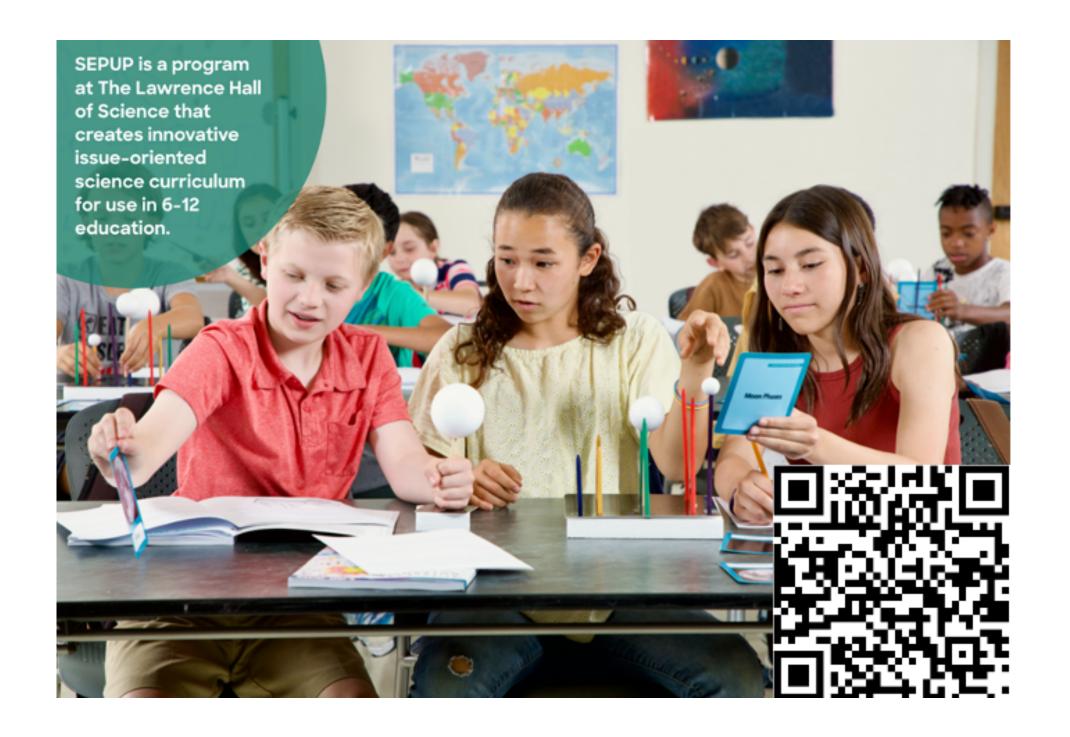
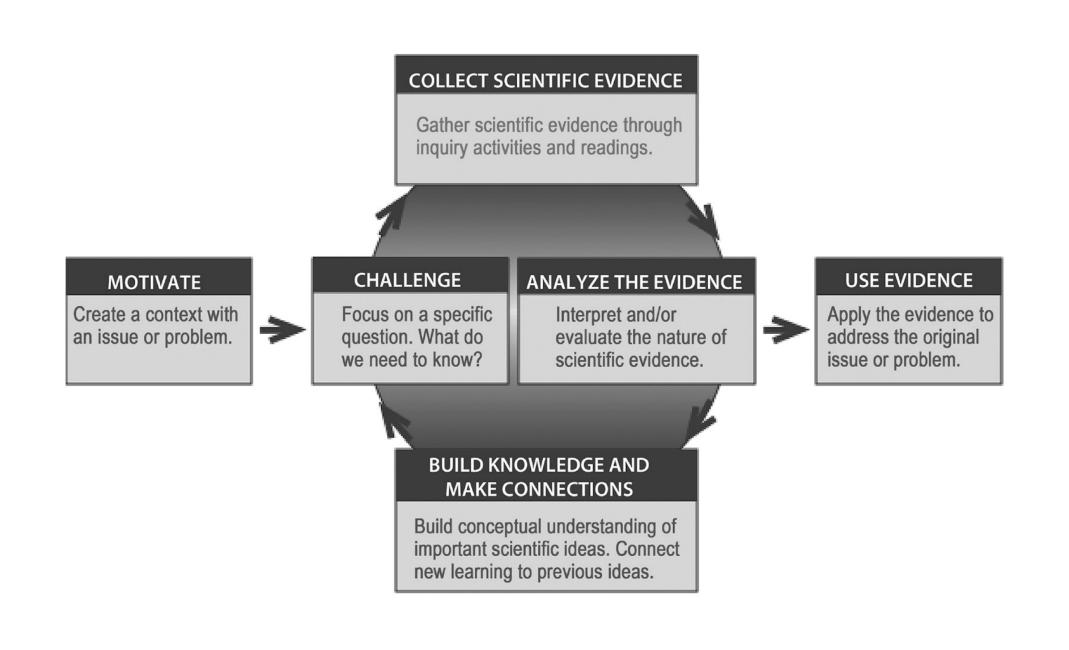


