

Management of Aquatic Vegetation in Monterey County

- Although we will be discussing control of problematic aquatic vegetation, it should be kept in mind that aquatic vegetation has benefits to the aquatic environment



BENEFITS OF AQUATIC VEGETATION

- Microscopic algae for the basis of the food chain
- They are fed on by microscopic animal life (zooplankton) which are then fed on by fish and thereby feeding the food chain
- Larger algae and flowering plants provide shelter and food for fish, water fowl, beavers, muskrats and other wildlife
- All plant life produces oxygen during the daylight hours which sustains the aquatic ecosystem
- Rooted plants can stabilize shorelines
- Denitrifies nitrates in the water

Aquatic Vegetation Weed Issues in Monterey County

- Irrigation reservoirs
- Irrigation and drainage ditches
- Small ponds used for recreation and fish habitat
- Golf course ponds
- Salinas River and other drainages
- Natural lakes and streams



Irrigation Reservoirs



Drainage Ditches



Seego Pondweed



Floating Pennywort



Water Cress

Aquatic Vegetation Weed Issues in Monterey County

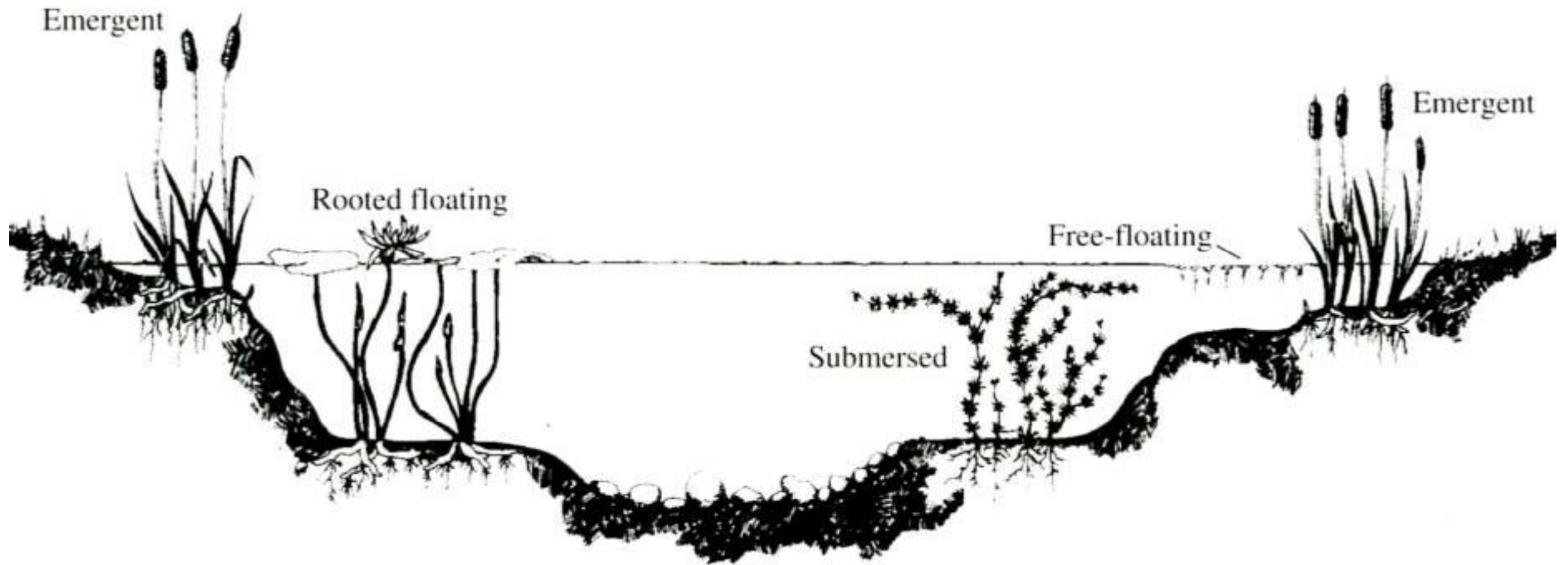
- Plant growth can become excessive and create problems
- Many water bodies tend to be rich in nutrients such as nitrogen and phosphorus (essential nutrients for plant growth)
- Excessive plant growth is often due to the fact that many water bodies are shallow and which allows sunlight to penetrate to the bottom and support photosynthesis
- Invasive species can also be aggressive and take over large areas of aquatic habitat.



Issues Caused by Aquatic Vegetation

- Clog waterways and reservoir outlets
- Can reduce oxygen – although plants produce oxygen during the daylight hours, they use oxygen during the night. If plant growth is excessive, they can use up the oxygen during the night and fish can be suffocated
- Oxygen depletion can also occur when aquatic plants die and decompose
- Decomposition of plants and sediments gradually fill in water bodies
- Provide quiet waters which are ideal mosquito breeding habitat
- Can impart a foul taste to water
- Some blue green algae can release toxins into water
- Invasive species can disrupt the natural balance of aquatic ecosystems
- Create esthetic issues
- Reduce the use of the water for recreational activities such as swimming, boating and fishing

