

# SWIMMER'S ITCH

IN

MICHIGAN



AQUATIC NUISANCE CONTROL PROGRAM  
WATER RESOURCES DIVISION  
MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

## INTRODUCTION

This bulletin is to provide the residents of Michigan with important information on swimmer's itch. Included in the article are the cause, description, prevention and possible control measures for swimmer's itch.

## HISTORICAL PERSPECTIVE

Swimmer's itch, also known medically as cercarial dermatitis, probably has been around as long as man. Although this condition was known to exist as early as the 19<sup>th</sup> Century, particularly in the logging days, it was not until 1928 that a biologist found that the dermatitis was caused by the larval stage of a group of parasitic flatworms. The adult parasites live in the blood vessels of birds and mammals. Since that time, it appears that reports of swimmer's itch have been on the increase. There may be several reasons for this. First, there appears to be more birds that serve as final or definitive hosts. Second, recreational demands have resulted in the construction of more lakes and ponds. And finally, more people are aware of the condition of swimmer's itch and do not confuse it with other skin ailments.

## SCOPE OF THE PROBLEM

In the early 1970's, it was estimated that swimmer's itch had been reported from about one percent of the more than 10,000 lakes in Michigan. However, it seems to affect swimmers and bathers especially from large recreational lakes.

## DISTRIBUTION OF SWIMMER'S ITCH

After the cause of swimmer's itch was determined in the late 1920's, it became evident that people from other states and even from other countries were also encountering these parasites in the water. Presently, there are more than 600 articles that have been published on the subject. In North America, cercarial dermatitis has been reported in the northern half of the United States, particularly in the states bordering the Great Lakes, all the way north to Alaska. There are a limited numbers of cases reported in the southern United States. Absence of suitable snail intermediate hosts in that area is the probably reason for low infections.

## CAUSE OF SWIMMER'S ITCH

Schistosome cercarial dermatitis is caused by entry into the human skin by a tiny (1/32 of an inch) larval flatworm that has emerged, usually from a specific snail species. This stage, known as a cercaria (pronounced SIR-CARE-E-AH), is unable to enter human blood vessels and therefore, dies. However, in some people an allergic reaction follows penetration into the skin. If the cercaria enters the proper vertebrate host (blackbird, duck, goose, or rodent) it enters into the vascular system and will reach the lungs of the host within two weeks following penetration. From there, the worms continue to migrate into the blood vessels of the liver where mating occurs. Gravid female schistosomes then enter tiny veins surrounding the intestine to deposit their eggs. Because of spines and secretions from the fully embryonated egg, breakdown of the surrounding tissues follows. This allows the eggs to enter the lumen of the intestine and pass out of the bird or rodent with the feces.

If the feces containing the eggs are deposited in water, a larva called the miracidium (pronounced MIR-A-SI-DE-UM) hatches and begins swimming. This stage is free-living, non-feeding and will survive up to a day, depending on the temperature and condition of the water. If it comes in contact with the suitable snail intermediate host, it will penetrate into the soft tissues or be ingested. The miracidium then elongates within the snail tissues to form a germinating sac called a sporocyst. Within a second generation of sporocysts the next stage of the life cycle develops. It should be emphasized that large numbers of these forms, called cercariae, are formed from a single miracidium that originally entered the snail.

Cercariae usually emerge from the snails in the early hours of the day. The daytime periodicity correlates beautifully with the increased activity of birds in the morning. Like miracidia, cercariae are free-swimming, non-feeding and will live for a day or two if conditions are optimal. Cercariae from some species of non-human schistosomes are attracted to light and will concentrate at the surface and can be carried several miles by wave action. To complete the life cycle, cercariae must penetrate the skin of a suitable final or definitive host. Occasionally, humans are accidentally penetrated, resulting in the death of the cercariae and leaving the swimmer with a rash. A summary of the life cycle of a non-human schistosome is depicted in Figure 1.

