THE ECOLOGY OF ENDANGERED FISH IN BAYOU PIERRE

by

Billy M. Teels
Biologist, USDA-Soil Conservation Service

INTRODUCTION

Planning of the PL-566 Bayou Pierre Watershed Project, Copiah and Lincoln Counties, Mississippi, was initiated during April 1970. Prior to this date, in September 1966, a new percid fish, the bayou darter (Etheostoma rubrum), which is endemic to the Bayou Pierre system, was described from the lower limits of the future watershed project (Raney and Suttkus, 1966). At the time of description, this new species was known only from the type locality (the Highway 18 crossing of Bayou Pierre) and from one of Bayou Pierre's major tributaries, White Oak Creek. In April 1975, Mississippi included the bayou darter as an endangered species in its state list of rare and threatened vertebrates, and in October 1975, the bayou darter was declared threatened according to the United States List of Endangered Fauna. Several fish collections from the Bayou Pierre system have included the crystal darter (Ammocrypta asprella) which is also considered endangered by Mississippi's list of rare and threatened vertebrates.

It is the policy of the Soil Conservation Service, a co-operating federal agency in the Bayou Pierre Watershed Project, to avoid any actions which will jeopardize the continued existence of endangered or threatened species listed by the Secretary of the Interior or by the appropriate state agencies. Before any determination of effects of the Bayou Pierre Watershed Project on the bayou or crystal darters could be made, it was necessary that the range and ecology of these two species in Bayou Pierre be more fully understood. To accomplish this it was necessary for the Soil Conservation Service to make a determination of where the darters occur in the Bayou Pierre system to avoid possible destruction of their habitats by watershed measures. Observations were also made on the type of habitat each species requires so that project planning could minimize detrimental effects on both species.

Study Area

The Bayou Pierre system is an eastern tributary of the Mississippi River with its headwaters arising 30-50 miles to the south and southwest of Jackson, Mississippi. The Bayou Pierre mainstem flows in a northwesterly fashion for its first 53 miles and then shifts to a westerly direction before entering the Mississippi River some 15 miles west of Port Gibson, Mississippi.

The Bayou Pierre mainstem has its headwaters in northern Lincoln County. Several small tributaries possessing sand and gravel bottoms and well developed canopies contribute to form the Bayou Pierre mainstream. For its first 30 or so miles, Bayou Pierre exhibits numerous holes and eddy areas and contains many snags and logs. This portion of

the mainstem is non-eroded and displays a well developed forest canopy, however, as the channel progresses downstream, the stream banks become much wider until a relatively narrow stream exists within a large eroded channel filled with sand and gravel and is void of canopy.

Turkey, Foster's, and White Oak Creeks are major tributaries to the mainstem and have feeder streams similar to the previously discussed headwaters of Bayou Pierre. Each of these streams also exhibits eroded sections in their lower portions.

Riffles are numerous in the system occurring primarily in the eroded stream sections. Two major riffle types occur in these streams; a gravel riffle possessing various degrees of stability and gravel sizes, and riffles composed of indurated sandstone which outcrop in the stream bottoms. Turkey and Foster's Creeks and Little Bayou Pierre contain several small waterfalls over sandstone outcrops.

As Bayou Pierre proceeds westerly through the thick loess deposits, a sand bottom predominates and the riffle effect becomes increasingly rare. Little Bayou Pierre enters the mainstem in the thick loess region. The lower portions of Little Bayou Pierre are very similar to the Bayou Pierre mainstem in the loessial area, possessing few riffles and having a predominantly sandy bottom. However, the mid and upper portions of Little Bayou Pierre contain numerous gravel and sandstone riffles similar to that in the upper and mid portions of the Bayou Pierre mainstem and its major tributaries.

The proposed watershed project has its lower boundaries at the point where White Oak Creek enters Bayou Pierre. All drainage to Bayou Pierre (exclusive of White Oak Creek) above this point is within the proposed project boundary.

