

Banded Woollybear (Isabella Tiger Moth larva)

basics

The banded woollybear gets its name for two reasons: its furry appearance and the fact that, like a bear, it hibernates during the winter.

Woollybears are the caterpillar stage of medium sized moths known as tiger moths. This family of moths rivals butterflies in beauty and grace. There are approximately 260 species of tiger moths in North America. Though the best-known woollybear is the banded woollybear, there are at least 8 woollybear species in the U.S. with similar dense, bristly hair covering their bodies.

Woollybears are most commonly seen in the autumn, when they are just about finished with feeding for the year. It is at this time that they seek out a place to spend the winter in hibernation. They have been eating various green plants since June or early July to gather enough energy for their eventual transformation into butterflies.

A full-grown banded woollybear caterpillar is nearly two inches long and covered with tubercles from which arise stiff hairs of about equal length. Its body has 13 segments. Middle segments are covered with red-orange hairs and the anterior and posterior ends with black hairs. The orange-colored oblongs visible between the tufts of setae (bristly hairs) are spiracles—entrances to the respiratory system.

Hair color and band width are highly variable; often as the caterpillar matures, black hairs (especially at the posterior end) are replaced with orange hairs. In general, older caterpillars have more black than young ones. However, caterpillars that fed and grew in an area where the fall weather was wetter tend to have more black hair than caterpillars from dry areas.

- The adult called the Isabella moth, is a common, medium-sized moth with a stout body and yellowish-orange to cream-colored wings spotted with black, and a wingspan of about 2 inches. Male Isabella moths will come in to lights at night and rest with wings folded over their backs.
- Predators include parasitic wasps, mantids, birds and flies.
- The banded woollybear caterpillar has been called the "weather worm" because according to folklore the width of its black bands in fall predicts winter severity. The longer the black at the ends of the body, the more severe will be the coming winter. In fact, the amount of black

varies with the age of the caterpillar and the moisture levels in the area where it developed.

habitat

Woollybears and the tiger moths they become are usually found near marshes and meadows, where there is sufficient food and moisture and a good accumulation of ground debris in which to overwinter.

adaptations

Banded woollybear caterpillars are covered entirely with dense clusters of tubercles from which arise short tufts of hairs or long hair "pencils" of varying colors. The hairs on these caterpillars protect them in two ways: they insulate them against heat and cold, and they can be irritating when touched.

They have the ability to tolerate very cold temperatures, aided in part by a body chemistry that serves as antifreeze. The colors may serve as camouflage against predators and the fuzzy dark surface absorbs solar radiation for warmth. They may be active on sunny winter days.

The caterpillars hibernate through the winter before becoming adult moths. (See below.) Dormancy can be induced in larvae by chilling them and keeping them cool. Larvae have been known to survive an entire winter completely frozen in an ice cube. Warmth stimulates them, and in an active state they require food.

food/feeding

Caterpillars have chewing mouthparts. Adults have siphoning mouths. Woollybear caterpillars generally eat low, herbaceous and wild plants such as dandelion, dock, aster, goldenrod, plantain, clovers, birches, maples and some grasses. The adults drink nectar from wildflowers.

reproduction

After dark, the female moth extends a scent gland from the tip of her abdomen. Night-flying males zigzag in their flights, pick up the airborne scent with their antennae, and locate the calling female to mate. Upon separating, the male looks for another mate while the female begins her ovipositing flight under cover of darkness.

The life of a tiger moth begins when an adult moth lays an egg on the surface of a food plant. A few days later, the egg hatches and the larva begins feeding on plant food.

There are 2 generations of banded woollybear caterpillars each year, May and August. The second generation is the one we see in late fall, scurrying to find an overwintering site under bark or inside cavities of rocks or logs.

Woollybears go through four or five developmental stages. They start out quite small and hairy and often go unobserved. We are more likely to notice them after they are

about half grown—about an inch long. By the time they go underground for the winter, however, they are about 2 inches long and quite furry.

In the early spring when the days get longer and the sun warms the earth the woollybear awakens from a long winter's nap. It feeds briefly before searching out a safe and secluded place to begin its transformation into an adult. At this time it forms a cocoon by producing silk and mixing it with body hair. By late May or early June the cocoon will start to wiggle, then split open for the new moth to emerge. At first, its wings are wet and deflated, but it will quickly dry itself and fly away. Eggs laid by the female moths start the cycle over again.

key facts

- **The Name:** The banded woollybear gets its name for two reasons: its furry appearance and the fact that, like a bear, it hibernates during the winter.
- **Appearance:** The colors may serve as camouflage against predators and the fuzzy dark surface absorbs solar radiation for warmth. Besides from its size, you can also get a hint of how far along the woollybear is in its development by the size of the red section, which is replaced by more and more black over time.
- **Metamorphosis:** (Undergoes complete metamorphosis.) Only after it has fed and grown all summer and hibernated through the long winter can it then go into metamorphosis to become a beautiful moth called The Isabella Tiger. (They have the ability to tolerate very cold temperatures from a body chemistry that serves as antifreeze.)
- **Food:** The caterpillar munches on all kinds of wildflowers and greens, but the only food for the adult moth will be the nectar it can sip from flowers. The adult moth lays the eggs in the early summer to start the cycle all over again.
- **Predators:** It is eaten by parasitic wasps, mantids, birds and flies.
- **Habitat:** They like wetlands because there are lots of green plants and moisture, and plenty of ground material in which to snuggle down into for winter. They are unique to North America, found throughout the U.S., Mexico and southern Canada, but nowhere else in the world.