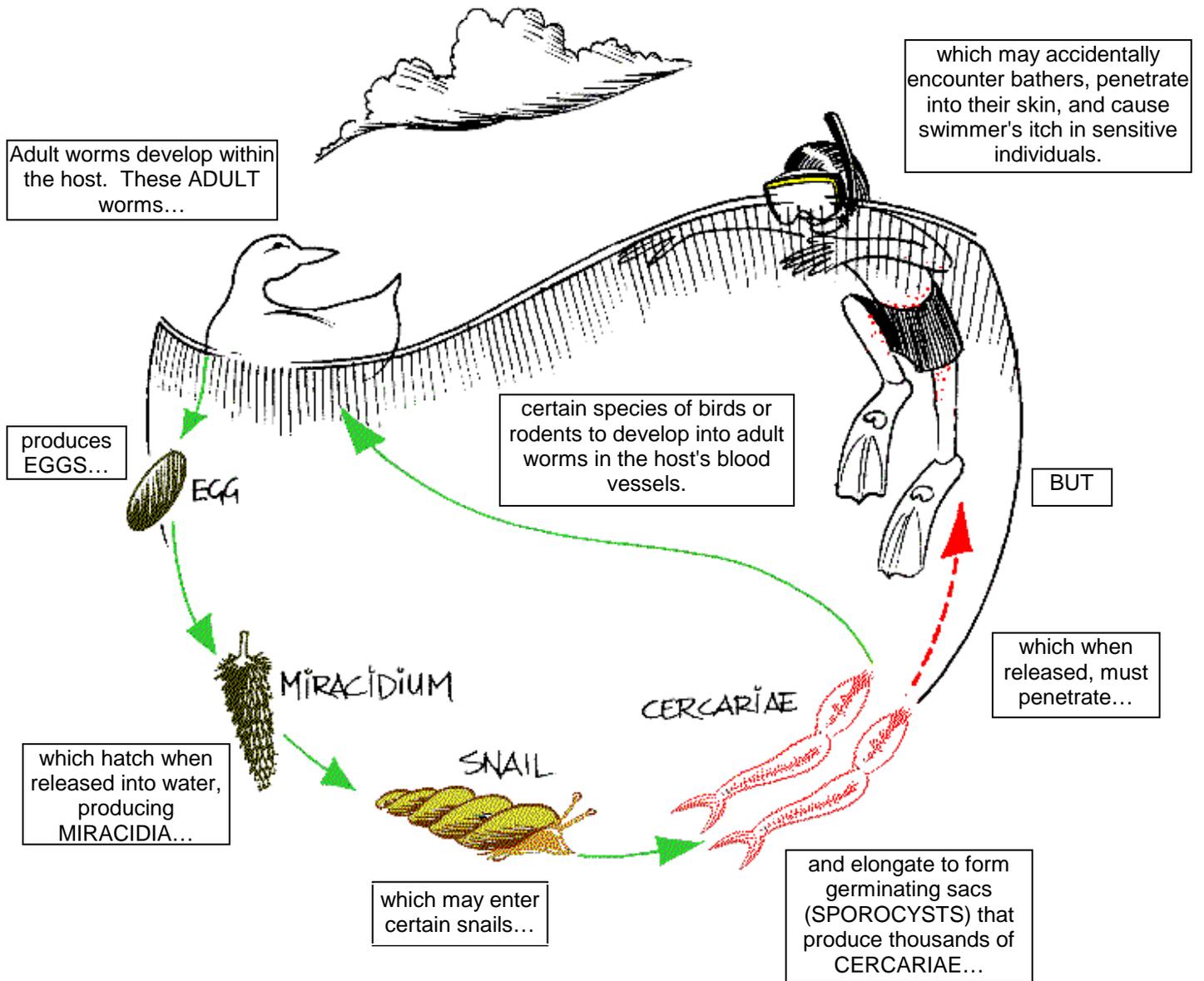
#### DESCRIPTION

Cercariae of avian schistosomes may enter the skin of bathers or swimmers in different ways. Some actually penetrate while the individual is swimming, while cercariae of other species appear to enter only after the person has emerged from the water. In any event, cercarial entry can be felt as a dull, prickly, and itchy sensation. In sensitized individuals a small, reddened area will develop at the site of entrance of each cercaria. Intermittent periods of itching will continue for several days. Many persons suffering from cercarial dermatitis experience the most severe itching early in the morning. After approximately 24 hours, the reddened areas reach their largest size. Swimmers, who have repeated exposures, may demonstrate increase size of the affected areas, especially if aggravated by persistent and intense itching. The victim suffers the most during the first four or five days after exposure. After a week, the reddened areas usually disappear; leaving a spot that resembles a small bruise.

