**Food chain (1)**

The diagram shows a complete food chain.





cabbages

chaffinches

caterpillars

owls

1. Read the statements about **cabbages**.

How do you feel about each statement?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statement** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | Cabbages are at the start of the food chain. |  |  |  |  |
| **2** | Cabbages are producers. |  |  |  |  |
| **3** | Cabbage are consumers. |  |  |  |  |
| **4** | Cabbages are herbivores. |  |  |  |  |

The diagram shows a complete food chain.





cabbages

chaffinches

caterpillars

owls

1. Read the statements about **chaffinches**.

How do you feel about each statement?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statement** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | Chaffinches are producers. |  |  |  |  |
| **2** | Chaffinches are consumers. |  |  |  |  |
| **3** | Chaffinches are predators. |  |  |  |  |
| **4** | Chaffinches are prey. |  |  |  |  |

The diagram shows a complete food chain.





cabbages

chaffinches

caterpillars

owls

1. Read the statements about the food chain.

How do you feel about each statement?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statement** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | Owls eat chaffinches. |  |  |  |  |
| **2** | Chaffinches eat owls. |  |  |  |  |
| **3** | Owls eat caterpillars and cabbages. |  |  |  |  |
| **4** | Caterpillars cannot eat cabbages because caterpillars are smaller than cabbages. |  |  |  |  |

*Biology> Big idea BOE: Organisms and their environments > Topic BOE1: Interdependence of organisms > Key concept BOE1.1: Food chains and food webs*

|  |
| --- |
| **Diagnostic question** |
| **Food chain (1)** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Feeding relationships within a community of organisms can be modelled using food chain and food web diagrams. |
| Observable learning outcome: | Explain the order of organisms in a given food chain, using ideas about producers, consumers, predators and prey. |
| Question type: | Confidence grid |
| Key words: | food chain, producer, consumer, predator, prey, herbivore, carnivore |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

In a multinational study of students aged 16-18 (Barman, Griffiths and Okebukola, 1995), the majority of students described a food chain as showing ‘what eats what’ (i.e. feeding relationships); however, only approximately 10% of students used the terms ‘producer’ and ‘consumer’ when asked to explain what is shown by a food chain. This study also found a common misunderstanding that an organism located higher in a given food chain is a predator of all organisms below it in the chain.

In another study of 506 children aged 9-10 years old, it was found that many of the children used their perceptions of an organism’s relative size and ferocity when making conclusions about predator-prey relationships, and when deciding which animals were likely to be herbivores and which were likely to be carnivores (Gallegos, Jerezano and Flores, 1994). For example, thinking about relative size led some children to believe that an eagle could not be a predator of a deer.

**Ways to use this question**

Students should complete the confidence grids individually. This could be a pencil and paper exercise, or you could use the PowerPoint presentation with an electronic voting system or mini white boards.

*Differentiation*

You may choose to read the statements to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

*Cabbages*

1. Cabbages are at the start of the food chain – **right** (students who think this is wrong may be readings the arrows the wrong way around, as if they mean “eats”)
2. Cabbages are producers – **right** (cabbages make their own food by photosynthesis)
3. Cabbage are consumers – **wrong** (cabbages do not eat other organisms)
4. Cabbages are herbivores – **wrong** (cabbages do not eat other plants)

*Chaffinches*

1. Chaffinches are producers – **wrong** (animals cannot make their own food)
2. Chaffinches are consumers – **right** (animals get food by eating other organisms)
3. Chaffinches are predators – **right** (they are predators of caterpillars)
4. Chaffinches are prey – **right** (they are prey of owls)

*The food chain*

1. Owls eat chaffinches – **right**
2. Chaffinches eat owls – **wrong** (students who think this is right may be readings the arrows the wrong way around, as if they mean “eats”)
3. Owls eat caterpillars and cabbages – **wrong** (students who think this is right may have the misunderstanding that an organism located higher in a given food chain is a predator of all organisms below it in the chain)
4. Caterpillars cannot eat cabbages because caterpillars are smaller than cabbages – **wrong** (students who think this is right may have the misunderstanding that only size determines the relationship between what is eaten and what eats it)

**How to respond - what next?**

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas (meaning making) through dialogue.

It has been suggested that children find it easier to correctly identify predator and prey arrangements within food chains when the species are familiar, and particularly when the names are accompanied by pictures (Schollum, 1983). If is felt that students have selected the correct responses because they are familiar with the organisms depicted in the food chain, the following BEST diagnostic question probes students’ understanding using a food chain without familiar name or pictures:

* Diagnostic question: Food chain (2)

Confusion about the direction and meaning of the arrows in a food chain is a commonly reported misunderstanding (Gallegos et al., 1994; Gotwals and Songer, 2010), and suggests that students interpret the arrow to mean “eats” (Allen, 2014). In the multinational study of 16-18 year olds (Barman et al., 1995), most students placed the arrows the wrong way around (e.g. from predator to prey) when asked to assemble a food chain using pre-printed cards, yet when presented with a correct depiction of a food web they did not question the direction of the arrows even though in most cases they contradicted the students’ own constructions.

If it is suspected that students have misunderstandings about the direction and meaning of the arrows in a food chain, the following BEST diagnostic questions and ‘response activity’ probe their understanding further and help to build understanding through small group discussion:

* Diagnostic question: Links in the chain
* Diagnostic question: What do the arrows mean?

A number of authors have suggested challenging students to construct their own food chains, including for meals they have eaten themselves, to increase engagement and help develop understanding (Barker and Slingsby, 2011; Grumbine, 2012). Accordingly, the following BEST ‘response activities’ can be used in response to this diagnostic question to help build understanding through model-making and small group discussion:

* Response activity: Build a food chain
* Response activity: Breakfast food chains

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