

The Pond: Community Ecology in Action

The Limnetic Zone

| Transcript

Narrator: Moving away from the shallow water of the littoral zone, we enter the limnetic zone. This area is characterized by deeper open water. Here in the upper-euphotic zone, light can penetrate and help floating algae such as single-celled diatoms grow. Deeper down is the profundal zone, where light is not strong enough to support primary production so no rooted plants grow.

In the limnetic zone, primary producers are mobile drifters: small microscopic single-celled algae and string algae that can clump together to form rafts at the surface. Algae rafts attract small insects. They use a property of water called surface tension to move across the surface of the pond. Surface tension is caused by the attraction between slightly polar water molecules. The surface tension of the pond creates an environment for many small animals that live on the surface. Snails can use surface tension to crawl upside down across the surface of the water. Those that cannot directly exploit surface tension will often ride on floating plants or algae.

Backswimmers, which are predatory aquatic insects that swim upside down, exploit surface tension in two ways: firstly, to stay floating just under the water surface; and secondly, to create an air film around them to prevent getting wet when they dive. They don't have gills, so they take their air supply with them. Surface tension holds the air against their body so they can breathe. Abundant populations of these small creatures are common in healthy ponds. They too rely on algae because algae provide the food and oxygen which all other organisms in this part of the pond depend on.

Animals are seriously inefficient when it comes to converting the food they eat into useful energy. It varies from organism to organism, but generally about 90 percent of the energy consumed is lost, mostly as heat. As a result, these snails must chomp through vast amounts of plant matter each day.

Imagine a simple two-step food chain: the primary producer, algae, eaten by snails. For every 10 units of energy the snail consumes as algae, only 1 unit is converted into energy that the snail can use. As we move through the food chain, the 10 percent rule applies at all levels. So at each level, only one-tenth of the energy from the previous level is available to the organisms.

Let's take this simple food chain and add an additional step. These ducks eat many different things, but hypothetically, let's assume they are only eating snails. To get 1 unit of energy from eating snails, a duck would have to consume 10 units of energy from snails. To achieve enough biomass to contain 10 units of energy, the snails would need to consume 100 units of energy from algae. Effectively then, 100 units of algae energy are ultimately needed to support the duck. Add a fourth animal to the chain, and you would need 1,000 units of energy from algae to support the hawk. Compare this to the 10 units in the two-step chain.

At each trophic level or step in the food chain, most of the energy is lost, with only 10 percent of the energy being passed on. And so as food chains become longer, less of the original energy becomes available for the higher-order consumers. It is this loss of energy at each stage that limits the length of food chains.