

APPENDIX J
RARE SPECIES INFORMATION



Eastern Massasauga Fact Sheet

Why Conserve a Poisonous Snake?

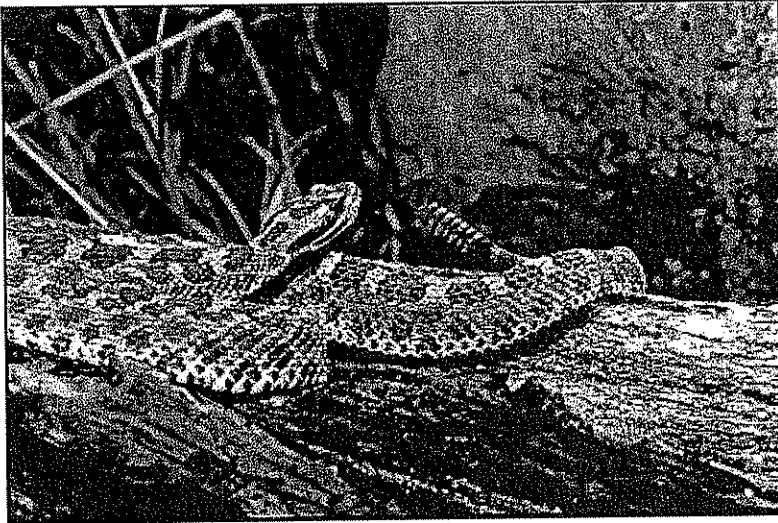


Photo by Dick Dickenson

The eastern massasauga is a small venomous rattlesnake found in the northeastern United States. Populations of this snake have declined so much that it is now necessary to work to conserve it or it could go extinct in the future.

To some people, conservation of a venomous snake may seem a waste of money, stupid, and even negligent. That view is somewhat unique to our culture. Other cultures do not hold such a dark view of snakes. For example, in India, a country where thousands die from snake bite each year, they hold an annual festival to honor the snake because it eats mice and rats that eat their crops. Australian aborigines eat snakes and believe that life on earth began with the

rainbow snake. Many Native Americans thought of snakes as sacred and would ask the animal to protect them.

The eastern massasauga is a natural part of our environment that has evolved over millennia. Yes, people and animals can be hurt by massasauga, but people and animals can be hurt and killed by many things. We do not eliminate something from our world because it may cause harm or death (dogs, deer, raccoons, bees, spiders, cars, etc). Instead we recognize the value of these animals or objects and adapt our actions to minimize risk. The same is true for an animal such as the massasauga rattlesnake. However, the U.S. Fish & Wildlife Service emphasizes that human safety always comes first. If you are threatened by a massasauga you may protect yourself.

Why conserve the massasauga?

The massasauga is an important part of its community because it's both predator and prey. It eats mainly small mammals (mice and shrews) and small snakes. It is also food for other predators in its community. Herons, hawks, eagles, and other snakes eat massasaugas.

Conserving massasaugas also means conserving the habitat where they live. These habitats are wetlands and adjacent natural habitat in uplands. Conserving these habitats results in conserving the many other wildlife and plants that are found there. Additionally, wetland conservation benefits people because wetlands store flood waters and filter sediments and other pollutants from water that people use.

Many plants and animals are directly important to humans now or may become important in the future as sources of food or medicine. By saving species from extinction we ensure that their beneficial uses will be available to us in the future. For example, rattlesnake venom has been explored for human medicinal use, including treatments for arthritis, MS, and polio. Rattlesnake venom also has anti-coagulant properties that stay localized, unlike coumadin and some other anti-coagulants that are currently used to prevent strokes and heart attacks.

How dangerous is the massasauga?

The massasauga is a secretive, docile snake that strikes humans only when it feels threatened or cornered. A massasauga will rely on its camouflage coloration to hide or will try to escape rather than strike a person. Many people who visit parks with massasaugas never see these shy creatures and may have walked by one without noticing it.

A bite from a massasauga can be very painful and is potentially life threatening. But, because of the snake's elusive and shy behavior, people rarely are bitten by them. Ontario and Michigan, the province and state with the most massasaugas, report an average of 1 to 2 bites a year. The other states in which massasaugas live each report only a few bites a decade. A large portion of the bites that do occur are the result of someone intentionally handling or harassing a massasauga or someone stepping on one.

The venom of a massasauga is more toxic than that of most other rattlesnakes, but the amount it injects is relatively small compared to those snakes. Venom, typically used by snakes to kill their prey, is expensive for snakes to produce. Therefore, many snake bites contain little or no venom. These venom-less bites, called dry-bites, occur in about 25 percent (and possibly as high as 50 percent) of all rattlesnake bites. As a result of this and the successful use of antivenin treatment, fatalities from an eastern massasauga bite are extremely rare. There are no known fatalities in the last 40 years, although there are several verified fatalities during the first part of this century. In comparison, many more people are injured or die from dog bites or bee stings.

How can I avoid being bitten by a massasauga?

Despite the infrequent occurrence of massasauga bites, people need to use caution when in rattlesnake habitat, just as they would with any wild animal.

- When walking in areas known to have massasauga, wear long pants and sturdy hiking boots and stay on the trails. Be alert, watch the trail in front of you and look around before you sit down or place anything on the ground.
- Massasaugas often hide under logs and rocks, therefore, do not reach under rocks or logs or step directly over them. Instead, step on them and then over them.
- The best way to avoid being bitten by a massasauga is to leave them alone. Many snake bites occur because people try to get close to them or try to kill them. If you see a massasauga, do not disturb it. Instead, stop, turn around and walk in the opposite direction.

How do I keep massasaugas out of my yard or away from my home?

Massasaugas are secretive animals that avoid exposed places. They also generally hibernate in wetlands rather than in places occupied by people. Thus they are not likely to enter your home. However, if you live near wetlands or uplands with natural habitat, a massasauga may find its way to your yard. If you wish to maintain a relatively snake-free yard, there are a few practical steps which can be taken. The best way to keep snakes from using your yard is to eliminate their food and shelter.

- Rodents are the primary food source of snakes, so by reducing their numbers near your home, you can also reduce the number of snakes.
- Removing wood piles and debris and maintaining a well mowed, well kept lawn, will eliminate much of the snakes' shelter.
- Unfortunately, the things you will need to remove from your yard to deter snakes will deter all other wildlife as well. If you enjoy having chipmunks and song birds in your yard, you may want to keep the shrubs, fire wood piles, brush piles, and long grass on the fringes of your yard, away from your home.



Questions and Answers about Conservation of the Eastern Massasauga Rattlesnake

- Q1. What action has the U.S. Fish and Wildlife Service (Service or we) taken to protect the eastern massasauga rattlesnake?**
- A.** We have designated the eastern massasauga as a "candidate" species. We are also partnering with other natural resource agencies and conservation organizations to research eastern massasauga biology and build upon the status information that we have already gathered. We are sharing with other agencies and land managers information about the snake's biology and what we know about its status. Finally, we are assisting private landowners in managing habitat for the eastern massasauga.
- Q2. What is a "candidate" species?**
- A.** A candidate species is a species that we believe needs the protection of the Endangered Species Act but we have not yet gone through the process of proposing it as a threatened or endangered species.
- Q3. Why did the Service designate the massasauga as a "candidate" species?**
- A.** Many people have seen declines in the numbers and range of the massasauga. Those people include biologists with state natural resource agencies, researchers, collectors, and people who just like snakes. In response to their concerns, we met with a number of people throughout the massasauga's range who had information on its numbers and population locations, we gathered information on past and ongoing surveys, and we conducted an analysis on the potential for the species to become extinct in the future. This information was put together and analyzed in a report called a Status Assessment (available for public review and on our website at www.fws.gov/r3pao/eco_serv/endangrd). We determined that threats to the massasauga still exist, that those threats will cause its numbers and range to continue declining, and as a result of those threats it may become extinct in the future. Therefore, we decided to take the next step to protect this species by designating it a "candidate" species.
- Q4. What are the major threats to the eastern massasauga?**
- A.** Habitat loss is one of the primary factors in the decline of the eastern massasauga. Massasaugas depend on wetlands for food and shelter but often use nearby upland areas during part of the year. Draining wetlands for farms, roads, homes, and urban development has eliminated much of the massasauga habitat in many states. Also, massasaugas are not long distance travelers, so roads, towns, and farm fields prevent them from moving between the wetland and upland habitats that they need. These barriers also separate and isolate remaining populations. Small, isolated populations are often lost due to inbreeding, disease, or severe adverse environmental conditions, such as storms or drought.
- A second major factor in the decline of the eastern massasauga is human fear and dislike of snakes which results in people killing large numbers of snakes. Not only are massasaugas killed when they show up near homes or businesses, but people may go out of their way to eliminate them from an area. Indeed, many states had bounties on all rattlesnakes, including massasaugas.

Q5. What is the current distribution of the eastern massasauga?

A. Massasaugas are found in Illinois, Indiana, Iowa, Michigan, Missouri, New York, Ohio, Pennsylvania, Wisconsin, Ontario and possibly Minnesota.

Although the massasauga may appear to live over a large area, it has suffered marked declines in all those states and in Canada.

- ▶ Of the 203 counties in which massasauga used to be found, 40 percent no longer have any populations.
- ▶ Nine of the 11 states/province that historically had massasauga populations now have less than 50 percent of their historic populations, while the remaining two have lost more than 30 percent of theirs. In fact, there are probably no longer any massasauga in Minnesota.
- ▶ In all states, less than 35 percent of the populations that still exist are healthy.

Q6. Even if the massasauga is declining and may go extinct, isn't human safety more important than the existence of this snake?

A. Human safety is always top priority and if someone feels threatened by a massasauga they can protect themselves. However we believe that it is in the best interest of all of us to conserve the massasauga. The following are some of the reasons why.