Sensitivity to schistosome cercariae varies with each individual. Some who contact the parasite will never show an allergic reaction while others are very prone to cercarial invasion. Members from the same family may demonstrate various degrees of susceptibility.

The itchy, reddened, and raised areas are often confused with bites from chiggers (red bug) or from mosquitoes. The symptoms may also be misdiagnosed as those resulting from poison ivy or stinging nettles. However, itching is limited to the points of cercarial entry, will not spread and never develops into watery blisters. Chigger bites are usually located at points where clothing contacts the skin such as around wrists, waist, ankles, etc. Cercariae usually enter the skin randomly over the exposed portion of the body.

Figure 1. Summary of the Life Cycle of the Causative Agents of Swimmer's Itch



Graphic image taken from <http://www.gov.mb.ca/environ/pages/publs97/cwgtext/swimitch.html>

## ROLE OF SNAILS

Four genera of snails serve as potential intermediate hosts for schistosomes which are the causative agents for swimmer's itch. Of these, two species are the most important carriers of the blood flukes. The first is Lymnaea catascopium which was previously known as Stagnicola emarginata. Early workers referred to members of this species of snails as "stags." This snail species was and continues to be public enemy number one in the northern portion of the Lower Peninsula and the Upper Peninsula. This was especially true in the 1930's and 1940's as was often cited in publications. However, Physa integra appears to be the culprit in the southern half of the Lower Peninsula. All of the snails that are potential host for avian and mammalian schistosomes in Michigan are illustrated in Figure 2.

Snail species that are commonly found on sandy beaches of many lakes, especially in the northern portion of the state include Physa integra, P. parkeri, and Lymnaea catascopium (= Stagnicola emarginata) listed in Table 1. Two other lymnaeid species (L. palustris and L. stagnalis) are found in bodies of water that are quiet, with little or no wave action. Marshes, streams, or river mouths are likely places for these two species to occur. This is especially true if the substrate or bottom is comprised of mud or silt.

Other snail species that carry dermatitis-producing cercariae, but are less important because they occur in areas where people do not swim are Aplexa hypnorum and Physa gyrina. However, certain species of schistosomes that develop in these snails have cercarial types that float on the surface of water and may be carried from marshy or swampy habitats into swimming areas of a lake. Also, these larval stages may be carried great distances across a lake. A very small snail, Gyraulus parvus is currently being studied to determine if it is important in the transmission of swimmer's itch. Because of its small size, it is often overlooked. Data gathered at the W.K. Kellogg Biological Station in 1979 indicate that several species of bird schistosomes utilize Gyraulus parvus as intermediate hosts.

Infections of avian or rodent schistosomes in snails run extremely low. Usually less than one percent of the snails are infected at any given time. This requires that large numbers of snails must be sampled if potentially infected snails are to be examined. Furthermore, if one is to distinguish schistosome cercariae from other species, it is necessary to use a compound microscope. Most cercariae belong to groups of flatworms other than schistosomes and, therefore, do not cause swimmer's itch. In the past, chemicals have been wasted and needlessly dumped into lakes because cercariae were incorrectly identified as those belonging to the schistosomes. Cercariae of many species of digenetic trematodes that do not cause swimmer's itch closely resemble schistosome cercariae. Flame-cell patterns, behavior, and presence or absence of structures, such as a pharynx are critical for proper identification.

Figure 2. Candidate Snails for Swimmer's Itch in Michigan\*



Physa gyrina



Physa integra



Physa parkeri



Aplexa hypnorum



Lymnaea stagnalis



Lymnaea palustris



Lymnaea catascopium



3X

Cyraulus parvus

\*All snail species represent their natural size as adults unless indicated otherwise. Variations in size and shape reflect the snail's age and environmental conditions.

