

Flies—Order Diptera

Pests and pollinators

Each summer, in Alaska's northern and western tundra, the air and the water alike swarm with insects. Swirl a net in either medium and the vast majority of what you'll catch are members of the order Diptera—the true flies. Mosquitoes, Chironomids, Biting Midges...they're a summer pestilence for bears, humans, and caribou, but they're also a summer feast that provisions fish, dragonflies, and migratory birds.

While many types of insects are referred to as “flies,” only the members of the order Diptera (meaning “two wings” because these insects have only one pair of wings) are considered the true flies. The Diptera are among the most diverse and evolutionarily advanced insect orders on Earth. Alaska's true flies range in size from near-microscopic Chironomids to burly Horse Flies. Many of them have aquatic or semi-aquatic larvae.

Because the Dipteran order is so diverse, the larvae vary quite a bit in shape, size, and color. But in general, aquatic fly larvae are worm-like or maggot-like. Unlike

many other aquatic insect larvae, fly larvae do not have long, jointed legs. Instead, they often have fleshy stubs (prolegs), fleshy knobs called creeping welts, and/or fans of stout hairs that help them squirm, burrow, and swim.

True flies go through complete metamorphosis—they pass through a pupal stage before they become adults. In this stage, they encase themselves in a hard capsule of exoskeleton-like material or in a softer cocoon. Some types go through their pupal stage in the water, while others crawl out of the water to pupate in waterside vegetation or detritus. Some pupae, such as those of Mosquitoes and many Chironomids, are very active, able to swim away from predators. Others are mostly immobile.



At times adult flies can be very abundant near water. These Chironomids are in a mating swarm over a small stream.



Many flies are important in the pollination of flowers. These flies (above) are feeding on pollen from a pond lily. The Flower Fly below mimics a bee (though it can't sting). Notice that unlike a bee, which has four wings, the Flower Fly has only two wings





The order Diptera contains the most notorious Alaskan insects, such as this female Mosquito. Mosquitoes, as well as Black Flies, Biting Midges, Horse Flies, and Deer Flies, can make life miserable for Alaska's humans and wildlife.

As adults, many dipterans (such as this Chironomid) don't feed at all, and may live only a few days.



Fly larvae—such as this Crane Fly larva—often look like worms. Notice the mayfly larva to the left.



Fly larval and pupal stages can look quite different from each other. Above is the larval stage of a Phantom Midge. To the right is the same insect's pupal stage just before the insect emerges as an adult.



Aquatic Dance Flies

Empididae

Aquatic Dance Flies are predators as both larvae and adults. The larvae crawl among rocks and moss in swift-flowing stream reaches. Many consume helpless Black Fly pupae, and some will even use the empty pupal cases as their own pupation chambers. Semi-aquatic species may be found along the wet margins of streams and ponds.

Adults subdue their prey, which may be larger than themselves, with a long dagger-like proboscis. Some have front legs adapted for grasping prey. A few species will also feed on nectar. Mating swarms are often seen over streams, where they fly in dance-like twisting and turning patterns.

Interesting facts

- ▶ Functional Feeding Group: predators

Identification notes

- ▶ **Larvae:** tan to white in color, with 7 or 8 pairs of fleshy prolegs under abdomen
- ▶ Abdomen may be tipped with up to 4 fleshy lobes and/or tufts of hair
- ▶ Small head usually tucked into thorax and visible through the skin as a pair of dark-colored rods
- ▶ **Adults:** dark, with rounded head, distinct “neck,” humped thorax, and tapered abdomen

Stories from the field

“Most dance flies eat other small flies, such as mosquitoes and midges. In some species, the male dance fly offers the female a nuptial gift of an insect he has caught. He can then mate safely while the female is distracted by eating. In other species, the male is more imaginative and artistic. He wraps his gift in silk before offering it to the female, gaining precious time as she unwraps the insect before consuming it. We’ve all known stingy people. But dance flies? One species captures an insect, sucks out the juices for his own meal, and then wraps it in silk. He offers a female the parcel and begins to copulate. By the time she has unwrapped the empty insect shell, he has completed mating and even gotten a meal to boot.” From Crump, Marty (2005). *Headless Males make Great Lovers and other Unusual Natural Histories*. The University of Chicago Press. p. 24.



