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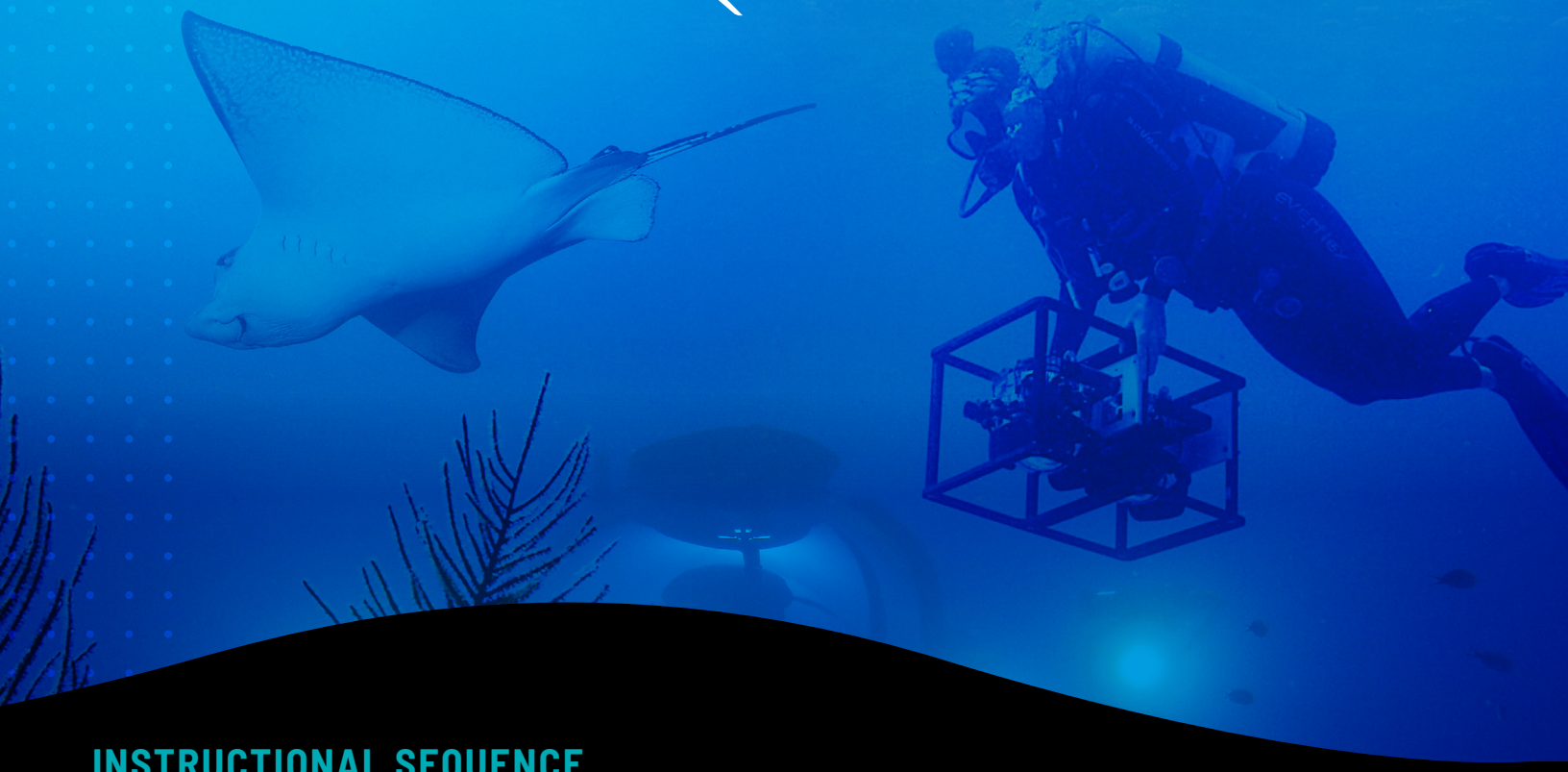

INSTRUCTIONAL SEQUENCE

EFFECTS OF NOISE POLLUTION ON MARINE LIFE (POST-VISIT)

Human Impact on the Environment

GRADE LEVEL: 9-12

ARIZONA SCIENCE CENTER

Never stop wondering.
Never stop imagining.™

Presented for Australian audience by:

WAM WESTERN AUSTRALIAN MUSEUM

PURPOSE

Many animals rely on sound to communicate and find food. Humans can impact a marine animal's ability to detect these sounds due to ocean noise from shipping and oil drilling.

OBJECTIVE

Students will obtain, evaluate, and communicate their findings on the impacts of noise pollution on marine organisms by participating in a debate and writing an argumentative essay.

YEAR 9

SCIENCE

Science Understanding - Biological Science:
WA9SSUB3 - Population size and species diversity can be affected by abiotic and biotic factors; sampling techniques can be used to monitor abiotic factors and estimate numbers of organisms; ecological monitoring can be used to inform ecosystem health and impacts of human activity.

WA9SSUB2 - Organisms have mechanisms to respond to changes in their environment; endotherms and ectotherms respond differently to changes in external temperature; tropisms help plants respond to external stimuli.

Science understanding - Physical sciences:
WA9SSUP1 - Sound waves are longitudinal waves produced by vibrating objects; sound waves travel through solids, liquids and gases at different speeds; sound is reflected when coming into contact with a solid or liquid surface.

