

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

---

Waterfowl Management Handbook

US Fish & Wildlife Service

---

January 1990

### 13.3.3. Aquatic Invertebrates Important for Waterfowl Production

Jan Eldridge

*Bell Museum of Natural History; University of Minnesota, Minneapolis, MN*

Follow this and additional works at: <https://digitalcommons.unl.edu/icwdmwfm>

 Part of the [Environmental Sciences Commons](#)

---

Eldridge, Jan, "13.3.3. Aquatic Invertebrates Important for Waterfowl Production" (1990). *Waterfowl Management Handbook*. 16.

<https://digitalcommons.unl.edu/icwdmwfm/16>

This Article is brought to you for free and open access by the US Fish & Wildlife Service at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Waterfowl Management Handbook by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

## 13.3.3. Aquatic Invertebrates Important for Waterfowl Production

Jan Eldridge  
*Bell Museum of Natural History*  
*University of Minnesota*  
*Minneapolis, MN 55455*

Aquatic invertebrates play a critical role in the diet of female ducks during the breeding season. Most waterfowl hens shift from a winter diet of seeds and plant material to a spring diet of mainly invertebrates. The purpose of this chapter is to give managers a quick reference to the important invertebrate groups that prairie-nesting ducks consume.

Waterfowl species depend differentially on the various groups of invertebrates present in prairie wetlands, but a few generalizations are possible. Snails, crustaceans, and insects are important invertebrate groups for reproducing ducks (Table). Most species of laying hens rely on calcium from snail shells for egg production. The northern shoveler and gadwall are dependent on crustaceans that swim in the water and forage on algae and fine organic matter. The northern shoveler has an enlarged bill and finely developed lamellae for sieving crustacea from the water. Early-nesting species such as northern pintails and mallards consume early-emerging midge larvae in addition to earthworms, which are often the most available food in ephemeral wetlands shortly after the snowmelt. The diving ducks consume free swimming amphipods or larger insects such as caddis fly and dragonfly larvae that tend to occur in deeper water.

The community of invertebrates present in a wetland can indicate the history of water changes in



that wetland. For example, invertebrates such as leeches, earthworms, zooplankton, amphipods, isopods, and gastropods are dependent on passive dispersal (they can't leave the wetland under their own power). As a result, they have elaborate mechanisms to deal with drought and freezing. A second group that includes some beetles and most midges can withstand drought and freezing but requires water to lay eggs in spring. A third group that includes dragonflies, mosquitoes, and phantom midges lays eggs in the moist mud of drying wetlands during summer. A fourth group that includes most aquatic bugs and some beetles cannot cope with drying and freezing, so they leave shallow wetlands to overwinter in larger bodies of water. Managers can use the presence of these invertebrates to determine the effectiveness of water management regimes designed for waterfowl production.

The following descriptions of invertebrate natural history are based on Pennak (1978).

### **Invertebrate Natural History**

#### **OLIGOCHAETA (Aquatic and Terrestrial Earthworms)**

**Natural History:** Earthworms mix the substrate soils and consume algae and detritus. Their distribution is usually not limited by temperature and many truly aquatic forms survive in low oxygen concentrations. Some earthworms form cysts or cocoons that are transported by birds or the wind.

Table. *Invertebrate classification. The following is a list of the taxonomy of aquatic organisms that will serve most management purposes.*

Phylum	Class	Order	
Annelida	Oligochaeta (terrestrial and aquatic earthworms)		
	Hirudinea (leeches)		
Arthropoda	Crustacea	Anostraca (fairy shrimp)	
		Conchostraca (clam shrimp)	
		Cladocera (water fleas)	
		Copepoda (copepods)	
		Ostracoda (seed shrimp)	
		Amphipoda (scuds and side-swimmers)	
		Insecta	Ephemeroptera (mayflies)
			Odonata (dragonflies)
			Hemiptera (true bugs)
		Trichoptera (caddis flies)	
	Coleoptera (beetles)		
	Diptera (flies and midges)		
	Lepidoptera (butterflies and moths)		
Mollusca	Gastropoda (Snails)		

**Importance to Waterfowl:** Terrestrial earthworms in temporarily flooded, ephemeral ponds early in spring are particularly important to early-nesting mallard and northern pintail hens.