Aquatic Dance Fly adult



genus *Oreogeton*

Aquatic Dance Fly larva

Biting Midges

Ceratopogonidae

Very few people will ever encounter the larval form of this tiny fly, which is known as a no-see-um or moose fly. Unfortunately, most Alaskans—of many species—are all too familiar with the adult females. To get the energy-rich blood they need to produce eggs, female Biting Midges slice into capillaries with their cutting mouthparts, and drink deep. Although several species are disease vectors, the bites leave only short-lived welts and mild burning sensations. Adult males feed on pollen or nectar.

Larval Biting Midges are able to absorb dissolved oxygen from the water directly through their body wall. They live in streams and ponds; many are adapted to tolerate brackish water and can be quite abundant in estuaries and salt marshes. Some burrow into mud and sand while others wriggle about on the surface of sediments and submerged vegetation. Their diet varies by species and may include invertebrates, algae, or detritus or all of the above.

Interesting facts

- ▶ Some adult females will prey on other insects—including their mates.
- ▶ Some larvae can swim in the water column by rapidly flexing (up to 9 times per second) their long, stiff bodies in a serpentine fashion.
- ▶ To keep themselves from sinking to the bottom, the air-breathing pupae hold pockets of air under their wing pads, keeping their breathing tubes at the surface.
- ▶ Functional Feeding Groups: predators, collectors-gatherers



Biting Midge adult (no-see-um)

Larval identification notes

- ▶ Burrowing larvae needle-shaped
- ▶ Larvae that crawl on the surface shorter, somewhat flattened, with prominent fleshy tubercles or hairs on top of abdomen



Biting Midge larva (burrowing type)

Black Flies

Simuliidae

Black Flies hold the record for the highest population density of any aquatic insect. Their densities are sustained by a constant food supply flowing past in the current of the streams and rivers where they live. Using a pair of fans that surround the mouth, the sedentary larvae of filter-feeding species strain particles such as algae, diatoms, bits of plant matter, bacteria, protozoans, and small invertebrates from the current. Such resources are abundant at lake outlets, where a single square meter may hold tens of thousands of Black Fly larvae. The larvae convert these tiny particles of food into much larger fecal pellets, making the residual nutrients and energy available to other invertebrates.

All Black Fly larvae possess a ring of tiny hooks on the base of the abdomen. To avoid being swept away by the current, they use the hooks to anchor themselves on a pad of silk glued to rocks, wood, or live vegetation. Short distance movements are made using an “inchworm” technique. Dissolved oxygen is absorbed through the body wall. Mature larvae pupate within a cocoon spun from silk.

Adult female Black Flies, with their sharp, serrated mouthparts, are notorious for their bloodsucking ways. Bites usually continue to bleed after the fly has departed, a lingering effect of the anticoagulant used to expedite blood flow. Both sexes feed on nectar, pollen, and a sugary fluid (honeydew) excreted by aphids and other insects. Feeding adults may venture many miles away from their larval habitats. Females lay hundreds of eggs and many species go through several generations in a single year.

Interesting facts

- ▶ Conspicuous white bands on the legs of adults of certain species give those Black Flies the common name “white socks.”
- ▶ Larvae of species without filter fans must move about to feed.
- ▶ To escape predators or to move to new locations, larvae travel downstream on the ends of anchored silken threads.
- ▶ In females the shape of the claw varies among species depending on whether they feed primarily on birds or on mammals.
- ▶ Functional Feeding Group: collectors-filterers or collectors-gatherers



Black Fly larva

Identification notes

- ▶ **Larvae:** Lower one-third of body swollen, so larvae resemble bowling pins
- ▶ **Adults:** Compact, black or brown, and humpbacked
- ▶ Legs short and stout, wings broad
- ▶ Most males have reddish eyes



Black Fly adult (photo by John Hudson)

