

# AMUSEUM



Image courtesy: Mark Wilson and Bryndis Snæbjörnsdóttir

## ***Trout Fishing in American and Other stories***

Bryndis Snæbjörnsdóttir/Mark Wilson

Arizona State University (ASU) Art Museum

Exhibition: October 4, 2014-January 17, 2015

Co-curated by Dr. Ron Broglio and Heather Sealy Lineberry

In collaboration with the ASU Global Institute of Sustainability and ASU School of Languages and Literatures

**Curriculum designed by Dr. Pamela Marshall, Associate Professor ASU**

**Food web activity designed by Dr. Pamela Marshall and Dr. Cristopher D. Marshall**

**Both in collaboration with the ASU Art Museum Education Department Staff**

Funding for the curriculum was made possible by the Arizona Game and Fish Heritage Fund.

**ASU** Art Museum  
ARIZONA STATE UNIVERSITY



Heritage Fund

## Case Study & Food Web

At the end of this lesson students will be able to:

- Identify what led both species (California Condor and Humpback Chub) to be registered as endangered species
- Describe three ways humans can collaborate to ensure a healthy ecosystem for the California Condor and the Humpback Chub
- Model the food web of the Grand Canyon ecosystem focusing on the California Condor and the Humpback Chub, identifying the role each plays in the ecosystem
- Identify who is responsible for wildlife in the Grand Canyon
- Increase understanding about the complexity of conservation efforts to reintroduce or preserve species
- Artist/scientist collaborations

Advanced/honors students will be able to:

- Discuss whether humans should allow extinction or intervene to repopulated endangered species and support their opinion.
- Discuss benefits of scientists and other professionals such as artists working together to solve problems.

The curriculum developed allows teachers to augment and personalize the lesson for his or her classroom. Extensions, suggestions, and requirements for assignments of both the Case Study and Food Web are tailored to address Arizona's College and Career Ready Standards for middle school (7<sup>th</sup>-8<sup>th</sup> Grade) and 9<sup>th</sup> Grade students, allowing teachers to utilize the curriculum in a way that fits into their standard semester curriculum.

## **Arizona’s College and Career Ready Standards**

### **English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects Standards**

#### **6th – 8th Grade**

##### **6-8.WHST.1**

Write arguments focused on discipline-specific content.

- a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
- b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
- c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
- d. Establish and maintain a formal style.
- e. Provide a concluding statement or section that follows from and supports the argument presented.

##### **6-8.WHST.2**

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
- b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
- c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
- d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
- e. Establish and maintain a formal style and objective tone.
- f. Provide a concluding statement or section that follows from and supports the information or explanation presented.

##### **6-8.WHST.4**

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

### **6-8.WHST.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.

### **6-8.WHST.9**

Draw evidence from informational texts to support analysis, reflection, and research.

## **Arizona's College and Career Ready Standards – English Language Arts – Speaking and Listening 6–8 Grade**

### **2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.**

7.SL.2 – Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, and orally) and explain how the ideas clarify a topic, text, or issue under study.

8.SL.2 – Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.

### **3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.**

7.SL.3 – Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.

8.SL.3 – Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.

### **4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.**

7.SL.4 – Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

8.SL.4 – Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

**6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate. 7.SL.6, 8.SL.6**

**Arizona’s College and Career Ready Standards – English Language Arts – Language 6–8 Grade**

**4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.**

7.L.4, 8.L.4

– Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade level reading and content, choosing flexibly from a range of strategies.

a. Use context (e.g., the overall meaning of a sentence or paragraph; a word’s position or function in a sentence) as a clue to the meaning of a word or phrase.

c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.

d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

**6. Acquire and accurately use a range of 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 encountering an unknown term important to comprehension or expression.**

7.L.6, 8.L.6

## **Arizona Department of Education Science Standards (old format)**

### **7<sup>th</sup> and 8<sup>th</sup> Grade Science Standards:**

#### **Strand 3 - Science in Personal and Social Perspectives**

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

- Concept 1 - Changes in Environments: Describe the interactions between human populations, natural hazards, and the environment.
  - PO1 - Analyze environmental risks (e.g., pollution, destruction of habitat) caused by human interaction with biological or geological systems.
  - PO2 - Analyze environmental benefits of the following human interactions with biological or geological systems:
    - reforestation
    - habitat restoration
    - construction of dams
  - PO3 - Propose possible solutions to address the environmental risks in biological or geological systems.
- Concept 2 - Science and Technology in Society: Develop viable solutions to a need or problem.
  - PO1 - Propose viable methods of responding to an identified need or problem.
  - PO 2 - Compare solutions to best address an identified need or problem.

