



AMERICAN SAMOA'S CORAL REEF

OUR SACRED LEGACY

A Teacher's Curriculum Resource Guide

William Thompson Mene Tauaa Jacqlin Ulu Lionel Vaitautolu Trevor Kaituu



Our Sacred Legacy

American Samoa's Coral Reef

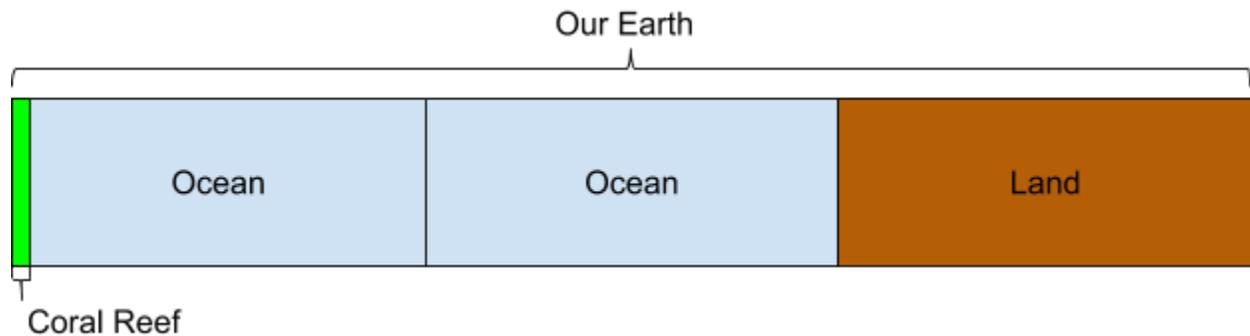
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A Lotonuu Project with the Coral Reef Advisory Group
2019

Summary (Why are we doing this)

As one Samoan saying goes, “e pua’ina i vao, ae liaina i le ala”, which is loosely translated as “what goes on in the private will be seen in public”. Another way to interpret that saying is to say “what happens on land will affect our oceans”. American Samoa hosts a special breed of living things right off the beaches of our islands, and that is the coral reef. Coral reefs only occupy 0.1% of the area of the ocean but they support 25% of all marine species on the planet.



Hundreds of millions of people rely on coral reefs for essential nutrition, livelihoods, protection from life-threatening storms and crucial economic opportunity.

About half the world’s shallow water coral reefs are already gone, and without urgent action to address climate change, pollution, overfishing and destructive coastal development, these life-sustaining natural wonders could all but disappear. ~ [World Wild Fund for Nature](#)

This curriculum book has been created to help instill in our young learners, especially here in American Samoa, that the protection and conservation of our coral reef, has a great impact on the world. We hope that our young learners are proud of this “Sacred Legacy” off the shores of our American Samoa. We also hope that they become stewards to protect this resource for generations to come.



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Lesson 1: Diagnostics Day

In this lesson, we will check student prior knowledge of coral reefs, show current images of our coral reef and the changes over time, and students will infer on the causes that affected the coral reef.

American Samoa Department of Education Standards and Benchmarks

3.8.1 Observe that some changes in ecosystems occur slowly, and others occur rapidly, and that these changes can affect life-forms, including humans.
5.8.2 Analyze how ecosystems change over extended time periods.

Objective: Students will be able to describe what is happening to our coral reefs and predict how the coral ecosystem has changed over time.

Lesson Procedures:

1. Begin the lesson by playing the sound of the ocean from underwater [Deep Sea Soundscape on YouTube](#) (See Link Section 1.1). Have students listen and try to determine what this sound is.
2. Tell students that this is the sound of the ocean underwater. Have students close their eyes in meditation to listen to the sound of the ocean. Guide their imagination with the following questions: How does the water feel? Is it warm? Is it cold? Think about what you see. What are some colors, and other things you see.
3. What about the taste of the ocean? What does the ocean smell like? Finally, focus on some of the sounds. What do you hear?

After the meditation exercise, go through a stretching exercise before beginning the next task. Guide students through voicing out what they felt, saw, tasted, smelled and heard using a Five (5) Senses Chart (Appendix 1.1) by having recording on the board what the students remembered from their meditation exercise.

4. After a full class discussion, have students work as a group to create a poster of what they imagine our coral reef looks like here in American Samoa. Provide paper, paint and markers for students to work together to create their image of American Samoa's Coral Reef
5. When students have presented their posters to the class, gather them together to show the video clip of what has been happening to our coral reef system, or if you do not have access to the internet, you may show images found in Appendix 1.2.
 - [YouTube Video Clip](#) (See Link Section 1.2)
 - [Google Maps Experience](#) (See Link Section 1.3)

6. **Assessment:** Have students reflect on the images by writing or drawing their feelings. What do you see? How do you feel? What are some questions you may have? Why do you think this is happening?
7. **Closure:** Discuss with students some or their answers. Tell them that they will be finding out why this is happening to our coral reef. Have students predict why they think this is happening.

MATERIALS AND RESOURCES:

[Deep Sea Soundscape on YouTube](#) (See Link Section 1.1) Recording, Laptop & Speakers, Five (5) Senses Chart (Appendix 1.1), Poster paper, paint, markers or other art supplies, [YouTube Video Clip](#) (See Link Section 1.2), laptop, projector & screen OR [Google Maps Experience](#) (See Link Section 1.3), laptop, projector & screen OR Printouts of Other Images (Appendix 1.2)

LINK SECTION:

- 1.1 - Deep Sea Soundscape - Found on Youtube at same as https://youtu.be/UjQxhOXco_k
- 1.2 - American Samoa Before and After- Found on Youtube at <https://youtu.be/-V6DJLSqA18>
- 1.3 - [Google Maps Experience](#) - Found at <https://shorturl.at/wyBGP>
- 1.4 - BREATHE IN, BREATHE OUT 90 sec - Found on Youtube at <https://youtu.be/OUDO4m8Z42U>

EXTENSION - YOU MAY EXTEND THIS LESSON IN SEVERAL WAYS:

- **Theatrical Expression:** Have students perform the before and after thoughts of how they imagine the coral reef systems. Use the [Deep Sea Soundscape on YouTube](#) (See Link Section 1.1) as a background sound, and have students perform the before scene and after scene of American Samoa's coral reef.
- **Storybook Creation:** Have students begin writing the Story of the Coral Reef. Students will gain experiences each day and can add to the book as the unit continues.
- **Technology Integration:** Google Cardboard may provide a Virtual Reality journey for your students into what the coral reef looks like with a virtual tour.
- **Relaxation Techniques:** This [90 sec clip](#) (See Link Section 1.4) helps with breathing exercises and also gives you a look at the breathing Earth.

Appendix 1.1 - Five Senses Chart

 What did you feel?	 What did you see?
What did you taste? 	 What did you hear?
 What did you smell?	

Appendix 1.2 - American Samoa Reefs



Lesson 2: Did the parrot fish do it?

This lesson describes the unique relationship between the coral reef and the parrotfish.

American Samoa Department of Education Standards and Benchmarks

3.8.2 Describe organisms' relationships in ecosystems
4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.

Objective: Students will describe and explain the relationship between the parrotfish and the coral reef ecosystem.

Lesson Procedures:

1. Begin the lesson by playing [American Samoa Before and After YouTube Video Clip](#) (See Link Section 2.1) to review yesterday's lesson. Explain that yesterday we left unsure of what happened to the coral reefs. Review their predictions of who or what could be the cause of the damage to the coral reef ecosystem?
2. Play the [Parrotfish video](#) (See Link Section 2.2) and ask students, what kind of fish is that? Do we have that fish in American Samoa? What is it eating? Could this fish be the reason for the damaged coral?
3. Tell students that the fish they see in the video is a parrotfish and that there are many types of parrotfish in our coral reefs. Show the [poster](#) (See Link Section 2.3) of parrotfish found in American Samoa.

In this lesson, we will be finding out what a Parrotfish is, where it lives and what it eats. Finally, we will discuss whether it helps or harms the coral reefs.

4. Display a T-Chart on the board, one side labeled "harms" and the other side "helps". Show the "fun facts about parrotfish" (refer to Appendix 2.1) to students and model taking two facts and placing it under the appropriate column on the T Chart.
5. Group students in 3's or 4's and have them organize the rest of the fun facts under the appropriate column of their group's T-Chart. (refer to Appendix 2.2)
6. **Assessment:** Have students discuss the T-Chart in small groups, explain their reasoning behind each helps and harms. Groups will present and share their reasoning for the facts in their T-Chart. Teachers may refer to the completed sample T-Chart in Appendix 2.3 to help explain each fact to the students.
7. **Closure:** Ask students if they believe that the parrotfish does more helping or harming to the coral reefs. Invite students to explain why. Ask students if they think the parrotfish caused all the harm from the [American Samoa Before and After](#) YouTube video clip shown at the beginning of the lesson.