Chironomids

Chironomidae

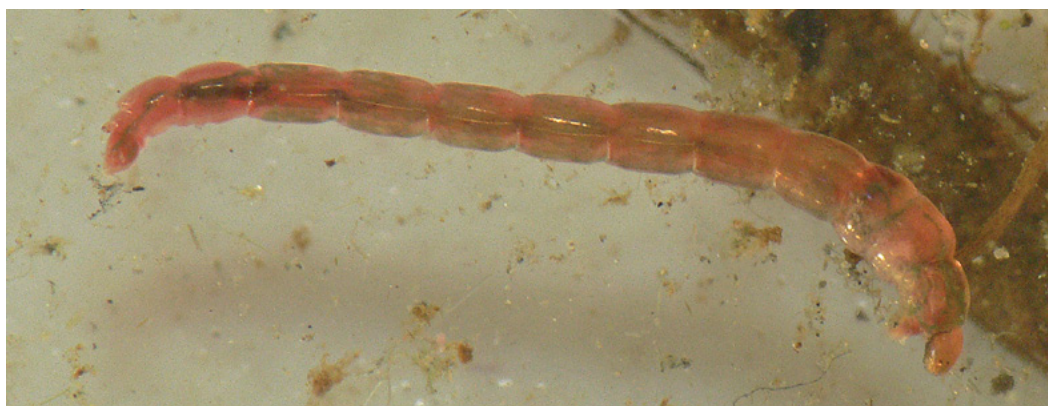
Chironomids are rather plain insects. To the naked eye, the larvae lack any obvious characteristics of an insect—most people dismiss them as worms. The pupae are seldom seen and the adults are easily confused with many other flies, including Mosquitoes. While charismatic critters such as Predaceous Diving Beetles and dragonfly nymphs draw lots of attention, few kids race home from streams to show off jars of larval Chironomids.

Yet, Chironomids may be the most evolutionarily successful and ecologically important aquatic insects on the planet. They hold records for most number of species found at a site, most insect biomass at a site, most numerous insect at a given site, and most widely distributed aquatic insect family. They're consumed by more different species than any other aquatic insect, and they're tolerant of more variation in pH, temperature (-15° to 39° C), and dissolved oxygen. They live in a vast variety of aquatic habitats, from the highest elevation streams to the bottoms of Earth's deepest lakes. Any place in Alaska with a little water—even salty estuaries and silty glacial streams—is likely to be home to at least one species of Chironomid. We've even seen Chironomid larvae living in urinals on supplied stream water.

Chironomid larvae feed on live plants, dead plants, fungi, and other invertebrates, using a wide variety of techniques. Dissolved oxygen is absorbed through the body wall. Most larvae live inside silk-lined tubes or elaborate cases, some are swimmers, and the predators crawl around in search of prey. Some case-builders attach their homes to snails, or to other insects such as mayflies and stoneflies.

Larval identification notes

- ▶ Elongate, slightly curved, and usually cylindrical, with head capsules
- ▶ Paired prolegs near head and at the end of abdomen



Chironomid larva

Interesting facts

- ▶ Some Chironomid larvae are bright red. Hemoglobin allows these larvae to live in low-oxygen environments such as lake bottoms.
- ▶ Adult Chironomids generally don't feed, but some may drink honeydew or nectar. They live only a few days.
- ▶ The larvae of several Chironomid species pass the winter in a dormant state under the ice inside special cocoons.
- ▶ Chironomid adults and larvae are critical food resources for many invertebrates, fish, and birds.
- ▶ Functional Feeding Groups: predators, collector-gatherers, collectors-filterers, scrapers-grazers, shredders



Chironomid adult

Crane Flies

Tipulidae

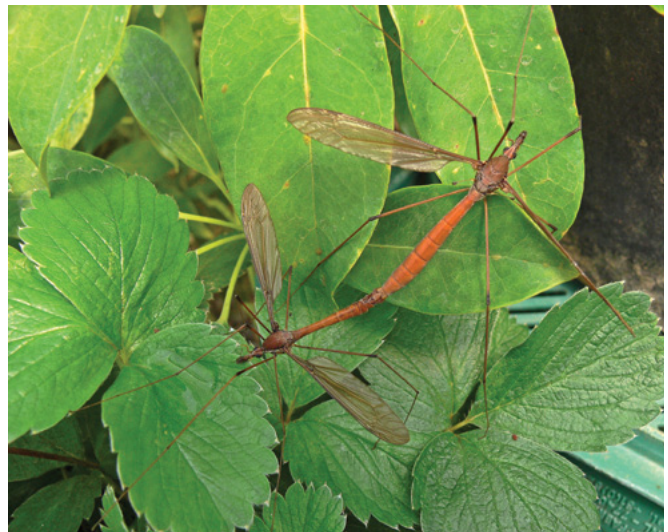
Crane Flies are the largest family of flies, with more than 15,000 aquatic and terrestrial species worldwide. Like the Chironomids, they can be found in just about any aquatic or semi-aquatic habitats and a few are adapted for life in brackish water. Larvae of most aquatic species live on the bottom where they feed on fine organic matter or shed leaves, especially alder leaves. Some species are predatory. Larvae often have swollen abdominal segments covered with spines or stout hairs. These provide the legless larvae with some traction for moving about on or within bottom substrates. While a few species can absorb oxygen from the water, most take in air at the surface through two large spiracles at the end of the abdomen. Fleshy lobes, sometimes covered with non-wettable hairs, surround the spiracles, allowing the larvae to hang from the surface film while replenishing their air supply.

