CRAFT IN AMERICA

A TREASURE IN THE SEA EDUCATION GUIDE

A TREASURE IN THE SEA: LEARNING ABOUT CORAL REEFS

"Artists can translate the science so that everyone can understand it." —Joan Takayama-Ogawa

LESSON OVERVIEW

In this lesson, students are introduced to artist Joan Takayama-Ogawa, whose recent ceramic sculptures highlight the effects of climate change on nature. Students learn about coral reefs, and how the reefs are affected by warming oceans and climate change. While constructing creative representations of coral through sketching and from clay, students learn how coral is formed and how it can become bleached by warming oceans and thus be in danger of dying. Students create representations of coral, choosing between a realistic or an exaggerated style, collaborate to arrange a "reef" of the finished pieces, and add infographics about coral reefs and their survival. The reef is displayed in school, serving as a model to teach others about the value of coral reefs and the effects of climate change on the reefs.

Grade Level: 1–5

Estimated Time: four to five class periods

Craft In America Theme/Episode: SCIENCE

Background Information

Artist Joan Takayama-Ogawa is an accomplished sansei, or third-generation Japanese American. Building on her family's rich creative history, she studied under the renowned Ralph Bacerra and went on to develop work that used ancient Japanese ceramic forms as a guide in creating contemporary pieces that utilize decoration and imagery of an American lifestyle. She continues to push the boundaries of ceramics by integrating clay with digital and rapid prototyping technologies. She served as a Pasadena Design Commissioner and on the Board of Directors, American Museum of Ceramic Art. Takayama-Ogawa has published over 30 books and magazines, and in 2004 she was Otis Teacher of the Year and Commencement Speaker.

Key Concepts

- Artists can make artworks that are designed to teach.
- Artists can create art about nature that is realistic or fanciful and exaggerated.
- Artists can experiment with clay to model textures found in nature.

Critical Questions

- How might artists make art that is designed to teach?
- How might artists make art about nature that is realistic? How might artists make art about nature that is fanciful and exaggerated?
- How might artists experiment with clay to model textures found in nature?

Objectives

Students will:

- understand that artists can make artworks that are designed to teach.
- create a realistic or fanciful/exaggerated representation of coral that is designed to teach about coral reefs.
- experiment with clay to sculpt and add texture to a model coral colony.

Vocabulary

acidic, algae, carbon emissions, colony, coral, coral reef, exoskeleton, infographic, kawaii, polyp, potable, scientific illustration, soft coral, stony coral, texture, undulate, zooxanthellae
*Note: The word algae can be used in place of the more complicated (to spell and pronounce) zooxanthellae. However, zooxanthellae may be a fun word for students to learn, master, and use during this lesson. You can find a recorded pronunciation online: zow-uh-zan-theh-lai.

Interdisciplinary Connections

- Science: Coral reefs and other ecosystems in water and on land, and the effects of climate change on each of these, are rich topics for further investigation in both science class and art class. See also: Extensions (below).
- Mathematics: Corals feature hyperbolic geometry in their structures that can be represented by shaping clay, by folding paper, and by crocheting with yarn. It is a complex topic that can be introduced at a basic level through these crafts. See Erik and Martin Demaine under Extensions (below).

National Standards for Visual Arts Education

This lesson addresses the following standards. The performance standards listed here are directly related to the lesson's goals.

- Creating:
  Anchor standard 1: Generate and conceptualize artistic ideas and work.
  VA: Cr1.1.1a
  Engage collaboratively in exploration and imaginative play with materials.
- Presenting:
  Anchor standard 5: Develop and refine artistic techniques and works for presentation.
  VA:Pr5.1.3a
  Identify exhibit space and prepare works of art including artists' statements, for presentation.
- Responding:
  Anchor standard 7: Perceive and analyze artistic work.
  VA:Re.7.2.2a
  Categorize images based on expressive properties.
- Connecting:
  Anchor standard 11: Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.
  VA: Cn11.1.1a
  Understand that people from different places and times have made art for a variety of reasons.

