

“Circle of Life: Pond Edition”



Target age group: 8-12

Number of players: 2 to 4

Purpose of game: to reinforce concepts related to food webs in ponds, and to become comfortable with the words “phytoplankton” and “zooplankton” and what type of organisms are found in these categories

Time required to construct the game: about 30 minutes (not counting time spent making copies)

Time required to play the game: about 20-30 minutes per game

Materials needed:

One complete game requires the following:

- 6 color copies on regular paper (for the game board)
- 3 copies (color optional) on heavy cardstock (for the cards)
- 1 sheet of posterboard
- a really good glue stick (the adult kind, not school glue)
- 3 blank wooden cubes if you can get some, or 3 dice that can be adapted for this game using markers or paper squares
- Markers or acrylic paint or colored paper for adapting the dice (see instructions below)
- 30 tokens of some kind for each player (pennies, raisins, cereal bits, whatever you want to use)

Directions for making the game:

- 1) Trim your 6 color copies so that you can overlap them, concealing the seam.
- 2) Glue them to the posterboard using a really good glue stick (not school glue). Trim the extra from around the circle. (NOTE: If you can't get posterboard, you can still make the gameboard. Just attach using clear tape on the back.)
- 3) Copy the card patterns onto cardstock. If you would like the tops of the cards to have the game logo, print this on the reverse side.
- 4) Cut apart the cards. Read through the cards and decide which ones are appropriate for your students. (You can add extras, too, if there are animals or algae on the board that you particularly want to draw attention to.)
TIP: If you are making more than one game and therefore have more than one set of cards, put a small colored dot on all the cards that belong to the same set. When the cards get mixed up during class time, as they inevitably do, it will be easy to sort them out. All the cards with the yellow dots belong to the same set, all the cards with the red dots belong together, etc. Otherwise, it can be very time consuming to sort them out.
- 5) Adapt the dice. If you can get small wooden cubes at a craft store, this is the best option. However, you can make do using regular dice. One of them will represent sunlight, one will be water and one will be carbon dioxide. Each die will have five sides painted or colored all the same (either sunlight, water or CO₂), and one side will be white or blank and will say CARD. You might want to use yellow for sunlight, blue for water, and gray purple or a dotted pattern for carbon dioxide. You can also draw a sun, a water droplet and the letters CO₂. On the sixth side of each die, the white or blank side, write the word CARD. When this side comes up they will draw a card. Use your discretion as to what art materials to use to make your dice. You could even use paper cube patterns from Google images; search “paper cube pattern.”

BEFORE YOU PLAY:

Take some time to look at the board with your students. They need to know that the outer green ring is what scientists call “phytoplankton.” “Phyto” means “plant” in Greek, and “plankton” means “wanderer” in Greek. These organisms act like plants because they do photosynthesis, and they “wander” because they float around with the water currents. These organisms can also be called “autotrophs” (“self-feeders”) or “primary producers.”

The blue ring represents the zooplankton. “Zoo-” is pronounced “zo-oh” and means “animal” in Greek. These creatures can’t do photosynthesis and must eat creatures that do. Zooplankton are generally microscopic but are larger than the phytoplankton.

You might want to have them point out all the organisms that fall into various categories, such as insects, crustaceans, protozoans, worms (just the tubifex), cnidarians (just the hydra), amphibians. It’s up to you whether to go into detail about the fact that protozoans are in the protist kingdom, not the animal kingdom. Protists include ciliates, amebas, diatoms and all algae. The cyanobacteria are not algae, but belong in the bacteria kingdom.

Also, be sure they understand that the pictures are not to scale. The phytoplankton and zooplankton are microscopic. Even the small tadpoles and baby salamanders are larger than life-size. The only ring that is life-size is the ring with the water scorpions.

The arrangement of the creatures underneath each other does not exactly represent reality. For example, a fish might or might not actually eat a water scorpion. It would depend on the size of the fish. Large fish would likely snap it right up but small fish might avoid it for fear of getting pinched. The hydra will eat many more things than those shown under it, and the zooplankton eat other kinds of phytoplankton besides what is underneath them in the game. Herons and turtles eat all kinds of things. Etc.

Lastly, these pictures do not represent a complete catalog of the food web. We are missing all the plants, which can be an important part of some animals’ diets, such as ducks eating duckweed or turtles eating vegetation. We’re also missing mammals such as raccoons and shrews who come to ponds to find food. We don’t have the airborne insects, either, such as dragonflies, bees and moths, and we don’t have snails and slugs. The game does not represent a comprehensive food web.

Additional notes:

- In real life, it takes millions of phytoplankton to support one top predator.
- Yes, bullfrogs really are top predators and will eat just about anything, including tadpoles or even other frogs!
- Very tiny tadpoles are mostly herbivorous, nibbling at leaves and algae. As they grow larger they begin to add small animals to their diet. By the time they reach adulthood, they are eating mostly insects. (Or, in the case of bullfrogs, more than just insects.)
- The spelling of “Ameba” reflects the recent trend toward removing the silent “o.” Either spelling is correct.
- The singular of plankton is “plankter.”