Identification notes

- ▶ **Larvae:** elongate, cylindrical to slightly flattened, and soft-bodied
- ▶ Head usually withdrawn into thorax
- ▶ Head consists mainly of soft tissues except for mouthparts and a few rod-shaped sclerites
- ▶ **Adults:** Look like large Mosquitoes with extremely long legs

Interesting facts

- ▶ Two species found in the state are named after Alaska.
- ▶ Adults are sometimes known as “mosquito hawks” and folk belief says they eat Mosquitoes. They don’t. Because they only live a few days (just long enough to mate and lay eggs), adult Crane Flies don’t feed at all.
- ▶ The thick and tough skin of some larvae has earned larval crane flies the name “leather jackets.”
- ▶ The rather large soft-bodied larvae provide juicy morsels for stream-dwelling fish such as Dolly Varden char and Arctic grayling
- ▶ Functional Feeding Groups: predators, collectors-gatherers, shredders



Crane Fly adults mating



Crane Fly larva

Dixid Midges

Dixidae

Dixid Midge larvae may be found in lakes, ponds, marshes and the slow-moving reaches of small streams. As air breathers they spend most of their time near the surface. Their diet of microscopic algae and animals is filtered from a current of water created by the movements of special brush-shaped mouthparts. By rapidly bending and straightening their bodies, the larvae propel themselves through the water or across the bottom. Mature larvae glue themselves to a fixed substrate just above the water where they pupate. The mosquito-like adults live less than a week, and males swarm at dusk near the edge of water bodies.

Larval identification notes

- ▶ Elongate body usually held in the shape of a “U”
- ▶ Thorax barely enlarged; first and (usually) second abdominal segments have paired short prolegs
- ▶ End of abdomen has breathing tube and pair of paddle-like structures

Interesting facts

- ▶ Because the body of resting larvae will push the water surface slightly upwards, creating a surface bulge called a *meniscus*, they have also been called “meniscus midges.”
- ▶ Functional Feeding Group: collectors-filterers



Dixid Midge larvae

Horse and Deer Flies

Tabanidae

The larvae of Horse Flies (the larger ones) and Deer Flies (the smaller ones) are seldom seen. They burrow through mud and decaying organic matter along the edges of streams and ponds and in the shallows of marshes and swamps. A few species live in estuaries and salt marshes. As air breathers, they're never far from the surface, where they take in oxygen through spiracles at the end of their abdomens. Most Horse and Deer Fly larvae are predators of snails, worms, and other insects. Mature larvae crawl onto land to pupate in moist soil.

Adults are large, and they're strong fliers and will venture miles from water. The females are infamous for their persistent attempts to get a blood meal from mammals, including humans. They inflict a painful bite with mouthparts designed to cut through skin and suck blood. Females also feed on pollen and nectar, as do the males.

Identification notes

- ▶ **Larvae:** cylindrical and tapered at both ends
- ▶ Most abdominal segments encircled with "creeping welts"
- ▶ Head is well developed, but usually withdrawn into the thorax
- ▶ **Adults:** stout-bodied with patterned wings and colorful eyes



Horse Fly adult

Interesting facts

- ▶ Adult Horse and Deer Flies are fond of sunny, warm weather; cool, cloudy weather keeps them grounded. Females, always on the lookout for blood, are attracted to large moving objects.
- ▶ American Emerald and Four-spotted Skimmer Dragonflies will readily grab and consume Deer Flies as they swarm about one's head.
- ▶ To avoid trips to the surface for air, a few species have breathing structures modified for tapping into plant roots to "steal" oxygen.
- ▶ Functional Feeding Group: collectors-gatherers



