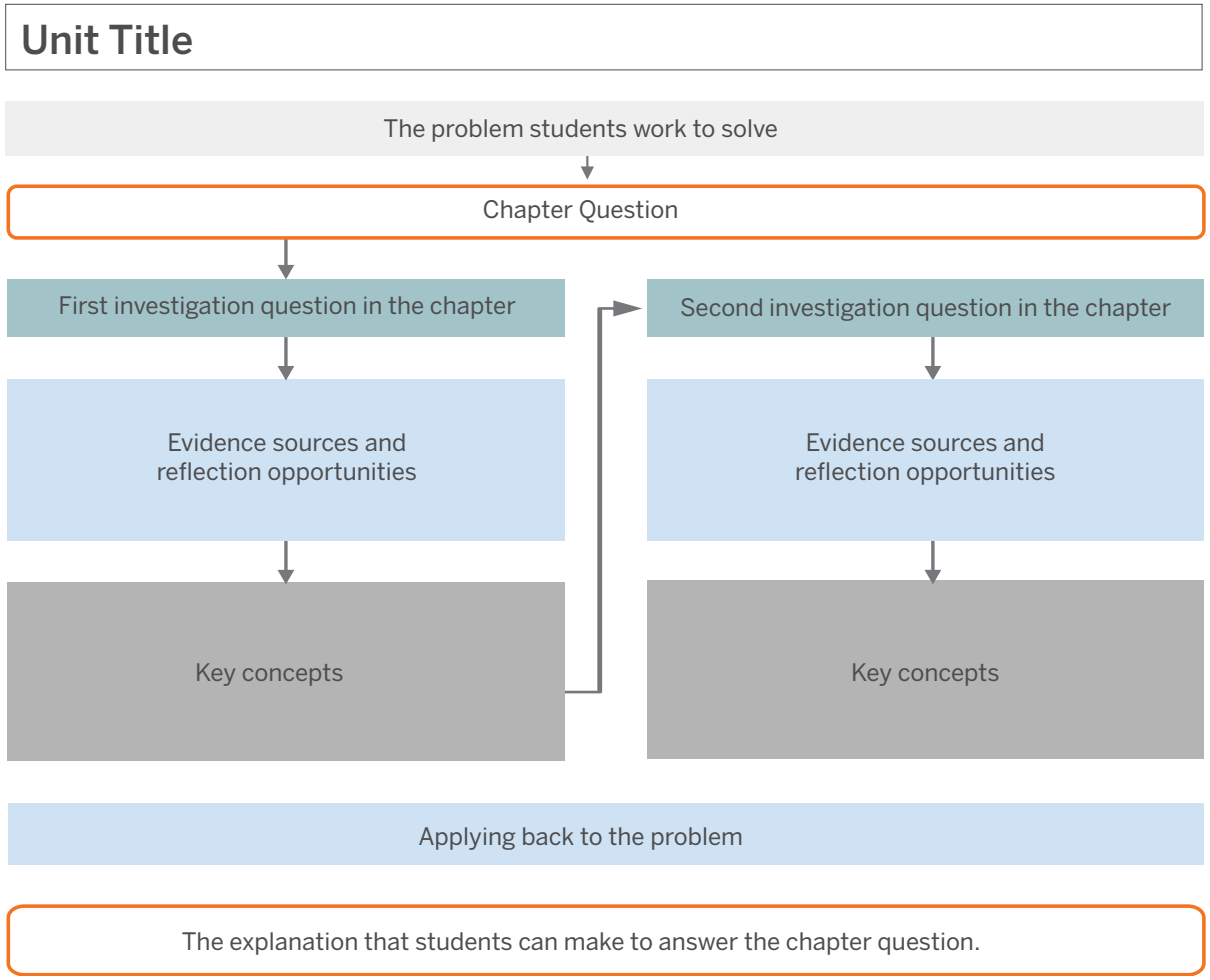
Populations and Resources Coherence Flowchart

