**Phytoplankton**

Tom looks at the following diagram:

billfish

herring

zooplankton

phytoplankton

The diagram shows a complete food chain from the Atlantic Ocean.

Tom doesn’t recognise the names in the food chain. But he thinks phytoplankton might be **producers**.

1. Which statement do you agree with?

|  |  |
| --- | --- |
| **A** | Phytoplankton must be producers. |
| **B** | Phytoplankton must be consumers. |
| **C** | Phytoplankton could be producers or consumers. |
| **D** | It is not possible to decide from the food chain diagram. |

1. What is the **best** explanation for your answer to question 1?

|  |  |
| --- | --- |
| **A** | Food chains always start with a producer. |
| **B** | Food chains always start with a consumer. |
| **C** | All of the food in a food chain is made by the first organism in the chain. |
| **D** | Light and carbon dioxide could not get through the ocean water. |
| **E** | Producers need carbon dioxide from air, and there is no air under water. |

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

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| --- |
| **Diagnostic question** |
| **Phytoplankton** |

**Overview**

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| --- | --- |
| 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: | Two-tier multiple choice |
| Key words: | producer, consumer, food chain, interdependence |

**What does the research say?**

There is evidence that, even after teaching about food chains, some students up to age 15 do not accept that producers exist in aquatic habitats, particularly when the students have little or no experience of habitats with plants living under water (Adeniyi, 1985; Driver et al., 1994). Even when students recognise the existence of plants in aquatic ecosystems, some thought that light and carbon dioxide could not penetrate the water and therefore believed that the aquatic plants could not be producers (Leach et al., 1992).

In a study of students aged from 13 up to undergraduate level, most biology students knew what 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**

This activity probes students’ understanding of the key idea that all food chains start with a producer, upon which all consumers in the food chain depend for food. The food chain presented in the student worksheet deliberately uses organisms that are less likely to be familiar to students, without pictures; this aims to reduce the likelihood that students will be able to answer the questions based on familiarity with the organisms, so that their ability to apply the key idea can be assessed.

Students should complete the questions 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*

Options 2D and 2E could be omitted to simplify the question for some students.

You may choose to read the questions and answers 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. A – Phytoplankton must be producers.
2. C – All of the food in a food chain is made by the first organism in the chain.

Answer 2A (“Food chains always start with a producer”) is also acceptable, but is more of a “rule of thumb”; answer 2C shows deeper understanding by explaining *why* food chains always start with a producer.

**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!

**Acknowledgments**

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**References**

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