

WARD'S

Investigating Pond Life

Teacher's Manual

87 W 9056

Contents

- Teacher's Manual
- Pond sample

Contents: The checked items (x) are included in your sample.

Microscopic Organisms

- Rotifers
- Gastrotrichs
- Euglena
- Volvox
- Diatoms
- Kerona (on Hydra)
- Trichodina (on Hydra)

Macroscopic Organisms

- Duckweed
- Planaria
- Snail
- Elodea
- Spirogyra
- Brown Hydra
- Green Hydra
- Water fleas Daphnia
- Ostracods
- Copepods

- Pad of 30 student worksheets including a dichotomous key

Care of the Pond Sample

Allow your pond sample to sit quietly prior to student observation. Unscrew the jar lid to allow for oxygen exchange. Place your pond sample in a cool place away from direct sunlight.

Suggested Activities

The pond sample is designed to acquaint students with a variety of life forms commonly found in freshwater habitats. The Teacher's Manual provides life history and field collecting information that may be presented during the classroom (or laboratory) activity. Student worksheets have an illustrated dichotomous key for students to use in identifying pond life. A separate sheet which details the pond inhabitants included in your specific "pond sample" is enclosed.

Students should gather around the sample jar and use their keys to identify pond life. Students should begin by first identifying pond life that they can readily observe (statements 1-14 in the dichotomous key). If practical, students can then examine divided portions of the pond sample using a stereomicroscope. Microscopic organisms are identified using statements 14-19 in the key. Pond life forms are illustrated for students on their worksheets.

Studying a Pond

A pond is a body of water shallow enough to permit the growth of rooted plants across its entire length. Based upon this definition, a pond can be a puddle, a depression in the land which temporarily fills with water, or a more permanent water body which is seldom deeper than 12 to 15 feet. Bodies of water deeper than 15 feet usually will not permit light to penetrate to the bottom, thus prohibiting bottom plant growth. Such bodies of water are lakes.

The Life of a Pond

Most ponds, when left undisturbed, develop in richness and variety, reach a peak of maturity, and then grow old. A young pond is clear-bottomed. Gradually it acquires clumps of submerged pondweeds and becomes populated by a few amphibians and small insects, snails, and crustaceans. These often enter the pond by accident. Since they find no competition, they may develop in abundance. Slowly, floating plants and emergent shoreline plants become established. Eventually the pond decreases in area because of encroaching shoreline plants, and becomes shallower from the deposition of decomposing organic material; bit by bit the pond is converted to marsh, then to swamp (if shrubs and trees become implanted) and then to dry land.

The Secret Life Within a Pond

Many microlife forms are ubiquitous within the myriad of microhabitats found in a pond. They may be observed as submerged hair-like strands floating at the water's edge (filamentous protist *Spirogyra*), as a fuzz on the surfaces of submerged aquatic plants (stalked ciliates); as greenish coverings on stones and other submerged objects or as a scum at the water's edge (filamentous protists). Most, however, require a stereo or compound microscope to observe their wanderings and habits.

FOOD WEB OF A POND		
Producers	The photosynthetic and chemosynthetic organisms that manufacture food.	Chiefly bacteria and green protists. Secondarily higher aquatic plants.
Consumers	Primary consumers that feed directly upon green plant material.	Chief among these are aquatic insects, and crustaceans. Secondarily, rotifers, protists, gastrotrichs, tadpoles, and a few fish.
	Secondary consumers that feed upon primary consumers or on other secondary consumers.	Carnivorous insects, most vertebrates, parasites, snails, and aquatic worms.
Decomposers	Scavengers, those that feed upon dead or decaying plant or animal material. These organisms change organic material back into inorganic material, to be used in nature's many chemical cycles.	Protists (ciliates), aquatic worms, crustaceans, snails, a few fish and turtles, bacteria and certain fungi.

Organisms in boldface are included in the "pond sample."

Natural Histories of Pond Inhabitants

The Microscope World:

Protists

Protists are microscopic cells or groups of cells, with or without photosynthetic pigments confined in chloroplasts. Many have specialized structures for locomotion (cilia, flagella or pseudopodia). Protist may be observed as single cells, in colonies, in filaments, or as stalked forms.