The storyline of the unit

In each Amplify Science unit, students figure out a phenomenon by asking questions, gathering evidence, and coming up with an explanation of how the phenomenon works. The Coherence Flowchart visually represents the storyline of the unit, showing the coherent flow of questions, evidence, and ideas that support students as they build complex explanations of the unit's anchor phenomenon. The Coherence Flowchart on the following pages (one chapter per page) can be used to see the connections between the questions that drive students' experiences, the evidence they gather, the ideas they figure out, and the new questions that those ideas generate. The diagram to the right explains the structure of a chapter in the Coherence Flowchart.

Note: The Coherence Flowchart is a tool for teachers and is not meant to be distributed to students.

Typical structure of one chapter in a Coherence Flowchart



Instruction is framed by questions about the unit's anchor phenomenon and the related problem students are solving. Chapter Questions then guide students in figuring out the phenomenon, piece by piece. Within each chapter, Investigation Questions focus students on a manageable piece of content that will help them figure out the Chapter Question. Each question motivates activities, and each activity provides specific evidence related to the Investigation Question. Students synthesize the understanding constructed over multiple activities, and this understanding is formalized through key concepts. Often a key concept leads students to an additional Investigation Question students need to pursue to answer the Chapter Question. At the end of the chapter, students' new understanding is applied back to the unit's anchor phenomenon and leads students to a new Chapter Question or a final explanation.

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Populations and Resources: Too Many Moon Jellies

The problem students work to solve

What caused the size of the moon jelly population in Glacier Sea to increase?

Chapter 1 Question

What caused the size of the moon jelly population in Glacier Sea to increase?

Investigation Question

How do births and deaths in a population affect its size? (1.3, 1.4)

Evidence sources and reflection opportunities

- Use the Sim to to observe what can happen to an organism in a population (1.2)
- Use a token to find out how births and deaths in a population can affect the population size (1.3)
- Watch a video demonstrating stability and change in a system (1.3)

Key concepts

- Within a population organisms are always being born and dying. (1.2)
- A system can be stable even as things are being added to and removed from it. If the amounts being added and being removed are not equal, then the system will change. (1.3)
- If the number of births and deaths in a given time are equal, then the population size will be stable. (1.3)
- If there are more births than deaths in a given time, then the size of the population will increase. If there are fewer births than deaths, then the size of the population will decrease. (1.3)

Application of key concepts to the problem

- Evaluate the quality of evidence about the moon jelly population (1.4)
- Use the paper Modeling Tool to show the cause of the moon jelly population increase (1.4)

Explanation that students can make to answer the Chapter 1 Question

There are always births and deaths happening in the jelly population. If the population increased it means that there were more births than deaths. This could have happened because births increased or because deaths decreased.

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Populations and Resources: Too Many Moon Jellies

The problem students work to solve

What caused the size of the moon jelly population in Glacier Sea to increase?

Chapter 2 Question

What could have caused the births to increase or the deaths to decrease in the moon jelly population?

Investigation Questions

What can change the number of births in a population? (2.1, 2.2, 2.3)

What can change the number of deaths in a population? (2.4)

Evidence sources and reflection opportunities

- Read "Reproduction and Energy" (2.1)
- Conduct a hands-on experiment with yeast to get evidence that more energy storage molecules result in an organism releasing more energy (2.2)
- Revisit "Reproduction and Energy" (2.2)
- Use the Sim to investigate what can increase the number of births in a population (2.3)

- Use the Sim to investigate what can change the number of deaths in a population. (2.4)
- Write and share about how changes to consumer populations can affect the size of their resource populations (2.4)

Key concepts

- Organisms need to release energy from energy storage molecules in order to reproduce. (2.2)
- Organisms in consumer populations get energy storage molecules from eating organisms in resource populations. (2.2)
- The more energy storage molecules available to a population, the more the organisms in that population can reproduce. (2.2)
- The larger the resource population, the more energy storage molecules are available for its consumer populations. (2.3)