The time of cercarial release from snail is variable. Water temperature is probably the most important single stimulus after the cercariae mature within the snail and are ready for release. However, all species of schistosome cercariae do not follow the same developmental timetable. Thus, different species of cercariae could be released at different times in the same lake. There is some evidence that peak releases of cercariae will occur on a warm day following a cool spell. However, that is the time that a lot of swimmers also enter the water. Other investigators have found that certain kinds of cercariae emerge from the snail at a definite and more less restricted time of day. So little is known about the host-parasite relationships of bird and rodent schistosomes that it is impossible to delineate the factors that would predict when and where swimmer's itch will be a problem from year-to-year.

In general, the first reports of swimmer's itch begin in late May or early June in the Lower Peninsula. In early July, the first cases have occurred in the Upper Peninsula. By late July or early August, most of the adult snails infected with schistosomes have died of natural causes. Their death reduces the problem except for sporadic outbreaks which are caused by newly infected juvenile snails.

### PREVENTION

There are several preventive measures that can be followed to eliminate or to reduce the problem of swimmer's itch. First, avoid situations that encourage birds to remain in areas where people frequent water. Feeding these birds should be strongly discouraged. Michigan laws do not allow for harassment of waterfowl, however. Second, some species of snails (particularly Physa integra) deposit their eggs on concrete walls or on rocks that have been used as rip-rap to prevent erosion of the shoreline. Not only do the rocks serve as a base for snail eggs, but they afford protection to the snails against wave action.

If recreational areas are being developed on a lake, it is advisable to have the swimming areas on the northern and western shores. Based on data obtained from many questionnaires, most swimmers contact cercariae while swimming on eastern and southern lakeshores. The reason appears to lie in the fact that the free-swimming stage (cercaria) of some schistosome species float to the surface of the water and drift with the wind to the shore. In fact, it is possible for these cercariae to be passively carried up to several miles from the infected snail. For this reason, if swimmer's itch is a problem in a specific area, it is not advisable for individuals to swim following a strong and persistent on-shore wind. Because winds in Michigan are often westerly or northerly, people contact the parasites on eastern and southern shores.

It should be noted that children who continually go in and out of the shallow water often get heavy cases of cercarial dermatitis. Continuous swimming along the shore should be avoided because large numbers of cercariae can accumulate there.

A final preventive measure for combating swimmer's itch is to towel off immediately after leaving the water. Floating cercariae of some species of schistosomes are sticky and attach to the body as the bather leaves the water. As an individual emerges from the water, the cercariae enter the skin as the body air dries. All parts of the body should be dried immediately.

## CONTROL OF SWIMMER'S ITCH

With our present knowledge of the relationship between schistosome cercariae and snails it follows that eradication of snails would eliminate the swimmer's itch problem. However, obtaining a total snail kill in a large lake would be practically impossible with present control methods. In attempting such eradication there would be danger of seriously affecting the fish and fish-food populations. Perhaps in the future small amounts of chemicals specifically toxic to snails may be efficiently and economically used for large-scale treatments. Although research work has been directed toward this goal, a universally satisfactory molluscicide has not yet been identified. Copper sulfate is the only molluscicide currently registered in Michigan for swimmer's itch control. To be effective, it must be applied at concentration greater than 20 parts per million (ppm) and even at these concentrations, it will not kill snail eggs or prevent cercariae released from snails from drifting into adjacent areas. It is relatively harmless to fish in unconfined areas, if applied properly.

Since the late 1930's, the Michigan Bureau of Water Management conducted a swimmer's itch control program from mid-June through early August. State aid for this program was gradually withdrawn placing more responsibility on the group or individual desiring beach treatment. The state portion of the program is presently limited to providing technical bulletins and the issuance of permits to treat waters for snail control.

The present policy was established in July 1970 when it was announced that funds for the control of swimmer's itch would not be available in Fiscal Year 1970-71. The original program employed three state beach-treatment specialists who offered free beach inspection and on-site technical advice, such as delineation of the area to be treated, the amount and type of chemicals to be used, and the identification of host snails. With the non-renewal of these funds this program had to be discontinued.