Types of Aquatic Vegetation



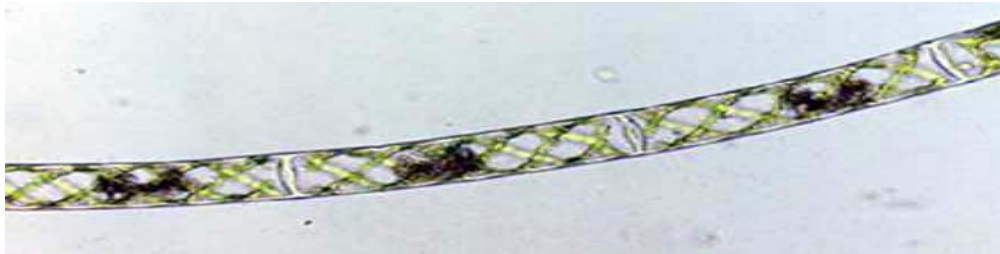
Microscopic Algae

- **Microscopic algae are primitive plants with no true leaves, stems or roots**
- **They are typically suspended in the upper few feet of water and can form scums and/or color the water green or yellow-green.**
- **When they occur in high numbers, they are called blooms**
- **Blooms usually occur where abundant nutrients reach the water.**
- **Reducing nutrient inputs into the water is key for reducing algal blooms**



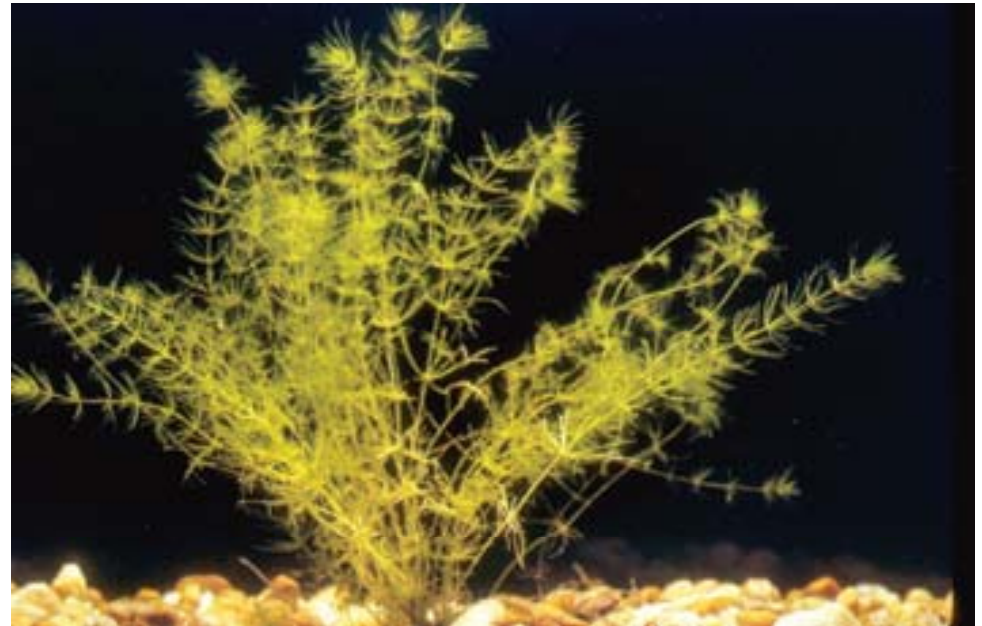
Filamentous Algae

- Filamentous, or mat-forming algae) form floating, mat-like growths that usually
- begin around the edges of water bodies in the spring. This type of growth is probably the most common and easily recognizable aquatic weed



Algae – Chara (Stonewort)

- Chara usually grows in very hard water and often is calcified and brittle. The plant is rooted, and leaves are arranged along the stem in whorls
- Because of this overall structure, it is often confused with flowering plants, but it is an alga and can be managed as such
- In bodies of water where it is low-growing, it provides valuable habitat for fish and can stabilize sediment



Submersed Plants

- Submersed plants are rooted on the bottom and grow up through the water. Flowers or flowering spikes can sometimes emerge above the water surface
- The main criteria for identification are leaf arrangement and leaf shape
- Many species are valuable for fish and wildlife habitat, but some can be aggressive and cause problems for agricultural reservoirs and other water bodies
- The following are some common species in Monterey County