MATERIALS AND RESOURCES

[YouTube Video Clip](#) (See Link Section 2.1), [Parrotfish video](#) (See Link Section 2.2), laptop, projector & screen, Computer, and Speakers, Different parrotfish in American Samoa [poster](#)

(See Link Section 2.3), Harms and Helps T-Chart, Parrotfish fun facts, T-Chart Reference for teachers

LINK SECTION

2.1 - American Samoa Before and After - Found on Youtube at <https://youtu.be/-V6DJLSqA18>

2.2 - Rainbow ParrotFish Munching on Coral - Found at <https://youtu.be/4MqXF6ctpcM>

2.3 - Parrotfish of American Samoa - Found at <https://shorturl.at/aHNX4>

2.4 - Jeopardy Parrotfish - Found at <https://shorturl.at/xALM9>

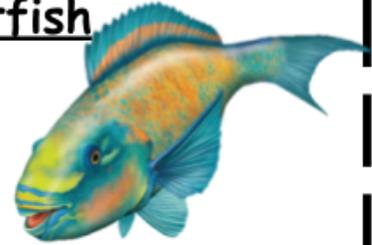
2.5 - Feeding Humphead Parrotfish | Blue Planet | BBC Earth - Found on Youtube at <https://youtu.be/o-blz2ghKOU>

EXTENSION

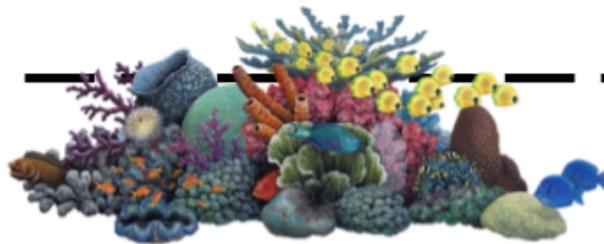
You may extend this lesson in several ways:

- Playing Jeopardy: Have students play the [Jeopardy Game](#) (See Link Section 2.4). Using “Fun Facts” students can study in groups of 3 or 4. Then, play Jeopardy, there’s 4 categories, each category have 5 questions, question is worth a certain amount. You pick the first category and question. First to slap the table answer first. If wrong, the amount is minus but if right, then group gets the that amount.
- Arranging Events: Use fact sheet, cut each fact and give one to each student. Label one side of the room “Harms” and the other side “Helps”. Students move to the side they feel that their fact belongs to. Have students explain why they chose that side.
- Expressing through Arts: Have students draw a coral reef with parrotfish and a coral reef with no parrotfish. Have them explain their artwork.
- Humphead Parrotfish Video (See Link Section 2.5)

Fun Facts about Parrotfish



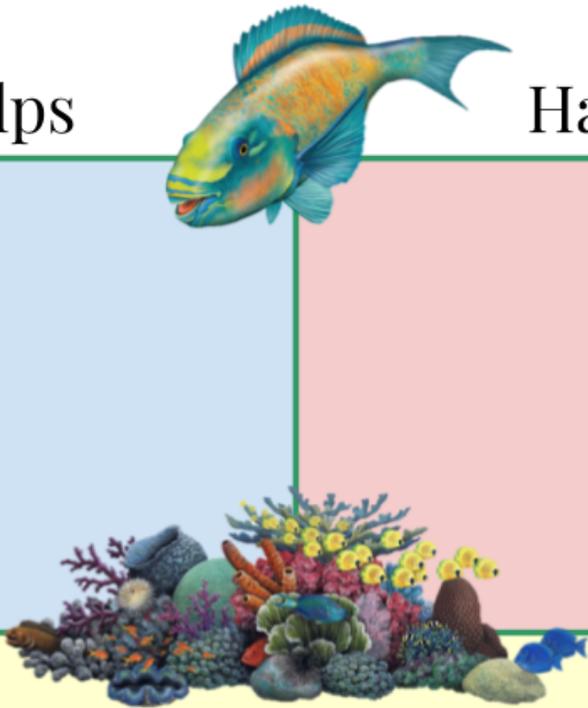
- ❖ Parrotfish live in coral reefs.
- ❖ They eat corals.
- ❖ They are known as the "Rainbow of the Sea"
- ❖ They eat algae.
- ❖ Parrotfish poops out sand.
- ❖ Parrotfish have strong teeth and jaws that can bite through rocks.
- ❖ They release their eggs into corals and it stays there until it hatches.
- ❖ Parrotfish graze and clean the coral reefs.
- ❖ Adult parrotfish can produce about 198 pounds of fine sand per year



Appendix 2.2 - Helps and Harms T - Chart

Determine if the Parrotfish helps or harms the coral reefs by filling in the T - Chart.

Helps	Harms
Not sure	



Appendix 2.3 - Teacher's Guide to T-Chart

Determine if the Parrotfish helps or harms the coral reefs by filling in the T - Chart.

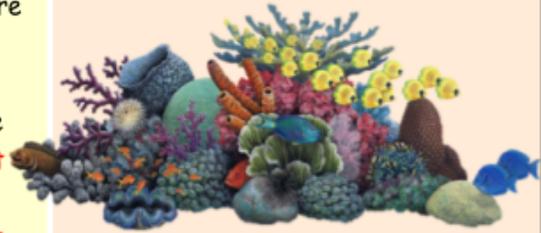


HELPS

1. Parrotfish live in coral reefs, they work as a team. (It can help the corals survive)
2. They eat algae. (If algae overgrows they can cover the coral reefs and suffocate the corals.)
3. They are known as the "Rainbow of the Sea". (Different kinds of parrotfish adds beautiful colors to the reef which helps beautify the corals reefs.)
4. Parrotfish poops out sand. (Sand makes for beautiful beachers)
5. Adult parrotfish can produce about 198 pounds of fine sand per year. (More sands helps build the reefs).
6. They release their eggs into corals and it stays there until it hatches. (If eggs are safe more parrotfish will hatch and help protect the corals.)
7. Parrotfish have strong teeth and jaws that can bite through rocks. (Their strong teeth and jaws can get the overgrown algae from the corals.)
8. Parrotfish graze and clean the coral reefs. (To keep the coral reefs healthy and strong.)

HARMS

1. Parrotfish eats coral. (if there's a lot of parrotfish it will have a disadvantage on the corals)



Lesson 3: Was it the Crown of Thorns?

Students will examine information regarding the Crown of Thorns starfish and discuss how this animal interacts with the coral reef ecosystem.

American Samoa Department of Education Standards and Benchmarks

3.8.2 Describe organisms' relationships in ecosystems
4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.
5.8.1 - Describe the types of interactions among organisms

Objective: Students will describe the relationship between the crown of thorns and the coral reef ecosystem.

Lesson Procedures:

1. Play the following video [“Royal Pain in the Coral Reefs”](#) (Link Section 3.1) that introduces the Crown of Thorns starfish.
2. Ask students if they have seen this animal before, what it could be, and how do students think this animal affects the coral reefs? Record students' answers to refer back to after the lesson.
3. Show students the pictures (Appendix 3.1) to explain that the alien looking animal is the Crown of Thorns or COTS for short. They are eating the corals making them weak and killing them. The white part is what remains from the coral as the COTS continues to eat it (shown on picture c). When there are a few of them they help by eating the fast growing corals but when there is a lot, this can threaten the safety of the coral reefs.
4. Tell students they will learn more about Crown of Thorns and their effect on the coral reefs as they read “The Crown of Thorns Tales” (Appendix 3.2)
5. **Activity:** In groups of 3 or 4, students will use the Crown of Thorns Tales to report breaking news. The news should be focused on the effects of the Crown of Thorns to the coral reefs. Students use the “My Crown of Thorn Report” (Appendix 3.3) sheet to help guide them in creating their news broadcast.

6. Teachers may use the following “Breaking News Report” to guide students in creating their newscast.
 - **Headline:** “Parrotfish is Innocent”
 - **Byline or writer** (that’s you),
 - **Leading Facts:** Who? parrotfish What happened? s innocent, he did not kill the corals Where it happened? at the Coral Reef, When did this happen? Yesterday in class.

Example: Yesterday, the parrotfish, in the coral reef, was announced innocent from all blame that they killed the coral.

- **Findings and Observation:** (What information helps support your story and your observations)

Example: The rainbow of the sea or the parrotfish survive by eating algae and corals. These fish graze the coral reefs as they use their strong beak to get the algae in the corals. This behavior may crush corals but, if they don't eat the algae it may overgrow and cover the reefs killing the corals. They graze and keep the coral reefs clean. Yesterday, according to Jonny he said, "parrotfish helps the coral reefs more than harms".

- **Result and Conclusion:** (What are your last thoughts or message that will make your newscast stronger leaving your audience wanting more.)