Science Inquiry Skills – Planning and conducting:
WA9SSIPL1 - Plan and conduct valid and reproducible investigations to answer questions and test hypotheses; develop and follow risk assessments, and consider ethical issues.

YEAR 10

SCIENCE

Science Inquiry Skills – Planning and conducting:
WA10SSIPL1 - Plan and conduct valid and reproducible investigations to answer questions and test hypotheses; develop and follow risk assessments, and consider ethical issues.

YEAR 11

Marine and Maritime Studies

Earth and Environmental Science

YEAR 12

Marine and Maritime Studies

Earth and Environmental Science

VOCABULARY

ECHOLOCATION
An animal's natural ability to detect and utilize sound waves for communication and survival

SONAR
Human-created technology that uses underwater sound waves to detect and locate underwater objects

MATERIALS

NOISE POLLUTION RESEARCH GUIDE

COMPUTER WITH INTERNET ACCESS

ONLINE RESOURCES

INFOGRAPHIC: UNDERWATER NOISE

LIVE MAP OF OCEAN SHIPPING ROUTES

BOAT MOTOR SOUND EFFECT

ARTICLE: 'DOES MILITARY SONAR KILL MARINE WILDLIFE?'

MAP OF OCEAN OIL DRILLING SITES

ENGAGE

Prompt students to think back to their experience at *OceanXperience*. Ask students to discuss the following with their partner:

- What is echolocation?
- What types of marine life use echolocation? Why do they use it?

Hand out the Noise Pollution Research Guide, and direct students to the online resources to research more information about echolocation. As they research, prompt students to record their findings in the 'Echolocation Basics' section of the research guide.

EXPLORE

Prompt students to consider the disadvantages of having to rely on echolocation to communicate. Allow students to share ideas, and record their responses on a class list. Optional: As students are sharing responses, purposely interrupt them by playing a recorded noise from a boat engine to simulate how echolocation is disrupted by noise pollution underwater. **Boat Motor Sound Effect**

Prompt students to use **Infographic: Underwater Noise** from the World Wildlife Fund and the article **'Does Military Sonar Kill Marine Wildlife?'** from *Scientific American* to record notes about the different types of ocean noise pollution on their research guide.

Prompt students to work in pairs to choose an organism from their earlier research to focus on for the remainder of the activity. Using the Noise Pollution Graphic Organizer, students will research how their organism is affected by each type of noise pollution. They will compare the **live map of ocean shipping routes** to a map of their organism's locations around the world to evaluate if their organism is affected by ocean noise from shipping. They will locate information on how Navy sonar impacts their organism, and they will use the **map of ocean oil drilling sites** to determine how their organism is affected. They will also record any other ways their organism is affected by noise pollution.

More information on the map's key:
DSDP Leg: Deep Sea Drilling Project (1968-1983)
ODP Leg: Ocean Drilling Program (1983-2003)
IODP Leg: International Ocean Discovery Program (2013-current)

EXPLAIN

Facilitate a class discussion where each pair shares their findings with their peers. Encourage audience questions and feedback.

Prompt students to brainstorm ways that people could lessen the amount of noise pollution that harms these organisms. Allow students to share any ideas they have, and record ideas as a class brainstorm on the whiteboard or butcher paper.

Prompt students to return to their partner and research any efforts already in place to reduce the impact of noise pollution on marine organisms. Students record their ideas in their research guide under the 'What is being done?' section, using data to evaluate the effectiveness of these efforts.

EXTEND

Organize a class debate to answer the question: Should the use of sonar be limited due to its harm to whales and other sea life? Arrange the class into debate teams- for example, six sets of five students, resulting in three rounds of debates. Allow debate teams time to prepare their research and determine roles before the debate.

EVALUATE

Students write an argumentative essay defending their opinion on whether sonar use should be limited to protect wildlife.

NOISE POLLUTION RESEARCH GUIDE

ECHOLOCATION BASICS:

Create a list of species that use echolocation for survival.	In what ways does echolocation help these species survive?
Predict two ways a species could be negatively affected if they could not echolocate properly.	Draw and label a diagram of the internal structures involved in echolocation.
Explain how echolocation functions in animals, including scientific information about sound waves and vibrations.	

SOURCES OF UNDERWATER NOISE POLLUTION:

Shipping:

Oil and gas exploration:

Military sonar:

Other sources of underwater noise pollution:

HOW IS MY ORGANISM AFFECTED BY NOISE POLLUTION?

Organism: _____

1. Locate a map or list of locations where your organism lives around the world. Compare your findings to this **Live Map of Ocean Shipping Routes**. Describe whether or not your organism is affected by noise pollution from shipping vessels, using specific evidence you gathered while making comparisons.

2. Locate a reputable source that gives evidence of whether or not your organism is affected by Navy sonar usage. Use this evidence to explain the extent of how your organism is affected.

3. Using the map of locations where your organism lives, make comparisons between those locations and the **map of ocean oil drilling sites**. Determine to what extent your organism is affected, and explain your reasoning using evidence from your comparisons.

4. Describe any other ways that noise pollution disrupts your organism's ability to echolocate properly that weren't already discussed.

WHAT IS BEING DONE?

Describe one way humans are trying to reduce the impact of noise pollution on marine organisms (laws, protected areas, limiting times of use, etc.).

Locate useful data from a reputable source to evaluate the effectiveness of these efforts. Describe the findings of the data below, and cite the source.

Evaluate the benefits and constraints.

BENEFITS OF THIS EFFORT:	CONSTRAINTS/WAYS TO IMPROVE:

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