Some protists are easily observed and include the following: Ciliates (cells with hair-like cilia) and flagellates (cells with long whip-like structures) thrive where there is decaying organic material, on the edge of weedy ponds or in stagnant pools. Some ciliates are stalked forms, visible to the eye as a "fuzz" on the surfaces of submerged aquatic plants. Other ciliates can be observed on the body of *Hydra*. (The commensal, ciliated protist *Kerona* and *Trichodina* are keyed in the dichotomous key). Some, like *Volvox* are ball-like colonies that are visible to the naked eye as tiny rolling spheres drifting about in the water. Others, like *Spirogyra*, are thin filaments composed of hundreds of cells attached end-to-end. It has the appearance of fine hair floating in the water. Still others, like diatoms, are single, generally non-motile, cells encased in beautifully-sculptured glass houses.

Rotifers

The "wheel animalcules" or rotifers are microscopic animals of great abundance and variety. They are the chief inhabitants of pond waters and the surfaces of submerged vegetation. They are easily identified by their crown of whirling cilia, appearing to the eye as two revolving wheels—hence their name. Most rotifers feed on bacteria and smaller protists. They may be collected from ponds by gathering shoreline vegetation and pond water and bringing it back to the classroom. As the oxygen concentration of the water in the jar decreases, rotifers will move to the surface, usually at the lighted side, where they can easily be collected with a medicine dropper for study under the microscope. A stereomicroscope can also be used to study attached forms on the surfaces of collected vegetation.

Gastrotrichs

Gastrotrichs are another microscopic form usually found in abundance on aquatic vegetation. They are easily identified by their conspicuous forked tail and bristled anterior (head) end. Most appear to be covered with numerous tiny hairs on their bodies. Normally colorless, most take on a greenish or reddish coloration due to the contents of their digestive tracts. Gastrotrichs feed on protist, bacteria, and detritus. They can be collected in any shallow water body, even the back yard bird bath, house gutter, or classroom aquarium. To collect, use a long pipette to suck up bottom sediments. Allow a small amount of the

collected sediment to settle in the observation dish. Study under a stereomicroscope. Aquatic plants are also good places to look for gastrotrichs; gently swish the plant in a dish of water to wash off gastrotrichs and other microlife. Allow the wash water to settle; examine under a stereomicroscope.

The Macroscopic World

Aquatic Plants

Plants adapted to life in the water tend to share similar characteristics:

- Submerged leaves are ribbon-like or finely divided to offer less resistance to the force of currents and more surface area for nutrient absorption.
- Plant tissues are weaker than those of terrestrial plants. Aquatic plants are supported by the water itself, without need for stronger tissues to support them against gravity.
- Root hairs and roots are often absent. Terrestrial plants need root hairs to extract water and nutrients from the soil; aquatic plants absorb nutrients directly from the surrounding water.

Floating Plants

Floating plants form a green blanket on ponds and other quiet waters in midsummer. The main constituents of these "water blankets" are the duckweeds, plants whose bodies consist of one or more flattened fronds, each with a single trailing root. These plants are home to varied microlife and larger forms, so do not neglect studying them closely!

Rooted Plants

Waterweed (*Anacharis*—*Elodea*). Normally rooted, plants may break loose and form floating mats. It is found in soft water bodies in the northeast, south, and central states.

Invertebrates

Hydras

Hydras are soft-bodied animals whose conspicuous tentacular crown atop its stalked body is readily observed without the aid of a microscope. Hydras may be white, brown, or green in color. Green hydras owe their color to the presence of symbiotic protists called zoochlorellae which contain green chloroplasts.

Hydras may be observed hanging from the surface film of standing waters dimpling its upper surface; sitting on vegetation, or on the surface glass of collecting jars or aquariums; or just drifting passively in the water. Their size and shape is difficult to describe since a hydra may look like a tiny frayed strand of thread, or may contract into a small knob-like affair.

