



# BACK BAY SCIENCE CENTER

## Fish Population Module

### BACKGROUND INFORMATION

Fish can be found in the wide array of waters on the planet. Marine fish have evolved mechanisms for handling salt, without losing cellular water through naturally occurring osmosis. Fresh water fish do not have this need. These adaptations usually select for life in either salt or fresh water. If an estuary is deep enough, it can actually maintain species within the different zones of its water column that are adapted to three habitats: salt water, the densest, on the bottom; fresh water, the least dense, on the top; and the brackish mix of the two in the middle. Besides adaptations for salinity, fish have evolved morphological and other traits that help them survive in their particular habitat. The more gentle waters of an estuary provide an ideal environment for spawning and developing young of many species.



There are some species that can live in both fresh and salt water. Perhaps the most well-known are the salmon, living for part of their life cycle in fresh water and then thriving in the open ocean as adults. In Upper Newport Bay,

### ACTIVITY I: Taking a Closer Look at Behaviors

#### CALIFORNIA STATE CONTENT STANDARDS

##### Grades 6 – 8

6<sup>th</sup> Gr. Science:  
Ecology - 5b, e.

7<sup>th</sup> Gr. Science:  
Evolution - 3a  
Investigation and  
Experimentation: 7a

##### Grades 9 - 12

Science:

Biology/Life Sciences:  
Ecology: 6b, d.  
Evolution: 8a, b

AP Science:  
Science Practices: SP1.2  
Life Science: LS 3.1, 3.2

EEI P and C: IIa; IV b, c

Ocean Literacy Principles: 1g; 6e

the Killifish, Longjaw Mudsucker and Arrow Goby can all live in fresh and salt water. There are also some species, like the Topsmelt, that are able to live in the brackish waters, where the salinity levels fluctuate.



Because there is zonation, fish have also evolved morphological adaptations to help them survive. Survival depends on the ability to find food without becoming prey in the process. It's important to accomplish this without losing tremendous energy, so there's enough for the animal's growth and reproduction. Many species, such as the Shiner Surfperch, have evolved torpedo-shaped bodies that allow sleeker and more energy-efficient movement through the water and the resisting force of drag. Benthic, or bottom dwellers, such as the Diamond Turbot, California Halibut, and the Rays, commonly have flat bodies with both eyes on the side facing the water. The reed-like body of the Bay Pipefish mimics the eelgrass where it is commonly found. The pectoral fins of Rays have evolved into wing-like extensions of body tissue, allowing sleek movement. The powerful caudal fin allows efficient movement of the predatory sharks.

There are other morphological adaptations besides overall body shape. Thrusting underbites can be found in a number of species that hunt at the top of the water column. Overbites characterize many fish that hunt along the sandy bottoms. Dentition is also an indicator of lifestyle. The Pacific Barracuda has teeth that are meant to bite and rip, while the forked teeth of the Topsmelt are adapted to foraging amongst plants. Because body tissue is denser than water, sinking is an issue for fish. Many bony fish have evolved an internal gas-filled swimbladder, just below their spine. By compressing or expanding the sac, buoyancy and vertical movement is regulated.

Fish have other adaptations that help them survive. Countershading is another adaptation commonly seen in fish. Many species have pale undersides and darker topsides. When seen by a predator from below, they will blend more with the sunlight filtering into the water. When seen by a predator from above, they will blend more with the sand, rocks and vegetation. This type of camouflage is also seen in silvery fish such as the



Deepbody Anchovy, when incoming sunlight bounces off their bodies. Lateral lines are common to many fish

species. Running along the length of its body, these receptors allow a fish to detect vibrations in the surrounding water. Large vibrations denote a potential predator, small ones a potential prey. The Longjaw Mudsucker can actually breathe air, helpful for survival during low tides. Behavioral adaptations such as schooling makes any one individual less susceptible to predation, and the group projects a larger image.



The calmer waters of an estuary support ideal conditions for spawning and developing fish. This rich supply of fish contributes to a thriving and strong ecosystem. Aquatic ecosystems, however, are being threatened by introduced species. Often hitch-hiking on the hulls of boats, or released by aquarium owners these invasive species can out-compete the native species for food. With no local predators, they can grow larger, hunt more successfully, and reproduce more. This seriously threatens the balance of the foodweb, and is an issue of concern for all who enjoy the beauty and resources of the estuary.

### RESOURCES:

[www.coastal.ca.gov/publiced/UNBweb/owow.html](http://www.coastal.ca.gov/publiced/UNBweb/owow.html) - Our Wetlands, Our World, Newport Beach

[www.coastal.ca.gov/publiced/waves/waves1.html](http://www.coastal.ca.gov/publiced/waves/waves1.html) - Waves, Wetlands, and Watersheds

[http://oceanservice.noaa.gov/education/tutorial\\_estuaries/welcome.html](http://oceanservice.noaa.gov/education/tutorial_estuaries/welcome.html) - background

<http://www.era.noaa.gov/> - Estuary Restoration information

<http://www.montereybayaquarium.org/animals/>



## TEACHER GUIDE – Fish Population Module

### ACTIVITY: Taking a Closer Look at Fish and Their Behaviors

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#### OBJECTIVES:

Students will be able to:

1. Identify several distinct zones within an estuary, providing different microhabitats.
2. Detail morphological as well as other adaptations fish have to their microhabitats.
3. Explain that the estuary provides shelter and food resources for developing fish, as well as adults.
4. Complete an ethogram recording the specific behaviors of observed fish.

#### KEY TERMS:

Adaptation Arrow Goby Bat Ray  
Bay Pipefish Benthic Brackish  
Camouflage California Halibut  
Caudal Fin Countershading  
Deepbody Anchovy Dentition  
Diamond Turbot Dorsal Fin Estuary  
Introduced Species Gray  
Smoothhound Shark Invasive  
Killifish Lateral Line Leopard Shark  
Longjaw Mudsucker Morphology  
Osmosis Pacific Barracuda  
Pectoral Fin Predator Round  
Stingray Salinity  
Shiner Surfperch Swimbladder  
Thornback Ray Topsmelt Water  
Column Zonation

#### MATERIALS:

Observation Sheets  
Colored Pencils  
Plain Pencils

