CHAPTER 11

INVERTEBRATES

The trained aquatic pest manager may identify several species of animals in aquatic environments. Accurate identification and an understanding of the overall health and desired conditions for each water body will help pest managers determine whether an animal, by its presence alone is a pest, or if the levels and condition of the animal's population cause it to be a pest.

Invertebrates are a class of animals that lack a spinal column and are important links in aquatic food chains. Typical aquatic invertebrates include worms, leeches, water fleas, insect larvae, snails and mussels. An aquatic pest manager must be familiar with invertebrates that are considered undesirable in certain aquatic situations and the impact of herbicide treatments on invertebrates.

Aquatic herbicides are used to reduce, remove or eliminate nuisance aquatic macrophytes (plant life large enough to be observed with the naked eye) or algae. Herbicide rates are selected for their toxicity to aquatic plants or algae but may also affect other aquatic life. Most aquatic herbicides are not toxic to aquatic invertebrates when used at or below the labeled rates. When toxic effects are found, the impacts are usually short-lived because the high reproductive rates of most invertebrates allow populations to return to normal quickly. Indirect impacts may be equally important.

A properly administered herbicide treatment will result in decaying plant material. Decomposition may reduce the amount of dissolved oxygen in the water and this may decrease the number of invertebrates. The increase in decaying organic material may also increase the amount of food for invertebrates, which may increase their numbers. Weed control may also affect cover, and loss of cover may reduce their numbers. Usually a treatment results in more individual invertebrates but fewer species. The remaining species are likely to be those tolerant of lower water quality, and this shift may be undesirable.

As an aquatic pest manager, you must monitor the impacts of your management strategies. High quality aquatic environments are usually characterized by a high diversity of species and low numbers of each type.

Mollusks

Mollusks are invertebrates with soft unsegmented bodies usually enclosed in shells. Snails and freshwater clams (mussels) are members of this group.

Snails

Snails and certain aquatic birds are carriers of a minute, free-swimming parasite larva that burrows into and may irritate human skin. This phenomenon, referred to as swimmer's itch, is more common in the northwestern portion of Michigan's Lower Peninsula than in other locations of Michigan. One method of controlling swimmer's itch entails managing the snails that are hosts for the swimmer's itch larvae. Most snails do not carry the swimmer's itch larvae, so the mere presence of snails is not sufficient to justify a management treatment. Management alternatives have varying impacts on other plants and animals in the aquatic environment. To control larvae-carrying snails with the least harm to fish populations, be sure the snails present are the swimmer's itch larvae host. Then remove the snails' habitat: algae, plants and benthic (bottom) debris.

A specific drug treatment (Praziquantel) for birds infested with the swimmer's itch parasite is under study. Birds that carry the parasite are vaccinated to prevent them from spreading the problem around the lake or to other lakes. Current observations and results suggest that this drug treatment for birds may be an acceptable and effective practice for managing swimmer's itch in the future.

Mussels

Michigan waters have a newly introduced mussel pest — the zebra mussel. The first zebra mussel appearance occurred in 1985 in lakes St. Clair and Erie. It took only four years to spread to all of the Great Lakes. To date the zebra mussel has negatively affected the ecosystem, industry and recreation associated with these aquatic areas.

Zebra mussels initially migrated from the Black and Caspian seas to Europe via manmade canals. For almost 200 years, the mussels had resided in the fresh waters of western and central Europe without further spread. Zebra mussels and other exotic species apparently journeyed via cargo ship ballast water from Europe to the Great Lakes in the 1980s.

Cargo ships take in ballast water to redistribute weight when cargo is unloaded. The water is loaded in one port and expelled in another, depositing anything present in the water.

Reproductive Cycle Promotes Spread

One mature female zebra mussel can produce up to 40,000 eggs per season, so they can rapidly colonize a water body. The spawning season apparently lasts as long as water temperatures exceed 54 degrees F (12 degrees C), although this is still under study and observation in the waters of our region.

Zebra mussel eggs hatch within a few days. The young are microscopic larvae, called veligers, and can be carried great distances in water currents. Veligers float in the water an average of eight to 14 days, and up to 30 days, during which time they must attach to a firm surface or they will die.

Variety of shell color and patterns seen in zebra mussels in North America. Credit: Ellen Marsden

Those that hatch and survive, transform within three weeks into double-shelled mussels with light and dark banding. They mature in a year. The veligers and adult mussels produce thread-like filaments to attach themselves to any hard surface.

Adult zebra mussel showing thread-like filaments used for attaching to hard surfaces. Credit: Ohio Sea Grant.