Hydras capture their food by the cooperative use of tentacles and stinging cells which are scattered about their bodies. The stinging cells fire needle-like barbs into a potential victim if it comes into contact with the animal; the tentacles, in turn, then sweep the paralyzed victim up into the animal's mouth located at the base of its tentacular crown.

Occasionally hydras are observed in pond habitats, but more often are better seen in jars containing collected water and vegetation from the pond's edge. This collected material is brought back to the classroom and allowed to stand, out of direct sunlight. After a period of time, hydras will be observed either attached to the surface of vegetation or on the sides of the container.

Planarians

These small, flattened, worms crawl over vegetation and debris and are often visible on the sides of glass aquaria or collection containers. They dine on bits of organic material, plants, and other microlife. They can be collected in ponds by examining the underside of submerged stones or aquatic vegetation. An alternative method is to scoop up an amount of bottom debris and place it in a flat-bottomed tray containing water from the collecting locale. After a number of hours planarians will be observed to emerge to the water's surface as the oxygen content of the water drops. The serious "planarian hunter" may choose to bait planarians by placing a few pieces of fresh liver or beef in a cloth bag tied shut with a piece of string. These bait bags are then placed at the water's edge; planarians will congregate around them after 20 minutes or so. This technique works the year round.

Leeches

Leeches are predominately creatures of freshwater habitats. Their flat bodies have a ribbed appearance with two prominent suckers at each end. Leeches use these suckers to creep along the substrate "inch-

worm" style, sometimes stretching their bodies to incredible lengths. Leeches will usually be observed clinging to the substrate with a least one sucker. Most leeches are predators on snails, insect larvae, crustaceans, or are general scavengers. Only a few feed on warm blood.

Most leeches are sensitive to vibration or to the presence of a foreign body introduced into the water. This explains why leeches are usually found on clothes and boots following a collecting excursion. The more elusive leeches can be found under logs, rocks, and other debris. They should be collected and handled by using forceps. Keep collected leeches in clean, cold (refrigerated) water. Be sure to have the top of the container securely covered.

Snails

Snails have a single shell which separates them from other molluscs (clams and mussels) which have a bivalve shell. Snails can be observed creeping about vegetation and submerged surfaces in all kinds of freshwater. Snails glide over the bottom, submerged objects of the underside of the surface film, by means of a slime tract from the undersurface of their foot. Snails feed on protists (algae) and other green vegetation, as well as dead animal and plant matter.

Microcrustaceans **Waterfleas, Ostracods, Copepods**

Probably the most common of microcrustaceans, at least to students, is the waterflea *Daphnia*. First described by Leeuwenhoek, these tiny cladocerans have delighted biologists through the years with their animated movements. Waterfleas can be observed at the edge of a quiet body of water busily darting about or under the stereomicroscope where the rhythmic beating of their hearts can be observed. Waterfleas are tiny crustaceans which are covered by a two-valved shell, giving the appearance of the inner works of a watch.

Cladocerans, as well as other microcrustaceans are an important link in the food chain, serving as food for hydras, insects, wading birds, and for fish. Rotifers are often attracted to them, especially to *Daphnia*. Stalked protists (*Vorticella* or *Epistyllis*) often live on *Daphnia*, and feed on bacteria in the water flow caused by oscillation of *Daphnia's* feathery antennae.

The ostracods or "seed shrimp," resemble tiny clams. The color of their bivalved shells may be white, yellow, red, brown, or black. These "active seeds with legs" creep along the bottom, and can often be observed doing a curious little side dance. For the most part ostracods are scavengers on bacteria, molds, protists, and detritus.

Copepods are easily recognized by their cylindrical shape, greatly narrowed abdomen and forked tails. Females are almost always observed bearing clutches of eggs. The great majority are less than 2mm in length, whitish or grayish in color. They are commonly found among aquatic vegetation at the water's edge.

Vertebrates **Tadpoles**

In the spring, tadpoles are frequently observed along the shores of pond waters. Tadpoles are an intermediate developmental stage of the frog. They possess a sucker, for clinging to the surfaces of aquatic plants upon which they feed, a pair of gills for respiration, and a long tail for locomotion.