- ▶ The massasauga may have current and future medical benefits. There is ongoing research on rattlesnake venom and its potential to treat a variety of diseases and also use of rattlesnake venom as an anticoagulant.
- ▶ The fact that the massasauga is declining is a warning bell that there are problems with our natural communities. By conserving the massasauga we can address some of those problems and protect human interests in wetlands and natural areas preservation.
- ▶ Rattlesnakes, which feed primarily on small mammals, help keep rodent populations in check and prevent the spread of rodent-transmitted diseases.
- ▶ Massasauga are members of natural communities that evolve over time. If the massasauga is removed from those communities the result may have negative impacts for humans.

Additionally, massasauga bites are rare and usually not life threatening. The Service has a fact sheet entitled "Eastern Massasauga Rattlesnake - Why Conserve a Poisonous Snake?" that provides more information on the frequency and toxicity of massasauga bites.

Q7. Are "candidate" species protected by Federal law?

A. No, candidate species do not receive the protection of any Federal law. However the "candidate" status gives Federal and state agencies as well as other groups, organizations, and private landowners notice that this species is in trouble and may need protection in the future. Thus any of these groups or individuals may volunteer to carry out conservation actions for the massasauga.

Q8. Now that the Service has designated the massasauga as a "candidate," what will happen next?

A. When a species becomes a candidate it is given a "listing priority number." This number is given because there is not enough Service personnel, time, or money to propose all the candidate species for listing. The purpose of the "listing priority number" is to ensure that the species that are in the most trouble are given the highest priority. The eastern massasauga has been assigned a listing priority number of 9. This number means that there will be a one to two-year delay while the Service addresses higher priority listing actions. During that time, we will promote conservation of the species to start its recovery before it is listed. If pre-listing conservation of the massasauga is successful during the next two years, the possibility exists that it may not have to be listed.

- Q9. If the Service decides to go forward with listing the massasauga as threatened or endangered, what is the process?**
- A. The Service would prepare a document, called a proposed rule, that would be published in the Federal Register and made available for public review. The public would be given at least 60 days to review the proposal and provide the Service with any comments or additional information. During this 60 day period, the Service would advertise in newspapers and on the internet that the proposal has been published and that the public is invited to comment on the proposal. Also, public hearings would likely be held to gather public input. After the comment period ends, the Service would consider and analyze all the public comments to make a final decision on whether to list the massasauga as a threatened or endangered species.
- Q10. What do I do if I see an eastern massasauga?**
- A. If you encounter an eastern massasauga rattlesnake, observe it from a distance and do not disturb or try to capture it. Massasauga are generally docile animals and, unless harassed, will usually remain still or hide. When you are ready, turn around and walk the other way. Report any sightings to your state natural resource agency. This will help us track the species and locate new areas where it is found. If you want more information on how to avoid being bitten and what to do if you are bitten by a massasauga or how to keep them away from your property, please see our fact sheet "Eastern Massasauga Rattlesnake - Why Conserve a Poisonous Snake."
- Q11. What can I do to help conserve the eastern massasauga?**
- A. The Service is doing several things to conserve the eastern massasauga. You can participate in the following ways:
- ▶ Contact your local U.S. Fish & Wildlife Service state office or your state natural resource agency if you see an eastern massasauga.
 - ▶ Volunteer to participate in habitat management activities on lands where agencies, groups, or individuals are interested in managing for the eastern massasauga.
 - ▶ Share information about eastern massasauga biology and status.
 - ▶ Share your concerns with U.S. Fish & Wildlife Service and state natural resource agency staff so that we can address them in the process of planning for massasauga recovery.
- Q12. How do I learn more about the eastern massasauga?**
- A. To learn more about the eastern massasauga, visit the Service's website at www.fws.gov/r3pao/eco_serv/endangrd ; write to the U.S. Fish & Wildlife Service - Endangered Species Division, 1 Federal Drive, Fort Snelling, MN 55411; or call 612/713-5350.

Bald Eagle

Haliaeetus leucocephalus



The bald eagle is truly an all-American bird. It ranges over most of the continent, from the northern reaches of Alaska and Canada down to northern Mexico.

While our national symbol was in danger of extinction throughout most of its range 30 years ago, the bald eagle has made a tremendous comeback, its populations greatly improving in numbers, productivity, and security in recent years.

Juvenile bald eagles have mottled brown and white plumage, gradually acquiring their dark brown body and distinctive white head and tail as they mature. Bald eagles generally attain adult plumage by 5 years of age. Most are capable of breeding at 4 or 5 years of age, but in healthy populations they may not start breeding until much older. Adults weigh 8 to 14 pounds (occasionally reaching 16 pounds in Alaska) and have wingspans of 5 ½ to 8 feet. Those in the northern range are larger than those in the south, and females are larger than males.

Bald eagles can live 15-25 years in the wild, and even longer in captivity. They typically mate for life and build huge nests in the tops of large trees near rivers, lakes, marshes, or other aquatic areas. Nests are often re-used year after year, with additions to the nests made annually. Nests are often 4 to 6 feet wide and may weigh up to 1,000 pounds. Although bald eagles may range over great distances, they usually return to nest within 125 miles of where they were raised.

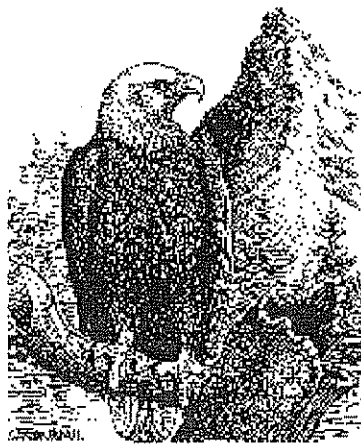
Breeding bald eagles typically lay one to three eggs once a year, which hatch after about 35 days. The young eagles are flying within 3 months and are on their own about a month later. However, disease, lack of food, bad

weather, or human interference can kill many eaglets; recent studies show that approximately 70% survive their first year of life.

The staple food of most bald eagle diets is fish, but they will also feed on waterfowl, rabbits, snakes, turtles, other small animals and carrion. In winter, eagles that nest in northern areas migrate south and gather in large numbers near open water areas where fish and other prey are plentiful. Eagles that nest in the south during the winter migrate north in the summer where food is plentiful.

Wildlife experts believe there may have been 100,000 nesting bald eagles in the lower 48 states when the bird was adopted as our national symbol in 1782. Since that time, the bald eagle has suffered from habitat destruction and degradation, illegal shooting, and contamination of its food source, most notably due to the pesticide DDT. By 1963 there were only 417 bald eagle nesting pairs in the lower 48 states.

Bald eagles are frequently seen perched on large snags above lakes or rivers. From this vantage point they can survey their surroundings for prey



Bald eagles have few natural enemies. In general they prefer an environment of quiet isolation; tall, mature trees; and clean waters. Those conditions have changed over much of the bald eagle's former habitat.

Although primarily fish and carrion eaters, bald eagles and other raptors were seen as marauders that killed chickens, lambs, and other domestic livestock. Consequently, large numbers were shot by farmers, ranchers, and others.

In 1940, noting that the national bird was "threatened with extinction," Congress passed the Bald Eagle Protection Act prohibiting, except under certain specified conditions, the taking, possession, and commerce of bald eagles. A 1962 amendment to this Act added the golden eagle, and the amended law became known as the Bald and Golden Eagle Protection Act. In 1967, bald eagles were officially declared an endangered species (under a law that preceded the Endangered Species Act of 1973) in all areas south of the 40th parallel.

The greatest threat to the bald eagle's existence arose from the widespread use of DDT and other pesticides after World War II. DDT was used for insect control throughout the country and its residues washed into lakes and streams. There, it was absorbed by aquatic plants and animals that were eaten by fish. The contaminated fish, in turn, were consumed by bald eagles.

The chemical interfered with the bald eagle's ability to develop strong shells for its eggs. As a result, bald eagles and many other bird species began laying eggs with shells so thin they often broke during incubation or otherwise failed to hatch. Their reproduction disrupted, bald eagle populations

plummeted. As the dangers of DDT became known, in large part due to Rachel Carson's famous book *Silent Spring*, this chemical was banned for most uses in the U.S. in 1972.

In addition to the adverse effects of DDT, bald eagles also died from lead poisoning as a result of feeding on hunter-killed or crippled waterfowl containing lead shot and from lead shot that was inadvertently ingested by the waterfowl. In 1991, a 5-year program to phase out the use of lead shot for waterfowl hunting was completed by the Service.

Gradually, the Service assembled the largest colony of breeding bald eagles in captivity at its Patuxent Wildlife Research Center near Laurel, Maryland, in a major effort to return healthy eagles to the wild. The center is now run by the U.S. Geological Survey.

Patuxent's scientists enhanced the species' breeding potential by removing the eagle's first clutch of eggs and incubating them artificially. The eagles would usually then lay a second clutch, which the birds were allowed to incubate themselves. In all, 124 bald eagles were hatched at Patuxent.

These captive-hatched bald eagles were an important source for restocking wild populations in certain areas of the country and helped to reestablish



As a recovery method, biologists place eagles into the nest of adult pairs whose own eggs failed to hatch. The pair then serve as "foster parents."

a broader distribution. Patuxent's program came to an end in 1988 as bald eagles began to reproduce more successfully in the wild and the center turned its efforts toward other more critically endangered species.

Some states, universities, and non-profit organizations have continued reintroduction efforts. Two methods are generally used. Eaglets used for reintroduction may be captive hatched or, since usually only two young per nest survive, they may be transferred from a bald eagle nest with a clutch of more than two. These "extra" eaglets are placed in the nest of an adult pair whose own eggs are infertile or fail to hatch. The "foster parents" readily adopt the chicks and raise them as their own.