Over many years of swimmer's itch control work in Michigan using motor-powered units, application of copper sulfate with fresh hydrated lime has proven to be a satisfactory, economical method. The mixture should be in the ratio of eight parts of copper sulfate (granular grade which is about the consistency of coarse coffee grounds) to one part of hydrated lime by weight. Best results are achieved by releasing a slurry of this mixture under water just above the beach floor at the rate of two pounds of copper sulfate per 1,000 square feet of bottom. This rate amounts to 87 pounds per acre or a concentration of 32 ppm in the first foot of water over the lake bottom.

Resorters with a small-scale annual problem and people from areas only sporadically affected by swimmer's itch may not find the purchase and operation of motor-powered equipment economically justified. Where no distributing equipment is available, fair results have been obtained by hand-sowing (broadcasting) small-crystal grade copper sulfate alone. These crystals are about the size of small peas. Distribution should be even, and rate of application should be two pounds per 1,000 square feet. Past experience has shown the need for adequately marking the area to be treated whether a machine is used or not. Without measuring and marking by stakes or floats it is next to impossible to distribute the chemicals evenly over the entire area.

Treatment methods described above have aimed at getting the chemicals down to snails on the lake bottom. If the area, or part of the area, to be treated contains a weed bed, large boulders, a breakwater, or wall where snails are living above the lake bottom, a different technique should be used. Copper sulfate instant powder is recommended for these particular areas. The powder should be mixed with a small amount of water to prevent it from blowing into the applicator's face. The mixture may be broadcast with a dipper from a pail or sprayed from a tank. This method is efficient for small, hard to reach areas, or shallow water. The treatment rate is the same, two pounds per 1,000 square feet.

If application of the necessary chemicals is made at the proper rate, free-swimming fish should not be killed. They will move out of the area. Treatment should not be made until pan fish and bass are off their beds in shallow water, usually after the middle of June in Lower Michigan. Bottom organisms, such as leeches, aquatic worms, and insect larvae are usually killed by copper sulfate. Some of these animals are used by fish as food, but their loss is unimportant when the whole fish-food producing area of the lake is compared to the treated area. Ratio of untreated area to treated is normally at least 2:1 or 50 percent.

If persons applying the chemicals are mindful of the following points, the control operation will have a good chance of success.

1. The snails responsible for the swimmer's itch problem are the ones which need to be controlled. It is better to locate the infected snails before treatment than to chance missing the bed. Pretreatment beach inspection by a knowledgeable agent will usually solve this problem.
2. A large enough area must be treated. Aided by winds and wind-created currents, cercariae may stay together in sufficient numbers to create a swimming beach hazard quite a distance from the snail bed. Treatment of 1,000 feet of lake frontage is recommended as minimum. This usually entails securing permission and the cooperation of several landowners along the shore. The group of individuals desiring treatment should have this permission in writing before treating. Where infected snails are uniformly distributed the area treated should extend from shore to the drop-off. Of course, local conditions plus the area originally described in the permit will determine the actual area to be treated.
3. Treatment should not be attempted when the lake is rough. The chemical will be dispersed throughout the water by excessive wave action and will drift out of the treatment area rather than remaining on the bottom in the desired location. A little wave action is desirable to aid in distribution, but treatment on a windy day is a waste of time, money, and effort.

4. Mark the area to be treated and divide it into small enough plots so that distribution can be even and at the proper rate. Wire-centered plastic clothes line with floats attached every fifty feet is very satisfactory as a marking and measuring device. It is necessary to commence treating next to and parallel with the shore and work towards deeper water to prevent trapping and killing fish. Remember, two pounds of copper sulfate per 1,000 square feet of lake bottom, or 50 pounds per 25,000 square feet. An unsuccessful treatment will probably be the result if the applicator finds himself with the job half done and no more copper sulfate to apply.

