**Producers and consumers**

The diagram shows a complete food chain.



owls

chaffinches



caterpillars

lavender

Lavender plants are producers.

Caterpillars, chaffinches and owls are consumers.

Read the statements in the table below.

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** | The consumers get food from the producers. |  |  |  |  |
| **2** | The consumers depend on the producers. |  |  |  |  |
| **3** | The lavender grows to make food for the caterpillars. |  |  |  |  |
| **4** | Caterpillars could survive without lavender. |  |  |  |  |
| **5** | Chaffinches could survive without lavender. |  |  |  |  |

*Biology> Big idea BOE: Organisms and their environments > Topic BOE1: Interdependence of organisms > Key concept BOE1.2: Interdependence within ecosystems*

|  |
| --- |
| **Diagnostic question** |
| **Producers and consumers** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | An ecosystem is made up of interdependent populations of organisms interacting with each other and the environment in which they live. |
| Observable learning outcome: | Recall that the community of organisms in an ecosystem depends on producers to make food. |
| Question type: | Confidence grid |
| Key words: | producer, consumer, food chain, interdependence |

**What does the research say?**

There is some evidence that even when students are aware of feeding relationships between organisms, they fail to appreciate that these are an example of the interdependence (or “connectedness”) of organisms (Driver et al., 1994).

Research shows that children up to age 11 commonly demonstrate egocentric (self-centred) or anthropocentric (human-centred) thinking. While they may be aware of organisms living in the wild (usually as individuals rather than populations), some students incorrectly think that these need to be fed, watered or cared for by humans; and some students demonstrate incorrect teleological thinking that organisms exist in order to provide food or other ecosystem services to others (e.g. “there are lots of rabbits so that foxes won’t get hungry”). Older children are more likely to think about populations of organisms (rather than individual organisms) living in the wild, though will often struggle to describe their interrelationships or interdependence without resorting to incorrect teleological explanations or simple statements such as “birds live in trees” or “foxes eat rabbits” (Leach et al., 1992; Driver et al., 1994).

There is evidence that incorrect teleological explanations of interdependence – namely that some organisms exist specifically for the benefit of others (e.g. to feed them) – persist in students up to tertiary level (Brumby, 1982).

In a study of students aged from 13 up to undergraduate level, most biology students knew that animals could not exist without plants, but only one quarter of these students could explain that this is because animals cannot make their own food and some thought that carnivores could exist seemingly indefinitely without plants by feeding on their prey (Eisen and Stavy, 1988).

**Ways to use this question**

Students should complete the confidence grid 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**

1. The consumers get food from the producers – **right**
2. The consumers depend on the producers – **right** (students who select ‘wrong’ may not appreciate that feeding relationships are an example of interdependence)
3. The lavender grows to make food for the caterpillars – **wrong** (students who select ‘right’ may be using teleological reasoning – i.e. thinking that producers grow or exist in order to feed consumers)
4. Caterpillars could survive without lavender – **wrong** (see below)
5. Chaffinches could survive without lavender – **wrong** (see below)

Using only the evidence provided in the food chain diagram, the expected answer to 4 and 5 is ‘wrong’, as consumers cannot survive without producers. However, students who think statements 4 and 5 are ‘right’ could be challenged to explain why – they might reason, or know from experience, that these consumers have other sources of food. However, in the case of the chaffinches in statement 5, they might also have the common misunderstanding that a secondary consumer could survive without producers if its prey (the primary consumer/caterpillars) multiplied plentifully (Eisen and Stavy, 1988).

**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.

If students have misunderstandings about producers and consumers, and the differences between them, key concept BOE1.1 *Food chains and food webs* provides diagnostic questions and response activities to further probe and develop their understanding.

A number of authors have suggested using games (e.g. Biffi et al., 2016; Hartweg et al., 2017) to increase engagement and help develop students’ understanding of interdependence within food chains. The following BEST ‘response activity’ describes how the game of Jenga can be adapted to help develop understanding, and thus could be used in follow-up to this diagnostic question:

* Response activity: Food chain Jenga!

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