BRUVS

BAITED REMOTE UNDERWATER VIDEO SYSTEMS

GRADES 6-8

BRUVS ARE A VALUABLE TOOL FOR DETERMINING WHICH SPECIES LIVE IN OR VISIT AN AREA, HOW ABUNDANT THAT SPECIES IS, AND HOW DIFFERENT SPECIES USE A HABITAT (FEEDING, NURSERY AREAS, ETC).

Link to Standards:

- NGSS
  - DCI- LS2.A, LS2.C, LS4.D, ETS1.A, ETS1.B, ETS1.C
  - SEPs- Analyze & Interpret Data, Asking Questions & Defining Problems, Developing & Using Models
  - CCCs- Structure & Function, Patterns, Scale, Proportion & Quantity
- Common Core- Math.content.6.SP.B.5, Math.Content.7.SP.A.1
- Ocean Literacy- P5B, P7A, P7B, P7C

LESSON PLAN

Learning Target:

- Students will have an understanding of the different components of BRUVS and how scientists study the underwater world.
- Design & construct 3D scaled models of BRUVS to help scientists collect data on the distribution of sharks & other organisms in an ecosystem.
- Analyze and Interpret data on the patterns of distribution of organisms in a sandy bottom ecosystem.

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Vocabulary:
BRUVS, nondestructive sampling, habitat, species

Interdisciplinary Connection:
This lesson helps students build skills in engineering and technology because it requires student to brainstorm and construct a model baited remote underwater video rig.

Essential Questions:
What would scientists use BRUVS to study? What are the different necessary components that are required to qualify as BRUVS? What do you need to take into consideration when designing BRUVS?

LESSON PLAN

Introduction:
The teacher introduced the lesson by discussing different research methods for studying marine organisms (or participating in a Sharks4Kids lesson with a shark research focus).

- Prior to showing students photos of what BRUVS are/ looks like, show a video from the Sharks4Kids website. Ask students to make a Notice/Wonder T-Chart in their notebook or on a piece of paper. This should take 5-10 minutes total.
- Have a quick partner/whole class share out and then discuss
    - How was this footage obtained?
    - Why is this kind of data helpful to scientists?

I Notice	I Wonder
Record anything you notice as you watch the clip	Record any questions you have while watching the clip.

LESSON PLAN

Part 1: Design your own BRUVS
Baited remote underwater video systems are a nondestructive sampling method to study a number of different things. The two essential components that make up a BRUVS rig are a camera to record underwater footage and bait. Most BRUVS are made of PVC or metal frames and many have a float for ease of locating and retrieval. Some also have weights to make sure it sits still on the ocean floor.

After introducing what BRUVS are made of and how it can be used, ask students to design their ideal BRUVS with an unlimited budget (H1).

Material Suggestions:

- Popsicle sticks/ BBQ Skewers/ Toothpicks
- Hot Glue & Hot glue gun/ Tape/ Styrofoam balls
- Cork/ Kitchen Sponge
- String
- Pompoms
- Scissors

Print-Out Suggestions:

- Design your own BRUV worksheet

Follow up questions: What type of habitat are you exploring?, what are the different parts of your BRUVS?, what marine life do you expect to see with your BRUVS?

Have students present their first BRUVS designs. After seeing other's models and the photo of modeled BRUVS designs (H2), student's can use the inspiration in the next activity.

LESSON PLAN

Part 2: Build 3D model BRUVS
Have students work in groups to design BRUVS given material or monetary constraints. Each group can get a supply of materials including- 15- 20 popsicle sticks or toothpicks, 2 pieces of string, 8 pompoms of different colors, a hot glue gun or tape, and a cork or sponge (H3).

Use the budget and price guide to price out each item and give each group a budget to work within (H4). Each group uses the given materials to construct 3D Model BRUVS. Students can follow the given instructions for building their BRUVS models (H5).

Take turns testing the buoyancy of the BRUVS for an added activity. Put each BRUVS in a Tupperware with water deep enough for the BRUVS to sink and the float to be at the surface.