Another method, called "hacking", involves placing eaglets in manmade towers at 8 weeks of age. These towers are located in remote areas where bald eagle populations are low or non-existent. The eaglets are kept in an enclosure and fed by humans who stay out of sight. When the birds are capable of flight, at about 12 weeks old, the enclosure around the artificial nest is opened and the birds are free to leave. Food is still provided at the release site until the birds learn to fend for themselves in the wild.

Thanks to the banning of DDT and these other recovery methods, bald eagle populations have steadily increased in the past 25 years. From 417 nesting pairs in the early 1960s, there are now approximately 7,066 bald eagle nesting pairs and an unknown number of immature bald eagles in the conterminous U.S. In the last few years, several states have had breeding bald eagles for the first time in years.

The bald eagle was originally listed as endangered under the Endangered Species Act in 43 of the lower 48 states and listed as threatened in Michigan, Minnesota, Oregon, Washington, and Wisconsin. (There are about 40,000 bald eagles in Alaska and none in Hawaii.) "Endangered" means a species is considered in danger of extinction throughout all or a significant portion of its range, while "threatened" is a less dire category, meaning a species is considered likely to become endangered within the foreseeable future, but is not currently in danger of extinction.

In July 1995, the Service announced that bald eagles in the lower 48 states had recovered to the point that those populations that were previously considered endangered were now considered threatened. The Service then formally upgraded those populations from endangered to threatened.

In July 1999, the Fish and Wildlife Service proposed to remove the bald eagle from the list of threatened and endangered species. Since then, the Service has reviewed the comments received on that proposal along with new data and information to determine the best ways to manage for the species once it is removed from the protections of the Endangered Species Act. In 2006, the Fish and Wildlife Service re-opened the public comment period due to new information on the proposal to delist. Data gathered during this comment period will be factored into a final decision on the status of the species.

Bald eagles normally lay two to three eggs a year, which hatch after about 35 days. The eagles learn to fly within three months and are on their own about a month later.



U.S. Fish & Wildlife Service
<http://www.fws.gov>

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Pennsylvania Game Commission - State Wildlife Management Agency

Threatened Species

Upland Sandpiper



CURRENT STATUS: In Pennsylvania, threatened; Migratory Bird of Management Concern in the Northeast.

POPULATION TREND: Upland sandpipers (*Bartramia longicauda*) are rare breeding birds with scattered nesting sites, mostly in the state's west and central regions. They are common in Midwestern states. Upland Sandpipers are more likely to be found in fields 150 acres or larger than in smaller fields. This bird has experienced dramatic population changes in Pennsylvania over the past 150 or so years. Their nesting population here increased with deforestation in the nineteenth century, then gradually decreased with the increased use of pesticides and changes in farming in the twentieth century. Upland sandpipers have been listed as threatened since the mid 1980s. Their nesting numbers are suspected to be growing in the Pymatuning region, but they are declining or have disappeared from most areas.

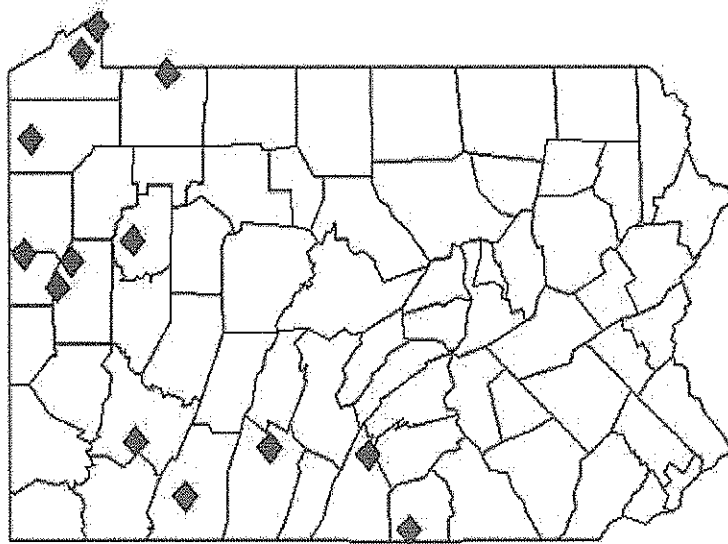
IDENTIFYING CHARACTERISTICS: The upland sandpiper, formerly called the upland plover, is a large, light-brown shorebird that comes inland to nest. This bird is about 12 inches tall and has a 20-inch wingspan. The upland sandpiper can be identified by its long neck, disproportionately small head, and long tail. Its back and wings are dark brown; breast streaked. The upland sandpiper is perhaps most readily identified by its preference for perching on wires and fenceposts, and its habit of holding its wings high above its back for a few moments after alighting.

BIOLOGY-NATURAL HISTORY: Upland sandpipers nest across North America; they winter in South America. These birds arrive in Pennsylvania in April, and then leave in July or August after nesting. They are almost exclusively insectivorous, feeding primarily on grasshoppers, crickets and weevils. Waste grain and weed seeds are sometimes eaten. This out-of-place shorebird typically nests on the ground in grassy fields. The normal clutch consists of four eggs. Young hatch in about three weeks, and the precocial young leave the nest as soon as the last one hatches. They can fly when they're about 18 days old.

PREFERRED HABITAT: Upland sandpipers are birds of open country. They may be found in large fallow fields, pastures and grassy areas. The most regularly occupied areas now are on reclaimed surface mines. Rarely are more than one or two pairs found in a field until migration, when family groups gather in flocks or are joined by migrants.

REASONS FOR BEING THREATENED: Upland sandpipers were once more common than they are today. Around the turn of the century they attracted the attention of market hunters looking for a bird to fill the void created by the decline – and ultimate extinction – of the passenger pigeon. Loss of farmland and changing agricultural practices and extensive pesticide use, which eliminates insect life, are thought to be keeping its numbers low.

MANAGEMENT PROGRAMS: Before any management programs can be initiated, surveys need to be conducted to determine where and how many upland sandpipers are currently breeding in Pennsylvania. When possible, grasslands found to be used by upland sandpipers should be managed to avoid disturbance during the nesting season. Mowing after July 15 ensures that young sandpipers – and other grassland birds – will not be harmed.



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Indiana Bat (*Myotis sodalis*)

The Indiana bat is an endangered species. Endangered species are animals and plants that are in danger of becoming extinct. Threatened species are those that are likely to become endangered in the foreseeable future. Identifying, protecting, and restoring endangered and threatened species are primary objectives of the U.S. Fish and Wildlife Service's endangered species program.

What is the Indiana Bat?

Description

The scientific name of the Indiana bat is *Myotis sodalis* and it is an accurate description of the species. *Myotis* means “mouse ear” and refers to the relatively small, mouse-like ears of the bats in this group. *Sodalis* is the Latin word for “companion.” The Indiana bat is a very social species; large numbers cluster together during hibernation. The species is called the Indiana bat because the first specimen described to science in 1928 was based on a specimen found in southern Indiana's Wyandotte Cave in 1904.

The Indiana bat is quite small, weighing only one-quarter of an ounce (about the weight of three pennies). In flight, it has a wingspan of 9 to 11 inches. The fur is dark-brown to black. The Indiana bat is similar in appearance to many other related species. Biologists can distinguish it from similar species by comparing characteristics such as the structure of the foot and color variations in the fur.

Habitat

Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions.



Photo by Rich Fields

Indiana bats eat up to half their body weight in insects each night.

Hibernation is an adaptation for survival during the cold winter months when no insects are available for bats to eat. Bats must store energy in the form of fat before hibernating. During the six months of hibernation the stored fat is their only source of energy. If bats are disturbed or cave temperatures increase, more energy is needed and hibernating bats may starve.

After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas.

Reproduction

Indiana bats mate during fall before they enter caves to hibernate. Females store the sperm through winter and become pregnant in spring soon after they emerge from the caves.

After migrating to their summer areas, females roost under the peeling bark of dead and dying trees in groups of up to 100 or more. Such groups are called maternity colonies. Each female in the colony gives birth to only one pup per year. Young bats are nursed by the mother, who leaves the roost tree only to forage for food. The young stay with the maternity colony throughout their first summer.

Feeding Habits

Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. Like all insect-eating bats, they benefit people by consuming insects that are considered pests or otherwise harmful to humans. Their role in insect control is not insignificant – Indiana bats eat up to half their body weight in insects each night.

Range

Indiana bats are found over most of the eastern half of the United States. Almost half of all Indiana bats (207,000

in 2005) hibernate in caves in southern Indiana. In 2005, other states which supported populations of over 40,000 included Missouri (65,000), Kentucky (62,000), Illinois (43,000) and New York (42,000). Other states within the current range of the Indiana bat include Alabama, Arkansas, Connecticut, Iowa, Maryland, Michigan, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia. The 2005 population estimate is about 457,000 Indiana bats, half as many as when the species was listed as endangered in 1967.

Why is the Indiana Bat Endangered?

Human Disturbance

Indiana bats, because they hibernate in large numbers in only a few caves, are extremely vulnerable to disturbance. During hibernation, they cluster in groups of up to 500 per square foot. Since the largest hibernation caves support from 20,000 to 50,000 bats, it is easy to see how a large part of the total population can be affected by a single event. Episodes of large numbers of Indiana bat deaths have occurred due to human disturbance during hibernation.

Cave Commercialization and Improper Gating

The commercialization of caves – allowing visitors to tour caves during hibernation – drives bats away. Changes in the structure of caves, such as blocking an entrance, can change the temperature in a cave. A change of even a few degrees can make a cave unsuitable for hibernating bats. Some caves are fitted with gates to keep people out, but improper gating that prevents access by bats or alters air flow, temperature, or humidity can also be harmful. Properly constructed gates are beneficial because they keep people from disturbing hibernating bats while maintaining temperature and other requirements and allowing access for bats.

Summer Habitat Loss or Degradation

Indiana bats use trees as roosting and foraging sites during summer months.

Loss and fragmentation of forested habitats can affect bat populations.

