THE THREAT OF HYDRILLA

Hydrilla (*Hydrilla verticillata*) is a non-native, aggressive, submerged water weed. Once hydrilla invades an aquatic ecosystem, it drives out all native and introduced aquatic plants, creating a pure stand.

Its competitive edge comes from several different mechanisms. For one, hydrilla can grow under lower light conditions than nearly any other species (only 1% of sunlight), allowing it to grow up underneath other plants and to survive at greater depths (up to 30 feet). Its ability to use low light also lets it start photosynthesizing earlier in the morning than other plants. This allows it to capture most of the carbon dioxide that has entered the water during the night. Underwater, the availability of carbon dioxide often limits plant growth. Hydrilla can also use bicarbonate as a carbon source, in addition to carbon dioxide. When it uses bicarbonate, it increases the alkalinity of the water, which inhibits native species.

Hydrilla also has excellent survival and dispersal strategies. Seeds play a very small role in its spread, and indeed most populations do not produce any seed at all. Instead, the plant breaks apart very easily and small pieces of stem, no more than one inch long, can produce entire new plants. Hydrilla also produces special survival structures on the stems (called "turions") and in the sediment (called "tubers"). The turions break off the stems in the fall and can drift for long distances before sinking to start a new plant. Each tuber also produces a new plant, and a single tuber can lead to the production of several hundred others in the course of one growing season. The tubers can survive for four to seven years in the sediment before sprouting, even if no water is present for much of that time. The long survival time of the tubers creates the major challenge in eradicating the plant.

Hydrilla's speed of growth is also impressive. The plant is 93-95% water, so it can create huge volumes of biomass with very few resources. As a result, it can grow very rapidly, doubling its biomass every two weeks in summer conditions. Hydrilla also branches profusely as it approaches the water surface, densely filling the entire water column up to 20 feet deep, and shading out other plants.

As a final competitive edge, when hydrilla was introduced into the U.S., it came without the various natural enemies that evolved with it, such as insects and diseases specialized for attacking it. There have been attempts to introduce its natural enemies into the U.S., but so far they have had little effect.

Hydrilla grows very aggressively in a wide variety of water conditions and temperatures, so few habitats are safe from it. The tangled mats of plant material that it forms have a variety of economic and ecological impacts.

Many of the potential economic impacts of hydrilla have not been fully studied, but even if a small fraction of the potential were realized, the results would be very alarming. Of particular interest to California, the mats can reduce the flow of water in canals and

ditches up to 85%, which could devastate a society that depends on moving large amounts of water. In one recent example here in California, a newly-discovered infested irrigation canal was so full of hydrilla that the water was backing up over the banks and running down a wooded hillside.

Like the problems caused in canals, hydrilla mats can clog and damage dams, power plants, and other water control structures. In one documented instance, hydrilla blocked the intakes on the St. Stephen hydroelectric facility on Lake Moultrie, South Carolina, in 1991, forcing the shutdown of the dam and loss of $4 million in power generation. In addition, the infestation cost $1.2 million for emergency treatment alone.

Hydrilla also interferes with boating and fishing, and increases the risk of drowning. Heavy hydrilla infestations decrease fishing stocks, and, along with the impact on boating, thereby reduce recreational opportunities and the economies they support. In one analysis, hydrilla coverage increased 400 percent between 1983 and 1992 on Lake Seminole, Georgia, leading to reduced tourism and causing an estimated loss of about $13 million per year to the local economy.

The ecological impacts of hydrilla are several. Because of its rapid and dense growth, it shades out all other plant species, including natives, reducing diversity to a single species. Dense hydrilla infestations increase daily swings in dissolved oxygen and pH, which influences habitat quality. Many people haven't thought about this, but plants only give off oxygen and use CO_2 when there is light, which is to say, in the day time. At night, plants use oxygen and give off CO_2, just like animals. Beneath a heavy stand of hydrilla, oxygen levels in the water can fall so low at night that fish could not survive there very long. Similar effects on oxygen and acidity can contribute to increased releases of nutrients from sediments. Such increases can lead to algae blooms and die-offs, which are signs of a polluted lake.

Aside from effects on water chemistry, the dense mass of plant material in the water alters habitat structure and food-web relationships for fish, which can lead to changes in fish populations. For instance, sunfish and bass are ambush-type predators that attack from cover. Increased plant cover can lead to larger numbers of these species, which can lead to lower salmon and trout populations. And at some point, hydrilla infestations become so dense that they even interfere with hunting by bass and sunfish, so fish populations tend to decline in general in very heavy infestations. Although some birds feed on hydrilla, generally bird populations also decline in a heavily infested area. Through a biological quirk, hydrilla even threatens bald eagles. Hydrilla encourages the growth of certain toxic blue-green algae. Coots eat the poisonous hydrilla, and then eagles eat the poisoned coots. Biologists have documented over 100 eagles killed by prey animals poisoned this way.

Some fishermen and wildlife enthusiasts sometimes argue that hydrilla improves habitat for fish and other wildlife. While it is true that some cover with hydrilla, up to 30 to 40 percent of an area, will often provide food and shelter for various animals, the plant usually doesn't trouble itself to stay at a population level where it is helpful. Instead, it

continues to expand until it monopolizes nearly every resource to itself. In addition, there are other species of underwater plants that are even more beneficial for wildlife, without the threat of runaway population explosions.