Resources and Materials for Teaching Resources

- Craft in America SCIENCE episode, craftinamerica.org/episode/science, Joan Takayama-Ogawa's segment, and Craft in America's website, craftinamerica.org
  *Note: The beginning of Joan's segment has powerful imagery of natural disasters that are appropriate to the topic but may be unsettling for the youngest students; in that case you could begin the segment at about a minute into her segment.
- Joan Takayama-Ogawa's website, joantakayamaogawa.com
- Images of Joan Takayama-Ogawa's work from the Craft in America website and the video, particularly her colorful oil-spill filled teacups, sushi tray with oil derricks and vehicles, and the bleached white coral pieces (*Tipping Point, America's Crude Awakening, Hope for a Cure, Crying Coral, Water Warrior*).
- Images of coral and coral reefs, and diagrams of coral polyps and zooxanthellae for reference in class. Gather books from the library that feature sea life including colorful imagery of coral reefs, seaweed, fish, sea turtles, etc.
- You can find and incorporate a game-like activity that demonstrates coral bleaching for students to play at this NASA website, climatekids.nasa.gov/coral-bleaching.
- The NOAA website has useful information that can help you explain the mutually beneficial relationship between coral polyps and zooxanthellae in more detail. (For example, use this information with Worksheet 2.) oceanservice.noaa.gov/education/tutorial_corals/coral02_zooxanthellae.html
- This poster explaining coral bleaching for use in the classroom, oceanservice.noaa.gov/facts/coral_bleach.html
- This downloadable guide to coral reefs with images of colorful coral, vocabulary, and activities for students, coral.org/en/blog/kids-guide-to-coral-reef-conservation

Worksheets

- Worksheet 1: A Treasure in the Sea
- Worksheet 2: Corals and Zooxanthellae Are Friends
- Worksheet 3: Our Coral Reef is Sick!

Materials

- Sketchbooks
- Pencils, markers, crayons
- Paper punches
- Scissors
- White clay (*Note: If clay and kiln are not available, other options are air-dry clay, oil-based clay, which remains pliable and is not fired, or a salt dough recipe that can be baked in an oven.)
- Slip (equal parts clay and water, used to glue clay pieces together while building.)
- Clay tools
- Kiln
- White glue
- Paintbrushes
- Watercolor paints, Tempera paints
- 8 ½ by 11-inch paper for making signs
- Colorful papers for creating algae/zooxanthellae, fish, turtles, seaweed, etc.
- Sets of alphabet stamps, up to about 3/8 inch in height, are useful for marking student names or initials on the base of the clay sculptures.

INSTRUCTIONAL STRATEGIES
(one to two class periods)

After asking students about their knowledge of ocean life, the class views the segment on ceramic artist and teacher Joan Takayama-Ogawa from the Craft in America: SCIENCE.

Using the questions on Worksheet 1: A Treasure in the Sea, the teacher guides the class to listening for and recording information about the artist. Students examine her work closely and think about what she wants her artwork to do. They draw and color a coral of their choice. Using Worksheet 2: Corals and Zooxanthellae Are Friends, students read basic facts about coral formation and the problem of bleaching in coral reefs. They sketch science-based diagrams of coral and zooxanthellae. Using Worksheet 3: Our Coral Reef is Sick!, students research why coral reefs are important and valuable.

The class again examines images of Joan Takayama-Ogawa's coral works and compares her works to photos of coral. Students consider whether they want their own clay coral models to be realistic or exaggerated and fanciful, and they sketch their ideas. Students begin making their coral out of clay. After clay sculptures are fired, they add paint and paper details. To make informative signs for the reef display, students choose which facts from Worksheet 2 they would like to highlight. Finally, they arrange a display of their combined coral reef to share with the rest of the school.

Before Viewing
Introduce the scope of the lesson to students, sharing the key concepts, critical questions, and objectives. Ask for some volunteers to make a list on the board in response to these questions.

- What are all the things you can think of that live in the ocean?
- What do you know about coral and coral reefs?

Responses may show some knowledge of coral reefs. Note: Students may have seen the PBS series *Splash and Bubbles* or the animated series *Octonauts*. Both children's programs feature appealing animated sea creatures and are meant to teach about ocean life. Students may eventually decide to make their coral realistic or to use a kawaii-like style or superhero features (seen in the shows and present in popular culture) to create their own models of coral that will attract interest and attention. Share images of coral and coral reefs (and the other sea life that relies on coral reefs as a home) with students and invite students to take turns describing what they see. Share with students: We are going to learn about coral reefs and make our own model of a coral reef together.