Pesticides and Environmental Contaminants

Insect-eating bats may seem to have an unlimited food supply, but in local areas, insects may not be plentiful because of pesticide use. This can also affect the quality of the bats' food supply. Many scientists believe that population declines occurring today might be due, in part, to pesticides and environmental contaminants. Bats may be affected by eating contaminated insects, drinking contaminated water, or absorbing the chemicals while feeding in areas that have been recently treated.

What is Being Done to Prevent Extinction of the Indiana Bat?

Listing

Prompted by declining populations caused by disturbance of bats during hibernation and modification of hibernacula, the Indiana bat was listed in 1967 as “in danger of extinction” under the Endangered Species Preservation Act of 1966. It is listed as “endangered” under the current Endangered Species Act of 1973. Listing under the Endangered Species Act protects the Indiana bat from take (harming, harassing, killing) and requires Federal agencies to work to conserve it.

Recovery Plan

The Endangered Species Act requires that recovery plans be prepared for all listed species. The U.S. Fish and Wildlife Service developed a recovery plan for the Indiana bat in 1983 and is now revising that Plan. The recovery plan describes actions needed to help the bat recover.

Habitat Protection

Public lands like National Wildlife Refuges, military areas, and U.S. Forest Service lands are managed for Indiana bats by protecting forests. This means ensuring that there are the size and species of trees needed by Indiana bats for roosting; and providing a supply of dead and dying trees that can be used as roost sites. In addition, caves used for hibernation are managed to

maintain suitable conditions for hibernation and eliminate disturbance.

Education and Outreach

Understanding the important role played by Indiana bats is a key to conserving the species. Helping people learn more about the Indiana bat and other endangered species can lead to more effective recovery efforts.

U.S. Fish & Wildlife Service

1 Federal Drive

Fort Snelling, Minnesota 55111

612/713-5350

<http://www.fws.gov/midwest/endangered>

December 2006

Pennsylvania Game Commission - State Wildlife Management Agency

Endangered Species

Indiana Bat



CURRENT STATUS: In Pennsylvania, endangered; nationally, endangered.

POPULATION TREND: The Indiana bat (*Myotis Sodalis*) has largely declined throughout much of its range because of disturbances to hibernacula during winter months. Distribution-wide populations have seen a decline of 28 to 30 percent with individual state declines ranging from eight to more than 73 percent. Within Pennsylvania, the Indiana bat is poorly represented, having occurred historically at only eight sites, all of which were natural caves. Recent surveys have found the Indiana bat at two caves, five limestone mines and two coal mines. Although the trend for finding new locations has improved, this may be because more complete surveys have been done and not that the Indiana bat population is increasing. At sites that have been monitored

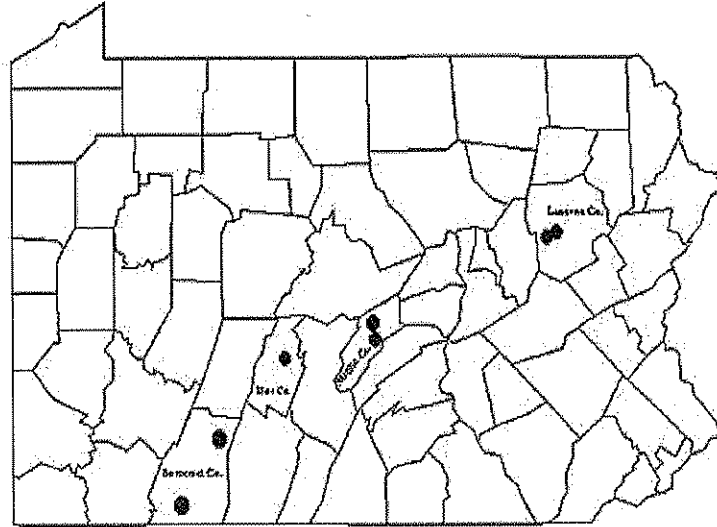
over a number of years, populations remain low, but stable. The major cause of declines in Indiana bat populations remains disturbance to winter hibernating populations and, in several cases, intentional vandalism to the hibernating site and the bats.

IDENTIFYING CHARACTERISTICS: The Indiana bat is very difficult to distinguish from other *Myotis* species. Three characteristics are generally used to identify the Indiana bat. Unlike the little brown bat, the Indiana bat has a well developed keel on the calcar, a spur of cartilage leading off the foot and used to support the tail membrane. The facial area of the Indiana bat also appears to be pink rather than black as in the other *Myotis* species, because of a lack of hair around the nose and mouth region. Another feature that is very easy to use to identify the Indiana is the short hairs on the foot which do not extend to the ends of the toes as they do on the little brown bat. When identifying these bats in the field, it is best to use the suite of listed characteristics than only one or two because individuals differ markedly across the range of this species.

BIOLOGY-NATURAL HISTORY: The Indiana bat occurs in the eastern United States from northern Florida into New England and from the west in northeastern Oklahoma, Arkansas and much of Missouri into the central Mississippi Valley. It does not occur along the Atlantic coastline. During hibernation, Indiana bats can be identified by the large, tightly packed clusters they form on cave and mine ceilings and walls. Indiana bats, and other hibernating bats, are most susceptible to disturbance during the winter months when they enter hibernation by lowering their respiration and body temperature. At this time they only have enough energy reserves to last through winter and relatively few waking periods. Repeated disturbance during winter could cause them to awaken in spring without enough energy to survive the cooler weather encountered upon leaving the hibernacula.

PREFERRED HABITAT: Hibernation sites are usually cold with temperatures ranging between 42 to 45 degrees and generally have some standing or flowing water in them. Maternity colonies are most often found behind flaking bark on dead or dying snags along stream or river corridors and frequently in upland forests. Females give birth to only one young or, in very rare cases, twins. Only one litter is raised annually.

MANAGEMENT PRACTICES:The protection from disturbance of hibernation sites is the most important factor in the conservation of this species. Historical and present sites should be gated during winter months to keep people from coming into contact with hibernating populations of Indiana bats. Many historical sites remain unused by Indiana bats and need to be further protected before the declines of this bat's numbers can be halted. Only after these winter sites are protected can we begin to address the question of protection of summer maternity habitat.



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Least Shrew (*Cryptotis parva*)

Pennsylvania Endangered

State Rank: S1B (critically imperiled), Global Rank: G5 (secure)

Identification

The total length of an adult least shrew is three to 3 ½ inches. Its tail length ranges from ½ to ¾ inches, which is the shortest tail of all Pennsylvania shrews. It has a black and ashy-gray belly. The only other species of shrew with a short tail, the northern short-tailed shrew, is larger (total length is four to five inches) and is dark slate colored.

Biology-Natural History

The least shrew is found throughout much of the eastern United States, ranging from Central America north and east to New York and Connecticut. Historically, this species may have been found throughout Pennsylvania. Most records, however, are confined to non-forested habitats in southern and western Pennsylvania. Least shrews have up to three litters, averaging five young per litter, between March and November. Like other shrews, they feed mainly on insects, earthworms and other invertebrates.

Habitat

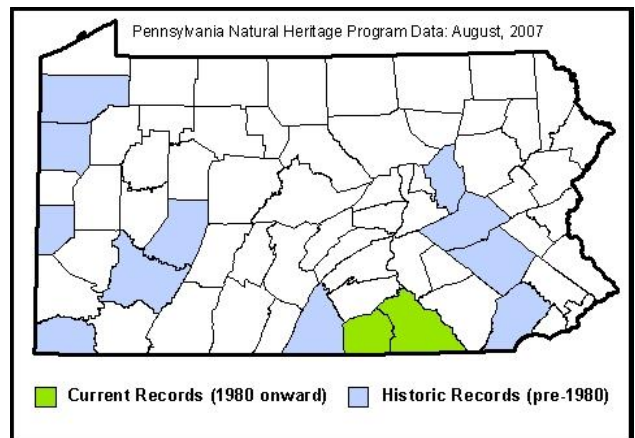
Unlike other shrews, this species does not inhabit moist, mature forests. Instead, it lives in meadows, pastures, old fields and other non-forested habitats.

Reasons for Being Endangered

Post-1970 surveys at historic Pennsylvania sites failed to reveal this species. In fact, numerous surveys in likely habitats have resulted in the collection of only three specimens in more than 20 years. Because



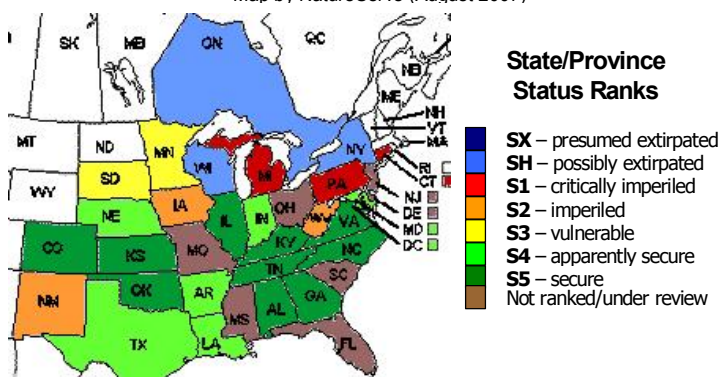
Photo Credit: Gregory S. Paulson and James A. Hart



this is a farmland shrew, it might have declined as a result of "DDT-era" (pre-1972) pesticide use. The loss of croplands to development and more intensive use of remaining farmlands may also be contributing to the apparent decline and current rarity of this shrew.

North American State/Province Conservation Status

Map by NatureServe (August 2007)



Management Practices

Management practices beneficial for the short-eared owl and other grassland animals should also benefit the least shrew. Surveys to find this species need to be intensified. If found, populations should be protected. Habitat studies in the vicinity of known populations on public lands should precede restoration efforts.