### HIRUDINEA (Leeches)

**Natural History:** Some leeches are blood sucking and forage on birds, mammals, fish, snails, insects, and earthworms. Leeches prefer warm water, and are common in protected shallows. They are primarily nocturnal and require a substrate of rocks or vegetation, so they are uncommon in wetlands that have pure mud or clay bottoms. Leeches survive winter and droughts by burrowing into the mud and becoming dormant.

**Importance to Waterfowl:** Leeches are not particularly important to waterfowl as food, although they are eaten by mallards in small amounts.

## Crustacea

### ANOSTRACA (Fairy Shrimp)



**General Description:** Fairy shrimp generally swim on their backs. They have 2 stalked, compound eyes, 11 pairs of swimming legs that resemble paddles, and no hard external covering.

**Natural History:** Fairy shrimp are common in small ephemeral and temporary ponds early in spring. They glide upside down, beating their legs in a wave-like pattern from tail to head. Their leg action draws food into the ventral groove toward the mouth. They feed on algae, bacteria, protozoa, and bits of detritus.

Fairy shrimp lay two kinds of eggs: summer eggs that hatch soon after laying, and resting eggs that sink to the bottom, where they withstand drying or freezing and hatch the next spring. Larvae develop through a series of "nauplius" instars and mature rapidly; some become adults in as few as 15 days.

**Importance to Waterfowl:** Because fairy shrimp are among the first invertebrates in spring, they are consumed by early laying northern pintail and mallard hens. They also occur in the diets of northern shoveler and blue-winged teal.

### CONCHOSTRACA (Clam Shrimp)



**General Description:** This organism is enclosed in a shell-like outer carapace, and resembles a tiny swimming clam. Clam shrimp have 10–32 pairs of legs and 2 pairs of antennae.

**Natural History:** Clam shrimp seem to prefer brackish water and swim by moving their large biramous antennae in a rowing motion. Their natural history is similar to that of the fairy shrimp.

**Importance to Waterfowl:** Clam shrimp form an important part of the diet of laying gadwall hens, and also occur in the diet of mallards and northern shovelers.

### CLADOCERA (Water Fleas)



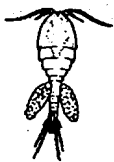
**General Description:** Water fleas range in size from 0.2 to 3.0 mm long. Superficially, the body appears bivalve with the abdomen and thoracic regions covered by a carapace. The head is compact with two large, compound eyes. Water fleas have large antennae with two segmented rami extending from a large base. They have five to six pairs of biramous legs that are hidden in the carapace.

**Natural History:** Water fleas use their antennae to swim and appear to hop uncertainly in the water. Their legs produce a current between the valves of their carapace where food collects in the median groove and streams toward the mouth. Algae, detritus, and protozoans are the major items consumed. Water fleas migrate vertically, moving upward in the evening and downward at dawn. They can exist in a variety of temperature and oxygen concentrations.

Water fleas hatch from resting eggs at first thaw. As the water warms they reproduce rapidly, often reaching a large population of 200–500 fleas per liter of water. The population wanes and by summer, few are present in the ponds. Usually they reproduce parthenogenetically; however, as conditions deteriorate later in the season, they produce eggs.

**Importance to Waterfowl:** Water fleas form a major part of the diet of the laying northern shoveler. Cladocera are also consumed by gadwall and mallard hens.

### COPEPODA (Copepods)



**General Description:** Most copepods are less than 2.0 mm long. Usually they are drab in color; however, in spring, some species are bright orange, purple, and red. The head and part of the thorax are fused in a cephalo-

thorax. The remainder of the thorax and abdomen are segmented. Copepods have large antennae and five thoracic segments that have legs that are used for swimming. They have no abdominal appendages.

