



The Glade

*The Newsletter of the Missouri Chapter of the Society
for Conservation Biology*

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News and Notes

IIPoster winner: Miranda Milam-Dunbar won the MOSCB annual poster contest at this year's Missouri Natural Resources Conference (MNRC) held at Tan Tar-a in January. Check out her article on page 4!

IIAddress change?: If you change your address, please let our secretary know so we can keep up to date on where to send the Glade. Email Dana at lennondd@sbcglobal.net.

II Elections: Board elections will be held at the annual business meeting at the MNRC. Nominations will be sought in November and nominees will be posted on the web site in December. Voting can occur via email.

II Members vote on Gravel Mining: MOSCB members voted in favor of the Gravel Mining Resolution to minimize damage to Missouri streams by in-stream gravel mining after a presentation at the annual business meeting by the MO American Fisheries Society president, Duane Chapman. The vote passed 19 to 0.

II Education Outreach: The education outreach committee has plans for two pilot programs this spring with middle schoolers in Columbia. If you're interested in participating in future programs, contact Bethany Williams at bkh5f2@mizzou.edu

II Membership: A separate sheet has been included in this edition of The Glade to try to boost dwindling funds for MOSCB. Your contribution will keep The Glade going!

Native Mussels: Wonders Down Under

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It is hard to imagine a more astonishing group of animals than native freshwater mussels (also known as Unionoids, or pearly mussels). These diverse bivalve mollusks number about 300 North American species. Some grow to 2 kg and live for over a century, yet they begin their lives as microscopic parasites imbedded in the gills of fish. Many female mussels are accomplished anglers that attract their host fish with complex lures. The North American species were historically harvested by the millions as raw material for button manufacture and pearl nuclei, and today most pearls are cultured entirely in Unionoids. Yet, despite all these remarkable aspects, the pearly mussels remain obscure to most people. They receive far less publicity than the zebra mussel and the Asian clam *Corbicula*, which are non-native species and only distantly related to Unionoids.

Conservationists should be acutely aware of native mussels. Of 12 federally endangered animal species found in Missouri, six are native mussels. Three more mussels are official candidates, meaning that they will eventually be proposed for listing as endangered. Most of these endangered mussels were formerly widely distributed and occurred in over a dozen states. A century ago they were abundant enough to be well-known to commercial fishermen, who gave them colorful names such as pink mucket, fat pocketbook, and spectaclecase. Remarkably, the largest remaining populations of several of these formerly widespread endangered species are found in Missouri. Why is it that so many species of native mussels are endangered? And why have they survived in Missouri while being lost from most of their former range?



About 65 species of native mussels are found in Missouri

Most species of native mussels live only in rivers, and their ecology and life history makes them vulnerable to an unusually broad range of impacts. A primary requirement of mussels is stable stream beds. Adult mussels are usually embedded shallowly in the substrate with their siphons at the water interface. Most species have limited capacity for movement, and they can be dislodged, buried, or stranded by bed or channel movements. Therefore, dense populations develop only in reaches where the stream bed is stable for decades. Unfortunately, many human impacts destabilize stream beds and banks, including deforestation, urban runoff, reservoir releases, channelization, and gravel mining.

Dams are undoubtedly one of the biggest reasons for the decline of native mussels. The river miles obliterated beneath reservoirs are only part of the damage, because negative impacts extend for many more miles downstream of dams. Release water from deep reservoirs is hypoxic and cold, interfering with mussel growth and reproduction. Reservoirs prevent normal sediment transport from upstream, so that the river bed below a dam is gradually stripped of fine substrates and becomes abnormally coarse and homogeneous. Hydropower dams release pulses of water that lead to bank erosion. These effects are dramatically evident below Stockton Dam on the Sac River in Missouri, for example. Water release from Stockton swings between 100 and 5,000 cubic feet per second, often on a daily basis, resulting in massive

cutbanks that extend further each year. Mussel numbers are minimal for 10 miles below the dam and do not fully recover even much further downstream. Apart from directly degrading habitat, dams also isolate the remaining reaches of good habitat. This fragmentation tends to prevent repopulation after local extirpations occur, so that losses become permanent.

Mussels are filter feeders that process enormous amounts of water to obtain the fine particles on which they feed. Thus, they are intimately exposed to water pollution. Recent studies at the USGS Columbia Environmental Research Center show that native mussels are relatively sensitive to common pollutants such as ammonia and copper. Juvenile mussels, which live interstitially, may be particularly affected by pollutants that lie in the sediments. More study is needed to understand pollution impacts on each life cycle stage. However, there is already clear evidence that existing water quality standards for some pollutants are inadequate to protect unionids.