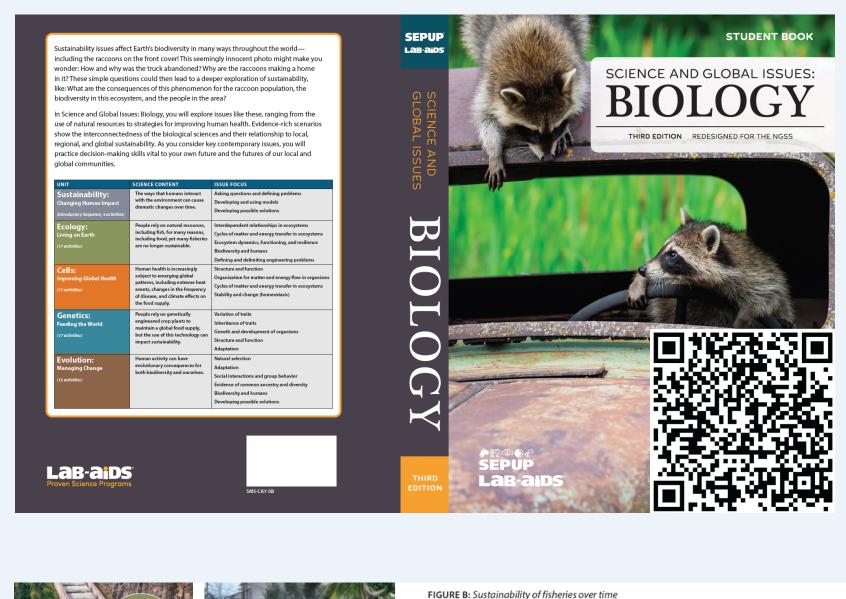
Middle and high school ecology curricula: Preparing students for 4D ecological learning

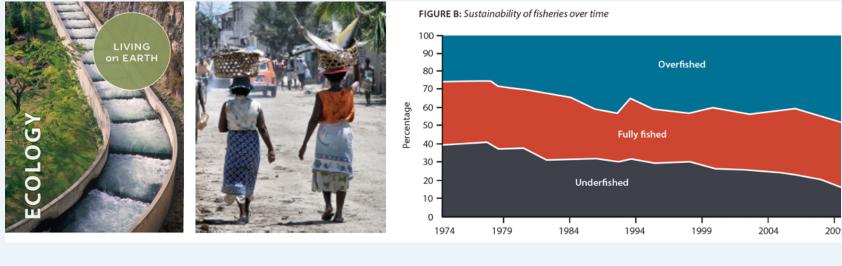
SEPUP



Issue-Oriented Science







Unit Issue

People rely on natural resources, including fish, for many reasons, including food, yet many fisheries are no longer sustainable.

Overarching Question

How can we use our knowledge about ecology to make informed decisions about managing fisheries to be more sustainable?

MIDDLE SCHOOL: ISSUES AND SCIENCE ECOLOGY UNIT

4DEE

3D Learning Aligned to the NGSS



I): the key ideas in science that have broad importance within or across multiple science or engineering disciplines.

