Aquatic Weed & Algae Control
Aquatic Systems: Multiple uses

- Fishing
- Swimming
- Boating
- Aesthetics
- Drinking Water

- Wildlife
- Flood Control
- Irrigation
- Hydroelectric
Aquatic Plant Management Plan

- Prevention
- Assessment
- Site-specific management
- Evaluation
- Monitoring
- Education
Aquatic Plant Management

- **Prevention**
  - Educational signs at boat launches, marinas
  - Volunteer Plant Survey to watch for invasive plants in pond
- **Identify plant species**
- **Site Considerations**
- **Select Management Approach**
  - mechanical
  - biological
  - herbicides
- **Monitor / Follow Up Application**
Boaters can help prevent the spread of Eurasian water milfoil by removing all aquatic weeds from trailer, boat, motor/propeller and anchors before launching and after leaving water. Special care should be taken to remove aquatic weeds from the wet wells of trailered boats and the interior of cartop boats and canoes.
Awareness can prevent the introduction of weedy aquatic plants.

STOP Spread of Eurasian Water Milfoil

Eurasian water milfoil is an aquatic weed which interferes with boating, swimming, waterskiing, and fishing in southern British Columbia and on Vancouver Island.

Fragments of Eurasian water milfoil may survive if transported on boating equipment and can initiate new colonies if introduced to noninfested lakes. It has not yet been found north of Shuswap Lake and in most of the Kootenay Regions.

Do not transport aquatic weeds!
Prevention

Eliminate shallow areas during construction
> 3 feet deep, except in designated swimming areas.

Prevent nutrients from entering the pond point sources
use 10 - 20 foot wide grass buffer strips
fertilize areas adjacent to pond sparingly
prevent livestock from entering the pond directly
reduce the number of waterfowl
Management Goals

Management approach will depend on your goals for the site:
Site Considerations

- Pond Dimensions
- Average Depth
- Inflows / Outflows
- Location in the Floodplain
- Types of Fish
- Water Uses
A. Diverse native community

B. Monospecific non-indigenous population
Costs of aquatic weed management

Ranges from $500 to $3,000 per acre

Ranges from $500 to $5,000 per mile of canal

What are the costs associated with?

- Consumable Materials (e.g. herbicides, fuel)
- Equipment (sprayers, harvesters, trucks, boats, safety gear)
- Personnel (salaries, training, insurance, benefits)
- Regulatory: NPDES-monitoring and compliance (sampling equipment, training, analysis, documentation, record storage)
Aquatic Plant Management Approaches

- Mechanical Control
- Cultural Control
- Biological Control
- Chemical Control
Mechanical Control

- Hand pulling and raking
- Cutting and harvesting
- Shredding
- Dredging
- Chaining
- Diver-operated suction harvesting
- Rotovating
Hand operated tools

AQUA WEED RAKE™

Removes Cut Weeds and Algae from Lakes and Ponds

• Fun and Easy because it’s LIGHT WEIGHT!

Just Throw it out and Rake in the weeds

Throw from Dock or Shore

Pull to shore while wading

ATTACHABLE FOAM FLOAT for removing Weeds & Algae that float.

Unwanted water weeds make excellent garden Fertilizer

Safe, Simple, Economical, and Effective

Environmentally safe. SWIM IMMEDIATELY after using—no more concern about toxic effects to fish, wildlife, pets or humans. SO SIMPLE any one person can use this lightweight (3½ pounds) - 36 inch—5½ foot Magnesium Aluminum Rake. Adjustable extension (6′ to 10′) allows for removing weeds and debris from lake bottoms. ECONOMICAL because it provides many years of weed removal for less than the cost of chemical treatments. Ideal for last and easy “Shoreline clean-up” or “Sand Raking” beaches or gardens. The Attachable Float makes the rake MORE EFFECTIVE for removing weeds that float.

What could be a better companion tool for “Aqua Weed Cutter” owners?

LAKE WEED-A-WAY INC. PO BOX 132 Caldonia Michigan 49316-0132 616 891-1294
HANDY MARKETING CO.

Dear Friend:

If you have a water weed problem, you already know what a job it is keeping the weed growth under control. Water weeds can greatly affect the use of your water property by inhibiting swimming, fishing and boating. Uncontrolled water weeds can also be an unsightly mess.

The AQUA WEED CUTTER will not only solve your water weed problem, but also help you do your part in preserving our nation’s most valuable resource. If for any reason you are not satisfied in 30 days with the operation of the AQUA WEED CUTTER, return it to wherever you purchased it for a full refund. This is a no risk offer on your part.

