Fish Diversity

Ecosystem Overview

The amazing array of fish body shapes and sizes reflects the equally amazing array of habitats in which they can be found. There are fish living everywhere from tidepools to the deep ocean.

Pelagic

Pelagic fishes are the free swimmers of the open ocean. These fish are large, predatory, and highly efficient swimmers. Adaptations include having forward-looking eyes, highly hydrodynamic (sleek shaped, minimizing frictional drag) bodies and a strong caudal peduncle region, which includes the caudal fin (tail) and caudal peduncle (muscular region just before the tail). This allows for accurate sighting of prey and the fast bursts of speed needed for prey capture. Examples include tuna, marlin and great white sharks. These fish typically spend all of their time swimming with a few hundred meters of the surface. Few venture below the oxygen minimum layer since the associated thermocline serves as an invisible barrier. Most fish are cold-blooded and cannot tolerate sudden changes in temperature. However, several of these pelagic "super-predators" have devised a countercurrent heat exchange system in which the heat generated by the flexing of their massive caudal peduncles is used to warm their blood allowing for brief crossings of these thermal barriers. Tunas and great whit sharks have this heating mechanism.

Rocky Shore (Reef) and Coral Reef

Rocky and coral reef fishes are generally smaller than their pelagic counterparts. Their bodes are adapted for finding shelter between rocks, boulders and coral heads. To accomplish this, many have body designs with more maneuverability rather than speed.

Rocky shore fishes are considered to be a transitional group between the kelp fishes and the coral reef fishes as they maintain drab colors to blend in with their rocky habitat, yet have similar body shapes to reef fishes. One example includes the Cortez Damselfish. A wide diversity of fishes with an equally large variety of morphologies may be found in rocky shore areas. Moray eels hide their snake-like bodies in crevices. Pufferfish utilize their inflatable bodies, spines, and the secretion of toxin considered to be 1000 times as deadly as cyanide for protection. Likewise, the stone scorpioinfish also uses venom-filled spines as a defense.

Coral reefs fishes are morphologically similar to those of the rocky reef, but they use their ornate coloration as a form of camouflage called disruptive coloration. Coral reefs provide various living spaces for animals. This variety or complexity of habitats helps to explain the enormous diversity and abundance of fishes found in coral reef areas. It is estimated that 30 to 40 percent of all fish species are associated with reefs. An example of fishes in these communities is the triggerfish, possessing a large spine that extends up

like a trigger for protection. The parrotfish is also common, having strong jaws used to bite off chunks of reef so that it may eat the coral polyps. Waste is excreted in the form of sand which accounts for most of the sand produced in the Caribbean Ocean, as parrotfish can excrete one metric tone of sand per year. Throughout the reef, smaller bottom hiders and clingers such as blennies and gobies are common, utilizing the reef's numerous cracks as homes.

Sandy-Bottom

The fishes of the sandy-bottomed habitats generally possess one of two basic forms: eel-like or flattened. The most obvious inhabitants are the flatfishes and rays. Both relay on camouflage to live in this habitat. Stingrays have an additional protective feature – a venomous spine on their tail. Rays use their pectoral "wings" to blow away sand and uncover buried crustaceans and mollusks. Eel-like fishes use their body shape to burrow in the sand. They form deep burrows in which they may hide when threatened. One example is the garden eels which congregate in large colonies on sandy bottoms. Jawfishes, blenny-like in form, but have large jaws to dig and spit out sand to form burrows are also common. The jawfish and the garden eel rarely leave their homes, with the exception of locating mates.

Kelp Forest

Kelp forest ecosystems, such as those located off of California are very rich marine environments. Nutrients are abundant due to upwelling. Primary productivity is substantial in both mico and macroscopic photosynthesizers. Nearly all members of the ecosystem are dependent on the lush canopy of kelp for shelter and nutrition. The giant bull kelp, *Macrosystis*, off the Pacific Coast is an example of a forest-building kelp. Kelp can grow 30 meters from the depth, with an additional 30 meters of surface growth that forms a lush mat. Within this mat, juvenile fishes take refuge. Drab colored fishes, such as sculpins, are shaped to mimic the kelp, cryptically living among holdfast communities. Wolf eels are also mottled so that they may blend in with the kelp while swimming through the fronds. In this system, camouflage and deception are the key to survival.

Deep Sea

In eth deep sea, fishes are so bizarre that thy have exchanged swimming abilities for huge gaping mouths. Since food is so scarce, they must devour any prey they encounter, regardless of size. Swimming is considered to be costly, as it requires energy and greater oxygen expenditure. Fishes at these depths either have supersensitive eyes, or no eyes at all. Prey may be attracted with bioluminescent lures and their mates may spend their whole lives as parasitic sacs. These fishes have exchanged the ornate colors of surface dwellers for ruddy reds and blacks.