Level	Marine Animal Tracking and Bathymetry
High School	

Time Required	Lesson Summary
90 min. (2-45 min. class periods or 1 ½ 60 min class periods)	Students will use their knowledge of seafloor features to learn about the movements of marine organisms (e.g. sharks). They will gain an understanding of how marine animals are tagged and tracked with satellite technology as well as gain insight regarding the pros and cons of learning about animal behavior.

Standards

NGSS

HS-PS4-2 Waves and their Applications in Technologies for Information Transfer. Evaluate questions about the advantages of using digital transmission and storage of information.

Vocabulary	Objectives
Bathymetry Satellite radiometer SPOT tags PSAT tags Acoustic tags	• Students will gain understanding of how electromagnetic energy is used to learn about animal behavior. • Students will gain understanding of how technologies, sensors, and tools are expanding our ability to explore the ocean. • 3. Students will observe the movements of marine animals and determine which seafloor features are important for species such as sharks.

Materials

- Headphones
- Student computer
- Marine Animal Tracking Worksheet (Color) OR Marine Animal Tracking Worksheet (Black & White)
- Shark Tracker App or Shark Tracker Website (see resources)

Pre-Requisites

Prior knowledge of bathymetry and names of seafloor features is needed.
Safety Considerations
None
Pacing Notes
Day 1: The Energy to Track Animals Video Sheet, shark tracker activity, read Shark Finning and shark facts article (Homework) Day 2: Watch preview of "Fin", class discussion Follow-Up (1 – 3 weeks after completion of lesson): finish shark tracker sheet
Before the Lesson
Students should be fluent in the area of bathymetry. Instruction on how sonar is used to collect bathymetric data should be covered prior to this activity. Students should be familiar with the following terms; continental shelf, continental slope, continental rise, seamount, abyssal plain, trench, mid-ocean ridge

Assessments	**Classroom Instructions**
Pre-Activity Assessments	**Introduction**
Discuss answers to the Google Maps activity. Determine whether the students have a decent grasp of the bathymetric features. If not reteach before starting the lesson.	While you take attendance, have Google maps projected on the board with several bathymetric features marked. Ask students to quietly write down what they think each feature is named.
Activity Embedded Assessments	**Activities**
Stop between each	1. **Introduce radio tracking of animals by watching three short videos**.

video and Ask: Who missed something important from the video? (This should be the answer to one of the questions) Allow the other students to provide the information. Collect the video sheet and grade. If students seem distracted during the discussion consider asking them one of the questions. Walk around while students are working. Check their understanding by asking some of the following questions. Where did you find this information? What kind of tag	a. Hand out the video sheet. Encourage students to read through the questions before the videos start. b. Video one: What is the Electromagnetic Spectrum https://www.youtube.com/watch?v=m4t7gTmBK3g c. Video two: Radio Waves https://www.youtube.com/watch?v=OzDmEA8x0nQ d. Radio tracking wildlife https://www.youtube.com/watch?v=gXCrvnTilgI 2. **Class discussion** After the videos have finished lead a short discussion. Consider using some of the following questions in addition to your own. What types of things do we use the electromagnetic spectrum for? Do you use the electromagnetic spectrum everyday? How? Why do you think people would choose to use a tag to track wildlife rather than just tracking them (following them)? Why do you think people are interested in tracking sharks? 3. **Shark Tracker** a. This web page, https://www.ocearch.org/tracker/, was created by OCEARCH - a global non-profit organization conducting research on mainly sharks. Their mission is to accelerate Earth's ocean's return to balance and abundance through research, education, outreach, and policy development. You'll notice that a lot of the tags are not currently active. While the students can still learn about animals and their movements from these tags if you want them to use active tags look for a circle radiating outward from a point. b. Introduce the Shark Tracker Worksheet. Have students complete the worksheet while working in pairs, with each student completing their own document.

does that animal have? What is the difference between these types of tags? Collect and grade the shark tagging sheet.	a. Discussion. After students have completed the worksheet hold a class discussion. Consider asking some of the following questions in addition to your own. Why are marine animals tracked? What tools are used to track marine animals? Do the SPOT tags hurt or hinder the shark? What are some pros and cons of using the SPOT tags? How are satellites used to track marine animals? (What part of the electromagnetic spectrum is used to communicate between the tag and the satellite?) 4. **Homework Activity** Have students read the sections on shark finning and shark fin facts (https://sharkstewards.org/shark-finning/shark-finning-fin-facts/)
Post Activity Assessments	**Closure**
Quiz - Use a marine animal track projected on the board. Ask students to list the seafloor features the organism traveled over or close to. Have students write a short paragraph as to why they feel the organism will stay over certain features.	**Day 2** 1. Class discussion Hold a class discussion on last night's homework reading. Consider using some of the following questions in addition to your own. What do sharks use their fin for? What is a sharks fin made of? What happens to a shark if its fin is cut off? Why are people finning sharks? How does a loss of sharks affect the ecosystem? Why is it important that we track marine animals? Why is it important to understand seafloor features? How does satellite technology help us understand animal movement and seafloor structure? Follow-Up: Students should complete the final portion of the data table on the Shark Tracker Worksheet at a later time (suggested time

	frame: 1 - 3 weeks after initial observation)

Culturally Inclusive/Responsive Components

Understanding the behavior and movement of sharks is important so we can protect their species and habitats. How could knowledge of their movements be detrimental to their existence? (Shark Finning)

Shark Finning and Shark Fin Facts by Shark Stewards
Shark Fin Soup; What is it? Who eats it?
"Fin" , Preview of Eli Roth's shark documentary on Shark Finning.
(all web pages last accessed 6/7/23)

Educator Resources

Shark Tracker Website
Shark Tracker App

Satellite Info:
Satellite Telemetry and Its Impact on Animal Migration (website)
Wildlife Journal Junior: Tracking Wildlife, New Hampshire PBS website

Shark Extension Topic:
Shark Fin Soup Article by Leaders in Wildlife Conservation
Shark Finning and Shark Fin Facts (website) by Shark Stewards
"Fin" , Preview of Eli Roth's shark documentary on Shark Finning

Turtles:
Tour de Turtles Race
(all web pages last accessed 6/7/23)

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Below is a list of the lesson titles included in the series. All lessons can be accessed from this web page, https://superknova.org/educational-resources/.

Middle School
Introduction to Satellites
Weather Predicting

Introduction to Radio Wave Communication
The Importance of Radio Astronomy
Cubesat Model Building
Understanding FM Radio
Radio Frequency Technology
Who Decides if You Get 5G?

High School

The Uses of Radio Waves and Frequency Allocation
Is Radio Technology Safe?
Diffraction of Radio Waves
Measuring Sea Surface Temperatures with Satellites
Marine Animal Tracking and Bathymetry
How to Design Your Own Crystal Radio
How Radio Waves Changed the World
Simple Wireless Communication
Seeing and Hearing the Invisible
Local Wireless Radio Frequency Communication
Investigating the Internet Connection
The Geometry of Radio Astronomy

Informal

Modeling Radio Astronomy