Praying Mantis or “Preying” Mantis

(The plural form is “mantids” or “mantises.”)

basics

Mantids are found throughout the warmer parts of the world. Worldwide approximately 2,000 species of praying mantids have been identified, the majority of species occurring in tropical rainforests. The Praying mantids are carnivorous insects with the largest mantids six inches long and the smallest less than ½ inch.

The name "mantis" comes from the Greek word for “prophet” or “soothsayer.” European and Chinese species were introduced to the Northeastern United States about 75 years ago as garden predators in hopes of overtaking the native pest population.

- The “praying” part of its name is due to the way it holds up the front of its body with huge front legs, as though in prayer and “preying” because they are carnivorous, feeding mostly on other insects.
- Their colors vary, ranging from light greens to pinks. Most mantids are pea green or brown. They have straight, leathery forewings.
- Mantids are most commonly seen in late September and early October either resting on a plant or “fluttering” through the air, sometimes mistaken for a hummingbird.

habitat

Mantids in Utah occur in a variety of habitats, from deserts to meadows. Especially where summers are warm, there is vegetation on which to hide and deposit eggs, and plenty of insects to eat. Great Salt Lake wetlands fit the bill just right.

adaptations

The Praying Mantis has many unique adaptive features:

Forelegs: It has spiny, grasping forelegs equipped with rows of sharp spines used to grasp its prey. These “grippers” can also give a sharp pinch to a human, when handled. The front legs are adapted for grasping to catch and hold prey, and modified to close like a pocket knife blade back against its handle.

Camouflage: Its color and sticklike body shape help to camouflage it among branches, leaves or flowers. Camouflage is very important for mantis survival for two reasons. First, it is more likely to catch its prey by surprise if it blends in with its surroundings. Second, it must conceal itself to avoid being eaten by birds and other predators.

Vision/Hearing: It has a triangular-shaped head with a large compound eye on each side, giving it a wide field of view without moving. Its eyes are sensitive to the slightest movement up to 60 feet away. It is also the only insect in the world that can turn its

head around to look behind itself (a full 180-degree angle). It has ultrasound ears on its metathorax, located on the thorax.

Bat Detection: In the bodies of some species of mantis, there is a hollow chamber that provides the mantis with a means of detecting bats, one of its most feared predators. When it hears certain frequencies of sound, the mantis in flight will drastically change its flight pattern often hurling to the ground in a spiral.

Hunting/Feeding: It hunts mostly by stealth, unmoving and almost invisible on a leaf or a stem, ready to catch any insect that passes. When potential prey comes close enough, it thrusts its pincher-like forelegs forward to catch it. The prey probably won't escape because the forelegs are so strong and armed with overlapping spines. It is fast enough to snatch even the fastest fly.

The praying mantis will prey on almost any insect small enough to be seized. It eats insects and other invertebrates such as beetles, butterflies, spiders, crickets, grasshoppers, and even spiders. It also eats vertebrates such as small tree frogs, lizards, mice and hummingbirds. The mantid bites the neck of its prey to paralyze it and begins to devour it. It almost always starts eating the insect while it's still alive, and almost always starts eating from the insect's neck. This helps ensure that the insect's struggle stops quickly. The adult female mantis eats up to 15 full-grown crickets a day.

Reproduction: One generation develops each summer. In late summer the male mantis performs a ritual dance and the female responds with a dance of her own. While the female's dance begins with a menacing stance, it ends with a nonthreatening posture signaling her receptiveness to the male.

In fall, females lay groups of 12-400 eggs in a large mass or cluster approximately an inch long, in a frothy, gummy substance glued to tree twigs, plant stems and other objects. This substance turns into a hard protective shell, which is how these insects survive the winter.

Small mantids emerge in April or May. The eggs hatch 3 weeks to 6 months after being laid. Mantis babies are wingless, but otherwise resemble the adults. Often, their first meal is a sibling. Young mantids or nymphs eat leafhoppers, aphids and small flies.

Young mantids shed many times before becoming full grown. It takes an entire summer or growing season to mature to adulthood. Many species of mantids resemble ants when they are small, but as they go through a series of molts, they begin to look more like adult mantids, reaching adulthood and the breeding season in August. Adults do not overwinter, so by September or October, most of them die.

