# Unraveling the History of Sharks

## Companion Lesson to X-STEM All Access Episode "Diving in with Sharks"

| **Grade/ Grade Band: 6-12** | **Topic:** Taxonomy | |
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**Brief Lesson Description**: In *Diving in with Sharks!* Lauren and Joe Romeiro share their love for one of the most misunderstood creatures on the planet, SHARKS! There are more than 500 species of sharks swimming in our oceans and, as feared as they are, sharks are in danger. In today's lesson, students will examine a few sharks and learn how they are classified and named.Through analyzing fossil records to observe patterns of existence, extinction, and change in life forms throughout the history of Earth. Students explore natural selection and adaptation through the classification of sharks. Identify shared characteristics and learn about taxonomy, shark anatomy, and evolution. Students are looking to answer the essential question: What makes a shark a shark?

**Performance Expectation(s):**

MS-LS4-1: Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations

**Specific Learning Outcomes:**

1. **Students will be able to identify organisms' Genus and species based on shared characteristics**
2. **Students will be able to explain the system scientists use to classify organisms**

**Narrative / Background Information**

**Prior Student Knowledge:**

Students should understand evolution and how evidence is used to explain a common ancestor.
Students should be able to define and explain the role of adaptations in populations.
Students should be familiar with taxonomy and binomial nomenclature.

**Science & Engineering Practices:**

**Analyzing and Interpreting Data**

Analyzing data in 6-8 on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to determine similarities and differences in findings. MS-LS4

**Disciplinary Core Ideas:**

**LS4.B: Natural Selection**

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

**LS4.C: Adaptation**

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

**Crosscutting Concepts:**

**Patterns**

- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4)

**Possible Preconceptions/Misconceptions:**

Some students may believe taxonomy is not important, but taxonomy is fundamental to understanding biodiversity on the planet. With the new technologies the study of taxonomy has changed and led to new characteristics of and connections between organisms.
Students believe that sharks are all the same or that you can mate a tiger and a shark to create a Tiger Shark. But there are more than 500 species of sharks. Students will learn that only organisms of the same species can mate and reproduce fertile offspring.

**LESSON PLAN – 5-E Model**

**ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:**
Ask students to create a word cloud about sharks, writing down all the words that come to mind when they hear SHARKS. Students then share their responses to generate a whole class word cloud about SHARKS.

Show students the video *Diving in With Sharks!*

Give students 1-2 min(s) to record any new wonderings.

**EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:**
Prior to the lesson, ensure the laptops can access the links to Joe Romeiro's videos on Vimeo (see worksheet for links) and upload worksheet to your learning management system (i.e. Google Classroom, Canvas).

Begin the exploration by asking students the essential question for today's lesson: "**what makes a shark a shark**". Students will view short clips of 6 sharks and record descriptions of their head shape, tail shape, and fins on What Makes A Shark A Shark worksheet. Students will identify similarities.

**EXPLAIN: Concepts Explained and Vocabulary Defined:**

Remind students that there are more than 500 species of shark. With this next activity students are going to work in small groups to determine the scientific names of the six sharks they observed earlier.

Explain that the scientific study of naming, defining, and classifying groups of organisms based on shared characteristics is known as taxonomy. Share the Amoeba Sisters video on Classification to quickly review taxonomy and classification. Emphasize for students that taxonomy is constantly evolving as a field thanks to new technologies and our understanding of DNA. Also highlight the Binomial Nomenclature system and explain that the first name or the Genus identifies closely related organisms and the second name, or the species refers to organisms that can mate and reproduce fertile offspring. Together the *Genus species* is known as the scientific name of an organism.

Give students the list of Latin and Greek Parts of Words Relevant to Sharks and have students determine the *Genus species* or scientific name of each of the 6 sharks they observed.
(ans.: Basking shark- Cetorhinus maximus, Great white shark- *Carcharodon carcharias*, Tiger shark-*Galeocerdo curvieri*, Whale shark-*Rhincodon typus*, Hammerhead Shark- *Sphyma zygaena*, Mako Shark- *Isurus oxyrinchus*)

Ask students to focus on 1 shark (suggestion: teacher assigns the shark to each group to avoid repetition; if there are more than 6 groups teacher can assign an unknown shark i.e. Angelshark, Nurse Shark, or Pygmy Shark to more advanced researchers). Students visit the Smithsonian Ocean, Sharksider, and the Shark Trust websites to research more about sharks and gather information to answer the question: **What makes a shark a shark?**

**Vocabulary:**
**Taxonomy:** scientific study of naming, defining, and classifying groups of organisms based on shared characteristics
**Classification:** a system for arranging organisms into categories based on structural similarities or evolutionary relationships
**Binomial Nomenclature:** a system for naming an organism with two names, the first identifies the genus the organism belongs to and the second identifies the specific species.
**Genus:** a taxonomic rank used in classifying organisms based on similar characteristics and are closely related through a common ancestor; contains multiple species
**Species:** a group of organisms that can reproduce with one another in nature and produce fertile offspring

**ELABORATE: Applications and Extensions:**

The teacher should have assigned each group 1 shark from the 6 observed before students begin to research.

Students prepare a poster presentation explaining what makes a shark a shark. The poster presentation should include an explanation of Shark Taxonomy from Kingdom to species of shark assigned and what they think makes a shark a shark.

**EVALUATE:**

**Formative Monitoring (Questioning / Discussion):** As students complete the What Makes A Shark A SHARK sheet, teachers should focus on the elements relating to structure and form in the first chart and scientific naming in the second chart to give teacher an understanding of what students know and understand about taxonomy and classification based on shared characteristics.

**Summative Assessment (Quiz / Project / Report):** Poster Presentations

**Elaborate Further / Reflect: Enrichment:** Have students do a gallery walk to observe other groups' posters. For each poster, students should use Post It notes to provide feedback. They can leave a positive (One thing you did well was…), areas of growth (Next time you could consider…) or clarifying questions (Can you explain….).

**SOCIAL EMOTIONAL LEARNING ACTIVITY**

**CASEL Competency: SOCIAL AWARENESS**

Joe and Lauren work hard to dispel myths about sharks. By studying sharks, the Romeiros gain a new perspective on these enigmatic animals and become more compassionate for them. Explain to students that they too have an enigmatic self, things about themselves that no one knows that can lead to misconceptions and a lack of empathy.

Students write down three aspects of themselves that no one else knows. Assign students to groups of three or four and ask them to read their information to each other. Have one member of the group read all of the group's fact sheets to the class and have the rest of the students guess which group member is which. Have students celebrate one another's unique selves, and make sure to reiterate the need to respect each other. Through this activity students are making connections with each other and becoming more aware of who their classmates are. Explain to students that with such awareness they will understand more about each person and become more empathic.

**INTERDISCIPLINARY CONNECTIONS/IDEAS**

During this lesson students are reading informational text in alignment with ELA standard RST 6-8.1

*Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions*

| Materials Required for This Lesson/Activity | |
|---|---|
| **Quantity** | **Description** |
| Per student | Laptops |
| Per team | Small poster paper |
| Class set | Colored pencils/markers |

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