Example: Parrotfish are free to continue eating algae, they might break some corals but it's a small price to pay for a much more healthier coral reefs.

7. **Assessment:** Students may present their breaking news in a form of a newscast. Teacher may use sound effects or a make-shift News set to set the mood for students.
8. **Closure:** Ask students if they believe that the effects of the crown of thorns may be the cause of all the damaged coral seen in previous lessons. Invite students to explain their reasoning.

MATERIALS AND RESOURCES

Video "[Royal Pain in the Coral Reefs](#)" (See Link Section 3.1), laptop, projector & screen, Computer, Speakers, Pictures and an article "[Crown of Thorns outbreak](#)" (See Link Section 3.2), "[American Samoa tackle a thorny issue](#)" (See Link Section 3.3) from the National Park of American Samoa, My Crown of Thorn, Tales Handout, Breaking News report Template

LINK SECTION

3.1 - Royal Pain in the Coral - Found at <http://go.hawaii.edu/JqG>

3.2 - "American Samoa tackle a thorny Issue" article found on <https://shorturl.at/mqrBQ>

3.3- National Park Protects Coral Reefs Destructive Crown of Thorns Starfish - Found at <https://shorturl.at/orDLU>

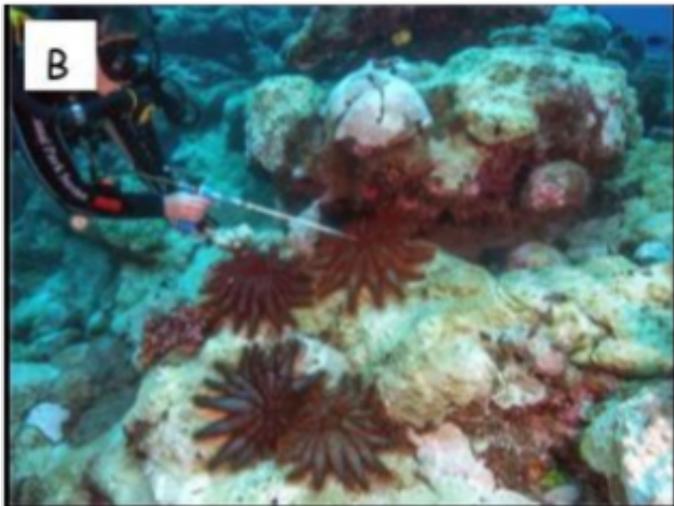
EXTENSION - YOU MAY EXTEND THIS LESSON IN SEVERAL WAYS:

- **Math:** In the "My Crown of Thorns Tale" students can use a meter ruler to measure the area that covers 13 square meters. When students are able to measure this area then have them imagine if there are two, three, four, or five crowns of thorns. This will help students visualize the effect of crown of thorns to the coral reefs.
- **Role Playing:** Have students recreate the video from the beginning. Have some students act as the different animals swimming happily in the coral reef. Have other students be COTS as they feed on the corals. As the COTS feed and the corals are dying have the happy animals moving away from the reef.
- **Writing:** Students write a letter from the perspective of the corals. Students will write a letter from the Coral to the COTS tell them how they feel about them overfeed on them.

Appendix 3.1 - Pictures of the Crown of Thorns



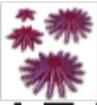
Picture A: *Crown of Thorns feeding on the coral.*



Picture B: *More and more crown of thorns are eating the coral. A diver is injecting a chemical to kill the COTS.*



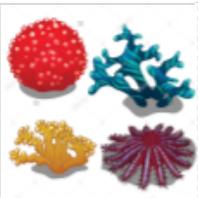
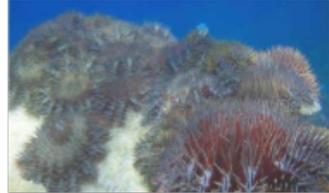
Picture C: *The white trail of corals left by the COTS as they feed on that big coral.*



Crown of Thorns Tales!



Crown of Thorns Starfish (COTS), known in Samoa as the Alamea, live on the coral reef. They are corallivores meaning they eat only coral. They can eat up to 13 square meters per year, *OMG!* that is about the size of a car parking spot. Now imagine 3 or 4 COTS eating coral!



You don't want to pet a COTS because they have long poisonous spines. That is why they have only a few predators. One predator is the trumpet Triton (foafoa) snail. There is a Samoan proverb is a reminder to anyone, if you get stung by a COTS just turn it over and have it remove the poison (e fofo e le alamea le alamea).

There is an outbreak of COTS in many reefs which threatens the survival of coral. They feed on the coral in the reef. Controlling them is hard with less and less natural predators. Also if a COTS is hurt or split in the ocean, it can grow into two or more cots. One female COTS can make 60 to 65 millions eggs in a breeding season!



Appendix 3.3 - My Breaking News Report

  <p>News Report: A Headline and Photo:</p> <p>_____</p> <p>Byline: <i>(name of the reporter):</i></p> <p>_____</p> <p>Placeline: <i>(where the story takes place):</i></p> <p>_____</p> <p>Leading Facts: <i>(2 sentences)</i></p> <p>Who was involved: _____</p> <p>What exactly happened? _____</p> <p>Where did it happen? _____</p> <p>When did it happen? _____</p> <p>Findings and Observations:</p> <p>Explain HOW and WHY the even happened. Include at least one quote from someone interview. (4 to 5 sentences)</p> <p>Results and Conclusion: additional information for the audience wants to know (1 sentence)</p>	  <p>News Report:</p> <p>Headline: _____</p> <p>Byline & Placeline: _____</p> <p>Leading Facts:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Findings and Observations:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Results and Conclusion:</p> <p>_____</p> <p>_____</p> <p>_____</p>
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Lesson 4: Perhaps Global Warming!

Find out about the short and long term effects of global warming on the coral reef ecosystem.

American Samoa Department of Education Standards and Benchmarks

3.8.1 Observe that some changes in ecosystems occur slowly, and others occur rapidly, and that these changes can affect life-forms, including humans.
3.8.2 Describe organisms' relationships in ecosystems
4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.
5.8.2 Analyze how ecosystems change over extended time periods.

Objective: Students will be able to analyze the relationship between global warming and coral.

Lesson Procedures:

1. Read aloud activity: Before conducting the read aloud, tell students to listen to remember 3-2-1 : 3 things they will hear, 2 interesting facts and 1 question they may have. View the [Lesson 4 Powerpoint slide](#) (Link Section 4.1) beginning with the poem “Down in the Blue Ocean” for students to read aloud. Slide 12 has the 3-2-1 Discussion for the class to talk about.

2. Continue on to the next slides to discuss “Corals: The Ocean’s Garden”. Go through the main points discussed in the slideshow. To deepen the knowledge of what happens during global warming, share the Coral bleaching animation found [here](#) (Link Section 4.2) and try out different scenarios (+1 °C Water Temperature or +2 °C Water Temperature). Discuss with students the changes they see to the coral when the temperature in the ocean rises.

3. In groups, have students roleplay the relationship between Coral, polyps, zooxanthellae & global warming. Give each group 4 labels and have students choose which role he/she will play. Groups practice before presenting to the class. During presentations, check for accuracy in the relationship.

4. **Assessment:** After group presentations, have students take the role of the coral reef, and create their own “I am Poem” in the perspective of the coral reef, using the following template:

I am a (two special characteristics you have as a coral)

I wonder (something you are curious about)

I hear (a sound)

I see (a sight)

I want (an actual desire)

I am (the first line of the poem repeated)

I hope (something you hope for)

I feel (a feeling about something real)

I say (something you believe)

I worry (something that really bothers you)
I cry (something that makes you very sad)
I am (the first line of the poem repeated)

Contact Trevor Kaituu at the Coral Reef Advisory Group - CRAG with your best poems to record for CRAG's radio Public Service Announcements (PSA)

- 5. Closure:** Have students retell the relationship of global warming to coral reefs and discuss ways that this will impact us humans.

MATERIALS:

projector, laptop, & downloaded Powerpoint slides, Internet connection if you choose to share the animation, Labels for the Group Role Playing activity, Science Notebooks / Pencils or pens for I Am Poem & Notes

LINK SECTION

4.1 - Lesson 4 Powerpoint Slides - Found at <https://shorturl.at/eitzS> or https://drive.google.com/file/d/1fpl1VQWePEskdiZ4M-FZg197lh_2E3-/view

4.2 - Climate Kids - Found at <https://shorturl.at/uEKQZ>

EXTENSION:

Science: Have students build a coral polyp using instructions in the following site: <https://shorturl.at/dfmq6>

Arts and Crafts: Have students create an under the sea pool noodle coral reef. <https://shorturl.at/wALW7>

Samoan: Write a letter to the editor in Samoan to Samoa News telling why it is important to save the corals in AS.