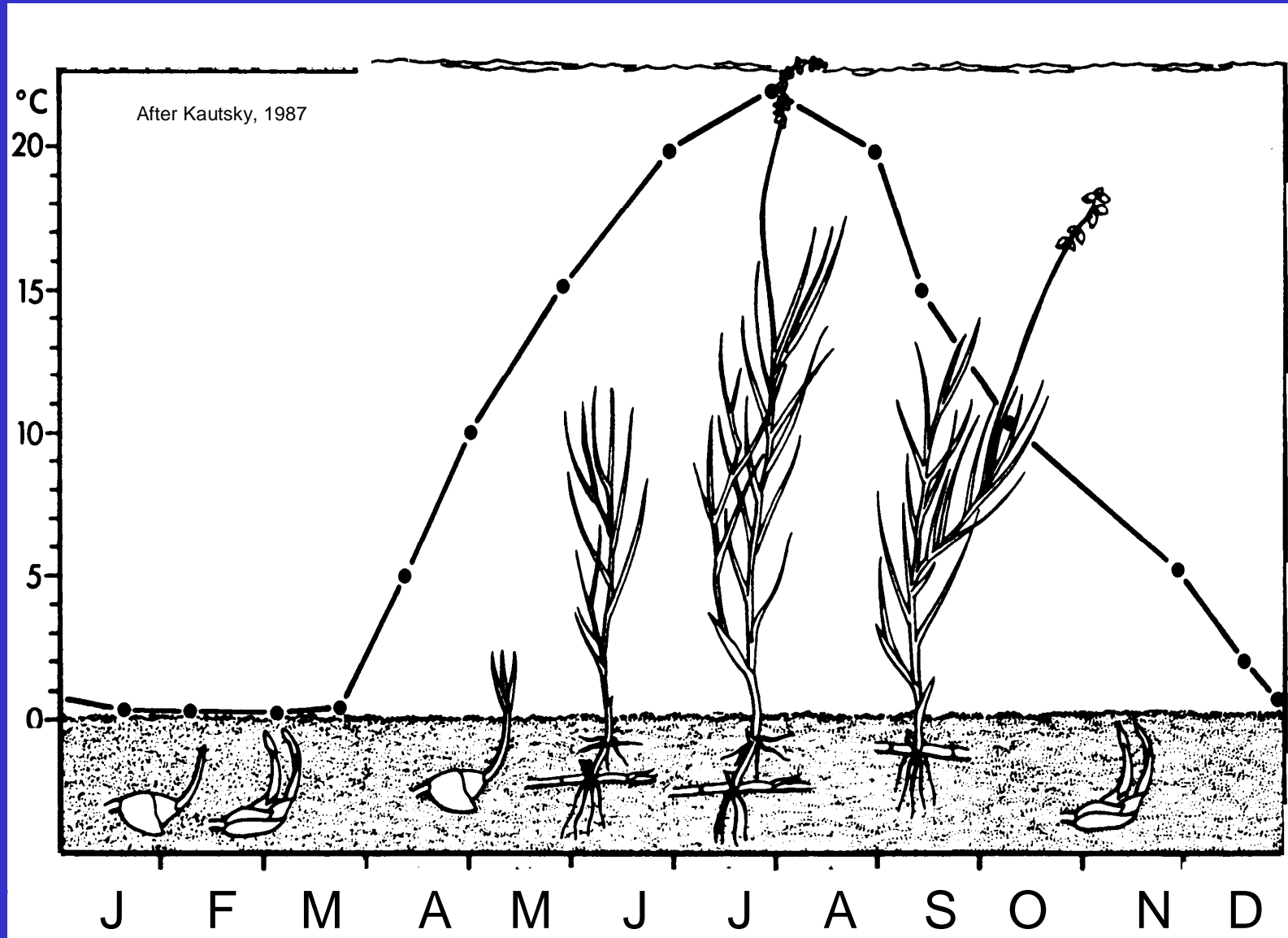


Sago pondweed

Very common in drainage ditches and irrigation reservoirs



Seasonal Development of Sago Pondweed



Eurasian watermilfoil