Another factor essential for native mussel survival is the native fish fauna. The larvae of mussels attach to the gills or fins of fish for a few days or weeks while they complete their development. Each mussel species can utilize only one or a few fish species as hosts. This host specificity is a remarkable saga of evolutionary adaptation and diversification. Blind

shellfish flaunt incredibly detailed lures, modeling small fish or crayfish to attract the strikes of smallmouth and rock bass. Others extrude red, wormlike aggregates of eggs and larvae to attract the attention of darters, or broadcast webs of nearly invisible threads studded with larvae to ensnare the fins of shad. We recently discovered that one Missouri species even grabs its host, logperch, by the head and then pumps water laden with larvae through the fish's mouth and gills! Sadly, these intricate relationships leave mussels at the mercy not only of their own frailties, but those of their fish hosts as well. If the host population declines for any reason, the mussels are unable to reproduce.

The greatest diversity and abundance of mussels in Missouri are found in the southern half of the state, in larger streams that drain the Ozark plateaus, including the Meramec, Gasconade, Black, and St. Francis rivers. Several globally endangered species have their last strongholds in these rivers. Their continued presence reflects the fact that these rivers are relatively intact, with watersheds that have been protected from tillage by the rocky thin soils of the Ozarks. However, multiple threats will escalate as human population rises. Without concerted conservation efforts, habitat degradation and the losses of native fauna will continue. Mussels can play an important role in protecting these rivers, because there are many funding opportunities to protect endangered species, and because practically any action to protect and restore river habitats can benefit native mussels.

We have much to learn about the pearly mussels, and perhaps not much time to learn about some of them. Students are often overwhelmed by Biology and think that it must be difficult to find unanswered questions. Certainly that is not the case with native mussels. Even the number of species that exist, the fish hosts they use, their physical requirements, and many other basic aspects of their natural history remain to be discovered. And despite their obscurity, mussels are in many ways a nexus in the life of rivers. John Muir's line rings true: "*When one tugs at a single thing in nature, he finds it attached to the rest of the world.*" To know mussels and their connections well, we need to understand rivers from the bottom up, and the inside out.



Female mussel (*Lampsilis reeveiana*) displaying fish-like lure (at top) to attract predatory host fish. The lower half of the mussel is normally embedded in the substrate.

Thermal Ecology of Hibernating Eastern Red Bats

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During daily rest or seasonal periods of inactivity, many bats will display mechanisms that allow them to conserve energy. Torpor, defined as a state of mental or physical inactivity, represents one of these mechanisms. This dormant state is typically classified as shallow (daily) torpor or seasonal (prolonged) torpor (also synonymous with hibernation). Overall metabolism (determined by ambient temperature – Figure 1) and energetic needs are decreased during these physiological states.

Throughout hibernation, bats will periodically arouse; this is an energetically expensive act in terms of calories needed for thermogenesis. Subsequent activity of arousals may also be of significance (re-hydration, feeding, reproductive activities, etc.). Therefore, arousal frequency and duration are important elements of the total winter energy budget.

The eastern red bat (*Lasiurus borealis*) is a species that faces these thermal challenges in an unusual way and was therefore chosen as a model for our study. Eastern red bats are a common, foliage roosting species that can be found throughout the United States, some southern parts of Canada, Mexico, Central America and into South America. They are solitary animals and are easily distinguished from most other insectivorous bats by their red coloration.

Like many temperate bat species, eastern red bats will prolong torpor bouts in response to decreasing temperatures in order to conserve energy during the winter season. However, unlike other temperate hibernating bats, eastern red bats do not utilize the typical hibernacula (e.g. caves, crevices, buildings). Instead, they will move into leaf litter on the forest floor during the cold bouts of winter months and arouse to forage on warm evenings. This leaf litter may provide the bat with a relatively stable microhabitat while still allowing them to monitor environmental (ambient) conditions and identify potential feeding opportunities. Other suitable characteristics of leaf litter include color (to aid in camouflage) and resistance to decay; both contribute to the success of a wintering site for eastern red bats.



Eastern red bat (*Lasiurus borealis*)

Because temperatures can fluctuate widely at these winter roost sites, our lab posed many questions as to how these bats can survive the winter season. Our goals include the following: 1) describe the correlation between arousals and ambient temperature; 2) track changes in metabolism and body temperature during hibernation and arousals at various ambient temperatures; 3) construct a winter energy budget for this species; and 4) determine how these thermal relationships will contribute to the conservation of this species.

