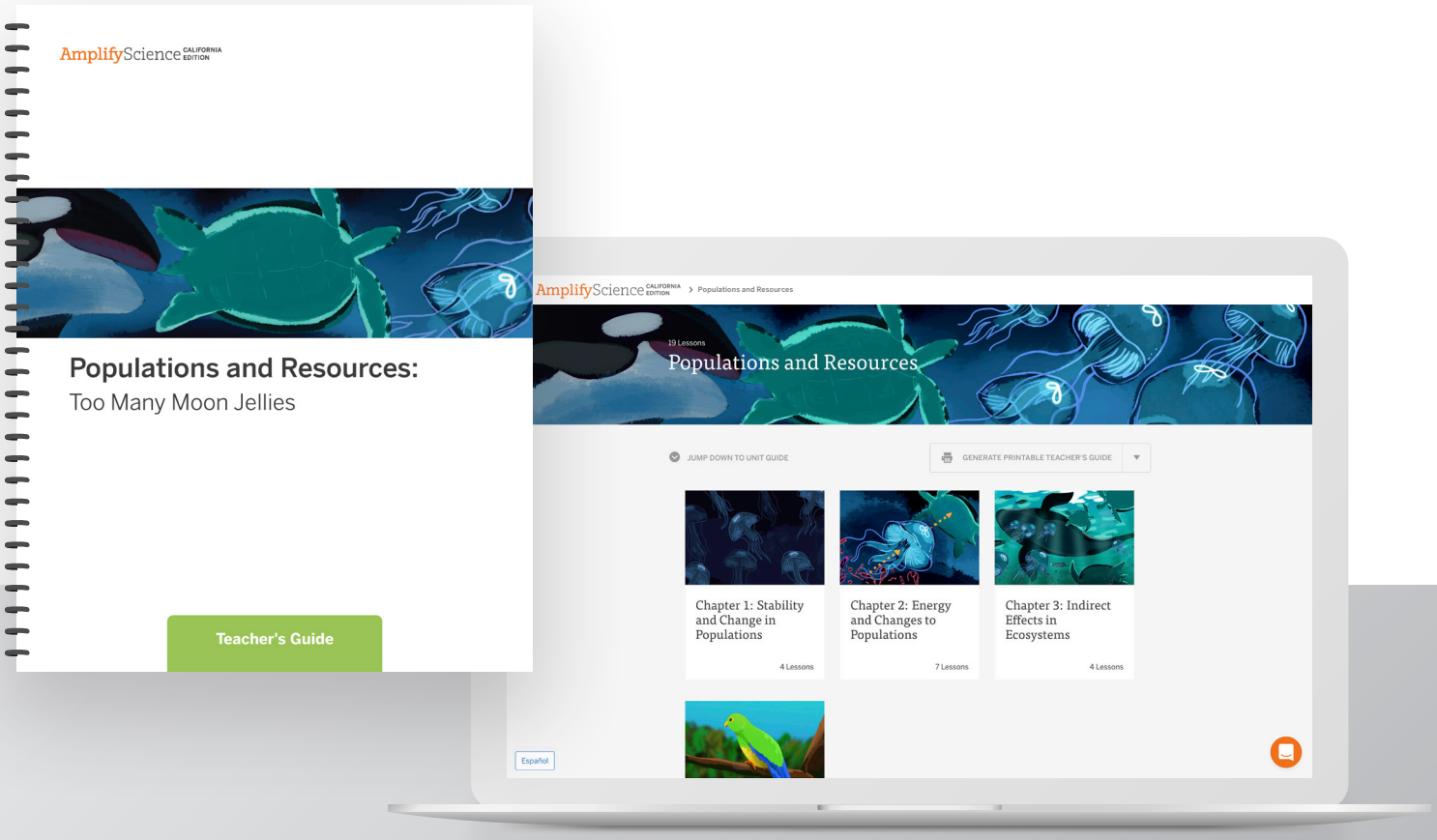
Amplify Science
CALIFORNIA

UNIT GUIDE

Populations and Resources



Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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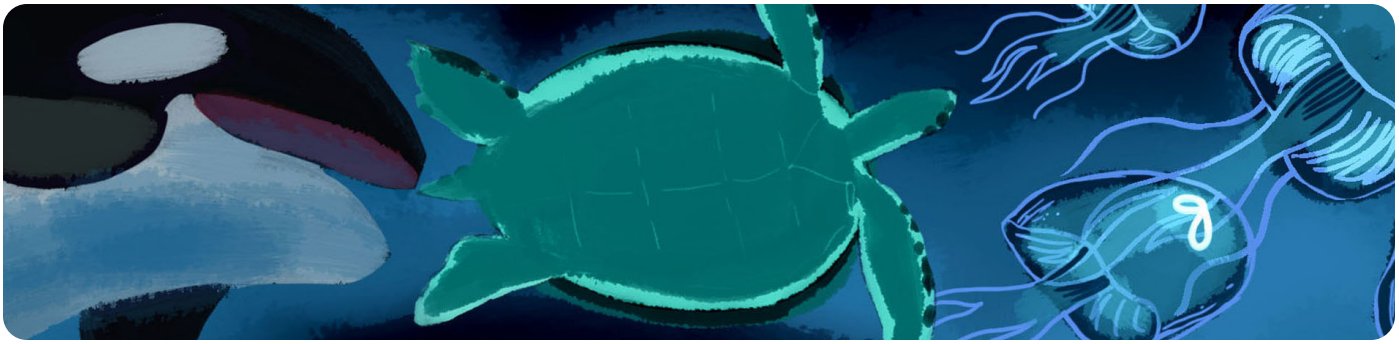


Welcome to Populations and Resources

The moon jelly population is increasing, which is a real and current issue with which ocean scientists around the world are grappling. Understanding and untangling the interconnected relationships of organisms in an ecosystem is not something for which there is a simple right answer. Rather, it's something that needs to be figured out based on the changing population data in a particular region. Amplify Science California helps students make these critically important connections by relating learning in this unit to what they've learned in the Metabolism unit previously. In this way, students begin to see how the functions and needs of an organism relate to the functions and needs of a whole population in an ecosystem.

> Unlike a typical curriculum, Amplify Science California anchors learning by inviting students to take on the role of scientists and engineers.