Horse or Deer Fly larva

Longlegged Flies

Dolichopodidae

Longlegged Flies are a diverse group of mostly terrestrial flies with nearly 7,000 species known worldwide. Aquatic and semi-aquatic larvae live in a variety of habitats: mud and sand along the edges of streams and lakes, algal mats, decaying seaweed, and damp soil and leaf litter. Some have been found in the hollow stems of sedges. Aquatic larvae stay close to the surface where they take in air through spiracles at the tip of their abdomens. Both the adults and larvae are predators. The maggot-like larvae use creeping welts to provide traction while in pursuit of their favorite prey: Chironomids and Mosquito larvae. Most adult Longlegged Flies have conspicuously long legs and metallic greenish-blue to greenish-bronze coloration. Like adult Dance Flies, they engage in dance-like mating swarms over water and some adults spend much of their time skimming over the water surface.

Larval identification notes

- ▶ Body white, cylindrical, and elongate with fleshy ridges encircling each abdominal segment
- ▶ Head is usually retracted into thorax and is mostly comprised of soft tissue containing 4 dark rod-shaped sclerites
- ▶ End of abdomen concave (enclosing the spiracles) and surrounded by rearward projecting lobes

Interesting facts

- ▶ Adult males engage in elaborate courtship displays that involve waving their boldly colored legs in the “face” of a potential mate.
- ▶ Functional Feeding Group: predators



*Longlegged Fly larva
(photo by California
Dept. of Fish & Game,
Aquatic Bioassessment
Laboratory)*

*Longlegged Fly larva showing the end
of the abdomen (photo by California
Dept. of Fish & Game, Aquatic
Bioassessment Laboratory)*



Longlegged Fly adult (photo by Tom Murray)

Mosquitoes

Culicidae

Mosquito larvae, often called “wrigglers,” move about by rapidly flexing their legless bodies. They are air breathers, spending much of their time at the surface where most replenish oxygen supplies through a snorkel-like tube at the tip of the abdomen. Nearby movements or looming shadows send these wrigglers downward to the safety of the depths. Larvae inhabit ponds, ephemeral pools and puddles, and slow-moving waters.

Most Mosquito larvae are suspension feeders. Mouth brushes create a current of water past the head from which they filter microorganisms, zooplankton, and detritus. Some scrape food off surfaces; others will actually drink water to extract the smallest of suspended particles. The pupae, sometimes called “tumbler,” can be quite mobile, but they spend most of their time hanging just below the surface until emerging as adults a few days later.

As with other blood-sucking flies, it's the female that does the biting (actually piercing) to get the protein she needs for her developing eggs. Victims include birds, mammals, and even amphibians.

Identification notes

- ▶ **Larvae:** lack prolegs, and thorax is much larger than rest of body
- ▶ Most possess a respiratory siphon that projects at an angle from the tip of the abdomen
- ▶ **Adults:** long proboscis
- ▶ Wings scaly and held flat over body

Interesting facts

- ▶ In Alaska's Interior, an 8-inch by 7-inch patch of the human forearm can receive an estimated 280 Mosquito bites per hour.
- ▶ Mosquitoes can beat their wings as fast as 600 times per second! Small species beat their wings faster than larger species, and wingbeat frequency increases with increasing air temperature. In mating swarms, males find females by the pitch of their wing vibrations.
- ▶ Functional Feeding Groups: collectors-filterers



Male Mosquito—note the feathery proboscis (a)



Mosquito larva



Mosquito pupa



Female Mosquito—note the piercing proboscis (b)

Moth Flies

Psychodidae

Moth Flies get their common name from the adult's resemblance to a tiny moth. The larvae, however, have been provided with their own special common names—filth flies, drain flies, or sewage flies. These names identify them with their habits and habitats, not their appearance. While some species live in clear, fast flowing streams, other species can be found living in moist to semi-liquid decomposing organic matter, the type of foul-smelling scum and sludge common in wastewater treatment plants, sink and shower drains, and sewage lagoons. Out in nature, floating mats of moss and algae and the margins of ponds make a nice home.

Not surprisingly, the larval diet consists of detritus, wastes, and the associated rich growths of algae, fungi, and bacteria. A short breathing tube on the end of the abdomen protrudes above the anoxic ooze to provide the larva access to fresh air. Larvae also have a pair of lateral spiracles on the thorax.