**Natural History:** Most copepods forage on algae, plankton, and detritus. Some forage by scraping food from the pond bottom and some by filtering plankton from the water. Many swim in a smooth, slow motion that is produced by the feeding movements of the mouthparts and antennae, punctuated by jerky leg movements. The front antennae are held stiff and act as a parachute to keep the copepod from sinking.

Copepods breed throughout summer, and are tolerant of oxygen depleted water and adverse conditions such as drying and freezing. Some survive winter as resting eggs, some go into diapause on the wetland bottom and others form cysts or cocoons. Development is through a series of stages before maturity. The time to maturity varies, depending on the environment and the species.

**Importance to Waterfowl:** Waterfowl do not depend on this group but copepods account for a small portion of the diet of laying northern shoveler and gadwall hens.

### OSTRACODA (Seed Shrimp)



**General Description:** Superficially, ostracods resemble tiny seeds. They are usually less than 1 mm long with an opaque, bivalve shell that varies in color.

**Natural History:** Seed shrimp tolerate a wide range of environments, temperature, and water chemistry. Most species occur in water less than 1 m deep on varying substrates. Omnivorous scavengers, they forage on bacteria, molds, algae, and fine detritus. Eggs can suspend development in dry and freezing conditions and some live as long as 20 years in the dried condition.

**Importance to Waterfowl:** Seed shrimp, like copepods, do not dominate the diet of laying females; however, they are consumed in small amounts by gadwall, northern shoveler, and blue-winged teal.

### AMPHIPODA (Scuds, Side-swimmers, or Freshwater Shrimp)



**General Description:** Most amphipods are 5–20 mm long with segmented thorax and abdomen. Their eyes are usually well developed.

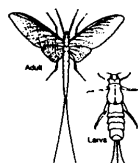
**Natural History:** Amphipods are primarily nocturnal. They swim rapidly just above the substrate, rolling from side to back. Omnivorous scavengers, they consume various plant and animal material. They often browse on the film covering vegetation that is composed of microscopic plants, animals, and detritus.

Amphipods are restricted to cold, shallow water, and an abundance of oxygen is essential. They are generally found in permanent wetlands where they can become abundant, and are not generally adaptable to withstanding droughts.

**Importance to Waterfowl:** Amphipods are very important to scaup, especially in fall, but they are not particularly important for dabbling ducks. Blue-winged teal, gadwalls, and mallards consume small amounts.

## Insecta

### EPHEMEROPTERA (Mayflies)



**General Description:** The aquatic juvenile stage of a mayfly, known as a nymph, is characterized by a long body with a large head, large eyes, and long antennae. The tracheal gills on the abdominal segments are the important

feature for distinguishing the mayfly nymph from other insects.

**Natural History:** Mayflies occur in fresh water with a high oxygen concentration. Most are herbivores or detritivores, however, some are carnivorous and feed on midge larvae. Mayflies are nymphs most of their lives, which can extend for 1–3 years. Adults live 24 h to a few days, mate, lay eggs, and then die.

**Importance to Waterfowl:** Although mayfly nymphs are not an important item in the diets of waterfowl, they are commonly found in wetlands.

### ODONATA (Dragonflies, Damselflies)



**General Description:** Nymph—Dragonfly nymphs according to Pennack are "...grotesque creatures, robust or elongated and gray, greenish or somber-colored." The body may be smooth or rough, bearing small spines; it is often covered with growths of filamentous algae and debris. The most striking feature of the larva is the modified mouthparts that are large and folded under the head and thorax.

**Natural History:** Many dragonflies and damselflies live for 1 year but the large aeschnids live for about 4 years. Odonate nymphs are carnivorous. Nymphs emerge from the water in the morning.