In this unit, students take on the role of ecologists. Their job is to help a research center near the fictional Glacier Sea investigate a puzzling increase in the moon jelly population there. Working together, students learn about how ecosystems are connected, and how changes to one population in the food web might cause changes to another. The unit concludes with a Science Seminar in which students use what they have learned to analyze evidence and participate in a discussion about what may have caused a decrease in the orange-bellied parrot population on an island in the South Pacific Ocean.

Unit Type: Core

Student Role: Ecologists

Phenomenon: The size of the moon jelly population in Glacier Sea has increased.

Core Concepts: Understanding how ecosystems work, and how different populations affect each other, both directly and indirectly

Target Performance Expectations:

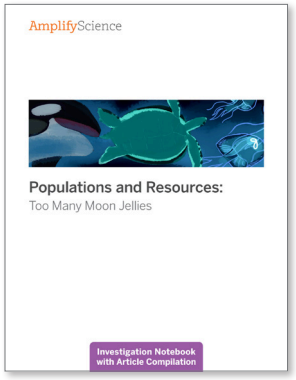
- LS2-1: Resources and Populations
- LS2-2: Ecosystem Relationships
- LS2-3: Flow of Energy and Cycling of Matter
- LS2-4: Changes Affect Populations
- LS2-5: Ecosystem Services

Related Performance Expectations:

- LS1-7: Cellular Respiration
- ESS3-3: Designs to Minimize Impact

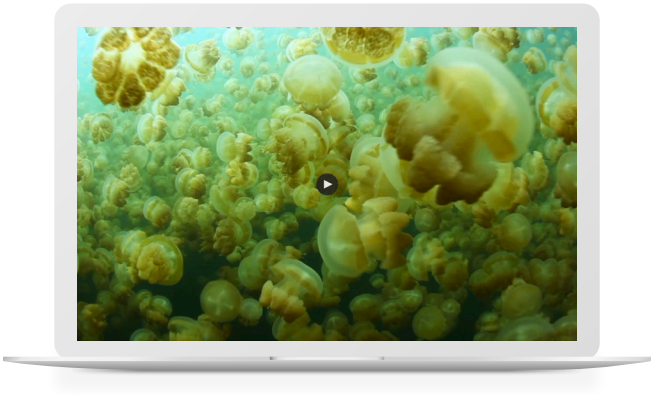
Students figure out the unit phenomenon through the use of a variety of resources.