For nearly 200 years the female praying mantis had a reputation for her peculiar habit of biting the head off her partner while they are mating. This grew out of early research with caged and underfed mantids distracted by brightly lit researchers. More recent research under natural conditions reveals that this rarely if ever happens in the wild.

key facts

- Two Names: Both “Praying” and “Preying” Mantis are correct—and they both fit!
- Habitat: The mantis does well in wetlands, because of the insect food.
- Well-Adapted: Its shape, color, swiftness, spiny front legs, sensitive compound eyes, powerful jaws and the ability to turn its head all make this an animal well-suited to its predatory lifestyle.
- Feeding: Although it focuses on invertebrates, it will sometimes eat frogs, lizards, mice and even hummingbirds! The mantid usually bites the neck of its prey to paralyze it and then begins to eat right away.
- Beneficial: The adult female mantis eats up to 15 adult crickets a day! This is an example of how valuable insects are in the world. Praying mantises are pest exterminators and help control insect populations that can be a threat to wetlands, gardeners and agriculture.
- One generation develops each summer. The mantids develop through a form of simple metamorphosis.

dragonfly

basics

Dragonflies go through three stages of development—egg, nymph and adult—called simple metamorphosis. A nymph hatches from an egg to become an aquatic predator, spending most of its time at the bottom of a pond. They are solidly built with a flattened shape and have a specialized lower lip with two teeth used for snaring food. They inch slowly toward their prey or just lie in wait for prey to pass by.

Adult dragonflies are beautiful flying insects with four large, fragile wings that look like fine gauze. Their long, slender bodies may be red, green, or blue, with white, yellow, or black markings. They have large compound eyes, which look like beads, covering most of the head.

Adult dragonflies live for only a few weeks to a few months, ranging in length from $\frac{3}{4}$ to 5 inches. Small, graceful damselflies look like dragonflies and have a similar life history, but their bodies are more slender and delicate in appearance. Neither dragonflies nor damselflies can fold their wings flat against their bodies; dragonflies rest with wings outstretched; most of the more delicate damselflies rest with vertically folded wings.

Fossils resembling dragonflies and damselflies date back 300 million years, some with wingspreads of $2\frac{1}{2}$ feet! Today there are 5,000 known species worldwide, including 45 in North America. Predators include leopard frog, birds

habitat

Wetlands ponds and moist meadows; some species dwell in forests.

adaptations

The nymph is able to surge suddenly forward, like a jet-propelled submarine, by forcing water from the back of its body. They are equipped with a specialized lower lip with two teeth used for snaring food. Bristles at the tip pull prey back into the mouth.

Adults have moveable heads with large compound eyes and sharp biting mouthparts to cut up insect prey. They have four powerful wings that move independently to fly forward or backwards, and six long legs covered with spines that are excellent for holding insects in flight or perching on a limb, but unsuitable for walking. They have been known to fly 50 to 60 miles an hour and fly so swiftly that they usually escape from birds or other animals.

food/feeding

Nymphs and adults eat only living prey that they capture. Wingless, aquatic nymphs prey upon aquatic insects, tadpoles and even small fish. Adult dragonflies are among the most skilled of insect fliers, catching meals of mosquitoes and other insects in

midair. As it flies, it holds its legs together to form a basket in which to capture insects. The dragonfly grabs hold of its prey with its legs or jaws, and may eat it while flying. They can see still objects almost 6 ft. away, and moving objects 2-3 times that distance.

reproduction

Adults often fly together and will mate in flight. The female then lays eggs in or close to fresh water or inside the stem of a water plant.

The nymph (young dragonfly) hatches within one to three weeks. It has a thick body, big head and mouth, and no wings. It has a folding lower lip, called a mask, which is half as long as its body. The lip has jawlike hooks at the end and can move out to capture victims. The nymph breathes by means of gills.

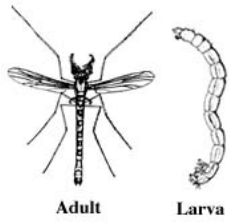
The dragonfly nymph remains in the water for one to five years. It eats a variety of aquatic invertebrates. Some large dragonfly nymphs feed on young fish. While developing into an adult dragonfly, the nymph molts about 12 times. For its final molt, the nymph leaves the water and climbs onto a reed or rock. It then sheds its skin for the last time and emerges as an adult that can soon fly.

key facts

- **Ace Pilot:** Four powerful wings give the dragonfly the ability to go forward or backwards, in midair, and they can fly up to 60 miles an hour!
- **Well-Equipped:** Good vision, spiny legs and sharp mouthparts make the adult a very efficient predator. As it flies, it holds its legs together to form a basket in which to capture insects. Both the nymph and adult are highly beneficial predators, eating huge numbers of mosquitoes and other insects.
- **Food Chains:** Dragonflies are mainly eaten by birds, shrews and frogs.
- **Double Life:** After hatching from an egg, it spends between one and five years as an aquatic nymph, breathing by gills, feeding on aquatic insects, tadpoles and small fish, and molting about 12 times. Dragonflies develop through a form of simple metamorphosis.

midge

basics



Midges are any of a large family of small flies. There are about 2,000 species, about 670 of which live in North America. Species' lengths range between $\frac{1}{8}$ and $\frac{1}{2}$ inch and resemble mosquitoes, but with a very short proboscis that is not used for biting and with wing scales only at the margins. The adults have slender bodies, are humpbacked and have long, thin legs. They are brown, black orange or gray, and usually near water. Adult males have feathery antennae.