Lesson 5: Fishing Practices

In this lesson students will discuss the different fishing practices and their contribution to the damage of coral.

**American Samoa
Department of
Education Standards
and Benchmarks**

5.8.2 - Analyze how ecosystems change over extended time periods
5.8.1 - Describe the types of interactions among organisms

Objective: SWBAT analyze ways human fishing activities directly affect the coral reef ecosystem

Lesson Procedures:

1. Play a [fishing game](#) (Link Section 5.1) with the students where they will each be “fishing” using straws, chopsticks and spoons to collect popcorn scattered across the room and placed in a boat (cup). Each group may invade other fishing areas when they run out of fish.
2. After the game, tell students that reef fish are important to the coral reef because they take care of the reef by cleaning up the algae that grows within the ecosystem. People fish for food, but the ways that we fish may have some negative effects on the reef.
3. Go over vocabulary words and the definition of each term with the students.

Vocabulary Words:

1. **Overfish:** when you take too much fish from the ocean
2. **Chemical Fishing:** using poison to get fish.
3. **Explosive Fishing:** using dynamite to get fish
4. **Cast Netting:** a net that is thrown to catch fish
5. **Traditional Fishing:** common fishing methods used by locals.

4. Use images associated with today's vocabulary words ([see linked worksheet](#)) (Link Section 5.2) to discuss a couple of the words in the vocabulary list.
5. Break students into groups so they can match the rest of the pictures with the vocabulary words. Have groups present what they chose and why they feel that it belongs in that category.
6. **Assessment:** Students will choose one method of fishing practices used in the game (straw, chopsticks or spoon) and explain which is most similar to the learned fishing practices. Have students explain in a couple of sentences.
7. **Closure:** Discuss with students the term “overfishing”. Ask students to share how each fishing practice may harm the coral reef ecosystem in terms of “overfishing”.

MATERIALS AND RESOURCES

Overfishing/ Sustainable fishing Activity (as a reference to the activity), Popcorn, Straws, Chopsticks, Glue/ staple

LINK SECTION

5.1 - Overfishing / Sustainable Fishing Activity - Found at <https://shorturl.at/eivGR>

5.2 - Fishing Practices Worksheet - Found at <https://shorturl.at/dluFo>

EXTENSION

You may extend this lesson in several ways:

- **Story Book:** Students may create storybooks displaying fishing practices using chemicals or explosives.
- **iMovie Presentation:** Students may utilize laptops to create an iMovie project about fishing practices their communities are involved in.
- **Guest Speaker/ Field Trip:** The Department of Marine and Wild Reserves offers educational programs via outreach or field trips to educate our students in legal and illegal fishing practices conducted by local fishermen as well as commercial fishing vessels. The DMWR Law Enforcement Agency provide insight for illegal fishing methods and gear as well as rules and regulations in regards to coral, fish, clams, and lobster size limit. They also extend their services beyond the sea in terms of species found on land such as the coconut crab, mangrove crab, and endangered species such as bats and doves (lupe). A boat ride is available to take students to National Marine Sanctuaries such as Fagatele Bay,

Lesson 6: Ridge to Reef

In this lesson we will look at how human activity on the land affects life-forms and the coral reef ecosystem. We will be focusing mainly the watershed zones and describe how littering and sedimentation affect the coral reef ecosystem.

American Samoa Department of Education Standards and Benchmarks

3.8.1 Observe that some changes in ecosystems occur slowly, and others occur rapidly, and that these changes can affect life-forms, including humans.
5.8.2 Analyze how ecosystems change over extended time periods.

Objective: Students will be able to describe how littering and sediments harm our coral reefs.

Lesson Procedures:

1. Play the [watershed zone video](#) (Link Section 6.1) for students and have students tell what zone they live in. Ask “Check for Understanding” questions such as: How do you know you live in that zone? What zone is our school in?

2. Introduce new vocabulary words to students:

Vocabulary Words:

1. **Sediments** - loose soil created by farming or building
2. **Littering** - trash that is not properly thrown away
3. **Watershed** - land area where the rain water or stream water flows through

3. Discuss the new vocabulary words with students and have students predict how they think it relates to the coral reef.

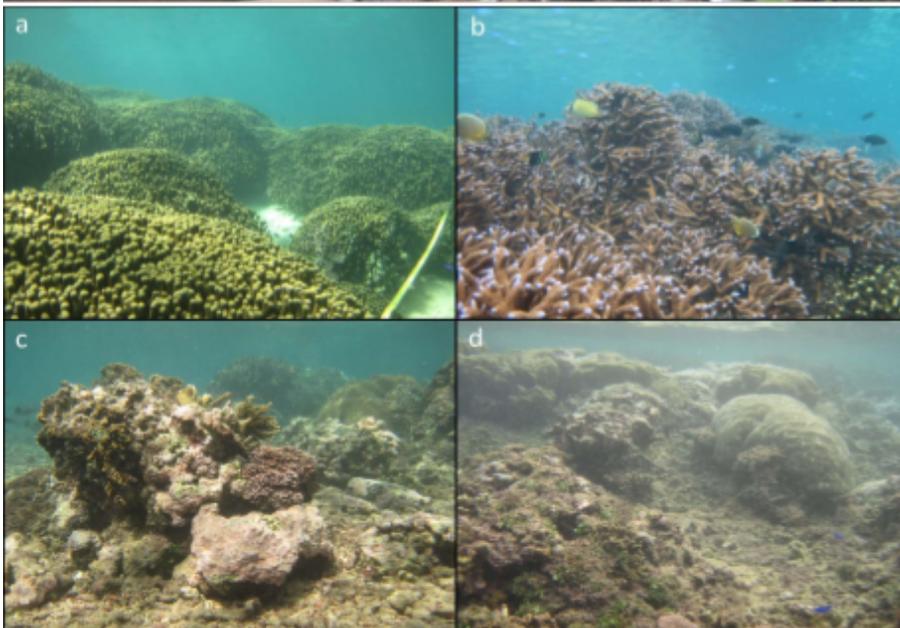
4. Show students their school watershed zone on [Google Earth](#) (Link Section 6.2) (best if used with Google Chrome). Utilize the different tools to show the map in 3D. Ask thought provoking questions such as: When it rains, where does the water go? What happens if there’s trash on the ground during a rainstorm? Predict what happens when there’s loose soil on the ground when it rains. You may want to refer to the watershed maps in Appendix 6.2 as a reference.
5. Work with students to try to recreate a model of their watershed area. Teacher may use the following videos to build personal knowledge on building a watershed demonstration and getting building ideas: ‘
1. YouTube Video [Demonstration of Watershed](#) (Link Section 6.3) or [Watershed Model Demonstration](#) (See Link Section 6.4)
 2. How to [Build Your Own Watershed](#) (See Link Section 6.5)
6. **Assessment:** Have students answer the following questions using a drawing and simple sentences:
- If you litter in your area, how might it affect the coral reef ecosystem?

- When people are farming or building homes, how might that affect the coral reef ecosystem?
7. **Closure:** Share with students the Samoan saying “e pua’ina i vao, ae liaina i le ala”. Discuss that this saying might also have meanings to activities that we do on land will affect our oceans. Show students the pictures of litter and sedimentation in and near American Samoa’s ocean:

Images to use during closure



Picture 1 A pilot study in 2015 revealed high accumulations of shoreline debris at Nu'uuli Lagoon on American Samoa. (Photo Credit: Arizona State University)



Picture 2 Visual, spatial comparison of coral growth, development, and appearance of shallow habitats of the (a) south, (b) central and (c, d) northern areas of the backreef in Faga’alu Bay, American Samoa. NOAA photos by Bernardo Vargas-Ángel

MATERIALS AND RESOURCES

Internet access, Projector, laptop & speakers to show the videos, pictures and use for Google Earth Activity (If internet is not available in the classroom, video can be downloaded before hand, as well as screenshots of Google Earth images), Materials for watershed model (a large waterproof box or a foil pan, newspapers, clay, soil, grass, toys and other decorations), Art material (notebooks, papers, markers, crayons)

LINK SECTION

6.1 - Watershed Zones - Found at <https://shorturl.at/oDHI9>

6.2 - Google Earth (google chrome) - Found at <https://shorturl.at/klrEY>

6.3 - Watershed Demo - Found on Youtube at <https://youtu.be/1cEPz5qNlyg>

6.4 - Watershed Model Demonstration - Found on Youtube at <https://youtu.be/P2JRik73mAE>

6.5 - How to Build Your Own Watershed - Found on Youtube at <https://youtu.be/g9gorwznzGI>

6.6 - From Ridge To Reef: Adapting to a changing climate - Found at <https://shorturl.at/evHM3>

EXTENSION

You may extend this lesson in several ways:

- **Real World Problems:** During a rainy day, take students around the school campus to see the watershed around your school. Have students describe where the rain is going, and where they think it will end up. Use Google Earth to confirm.
- **Science Project Idea:** Extend on the building of your watershed model, and have students hypothesize ways to hold sedimentation or littering from entering the ocean.
- **Technology Center:** [Interactive website from PBS](#) (See Link Section 6.6) explains many of the concepts that relate to Ridge to Reef human activities. Students who complete their work early or students who want to know more about this situation can use this as a way to learn more.