Though the majority of the mussels are thumbnail size, zebra mussels can reach 2 inches long when fully grown. The mussels live an average of 3.5 years but can live as long as five years.

Biological and Ecological Concerns

The zebra mussel's feeding habit is of great concern because of the damage it may cause to the Great Lakes' food chain. Each adult mussel is capable of filtering about 1 liter of water per day. Nearly all particulate matter, including plankton, is strained from the water. The zebra mussels eat mostly algae, selecting primarily those in the 15 to 40 micrometer size range for consumption.

Instead of passing the uneaten plankton back into the water, the mussels bind it with mucous into a pellet called pseudofeces. These pseudofeces are ejected from the mussel's siphons and accumulate among the shells in the colonies. Thus, a considerable quantity of plankton is removed from the water and becomes unavailable to the microscopic crustaceans that feed larval and juvenile fishes and unavailable to the plankton-feeding forage fish that support some of the Great Lakes' sport and commercial fisheries.

There are other concerns regarding reefs and rocky habitats. Most rocky areas in Lake Erie appear to be almost completely covered with mussels. The zebra mussels attach to a hard surface and then to one another, sometimes forming layers several inches thick. The accumulation of pseudofeces in these beds creates a foul environment. As the waste particles decompose, oxygen is used up and the pH becomes very acidic. Research is occurring to determine if these anaerobic, acidic conditions

will be detrimental to the hatching success of reef-spawning fish species such as walleye, white bass and smallmouth bass.

Zebra mussel cluster on rock. Credit: Ontario Ministry of Natural Resources.

Impact on Industry and Recreation

In addition to Great Lakes ecosystem damage, zebra mussels can also harm industry and recreation. Mussels encrust and clog municipal and industrial water intake pipes, reducing pumping capabilities. When zebra mussels die and decompose, they can cause bad tastes and odors in drinking water. Though a zebra mussel may die, its shell stays firmly attached to whatever it adhered to when it was alive. Other zebra mussels can attach themselves to the hard shells and create layers of zebra mussels several inches thick. Zebra mussels have the potential of ruining Great Lakes recreational activities such as sport fishing, shipwreck diving and beach walking.

Shipwrecks can become colonized by mussels. Scuba divers have already reported wrecks virtually unrecognizable because of mussels. Beaches become less attractive when the sharp zebra mussel shells wash ashore.

Zebra mussels can accumulate in water intakes of both inboard and outboard motors, grow inside motors and cause engines to overheat. Navigational buoys can become encrusted with zebra mussels and sink out of sight from the weight.

Zebra Mussel Management

Methods of zebra mussel control such as chemical treatment (including chlorination), heat, electrical shock and sonic vibrations are being researched. Though some treatments are effective in managing the mussels in enclosed areas, researchers have yet to find a way to manage the mussels on a lake-wide basis.

Slow the Spread of Zebra Mussels

Microscopic larvae (veligers) can be unknowingly transported in bilges, engine cooling systems, minnow buckets, live wells and anywhere else that water is trapped. Zebra mussels will likely spread from the Great Lakes to inland waters. Here are some precautions you should take to avoid being a zebra mussel carrier:

-Always inspect your boat and trailer carefully before transporting them.

-Flush clean water (from hose spigot, etc., not lake water) through the cooling system of your motor to rinse out any veligers before relocating.

-Drain all bilge water, live wells, bait buckets and engine compartments. Make sure water is not trapped in your trailer.

-In their earlier stages, attached zebra mussels may not be easily seen. Pass your hand across the boat's bottom — if it feels grainy or grimy, it's probably covered with mussels. Don't take a chance — clean them off by scraping or blasting.

-Full-grown zebra mussels can be easily seen clinging tightly to surfaces. Carefully scrape the hull or trailer or use a high pressure spray (250 psi) to dislodge them. An alternative is to leave the boat out of the water for at least 14 days. The zebra mussels will die and can be scraped off.

-Dispose of the mussels in a garbage container. Don't leave them on the shore where they can be swept back into the lake or rot and foul the area.

-Before you leave the boat launch site, remove any plant debris from the trailer — small mussels may be entangled in it.

-Avoid transporting bait fish or water from one lake to another — you could be transporting microscopic veligers.

-Certain polymer waxes discourage zebra mussels from attaching. You will still need to check your hull periodically because the mussels cling to drain holes and speedometer brackets.

Some boat hull paints have pesticidal qualities. Before applying a chemical to your boat, be sure it is a legal and environmentally sound application by checking with the Pesticide and Plant Pest Management Division of the Michigan Department of Agriculture which regulates pesticide use. Do not use copper paints on aluminum hulls — galvanic corrosion would result.