Bats were captured in southwestern Missouri and kept in captivity during the winter season in environmental chambers simulating natural conditions. Torpor bout durations were assessed at various ambient temperatures which would typically be encountered in southwestern Missouri via temperature-

sensitive data-logging devices. Torpid metabolism, measured as oxygen consumption rates, was assessed at similar ambient temperatures within metabolic chambers while simultaneously recording body temperature.

Our results suggest that arousals from hibernation are spontaneous, as seen in other hibernating mammals, and their frequency is negatively correlated with ambient temperature. Metabolism of hibernating bats followed a similar pattern to that in Figure 1 and body temperatures of hibernating bats typically remained a few degrees above that of the ambient temperature.

Our laboratory measurements of these physiological aspects in regards to eastern red bat over-wintering strategies complement field studies by providing specifics of thermal ecology for this species. These types of studies are beneficial for many bat conservation programs that are limited due in part to lack of information concerning their physiological adaptations and requirements at their winter roost sites. Our research findings are applicable to conservation efforts through the following: better scheduling of prescribed burns; habitat/forestry management; and potential relatedness to other hibernating species' thermal ecology. These studies of ecophysiology yield a better understanding of this species' thermal limits and have predictive value when estimating winter energy budgets. For our future studies, we plan to increase sample sizes and assess potential differences in over-wintering strategies between the sexes from populations at different latitudes.

Missouri's Natural Areas System

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Demographic data tell us that most people live in urban or suburban environments. In these places, evidence of humanity dominates the landscape. We travel mainly on concrete and asphalt, past manicured lawns, steel, concrete, and plastic buildings, eye-catching billboards; under power lines and glaring neon. Native species are often reduced to a few stately old trees; it can be hard to imagine what the native landscape looked like a few hundred years ago. Fortunately, Missouri has a network of places where one's experience can be quite the opposite- the Missouri Natural Areas system.

MULE HOLLOW GLADE NATURAL AREA



A 44-acre portion of the Peck Ranch Conservation Area in Section 34, T28N, R2W, and Section 3, T27N, R2W, Stegall Mountain 7.5 min. topographic map. Designated December 18, 1973.

Natural Features--About 20 acres of open glade occur on Gasconade dolomite with a high number of plants and animals including collared lizards. Mule Hollow Glade Natural Area is owned by the Department of Conservation. As part of the continuing process to improve representation in the Missouri Natural Area System, this natural area is being considered for expansion. An additional 325 acres of glades and woodlands are being evaluated for designation.

For more information contact the Missouri Department of Conservation, Wildlife Division, Ozark Regional Office, 551 Joe Jones Blvd., West Plains, MO 65775, phone 417-256-7161.

Natural area systems are designed to protect and represent sites of high ecological integrity. Many states have them, and they vary in degree of protection and emphasis. In 1970, the Missouri Department of Conservation (MDC) created a system of natural areas on its land. In 1977, a memorandum of understanding between MDC, and the Missouri Department of Natural Resources (DNR) created an interagency natural areas system.

Natural areas are owned by both public and private entities, ranging from federal agencies to conservation-minded individuals. Though natural areas can be located within existing public lands, they are managed first and foremost to perpetuate their natural qualities and ecological integrity. Consumptive or human uses are permitted only as long as they do not conflict with this primary goal. Many natural areas have trails, but many do not. Some are readily accessible; others are best found using a topographic map and compass.

The designation of a Natural Area requires some basic steps. A nomination must first be written, describing the area and its natural features in detail. The nominators use botanical and zoological expertise, ecological classification systems, and other resources to describe the area and justify its designation. The nomination is usually reviewed by a DNR or MDC natural areas committee before it proceeds to the Missouri Natural Areas Committee, or MONAC. MONAC is composed of representatives from MDC, DNR, the U.S. Forest Service, the U.S. Fish and Wildlife Service, National Park Service, and The Nature Conservancy. If approved by MONAC, the nomination then goes to the Conservation Commission for final approval and subsequent designation.

Of course, the most interesting aspects of natural areas are the features that merited their designation in the first place. Natural areas provide a sampler of the full range of Missouri's terrestrial and aquatic flora and fauna and geology. Collared lizards bask on dolomite, igneous and chert glades within several Natural Areas. Five hundred year-old Ashe junipers preside over the tributaries of the White River at Stone County's Ashe Juniper Natural Area (NA); unique southern species such as yellowwood and smoke tree grow in between. At Donaldson Point NA- part of the New Madrid County Conservation Area of the same name- one can catch a glimpse of the now rare bottomland forest and swamps that once covered the Bootheel. Elusive Swainson's warblers sing from stands of giant cane, and the area is a stronghold for swamp rabbits.

