

## Living Lab Trip

**Guiding Concept:** Students will learn about how kelp and the organisms that live in the kelp forest are adapted to the physical environment and why it is important to protect kelp.

**Make a Difference Actions:**

- (Today) Work as an urban planner to design a protected area in your neighborhood.
- (Tomorrow) Become a biomechanic and study how plants and animals are adapted to their environment.

**STEM Discovery Focus:** Investigate and Analyze

Ocean Discovery Unit

**Cross Cutting Concept:** Understanding Structure and Function: *The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.*

**SE Practice:** Constructing Explanations & Designing Solutions: *The products of science are explanations and the products of engineering are solutions.*

**DCI:**

- Physical Science: 4-PS4-1 *Waves and Their Applications in Technologies for Information Transfer*
  - Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
- Life Science: 4-LS1-1 *From Molecules to Organisms: Structures and Processes*
  - Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Unit NGSS Alignment

**Main Instructor Roles**

- Classroom management & timing of lesson
- Lead discussions & ask guiding questions to get students thinking about science
- Use Belief and STEM exploration language during lesson
- Provide rules for activities
- Call on students to include as much of the class as possible

**Additional Staff/Volunteer Roles**

- Prep materials
- Whenever not prepping supplies
  - Sit with students during lesson and provide a model of behavior
  - Walk around and interact with students, ask questions, help, etc. when activities are in progress
  - Help motivate students who seem off task

**Supplies:**

- Laminated time table (1/instructor/volunteer)
- Community Agreements poster (2)
- Water bottle (1/student)
- Field Notebook (1/student)
- Pen (1/student)
- Ocean Leader video
- Kelp poster (1)
- 5 gallon bucket (6)
- 100 mL beaker or similar (4)
- Rubber surgical tubing (2)
- 4 in. diameter plumbing pipe slit lengthwise on one side to slip over bucket handle (8)
- A bar, hook, or other attachment point to hang algae from (4)
- Long piece of giant kelp (2)
- Plastic 6-pack ring (4)
- Towels for cleaning up water spills (if algae experiment has to be done indoors on a rainy day) (5-6)
- VR glasses (1/student)
- Ipad (1/student)
  - with kelp forest video loaded onto ipad
- Pencils (100)
- Laminated City Heights map (12)
- Laminated Triangle Map (12)
- Paper with outline of “Triangle Property” (25)
- Eraser (12)
- Ruler (12)
- Plastic art bin (6)
- Tape (2)
- Laminated numbers 1 - 6
- Digital Camera (1)
- Blank paper (20)
- Post it notes (100)
- Hand sanitizer
- Blankets to sit on for lunch (8)
- Trash & recycling bag
- Water cooler (2)
- Postcards (100)
- 3 folders
- Coastal Field Trip field notes (in a folder with teacher/school name)
- 3 large manila envelopes (pre-stamped)
- Stapler (4)
- Large pieces of 11x17 construction paper (1/student)
- Engineer of the Day Wall
- Extra letter for Engineer of the Day Wall
- Folding Tables (1) – for water coolers
- Curiosity cubes (3)

**Timing**

<b>Time</b>	<b>Group 1</b>	<b>Group 2</b>
9:30	Arrival-Watershed Plaza	
9:35-9:55	Welcome + Community Agreements + Ocean Leader Video Group 1: SciTech Lab Group 2: EcoLab	
9:55-10:40	SciTech Lab/Plaza Del Sol - Kelp Adaptations	EcoLab - Citizen Science
10:40-10:45	Bathroom Break	
10:45-11:30	EcoLab - Citizen Science	SciTech Lab/Plaza Del Sol - Kelp Adaptations
11:30-11:55	Lunch/Bathroom Break Fisler Family Adventure Tree	Scientist Career Show & Tell Ocean Alcove
11:55-12:20	Science & Conservation Leader Show & Tell Ocean Alcove	Lunch/Bathroom Break Fisler Family Adventure Tree
12:20-12:40	Reflection - Ecolab	Reflection - SciTech Lab
12:40-12:50	Believe Survey - Ecolab	Believe Survey - SciTech Lab
12:50-1:00	Clean Up & Depart	