### WARNINGS AND PRECAUTIONS

1. Copper sulfate is poisonous to humans and animals if taken internally. Do not leave open bags where small children have access to them. The strong, unpalatable, metallic taste of copper should stop anyone from ingesting enough to result in serious consequences.
2. Care should be taken to keep chemical crystals, powder, or slurry out of the eyes, nose, and mouth. The chemical will cause irritation to these sensitive membranes. Glasses or goggles may be worn to protect the eyes. Persons who find the dust especially bothersome should wear facemasks.
3. Gloves should be worn to protect the hands. Exposure to the chemical will color the skin and may have an irritating and drying effect.
4. If a copper sulfate solution is placed in a galvanized container, a chemical reaction takes place which causes the copper to displace the galvanized coating. Painted, enameled, or copper-lined containers should be used. Copper sulfate has a corrosive effect on iron and some steel alloys. Brass or hard copper piping is desirable on distribution equipment.
5. Equipment used to distribute copper sulfate should be thoroughly rinsed and flushed with water following use. A heavy residual layer of chemicals will build up quickly and restrict the diameter of pipes and openings if this practice is not followed.
6. Swimming and the use of motor boats should not be allowed in the area for 24 hours following treatment. While there is little danger to swimmers from the chemicals, safety dictates keeping out of the water for this period. This restriction also prevents the layer of chemicals from being disturbed. Agitation of the water will cause mixing with bottom materials, and a subsequent loss of effect will result. There are also indications that dying snails release large numbers of cercariae.
7. Fish confined by live boxes within the treated area will probably be killed. To prevent mortality, the fish should be removed and not returned for 24 hours following chemical treatment.

## HOW TO SECURE A PERMIT

Until further notice all “Swimmer’s Itch Treatment Permits” will be issued by the Department of Environmental Quality in Lansing, upon the completion of a permit application from property owners, lake associations, governmental units, or agencies, and/or their authorized agents. This application requires the following information regarding the body of water for which the treatment is proposed:

1. Name, address, and telephone number of the applicant.
2. Name of lake or pond, county, township, range, and section, if known.
3. A map or sketch of the lake, surface area to be treated, and the approximate dates when treatment is expected.

Blank copies of application forms are available on the Aquatic Nuisance Control webpage at [www.michigan.gov/anc](http://www.michigan.gov/anc), or available upon request at 517-284-5593 or email [DEQ-WRD-ANC@michigan.gov](mailto:DEQ-WRD-ANC@michigan.gov).

Please send completed application to:

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
CASHIER’S OFFICE – WRD - AQ  
P.O. BOX 30657  
LANSING MI 48909-8157

All persons who anticipate conducting swimmer’s itch control activities within Michigan are reminded that any person who fails to obtain the necessary permit in advance of undertaking such work, or who fails to abide by the rules and regulations of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA), and Part 33, Aquatic Nuisance Control, of the NREPA, or the conditions of any valid permit, is guilty of violating state law.

# TABLE 1

Summary of snails that serve as intermediate hosts for  
avian and rodent schistosomes in Michigan.

SNAILS	HABITAT	DISTRIBUTION IN MICHIGAN
<b>LYMNAEIDS</b>		
Lymnaea catascopium* (= Stagnicola emarginata)	Sandy areas of lake.	Northern Lower Peninsula and Upper Peninsula
Lymnaea palustris	Muddy bottoms of streams, marshes, and occasionally lakes.	Widespread
Lymnaea stagnalis	Muddy or silt bottoms of streams, marshes, and lakes	Northern Lower Peninsula and Upper Peninsula
<b>PHYSIDS</b>		
Aplexa hypnorum	Temporary woodland pools with silt or muddy bottoms.	Widespread
Physa gyrina	Muddy bottoms of streams, marshes, and ponds.	Widespread
Physa integra**	Lakes with sandy bottoms.	Widespread
Physa parkeri	Lakes with sandy bottoms.	Northern Lower Peninsula and Upper Peninsula
<b>PLANORBIDS</b>		
Gyraulus parvus	Sandy or muddy bottoms of lakes, ponds, streams, and marshes.	Widespread

\*Most important snail in northern Lower Peninsula and Upper Peninsula.

\*\*Most important snail in half of Lower Peninsula.