Perennial propagated by rhizomes, axillary buds and seeds



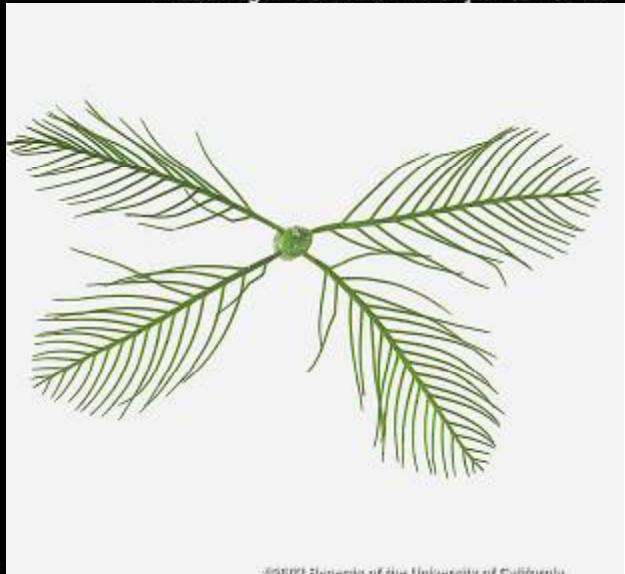
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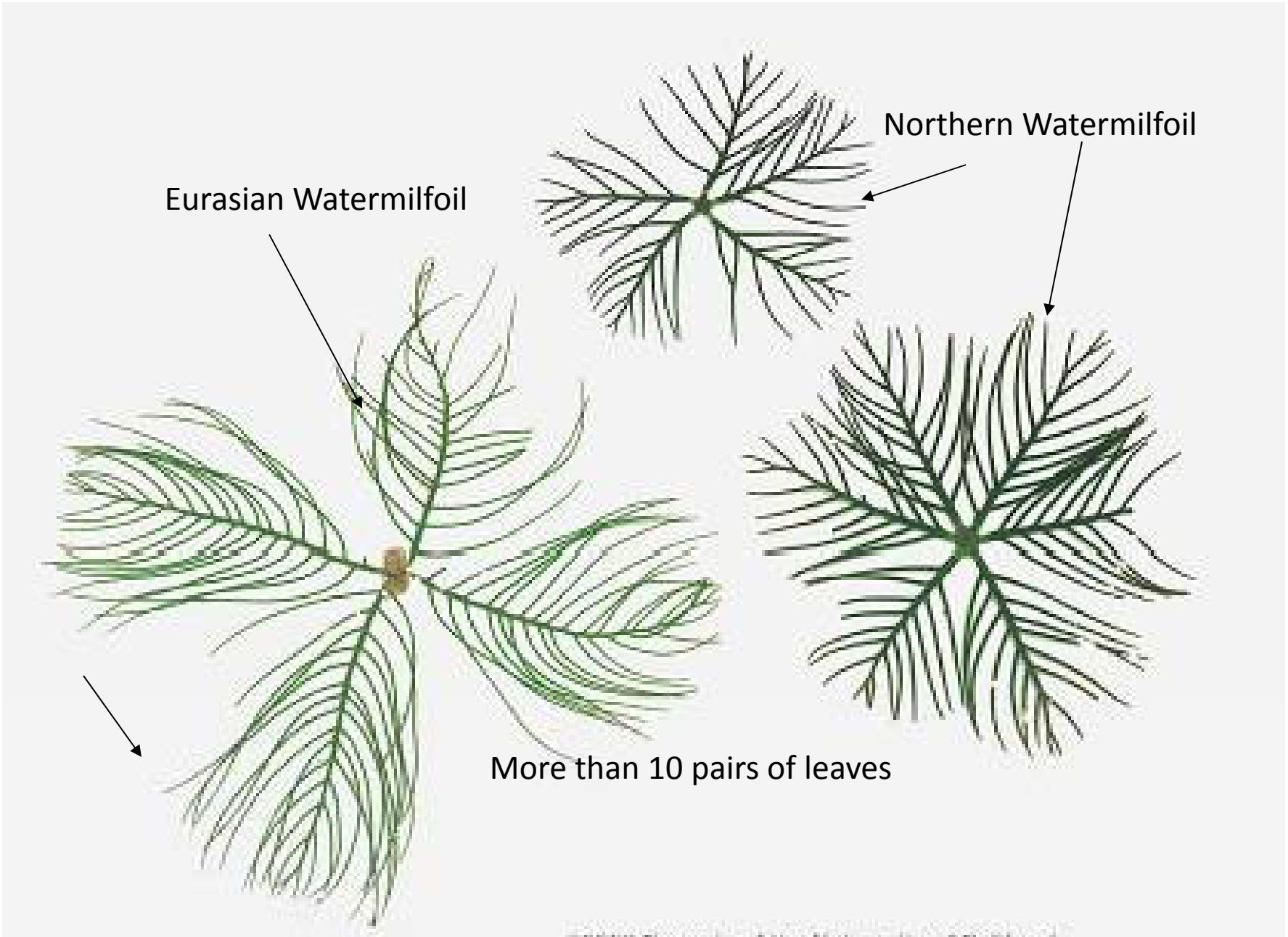