References:

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Pennsylvania Natural Heritage Program

Fact Sheet adapted from: Felbaum, Mitchell, et al. *Endangered and Threatened Species of Pennsylvania*. Harrisburg, PA: Wildlife Conservation Resource Fund, 1995.



Pennsylvania Game Commission - State Wildlife Management Agency

Threatened Species

Small-footed Myotis



CURRENT STATUS: In Pennsylvania, threatened; nationally, no special protection.

POPULATION TREND: Population trends of the Small-footed Myotis (*Myotis Leibii*) remain largely unknown due to the secretive nature of this species during its winter hibernation. Although historically known from only a few sites across the state, recent discoveries have substantially increased the number of sites at which it occurs. Populations of bats found at these sites, however, remain very low and, in many cases, only one or two bats are seen. The largest hibernating population in the state numbers less than 50 small-footed bats. It is because of the very

low numbers of bats found during the hibernacula censuses and the many unknown factors concerning its biology that this species remains classified as threatened.

IDENTIFYING CHARACTERISTICS: The small-footed bat is our smallest bat. It's little more than 3½ inches long, including a 1½-inch tail. It is most often recognized by its short, black forearms (less than 1½ inches) and small feet (less than a half-inch). While its coloration is very comparable to the more common little brown bat, a distinctive characteristic is the black facial mask that spreads from the base of each ear across its face.

BIOLOGY-NATURAL HISTORY: Little is known about the biology and natural history of the Small-footed Myotis. It appears to enter into hibernation later than other bat species and is generally found in low numbers. While other bats, such as the little brown bat, form large clusters, this small bat remains solitary during the hibernating season. One young is produced a year, although one record for twins has been recorded. There is little to no information on the feeding habits of the Small-footed Myotis.

PREFERRED HABITAT: Again, very little is known about the preferred habitats of this bat. It is often found hibernating closer to the entrances of caves and mines than other bats and generally alone. This could be because they're often overlooked during census counts because of their use of small, tight crevices in the walls and ceilings and sometimes among the rocks lying the hibernacula's floor. Summer records of this species remain rare with only a few being captured in mist nets. It is thought that they may form small maternity roosts in crevices along rock outcrops, but this remains unconfirmed.

MANAGEMENT PRACTICES: As with other species of hibernating bats in Pennsylvania, control of winter disturbances is seen as the biggest factor influencing the small-footed bat's survival. Restricting access to hibernacula during winter months is seen as the best way to ensure the continued existence of the Small-footed Myotis.

Eastern Small-footed Myotis (*Myotis leibii*)

Pennsylvania Threatened
S1B, S1N (critically imperiled) G3 (vulnerable)

Identification

The small-footed myotis may be distinguished from other small brown bats by its diminutive size (3 ½ inches, including a 1 ½-inch tail), black face, small feet (less than 1/3-inch), and short forearms (less than 1 ½ inches). Its wing and tail membranes are blackish brown. This bat, however, is so similar in appearance to our most common bat, the little brown bat, and several other species that field identification is difficult. Positive identification is best determined only by examining skull characteristics.

Biology-Natural History

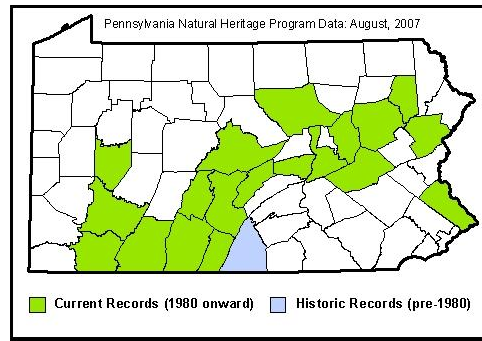
The small-footed myotis is noted for hibernating closer to cave openings than other bats, and for hibernating alone, not clustered like the more common little brown bat. Because this bat occurs in such small numbers, the likelihood of encountering any outside of hibernating areas is extremely remote. Therefore, little is known of this animal's habitats when not in hibernation.

Habitat

Small-footed bats apparently prefer caves and abandoned mine shafts located in the Allegheny mountains, with a possible preference for those located in hemlock-covered foothills and near water.

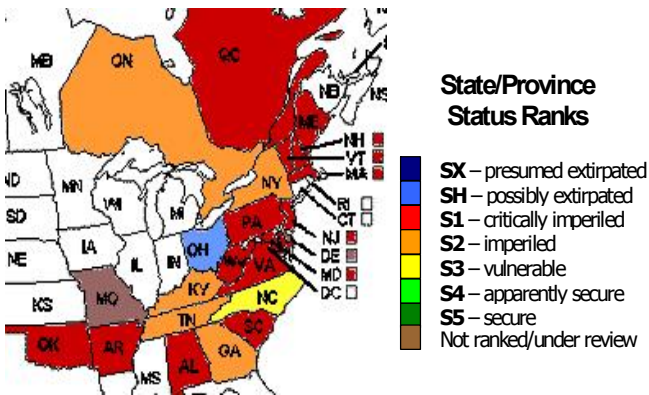


Photo Credit: Merlin Tuttle



North American State/Province Conservation Status

Map by NatureServe (August 2007)



Reasons for Being Threatened

The small-footed myotis has always been considered rare in Pennsylvania, but it is classified as threatened because of an apparent population decline between the 1930s and the late 1970s. Between 1930 and 1944, mammalogist Charles E. Mohr made repeated surveys of hibernating bats in more than 100 caves in Pennsylvania and West Virginia. He found only 363 small-footed myotis, all in only seven of the surveyed caves, and all of these in central Pennsylvania. In 1978 and 1979 these seven caves were surveyed again, and no small-footed myotis were found. Subsequent to 1979, more than 200 abandoned mines and caves were surveyed for hibernating

bats. Small-footed bats were found at 32 sites. At 25 of these sites, this species was represented by fewer than five individuals.

Management Practices

Some caves and mines where this species hibernates have been gated to eliminate human access, as disturbance during this period causes the animals to needlessly expend energy reserves needed to sustain them through the winter. Regular surveys are being conducted to monitor the status of the small-footed bat, and summertime mist-netting at likely caves and overrock-crevices may uncover more about where this species goes at that time.

References:

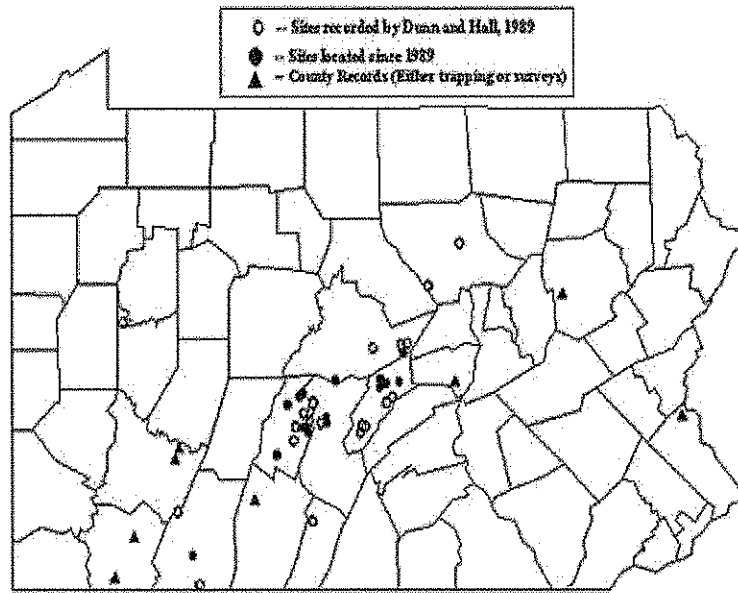
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Pennsylvania Natural Heritage Program

Fact Sheet adapted from: Felbaum, Mitchell, et al. Endangered and Threatened Species of Pennsylvania. Harrisburg, PA: Wildlife Conservation Resource Fund, 1995.





Content Last Modified on 10/30/2003 10:40:50 AM

Brook Floater

Alasmidonta varicosa

Freshwater Mussel Species of Concern

State Rank: S2 (imperiled), Global Rank: G3 (vulnerable)

Identification

The brook floater (*Alasmidonta varicosa*) is a small mussel, usually less than 70 mm in length. The shell is thinner towards the posterior margin and the mussel has a subovate or subtrapezoidal shape (Strayer and Jirka 1997). The ventral margin is slightly indented and the anterior end is abruptly curved. The valves are laterally inflated, giving the mussel a swollen appearance in cross section (Connecticut DEP 2003; Bogan 2002; Nedeau 2000). The posterior ridge is broad and rounded with well-defined ridges crossing the growth lines on the posterior slope. The periostracum (outer covering) is commonly yellowish-green (juveniles) to greenish-brown (adults) and usually has radiating dark green rays across the surface. This species possesses a cantaloupe colored foot (Bogan 2002; Connecticut DEP 2003; Nedeau 2000; Strayer and Jirka 1997).



Photo:

http://www.mass.gov/dfwele/dfw/nhesp/images/al_varicosa.jpg

Habitat

The brook floater is only found in habitats that have consistently flowing water – from small streams to large rivers. It is not found in water bodies that have static water flow such as ponds or lakes (Connecticut DEP 2003; Nedeau 2000). This species favors clean water in gravel or sand and gravel substrates in riffles of creeks and small rivers (Nedeau 2000; www.natureserve.org/explorer; www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_8.htm; <http://research.amnh.org/biodiversity/mussel/alasmidontagenusframeset.html>).



Photo:

<http://research.amnh.org/biodiversity/mussel/alasmidontagenusframeset.html>



Photo:

<http://www.mass.gov/dfwele/dfw/nhesp/images/bioimgback.jpg>

Host Fish

Identified potential fish hosts for the brook floater include: blacknose dace, longnose dace, golden shiner, pumpkinseed, slimy sculpin, yellow perch, and margined madtom (Bogan 2002; Nedeau 2000; www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_8.htm; <http://research.amnh.org/biodiversity/mussel/alasmidontagenusframeset.html>).