HOW TO PLAY:

1) Each player chooses a top predator. They will attempt to fill the quarter of the board that branches out from that predator. To place a token on an animal, you must have fed the two animals beneath it. Therefore, you need to first fill your phytoplanktons so your zooplankton can eat. Then the zooplankton will feed the creatures above them. And so on. So by the time the top predator is fed, all the squares in that quarter will be filled with tokens.

2) Players take turns rolling the three dice. If the dice land with SUN, WATER and CO₂, then photosynthesis occurs and one phytoplankton gets fed by placing a token on any phytoplankton space. (This will happen 57% of the time.)

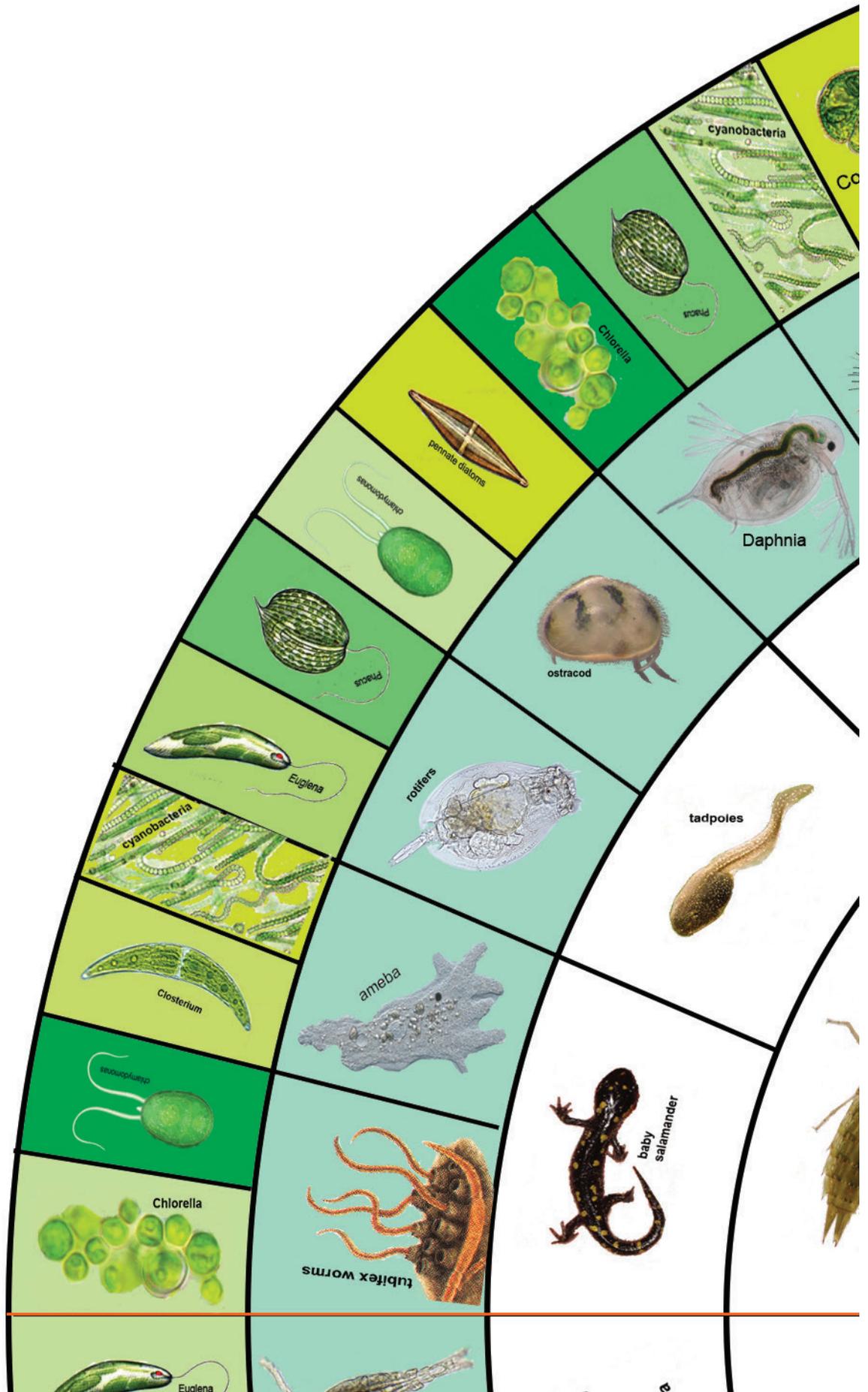
3) If one or more of the dice turns up a CARD side, then instead of getting a token for photosynthesis, the player draws a card. The card is read aloud and the instructions apply to all players, not just to the person who drew the card. So all players must listen carefully as the card is read aloud. (If a player has trouble reading the card, another player or an adult can read the card for them.) Not every card will apply to all players. The quarters are not identical.

