

Specification for Assessment #7

Drawing a Food Web

Competency

Student can create a diagram (i.e., food web) that illustrates the flow of energy among producers, consumers, and decomposers within an ecosystem.

Focus of this assessment:

- ☐ Declarative knowledge
- ☒ Procedural knowledge
- ☐ Problem solving

Evidence

Students are given “field notes” that a biologist observing and describing an ecosystem might make. These field notes contain enough information to discern ways in which energy is transferred between organisms in the ecosystem, or, in other words, the field notes contain enough information to draw a food web diagram of the ecosystem. Students must use the field notes to produce a food web that depicts the implied energy flow.

The work reported in this paper is supported through a grant from Education Research Programs at the Institute of Education Sciences (IES), award number R305A110121, administered by the U.S. Department of Education. Faranak Rohani is the principal investigator for this research. Related information is available at <http://cala.fsu.edu/ies/>. Findings and opinions do not reflect the positions or policies of IES or the U.S. Department of Education.

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Example Task


Below is a picture of a pond ecosystem. A biologist visited this ecosystem and made observations about many of its living organisms. The biologist wrote these observations in the form of field notes.

Read the field notes on the next page, and use the information to construct a food web diagram of the living things in the pond ecosystem.



Example Task (continued)

Field Notes

Picture	Organism	Observations and Notes
	Largemouth bass fry (juvenile)	<ol style="list-style-type: none"> About 1 inch long Seen in a school of fish near the surface of the pond water Eats worms Sucks water in its mouth rapidly to capture prey Feeds on water fleas Feeds on insect larvae
	Blue-green algae	<ol style="list-style-type: none"> Obtains energy through photosynthesis Also called cyanobacteria Microscopic Seen in a sample of pond water under a microscope
	Snapping turtle	<ol style="list-style-type: none"> Seen basking on a log in the middle of the pond Captures and feeds on fish with its beaklike jaws About 20 inches long from back of shell to front of shell Eats crayfish Consumes pond lilies and hydrilla Mostly active at night and hunts by ambushing prey
	Water flea	<ol style="list-style-type: none"> Microscopic Has a hard outer shell for protection from some predators Seen in a sample of pond water under a microscope Filters the water to feed on bacteria, algae, amoebas, and flatworms
	Crayfish	<ol style="list-style-type: none"> Will eat tadpoles, leeches, and earthworms Has many predators, such as raccoons, snakes, and muskrats About 3 inches long Seen underneath a large rock in the pond Eats very small fish Consumes some plants, such as hydrilla
	Hydrilla	<ol style="list-style-type: none"> Several feet long Seen growing from the bottom of the pond up toward the surface and also free-floating in the pond at the surface Provides shelter for many animals, such as fish, frogs, turtles, and aquatic insects Obtains energy through photosynthesis
	Bullfrog tadpole	<ol style="list-style-type: none"> Seen swimming around aquatic plants in the pond About 2 inches long Feeds on water fleas and aquatic insects Lives up to two years and grows up to 6 inches before turning into a frog Eats algae

Photographs courtesy of Creative Commons in Flickr. Largemouth bass fry: U.S. Fish & Wildlife Service—Pacific Region; blue-green algae: Lake Improvement Association; snapping turtle: Dan Mushrush; water flea: Wellcome Images; crayfish: jcantroot; hydrilla: looseBits; bullfrog tadpole: Dave Huth.

Example Task (continued)

Answer Sheet

Draw your food web diagram on this page. When drawing your food web, be sure to do each of the following:

- Base your food web **only** on the information included in the field notes.
- Only use the seven plants and animals **pictured in the field notes** in your food web.
- Include the sun in your food web.
- For each statement in the field notes that describes a flow of energy, **draw an arrow** to represent the direction of the flow of energy in your food web. Then, **label the arrow** with the corresponding number from the field notes. **Arrows that are not labeled with a number from the field notes will not be scored.**
- Do not use the same number from the field notes more than once.

Scoring Plan for the Example Task

Note: Only score arrows in the student's food web that are labeled with a number. Ignore arrows that are not numbered. The correct number justifying each arrow is presented in parentheses in the scoring plan.

Only award points for an arrow when it is the **only** arrow between its respective nodes in the food web. For instance, award a point for an arrow labeled "30" between the sun and hydrilla only if there are no other arrows connecting the sun and hydrilla.

