Unit 2. Fish Ecology

Lesson 1. --What is a Fish?

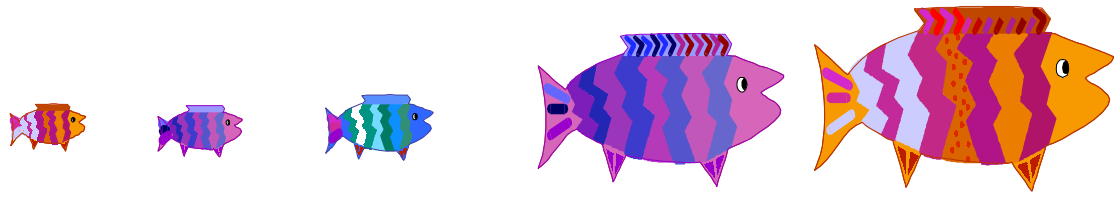
Lesson objectives:

- Students will understand external fish anatomy, and that fish come in many shapes and sizes
- The students will be able to identify the different zones of the ocean
- Students will become familiar with the methods that are used to study fish are diverse, and each has a purpose.

Vocabulary words: vertebrae, planktonic, nektonic, benthic, continental margin, and many more pertaining to ocean zonation

What is a Fish?

A fish is defined as an aquatic or marine animal with **vertebrae**. All fish have vertebra, except sharks and rays that have cartilage. Cartilage is more flexible than bone, but strong enough to support the body. They usually possess gills in the adult stage and have limbs in the form of fins. Fishes also include the jawless vertebrates such as the lamprey and hagfish; and the shark, ray, chimaera, lungfish, and bony fishes. The bony fishes are the most common. A bony fish has jaws that are well developed, formed by true bone rather than cartilage. Fish are very different in appearance, size and shape. This all depends on the environment that it lives in.



Fish Habitats

Fish occupy almost every conceivable aquatic habitat. Describing the ocean is difficult, as there are many words that are used to explain the land and water realms. These habitats are defined by the critters that live in each. Visualize a column of water. This is the **pelagic** (the water, not associated with land) realm of the ocean.

Geographic zonation defines the coastline, and submerged land. Scientists use these words to help in the identification of animals that live on the **substrate** (land).

Some fish live in man made habitats in peoples homes. These habitats are called aquaria.

There are other terms that describe the geographic zones that pertain to the continent and landmasses under the water. Between the continental land and seafloor is the **continental margin**. It is the submerged part of the continent, and makes up a transition zone between the continents and ocean basins. The continental margin includes the **coast** (also known as the littoral **zone**), the **continental shelf**, the **continental slope**, and the **continental rise**. The continental rise ends where the **abyssal plain** begins. The deepest parts of the ocean are located in the **trenches**, or **hadal** areas.

(Activity 1 is an illustration that is to be labeled with the different vocabulary words found in this section.)

Prefix (most have Greek origins)	English definition	Realm (water or land)	Depth	Example of what lives there
pelag(os)	of the sea	water	no specific depth, just pertaining to the water realm, NOT the land	all organisms found in the water column
epi	outer, exterior	water	0-200m	plankton, fish larvae, very small fish
meso	middle	water	200-600m	active swimmers such as the tuna, squid and marine mammals
littoral *(littoralis)* origin is Latin	of or pertaining to the edge of a lake, sea or ocean	water and land boundary	seashore area	crabs, juvenile fish, plankton, larvae
batho- or bathy-	depth	both	4000m and deepter	deep sea organisms, gulper eel
abyssos	deep area or space, chasm	both	4000m to 6500m	deep-water organisms
benthos	depth of the sea, bottom	land	0 (beach zone) to deepest ocean bottoms	flounder, stargazers, crabs, starfish, urchins, snails, christmas tree worms
hadal	deepest part of the sea, trenches	land	6500m and deeper	deep sea organisms, some eels, lantern fish

How Do We Study Fish?

