Understanding the Rewilding of Cape Cod
Educator Guide

Unit 2: The Science Around Us

Day 1 – Introducing White Shark Research

Warm Up (3-5 minutes)
Individual reflection – Have students brainstorm and make notes on what they already know about white shark or shark research in general. If they don't feel they know anything currently, have them write down questions they have about shark research. Ask students to share out. **Slide #1**

Watch Interview with Megan Winton (10 minutes) **Slide #2**

Video Debrief/ Discussion Around Wildlife Research (20-25 minutes) **Slide #3**

Based on Megan's interview, what is the driving force behind white shark research?

- Look to students for answers regarding how understanding white shark behavior and movement can have an impact on public safety initiatives.

Shark research isn't like what you see in the movies or on Shark Week **Slide #4**

- What do you think are some of the priorities when planning a research project with living things?
    - Safety
    - Budget
    - Permissions (you often need permits to work with wild animals)
    - Planning (time of year, materials needed, etc)

Going into a research project requires collaboration and building your background knowledge. **Slide #5**

- Have other scientists already done what you are trying to?
    - If so, can you learn from them or modify?
- Is the tech available or do you need to build it?
- What skills are going to be needed?
- Where do you need to go to set yourself up for success?

Homework Review (5 minutes) **Slide #6**

Have students watch the Interview with Megan Winton a second time. This time have them complete the notes page and collect information from the video.

Day 2 – Tagging Sharks & How Tags Work

Warm Up (5 minutes) **Slide #7**
Guiding question, what are the questions that Megan Winton have been trying to answer about white sharks in the Northwest Atlantic?
- Have students reflect on yesterday's lesson to answer this question

Answer: Where are white sharks going? **Slide #9**
To answer this question, the research team is deploying tags on the sharks to track their movement.

- The primary tag used is an acoustic tag, and acoustic telemetry works as a communication system.
    - Background Information: Acoustic Telemetry is a communication system. The tag on the shark sends out a signal, that is picked up by the receiver in the water. The shark has to be within range of the receiver (about 300 m) for the receiver to receive the signal. (Think of it like your cell phone, you need to be in service range to work)
    - The receiver then stores all of the data, logging the date, time, and identity of the shark. When researchers bring the receiver out of the water, they download all of the data from the receiver and then know what sharks were in that area and when.
- The shark has a tag attached
    - Tag is placed next to the dorsal fin, a dart embeds the tether of the tag into the muscle of the shark, so the tag is securely attached to the shark
        - The tag is constantly sending out what we call a 'ping' or a message with the shark's identity

How is this a communication system? **Slide #10**
Use the slide to outline and describe the parts of the communication system and how the tag and receiver work.

- Students can complete notes on how the system works in their diagram to help them understand the process.

New technology is allowing scientists to test out a prototype for a 'real time receiver' **Slide #11**

- It would be impactful for beach managers to know in the moment, if a tagged shark is near a recreational swimming zone. Real Time receivers build out the system further and send notifications to scientists and beach managers when a tagged shark is in range of the receiver.
    - Important to Note: If a shark doesn't have a tag – will the receiver know it is there? No, this system only tracks tagged sharks

- Help the students to see the difference in the two types of receivers, and how each has different functions as part of the communication system

Communicating Data **Slide #12**
Scientists are deploying tags, and using technology to follow white shark movement, and then what are they doing with that information? Where does that data go?

Lesson (15 minutes) **Slide #13**
Have students access the white shark logbook, found on the AWSC website. Provide them with a quick tutorial on how to navigate the logbook and view white shark movement data.

- Review using the menu tab on the left-hand side
- Demonstrate how to look up individual movement data for each shark
- Display the different tabs on a shark's movement profile

After the review, have students complete the Logbook Scavenger Hunt to begin reviewing data. **Slide #14**

Day 3 – Designing Technology for Shark Research

Everything we discussed in how we track shark movement relies on the technology working where? **Slide #15**

- Underwater! In a salt water environment (which is more harsh than fresh water)
- On living, moving things

This important for scientists to think about and plan for when they design their research project. Some technology is readily available, but not all tech is. Scientists often work with engineers to design and try out new tech to better help them answer their questions

Review the engineering and design process with students. **Slide #16**

- Discuss with them on how the real time receiver is still in this process, the design is still considered a prototype, and they are working to improve its functionality.

Explain to students how a big component of working with marine life, is having technology that is waterproof.

Introduce the engineering and design challenge to the students. For this challenge, they need to make a watertight housing that will support a camera being underwater, fully submerged, for 30 seconds. **Slide #17**

- For this challenge, the camera will be a cotton ball, and underwater will be a large bin with tap water that had been colored blue or green. The color additive to the water will stain the cotton ball if any part of it gets wet.
- Outline the constraints for the students:
    - Cotton ball must stay dry
    - You must be able to access your cotton ball after it has been submerged

    - Your ‘case’ needs to be reusable
    - Your cotton ball needs to be fully submerged, no floating

Modifications/ Extensions:

- Set up a ‘store’ of materials to integrate a math lesson with budgeting and planning
- Modify the parameters:
- The camera needs to be fixed and have a buoy marker
- The camera needs to be in the middle of the water column
- If you have access to a 3D printer – you could take this even further with the design component!