PISCES LECTURE RESOURCES

The Ecology of Freshwaters

LECTURE 4 - Animal life in freshwaters – Invertebrates

Introductory remarks:

This collection of slides is intended to give a glimpse of the great diversity of invertebrate animals that inhabit freshwaters, and the role of the individual species in freshwater systems, particularly from the trophic and physical adaptation standpoints.

Slide One: Title slide.

Slide Two: The basic divisions of freshwater animals into their main taxonomic Classes. This is, of course, a much simplified schema, using familiar language, but gives a helpful starting point for the beginner.

Slide Three: Drawing the distinction between animals with different levels of dependence on freshwater, from those that cannot survive without it to those that make use of it when it happens to be present.

Slide Four: Introductory, depicting an insect superbly adapted to an aquatic life.

Slide Five: A typical food web, or chain, of open freshwater systems

Slide Six: A typical food web of benthic systems, where the role of detritus and detritivores is much greater.

Slide Seven: Common freshwater detritivores. Introduces the terms auto- and allochthonus to indicate 'originating where found' and 'originating elsewhere'.

Slide Eight: How to identify a Gammarus species. A shrimp-like crustacean, little difference between the thoracic and abdominal body segments, the heart and gills inside the thorax rather than the abdomen, no carapace, and usually with a laterally compressed body. About 3000 species in total, including marine species.

Slide Nine: And how to identify an Isopod. The terrestrial species should be familiar to most students, and the freshwater species look very similar, if somewhat more flattened.

Slide Ten: Three species of grazing molluscs. Some are more difficult to identify than others and identification often depends on the relative dimensions of different parts of the shell.

Slide Eleven: The pulmonate freshwater limpet *Ancylastrum fluviatile* prefers running water and is an indicator of permanent - as opposed to seasonal - streams.

Slide Twelve: Molluscs are highly efficient filter feeders. The zebra mussel has become a pest species in many countries, interfering with the operation of water facilities. As the scientific name implies, the shell can have many shapes, ranging from long and thin to more fan-like, like this one. In some parts of the American Great Lakes, water clarity has increased greatly as a result of invasive zebra mussels effectively clearing the water of small particles. The intake and exhaust siphons of the juvenile *Pisidium* sp can be clearly seen in this photograph.

Slide Thirteen: Some caseless caddis fly larvae are filter feeds while some are predatory such as this *Rhyacophilida* sp.

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Slide Fourteen: Dragonfly and damselfly nymphs are voracious predators. Nymphs bear all the characteristics of the adult animal, only lacking wings and genital organs. There is no quiescent or pupal stage as in the hemimetabolous insects, the juvenile stage of which is a larva that bears no resemblance to the adult.

Slide Fifteen: Water beetles are a dominant group in small ponds and still waters. Another voracious freshwater predator. Note the hairs on its legs for swimming and also the forward pointing spines on its feet for holding on to prey. These animals vigorously pursue their prey.

Slide Sixteen: …whereas dragonfly nymphs are ambush predators, catching species that come into range.

Slide Seventeen: Most crabs living in mud consume detritus and algae from the mud itself. Fiddler crabs such as these pass small balls of mud to their mouth with their small claw, food particles are extracted and the mud is returned to the beach.

Slide Eighteen: Micro-predators – all waters hold a rich range of micro-organisms, forming a major component of any food web, as discussed in Lecture 7, Food Webs.

Slide Nineteen: A predatory true bug. Up to 5cm in length, the water stick insect feeds on small aquatic insects, but will also take small fish.

Slide Twenty: Another group of abundant true bugs are the water boatmen.Note the paddle-like first and third limbs, conferring both speed and agility whilst swimming. Also, the film of air on the abdomen, enabling the animal to absorb air through its spiracles, even while underwater.

Slide Twenty-one: Freshwater leech. Note the three pairs of eyes at the head end (right hand side). Preys on worms, crustaceans and molluscs.

Slide Twenty-two: Flatworms, have flat, smooth unsegmented bodies. They consume animal derived detritus and small insect larvae.

Slide Twenty-three: Another important ecological topic is the adaptation of animals to their environments. In the following few slides we look at how different species are adapted to their particular part of the aquatic environment.

Slide Twenty-four: The surface film. Pond skaters and water striders have minute hairs on their feet to prevent them from penetrating the surface. The very small size of mosquito larvae means that surface tension is quite sufficient to keep them afloat.

Slide Twenty-five: Free-living in the water column. Minute planktonic organisms can be found in most freshwater bodies. Cladocerans are crustaceans, usually between 1 and 3mm long. There are approximately 400 species. The Daphniidae is the most well-known family. They feed on algae, although the actual method is somewhat contentious. Copepods are very small, usually under 1mm in length. They feed on bacteria, diatoms and algae. They have a single eye, and a shield-like structure over the head.

Slide Twenty-six: Hard surfaces. Many animals crawl over the hard substrates on lake and, particularly, river bottoms. River bottoms are more likely to have hard surfaces, as the current keeps sediment moving. Here we illustrate these crawling animals with two species of case-bearing caddis-fly larvae.

Slide Twenty-seven: Within the substrate. This is *Ephemera danica,* a familiar mayfly, widespread in Britain and Ireland. The orange-brown nymph has tapering, snout-like projection and three tail appendages; it lives buried in the silt and sand at the bottom of alkaline rivers and lakes.

Slide Twenty-eight: On plant surfaces. The Gastropoda is one of the primary grazing groups. Snails such as these are found in most freshwaters and, like terrestrial snails, will consume most types of vegetation.

Slide Twenty-nine: In temporary aquatic habitats. Species specially adapted to temporary environments must be adapted to desiccation. These two species lay eggs that can withstand total drying, and remain dormant, sometimes for many years. They are highly vulnerable to fish predation so only occur in fishless, temporary habitats.

Slide Thirty: Ostracods show a range of adaptations to the temporary pool habitat including rapid life cycle, parthenogenetic reproduction, and drought-resistant eggs. These images are of one of the most abundant freshwater ostracods, *Cypridopsis vidua*, which is found throughout temperate Asia, Europe and N. America. It is a general scavenger but will attack living organisms.

Slide Thirty-one: Land and water meet – as these slides have shown, a number of animals make use of the freshwater environment for only a part of their life cycle. Dragonflies are an obvious example, where the nymph may spend far longer in the water than the adult ever does as a terrestrial animal (albeit airborne much of the time). Of course, most of the time dragonflies hunt near water for other insects that make use of freshwaters.

Slide Thirty-two: Dragonfly again

Take-home message:

The invertebrates that inhabit the different habitat types within freshwater bodies all display physical adaptations to them. Because they tend to be small they are also near the bottom of the food chain, and often form the prey for the species we encounter in the next lecture.