**Arrival & Walk to Site (5 min)**

- Play Welcome Song
- Meet buses or walking students
- Bathroom/water break
- Introduce Living Lab
  - Ask students if they have visited before
  - Our Living Lab is a place where elementary, middle, and high school students, like you, from City Heights can come to visit after school to explore and learn all about science
- Divide students into two groups (1 group/class)
- Intro ODI the fish mascot and have students high five him on the way past
- Take Group 1 to the Eco Lab Lab
- Take Group 2 to the Sci Tech Lab

### **Welcome & Community Agreement & Ocean Discovery Alumni Video (20 min)**

#### Set Up

*This will need to be set up in each lab*

- Water bottles (35/lab)
- Community Agreement poster (1/lab)
- Load up Ocean Leader video (play through one time to check audio)
- Field notebooks (35/lab)
- Pens (45/lab)
- Fill water bottles
- Make sure all previous notes in field journals have been removed
- Have folder of coastal field trip notes ready to return to students

#### Teaching Notes

- Help to hand out water bottles
- Move lunches to Achievement Alcove
- Take students to bathroom
- Hand out field notebooks and pens.
- Walk around and confirm that each student has written their first AND last names on the first page of their journals

**Goal of Station:** Students will agree to behavioral expectations for the day, students will feel like scientists and will continue to construct an explanation of how kelp is adapted to its physical environment and how they can be an urban planner in the future to create and protect important natural spaces.

- Introduce yourself.
- Let all staff members introduce themselves and say one sentence about themselves.
  - Ex. My name is David I have been volunteering with Ocean Discovery for two years now and I am a student at San Diego State.
- Review of community agreements -expectations about **how scientists work together**.
- Ask students to abide community agreements with a verbal “yes” or thumbs up, etc.
- Explain that you will again be **working as a team of scientists** to continue your **investigation** of kelp forests.
- Remind students that scientist ask a lot of **questions, make observations, look for patterns** and try to **construct explanations** for their observations and questions.
- Give each student a water bottle, field journal and pen.
- Have students open to the first blank page and write their full name and teacher’s name on top.
- Introduce alumni video.
- Play video.
- *After video and while students are doing think-pair-share have teacher hand back field notes from the coastal field trip.*
- THINK-PAIR-SHARE: Could you be a scientist like Tony?

- THINK: Write in your field notebook- could you be a scientist like Tony?
- PAIR: Share your thoughts with a partner
- SHARE: Call on a couple of students to share their thoughts.

### **Kelp Adaptations – Plaza Del Sol (45 min)**

**Objective of Station:** Students **investigate and analyze** how kelp is adapted to survive its physical environment.

Instructor Notes: The goal of the experiment is NOT to break the kelp, the goal is to show that kelp is elastic and does not get deformed by stretching while the plastic 6 pack ring is not elastic and will stretch out and not be able to return to its original shape (non-elastic).

#### **Set Up:**

- Set up two identical experiment stations. The group will be split in half so that each half of the group can perform the same experiment.
- Each station will have:
  - 5 gallon buckets with 4 in diameter plumbers pipe on the handle (2)
  - 5 gallon bucket
  - Piece of giant kelp (1)
  - Plastic 6-pack ring (2)
  - Hanging point with piece of 4 in diameter plumbers pipe
  - 100 mL beaker (2)
- Find two locations where you will be able to hang the algae and the plastic six pack ring.
- Place a 4-6 inch piece of the 4 in. diameter plumbers piping over the handle of a five gallon bucket. Repeat for all four buckets.
- Unsnap bucket handle and slip plastic 6-pack ring over handle so that one of the holes sits over the plastic plumbers pipe. Secure it with surgical tubing. Repeat for a 2<sup>nd</sup> bucket.
- Attach the other end of the plastic 6-pack ring to your hanging point and secure the 6 pack ring to the 4in diameter plumbers pipe with surgical tubing. Repeat for other 6 pack ring.
- Do not set up algae yet you will do that with the students.

#### **Teaching Notes**

- Run experiment with half the students.
- Help students pour 100 mL increments of water.
- Help students understand what is happening during the experiment.