Appendix 6.1 - Video Credits

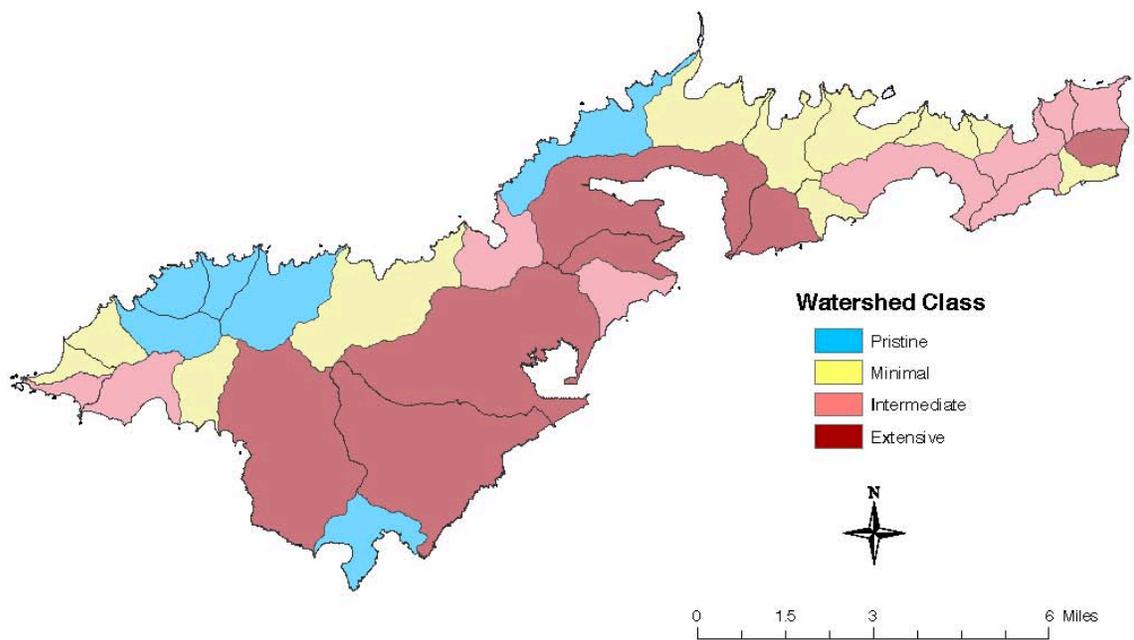
Watershed Zones Video

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- Source: GEF Pacific IWRM Project
- Project funded by: National Science Foundation

Appendix 6.2 - Watershed Image (Tutuila & Aunuu)



View publication stats

Lesson 7: The Tale of the Parrotfish

In this lesson, students will use a cheer to propose ways to improve the coral ecosystem

**American Samoa
Department of
Education
Standards and
Benchmarks**

3.8.2 Describe organisms' relationships in ecosystems
4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.
5.8.1 - Describe the types of interactions among organisms

Objective: Students will be able to develop alternative solutions for dangerous fishing practices.

Lesson Procedures:

1. Teach the following cheer to the students:

Sha boo yah sha sha sha boo yah - roll call x 2

My name is Parrot - (Fish)

And I'm on top (Yeah)

Your fishing practices (Huh?)

They need to stop (Why?)

Sha boo yah sha sha sha boo yah - roll call x 2

2. Review the different fishing practices with students using the vocabulary words from lesson 5 fishing practices.

Vocabulary Words:

1. **Overfish:** when you take too much fish from the ocean
2. **Chemical Fishing:** using poison to get fish.
3. **Explosive Fishing:** using dynamite to get fish
4. **Cast Netting:** a net that is thrown to catch fish
5. **Traditional Fishing:** common fishing methods used by locals.

3. Explain that people fish for different reasons (food or sale). Some people use different fishing practices to catch more fish. We have already learned, that some fishing practices are friendly to the coral reef ecosystem while others are dangerous. These dangerous fishing practices can disturb the food chain and threaten the coral reef ecosystem.
4. Display the food chain diagram (Appendix 7.1) explain this simple food chain to students. Food chain starts with the sun -> zooxanthellae -> coral -> parrotfish -> people. Discussion: if a fisherman uses chemicals to catch the parrotfish, would it kill only the parrotfish? Explain that it will also kill the zooxanthellae and corals (**you can remove these from the food chain as you are explaining**). Without zooxanthellae and coral, there will be no food for the parrotfish and no food for you. You may follow-up with the question, "what if the fisherman used traditional fishing practices?"
5. Play the Fishing Game: Give out the cut up food chain (see Appendix 7.2) for each group. Each group will arrange their food chain. To play the game the teacher holds the dice. Each side of the dice (see Appendix 7.3) has one of the fishing practices on it with

how many organisms in the food chain it destroys or saves. One member from each group will roll the dice. Last team standing is the winning team.

6. **Assessment:** Students will add two lines to the cheer used at the beginning of the lesson. The purpose is to advise the public on friendly fishing practices.

Sha boo yah sha sha sha boo yah - roll call x 2
My name is [student name here] (Yeah)
[add first line talks about you] (Yeah)
[add second line includes fishing practice] (Yeah)
[add final line includes advice] (Yeah)
Sha boo yah sha sha sha boo yah - roll call x 2

7. **Closure:** Explain to students that they are all connected in the circle of life, one way is through the food they eat. Corals are meant to be eaten by parrotfish, parrotfish are meant to fish and eaten by fishermen and people but when fishermen overfish, and use intense fishing methods this damages the coral reef ecosystem.

MATERIALS:

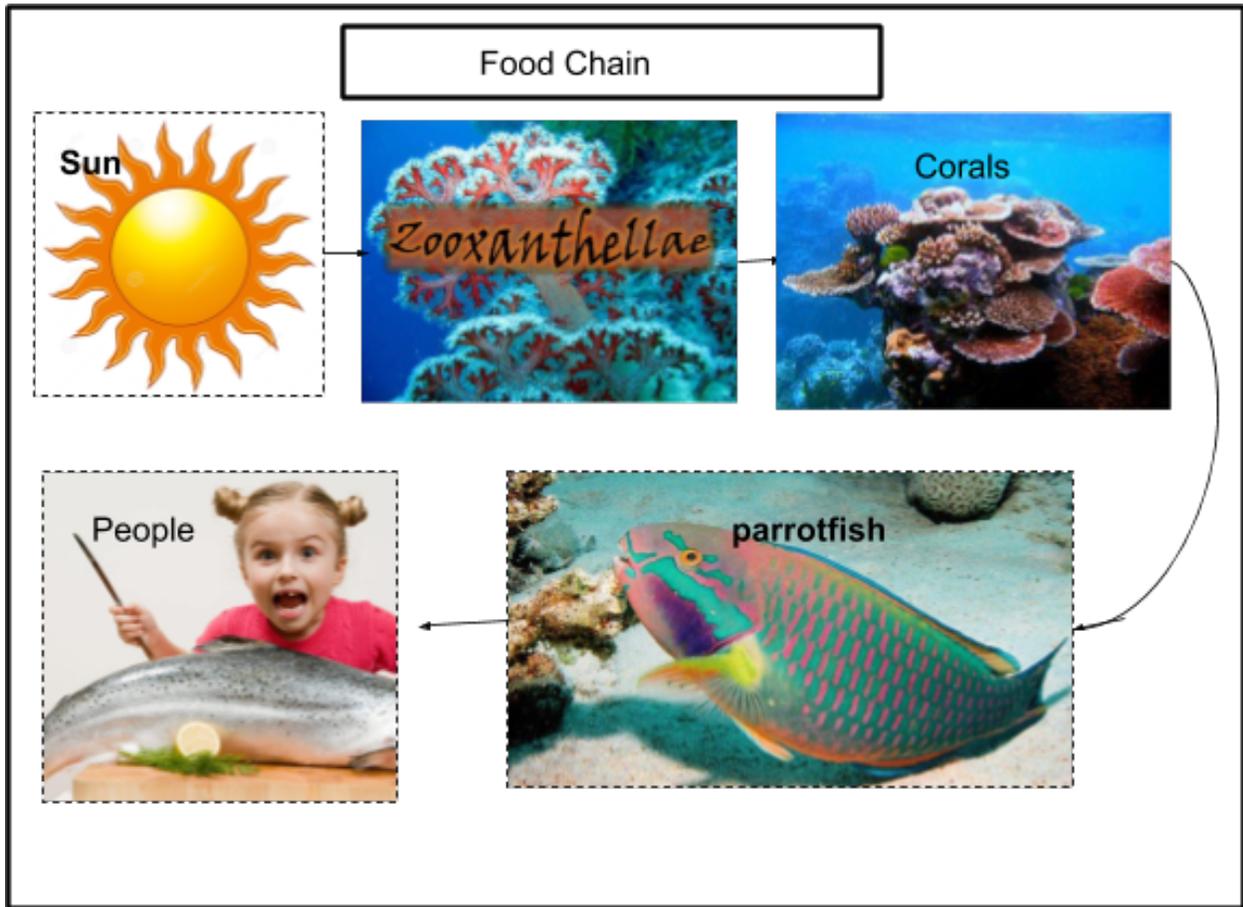
Cheer (youtube video for the rhythm of the beat), Computer, speaker, Copy of the Appendix 7.2 and 7.3, scissors, glue, printer

EXTENSION:

Role Playing: Students can pretend they are the are one of the organisms in the food chain. Then, tell them they will hunt the thing that their organism eats. Have them pretend they are underwater as they swim or act like their animal or plant. Students can switch out roles and then start again.