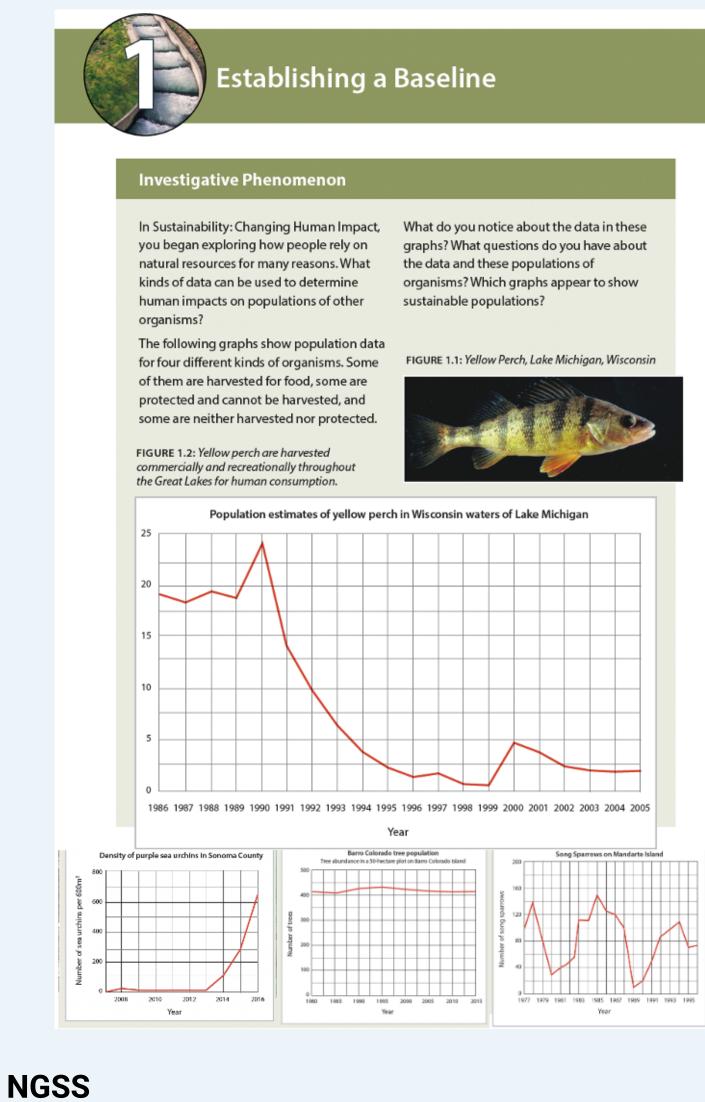
Science and Engineering Practices (SEP): describe what scientists do to investigate the natural world and what engineers do to design and build systems