### Introduce Experiment (15 min)

- Review with students the anatomy of kelp using kelp poster
  - Canopy
  - Stipe
  - Air bladders
  - Blades
  - Holdfast
- Have students look over their field notes from the Physical Environment station at the coast.
- Review with students what the physical environment that kelp lives in is like.
  - Sunny
  - Cold
  - Waves
- Tell students that you are going to focus more today on how kelp is adapted to waves.
- Play video:
  - <https://www.youtube.com/watch?v=oNwkukrt-eo>
  - <https://www.youtube.com/watch?v=oMYGJAO-0k8>
    - Start at 0:30 and let play in the background silently after students have watched for approximately 30 seconds.
- Ask students what they notice about kelp in the waves.
  - Focus the conversation on movement – the kelp moves a lot.
- Ask students to consider what kelp must be made of to move like that. Could it move like that if it was a made of glass? – No.
- Explain that kelp must be bendable and stretchy in order to survive in an environment where waves are always moving it around.
- Kelp has a special adaptation that helps it survive in this environment and that is called elasticity.
- Ask students if they can think of things that are elastic.
  - Rubberbands
  - Hair scrunchies
  - Springs, etc.
- The definition of elastic is: something capable of returning to its original shape after being stretched, pressed or squeezed together.
- Explain to students that they are going to do an experiment to compare the elasticity of kelp to the elasticity of a plastic six pack ring.
- THINK-PAIR-SHARE: Hypothesis: Which will be more elastic kelp or the six-pack ring?
  - THINK – Students think and write their hypothesis in their field notebook.
  - PAIR – Students share their hypothesis with a neighbor.
  - SHARE – Teacher calls on different students to share their thoughts or neighbors thoughts.
- Explain to students that they will do an experiment to see if their hypothesis is correct.
- Take students outside to do experiment.

### Experiment (15 min)

- Let students touch and feel the kelp before attaching it to system.
- Ask students what it feels like and if they think kelp will be elastic.

- Set up the experiment and talk students through it.
  - Attach kelp to 5 gallon bucket by wrapping it several times around the plumbers pipe around the bucket handle and securing it with surgical tubing.
  - Attach the other end of kelp to hanging point by wrapping the other end around the plumbers piping several times and securing it with surgical tape.
  - Show students that the same set up is already in place for the plastic 6 pack ring.
  - Explain to students that you will add water to the bucket to add weight.
  - You will add the same amount to both buckets.
  - You will add a little bit at a time so you can observe what is happening to the kelp and the 6-pack ring.
  - Choose two students to help add water to the bucket. Add 100mL of water. Pause and make an observation.
  - Repeat until the kelp is still holding up but the plastic 6-pack ring is deforming.
- Detach Kelp and 6 pack ring and return to lab to debrief.

#### Debrief (10 min)

- THINK-PAIR-SHARE – What observations did you make during the experiment?
  - THINK – Students think and silently write in their field notebooks any observations they made during the experiment about the elasticity of kelp versus the plastic 6-pack rings.
  - PAIR – Students share their observations with a neighbor.
  - SHARE – Teacher calls on students to share thoughts or neighbors' thoughts.
- Focus debrief on:
  - How experiment showed kelp is elastic because it maintains its shape after being pulled.
  - Plastic is not elastic. When it is pulled by the same forces as kelp it is unable to maintain its shape.
  - Elasticity is an adaptation that helps kelp survive the constant pushing and pulling of the waves because the waves exert force like the force of the weight of the bucket with water in it.
  - Plants and animals are adapted to live in the environment where they are found.
- If time allows ask students if they can think of other elastic versus not elastic things and make a list.
  - Elastic:
    - human arteries near the heart are elastic so that they can stretch each time the heart beats and sends more blood through the artery.
    - Balloons
  - Non-elastic: glass, wood, taffy,

#### Closing (5 min)

- Reminds students that kelp is a very special habitat for hundreds of animals and that it needs to be protected so that it can be around forever.
- Remind students that some kelp forests are protected and that they saw one on their coastal field trip.
- Explain to students that they can visit the same MPA's they saw on the field trip with their family any time and that there are other protected areas close to their home that they can visit.

