Getting to the Core

HS Biology Unit of Study

TEACHER EDITION

Tidepools

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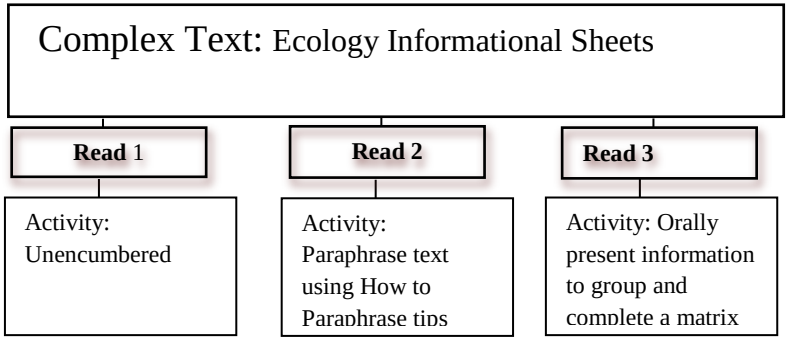
Santa Ana Unified School District Common Core Unit Planner-Literacy

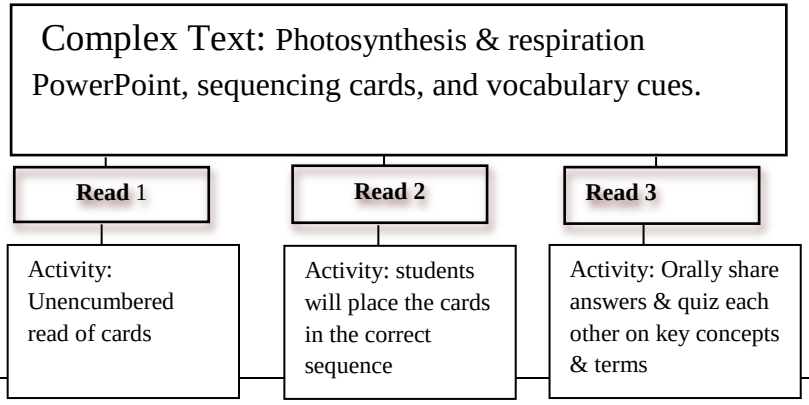
Unit Title:	**Tidepools**	
Grade Level/Course:	**High School Biology**	**Time Frame: 15 Days**
Big Idea *(Enduring Understandings):*	**Big Idea- Interdependent Relationships in Ecosystems:** *There are many interdependent relationships that affect the stability of any given population.*	
Essential Questions:	• How are the principals of ecology demonstrated by focusing on a rocky intertidal (tidepool) ecosystem, specifically biodiversity, human impact, biotic interactions, and abiotic limiting factors? • What are trophic levels and what types of organisms are found at each level? • How is energy cycled through an ecosystems, specifically how is energy transferred among trophic levels and how is energy lost between trophic levels? What is biomass? • How can the biomass of each trophic level predict the stability of the ecosystem? • How is biomass used as an indicator for how energy is transferred between trophic levels in ecosystems? • How are organisms organized within an ecosystem? • Which types of species are vital to the health and stability of a biodiverse ecosystem? • What are the potential impacts on the interdependent relationships of the organisms within an ecosystem if a single species population is changed? • How have humans impacted the ecology of the coastal marine environment? • What effects have occurred to the way energy is transferred in an ecosystem, the distribution of marine organisms, and overall stability of an ecosystem in direct result of human activity?	

Instructional Activities: Activities/Tasks

Lesson 1: Days 1 & 2- Intro to Tidepools



Lesson 2: Days 3-5- Photosynthesis & Respiration



Lesson 3:Flow of Energy: Energy Pyramids

Complex Text: Ecology: Trophic Transfer of Energy in an Ecosystem

Read 1	Read 2	Read 3
Activity: Annotate the text for new vocab & content	Activity: Use the text to complete energy flow circles	Activity: Cite evidence from text to answer questions

Lesson 4: Flow of Energy: Biomass

Complex Text: The dead sea article, Marine biomass vs. terrestrial biomass

Read 1	Read 2	Read 3
Activity: Unencumbered	Activity: annotate: confusing, interesting, surprising	Activity: Chose 1 sentence for "Save the Last Word"

Lesson 5: Food Webs: Keystone Species and Factors that affect the stability of an ecosystem

Complex Text: Keystone Species: prairie dog, sea otter, African elephant, gray wolf; Disruption of food chain

Read 1	Read 2	Read 3
Activity: Unencumbered	Activity: Paraphrase/ annotate	Activity: Orally present and complete a matrix

Lesson 6: Final Assessment

Complex Text: Student driven based on interest

Read 1	Read 2	Read 3
Activity: Unencumbered	Activity: Pull relevant information using paraphrasing and bulleting techniques	Activity: Synthesize information researched with information presented in unit; present orally to class in a group

21st Century Skills:	**Learning and Innovation:** ☒ Critical Thinking & Problem Solving ☒ Communication & Collaboration ☒ Creativity & Innovation **Information, Media and Technology:** ☒ Information Literacy ☒ Media Literacy ☒ Information, Communications & Technology Literacy

<table>
<tr>
<td>Essential Academic Language:</td>
<td>Tier II: (Academic Vocabulary)
<u>Lesson 1</u>
Paraphrase
Plagiarism
Abundant
Desiccation

<u>Lesson 2</u>

<u>Lesson 3</u>
Predator
Prey
Consumer

<u>Lesson 4</u>
Annotate
Terrestrial

<u>Lesson 5</u>
Turbulence
Gillnet
Organic

<u>Lesson 6</u>
Implications
Impact</td>
<td>Tier III: (Biology Specific)
<u>Lesson 1</u>
Ecology
Ecosystem
Intertidal
Tides
Biodiversity
Tidepool
Zonation

<u>Lesson 2</u>
Photosynthesis
Cellular respiration
Organism
Cell
Oxygen & Carbon Dioxide
Chloroplast
Heterotroph
Autotroph

Energy
Organelle

<u>Lesson 3</u>
Trophic Level
Biomass

<u>Lesson 4</u>
Microorganism
Zoomass
Phytoplankton

<u>Lesson 5</u>
Keystone Species

<u>Lesson 6</u></td>
</tr>
<tr>
<td colspan="2">What pre-assessment will be given?
Extended Anticipatory Guide about Ecology of the Tidepools</td>
<td>How will pre-assessment guide instruction?
Teachers will use student foreknowledge about ecology to determine the areas of ecology specific to tidepools and a marine environment they need to be sure to focus on.</td>
</tr>
<tr>
<td colspan="3">End of Unit Performance Task:
Research how humans have negatively impacted the ocean environment and identify changes in how energy is transferred and how the interactions among the organisms help with the overall stability of the ecosystem.</td>
</tr>
<tr>
<td colspan="2">Standards</td>
<td>Assessment of Standards (include formative and summative)</td>
</tr>
<tr>
<td colspan="2">Content Standard(s):
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity</td>
<td>Formative:
Teacher observation of student discussions while completing Ecology of Tidepool Jigsaw matrix- Lesson 1. 4 Day 2
Extended Understanding of Photosynthesis and cellular Respiration- Lesson 2.3 Day 3
Teacher must check understanding and accuracy of the Photosynthesis and Cellular Respiration Lab- Lesson 2.5 Day 6
Teacher must check understanding and accuracy of the photosynthesis and cellular respiration vocabulary- Lesson 2.6 Day 7</td>
</tr>
</table>

and populations in ecosystems of different scales. HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	Construct an Energy Pyramid- Lesson 3.3 Day 7 Teacher observation of discussion following the biomass PowerPoint- Lesson 4.1 Day 8 Graph Ocean Biomass vs. Terrestrial Biomass- Lesson 4.4 Day 9 Teacher observation of student discussion during Keystone Species paraphrasing matrix-Lesson 5.2 Day 10 Teacher observation and check for understanding and accuracy during Tidepool Go Fish- Lesson 5.3 Day 11 **Summative:** Extended Anticipatory Guide from Day 1 (Day 13 has facts and evidence cited) Disruption of Food web- Lesson 5.6 Day 12 Final Assessment Lesson 6- Day 13-15: Research a specific type of human impact on a marine ecosystem and synthesize the content from the unit to construct a wholistic view of the implications of the specific event or type of pollution.	
Common Core Learning Standards Taught and Assessed (*include one or more standards for one or more of the areas below. Please write out the complete text for the standard(s) you include.)*	**What assessment(s) will be utilized for this unit?** *(include the types of both formative assessments (***F***) that will be used throughout the unit to inform your instruction and the summative assessments (***S***) that will demonstrate student mastery of the standards.)*	**What does the assessment tell us?**
Bundled Reading Literature Standard(s): NA		
Bundled Reading Informational Text Standard(s): **RST.10-11. 1**. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **RST.9-10. 2.** Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. **RST.9-10. 7**. Translate quantitative or technical information expressed	F- How to Paraphrase F- Ecology Information Sheets F- Keystone Species	F- Students will need to read the text and decide the central ideas and the revelent content to present to their group

in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	S- Extended Anticipatory guide with evidence S- Formal Ecology Assessment	S- Students need to cite specific evidence from the unit to support their findings.
Bundled Foundational Skill(s) Standard(s): *(K-5 only)*		
Common Core Learning Standards Taught and Assessed (*include one or more standards for one or more of the areas below. Please write out the complete text for the standard(s) you include.)*	**What assessment(s) will be utilized for this unit?** *(include the types of both formative assessments (***F***) that will be used throughout the unit to inform your instruction and the summative assessments (***S***) that will demonstrate student mastery of the standards.)*	**What does the assessment tell us?**
Bundled Writing Standard(s): **WHST.9-10.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **WHST.9-10.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. **WHST.9-10.9** Draw evidence from informational texts to support analysis, reflection, and research.	F- How to Paraphrase F- Matrixes and Annotation of the text S- Extended Anticipatory Guide S- Disruption of Food Web S- Ecology Final Assessment	F- Create clear and informative bullets and short paraphrased sentences of relevant content S-Students will need to gather relevant information and paraphrase the data
Bundled Speaking and Listening Standard(s): **SL 9-10** 1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades *9-10 topics, texts, and issues*, building on others' ideas and expressing their own clearly and persuasively. **SL 9-10 4.** Present information, findings, and supporting evidence	F- Pair Share F- Expert/Base Groups F- Collaborative Grouping for lab activities	F- Present information in an informal setting to peers F- Collaborate to complete set tasks

clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	S- Ecology Final Assessment	S- Present information on a specific topic and its relevancy to the ecology unit to the class in a formal setting
Bundled Language Standard(s): **L.9-10.1** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. **L.9-10.2** Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. **L.9-10.3** Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening. **L.9-10.4** Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, choosing flexibly from a range of strategies. **L.9-10.6** Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.	F- Pair Share F- Expert/Base Groups F- Collaborative Grouping for lab activities S- Ecology Final Assessment	F- Present information in an informal setting to peers F- Collaborate to complete set tasks S- Present information on a specific topic and its relevancy to the ecology unit to the class in a formal setting
Resources/ Materials:	**<u>Complex Texts to be used</u>** Informational Text(s) Titles: Reading for jigsaw matrix: Ecology of Tide pool information sheets Photosynthesis and Cellular Respiration Trophic Transfer of Energy in an Ecosystem Reading for “Save the last word”: The dead sea: Global warming blamed for 40% decline in ocean’s phytoplankton Keystone species: Sea Otters, Prairie Dogs, African Elephant, and Grey Wolf	

	Reading for Annotated Matrix: Freshwater mussel biodiversity and conservation, Motor boat turbulence kills zooplankton, Gillnets taking toll on seabird, Seaweed records impact of global warming **Literature Titles: NA** **Primary Sources:** **Media/Technology:** Video Clips from Discovery Streaming, Explocean- Newport Harbor Nautical Museum, and Save our Seas-Untamed Science **Other Materials:**	
Interdisciplinary Connections:	**Cite several interdisciplinary or cross-content connections made in this unit of study (i.e. math, social studies, art, etc.)** Graphing activities for biomass, art for drawing food webs, geopolitical and social science research for final assessment.	
Differentiated Instruction:	**Based on desired student outcomes, what instructional variation will be used to address the needs of English Learners by language proficiency level?** A mixture of inquiry based learning, direct instruction, and cooperative groups. Visual cues and short video clips will show the new vocabulary in context.	**Based on desired student outcomes, what instructional variation will be used to address the needs of students with special needs, including gifted and talented?** **Special Needs:** Lessons can be slowed down if needed. Auditory processing students can be given transcripts of the video clips and PowerPoint presentations. Complex text can be recorded beforehand for visually impaired students. **GATE:** Depth and complexity of final assessment is open for interpretation by the students, there are minimal guidelines. Ample opportunities to be peer teachers and to communicate with one another.

SAUSD Common Core High School Biology Unit – Tidepools

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SAUSD Common Core Lesson Planner **Teacher:**

<table>
<tr><td>Unit:
Tidepools
Day: 1-2
Lesson: 1</td><td>Grade Level/Course:
High School/Biology</td><td>Duration: 2 class periods
Date:</td></tr>
<tr><td colspan="3">Big Idea: Interdependent Relationships in Ecosystems: There are many interdependent relationships that affect the stability of any given population.
Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: How are the principles of ecology demonstrated in on a rocky intertidal (tidepool) ecosystem? Specifically how do biodiversity, human impact, biotic interactions, and abiotic limiting factors affect the tidepool ecosystem?</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS2-6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7-Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8- Evaluate the evidence for the role of group behavior on individual and species' chances of survival and reproduce.
Reading Standards for Literacy in Science and Technical Subjects 9-10: 1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Writing Standards for Literacy in Science and Technical Subjects 9-10:
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Speaking and Listening Standards (ELA) 9-10: 1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</td></tr>
</table>

<table>
<tr><td>Materials/ Resources/ Lesson Preparation</td><td colspan="2"><u>Day 1</u>
Teacher Resource 1.1: Tidepool Prezi Presentation. (Smartboard if available)
Student Resource 1.1: Day 1/Day 13 Extended Anticipatory Guide Student Sheet
Teacher Resource 1.2: PowerPoint for “How to Paraphrase” (Smartboard if available)
Student Resource 1.2: How to Paraphrase student form
<u>Day 2</u>
Tidepool Ecology Information Sheets
Student Resource 1.3a: Organisms of the Tidepool (Lexile 1109)
Student Resource 1.3b: How Tides are Created (Lexile 1109)
Student Resource 1.3c: Where are Tidepools? (Lexile 1152)
Student Resource 1.3d: Ecology of Tidepools Lexile 1603)
Student Resource 1.3e: Human Impact on Tidepools (Lexile 1321)
Student Resource 1.3f: California Biodiversity (Lexile 1554)
Student Resource 1.4: Ecology of Tidepools Jigsaw Paraphrase student form</td></tr>
<tr><td>Objectives</td><td>Content:
Students will be able to coherently paraphrase scientific information as a means of being able to describe several ecological factors that determine and define rocky tidepools.</td><td>Language:
In groups of three, students will act as experts and verbally express observations and evidence pertinent to their assigned tidepool ecology information sheet.
Students will listen to the information presented verbally by their peers and paraphrase the important facts.</td></tr>
<tr><td>Depth of Knowledge Level</td><td colspan="2">☐ Level 1: Recall ☒ Level 2: Skill/Concept
☒ Level 3: Strategic Thinking ☐ Level 4: Extended Thinking</td></tr>
<tr><td>College and Career Ready Skills</td><td colspan="2">☐ Demonstrating independence ☒ Building strong content knowledge
☒Responding to varying demands of audience, task, purpose, and discipline
☐ Comprehending as well as critiquing ☒Valuing evidence
☐Using technology and digital media strategically and capably
☐ Coming to understand other perspectives and cultures</td></tr>
<tr><td>Common Core Instructional Shifts</td><td colspan="2">☒ Building knowledge through content-rich nonfiction texts
☒ Reading and writing grounded from text
☒ Regular practice with complex text and its academic vocabulary</td></tr>
<tr><td>Academic Vocabulary (Tier II & Tier III)
TEACHER PROVIDES SIMPLE EXPLANATION</td><td>KEY WORDS ESSENTIAL TO UNDERSTANDING</td><td>WORDS WORTH KNOWING</td></tr>
</table>

		Tidepool Paraphrase Plagiarism	Ecology Ecosystem Intertidal
	STUDENTS FIGURE OUT THE MEANING	Desiccation Tides Zonation Biodiversity	Abundant
Pre-teaching Considerations **Note: This lesson is differentiated to meet the needs of all our learners.**	Group students ahead of time in order maximize instructional minutes during class. **Base Group:** The Base Group should be made up of 3 students, one from each Expert Group. On day two of this lesson, students will be working together in groups of 3 (one from each expert group). This task is differentiated by reading ability. Divide student groups accordingly. **Expert Groups:** Students should be placed in groups based on different reading abilities. In order to place students into the correct expert group, the teacher should identify the high, low, and average readers on the basis of their CELDT reading score, CST reading score, or performance with text within their specific content area before the lesson. • Expert Group 1 would contain the lower readers and will read fact sheets 1.3a and 1.3b, *Organisms of the Tidepools* and *How Tides are Created*. • Expert Group 2 would contain the average readers and will read fact sheets 1.3c and 1.3e. *Where are the Tidepools?* and *Human Impact on the Tidepools* • Expert Group 3 would contain the highest readers and will read fact sheets 1.3d and 1.3f, *Ecology of the Tidepools* and *California Biodiversity*	
CCSS Foundational Standards (K-5 only)		
Lesson Delivery		
Instructional Methods	**Check method(s) used in the lesson:** ☒ **Modeling** ☒ **Guided Practice** ☒ **Collaboration** ☒ **Independent Practice** ☐ **Guided Inquiry** ☐ **Reflection**	

Lesson Continuum	**Lesson Opening**	**Preparing the Learner** Prior Knowledge, Context, and Motivation: **Day 1: Introduction to Tidepools** To begin the Ecology of Tidepool unit, the teacher will show a 10 step Prezi Presentation that has videos about the ecology of tidepools embedded within it. While watching this presentation students will complete an extended anticipatory guide that asks them to agree or disagree with 10 statements regarding all topics included in the Ecology of Tidepool unit. Students will **only** complete the Day 1: column, the remaining columns will be filled out at the completion of the unit during the first part of the final assessment on day 13. **Day 2: Ecology of Tidepool Information Sheets** Students will need to be placed into groups of 3 where each group has an expert reader at each of the three designated reading levels as discussed in the pre-teaching section prior to begin this task. This will require pre-teaching time to ensure a smooth transition and to allow students the maximum amount of time to complete the task.

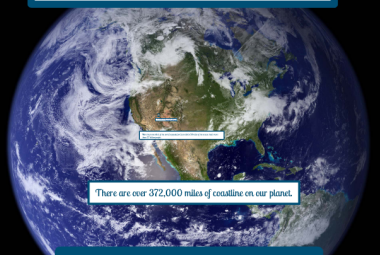
Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with the concept/text:** **<u>Day 1: How to Paraphrase</u>** ***Note: This is a skill that students will be asked to master and a strategy that will be used a number of times throughout the Ecology Unit.* 1. The teacher should work through the paraphrasing Power Point with students. 2. The students should copy the red text from the Power Point onto the student handout 1.2- How to Paraphrase. In order to master the skills needed to paraphrase students should be asked to add additional information that they might find relevant or helpful from the Power Point presentation. 3. Students will then be asked to independently practice paraphrasing three simple sentences. Students should be given between 4-6 minutes to complete this task. 4. Once all students have finished paraphrasing the sample sentences they should compare their paraphrased sentence with their elbow partner making corrections or additions to their sentences if necessary. Students should be allowed time to share all three of their paraphrased sentences. 5. Students should also compare their paraphrased sentence to the original sentence and take not of how language changed, but meaning remained consistent. 6. Students should then be given 4-6 minutes to read and paraphrase a short paragraph from a news article about a woman who tried to live on sunlight without food. 7. Students should then be asked to share their paraphrased paragraph with their elbow partner again making any modifications that may be necessary. **<u>Day 2: Ecology of Tidepools Information Jigsaw</u>** **Note: Student will need to be placed in groups of three for the following activity. 1. The teacher will assign each student a number that corresponds to the Tidepool Information sheets they will be asked to read. Student 1: 1.3a and 1.3b, *Organisms of the Tidepools* and *How Tides are Created*. Student 2: 1.3c and 1.3e. *Where are the Tidepools?* and *Human Impact on the Tide* Student 3: 1.3d and 1.3f, *Ecology of the Tidepools Pools* and *California Biodiversity* **First Read: (familiarization with concept)** 2. Once students know which information sheets they are to read, the teacher will tell the students they will be reading their information sheets silently on their own for 5 minutes. The teacher will remind students that the goal is not necessarily to finish in the allotted time but to understand what they read. The teacher will note the time and instruct students to begin reading. The teacher will give a "one minute left" heads up. At the end, the teacher will remind students that it is acceptable if they did not finish. They will have other chances to finish.	**Differentiated Instruction for students that need additional support:** **English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Dyad share **Special Needs:** • Provide students who are visually impaired an electronic copy of the power point. • Provide the case carrier or student the paraphrasing activity beforehand so he/she can practice with the student • For 1st read, place students in small groups to perform a guided reading • For struggling readers, place in dyads, or pull out with teacher

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Second Read: (identification of key concepts)** 3. The students should then be given the task of re-reading the information sheets and underlining the author's main ideas on each sheet. Students should be made aware that they will need to paraphrase the key ideas in the material they are responsible for reading. 4. Students should then be asked to paraphrase their information sheets on the student handout titled: Ecology of Tidepool Information Sheets Jigsaw Matrix (student resource 1.4). Students should be allowed 5-8 minutes to complete this task. 5. When each student has finished paraphrasing their information sheets, with at least 20 minutes left, direct the students to share their paraphrased paragraph with the group. Each student should explain what they read and the main ideas of each information sheet. While the "expert" is speaking the remaining group members should take notes on their matrix about each information sheet being discussed. This pattern will continue until each expert has had a chance to share while the others record the important information. 6. Student may ask clarifying questions as needed and the expert may refer back to the text to strengthen their paraphrasing or to answer questions. (Using clarifying bookmarks as sentence starters can be used with select groups or the whole class if needed). **Extending Understanding:** 7. Once students have completed their matrix they will be asked to review the information they have gathered and write a 2-3 sentence summary that synthesizes the major ecology ideas presented in the information sheets.	**Differentiated Instruction:** • Provide students with a copy of the reading the day before so that they have more time to digest the information. • Information sheets and paraphrasing activity can be read aloud by partners or recorded beforehand **Accelerated Learners:** • Opportunities to explain topics/ reasoning/ thoughts to their partner/group
Lesson Reflection			
Teacher Reflection Evidenced by Student Learning/ Outcomes			

Our Planet

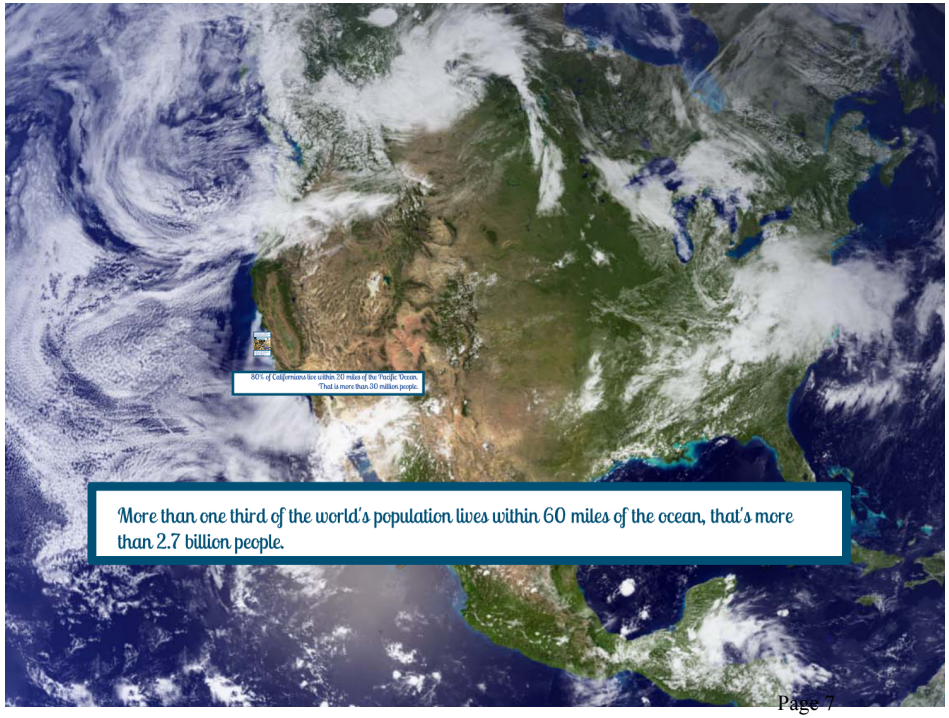
is 71% salt water ocean.

Our Planet



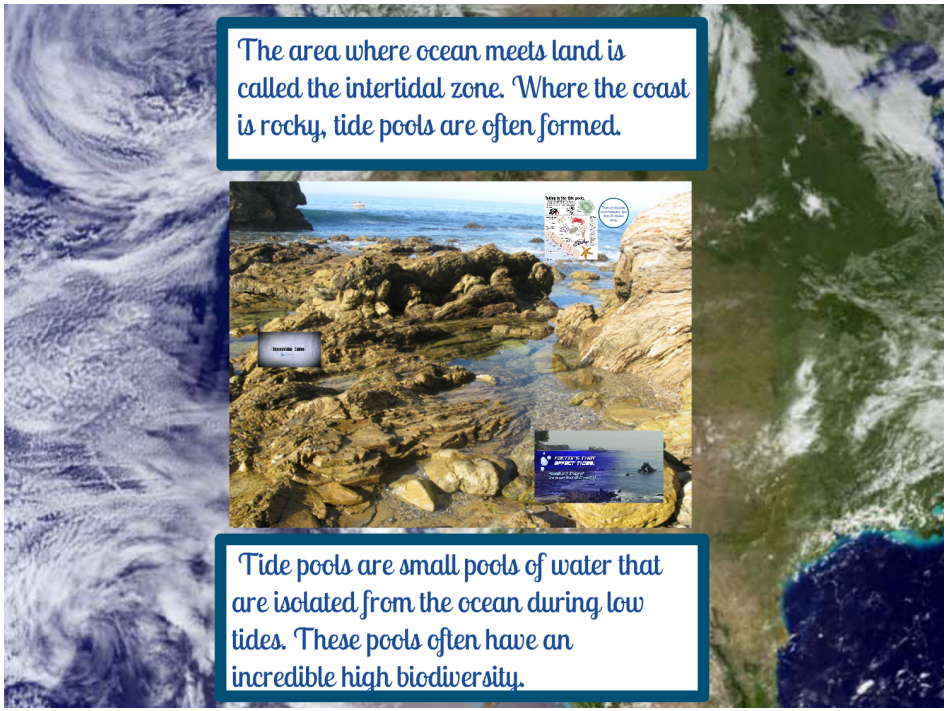
is 71% salt water ocean.

There are over 372,000 miles of coastline on our planet.



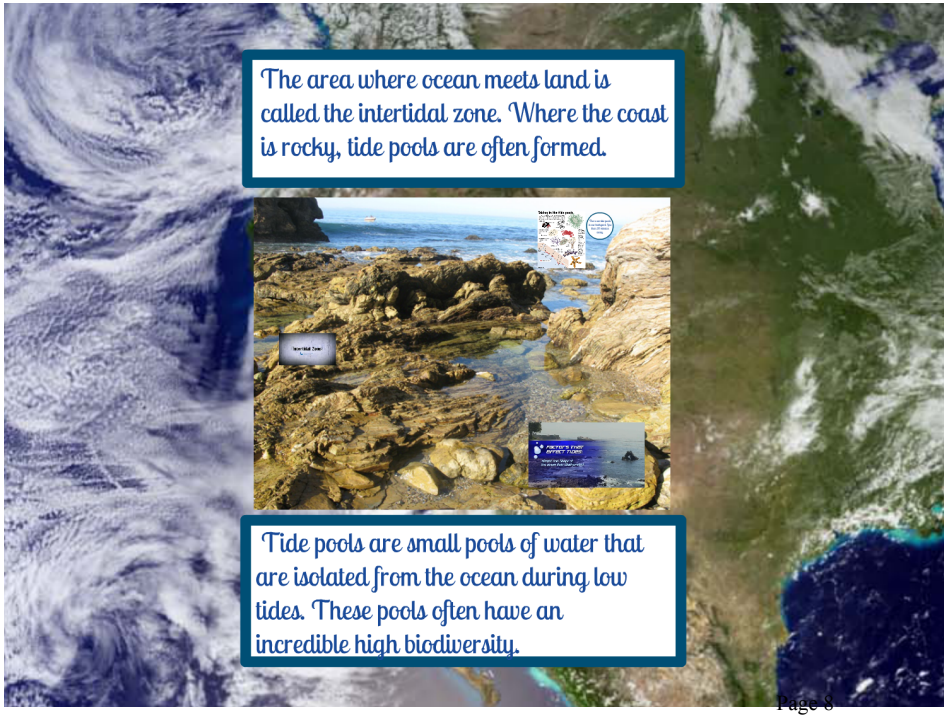
More than one third of the world's population lives within 60 miles of the ocean, that's more than 2.7 billion people.