The AQUA WEED CUTTER is manufactured with the highest degree of workmanship and the highest quality of materials. The AQUA WEED CUTTER is 100% manufactured in the United States. Zinc plating and the stainless steel resharpenable blades offer a high degree of corrosion resistance. We are so sure of the quality of materials and workmanship that goes into each AQUA WEED CUTTER that we have recently extended the limited warranty period from 90 days to 1 year.

Sincerely,

Don Breckenridge,
President

SATISFIED CUSTOMERS

"Does a fantastic job. I figured I cleared more weeds in two hours than I’ve previously been able to in a whole summer."

-South Haven, MI

"My friend brought his AWC over to my house and I tried it. I thought it was great and I ordered one. The AWC is effective and easy to use."

-Webster, WI

"I like it very much. It does a very good job. I had to put a longer rope on it because I can throw it farther than the rope would permit. It’s nice to be able to cut weeds without getting wet, especially when the water is cold."

-Aitkin, MN

"Gentlemen, I wish to inform you that your AQUA WEED CUTTER does a very good job and I am pleased. Several of the neighbors have also ordered them."

-Gowen, MI

"We have tried the AQUA WEED CUTTER and find it does an excellent job of cleaning the weeds in our beach, along the long pier and boat docks. We are very satisfied with the product and would recommend it to anyone who has a need."

-Claypool, IN

BEACHES • PONDS & SMALL LAKES CAN BE WEED FREE!
SAFE, EASY-TO-USE • HELPS TO CONTROL WATER WEEDS

- Cuts a 48" path up to 20' deep (without operator getting wet!)
- Just throw it out and pull it in from Any Dock or Shore!

Stainless Steel Resharpenable Blades!
30-DAY MONEY BACK GUARANTEE!!
Cutting/Harvesting
Cutting/Harvesting
Underwater cutting head
Small fish and invertebrates become trapped in the plant material. The plant material has to be carried to appropriate disposal site.
Shredding

- Shredders chop material in place, too small for clogging waterways
- Immediate relief
Dredging: remove nutrient-rich sediments expose nutrient poor layers; deepens and results in less light penetrating to the bottom.
Chaining
Cultural Control

- Drawdown
- Benthic Barrier
- Shading
- Nutrient Inactivation
- Barley Straw
Drawdown

- Effective on some species, and inexpensive
- Damage to other non-target organisms
- Can impact human use of water
- Need water controls
Water Level Drawdown

Coontail, Egeria, Eurasian watermilfoil, Southern Naiad, Water Lily, Robbin’s Pondweed

Alligator weed, Hydrilla, Bushy Pondweed

Waterhyacinth, Elodea, Cattail
Benthic Barrier

- Frees areas for immediate use.
- Last up to 10 years
- Easy to install in small areas.
- Prevent new plant growth if used early in the spring.

- Not suitable for large-scale (expensive)
- Must be removed and cleaned in the fall.
- Too shallow an installation may entangle props.
- Habitat can be eliminated.
- Installation may be strenuous especially in deep water.
Light Alteration as a Management Approach

- Increase water depth by dredging.
- Increase shade from stream banks by planting tall grass, shrubs or trees.
- Add nutrients to stimulate algal blooms.
- Increase turbidity due to suspended clay.
  - Use light absorbing dyes.
    - (slow water turnover, dilution, apply early in growing season, most effective in clear water, require minimum depths of > 0.5 to 2 m)
Shading

- Water-soluble dye
- Inexpensive
- Discoloration appears artificial
**AQUASHADE®**

**AQUATIC PLANT GROWTH CONTROL**

**FOR ALL SEASONS**

**ACTIVE INGREDIENTS:**
- Blue Dye
  - Add Yellow 25

**INERT INGREDIENTS:**

**TOTAL:**

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**

**STATEMENT OF PRACTICAL TREATMENT:**

**DIRECTIONS FOR USE**

**GENERAL CLASSIFICATION**

**WHERE TO APPLY**

Natural and manmade controlled Ponds, Lakes & Fountains including Ornamental, Recreational, Paddling, and Pari-mond Ponds with little or no outflow, Off Shore Ponds, and Winching Tank.

**DO NOT apply directly to streams, rivers, or other bodies of water where any body of water not under total control of the user.**

**ENVIRONMENTAL**

- Avoid contact with fish or wildlife. Do not apply to water that will be used for human consumption.
  - 

**HOW TO APPLY**

- Pour fresh the container near shoreline into water. It will mix thoroughly. For early spring, pour onto the lake in a wide diameter circle. It will mix & disperse underneath.