Creative Writing: Student can pick one of the organisms in the food chain except for people. Students will pick one dangerous fishing methods and write a letter to the fishermen informing them what happens to them when they use these methods. Have students read their letters to each other.

Appendix 7.1 - Food Chain



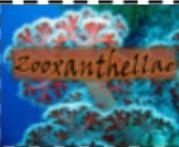
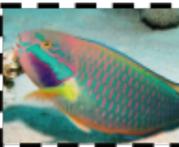
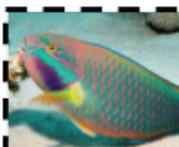
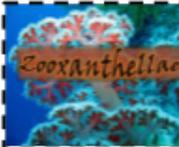
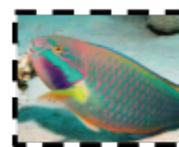
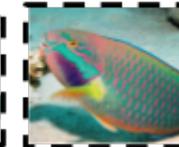
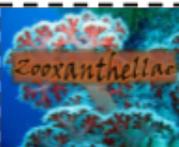
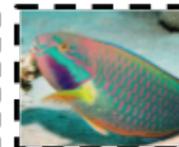
Appendix 7.2 - Food chain for kids

Direction: Cut each organism and arrows then arrange them in a food chain. Put all the same organism together.

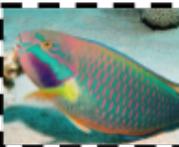
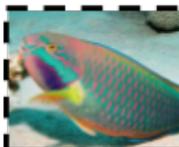
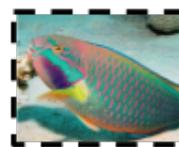
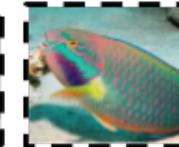
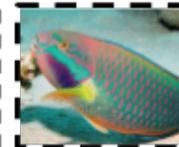
_____ → _____ →

_____ → _____ →

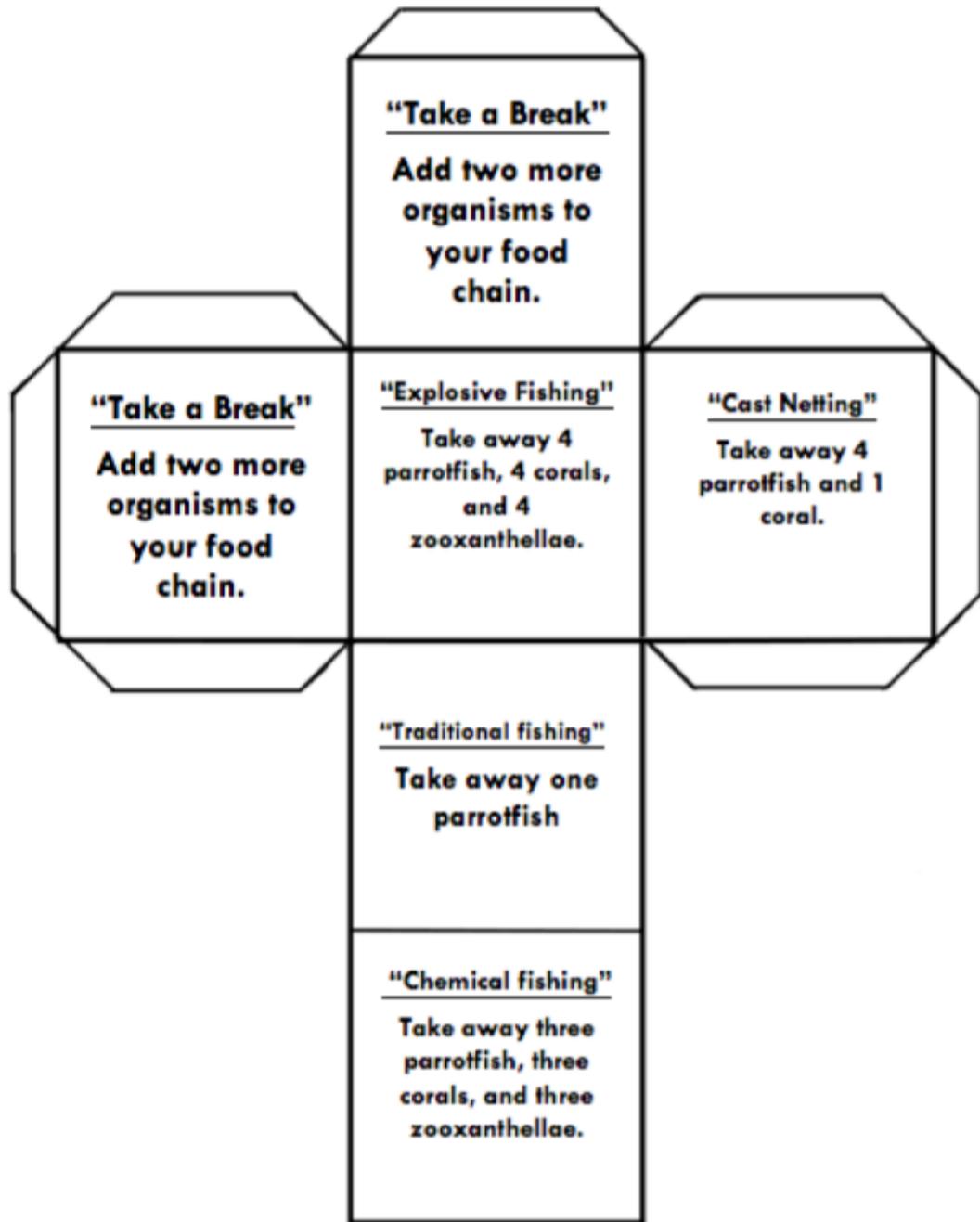


Extra pieces

Appendix 7.3 - Dice template



Lesson 8: Advice from the Crown of Thorns

In this lesson, we will be building on the demonstration conducted in Lesson 6, but trying out different solutions to the problem. Students will be using the scientific method to figure out what needs to be done to help our coral ecosystem.

**American Samoa
Department of
Education
Standards and
Benchmarks**

3.8.2 Describe organisms' relationships in ecosystems
4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.
5.8.1 - Describe the types of interactions among organisms

Objective: Students will be able to describe how littering and sedimentation affect the coral reef ecosystem, and suggest ways to help.

Lesson Procedures:

1. Read aloud the following poem "It's Up To Us" by William Thompson

*The crown-of thorns crawls on the reef
Munching, crunching away
On different coral within the reef
It would seem like any other day*

*The crown of thorns controls the growth
Of different reef species
But recently a lot more of them
Has made it pretty creepy*

*More crowns-of-thorn around the world
Are munching on the reef
Human changes caused more to grow
Much more than you believe*

*It's up to us to make a change
To help our coral reef
Although it seems so far away
Together we will succeed
(This poem was inspired by information from this reading
[Found on Page 66](#))*

2. After reading the poem to students, highlight the 3rd stanza. Discuss with students how humans have caused the crown-of-thorns to grow. You may also use the YouTube video here: [Crown of thorns](#) (no need for speakers)

3. Review Lesson 6 Ridge to Reef discussion about watershed. Remind students that our activity on land affects what happens in the oceans.
4. Have students work on the watershed model that they have created in Lesson 6. Using scientific inquiry processes, let students experiment on ways that may lessen the flow of pollutants into the oceans. Discuss the ideas of building a wall, digging a hole or planting plants in small groups and plan out the experiment.
5. Have groups build and test their model.
6. **Assessment:** Individually, students will fill out the worksheet below (see Appendix 8.1) to explain their thinking before and after their experiment.
7. **Closure:** Discuss as a class which seemed to be a better hold for the sedimentation and littering? Have students offer advice for people when it comes to planning out their homes and the areas around their home.