**Importance to Waterfowl:** Dragonfly nymphs are more important to diving ducks than to dabbling ducks.

### HEMIPTERA (True Bugs)



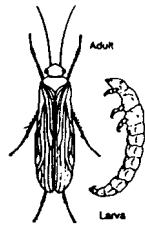
**General Description:** True bugs have mouthparts that form a piercing beak. Their wings are leathery at the base and membranous at the tip. Their size and shape varies.

**Natural History:** Aquatic bugs are predaceous, primarily foraging on other insects. They grasp their prey with specialized front legs and suck body fluids with their beak. They winter as adults hidden in the mud and vegetation.

**Importance to Waterfowl:** Hemiptera occur in small amounts in the diets of gadwall, blue-winged teal, and northern shoveler hens.

### TRICHOPTERA (Caddis Flies)

**General Description:** Adult—Adults are small and inconspicuous. They resemble moths with folded wings and a dodging flight pattern. Caddis

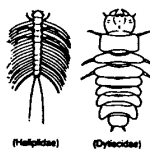


fly larvae are aquatic and most build portable cases of debris.

**Natural History:** Caddis flies occur in a variety of wetland types that have sufficient oxygen concentrations. They may have one or two generations per year and many larvae overwinter in the wetland. Most are omnivorous but there are grazers, scrapers, suspension feeders, filter feeders, and carnivores.

**Importance to Waterfowl:** Caddis flies are particularly important to laying canvasbacks and they also occur in the diets of mallard, gadwall, blue-winged teal, and redhead hens.

### COLEOPTERA (Beetles)



**General Description:** Beetles are easily distinguished as adults—their forewings are modified into horny shields that cover the abdomen. Larvae are long and thin with six legs—three on a side—characteristic of insects.

**Natural History:** Most adult aquatic beetles are dependent on air. Adults and larvae occur in shallow water near shore, particularly where there are quantities of debris and aquatic vegetation. Beetles are generally absent from wave-swept shores and deep water. Adults overwinter by burrowing into debris or mud on the bottom of the wetland. The aquatic larvae are highly variable; for example, Dytiscidae (predatory diving beetles) are adapted for a carnivorous life style, whereas Haliplidae (crawling water beetles) larvae are vegetarian, slug-like and sticklike in appearance. Aquatic beetles often have terrestrial pupae.

**Importance to Waterfowl:** Aquatic beetles occur in small amounts in the diets of gadwall, mallard, northern pintail, blue-winged teal, northern shoveler, redhead, and canvasback hens.

### DIPTERA (Flies and Midges)



**General Description:** This order includes all two-winged flies such as horseflies, mosquitoes, crane flies, midges, houseflies, hover flies, and bot flies. Aquatic diptera larvae are highly variable; most are wormlike and lack eyes or jointed thoracic legs.

Their bodies are usually soft and flexible. Some larvae such as midges (Chironomidae) have short, stumpy forelegs.

**Natural History:** Midges are especially important to waterfowl. They occur throughout aquatic vegetation and on the bottom of all types of wetlands. Many hide in fragile tubes they construct of algae and silt. The most abundant type, known as "bloodworms," are bright red in color. Midge larvae are chiefly herbivorous and feed on algae, higher plants, and detritus.

**Importance to Waterfowl:** Aquatic Diptera are of major importance to blue-winged teal, northern pintail, mallard, gadwall, and redhead hens.

## LEPIDOPTERA (Butterflies and Moths)

**General Description:** Only one family of Lepidoptera have larvae that are truly aquatic. These larvae resemble terrestrial caterpillars—adults are small and inconspicuous.

**Natural History:** The aquatic moth larvae are found in ponds that are densely overgrown with aquatic vegetation. Larvae often construct cases with two leaves and crawl around with the case. Species winter as immature larvae.

