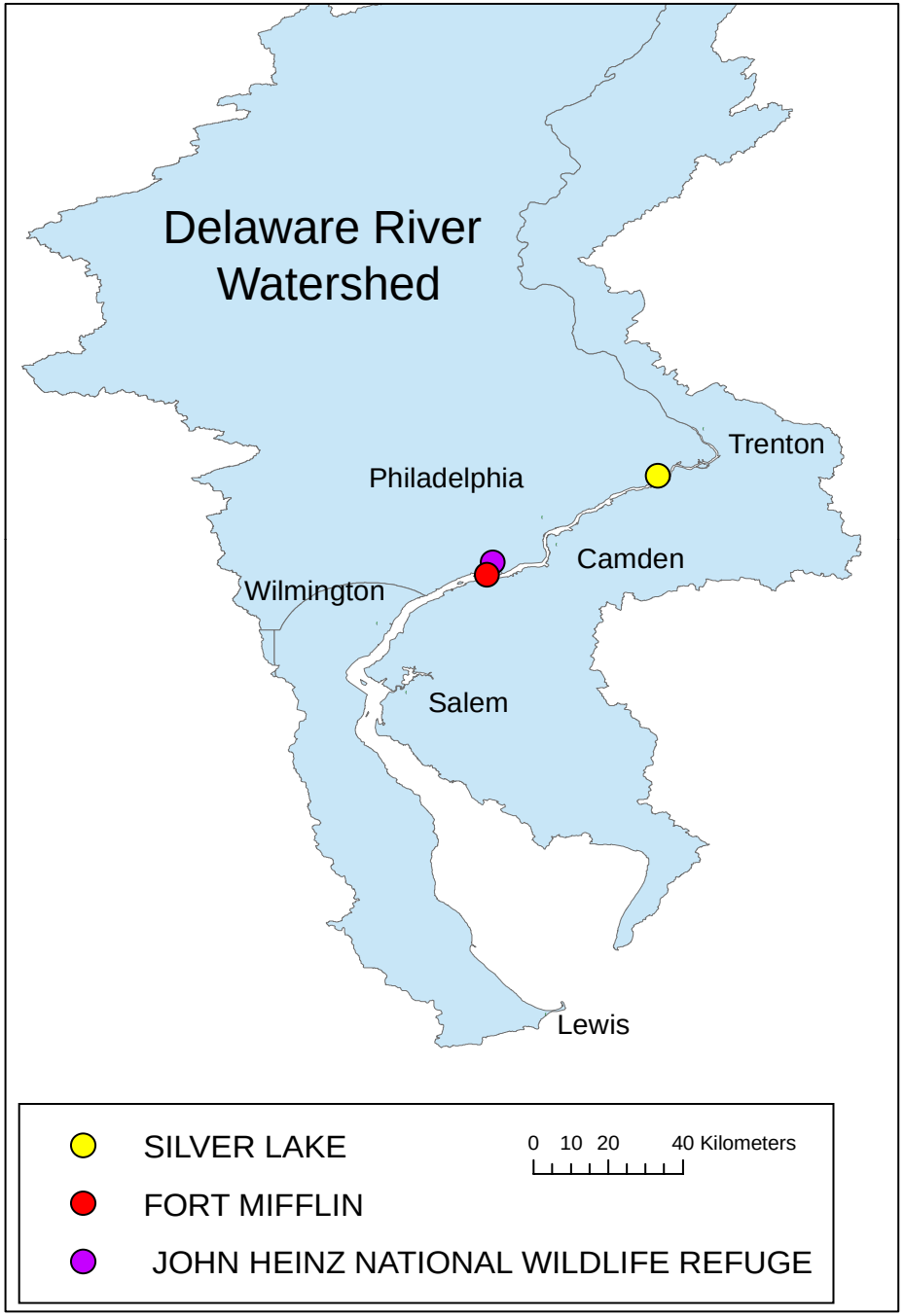
- **Spatial & Temporal Overlap**
  - Intensive trapping
  - Radio telemetry
  - Visual observation