Leeches

Of the 50 species of leeches found in Michigan, only four attach themselves to humans. Therefore, it is vital to determine if the leeches you see are truly causing a problem and can be considered pests. To some, a pest leech is known as a "blood-sucker."

Leeches dwell in accumulations of twigs and leaves at the lake bottom. A desirable leech management strategy is to allow large bluegills and bass to eat them — leeches are their preferred prey. Reducing the amount of organic debris and preventing or controlling beds of dense vegetation will also help reduce leech populations. Remember that a combination of shallowness and over fertility may be the cause of the excessive vegetation and organic debris buildup.

Insect Pests Associated with Aquatic Areas

Insects are invertebrates that have an exoskeleton — an external supportive covering for the other body parts. There are many aquatic insects, but only two of the most common and annoying insect pests requiring control are mentioned here.

Black Flies

Black flies are true flies *(Diptera)*, related to mosquitoes, gnats, midges and crane flies. The larvae of black flies live in clean, fast-flowing streams and rivers. Adult black flies often emerge in great numbers from these water bodies in the spring and continue through the summer, though black fly adults are usually most abundant in May and June. Female black flies bite and suck blood, so they are important pests in resort and tourist areas and on farms.

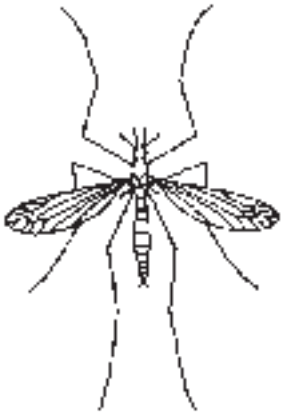
Black flies may become so numerous that people wish to control them. One way is to treat the larval stage by applying an insecticide derived from a common soil bacterium in the water where larvae are found (permission must be obtained before this treatment can be executed, inquire with the MDEQ). This insecticide is available commercially in liquid form. When used according to the label directions, it is highly specific — it affects only black fly larvae and a small percentage of the midge larvae in streams and rivers, and it does not harm other aquatic organisms.

This bacterium-derived insecticide produces a crystalline, proteinaceous toxin that black fly larvae must ingest to be effective. After ingestion, the toxin is activated by the presence of a high gut pH and certain enzymes. The toxin binds to specific sites on the gut walls of the larvae. The gut walls disintegrate and the larvae die.

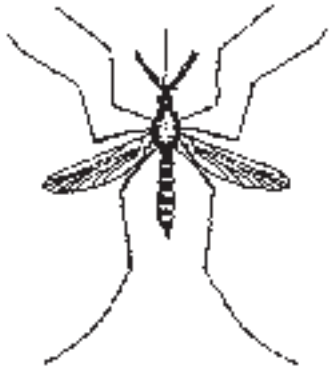
Anyone who wishes to control black flies should seek expert help from an MSU Extension aquatic insect specialist to learn about the biology and seasonality of black flies and the best management techniques available.

Mosquitoes

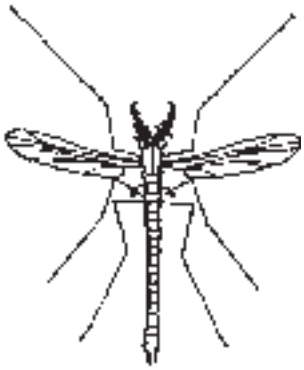
Mosquitoes have four distinct stages of development: egg, larva, pupa and adult. Eggs must be in water to hatch. They can be deposited either directly on water or in locations subject to periodic flooding. The larvae and pupae are aquatic, but the adults are active, free-flying



CRANE FLIES
Proboscis usually not present. Scales never present on wing veins or edge. Legs very long.