**Urban Planning - Make a Difference Today & Tomorrow** – EcoLab (45 min)

**Objective of Station:** Students visit a virtual Marine Protected Area, consider green space in their community and urban plan a plot of land to benefit their community.

**Set Up** - Atrium/Ocean Alcove

- VR glasses (1/student)
- Ipod (1/student)
  - with kelp forest video loaded onto ipod
- Post-it Notes (1/student)
- Pencils (1/student)

**Teaching Notes**

- Distribute VR glasses to students
- Help students put on VR glasses and watch videos
- Collect VR glasses
- Distribute a pencil and post-it note to each student
- Help students who are struggling to come up with words to write on post-it
  - Ex. What did being in the kelp forest make your think of?
  - What do you think it would feel like?
- Collect pencils after circle share

**KELP FOREST EXPERIENCE (10 min)** - Ocean Alcove

- Have students sit in Ocean Alcove.
- Review with students why kelp forests are important.
- Remind students that they visited a Marine Protected Area (MPA) during their field trip to the coast.
- Review why we have MPA's:
  - Protect a natural area from human interaction.
- Review that MPA's are special area's with rules that protect the ecosystem.
- Tell students that they are now going to get to visit the MPA they saw on their field trip through virtual reality. They will get to "swim" through a protected kelp forest.
- Have students put on VR glasses with ipods and play video to experience what life is like in a kelp forest.
  - <https://www.youtube.com/watch?v=fvEn9cNC9gc>
- Collect VR glasses.
- Pass a post-it note and pencil to each student.
- Ask students to think of write down **three** words to describe what it is like in the Kelp forest.
- Walk students out to Atrium with post-it notes.
- Circle Share:
  - Have students stand in a circle.



- Tell students that you will go in a circle and that they will get the chance to say one word that describes what it is like in the kelp forest.
- Students should not repeat so if one of the words they were thinking has been used they can use one of the two others they thought of.
- Teacher or volunteer/staff member should start.
- Thank students for sharing once every student has gone.
- Walk students to EcoLab.

**URBAN PLANNING (20 minutes)** – EcoLab

Set Up - EcoLab

- Laminated City Heights map (1 per 3 students)
- Laminated Triangle Map (1 per 3 students)
- Paper with outline of “Triangle Property” (1 per 3 students)
- Pencils (1/student)
- Eraser (1 per 3 students)
- Ruler (1 per 3 students)
- Plastic art bin (1/table)
- Place pencils, rulers and erasers in art bins at center of the table

Teaching Notes

- Help divide students into groups of three.
- Help orient students to map of city heights. Help them make observations about (houses, streets, highways, canyons, fields, etc.).
- Help groups decide how to develop the ““Triangle Property””. Steer students towards natural ideas.
  - Prompt students with questions like: What do you want do about the fact that the “Triangle Property” is so close to a busy street?
  - What could you build in this area that would make people in your community happy? Or healthier?
- Walk around the room whenever the instructor is teaching and help students who are struggling to focus or who are talking while the teacher is talking.

- Explain that students will be working as teams of Urban Planners like Ocean Leader Tony they saw on the video earlier today.
- Urban planners are people who develop plans and designs for the use of space within cities, towns, etc.
- Divide students into groups of three.
- Provide a map of City Heights to each group of students (approx. 3 students per group).
- Give students one minute to look over map with group and make observations with group members.
- Call on students in different groups to make observations about City Heights.
  - Lots of houses

- Many houses are on a grid
- Large highways
- Canyons
- Little green space
- Focus on the lack of green/open space in City Heights.
- Explain to students that because there is very little green space in City Heights so it is important to protect the space so people have natural places to spend time.
- Explain to students there is a space next to the Living Lab that is owned by Ocean Discovery Institute known as the “Triangle Property” (If students passed it by earlier remind them where it is or point from the lab).
- Explain to students that they will be urban planners and they will have the opportunity to develop the “Triangle Property” in any way they want that they think will benefit the people in their community. It must fit in the space so no soccer or baseball fields. 😊
- Tell students they will have five minutes to look over the “Triangle Property” and discuss their ideas before they begin to design it.
- Give each group a map of the “Triangle Property” and set a visual timer for five minutes on the board. Give 2-3 verbal reminders of time.
  - If students are struggling to come up with any ideas after 3-4 minutes give them some of the below suggestions to get started.
    - Add or take away trees
    - Community garden
    - Exercise area
    - Fruit trees
    - Play structure
    - Monument to some special in community
    - Zen garden
- After five minutes let students know they can now begin to design the space.
  - They are working to make a sketch – it does not need to be near or perfect.
  - They only get one paper to work with so use erasers if you need them.
  - They will have 10 minutes to work.
- Set a visual timer for ten minutes on the board.

