

Hatchetfish vs Dragonfish

In this episode of Sketch and Coffee Live, the host pulled a toy labeled as a hatchetfish but discovered it resembled a dragonfish. The discussion compared the two species, focusing on differences in size, light-producing organs, and hunting strategies. Hatchetfish are tiny and use light on their bellies to erase shadows, while dragonfish are larger and generate their own spectrum of light to hunt. Both belong to the order Stomiiformes, splitting from shallow ancestors about 100 million years ago and further diverging around 60 million years ago. With no fossil record, scientists rely on mitochondrial DNA to trace their history. They live in deep ocean zones from 200 to 4,000 meters, and their bioluminescence has inspired new technologies for medicine, transportation, and space exploration.

<https://www.youtube.com/live/VGXfa9C4azc?si=ETMaIOFHBzsxwXLg>

Objective

Students will analyze the differences between hatchetfish and dragonfish, understand their evolutionary history, and explain how bioluminescence has influenced modern technology.

Materials

Copies of the 9 Fun Facts

Worksheet (provided)

Optional: images or short video clips of bioluminescent fish

Introduction

Show students an image of both a hatchetfish and a dragonfish. Ask them to describe what they see and how the two animals might use their shapes or features to survive. Explain that even though these fish are small, their adaptations play important roles in deep-sea ecosystems and modern science.

Activity

1. Read through the 9 Fun Facts with the class.
2. Highlight the evolutionary split between the two families.
3. Compare and contrast their light-producing strategies.
4. Discuss how humans have borrowed these adaptations for technology.

Assessment

Completion of worksheet questions.

Participation in group discussion.

Ability to describe adaptations and their technological applications.

Rubric

Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Content Understanding	Clear and accurate	Mostly accurate	Some errors	Minimal understanding
Discussion Participation	Frequent and thoughtful	Regular participation	Occasional	Rare
Worksheet Completion	All complete and correct	Mostly correct	Some correct	Incomplete
Technology Connections	Strong and clear	Adequate	Weak	None

9 Fun Facts

1. Ancient deep-sea origins

Hatchetfish and dragonfish trace their ancestry to shallow-water fishes that adapted to the deep ocean about 100 million years ago in the late Cretaceous. As oceans shifted, new ecological niches opened up, giving rise to many of today's bioluminescent species. These fish represent survival in one of the harshest habitats on Earth.

<https://www.sciencedaily.com/releases/2022/10/221031144935.htm>

2. Split into families

Roughly 60 million years ago, these fish diverged into different families. Hatchetfish became small, flattened specialists with light organs to mask their presence. Dragonfish evolved larger bodies for their scale, huge jaws, and glowing lures that make them effective ambush predators. Both belong to the order Stomiiformes but followed very different evolutionary paths.

<https://www.pnas.org/doi/10.1073/pnas.2123544119>

3. Deep-sea zones

Both hatchetfish and dragonfish live in the mesopelagic and bathypelagic zones of the ocean, ranging from 200 to 4,000 meters deep. Sunlight does not reach these levels, so the environment is dominated by cold, pressure, and total darkness. Bioluminescence becomes the main way to hunt, hide, and communicate.

<https://www.noaa.gov/jetstream/ocean/layers-of-ocean>

4. Size differences

Hatchetfish are tiny, usually between 3 and 5 centimeters long, about the length of a paperclip. Dragonfish, while still small compared to many predators, grow to about 15 centimeters, close to the size of a human hand. These size differences also shape their roles in the food chain, with dragonfish often preying on hatchetfish.

<https://www.mbari.org/animal/dragonfish/>

5. Predator-prey link

Dragonfish are indiscriminate hunters, eating whatever small animals they can catch, including hatchetfish. Hatchetfish, in turn, feed on zooplankton and tiny shrimp that drift in the currents. This creates a direct predator-prey relationship in the deep ocean, where energy must pass through many small steps in the food web.

<https://www.mbari.org/animal/dragonfish/>

6. Light strategies

Hatchetfish use photophores on their bellies to shine light downward, blending in with the faint glow from above and erasing their shadows. Dragonfish generate their own red and blue light, wavelengths invisible to most other species. This gives dragonfish an edge in ambushing prey that cannot detect their glow.

<https://www.nature.com/articles/nature01433>

7. Studying vision

Because these animals live where no sunlight reaches, their eyes are tuned to detect extremely faint or unusual light. Scientists study their vision and light organs to learn how to build cameras that can pick up signals in conditions where normal equipment fails. This helps reveal new animals and behaviors in the deep.

<https://www.sciencedaily.com/releases/2019/05/190509142831.htm>

8. Technology inspired by fish

Deep-sea adaptations are already being applied to modern technology. Bio-inspired low-light cameras are used in underwater robots to study fragile ecosystems, in self-driving cars to improve nighttime safety, and in surgical tools that let doctors see during delicate procedures inside the body. The lessons from these fish are already saving lives.

https://www.optica.org/about/newsroom/news_releases/2018/bioinspired_camera_could_help_self-driving_cars_see_better/

9. Space science connection

The same principles that help deep-sea fish see in darkness are being used in astronomy. Instruments like lobster-eye optics, inspired by marine vision, now fly on missions such as the Einstein Probe. They allow telescopes to capture faint X-ray signals from faraway galaxies, showing how lessons from the ocean can illuminate the universe.

https://www.esa.int/Science_Exploration/Space_Science/Einstein_Probe_opens_its_wide_eyes_to_the_X-ray_sky

Worksheet

Name: _____ Date: _____

Review Questions

1. How big are hatchetfish compared to dragonfish?
2. In which zones of the ocean do these fish live?
3. What tool do scientists use to study their history without fossils?

Discussion Questions

1. Why might a hatchetfish toy be mislabeled and resemble a dragonfish?
2. How does each species use bioluminescence to survive?

Data Analysis

1. Compare how hatchetfish and dragonfish use light in hunting. Which method is more effective in the midnight zone?
2. List two human technologies influenced by studying these fish.

Reflection

1. What detail about these fish surprised you the most?
2. Why is it important to keep studying deep-sea animals?