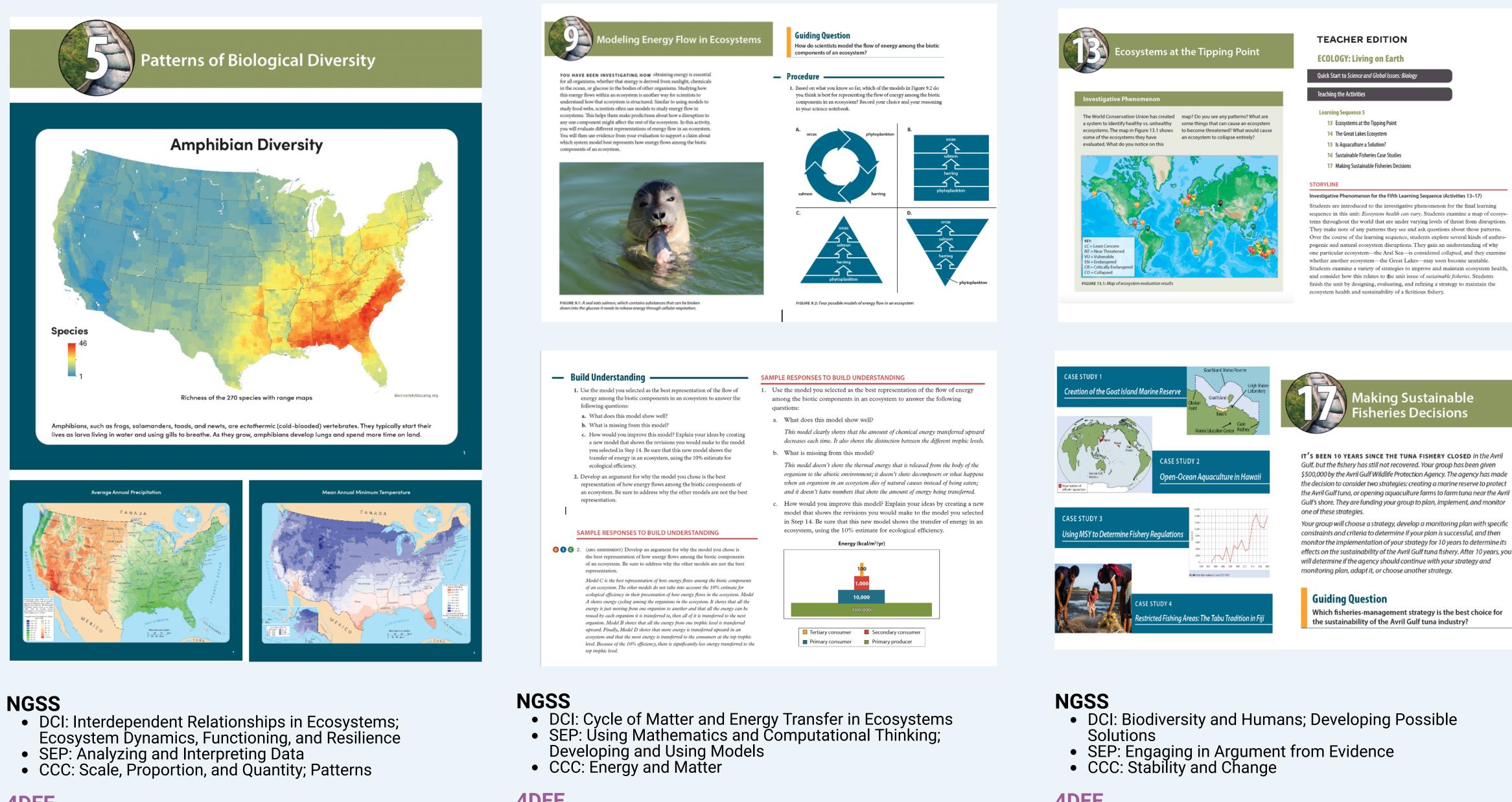
Crosscutting Concepts (CCC): help students explore connections across the domains of science and engineering.