Scientists study fish in many ways because sometimes they want to observe them in their natural environment, and other times, scientists need to observe the internal body structures. The study of fish might be completed through the use of **SCUBA**, nets, trawls, **seines**, and videography.

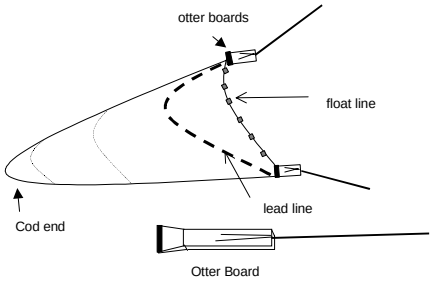
Scientists use SCUBA observe fish in their natural habitat, collect them to dissect or observe live, or capture their movements on video camera. Another way that a scientist studies fish is with the use of a manned or unmanned **ROV** (Remotely Operated Vehicle). Using an ROV, a scientist may observe fish and their habitat without disturbing it. ROV's are extremely useful for scientists to use at great depths. When an ROV is used for research, the materials are almost always captured on video. They are also useful for capturing live fish into containers without inflicting harm.

Nets may be small enough that one or a few persons can use them. These might be trailed in the water over a distance, or the fish may be directly caught in them. Other nets are very large, and require use of a boat and heavy machinery to use them.

Beach seines are long mesh nets with lead weighing down the bottom of the net, and styrofoam or airfilled floats on the top of the net that stay at the water's surface. Wooden poles attached to either end of the net are used to move the net through the water. Seine nets may be used nearshore where the leadline will rest on the bottom, while other times it may be used in the pelagic realm, and never rest on the bottom. Sometimes, a seine net will have a bag or a sack attached to the middle of the net to help in the capture of fish in the center of the net.

Otter trawls are much like seine nets. They are dragged across the bottom of seagrass and soft

sediment communities for the sampling of **demersal** and near-bottom fishes as well as **epifaunal** invertebrates. The structure of the otter trawls is slightly different in that they are shaped like an ice cream cone.



The fish are captured in the **cod-end** of the net. This is the pointed end of the cone. Often within the mouth of the net, scientists will attach a plankton net. The plankton net captures the microscopic plants and animals. That way, the fish in the trawl do not eat them in the trawl, and there is something to feed the live fish scientists are studying.

This is a sketch of a research vessel towing a 1-m **MOCNESS (Multiple Opening Closing, Net E S System)**. The MOCNESS is a 'special' sampling device used to collect multiple samples at variable depths. One meter (1-m) refers to the open area (one square meter) of the net opening (mouth) as it is towed. There are instruments at the top to collect information about the water (such as temperature, salinity, depth, and chlorophyll). In this schematic, there are eight nets. A computer can control each net to open and close at various depths. Samples are collected at each depth and stored until the entire net is brought to the surface. In the drawing, they all are closed, except one. The top net, is sampling the shallowest depths on its way back to the surface. When the MOCNESS is retrieved on board, the collectors (nets and cod ends) are each handled separately for sorting and preserving.

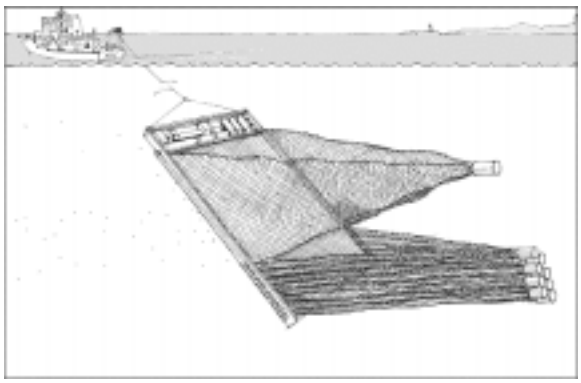


Diagram 2. MOCNESS

There are many more kinds of nets, and special uses for each. This is just a brief overview of a few that can be used.