80% of Californians live within 20 miles of the Pacific Ocean. That is more than 30 million people.



The area where ocean meets land is called the intertidal zone. Where the coast is rocky, tide pools are often formed.

Tide pools are small pools of water that are isolated from the ocean during low tides. These pools often have an incredible high biodiversity.

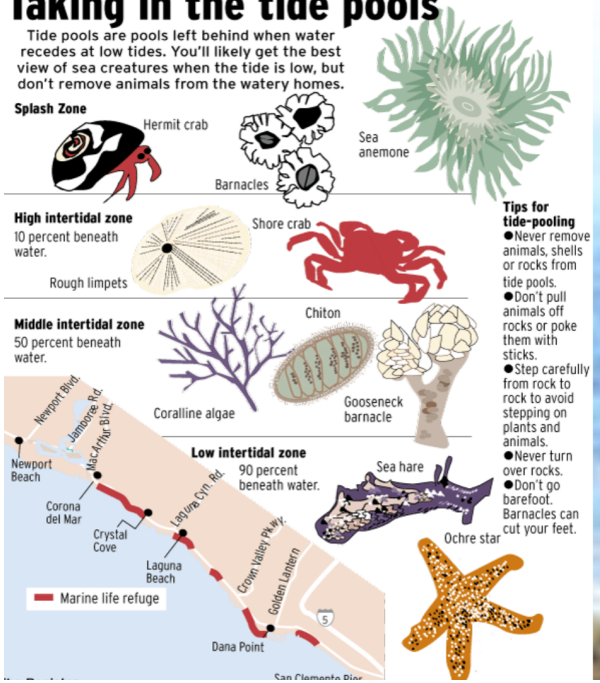


The area where ocean meets land is called the intertidal zone. Where the coast is rocky, tide pools are often formed.

Tide pools are small pools of water that are isolated from the ocean during low tides. These pools often have an incredible high biodiversity.

Taking in the tide pools

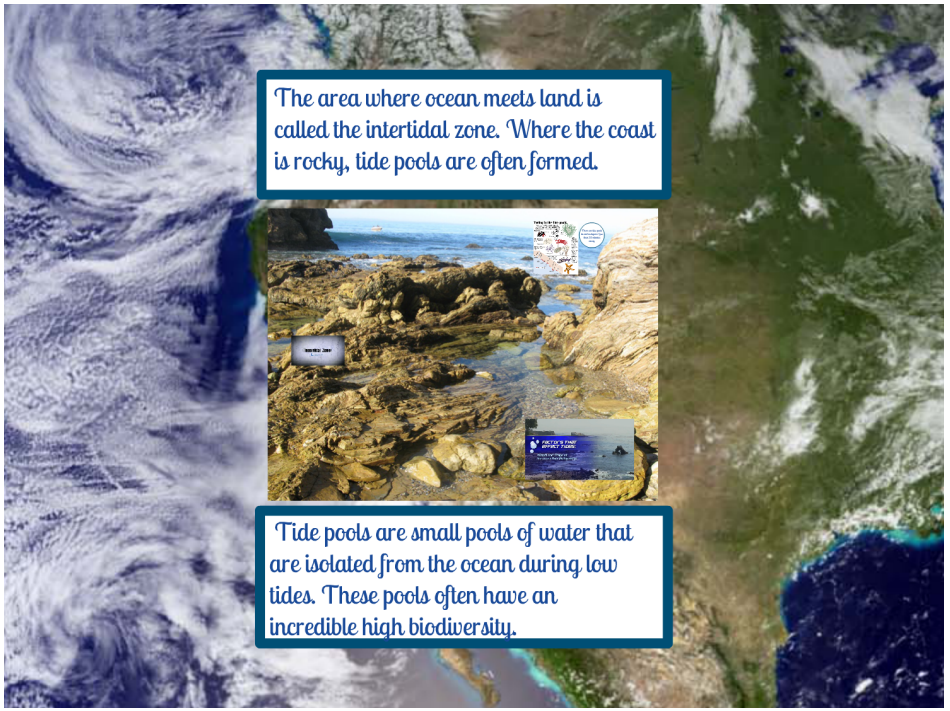
Tide pools are pools left behind when water recedes at low tides. You'll likely get the best view of sea creatures when the tide is low, but don't remove animals from the watery homes.



Tips for tide-pooling

- Never remove animals, shells or rocks from tide pools.
- Don't pull animals off rocks or poke them with sticks.
- Step carefully from rock to rock to avoid stepping on plants and animals.
- Never turn over rocks.
- Don't go barefoot. Barnacles can cut your feet.

There are tide pools in our backyard. Less than 20 minutes away.



Name_____

Tidepool Ecology

Day 1/Day 13 Extended Anticipatory Guide

Statement	Day 1		Day 13		Day 13 Evidence
	Agree	Disagree	Agree	Disagree	**Evidence: Explain using your own words**
1. Sea stars are the true killers of the rocky tidepools.					
2. Tidepools are hostile environments that are constantly changing and are extremely susceptible to human impact.					
3. Photosynthesis occurs in organelles called chloroplasts.					
4. Cellular respiration creates oxygen for other organisms to use.					
5. Autotrophs are organisms that are able to transform chemical energy from light energy.					
6. 90% of energy is passed from one trophic level to the next in any given ecosystem.					
7. A Blue Whale can grow to over 100 feet in length yet its primary food source is no more than 2 ½ inches long.					
8. In a typical ecosystem predators account for the majority of the ecosystem's biomass.					
9. The stability of an ecosystem is dependent on the balance between producers and consumers.					
10. The biodiversity of California's kelp forest is dependent on the presence of sea otters.					
11. Tidepools are an important part of our ecosystem in Orange County.					
12. Santa Ana is not directly next to the ocean so it has no impact on the health of the costal ecosystem.					

Paraphrasing

A good tool to understand complex text

1

What is it?

Paraphrasing

It is a passage

Borrowed from a source

And rewritten in your own words.

A paraphrase should be true to the original author's idea, but is rewritten in your own words and sentence structure.

2

Why you need to know how to paraphrase

- "Use your own words" is a common strategy of checking to make sure you actually know what you read
- It helps you focus on the key parts of what you are asked to read and ignore the extra stuff that you don't need to know
- Paraphrasing in written responses is NOT plagiarism but you MUST cite the source as ideas are someone else's!

3

How you paraphrase

- **Read** the article, paragraph, or sentence- you may need to read it more than once
- Identify the critical ideas that the author is focusing on
- Rephrase words or phrases to express those ideas in a different way
- Change word order or sentence order to clarify meaning
- Use vocabulary that you know to help understand the author's meaning
- CITE the original source to show what you are paraphrasing

4

Examples of Paraphrasing

- **Sample text**: Some people consider hedgehogs useful pets because they prey on many common garden pests. While on the hunt, they rely upon their senses of hearing and smell because their eyesight is weak.
  ~National Geographic
- **Paraphrased text**: According to National Geographic, Hedgehogs are thought of as useful pets because they eat many garden pests. Hedgehogs have weak eyesi[illegible] their hearing and sense of sm[illegible]

http://animals.nationalgeographic.com/animals/mammals/hedgehog/

5

Examples of Paraphrasing

- **Sample Text**: *T. rex*'s serrated, conical teeth were most likely used to pierce and grip flesh, which it then ripped away with its brawny neck muscles. Its two-fingered forearms could probably seize prey, but they were too short to reach its mouth. ~National Geographic Online
- **Paraphrased**: T. Rex had serrated, cone-shaped teeth that they used to grab their prey, explains National Geographic. Then, using their powerful neck muscles they would rip flesh off of their prey. T .Rex's short, two fingered arms could help hold their prey but could not reach their mouths.

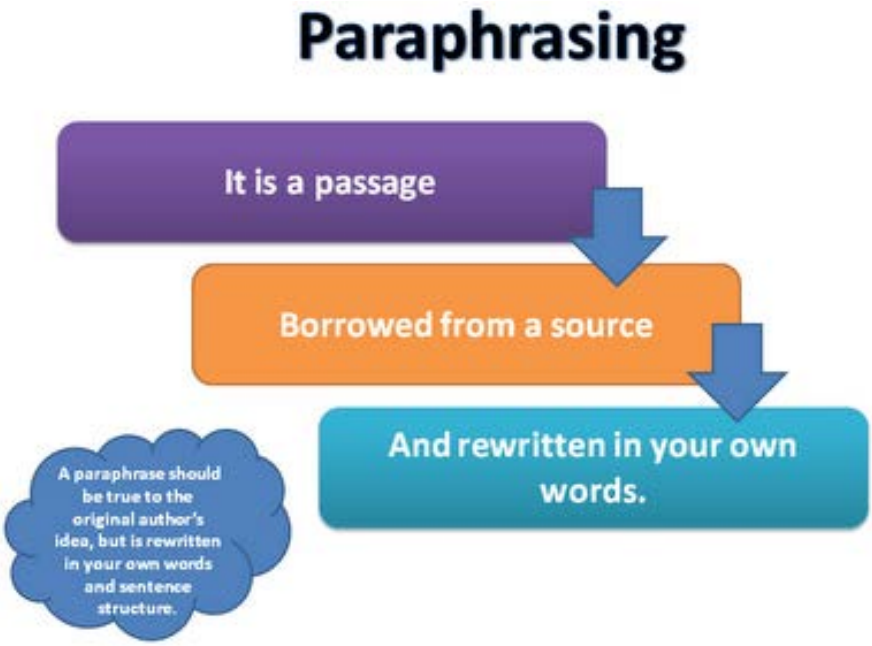
http://animals.nationalgeographic.com/animals/prehistoric/tyrannosaurus-rex/

6

Name_____

How to Paraphrase

- **Use the space surrounding the picture below to take notes on paraphrasing.**
- **You only need to write down the red text seen in the Power Point, but feel free to add additional information if you think it will be useful to you.**



Name_____

Examples of Paraphrasing

Original Sentence 1- There is little chance that the situation will improve.

Paraphrased: There is little possibility that the circumstances will get better.

Original Sentence 2- The Great White Shark is the largest predatory fish in the world. The Great White can often be seen hunting elephant seals off of the coast of California.

Paraphrased: The largest predatory fish in the ocean is the Great White Shark; they are frequently seen eating elephant seals along California's coast.

Original Sentence 3- Sparky the dog is really excited when her owner returns from work.

Paraphrased: When her own returns Sparky the dog is excited.

Analysis: Pick one sentence pair above and describe one similarity and one difference between the original sentence and the paraphrased sentence.

_____

_____

Practice Paraphrasing Sentences

Directions: Paraphrase the following sentences.

1. Angel is often late to school because he stays up late watching Netflix.

_____

_____

3. Mira has little time to go out with her friends because she needs to study for her Biology test in the morning.

_____

_____

4. People frequently laugh at me when I tell them my dog's name his name is Funyuns. Sometimes I feed my dog Funyuns chips and tell people he is a cannibal.

_____

_____

_____

_____

5. Share your paraphrased sentences with a partner. Use the following student exchange sample to help you communicate your ideas clearly.

Student 1: *"After reading the first sentence "Angel is often late to school because he stays up late watching Netflix," I paraphrased that sentence as_____."*

Student 2: *"After reading the first sentence I found that the author's main idea was _____ so I made sure to include that idea in my paraphrased sentence of _____."*

Continue sharing your paraphrased sentences until you have shared all three. Change or add any information that you may be missing from your paraphrased sentences.

Name_____

Practice Paraphrasing a Paragraph

Directions: Read the paragraph below and paraphrase the main ideas and evidence used in the article in the space provided. Be sure to give credit to "Erik Lacitus" from the Seattle Times for his research!

Fasting woman to end attempt to 'live on light' diet

Originally published June 17, 2013 at 2:43 PM | Page modified June 17, 2013 at 9:45 PM
By Erik Lacitis at the Seattle Times

Naveena Shine, seen in her Redmond home, by Monday had lost 33 pounds after 45 days without food.

After dropping about 20 percent of her body weight, Naveena Shine, the 65-year-old Eastside woman who got worldwide publicity for trying to live on just light and no food, is calling it quits with her grand experiment.

Shine had dropped to 126 pounds from her original weight of 159 pounds on her 5-foot, 4-inch frame.

Shine says she simply wanted to know if "breatharianism," a New Age belief that sunshine can substitute for food, was possible. She posted about her experiment on Facebook, YouTube and her Living on Light website.

"I didn't prove it," she admits. But, says Shine, it certainly got people talking.

Doctors have warned that it is not possible for humans to photosynthesize, and four deaths have been linked to people who apparently had tried.

Adapted by SAUSD teachers from an article in The Seattle Times

(Begin by citing your source!)

_____
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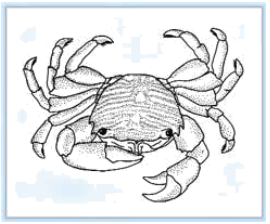
Don't forget to cite where you got the information!



Organisms of the Tide Pools

Advantages to living in the tide pools

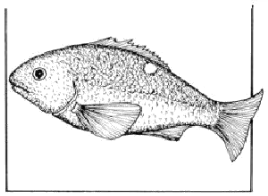
- There is lots of sunlight therefore there are lots of plants and algae that grow
- Food is abundant
- Lots of hiding places
- Constant wave action supplies the tide pool with nutrients

Challenges of living in the tide pools

- There is lots of sunlight therefore animals can dry out quickly
- Exposed to predators during low tides
- Limited space
- Constant wave action can carry unprotected animals

Food Webs of the tide pools

- Many marine animals rely on tide pools for food and other resources.
- Gulls and other seabirds, as well as some mammals, forage in tide pools. Tide pools even serve as "nurseries" for some fish species.

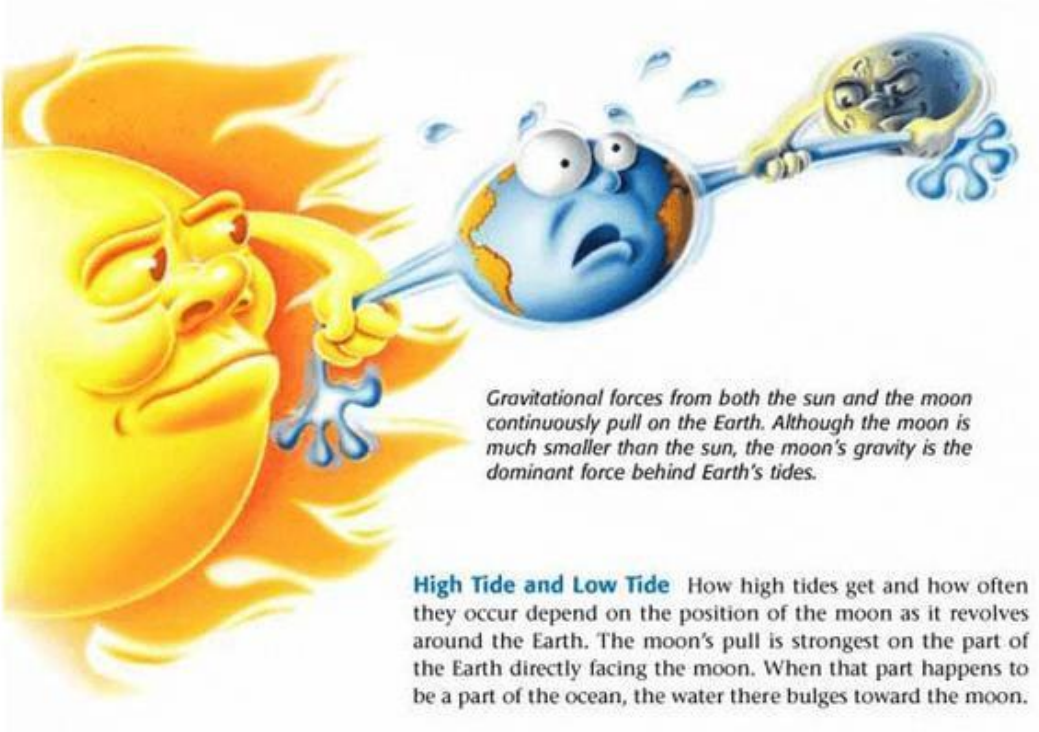


Adaptations to living in the tide pools

- Shells that can trap water to prevent animals from drying out
- Cluster together to help retain moisture
- High tolerance for changes in moisture and temperature

How Tides Are Created

Have you ever heard the term high tide and low tide? Tides are periodic rises and falls of large bodies of water. The gravitational pull of the moon causes the ocean to bulge out in the direction of the moon. In other words, the moon pulls the water of the earth towards itself causing high tide. This creates a low tide on the opposite side of the earth. Because the earth is rotating there are two tidal cycles every day, two high tides and two low tides. The sun also has an effect on tides on the earth but its role in the daily tide cycle is lessened because the sun is so far away.

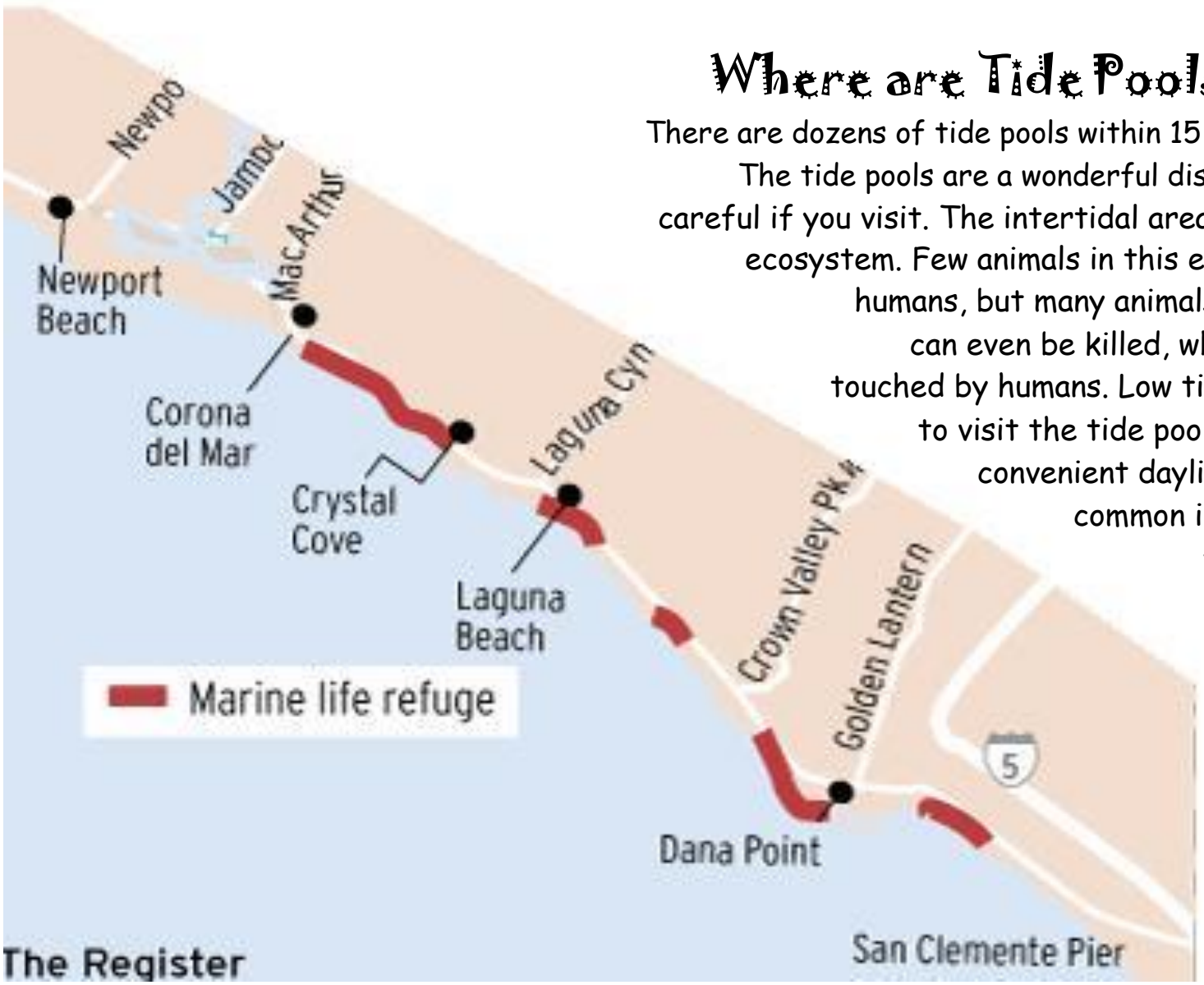


Gravitational forces from both the sun and the moon continuously pull on the Earth. Although the moon is much smaller than the sun, the moon's gravity is the dominant force behind Earth's tides.

High Tide and Low Tide How high tides get and how often they occur depend on the position of the moon as it revolves around the Earth. The moon's pull is strongest on the part of the Earth directly facing the moon. When that part happens to be a part of the ocean, the water there bulges toward the moon.

Where are Tide Pools?

There are dozens of tide pools within 15 miles of Santa Ana. The tide pools are a wonderful discovery zone, but be careful if you visit. The intertidal area is a very sensitive ecosystem. Few animals in this ecosystem can harm humans, but many animals are sensitive, and can even be killed, when handled or just touched by humans. Low tide is the best time to visit the tide pools. Low tides during convenient daylight hours are most common in the winter during full and new moons.



Ecology of Tide Pools

What is Ecology?

Ecology is the study of an environment, the organisms that live in the environment, and their interactions. In the study of ecology, a group of a particular species of organism living in a defined area is considered to be a population. Thus, when discussing a population, an ecologist will identify both the organism and the place.

Zonation of Tide Pools

The plants and animals of the intertidal zone occupy bands of distinctly different species composition. The distance above or below the mean sea level determines the vertical distributions of plants and animals.

The Hostile Environment of Tide Pools

Desiccation (drying out) is one of the primary factors that restrict the vertical distribution of organisms. Another restricting factor is the ability to survive drastic fluctuations in temperature, salinity and oxygen levels as they are exposed to the variations in the tides. In some organisms, for example barnacles and mussels, the ability of food depends upon submergence in seawater. These organisms may be restricted by starvation problems in the high intertidal zone. Furthermore, the abundance of competitors and predators with which an organism must coexist is influenced by the tides.

Human Impact on Tide Pools

Many intertidal animals, like the black abalone—prized for its shell and meat—are now scarce or absent in areas where they were once abundant.

Humans, historically and currently, harvest animals and plants from the intertidal environment for food, bait, and, more recently, for home aquariums.

While visiting tide pools people often crush or destroy shells and organisms.

The intertidal zone endures a variety of negative human impacts, including direct human contact and indirect contact through runoff and litter.

Coastal runoff hits the tide pools first and often in its highest concentration. This includes pesticides, car fluids from roads and driveways, and general litter.

As the world heats up, so too does the ocean. Organisms are dying in the hot tide pools or moving higher out of the water in an effort to remain cool.

California Biodiversity

Over millions of years, geology and climate have shaped California's unique habitats and produced a rich mosaic of life. Within its 160,000 square miles, California harbors more unique flora and fauna than any other state. For example, there are over 30,000 species of insects found in California, as well as 63 different types of freshwater fish, 46 amphibian species, 96 reptile species, 563 bird species, 190 mammal species, and over 8,000 different types of plants.

Biodiversity refers to all the different kinds of living organisms within a given area. Biodiversity includes plants, animals, fungi, and other living things.

California's nearshore waters provide a rich and varied habitat for a diversity of marine life; vast numbers of algae, invertebrates, fish, seabirds, and mammals inhabit these shallow waters, which overlie a gently sloping region called the continental shelf.

Name_____

Ecology of Tidepool Information Sheets

Jigsaw Matrix

	Paraphrase the information sheet below
Organisms of the tidepool	
How tides are created	
Where are tidepools?	

Name_____

Ecology of tidepools	
Human impact on tidepool	
Biodiversity	
Use the space below to write a 2-3 sentence summary of the overarching main ideas of the information sheets:	

SAUSD Common Core Lesson Planner **Teacher:**

<table>
<tr><td>Unit:
Tidepools
Day: 3, 4, 5
Lesson: 2</td><td>Grade Level/Course:
High School Biology</td><td>Duration: 3 class periods
Date:</td></tr>
<tr><td colspan="3">Big Idea: Interdependent Relationships in Ecosystems: There are many interdependent relationships that affect the stability of any given population.
Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: How does photosynthesis enable cellular respiration to occur in both autotrophs and heterotrophs? Consider the chemical processes, cellular organelles involved, and the input and output of energy in the form of glucose and ATP.</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS2-5 Develop a model to illustrate the role of photosynthesis in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
Reading Standards for Literacy in Science and Technical Subjects:
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Writing Standards for Literacy in Science and Technical Subjects:
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Speaking and Listening Standards (ELA):
1. Initiate and participate effectively in a range of collaborative discussions with diverse partners on grades 9-10 topics, texts, and issues, building on other’s ideas and expressing their own clearly and persuasively.
2.</td></tr>
<tr><td>Materials/ Resources/ Lesson Preparation</td><td colspan="2"><u>Day 3</u>
Teacher Resource: Day 3 2.1 Preparing the Learner PowerPoint (Smartboard if available)
Student Resource: Day 3 2.1 Preparing the Learner Response Sheet
Teacher Resource: Day 3 2.2 Photosynthesis and Cellular Respiration PowerPoint
Student Resource: Day 3 2.2 Photosynthesis and Cellular Respiration PowerPoint notes
Student Resource: Day 3 2.3 Extended Understanding
Colored Pencils
<u>Day 4</u>
Student Resource: Day 4 2.4 Anticipatory Guide
Teacher Resource: Day 4 2.4a Photosynthesis 1 of 3
Teacher Resource: Day 4 2.4b Photosynthesis 2 of 3
Teacher Resource: Day 4 2.4c Cellular Respiration 3 of 3
Teacher Resource: LAB-AIDS KIT #30S (3 kits with 18 sets of cards- 1 per 2 students)</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">Class Set Resource: Day 4 2.5 Photosynthesis and Cellular Respiration Lab (18 sets for a class of 36)
Student Resource: Day 4 2.5 Photosynthesis and Cellular Respiration Lab
Colored Pencils
<u>Day 5</u>
Class Set Resource: Day 5 2.6 Card Set (1 set per group of 4 students)
Student Resource: Day 5 2.6 Vocabulary Review Jigsaw Worksheet
Teacher Resource: Day 5 2.6 Vocabulary Review Jigsaw with answer key
Student Resource: Day 5 2.7 Thinking Map Planner</td></tr>
<tr><td>Objectives</td><td>Content:
Students will be able to explain the differences and similarities between photosynthesis and cellular respiration.</td><td>Language:
In groups of two, students will discuss their initial understanding of how plants and other living organisms get energy.
In groups of two, students will ask and answer questions about photosynthesis and cellular respiration.
In groups of four, students will work to together to make meaning of key vocabulary words.</td></tr>
<tr><td>Depth of Knowledge Level</td><td colspan="2">☒ Level 1: Recall ☒ Level 2: Skill/Concept
☒ Level 3: Strategic Thinking ☒ Level 4: Extended Thinking</td></tr>
<tr><td>College and Career Ready Skills</td><td colspan="2">☒ Demonstrating independence knowledge ☒ Building strong content knowledge
☐ Responding to varying demands of audience, task, purpose, and discipline
☒ Comprehending as well as critiquing ☒ Valuing evidence
☐ Using technology and digital media strategically and capably
☐ Coming to understand other perspectives and cultures</td></tr>
<tr><td>Common Core Instructional Shifts</td><td colspan="2">☒ Building knowledge through content-rich nonfiction texts
☒ Reading and writing grounded from text
☒ Regular practice with complex text and its academic vocabulary</td></tr>
<tr><td>Academic Vocabulary (Tier II & Tier III)
TEACHER PROVIDES SIMPLE EXPLANATION</td><td>KEY WORDS ESSENTIAL TO UNDERSTANDING
Photosynthesis
Cellular respiration
Organism
Cell
Oxygen & Carbon Dioxide</td><td>WORDS WORTH KNOWING
Glucose
ATP
Mitochondria
Metabolism
Enzyme</td></tr>
</table>

	STUDENTS FIGURE OUT THE MEANING	Chloroplast Heterotroph Autotroph Energy Organelle	Glycolysis Aerobic Respiration Chlorophyll
Pre-teaching Considerations		Before the unit Day 4: You might want to put the LAB-AIDS KIT Shuffle Cards, Shuffle Strips, and Category Cards in sets inside of gallon size ziplock type bags (you need 18 bags) so that you can quickly hand them out and get them back from your 18 groups of 2 (in a class of 36).	
CCSS Foundational Standards (K-5 only)			
Lesson Delivery			
Instructional Methods		**Check method(s) used in the lesson:** ☒**Modeling** ☒**Guided Practice** ☒**Collaboration** ☒ **Independent Practice** ☒**Guided Inquiry** ☐ **Reflection**	
Lesson Continuum	**Lesson Open-ing**	**Preparing the Learner** Day 3: Preparing the Learner PowerPoint 1. The teacher will direct the students to the Student Resource: Day 3 2.1, Preparing the Learner Response Sheet. 2. The teacher will show the Teacher Resource: Day 3 2.1 Preparing the Learner PowerPoint, allowing time for students to brainstorm and discuss their ideas with a partner. Day 4: Anticipatory Guide 1. As students enter the classroom, the teacher should conduct a quick spot check for completion of Day 3 2.3 Extended Understanding sheet. Depending on how you organize your classroom, you could ask to see it as they come in the door and stamp it for work that is at least 50% completed (or whatever % you feel comfortable with), or you could ask them to open their Student Resource Book to that page and place it in front of them so you can walk through to give credit/no credit. Remind students they will be using this resource on Day 5. Additionally, it will be counted for points in their overall grade for the unit. 2. The teacher will direct students to the Student Resource: Day 4 2.4, Anticipatory Guide. 3. The teacher will allow time for the students to read through the 8 statements and mark the appropriate box for their opinion. 4. The teacher will show the 3 video clips, 4 2.4a, 4 2.4b, and 4 2.4c. The first time you show them, encourage students to watch with no task to accomplish. Some students will naturally start adjusting their Anticipatory Guide and citing evidence, but this is not required at this point. 5. The teacher will show the videos a second time, this time instructing the students to record their answers in the "Findings" section of the Anticipatory Guide. 6. After the videos, students should be encouraged to provide evidence for their findings based on what they remember from the videos.	

