

## About Water

One of the most interesting and most important things about fish, something that makes them different from all other vertebrates, is the fact that all fish live in water. And water is a very different medium than air. And as you will learn in this course, that has tremendous indications and ramifications for our understanding not only of the evolution of fish, but of their ecology, their behavior, their sensory systems. Everything about them really hinges on the fact that they live in water.

Now, our planet is called the planet Earth, when in fact it should really be called the planet Water. Two-thirds of the planet is covered in water. Yet, of that water, about 97.5 percent is in the oceans. Now, many fish live in the oceans, obviously. About 51 percent of all species of fish live in the ocean. But what about the rest of the water on the planet? If I say 97.5 percent of water is the oceans, that leaves us 2.5 percent. This 2.5 percent of the earth's water is fresh water. Yet if we look at how that water is distributed, here are some very interesting facts.

Sixty percent of the earth's fresh water is actually tied up as ice at the polar caps, either in the Arctic or the Antarctic. There are some fishes in both the Arctic and Antarctic waters, but not very many. Most of the water that is tied up as ice is completely inaccessible to fishes. Now, 30 percent of the earth's fresh water is

tied up underground in aquifers. Aquifers hold the so-called "fossil water" that makes up the water table of our planet. So 60 percent is ice, 30 percent is ground water. That leaves a very small amount of water that is actually available as a habitat for freshwater fishes; less than one one-hundredth of a percent of the earth's water is available as rivers and lakes on the planet. That's a tiny fraction. Yet in that tiny fraction of the earth's water lives an extraordinary diversity of freshwater fishes. Okay, what else can I say about fish and water? Well, very broadly, I have said that there's a lot of water on the planet, but it is divided between fresh water and marine. The great bulk of it is marine. A tiny fraction is fresh, but in that fresh water live a large number of fish species. But let's look at the distribution of fish through space in another way; let's look at another axis; let's look up and down. If you think of all of the groups of animals alive on the planet, which one of them lives in the widest bandwidth? The answer is going to be fish. Because you can go to very high mountain streams. At over 4 kilometers above sea-level, you're going to find fish living in torrential streams, in Tibet, for example. Then you can go to the other extreme and go to the very depths of the ocean, to the deepest points in the ocean, over eight kilometers below the water's surface where there are tremendous pressures,

where the water is extremely cold, where there's no light at all, and you will also find fish. So we have a bandwidth of 15 kilometers in which there is habitat in which you will find fishes. So not only is there a lot of water, but that water is distributed in an extraordinary way.