Student Investigation Notebook

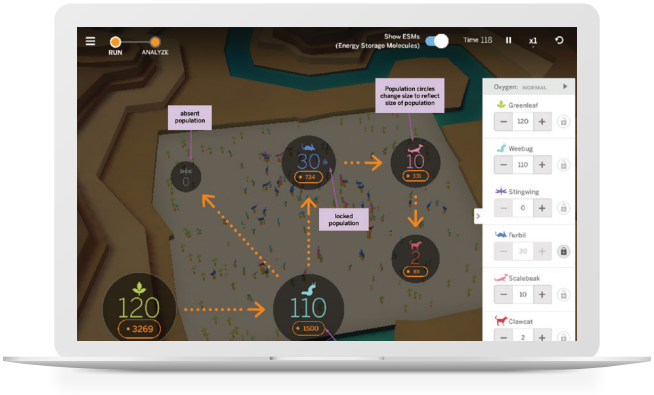


Hands-On Kit

Videos



Digital Tools



About technology in this unit:
All Amplify Science California lessons were designed with device sharing in mind, and never assume that every student has a separate device.

In this grade, student-facing technology includes Practice Tools and digital Simulations. When the use of a digital tool is called for in a lesson, teachers have several implementation options:

If limited student devices are available—teachers can have students do activities in pairs or small groups.

If no student devices are available—teachers can project the digital tool to the class and either "drive" the digital tool themself or invite students to "drive" by using their device.

If internet access is unavailable—teachers can "pre-load" the digital tool on their device for use offline.

Chapter 1:
The storyline begins

What students investigate:

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

What students figure out:

Within a population, organisms are always being born and dying. If the number of births and deaths in a given time are equal, then the population size will be stable. 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.

How they figure it out:

- Watching a documentary video about ecologists studying jelly populations
- Reading an article about other populations that are part of the moon jelly ecosystem
- Modeling births and deaths in a population using tokens
- Watching a video about stability and change
- Evaluating evidence about the jelly population
- Creating a visual model showing two possible reasons the jelly population may have increased

KEY


CLASS


HANDS-ON


HOMEWORK


MODELING


READING


SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WARM-UP


WRITING

DAY 1 | LESSON 1.1

Pre-Unit Assessment

- Multiple-Choice Questions (25 min)
- Written-Response Question #1 (10 min)
- Written-Response Question #2 (10 min)

Pre-Unit Assessment

DAY 2 | LESSON 1.2

Mysterious Moon Jelly Increase

- Warm-Up (5 min)
- Video: Studying Jelly Populations (5 min)
- Introduction to the Glacier Sea Ecosystem (10 min)
- Exploring the Populations and Resources Sim (25 min)
- Homework

DAY 3 | LESSON 1.3

Births and Deaths in Populations

- Warm-Up (5 min)
- Birth and Death Token Model (30 min)
- Playing Stability and Change Video (10 min)
- Homework

On-the-Fly Assessment

DAY 4 | LESSON 1.4

Births and Deaths in the Jelly Population

- Warm-Up (10 min)
- Sampling a Jelly Population Video (5 min)
- Evaluating Moon Jelly Population Evidence (15 min)
- Modeling the Moon Jelly Population (20 min)
- Homework
- Self-Assessment (Optional)
- Family Homework Experience (Optional)

On-the-Fly Assessment
Self-Assessment

Chapter 2:
The storyline builds

What students investigate:

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

What students figure out:

The jellies may have increased because of an increase in zooplankton or a decrease in sea turtles. Organisms need to release energy from energy storage molecules in order to reproduce. Organisms in consumer populations get energy storage molecules from eating organisms in resource populations. The more energy storage molecules available to a population, the more the organisms in that population can reproduce. The larger the resource population, the more energy storage molecules are available for its consumer populations. 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.