#### **Strand 4 - Life Science**

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

1. Concept 3 - Populations of Organisms in an Ecosystem: Analyze the relationships among various organisms and their environment.

- PO1 - Compare food chains in a specified ecosystem and their corresponding food web.
- PO2 - Explain how organisms obtain and use resources to develop and thrive in:
  - niches
  - predator/prey relationships
- PO 3. Analyze the interactions of living organisms with their ecosystems:
  - limiting factors
  - carrying capacity
- PO 4. Evaluate data related to problems associated with population growth (e.g., overgrazing, forest management, invasion of non-native species) and the possible solutions.
- PO 5. Predict how environmental factors (e.g., floods, droughts, temperature changes) affect survival rates in living organisms.
- PO 6. Create a model of the interactions of living organisms within an ecosystem.
- Concept 4 (8<sup>th</sup> Grade) - Diversity, Adaptation, and Behavior: Identify structural and behavioral adaptations.
  - PO1 - Explain how an organism's behavior allows it to survive in an environment.
  - PO4 - Compare the symbiotic and competitive relationships in organisms within an ecosystem (e.g., lichen, mistletoe/tree, clownfish/sea anemone, native/non-native species).

## **Grade 9 Science Standards:**

### **Strand 2 - History and Nature of Science**

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

- Concept 1 - History of Science as a Human Endeavor: Identify individual, cultural, and technological contributions to scientific knowledge.
  - PO3 - Analyze how specific changes in science have affected society.
  - PO4 – Explain how specific cultural and/or societal issue promote or hinder scientific advancement.

### **Strand 3 - Science in Personal and Social Perspectives**

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

- Concept 1 - Changes in Environments: Describe the interactions between human populations, natural hazards, and the environment.
  - PO1 - Evaluate how the processes of natural ecosystems affect, and are affected by humans.
  - PO3 - Assess how human activities (e.g., clear cutting, water management, tree thinning) can affect the potential for hazards.
  - PO5 - Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.
- Concept 2 - Science and Technology in Society: Develop viable solutions to a need or problem.
  - PO3 - Support a position on a scientific or technological issue.
  - PO5 - Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).

#### **Strand 4 - Life Science**

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

- Concept 3 - Interdependence of Organisms: Analyze the relationships among various organisms and their environment.
  - PO 1 - Identify the relationships among organisms within populations, communities, ecosystems, and biomes.
  - PO 2 - Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.
  - PO 3 - Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.

- Concept 4 - Biological Evolution: Understand the scientific principles and processes involved in biological evolution.
  - PO4 - Predict how a change in an environmental factor (e.g., rainfall, habitat loss, non-native species) can affect the number of and diversity of species in an ecosystem.

## **Trout Fishing in America and Other stories**

### **Case Study and Notes**

*Before the Case Study is read, each student is assigned a role that they will play in the Case Study. As the Case Study is being read, each student should be jotting down notes about what they think their character would say. Each student needs to make sure that they stay in character in the Case Study.*

#### Players:

Artist

Educator

Environmentalist

Farmer

Grand Canyon visitor

Hunter

Native American

Park Ranger

Taxpayer curmudgeon who thinks her/his taxes are too high

Wildlife biologist/scientist

An election is coming up. Can you believe it? Another one, every 4 years just like clockwork. But this one is a little different. Usually the topics on everyone's mind are the economy, education, and safety. But this time the environment is a topic everyone is talking about. In fact, they're fighting about it. People are very concerned about the past and future of the Grand Canyon and the species that reside within it. Recently a new art exhibit opened up at Arizona State University, highlighting the interconnectedness of all species in the Grand Canyon and the necessity of all people to work together to conserve our wilderness, "Trout Fishing in America". However, a small group of concerned citizens has rallied against conservation stating that the stakes and price are too high and that spending tax money on projects like saving a bird is a waste. They have even picketed the art exhibit! On the other side of the topic are concerned citizens who believe that nature should be conserved for future generations, even if it costs tax money to do so. However, most people fall in between and try to weigh all the pros and cons of every action that requires tax monies.