Adult midges thrive near ponds, lakes and other bodies of water, sometimes inciting fish to jump. They are easiest to find when they gather in mating swarms that resemble a moving haze or columns of smoke, sometimes with a "humming" can be heard over a considerable distance. Swarms are most common in the morning and evening but occur in midday as well. They can be found anywhere, but especially good places are at the edges of water. As you become aware of midge swarms, you will also begin to see swarms of other types of flies, and these are often formed just over the top of a prominent object, such as a tree in a meadow or even your own head.

Densities of over 4,000 larvae per square foot often occur on the bottoms of nutrient rich bodies of water. During emergence periods, it is not unusual for several thousand adults per square yard of surface to emerge on a nightly basis.

The general public often incorrectly refers to midges as "gnats." Several families of flies that have the word midge as part of their name are not really midges at all. These include the biting midges, also known as punkies or no-see-ums. Biting midges have stout bodies and a painful bite. They are seen near lakes and rivers and at the beach.

Swarming:

Most people, when they see a swarm of flies, assume two things: that they are all mosquitoes and that they are about to bite you. Neither is true. Thousands of species of flies form swarms and only a very small proportion of these bite humans at all. And even if the swarm is of mosquitoes, chances are that you will not be bitten, since most swarms are composed only of males and the males do not bite.

The majority of swarms you see are likely to be composed of non-biting midges, so there is no danger in getting near them to watch. If you take the time to watch, you will find that there is more order and predictability in the behavior of these swarms than you would expect, and that seeing the patterns of behavior in swarms can be great fun. The swarming behavior of midges is described below, but most of their behavior can be applied to other types of fly swarms that you will see as well.

Midge swarms tend to be localized both in place and time. If you see one at a certain time and in a certain place, chances are good that you will see it the next day at the same time and same place. Most midges have specific times of the day when they

swarm. It may be twice a day, in the morning and evening, or it may be just once, maybe in the middle of the day. The timing for each species is believed to be either triggered by a certain level of light, or regulated by an internal clock. Each species has its own fixed pattern of timing.

Why swarms form where they do is not as easy to understand. You might have already seen swarms over water, in patches of afternoon light, or even right over your head. It has been found that certain species of flies respond to specific aspects of the environment, called "swarm markers," and always form swarms in these or very similar circumstances. In some cases, researchers have even been able to mimic enough aspects of the swarm marker to actually cause flies to swarm over certain spots. For instance, a common midge will swarm over shiny black plastic at least four inches by four inches, placed on the ground. Some other flies swarm just above the top point of a tree, and others just beneath the tip of a branch.

A swarm also typically stays within a certain distance of its marker. This is believed to be the result of the limited vision of the insects. At some point from the marker they can no longer see or discern its significant factors. This is the maximum distance they can move away from it without losing it. Thus, in the absence of wind, the swarm will generally stay at about the same height fairly constantly. But you will also see the swarm drop down and even out of sight and then reappear again. This is almost always in response to breezes. As the wind gets stronger, the swarm moves lower so as to be able to remain over or under the marker and not get blown away. As the breeze subsides, the swarm rises. On very windy days, flies may be unable to swarm.

If there is a slight breeze, all of the flies in the swarm face the wind. They often seem to fly forward, possibly to the windward limit of the marker, and then drift back with the wind, possibly to the leeward limit of the marker, and then fly forward again. This creates a kind of circular motion, which has often led to people describing the flies as "dancing." There are other types of movement that you will see among the flies in a swarm, many of them seem synchronized, and their function is still unknown.

One problem for midges in a swarm is being able to distinguish females from males. Studies have shown that the antennae of midges play a key role in sexual recognition.



This is also true of mosquitoes. The antennae of the males in these species are long and extremely plumose, and at their bases have special organs, which, along with the antennae, pick up vibrations in the air. The females give off a buzz of a certain pitch, or range of pitches, when they are sexually mature, and the males are attracted to this pitch when it is within about a foot of them. The flight buzz of certain common female mosquitoes is around middle C on the piano. Singing this pitch near a swarm of male mosquitoes will make them all immediately fly in your direction.

habitat

Midges are found in wetlands or near lakes and streams. Their populations are dependent on water, which can be found from a variety of sources, including wet soil or plant irrigation. The larvae of some species live in saltwater. They also occur on land in tree holes and even in piles of animal droppings.

adaptations

Female antennae are lightly feathered, while those on the males are more conspicuous and bushy.

food

Most larvae feed on algae or small aquatic plants.

reproduction

There are four stages in the life cycle of midges. In each species, male and female flies are internally programmed to swarm over a given marker, conspicuous and usually light colored, at a fixed time of day. This may include a plant or patch of ground, an automobile, and a piece of lawn or porch furniture or even a person. These mating swarms may contain millions of insects, but are made up almost entirely of the males. When the wingbeat frequency of approaching females is detected, a few will dart out to meet and mate with her. Because of the sensitivity of the swarming males to sound, you can often see erratic changes in the swarm pattern in response to sounds such as a handclap or even spoken word.

Once she is mated she will go off and start egg-laying, whereas the males are more likely to return to the swarm. Thus, swarms seem to help males and females of a species locate each other for mating. Fertilized females spend one or two days laying thousands of eggs in gelatinous masses on the surface of water or on aquatic vegetation. Each egg mass may contain up to 3,000 eggs depending on the species. These eggs sink to the bottom where they hatch into larvae in 2–7 days.