**PRESENTATION OF URBAN PLANNING IDEAS (10 min) – EcoLab**

Set Up - EcoLab

- Tape (2)
- Laminated numbers 1 - 6
- Urban Planners of the Day Wall
- Extra letters for Urban Planners of the Day Wall
- Digital Camera
- Blank paper cut into small squares for casting votes

#### Teaching Notes

- Walk around the room during presentations to help quiet any students who are talking during presentations
  - Collect votes
  - Count votes
  - Let instructor know who the winner is
  - Collect laminated City Heights and “Triangle Property” maps
  - Make sure rulers, pencils and erasers are back in bins at center of table
  - Make sure all garbage is off the floor and off lab tables
- 
- Explain that each group will present their idea and sketch for the urban planning of the “Triangle Property”.
  - Explain that after each group has presented everyone in the room will get to vote on which idea they like best – it can be their own idea or another group’s.
  - Have each group of students come to the front of the room to share their sketch and explain their thoughts
    - Remind students of community agreements and how important it is to listen to other scientists speak so that you can build off of each other’s ideas.
    - Be diligent about quieting all students before a group speaks (it is okay if this takes a little while- be patient).
    - If time allows, after each presentation allow for 30 seconds of Q & A from the audience.
  - Tape each group’s drawing to the front board below the group number (#1-6).
  - Tell students that they all did an amazing job as urban planners. Remind students that this is a real job and they can be urban planners in the future if they wish.
  - After each group has presented pass out slip of paper.
  - Tell each student to write down the number of the idea they think would best develop the “Triangle Property” for City Heights.
  - Give students one minute to consider and vote.
  - Have students fold paper in half and place in plastic bin at center of the table.
  - Collect all votes and have one staff member tally them up.
  - Other students should help clean up the lab space (all pencils and erasers as center of table, collect City Heights and “Triangle Property” maps, toss any recycling into the trash)
  - Announce who the Urban Planners of the day are.
  - Ask these students to write their first names down on a piece of paper.
  - During lunch put the names of these students on the Urban Planner of the Day board and take a photo of the students holding their sketch in front of the board.

**Science and Conservation Leader (25 min)**

Objective of Station: Students will meet, talk to and ask questions of a real local science and/or conservation leader whom they can see themselves becoming in the future.

Set Up

- Load any picture or other audio/visual the visiting scientist has brought

Teaching Notes

- Walk around and monitor students
- Sit with any students who are struggling to help keep them focused during show and tell and the Q & A portion

Show and Tell (10 min)

- SCL talks about what they do for a living in student friendly language.
- Focus on their background (if from the community or a similar community).
- Focus on how they make a difference in the world.

Q & A (10 min)

- Let students ask questions if they have them.
- If students are shy or struggling to come up with questions, use curiosity cubes.

**Lunch & Bathroom Break (25 min)**

Set Up

- Hand sanitizer
- Blankets to sit on
- Trash bag
- Recycling Bag
- Water cooler (2)

Teaching Notes

- Walk around and monitor students while they eat lunch – ask them questions about their experience
- Hand out hand sanitizer
- Monitor water cooler and help students refill water bottles
- Walk around with trash bag when you see students starting to finish up
- Supervise and encourage clean- up of surrounding area when clean up begins

- Before lunch have students take a bathroom break.
- Refill water bottles.
- Give hand sanitizer to each student before lunch.
- Give students a five-minute warning before clean up.
- Remind student that we are connected to the ocean through the canyon watershed and that any trash that ends up on the ground here can end up in the ocean so we need to be careful.
- Have students take 2 minutes to walk around and clean up their area.
- Refill water bottles.

