Instructor's Notes: What Makes a Shark a Shark?

Lesson Overview:

This lesson introduces students to the distinctive anatomical, physiological, and behavioral traits that set sharks apart from other fish. Students will explore shark-specific adaptations in skeleton structure, buoyancy, skin texture, respiration, reproduction, dentition, and sensory systems. These features not only define sharks as a group but also explain their evolutionary success and ecological dominance.

NGSS Alignment:

- **HS-LS1-2:** Develop and use a model to illustrate the hierarchical organization of interacting systems.
- **HS-LS4-1:** Communicate scientific information about common ancestry and diversity.
- **HS-LS4-2:** Construct an explanation based on evidence for how natural selection leads to adaptation.

Key Concepts and Background Information:

I. Skeletal Structure and Buoyancy

- Sharks belong to class **Chondrichthyes** and have a **cartilaginous skeleton** rather than bone.
- Cartilage is lighter and more flexible, aiding maneuverability and reducing body weight.
- Unlike bony fish, sharks **lack a swim bladder**, making them naturally negatively buoyant.
- **Large oil-filled liver** provides buoyancy; the **heterocercal tail** helps generate lift during swimming.

II. Skin and Respiration

- Shark skin is covered in **dermal denticles (placoid scales)**—tooth-like structures that reduce drag and resist parasites.
- Most sharks have **5 to 7 gill slits** (bony fish have 1 gill opening per side, protected by an operculum).
- Many sharks rely on **ram ventilation**, requiring constant movement to pass water over gills.
- Some can also use **buccal pumping** (e.g., nurse sharks).

III. Reproduction and Teeth

- Sharks reproduce via **internal fertilization**; males use **claspers** (modified pelvic fins).
- Reproductive strategies:
    - **Oviparous** (egg-laying): e.g., horn sharks.
    - **Ovoviviparous** (eggs hatch inside body, live birth): e.g., great white sharks.
    - **Viviparous** (placental connection): e.g., hammerheads.
- Sharks have **multiple rows of teeth**, and most species **shed and replace teeth** throughout life.

IV. Sensory Adaptations

- **Lateral line system** detects vibrations and pressure changes in water.
- **Ampullae of Lorenzini** detect electrical fields produced by muscle contractions of prey.
- Sharks also have:

- Highly developed **olfactory system** (can detect blood at very low concentrations).

- Acute **vision** adapted for dim light conditions.