- The larger the consumer population, the more energy storage molecules it will need. Therefore, it will eat more, causing more deaths in the resource population. (2.4)

Application of key concepts to problem

- Use the paper Modeling Tool to model a claim about why the moon jelly population increased (2.7)
- Evaluate the quality of evidence about Glacier Sea populations (2.7)

Explanation that students can make to answer the Chapter 2 Question

The moon jelly population increased there were either more births or fewer deaths in the population than before. Moon jellies eat zooplankton and the zooplankton population increased, so there are more energy storage molecules available for the jellies to eat. To reproduce, organisms need to release energy from energy storage molecules. If there are more energy storage molecules available to the moon jellies, they can reproduce more, resulting in more births. Fewer deaths would also cause the jelly population to increase. The sea turtle population, the moon jellies consumer population, decreased. A smaller consumer population needs fewer energy storage molecules so the turtles would eat less of the moon jellies, so fewer moon jellies would die. As a result, the moon jelly population increased.

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Populations and Resources: Too Many Moon Jellies

The problem students work to solve

What caused the size of the moon jelly population in Glacier Sea to increase?

Chapter 3 Question

How could a population besides the zooplankton or sea turtles have caused the moon jelly population to increase?

Investigation Question

What can affect the size of a population besides its resource or consumer populations? (3.1, 3.2, 3.3)

Evidence sources and reflection opportunities

- Read "Jelly Population Explosion" (3.1)
- Revisit "Jelly Population Explosion" (3.2)
- In the Sim, find two two populations that compete for the same resource and try to change one population in order to increase the other (3.2)
- Investigate other indirect effects in the Sim by changing the size of a population without changing its resource or consumer population (3.3)

Key concepts

- Two populations can compete for the same resource population. A change to one of these populations affects the size of the other. (3.2)
- The size of a population can be affected by any population that is connected to it in a food web, even if they are not directly connected. (3.3)

Application of key concepts to the problem

- Write and share about indirect effects on the size of the moon jelly population in the Glacier Sea (3.3)
- Evaluate and analyze evidence about populations in the Glacier Sea ecosystem (3.4)
- Write an argument about the cause of the Moon Jelly population increase (3.4)

Explanation that students can make to answer the Chapter 3 Question

When the walleye pollock population decreased, there were more zooplankton available for the moon jellies to eat. Since the jellies had more energy storage molecules, they were able to reproduce more. This lead to more births than deaths in the moon jelly population, which caused the jelly population to increase.

Populations and Resources: Too Many Moon Jellies

Problem students work to solve and the Chapter 4 Question

What was the main cause of the decrease in the size of the orange-bellied parrot population?

Application of key concepts to new problem

- Create food webs for the Tasmanian ecosystem (4.1)
- Evaluate the quality of evidence about the Tasmanian ecosystem (4.1)
- Analyze and sort evidence based on claims (4.2)
- Participate in the Science Seminar (4.3)
- Write an argument to support a claim (4.3)

Explanation that students can make to answer the Chapter 4 Question

One possible explanation students can make:

The parrot population decreased because births decreased. The evidence shows that sparrow hawks decreased. A smaller population needs fewer energy storage molecules so they would eat fewer sparrows. This means that there would be fewer deaths in the sparrow population. The evidence also shows that births of the sparrows increased. If the births increased and the deaths decreased, the sparrow population would increase. A larger population would need more energy storage molecules so they would eat more buttongrass causing more buttongrass deaths. If the deaths of the buttongrass increased, there could be a decrease in the buttongrass if births were less than deaths. A smaller buttongrass population means that fewer energy storage molecules would be available to the parrot population. Ecologists found parrots had less fat on their bodies, which is evidence that they have been eating fewer energy storage molecules). With fewer energy storage molecules, they would reproduce less and have fewer births. This could cause births to be less than deaths, and the population would decrease.