Aquatic Habitat Management

Aquathol® K A Selective Herbicide

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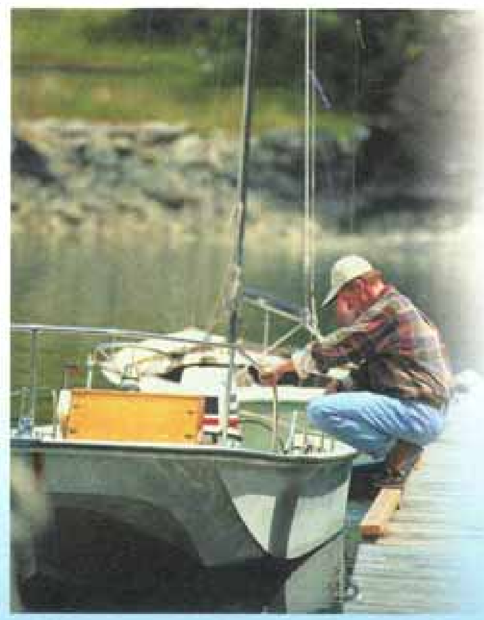
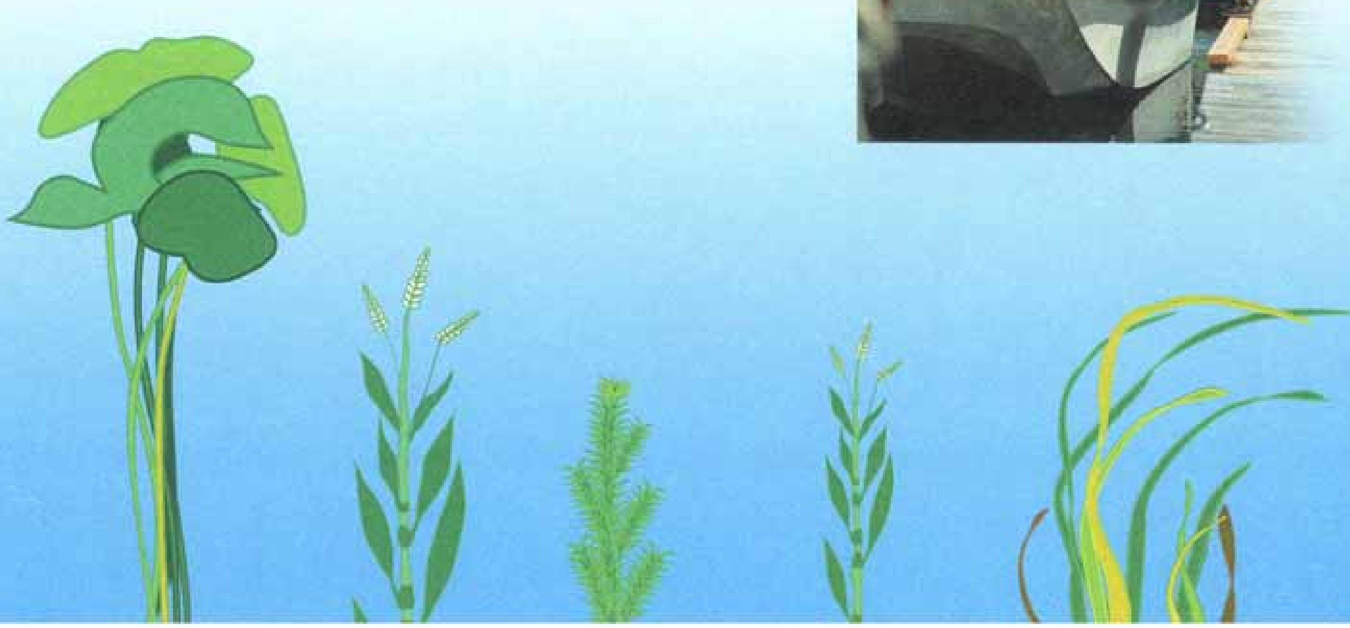
Aquatic plants are only a part of the aquatic ecosystem. Aquatic vegetation plays an important role in the health of the aquatic environment. Aquatic plants affect water movement, sedimentation, and water quality. In addition, they provide habitat and diversity to the aquatic ecosystem.