Follow up questions (H6): Does your BRUVS sink to the bottom? If it doesn't, what can you add to act as weights? Does your float stay at the surface? What is the importance in using weights and a float? If you were to make another BRUVS, how would you change your design?

LESSON PLAN

Part 3: Analyze the footage (H7)
Using the associated video and data sheet, identify what type of ecosystem this video is studying. This video features four Caribbean reef sharks and other fishes such as remoras, grey triggerfish, bar jack, and white margate. Pause the video when you see the first organism and identify what animal it is, what time it was seen in the video and how many individuals are in the frame.

Optional use of the species ID guide (H8)

Follow up questions: What are the challenges of figuring out how many individuals are in the area? Why is the quality of equipment important? How can you use this information to asses the health of an ecosystem?

Optional activity for high school students:

Check out the Journal Article Activity on the Sharks4Kids website for the paper titled "Widespread diversity deficits of coral reef sharks and rays" to explore and breakdown a scientific study that uses BRUVs to collect data.

DESIGN YOUR OWN BRUVS!

H1

What type of habitat are you exploring?

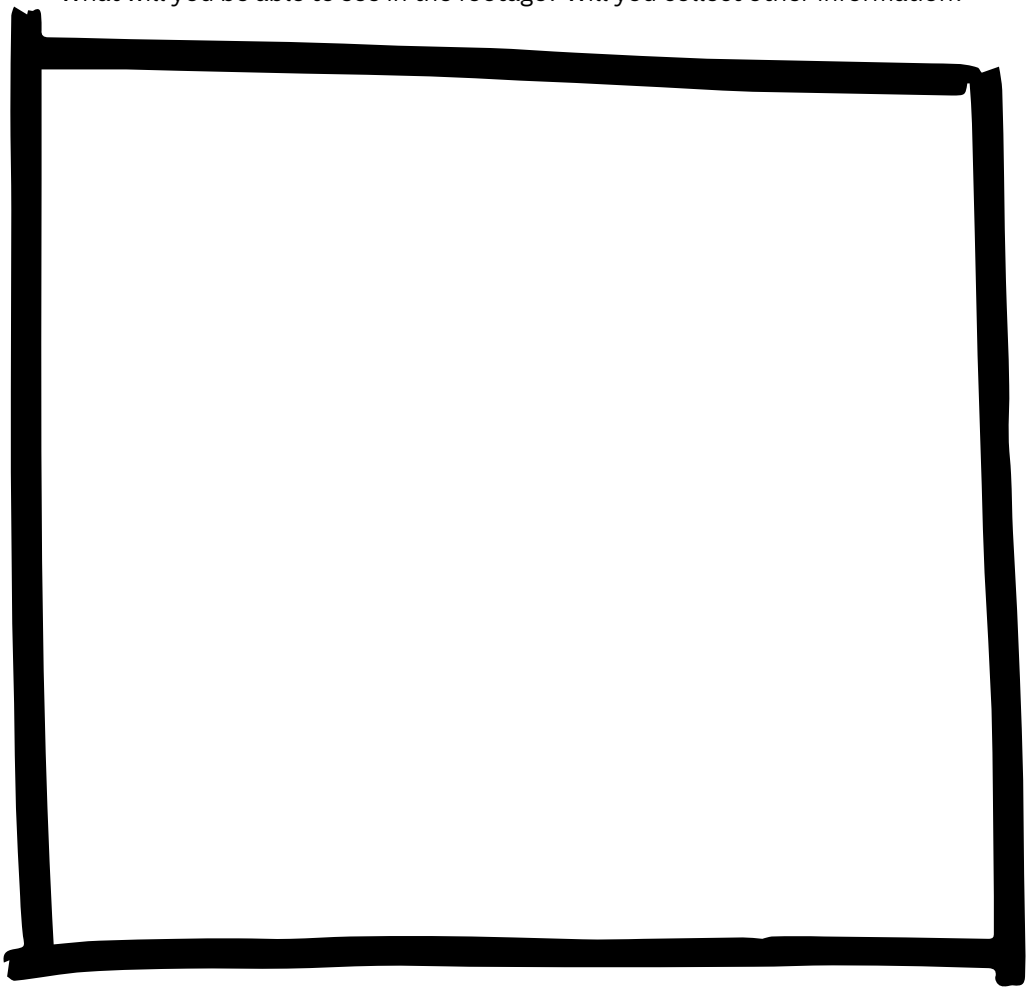
How does your design change based on habitat? Think about accessibility and impact.