Methods

From July 1974 to December 1975, seining was conducted at 66 locations within the Bayou Pierre system whereby riffles were sampled by kicking the substrate and seining the disturbed area with a 10 x 6 foot, 1/8 inch mesh nylon seine. During the fall of 1975, night seining was incorporated into the sampling scheme to enhance the possibility of collecting the crystal darter which is chiefly nocturnal. Except for a few specimens, which will be used in later studies dealing with food habits and fecundity, all fish collected were returned to the stream.

Observations regarding preferred habitat were made at each of the locations where the darters were collected. The upstream and downstream limits of each darters range were established by returning repeatedly to preferred habitat locations below or above sites previously sampled where the darters occurred. If either species were eventually collected at new upstream or downstream locations, then further attempts at collection were repeated above or below the newly found sites within the darter's range. Special attempts were made to determine whether or not those areas designated as sites for floodwater retarding structures contained either of the darters.

Results

The bayou darter is an inhabitant of eroded channel sections where water flowing over gravel or sandstone has created a riffle effect. The upstream range of the bayou darter extends to the point in the mainstem where the eroded and non-eroded channels meet, approximately 2 miles downstream from the Smyrna crossing (Figure 1). From this point to the point where White Oak Creek enters, the bayou darter is a common inhabitant in the mainstem and lower portions of major tributaries. The species appears to be most abundant in the upper 2/3 of this section, from Foster's Creek to the Smyrna crossing, and it is this stream segment where the greatest ratio of gravel and sandstone riffles occur. The fish are common in Turkey Creek, occurring in its lower 2 miles; Foster's Creek, occurring in its lower 5 miles; and White Oak Creek, occurring in its lower 5 miles.

Below White Oak Creek the bayou darter becomes progressively more rare to its lower range limits in the Port Gibson area. As Bayou Pierre proceeds downstream leaving the coastal plain and entering the bluff hills physiographic regions, riffles become fewer and fewer due to the lack of gravel or sandstone substrate. In the area of Port Gibson the channel becomes deeper and possesses a sandy bottom which provides little or no habitat. None of the tributaries in this area harbor the bayou darter. Even Little Bayou Pierre, whose mid and upper stream sections are quite similar to Bayou Pierre where the bayou darter occurs, does not possess this species. The lack of habitat in the lower portions of both streams may be acting as an effective barrier preventing the colonization of suitable habitat in Little Bayou Pierre.

The bayou darter prefers the more stable gravel riffles with larger gravel or rock. No bayou darters have been collected in riffles composed primarily of loose gravel or sand. No bayou darters have been collected in headwaters even though suitable substrate conditions seem to exist.

Shallow water (less than 6 inches), with moderate to swift flow, seem to be habitat requirements at each location where collections have been made. During mid summer adults aggregate in riffle heads where it is assumed that reproduction takes place. Reproductive activities appear to begin during mid to late summer and continue to perhaps as late as November. The first juveniles collected in 1974 were in late July, and in late August in 1975. Females were observed in gravid conditions during October in 1975, which suggests that egg laying in this species proceeds well into the fall, unlike most other darter species.

After reproduction has taken place, there seems to be a definite segregation of age groups. Adults remain in the larger riffles with swift to moderate flow, while young seek out smaller riffles or portions of large riffles where flow is not so great. The emergence of the juveniles is accompanied by an emergence of mayfly larvae which also inhabit the riffles and possibly furnish food to the new bayou darter crop.

Probably the most common habitat associate of the bayou darter is the banded darter (Etheostoma zonale), which is often collected with the bayou darter in the same seine haul. The least madtom (Noturus hildebrandi) occupies a number of habitats including those riffles where the bayou and banded are found. Both the least madtom and banded darter are common throughout most of the Bayou Pierre system, in smaller tributaries and lower sections of the mainstem, whereas the bayou darter is restricted to mid portions of the mainstem and larger tributaries entering that section. This suggests that the bayou darter has a more limited habitat requirement than either the banded darter or least madtom even though their habitats are similar. The intolerance of the bayou darter to conditions outside its present range have severed genetic interchange with any closely related species resulting in a complete isolation of the bayou darter to a very select habitat.