Interesting facts

- ▶ Drain-dwelling Moth Fly larvae successfully contend with hot water, soaps, and cleaners and other chemicals
- ▶ The nocturnal adults are weak fliers usually found in damp habitats; they feed on polluted water and flower nectar.
- ▶ Functional Feeding Groups: collectors-gatherers



Moth Fly adult (photo by Tom Murray)

Identification notes

- ▶ **Larvae:** body segments (a) divided two or three times into secondary segments—many topped with a sclerotized plate
- ▶ Thorax similar in width to the rest of the body
- ▶ Abdomen ends in a short breathing tube
- ▶ **Adults:** body hairy; wings covered with hairs or scales
- ▶ Wings often broadly rounded ending in a slight point and held over body roof-like or flat and to the sides
- ▶ Color varies from yellow to black



Moth Fly larva (photo by California Dept. of Fish & Game, Aquatic Bioassessment Laboratory)

Mountain Midges

Deuterophlebiidae

Mountain Midges live in extreme habitats. The larvae of most species are found in very steep, cold, and swift-flowing mountain streams. These lives in the “fast lane” require a highly specialized body form to endure the pounding of falling water. Flattened bodies, and clusters of tiny curved hooks on their abdominal prolegs, help the larvae hold their own and even crawl about over slick algae-covered rocks. High levels of dissolved oxygen in these cold and turbulent streams allow the larvae to literally breathe through their skin. They graze on the thin layer of biofilm growing on the bedrock and boulder surfaces.

Adult Mountain Midges are delicate and extremely short-lived flies. The time from emergence through mating and egg-laying to death is less than two hours. Males emerge first—early in the morning—and swarm over the water awaiting the emergence of females. After mating, the female lays her eggs underwater, losing her wings as she crawls below the surface. Eggs hatch in spring. The oval-shaped pupae affix themselves to the surface of rocks. Most species complete one generation per year.

Interesting facts

- ▶ Adults lack functional mouthparts.
- ▶ Evolutionarily, Mountain Midges are one of the most primitive families of flies.
- ▶ Only six species have been found in North America.
- ▶ Functional Feeding Group: scrapers

Identification notes

- ▶ **Larvae:** Forked antennae
- ▶ Head and thorax distinct from abdomen
- ▶ Seven pairs of long lateral prolegs
- ▶ **Adults:** Silvery blue fan-shaped wings widest at the base
- ▶ Male antennae can be nearly four times as long as the body

Mountain Midge larva



Stories from the field

Researchers from Michigan State University were the first to discover Mountain Midges in Alaska, in Fish Creek near Juneau. Intent on photographing the larvae, we visited the stream in early winter while it was ice-free and still flowing well. We had high hopes of collecting them, as most aquatic insect larvae can be found during any time of the year. Armed with a stiff brush, waders, and winter clothes we searched the areas of the stream where they had been found before. After a few hours we got lots of aquatic insects, especially stoneflies and mayflies, but no Mountain Midges. After returning home we discovered that Mountain Midges overwinter as eggs, rather than as larvae or pupae. Most species have a single generation per year.

Net-winged Midges

Blephariceridae

Net-winged Midge larvae are uniquely equipped to live in current that would sweep most other insects downstream. On the undersides of their abdomens are six attachment discs. Pressure applied to the disc creates suction by forcing water out through a v-shaped notch. To move around, the larvae alternately release, move, and attach the three front and three rear sets of discs, their route thus tracing a zig-zag pattern. The larvae scrape biofilm from rock surfaces. Dissolved oxygen is absorbed through the body wall and through paired tufts of gills on the undersides of the abdominal segments.

Adult Net-winged Midges look like delicate versions of Crane Flies. Females are predators of other insects; males feed on nectar or not at all. Females crawl under water to cement their eggs to substrates, or lay them on the wet surfaces of rocks near the stream. Net-winged Midges have a single generation each year and overwinter as larvae.