At a broader scale, Natural Areas provide the opportunity to learn about Missouri's natural communities. Combinations of geology, aspect, soil types, and moisture regimes yield distinct communities. Igneous glades cap Stegall Mountain NA in Carter County, and some of Missouri's last intact dry loess prairie occurs at Star School Hill Prairie NA in Atchison County. East Drywood Creek NA, located within Prairie State Park, features a fine example of a prairie headwaters stream.

Natural areas can also be designated solely or partly for geologic features. The Pinnacles NA north of Columbia features striking limestone formations along a high-quality stream. Further east, at Sandy Creek Tunnel NA in Lincoln County, are an impressive natural tunnel and cliff face carved from Burlington limestone; an Ozark headwaters stream flows below.

Natural areas are often notable for many other reasons. The Sunklands NA showcases some of the state's best examples of karst processes. Here one finds one of the longest karst valleys in Missouri, and multiple sinkhole ponds, caves, and springs. The Sunklands is also Missouri's largest natural area at 6295 acres. As

many have recognized, small parcels of land may be prone to reduced long-term viability. Accordingly, when possible, new natural areas and expansions encompass substantial acreages. Larger sizes buffer high-quality communities and make it easier to implement large-scale management activities such as prescribed fire.

There are currently 180 designated Missouri natural areas totaling roughly 60,000 acres- and counting. (Table 1.) Nominations and expansions are almost always in progress. Restoration and management of natural areas are also ongoing, contrary to the notion of a preserve that simply is fenced off, left alone, and thus “protected.” Managers must address threats such as exotic species, implement disturbance regimes to mimic historic patterns, and evaluate the results.

MISSOURI NATURAL AREA OWNERSHIP (last update – October 6, 2004)			TABLE 1
Agency*	# of Natural Areas	# of Acres (Hectares)	*Agencies abbreviated are: MDC- Missouri Department of Conservation, DNR- Missouri Department of Natural Resources, USFS- United States Forest Service Mark Twain National Forest, NPS- National Park Service Ozark National Scenic Riverways, TNC- The Nature Conservancy, LAD- Leo A. Drey Foundation
MDC	85	29,628 (11,999)	
DNR	38	16,450 (6,662)	
USFS	19	6,231 (2,523)	
NPS	9	2,776 (1,124)	
TNC	12	1,900 (770)	
LAD	10	1,637 (663)	
Other	22	1,421 (576)	
Total # of Natural Areas **180	Total Acres:	60,043 (24,317)	**Agency totals are greater than the total number of natural areas due to several natural areas with multiple ownerships.

Our state has a natural areas system we can be very proud of. With careful attention and continued support, natural areas will continue to showcase the best of Missouri’s natural features for many years to come. The next time you have a craving for the natural world, seek out some of our finest examples. Visit a Missouri natural area!

To request a free Missouri Natural Areas Directory, containing descriptions of and directions to each area, please send your address to: Wildlife Division, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-0180.

BioBlitz events raise awareness in Missouri

A BioBlitz is a 24-hr race against time to identify as many species as possible in a defined area. So if you’re interested in getting outside and learning about your local birds, bats, frogs and flowers, look for a BioBlitz in your area!

•The **Ferguson-Florissant School District** is celebrating thirty years of environmental education at the Little Creek Nature Area by hosting a BioBlitz event September 23-24, 2005. The focus is to highlight the biodiversity of the area and allow opportunities for the community to get excited about science education. Scientists and naturalists are needed for the survey teams. If interested contact Nicole Wulff at nwulff@fergflor.k12.mo.us or Barbra Stephenson at (314)831-7386.

•A BioBlitz will be held in **Columbia, MO** September 9-10. Survey teams will explore the Flatbranch watershed from 3pm on Friday to 3pm on Saturday. A cookout will follow for all registered participants. Registration is free. For more information, email Sara Storrs at sisk95@mizzou.edu.

•There are usually annual events in **Kansas City** and **St. Louis** as well. Just check your local search engine using “BioBlitz” and “your town name.”

The Glade
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*When one tugs at a single thing in nature,
he finds it attached to the rest of the world. --John Muir*

Membership Information

The goal of MOSCB is to promote communication among conservation biologists throughout the state of Missouri. Membership in MOSCB is free. Please visit our MOSCB web page for more detailed information (<http://www.snr.missouri.edu/moscb>).

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