- **Dietary Overlap**
  - Stomach flushing
  - Stable isotope analysis

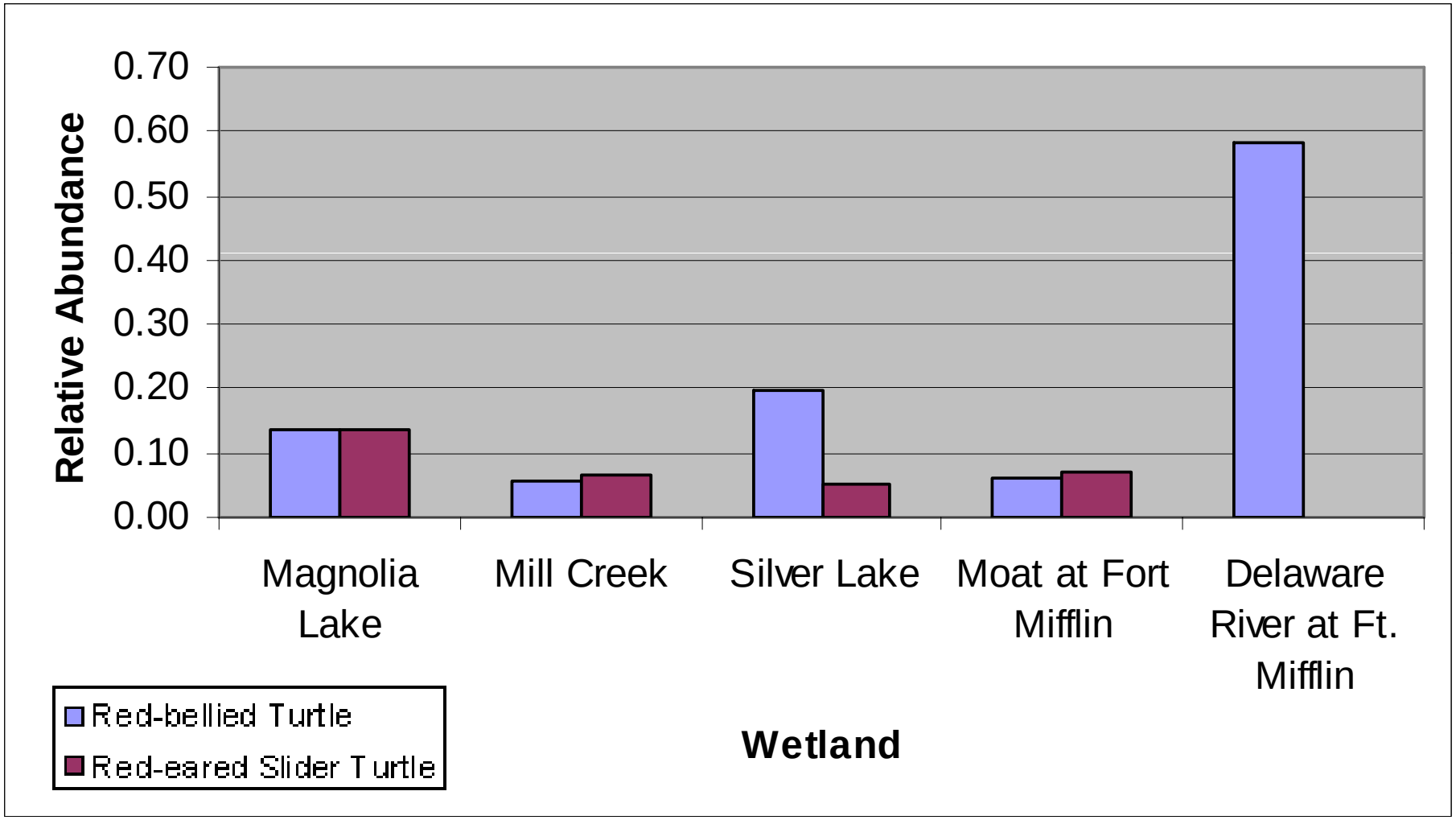
Study Sites

Moat at Fort Mifflin

Mill Creek at Silver Lake N.C.