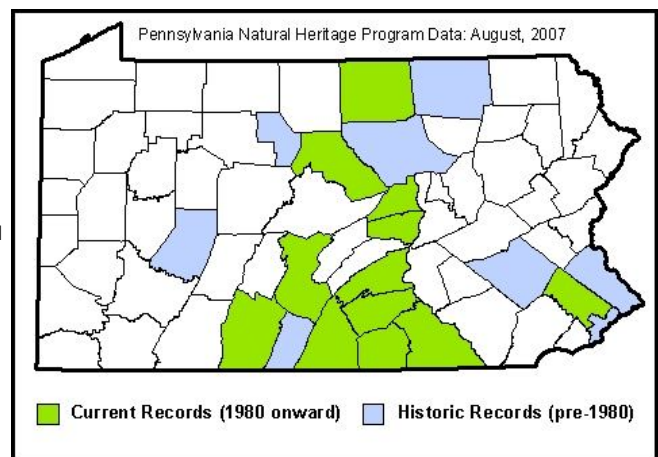
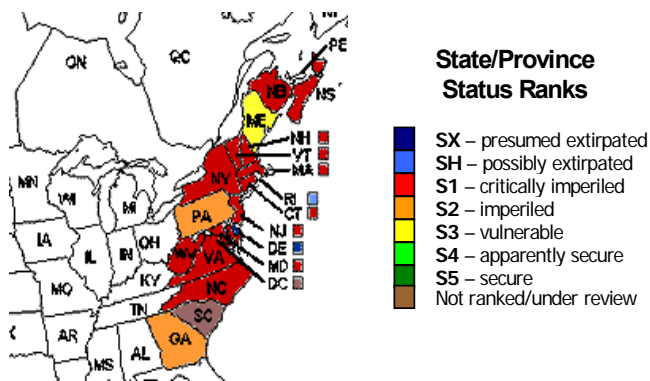
Status

Alasmidonta varicosa is sporadically distributed in Atlantic drainages from Nova Scotia to South Carolina. It appears to be extant from most of the sites it was previously reported in along the Atlantic coast in Maine. This species is observed frequently in Maine; however, when found, populations consist of only a few individuals (Nedeau 2000). In an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993), the brook floater was listed as threatened. The Pennsylvania status of the brook floater is imperiled (S2) due to a lack of individuals found during surveys throughout most of its range within state boundaries (www.naturalheritage.state.pa.us/invertebrates.aspx). More surveys are required to determine the status of this species and other freshwater mussels in Pennsylvania.

The brook floater has experienced significant declines in population size throughout most of its range. This species has been affected by general pollution, siltation, wastewater runoff, impoundments, and biological collection. Additionally, introductions of the zebra mussel and Asiatic clam have had negative impacts on the distribution of this species. The brook floater is extremely sensitive to hypoxia, pollution, and silt (Nedeau 2000; www.natureserve.org/explorer).

North American State/Province Conservation Status

Map by NatureServe (2007)



References

- Bogan, A.E. 2002. Workbook and Key to the Freshwater Bivalves of North Carolina. North Carolina Freshwater Mussel Conservation Partnership, Raleigh, NC. 101 pp and plates.
- Connecticut DEP. 2003. A Field Guide to the Freshwater Mussels of Connecticut. Hartford, CT 31 pp.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: September 4, 2007).
- Nedeau, E.J., M.A. McCollough, and B.I. Swartz. 2000. The Freshwater Mussels of Maine. Maine Dept. of Inland Fisheries and Wildlife, Augusta, ME.
- New York Metropolitan Region and New Jersey Freshwater Mussel Identification Handbook. Website: <http://research.amnh.org/biodiversity/mussel/alasmidontagenusframeset.html>
- North Carolina Mussel Atlas, Species Information and Status. Website: www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_8.htm
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Pennsylvania Natural Heritage Program



Creek Heelsplitter

Lasmigona compressa

Freshwater Mussel Species of Concern

State Rank: S2S3 Global Rank: G5

Identification

The creek heelsplitter (*Lasmigona compressa*) is a moderately sized mussel, usually less than 100 mm in length. The shell is subtrapezoidal in shape, compressed, and moderately thick. Juvenile specimens can sometimes have a small dorsal wing (Strayer and Jirka 1997). The periostracum (outer covering) is somewhat smooth and varies from greenish (juvenile) to greenish-black (adult), sometimes with fine green rays (usually apparent in young individuals). The beak sculpture is obvious and double-looped (Sietman 2003; Strayer and Jirka 1997). Pseudocardinal teeth are present but are usually smooth and lamellar (reduced). Lateral teeth are delicate, but functional and interlocking. There is a prominent interdental tooth in the left valve between the lateral teeth and pseudocardinal teeth (Strayer and Jirka 1997). The nacre (inner iridescent coloring) is usually white, but can be cream or salmon colored (especially toward the beak cavity) (Sietman 2003; Strayer and Jirka 1997).



www.darbycreeks.org/creekheelsplitterLittleDarby72.jpg

Habitat

The creek heelsplitter is typically located in creeks, but can sometimes be observed in streams too small to adequately support other species of freshwater mussels (Strayer and Jirka 1997). It is most commonly found in headwaters of small or medium rivers in fine gravel or sand (Sietman 2003; www.nps.gov/miss/features/mussels/musselpages/creekheelsplitter.html).



Photo: PA Science Office TNC



Photo: PA Science Office TNC

Host Fish

Suitable host fish for the creek heelsplitter include the slimy sculpin, spotfin shiner, black crappie, and the yellow perch (Strayer and Jirka 1997; www.nps.gov/miss/features/mussels/musselpages/creekheelsplitter.html).

Status

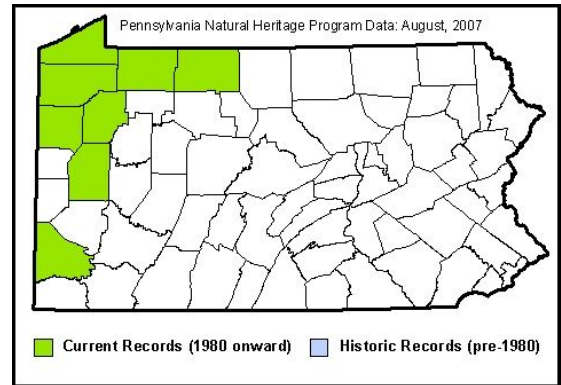
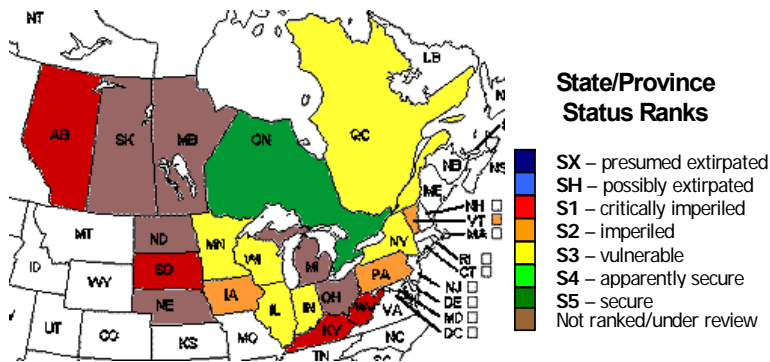
Lasmigona compressa lives in the Mississippi River basin from Kentucky north, as well as in the St. Lawrence basin, the Great Lakes basin, and the Hudson River basin (Strayer and Jirka 1997; www.natureserve.org/explorer). Additionally, *Lasmigona compressa* has been located in the northeastern headwaters of the Susquehanna River

basin (Strayer and Jirka 1997). It is not well understood how this species migrated to these locations. The Pennsylvania proposed state status of the creek heelsplitter is condition rare (CR) due to a lack of individuals located during mussel surveys (www.naturalheritage.state.pa.us/invertebrates.aspx). Little is known about the status of freshwater mussels in Pennsylvania and the United States. Because of this, more surveys are required to determine the status of this species and other freshwater mussels in Pennsylvania.

The creek heelsplitter can be characterized by its compressed, trapezoidal shape, small dorsal wing, and large interdental tooth. However, it can be confused with *Lasmigona subviridis*. The latter species is smaller, more ovate, and has a significantly smaller interdental tooth. Additionally, its beak sculpture only has three to four smaller, less deeply curved double-looped bars that are distinctly nodulous. The beak sculpture of *Lasmigona compressa* consists of four to five large, deeply grooved double-looped bars of even height. Additionally, *Lasmigona compressa* is one of the few freshwater mussels that are hermaphroditic (Strayer and Jirka 1997).

North American State/Province Conservation Status

Map by NatureServe (2007)



Pennsylvania Natural Heritage Program



References

- National Park Service. U.S. Department of the Interior. Mississippi National River and Recreation Area. Website: www.nps.gov/miss/features/mussels/musselpages/creekheelsplitter.html
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- Strayer, D.L. and K.J. Jirka. 1997. The Pearly Mussels of New York State. The New York State Education Dept., Albany, NY 113 pp and plates

Cylindrical Papershell

Anodontooides ferussacianus

Freshwater Mussel Species of Concern

State Rank: S2S3 (imperiled/vulnerable) Global Rank: G5 (secure)

Identification

The cylindrical papershell (*Anodontooides ferussacianus*) is a small mussel, usually less than 75 mm in length. The shell is subelliptical, elongate, thin, and moderately inflated (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997). The anterior margin is rounded whereas the posterior margin is bluntly pointed. The posterior ridge is rounded but distinct. The dorsal margin is straight and the ventral margin has a slight indentation, appearing “pinched” at the midpoint. The beaks are somewhat inflated and slightly raised above the hinge line (Parmalee 1998). The beak sculpture is fine and consists of two or three concentric ridges at the peak of the umbo (beak). Hinge teeth are absent but pseudocardinal teeth appear as irregular swellings along the hinge line. The periostracum (outer covering) is usually light green to yellowish brown, sometimes displaying green rays (may appear faint in adult specimens). Black concentric bands on the surface are indicative of rest periods during growth. The nacre (inner iridescent coloring) is bluish white or silvery (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997).