Introduce the video and artist Joan Takayama-Ogawa to students. You might say, We are going to see an artist, Joan Takayama-Ogawa, who creates sculptures of coral from clay.She is worried about climate change caused by things like carbon emissions from car and airplane engines. She makes art about how climate change affects nature. You will see her work with clay. And since she is a teacher as well as an artist, you will see her working with her students.

While watching the video, have students use Worksheet 1: A Treasure in the Sea to fill in answers to questions about the video. Pause the video at different times so students can record their answers. You might allow them to work together in small groups to spot and share the answers to the questions. (Possible discussion responses are listed in the Worksheet 1 teacher's guide.)

After Viewing

Explore the Artwork

Share printed images of Joan Takayama-Ogawa's work with students and take time for students to more closely examine the works (including the titles). Engage students in a conversation about her work. Some possible questions from students, and responses, might be:

- Why does she have oil spilling out of a teacup? We couldn't drink that.
- Why are there airplanes on the sushi? You're right! We couldn't drink the oil. It would make us sick.
- Do you think maybe that is what she is saying? That climate change could affect what we eat and drink in some way?
- Why is the coral all white instead of colorful?
- Why is it on those pedestals like statues? Remember Joan Takayama-Ogawa said that bleached coral is white. If it stays bleached for too long it dies, like the coral her student brought back from the beach. It looks like bones.
- Could these be like gravestones or memorials to remember the coral?

Return to Worksheet 1 and suggest that students add a colorful drawing of a coral they choose from the images available in the classroom or online.

Learn More About Bleaching

This is a good time to allow students to play NASA's game-like interactive feature (listed in the Resources section.) It allows students to increase ocean temperature and acidity to view what happens to coral during the process of bleaching.

More About Coral

Use Worksheet 2: Corals and Zooxanthellae Are Friends to introduce more facts about coral and coral bleaching. These facts explain that the coral and zooxanthellae rely on each other for survival. After you have read the facts along with the students, hand out images (or have students search for them online) of coral polyps, which look like little plants with tentacles, and zooxanthellae, which look like little round cells. Guide students in drawing and labeling these on the back of Worksheet 2.

Coral Reefs in Danger

With Worksheet 3: Our Coral Reef is Sick! guide students to research online or with handouts why coral reefs are important and valuable. Some facts are listed in the Worksheet 3 teacher's guide. Have the class revisit the process of bleaching. Help students think about ways people can help coral reefs stay healthy. Remind them that they will make a model coral reef together and display it with information about coral and coral reefs. Their model reef with information may help spread the word about the importance of coral reefs and the dangers they face through climate change.

Have students look again at Joan Takayama-Ogawa's work. Remember when we talked about what her work might mean? That we can't really eat polluted things like oil in teacups or sushi with airplanes. And that her bleached coral is like a statue that shows coral is important. She wants people to know this. She wants to get their attention. How would you make a clay coral that would get people's attention? Here you can highlight images of coral reefs and related sea life that range from realistic (photographs and photo-like representations) to cartoon like, as well as Joan Takayama-Ogawa's work which includes exaggeration and puns (in the colorful pieces) and some abstraction (in the coral pieces).

Planning For Art Making
Remind students that they will be creating their own coral to teach others about the effects of climate change on coral reefs. They will need to create a clay model of coral. They will also create infographics to explain the characteristics of coral reefs and the dangers they face. On their worksheet, students can sketch ideas for their own realistic or exaggerated or fanciful coral models.

Studio Production
(two to three class periods)

Some premade examples of coral models may be helpful during studio work. Explain to students that the coral they each make will be arranged with all the other coral sculptures to represent a reef. Students may want to work together to make their coral, as they share ideas and opinions. Remind students that the coral reef display will need some bleached (white) coral since one goal is to teach about the bleaching that is happening to coral. You could have students make a second pinch pot base that will be textured but left unpainted, or have some fast workers make extras of these to share in the coral reef display.

Demonstrations

Gather students for demonstrations in between letting them experiment with the clay. It is helpful to have a student volunteer or two following your lead so the class can watch a peer try out the demonstrated techniques. In general, guide students in making a roundish base for their coral, adding sculpted detail, and experimenting with creating texture.

