Introductions and Reservoirs

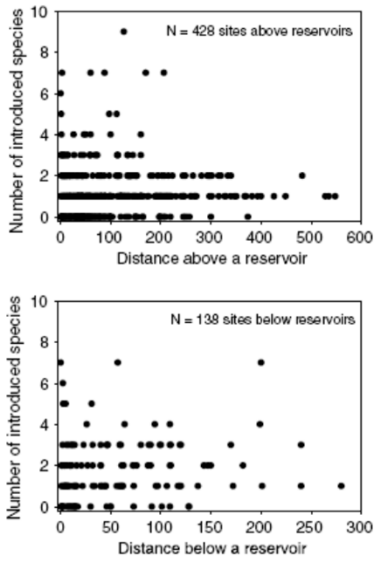

Fig. 4. Relationship between total number of introduced species and distance upstream (top) and downstream (bottom) from a reservoir. Only sites in which water flowed directly to or from a reservoir were used in these plots.

Reservoirs – combined threats

- Habitat alteration
- Hydrograph alteration
- Barrier to migration
- Source for introduced species
- Spurs urban development

Climate Change and range contractions

Ecology Letters, (2006) **9**: 1321–1330 doi: 10.1111/j.1461-0248.2006.00986.x

Thermal range predicts bird population resilience to extreme high temperatures

Update *TRENDS in Ecology and Evolution* Vol.21 No.8

Research Focus

Range retractions and extinction in the face of climate warming

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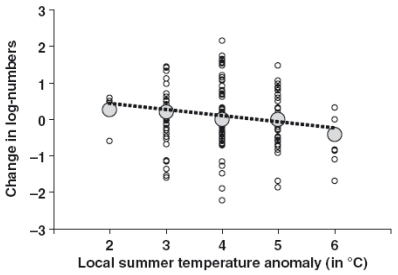
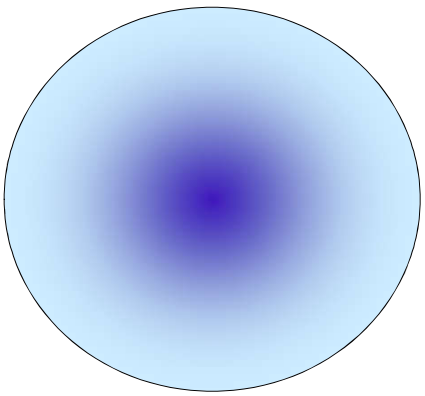


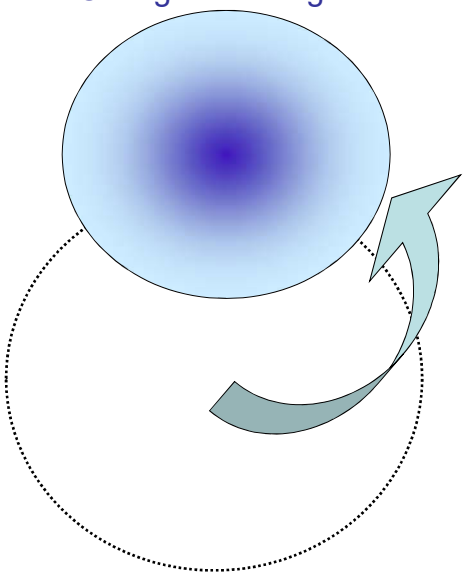
Figure 1 Example of the response of 2003–2004 local population growth rates to 2003 temperature anomalies in the Rook *Corvus frugilegus* (L.), showing a negative linear trend with summer temperature anomaly (in °C). Small circles represent each site where the species was recorded during the breeding bird survey, large grey circles are mean values, and the dashed line shows the linear response of growth rate to the temperature anomaly. The local growth rate (*y*-axis) shown here is the change in log-numbers between 2003 and 2004.

Climate Change and range contractions



Core theory – conditions at the core of a species range are ideal. Optimal conditions deteriorate linearly from the core. Species are least fit on the edges of their distribution.