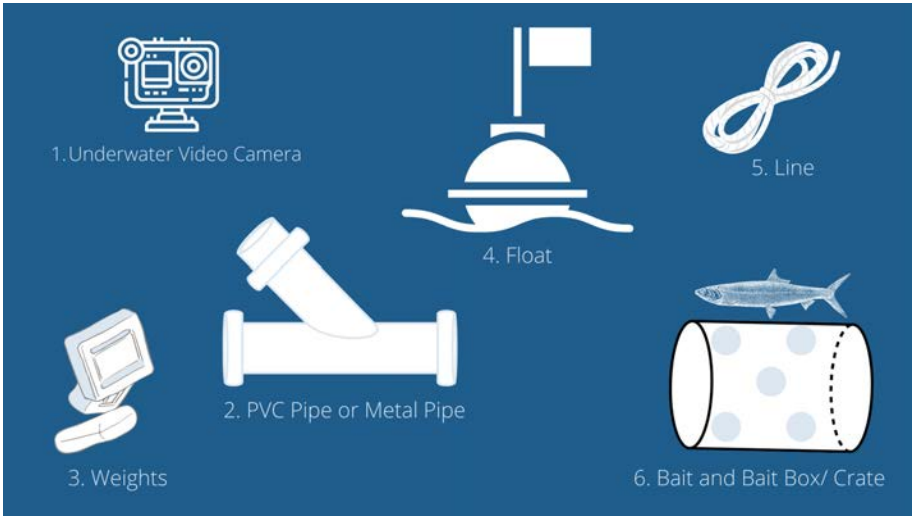
What are the different parts of your BRUVS?

Does your BRUV need extra parts for collecting data at night or in extraordinary conditions?

What data do you plan to collect and what does that tell you about the ecosystem?

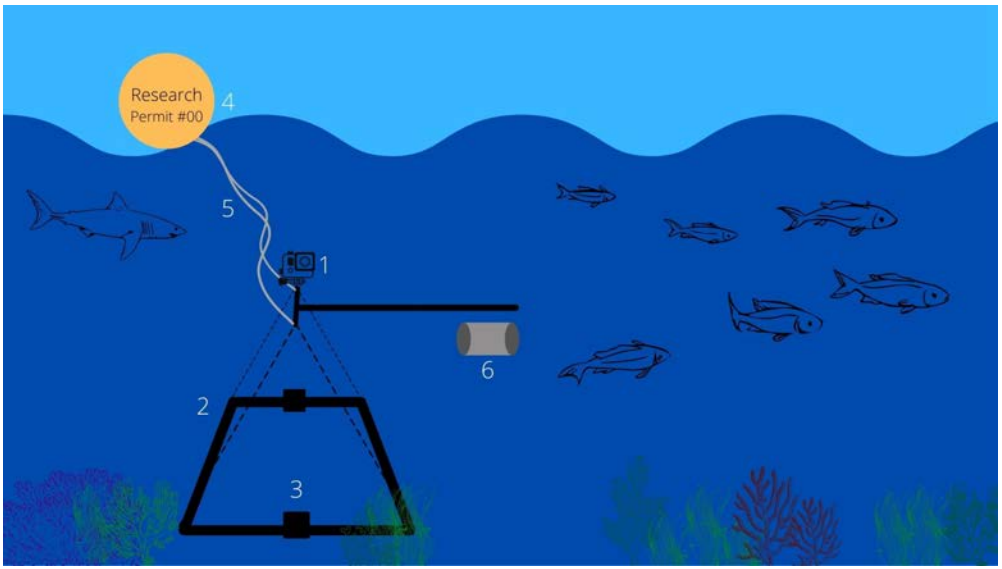
What will you be able to see in the footage? Will you collect other information?