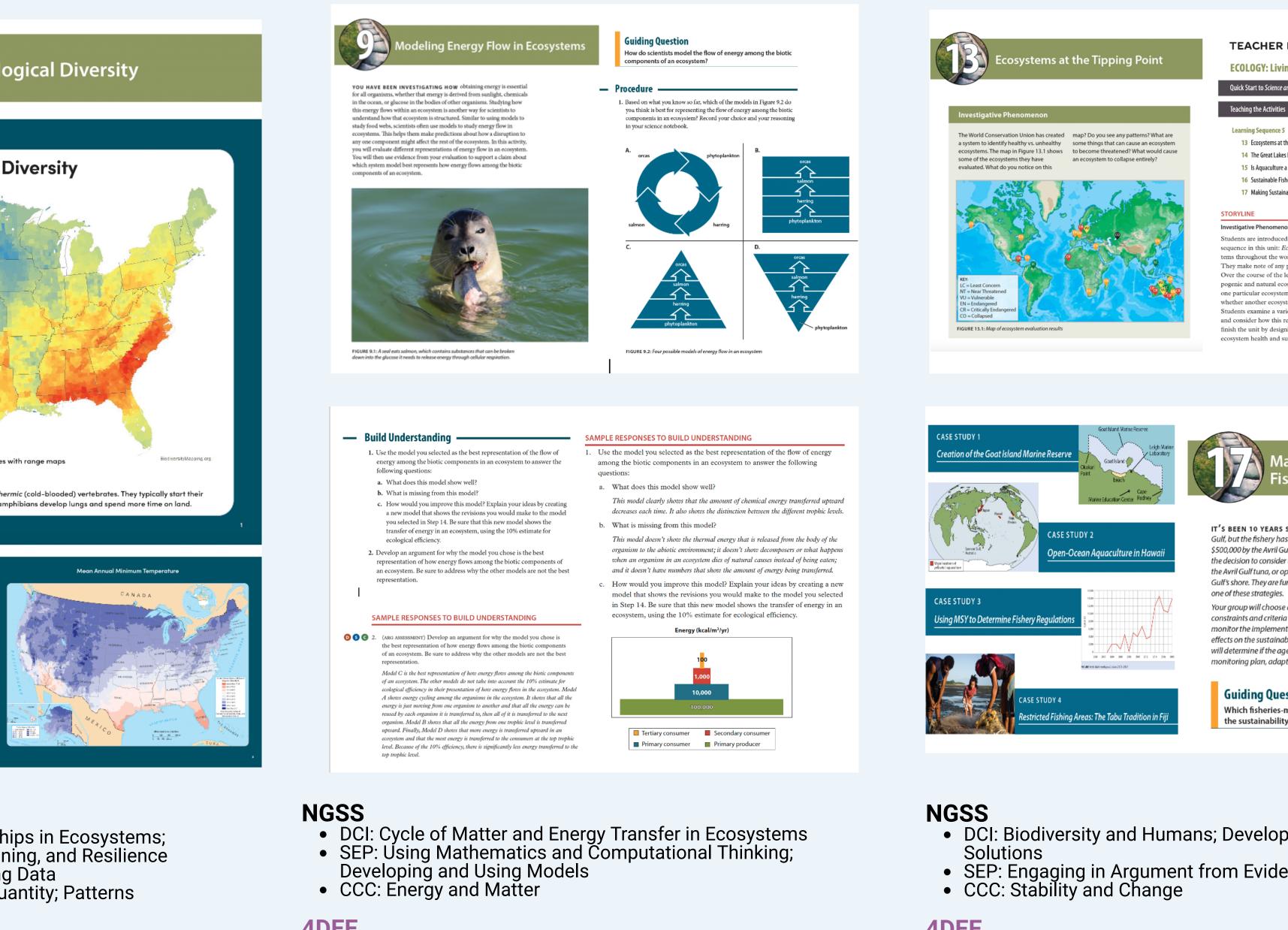
Maia Binding and Wendy M. Jackson

HIGH SCHOOL CURRICULUM: SCIENCE AND GLOBAL ISSUES ECOLOGY UNIT

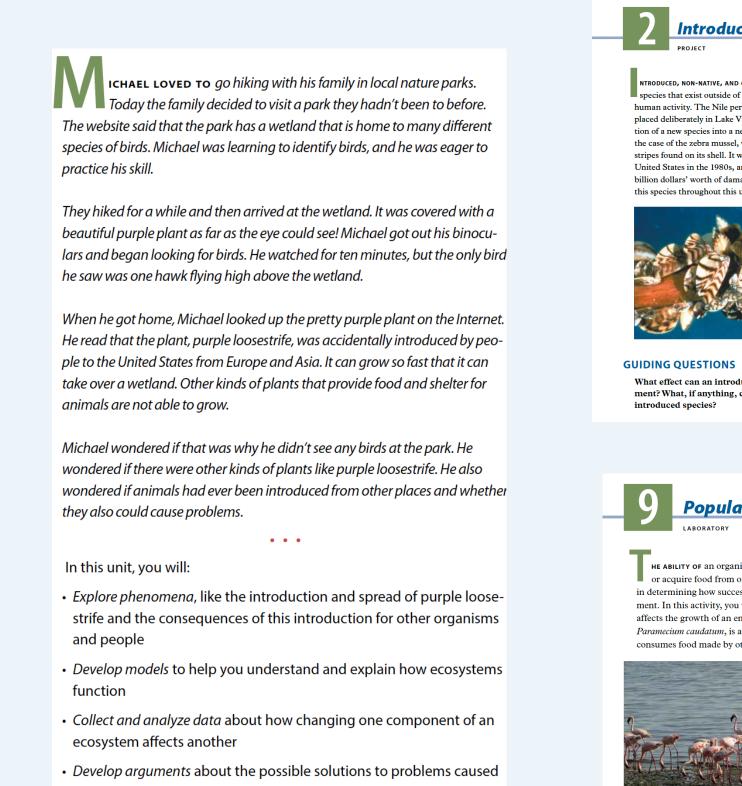








- Community: Habitat types; Species Diversity
 Quantitative reasoning and computational thinking: Data
- B. Human accelerated environmental change: Global climate
- 4. Spatial & Temporal: Scales; Biogeography range



by the introduction of a species into an ecosystem *Investigate the issue* of environmental impacts of introduced species

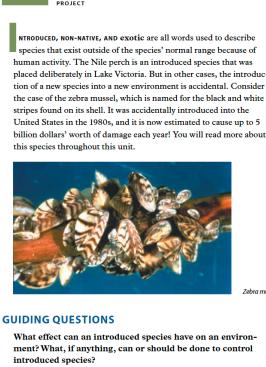
2 Introduced Species

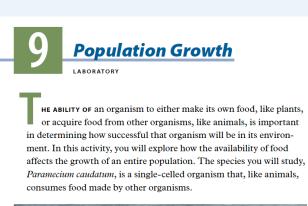