#### *Grand Canyon - History, Development, and Current Issues*

The Grand Canyon is a majestic natural geological formation, a mile deep, as wide as 18 miles, and 277 river miles long. Over a period of millions of years, it

was carved out of the solid rock by constantly flowing water of the Colorado River. In the last three thousand years, several Native American tribes have inhabited the area, beginning with the Pueblo and Cohonina peoples. Spanish explorers first visited the Canyon in the mid-16th century, but abandoned their mission due to lack of water. Exploration of the area did not continue until American settlers began leading expeditions in the mid-to-late- 19th century in efforts to track the Colorado River and find shipping routes to the Gulf of California. American westward expansion increased the numbers of travelers to the region seeking the beautiful scenery and rugged landscape. President Teddy Roosevelt, who grew up enjoying camping and hunting there, recognized the importance of conserving this place for future generations of Americans to enjoy. He was a major force in the effort to establish Grand Canyon area as a US National Park, which was achieved in 1919.

Pueblo and Cohonina descendants and other Native American tribes lived in and around the Canyon area when Grand Canyon Nation Park was established, and continue to today. These groups include the Hopi, Yuman, Havasupai, Dine', and Walapai tribes. They regard the land as a sacred place and hold religious activities there. These sites, many believe, should be off limits to all but the individuals who hold them sacred. Animals in the Canyon, such as the eagle and the California Condor, have special significance in Native cultures, as well.

Westward expansion also meant an increase in the human population of the entire region, with more and more settlers founding towns and cities that supplied their electricity generation and drinking water by damming and diverting the flow of the Colorado River. Every year, five million people visit the Grand Canyon from all over the world. These factors have greatly altered the ecology of the Canyon from even 100 years ago. On the earth, human changes to the environment have managed to alter ecosystems in a way that has led to massive die-offs of many creatures. We call animals that are in danger of extinction "Endangered Species." In the US alone, there are over 1000 endangered species.

Arizona State University's exhibition, *Trout Fishing in American and Other stories* focuses on two species that have become endangered through the actions of humans in the Canyon, the California Condor and the Humpback Chub.

### *The California Condor*

The California Condor soars through the Grand Canyon air. It has a wingspan of up to 9-10 feet long, exceeding the wingspan of any other North American species. Upon taking flight, this condor is hard to miss as it is the largest soaring bird in our region. It has an average weight of about 19 pounds, and belongs to the carrion feeder family of vultures. This means that it is not adapted to seizing pray, but instead feeds on the inner recesses of dead animals, or carcasses. Instead of having many young, and gambling that a few will survive, condors produce very few young and provide an extensive amount of parental care. The chick learns to fly when they are about 6 months old but will stay with the parents for many more months. Their very low reproductive rates and slow maturity rate means that this species must maintain low mortality rates to live; however, this is not always the case when human changes to the environment are involved. The most prominent mortality factor that affects the condor is lead poisoning through lead bullets used by hunters. Condors are also victims of cyanide or thallium poisoning in traps meant for other species such as coyotes or squirrels. Ingestion of small plastics or metals found within the Grand Canyon serves as another factor that is affecting condor lifespan. These factors put the species at risk, and have led to their endangerment.

### *The Humpback Chub*

Another endangered species of the Grand Canyon does not fly in the air, but rather swims underwater. Ranging from 12-15 inches in length, the Humpback Chub has also faced problems while inhabiting the Grand Canyon. Humpback chub is capable of surviving more than 30 years in the wild, but the reason for the chub's endangerment resides in a combination of factors that include dams, irrigation, pollution, and space, an important limiting factor, as well as predation by non-native species. Non-native gaming fish, such as trout, have been introduced to the river, which has increased competition and predation for the chub. Chub habitats have been lost due to the construction and operation of several dams including Flaming Gorge, Glen Canyon, and Hoover Dam. Due to these dams, water flow below them significantly declined. The U.S. Fish and Wildlife Service determined that if the Colorado River experienced more water diversion from these dams, the chub's survival would further be endangered. This separation of the water systems in the Colorado River separates and isolates subpopulations of chub, and also restricts gene flow. The Humpback chub has trouble persisting under such stressful habitat alterations.