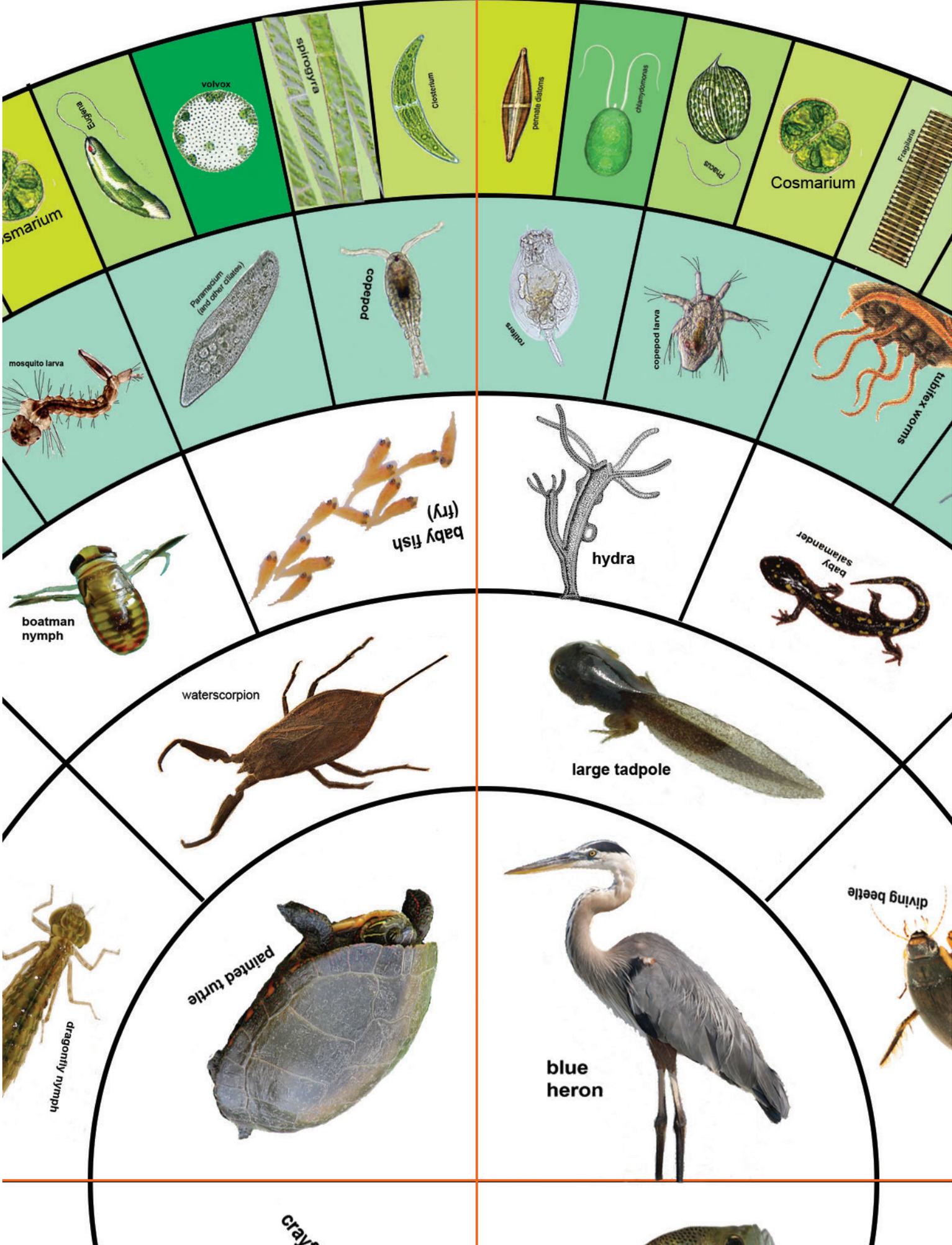
4) You only take one card, no matter how many CARD sides turn up. (In fact, you could play where you roll one die at a time, and stop as soon as you turn up a CARD side.)