Photo:

http://webdev.museum.state.il.us/ismdepts/zoology/mussels/gallery.html?RollID=mussel_01&FrameID=anodontooides_ferussacianus6

Habitat

The preferred habitat of the cylindrical papershell is shallow water near shore in silt. It is thought to inhabit small streams, creeks, and lakes in sand or fine gravel (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997).



Photo: PA Science Office TNC



Photo: PA Science Office TNC

Host Fish

Known glochidial hosts for the cylindrical papershell include the bluegill, black crappie, spotfin shiner, largemouth bass, mottled sculpin, bluntnose minnow, common shiner, Iowa darter, white sucker, and the sea lamprey (Parmalee 1998; Strayer and Jirka 1997; www.natureserve.org/explorer).

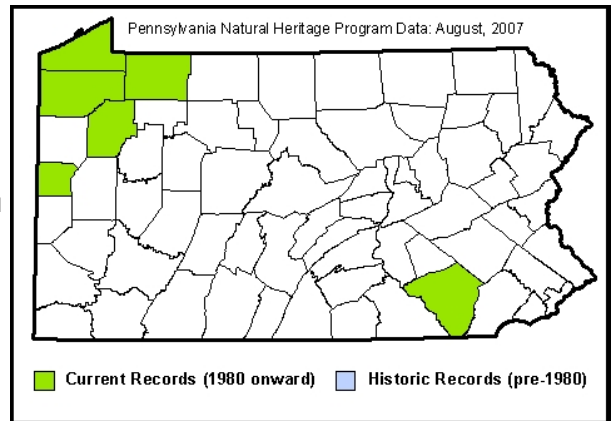
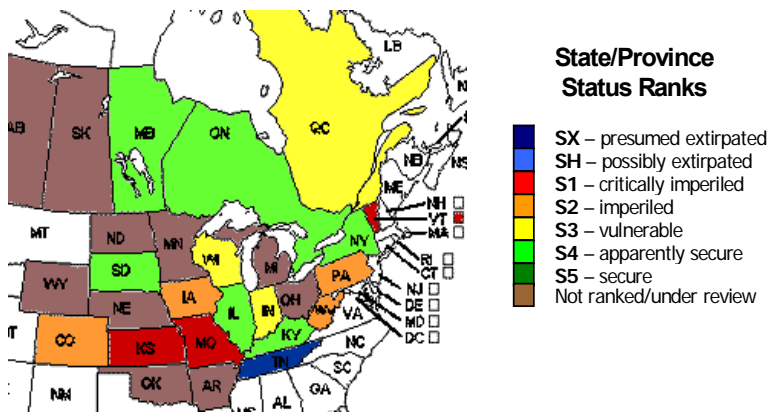
Status

Populations of *Anodontooides ferussacianus* can be found in the Mississippi River basin from Pennsylvania and West Virginia west to Minnesota and Colorado. Individuals have been located throughout the St. Lawrence River system and the Great Lakes, James Bay and Hudson Bay drainage from central Ontario to southeastern Saskatchewan (Parmalee 1998; Strayer and Jirka 1997). This mussel is thought to possibly be extirpated from Tennessee since it has not been reported during surveys for several decades (Parmalee 1998; www.natureserve.org/explorer). This species is not common in Pennsylvania but has been found in the Susquehanna River system and Delaware basin.

The Pennsylvania proposed state status of the cylindrical papershell is condition rare (CR) due to the lack of individuals located during mussel surveys (www.naturalheritage.state.pa.us/invertebrates.aspx). The distribution and origin of *Anodontooides ferussacianus* populations call for further study because it is not well understood how this species crossed over into the Susquehanna River basin. It could have migrated due to postglacial influences or it may have been introduced by humans (Strayer and Jirka 1997). More surveys are required to determine the status of this species and other freshwater mussels in Pennsylvania.

North American State/Province Conservation Status

Map by NatureServe (2007)



Pennsylvania Natural Heritage Program



References

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- Strayer, D.L. and K.J. Jirka. 1997. The Pearly Mussels of New York State. The New York State Education Dept., Albany, N.Y. 113 pp and plates.

Elktoe (*Alasmidonta marginata*)

Freshwater Mussel Species of Concern

State Rank: S4 (apparently secure), Global Rank: G4 (apparently secure)

Identification

The Elktoe (*Alasmidonta marginata*) is a moderately sized mussel, commonly reaching 75 mm in length. The shell is trapezoidal or rhomboid shaped, inflated, and thin (Parmalee 1998, Strayer and Jirka 1997). The anterior margin is rounded, with a somewhat straight ventral margin. The ventral and posterior margins meet in a blunt, squared point (Parmalee 1998). The posterior ridge is the focal point of the shell and is sharply angled. The posterior slope is flattened with fine, well-developed ridges crossing the growth lines. The beaks are high, inflated, and are comprised of three to four heavy double-looped ridges. The periostracum (outer covering) is usually yellowish or greenish, with green rays and darker spots that may appear connected to the rays (rays may appear interrupted). Lateral teeth are vestigial and appear as nothing more than indistinct bumps along the hinge line. The nacre (inner iridescent coloring) is usually bluish-white (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997).



Photo:
http://www.lwatrous.com/missouri_mollusks/mussels/images/a_marginata.jpg

Habitat

The Elktoe can be found in medium to large size streams, but is most common in smaller streams. This species is present in greatest abundance in small shallow rivers with a moderately fast current and riffles. The preferred substrate is fine gravel mixed with sand (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997; NatureServe 2005).

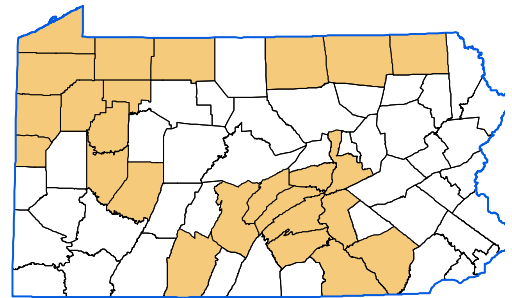
Host Fish

Hosts for Elktoe glochidia include the white sucker, northern hogsucker, shorthead redhorse, rockbass, and warmouth (Parmalee 1998; Strayer and Jirka 1997).

Status

Populations of *Alasmidonta marginata* can be found from Ontario, Canada to Alabama. Its eastern boundary ranges along the east coast from New York to Virginia and the western boundary ranges from North Dakota to Oklahoma. Most populations are located in Ohio, Indiana, and Illinois. This mussel is thought to have been extirpated from Alabama since it has not been reported during surveys for several decades (NatureServe 2005; Parmalee 1998; Strayer and Jirka 1997). This species is not common in Pennsylvania but has been found in the Susquehanna River and Ohio drainages. The proposed state status of the Elktoe is not ranked (N), meaning there is insufficient data available to provide an adequate basis for assignment to specific categories concerning the security of known populations (PNHP). The state rank of this species suggests it is secure at some sites within Pennsylvania state boundaries. However, more surveys are required to determine the status of this species and other freshwater mussels in Pennsylvania.

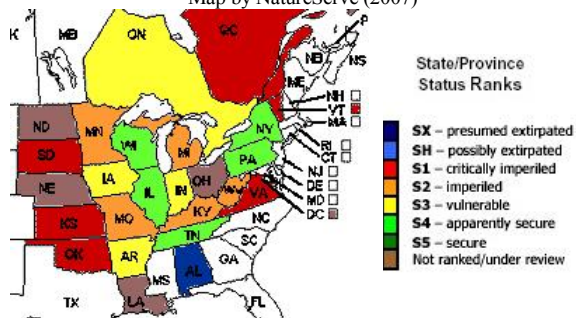
Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2007

North American State/Province Conservation Status

Map by NatureServe (2007)



Alasmidonta marginata is typically thought of as an interior basin species. It is not well understood how *Alasmidonta marginata* reached the Susquehanna River basin from its native range. Some researchers believe it may have drifted from the Allegheny River basin to Susquehanna via postglacial influences. An alternative theory states this species was introduced to the Susquehanna River basin via human activity (Strayer and Jirka 1997).

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Green Floater (*Lasmigona subviridis*)

Freshwater Mussel Species of Concern

State Rank: S2 (imperiled), Global Rank: G3 (vulnerable)

Identification

The green floater (*Lasmigona subviridis*) is a small mussel, usually less than 55 mm in length. The shell is thin and the mussel has a subovate or trapezoidal shape. The color varies from a dull yellow to green with many dark green rays visible, especially in young individuals. This species may be confused with the creek heelsplitter (*Lasmigona compressa*) (NatureServe 2005; Strayer and Jirka 1997). The creek heelsplitter is larger, thicker shelled, and less ovate. Also, the creek heelsplitter has only been found in the Ohio River Drainage in Pennsylvania while the green floater is also present in the Susquehanna and Delaware River Drainages.



Habitat

The green floater is often found in small creeks and large rivers and sometimes canals. This species is intolerant of strong currents and occurs in pools and other calm water areas (NatureServe 2005, North Carolina Mussel Atlas, Strayer and Jirka 1997). Preferred substrate is gravel and sand in water depths of one to four feet. This species is more likely to be found in hydrologically stable streams, not those prone to flooding and drying. Good water quality is also important for this mussel species (North Carolina Mussel Atlas).