After leaving the egg mass, the larva (immature form) of most midges live in fresh water, while others are found in mud, in wet moss, and under damp bark or other decaying plant matter. It is often whitish, cylindrical-like, elongate or wormlike, between $\frac{1}{2}$ and $\frac{3}{4}$ inch long, usually with paired prolegs and a dark head. Some are known as "bloodworms" or "red worms" due to the presence of hemoglobin in the blood. Others have a greenish color.

Young larvae feed or scavenge on algae, plankton and organic debris with some, such as those of the Phantom Midge, becoming aquatic predators of small swimming insects and crustaceans, using their antennae as grasping organs. Larvae of many species construct tubes of debris around them in which they mature and feed.

Several generations of midges will be produced throughout summer, resulting in mass emergences of adults. The entire life cycle from egg to adult can be completed in as little as 2 to 3 weeks. There are many broods and the larvae of the last brood overwinter. The

pupa emerge from their pupal skin, rising to the water surface like a mosquito. Adults do not eat and have a short life span of five to ten days.

In the fall, larvae do not pupate, but they suspend development and pass through the winter months underwater in mud or decaying vegetation as mature larvae. Pupation and emergence of adults occurs the following spring in late March or early April.

ecology

Because there are so many different kinds of these prolific creatures in aquatic systems, you would think we would be overwhelmed by the sheer number of these critters. Not so. Larval midges are the food base of just about every predatory creature in our aquatic systems. Young-of-the-year fish are especially dependent upon larval midges. Emerging adult midges are heavily preyed upon by birds and adult fish of many kinds. They are also an important source of food for other aquatic insects.

key facts

- Midges are misjudged by most people, because of their resemblance to mosquitoes and their habit of forming swarm clouds. They don't bite, and their swarms are just their way of finding a partner.
- Midge larvae "clean" the aquatic environment by consuming and recycling organic matter.
- Up to 50,000 larvae may be found in a square yard of lake mud.
- Ecological Wonders: Larval midges are the food base of just about every predatory creature in our aquatic systems. Emerging adult midges are heavily preyed upon by birds and adult fish of many kinds. They are also an important source of food for aquatic insects.
- Midges undergo complete metamorphosis.
- In each species, male and female flies are internally programmed to swarm over a given marker. Swarms seem to help males and females of a species locate each other for mating.

Common Water Strider (also called “skater.”)

basics

Water Striders are slender, elongate insects with dark brown bodies, between $\frac{3}{8}$ and 1 inch long. All species have short forelegs and longer slender middle and hind legs that arise close together. They dart about on the surface film of fresh and salt water and only a few species have wings.

- Water Striders are the world's most advanced surface-dwelling water bugs. One of the few insects to conquer the oceans, some intrepid species venture hundreds of miles across calm tropical seas.
- Predators of the water strider, like birds and fish, take advantage of the fact that water striders cannot detect motion above or below the water's surface.
- Water striders do not bite people.

habitat

Surfaces of marsh, ponds, slow streams and other quiet waters. They are usually in large groups, prefer shade, and the protection of overhanging trees and boardwalks.

adaptations

Water Striders have very good vision to see their prey. They are very sensitive to motion and vibrations on the water's surface and use this ability to locate prey.

The two short front legs are for grabbing prey, the middle pair of legs thrust the strider forward like paddles and the hind pair steer and act as brakes. They can move very quickly across water and must always keep moving so they don't become prey themselves to fish or other predators.

The water strider's feet make small dents in the water surface, but oily hairs repel water and trap air to both keep their feet dry and allow them to walk or run along the surface without breaking through the surface tension of the water. (“Surface tension” is a force that causes water and some other liquids to appear as if a thin elastic skin covered its surface, which is caused by the attraction of water molecules to each other. Very light objects are supported by this force.) The shape of their legs and their light weight also help prevent sinking.

They can escape predators by going underwater. Their bodies are covered with soft, velvety hairs that hold a thin film of air through which they breathe. When the danger is past, they pop to the surface of the water and stand back up on their four legs.

If their habitat dries up they can burrow into the mud and remain dormant until water is replenished.

food/feeding

Water striders feed on living and dead aquatic insects, including mosquito larvae that rise to the surface and terrestrial insects that drop into the water. Injured dragonflies are a favorite food, as are worms that fall in the water.

Water striders have a sharp piercing, sucking mouthpart, called a rostrum, that they insert into prey to extract body juices.

reproduction

Courtship and mating involve communications by ripples in the surface film of water. The female lays parallel rows of cylindrical eggs on an object at water's edge, usually on plant stems. When eggs hatch, nymphs (baby striders) must grow for 4–5 weeks before they become adult water striders.