Although aquatic vegetation comes in several forms, including algae and both submerged and emerged plants, today's greatest challenges involve the management of submerged exotic plants (not native to the U.S.) including Hydrilla, Eurasian Watermilfoil, and Curlyleaf Pondweed.

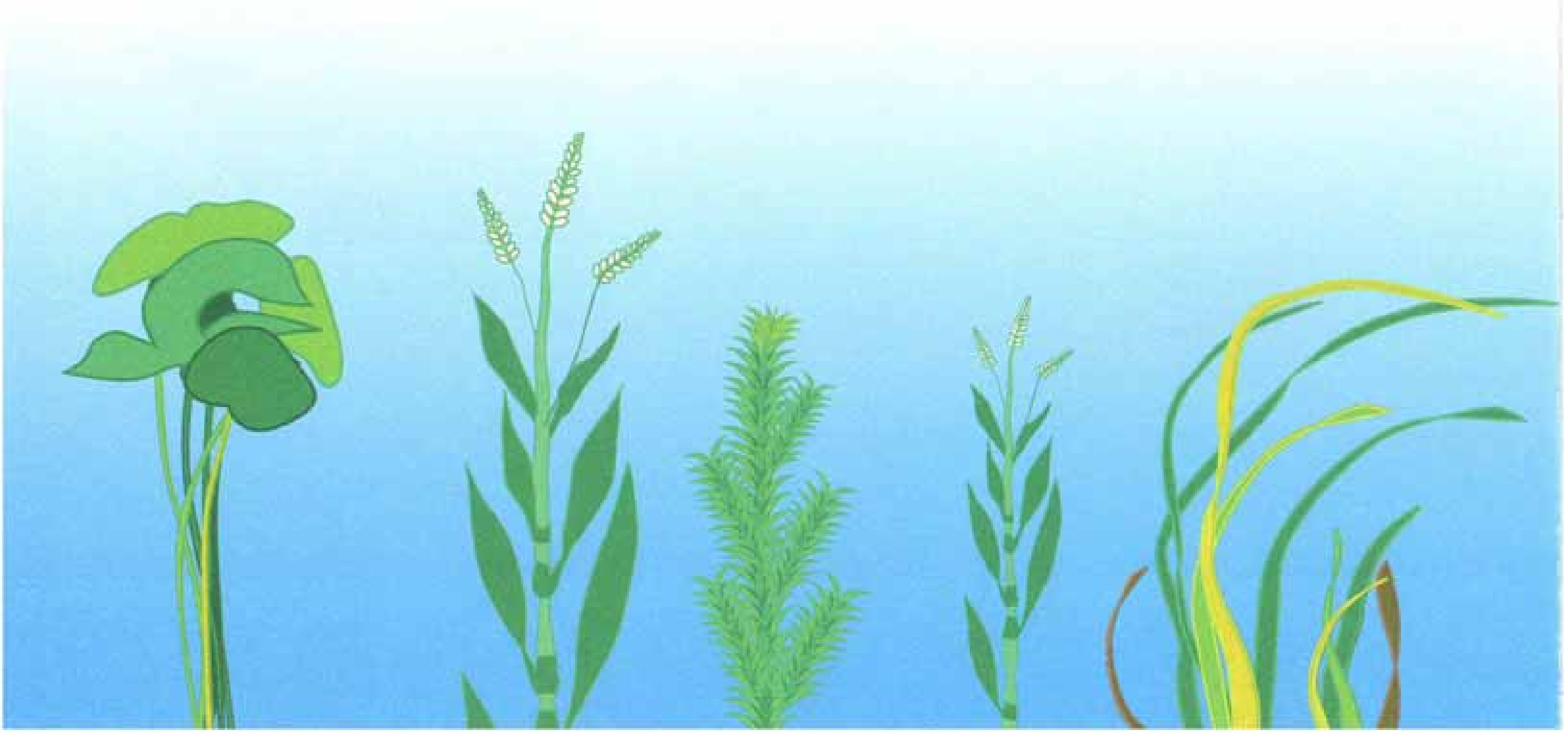




Excessive levels of exotic aquatic plants cause problems in the aquatic environment by out-competing native plant species, and by occupying significant portions of water bodies. The native species have evolved and adapted to conditions and, as such, have natural checks that keep them "in balance." The evolution of native species has also created a diverse community of plants. The exotics, however, have not long occupied their present "niche" in the environment and without natural checks,

Achieving Balance in the Aquatic Ecosystem

achieve population levels that interfere with man's use of the water bodies. If these exotic species become too abundant, they can have a detrimental effect on several components of the aquatic ecosystem: water quality, biodiversity, and the fishery. The detrimental effects of too many exotic plants have a definite impact on one of the most popular sports in America today — fishing.