Interesting facts

- ▶ Upon emergence, adults' wings are quickly unfolded and immediately functional, allowing them to depart the water surface before drowning in the swift current. Creases in the wing give it a netlike appearance.
- ▶ Larvae are restricted to smooth-surfaced rocks because their attachment discs cannot generate suction pressure on moss-covered or rough-textured rocks.
- ▶ Functional Feeding Group: scrapers

Larval identification notes

- ▶ Flattened, with seven apparent segments; first through sixth segments each bear a single attachment disc on the underside and a pair of short lateral leglike structures called pseudopods



Net-winged Midge larva showing the attachment discs (a)



Net-winged Midge larva top view



Net-winged Midge larva side view

Phantom Crane Flies

Ptychopteridae

Larval Phantom Crane Flies are quite at home in a habitat that few aquatic insects would tolerate. They prefer the stagnant shallow (3 cm deep) margins of swamps and ponds, where they live in and on water-saturated decaying organic matter – otherwise known as muck. While the front end is occupied with the consumption of fine decaying organic matter and associated microorganisms, a long narrow extendable breathing tube at the back end pokes up like a snorkel through the muck and water surface to obtain air.

Ice formation in the fall sends the larvae deep into the sediment, where they remain dormant while absorbing oxygen through their cuticles. Like the larvae, pupae obtain air through a long breathing tube. Adults emerge in May and June to mate.

Identification notes

- ▶ **Larvae:** body extendable
- ▶ Pairs of prolegs (b) on each of first 3 abdominal segments
- ▶ Long breathing tube (a) on tip of abdomen
- ▶ **Adults:** resemble adult Crane Flies



Phantom Crane Fly larva

Interesting facts

- ▶ Some adults have very long, swollen legs with conspicuous bands of white and black. These species extend their legs outward to “sail” through the air on a breeze. When flying through partial shade the black parts on the adult appear and reappear, phantom-like.
- ▶ Functional Feeding Group: collectors-gatherers, shredders

Stories from the field

Seeing an adult for the first time was an exciting experience. While looking for insects at night with a head lamp, we came across something white that was rapidly revolving in a circle. Only after taking its photo with a high speed flash did we realize it was a Phantom Crane Fly adult. It had black and white markings on each leg and was rapidly moving up and down, which presented a very confusing circle of white.



Phantom Crane Fly adult (photo by Tom Murray)

Phantom Midges

Chaoboridae

Phantom Midges are named for the transparent larvae of some species. These long, narrow larvae float horizontally in the water column, with the assistance of air bladders. They absorb oxygen through their body walls directly from the water. Other Phantom Midge larvae resemble Mosquito wrigglers, and like wrigglers they breathe air and spend most of their time at the surface.

All Phantom Midges are predators. They use a sit-and-wait strategy to get their food, capturing, impaling, or crushing any prey that wander within reach of their grasping antennae. Prey include Mosquitoes and other small invertebrates, including those that fall into the water.

Like Mosquito larvae, Phantom Midge larvae propel themselves through the water by rapidly flexing and jerking their bodies. Adults live for less than a week. They feed on nectar, pollen, and insect secretions or not at all.

Interesting facts

- ▶ Phantom Midges are among the most common fossil insects found in lake sediments.
- ▶ Many lake-dwelling species make daily vertical migrations. Daytime is spent hidden within bottom sediments; at night the larvae ascend into the upper waters to feed. This behavior reduces the risk of being eaten by fishes that feed by sight.
- ▶ Phantom Midges were once classified as belonging to the Mosquito family (Culicidae).
- ▶ Functional Feeding Group: predators



Phantom Midge pupa



Phantom Midge adult
(photo by Tom Murray)

Larval identification notes

- ▶ Some almost transparent, with a single jointed grasping antenna above the mouth (a)
- ▶ Mosquito-like species lack the mouth brushes of Mosquitoes and have grasping antennae and large mandibles



Two types of Phantom Midge larva (above and below)

Rattailed Maggots/Flower Flies

Syrphidae

The larvae of these flies are aptly named for their maggot-like body form and long, tail-like, retractable breathing tubes. In some species the tube can be several times longer than the body. The larvae of aquatic and semi-aquatic species live in tree holes and the shallow margins of marshes and ponds. In these habitats they burrow within sediments so highly enriched with organic matter that oxygen is often lacking. By extending their breathing tubes to the water surface, the larvae are able to remain buried while feeding on decaying organic matter and associated microorganisms.

The adults, commonly called “flower” or “hover” flies, feed on nectar and frequently hover during flight. Although harmless, the adults mimic bees and wasps. Their yellow and black stripes suggest to would-be predators that they can sting.