Adults live many months, overwintering beneath fallen leaves or other organic material near water. In severe cold, they will crawl inside a plant stem.

key facts

- **A Hunter's Life:** Water striders combine speed, good vision and a high sensitivity to water surface vibrations to succeed as predators. The two short front legs are for grabbing prey, the middle pair thrust the strider forward like paddles and the hind pair steer and act as brakes.
- **The Weak Spot:** Predators of the water strider, like birds and fish, take advantage of the fact that water striders cannot detect motion above or below the water's surface. Water Striders must always keep moving to so they don't become prey.
- **Plan B:** If their habitat dries up they can burrow into the mud and remain dormant until water is replenished.
- **Dive to Safety:** They can escape predators by going underwater. Their bodies are covered with soft, velvety hairs that hold a thin film of air through which they breathe. When the danger is past, they pop to the surface of the water and stand back up on their four legs.
- **Fast:** Water striders can cover 100 body lengths in one second! This is equivalent to a six-foot-tall human swimming at speeds of over 400 miles per hour, a velocity faster than many jet aircraft.

Mosquito

basics

Mosquito is the name of a large group of slender insects that feed on blood and other liquids. Certain mosquitoes spread some of the world's worst diseases, including dengue, encephalitis, malaria, and yellow fever. Many others do not spread disease, but they inflict itchy "bites." Mosquitoes belong to a large group of insects that scientists call flies (insects with two wings). The word mosquito means little fly in Spanish.

- Most mosquito species grow about $\frac{1}{4}$ inch long but some can grow to about $\frac{1}{2}$ inch. The hum of a mosquito is the sound of its wings beating. A mosquito's wings move about 1,000 times a second.
- There are approximately 2,700 species worldwide, with 150 species in the US. Not all species bite humans; some prefer birds, horses, amphibians or reptiles.

adaptations

A mosquito hears and smells with its two long antennae, which grow near the center of its head between the eyes. The antennae of a female mosquito have a covering of soft hair. The male's antennae possess bushy hairs that give them a feathery appearance. The long hairs on male antennae help them locate flying females.

Mosquitoes can only eat liquids; females drink blood and plant nectar, males only sip plant nectar. The mouth of a mosquito looks somewhat like a funnel. The broadest part is nearest the head, and a tubelike part called the proboscis extends downward. A mosquito uses its proboscis to "bite," and as a straw to sip.

Only female mosquitoes "bite," and only the females of a few species attack human beings and other animals. Females are attracted to prey by sight/light/color, smell (including perspiration, body odor and CO₂), warmth detection and movement. They sip the victim's blood, which they need for the development of the eggs inside their bodies.

A mosquito has six long, slender legs, and each leg has five major joints. A pair of claws on each leg helps the insect cling to such flat surfaces as walls and ceilings.

Two huge compound eyes cover most of the head. These eyes, like those of most other insects, consist of thousands of six-sided lenses. Each lens points in a slightly different direction and works independently. A mosquito cannot focus its eyes for sharp vision, but it quickly sees any movement. The eyes are always open, even when the insect rests.

A female's wings make a higher tone than a male's wings, and the sound helps attract mates. Mosquitoes have two wings, unlike most other kind of insects, which have four. The wings are so thin that the veins show through. The veins not only carry blood to the wings, but also help stiffen and support them.

A mosquito lifts itself into the air as soon as it beats its wings. It does not have to run or jump to take off. In the air, the mosquito can dart quickly and easily in any direction. Instead of a second pair of hind wings, which most other insects have, a mosquito has two thick, rodlike parts with knobs at the tips—these are what keep the insect in balance. A mosquito must beat its wings constantly while it is in the air. It does not glide during flight nor when coming in for a landing as do butterflies, moths, and most other flying insects. A mosquito beats its wings until its feet touch a landing place.

A mosquito breathes through air holes called spiracles along the sides of its body. The abdomen has eight pairs of spiracles, and the thorax has two pairs. Air flows into the holes, and tubes carry the air from the spiracles to all parts of the mosquito's body.

Most species overwinter in the egg stage, although some species' mated females overwinter to lay eggs in spring.

food/feeding

The males and females of many species sip plant juices, but the females of most species must sip blood before they can lay eggs that will hatch. Each species of female prefers the blood of certain kinds of animals. Some feed only on frogs, snakes, or other cold-blooded animals. Other mosquitoes prefer birds. Still other mosquitoes suck the blood of cows, horses, and people.

Mosquitoes can't really bite because they lack jaws. When a mosquito "bites," it stabs through the victim's skin with six needlelike parts called stylets, which form the center of the proboscis. The stylets are covered and protected by the insect's lower lip, called the labium. As the stylets enter the skin, the labium bends and slides upward out of the way. Then saliva flows into the wound through channels formed by the stylets. The mosquito's saliva keeps the blood from clotting, making it easier to sip.

Most people are allergic to the saliva, which is why an itchy welt called a "mosquito bite" forms on the skin. After the mosquito has sipped enough blood, it slowly pulls the stylets from the wound, and the labium slips into place over them. Then the insect flies away. The amount of blood taken varies greatly among individual mosquitoes. Some may consume more than their own weight from a single "bite".

reproduction

Mosquitoes undergo complete metamorphosis (4 stages of development): (1) egg, (2) larva, (3) pupa, and (4) adult. At each stage, the mosquito's appearance changes completely, and the insect lives a different kind of life. They need fresh water to complete this cycle, which takes one to several weeks.

(1)Egg: The female lays 40–400 tiny white eggs at a time, depending on the species, in stagnant or slow-moving fresh water. One female may lay as many as 1,000 eggs in her lifetime. She lays the eggs through an opening at the tip of her abdomen.