Host Fish

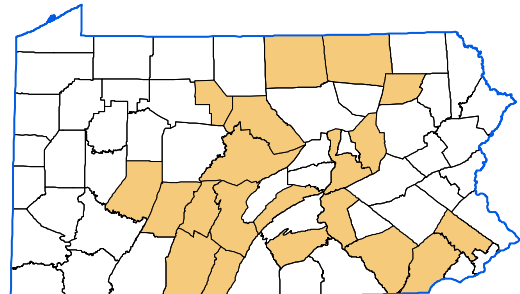
Glochidial (larval) hosts for the green floater are not known (NatureServe 2005, Strayer and Jirka 1997).

Status

From New York south to Georgia and west to Tennessee the green floater is found. This species is not very common in Pennsylvania, but has been found in the Susquehanna, Delaware, and Ohio River Drainages (NatureServe 2005). The state status of the green floater is imperiled (S2), as it is not frequently encountered within its expected range (www.naturalheritage.state.pa.us/invertebrates.aspx). The small size of this species may make it difficult to locate live animals during surveys. Shells of dead green floaters tend to get buried in the surrounding habitat. More extensive surveys are necessary to determine the current status of this species in Pennsylvania and the United States.

The green floater was listed as threatened in an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993). The green floater has been historically widespread in the Susquehanna River drainage in New York; however, populations have declined since the early 1990s, probably due to pollution (Strayer and Jirka 1997). Decline in the abundance of this species in other places could be due to stream transport of their preferred habitat, as well as increases in pollutants. The introductions of zebra mussels and Asian clams have also negatively impacted abundance of this species in surveys. However, since this mussel species is hermaphroditic, small populations might survive slightly better than other mussel species in less than ideal conditions (NatureServe 2005).

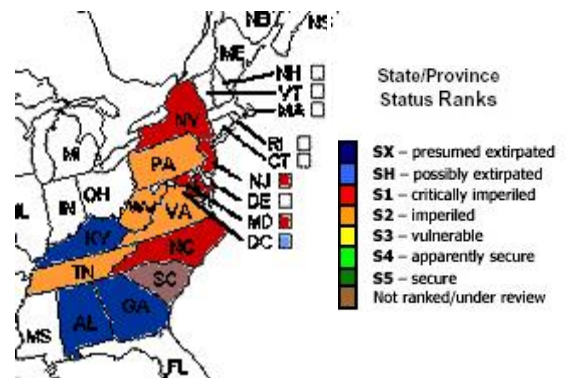
Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2007

North American State/Province Conservation Status

Map by NatureServe (2007)



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Northern Riffleshell (*Epioblasma torulosa rangiana*)

Pennsylvania Endangered

State Rank: S2 (imperiled) Global Rank: G2T2 (imperiled)

Identification

A small to medium size mussel with an oval shaped shell 2-3 3/4 inches long and 1-2 1/2 inches high. Base color is light tan to olive-green with numerous fine greenish wavy lines radiating outward. Male and female species are of different shapes (see photo). Internal shape of a dead shell aids in identification.

Biology-Natural History

All 65 species of PA's freshwater mussels filter food and absorb dissolved oxygen from water drawn in and released by way of a tubular siphon system. A muscular "foot" allows some slow movement, but this species, like most others, is largely sedentary. The male discharges sperm into the surrounding water, which fertilizes eggs when siphoned in by a mature female. After gestation, tiny larvae are discharged and quickly attach to certain fish for several days before dropping to the stream bottom where they grow, adding concentric rings of shell material similar to the growth rings of a tree. The life span of the riffleshell is about 15-20 years; much less than other species. Predators include the muskrat and raccoon.

Habitat

The mussel occupies swift runs and rimes with beds of clean gravel, sand and stones. In Pennsylvania it has been recorded from streams ranging from medium size creeks to large rivers in drainages of glacial landscapes of the Ohio River basin. The riffleshell shuns areas of calm water or deep silt.

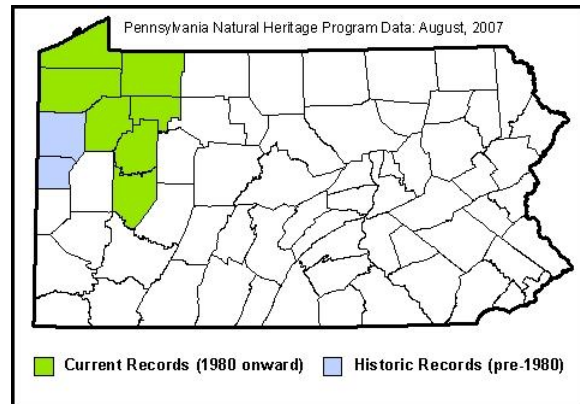
Reasons for Being Endangered

Imperiled throughout its range, the surviving Pennsylvania populations are some of the best remaining in the world.

Water pollution, darn construction and dredging are the major causes for its decline, but other threats include stream sedimentation, channelization and reduced host fish populations. The *Epioblasma* mussels are some of the most environmentally sensitive species in North America.



Photo Credit: Charles Bier, Western Pennsylvania Conservancy



North American State/Province Conservation Status

Map by NatureServe (August 2007)



State/Province Status Ranks

- SX – presumed extirpated
- SH – possibly extirpated
- S1 – critically imperiled
- S2 – imperiled
- S3 – vulnerable
- S4 – apparently secure
- S5 – secure
- Not ranked/under review

Management Practice

In Pennsylvania, responsibility for aquatic organisms and is supporting on-going research to describe the riffleshell's range and status. Threats to this species should be monitored. The host fish or fishes needs to be identified. Because the host fish is the critical factor in the reproductive cycle and allow for dispersal, such fish must also be protected. If damaged habitat is reclaimed, the northern riffleshell might expand to recolonize parts of its earlier range.

References:

- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: August 21, 2007).



Pennsylvania Natural Heritage Program

Fact Sheet adapted from: Felbaum, Mitchell, et al. Endangered and Threatened Species of Pennsylvania. Harrisburg, PA: Wildlife Conservation Resource Fund, 1995.



Rainbow Mussel

Villosa iris

Freshwater Mussel Species of Concern

State Rank: S1 (critically imperiled) Global Rank: G5 (secure)

Identification

The Rainbow mussel is subelliptical to subovate with straight dorsal and ventral margins. The shell is somewhat thin, becoming thicker towards the anterior end (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, Parmalee 1998). It is slightly inflated and the beaks are low (not above the hinge line). The shell has a rounded anterior end with an arched posterior ridge. The periostracum (outer coloring) is yellowish brown with fine green radiating rays that become wider on the posterior portion of the shell (rays may appear interrupted at growth lines) (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, Parmalee 1998, Strayer and Jirka 1997).



Photo:

www.lwatrous.com/missouri_mollusks/mussels/images/v_iris.jpg

Habitat

The Rainbow mussel is commonly found within or directly below riffles in small streams with moderate to strong currents. Preferred substrates include coarse sand, gravel, and mud in clean, well-oxygenated areas that are less than 1 m deep (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, Parmalee 1998). It has also been found in large rivers and lakes (Strayer and Jirka 1997).



Photo: PA Science Office TNC



Photo: PA Science Office TNC

Host Fish

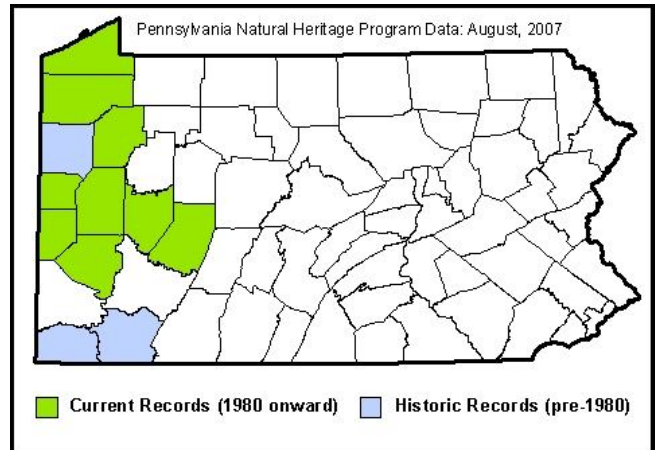
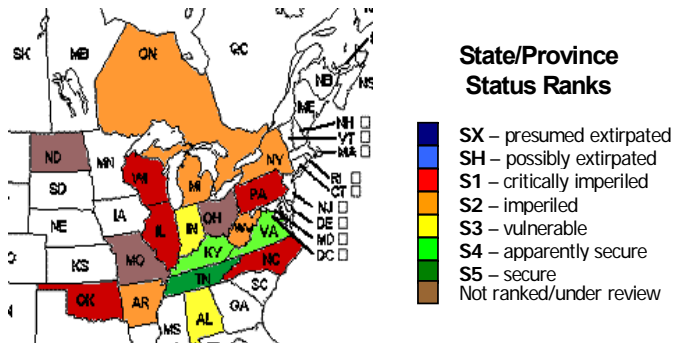
The Rainbow mussel may use one of several fish hosts to complete their life cycle, including largemouth bass, smallmouth bass, spotted bass, rock bass, Suwannee bass, and western mosquitofish (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm).

Status

The Rainbow mussel is widespread throughout the St. Lawrence, upper Mississippi, Ohio, Tennessee, and Cumberland River basins (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, www.natureserve.org/explorer, Parmalee 1998). This species is rarely encountered in the Allegheny basin in New

York and Pennsylvania even though it appears to be widespread throughout other areas in New York (Strayer and Jirka 1997). The rainbow mussel is found in the Susquehanna drainage in Pennsylvania. The state status of the rainbow mussel is Pennsylvania critically imperiled (S1) since few individuals have been observed throughout their native range within state boundaries (www.naturalheritage.state.pa.us/invertebrates.aspx). The Rainbow mussel was listed as stable in an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993). More extensive surveys are necessary to determine the current status of this species in Pennsylvania and the United States.

North American State/Province Conservation Status
Map by NatureServe (2007)



References



Pennsylvania Natural Heritage Program



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www.lwatrous.com/missouri_mollusks/mussels/images/v_iris.jpg

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