### *Efforts*

Conservation efforts have taken place in order to protect these animals. For the California Condor, effective capture and release research methods to conserve condor's lives have been very important in finding out reasons for their decline. The condors that are taken from their environments for research are equipped with amazingly small radio transmitters that track their movements and behavior. Another monitoring strategy, photo-censusing, offers a non-invasive and inexpensive method to document this species. Ways to counter lead poisoning threats have been considered through the creation of no-hunting zones, and the adoption of non-toxic ammunition for condor ranges has also come into effect. U.S. Fish and Wildlife Services has placed a ban on cyanide traps for coyote control in areas where condors are present. An effort to educate hunters has already taken place in order to increase awareness, including an ammunition exchange program led by Arizona Game and Fish Department to remove lead bullets from the environment. If success can indeed be achieved through reducing these threats of lead contamination and other mortality factors, the California condor can be reestablished successfully in the wild, and not just within the Grand Canyon.

Under the U.S. Fish and Wildlife Services, a recovery plan has been developed in order to help maintain chub populations. This plan includes identifying and monitoring Humpback chub populations through the use of tiny radio transmitters. Other efforts to save the chub include the removal of non-native species that serve as a threat to the chub, and drought-induced warming of the river, as warm water temperatures benefit this species. Fish hatcheries will be expanded to include facilities for the chub as well. Agreements made by the recovery program for the Colorado River basin contains provisions for habitat rehabilitation, restocking of native fishes, and the continual monitoring of wildlife populations.

### *Results thus far*

Some progress has been made in restoring the populations of the Condor and the Chub. The California Condor, whose wild populations were extensively diminished to 22 in the late 1980s, is beginning to repopulate the Canyon. Those last condors were taken into captivity in order to save the species from extinction. The first group born and raised in labs and artificial habitats by scientists began to

be released in 1992. They are now having babies of their own that will live their whole lives in the wild. As of May 2013, there were approximately 435 California condors in the world, about 237 of which are free-flying in California, Arizona and Baja California, Mexico.

Another recovery effort for the chub, the construction of fish passages and screens at major diversion dams, has eased space as a limiting factor. They provide endangered fish with access to hundreds of miles of critical habitat. In 2009, the U.S. Geological Survey announced that the Chub population living in the Grand Canyon region has increased by about 50 percent from 2001 to 2008. The agency estimates that the number of adults is between 6,000 and 10,000, with the most likely number being 7,650 individuals. Efforts continue to legally protect essential habitats, including required stream flows and necessary water quality.

What do you think? Are we doing enough to save the California Condor and Humpback Chub? Are there additional ways in which we could save or use the Grand Canyon? Is too much being spent on the conservation efforts? Are there too many people at the Canyon and we should block so many visits? Or should we encourage more people to visit? How should the Canyon be used and preserved for future generations and for the native species that live there?

## Teacher's Copy:

### *Instructions for Students*

#### References:

Wiki

<http://www.nps.gov/grca/naturescience/plants.htm>

<http://snaebjornsdottirwilson.com/category/projects/trout-fishing-in-america/>

[http://grandcanyonhistory.clas.asu.edu/history\\_nativecultures.html](http://grandcanyonhistory.clas.asu.edu/history_nativecultures.html)

<http://www.mygrandcanyonpark.com/2010/06/native-american-tribes/>

<http://www.fws.gov/Midwest/Endangered/glossary/index.html>

<http://www.fws.gov/endangered/>

<http://www.nps.gov/grca/naturescience/index.htm>

<http://www.nps.gov/grca/naturescience/california-condors.htm>

In your role as the character you are assigned, it's up to you to write and give a 5-7 minute speech (500-700 words) advocating your position. You're going to give it in a public Open House where candidates running for US House of Representatives are discussing the future of the Grand Canyon. (One possibility is for the students who are assigned the same role to work together, or they can work separately to see how similar their speeches are.) You are free to use books, magazines, and/or the internet, to develop your response.