How they figure it out:

- Reading articles about why organisms need energy in order to reproduce
- Conducting a yeast experiment in order to test the effect of more or less food available for a population
- Testing ways of changing the amount of reproduction and ways of changing the amount of deaths in the Sim
- Creating visual models showing possible reasons for the increase in moon jellies
- Evaluating and analyzing evidence about other populations in the ecosystem

KEY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STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WARM-UP


WRITING

DAY 5 | LESSON 2.1

"Reproduction and Energy"

- Warm-Up (5 min)
- Reading "Reproduction and Energy" Article Set (20 min)
- Discussing Annotations (20 min)
- Homework

On-the-Fly Assessment

DAY 6 | LESSON 2.2

Energy Storage Molecules

- Warm-Up (5 min)
- Setting Up the Yeast Experiment (15 min)
- Rereading "Reproduction and Energy" Article Set (15 min)
- Returning to the Yeast Experiment (5 min)
- Yeast Reproduction (5 min)
- Homework

DAY 7 | LESSON 2.3

Births Changing in a Population

- Warm-Up (5 min)
- Changing the Number of Births in the Sim (30 min)
- Reflecting on Changing Births (10 min)
- Homework

On-the-Fly Assessment

DAY 8 | LESSON 2.4

Deaths Changing in a Population

- Warm-Up (5 min)
- Changing the Number of Deaths in a Population (35 min)
- Write and Share: Discussing Changes to Ecosystems (20 min)
- Homework

On-the-Fly Assessment

DAY 9 | LESSON 2.5

Critical Juncture Assessment

- Multiple-Choice Questions (25 min)
- Written-Response Question #1 (10 min)
- Written-Response Question #2 (10 min)

Critical Juncture Assessment

DAY 10 | LESSON 2.6

Revisiting Key Concepts

- Warm-Up (5 min)
- Introducing the Population Puzzles (5 min)
- Population Puzzles (25 min)
- Sharing Population Puzzles and Solutions (10 min)

DAY 11 | LESSON 2.7

Claims About the Jelly Increase

- Warm-Up (5 min)
- Modeling the Jelly Ecosystem (20 min)
- Evaluating Evidence (20 min)
- Homework
- Self-Assessment (Optional)

Self-Assessment

Chapter 3:
The storyline gets more complex

What students investigate:

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

What students figure out:

The jellies may have increased because of an increase in phytoplankton, leading to an increase in zooplankton; a decrease in walleye pollock, leading to an increase in zooplankton; or an increase in orcas, leading to a decrease in sea turtles. Two populations can compete for the same resource population. A change to one of these populations affects the size of the other. 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.

How they figure it out:

- Reading an article about two real populations of moon jellies: one that increased and one that remained stable
- Investigating competition and other indirect effects in the Sim
- Evaluating and analyzing evidence about different populations in the ecosystem

KEY

- CLASS
- HANDS-ON
- HOMEWORK
- MODELING
- READING
- SIM
- STUDENT-TO-STUDENT DISCUSSION
- TEACHER
- TEACHER-LED DISCUSSION
- WARM-UP
- WRITING

DAY 12 | LESSON 3.1

"Jelly Population Explosion"

- Warm-Up (5 min)
- Reading "Jelly Population Explosion" (25 min)
- Discussing Annotations (10 min)

On-the-Fly Assessment

DAY 13 | LESSON 3.2

Competition in Ecosystems

- Warm-Up (5 min)
- Rereading "Carbon in the Global Ecosystem" (15 min)
- Competition in the Sim (20 min)
- Thinking About Indirect Effects (5 min)
- Homework

On-the-Fly Assessment

DAY 14 | LESSON 3.3

More Indirect Effects

- Warm-Up (5 min)
- More Indirect Effects in the Sim (20 min)
- Discussing Indirect Effects in Glacier Sea (20 min)
- Homework

On-the-Fly Assessment

DAY 15 | LESSON 3.4

Final Arguments About the Jelly Increase

- Warm-Up (5 min)
- Evaluating and Analyzing Evidence (15 min)
- Writing Final Arguments (15 min)
- Beginning Final Models of the Population Increase (10 min)
- Homework
- Self-Assessment (Optional)

Self-Assessment

Chapter 4:
Application to a new storyline

What students investigate:

The size of an orange-bellied parrot population on an island off the coast of Australia has decreased. But why? Is it due to a decrease in births across the population, or due to a increase in deaths?