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Eurasian Watermilfoil

Northern Watermilfoil

More than 10 pairs of leaves

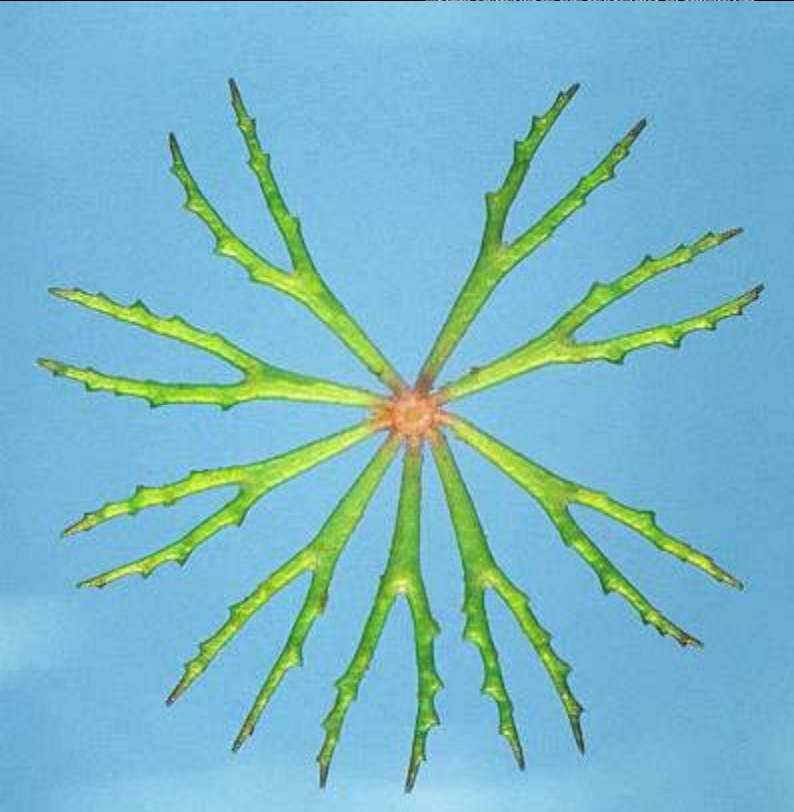


Coontail

Annual-perennial



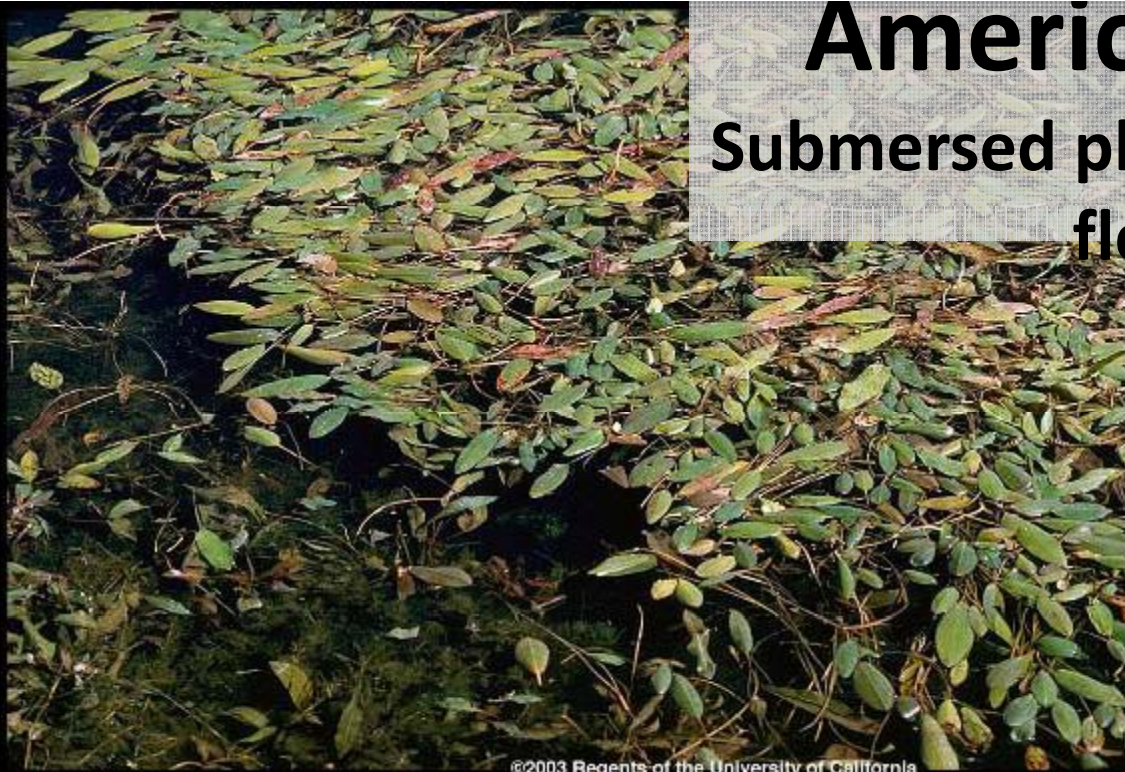
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American Pondweed

Submersed plant with submersed and floating leaves



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Floating leaves

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Submersed leaf



Needle Spike-rush

- A valuable native plant that grows on the bottom of marshes, ponds and riverbanks
- It became a problem in ag reservoirs in Castroville because it would dislodge in the fall and plug the outflow pipes



Dislodged plants floating on surface

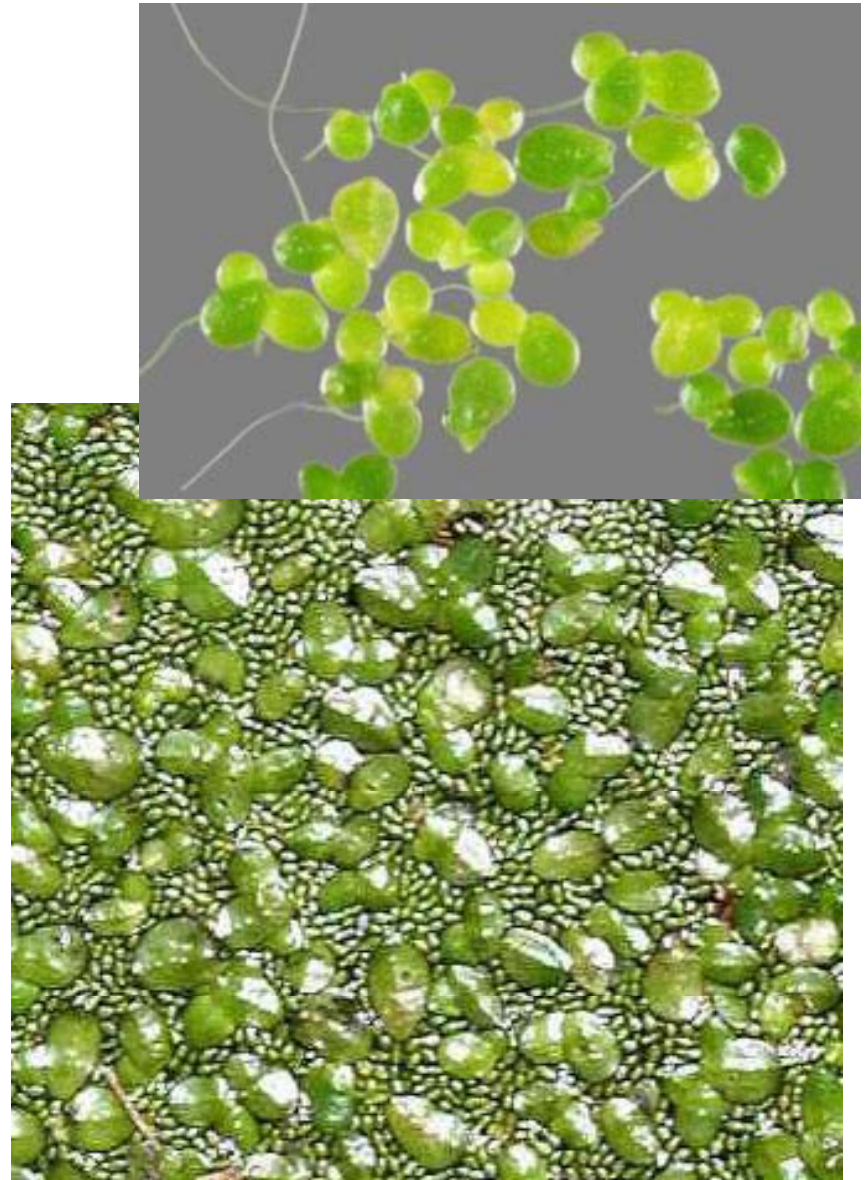
Free Floating Plants

- Free-floating plants such as duckweed, azolla and water hyacinth can completely cover the surface of a pond.
- Complete surface coverage by these plants shades out underwater plants, thus causing oxygen depletion in the deeper water.
- Plants have roots that hang into the water.
- Large populations of these plants are stimulated by nutrient inputs (N and P) into water