WARD'S Teaching Aids for Advanced Freshwater Life Studies

32 W 2203 Visual Guide to Freshwater Protists,
21 x 34 poster with Dichotomous Key
to the Protozoa

32 W 2205 Dichotomous Key to Algae
32 W 2206 Dichotomous Key to Rotifers
32 W 2204 Dichotomous Key to Floating Plants

WARD'S

5100 West Henrietta Road
P.O. Box 92912
Rochester, New York 14692-9012

Fax: 716-334-6174 / 1-800-635-8439
Phone: 716-359-2502
Toll-Free: 1-800-962-2660

397 Vansickle Road
St. Catharines, Ontario L2S 3T5

Fax: 416-984-5952
Phone: 416-984-8900
Toll-Free: 1-800-387-7822

© 1995 WARD'S Natural Science
All rights reserved

WARD'S

Dichotomous Key to Pond Life 87 W 9056

Instructions

Use the key below to identify the pond life in the collection jar. Begin with statement 1 continuing according to the key until it terminates in the name of an organism or group of organisms.

1

Visible to the eye	2
Not visible to the eye	14

(Use a stereomicroscope to look at samples provided by your teacher)

2

Moves about	7
Does not move about	3

3

Water plant	4
Not a water plant	5

4

Floats on the surface. With one to three "leaves"; each with a single root	Floating aquatic plant— Duckweed
--	-------------------------------------

Submerged. A single stem with leaves in bunches at regular intervals	Rooted aquatic plant— Elodea
--	---------------------------------

5

Organism attached. Looks like a tube with a crown of waving tentacles, brown or green in color.	6
---	----------

Not attached. Long thread like form; looks like a strand of hair.	Filamentous protist— Spirogyra
---	-----------------------------------

(Examine further under a stereomicroscope to observe individual cells within the filament as well as spiral chloroplasts)

6

Brown in color	Brown hydra
Green in color	Green hydra

(Green color due to the presence of numerous green protists (Zoochlorellae which give this hydra its green color. Such a relationship is termed symbiotic.)

7

Body flattened	8
Body not flattened	9

8

Body small and worm-like with triangular head. Body brown in color	Brown planaria
--	----------------

Body large and flattened. Body with numerous wrinkles; with two suckers, one at each end (one larger than the other)	Leech
--	-------

9

Body form very small, ball-like in shape; just barely visible to the eye. Floats about, may appear to rotate.	Protist Volvox
---	-------------------

Body form not ball-shaped	10
---------------------------	-----------

10

Body with distinct tail. Usually observed attached to a surface by a very small sucker. Body with a pair of gills	Tadpole
---	---------

Body does not have a distinctive tail.	11
--	-----------

11

Large animal inside a shell. Animal moves about over surfaces using a visible foot.	Snail
---	-------

Small animal, observed swimming or on the bottom	12
--	-----------

(Capture the animals; observe under a stereomicroscope)

12

Swims with a darting motion. Animal partly inside a transparent shell. Looks like a bird. Animal possesses feathery antennae.	Water flea— Daphnia
---	------------------------

Does not swim. Usually observed on the bottom	13
---	-----------

13

Animal not inside a shell, with a pair of long antennae that point backwards along the body. Tail forked; usually with a pair of egg sacs.	Copepod
--	---------

Animal inside a seed-like shell. Shell usually colored. Animal walks on surface; rarely swims.	Copepod
--	---------

14

Single cell (Protist)	16
Multicellular animal	15

15

Tiny animal with a set of revolving wheel-like structures on its head. Body tapers to a point. Usually crawls about inchworm-fashion.	Rotifer
---	---------

Tiny animal without revolving wheels on head. Instead has bristles on head region and little "hairs" on body. Body has forked tail. Crawls along bottom.	Gastrotrich
--	-------------

16

On body of Hydra	17
Not on body of Hydra	18

17

Vase-shaped. Crawls about Hydra's body.	Ciliated protist— Trichodina
---	---------------------------------

Kidney-shaped. Crawls about Hydra's body.	Ciliated protist— Kerona
---	-----------------------------