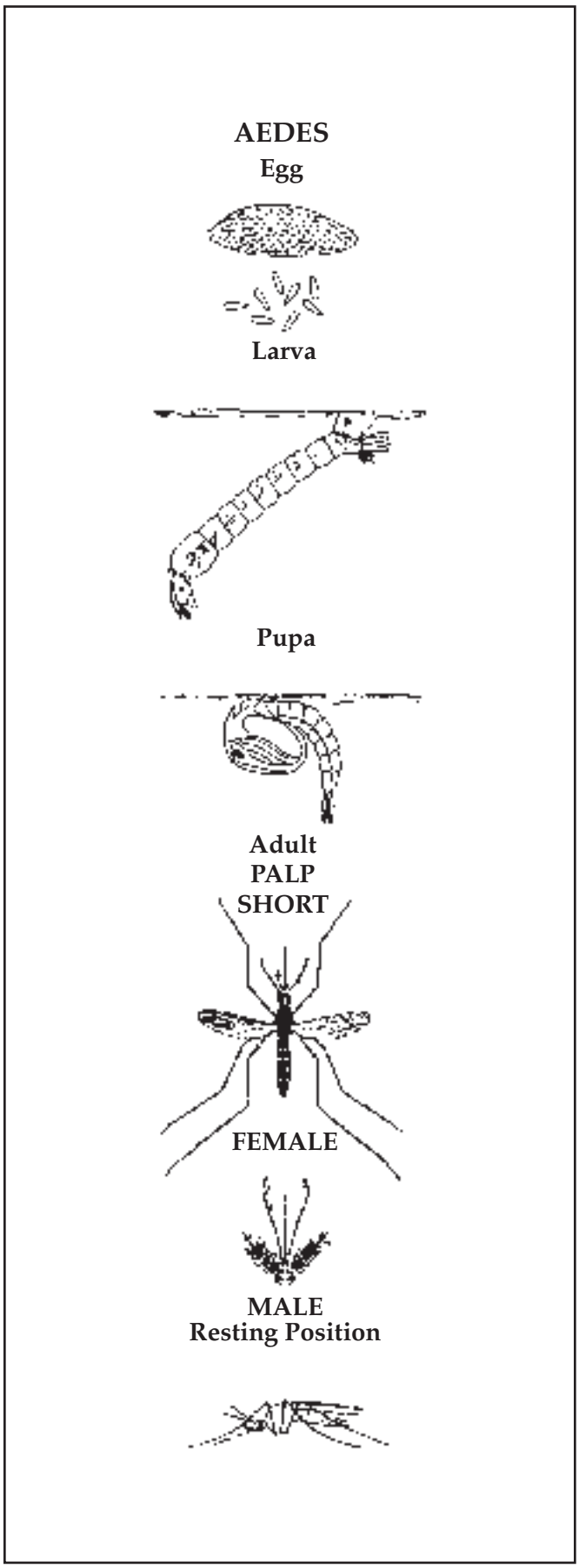


MOSQUITOES
Proboscis (elongated mouthparts) on front of head. Scales present on wing veins and wing edge. Rest with body held away from substrate



MIDGES
Proboscis never present. Scales never present on wing veins or edge. Rest with body nearly contacting substrate.

Crane flies and midges are insects commonly confused with mosquitoes.



Four life stages of a common mosquito species in Michigan: egg, larva, pupa and adult.

insects. Several species of mosquitoes are found in Michigan.

If you desire to manage mosquitoes commercially and make pesticide applications for this purpose, you must become a certified pesticide applicator in category 7F, mosquito control. Your certification as an aquatic pesticide applicator does not allow you to recommend or apply treatments for mosquito management.

Nonchemical approaches to mosquito reduction may include:

- Eliminating sources of stagnant water from the yard (bird baths, tires, pet dishes, buckets, etc).
- Increasing water movement in permanent water features.
- Reducing shallow water where feasible.
- Reducing the density of aquatic plants.

Chapter 11 – Invertebrates Review Questions

Write the answers to the following questions, and then check your answers with those in the back of this manual.

1. Which invertebrate is the host for the pest that causes swimmer's itch?
   a. Leeches.
   b. Mussels.
   c. Snails.
   d. Water fleas.

2. A molluscicide labelled for use in an aquatic setting is safe for all organisms in that aquatic environment. True or False?

3. Which statement about leeches is incorrect?
   a. Leeches dwell in twig and leafe accumulations on lake bottoms.
   b. Reducing amounts of organic debris and preventing/controlling beds of dense vegetation can help reduce leech populations.
   c. All 50 species of leeches could be harmful to humans at some time.
   d. Leeches are the preferred prey of bluegills and bass.

4. Which statement about the zebra mussel is incorrect?
   a. A mature female can produce up to 40,000 eggs in one season.
   b. The young, microscopic larvae are called veligers.
   c. During their 8 to 14 days as larvae, they must attach to a firm surface.
   d. The zebra mussel has been relatively harmless since arriving in the Great Lakes in the mid-1980s.

5. What type of organism does the zebra mussel filter from the water but not eat or pass back into the water, thus making this organism unavailable to crustaceans and fish?

6. Name four experimental treatments for zebra mussel management.
   1.
   2.
   3.
   4.

7. Zebra mussels can potentially be spread from the Great Lakes into inland waters unknowingly in bilges, engine cooling systems, live wells, and in any trapped water. True or False?

8. Instead of a spinal column, what do insects have that classify them as invertebrates?