Duckweed

- A very common weed in this area
- Plants are $\frac{1}{4}$ - $\frac{1}{2}$ inch in diameter
- Stimulated to grow by nutrient rich waters (N & P)
- Difficult to control because there are multiple layers that protect each other from contact herbicides



Mosquito Fern (Azolla)

- It is a fern and reproduces by spores and stem fragments
- Desirable native species in natural habitat
- It is sold in aquarium trade and disposal of water is one way that it is introduced into new areas
- It can take over ponds later in the growing season



Water Hyacinth

- Introduced from Africa
- Floating and attractive plant
- Has a tremendous reproductive capacity and overtook a lake in the Watsonville area
- Has been a problem in the San Joaquin Delta and extensive control programs have been undertaken to bring it under control



Rooted Floating Plants

- Rooted floating plants are generally found in shallow water less than 4 to 5 feet deep
- Can greatly reduce flows in drainage ditches and provide breeding habitat for mosquitos
- This group of plants provides valuable wildlife habitat and should be protected innatural lake and wetland areas



Floating Pennywort

- Native to North America
- Roots on the side or bottom of the ditch
- Common in the ditches along Blanco Road
- Used to stabilize the ditch banks and to help remove nitrate from the drain water



Drain along Blanco Road

Creeping Water Primrose

- Three species in California (one is native)
- Can develop thick mats that interfere with water flow
- Roots on the side or bottom of pond or canal
- Reproduces by seed, creeping stems and stem fragments



Emergent Plants

- Emergent (shoreline or marginal) plants include grass-like and broadleaved plants.
- Grass-like plants include cattails, bulrushes and spikerushes
- Broadleaves include willow creeping water primrose
- Many of these plants spread rapidly by underground root systems as well as by seed.



Cattail

- It is a desirable native that is a valuable source of food and shelter for wildlife
- It prevents shoreline erosion, and help remove excess nutrients from water.
- Spreads by seed and extensive rhizome system-



Bullrush (Tule)

- **Common native perennial sedge that provides extensive cover and habitat for wildlife**
- **It becomes a problem when it moves from the edges of a pond and encroaches on the middle**



Aquatic Weed Control Methods

- **Prevention**
- **Cultural Modification**
- **Mechanical**
- **Biological**
- **Chemical**

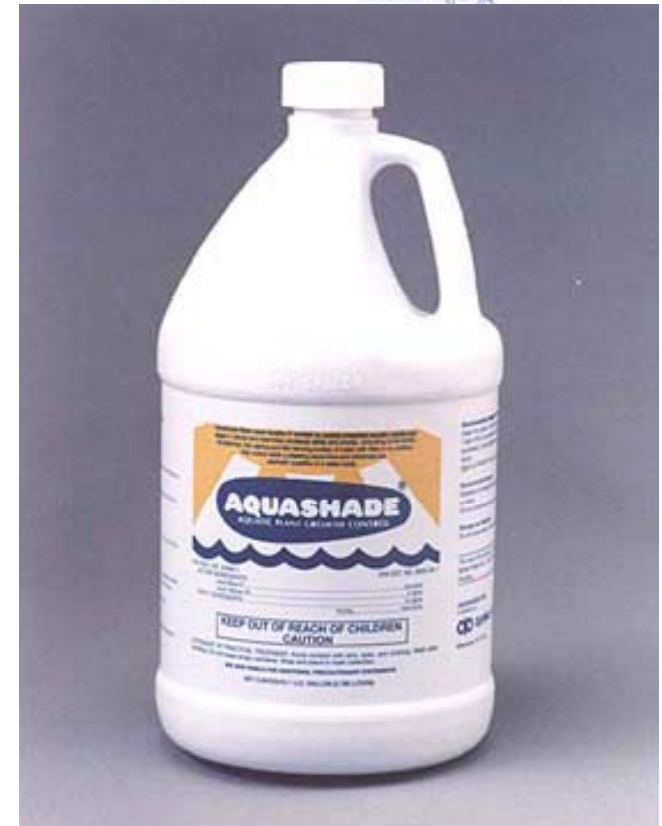
Prevention

- **Eliminating the inflow of nutrients (nitrogen and phosphorus) to the water body**
 - **Not allowing livestock to have access to the pond**
 - **Eliminate runoff from livestock, fertilized lawns**
 - **Planting a buffer around the pond to absorb nutrients**
- **Particularly useful for floating aquatic weeds and algae**



Prevention

- Drawdown
 - Dry out the bottom of the pond
 - Mechanically work the pond bottom
- Benthic barrier
 - Rubberized material to cover the bottom of a pond
- Deepening the depth of the pond
- Shade
 - Natural (Trees)
 - Artificial (Aquashade)
 - Absorbs photosynthetically active wavelengths of light, thus depriving plants of a food source
 - Useful for submersed plants



