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Musshel DIVERSITY in Bear Creek

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North America harbors about 300 species of freshwater mussels, more than anywhere else in the world. Most of the mussel diversity is concentrated in the southeast, and Alabama boasts around 175 species, more than any other state. The Muscle Shoals area of the Tennessee River, located in northwest Alabama, is the site of the most diverse freshwater mussel fauna ever known. About 80 species were found there historically. Unfortunately, only about half of them remain.

Reasons for Decline

The decline of the mussel fauna at Muscle Shoals is reflective of the situation across most of North America. Over the past 200 years diversity and population densities have been drastically reduced in most river systems. The primary culprit behind the decline of freshwater mussels has been the construction of dams on almost all of the major rivers in the United States, as well as many small and medium rivers and streams. Whenever habitat is changed from its original state, many sensitive species, be they mussels, fish or other creatures, are lost. Other causes of mussel declines are stream channelization, sedimentation from mines, farms and areas of timber harvest, and water pollution from municipal and domestic sources.

Bear Creek Mussels

Some areas have been hurt worse than others, but fortunately small pockets of high mussel diversity remain. With 40 species, the Muscle Shoals area is home to one of the most diverse mussel communities remaining. Other pockets of diversity remaining in the Tennessee River drainage include Clinch and Duck rivers in Tennessee and Paint Rock River in northeast Alabama. Another small pocket of diversity, often overlooked, is in a short reach of the Bear Creek system in northwest Alabama and northeast Mississippi.

The Bear Creek population is important because it is in a geographical area where two important mussel groups overlap. Members of one group, referred to as the "Cumberlandian" fauna, originated in the upper Cumberland and Tennessee River drainages. They generally inhabit streams with swiftly flowing water and stable gravel bottoms. The other group is called the "Ohioan" fauna, and consists of species which originated in the interior basin of the United States, including the Ohio River. This group contains a higher percentage of species that are tolerant of more sluggish streams and softer sediments, such as mud.

The Bear Creek mussel community has undergone drastic changes over the past century as a result of habitat alterations. Four dams were built within the Bear Creek watershed between 1969 and 1979, two on Bear Creek



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proper, and one each on Little Bear and Cedar creeks. These dams affect habitat and mussel populations in three ways.

First, the stream was changed from a free flowing system about 135 miles long, to a series of relatively short free flowing reaches separated by impoundments. Most species of shoal habitat cannot survive in sluggish water, where silt is deposited over the gravel bottom. Second, habitat downstream of the dams is degraded by detrimental water releases. During late autumn and early winter, reservoir levels are lowered to increase flood water storage capacity. During this period, heavy discharges from the dams destabilize stream bottoms and banks. Mussels require a stable bottom, and usually cannot survive in areas where the stream bottom shifts frequently, which may bury them. Finally, dams isolate populations in headwater stream reaches. Species which require shallow, riffle habitat cannot cross the broad expanses of reservoirs, effectively cutting them off from other populations. These small populations are more susceptible to elimination from natural or human induced causes. Once the populations are eliminated, natural recolonization is impossible.

In addition to habitat deterioration as a result of the dams, an 18-mile-long floodway was constructed along a portion of Bear Creek, crossing it five times. The floodway was designed to act as a relief channel during occasional periods of high water. However, straightening the path of floodwater increases its velocity, dramatically increasing the potential for scour and bank destabilization, leading to sloughing of banks and loss of farmland and timberland along the banks. Sediments introduced into the stream form an unstable substrate and smother mussels.

Another factor affecting the decline of Bear Creek mussels is decreasing water quality. Activities in the watershed that may have contributed to these problems include discharge of wastewater into the system from private and municipal septic systems, strip mining coal, and allowing runoff from animal production operations. Some coal mines were inundated in the upper reaches of the system, and appear to be a continuing cause of water quality problems.

As a result of modifications to stream flow and pollution in the Bear Creek system, freshwater mussels have been virtually eliminated from almost the entire watershed. Historically, mussels were widespread in the system. In a recent survey

by the Geological Survey of Alabama and the Alabama Division of Wildlife and Freshwater Fisheries, most species were found to be limited to a short (less than six miles long), free flowing reach just upstream of the lower portion of Bear Creek that is impounded as part of Pickwick Reservoir. Populations within this reach appear healthy, with sub-adult individuals encountered for many of the species. A few additional species occur in the lower, impounded reaches.

Mussel Diversity Remains

Though mussels have been eliminated from most of the Bear Creek system, diversity is high in the short reach where they remain. A total of 34 species remain in the Bear Creek system, with 32 of those confined to the lower reaches. However, a dramatic change in composition of the Bear Creek mussel community was observed during the recent survey. Many of the 22 species known from the Bear Creek system historically have disappeared, including almost all of the Cumberlandian elements, and have been replaced mostly by species of the Ohioan fauna. Early mussel surveys in the Bear Creek system were limited, so it is possible that those Ohioan elements that were found there later were overlooked. However, many of the Ohioan species are large and conspicuous, so their recent colonization of Bear Creek appears to be real. Additionally, an increase in Ohioan elements in the Tennessee River mussel community, including upstream range expansions for several species, has been documented since the river was impounded.

Reasons for the disappearance of more sensitive Cumberlandian species following habitat alteration seem straightforward. However, factors involved in colonization of Bear Creek by Ohioan species are unclear. In the limited shoal habitat where mussels still occur, there doesn't appear to be any identifiable habitat changes that would favor the colonization. A plausible explanation could be related to the life cycles of freshwater mussels. They pass through a larval stage, called a glochidium, which is



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Bear Creek Dam

an obligate parasite on the gills or fins of fish. Many mussel species show some host specificity. That is, they are restricted to using one or only a few species as hosts. Changes in the fish fauna in the Bear Creek system could have allowed colonization of the Ohioan species. In any case, this development in the mussel fauna of Bear Creek is interesting from a natural history standpoint.

Future Outlook

Even though the Bear Creek fauna has suffered from negative effects of dams, channelization and several forms of water pollution, in a short reach it remains relatively diverse and healthy, compared to most other Tennessee River tributaries. In the population of mussels recently documented in the system, some, mostly the remaining Cumberlandian elements, are quite rare and located on the extreme western portions of their ranges. This makes the Bear Creek population critical for efforts aimed at preserving these species.

Several agencies have recently taken an interest in the plight of Bear Creek and have initiated a program to identify specific problems within the system and determine what can be done to mitigate habitat loss. This effort is being spearheaded by the Geological Survey of Alabama and Tennessee Valley Authority. Should environmental problems farther upstream be corrected, mussels from this population could expand their ranges upstream into those areas. Also, the Bear Creek population will likely prove to be a valuable source of brood stock, as mussel culture and reintroduction efforts expand in the future. 