		7. This would be a good point to allow students to compare their answers with their partners answers, making adjustments where necessary. 8. Remind students they will be referring back to this document later in the unit, so the more complete and accurate their answers are, the better it will be for them later on. <u>Day 5: Review of Photosynthesis and Cellular Respiration Shuffle Cards and Strips</u> 1. For extra credit (or for nothing at all), invite an adventurous pair of students up to the front to arrange the Shuffle Cards and Strips in the correct order on the document camera. 2. Solicit input from the class as to whether they are correct or not.

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with text:** Day 3: Photosynthesis and Cellular Respiration PowerPoint 1. The teacher will direct students to the Student Resource: Day 3 2.2 Photosynthesis and Cellular Respiration PowerPoint notes sheet. Answers to the note sheet are the information written in red in the PowerPoint. 2. The teacher will explain that students should write down any information in the PowerPoint written in red font. Invite students to write additional information as they see fit, but remind them they must record all information written in red font. 3. **Alternate PPT Option**, have students focus on extracting the key information from the PowerPoint by changing all text to the same color. Allow students 1 minute after each slide to decide with their elbow partner what information is essential to understanding the slide. Students record this information in their workbook in the appropriate section. 4. At the end of the PowerPoint, demonstrate the "asking your partner 3 questions" part of the lesson. • Choose a student to be your partner. • Ask them a question from the lecture notes like, "What are the reactants in photosynthesis?" • If they answer correctly, acknowledge their answer by checking off box 1 at the bottom of the lecture notes page. Have this page displayed on the document camera, so students have a visual of what to do. • Switch roles and have the partner ask you a question. Use your notes to answer correctly. • Continue by asking your partner a 2nd and 3rd question, checking off box 2 and 3. Don't forget to alternate between each question to keep both partners engaged. (If your partner has trouble answering your questions, guide them to the section of their notes that would help them.) • Now, direct the students to work with their partner and complete the asking and answering 3 questions task. To jump start the interaction, you may want to direct the student with the longest last name to begin asking questions. • Depending on how well the question/answer sessions progress, assist students in asking more complex questions. Ex: What would happen if plants could not complete photosynthesis? What would happen if humans could go through photosynthesis? Encourage them to think of the big picture and the many elements that would be affected. • As students finish, direct them to read instructions on the Day 3, 2.3 Extended Understanding sheet. Day 4: Photosynthesis and Cellular Respiration Lab 1. The teacher will direct students to the Student Resource Day 4 2.5 sheet.	**Differentiated Instruction:** **English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Visual cues for concepts **Special Needs:** • Provide students who are visually impaired with an electronic copy of power point. • Partner students with peer-helpers • Assign the questions to students instead of letting them chose • Visual cues for concepts (see additional copy of 2.5 with supplements • Add reference numbers to PPT slides

Lesson Continuum

Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding

First Read: The teacher will read the first 3 paragraphs out loud to the class. The teacher will point out the structures and labels in the diagram. The teacher will conclude by reading the boxed statement,

"Photosynthesis and cellular respiration meet the energy needs of organisms."

2. Second Read: The teacher will direct students to read the same three paragraphs and diagram silently, on their own. During this read, instruct students to underline or highlight parts of the text that stand out to them.
3. During the second read, the teacher will hand out the materials for the photosynthesis and cellular respiration lab, preferably in Ziploc bags- one per pair of students.
4. Direct the students to the Procedure part of the lab. Encourage the students to follow the procedures with their partner. If students need assistance, encourage them to look at the direction the arrows are going, indicating whether materials are entering or leaving an organism.
5. NOTE: There are two "check for understanding" points built into procedure 4 and 12, where the student needs to get your initials to proceed.
    - The correct order for the Photosynthesis and Cellular Respiration Cards is as follows:
      -Photosynthesis E,D,F,A
      -Cellular Respiration B,H,G,C
    - The correct order for the Photosynthesis and Cellular Respiration Strips is as follows:
      -Photosynthesis K,G, J,D,I (steps K and G can be reversed)
      -Cellular Respiration E,A,F,C,L,H (steps C,L, and H are interchangeable)
6. When students have successfully placed all cards and strips in order, they will complete procedures 13-16 in pairs.

<u>Day 5: Vocabulary Review Jigsaw</u>

NOTE: Direct students to the Day 5 2.6 Vocabulary Review Jigsaw worksheet. Using a "fishbowl" approach, demonstrate how this works by having three students join you at the front of the class. Using the four Vocabulary Review Jigsaw Cards, model how each group member participates by reading their clue. Model how to fill out the Vocabulary Review Jigsaw Worksheet, by displaying it on the document camera. Work through the #1 Vocabulary term as needed so that all class members have a clear idea of how this strategy works. **Ensure that each group shuffles the order of vocabulary words so clues are not in the same order.

The teacher should give each group of four a set of the Vocabulary Review Jigsaw cards.

1. To get set up:
    •Student 1 will be holding Card A
    •Student 2 will be holding Card B
    •Student 3 will be holding Card C
    •Student 4 will be holding Card D

Differentiated Instruction Continued:

For students needed additional support

Step 4-6

- Teacher proximity with immediate feedback
- Peer partner support

Accelerated Learners:

- Opportunities to explain topics/ reasoning/ thoughts to their partner/group

2. To begin:
    - Student 1 will select a number (1-15). All group members will circle that number on their Vocabulary Review Jigsaw worksheet. Student 1 will read that clue out loud to the group. Each group member will write the clue on their worksheet.
    - Student 2 will read the clue on their card for that number. All group members will record the clue on their worksheet.
    - Student 3 will read the clue on their card for that number. All group members will record the clue on their worksheet.
    - Student 4 will read the clue on their card for that number. All group members will try to guess the vocabulary word based on all of the clues. All group members will record their best guess on their worksheet.
3. To continue, the cards shift, giving each student shared responsibilities:
    - Student 1 will be holding Card D
    - Student 2 will be holding Card A
    - Student 3 will be holding Card B
    - Student 4 will be holding Card C
4. Now Student 2 will select a number to work on. All group members will circle that number on their worksheet. Student 2 will read the clue for that number.

This pattern will continue until the group has attempted to correctly identify all 15 vocabulary words.

5. To conclude, have each group choose one group members worksheet to be graded (perhaps the person's worksheet with the best printing or handwriting).
6. Guide students in determining the correct answers with the class. Try to not read out a list of answers, but rather asking groups to share what answer they think is correct and WHY. If all groups agree, ask them to cite the evidence that supports their argument. If they disagree, ask them to challenge each other's ideas. Collaborative Academic Conversation starters can help guide this discussion if needed. Students should also be practicing paraphrasing of the text clues and their answers as well as asking other students to elaborate or clarify any unclear response.
7. Direct groups to pass their paper to another group to be graded.

		8. Collect the graded worksheets to be recorded in the grade book **Extending Understanding:** <u>Day 3: Extended Understanding</u> 1. Direct students to the Day 3 2.3 Extended Understanding sheet. 2. Explain that students will be using the text book to extend their understanding of chloroplasts and mitochondrion by drawing and labeling them. 3. Option: Have students post their pictures in an edmodo group for peer feedback. Ask students to include a sentence to describe the essential features of their cell. NOTE: Students will be using this later as a brainstorming page for looking at the similarities and differences between photosynthesis and cellular respiration and creating a thinking map. <u>Day 4:Extended Understanding</u> 1. Direct students to the Analysis part of their lab and encourage them to answer the questions while working with their partner. What they do not complete during class can be completed at home. 2. You may want to begin the next class period by allowing volunteers to share their analysis answers and get feedback from their peers. <u>Day 5: Extended Understanding</u> 1. Direct students to the Day 5 2.7 Photosynthesis and Cellular Respiration Thinking Map Resource**.** **If needed**, give them a Helpful Hint: you want to use a thinking map that will best allow you to show the differences and similarities between the processes of photosynthesis and cellular respiration. 2. Direct the students to read the directions silently to themselves. 3. After 2 minutes or so, the teacher will read the directions out loud to the class. 4. Due to the space limitations inherent in the <u>Student Resource Book</u>, you may want to provide legal size paper, construction paper, or just a blank piece of white 81/2 X11 paper. 5. Have students snap a picture of their work with a cellphone and post it to a class edmodo page. Ask students to include on sentence about how they decided to pick this type of thinking make. Additionally, ask them to comment on one other person's work. This work can be completed at home, if time becomes an issue.	
Lesson Reflection			
Teacher Reflection Evidenced by Student Learning/ Outcomes			

How does a plant get energy to grow and survive?

How does a person get energy to grow and survive?

- Write as many ideas as you can on your paper.
- Compare your ideas to your partner's ideas using sentence starters.

- This is a photograph of Naveena Shine taken on Tuesday, June 18, 2013.
- She has been living on the "sunshine diet" for 47 days.
- Shine claims she's only taken in water and tea with splashes of milk.
- She has lost 20% of her body weight –going from 159 pounds to 126 pounds.
- The Seattle, Washington, woman is ending an experiment in which she is trying to prove that humans don't need food and that they can survive on sunshine.

http://www.guardian.co.uk/lifeandstyle/2013/jun/18/seattle-woman-naveena-shine-live-on-light

Do you think it is possible for people to "live on sunshine?" Why or why not?

Name_____

1. How does a plant get energy to grow and survive? Brainstorm your ideas here:

2. How does a person get energy to grow and survive? Brainstorm your ideas here:

3. Use at least one of these sentence starters to share your ideas with your partner about how people and plants get their energy.
    - I am not exactly sure how this happens, but I think one way may be…..
    - I know that this happens because ….

Name_____

4. Do you think it is possible for people to "live on sunshine?" Why or why not?

- If you would like, use this sentence starter to write at least 1 complete sentence. "I think it is/is not possible for people to "live on sunshine" because…."
- Or you can write your own complete sentence below.

My complete sentence for question 4 above:

- When your teacher tells you to, turn to your partner and figure out who has the longest pinkie finger.
- The partner with the longest pinkie finger reads their complete sentence to their partner, while the partner writes a summary.
- The partner with the shortest pinkie finger reads their sentence second, while the first partner writes a summary.

My partner's complete sentence:

So, how do living organisms get energy?

Photosynthesis & Cellular Respiration

1

Photosynthesis

- Cells inside the kelp use energy from the sun to make glucose.
- The kelp stores the glucose in its leaves.

2

Cellular Respiration

- Cells in fish use glucose from plants to make ATP or ENERGY.

3

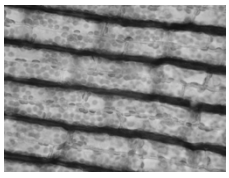
Chemical Equation & Label

- Photosynthesis
  $6\ CO_2 + 6\ H_2O + \text{Sunlight} \rightarrow C_6H_{12}O_6 + 6\ O_2$
  Carbon Dioxide + Water + Sunlight → Glucose + Oxygen
- Cellular Respiration
  $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 38\ ATP$
  Glucose + Oxygen → Carbon dioxide + Water + Energy

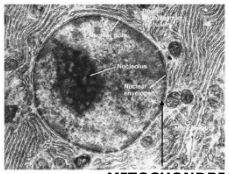
4

Type Of Cell

- Photosynthesis
  - Green plants



- Cellular Respiration
  - All living cells, including plants

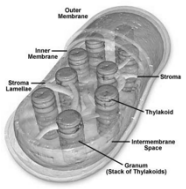


MITOCHONDRIA

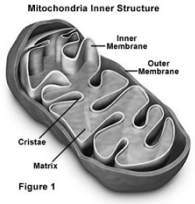
5

Organelle

- Photosynthesis
  - Chloroplasts



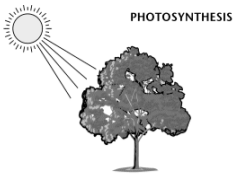
- Cellular Respiration
  - Mitochondria



6

When does it occur?

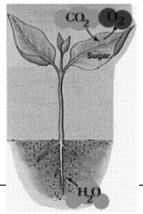
- Photosynthesis
  - Daylight Hours
- Cellular Respiration
  - At all times

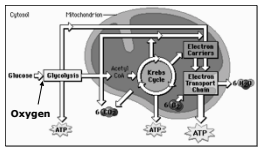


7

Reactants (what you start with)

- Photosynthesis
  - Carbon dioxide
  - Water
- Cellular Respiration
  - Glucose (sugar)
  - Oxygen

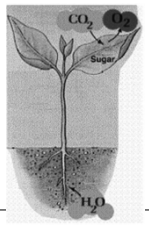


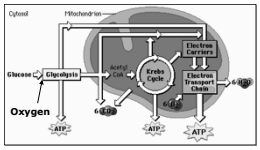


8

Products (what you end with)

- Photosynthesis
  - Glucose (sugar)
- Cellular Respiration
  - Chemical energy = ATP

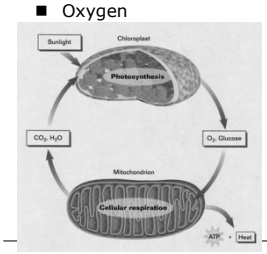




9

By-Products (Waste Products)

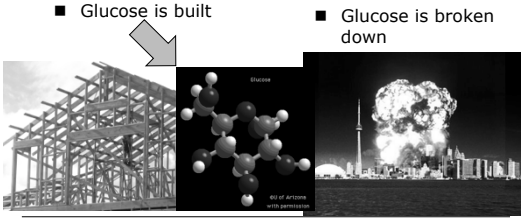
- Photosynthesis
  - Oxygen
- Cellular Respiration
  - Carbon dioxide
  - Water



10

Type of Process

- Photosynthesis
  - Constructive
  - Glucose is built
- Cellular Respiration
  - Destructive
  - Glucose is broken down



11

What occurs?

- Photosynthesis
  - Energy is stored in glucose
- Cellular Respiration
  - Glucose is broken down to release energy

12

Name_____

How Do Living Organisms Get Energy?	Photosynthesis	_____
What are the essential chemical equations?		
Write out the terms (labels) for the chemical symbols	Carbon Dioxide + Water+ sunlight →_____+ _____	
Which Type of Cell performs this reaction?		
Describe key organelles and their function for this reaction		Mitochondria -
When does this Occur?		
How Do Living Organisms Get Energy?	Photosynthesis	_____

Name_____

What are the reactants in each process?		
What are the products in each process		ATP= chemical energy!
What type of process is this reaction? Give examples		
What occurs in is this reaction. Give examples.		

- Using your notes, ask your partner one question.
- For example say, "When does photosynthesis occur?"
- Alternate who asks the question until you have each asked and answered three questions. Repeat the question for your partner if needed.
- If your partner does not remember the answer, allow them to use their notes to answer your question correctly. Check off their progress here: 1 2 3
- Continue until you have BOTH answered three questions correctly. Use your notes if needed.

Name_____

Use Figure 8.5 on page 222 to *draw* and

label a Plant Cell and a Chloroplast.

Use Figure 8.11 on page 228 to *draw* and

label an Animal Cell and a Mitochondrion.

Name_____

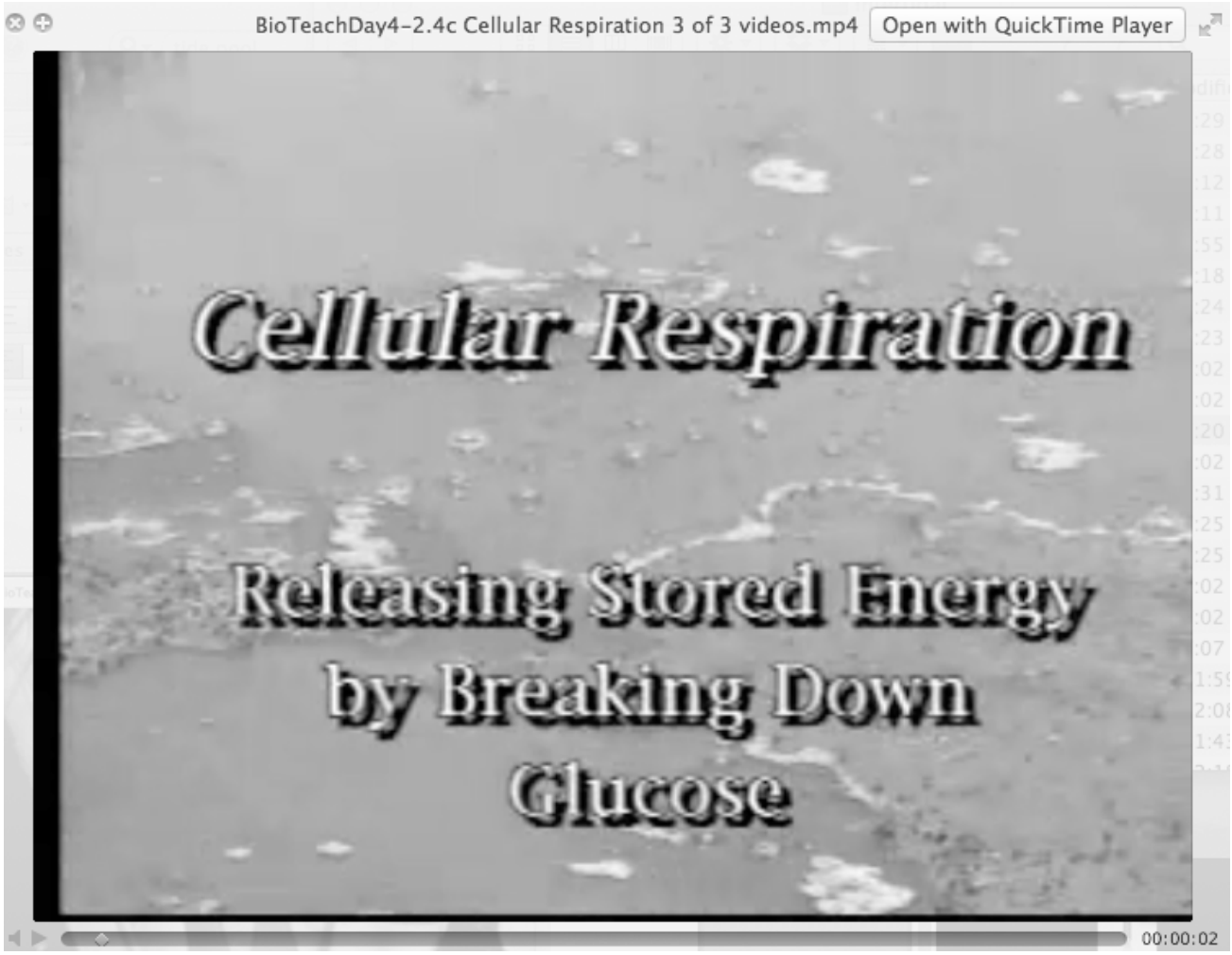
Lesson 2 Anticipatory Guide

	Before 3 Videos		After 3 Videos		
	Opinion		Findings		
	Agree	Disagree	Agree	Disagree	Evidence: Explain using your own words
1. The energy used by all living things comes from the sun.					
2. Autotrophs are organisms that cannot photosynthesize.					
3. Glucose is a needed by all organisms					
4. Chlorophyll is a green, light trapping molecule found in most plants.					
5. All animals are dependent on photosynthesis for their source of energy.					
6. Photosynthesis produces sugar and oxygen.					
7. All living organisms must have carbon dioxide in order to break the chemical bonds in glucose.					
8. One of the products of cellular respiration is energy, or ATP (Adenosine Triphosphate).					

Photosynthesis Video 1 of 3

Photosynthesis Video 2 of 3

Photosynthesis Video 3 of 3



You will be using a Lab-Aids Kit which will provide enough sets of cards for a class of 36 students to work in groups of 2.

This activity allows multiple opportunities for students to read, discuss, and negotiate meaning together.

If students struggle, allow them time to try to figure it out with the resources available to them; pictures, text, and their classmates.

Photosynthesis and Cellular Respiration (Developed by SEPUP)

KIT #30S

Part One is an investigation into the reactions of photosynthesis and cellular respiration using a series of images and statements. Students then discuss these processes relative to ecosystems and the carbon cycle. In Part Two, students read about the details of photosynthesis and cellular respiration, including light and dark reactions, glycolysis, the Krebs cycle, and the electron transport chain.

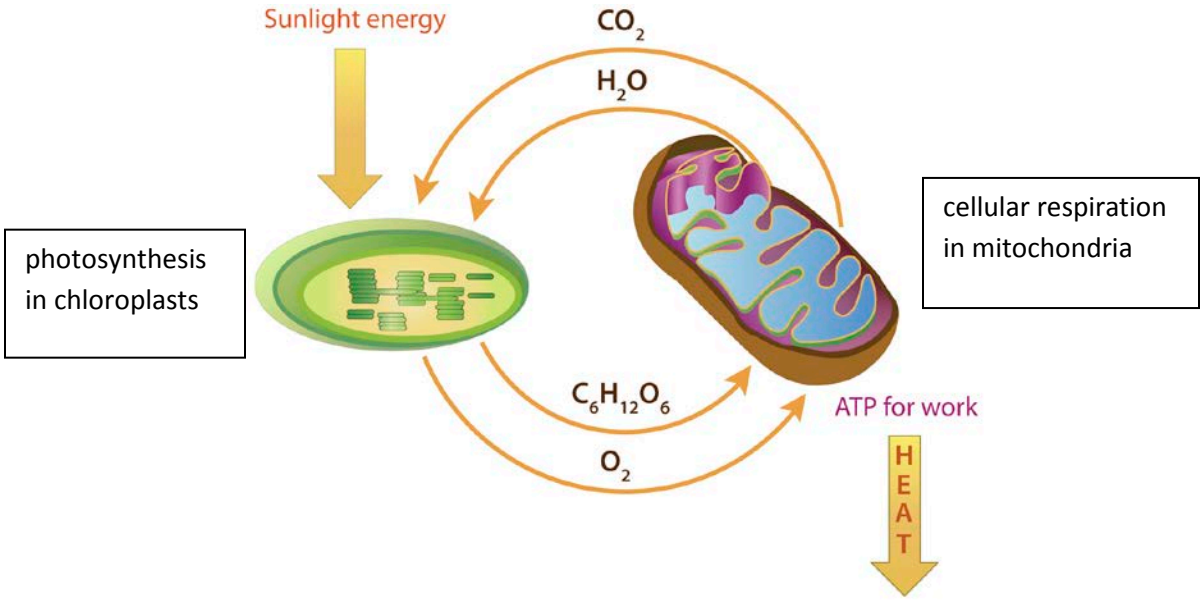
Name_____

PHOTOSYNTHESIS AND CELLULAR RESPIRATION LAB

Every living cell needs a source of energy. Without energy, metabolism- all of the chemical reactions that occur within cells- will not occur. Two elements that are continuously cycled by organisms are carbon and oxygen. These elements sustain both organisms and ecosystems. Two fundamental cellular processes- cellular respiration and photosynthesis- provide organisms with energy and recycle carbon and oxygen in ecosystems.

Cellular respiration is the process by which cells release stored energy from such sugars as glucose. Photosynthesis is the process in which producer cells use carbon dioxide, water, and nutrients to produce glucose and oxygen. Together these two processes make the carbon cycle possible, moving essential molecules through ecosystems.

You will learn how the complex chemical reactions of photosynthesis and cellular respiration help meet the energy needs of living things. You will also examine the organelles, molecules, and chemical reactions involved in these two processes.



Photosynthesis and cellular respiration meet the energy needs of organisms.

Materials

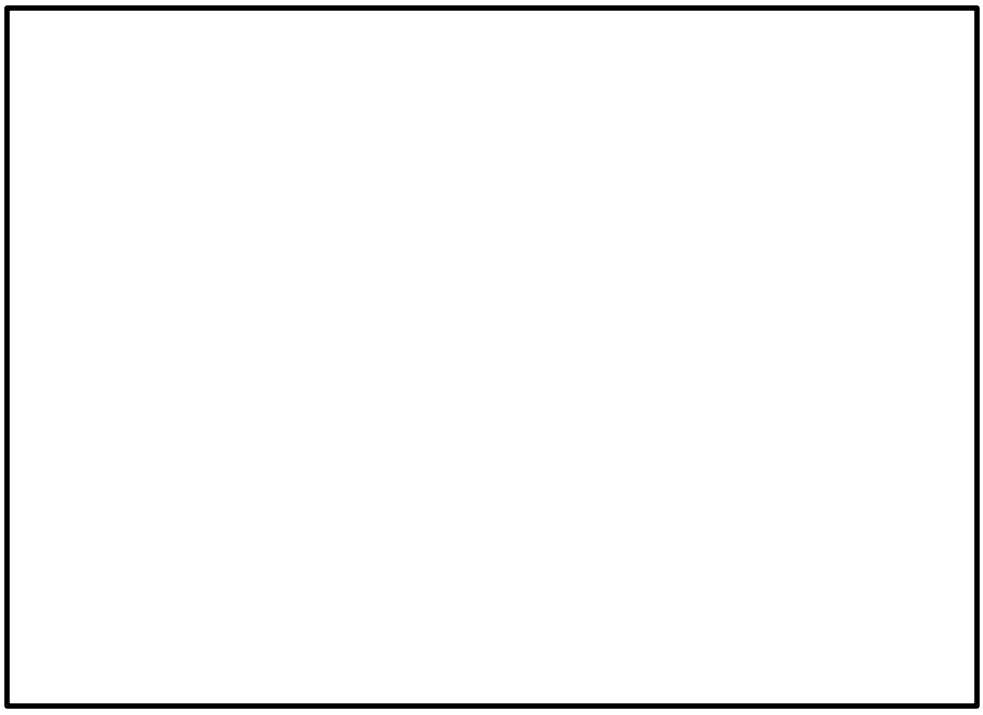
For each group of 2 students

1 set of 8 Photosynthesis & Cellular Respiration Shuffle Cards
1 set of 12 Photosynthesis & Cellular Respiration Shuffle Strips
1 set of 2 Photosynthesis & Cellular Respiration category cards

Name_____

Procedure

1. Spread out the 2 Category Cards, Photosynthesis and Cellular Respiration.
2. With your partner, sort the Shuffle Cards into two sets, based on what you already know about the processes of cellular respiration and photosynthesis.
3. Carefully examine the image on each Shuffle Card, and then put each card under the appropriate Category Card based on what you observe in the image.
4. When you think you have the Shuffle Cards under the appropriate Category Card, get approval from your teacher to confirm that the cards are correctly placed. If they are not placed correctly, use your text to help you make corrections. Teacher Initials for Shuffle Cards placed correctly = ☐
5. After getting your teachers initials, obtain the Photosynthesis and Cellular Respiration Shuffle Strips from your teacher.
6. With your team, lay all of the Shuffle Strips out on the table, and read each one aloud.
7. Sort the Shuffle Strips into two stacks, one for cellular respiration and one for photosynthesis. If you are unsure about where any of the strips belong, lay them out next to where you will be working so that you can see them as you work.
8. Choose a stack to start with. Put the Shuffle Strips in the order in which you think the processes are happening.
9. Repeat Procedure Step 8 for the stack you have not ordered yet.
10. If you had any Shuffle Strips that you did not place, try to decide where they belong now that you have ordered the other strips.
11. Note: There are more Shuffle Strips than Shuffle Cards, and so more than one strip may fit with a single card.
12. Get approval from your teacher to confirm that the Shuffle Strips are correctly placed before moving on. Use your text if you need help. Teacher Initials for Shuffle Strips placed correctly = ☐
13. Using the Shuffle Cards to help you, draw a simple picture that shows the process of Photosynthesis taking place in a pond with plants and fish.



