



# Stream temperature relationships to fish and crayfish distributions in north Mississippi

## BACKGROUND

Climate change is expected to adversely affect numerous warmwater animal species. Although some warmwater species, particularly those that are abundant, widely distributed, and habitat generalists, are expected to expand their ranges as streams warm, many others will likely face range reductions and population extinctions. Although warmwater fishes tolerate relatively high temperatures, every species has an upper thermal limit above which it becomes stressed and eventually dies. The thermal ecology of warmwater fauna in general has not been well explored. Also, stream temperature monitoring networks in warmwater habitats of the southeastern U.S. are sparse in comparison to those in coldwater habitats farther north.

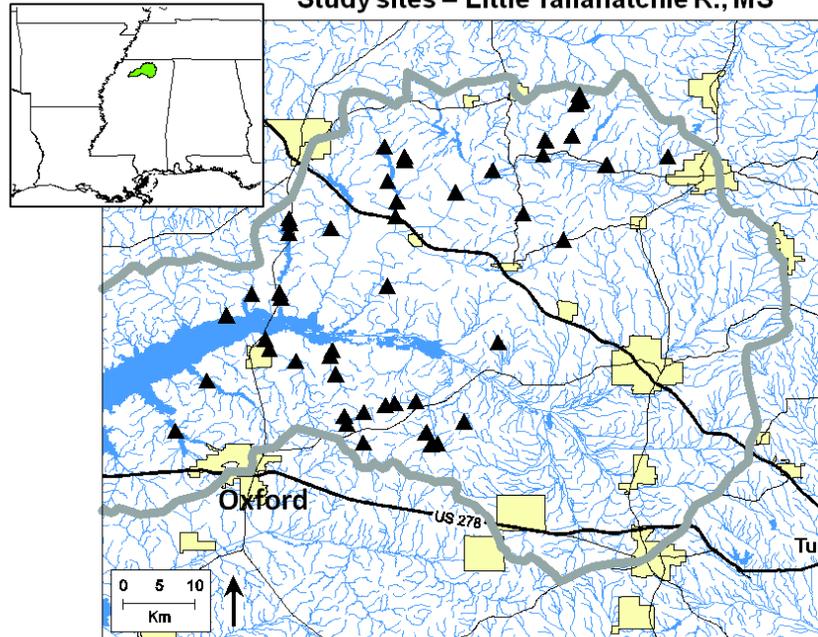
## RESEARCH DESCRIPTION

In 2011, we began establishing a network of stream temperature recorders in the Little Tallahatchie River watershed. In 2012, we expanded the network south into the Yocona River watershed. Our study has multiple objectives (see below), but site selection was based largely on the distribution of the Yazoo darter (*Etheostoma raneyi*). The Ya-

zoo darter is a rare fish endemic to the Little Tallahatchie and Yocona river watersheds. Ongoing work by Warren and Sterling has confirmed the species' patchy distribution. The species' distribution appears to be associated with spring-influenced areas. We are unsure whether such areas are important because of moderated temperatures or other chemical or hydrologic reasons.

In 2012, we quantitatively sampled fish and crayfish communities at 60 temperature recording sites in streams with and without Yazoo

Study sites – Little Tallahatchie R., MS



Yazoo Darter with the distinctive orange pigment of a breeding male.

darters. Results from 2012 will be used to evaluate correlations between temperature and fish and crayfish distributions. Results from subsequent years will allow us to

track changes in temperature and animal distributions.

Temperature recorders will be maintained at a subset of sites to collect long-term temperature data. We are also attempting to develop a protocol for effectively installing long-term temperature data recording stations in unstable, sand bed streams.



Nick point on unnamed tributary of Tippah River, Benton County, MS.

## OBJECTIVES:

### TEMPERATURE AND FAUNAL DISTRIBUTIONS

1. Define the range of stream temperatures used by Yazoo darters.
2. Quantify the range of temperatures in sites not used by Yazoo darters, both in superficially similar streams and beyond the species' distribution within streams where they exist.
3. Test for correlations between water temperature and aspects of fish and crayfish communities. *Etheostoma parvipinne* is another species of potential

interest because of its known affinity for small, shaded streams.

### TEMPERATURE – METHODS AND PHYSICAL PROCESSES

4. Test modes of deploying temperature sensors for year-round application in unstable sand-bed streams. We will compare:
  - temperatures in adjacent open versus shaded sites
  - temperatures by recorders in open water versus buried in sand
  - temperatures from cases filled with mud versus clean and from cases with holes compared to those without holes
5. Establish a long term network of year round stream temperature recorders across the Holly Springs Ranger District. In choosing sites, we will use sites that coincide with the darter objectives and with the Holly Springs Ranger District's water quality sampling sites (N = 70) where possible. We will include 2 sites on or near the Experimental Forest.

### POSSIBLE FUTURE OBJECTIVES:

6. Compare seasonal changes in density of Yazoo darters in sites influenced versus not influenced by groundwater.
7. Determine if Yazoo darters are using temperature refugia. Map fine-scale streambed temperatures within reaches and compare to Yazoo darter locations.

### STUDY DESIGN

Temperature recorders were placed in streams with and with-

out Yazoo darters. In a subset of streams with Yazoo darters, we also placed recorders near the species' up- and downstream distribution limits and additional recorders beyond the distribution limits. We also put recorders up- and downstream of several small reservoirs to examine the influence of the impoundments on stream temperatures.

At six sites, we installed an additional temperature recorder, buried about 15 cm in sand to test the effects of burying on stream temperature records. Three of the six sites were strongly influenced and the other three weakly influenced by groundwater. At six sites we also placed one thermograph in the sun and another in the shade to test whether direct sun on the PVC cases influenced recorded temperatures. Thermographs for both of these objectives remained in place for one year.

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