MATERIALS:

Copy of poem, computer, projector, watershed modeling materials, copy of Appendix 7.1 and pencil

Appendix 7.1: Scientific Inquiry Method

Scientific Method

1. Question: _____
2. Research: _____
3. Make a Hypothesis: _____
4. Test: _____
5. Analyze: _____
6. Report: _____

Experiment		
a wall	a hole	plants
Which will be most helpful in keeping the chemicals away from the water?		
I think _____ will keep the most chemicals out of the water because _____.		
Which one helped the most?		
Were you right?		

Lesson 9: What is your carbon footprint?

Propose possible solutions to combat the negative effects of Global Warming to the coral ecosystem.

American Samoa Department of Education Standards and Benchmarks

3.8.1 Observe that some changes in ecosystems occur slowly, and others occur rapidly, and that these changes can affect life-forms, including humans.

3.8.2 Describe organisms' relationships in ecosystems

4.8.1 Describe ecosystems and explore the relationships between living and nonliving things in an ecosystem.

5.8.2 Analyze how ecosystems change over extended time periods.

Objective: Students will be able to create a plan to tackle global warming effects to the coral system

Lesson Procedures:

1. Read aloud or sing the following lyrics of the adapted version of “Imagine” by John Lennon as the instrumental is played.

IMAGINE *Adapted version by Mene Tauaa*

Imagine no global warming
It's easy if you try
No coral bleaching below us
Above us only clean sky
Imagine all the corals
Living healthy today... Aha-ah... ou

Imagine no global warming
It isn't hard to do
Living things in the ocean
Have no problems, too
Imagine ocean creatures
Living life in peace... You...

You may say I'm a dreamer
But I'm not the only one
I hope someday you will join us
And the world will live as one

(you may visit [John Lennon - Imagine - Piano Instrumental - Revisited - HD](#) on YouTube for a piano instrumental)

2. Revisit “Coral: The Ocean’s Garden” Powerpoint in Lesson 4 and lead a discussion with students on the impact of global warming to the survival of the corals. Sample Questions: How does global warming affect corals? What would the loss of coral reefs mean for humankind?
3. Explain that scientists connect human activities such as burning of fossil fuels and deforestation to global warming. Global warming heats the ocean which causes coral

bleaching. Explain that there are more human activities that cause global warming but today's lesson is on "Burning of Fossil Fuels."

BACKGROUND INFORMATION:

When fossil fuels such as oil and coal are burned, they provide energy to drive cars, provide power to produce electricity at home. Fossil fuels also provides power for businesses, such as stores and offices, or industries, such as canneries and construction. When humans burn more fossil fuels, more carbon dioxide is released into the earth's atmosphere. Adding carbon dioxide into the earth's atmosphere, makes the earth hotter than before. This causes global warming.

Global warming is the warming of the earth's atmosphere for long periods of time. The heat trapped in the atmosphere is absorbed by the ocean. The ocean gets warmer, this stresses the corals, and the coral polyps ejects zooxanthellae from them. The coral loses its food supply (zooxanthellae) and turns white. This event is called coral bleaching.

4. **Class activity** to show what daily activities contribute to global warming. Students will gather in the middle of the classroom. Teacher selects a statement from the list of daily activities to read aloud. Students who answer yes, move to the right, those who answer no, move to the left, if you are not sure, you may stay in the middle.

Daily Activity Statements:

- My family has one or more air conditioners in our home.
 - Someone in my family walks to the store rather than drive.
 - In our house, we have a t.v
 - When there's nobody in a room, we turn the lights off.
 - My dad or someone in my family leaves the fan on without using it.
 - Our family has a dryer.
5. Tell students that almost all of the energy usage in American Samoa comes from the power plants. Our power plants use fuel to run the generators. This fuel releases CO₂ (Carbon dioxide) into the air. The more power that we use here in American Samoa, the more CO₂ gets released into the air.
 6. Pass out copies of Appendix 9.1. Have students work in pairs to interview each other regarding the different appliances that they have in their homes. Each appliance has a certain number of CO₂ clouds that represents the estimated appliance usage per month (large CO₂ clouds = 10 kilowatt hour, small CO₂ clouds = 1 kilowatt hour). Based on the number of appliances in the home, have students cut out the CO₂ clouds to paste above the power-plant, and they may also glue the labels of appliances found in their home. The clouds above the power-plant represents a fraction of their carbon footprint.
 7. Remind students that too much CO₂ in the atmosphere causes global warming. Lead the discussion with students on how they can help decrease the carbon released into the atmosphere. Redirect their attention to their Carbon Contribution. Who has a lot of CO₂ coming from their home? What can we do to lessen it? Do we have to throw away

everything? What can adults and kids do to help lessen global warming? How does saving energy help the ocean and coral reefs?

8. **Assessment:** Have students create signs to post around their community or school to encourage adults and other kids to act more responsibly toward saving energy and the coral reefs. Ask students as they work on their signs make sure they consider the following:
 - The sign clearly relates a message on an effective way to reduce global warming
 - The message on the sign catches the attention of the adults or kids.
 - The sign has pictures/illustrations that are creative and matches the message on the sign.
 - The sign is neat and clean
 - The sign would encourage adults or kids to take action.
9. **Closure:** Select a singer or singers to sing “Imagine” while others walk around the classroom holding up their signs like in a parade. Later, have students post their signs around the school or in classrooms.

MATERIALS:

Computer / speaker, Individual Copies of Appendix 9.1

EXTENSION:

- Light Bulb Sale - Hold a light bulb drive by selling energy efficient compact fluorescent light bulbs (CFLs) to raise money to support your community campaign or to help the school buy new light bulbs. Work to get your community to change their bulbs from incandescent to the more energy efficient CFLs.
- School Car Pool or Ride Share - Do you see more and more students being dropped off rather than taking the school bus? Try to reduce the number of cars dropping off and parking at your school by starting a carpool program for students and teachers. This will reduce congestion at school and reduce CO₂, and you may even meet some new friends.
- LetterWriting - Write a friendly letter to your elected officials to communicate your concerns about global warming and its effects on coral reefs. Your letters do COUNT and most officials will listen. This activity will definitely make a lot of difference in making your VOICE heard.

