Composition of Salamander Species Utilizing the Pigeon River Watershed



M. S. Proposal
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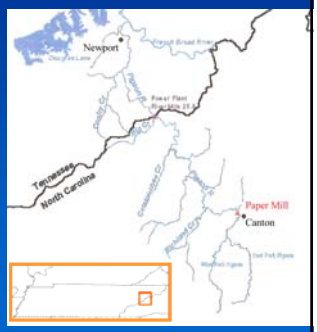
Introduction

- The Pigeon River flows out of Haywood County, North Carolina into Cocke County, Tennessee
- Drains into the French Broad River near Newport, TN
- 69.5 miles in length
- 5th order stream



Introduction

- 1908 – Champion International began operation on paper mill
- Chlorine bleaching process used to process wood
- Toxic byproducts were dumped directly into the Pigeon River
  - Dioxins, furans, and chloroform
- 1964 – NC Wildlife Resources Commission found the upper portion of Pigeon so polluted that it supported NO fish or mollusk species
  - Historically supported approximately 95 species of native fish and 40 species of mollusks

Introduction

- IBI (Index of Biotic Integrity) metrics, such as number of native, darter, and intolerent fish species, are used to assess the health of rivers and streams
- Pigeon River IBI scores were 38 points (or less) out of a possible 60 until 1993
- 1992 – Chlorine bleaching process at the paper mill was replaced, virtually eliminating toxic chemicals dumped into Pigeon
  - Chlorine dioxide and oxygen delignification system
- IBI scores have steadily improved since, with a score of **54 out of 60** in 2007

Justification for Research

- In depth fish and benthic invertebrate surveys have been conducted for the Pigeon River
- "Atlas of Amphibians in Tennessee" by Redmond & Scott documents species in Cocke Co. but no records exist for Pigeon
- Know dioxins have eliminated all fish species historically but effect on salamander diversity is unknown

Justification for Research

- Dioxins act as an endocrine disrupter and can cause abnormal development
- Dioxins are known to accumulate in body fat of amphibians and resist biological breakdown
- Aquatic salamanders and eggs/larvae of terrestrial salamanders are exposed to sediments containing these contaminants

Has the historical release of dioxins from the Canton paper mill decreased salamander species diversity?

Research Objectives

1) Conduct aquatic surveys of Pigeon River, the bypass portion of the Pigeon, and 2 tributaries to identify and compare aquatic salamander species
2) Conduct terrestrial surveys to identify terrestrial salamander species that utilize streams for reproduction and development
3) Test water quality at each site to accurately compare species composition

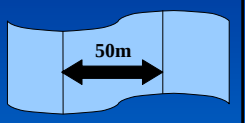
Proposed Methods

- Each stream will have 5 aquatic sampling sites at least 100 m apart
- All sites at each stream will be sampled once per month for 3 months (May, June & July 2008)
- Preliminary survey in May 2008 to determine which tributaries will be sampled for research
- Selection will depend on flow levels, easy of access, and suitable habitat
- Possible tributaries for sampling
  - Johnathans Creek
  - Fines Creek
  - Hurricane Creek

Proposed Methods

Objective 1: Conduct aquatic surveys of Pigeon River, the bypass portion of the Pigeon, and 2 tributaries to identify and compare aquatic salamander species

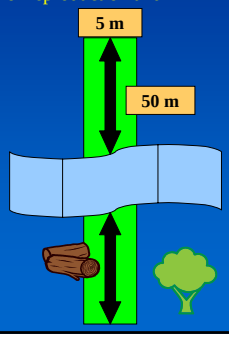
- Area constrained search (50 m)
- Snorkel surveys – flipping large rocks
- Capture salamander and place in mesh bag to be processed
- Measure SVL (snout-vent length), total length, weight, and determine sex and species for each individual captured
- Return individual to location found to minimize stress



Proposed Methods

Objective 2: Conduct terrestrial surveys to identify terrestrial salamander species that utilize streams for reproduction and development

- Belt transects from shoreline corresponding with each aquatic sample site
  - 5 m wide and 50 m long
- Area constrained search
- Transect on each side of stream treated individually



Proposed Methods

Objective 2: Conduct terrestrial surveys to identify terrestrial salamander species that utilize streams for reproduction and development

- Turn rocks and logs; sort through leaf litter
- Capture salamander and place in plastic container to be processed
- Measure SVL (snout-vent length), total length, weight, and determine sex and species for each individual captured
- Return individual to location found to minimize stress

Proposed Methods

Objective 3: Obtain water quality measurements to determine if differences in species found between sites is a result of water quality

- Record pH, dissolved oxygen and temperature at each site on each visit
- Remove salamanders during aquatic sampling for dioxin testing
- Compare dioxin levels in water measured by TWRA with historical and current salamander species composition

Proposed Methods

What species historically existed in the Pigeon River watershed?

Blue Ridge two-lined salamander (*Eurycea wilderae*)

Shovel-nosed salamander (*Desmognathus marmoratus*)

Mudpuppy (*Necturus maculosus*)

What species exist today?

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