A BRUVS unit is made of...

1. Camera to observe and record animal species and underwater activity
2. Base frame of PVC, stainless steal or rhubarb pipes
3. Weights to keep it from floating up
4. Float to identify it in the water
5. Line to attach the float to the unit
6. Bait box or crate with bait to attract animals to camera



BUILD A 3D MODEL OF YOUR BRUVS USING HOUSEHOLD ITEMS

Important components of your BRUV:

- Frame
- Camera
- Bait
- Float

Material Suggestions:

- Popsicle sticks
- Toothpicks
- Hot Glue
- Tape
- Cork
- Kitchen Sponge
- String
- Pompoms

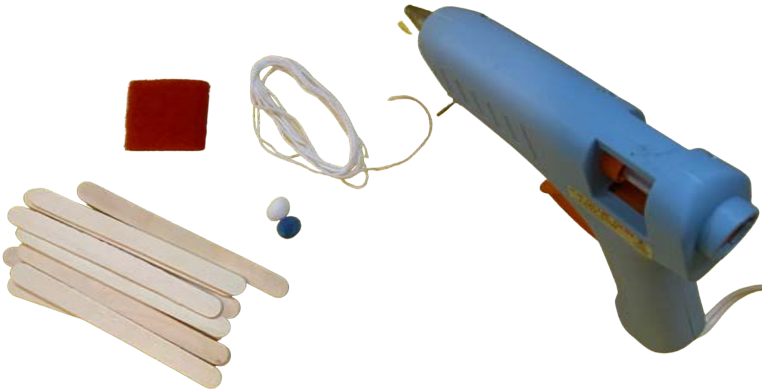
BUDGET AND PRICE GUIDE

Funding for BRUVS construction: $1,200

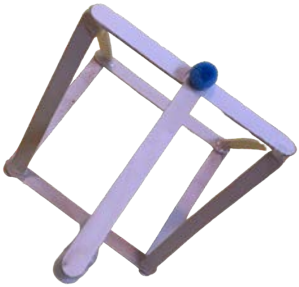
Material Prices:

- Popsicle sticks: $15 each
- Toothpicks: $10 each
- Hot Glue: $10 for one stick
- Tape: $20 for a roll
- Cork: $50
- Kitchen Sponge: $30
- String: $8 for 6"
- Pompoms
    - Bait choices
        - Old, stinky bait $10
        - Fresh chum: $20
    - Camera choices
        - Generic underwater camera: $150
        - High quality footage: $400
        - Red light for night use: $750
        - 360 degree view: $900
        - Collects information on water temperature, salinity, and dissolved oxygen: $1000

1. Collect necessary materials.



2. Construct frame and main structure of your BRUV



3. Add pompoms or other material to represent where your camera(s) and bait are located

4. Attach a float to the BRUV structure with a string

TEST IT OUT!

- Does your BRUVS sink to the bottom? If it doesn't, what can you add to make it sink? Why is it important that the BRUVS is sitting on the bottom? How would the study change if the BRUVS was at the surface?

- Does your float stay at the surface? What could you use to make it float so you can later find the BRUVS? Why is it important to have a float attached to the BRUVS?

- If you were to make another BRUVS, how would you change your design? What if you had more funding? Less funding?

- As a scientist using this research method, what are some of the limitations you would face? What information can you gather with underwater footage? What would you be missing?

Analyze BRUVS Footage

Use the BRUV video associated with this activity and record the marine species that you see!

Habitat Type: _____

Common Name	Scientific Name	Time in Video	How many individuals?	Notes

Analyze BRUVS Footage
SPECIES ID GUIDE

Caribbean Reef Shark

Remora

Grey Triggerfish

Bar Jack

White Margate