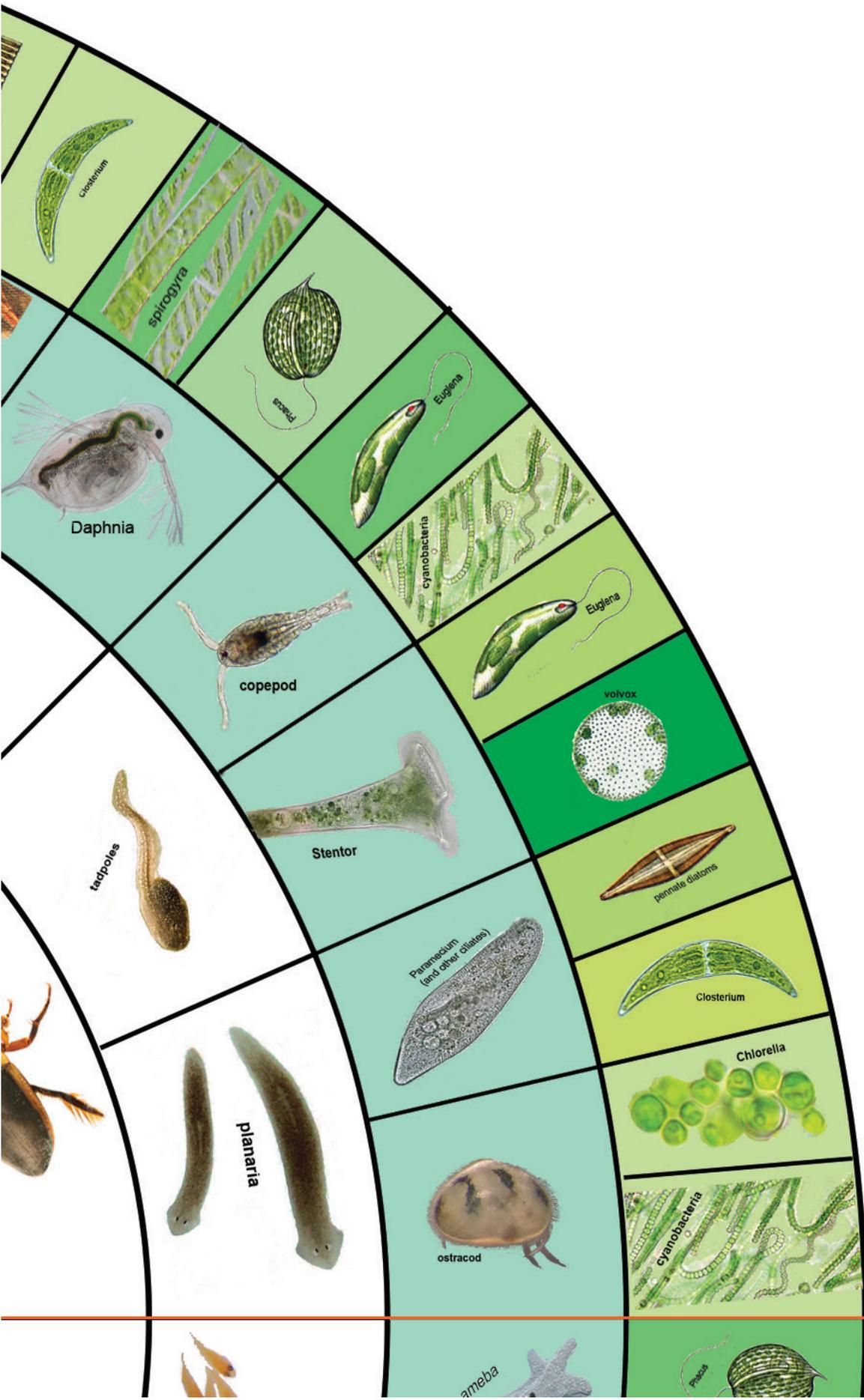
5) As soon as you fill two phytoplankton spaces that are under a zooplankton, you may automatically put a token on the zooplankton. You don’t need to wait until the next turn. As soon as a 3rd-tier creature’s zooplankton are filled, you may immediately place a token on that creature. (Towards the end of the game you might run into a scenario where upon filling in one last phytoplankton, a player might be able to then put tokens on quite a few places all at once.)