Depiction of Energy Flow

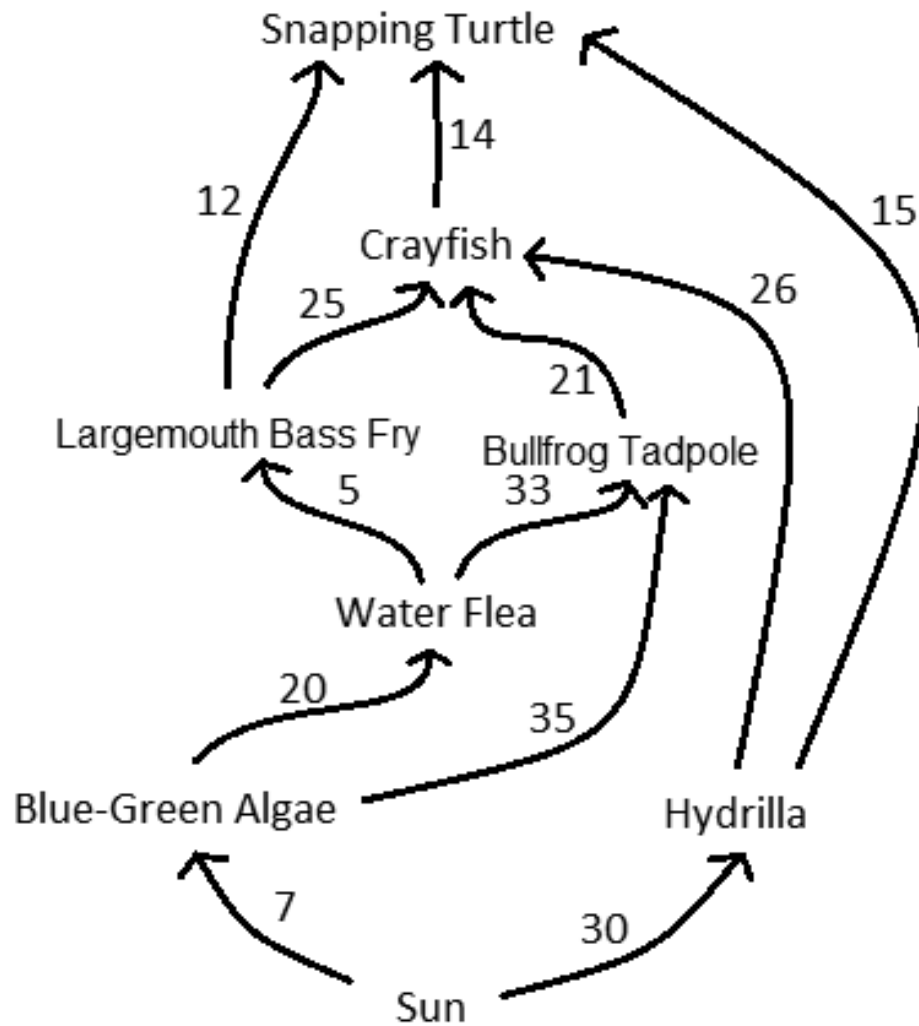
Sun to producers	Arrow from the sun pointing to hydrilla (30).	1 pt.
	Arrow from the sun pointing to blue-green algae (7).	1 pt.
Producers to consumers	Arrow from blue-green algae pointing to water flea (20).	1 pt.
	Arrow from blue-green algae pointing to bullfrog tadpole (35).	1 pt.
	Arrow from hydrilla pointing to crayfish (26).	1 pt.
	Arrow from hydrilla pointing to snapping turtle (15).	1 pt.
Consumers to consumers	Arrow from water flea pointing to bullfrog tadpole (33).	1 pt.
	Arrow from water flea pointing to largemouth bass fry (5).	1 pt.
	Arrow from bullfrog tadpole pointing to crayfish (21).	1 pt.
	Arrow from largemouth bass fry pointing to crayfish (25).	1 pt.
	Arrow from largemouth bass fry pointing to snapping turtle (12).	1 pt.
	Arrow from crayfish pointing to snapping turtle (14).	1 pt.

Lack of Errors

Food web contains four or fewer incorrect arrows. <ul style="list-style-type: none"> An arrow is incorrect if <ul style="list-style-type: none"> it does not depict a transfer of energy indicated by the field notes. it is not labeled with the correct number from the field notes. the arrow is drawn in the wrong direction (e.g., pointing from a consumer to a producer). 	1 pt.
Food web contains two or fewer incorrect arrows. <ul style="list-style-type: none"> A student is awarded this additional point for having fewer errors. 	1 pt.
Food web contains exactly 12 correct arrows and no incorrect arrows.	2 pts.