**Importance to Waterfowl:** Moth larvae are only of minor importance to mallard hens.

## GASTROPODA (Snails)

**General Description:** Most snails are readily identified because of their coiled shell.

**Natural History:** Most snails are vegetarian. They consume the film of algae that coats submerged surfaces. Many are hermaphroditic and may be self-fertilized or cross-fertilized. Eggs are often deposited in a gelatinous mass in spring, and early development takes place before hatch. When a snail leaves the egg mass, it has taken on the morphological characteristics of the adult. Most snails live 9 to 15 months. In warmer climates, snails may have two to three generations per year.

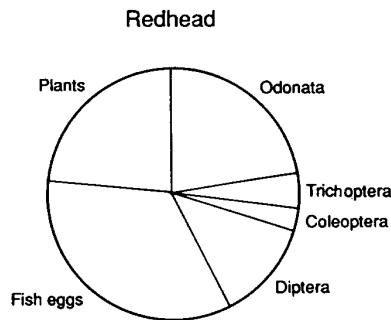
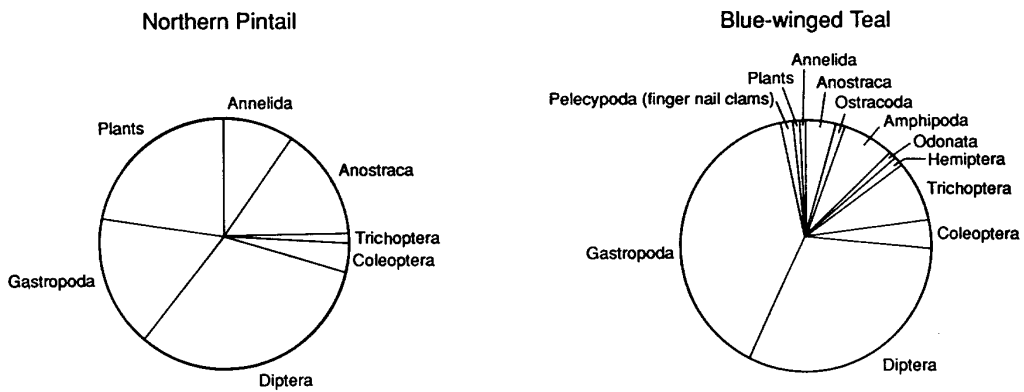
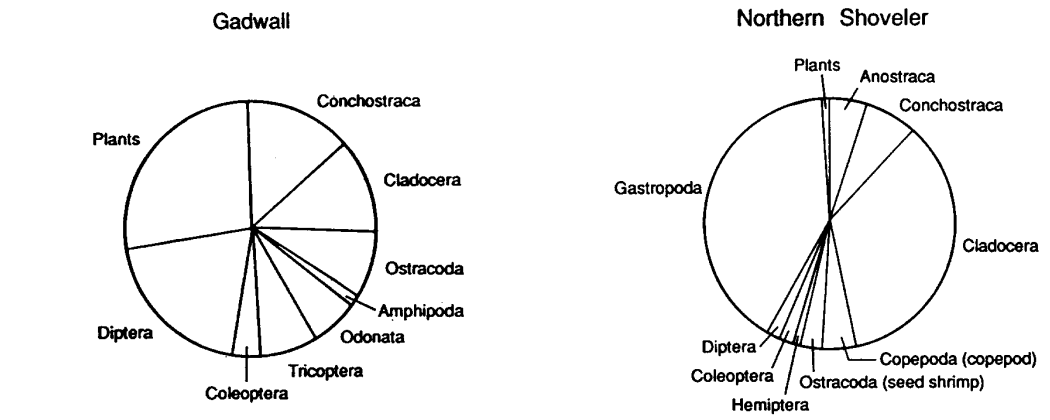
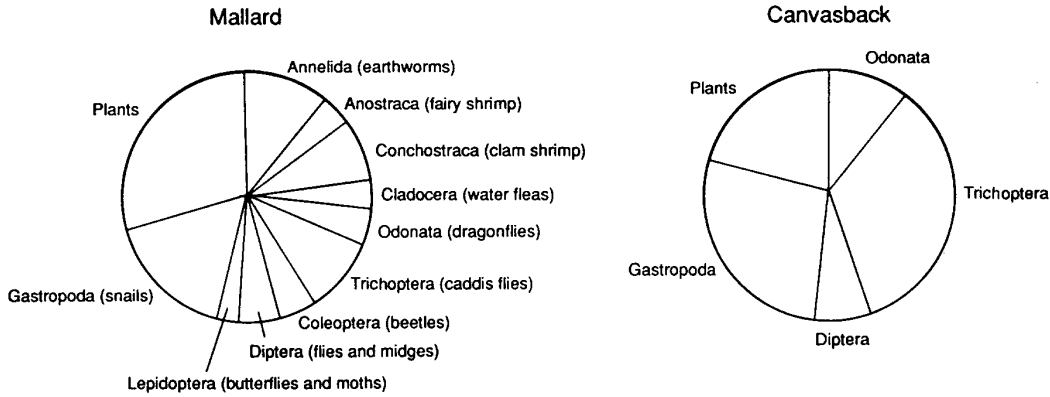
They overwinter by burrowing into the mud and hibernating.