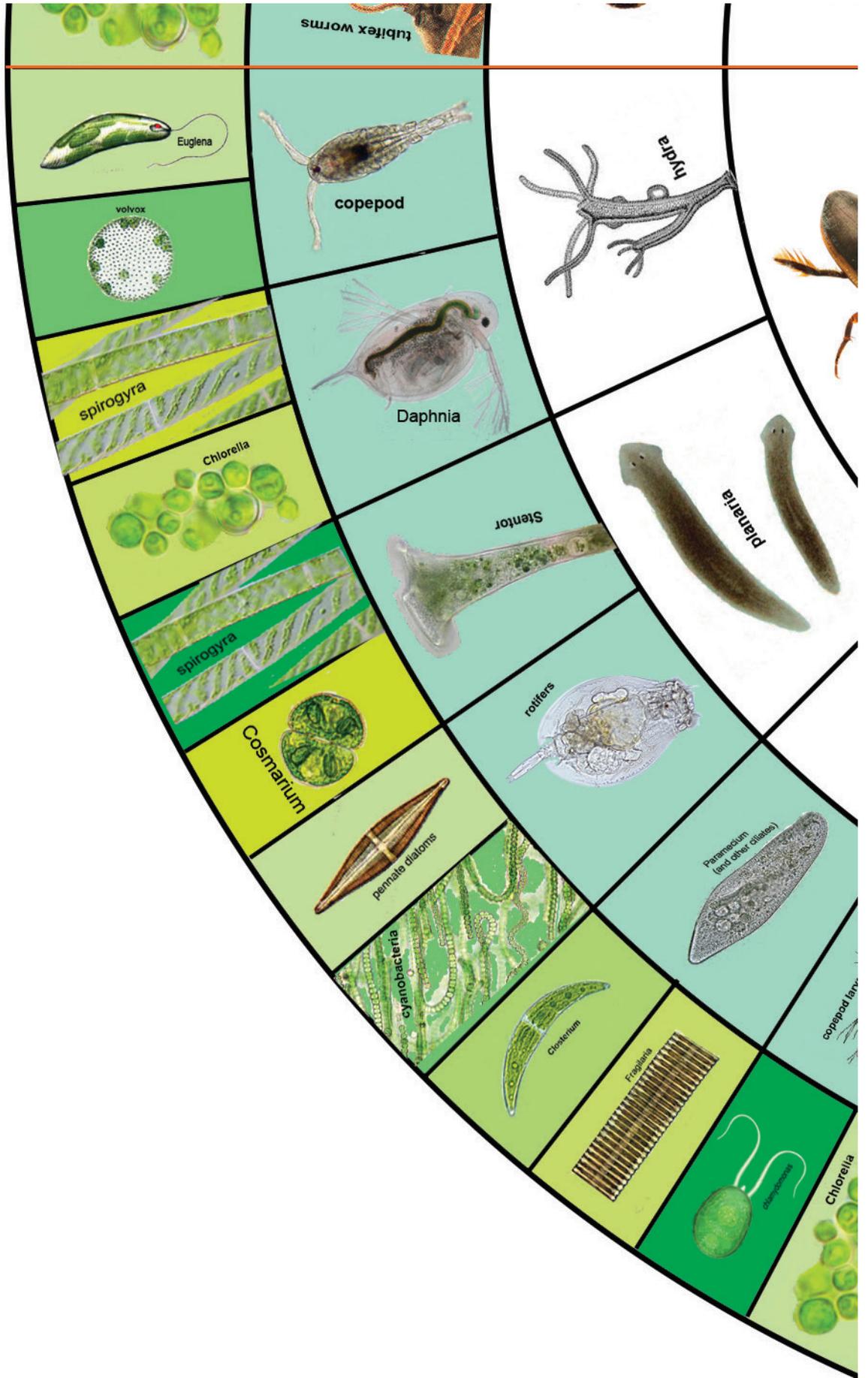
6) You can make the game less competitive by making the emphasis be on feeding the top predator, not winning the game. Younger players, especially, will want to finish feeding their predator even after someone has “won.”