Scoring Plan for the Example Task (continued)

To facilitate scoring, you may refer to this completed food web diagram, which depicts all 12 links represented in the field notes. Note that a food web may differ structurally from this one (due to its arrangement of organisms), yet contain the same links.

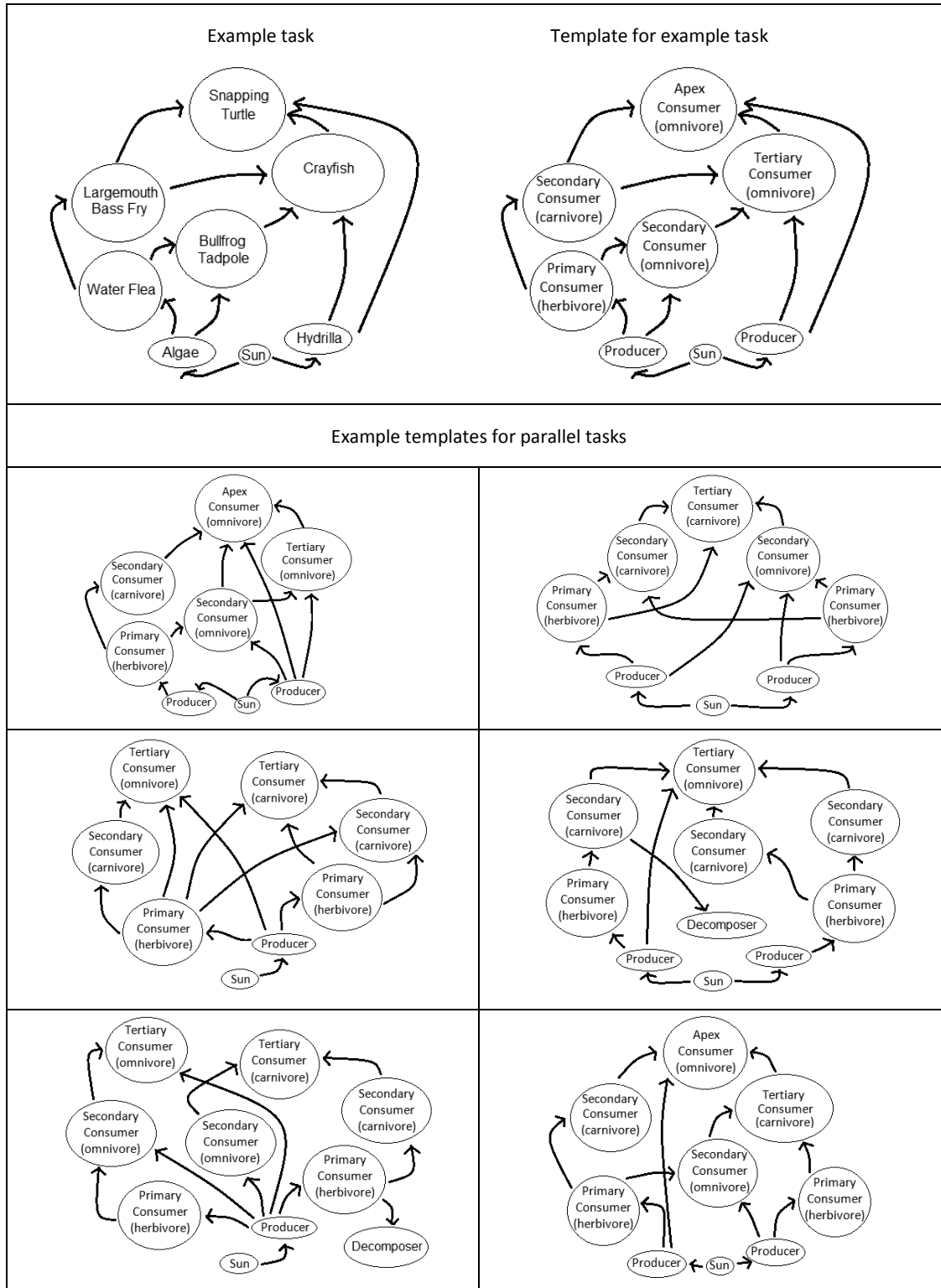


Procedure for Creating Parallel Tasks

Each parallel task pertains to a different ecosystem and contains a different set of field notes for a different set of organisms. **The directions to the student, however, will remain the same across all tasks.**