Demonstration 1: Make a coral base from clay
Show how to make a small pinch pot base for the coral. Hold a small 2-3 inch ball of clay in one cupped hand. Show students how to roll the ball from their piece of clay. Press into the ball with the opposite thumb to make a hole but not all the way through to the bottom. Turn the ball of clay a quarter turn or so in your hand while pinching with your thumb and forefinger of the other hand; continue turning and pinching until clay forms a cup-like shape with walls about ¼ inch thick. Remind students to not pinch too hard or the clay walls will get too skinny. If the walls get too thin, the cup may collapse. Note: This method can be tricky. A second way that can be helpful for some students is to have them roll the clay into a ball and then scoop out the inside with a clay loop tool to hollow out the ball. After the cup-like shape is formed, they can smooth out the inside and outside of the clay. The coral cup shape can be placed open end up, or be turned upside down for varied coral shapes. Show students how to label their coral cups with the rubber alphabet stamps, adding, for example, class number and then student initials.

Demonstration 2: Sculpt details and add texture
Using images for ideas, students can add small shapes to their coral. For example, demonstrate how to make a snake-like roll, cut it into small pieces, and then attach the tube-like pieces to the coral model, using slip as glue. Show how to gently press tools into the clay, or scrape the clay with a tool, or "draw" on it with a pencil to make interesting textures. It can be helpful to have a large slab of clay for students to try out texturing ideas before they carefully apply them to their own coral. Note: If students are choosing a fanciful, exaggerated style such as kawaii, or adding other personified or superhero features for their coral, they can add such features with clay now or later with paint or paper pieces. When coral shapes are finished, allow them to dry completely, then fire.

Demonstration 3: After firing, add paint and paper zooxanthellae
It is time to add color to the fired coral. Let students know that the paint and paper details will represent the zooxanthellae. Watercolor and tempera will each look different on the clay. It's helpful to show students examples of each so they can choose. Show students how to cut small paper shapes of colorful papers using a scissors or paper punch (which resembles the round shape of zooxanthellae). These can be glued to the clay coral.

Planning the Display: Help students plan the arrangement of the coral reef display. Returning to Worksheet 2, they can refer to the facts they would most like to share and plan the infographics (signs) that will feature this information and be displayed with the reef. Students may want to work with a partner or small group to create signs. Paper (8 ½ by 11 inches gives students room to letter) rulers, pencils, and markers can be used. Students can draw and color images of soft corals, fish, sea turtles and the like to cut out and place among the clay corals. They can also cut such images out of color copies or from magazines.

CLOSING STRATEGIES

Decide how long to display the coral reef. Talk with students about possible publicity for the project. Students may want to write a letter to the public relations representative at your school, requesting that the project be photographed and featured on the school website.

Reflection
After the installation of coral reef has been shown for a while, you can engage students in a discussion about whether they had any interactions with viewers. Some prompts include:

- Did anyone ask you about the coral reef?
- Did you share the project with anyone, such as family or friends?
- What would you change about our coral reef project, if anything?

Assessment
In discussions with the class and with individual students throughout the lesson; by examining the students' worksheets; and by witnessing the students' studio work, it should be evident that the student:

- understands that artists can make artworks that are designed to teach.
- constructed a realistic or fanciful/exaggerated representation of coral that is designed to teach about coral reefs.
- experimented with clay to sculpt and add texture to a coral colony.

Extensions
Craft in America: SCIENCE includes additional artists whose art is based in science: Erik Demaine and Martin Demaine (representing math theories in paper and glass); John Luebtow (a glass artist); Chris Maynard (detailed cutwork made from bird feathers); Karen Nyberg (an astronaut who has quilted in the space station); and Joseph and Sergio Youngblood Lugo (crafting wood fired pottery using traditional methods of the Santa Clara Pueblo, known as cultural science.)

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Worksheet #1: A Treasure in the Sea

As you view the video about the artist, Joan Takayama-Ogawa, think about the following questions:

1. What is Joan Takayama-Ogawa's job?

2. What does Joan Takayama-Ogawa use to make her art?

3. What does the artist hope people learn from her art?

4. What did the artist need to learn about to make her coral artworks?

5. Who told her about coral bleaching?

6. Do her coral sculptures look exactly like real coral?

Choose a coral from the pictures you see in your classroom. Draw it on the back of this sheet. Add color with crayons or markers.

Worksheet 1: A Treasure in the Sea Teacher's Guide

1. What is Joan Takayama-Ogawa's job?
   She is a teacher and an artist.

2. What does Joan Takayama-Ogawa use to make her art?
   She uses clay.

3. What does she hope people learn from her art?
   She wants people to learn about climate change. She says, "If a person is drawn in by a piece of my art, maybe the story I'm trying to tell about climate change will reach them."