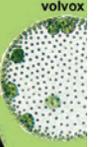
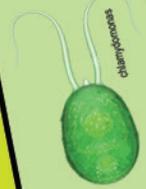
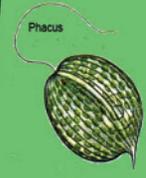
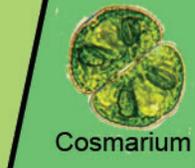
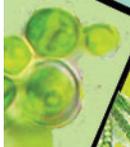
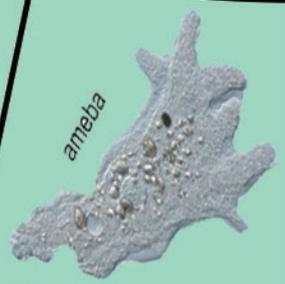
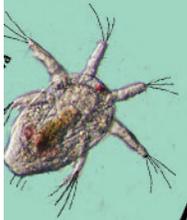
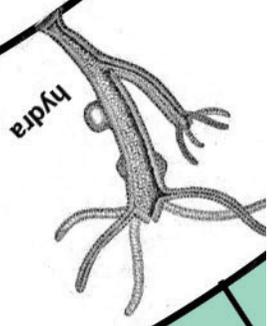
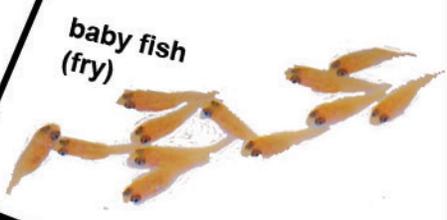
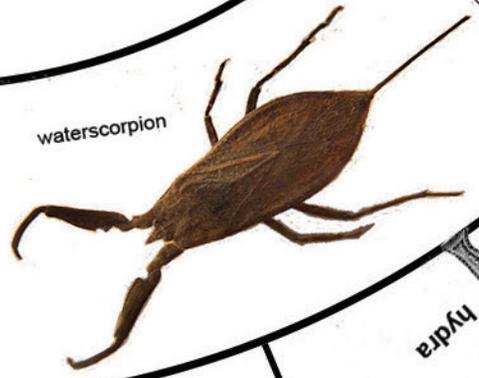
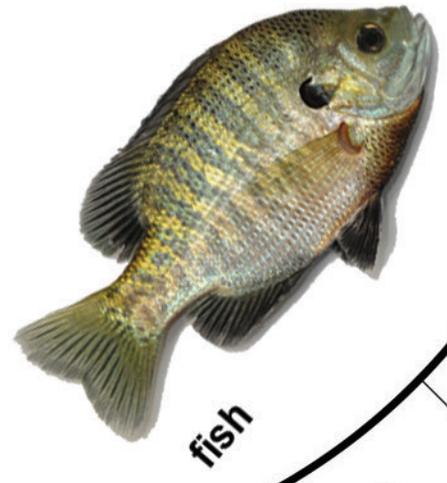
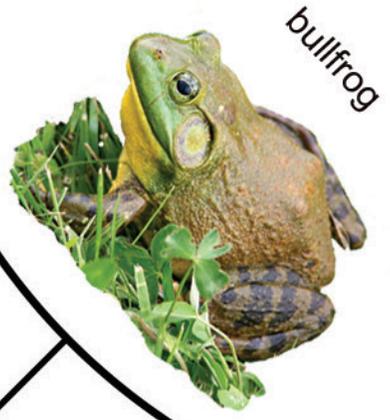
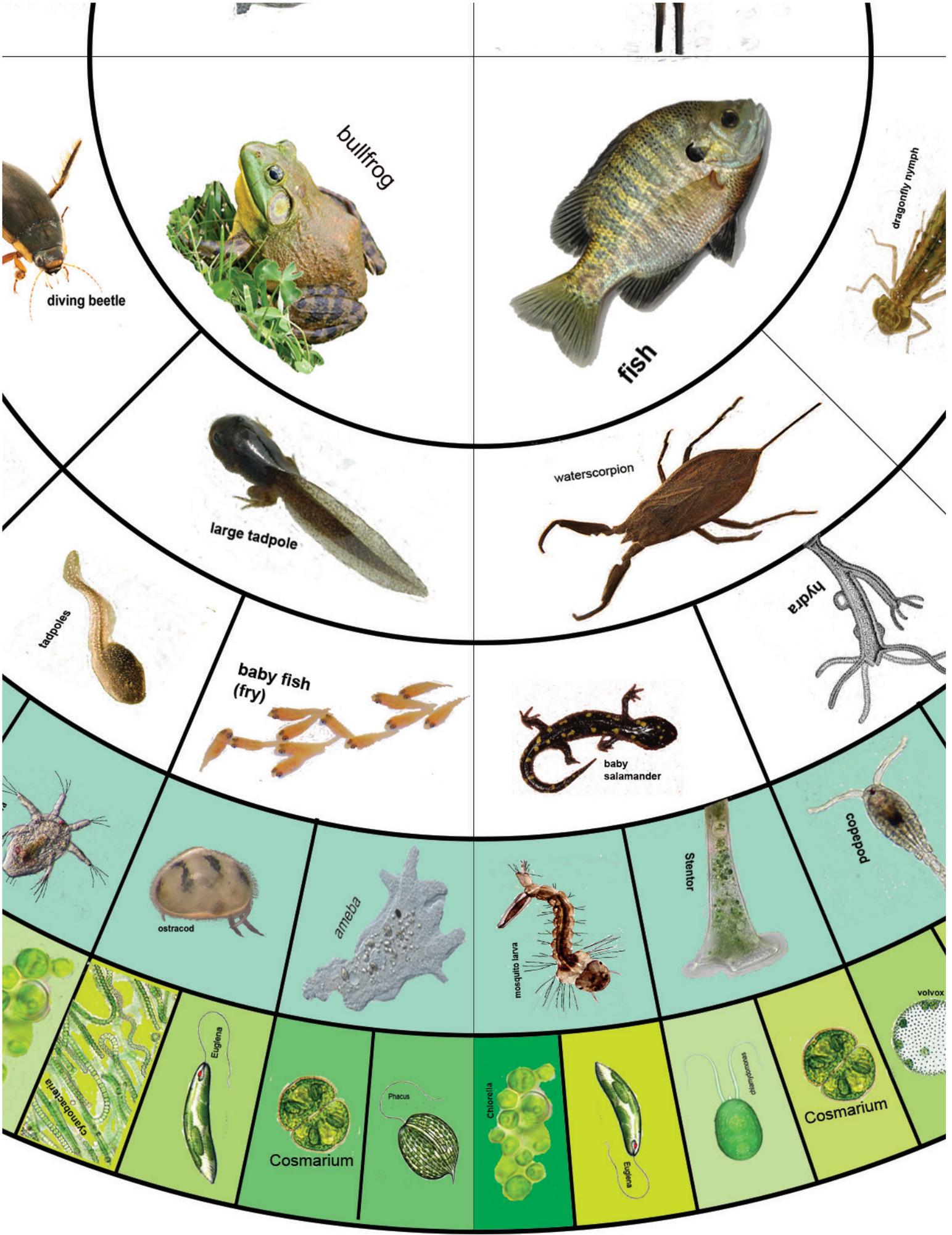