Control methods that preserve and promote the development of native aquatic vegetation and manage exotic plants can provide useful tools to manage aquatic habitat.

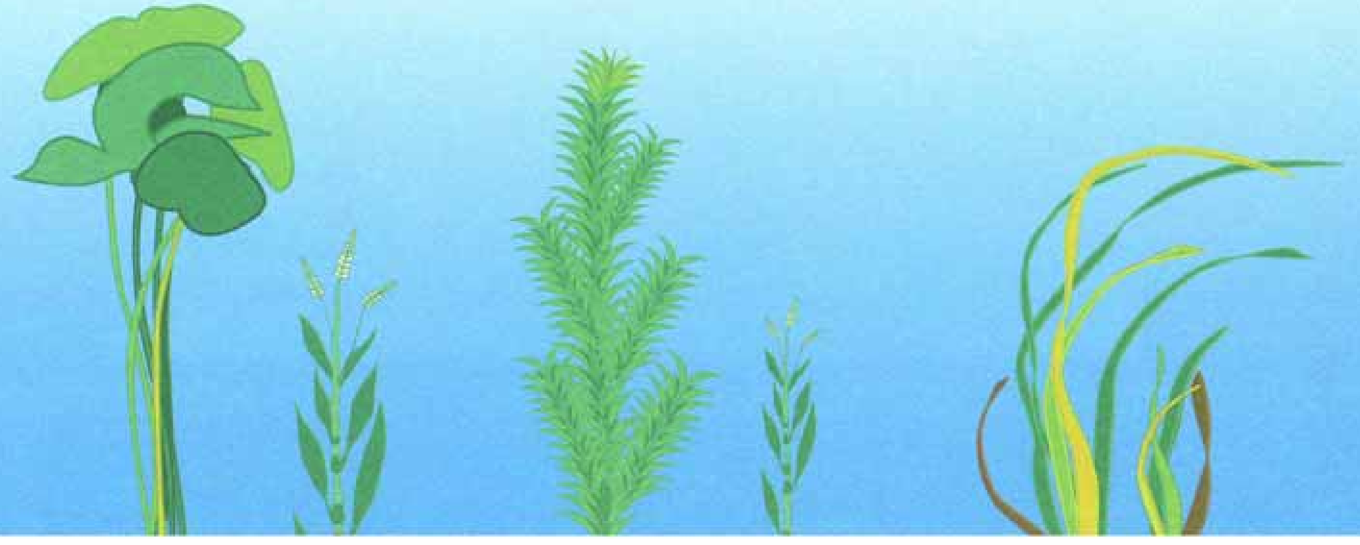
Utilizing Herbicide Selectivity in Aquatic Habitat Management

In order to reduce problematic vegetation to beneficial levels, and maintain those levels, a long-term approach must be followed. Such an approach takes advantage of spatial and species selectivity to effectively maintain the vegetation as habitat. Using effective application rates, **Aquathol K provides the ability to affect only those species that are targeted,** thus maintaining the proper levels of aquatic plants that can enhance the development of fisheries.

- Species selectivity provides results that are the basis for re-establishing native diverse communities and providing a way to maintain them.
- Spatial selectivity provides the capability to contain the treatment within the target area. This is an attribute of a contact herbicide.

Aquathol® K

Aquathol K is an environmentally compatible aquatic-plant management tool for the removal of nuisance submerged aquatic plants. Management using Aquathol K can restore the aquatic habitat for fishing and other recreation. Aquathol K has been used for more than 35 years in the aquatic environment. With a relatively short half-life (typically 1–3 days in the lake environment), Aquathol K does not bioaccumulate in the hydrosoil or the food chain. It breaks down to carbon dioxide and naturally occurring "compounds" in the environment. Aquathol K provides a selective, site-specific, effective, and environmentally compatible aquatic plant management tool.