#### Each character should include in their speech:

- What their role is in the Grand Canyon in one sentence (i.e. the park ranger describes what s/he does in the Canyon, the Native American describes the Canyon as her home and her sacred lands, etc.)
- What their position is in the debate (i.e. the taxpayer might complain mainly about their taxes being too high and not seeing a reason to save the animals).
- List and explain the reasons behind their position.
- Describe the interactions between human populations and the environment that have benefitted or harmed either side (including pollution, habitat destruction/restoration, construction of dams).
- In your research, include references to articles from multiple sources that support and challenge your character's position. Reference at least two media sources (one agreeing/one disagreeing) in your speech.
- Describe what courses of action you would suggest taking in response to the issue of conservation in the canyon.
- Describe the courses of action you would suggest taking on the issues of conservation and why you would make these decisions. Include why this is a better choice of action than those with opposing viewpoints.
- Be sure to use vocabulary words and phrases from the case study in your speech.
- End your speech with a concluding paragraph restating your position and summarizing the main points of your argument.

**Extension:** Students evaluate each other's speeches based on motivations of the character and quality of evidence presented, and then vote for the candidate that is closest to their personal views on the future of conservation in the Canyon. You can ask them to find a partner who voted differently and compare and contrast their two positions. Can they come to a consensus or agreement about how to move forward to help the California Condor and Humpback Chub? What difficulties or conflicts remain between the two positions?

**Extension:** Students identify which case study players are allies and adversaries and then form teams with 1 or 2 allies based upon their shared interests and concerns. Students draft a one page proposal outlining the future of the Grand Canyon based upon their shared interests. Students should focus only on one or two interests in order to produce the best proposal.

**Extension:** Instead of a case study, students are divided into two groups ahead of time and are labeled into PRO or CON. After hearing the case study, students are challenged with this statement, "The Grand Canyon and all of its inhabitants should be saved for future generations and we should do everything within our power, no expense spared, to insure this future." Teams are allowed to research their position and then debate.

#### Case study wrap up:

Students should find a partner who had a different role than they did and answer the following questions:

1. What are some of the obstacles to saving or reintroducing endangered species?
2. What could a common goal be for all of the players in the case study? How could all of the players in the case study work together towards this common goal? What complications exist that would hinder working towards this goal?
3. What are three ways humans can collaborate to ensure a healthy ecosystem for the California Condor and Humpback Chub?

## Trout Fishing in America and Other stories

### Case Study and Notes



*The California Condor*



*The Humpback Chub*

In your role as the character you are assigned, it's up to you to write and give a 5-7 minute speech (500-700 words) advocating your position. You're going to give it in a public Open House where candidates running for US House of Representatives are discussing the future of the Grand Canyon. (One possibility is for the students who are assigned the same role to work together, or they can work separately to see how similar their speeches are.) You are free to use books, magazines, and/or the internet, to develop your response.

#### Players:

Artist

Educator

Environmentalist

Farmer

Grand Canyon visitor

Hunter

Native American

Park Ranger

Taxpayer curmudgeon who thinks her/his taxes are too high

Wildlife biologist/scientist

#### Each character should include in their speech:

- What their role is in the Grand Canyon in one sentence (i.e. the park ranger describes what s/he does in the Canyon, the Native American describes the Canyon as her home and her sacred lands, etc)
- What their position is in the debate (i.e. the taxpayer might complain mainly about their taxes being too high and not seeing a reason to save the animals).
- List and explain the reasons behind their position.
- Describe the interactions between human populations and the environment that have benefitted or harmed either side (including pollution, habitat destruction/restoration, and construction of dams).