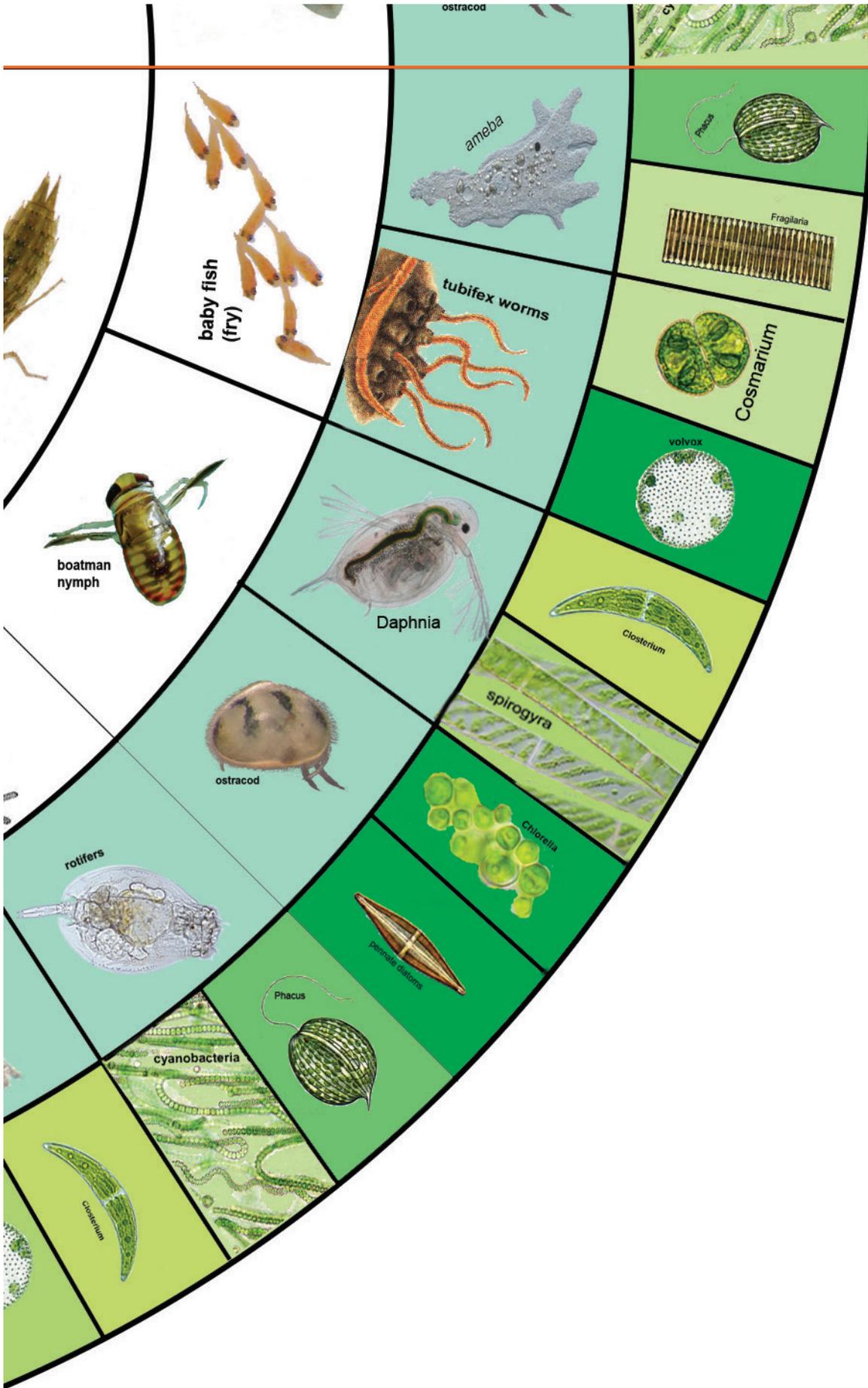








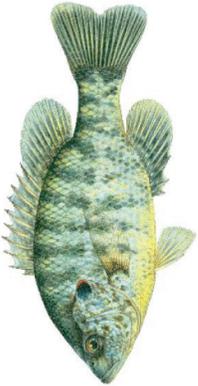




<p>If you have a copepod larva, you may put a token on one of its phytoplankton.</p>	<p>If you have a mosquito larva, you may put a token on one of its phytoplankton.</p>	<p>Some green algae cells have one or two tail-like structures called flagella. These algae are like plant cells with tails! You may place tokens on all algae cells that have flagella.</p>
<p>Baby fish are called “fry.” If you have fry in your quarter, you may place a token on one of the zooplankton it will eat. This means you will also place tokens on the 2 phytoplankton beneath it.</p>	<p>Euglena is a type of phytoplankton that has a red eye spot. You may place tokens on all of your euglenas.</p>	<p>The word “phyto” means “leaf.” Phytoplankton are like leaves because they can do photosynthesis. If you have a green algae that you think is shaped like a leaf, put a token on it.</p>
<p>Daphnia is one of the smallest members of the crustaceans, the group to which crabs and lobsters belong. Feed your Daphnia a phytoplankton. If your Daphnia is full, you may feed your copepod instead. Copepods are also crustaceans.</p>	<p>Volvox is a green algae that looks like a ball. The individual cells cooperate to form a hollow sphere. Put tokens on all Volvoxes.</p>	<p>Some people eat dried, powdered Chlorella algae because it is full of vitamins and minerals. You may place tokens on all of your Chlorellas.</p>

<p>Stentors might not look similar to Paramecia, but they are. Both use tiny hairs, called cilia, to move and to gather food. If you have a Stentor, feed it a phytoplankter.</p>	<p>The word "cyan" means "blue." The cyanobacteria used to be called the blue-green algae. They are an important food source for many zooplankton. If you have an open cyanobacteria space, you may place a token on it.</p>	<p>Rotifers are the smallest members of the animal kingdom. They are the same size as single-cell protozoans! If you have a rotifer, feed it a phytoplankter.</p>
<p>As a boatman nymph gets older, it eats fewer zooplankton and more plants and algae. As an adult it will be able to leave the water and fly around when it wants to. Help your nymph by placing a token on one of the phytoplankton on which it relies.</p>	<p>Dragonfly nymphs live in the water for two years before becoming an adult. If you have a dragonfly nymph, you may place a token on one of the phytoplankton on which it relies. (but not on zooplankton)</p>	<p>The paramecium looks and acts like an animal, but it is made of only one cell. If you have a paramecium, feed it a phytoplankter if it still needs one.</p>