What students figure out:

Students consider whether the decrease in this parrot's population is due to a decrease in births or an increase in deaths by being eaten.

How they figure it out:

- Analyzing evidence about several populations in the ecosystem including Tasmanian devils, buttongrass seeds, foxes, and more
- Reviewing available evidence to make an argument
- Engaging in oral argumentation in a student-led discourse routine called a Science Seminar
- Writing final arguments

KEY


CLASS


HANDS-ON


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SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WARM-UP


WRITING

DAY 16 | LESSON 4.1

The South Pacific Island Ecosystem

- Warm-Up (5 min)
- Introducing the Science Seminar (20 min)
- Evaluating Evidence (20 min)
- Homework

DAY 17 | LESSON 4.2

Analyzing Claims and Evidence

- Warm-Up (5 min)
- Analyzing the Food Web (15 min)
- Evidence Sorting (25 min)

DAY 18 | LESSON 4.3

Science Seminar

- Warm-Up (5 min)
- Preparing for the Science Seminar (10 min)
- Introducing the Science Seminar (5 min)
- Participating in the Science Seminar (25 min)
- Homework
- Self-Assessment (Optional)

On-the-Fly Assessment
Self-Assessment
Optional Flextension: *Measuring Nonliving Factors in Ecosystems*

DAY 19 | LESSON 4.4

End-of-Unit Assessment

- Multiple-Choice Questions (25 min)
- Written-Response Question #1 (10 min)
- Written-Response Question #2 (10 min)

End-of-Unit Assessment

All students. All standards.

Rather than treating the standards simply as a list of topics to cover, we designed Amplify Science California to allow for truly in-depth and integrated coverage of the disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). Unlike other programs, however, ours makes the NGSS' vision of "all students, all standards" a reality by creating a unit-specific learning progression for every unit called a Progress Build.

Each Progress Build defines several levels of understanding of the unit's anchoring phenomenon, with each level integrating and building upon the knowledge and skills from lower levels. In this way, each Progress Build provides a clear roadmap for how students' understanding of the phenomenon is expected to deepen and develop with each successive chapter and lesson.

What's more, the program's system of assessments is also tied to these Progress Builds. This carefully crafted integration provides teachers with credible, actionable, and timely diagnostic information about student progress toward the unit's learning goals and grade-level performance expectations. Armed with this powerful data, teachers have the ultimate flexibility to decide when to move on and when to slow down and dive deeper.

Populations and Resources Progress Build

The Progress Build in this unit consists of three levels of understanding. At each level, students add new ideas and integrate them into a progressively deeper understanding of how populations in an ecosystem can affect one another's size.

Progress Build Level 1:

There are always births and deaths occurring in a population. Changes in the number of births and deaths can change the size of a population.

Progress Build Level 2:

A change in the number of births and deaths in a population can be caused by a change in the size of its resource populations or consumer populations.

Progress Build Level 3:

A change in the number of births and deaths in a population can be caused by a change in the size of a population other than its resource or consumer population.

Examples of differentiation in this unit

In addition to providing unit-specific Progress Builds that break learning goals into smaller, more achievable levels of understanding, Amplify Science California makes learning accessible for all students through a variety of scaffolds, supports, and differentiation strategies for every lesson. **For a complete list of strategies, see the Differentiation section of every Lesson Brief**.

Below are a few examples of strategies embedded in this unit.