Name_____

14. Based on what you see on the cards and on the strips, write a short paragraph describing photosynthesis. Be sure you write in your own words, and do not just copy the Shuffle Strips.
Photosynthesis Paragraph:

_____

_____

_____

_____

_____

_____

_____

15. Using the Shuffle Cards to help you, draw a simple picture that shows the process of Cellular Respiration taking place in a pond with plants and fish.

16. Based on what you see on the cards and on the strips, write a short paragraph describing cellular respiration. Be sure you write in your own words, and do not just copy the Shuffle Strips.

Name_____

Cellular Respiration Paragraph:

_____

_____

_____

_____

_____

Analysis

1. What does a producer need for performing photosynthesis, and what does photosynthesis produce?

_____

_____

2. What does an organism need to perform cellular respiration, and what does cellular respiration produce?

_____

_____

3. What roles do photosynthesis and cellular respiration have in an ecosystem?

_____

_____

_____

4. Explain whether the following statement is correct or incorrect: "Only organisms that breathe can perform cellular respiration."

_____

_____

5. If the mitochondria of half the organisms in an ecosystem stopped functioning, what might change in the ecosystem? Explain.

_____

_____

_____

Adapted from LAB-AIDS© KIT #30S

How Energy Flows

Vocabulary Review Jigsaw

Card A

1. This word starts with the letter S

2. The word starts with the letter E

3. This abbreviation starts with the letter A

4. This word starts with the letter G

5. The words starts with the letter M

6. This word starts with the letter O

7. This word starts with the letter A

8. This phrase has two words.
   The first word starts with C
   The second with the letter R

9. This word starts with the letter C

10. This phrase has two words.
    The first word starts with C
    The second with the letter D

11. This word starts with the letter M

12. This word starts with the letter P

13. This word starts with the letter H
14. This word starts with the letter C
15. This word starts with the letter E

How Energy Flows

Vocabulary Review Jigsaw

Card B

1. This word has 2 syllables.
2. This word has 3 syllables.
3. This abbreviation has 3 letters.
4. This word has 2 syllables.
5. This word has 4 syllables.
6. This word has 3 syllables.
7. This word has 3 syllables.
8. The first word has 3 syllables. The second word has 4 syllables.
9. This word has 3 syllables.
10. The first word has 2 syllables. The second word has 3 syllables.
11. This word has 5 syllables.
12. This word has 5 syllables.
13. This word has 4 syllables.
14. This word has 3 syllables.
15. This word has 2 syllables.

How Energy Flows

Vocabulary Review Jigsaw

Card C

1. The last letter in this word is t
2. The last letter in this word is y
3. The last letter in this abbreviation is p
4. The last letter in this word is e
5. The last letter in this word is m
6. The last letter in this word is n
7. The last letter in this word is h
8. The last letter in this phrase is n
9. The last letter in this word is t
10. The last letter in this phrase is e
11. The last letter in this word is a
12. The last letter in this word is s
13. The last letter in this word is h
14. The last letter in this word is l
15. The last letter in this word is s

How Energy Flows

Vocabulary Review Jigsaw

Card D

1. It "provides the energy for all living things."
2. It means "the ability to do work."
3. It is "short for Adenosine Triphosphate. It serves as a source of energy for all cells."
4. It is "a chemical compound and type of sugar which ends up storing the sun's energy in its chemical bonds."
5. It is "all of the chemical reactions in a cell."
6. It is "one of the products of photosynthesis. It is also a necessary reactant during cellular respiration. It is found in the air."
7. It is "organisms that make their own food through photosynthesis. Self-feeders."
8. It is "the process by which cells release stored energy from sugars such as glucose."
9. It is "organelles inside plants that capture light energy and use photosynthesis to make the energy into glucose."
10. It is "one of the carbon containing reactants in photosynthesis. It is also a produced during cellular respiration."
11. It is "an organelle in which cellular respiration takes place."
12. It means "to make from light. It is the process by which cells use carbon dioxide, water, and nutrients to produce glucose and oxygen."
13. It is "organisms that cannot photosynthesize. These organisms get food by eating autotrophs and other organisms."
14. It is "a green light-trapping molecule found inside chloroplasts in plants."
15. It is "a protein that speeds up chemical reactions in cells."

How Energy Flows

Vocabulary Review Jigsaw

Answer Sheet

1. Sunlight
2. Energy
3. ATP
4. Glucose
5. Metabolism
6. Oxygen
7. Autotroph
8. Cellular respiration
9. Chloroplast
10. Carbon dioxide
11. Mitochondria
12. Photosynthesis
13. Heterotroph
14. Chlorophyll
15. Enzymes

Name_____

Vocabulary Review Jigsaw Worksheet

- Work with your partners to complete the Vocabulary Review Jigsaw.
- Your goal is to correctly identify as many of the 15 vocabulary words as possible.
- Your group will receive points for each correct vocabulary word.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

Name_____

Photosynthesis and Cellular Respiration Thinking Map

Step 1: Go back to Day 3 2.3 where you drew and labeled the chloroplast and the mitochondria. Use that page to brainstorm your ideas about the differences and similarities between the processes of photosynthesis and cellular respiration.

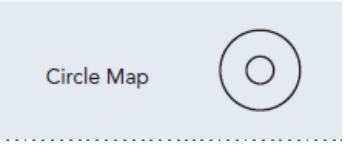
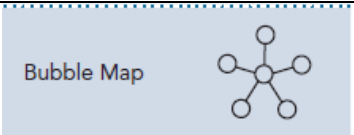
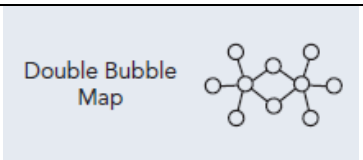
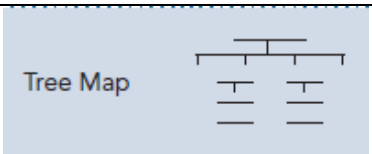
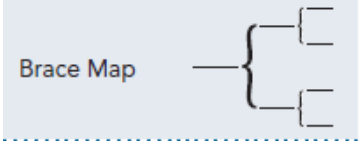
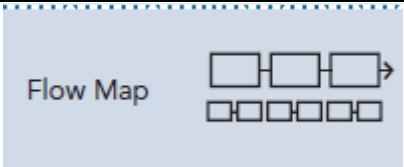
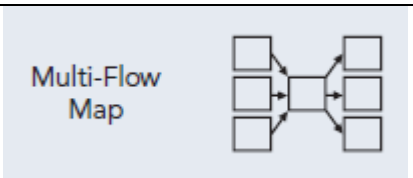
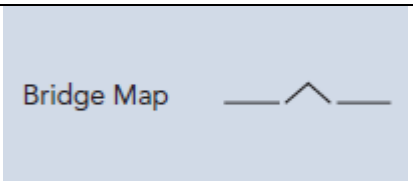
Step 2: Read the text on page 222 about Photosynthesis. Add to your brainstorm on the chloroplast part of the page.

Step 3: Read the text on page 228 about Cellular Respiration. Add to your brainstorm on the mitochondria part of the page.

Step 4: Use the thinking maps on the next page to help you decide what type of thinking map will best organize the information on your brainstorm page from Day 3.

Step 5: Draw your thinking map here: (If you need more space, you can use another piece of paper!)

Name_____

Common Core Standards & Questions	**Thinking Process**	**Thinking Maps as Tools**
Understand and use general (tier 2) and domain-specific (tier 3) academic vocabulary. What does _____ mean? Can you define_____?	Brainstorming or Defining in Context	
Use relevant descriptive details and sensory language in reading and writing. How would you describe_____? What are the characteristics of _____?	Describing	
Compare and contrast important points in two texts or points of view; draw comparative inferences about two populations. What are the similarities and differences between_____ and _____? How are _____ and _____ alike? different?	Comparing and Contrasting	
Determine the main idea(s) of text(s) and key supporting details in complex texts. What is the main idea of _____? What are the supporting details?	Classifying	
Use common affixes to determine and clarify the meaning of unfamiliar terms. Analyze the structural parts of _____ to suggest improvements.	Part-to-Whole	
Understand the steps and patterns in complex processes in order to answer questions and solve problems. What ordered steps would you follow to solve_____? How would you demonstrate the steps for solving_____?	Sequencing	
Evaluate the argument and specific claims in a text; determine the impact the author's purpose and point of view have on a text. What is the impact of the author's point of view on _____? How would you evaluate the argument and claims in_____?	Cause and Effect	
Analyze the relationship between a primary and secondary source; analyze patterns and relationships. What is the relationship between _____ and _____? How would you analyze the relationships and analogies in _____?	Seeing Relationships	

SAUSD Common Core Lesson Planner **Teacher:**

<table>
<tr><td>Unit: Tide Pools
Day: 6-7
Lesson: 3</td><td>Grade Level/Course:
High School/Biology</td><td>Duration: 2 class periods
Date:</td></tr>
<tr><td colspan="3">Big Idea: Interdependent Relationships in Ecosystems: There are many interdependent relationships that affect the stability of any given population.
Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: What are the different trophic levels and what types of organisms are found at each level? How is energy cycled through an ecosystem? Specifically, how is energy transferred among trophic levels and how is energy lost between trophic levels?</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS2-1- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-4- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Reading Standards for Literacy in Science and Technical Subjects 9-10: 1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
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4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</td></tr>
</table>

Materials/ Resources/ Lesson Preparation	Day 6 Teacher resource 3.1: The Energy Flow Video Student resource 3.1: Ecology: Trophic Transfer of Energy in an Ecosystem article Student resource 3.2: Flow of Energy in an Ecosystem student form Day 7 Student resource 3.3: Energy Flow in an Ecosystem: Energy Pyramid student form Scissors-suggested 1 pair of scissors per 2 students Tape- suggested 1 roll of tape per 4 students
Objectives	**Content:** Students will be able to model how energy flows through an ecosystem and analyze and explain how energy is used and lost at each trophic level. **Language:** Students will be able to communicate effectively with their partners to construct a model of how energy moves through an ecosystem.
Depth of Knowledge Level	☐ **Level 1: Recall** ☒ **Level 2: Skill/Concept** ☒ **Level 3: Strategic Thinking** ☒ **Level 4: Extended Thinking**
College and Career Ready Skills	☒ **Demonstrating independence** ☒ **Building strong content knowledge** ☒**Responding to varying demands of audience, task, purpose, and discipline** ☐ **Comprehending as well as critiquing** ☒**Valuing evidence** ☐**Using technology and digital media strategically and capably** ☐ **Coming to understand other perspectives and cultures**
Common Core Instructional Shifts	☒ **Building knowledge through content-rich nonfiction texts** ☒ **Reading and writing grounded from text** ☒ **Regular practice with complex text and its academic vocabulary**

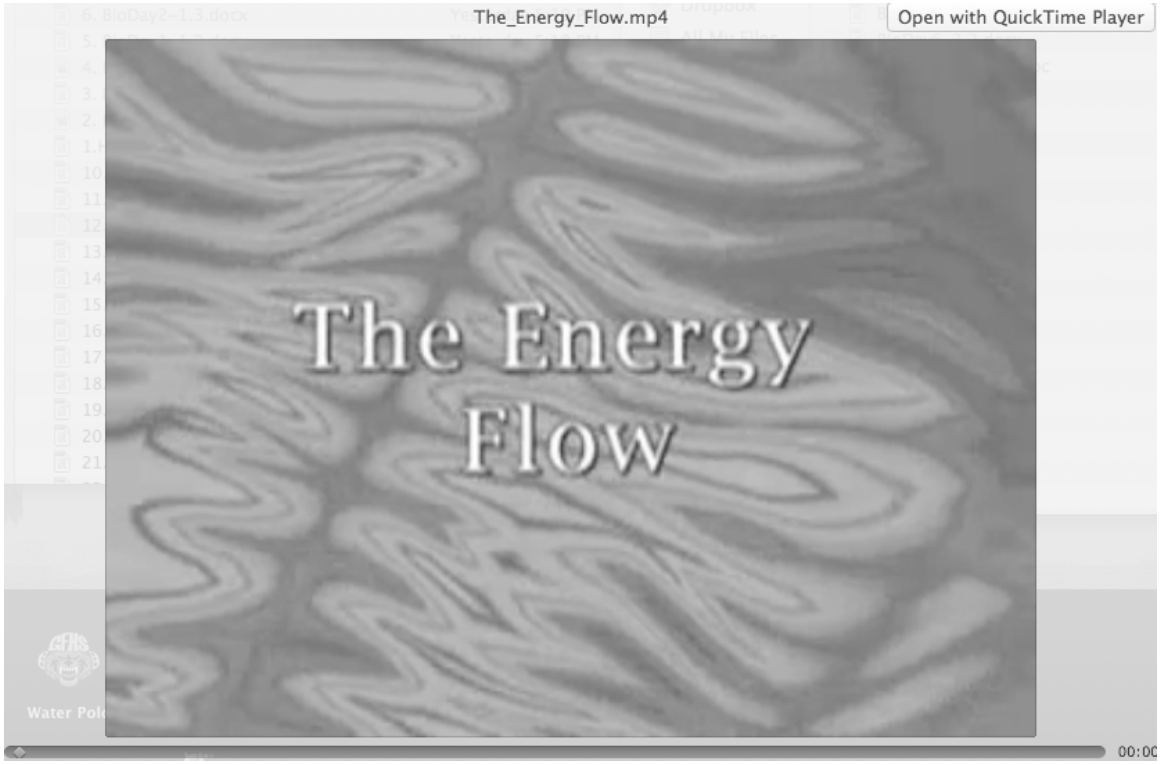
Academic Vocabulary (Tier II & Tier III)	**KEY WORDS ESSENTIAL TO UNDERSTANDING**	**WORDS WORTH KNOWING**
TEACHER PROVIDES SIMPLE EXPLANATION	Trophic Level Biomass	Energy Ecology Ecosystem Chloroplasts
STUDENTS FIGURE OUT THE MEANING	Autotroph Heterotroph Omnivore Carnivore Consumer Producer	Predator Prey

<table>
<tr><td colspan="2">Pre-teaching Considerations</td><td>Both days of this lesson require that students have access to scissors and tape. It is suggested that each pair of students have a pair of scissors to share and that every four students have a roll of tape to share. Having the suggested amount of materials will help speed the lessons and ensure that students finish in the allotted time.</td></tr>
<tr><td colspan="2">CCSS Foundational Standards (K-5 only)</td><td></td></tr>
<tr><td colspan="3">Lesson Delivery</td></tr>
<tr><td colspan="2">Instructional Methods</td><td>Check method(s) used in the lesson:
☒Modeling ☒Guided Practice ☒Collaboration ☐ Independent Practice
☒Guided Inquiry ☐ Reflection</td></tr>
<tr><td rowspan="2">Lesson Continuum</td><td>Lesson Open-ing</td><td>Preparing the Learner
Prior Knowledge, Context, and Motivation:
<u>Day 6: The Energy Flow Video (2:08)</u>
1. This video is a good way to introduce the key vocabulary needed to understand and explain the flow of energy between trophic levels in an ecosystem. During this first viewing students should simply watch the video and pay attention to the new concepts and vocabulary that it discusses.</td></tr>
</table>

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with the concept/text:** **<u>Day 6: Flow of Energy in the Ecosystem</u>** **First Read** 2. Following the viewing of the Energy Flow video students will be asked to silently read the article Ecology: Trophic Transfer of Energy in an Ecosystem. 3. While reading the article students should annotate the text, underlining or circling new vocabulary and new concepts. 4. Give students 1 minute to pull a quote that they think represents the most important idea of the text and have them share this quote and WHY they selected it with their elbow partner. Alternatively, they could pull a quote they are confused about or a quote that sounds interesting. 5. After all students have been given a chance to read, explore the text and share, the students will then read the background information on the Flow of Energy in the Ecosystem (student resource 3.2) in partners. The first partner will read the first 4 sentences out loud while their partner listens and follows the text. The last 4 sentences will then be read by the second partner while the first partner listens and follows along. Students should then re-read the background information and annotate the text, looking for new vocabulary and how the new terms are interconnected. 6. The teacher will then read the procedures out loud to the class using the ELMO as a tool to focus the student's attention. 7. Students will then be asked to read the word bank and concept bank with their original partner. Students should take turns reading the terms and the concepts. **Second Read/Viewing** 8. Re-watch the Energy Flow video. While watching the video the students will need to begin to match the main vocabulary words with the synonyms and begin to identify the concepts in the concept bank with each trophic level. 9. Students will then complete each of the 4 circles as described in the procedures using the text in the article and background and the information from the video to connect with the vocabulary. 10. Upon the completion of the vocabulary and concept circles the students should work with their partner to answer the conclusion questions referring back to the text and their circles as needed.	**Differentiated Instruction:** **English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Visual cues for concepts • Read text aloud if needed **Special Needs:** • Provide articles/work sheets in large print for those who need it • For students who are hearing impaired, provide a peer to take notes on NCR paper for videos • Visual cues for concepts • Step 8: guide students in matching vocabulary terms. • Step 9: Teacher proximity for immediate feedback • Step 10: Provide visual representation of the term to help identify the word.

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding		
		Extending Understanding: **<u>Day 6: Flow of Energy in an ecosystem: Vocabulary circles</u>** 1. Have students snap a picture of their favorite vocabulary circle (or the term that was the most difficult) and post it to the class edmodo website. Have students include one sentence about why they picked this term. Alternatively/additionally, have students make a comment about a peer's work. **<u>Day 7: Energy Flow in an Ecosystem: Energy Pyramid</u>** 1. This lesson is a representation of the text from day 6. Students will be creating a summative diagram that they will then use to answer a series of questions that asks them to apply their understanding of the complex text. 2. Students will be working on student resource 3.3 in groups of no more than 3 and will need access to scissors and tape to complete the assignment.	**Accelerated Learners:** • Opportunities to explain topics/ reasoning/ thoughts to their partner/group • Possible introduce the final assessment to increase rigor and depth of project
Lesson Reflection			
Teacher Reflection Evidenced by Student Learning/ Outcomes			

Energy Flow Video



Ecology: Trophic Transfer of Energy in an Ecosystem

How energy is transferred in an Ecosystem

Ecology, the study of the interactions of living organisms with one another and with their environment, is the study of ecosystems, an ecological system encompassing a community and all the physical aspects of its habitat.

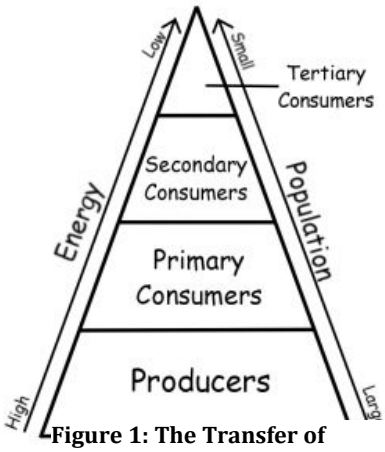


Figure 1: The Transfer of Energy

A place where a certain species lives is called its habitat, and groups of different species living together are called a community. All of the physical aspects of a community are called an ecosystem.

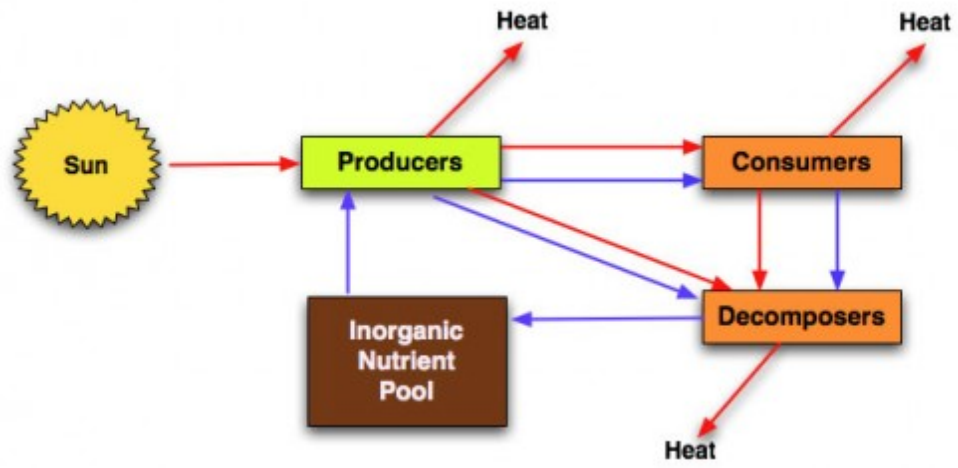
Ecosystems run on energy, which flows from the sun. Life is possible because photosynthesis captures the light energy from the sun and turns it into chemical energy of organic molecules. This is a basic principle of ecology. The organic molecule compounds are composed of what we call food, which gives us energy.

The energy budget of an ecosystem is determined by primary productivity, the amount of organic materials that the photosynthetic organisms of an ecosystem, produce.

Energy flows through food webs, a network of feeding relationships in an environment, which contain food chains, a linear pathway of energy transfer in an ecosystem. Food chains are composed of trophic levels, a group of organisms that have the same source of energy, a step in the food chain. The lowest trophic level consists of producers: plants, algae, bacteria. The 2nd level: cows, horses, caterpillars, ducks. The 3rd level: tigers, wolves, snakes. The 4th level: tertiary consumers (Top carnivores) such as a hawk eating a snake. A carnivore eating another carnivore.

Omnivores are animals that eat both plants and animals.

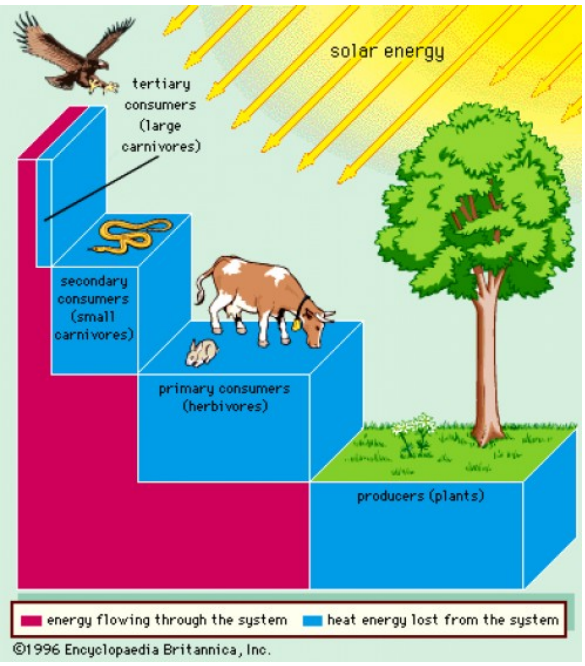
An organism acquires energy from the food it eats. Some of that energy is stored as fat, some is lost through wastes, urine, and feces. But most escapes as heat, which is produced when energy is transferred from one form to another. Only 10% of energy if incorporated into the next trophic level, so because the loss of energy from one level to the next is so great, the number of trophic levels is limited.



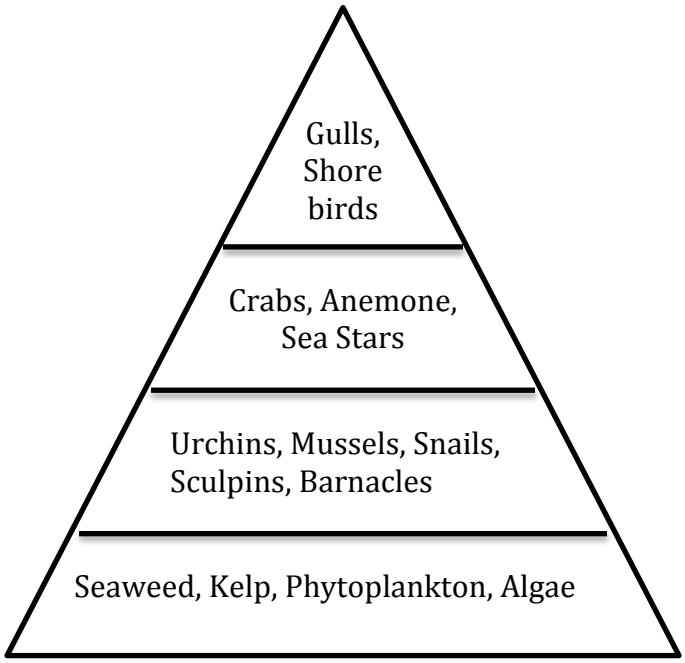
Transfer of energy and heat loss

Conclusion

To sum up, once a producer receives energy from the sun, it is eaten by a primary level consumer and gives around 10% of its energy to the primary level consumer. 90% is lost as heat. This process of ecology happens in an ecosystem all the time. The transfer of energy in an ecosystem is very inefficient, that is why consumers at the top of the food chain must constantly eat a lot of food, because less and less energy is available as we go further into the food chain.



Trophic Levels in an Ecosystem



Example Tropic Level Tidepool

http://londonlady.hubpages.com/hub/The-Transfer-of-Energy-in-an-Ecosystem

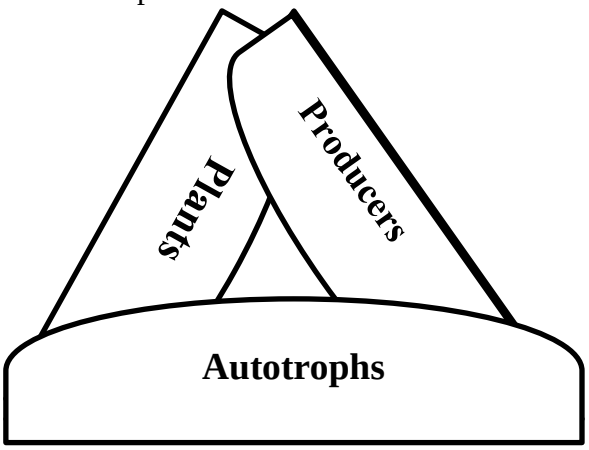
Flow of Energy in the Ecosystem

Objective: Create vocabulary connections to be able to understand how energy flows through an ecosystem.

Background: Energy is defined, as the ability to cause change, in ecology energy is the key component of an organism being able to survive. Every ecosystem has a specific flow of energy between organisms. Autotrophs- plants, algae, and some bacteria- capture energy from the sun in special structures called chloroplasts or special pigments that capture sunlight. Autotrophs form the foundation for the flow of energy in an ecosystem and are sometimes called producers. Autotrophs in turn are eaten by heterotrophs-herbivores, and omnivores- who are able to use the energy stored in the autotroph to fuel their energy needs. Carnivores such as birds, wolves, bears, and lions then eat herbivores such as deer, insects, rabbits, and cows. All organisms that do not use the sun for their direct energy needs are classified as consumers, meaning they physically eat another organism. This chain of energy usage is called the flow of energy in an ecosystem.

Procedures:

1. Follow the directions on the next page on how to cut out and fold each of the vocabulary circles.
2. Once all of the circles are cut out and folded, add the following information on each circle using the text to correctly place each term.
3. The three outer tabs of your circle should have the main vocabulary word and two synonyms. The first circle is done for you as an example.



4. Each circle should then have **four** key concepts that describe the main vocabulary word and how it is connected to the ecosystem as a whole.
    A. You will need to match **two** concepts from the concept bank to each circle.
    B. You will also need to pull **two** concepts from the text and add them to each circle.
5. Once your circles are complete tape them on the Flow of Energy in an Ecosystem page.