DCI: Interdependent Relationships in Ecosystems
SEP: Using Mathematics and Computational Thinking;

Developing and Using Models
CCC: Stability and Change; Scale, Proportion, and Quantity

Organisms: Abiotic and biotic features of the environment; Population dispersion: Exponential and logistic growth
 Quantitative reasoning and computational thinking: Modeling

Human accelerated environmental change: Anthropogenic impacts, intentional and unintentional
 Spatial & Temporal: Stability & change







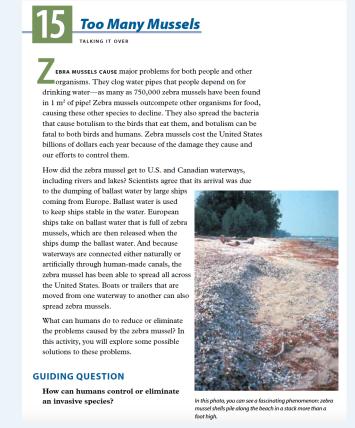
GUIDING QUESTION

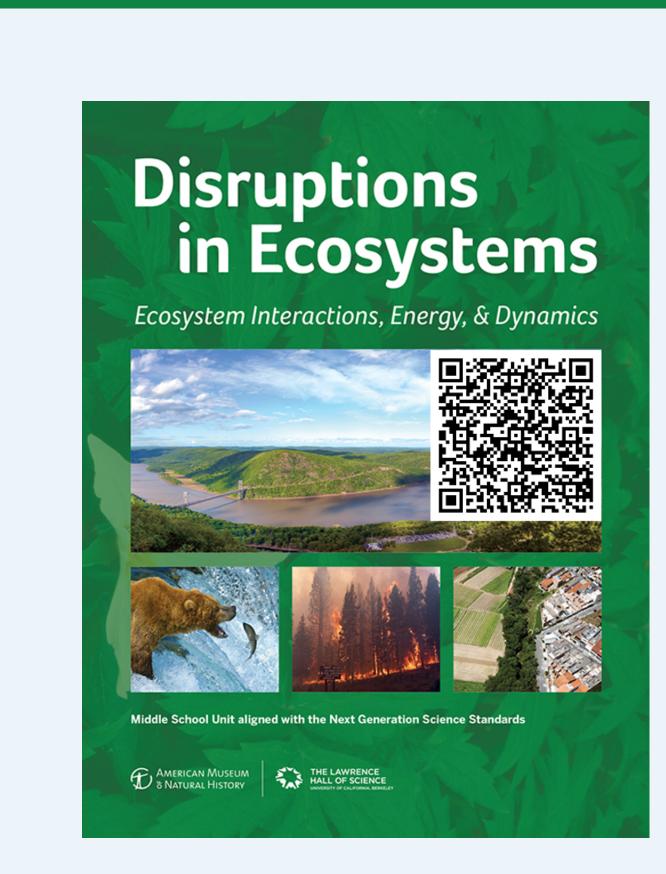
How does the availability of food affect a population?