<p>An ostracod is one of the smallest and simplest members of the crustaceans. Anyone who has an ostracod eating a diatom may place a token on the diatom.</p>	<p>Filamentous green algae, like Spirogyra, form long strings. Each square is an individual cell, but they live together in long neighborhoods. You may put tokens on all of your Spirogyras.</p>	<p>Planaria are flatworms. Though their eye spots look like real eyes, they can only see light and dark. If you have planaria, you may put a token on one of the four phytoplankton beneath them.</p>

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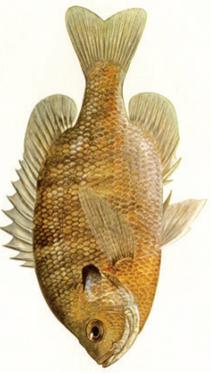
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<p>Copepods are tiny members of the class of animals to which crabs and lobsters belong. If you have a copepod or a copepod larva, you may feed one phytoplankton to each of them.</p>	<p>A diatom is an organism that lives in a glass shell. It does photosynthesis even though it is not green. Anyone who has a paramecium eating a diatom may place a token on that diatom.</p>	<p>The only ring that shows life-size creatures is the ring with the water scorpions in it. If your section of this ring has a water scorpion, you may put a token on one of the 8 phytoplankton way down beneath it .</p>
<p>Hydras belong to the same group as jellyfish. They have stinging cells at the ends of their tentacles. All hydras are permitted to catch one crustacean. This means that you automatically get tokens for the phytoplankton underneath that crustacean. (The crustaceans are copepods, ostracods, Daphnia.)</p>	<p>Fragililaria is a diatom that looks like a stack of books. Each "book" is an individual cell. They live in these long neighborhoods so they are less likely to be eaten. If you have a Fragililaria, put a token on it.</p>	<p>Tubifex worms are related to earthworms, but they live their whole lives under water. They anchor themselves in the dirt in a shallow part of the pond. They are very small. If your tubifex worms are about to eat any green phytoplankton, put tokens on those green phytoplankton.</p>
<p>Stentor is a trumpet-shaped protozoan. Though it acts like an animal, it is a single cell. It has a "mouth" in the large part of the cone. If you have a Stentor, feed it one phytoplankton.</p>	<p>Closterium is a green algae cell that is shaped like a banana. If your Closterium will be eaten by a protozoan (not an animal) you may put a token on it. (The protozoans are the Ameba, Stentor, and Paramecium.)</p>	<p>If your quarter of the board contains a nymph of any kind, you may place a token on one of the phytoplankton on which it relies.</p>