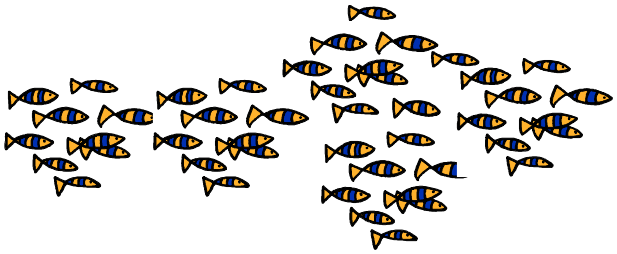
Why do We Study Fish in the Ocean?

Fish play an important role in aquatic ecosystems and have long provided valuable resources to humankind.

Fish are very important economically. Fish are one of the most important sources of animal protein for humans, thus many fishes are used as food. Other products made from fish include nitrogenous fertilizers from fish and fish scraps and the oil extracted from fish livers is one of the sources of vitamin D. Fish scales are sometimes used in making artificial pearls. **Isinglass**, a form of gelatin, is prepared from the air bladders of certain species, and glue is made from fish **offal**.

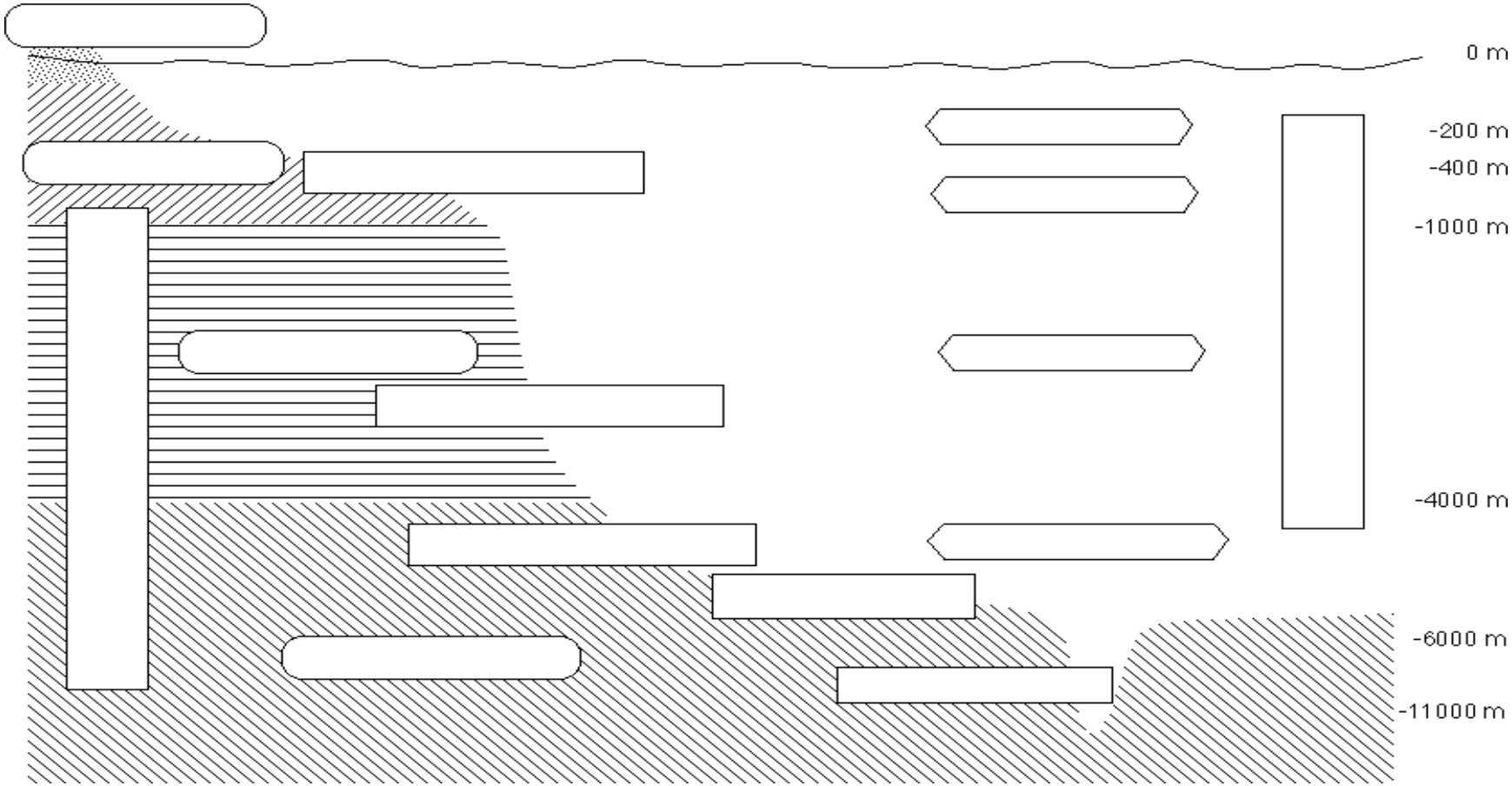
Fish Conservation

Many fishes are threatened with extinction including the great white shark, most killifish, and every species of sturgeon and paddlefish. The threat comes from a variety of sources. Seventy percent of fish species commercially caught around the world are **overexploited**. That is, they are harvested beyond their ability to sustain a given population size, caught to the limit, or are recovering from overexploitation. One third of the world catch is **bycatch**, fish caught unintentionally and discarded as waste. Coastal fisheries are vulnerable to pollution and habitat destruction. **Exotic** fish have been introduced and often replace or threaten **native** fish populations. Dams that keep adults from reaching their spawning grounds hinder populations from reproducing.