The closest relatives of the bayou darter occur in widely disjunct distributions. Other members of the subgenus, Nothonotus, are common in the Ohio and Tennessee drainages. Another species of this darter group, Moores darter (Etheostoma moorei), occurs in an isolated locality in a situation similar to that of the bayou darter, found only in certain tributaries of the White and Little Red Rivers in north-central Arkansas. The bayou darter and Moores darter are closely related forms and are probably remnant populations of a species that was once more widely spread in the eastern United States. Due to loss of habitat by man induced or other causes, the former population dwindled drastically in the South and West leaving behind two small isolated populations which have developed enough different characteristics to each warrant species status.

The crystal darter is an inhabitant of the eroded mainstem occurring in riffle areas from Dentville to the Willows crossing. Although the crystal darter is common in the lower 3/4 of this stream segment, it does not appear to be nearly as abundant as the bayou darter in terms of total numbers within the system.

The crystal darter seems to prefer only the eroded mainstem of Bayou Pierre and is absent in all other tributaries except Foster's Creek where it is by no means common (one specimen collected near the mouth of Foster's Creek). Only one specimen has been taken at the Dentville crossing of the mainstem, however, the species becomes progressively more abundant downstream. This species is found in a variety of substrate types ranging from sand to gravel, however, it is nearly always collected in shallow water, usually in riffles, where the flow is moderate to swift. The crystal darter seems to tolerate the transition between coastal plain and bluff hills better than the bayou darter where change in the substrate trends toward sand from gravel. The crystal darter is nocturnal and all the collections made in this study were at night. Observations of its diurinal habitat are lacking.

The toal range of the crystal darter is rather widespread. It inhabits many larger streams in the Mississippi and Alabama River systems. Throughout its range it prefers swift currents over sand or gravel bottoms. Siltation, pollution, and inundation of riparian habitat have eliminated

this species over much of its range leaving populations only in a few last strongholds, which Bayou Pierre is among.

Bayou Pierre is unique in that it contains the only endemic vertebrate species in Mississippi. Bayou Pierre is unique in that such a small system should contain two of the five species of fish considered endangered by Mississippi's List of Rare and Threatened Vertebrates. The fish fauna of Bayou Pierre reflects an unusually high quality of habitat and every consideration should be given to preserving that habitat quality while planning the Bayou Pierre Watershed.

Summary

The Bayou Pierre system is unique in that it contains the endemic bayou darter which is considered endangered by Mississippi's List of Rare and Threatened Vertebrates, and threatened by the United States' List of Endangered Fauna. It also contains the crystal darter which has been declared endangered by Mississippi's list. To minimize detrimental effects of the Bayou Pierre Watershed Project on those two species, it was necessary to define range and generalized habitat requirements so these aspects of their ecology might be maintained.

Both darters are inhabitants of eroded channel sections. The bayou darter is most common where the greatest ratio of gravel and sandstone riffles occur. The range of the bayou darter extends from approximately 2 miles below the Smyrna crossing to the Port Gibson area, with the range extending a few miles into Turkey, Foster's, and White Oak Creeks.

The crystal darter has a broader habitat requirement and is more common in the mainstem of Bayou Pierre where there is an intermingling of sand and gravel substrates.

The unique fish fauna of Bayou Pierre reflects the quality of stream habitat that presently exists. Every consideration should be given to maintaining those aspects of both darters environment which are essential for their existence in planning the Bayou Pierre Watershed Project.

Literature Cited

Raney, E. C., and R. D. Suttkus, 1966, Etheostoma rubrum, a new Percid fish of the subgenus Nothonotus from Bayou Pierre, Mississippi. Tulane Stud. Zool. 13(3): 95-102.

FIGURE 1. DISTRIBUTION OF SAMPLING POINTS AND COLLECTION SITES OF THE BAYOU AND CRYSTAL DARTERS WITHIN THE BAYOU PIERRE SYSTEM.