**DIAGNOSIS:**

- For best results, apply before growing season starts, or when growth is 1'-2' in height. Apply 1 gallon of AQUASHADE® per 1,000 square feet of water. Apply before growth already above surface may be done after AQUASHADE® application. When applying an excessive quantity, follow all local restrictions, precautions and directions for use.

**PRECAUTIONS:**

**TECHNICAL BULLETIN**

**DESCRIPTION:**

- AQUASHADE® is a non-ionic, aqueous, non-toxic liquid formulated to impart an attractive blue-coloring to restricted and manmade ponds, lakes, fountains and water hazards.

**ADVANTAGES:**

- Non-toxic, non-hazardous to fish, wildlife, and other aquatic species.
- Non-toxic to plants.
- Easy to use.
- Long-lasting.
- Economical.
- Highly effective.

**APPLICATION:**

- AQUASHADE® is designed for use in ornamental, recreational, and parimond ponds with little or no outflow. It is also effective in controlling aquatic growth in off-shore ponds and winching tanks.

**LIMITATIONS:**

- AQUASHADE® should not be applied directly to streams, rivers, or other bodies of water where any body of water not under total control of the user.

**STORAGE & DISPOSAL:**

- AQUASHADE® should be stored at 32°F or above and should not be frozen. Do not apply to water that will be used for human consumption.

**MAINTENANCE:**

- The information contained in this bulletin is based on information which is believed to be reliable. However, the manufacturer makes no warranty, expressed or implied, of any kind, to any person or entity for use of the product or for the consequences of any use of the product. The supplier shall not be liable for any loss or damage caused by or arising out of use of the product, whether caused by negligence or otherwise.
Nutrient Inactivation

- Complex P with
  - Alum
  - Iron
  - Other
- Controls algae relatively inexpensively and can clarify water
- May not effect plants, particularly rooted ones
- Can have an effect on fish and other organisms
Biological Control

- Insects
  - Classical
  - Native
- Herbivorous Fish
  - Grass Carp
- Pathogens
  - Classical
  - Native
West Indian Manatee
Grass Carp

- Advantages
  - Effective
  - Inexpensive
  - Long-term

- Disadvantages
  - “All-or-none” response
  - Not selective
  - Cannot control feeding sites
  - Cannot stop fish
  - Difficult to contain
  - Reproduction?
Triploid Grass Carp Prefer Other Species

Pine et al. 1990
Classical Insect Control

Advantages
- Public perception
- Low cost after R&D
- Long-term

Disadvantages
- No agents for several target nonindigenous plants
- Long time for R&D
- Unpredictability of results
Agasicles hygrophila – Alligatorweed Flea Beetle
Goal of a Classical Insect Biological Control Program
Chemical control to submerged or floating leaf aquatics

- **Contact**
  - Complexed copper
  - Diquat
  - Endothall

- **Systemic**
  - 2,4-D
  - Fluridone
  - Glyphosate
  - Triclopyr
Proper identification of the target species of plant (or algae) is critical for optimal control.

For instance, herbicide selection:
- Aquathol-K works well on hydrilla
- Aquathol-K does not work well on egeria
Submersed Application Techniques

- Helicopter, Boat, Airboat
- Surface spray, Subsurface injection, granular spreader
Aquatic Herbicides

Read and follow the label!

Check with Ag Commissioner for local use restrictions.
Adding Copper Sulfate to an Irrigation Canal
SUBMERSED TREATMENT

WATER EXCHANGE
- FLOW
- TIDES
- WIND
- TEMP

LIQUID

GRANULES

UPTAKE

UPTAKE
Submersed Plants: Dose & Exposure

- Herbicide efficacy and selectivity dependent on dose and length of exposure to target plant

- Relationships identified for hydrilla and milfoil
  - 2,4-D
  - Endothall
  - Fluridone
  - Triclopyr

![Diagram showing herbicide efficacy and exposure time](image)
# Herbicides Used for Submersed Weed Control in Lakes and Reservoirs

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Uptake</th>
<th>Half-life (days)</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diquat</td>
<td>FAST</td>
<td>1-7</td>
<td>Spot applications</td>
</tr>
<tr>
<td>Copper</td>
<td>FAST</td>
<td>1-5</td>
<td>Spot applications</td>
</tr>
<tr>
<td>Endothall</td>
<td>Fast</td>
<td>4-7</td>
<td>Spot applications</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>Fast</td>
<td>1-4</td>
<td>Spot applications</td>
</tr>
<tr>
<td>Fluridone</td>
<td>Slow</td>
<td>20-90</td>
<td>Only large areas, except for pelleted formulation</td>
</tr>
</tbody>
</table>
Sonar used in golf course pond
Management Goals and Plans

- The question:
  - "What’s the best method to control plant X?"