Aquathol® K Selectivity Study Results

Study Objectives

- To evaluate the tolerance/sensitivity of selected aquatic plants to the herbicide Endothall (as Aquathol K) when applied over a range of concentrations generally recommended for field use.

Low Rates (0.5–1.0 ppm)

Submerged Plants

- Target plants including Eurasian Watermilfoil and Curlyleaf Pondweed were effectively controlled by Aquathol K at low application rates of 0.5–1.0 ppm.
- At lower rates (<1.0 ppm), Aquathol K has proven to be beneficial by selectively controlling competition from M. spicatum and P. crispus.
- Some submerged plants were not significantly injured by application rates of 0.5–1 ppm of Aquathol K valuated. This group includes Coontail, Elodea (E. canadensis), and Waterstargrass.
- Certain plants were injured by Aquathol K, but recovered in 4–8 weeks after treatment particularly at low application rates of 0.5–1.0 ppm. Plants in this group are Illinois Pondweed, Sago Pondweed, American Pondweed, Tape Grass or Wild Celery, and Southern Naiad.

Emerged Plants

- None of the emergent species were affected by Aquathol K applications.

Application Rate	Species Controlled	Species Recovered in 4–8 weeks after treatment	Species Not Affected
0.5–1.0 ppm	Curlyleaf Pondweed Eurasian Watermilfoil	American Pondweed Illinois Pondweed Sago Pondweed Southern Naiad Tape Grass or Wild Celery	Coontail Elodea (E. canadensis) Waterstargrass Spatterdock Fragrant Waterlily Watershield Pickerelweed Smartweed Bulrush Cattail Arrowhead

Mid-High Rates (2.0–5.0 ppm)

Submerged Plants

- Target plants including Eurasian Watermilfoil, Curlyleaf Pondweed, Hydrilla, American Pondweed, Southern Naiad, and Coontail were effectively controlled with Aquathol K at rates of 2.0–5.0 ppm.
- Some plants were not significantly affected even at the higher rates of Aquathol K. This group includes Elodea (E.canadensis), Coontail (rates of <3.0 ppm), and Waterstargrass.
- Certain plants were injured by Aquathol K, but recovered in 4–8 weeks after treatment at higher rates of Aquathol K. Plants in this group are Illinois Pondweed, Sago Pondweed, Tape Grass or Wild Celery, and Coontail.

Emerged Plants

- None of the emergent species were affected by Aquathol K applications.

Aquathol K selectivity study conducted through the Aquatic Ecosystem Restoration Foundation, 1997–1998.

Application Rate	Species Controlled	Species Recovered in 4–8 weeks after treatment	Species Not Affected
2.0–5.0 ppm	Curlyleaf Pondweed	Illinois Pondweed	Elodea (E. canadensis)
	Eurasian Watermilfoil	Sago Pondweed	Waterstargrass
	American Pondweed	Tape Grass or Wild Celery	Spatterdock
	Southern Naiad		Fragrant Waterlily
	Coontail		Watershield
	Hydrilla		Pickerelweed
			Smartweed
			Bulrush
			Cattail
			Arrowhead