### **Self Reflection (20 minutes)**

**Objective of Station:** Students reflect on what they have learned and reflect on their belief that they are scientists and can do science and can give advice to other future scientists.

#### **Set Up**

- Put up kelp forest video on silent in the background
- Have guiding questions for postcards ready to put up on screen
- Pencils w/ erasers
- Postcards (100)
- 3 folders
  - One labeled with school and date
  - One labeled with one teacher's name
  - One labeled with the other teacher's name

#### **Teaching Notes**

- Walk around and help students with reflection activities
- Don't let students get bogged down in the perfect postcard
- If students are struggling to write, sit with them and quietly ask them the answer to one of the guiding questions. When they give you an answer -encourage them to write that down
- Collect post cards and place in folder with school name and date
- Collect field notebooks and remove pages.
- Staple each notebook's pages together and place pages in a folder and give to classroom teacher

### **Field Notebook & Process Reflection (10 min)**

- Ask students if they have enjoyed doing science with Ocean Discovery Institute.
- Explain that you will be giving them three minutes to write in their field notebooks to answer the following three questions:
  - Do you think you can be a scientist? Why or why not?
  - What was your favorite part of Ocean Discovery Institute?
  - Who would you like to bring back to visit the Living Lab with you?
- Set a timer on the board and let students write. When time is up put pencils down.
- Reminds students of all the science they have done over the last couple of weeks with Ocean Discovery Institute.
- Remind students of all the notes they have taken in their field notebooks. All scientists keep their own journals so we will give you yours.
- Have students take out pages from today's field notebook and add it to the pages from the coastal field trip.
- Have students design a cover for their field notebook with a drawing of them working as an urban planner creating areas to protect for the future.
- Show students how to fold construction paper.
- Tell students the drawing does not need to be perfect and they can finish it at home if they do not have time now.

- Put a 5-minute timer on the board and let students use pencils to draw.
- As students are working on drawing have staff go around and staple notes into construction paper to create a field journal for each student and collect field notebooks.

### Self-Reflection (10 min)

- *While students are working have the teacher address the large manila envelope to themselves at school so that the postcards from the first day can be mailed to them next week.*
- Let students know that as their final act as ocean discovery scientists today they will share their knowledge with someone else.
- Remind students that 1<sup>st</sup> graders at their school will also visit Ocean Discovery and they will learn about kelp forests as well.
- Tell students that as ocean discovery scientists they will share some knowledge with a 1<sup>st</sup> grader at their school by writing them a postcard.
- Have students write post cards to 1<sup>st</sup> graders who will visit the Living Lab and learn about Kelp Forest. Post guiding questions:
  - What was your favorite part of being a scientist with Ocean Discovery?
  - Write a sentence of encouragement to a 1<sup>st</sup> grader about doing science who might be nervous or scared of science.
  - Write about what it was like to virtually swim through the kelp forest.
  - Tell a 1<sup>st</sup> grader something you know that is important about kelp forests.
  - Tell a 1<sup>st</sup> grader why it is important to protect our kelp forests.
  - Tell a 1<sup>st</sup> grader about your idea for the “Triangle Property” why you worked as an Urban Planner
  - Extra time: Draw a picture of kelp or an animal that you learned lives in the kelp forest
- Give students multiple time warnings as they work (4 minutes left to write... 2 minutes left.... You have one minute to finish your last sentence.... Finish up your last thought, etc.)
- Have students sign cards with first name and last initial.
- If time allows call on some volunteers to share their post cards out loud with the group.
- Collect post cards.

### Believe Survey (see protocol) (10 min)

#### Clean-Up & Depart (10 min)

- Have students turn in pencils.
- Have students turn in water bottles.
- Look around you on table and floor – pick up any trash you see.
- Hold up your field notebook so you don’t forget it.
- Push in chairs at tables.
- Walk students to watershed plaza.
- Today, we tried new things, and made new discoveries. Whenever we do that, we have an Ocean Discovery cheer to send us off. We say “Go Awesome!” Say it with me on the count of 3. 1, 2, 3... Go Awesome!!
- Walk students back to bus area with a stop at the restrooms if time allows.



**Photos of La Jolla Coast**