- In your research, include references to articles from multiple sources that support and challenge your character's position. Reference at least two media sources (one agreeing/one disagreeing) in your speech.
- Describe what courses of action you would suggest taking in response to the issue of conservation in the canyon.
- Describe the courses of action you would suggest taking on the issues of conservation and why you would make these decisions. Include why this is a better choice of action than those with opposing viewpoints.
- Be sure to use vocabulary words and phrases from the case study in your speech.
- End your speech with a concluding paragraph restating your position and summarizing the main points of your argument.

#### Case study wrap up:

Find a partner who had a different role than they did and answer the following questions:

1. What are some of the obstacles to saving or reintroducing endangered species?
2. What could a common goal be for all of the players in the case study? How could all of the players in the case study work together towards this common goal? What complications exist that would hinder working towards this goal?
3. What are three ways humans can collaborate to ensure a healthy ecosystem for the California Condor and Humpback Chub?

#### References:

Wiki

<http://www.nps.gov/grca/naturescience/plants.htm>

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[http://grandcanyonhistory.clas.asu.edu/history\\_nativecultures.html](http://grandcanyonhistory.clas.asu.edu/history_nativecultures.html)

<http://www.mygrandcanyonpark.com/2010/06/native-american-tribes/>

<http://www.fws.gov/Midwest/Endangered/glossary/index.html>

<http://www.fws.gov/endangered/>

<http://www.nps.gov/grca/naturescience/index.htm>

<http://www.nps.gov/grca/naturescience/california-condors.htm>

**Your Character:** \_\_\_\_\_

**Key words or phrases to describe/explain:**

*Example:*

- *Ecology - the interrelationship of organisms to one another and their physical surroundings*

- Grand Canyon -

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- Conservation -

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- Colorado River -

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- Endangered Species -

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- California Condor -

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- Humpback Chub -

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- Trout Fishing in America -

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**Note how the following concepts influence the ecology of the Grand Canyon**

- American westward expansion -

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- increase in the human population -

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- damming and diverting the flow of the Colorado River -

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**Using context clues, note how the following terms and concepts are used to describe the California condor:**

*Example: -carrion feeder – an animal who does not hunt its own food, but scavenges for leftovers of other carnivore’s food. This is the type of diet of the condor.*

- reproductive rate
- maturity rate
- mortality rate
- mortality factor
- lead contamination

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**Using context clues, note how the following terms and concepts are used to describe the Humpback Chub:**

- limiting factor
- non-native species
- predation
- dams and water diversion
- isolated subpopulations and restricted gene flow

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Food Web

In a group of up to 4 students, identify 10-15 items from the following list of animals that live in the Grand Canyon. You will use those selected to construct a food web of the Grand Canyon, highlighting the California Condor or Humpback Chub. Make sure you use either the California Condor or the Humpback Chub as one of your factors and make at least 2 connections to the Condor or Chub. Think carefully about the role your animal (Condor or Chub) plays in the food web.

Food Web Players

Abiotic factors (soil, leaf litter, etc)	Freshwater shrimp
Algae	Fungi
Ants	Golden Eagle
Bacteria	Ground squirrel
Bald Eagle	Humpback chub
Bats	Krill
Bee	Lichens
Beavers	Mountain lion
Bighorn sheep	Mule deer
Black bear	Owl
Blackflies	People
Butterfly	Phytoplankton
Cacti	Plants/Shrubs/Trees (specify species if you wish)
California Condor	Rabbits
Coyote	Rodents (mice, shrews, voles, woodrat, etc)
Cricket	Spiders (tarantula, black widow, wolf spider, etc)
Cyanobacteria	Sun
Desert tortoise	Swift
Detritivore invertebrates (beetles, flies, moths, snails, etc)	Trout
Earthworms	Water
Elk	
Fox	

*\*Alternatively, students can research the players in the ecosystem, instead of relying on the above list. Suggested Resource Websites:*

<http://www.nps.gov/grca/index.htm>

<http://www.coloradoriverrecovery.org/general-information/the-fish/humpback-chub.html>