Cultural Modifications

- **Aeration**
 - Reduces the release of nutrients from sediments – not been shown to reduce weed growth
- **Barley Straw**
 - Research from England but has not been well documented in the US thusfar



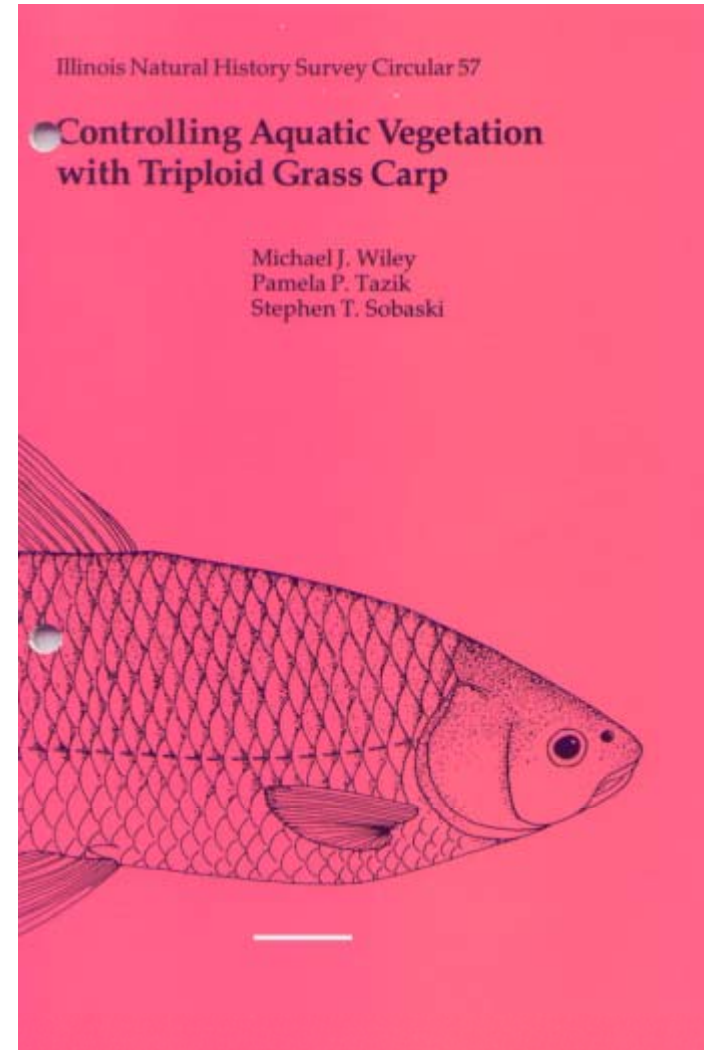
Mechanical

- Raking & hand pulling
 - Made difficult by the fact that many emerged species are perennial and have extensive root systems
 - Done to some degree for duckweed
- Mechanized removal
 - Used in larger water bodies (none in this area that I am aware of)



Biological

- **Some biological agents such as insect have potential (e.g. against Eurasian Watermilfoil)**
- **Triploid Grass carp**
 - **Sterile (to make sure it does not become invasive)**



Stocking rate: 15-30 fish/A

Triploid Grass Carp

- **Advantage**
 - Effective on many weed species
 - Non-toxic weed control alternative
 - Can provide long lasting results
- **Disadvantages**
 - Need to obtain a permit from the Dept of Fish and Game in order to be able to purchase
 - Meeting permit requirements is not easy
 - Do not eat all species of aquatic weeds (e.g. duckweed)

Chemical

- **When properly applied, certain herbicides can control aquatic vegetation without harming fish and other wildlife**
- **In some instances, herbicides can be used selectively, that is, to control certain plant species without killing others. They can be particularly effective for controlling certain aggressive weed species such as Eurasian watermilfoil**
- **Aquatic herbicides, however may only offer a temporary solution and the target species may reappear, requiring retreatment**

Details to Consider Regarding the Use of Chemicals for Aquatic Weed Control

- **Need to ID the plant**
- **Need to know the various restrictions regarding the use of the water**
 - **Drinking**
 - **Swimming**
 - **Irrigation**
 - **Fishing**
- **Dosage**
 - **Rates are applied per acre foot of water**
- **Timing**
 - **Don't wait until the problem is too advanced**
- **Temperature**
 - **Apply when warm enough for active plant growth**
- **Contact vs translocated**
- **Retreatment may be necessary**

Common Aquatic Herbicides

- **Copper sulfate and copper chelates (various trade names)**
 - Used to control algae
- **Endothal (Aquathol)**
 - Used for submersed plants
- **Diquat (Reward)**
 - Contact material
- **Fluridone (Sonar)**
 - Submersed plants and duckweed
- **Triclopyr (Renovate)**
 - Controls broadleaf weeds, but will not affect grass like materials such as cattails
- **Glyphosate (Rodeo)**
 - Used for emergent weeds such as cattails
- **Carfentrazone (Stingray)**
 - A newly registered contact material
- **Imazapyr (Habitat)**
 - Newly registered. Effective on woody plants around the edge of aquatic habitats
- **Penoxysulam (Galleon)**
 - Effective on submerged weeds such as the pond weeds

Alternative Material for Controlling Algae

- Sodium carbonate peroxyhydrate
 - Oxidizes and disrupts algae membranes and kills them