Snails are most common in shallow water, less than 3 m deep. Most species occur in greatest abundance in slightly alkaline conditions. They need calcium carbonate for shell production. They also need water that is clean and has high levels of dissolved oxygen.

**Importance to Waterfowl:** Snails are very important as a source of calcium for most laying ducks.

## Suggested Reading

- Drobney, R. D., and L. H. Fredrickson. 1979. Food selection by ducks in relation to breeding status. *J. Wildl. Manage.* 43:109-120.
- Merritt, R. W., and K. W. Cummins. 1984. An introduction to the aquatic insects of North America. Kendall-Hunt Publishing Company, Dubuque, Iowa. 722 pp.
- Pennak, R. W. 1978. *Freshwater invertebrates of the United States.* John Wiley & Sons, New York. 803 pp.
- Swanson, G. A., G. L. Krapu, and J. R. Serie. 1979. Foods of laying female dabbling ducks on the breeding grounds. Pages 47-57 in T. A. Bookhout, ed. *Waterfowl and wetlands—an integrated review.* North-central Section, The Wildlife Society, Madison, Wis.
- Swanson, G. A., M. I. Meyer, and V. A. Adomaitis. 1985. Foods consumed by breeding mallards on wetlands of south-central North Dakota. *J. Wildl. Manage.* 49:197-203.
- van der Valk, A. 1989. *Northern prairie wetlands.* Iowa State University Press, Ames. 400 pp.
- Weller, M. W. 1987. *Freshwater marshes: ecology and wildlife management.* Second ed. University of Minnesota Press, Minneapolis. 150 pp.
- Wiggins, G. B., R. J. MacKay, and I. M. Smith. 1980. Evolutionary and ecological strategies of animals in annual temporary pools. *Arch. Hydrobiol. Suppl.* 58:97-206.



Dietary preferences by laying females of 7 duck species.

## Appendix. Common and Scientific Names of Animals Mentioned in the Text.

---

Northern pintail . . . . .	<i>Anas acuta</i>
Northern shoveler . . . . .	<i>Anas clypeata</i>
Blue-winged teal . . . . .	<i>Anas discors</i>
Mallard . . . . .	<i>Anas platyrhynchos</i>
Gadwall . . . . .	<i>Anas strepera</i>
Lesser scaup . . . . .	<i>Aythya affinis</i>
Redhead . . . . .	<i>Aythya americana</i>
Greater scaup . . . . .	<i>Aythya marila</i>
Canvasback . . . . .	<i>Aythya valisineria</i>

---



UNITED STATES DEPARTMENT OF THE INTERIOR  
 FISH AND WILDLIFE SERVICE  
*Fish and Wildlife Leaflet 13*  
 Washington, D.C. • 1990