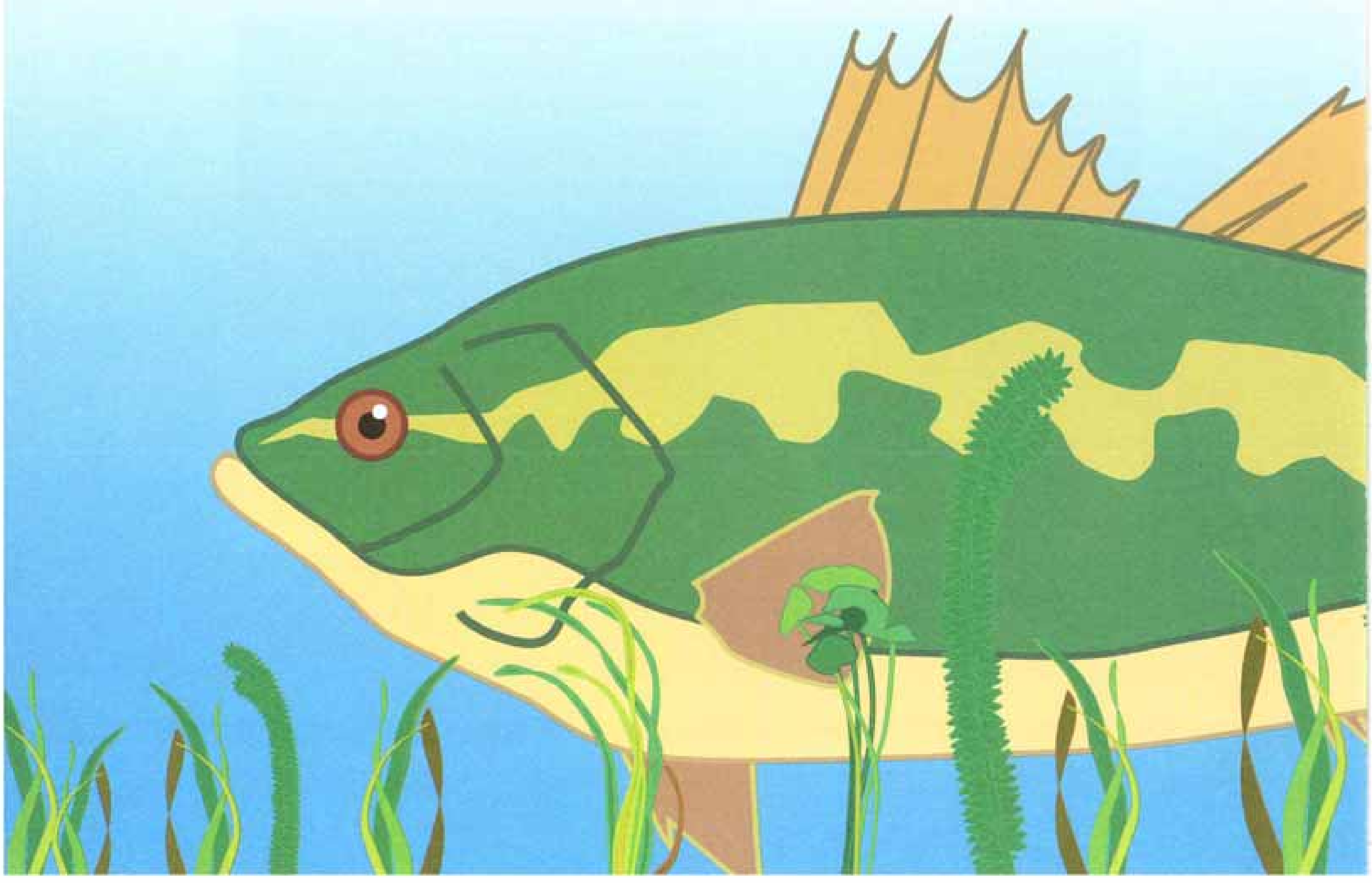
The proliferation and spread of native and sometimes exotic aquatic plants have enhanced or created quality largemouth bass fisheries. However, excessive levels of aquatic plants can be detrimental to both bass and other fisheries, and can limit the types of recreational use on lakes and reservoirs. Today, government agencies try to strike a delicate balance to maintain some plants in water bodies, and water skiing are hindered when aquatic plants become too abundant. In many instances, reservoirs are constructed for navigation and hydropower electrical generation, and plants can interfere with these activities. Finally, excessive levels of aquatic plants can have detrimental effects on other fisheries, such as crappie, striped and hybrid-striped bass, catfish, and sunfish.

The Relationship Between Largemouth Bass and Aquatic

yet provide for maximum benefits for all users.