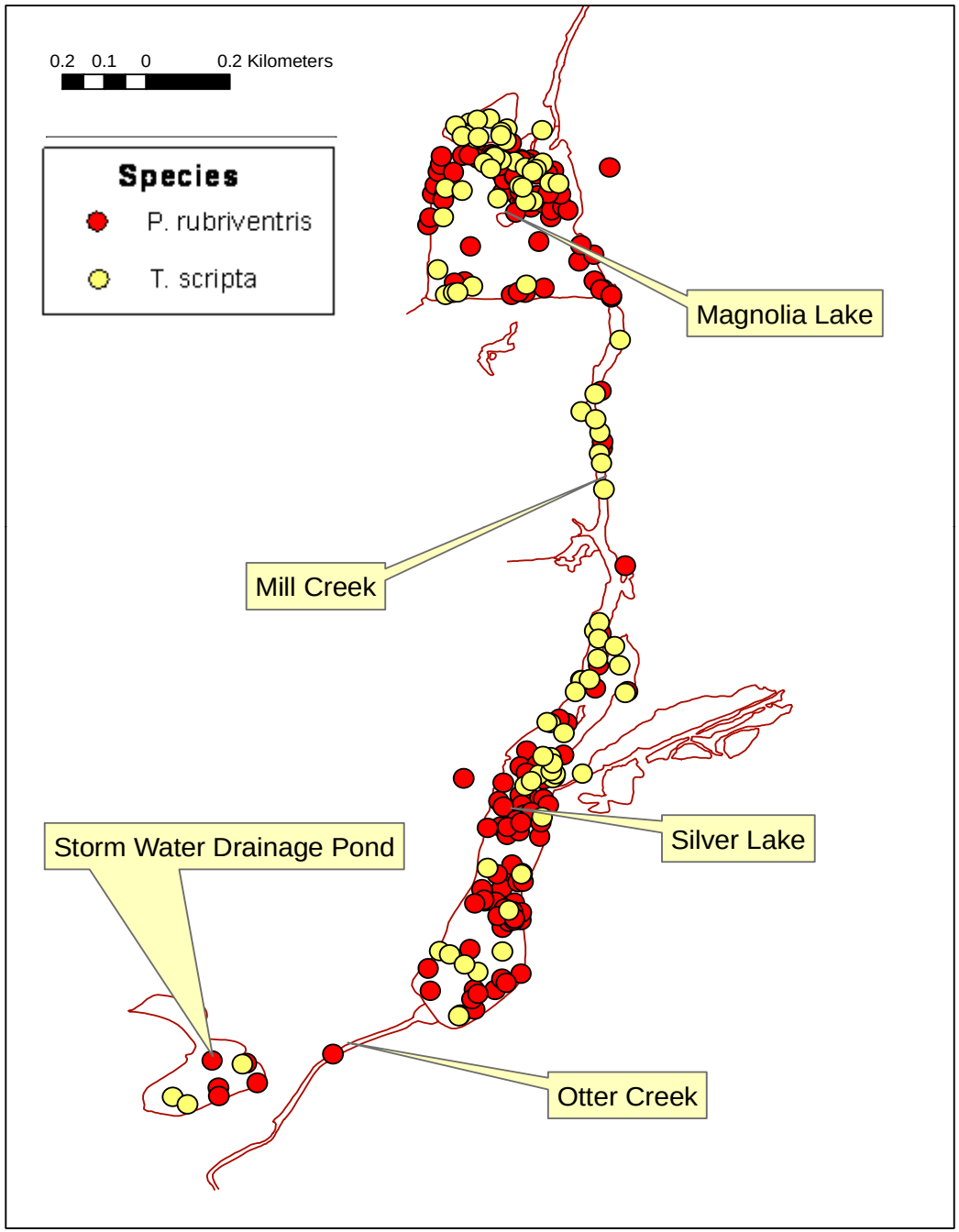
Relative Abundance of Red-bellied Turtles and Red-eared Slider Turtles



Three other species are also found at these wetland sites

Overlap in Habitat Use

- **Two areas of intense overlap**
  - **Characterized by**
    - **Aquatic Vegetation**
    - **Potential Basking Sites**