AQUATIC WEEDS - Herbicide Susceptibility Table

Plant	Aquathol K endothal	Copper Chelate	Copper Sulfate	Reward Diquat	Hydrothol 191 endothal	Sonar Fluridone	Aquamaster, Glyphosate	Aqua-Kleen	Renovate triclopyr	Stingray carfentrazone	Habitat imazapyr	Galleon penoxsulam
Hydrilla	x	x	-	x	x	x	-	-	-	-	-	xc
Sago Pondweed	x	-	-	x	x	xc	-	-	-	-	-	xc
American Pondweed	x	-	-	x	x	x	-	-	-	-	-	x
CurlyLeaf Pondweed	x	-	-	x	x	x	-	-	-	-	-	x
Variable Leaved Pondweed	x	-	-	x	x	x	-	-	-	-	-	x
Naiads	x	-	-	x	x	x	-	-	-	-	-	x
Water Hyacinth	x	x	-	x	-	-	x	x	X	X	X	x
Coontail		x		x								
Fanwort (Cabomba)				x		x						x
Brazilian Elodea	x	x	-	x	x	x	-	-	-	-	-	x
Common Waterweed	-	-	-	x	x	x	-	-	-	-	-	x
Horned Pondweed	x	-	-	-	x	-	-	-	-	-	-	
Widgeon Grass	x	-	-	x	-	-	-	-	-	-	-	
Filamentous Algae	-	x	x	x	x	-	-	-	-	-	-	
Eurasian Watermilfoil	x	x	-	x	x	x	-	x	X	X	-	xc
Parrotfeather	x	-	-	x	x	x	x	x	X	-	X	x
Chara	-	x	x	x	x	-	-	-	-	-	-	
Water Primrose	-	-	-	x	-	x ^b	x	x ^b	X	X	X	
Water Pennywort	-	-	-	x	-	x ^a	-	-	-	-	-	x
Duckweed	x	-	-	x	-	x ^c	x	-	-	X	X	x
Watermeal	-	-	-	-	-	x ^a	-	-	-	X	-	?
Waterfern - azolla	-	-	-	x	-	x	-	-	-	X	-	
Cattail	-	-	-	x	-	x ^b	x	-	-	-	X	
Planktonic Algae	-	x	x	x	x	-	-	-	-	-	-	

a A.S. Formulation Only

b Labeled for Partial

Control Only

c Can be used as drawdown

application in de-watered

canals

Aquatic weed	Herbicide	Typical product dose ¹	Restrictions ²
Algae (microscopic, filamentous, Chara)	Copper sulfate (25% Cu)	2.7 lb/A-ft.	Do not use in trout-bearing waters
	Copper chelates	Rate varies with formulation	Do not use in trout-bearing waters
	Endothal (Hydrothal 191) Liquid Granular	0.6 to 8.8 pt/A-ft. 2.2 to 13.2 lbs/A-ft.	F= 3 days; I, L, D = 7-25 days Recommended for use by certified applicators only.
Submersed plants (pondweeds, naiads, elodea)	Endothal (Aquathol K liquid) (Aquathol Super K granular)	0.6 to 1.3 gal/A-ft. 27 to 54 lbs/A-ft.	F= 3 days; P, L, D = 7-25 days
	Diquat (Reward)	1 to 2 gal/SA	I = 1-5 days; D= 1-3 days; L = 1 day
	Fluridone (Sonar, Avast!)	Dose varies with formulation	I = 7-30 days: do not apply within 1/4 mile of potable water intakes
Submersed plants (Eurasian watermilfoil, coontail)	2,4-D (Navigate)	100 to 200 lbs/SA	Do not apply to waters for I, D
	Fluridone (Sonar, Avast!)	As above	As above
Submersed plants (Eurasian watermilfoil)	Triclopyr (Renovate 3)	0.7 to 2.3 gal/A for each ft. of depth (see label)	See label for required setback distances from potable water intakes
Free-floating plants (duckweed, watermeal)	Diquat (Reward)	1 gal/SA; add surfactant	As above
	Fluridone (Sonar AS, Avast!)	1 to 1.5 qt/SA	As above
Rooted-floating plants (waterlilies, spatterdock)	Glyphosate (Rodeo, Aqua Neat, Eagle) plus surfactant	Consult label.	Do not apply within 1/2 mile upstream of potable water intake

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	Triclopyr (Renovate 3) plus surfactant	2 to 8 qt/SA	As above
Emergent plants (Most plants including cattails, grasses, purple loosestrife, willows)	Glyphosate (Rodeo, Aqua Neat, Eagre) plus surfactant	Consult label.	As above
Emergent plants (Purple loosestrife, creeping water primrose)	Triclopyr (Renovate 3) plus surfactant	6 to 8 qt/SA	Minimize overspray to open water

Footnotes

¹SA= surface acre; A-ft = acre-feet. These dosages are given only as an indication of amount to use and will vary according to target species, state restrictions, etc. **Please read the label to determine actual dosage for the target plant.**

²F = fishing; I = irrigation; L = drinking water for livestock; D = drinking water for humans. Where range of days is given (e.g., 7-25 days), the waiting time depends on dose used. These restrictions apply to Indiana. If you wish to use these chemicals outside of Indiana, be aware that additional restrictions can be imposed by other states. Check with local and state regulatory agencies.

³Liquid formulation only: treated water can be used for sprinkling bent grass immediately.

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