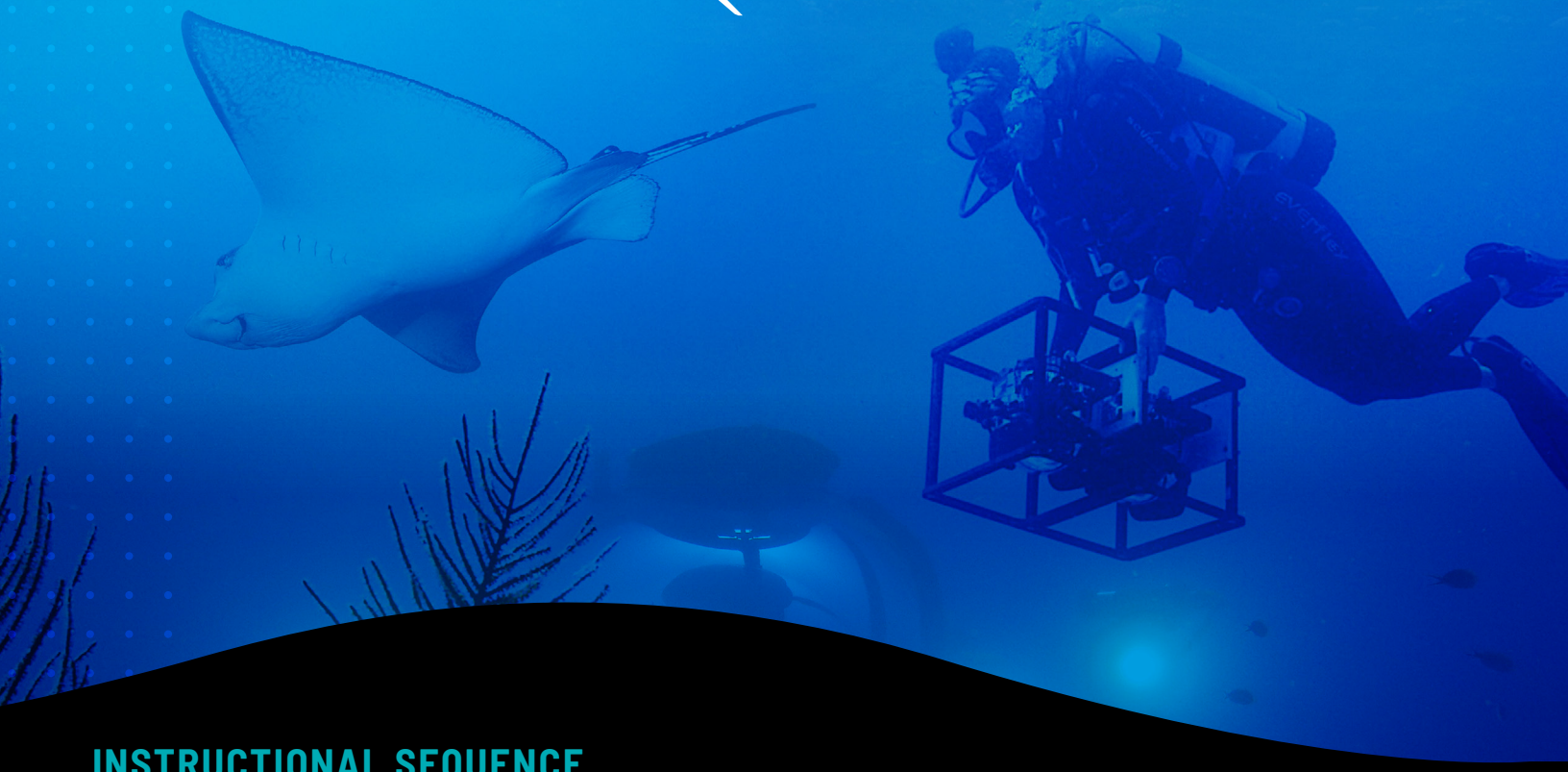
OCEANX

FLYING FISH

OCEANXPERIENCE



INSTRUCTIONAL SEQUENCE

HAMMERHEAD BYCATCH ENGINEERING DESIGN CHALLENGE

Threats to the Ocean, Career Exploration

GRADE LEVEL: 9-12

ARIZONA SCIENCE CENTER

Never stop wondering.
Never stop imagining.™

Presented for Australian audience by:

WAM WESTERN AUSTRALIAN MUSEUM

PURPOSE

Human activity within the fishing industry has had an impact on ocean life. Some people are working to find solutions to reduce the impact on living things in the ocean.

OBJECTIVE

Students will utilize 21st-century skills and the Engineering Design Process to develop a solution to reduce the number of hammerhead sharks caught as bycatch.

YEAR 9

SCIENCE

Science understanding – Biological sciences:
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.

DESIGN AND TECHNOLOGY

Contexts – Food and Fibre Production:
WA9TDECFF1 - Competing factors influence the design and function of specialised food and fibre products and systems. Social, environmental, economic and sustainable considerations for the design and development of specialised food and/or fibre products and systems, including consumer and/or producer values and management of resources to achieve designed solutions for a specified community need.

Technologies and Society:
WA9TDETS1 - People consider social, ethical and sustainable factors, and use specialised technologies for designed solutions to address community needs.

WA9TDETS2 – Products, services and environments are designed and developed with consideration of economic factors and alternative technologies.

Design thinking skills – Investigating and defining:
WA9TDEDTID1 - Ideate a problem and define the needs of an end user, through interviews and/or surveys.

WA9TDEDTID2 - Develop a design brief for a solution based on end user needs.

WA9TDEDTID3 - Investigate a range of technologies, resources and/or components to develop ideas and solutions, with consideration of social, ethical and other constraints.

YEAR 9 - CONTINUED

Design thinking skills – Designing:
WA9TDEDTD1 - Design alternative solutions considering available technologies, usability and aesthetics, using appropriate technical terms.

Design thinking skills – Producing and implementing:
WA9TDEDTPI1 - Select, implement and test a range of technologies, techniques and processes to produce designed solutions and/or prototypes.

Design thinking skills – Evaluating:
WA9TDEDTE1 - Evaluate design processes and solutions against student-developed criteria.

YEAR 10

DESIGN AND TECHNOLOGY

Contexts – Food and Fibre Production:
WA10TDECFF1 - Role of technological innovations in ways food and fibre products are grown, processed and marketed, in the design of ethical and sustainable products and systems Social, ethical, sustainable, consumer and producer considerations in the design and development of entrepreneurial and marketing strategies for a food- and/or fibre-based enterprise, including management of risks, security measures and regulatory responsibilities for optimum quality and performance to achieve designed solutions.

Technologies and Society:
WA10TDETS1 - People consider social, ethical, sustainable and security factors to improve design and production systems using specialised technologies to achieve designed solutions.

WA10TDETS2 - Products, services and environments are designed and developed with consideration of specialised occupations, economic and environmental factors to identify market opportunities, innovate, create and develop entrepreneurial behaviours.

Design thinking skills – Investigating and defining:
WA10TDEDTID1 - Ideate a problem and define the needs of the client/stakeholder through anecdotal evidence and/or data gathering techniques.

Design thinking skills – Designing:
WA10TDEDTID2 - Develop a design brief for a solution or to innovate an existing product, service or environment.

Design thinking skills – Evaluating:
WA10TDEDTE1 - Evaluate design processes and solutions against student developed criteria.