18

Tiny stalked forms having a bell-shaped end. Bell-shaped portion has a ring of cilia (tiny hair-like structures). Either single or in a group. Attached to various substrates.	Stalked ciliate: Vorticella—(single cell; contracts) Epistylis—(colony of cells; does not contract) Carchesium—(colony of cells; contracts)
--	---

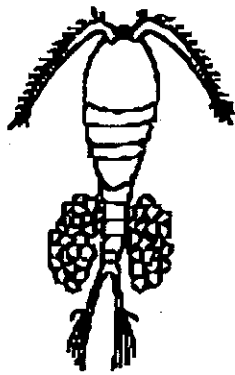
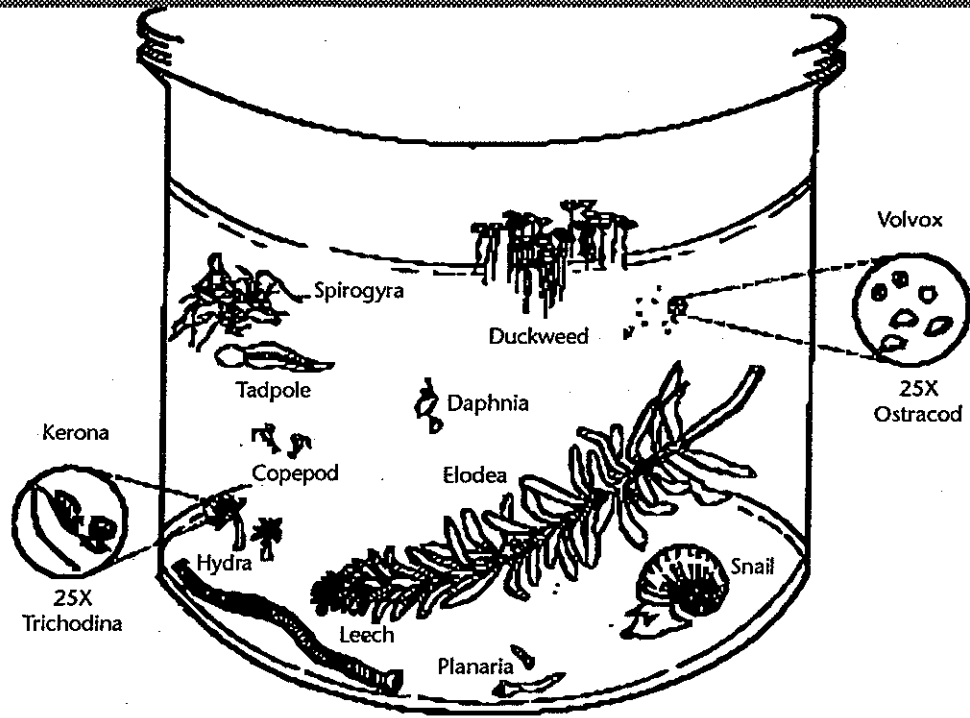
Not attached	19
--------------	-----------

(Best observed as a wet mount using a compound microscope)

19

Extremely small cell, green in color. Swims about using a long whip-like flagella.	Flagellated protist— Euglena
--	---------------------------------

Extremely small cell, brown to yellow-brown in color. Does not swim. Cell inside tiny glass house.	Diatom
--	--------



Copepod



Rotifer



Daphnia



Euglena



Gastrotrich



Epistylis



Diatoms



Kerona Trichodina

WARD'S

5100 West Henrietta Road
 P.O. Box 92912
 Rochester, New York 14692-9012

Fax: 716-334-6174 / 1-800-635-8439
 Phone: 716-359-2502
 Toll-Free: 1-800-962-2660

397 Vansickle Road
 St. Catharines, Ontario L2S 3T5

Fax: 416-984-5952
 Phone: 416-984-8900
 Toll-Free: 1-800-387-7822

Copyright. Permission granted to make unlimited copies for use in any one school building. For educational use only, not for commercial use or resale.

© 1995 WARD'S Natural Science
 All rights reserved