Largemouth bass anglers prefer to fish in areas that contain aquatic plants. The invasion and spread of exotic plants, particularly Hydrilla and Eurasian Watermilfoil, have created excellent bass fisheries, for example, in impoundments of the Tennessee River and, more recently, in the Potomac River near Washington, D.C. However, as aquatic plant abundance increases, problems and conflicts occur. Other lake and reservoir recreational activities such as swimming, boating,

Most of the energy to fuel fish populations comes from two types of aquatic vegetation. The first type of is microscopic phytoplankton algae and the second is larger aquatic plants or macrophytes (macro=big). A wide variety of small invertebrates feeds on these two types of plants, and small fish feed upon the invertebrates. Predator fish, like the largemouth bass, then feed on these small fish. Some organic material entering a water body can also help with fish production. If there is sufficient light, and nutrients such as phosphorus and



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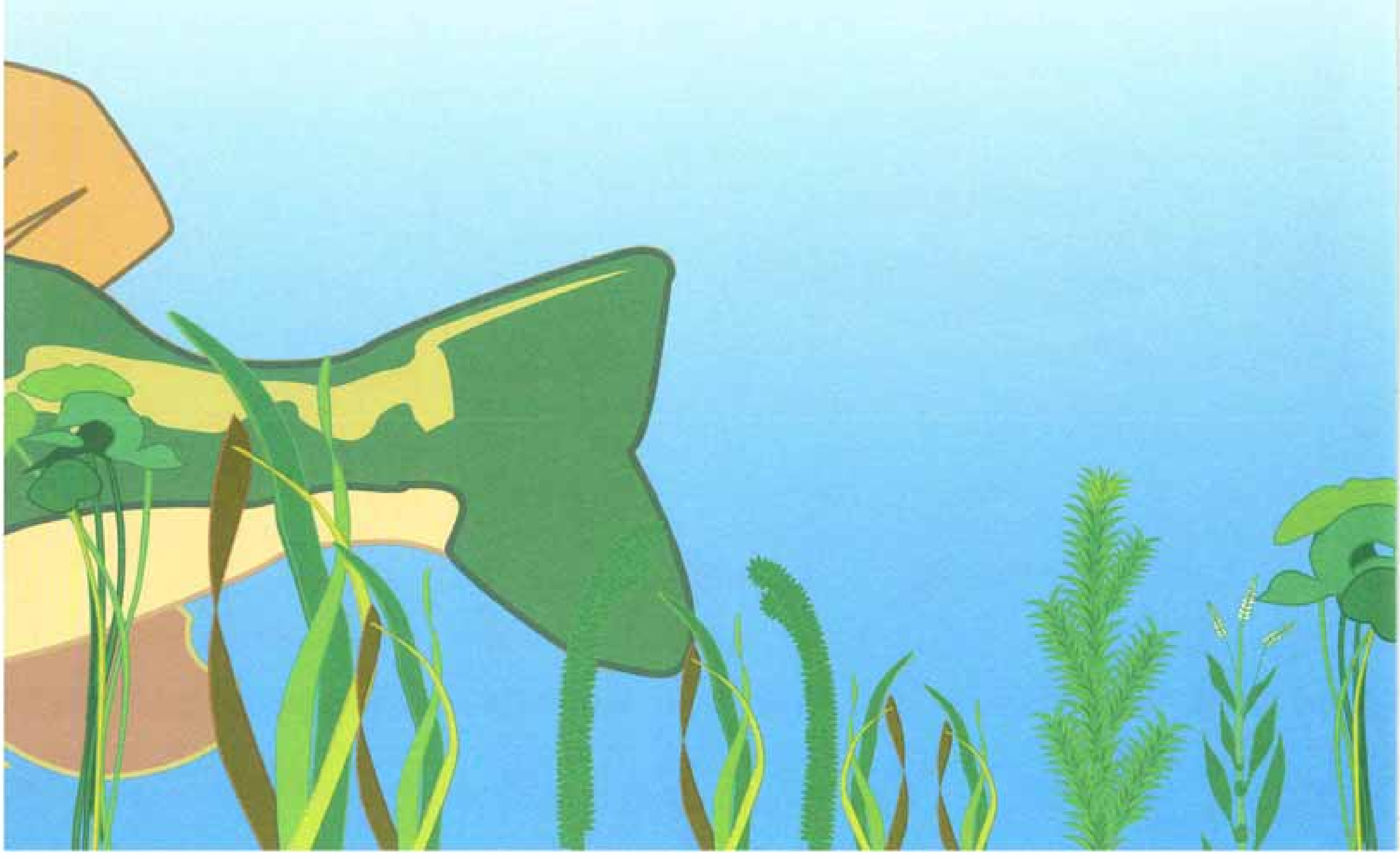
by Dr. Mike Maceina, Fisheries Professor, Auburn University, Alabama.

nitrogen are available, then either type of these plants can be found. If a water body is turbid from sediments and mud, then plant production is limited and fish production is poor. Shallow water bodies with stable water levels are more suitable for macrophyte colonization, as root systems need to be established for these larger plants to live. Fish communities respond differently, depending on whether the bottom of the food chain is phytoplankton or macrophyte dominated.