Word Bank

Main Vocabulary	Synonyms
Autotroph	Heterotroph Plants
Primary Consumer	Heterotroph Herbivore
Secondary Consumer	Producer Heterotroph
Tertiary Consumer	Carnivore Predator

Concept Bank

* Stores the most energy in every ecosystem
* Has the fewest number of organisms
* Consists of seaweed, algae, and plankton
* A heterotroph that eats other heterotrophs
* Barnacles eat plankton in rocky tidepools
* Able to use only 10% of energy stored in plants
* Able to hunt during both low tide and high tide Gulls are the top predator in the tidepools.
* Sea stars are carnivores that eat 1000s of mussels a year

Conclusion Questions:

1. Based on the text. Why are there more autotrophs in an ecosystem than top-level predators?

_____
_____
_____

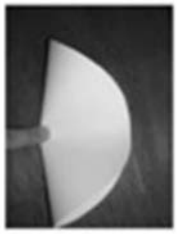
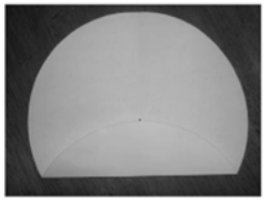
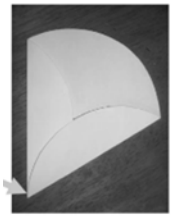
2. What are the 4 basic trophic levels in an ecosystem? Give an example of an organism found in each trophic level?

_____
_____
_____

3. Describe how energy would flow through a tidepool ecosystem. Please be specific.

_____
_____
_____
_____
_____
_____

Folding Directions:
1. Cut out each of the circles.
2. Gently bend the circle in half like a taco, and then gently bend in half like a hamburger. Make a mark where the two folds intersect in the center of the circle.
3. Select a point on the outer edge of the circle and bend it towards the middle mark. Fold the circle so that you create a crease along the edge.
4. Repeat with each remaining side so that your circle now looks like a equilateral triangle.

1. 
2. 
3. 
4. 

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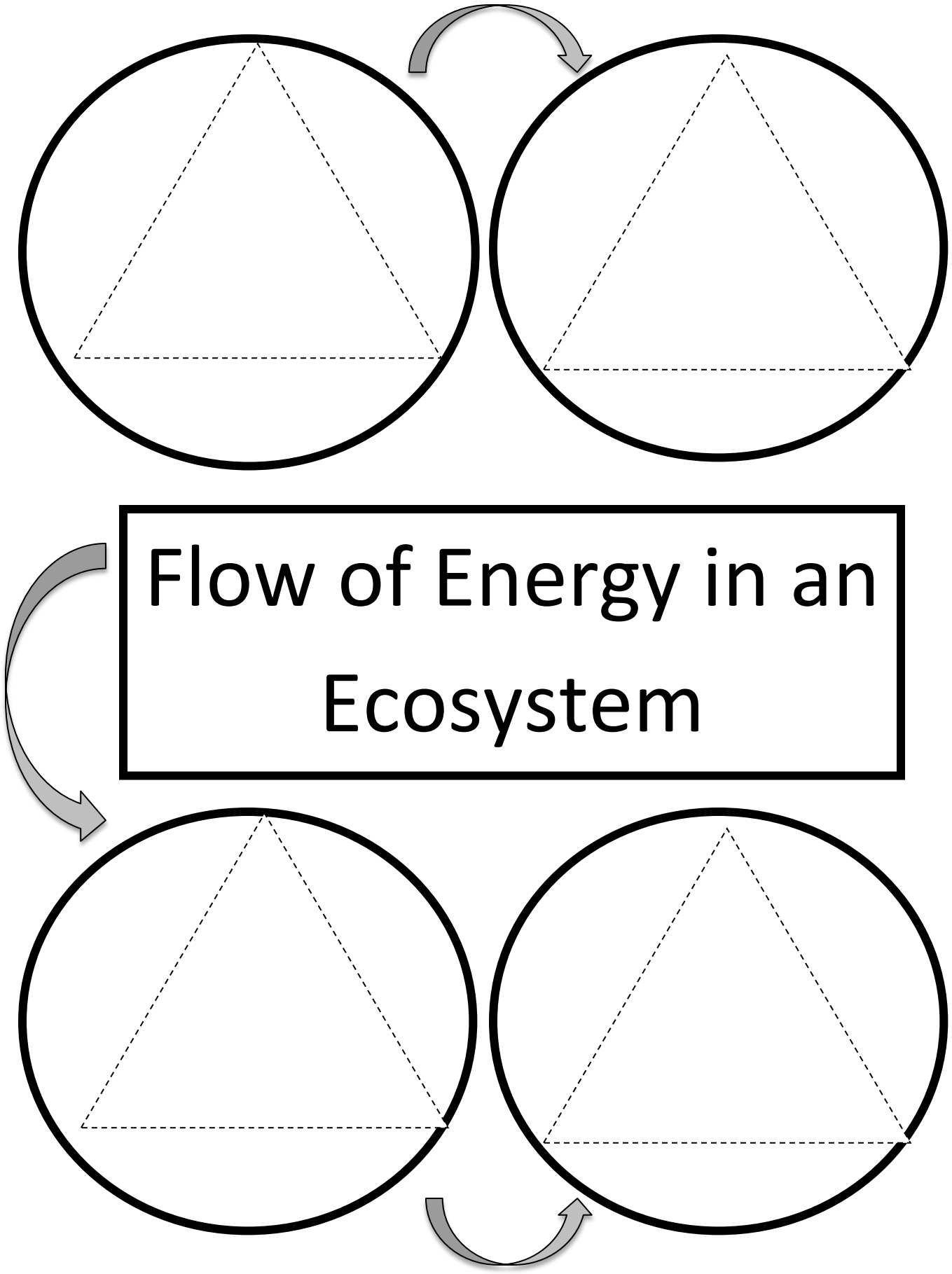

Flow of Energy in an Ecosystem

Name_____

Energy Flow in an Ecosystem: Energy Pyramid

Ecological pyramids are models that ecologists use to show how energy flows through ecosystems. There are three main types of ecological pyramids: pyramid of energy, pyramid of biomass, and pyramid of numbers. In this activity you will create a pyramid that shows the information found in each of these ecological pyramids.

Pyramid of Biomass

In a pyramid of biomass, each level represents the amount of biomass (the total mass of living matter at each trophic level) consumed by the level above it.

Follow the directions to make a Pyramid of Biomass
EACH LEVEL SHOULD DECREASE IN WIDTH JUST LIKE A PYRAMID.

1. Cut out the primary producers and glue them along the bottom of the triangle
2. Cut out the primary consumers and glue them above the primary consumers
3. Cut out he secondary consumers and glue them above the primary consumers
4. Cut out the tertiary consumer and glue it above the secondary consumers
5. Label each of the trophic levels using the main vocabulary from yesterday's lesson.

Pyramid of Energy

In a pyramid of energy, each level represents the amount of energy that is available to that trophic level. With each step up there is a energy loss of 90%.

Follow the directions to make a Pyramid of Energy.

1. To the right of your pyramid: Label each level with the correct energy % available
   - Primary consumers start at 100%)
   - REMEMBER YOU LOSE 90% (for each trophic level multiple the number by 10% example: 100 x .1 = 10%)
2. Draw an arrow up the pyramid and label the arrow "Available Energy decreases due to loss of energy in the form of heat".
3. Across the bottom write: Parasites and decomposers feed at each level

Pyramid of Numbers

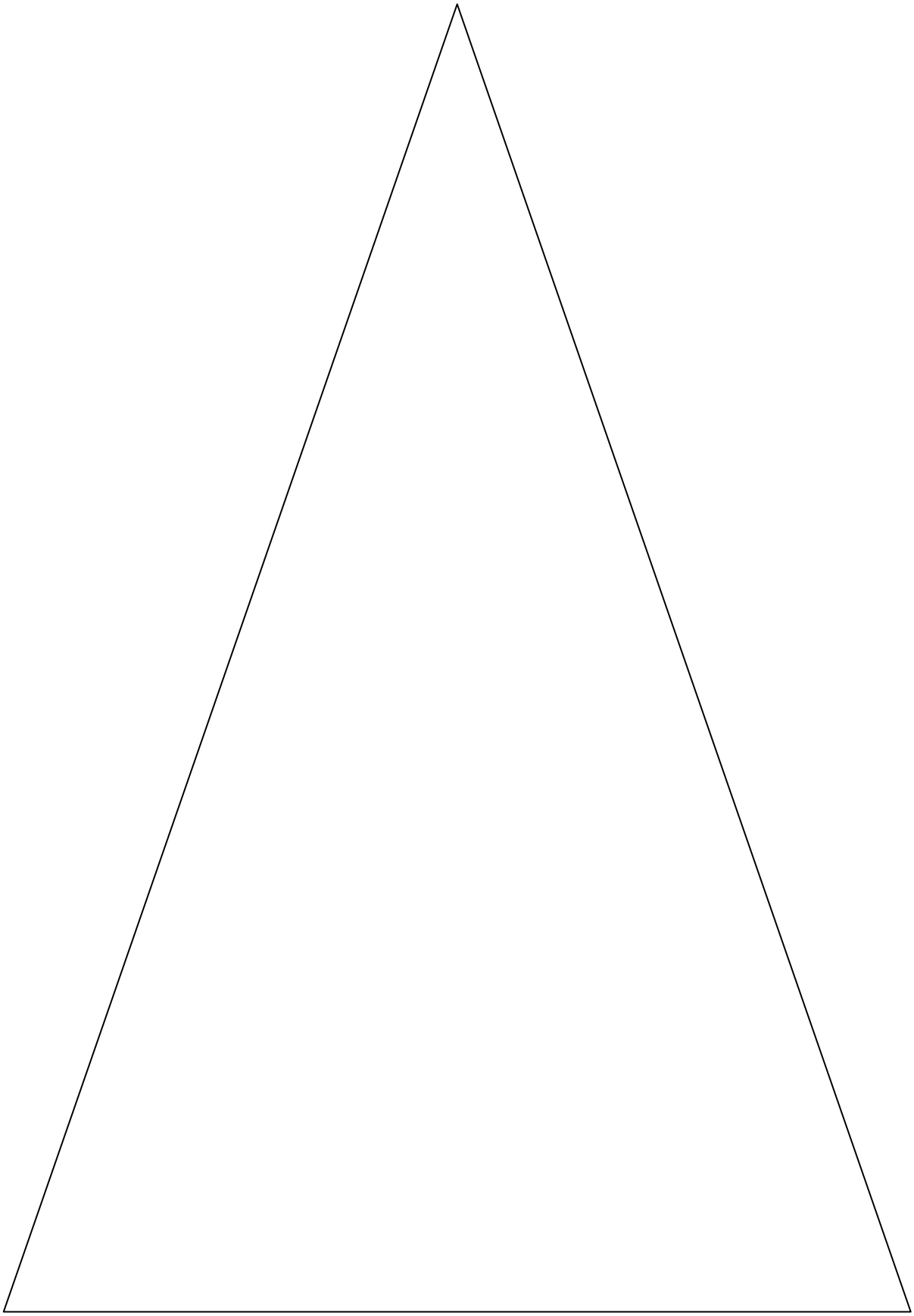
In a pyramid of numbers, each level represents the number of individual organisms consumed by the level above it. Each trophic level needs more individual animals to support it.

Follow the directions to make a Pyramid of Numbers.

1. On the left side draw an arrow up the pyramid and label the arrow "Population Size decreases".
2. As you go up your pyramid you lose animals label the pyramid from bottom to top with the following numbers:

10,000 pounds of phytoplankton
1,000 pounds crab larvae, zooplankton
100 pounds mussels
10 pounds sea star

Name_____



Name_____

Analysis Questions:

1. Describe the flow of energy through a simple food chain that ends with a lion as the final consumer.

_____
_____
_____
_____

2. Predict what might happen to the pyramid of biomass if the Sun began to produce less energy and then finally burned out?

_____
_____
_____
_____

3. Determine approximately how much total energy is lost from a three-step food chain if 1000 calories enter at the autotroph level.

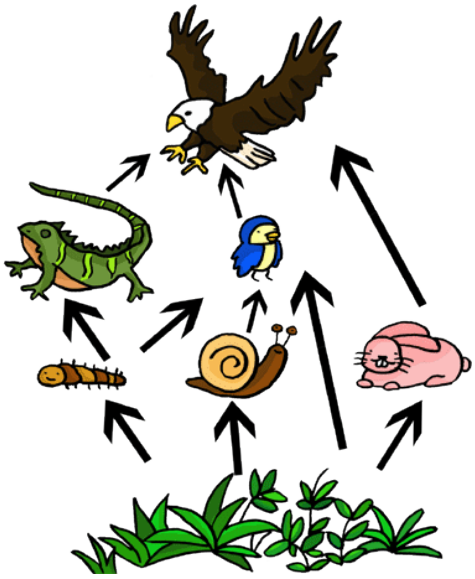
_____
_____
_____
_____

4. Apply what you know about how energy is transferred between trophic levels to explain why there can be only one Great White shark in your pyramid of biomass?

_____
_____
_____
_____

5. In the food web to the right which part of the food web would contain the greatest biomass? WHY?

_____
_____
_____
_____
_____
_____



Name_____

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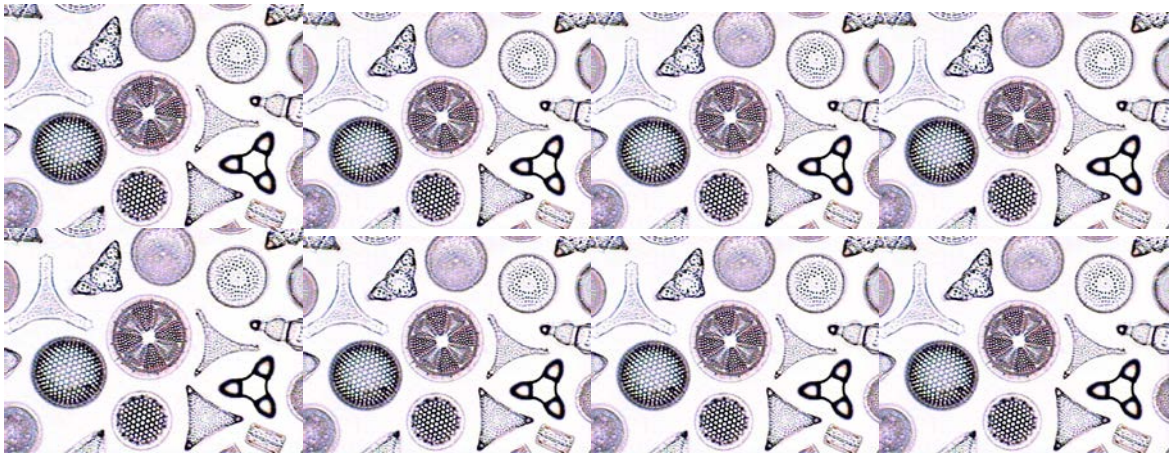
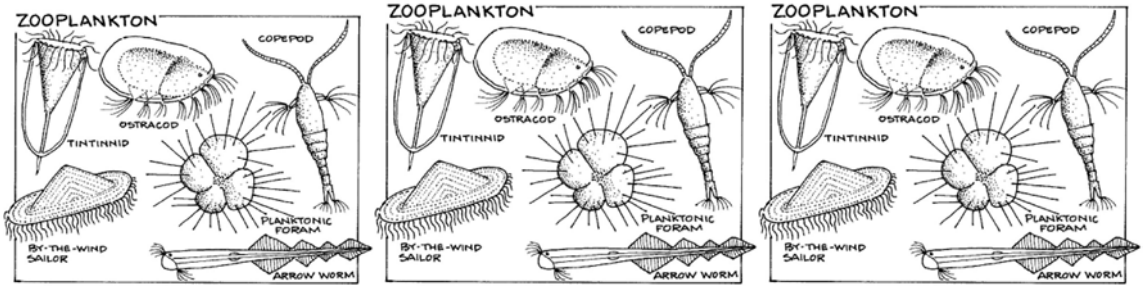
Name_____

Animal cut outs for the pyramid of biomass in a tidepool.





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<table>
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Day: 8-9
Lesson: 4</td><td>Grade Level/Course:
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Date:</td></tr>
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Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: What is biomass? How can the biomass of each trophic level predict the stability of the ecosystem? How is biomass used as an indicator for how energy is transferred between trophic levels in ecosystems?</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS2-1- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2-Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-4- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

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1. Write arguments focused on discipline-specific content.
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Teacher Resource 4.1: Biomass PowerPoint
Student Resource 4.1: What is Biomass? student form
Student Resource 4.2: The dead sea: Global warming blamed for 40 percent decline in the ocean’s phytoplankton article
Student Resource 4.3: Biomass: The dead sea article “Save the Last Word” student form
Day 9
Teacher Resource 4.4: Biomass Video
Student Resource 4.4: Graphing Ocean Biomass vs. Terrestrial Biomass student handout</td></tr>
<tr><td>Objectives</td><td>Content:
Students will be able to explain the role of producers in the ecosystem and identify and analyze the connection between the total masses of producers in relation to consumers in a stable ecosystem.</td><td>Language:
Students will interact with a complex text and then listen to information and opinions presented verbally by their peers and write the summative synthesizing important facts from the discussion on a matrix.</td></tr>
<tr><td>Depth of Knowledge Level</td><td colspan="2">☒ Level 1: Recall ☒ Level 2: Skill/Concept
☒ Level 3: Strategic Thinking ☒ Level 4: Extended Thinking</td></tr>
<tr><td>College and Career Ready Skills</td><td colspan="2">☐ Demonstrating independence ☒ Building strong content knowledge
☒Responding to varying demands of audience, task, purpose, and discipline
☐ Comprehending as well as critiquing ☒Valuing evidence
☐Using technology and digital media strategically and capably
☐ Coming to understand other perspectives and cultures</td></tr>
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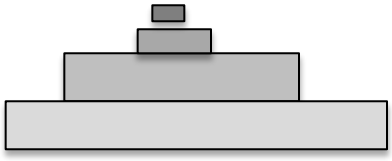
<tr><td rowspan="2">Academic Vocabulary
TEACHER PROVIDES SIMPLE EXPLANATION</td><td>KEY WORDS ESSENTIAL TO UNDERSTANDING</td><td>WORDS WORTH KNOWING</td></tr>
<tr><td>Annotate
Biomass</td><td>Zoomass
Phytomass</td></tr>
</table>

	STUDENTS FIGURE OUT THE MEANING	Terrestrial Microorganisms	Phytoplankton
Pre-teaching Considerations		Before the unit	
CCSS Foundational Standards (K-5 only)			
Lesson Delivery			
Instructional Methods		**Check method(s) used in the lesson:** ☒**Modeling** ☐**Guided Practice** ☒**Collaboration** ☐ **Independent Practice** ☒**Guided Inquiry** ☐ **Reflection**	
Lesson Continuum	**Lesson Open-ing**	**Preparing the Learner** Prior Knowledge, Context, and Motivation: 1. The teacher will show the students a PowerPoint that introduces Biomass. This PowerPoint has a video embedded that shows an interaction between multiple species. Students will brainstorm and take notes on Biomass on the accompanying student resource handout 4.1.	

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with the concept/text:**	**Differentiated Instruction:**
		<u>Day 8: The dead sea article and "Save the Last Word"</u> **First Read** 2. Students will read the article "The dead sea: Global Warming blamed for 40 percent decline in ocean's phytoplankton" (student resource 4.1), this is a first read and should be unencumbered (no clear task should be given at this point). **Second read** 3. Students will then read the article a second time and underline or annotate the text to identify sentences or sections that they found to be surprising, confusing, interesting, or difficult. 4. They will then chose one of the sentences that they identified as being surprising, confusing, interesting, or difficult and copy the sentence and identify the paragraph (**¶**) from which it came on their accompanying matrix as group member one. They will need to circle which adjective best fits the sentence that they chose. 5. Once all students have completed the first row on the matrix they should form groups of four to complete the remainder of the matrix. 6. The groups should pick who begins. The first student will then identify the paragraph that they chose a sentence from. They will then identify the appropriate adjective and read the sentence to their group members. The group must then add the information to their matrix so that the first 3 columns are complete. The group will then discuss, comment, or respond to the sentence and make notes in the accompanying fourth column. 7. This should continue until all students have had a chance to discuss their chosen sentence and all boxes on the matrix are completed. **Note**: To save time, announce which partner goes first, ex. youngest, the student with the most brothers, the student with the brightest backpack or shoes, the student with the birthday closest to the date, etc. **Third read** 8. On the completion of the article the students should once again read the article silently. 9. The students should then be given time to write a summary of what they learned directly from the article citing evidence to strengthen their learning. 10. Students will then be given time to summarize the information learned from the discussion with their peers. **<u>Day 9: Graphing Ocean Biomass vs. Terrestrial Biomass</u>** 1. The teacher will show the students a video that demonstrates the importance of producers in a marine ecosystem (Teacher Resource 4.3-Biomass Video) 2. Students will be completing a biomass graphing activity using real world data from both an ocean ecosystem and a terrestrial ecosystem. 3. Students will create two separate graphs. Each square on the graph is equal to 1 ton of biomass. Students will color in the appropriate number of squares for each species of organisms. Instruct students	**English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Visual cues for concepts **Special Needs:** • Provide students the article the day beforehand • Enlarge article for students with visual impairment • Partner with a peer helper • May need pre-teaching or extra support from special education staff for annotating, writing summaries and providing evidence • **2nd read**: Step 3-7: Teacher proximity for immediate feedback • Peer partners for immediate support • **Day 9**: Step 2-4. Teacher guided shadowing. Reduce intervention from lesson 1-3

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	to try to make their graphs as close to pyramid shape as possible.  4. Students should make sure that they follow the procedures to label their graph. 5. Once students have completed their graphs they will participate in a Dyad share with their elbow partner. Students may use the sentence starters to help facilitate their discussion about the information contained in each graph. Student should be given 3-4 minutes to discuss their graphs and the concepts presented in the background information of the activity. **Extending Understanding:** 5. Students will then answer a deeper understanding inquiry that asks them to plausibly predict what might happen to the world's biomass distribution in light of the human population boom. They should cite evidence to credit where they are drawing their ideas from (resource book page #, personal experience, news story, etc.) Students should be allowed 4-6 minutes to formulate and write their own ideas. 6. Once students have had time to write their own thoughts they will then turn to a partner and write at least 3 complete sentences in response to the prompt.	• For students with hearing impairments, have a peer take notes on the video on NCR paper • Provide enlarged graph paper for students who are visually impaired • Visual cues for concepts **Accelerated Learners:** • Opportunities to explain topics/ reasoning/ thoughts to their partner/group • Research outside sources for plankton blooms and the effects of biodiversity in a given habitat • Possible introduce the final assessment to increase rigor and depth of project
Lesson Reflection			

Teacher Reflection Evidenced by Student Learning/ Outcomes	

Biomass

Bio = life

Mass = how much matter is in an object (measure of weight)

Blue Whale

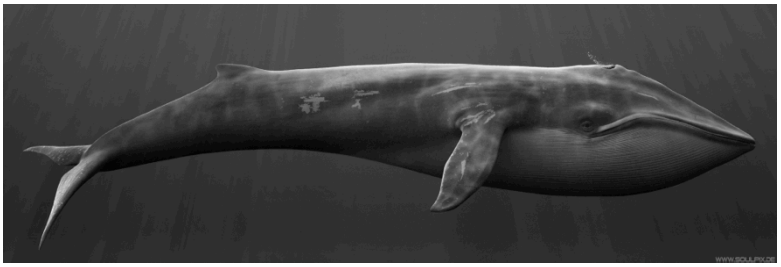
- The largest animal ever known on Earth
- Can be up to 100 feet (30 meters) long and weigh upwards of 200 tons
- World wide blue whale: population of about 12,000

Krill

- The lowly krill averages only about two inches (five centimeters) in length, but it represents a giant-sized link in the global food chain.
- Their estimated numbers range from 125 million tons to 6 billion tons in the waters around Antarctica.

Brainstorm with a partner

How can this



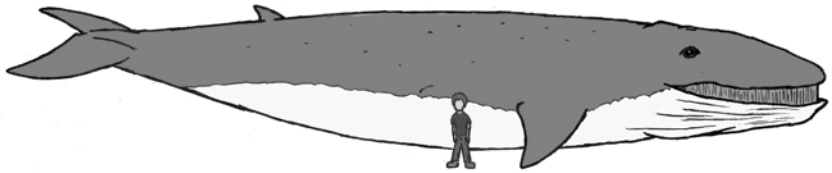
eat only this

and still be the largest animal on earth?

Name _____

What is Biomass?

1. Write the information in RED from the PowerPoint.



2. Record you ideas about how the Blue Whale, who primarily eats tiny krill, is still the largest animal the Earth has ever known.

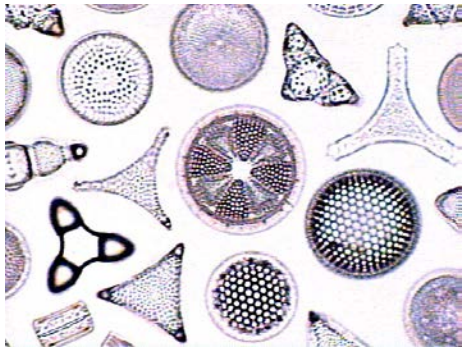
3. Calculate the total biomass of the Blue Whale population. (number of individuals x mass of individual whale)

4. In 2-3 complete sentences compare the worldwide biomass of the Blue Whale population to that of the Antarctic Krill population.

_____
_____
_____
_____
_____

The dead sea: Global warming blamed for 40 percent decline in the ocean's phytoplankton

Microscopic life crucial to the marine food chain is dying out. The consequences could be catastrophic By Steve Connor , Science Editor



1 The microscopic plants that support all life in the oceans are dying off at a dramatic rate, according to a study that has documented for the first time a disturbing and unprecedented change at the base of the marine food web.

2 Scientists have discovered that the phytoplankton of the oceans has declined by about 40 per cent over the past century, with much of the loss occurring since the 1950s. They believe the change is linked with rising sea temperatures and global warming.

3 If the findings are confirmed by further studies it will represent the single biggest change to the global biosphere in modern times, even bigger than the destruction of the tropical rainforests and coral reefs, the scientists said yesterday.

4 Phytoplankton are microscopic marine organisms capable of photosynthesis, just like terrestrial plants. They float in the upper layers of the oceans, provide much of the oxygen we breathe and account for about half of the total organic matter on Earth. A 40 per cent decline would represent a massive change to the global biosphere.

5 "If this holds up, something really serious is underway and has been underway for decades. I've been trying to think of a biological change that's bigger than this and I can't think of one," said marine biologist Boris Worm of Canada's Dalhousie University in Halifax, Nova Scotia. He said: "If real, it means that the marine ecosystem today looks very different to what it was a few decades ago and a lot of this change is happening way out in the open, blue ocean where we cannot see it. I'm concerned about this finding."

6 The researchers studied phytoplankton records going back to 1899 when the measure of how much of the green chlorophyll pigment of phytoplankton was present in the upper ocean was monitored regularly. The scientists analyzed about half a million measurements taken over the past century in 10 ocean regions, as well as measurements recorded by satellite.

7 They found that phytoplankton had declined significantly in all but two of the ocean regions at an average global rate of about 1 per cent per year, most of which since the mid 20th Century. They found that this decline correlated with a corresponding rise in

sea-surface temperatures – although they cannot prove that warmer oceans caused the decline.

8 The study, published in the journal Nature, is the first analysis of its kind and deliberately used data gathered over such a long period of time to eliminate the sort of natural fluctuations in phytoplankton that are known to occur from one decade to the next due to normal oscillations in ocean temperatures, Dr. Worm said. "Phytoplankton are a critical part of our planetary life support system. They produce half of the oxygen we breathe, draw down surface CO2 and ultimately support all of our fishes." he said.

9 But some scientists have warned that the Dalhousie University study may not present a realistic picture of the true state of marine plant life given that phytoplankton is subject to wide, natural fluctuations.

10 "It's an important observation and it's consistent with other observations, but the overall trend can be over interpreted because of the masking effect of natural variations," said Manuel Barange of the Plymouth Marine Laboratory and a phytoplankton expert.

11 However, the Dalhousie scientists behind the three-year study said they have taken the natural oscillations of ocean temperatures into account and the overall conclusion of a 40 per cent decline in phytoplankton over the past century still holds true.

12 "Phytoplankton are the basis of life in the oceans and are essential in maintaining the health of the oceans so we should be concerned about its decline.

13 "It's a very robust finding and we're very confident of it," said Daniel Boyce, the lead author of the study.

14 "Phytoplankton is the fuel on which marine ecosystems run. A decline of phytoplankton affects everything up the food chain, including humans," Dr Boyce said.

15 Phytoplankton is affected by the amount of nutrients the well up from the bottom of the oceans. In the North Atlantic phytoplankton "blooms" naturally in spring and autumn when ocean storms bring nutrients to the surface.

16 One effect of rising sea temperatures has been to make the water column of some regions nearer the equator more stratified, with warmer water sitting on colder layers of water, making it more difficult for nutrients to reach the phytoplankton at the sea surface.