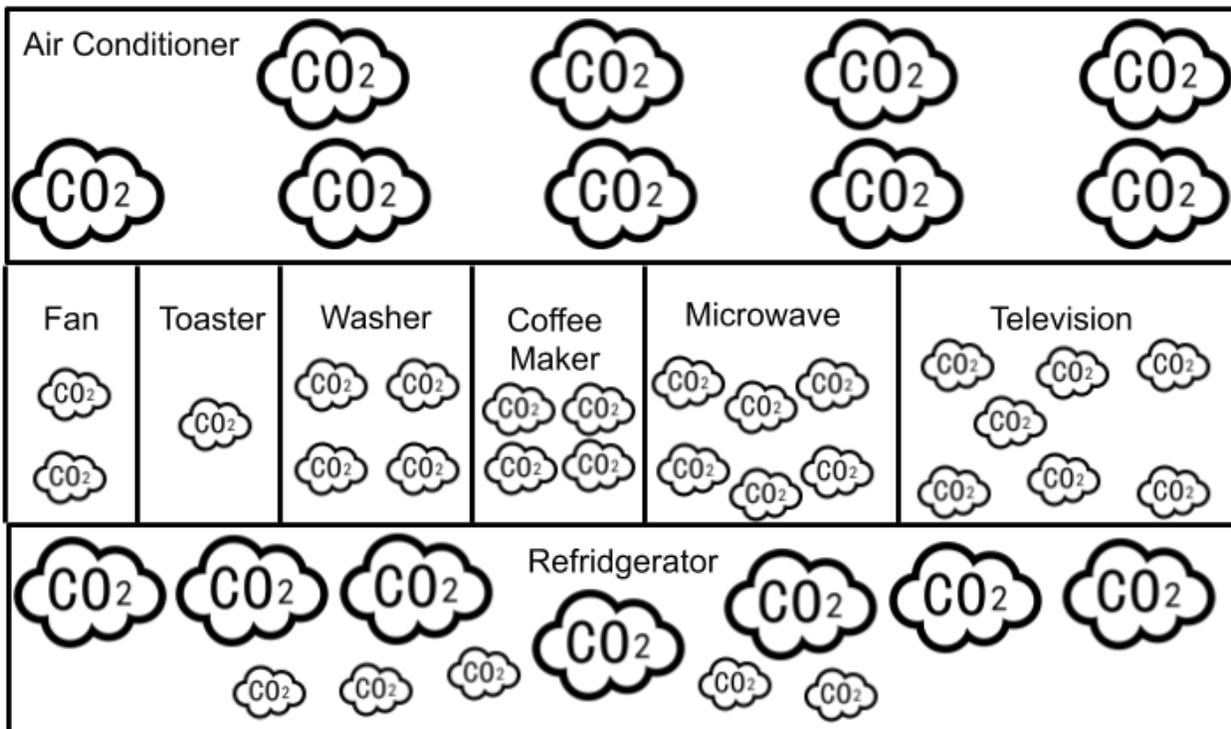
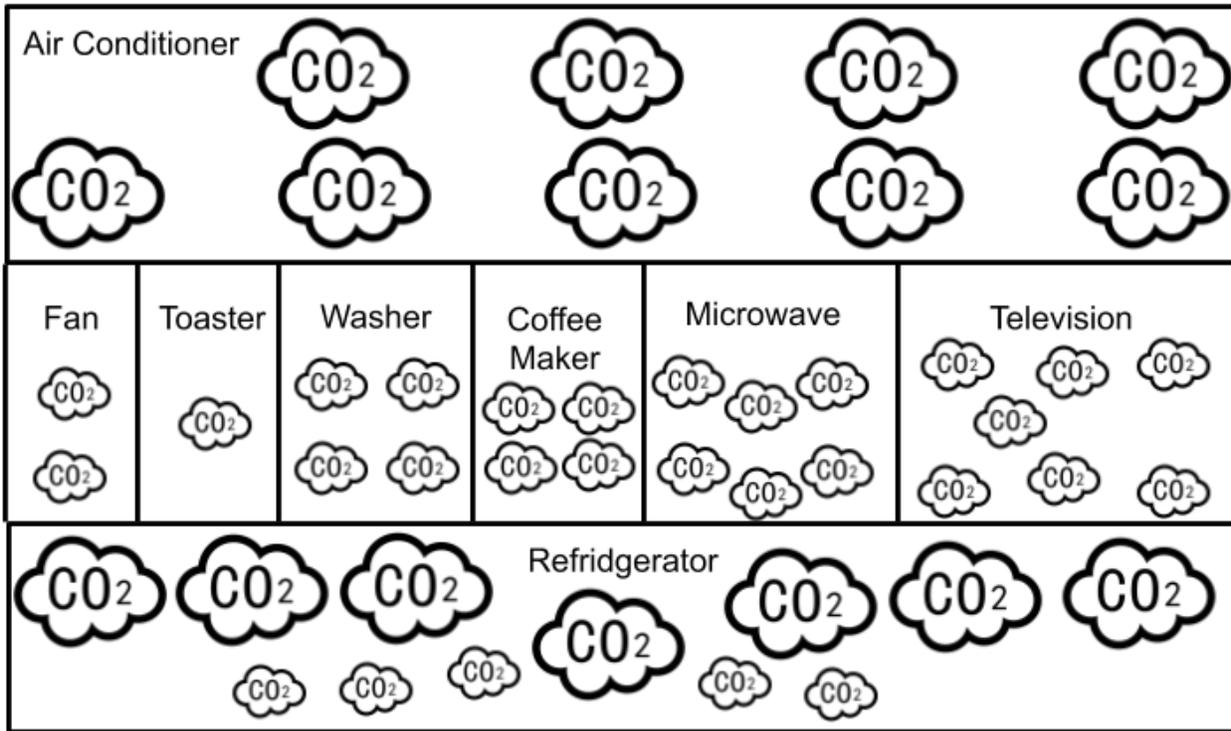
Appendix 9.1: Your Carbon Contribution

Cut out CO₂ contributions based on the appliances found in your home, and paste them above the powerplant.



Air Conditioner					
CO ₂		CO ₂		CO ₂	
CO ₂		CO ₂		CO ₂	
Fan	Toaster	Washer	Coffee Maker	Microwave	Television
CO ₂	CO ₂	CO ₂ CO ₂	CO ₂ CO ₂	CO ₂ CO ₂ CO ₂	CO ₂ CO ₂ CO ₂
CO ₂		CO ₂ CO ₂	CO ₂ CO ₂	CO ₂ CO ₂ CO ₂	CO ₂ CO ₂ CO ₂
Refridgerator					
CO ₂		CO ₂		CO ₂	
CO ₂		CO ₂		CO ₂	
CO ₂		CO ₂		CO ₂	

Appendix 8.1: Your Carbon Contribution (Extra appliances)



Lesson 10: The New Me!

This lesson will help guide students in building a Public Service Announcement (PSA) to share ways to help protect our Sacred Legacy - The Coral Reefs.

American Samoa Department of Education Standards and Benchmarks

5.8.2 - Analyze how ecosystems change over extended time periods
 5.8.1 - Describe the types of interactions among organisms

Objective: Students will be able to explain ways humans can help our coral reef ecosystem by their interactions within the environment over an extended period of time.

Lesson Procedures:

1. As a class, watch the [Read A Book PSA by 4th Grade Class](#). Ask students the following guided questions: What was the message in the video? Who do you think this video is for? How did you feel when you watch the video? Was the message positive or negative?
2. Explain to students that we will be creating our own PSA just like the one that they had just watched. We will be using a Storyboard tool to help guide our thinking. Show the students a blank storyboard (See Appendix 10.1) and guide students through filling it in. Explain to students that the first box contains the opening in the

first three seconds of the video (time frame is on the top left corner of the boxes). As a class, watch the video again, and complete the statements in the boxes. What did people say? Were there any special effects? What words were on the screen? Use the following as an example:

<p>3 seconds 1</p> <p>What people will say: None Any special effects: Trumpet sound Words on the screen: Book Patrol to the Rescue!</p>	<p>4-8 seconds 2</p> <p>What people will say: Got nothing to do? Any special effects: none Words on the screen: none</p>	<p>8-12 seconds 3</p> <p>What people will say: Read a book! Any special effects: none Words on the screen: none</p>
<p>12-16 seconds 4</p> <p>What people will say: Tired of the same old boring T.V programs? Any special effects: none Words on the screen: none</p>	<p>16-18 seconds 5</p> <p>What people will say: Read a book! Any special effects: none Words on the screen: none</p>	<p>19-23 seconds 6</p> <p>What people will say: none Any special effects: none Words on the screen: none</p>

3. In small groups, have students use the blank storyboards in Appendix 10.1 to organize their ideas for their PSA.
4. **Assessment:** Students will plan out and record a powerful PSA that is a minute or less that offers solutions for human activities affecting the ocean such as littering, pollution, watershed, sedimentation. Student PSA's should have a strong connection to the theme "Preserve our sacred legacy".

Explain to students that the audio line contains what people say, the Special Effects (SFX) line should describe any effects they use such as motion, color, etc. The Text lines should contain any words to be displayed on the screen.

5. **Closure:** Discuss the different ideas from different groups. Have students think about their introduction to their PSA and how they will showcase this to the audience.

MATERIALS:

Computer, projector & speakers, Classroom copies of Appendix 10.1 - PSA Storyboard, pencils, Video Creation software or just a phone with a camera.

LINK SECTION

10.1 -Read A Book PSA by 4th Grade Class - found at <https://shorturl.at/nU138>

Appendix: 10.1 PSA Storyboard

<p style="text-align: right;">1</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>	<p style="text-align: right;">2</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>
<p style="text-align: right;">3</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>	<p style="text-align: right;">4</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>
<p style="text-align: right;">5</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>	<p style="text-align: right;">6</p> <p>What people will say:</p> <p>Any special effects:</p> <p>Words on the screen:</p>

Culmination: “Preserve our Sacred Legacy”

Public Service Announcement Creation - Be proud of your reef. Conserve, sustain, maintain, and preserve our Coral Reefs (Culminate with a Movie Premiere of all PSA)

American Samoa Department of Education Standards and Benchmarks
3.8.2 Describe organisms' relationships in ecosystems 5.8.2 Analyze how ecosystems change over extended time periods.

Objective: Students will be able to describe positive ways humans can help our coral reef ecosystem over an extended period of time.

Lesson Procedures:

1. Introduce the unit to the audience
2. Have groups or individual students discuss the different topics discussed during the unit. (Teacher may also have a slideshow of all of the different activities that students have done throughout the unit)
 - The relationship of the parrot fish to the coral reef
 - Crown of thorns and the coral reef
 - How global warming causes coral bleaching
 - What humans do to harm the coral reef ecosystem
3. Explain that the students have created Public Service Announcements to advise their friends, families and the community of ways to help Preserve our Sacred Legacy - The Coral Reef Ecosystem.
4. **Assessment:** Have groups introduce their team, and show their PSA for the audience.
5. **Closure:** Discuss reasons why this is important for our island, and ways to help protect our sacred legacy beginning today.

MATERIALS:

Computer, Projector, Speaker, Student Works from the Unit.