For English learners:

Supporting students to demonstrate their learning in writing (Example from Lesson 3.4)
This lesson includes a writing assignment with written prompts in English. Some English learners, especially those at the early Emerging level of English language proficiency (i.e., Newcomer ELs) may experience more success expressing their ideas when provided a few different options. It would be appropriate for this group of students to read the prompts and express their ideas in writing, using their primary language. Providing students with this opportunity allows them to show what they know about the science concepts, rather than whether or not they can express their understanding of concepts in English. After students have written in their primary language, you may ask them to explain what they wrote as you record their ideas. If this discussion is done in English, it will provide you with insights into how they use English to express their knowledge. It may also be appropriate for these students to express their ideas by using labeled drawings or diagrams rather than providing purely written responses. After students have recorded their responses in this way, you may invite them to elaborate orally as you record their ideas. Additionally, consider providing a structured time for students to share their ideas orally with a partner before they write their final argument.

For students needing more support:

Creating a positive environment by setting attainable goals (Example from Lesson 2.1)
You might find that many students disengage during independent reading time. These students might feel overwhelmed by the length of the articles or the cognitive load involved in having to read an entire article and record questions and connections about it. It is important that students who struggle or who are intimidated by reading have a strategy for feeling successful as they read, even if they do not finish the entire text. Assure them that the goal is to think of at least one question they have about the article as they annotate. They can focus on a single paragraph or a visual representation and do not need to read the entire article during class.

For students ready for a challenge:

Asking deeper questions and making broader connections (Example from Lesson 2.1)
Students who need more challenge should be encouraged to push themselves to ask deeper questions and make broader connections while they read. Active Reading is a very sophisticated way to read, and many advanced learners who haven't used this practice before are surprised and pleased to see how much more they get out of reading when they take the time to slow down and interact with the text in this way. You can also ask students who need more challenge to record ideas and questions they have about the population the read about, reproduction, or energy storage molecules that weren't addressed in the text.

3-D Statements

In order to help teachers recognize the three-dimensional structure of every unit, chapter, and lesson, each unit contains a 3-D Statement document that makes the integration clear.

Making the 3-D statement document all the more effective, the three dimensions are color-coded for easy recognition.

Populations and Resources 3-D Coverage

SEPs
Science and Engineering Practices

DCIs
Disciplinary Core Ideas

CCCs
Cross-Cutting Concepts

Unit Level

Students develop and use models, obtain information from articles, and analyze and interpret data to understand energy transfer within ecosystems, relationships between populations (energy and matter), and how changes to one part of the ecosystem can affect the rest of the system (systems and system models). Students construct explanations about what caused the moon jelly population to dramatically increase (stability and change) in the fictional Glacier Sea.

Chapter Level

Chapter 1: Stability and Change in Populations

Students investigate population change within an ecosystem (stability and change)—through the case of the moon jelly population explosion in Glacier Sea—by using physical and digital models to gather evidence of how births and deaths affect population size (cause and effect).

Chapter 2: Energy and Changes to Populations

Students gather evidence from a digital model, hands-on experiments, and science texts about how changes to a population's resource and consumer populations affect the flow of energy storage molecules in an ecosystem, resulting in a change to a population's size (stability and change, energy and matter). Students also construct explanations about what could have caused births to increase or deaths to decrease in the Glacier Sea moon jelly population (cause and effect).