What patterns do you observe when you investigate your own environment, and what might be causing these patterns?

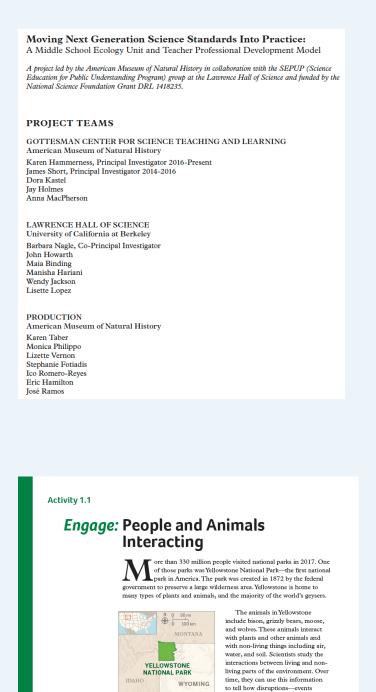
GUIDING QUESTION

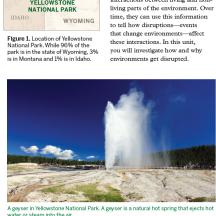


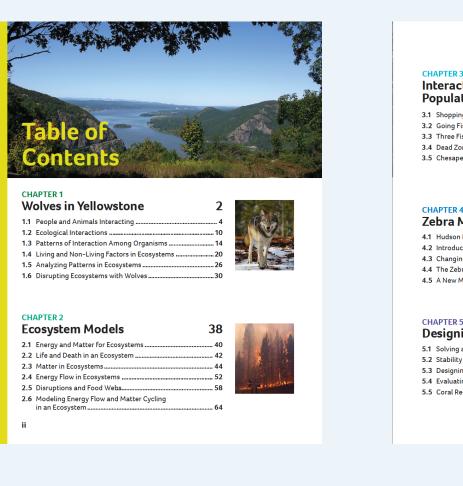


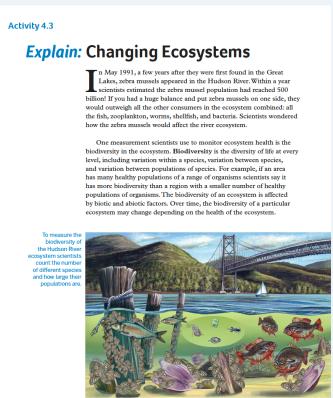
- Ecosystems: Trophic levels; Food chain food web; Energy flow
 Quantitative reasoning and computational thinking: Modeling
- Human accelerated environmental change: Anthropogenic impacts, intentional and unintentional
- 4. Pathways & Transformations of Matter and energy; Systems
- Organisms: resources and regulators; Community: Stability resistance, resilience, disturbance
- Designing and critiquing investigations
 How humans shape and manage resources/ecosystem the environment; Ethics: Sustainability as a normative,
- socially constructed, aspirational goal Systems