Climate Change and range contractions



Climate change will shift species range, move the core and potentially shrink the range.

Population Genetics

Conserv Genet (2012) 13:859–872
DOI 10.1007/s10592-012-0335-0

RESEARCH ARTICLE

Genetic effects of habitat fragmentation and population isolation on *Etheostoma raneyi* (Percidae)

Ken A. Sterling · David H. Reed · Brice P. Noonan · Melvin L. Warren Jr.

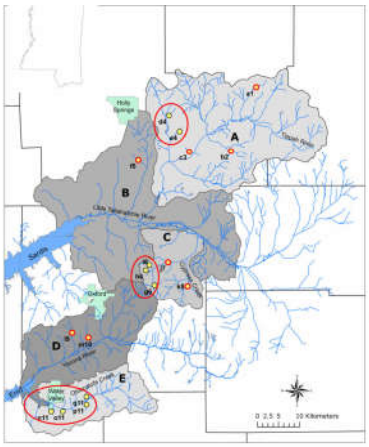
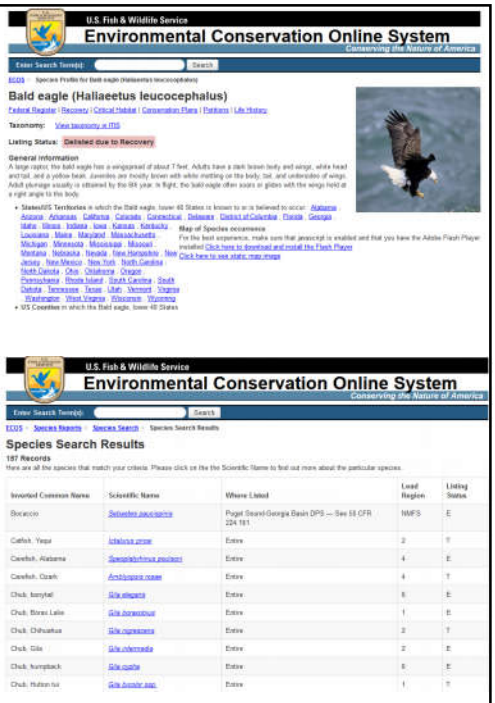


Fig. 1 Major drainages, watershed units, and cities within the range of the Yazoo darter (*shaded area*) in north-central Mississippi. Numbered *yellow circles* and *red circles* correspond to DNA tissue sample sites and genetic clusters (GENELAND), respectively (Table 1). Tallahatchie R. watershed units are outlined and lettered as: *A* Tippah River Unit; *B* Tallahatchie River Tributaries Unit; *C* Cypress Creek Unit. Yocona R. watershed units are outlined and lettered as: *D* Yocona River Unit; *E* Otoucalofa Creek Unit

ulation sizes. We conclude that anthropogenic habitat alteration and fragmentation has had a profoundly negative impact on the species by isolating *E. raneyi* within headwater stream reaches. Further research is needed to inform conservation strategies, but populations in the Yocona River drainage are in dire need of management action. Carefully planned human-mediated dispersal and habitat restoration should be explored as management options across the range of the species.

Recovery Plans

- Endangered Specie Act mandates the Department of Interior develop a recovery plan for any species that is listed.
- Plans must establish the current status, reasons for decline, and a plan for recovery and eventual delisting of the species.
- http://www.fws.gov/endangered/species/



Bayou Darter (E. rubrum) Recovery Plan - 1983

EXECUTIVE SUMMARY

Current Status: The bayou darter is a threatened species which is known only from the Bayou Pierre system of southwestern Mississippi.

Goal: The objective of this plan is to remove the bayou darter from the list of threatened species.

Recovery Criteria: The necessary criteria for delisting the species are:

(1) Evidence of a stable or increasing population over at least a 10-year period in Bayou Pierre and Foster Creek;

(2) Evidence of the continued existence of the bayou darter in White Oak and Turkey Creeks;

(3) Data on the fluvial geomorphic processes operating in the Bayou Pierre system which indicates a trend of no net loss of, or improving, habitat for the species;

(4) An established continuing plan of periodic monitoring of population trends and habitat stability; and

(5) Protection of bayou darter habitat through full implementation of task 4 of this recovery plan.