17 Warmer seas in tropical regions are also known to have a direct effect on limiting the growth of phytoplankton.

Adapted by SAUSD teachers from:
http://www.independent.co.uk/environment/climate-change/the-dead-sea-global-warming-blamed-for-40-per-cent-decline-in-the-oceans-phytoplankton-2038074.html

Image Courtesy of NOAA

Name_____

Biomass: The dead sea article
"Save the Last Word"

Group Member	¶ Number	Circle the adjective that best fits your underlined sentence	Sentence from Article	Group's Comments/Response/Discussion Notes
1		Surprising Interesting Confusing Difficult		
2		Surprising Interesting Confusing Difficult		
3		Surprising Interesting Confusing Difficult		
4		Surprising Interesting Confusing Difficult		

Name_____

2. What I learned from the article. Cite evidence from the article to support your findings.

3. What I learned from the discussion with my group members. Give credit to each member as you write about his or her specific contribution.

Biomass Video

Name_____

Graphing Ocean Biomass vs. Terrestrial Biomass

Objective: Using comparative graphs explain the potential difference of biomass pyramids between an ocean ecosystem and a terrestrial ecosystem

Background: Biomass, in ecology, is the mass of living biological organisms in a given area or ecosystem at a given time. Biomass can refer to species biomass, which is the mass of one or more species, or to community biomass, which is the mass of all species in the community. It can include microorganisms, plants or animals.

The mass can be expressed as the average mass per unit area, or as the total mass in the community. Most of this biomass is found on land, with only 5 to 10 billion tonnes C found in the oceans.

On land there is about 1,000 times more plant biomass (phytomass) than animal biomass (zoomass). About 18% of this plant biomass is eaten by the land animals. However, in the ocean the animal biomass is nearly 30 times larger than the plant biomass. Ocean animals eat most of the existing ocean plant biomass, which is quickly replaced before affecting the stability the animal populations.

Ocean environments can have inverted biomass pyramids. In particular, the biomass of consumers (copepods, krill, shrimp, forage fish) is larger than the biomass of primary producers. This happens because the ocean's primary producers are tiny phytoplankton that grow and reproduce rapidly, so a small mass can have a fast rate of primary production. In contrast, terrestrial primary producers grow and reproduce slowly.

Procedure:

1. Using the data provided create two graphs that show the varying biomasses found at each trophic level in an ocean ecosystem and a terrestrial ecosystem.

Biomass Data

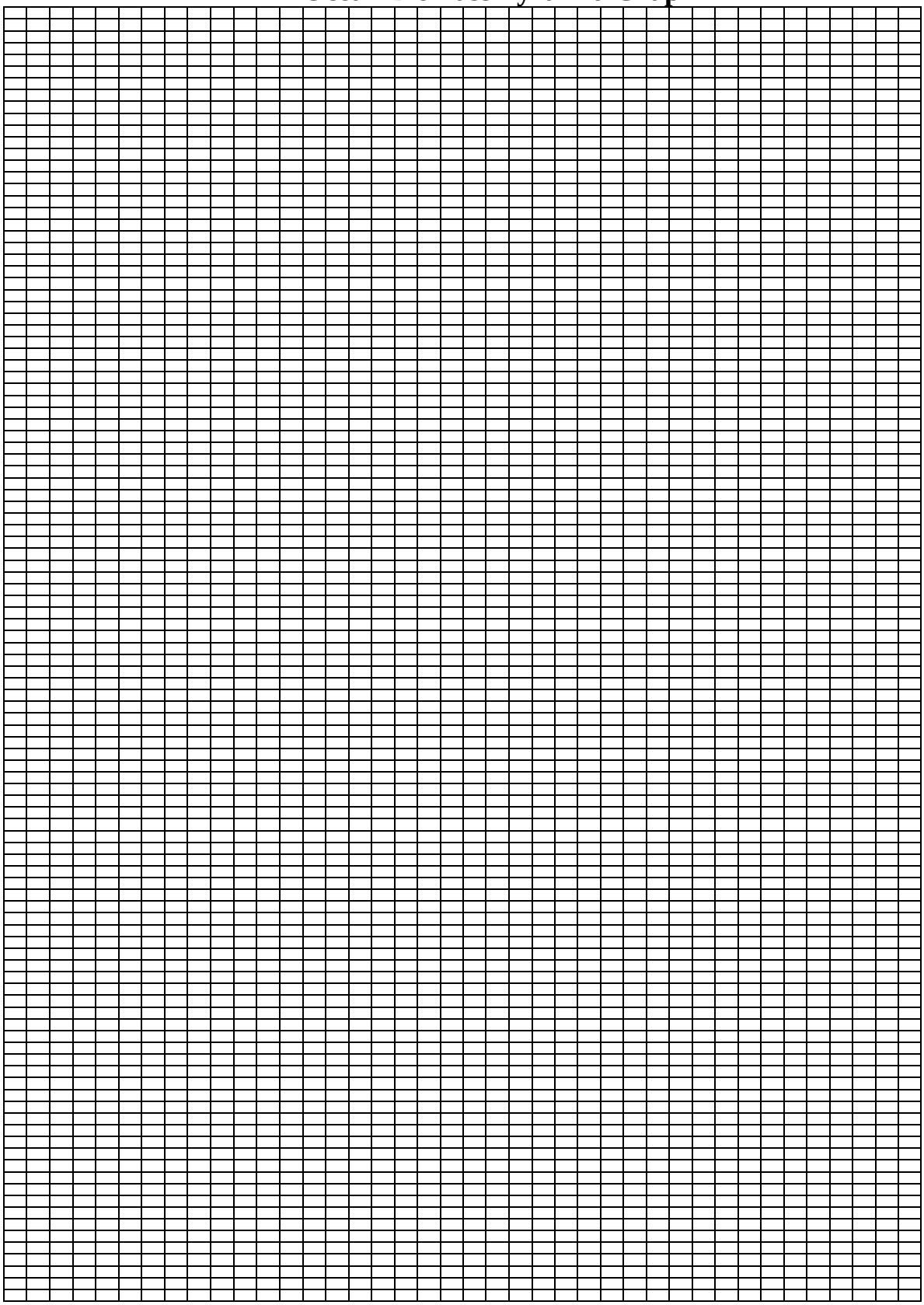
	Organism	Global wet biomass in million tons		Organism	Global wet biomass in million tons
	Cyanobacteria (picoplankton)	1,000		Domesticated Crops (wheat, corn, grain)	2,000
Ocean	Antarctic Krill	500	**Terrestrial**	Insects	1,050
	Marine Fish	1,300		Domesticated animals (chicken, goats, sheep cattle)	700
	Blue Whales	0.5		Humans	350

Your graph should be constructed as follows:

- 1 square = 1 million tons
- Color the appropriate number of squares to demonstrate biomass
- 3 tons of biomass = 
- Label each level of your biomass graph with the correct trophic level and the name of the organism.
- Label each level with the biomass

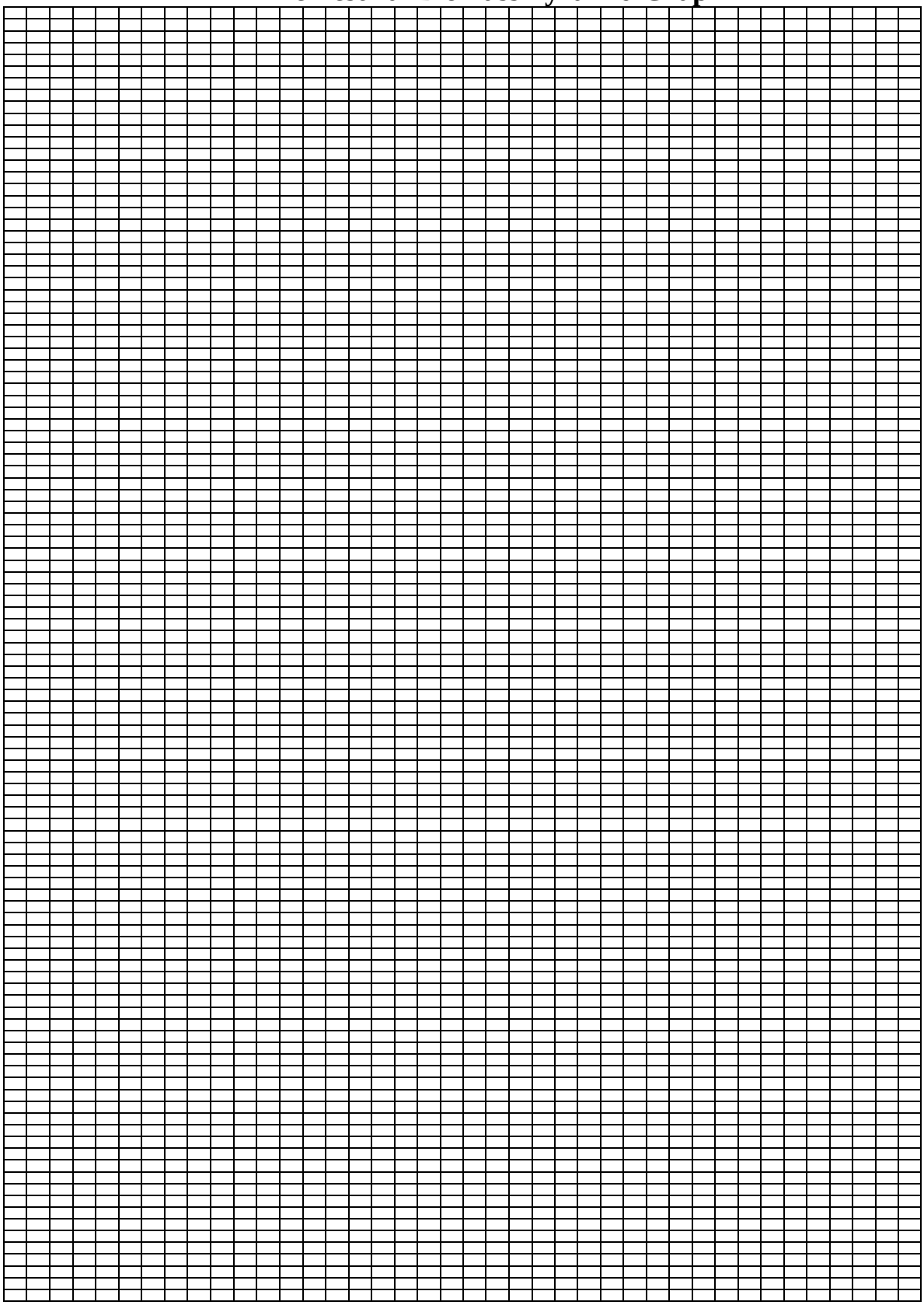
Name_____

Ocean Biomass Pyramid Graph



Name_____

Terrestrial Biomass Pyramid Graph



Name_____

2. Discuss your graph with a partner.
Use the following to support your discussion with your elbow partner.
Possible student exchange:
Student 1: *In looking at my graph of biomass in the ocean I found that _____. This is clearly shown by_____.*
Student 2: *I agree/disagree with your findings _____. In looking at the terrestrial graph I found it interesting that _____.*

3. Based on current biomass data the global population of humans has increased by 20% in the last 7 years, this in turn means that the human population has grown by 2.5 billion individuals. If our population continues to expand at such an alarming rate what do you think will happen to the biomasses of all other organisms on our planet? Cite evidence from what you have learned about ecology and biomass to support your conclusions.

1. My own thoughts:

_____
_____
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2. Three to four sentences written with my elbow partner:

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SAUSD Common Core Lesson Planner **Teacher:**

<table>
<tr><td>Unit:
Tidepools
Day: 10-12
Lesson: 5</td><td>Grade Level/Course:
High School/Biology</td><td>Duration: 3 class period
Date:</td></tr>
<tr><td colspan="3">Big Idea: Interdependent Relationships in Ecosystems: There are many interdependent relationships that affect the stability of any given population.
Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: How are organisms organized within an ecosystem? Which types of species are vital to the health and stability of a biodiverse ecosystem? What are the potential impacts on the interdependent relationships of the organisms within an ecosystem if a single species population is changed?</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS2-1- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2-Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-4- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Reading Standards for Literacy in Science and Technical Subjects 9-10: 1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Writing Standards for Literacy in Science and Technical Subjects 9-10:
1. Write arguments focused on discipline-specific content.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Speaking and Listening Standards (ELA) 9-10: 1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.
4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</td></tr>
</table>

<table>
<tr><td>Materials/ Resources/ Lesson Preparation</td><td colspan="2">Day 10
Teacher Resource 5.1 A Keystone Species Video
Keystone Species Articles
Student Resource 5.1a- Sea Otter
Student Resource 5.1b- Prairie Dog
Student Resource 5.1c- Grey Wolf
Student Resource 5.1d- African Elephant
Student Resource 5.2- Keystone Species Jigsaw
Teacher Resource 5.2a- California Sea Otter Video
Teacher Resource 5.2b- Prairie Dog Video
Day 11
Teacher Resource 6.1- Final Assessment PowerPoint: Snapshot of Final Assessment that begins on day 13 (slide 1 only)
Teacher Resource 5.3- Food Web Go Fish Cards
Student Resource 5.3- Tidepool Go Fish Student Handout
Day 12
Disruption of Food Chain Articles
Student Resource 5.4a- Freshwater mussel biodiversity and conservation
Student Resource 5.4b- Motorboat turbulence kills zooplankton
Student Resource 5.4c- Gillnets taking toll on seabirds
Student Resource 5.4d- Seaweed records impact of global warming
Student Resource 5.5- Food Web Impact Jigsaw Matrix
Teacher Resource 5.6- Tidepool Food Web Prezi
Student Resource 5.6- Disruption in the Food Web</td></tr>
<tr><td>Objectives</td><td>Content:
Students will be able to build models of tidepool food webs and explain how energy is transferred through the trophic levels.</td><td>Language:
Students will interact with a complex text, listen to information and opinions presented verbally by their peers, and summarize important facts from the discussion in a written matrix.
Students will play a game in which they must express themselves and content-specific knowledge effectively.</td></tr>
<tr><td>Depth of Knowledge Level</td><td colspan="2">☒ Level 1: Recall ☒ Level 2: Skill/Concept
☒ Level 3: Strategic Thinking ☒ Level 4: Extended Thinking</td></tr>
<tr><td>College and Career Ready Skills</td><td colspan="2">☒ Demonstrating independence content knowledge ☒ Building strong
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<tr><td rowspan="3">Academic Vocabulary (Tier II & Tier III)</td><td>TEACHER PROVIDES SIMPLE EXPLANATION</td><td>KEY WORDS ESSENTIAL TO UNDERSTANDING</td><td>WORDS WORTH KNOWING</td></tr>
<tr><td></td><td>Organic Matter</td><td>Gillnets</td></tr>
<tr><td>STUDENTS FIGURE OUT THE MEANING</td><td>Keystone Species
Autotrophs
Heterotroph</td><td>Turbulence
Predator
Prey</td></tr>
<tr><td colspan="2">Pre-teaching Considerations</td><td colspan="2">Before the unit
Before beginning day 11 teachers will have to make sure that they cut the tidepool go fish cards apart. There should be 10 sets of 54 cards on 6 sheets of cardstock.
**Note: To make the cards last longer teachers may want to laminate the cards prior to cutting them apart.</td></tr>
<tr><td colspan="2">CCSS Foundational Standards (K-5 only)</td><td colspan="2"></td></tr>
<tr><td colspan="4">Lesson Delivery</td></tr>
<tr><td colspan="2">Instructional Methods</td><td colspan="2">Check method(s) used in the lesson:
☒Modeling ☒Guided Practice ☒Collaboration ☐ Independent Practice
☒Guided Inquiry ☐ Reflection</td></tr>
<tr><td rowspan="2">Lesson Continuum</td><td>Lesson Open-ing</td><td colspan="2">Preparing the Learner
Prior Knowledge, Context, and Motivation:
<u>Day 10: Keystone Species</u>
1. Teachers will show A Keystone Species Video (teacher resource 5.1). Students will be watching the video unencumbered.
2. Contextualize for students what a Prairie Dog, African Elephant, Grey Wolf and a Sea Otter are by showing a few pictures of each animal in the Keystone Species Articles on the document camera.</td></tr>
</table>

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with the concept/text:** **<u>Day 10: Keystone Species</u>** 3. Following the Keystone Species video students will read a brief description of what qualifies a species as a keystone species in an ecosystem. Students will then paraphrase the description on student resource 5.2. 4. Students should be divided into groups of four to complete the reading and the accompanying matrix. 5. Each student will read about one of the four keystone species: Sea otters, prairie dogs, African elephants, or grey wolves. 6. After reading about their keystone species the students will draw a food web that emphasizes the position of the species in the ecosystem. Instruct students that if drawing is not their strength then they may use names of plants and organisms and show the species interactions with arrows. Students should also pull the key points or main ideas from the article that they were responsible for reading and add them to their matrix as bulleted information. 7. Once all students have completed the square that accompanies their article they will share the information with the remainder of the group. While one partner is sharing the other group members will need to take notes on the main ideas from each article and draw or diagram the role of the keystone species in their given ecosystem or habitat. 8. At the end of this lesson every student will have a completed matrix that diagrams the importance of a keystone species in 4 different ecosystems. If time permits: 9. As a concluding piece the teacher will show the following videos: -California Sea Otters -Prairie Dogs Each of these videos provides a visual and auditory summary of how the ecosystems in which these species live are dependent on their presence. They both show how the presence or absence of a species can have a large affect on the overall biodiversity of an ecosystem. **<u>Day 11: Tidepool Go Fish</u>** ****Note:** In order to prepare students for the final assessment the teacher will show the first slide of the final assessment PowerPoint. This will allow students time to start organizing their new content knowledge into a valuable resource. Introducing the final project at this time can also help speed the process along during days 13-15, student may be instructed to think about their groups or can be assigned a group before hand and can begin to finalize the direction that they want to take with the final assessment. 1. The teacher will need to place the students into groups of 4. If this is not possible than groups that have 3 or 5 people can also be created. 2. Students will play “Go Fish” using the tidepool cards provided. There are numerous ways to make a viable food chain and it is up to the students to recognize and build a workable model.	**Differentiated Instruction:** **English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Visual cues for concepts **Special Needs:** • Day 10: Step 3-6: Teacher support with • Decoding • Article support • minor guiding interventions to promote student independence • Help contextualize the animals students are reading about with visual representations in the form of photos or video clips. • Provide peer helper • Provide student with a copy of the game instructions the day prior to playing • Provide student with copy of the article the day before reading • Visual cues for concepts

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	3. Go Fish Rules: a. Every player is dealt 5 cards, they can look at these cards but they should not let the other players see their cards b. The remaining cards are placed faced down in the middle of the players. c. While looking at their cards the students will read the information on the card and begin to make valid food chains. If the food chain is 4 cards long the student should place the cards in front of them (like you would with pairs in a real game of Go Fish). The students will then draw from the pile of cards until they have 5 cards in their hands once more. All players should have 5 cards in their hands at the start of the game. d. Designate a player to go first: in order to speed this process along it is advised that you give the students a direction such as the student with the longest pinkie goes first, the student with the shortest/longest hair goes first, the student with a birthday closest to Christmas goes first etc. Presenting the students with this type of direction promotes student interaction and communication. e. The first player will look at their cards and read the information on card and determine a specific organism that they will ask for. Player 1 will then direct their inquiry to a single player. “Hey Bob, do you have a gooseneck barnacle?” If the player has that particular species of barnacle then they will need to give their card to player 1. If they have two of the same card they need to only give ONE of their cards to the player that asked. f. If player 1 gets a card from the player they asked, they get another turn. Player 1 may ask any player for any plant or animal they need, including the same one you just asked for. g. If the person player 1 asked doesn’t have the specific card they asked for, the other player will say, "Go fish." Player 1 must then draw the top card from the draw pile. h. If player 1 happens to draw the card they asked for, the need to show it to the other players and then player 1 gets another turn. However, if player 1 draws a card that's not the card they asked for, it becomes the next player's turn. Player 1 keeps the drawn card, whatever card it is. i. The "next player" is the one who said, "Go fish." j. When players collect a set of cards that form a 3 or 4 card food chain, immediately show the set to the other players and place the food chain face up in front of themselves. k. Go Fish continues until either someone has no cards left in their hand or the draw pile runs out. The winner is the player who then has the most sets of food chains. A 3-card food chain is worth 5 points and a 4-card food chain is worth 10 points. 4. Once every student has had a chance to play Tidepool Go Fish the teacher will then instruct students to complete the data section and conclusion questions on student resource 5.3.	**Differentiated Instruction:** **Accelerated Learners:** • Opportunities to explain topics/ reasoning/ thoughts to their partner/group • Introduce the final assessment to increase rigor and depth of project

		Day 12: Disruption of Food Webs 1. The teacher will place students in groups of four. 2. Each student should be assigned one of the four articles to read a. Freshwater Mussel Biodiversity and Conservation b. Motor Boat Turbulence c. Gillnets taking a toll on Seabirds d. Seaweed records impact of global warming First Read 3. The teacher should instruct students on how to annotate the text. Demonstrated by reading aloud the first few sentences and modeling the use of annotation symbols. Students will be using the following symbols to annotate the text ***** = The author's main point, a significant idea, or a key idea **!** = Something that surprised or shocked you. **0** = A statement that reminds you of something or an idea that you connect with. 4. The teacher might practice with the first few lines of a different text as an example. Then instruct students to read silently and annotate using the symbols above. Second Read 5. Have students reread the text, looking for text to support the text-dependent questions in the matrix for keystone species. 6. Once finished rereading, students should complete their section of the matrix by writing the author's main point and key ideas, and if applicable, something they found interesting or surprising about the article. 7. The students can use the Sample Language Support sentence starters to facilitate a discussion with their group (use as needed). As each student presents the main ideas of the articles that they read their partners should make notes in the corresponding jigsaw matrix. NOTE: By day 12, students have been exposed to several instances of sentence starters and may not need these to carry out a meaningful conversation. Use Sample Language Support with select groups or as needed. **Extending Understanding:** 8. With 20 minutes left, the teacher should show the students the tidepool food web Prezi. 9. This prezi is to be shown in conjunction with student resource 5.6. The first four questions on the student resource are in direct response to real world scenarios presented in the Prezi presentation. The teacher should allow students to communicate with one another while formulating their answers.	**Students needing additional support:** • Day 12: Second read: Students have been exposed expectations on annotating text. Allow for independent work. • Students may be more familiar with annotation "I, We, You." Make the connection explicit that these symbols are another way of making the same connections.

		If time permits in class, if time does not permit this section should be completed for homework. 10. The main idea of this lesson is to see that all organisms in an ecosystem or habitat are interdependent on one another and that even seemingly insignificant changes can have disastrous effects on the entire system. Students will need to answer the prompt on student resource 5.6 and apply this main idea to a real life situation.	
		Lesson Reflection	
Teacher Reflection Evidenced by Student Learning/ Outcomes			

A Keystone Species Video

Keystone Species: Sea otter

The sea otter is an example of a keystone species in the Pacific Northwest. These mammals feed on sea urchins, controlling their population. If the otters didn't eat the urchins, the urchins would eat up the habitat's kelp. Kelp, or giant seaweed, is a major source of food and shelter for the ecosystem. Some species of crabs, snails, and geese depend on kelp for food. Many types of fish use the huge kelp forests to hide from predators. Without sea otters to control the urchin population, the entire ecosystem would collapse.

In the 1700-1800s, on the coast of California, the sea otter was hunted for its sleek, beautiful fur. It was also killed by fishermen who thought they were eating too many of the fish they wanted to catch. The sea otters were hunted almost to extinction. Without the sea otter, fishermen began to see changes in the ecosystem. Sea otters are one of the few animals that can eat sea urchins. When the otters disappeared, the sea urchin population grew very quickly. Soon there were more sea urchins on the California coast than ever before.

Sea urchins eat kelp. With so many more sea urchins, they ate up all the kelp beds. The kelp beds are very important to many fish as a place to have their young. This set off a chain reaction. With the otters gone and the sea urchins numbers growing quickly, the kelp beds began to disappear. Then the fish, with no safe place to spawn, began to disappear. In just a few years, the fishermen noticed that the fish were suddenly gone. Killing off the sea otter had the opposite effect they had hoped. They didn't know the sea otter actually helped protect the fish populations by eating sea urchins. The sea otter is a keystone species for its ecosystem.

In 1911, a treaty was passed to protected the sea otters from hunting. This was called the International Fur Seal Treaty. In some areas the sea otters came back. The sea urchins in those areas were brought back into control. Their kelp beds recovered and the fish population came back too. This is an example of how a keystone species is interconnected with a whole ecosystem.

www.fws.gov

www.geog.ucsb.edu

Adapted by SAUSD Teachers from http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1

And from http://www.exploringnature.org/db/detail.php?dbID=7&detID

Keystone Species: Prairie dog

Conservation of prairie dogs is of great importance to the prairie ecosystem. These animals were largely exterminated by farmers who worried their cattle would break legs by stepping in the burrows. In reality, however, there are no known cases of any cattle ever being injured by a prairie dog burrow. Hunting prairie dogs for sport and for pest-control has persisted right up to modern times. If such hunting continues, the populations will continue to drop disastrous consequences will ensue for the ecosystem of the Great Plains.

Prairie dogs are considered a “keystone species” for the prairies. This means that they are a species whose existence adds to a diversity of life. If this keystone species becomes extinct, it would mean the extinction of many other forms of life as well. Over 200 other species have been observed living on or near prairie dog colonies. These colonies contribute to the ecosystem by providing burrows for other animals such as burrowing owls, black-footed ferrets, and snakes; providing a food source for such species as badgers, black-footed ferrets, coyotes, and many birds of prey; and their burrowing churns the soil to enable the earth to better sustain plant life. Without prairie dogs present, many aspects of the prairie life would change or disappear.

The prairie dog is one of the most important species in the American prairie. Its numbers used to be so great that Lewis and Clark on their journey up the Missouri River noted that the animal "appears in infinite numbers". Now due to the intrusion of man, this wonderful creature's populations have been dramatically reduced. We must save this animal not only because we are responsible for its demise, but also because western ecosystems depend on the prairie dog.

Kathy Milani/The HSUS.

Adapted by SAUSD teachers from http://www.conservenature.org/learn_about_wildlife/prairie/prairie_dog.htm

Keystone Species: Grey Wolf

Once the world's most widely distributed land mammal, the gray wolf, or timber wolf, was systematically eradicated from the continental United States in the 20th century and was added to the endangered species list in 1973. Gray wolves are considered a "keystone" species — one with a dramatic effect on its environment. For example, the recent reintroduction of gray wolves to Yellowstone National Park has led to the recovery of the entire ecosystem, from vegetation to beavers to hawks and eagles. The animal is the direct descendent of the ancestor to dogs.

Following is a excerpt from Smithsonian Magazine of how this occurred: The reintroduced wolves appear to be doing the job they were recruited to do—put more teeth in the natural order that had been out of whack since the wolves disappeared in the early 20th century. By 2005, they (wolves) were killing around 3,000 elk every year in Yellowstone, where oversized herds had been denuding the park's vegetation. Much of the elk predation took place in the Lamar Valley in the northeast quarter of the park, a stretch of open space that has been compared to East Africa's Serengeti Plain. For all its magnificence, it has been something of an unbalanced ecosystem, the absence of trees due in no small part to an overabundance of browsing elk.

With wolves back on the prowl, the elk became more restive. And as the elk spent less time foraging along stream banks, scientists have reported that willows and other plants that had been eaten to the nubs began to flourish again. So did some of the animals that depend on the trees, like beavers, which use willow branches to build lodges. Since the wolves were reintroduced, beaver colonies have increased eightfold. So there are more beaver ponds—habitat for insects, fish, amphibians, reptiles, birds and mammals, even moose, Smith says. Especially in winter, wolf kills have provided food for other park dwellers, including ravens, magpies and bald and golden eagles. For human visitors to the park, one of the highlights of wildlife viewing in recent years has been watching the combat between wolves and grizzly bears, alternately fierce and comical, for control of elk carcasses.

Adapted by SAUSD teachers from the following sources:
http://www.pbs.org/wnet/nature/animal-guides/animal-guide-gray-wolf/476/
http://keystoneconservation.us/keystone_conservation/wolves.html
http://www.smithsonianmag.com/science-nature/Howling-Success.html#ixzz2WnBhHVx9

Keystone Species: African Elephants

There once was a time that the African elephant roamed most all of the African Continent. It was estimated that around 7-10 million elephants existed in the 1930's. Today that number is a shocking 300,000 individuals and still declining at a rapid pace. Demand for ivory, combined with habitat loss from human settlement, has led to a dramatic decline in elephant populations.