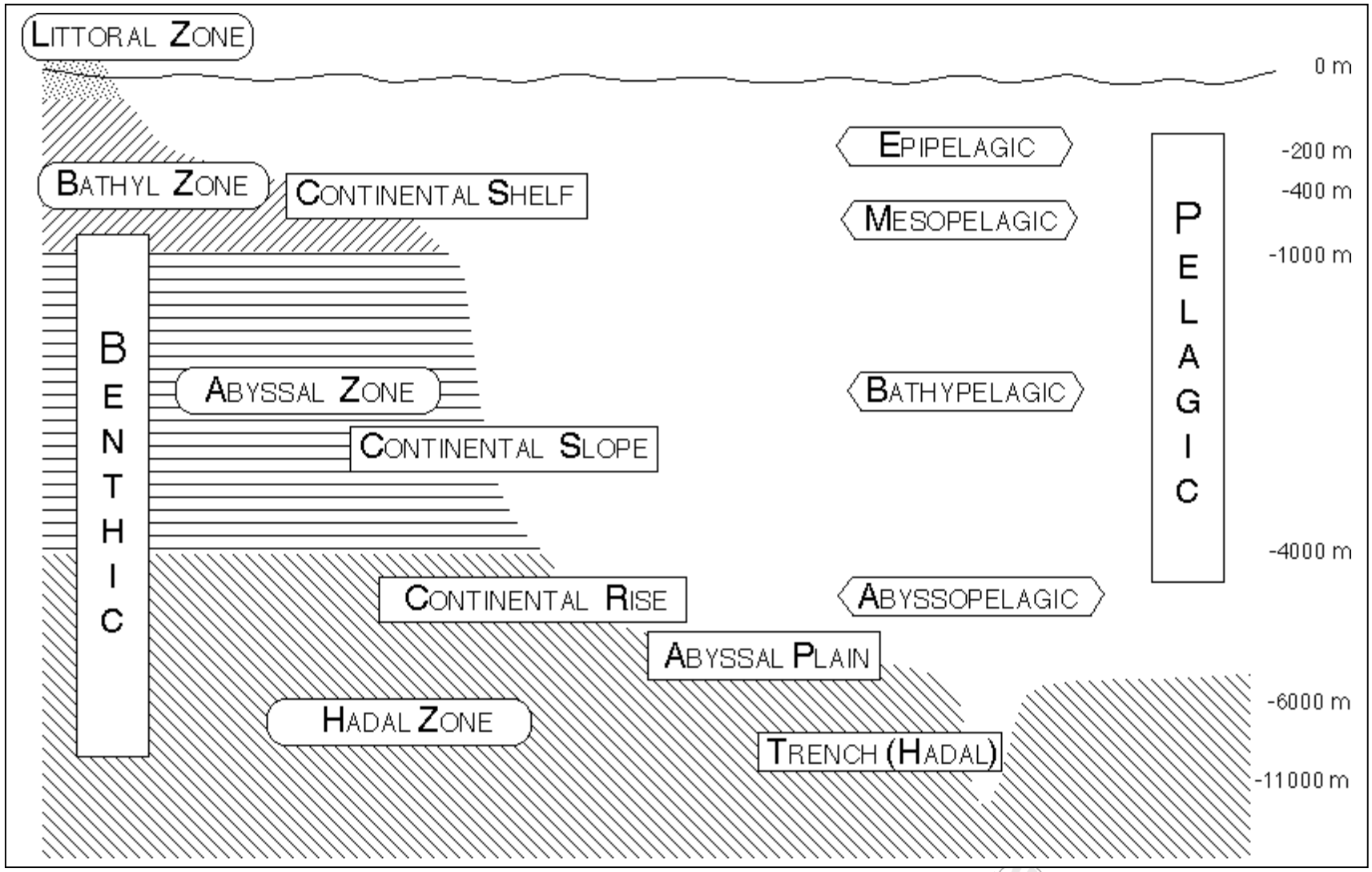


Activity 1-1. Ocean Zonation

Objective: Have the students fill in the blanks with the different vocabulary words found in the 'Where do I Live' section of this informational packet. Students will then learn how the ocean has many zones and places for fish to live.



Activity 1-1. Ocean Zonation -- Teacher's Key



Activity 1-2. Fish Body Outlines

Method: Outline the general body shape of your fish and identify the different body components. Save picture for use in Unit 3.

Discussion: Have the students discuss the differences in body shapes, and how that might affect how a fish swims. Using this information, and looking at the coloration or pattern of their fish, the students might be able to guess, or draw conclusions about the habitat their fish might be best adapted to live in.

Outline of fish goes here.

Student Information Sheet 1.
What is a Fish?

Fish are the main food we take from the ocean. They are caught primarily in areas of the ocean that lie over continental shelves. There the water is rich in the phytoplankton. Phytoplankton are the basis of most ocean food chains. Some areas near the coasts act like natural fish farms. This is partly because of natural **upwelling** that brings up nutrients from the ocean bottom that is needed for the growth of phytoplankton.

Today, the fish population is greatly impacted by human fishing. Nearly one-third of all the fish large enough to be taken in nets are caught. Laws currently protect some of the endangered fish populations, and other laws limit the number of fish that can be taken without destroying the populations in the ocean.

Scientists study fish populations and their environment to determine how the conditions of the ocean affect fish populations. Water temperature, pollution, commercial fishing, weather patterns, light, recreation and others affect the fish population and the marine food web. When one link in the web is impacted it effects every other member of the web. Scientists use all of this information together to help ensure that there will always be a supply of fish.

Fish live in three areas of the water column: the **planktonic**, the **nektonic**, and the **benthic**. The underwater environment can be divided into geographic zones, as well as regions of life where organisms live.

Organisms that drift passively in water and usually near the surface are called **plankton**. Organisms that move and swim independently of currents and are capable of long migrations are called **nekton**. Organisms that live along the ocean bottom are called **benthos**.

Match the following. Column two may have more than one answer.

column 1	column 2
phytoplankton	benthic
whale	
jellyfish	pelagic
crab	
bluefin tuna	nektonic