Two beliefs are generally accepted that justify the maintenance or enhancement of aquatic plants to provide for quality largemouth bass fisheries. The first is that aquatic plants improve bass reproductive success and protect young and yearling fish from predators. If more young bass are produced, then more adults will be available for anglers to catch. The second belief is that anglers desire to fish the structure offered by larger aquatic plants. Bass prefer to live in structure and are an ambush predator. Lure placement at the edge of plants or through these plants will catch more fish.

Young bass production during the first year of life is typically higher in aquatic plants. Submerged plants such as milfoil, hydrilla, pondweed, muskgrass, and tapegrass provide the best habitat for young bass. Emergent plants such as bulrushes, water willow, and maidencane grass, followed by the floating leaved plants such as lily pads, also typically produce more young bass than do shallow areas without plants. In late summer, when young bass are about 4–5 months old, densities can be as high as 1000 fish per acre in submerged plants, compared to a low of 20 fish per acre in areas that don't contain plants. However, bass populations follow the same rules as any other animal population: higher densities mean more competition for food and space. Hence, the death rates are higher and growth rates are lower for bass living in plant areas than their counterparts living in plant-free areas. Young bass living in plant areas are much smaller



in size by the fall, at the end of their first year of life, than bass in plant-free areas.

Although excessive plant infestation can be detrimental to bass recruitment, generally bass reproduction or recruitment to age-1 is enhanced when aquatic plants are present. In most instances, areas with plants will produce 2–5 times as many age-1 bass than bare areas, even though a difference of up to 10–40 times may be evident during the previous late summer when these fish were age 0. However, the size and type of water body have been found to influence this relation. The number of other fish species living in small farm ponds and lakes is low and environmental stability is high compared to larger lakes, and especially reservoirs. In these small systems, largemouth bass tend to over-reproduce and stunt, and vegetation can compound this problem. In Alabama, ponds with a phytoplankton production base and no rooted aquatic plants should undergo a bass harvest of about 15 pounds per acre each year. This removes the excess bass competing with each other for food and habitat, and diminishes the problem of over-production. In a reservoir, which is a hybrid between a river and lake, environmental instability is also much greater. The abundance of competing species increases with river size, and plants appear to provide a cushion to enhance bass reproduction. Management agencies recognize this as aquatic-enhancement programs are occurring in many large reservoirs currently devoid of plants.

The best science and consensus among fishery biologists is tha

After reproduction and recruitment to age-1, largemouth bass average about 5–8 inches in length by the first spring. At this point, the strength of last year's spawn is established, but fish must continue to grow to enter the fishery. When aquatic

vegetation exceeds 30-40 percent of the surface area of a water body, bass growth is slower and fish tend to be skinny. At 4 inches in length, bass should be feeding almost exclusively on fish. In dense vegetation, bass consume more invertebrates such as glass shrimp, crayfish, and aquatic insect larvae. If bass do feed on fish, they typically prey upon many small fish. This feeding activity is not energetically efficient. A largemouth bass should consume one or a few large-prey items and the dense maze of plants can inhibit feeding efficiency. In open water, largemouth bass can effectively feed and grow rapidly by consuming numerous and easily available shad. But when vegetation exceeds 40 percent, shad populations typically decline, and sunfish and top minnows increase. Thus, vegetation both directly and indirectly affects feeding by altering feeding strategy and changing the types of prey that are available to bass.

The best science and consensus among fishery biologists is that 10–40 percent coverage of submerged vegetation is ideal for bass fisheries in larger systems. Higher plant abundance has the potential to negatively affect bass fisheries, hurt other fisheries, cause ecological imbalances, and certainly reduce recreational opportunities besides fishing.

0–40 percent coverage of submerged vegetation...

Bass anglers should participate in aquatic plant management decisions when other public users request natural resource managers to reduce what they perceive as excessive vegetation. Aquatic vegetation management can affect the bass fishery.