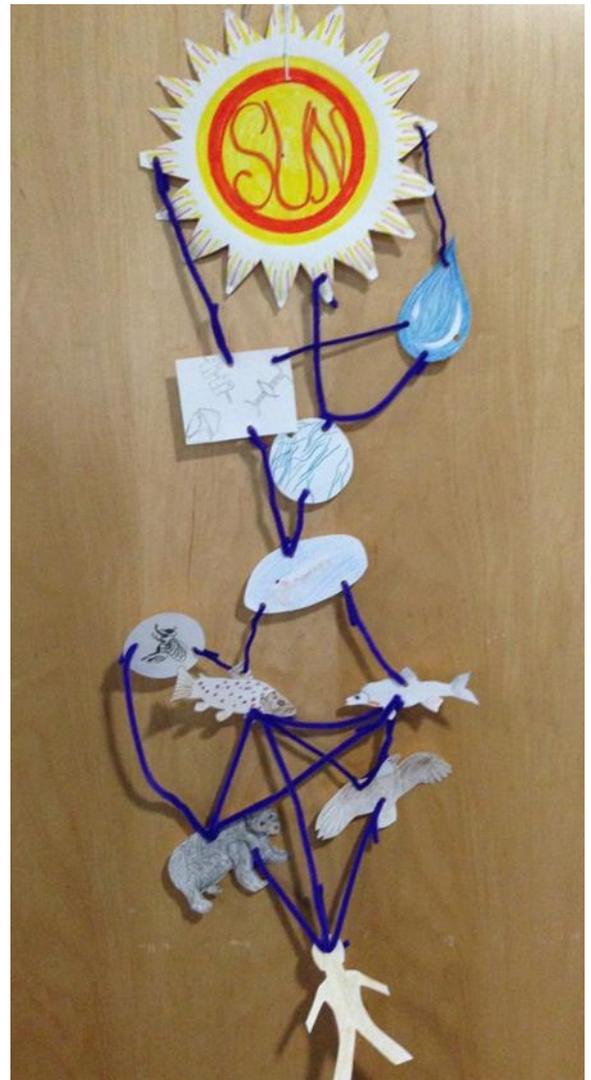
[http://www.allaboutbirds.org/guide/california\\_condor/lifehistory](http://www.allaboutbirds.org/guide/california_condor/lifehistory)

<http://www.nps.gov/grca/naturescience/animals.htm> - scroll down to bottom for "Animal Checklists"

## Instructions for Constructing Your Food

### Web:

- Label one index card for each factor and create a food web using the cards, hole puncher, and pipe cleaners to attach them. Attach the entire food web on a paper plate, so it hangs a mobile, like in the example shown.
- Simpler trophic levels should be closer to the top.
- You may wish to add arrows to your food web, rather than just noting connections between factors.
- Also ensure abiotic factors, such as the sun and soil/leaf litter are included.



*\*An extension could be to have students draw a picture of the factor or list relevant details about the factor on the back of the card*

### Student Response Sheet:

1. Describe your food web. Why did you choose those items? All of the items on the list (or in your research) live in the Grand Canyon. Why did you leave out the things you did for the food web?
2. Think-Pair-Share: What are the most important links in the chain? What is the most important link or links to the Condor/Chub? Why?
3. Inspect another group's food web. How is it different than yours? How is it the same? What did they emphasize?
4. The California Condor and Humpback Chub are endangered species. Model what would happen if the species totally disappear. Use a pair of scissors to cut out (completely

remove) the Condor/Chub from your food web. What happens? How did your food web change? How did it stay the same?

5. Inspect another group's food web. What happened to their food web? What changed? What stayed the same?
6. Now, using your remaining items, remake your food web. You can move players, add string, remove string, etc. You can add items if you choose. What relationships change? How do they change? Why do they change?

### **What? So What? Now What?**

*(This is a group sharing activity. This could be implemented through an individual writing assignment, a group presentation, or an open class discussion.)*

#### **What?**

- Students should share what they did and what they thought about as they were making their food web.
- After they removed the endangered species, how did they feel? What did they think?

#### **So What?**

- Students should share what they learned from the experience. What did they learn? Relearn?
- How does the activity relate the Grand Canyon ecology? Where is it lacking?

#### **Now What?**

- Does this activity make you want to learn more about the Grand Canyon, if so what aspect?
- What should we do in the future about endangered species?