Actions Needed: To bring about the recovery of this species, it will be necessary to continue population and habitat monitoring programs, identify sources of habitat degradation, and protect darters and their habitat.

Anticipated Date of Recovery: Provided that adequate funds are available to complete the recovery actions listed in the plan, full recovery of the bayou darter can likely be accomplished by 2010.

Factors Affecting the Species

The major threat facing Etheostoma rubrum is man-induced alteration of its habitat. These geomorphic alterations may be caused by human activities in the immediate vicinity of the habitat, by conditions and activities occurring regionally within the basin, by upstream conditions, or by conditions/activities downstream of the habitat. Often, more than one type of activity or condition will be responsible for the historic alteration and deterioration of fluvial environments. Changes resulting from human activities may not become known until many years after the initiation of the activity. Descriptions (with illustrations) of the dynamic effects of these geomorphic processes on the Bayou Pierre system are given in Hartfield (1988) and Hartfield and Ebert (1986).

Three activities which may adversely impact the bayou darter habitat are considered individually:

1. Floodplain/Channel Modification. Projects such as channelization and impoundment may cause extensive changes in erosion/sedimentation conditions. These changes may be transmitted throughout the basin and when combined with land use practices, may significantly change the fluvial and geomorphic environment of the basin (Whitten and Patrick 1980). Floodplain mining operations usually result in additional sediment loads in nearby channels. Channel dredging for navigation or mining purposes is even more deleterious to the stream. The mining of gravel and sand bars results in the

4

shortening and straightening of the stream channel, increased channel gradient, and concomitant higher water velocities. This, in turn, results in channel degradation or deepening by erosion, the formation of new knickpoints, and the potential for headcutting. Channel degradation also results in streambanks which are too steep and too high for stability. Such banks are susceptible to collapse, further increasing the sediment load in the stream.

2. Petroleum Exploration and Transportation. In 1982, a well was drilled within 1.6 km (1 mi) of Bayou Pierre upstream of the Turkey Creek confluence. A catch basin dike borders the eastern edge of the stream next to the well. An underground transmission line crosses Bayou Pierre about 0.8 km (0.5 mi) downstream of Turkey Creek.

Most construction activities, particularly those which involve significant earthwork, will result in increased sediment loads in nearby streams during the actual construction, and greater water discharges afterwards. Saltwater intrusion from petroleum exploration wells and petroleum spills from wells and pipelines would adversely influence the darter habitat. A severe spill could remove the darter from the downstream portion of the affected stream.

3. Farming and Silviculture. More than 90 percent of Foster Creek is bordered by timber land. Turkey Creek is wooded with the canopy extending to the water's edge in most areas. In the upper reach, well above the darter habitat, there is some open land, including farms adjacent to the stream. Pasture land extends approximately 1 mile upstream from Bayou Pierre. Over 50 percent of Bayou Pierre and White Oak Creek are bordered by open fields and pastures.

Land use practices affect sediment and/or water discharges to the stream system and, in turn, change erosion/sedimentation patterns within the system. The destruction of riparian vegetation encourages bank collapse, increased turbidity and water temperature.

Land uses that encourage extensive use of fertilizers and pesticides pose the threat of increased nutrient loading and higher levels of toxic chemicals. Use of herbicides for timber management has been observed near Foster Creek.

- Recovery Plan
  - Survey and monitor current populations (distribution and density)
  - Obtain life history, habitat use and other pertinent ecological information (movement, reproductive capacity).
  - Determine cause of decline.
    - Monitor: water quality, toxins, land use patterns, fluvial geomorphic processes,.
    - Protect current populations: various plans to reduce head cutting, establish riparian buffer zones.
    - Limit mining operations
    - Cooperative agreements with land owners
    - Prepare emergency translocation plan

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