MIDDLE SCHOOL: DISRUPTIONS IN ECOSYSTEMS









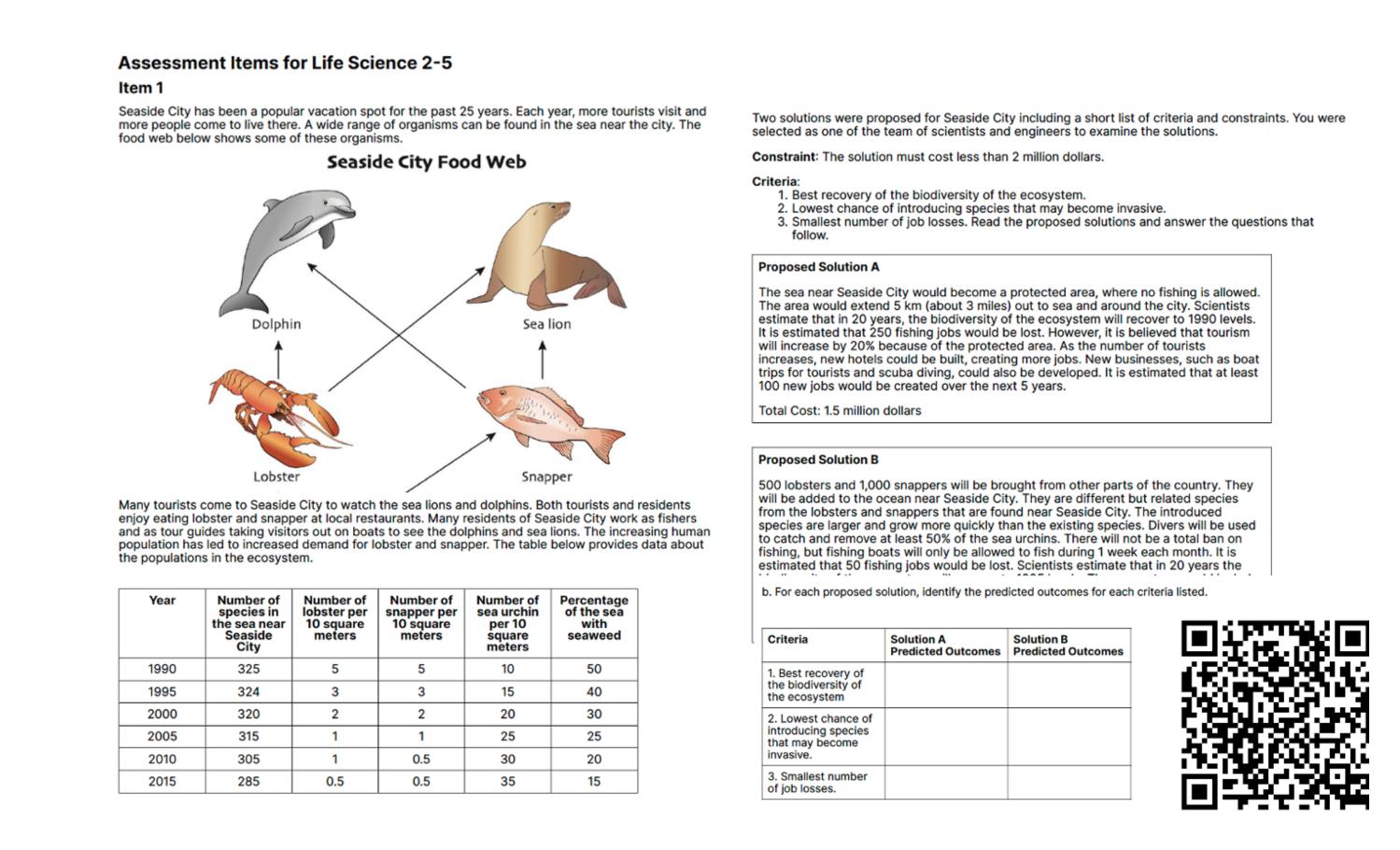




The Lawrence Science

UNIVERSITY OF CALIFORNIA, BERKELEY

ASSESSMENT



Curriculum Independent Next Generation Assessments (CINGA)

These curriculum-independent items were developed for summative assessment of the NGSS Performance Expectations. They are intended for use with any curriculum that supports the NGSS. We are currently partnering with multiple middle school curricular programs as well schools and districts to implement the use of these assessments.

LESSONS LEARNED

- Significant alignment across the middle and high school units with 4DEE Framework provides students with the skills, knowledge, and experience to prepare them for college-level ecology courses.
- Making framework dimensions explicit for students is critical for student sensemaking of complex ecological concepts.
- Making connections with students' local environments and contexts is essential for increasing the engagement and including the diverse perspectives of all students.
- Teacher feedback indicates our curriculum supported the significant broadening of students' understanding and appreciation of resource accessibility and use beyond their individual experiences, toward more community- and globally-oriented perspectives.

SUPPORTERS AND PARTNERS





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