In African savannas such as the Serengeti plains in Tanzania, elephants are a keystone species. Elephants eat small trees, such as acacia, that grow on the savanna. Even if an acacia tree grows to a height of several feet, elephants are able to knock over the tree and uproot it. This feeding behavior keeps the savanna a grassland and not a forest or woodland. With elephants to control the tree population, grasses thrive and sustain grazing animals such as antelopes, wildebeests, and zebras. Smaller animals such as mice and shrews are able to burrow in the warm, dry soil of a savanna. Predators such as lions and hyenas depend on the savanna for prey. Elephants are the keystone species that maintain the entire savanna ecosystem.

They dig waterholes in dry riverbeds that other animals can use as a water source, and their footprints create deep holes that water can collect in. They create trails that act as fire breakers and water run offs. Other animals, including humans, depend on the openings elephants create in the forest and brush and in the waterholes they dig. Elephant dung (droppings) is important to the environment as well. Baboons and birds pick through dung for undigested seeds and nuts, and dung beetles reproduce in these deposits. The nutrient-rich manure replenishes depleted soils so that humans can have a nutrient rich soil to plant crops in. Elephant droppings are also a vehicle for seed dispersal. Some seeds will not germinate unless they have passed through an elephant's digestive system.

Elephants need a large amount of habitat to live in. Habitat destruction is not the only threat to the African Elephant. Poaching is the illegal taking of wild plants and animals or parts of the plants or animals. It is estimated that 30,000 to 38,000 elephants are poached every year for their Ivory. With statistics like this the African elephant is doomed or extinction in 15-20 years, unless we can put a stop to these illegal activities thru education and alternative recourses for income in communities that assist in the ivory trade.

Adapted by SAUSD teachers from the following sources:
http://www.elephanttag.org/
http://www.soselephants.org/about_elephants.html

Name_____

Keystone Species

A keystone species is a plant or animal that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether. All species in an ecosystem, or habitat, rely on each other. The contributions of a keystone species are large compared to the species prevalence in the habitat. A small number of keystone species can have a huge impact on the environment.

Adapted by SAUSD teachers from:
http://education.nationalgeographic.com/education/encyclopedia/keystone-species/?ar_a=1

Paraphrase the paragraph above to explain a **keystone species.**

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Keystone Species Articles

Directions:

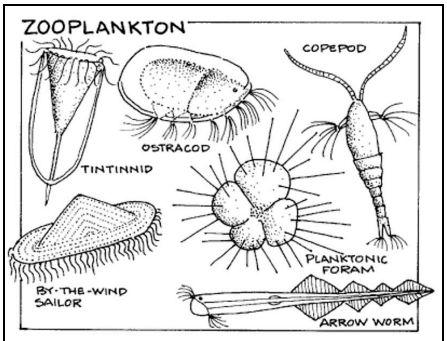
- There are 4 examples of keystone species.
- Complete the matrix on the next page using the following guidelines
    - Each person in your group should read one of the passages and draw a food web that emphasizes the position of the species in the ecosystem. If drawing is not your strength then use names of plants and organisms and show species interaction with arrows.
    - Use bullet points to find the main ideas or points of interest from the paragraphs
    - Share the key points with the group while everyone takes notes to create a food web for all four of the keystone species.

Name_____

Prairie Dog	African Elephant
Sea Otter	Grey Wolf

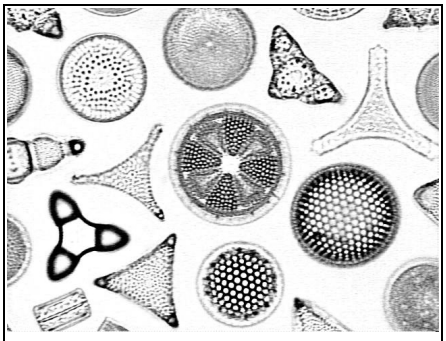
Sea Otter Keystone Species Video

Prairie Dogs Keystone Species Video



Zooplankton

Made of fish, crab, and eggs and larvae of several ocean species.
What it eats: Phytoplankton
Who eats it: filter feeders (mussels, barnacles, other bivalves)



Phytoplankton: Diatoms

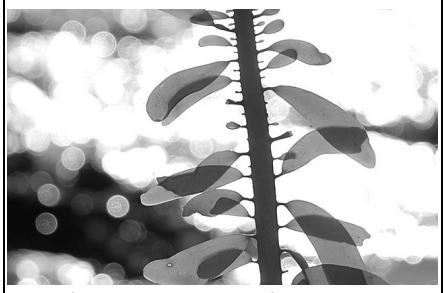
Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: zooplankton, filter feeders (mussels, barnacles, other bivalves)

Red Algae

Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: periwinkle snails, crabs, limpets, chiton, sea urchins

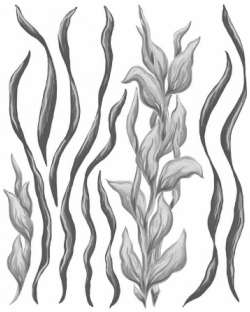
Brown Algae

Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: periwinkle snails, crabs, limpets, chiton, sea urchins



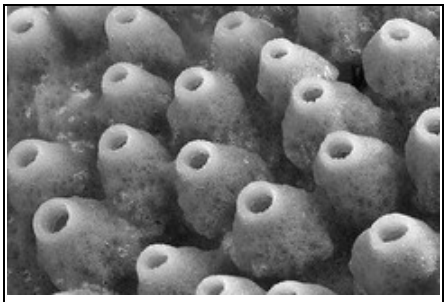
Feather Boa Kelp

Photosynthetic marine plants, can grow up to 10 m long (30 feet)
Uses the sun to create it's energy
Who eats it: kelp crabs, limpets, sea urchins



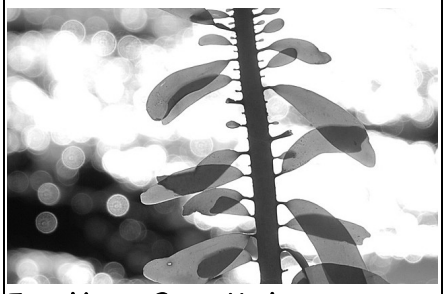
Surf grass

Photosynthetic marine plants. One of the only flowering plants in the ocean.
Uses the sun to create it's energy
Who eats it: some species of sea stars



Sponges

Sponges are colonial one-celled animals.
What it eats: plankton and detritus (typically includes the bodies or fragments of dead organisms as well as fecal material)
Who eats it: limpets, sea urchins



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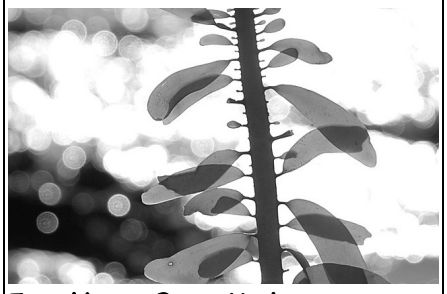

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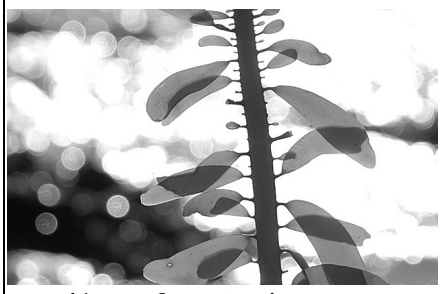

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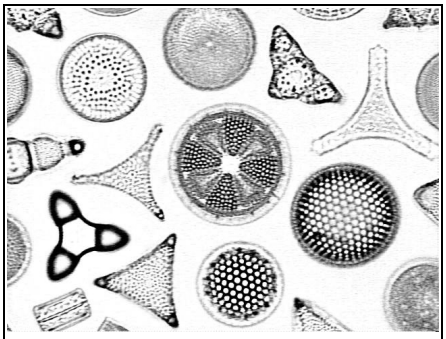
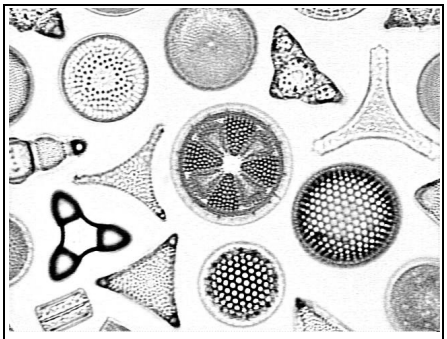
Who eats it: kelp crabs, limpets, sea urchins



Phytoplankton: Diatoms
Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: zooplankton, filter feeders (mussels, barnacles, other bivalves)



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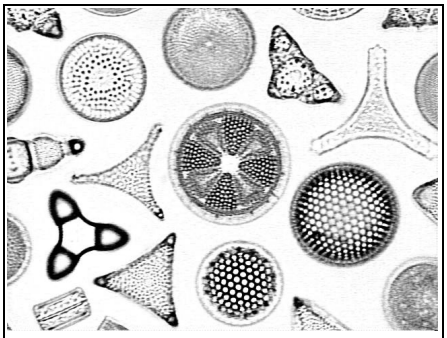

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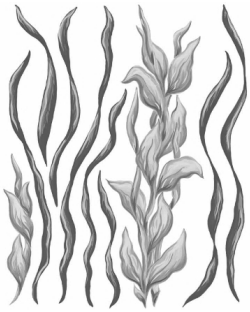
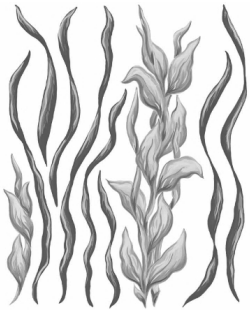


Surf grass
Photosynthetic marine plants. One of the only flowering plants in the ocean.
Uses the sun to create it's energy
Who eats it: some species of sea stars



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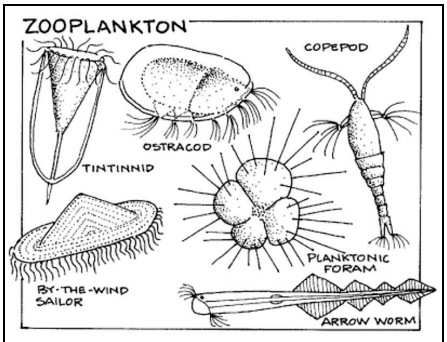
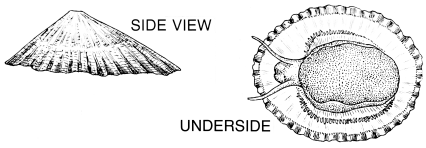


Zooplankton
Made of fish, crab, and eggs and larvae of several ocean species.
What it eats: Phytoplankton
Who eats it: filter feeders (mussels, barnacles, other bivalves

Brown Algae
Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: periwinkle snails, crabs, limpets, chiton, sea urchins

Brown Algae
Photosynthetic marine plants.
Uses the sun to create it's energy
Who eats it: periwinkle snails, crabs, limpets, chiton, sea urchins

Periwinkle Snails
Secrete mucus to help cement them to the rocks
What it eats: Scrape algae off rocky surface with a special structure called a radula, which looks and acts like a mini chainsaw
Who eats it: sea stars, some fish

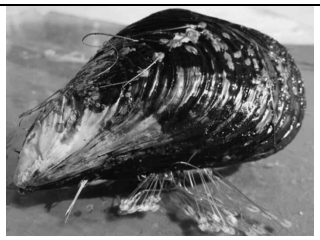


Fingernail Limpets
Make their shell in the exact shape of the rock, this is their "home base" called a home scar that they return to during low tide
What it eats: Scrape algae off rocky surfaces
Who eats it: American Oystercatcher

Buckshot Barnacles
Enclosed in a greyish colored shell that can be completely closed during high tide to prevent drying out
What it eats: Filter feed zooplankton and phytoplankton during high tides when they are covered by water
Who eats it: sea stars, American Oystercatcher

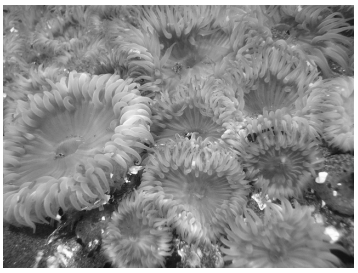
Balanus Barnacles
What it eats: Filter feed zooplankton and phytoplankton during high tides when they are covered by water
Who eats it: sea stars, American Oystercatcher,

Gooseneck Barnacles
Can live 20 or more years
What it eats: Filter feed zooplankton and phytoplankton
Who eats it: sea stars, American Oystercatcher



Mussels
Attach to rocks in clumps by secreting a thin thread called a byssal thread that acts as super glue attaching the mussel to the rock
What it eats: Filter feed zooplankton and phytoplankton
Who eats it: sea stars, American Oystercatcher, Western Gulls

Lined Shore Crab
Can live 20 or more years
What it eats: Algae and Detritus- typically includes the bodies or fragments of dead organisms as well as fecal material
Who eats it: Western Gull, sea anemone, fish

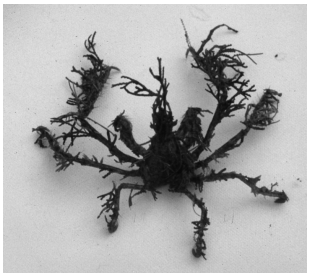


Aggregating Anemone

Often found with shells attached to body because it is unable to digest these hard parts
What it eats: stinging cells in tentacles help capture small crabs, small fish, and snails
Who eats it: No natural predator while alive

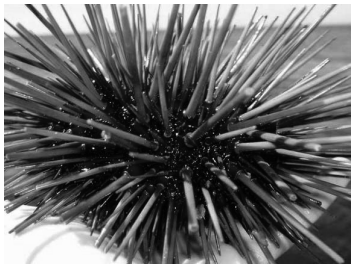
Ochre Sea Star

Keystone species of the tide pools, increase biodiversity of the tide pools.
What it eats: up to 80 adult muscles a year and 1000s of barnacles
Who eats it: Limited natural predators, desperate Gulls will try to eat occasionally



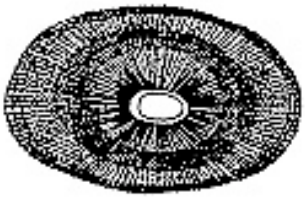
Decorator Crab

Uses pieces of kelp and algae to camouflage its shell
What it eats: Detritus- typically includes the bodies or fragments of dead organisms as well as fecal material
Who eats it: Western Gulls, octopus, larger fish



Red & Purple Sea Urchins

Are circular with spikes sometimes called the "hedgehog of the sea."
Related to sea stars
What it eats: Kelp and some species of rock algae
Who eats it: Western Gulls, sea otters, fish

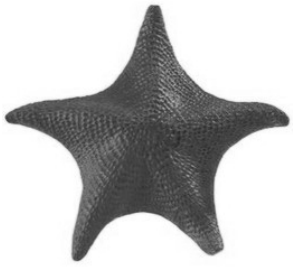


Giant Key Hole Limpet

Are circular with spikes sometimes called the "hedgehog of the sea."
Related to sea stars
What it eats: Scrape algae off rocky surface with a special structure called a radula
Who eats it: American Oystercatcher, Western Gull

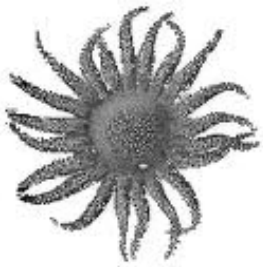
Chiton

Have segmented shells to help protect them from pounding wave action
What it eats: Scrape algae off rocky surface with a special structure called a radula
Who eats it: sea stars, octopus, American Oystercatcher



Bat Star

Come in a variety of colors: red, yellow, orange, purple
What it eats: muscles & barnacles
Who eats it: Limited natural predators, desperate Gulls will try to eat occasionally, other sea stars

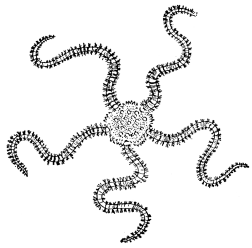


Sunflower Star

Up to a meter across (3 feet) with 24 arms
What it eats: sea urchins, limpets, snails, brittle stars, sand dollars, mussels, barnacles
Who eats it: Apex predator, no natural predators

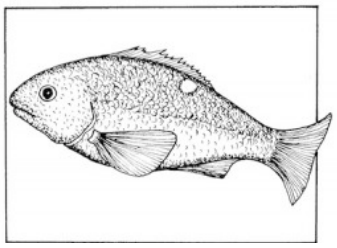
Sunburst Anemone

Fights with neighbors to remain a little more than tentacle distance apart
What it eats: fish and crabs
Who eats it: Sea stars, nudibranch (sea slugs)



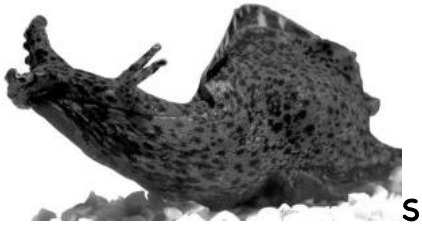
Brittle Star

Called brittle because they can drop their legs when threatened
What it eats: filter feeds phytoplankton and zooplankton
Who eats it: sunflower stars, some small fish



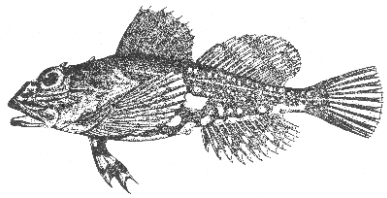
Opaleye

Use tidepools as a nursery, opaleyes are able to breathe air when in a low oxygen tide pool environment
What it eats: red and green algae, small invertebrates, small jellyfish
Who eats it: larger fish, Western Gull



Sea Hare

A large marine invertebrate, a giant slug that can weigh up to 16 pounds. Sea hares can squirt ink to confuse predators.
What it eats: red and green algae
Who eats it: nothing while alive they cover themselves with a yucky tasting mucus that deters would be predators



Sculpin

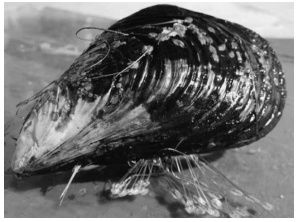
Excellent at camouflage, able to avoid predators by hiding in cracks in the rocks in the tide pool
What it eats: isopods, worms, larger zooplankton
Who eats it: bigger fish, birds during low tide

Western Gull

Hunt at low tide in the tide pools.
What it eats: fish, urchins, limpets, muscles, sea stars if desperate
Who eats it: sharks if they can catch them on the water

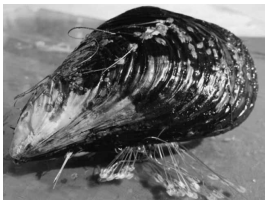
American Oystercatcher

Found from the Aleutian Islands in Alaska to Baja California.
What it eats: limpets, chitons, barnacles, mussels
Who eats it: sharks if they can catch them on the water



Mussels

Attach to rocks in clumps by secreting a thin thread called a byssal thread that acts as super glue attaching the mussel to the rock
What it eats: Filter feed zooplankton and phytoplankton
Who eats it: sea stars, American Oystercatcher, Western Gulls



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Gooseneck Barnacles

Can live 20 or more years
What it eats: Filter feed zooplankton and phytoplankton
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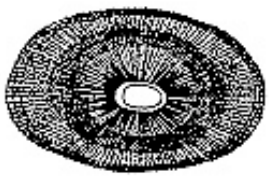

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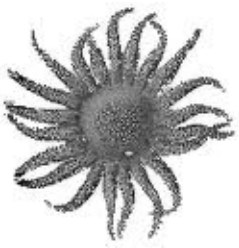

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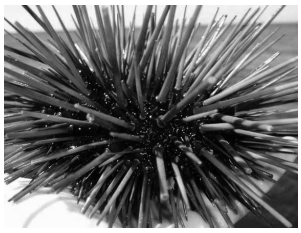

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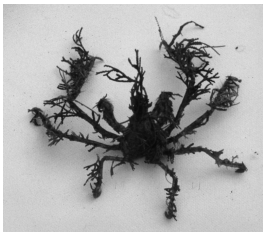

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Who eats it: sharks if they can catch them on the water

Name_____

Tidepool Go Fish

Objective: Construct multiple tidepool food chains

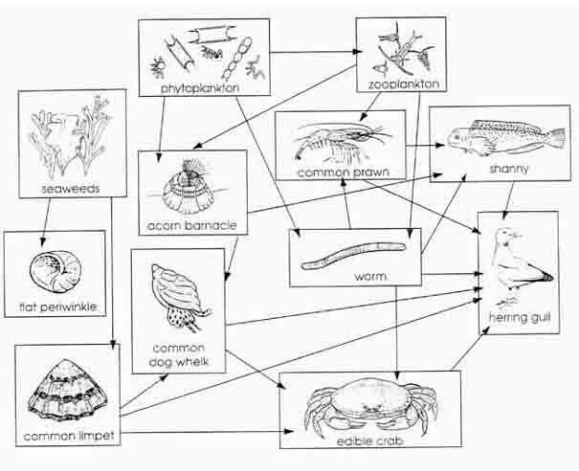
Background: Ecosystems maintain themselves by cycling energy and nutrients obtained from external sources. At the first trophic level, primary producers (plants, algae, and some bacteria) use solar energy to produce organic plant material through photosynthesis. Herbivores—animals that feed solely on plants—make up the second trophic level. Predators that eat herbivores comprise the third trophic level; if larger, more aggressive predators are present, they represent an even higher trophic level. Organisms that feed at several trophic levels (for example, grizzly bears that eat berries and salmon) are classified at the highest of the trophic levels at which they feed. Decomposers, which include bacteria, fungi, molds, worms, and insects, break down wastes and dead organisms and return nutrients to the soil.

Procedure:

1. In groups of three to six students, each player is dealt five cards.
2. All remaining cards are placed face down in a draw pile.

GAMEPLAY

3. Choose a player to go first.
4. On your turn, ask a player for a specific animal or plant that you need to build a food chain. For example: "Joe, do you have any phytoplankton?" You must already hold at least one card of the food chain you are trying to build.
5. If the player you ask has the card you requested, they must give you the card that you asked for. In the example, Joe would give you one of his phytoplankton cards.
6. If you get a card from the player you ask, you get another turn. You may ask any player for any plant or animal you need, including the same one you just asked for.
7. If the person you ask doesn't have the specific card you asked for, they say, "Go fish." You then draw the top card from the draw pile.
8. If you happen to draw the card you asked for, show it to the other players and you get another turn. However, if you draw a card that's not the card you asked for, it becomes the next player's turn. You keep the drawn card, whatever card it is.
9. NOTE: The "next player" is the one who said, "Go fish."



10. When you collect a set of cards that form a three or four card food chain, immediately show the set to the other players and place the food chain face up in front of yourself.

WINNING

11. Go Fish continues until either someone has no cards left in their hand or the draw pile runs out. The winner is the player who then has the most sets of food chains. A three-card food chain is worth five points. A four-card food chain is worth ten points.

Name_____

Data:

Record the winning hands:

Food chains formed	Winning hands. Write out five examples of rocky tidepool food chains. Include the name of the organism and what it eats.
1	
2	
3	
4	
5	

Conclusion:

1. Define the following terms- herbivore, trophic level, predator, prey

Name_____

2. What is detritus? Why do you think it is important to have detritivores (organisms that eat detritus) in an ecosystem?

_____
_____
_____
_____
_____

3. What would happen if all of the predators were removed from a certain habitat?

_____
_____
_____
_____
_____

4. In general, are there more tertiary consumers or producers in a healthy habitat? Why?

_____
_____
_____
_____
_____
_____

5. Create a food web using the cards that you saw in the game. Your food web should have at least seven organisms and show the interactions between each of these organisms, be sure to label the trophic levels.

Sustaining America's Aquatic Biodiversity - Freshwater Mussel Biodiversity and Conservation

420-523

Louis A. Helfrich, Department of Fisheries and Wildlife Sciences; Richard J. Neves, Department of Fisheries and Wildlife Sciences; Virginia Tech; and Hilary Chapman, U.S. Fish and Wildlife Service

Water pollution

The contamination of rivers and streams with toxic chemicals is a serious and growing problem for adult and young mussels and their host fish. Deadly chemicals, including heavy metals (e.g., copper and mercury), coal-mine acids, pesticides, chlorine, gasoline, and oil, flushed daily into tributary streams of the Ohio River system, threaten mussels and other aquatic animals.

Although adult mussels have the ability to "clam up" for a limited time and avoid poisonous chemicals that flow downstream, young mussels are often killed immediately. Multiple spills or the long-term, chronic leaching of toxins into streams will eventually kill the entire population. Water pollution is "double trouble" for mussels. It can either kill mussels directly or kill the fish hosts on which they depend for successful reproduction, ultimately eliminating the mussels

Adapted by SAUSD teachers from http://www.pubs.ext.vt.edu/420/420-523/420-523.html

Motor boat turbulence kills zooplankton in estuaries

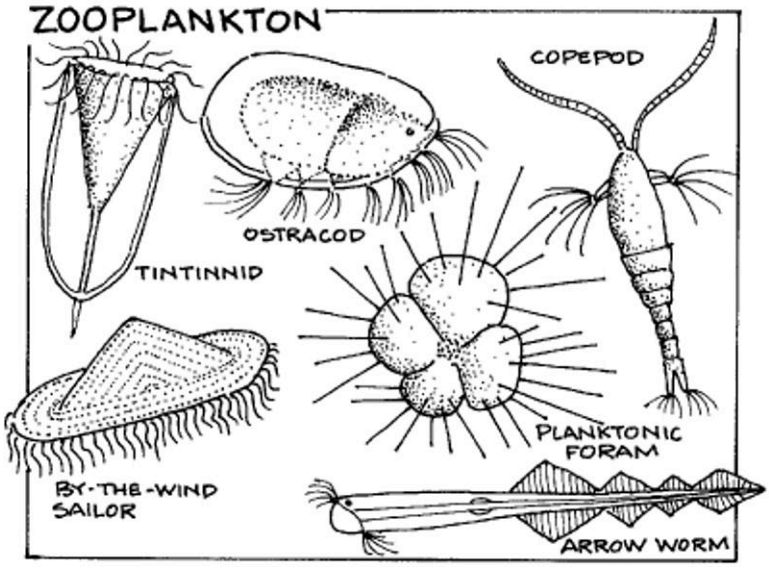
By Matt Walker
Editor, Earth News

Turbulence generated by speeding motor boats kills significant numbers of zooplankton, a study has revealed for the first time. Experiments on copepods, tiny crustaceans that live and float in water, show that a third die in waters frequented by propeller-driven boats. That is significantly more than in bodies of water not used by boats.

Zooplankton play a crucial role in water ecology and their death may have hitherto unknown impacts. These prior studies had showed that even a small amount of turbulence can affect a copepod's ability to feed and grow. So "it seemed intuitive that the sudden and intense turbulence created by a boat could harm or even kill copepods".

For example, 34% of copepods were dead in a channel while only 5-6% were dead in a marina and along a shoreline. More copepod carcasses were found inside boat wakes (14%) than outside boat wakes (7%) and the fraction of dead copepods increased with increasing turbulence intensity. "This suggests that turbulence generated by boats can be an important source of mortality among copepods," Ms Bickel said. "This could have a number of important impacts within aquatic systems."

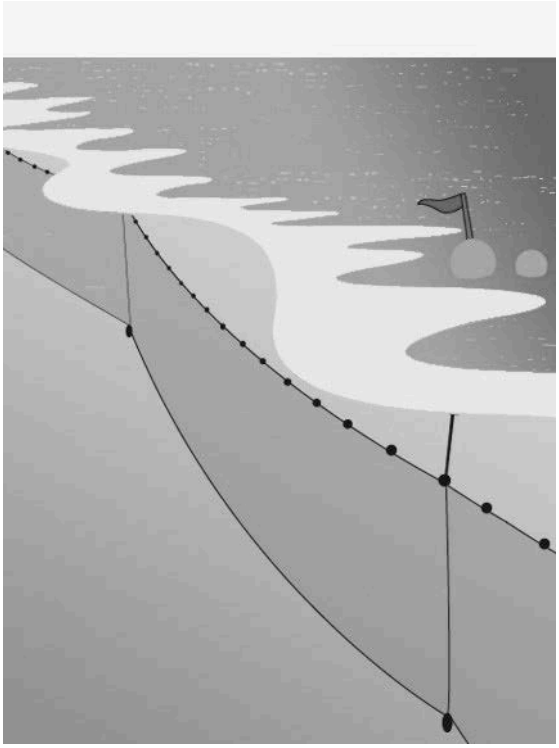
Zooplankton are a critical link between phytoplankton and fish in aquatic food webs. High mortality in copepods could reduce the ability of a zooplankton population to graze down phytoplankton blooms and reduce the amount of food available to smaller fish that eat zooplankton, says Ms Bickel. Also, if copepod carcasses are not consumed, they could transport high quality organic materials to the sediments or be decomposed by bacteria within the water column, she adds. "So the zooplankton biomass that would normally go towards feeding fish would be diverted to feed bacteria instead."