Rattailed Maggot adult known as a Flower Fly

Stories from the field

Seeking to get a photo of a Rattailed Maggot, we searched several marshy areas that appeared to be oxygen deficient, but to no avail. Would they be at our local sewage treatment plant? We requested and received a personal tour and permission to look for the “maggots.” When we found a perfect lagoon—the foulest spot in the facility—we said, “We’ll think about it.” In the meantime, someone suggested trying our local horse stables. Much to our relief we found Rattailed Maggots living in the pond where horse manure was disposed of.

Interesting facts

- ▶ Some species are common in the organic sludge found in sewage-treatment lagoons.
- ▶ Breathing tube lengths vary with the depth of each species’ preferred habitat.
- ▶ In Juneau we’ve seen Rattailed Maggot larvae living in small bedrock pools covered by the Mendenhall Glacier several decades ago.
- ▶ Functional Feeding Groups: collectors-gatherers, predators

Larval identification notes

- ▶ Semitransparent with blunt front end and long breathing tube at back end
- ▶ Some species have prolegs



Rattailed Maggot larva

Shore Flies

Ephydridae

Shore Fly larvae are air breathers. Most species get their oxygen at the water surface through a short breathing tube. For this reason they are restricted to the shallows, fine organic matter saturated with water, and floating mats of algae. Although confined to living near the air-water interface, Shore Flies have colonized an impressive variety of habitats: streams, lakes, ponds, bog pools, and thermal springs as well as alkaline lakes, salt marshes, estuaries, and tide pools.

Larval diets are equally varied. Depending on the species, larvae prey on live invertebrates or scavenge dead ones, shred or scrape algae, and engulf dead organic matter and the microorganisms contained therein.

The adults, often called Brine Flies, are small flies commonly seen swarming in the air, skating on the water surface, or running about on algal mats. They feed on algae and dead insects; some even prey on springtails.

Interesting facts

- ▶ Outside of Alaska, Shore Flies have been found living in natural pools of crude oil and in hot springs where water temperatures exceed 45°C (133°F).
- ▶ Some larvae have breathing tubes designed to pierce and obtain oxygen from plant roots. This behavior reduces the risk of being eaten by sight-feeding fishes while breathing at the surface.
- ▶ Many of the pupae are quite distinctive: they have a pair of hooks or a hook-like structure for gripping vegetation (a).
- ▶ Functional Feeding Groups: predators, collectors-gatherers, shredders, scrapers

Larval identification notes

- ▶ Body cylindrical and tapering towards the head
- ▶ Head inconspicuous
- ▶ Abdomen ending in a pair of small spines or a breathing tube, which may be forked



Shore Fly pupa



Shore Fly larva (photo by Rich Merritt)



Shore Fly adult (just emerged)

Snail-killing Flies

Sciomyzidae

Most Snail-killing Flies, true to their name, kill snails during the larval stage—but different species kill in different ways.

Predatory larvae burrow into snail egg masses to engulf and consume eggs, or they attack snails by biting the foot. In the latter case when the snail responds by withdrawing its foot, it pulls the larva into the shell, where the larva quickly consumes its victim. Each larva may kill and consume several snails.

In contrast, "parasitoid" Snail-killing Fly larvae invade and consume a single "host." Death is prolonged for the victim of a parasitoid; these larvae take their time consuming the snail—while it's still alive—over a period of several days.

As air-breathers, Snail-killing Fly larvae are usually found close to the water surface, where they take in air through abdominal spiracles. Pupation may occur inside snail shells and in moist detritus. Some pupae are free-floating.

Interesting facts

- ▶ The larvae can gulp air to maintain buoyancy.
- ▶ Some parasitoid species feed on Fingernail Clams as well as snails.
- ▶ Adults are commonly called Marsh Flies.
- ▶ Functional Feeding Group: predators, parasitoids

Identification notes

- ▶ **Larvae:** yellow to dark brown, cylindrical, tapered at both ends
- ▶ Body segments of many species encircled with rounded tubercles
- ▶ Spiracles surrounded by fleshy lobes or located on a short, broad breathing tube
- ▶ Some larvae covered in a thick layer of short, fine hairs
- ▶ **Adults:** house-fly size, yellowish to brownish in color
- ▶ Conspicuous forward-pointing antennae
- ▶ Many have brown markings on wings

Snail-killing Fly larva (photo by California Dept. of Fish & Game, Aquatic Bioassessment Laboratory)



Adult Snail-killing Flies mating (photo © Bruce Marlin)