*(For Teacher's Reference)*

#### **Humpback Chub Diet:**

The Humpback chub's diet consists primarily of insect and other invertebrates, arthropods and plankton (e.g., krill, shrimp), and less frequently algae or other small fishes, as available.

#### **California Condor Diet**

As carrion feeders, the California Condor's diet consists almost exclusively of dead animal carcasses available to them. This carrion can range in size, from large animals such as a deer, to smaller animals such as rabbits.

## *Trout Fishing in America and Other Stories*

### Food Web

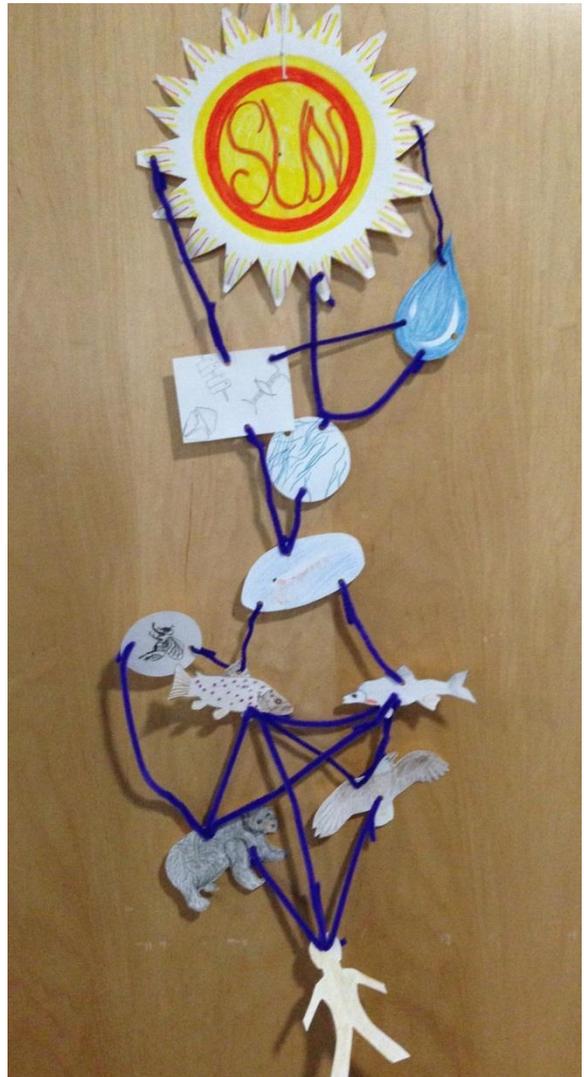
In a group of up to 4 students, identify 10-15 items from the following list of animals that live in the Grand Canyon. You will use those selected to construct a food web of the Grand Canyon, highlighting the California Condor or Humpback Chub. Make sure you use either the California Condor or the Humpback Chub as one of your factors and make at least 2 connections to the Condor or Chub. Think carefully about the role your animal (Condor or Chub) plays in the food web.

### Food Web Players

Abiotic factors (soil, leaf litter, etc)	Freshwater shrimp
Algae	Fungi
Ants	Golden Eagle
Bacteria	Ground squirrel
Bald Eagle	Humpback chub
Bats	Krill
Bee	Lichens
Beavers	Mountain lion
Bighorn sheep	Mule deer
Black bear	Owl
Blackflies	People
Butterfly	Phytoplankton
Cacti	Plants/Shrubs/Trees (specify species if you wish)
California Condor	Rabbits
Coyote	Rodents (mice, shrews, voles, woodrat, etc)
Cricket	Spiders (tarantula, black widow, wolf spider, etc)
Cyanobacteria	Sun
Desert tortoise	Swift
Detritivore invertebrates (beetles, flies, moths, snails, etc)	Trout
Earthworms	Water
Elk	
Fox	

### Instructions for Constructing Your Food Web:

- Label one index card for each factor and create a food web using the cards, hole puncher, and pipe cleaners to attach them. Attach the entire food web on a paper plate, so it hangs a mobile, like in the example shown.
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<http://www.nps.gov/grca/naturescience/california-condors.htm>

<http://www.nps.gov/grca/naturescience/plants.htm>