4. What did she need to learn about to make her coral artworks?
   She had to learn about how to use clay. Her teachers taught her lots of ways to work with clay. She had to learn about climate change. And about coral.

5. Who told her about coral bleaching?
   One of her students shared some bleached coral from their home in Guam. The student said, "Our coral reef is sick."

6. Do her coral sculptures look exactly like real coral?
   Kind of. They look like bleached coral because they are all white. And they have bumpy textures like coral. But they are also not exactly like real coral. They are on pedestals. They are interesting looking, like people would want to get closer to see what they are and see the texture and detail.

Choose a coral from the pictures you see in your classroom. Draw it on the back of this sheet. Add color with crayons or markers.

Worksheet 2: Corals and Zooxanthellae Are Friends

Facts About Coral

With your teacher and fellow classmates, read the following facts about coral. Choose at least one fact that you personally find especially interesting and would like to share with others. Place a symbol (heart, exclamation point, star, etc.) next to that fact.

1. Millions of tiny creatures called coral polyps attach themselves to each other on a rock base and grow to make a large, solid coral. It is called stony coral.

2. Some coral looks like seaweed and undulates (sways back and forth) in the water. It is called soft coral.

3. Zooxanthellae are tiny algae. They attach to the coral and make it look colorful.

4. The coral polyps and the zooxanthellae need each other to survive.

5. The coral gets substances from the zooxanthellae that help it make food.

6. The zooxanthellae get protection from the coral, and materials to help with photosynthesis.

7. Many corals make up a coral reef. The reef provides food and homes for lots of other sea creatures.

8. When ocean water gets too hot, the coral polyps are stressed and may reject the zooxanthellae. The coral turns white.

9. When coral turns white it is called bleaching. At this point the coral does not have food anymore, and it may die.

10. If all the coral in the reef is bleached, other animals that live there may die, too.

Draw to Learn!
From the pictures provided by your teacher, choose a picture of a coral polyp and draw one on the back of this sheet.
Find a picture of a zooxanthellae and draw one on the back of this sheet.
Make sure to label both of your drawings.

Worksheet 3: Our Coral Reef is Sick!

It's time to do research! Find answers to this question:
Why are coral reefs valuable and why should we care about them?

One reason is that they are beautiful and interesting. Another reason is that coral reefs are ecosystems: an area filled with all kinds of plants and animals that live together and make a healthy place in nature. But there are many more reasons. Try to find at least three.

1.

2.

3.

DANGER! DANGER! DANGER!

1. What happens when the ocean gets too warm?

2. What is bleaching?

3. What does the artist, Joan Takayama-Ogawa do to teach about the importance of healthy coral reefs?

4. What are some things you want people to know about coral and coral reefs?

Draw to Share Ideas!
Draw a coral you think you would like to make to share your ideas about coral. Make it realistic, or make it exaggerated or cartoon-like. Think about what would get people's attention.

Worksheet 3: Our Coral Reef is Sick! Teacher's Guide

It's time to do research! Why are coral reefs valuable and why should we care about them? One reason is that they are beautiful and interesting. Coral reefs are ecosystems: an area filled with all kinds of plants and animals that live together and make a healthy place in nature. But there are many more reasons. Try to find at least three.

1. Coral protects fish that are food for many people.

2. Coral can protect seashores from large storms that can wash away land.

3. Researchers are looking in coral reefs for new medicines to help people.

4. Coral reefs provide jobs for many people, for example through fishing or taking tourists to see the reefs.

DANGER! DANGER! DANGER!
Remember that when the ocean gets too warm, the coral gets stressed and then rejects the zooxanthellae. This is called bleaching. Then the coral loses its food. It turns white. If the coral is stressed for too long, the coral and the reef will die. Can we help the coral?

- Joan Takayama-Ogawa says that we can use less fuel by not wasting food.

- And that we can be artists who help to teach other people about the importance of healthy coral reefs.

- We can tell others about the value of coral reefs by making artwork about it.

Can you think of other ideas?

- We can support research about helping coral reefs stay healthy.

- We could walk or ride our bikes sometimes instead of driving in cars.

Draw to Share Ideas!
Draw a coral you think you would like to make to share your ideas about coral. Make it realistic, or make it exaggerated or cartoon-like. Think about what would get people's attention.