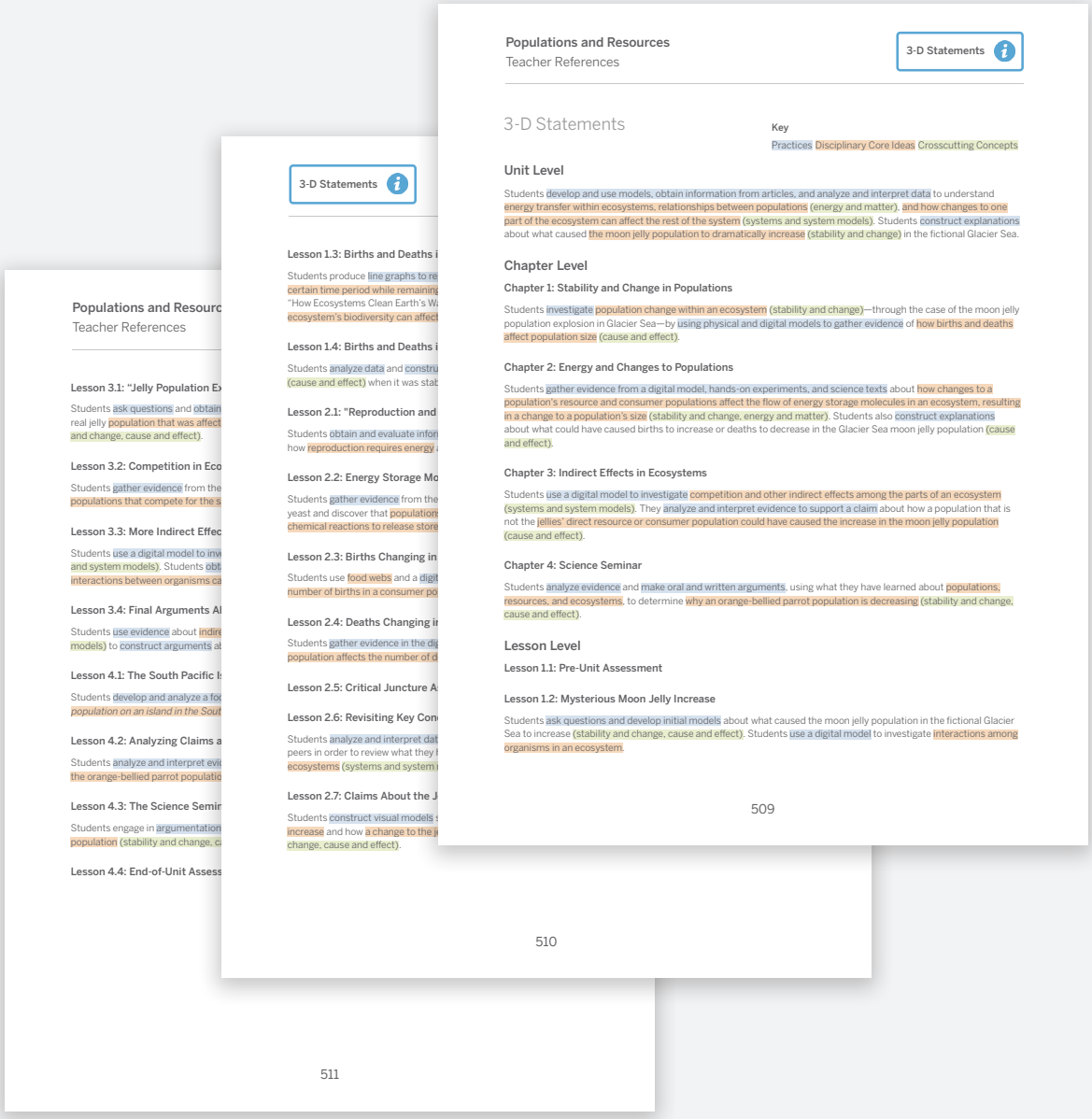
Chapter 3: Indirect Effects in Ecosystems

Students use a digital model to investigate competition and other indirect effects among the parts of an ecosystem (systems and system models). They analyze and interpret evidence to support a claim about how a population that is not the jellies' direct resource or consumer population could have caused the increase in the moon jelly population (cause and effect).

Chapter 4: Science Seminar

Students analyze evidence and make oral and written arguments, using what they have learned about populations, resources, and ecosystems, to determine why an orange-bellied parrot population is decreasing (stability and change, cause and effect).

To review the 3-D Statements at the lesson level, see the Lesson Brief section of every lesson.



Populations and Resources
Teacher References

3-D Statements

Key
Practices Disciplinary Core Ideas Crosscutting Concepts

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Lesson Level

Lesson 1.1: Pre-Unit Assessment

Lesson 1.2: Mysterious Moon Jelly Increase

Students ask questions and develop initial models about what caused the moon jelly population in the fictional Glacier Sea to increase (stability and change, cause and effect). Students use a digital model to investigate interactions among organisms in an ecosystem.

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3-D Statements

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Notes

Notes

For more information on Amplify Science, visit **amplify.com/science/california**.

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