Adapted by SAUSD teachers from
http://news.bbc.co.uk/earth/hi/earth_news/newsid_9449000/9449070.stm

Gillnets taking a toll on seabirds

By MICHAEL WINES The New York Times
Published: Thursday, June 13, 2013 at 1:00 a.m.



Fishing vessels that deploy gillnets snare and drown at least 400,000 seabirds every year, and the actual figure could be considerably higher, according to research published in the June edition of an academic journal devoted to conservation.

The study, in the journal Biological Conservation, uncovered reports of 81 species killed by gillnets, including penguins, ducks and some critically endangered birds like the waved albatross. One of its three authors, Cleo Small, called the estimated toll a bare minimum.

"It's quite startling," said Small, who heads the global seabird program at the British conservation group BirdLife International, which sponsored the study.

Gillnets, mesh nets that are much smaller, are used both by commercial and small local fishermen. Anchored in the water by weights and buoys, they are designed to snare fish by their gills.

Nearly half of the seabirds killed by gillnets were in a section of ocean stretching from the northern tip of Africa to north of Greenland and Scandinavia.

Adapted by SAUSD teachers from http://www.heraldtribune.com/article/20130613/ARCHIVES/306131023/-1/TODAYSPAPER?template=printpicart

Kelp! Kelp! It's warming!

Posted on October 27, 2011by Anthony Watts

Seaweed records show impact of ocean warming

As the planet continues to warm, it appears that seaweeds may be in especially hot water. New findings reported online on October 27 in *Current Biology*, a Cell Press publication, based on herbarium records collected in Australia since the 1940s suggest that up to 25 percent of temperate seaweed species living there could be headed to extinction. The study helps to fill an important gap in understanding about the impact that global warming is having on the oceans, the researchers say.

The changes observed in the seaweed community could have cascading effects across marine ecosystems, Wernberg said, as seaweeds are the "trees of the ocean," providing food, shelter, and habitat to a diversity of other species.

"I hope people will appreciate that the threats of climate change to marine environments are not just about exotic tropical coral reefs but also are likely to affect the diversity of life across a much broader spectrum of marine ecosystems," Wernberg said.

Adapted by SAUSD teachers from http://wattsupwiththat.com/2011/10/27/kelp-kelp-its-warming/

Name_____

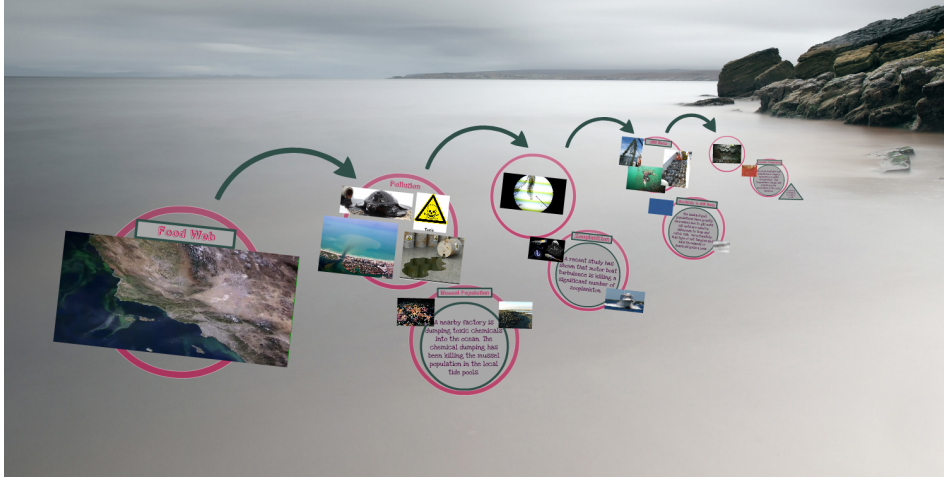
Food Web Impact Jigsaw Matrix

Freshwater Mussel Biodiversity	**Motor Boat Turbulence**	**Gillnets taking a toll on seabirds**	**Seaweed records impact of global warming**

Symbol	Comment/Question/ Response	Sample Language Support
*	• Author's main point • Key ideas expressed • Significant ideas	• One significant idea in this text is… • The author is trying to convey… • One argument the author makes is that…
!	• Shocking statements or parts • Emotional response • Surprising details/claims	• I was shocked to read that… • How can anyone claim that… • That part about ____ made me feel…
o	• Ideas/sections you connect with • What this reminds you of	• This section reminds me of… • I can connect with what the author said because… • This experience connects with my own experience in that…

Tide Pool Food Web

A study of change



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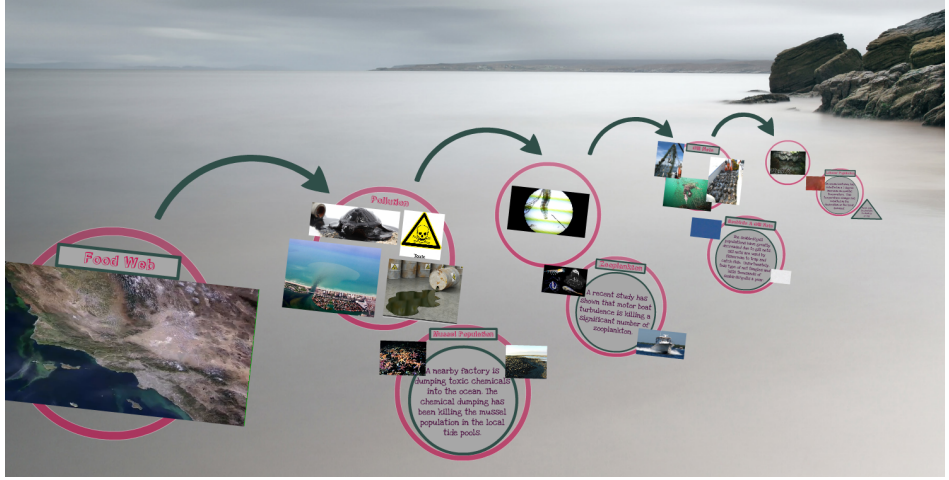
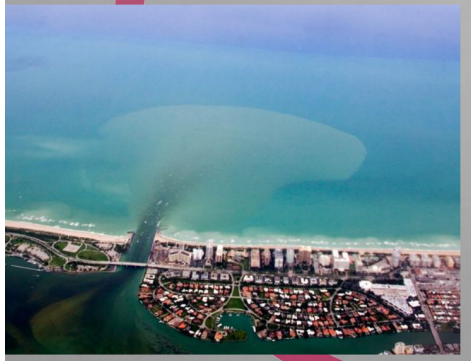


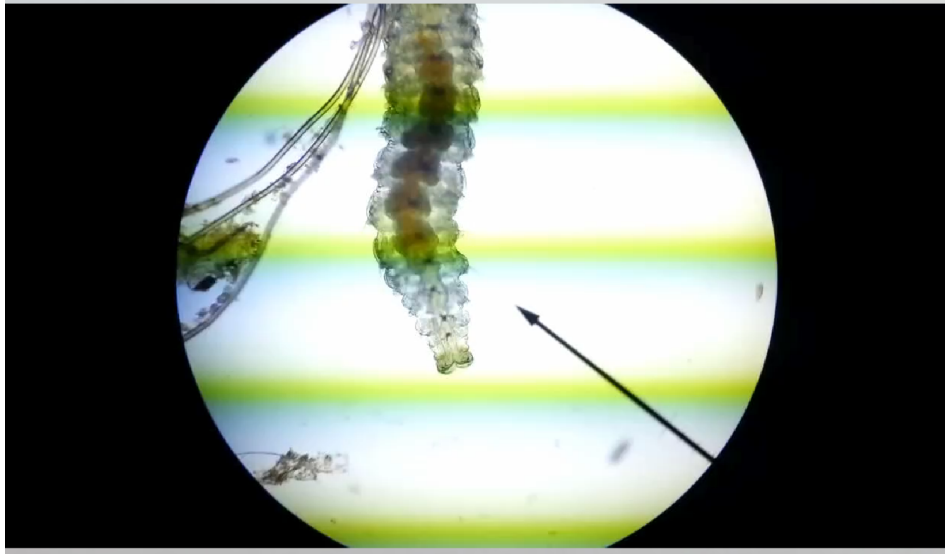
Food Web

Pollution



Mussel Population

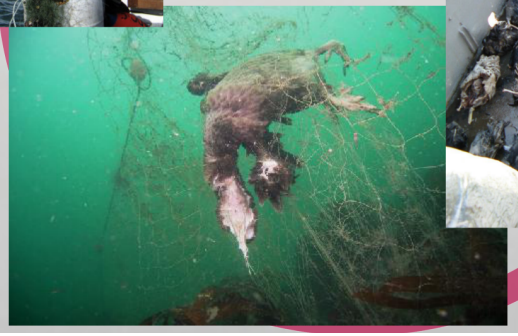
A nearby factory is dumping toxic chemicals into the ocean. The chemical dumping has been killing the mussel population in the local tide pools.



Zooplankton

A recent study has shown that motor boat turbulence is killing a significant number of zooplankton.

Gill Nets



Seabirds & Gill Nets

The seabird/gull populations have greatly decreased due to gill nets. Gill nets are used by fisherman to trap and catch fish. Unfortunately, this type of net tangles and kills thousands of seabirds/gulls a year.

Lobster Population

An ocean heatwave has resulted in a 5 degree increase in coastal temperature. This temperature change has resulted in the decimation of the local seaweed.

Vocab Hel
Decimatio
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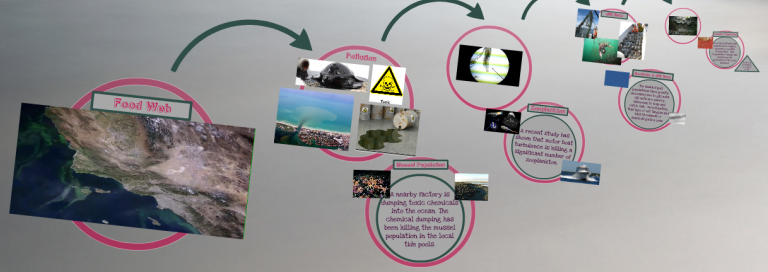
or kill

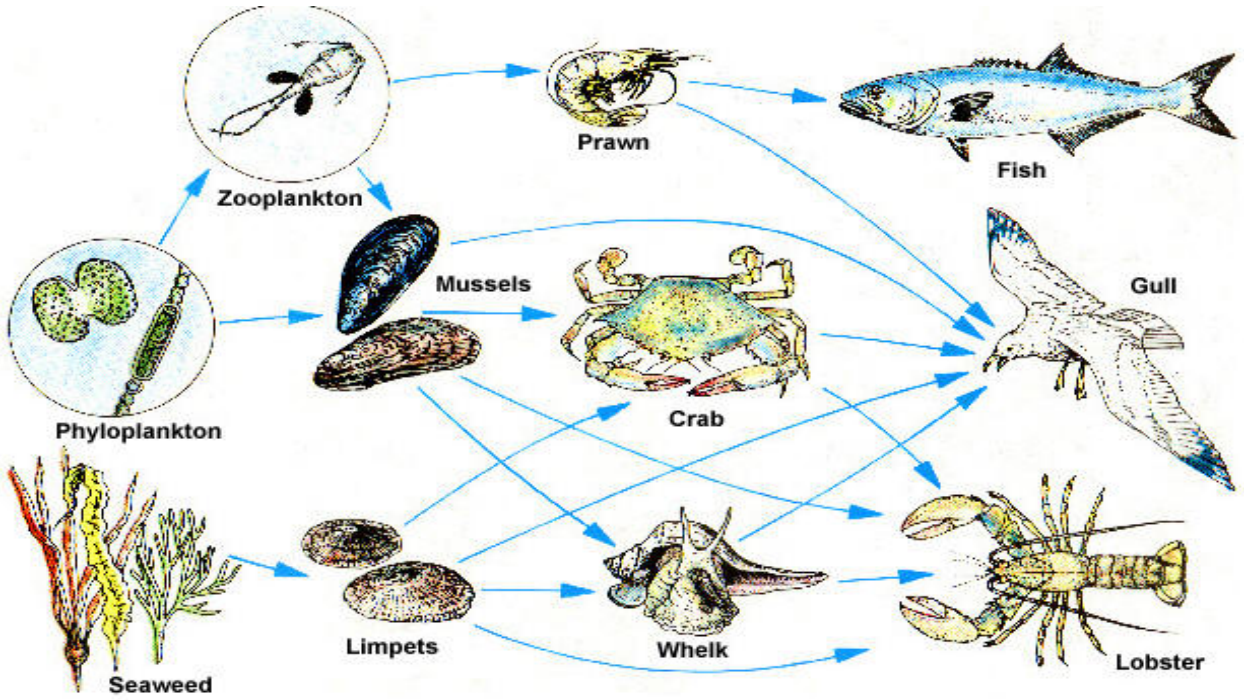
Tide Pool Food Web

A study of change



Name_____

Disruption in the Food Web



Directions: ***Provide a short answer to the questions below while watching the Prezi Presentation .***

1) What populations are directly affected by the reduction of mussels? How are each of these populations affected?

_____
_____
_____
_____
_____
_____

2) The reduction of zooplankton has a direct effect on which populations? What is the effect on the secondary populations? List them and describe the effect.

_____
_____
_____
_____
_____
_____

3) Explain how the reduction of the seabird/gull population affects phytoplankton.

Name_____

4) Describe how the change in coastal temperature affected the lobster population.

Take what we have learned today and make a connection to your own life.

5) If your parents were to lose their jobs, who would that affect in your immediate family, explain how it would effect each family member? Describe any potential changes that might occur within your circle of friends.

SAUSD Common Core Lesson Planner **Teacher:**

<table>
<tr><td>Unit:
Tidepool
Day: 13, 14, 15
Lesson: 6</td><td>Grade Level/Course:
High School/Biology</td><td>Duration: 3 class periods
Date:</td></tr>
<tr><td colspan="3">Big Idea: Interdependent Relationships in Ecosystems: There are many interdependent relationships that affect the stability of any given population.
Enduring Understanding: Autotrophic organisms, like plants, and heterotrophic organisms, like mammals, have an interdependent relationship connected by the production and consumption of oxygen and carbon dioxide.
Essential Question: How have humans impacted the ecology of the coastal marine environment? What effects have occurred to the way energy is transferred in an ecosystem, the distribution of marine organisms, and overall stability of an ecosystem in direct result of human activity?</td></tr>
<tr><td>Common Core and Content Standards</td><td colspan="2">Content Standards:
HS-LS2-1- Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2-Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-4- Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-LS2-6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7-Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8- Evaluate the evidence for the role of group behavior on individual and species' chances of survival and reproduce.

Reading Standards for Literacy in Science and Technical Subjects 9-10: 1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
Writing Standards for Literacy in Science and Technical Subjects 9-10:
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Speaking and Listening Standards (ELA) 9-10: 1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades *9-10 topics, texts, and issues*, building on others' ideas and expressing their own clearly and persuasively.</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.</td></tr>
<tr><td>Materials/ Resources/ Lesson Preparation</td><td colspan="3">Teacher Resource 6.1- Final Assessment PowerPoint Presentation
Student Resource 1.1- Extended Anticipatory Guide
Student Resource 6.1- Ecology Final Assessment student form
Student Resource 6.2- Final Assessment Research Notes student form
Student Resource 6.3- Final Assessment Peer Presentation Notes student form</td></tr>
<tr><td>Objectives</td><td colspan="2">Content:
Students will be able to synthesize a number of topics learned over the past 13 days and apply them to a real world situation.</td><td>Language:
Students will interact with a complex text and then listen to information and opinions presented verbally by their peers to create a presentation that addresses the big idea of the unit. Students will create a project to answer the essential questions.</td></tr>
<tr><td>Depth of Knowledge Level</td><td colspan="3">☒ Level 1: Recall ☒ Level 2: Skill/Concept
☒ Level 3: Strategic Thinking ☒ Level 4: Extended Thinking</td></tr>
<tr><td>College and Career Ready Skills</td><td colspan="3">☒ Demonstrating independence knowledge ☒ Building strong content knowledge
☒Responding to varying demands of audience, task, purpose, and discipline
☐ Comprehending as well as critiquing ☐Valuing evidence
☒Using technology and digital media strategically and capably
☒ Coming to understand other perspectives and cultures</td></tr>
<tr><td>Common Core Instructional Shifts</td><td colspan="3">☒ Building knowledge through content-rich nonfiction texts
☒ Reading and writing grounded from text
☒ Regular practice with complex text and its academic vocabulary</td></tr>
<tr><td rowspan="3">Academic Vocabulary (Tier II & Tier III)</td><td></td><td>KEY WORDS ESSENTIAL TO UNDERSTANDING</td><td>WORDS WORTH KNOWING</td></tr>
<tr><td>TEACHER PROVIDES SIMPLE EXPLANATION</td><td>Implications</td><td>Impact
Plagiarism</td></tr>
<tr><td>STUDENTS FIGURE OUT THE MEANING</td><td>Ecosystem
Ecology</td><td>Tidepools
Biodiversity</td></tr>
</table>

Pre-teaching Considerations	1. Students need to revisit the Extended Anticipatory Guide from lesson 1. Students should use their Student Resource Handbook to review information and support their arguments. This activity could be completed individually as an assessment, a review activity, or in pairs. 2. If possible schedule two days at the end of the unit in the computer lab, if two days are not possible then schedule at least one day in the computer lab to allow students time to research a specific type of human impact on the ocean ecosystem. If only one day is available the teacher will need to instruct the students to gather as much information as they can and print it out to bring to class the following day. 3. The teacher will need to decide how the students will be grouped for the final assessment. Students may be assigned groups or instructed to choose their partners it is entirely up to the individual teachers. 4. To make the day in the computer lab have the greatest effect on the assessment at some point prior to the first day of the assessment the teacher will preview the final assessment with their class by showing the first slide of the assessment PowerPoint (teacher resource 6.1). In doing so the teacher will minimize the need to organize students into groups and students will already have an idea of what they will need to be researching in the computer lab. **NOTE: If you are unable to schedule a day in the computer lab on day 13 and 14 you can have the days come sooner in the lesson and move the quick introduction to the day right before so that students will enter the computer lab with an idea on exactly what they have to get done.
CCSS Foundational Standards (K-5 only)	

Lesson Delivery

Instructional Methods	**Check method(s) used in the lesson:** ☐ **Modeling** ☐ **Guided Practice** ☒ **Collaboration** ☒ **Independent Practice** ☐ **Guided Inquiry** ☒ **Reflection**

Lesson Continuum	**Lesson Opening**	**Preparing the Learner** Prior Knowledge, Context, and Motivation: 1. The teacher will show the Final Assessment PowerPoint in its entirety to the class. The idea of the PowerPoint is to guide the students without limiting their creativeness or pigeonholing their interests. 2. The PowerPoint is designed to help clarify the expectations of the final assessment and to get students thinking about what they will need to present and how to present the information to the class. **NOTE: The PowerPoint is a companion to the Final Assessment student resource 6.1 and may not be presented in the same order as listed here due to availability of campus

		computer lab time and the student resource can act as a standalone document.

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Interacting with the concept/text:** **<u>Day 13 & 14: Research and Synthesis of Ideas</u>** 1. In groups of four students will be asked to research two specific ways that humans have had an impact on the coastal oceans and relate those impacts to changes in the stability and overall health of the ocean ecosystem. Student will be taking what they have learned over the last 13 days and apply their new content knowledge to a number of existing real world situations. 2. Within their group of four, students will be asked to pair off into subgroups of two. Each group of two will then research the same human impact topic and record their notes on the Final Assessment Research Notes (student resource 6.2). Students will need to consolidate their research into a brief overview of the event, such as the history or causes of the human impact topic, and the ecological impact that their chosen event has had on the ocean environment. 3. The teacher will instruct the students that they can choose a topic from the human impact list or if they have prior knowledge of how a human caused event that had an impact on the ocean they can research that event. Under each topic there are specific pathways, these pathways are to help students narrow their focus within the much larger topic. 4. Once student have an idea of what they will be researching they will need to analyze their complex text and their student handbooks from the unit to synthesize their understanding of interdependent relationships in ecosystems. Students should be told to research a specific human impact on an ocean environment through the effect that it had on the ecosystem's ecology: How did the event that you choose change … ➢ The overall stability of the ecosystem? ➢ The food web of the ecosystem? ➢ The flow of energy in the ecosystem? ➢ The biodiversity of the ecosystem? ➢ The numbers and distribution of the ecosystem's biomass? 5. Depending on the depth in which students explore the ecological implications of their topic, they may choose to focus on only one or two questions above, or they may choose to answer all of the questions. It is entirely up to the student as long as they show a depth of complexity and a thorough knowledge of the content. Teacher can explain this to the whole class or on a group-by-group basis.	**Differentiated Instruction:** **English Learners:** • Pair share • Cooperative Groups • Multiple opportunities to speak • Structured presentations **Special Needs:** • Provide student and case carrier with the instructions at least two days before the start of the project • Multiple options for a variety of learning modalities • Provide peer helper • Cooperative Groups **Accelerated Learners:** • Research levels can be adjusted to higher level • More in depth opportunities to explore topics

Lesson Continuum	Activities/Tasks/ Strategies/Technology/ Questioning/Engagement/Writing/Checking for Understanding	**Extending Understanding:** **<u>Day 14-15: Presentations</u>** 6. Once students have completed their research of their chosen topic they will need to prepare a visual representation of their research that they will present to the class on the last day of the unit. 7. Students should be given a variety of choices in how they can present their research but they should not be limited to only these ideas. The teacher will need to instruct the students that they may choose one of the ideas or they can combine a number of them or they can come up with something completely new. The idea behind the presentations is to allow the students to interact with their own knowledge and to effectively communicate what they have learned to their peers in a way that makes sense to them. Some ideas for presentations include: ➢ Tri-fold brochure ➢ PowerPoint ➢ Prezi Presentation ➢ Poster ➢ 3-dimensional Models ➢ Create a video ➢ Research paper ➢ Skit or song 8. The teacher will then let students know that they will need to present their research to their classmates in a 3-5 minute presentation. Some ideas to make the presentations go smoothly: • Assign an order of presentation before the presentation date, can be randomly assigned or teacher assigned. If students are interested in going first or in a particular order it is a good thing to take their requests to alleviate student stress and moves the transition between groups along. • Circulate the room during the research and design phase of the presentation process and steer the groups in the correct direction if they are off path • Make sure that if the students create student handouts that they are brought to class before the presentation and not at the start of the period. 9. During the presentation the students will be actively listening with pencils down. During the transition between groups the students will be asked to paraphrase the presentations (student resource 6.3), this will help ensure that the students are actively listening to their peers.	
Lesson Reflection			

Teacher Reflection Evidenced by Student Learning/ Outcomes	

Ecology Final Assessment Snapshot

Grouping
- Groups of 4
- 2 partners research 1 human impact

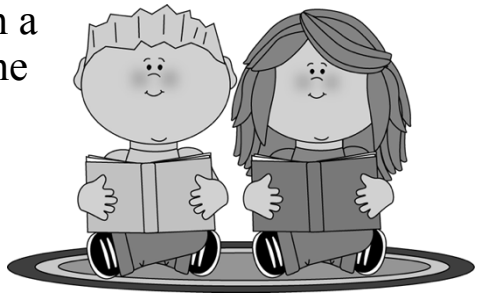
Human Impact on Ecosystem
- Tidepool destruction
- Global Warming
- Coastal Runoff
- Oil Spills
- Overfishing
- Over hunting
- Pacific Garbage Patch

Ecological Implications
- Change in how energy is transferred
- Change in biomass
- Change in food web
- Changes in biodiversity

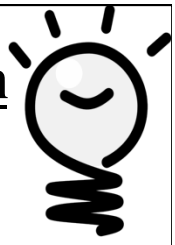
Research & Present

Breaking Down the Prompt

- Research two specific ways that humans have had an impact on the coastal oceans and relate those impacts to changes in the stability and overall health of the ocean ecosystem.
- Each set of partners in a group will research one of the human impacts you have chosen



Some Ideas and Information



- Stay on task
- You will present your research orally to the class
- You can chose from the lists of ideas or you can research and find a new idea
- Chose something that interests you
- Look at the work you have completed the answers are in it
- All members of your group must participate

Name _____

Ecology Final Assessment

Our planet is over 70% salt-water ocean and there is more than 370,000 miles of coastline. Of the estimated 7 billion people living on our planet more than 2.5 billion live within 60 miles of the ocean. Not only do oceans produce more than half of the oxygen in the atmosphere, and absorb the most carbon from it but, the water you drink, the food you eat, the products that keep you warm, safe, informed, and entertained — all can come from or be transported by the ocean. Ocean-based businesses contribute more than $500 billion to the world's economy.

The sheer number of people who use and depend on the ocean, and the sometimes unwise practices we adopt, have created problems such as overharvest of resources, reduction in biodiversity, and degradation of marine habitats and species, among others. We risk the very ecosystems on which our survival depends.

Over the past 3 weeks we have explored the ecology of the rocky tidepools in California. The tidepools are a small portion of the global marine environment. In this project you will be asked to apply your knowledge of the interactions of species and the flow of energy in an ecosystem not only to the tidepools but also to the coastal marine environment as a whole.

In groups of 4 you will be asked to research two specific ways that humans have had an impact on the coastal oceans and relate those impacts to changes in the stability and overall health of the ocean ecosystem.

Guidelines:

1. Divide your group of 4 into pairs. Each pair will select and research one method in which humans have impacted the coastal ecosystem. You may chose from the list provided or research a topic that you are interested in.

Human Impact List (cause)

Each idea is divided into pathways that you may explore; you do not need to research all topics you will only need to pick one pathway. For example if you are interested in coastal runoff after storms then you will only need to research stormwater runoff.

- Coastal runoff: stormwater runoff, effects of fertilizer, litter, industrial pollution
- Global warming: temperature increase of ocean, sea level rising
- Pacific Garbage Patch
- High Visitation of tidepools
- Overfishing: abalone, tuna, sardines, shrimp
- Oil Spills: Exxon Valdez 1989, Deepwater Horizon 2010, BP oil spill Huntington Beach, CA 1990
- Marine Mammal Hunting: Sea otter hunting, whaling- blue whales, grey whales

Name _____

2. Once you have decided which of the two ways that humans impact the ocean to research you will need to use the following list to guide your research. Again you do not necessarily need to find the answers for all of these effects listed but you should chose one or two that you will thoroughly explore.
You should be able to:


Picture courtesy of NOAA

Ecological Implications list (effect)

How did the event that you choose change …

- The overall stability of the ecosystem?
- The food web of the ecosystem?
- The flow of energy in the ecosystem?
- The biodiversity of the ecosystem?
- The numbers and distribution of the ecosystem's biomass?

3. Ideas of where you can gather information include: general websites, news articles, government sites such as NOAA or EPA, research papers, journal articles, and conservation websites.

4. Once you have a firm grasp on the event, including the history of the event and why it happens or happened, and you have identified the ecological implications of the event, you will need to create a visual representation to present to the class.

Ideas for presentations

- Tri-fold brochure
- PowerPoint
- Prezi Presentation
- Poster
- 3-dimensional Models
- Create a video
- Research paper
- Skit or song

5. Presenting information in front of your peers can be stressful. Here are some tips and things to think about to make sure your presentation is of the highest quality.

Tips and Things to think about

- Your presentation addresses all 5 of the guidelines.
- Your presentation is completed by the due date and that each team member has all necessary materials and or visuals prepared.
- All 4 members of your group speak during the presentation and your group is aware of the order in which they will speak.
- You know the material before you present so you are not simply reading it to the class.
- Your presentation is designed to capture your classmates' attention and interest. Make sure that it can be read, heard, and seen from all corners of the classroom.
- Time your presentation beforehand to make sure that it is at least 3 minutes long but no more than 5 minutes in length.

Name_____

Final Assessment Research Notes

Group members: _____

Research Partner: _____

Human Impact being researched: _____

Name_____

Name _____

Final Assessment Peer Presentation Notes

Directions: During the transitions between groups you will need to paraphrase each group's presentation. Your paraphrase must touch on the main ideas that the group presented and be written in complete sentences.

Title of Presentation: _____
Ocean Ecosystem Affected: _____
Paraphrase of main ideas:

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Title of Presentation: _____
Ocean Ecosystem Affected: _____
Paraphrase of main ideas:

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Ocean Ecosystem Affected: _____
Paraphrase of main ideas:

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Name _____

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Ocean Ecosystem Affected: _____
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