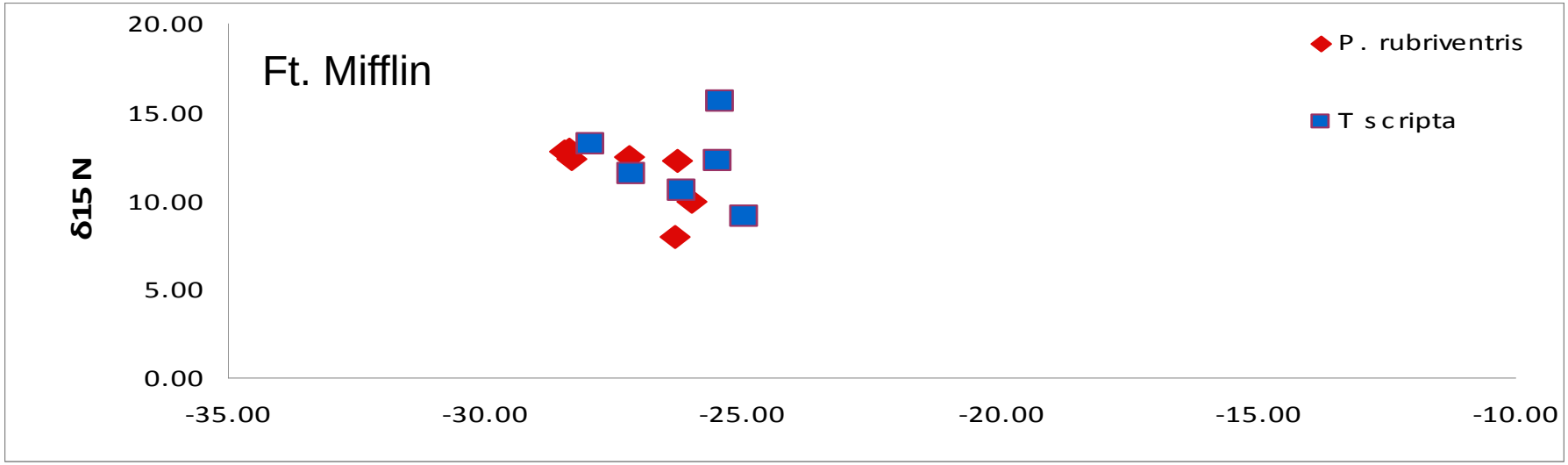
Dietary overlap

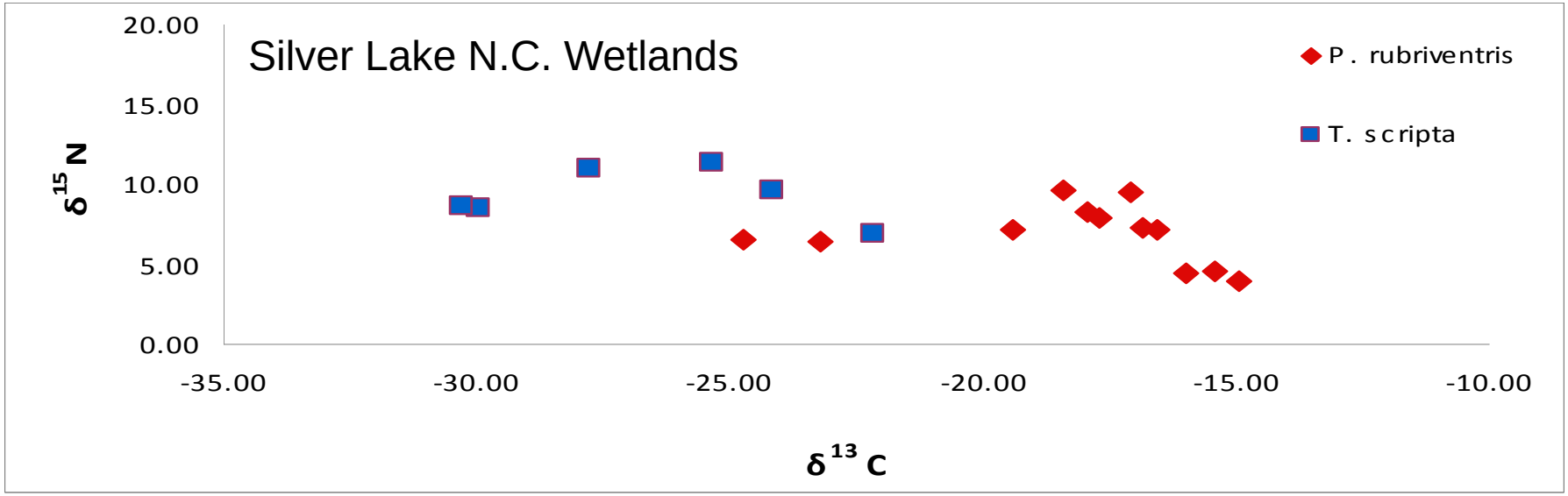
Adult turtles

- **Silver Lake Nature Center**
  - **Red-bellied turtle** stomachs contain only vegetation
  - **Red-eared slider turtle** Stomachs contain vegetation and some insects

- **Fort Mifflin**
  Both species stomachs contain only vegetation

Stable Isotope Analysis





Summary of Findings

- High proportion of red-eared slider turtles at most sites
- Extensive spatial overlap
- High overlap of food types in stomach contents
- Stable isotopes reveal nearly complete dietary overlap at one site and resource partitioning at another

Ongoing Research

Juvenile growth rates impact lifelong reproduction and overall fitness

- Influenced by resource availability
- Decreased growth rates may delay maturity, age of first reproduction and lifelong clutch sizes

Dr. Hal Avery

Sources: Avery et al. (1993)

Solutions to Species Introductions in the Delaware Estuary

- Educating the public
  - Brochures and outreach
- Invasive species drop off
  - Centralized location for unwanted pets
- Volunteer removal of invasive species
  - Turtle roundups similar to *Phragmites* removals

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Amsinckia tessellata