The females of most species of mosquitoes lay their eggs in water or near it, but each species has a favorite spot. Some species' eggs attach to form a raft; others float individually on water, still others lay eggs above the waterline to hatch after the water level rises. The eggs of most kinds of mosquitoes hatch in 2-3 days in warm weather.

The female rests on the surface of the water while laying her eggs, which are narrow at the top. With her hind legs, she carefully pushes the eggs, wide ends downward, into a floating pad.

All mosquito eggs must have moisture to hatch, but not all species lay their eggs in water. Certain mosquitoes, called floodwater mosquitoes, drop their eggs in moist soil on flood plains and on irrigation sites. The eggs hatch after a flood takes place-perhaps a year later.

(2)Larva: An egg hatches into what is often called a wriggler because it is so active. The wrigglers of most species move about by jerking their bodies through the water. A wriggler looks somewhat like a worm or a caterpillar with a thin, skinlike shell covering its body. The wriggler has a broad head with two short, bushy antennae on each side. It has two eyes behind the antennae, near the back of the head.

Unlike an adult mosquito, a wriggler can open its jaws and chew food. Its mouth is on the underside of the head, near the front. Long hairs called mouth brushes grow around the jaws and sweep food into the wriggler's mouth. It eats tiny aquatic life, including bacteria, algae, and one-celled organisms called protozoans. The larvae of some species may eat other wrigglers.

A wriggler breathes through a tubelike siphon (air tube) at the rear of its body. To get air, it pushes its siphon above the surface of the water. The larvae of certain swamp mosquitoes need not come to the surface for air. They get air from the leaves, stems, and roots of various underwater plants. These larvae have a breathing tube with two sharp tips. A larva uses one tip to hold itself to the plant, and moves the other tip back and forth in the plant tissue to get the oxygen stored there.

The larvae of many species of mosquitoes grow quickly. They molt (shed their skins and grow new ones) four times in 4-10 days. After the last molt, the larvae change into pupae. The larvae of some species hibernate in winter. They change into pupae early in spring.

(3)Pupa: A mosquito pupa is shaped somewhat like a comma. The head and thorax are rolled into a ball, and the abdomen hangs down like a curved tail. A thin "skin," like that of the larva, covers the pupa's body.

An air space on each side of the body makes the pupa lighter than water. The pupa breathes through a pair of trumpet-shaped tubes attached to the top of its thorax. It sticks these tubes out of the water to get air. The pupa of certain swamp mosquitoes, whose larva gets air from underwater plants, pushes its tubes into the plant. After this pupa has changed into an adult, it pulls out the tubes and then swims to the surface.

The pupae of most species of insects do not move, but almost all kinds of mosquito pupae can swim. These pupae are sometimes called tumblers because they roll and tumble in the water.

A mosquito pupa does not eat. It changes into an adult in two to four days. The pupal "skin" splits down the back, and the adult mosquito pushes its head and front legs out and then pulls out the rest of its body.

(4)Adult: After the adult mosquito leaves the pupal "skin," it takes several days to rest and harden its outer cuticle. The males are deaf for the first 24 to 48 hours of their lives, until the hairs on their antennae fully develop.

Females seek blood several days after emerging from pupae. Males mate with females one or two days after females emerge. Most species of mosquitoes spend their whole lives within 1 mile of the place where they hatched, but a few kinds may travel as far as 20 miles to find food or mates.

Male mosquitoes live about 7-10 days, but females survive 30 days or more. The females of some species live through the winter in barns, garages, houses, caves, or hollow trees. Some species spend the winter as eggs or as larvae and then mature in the spring.

hazards

(West Nile Virus) The majority of bites do not lead to WNV infection. Less than 1% of persons infected with West Nile Virus develop serious illness. Mammals are believed to be "dead-end hosts," and cannot be a reservoir of transmittable infection. It is assumed that a person infected with WNV will develop lifelong immunity.

Since the 1960's, scientists have turned increasing attention to the biological control of mosquitoes. These programs try to control the populations of certain species without damaging other parts of the environment. One program uses fish that eat mosquito larvae. Another uses the spores of a bacterium, *Bacillus thuringiensis*, to kill the larvae.

Many chemicals are not selective and harm beneficial insects and other non-target organisms. Furthermore, these chemicals only provide temporary reductions in mosquito numbers. Modifying or eliminating breeding sites is the only long-term solution to mosquito problems. Human activities often create breeding sites, as from construction, waste lagoons, ditches, logging, and objects around the home.

Most healthy natural bodies of water have a sufficient variety of predatory insects and fish to keep mosquitoes from reaching nuisance levels. Farm ponds and lakes are not typically major breeding areas if they contain fish and are free of weeds, algae or floating debris in which larvae can hide.

key facts

That Buzz: The hum of a mosquito is the sound of its wings beating. A mosquito's wings move about 1,000 times a second.

Home Bodies: Most species of mosquitoes spend their whole lives within 1 mile of the place where they hatched.