- On the first page of the assessment, students are presented with a picture that represents the ecosystem described by the field notes. The picture may or may not include some of the organisms in the field notes.
- On the second page of the assessment, students are presented with field notes that represent a biologist's observations and notes related to some of the organisms within the ecosystem.
 - The field notes should be formatted in a table in which the first column contains a picture of the organism, the second column names the organism, and the third column contains observations and notes about the organism.
 - The observations and notes in this table should always provide (1) the approximate size of the organism; (2) the location within the ecosystem in which the organism was observed; (3) the organism's diet or means of acquiring energy, such as photosynthesis or decomposition; and (4) at least one miscellaneous observation or fact related to the organism. This information should be presented in random order for each organism.
 - Each piece of information should be numbered because, for each arrow in their food webs, students must indicate the number corresponding to the information in the field notes that justifies the arrow. For this reason, each feeding relationship to be depicted in the food web should receive its own number. In other words, separate the information regarding an organism's diet into multiple numbers so that **each arrow to be depicted in the food web corresponds with only one number in the field notes.**
 - The information in the field notes defines the correct arrows between all organisms in the food web. It is **critical** that the information pertaining to an organism's diet is sufficient for students to determine which other organisms listed in the field notes provide it with energy. Because plants do not have a "diet," this section may simply state that the plant derives energy from photosynthesis.
 - The number of organisms in the field notes to be depicted in the food web should be **7–8**, and the number of arrows indicating energy flow between these organisms should be **exactly 12**. Avoid omitting from the field notes any feeding relationships that are likely to be known by students. This will help prevent students from offering their own, scientifically justifiable arrows in the food web that are not captured by the field notes.
 - Include at least one producer, one primary consumer, and one secondary consumer in the field notes. Decomposers and higher level consumers are optional.
 - In order to facilitate creating a food web that uses 7–8 organisms and contains exactly 12 arrows, **you may use any of the following templates** as starting points. Note that these are only a sample of possible templates that conform to this specification and many others may be valid. Each template already depicts 12 arrows, but other configurations of arrows are possible using the same types of organisms.

Templates for Parallel Tasks



Scoring Plan for Parallel Tasks

Note: Only score arrows in the student's food web that are labeled with a number from the field notes. The correct number justifying each arrow is presented in parentheses in the scoring plan.

Only award points for an arrow when it is the **only** arrow between its respective nodes in the food web. For instance, award a point for an arrow labeled "30" between the sun and hydrilla only if there are no other arrows connecting the sun and hydrilla.

Scoring plan used for the example task	Generic scoring criteria for all parallel tasks
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Depiction of Energy Flow

Arrow from the sun pointing to hydrilla (30).	Student earns one point for each correctly labeled arrow.	12 pts. max.
Arrow from the sun pointing to blue-green algae (7).		
Arrow from blue-green algae pointing to water flea (20).		
Arrow from blue-green algae pointing to bullfrog tadpole (35).		
Arrow from hydrilla pointing to crayfish (26).		
Arrow from hydrilla pointing to snapping turtle (15).		
Arrow from water flea pointing to bullfrog tadpole (33).		
Arrow from water flea pointing to largemouth bass fry (5).		
Arrow from bullfrog tadpole pointing to crayfish (21).		
Arrow from largemouth bass fry pointing to crayfish (25).		
Arrow from largemouth bass fry pointing to snapping turtle (12).		
Arrow from crayfish pointing to snapping turtle (14).		

Lack of Errors

Same as generic.	Food web contains four or fewer incorrect arrows. <ul style="list-style-type: none">• An arrow is incorrect if<ul style="list-style-type: none">○ it does not depict a transfer of energy indicated by the field notes.○ it is not labeled with the correct number from the field notes.○ the arrow is drawn in the wrong direction (e.g., pointing from a consumer to a producer).	1 pt.
Same as generic.	Food web contains two or fewer incorrect arrows. <ul style="list-style-type: none">• A student is awarded this additional point for having fewer errors.	1 pt.
Same as generic.	Food web contains exactly 12 correct arrows and no incorrect arrows.	2 pts.