YEAR 11

Animal Production Systems
Marine and Maritime Studies
Materials Design and Technology
Design
Engineering
Food Science and Technology

YEAR 12

Animal Production Systems
Marine and Maritime Studies
Materials Design and Technology
Design
Engineering
Food Science and Technology

VOCABULARY

BYCATCH
An accidental capture of marine species such as sea turtles and sharks during routine fishing expenditures

MARINE
From the ocean

COMMERCIAL FISHING
When fish are harvested from the ocean with the intent to sell for profit

MATERIALS

COMPUTER WITH INTERNET ACCESS

ONLINE RESOURCES

HOW SOLAR SAVES SEA TURTLES AND THE FUTURE OF FISHING: JESSE SENKO: ARIZONA STATE UNIVERSITY (ASU)

THE IMPACTS OF BYCATCH ON HAMMERHEAD SHARKS: WHY THEY SHOULD FEAR US MORE THAN WE FEAR THEM ARTICLE BY LAURA RUMEO FROM UNIVERSITY OF TORONTO

ENGAGE

What problem are we trying to solve?
Thinking back to our field trip to *OceanXperience*, we were able to explore how one threat to marine life is entanglement in fishing gear. What do you remember observing about this topic during our field trip?

Quick class discussion using the 'think-pair-share' strategy about what students remember observing regarding this threat. Students should recall learning about bycatch (when an unwanted fish, etc is caught during commercial fishing).

Ask students to generate a definition for the vocabulary word, 'bycatch', and add this to their science notebooks and/or word wall.

Tell students that you have heard an inspiring story of a scientist named Jesse Senko who is fascinated by sea turtles and found a way to help them avoid becoming bycatch by engineering something new.

Show students the YouTube **video: How solar saves sea turtles and the future of fishing: Jesse Senko: Arizona State University (ASU)**

After the video, facilitate a class debrief of observations and interesting moments from the video.

Ask students if they think a similar solution would work for the hammerhead sharks they learned about while visiting OceanX.

Create a class KWL chart to begin brainstorming how they could accomplish this. Under the K section, ask students what they already know about hammerhead sharks, and make a class list.

Under the W section, ask students for what they want to know, or what topics they might need to research more before deciding how to best help the hammerhead sharks not become bycatch. Example response: Why do the lights help sea turtles? Would the lights help hammerhead sharks in the same way? What causes the hammerheads to swim into fishing nets?

Leave the L section open- students can add the answers to these questions in the L section during/after their research.

EXPLORE

Prompt students to read **"The Impacts of Bycatch on Hammerhead Sharks: Why They Should Fear Us More Than We Fear Them"** article by Laura Rumeo from the University of Toronto. Ask students to record any useful information that may help them design a solution to the problem in their science notebooks. Allow students to locate other resources for research as well, and add their findings to their notebooks. Suggested research time: 1-2 class periods.

Once students have collected enough research, prompt students to imagine at least two solutions independently. They may record their labeled diagrams in their science notebooks.

After students have imagined their own ideas, arrange students into groups of three-four. Prompt students to each share their diagrams to their team. Teams should then decide on a final design together, incorporating ideas from all team members.

Prompt students to record their team's design in their science notebooks. Remind them to show detail and include labels.

Prompt students to create a list of materials they would need to build their design, and add this list to their notebooks.

EXPLAIN

Explain to students that they will be creating a presentation featuring their product proposal. If possible, reach out to OceanX to coordinate local experts in the field of marine biology, ocean exploration/research, engineers, etc. to join the class on presentation day.

Teams must develop a presentation to convince their audience of the potential positive impact their product will have on reducing the amount of hammerhead shark bycatch. Students can choose their presentation style.

After each presentation, encourage feedback from the audience in the form of questions and suggestions for improvement.

EXTEND

After presentations have concluded, teams debrief together and discuss ways they could improve their design. Each student creates a final design in their science notebooks.

EVALUATE

Ask students to respond to the following prompts in their science notebooks:

- How will your team's design reduce the amount of hammerhead sharks that are caught as bycatch?
- What went well for your team during this project?
- In what way did you improve your design after hearing feedback from the audience?
- How do you think this improvement will be even more beneficial to the hammerhead shark population?

After responding to the prompts, ask students to turn in their science notebooks for grading.

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