Food: Mosquitoes can only eat liquids; Only female mosquitoes "bite" to obtain blood, which they need for the development of the eggs inside their bodies. She injects anticoagulant to maintain victim's blood flow. Males only drink plant nectar.

The Senses: A mosquito hears and smells with its two long antennae. The long hairs on male antennae help them locate flying females, whose wings make a higher tone than a male's. Females are attracted to prey by sight/light/color, smell (including perspiration, body odor and CO₂), warmth detection and movement.

The larvae of mosquitoes are a favored food of water striders and some fish; adult mosquitoes are eaten by dragonflies.

A mosquito is a type of fly. It undergoes complete metamorphosis.

snails

basics

The snails are related to the oyster, the clam, the mussel, the squid and the octopus. All of these animals are called mollusks. The Snail is a gastropod, a soft-bodied type of mollusk that is basically a head with a flattened foot.

A snail's soft body is usually covered with a coiled shell. Some snails have a conical or tubular shell. Others, including most slugs, have no shell at all. A snail creeps along on a broad muscular organ called a foot. Its body has a head with tentacles (feelers), eyes, and a mouth. In most species, the mouth includes a ribbon of hard, tiny teeth called a radula. Snails move by crawling, swimming, or floating with currents. They inhabit many kinds of environments—forests, deserts, rivers, ponds, ditches, and all parts of the ocean.

- People have traditionally divided snails into three groups, according to where they live: on land, in fresh water, or in salt water. Most of what we are likely to see at the Preserve are freshwater snails.
- Humans have spread some kinds of snails to regions where the animals have become pests. For example, the giant African snail, once found only in Africa, now threatens farmers in North America because it destroys many kinds of plants.
- There are more than 40,000 kinds of living snails. Some are smaller than a pinhead, others measure 2 feet long. A snail's lifespan can range from 1 to over 20 years.

habitat

Land snails usually thrive on the ground in damp shady places—under logs and stones, at the edges of ponds and rivers, and in woods. Freshwater snails live in rivers, ponds, lakes, and hot springs.

adaptations

The soft body is usually protected by a hard shell, which the snail retreats into when alarmed.

Snails have two pairs of tentacles on the head. Land snails have a light-sensitive eyespot located on each of the larger tentacles. Most freshwater snails have a distinctive head with two conspicuous tentacles and a small black eye at the base of each, or eyes on the tips of the tentacles. The smaller pair of tentacles is used for the sense of smell and the sense of touch.

A land snail moves along the ground on its "stomach foot," usually an elongated muscular disk on which it travels by wave-like contractions that pass from front to rear.

The muscles of the foot can move in a wavelike motion that propels the snail forward. A moving snail has a special gland in the foot that secretes mucus (a slimy fluid) to help it glide over the surface. . Most land snails possess a primitive lung-like organ that enables them to take in oxygen from the air.

Some freshwater snails have gills by which they obtain oxygen from the water. Others, such as most of our common pond snails, and the land snails and slugs, breathe with a lung and those living in water must come to the surface frequently.

Some snails have a solid plug to seal the shell opening after the animal retreats inside. The land snails, slugs, and most pond snails have no plug but seal themselves in with a slimy covering when they hibernate to pass the winter, or in order to survive a hot summer drought when ponds go dry. In dry weather, many land snails seal themselves in their shells with a "door" of dried slime called an epiphragm. The snails rest in this condition, called aestivation, until the dry spell ends

food/feeding

Most snails eat living and decaying plants and algae, but some are scavengers and some are predators. When feeding or moving about, a snail can come almost entirely out of the shell, which is permanently attached to and carried on its back

The snail's mouth is on the underside of the head, inside of which is a rough, horny tongue-like organ that has thousands of tiny tooth-like protrusions called denticles. These scrape the algae and other growths from the surfaces of rocks, submerged plants, and muddy or sandy bottoms.

reproduction

Land snails, slugs and air-breathing water snails do not have separate sexes. Instead, each animal has both male and female organs Most other types are either male or female. A few kinds change sexes during their lifetime, usually from male to female.

Land snails typically lay eggs, about 50 at a time, during summer or early autumn in moist areas under rocks or buried in sediment. Some of these eggs have a hard protective cover.

The air-breathing water snails lay tiny eggs, imbedded in clear blobs of jelly, at frequent intervals throughout the year. Most of the gill-breathers have separate sexes and bear their young alive.

key facts

- At the Preserve, most of what we see is species of freshwater snails. On its head are two conspicuous tentacles and a small black eye at the base of each, or eyes on the tips of the tentacles. The smaller pair of

tentacles is used for the senses of smell and touch. They breathe with a lung and must come to the surface frequently to breathe.

- The snail's shell is its protective armor, built of the minerals it takes in when it feeds.
- The snails we see eat living and decaying plants and algae. The mouth is on the underside of the head, inside of which is a rough, horny tongue-like organ that has thousands of tiny tooth-like protrusions called denticles. These scrape the algae and other growths from the surfaces of rocks, submerged plants, and muddy or sandy bottoms.
- Snails provide food for birds, fish, crayfish, frogs, snakes, turtles, beetles and other insects and even other snails.
- Most pond snails can seal themselves in with a slimy covering when they hibernate, or to survive a hot summer drought when their pond goes dry.