- The best method depends on your management goals and your acceptable economic, environmental, and regulatory limitations.
## Example of Goals and Management Selection

<table>
<thead>
<tr>
<th>Target Plant</th>
<th>Limitation</th>
<th>Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurasian watermilfoil in a small farm pond with ability to drain and add water</td>
<td>Funds</td>
<td>Drawdown or backhoe</td>
</tr>
<tr>
<td></td>
<td>Maintain plant diversity</td>
<td>Triclopyr</td>
</tr>
<tr>
<td></td>
<td>No fishing restriction</td>
<td>Fluridone (SONAR)</td>
</tr>
<tr>
<td></td>
<td>Fish production pond</td>
<td>Shading</td>
</tr>
</tbody>
</table>
### Summary of biological management methods for aquatic plants.

<table>
<thead>
<tr>
<th>Management Method</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Systems where used effectively</th>
<th>Plant species response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Carp / White Amur</td>
<td>Herbivorous Fish</td>
<td>Long-term (decades), relatively inexpensive</td>
<td>Cannot control feeding sites, difficult to contain in water body, tendency for “all or none” community response, persistent</td>
<td>Isolated water bodies, effective against hydrilla and other preferred species. Operational.</td>
<td>Fish have strong preference for hydrilla and some native plants, avoid Eurasian watermilfoil, generally do not prefer floating plants</td>
</tr>
<tr>
<td>Neochetina spp.</td>
<td>Waterhyssinth weevils</td>
<td>Species selective</td>
<td>Not effective in reducing areal coverage in many situations</td>
<td>Released in Florida, Gulf Coast states. (Developmental)</td>
<td>Leaf scars, some reduction in growth</td>
</tr>
<tr>
<td>Hydrellia spp. Bagous spp.</td>
<td>Hydrilla fly, hydrilla stem weevil</td>
<td>Species Selective</td>
<td>Has not yet been established</td>
<td>Released in Florida, Alabama, Texas. (Research)</td>
<td>Limited</td>
</tr>
<tr>
<td>Euhychiopsis lecontei and other native insects</td>
<td>Weevil - native or naturalized</td>
<td>Already established in U.S.</td>
<td>Less selective, currently under R&amp;D</td>
<td>Currently under study in Vermont, Minnesota (Research)</td>
<td>Plants lose buoyancy, weevil interferes with transfer of carbohydrates</td>
</tr>
<tr>
<td>Mycoleptodiscus terrestris (MI)</td>
<td>Fungal pathogen; acts as a contact bioherbicide</td>
<td>Low dispersion, fairly broad spectrum</td>
<td>Expense, cross-contamination, inconsistent viability and virulence of formulation</td>
<td>Under R&amp;D for both Eurasian watermilfoil and hydrilla</td>
<td>“Contact Bioherbicide”, plants rapidly fall apart, but regrow from roots</td>
</tr>
<tr>
<td>Native Plant Community Restoration</td>
<td>Planting of desirable native plant species or community</td>
<td>Provides habitat, may slow reinvasion or initial invasion</td>
<td>Expensive, techniques still under development</td>
<td>Under R&amp;D around the country</td>
<td>Native plants provide ecosystem benefits, slow invasion</td>
</tr>
</tbody>
</table>
Use suggestions for US Environmental Protection Agency-approved aquatic herbicides.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Exposure Time (Water)</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Systems where used effectively</th>
<th>Plant species response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexed Copper</td>
<td>Intermediate (18-72 hours)</td>
<td>Inexpensive, rapid action, approved for drinking water</td>
<td>Does not biodegrade, but biologically inactive in sediments</td>
<td>Lakes as algicide, herbicide in higher exchange areas</td>
<td>Broad-spectrum, acts in 7-10 days or up to 4-6 weeks</td>
</tr>
<tr>
<td>2,4-D</td>
<td>Intermediate (18-72 hours)</td>
<td>Inexpensive, systemic</td>
<td>Public perception</td>
<td>Waterhyacinth and Eurasian watermilfoil control, Lakes and slow-flow areas, purple loosestrife</td>
<td>Selective to broad-leaves, acts in 5-7 days up to 2 weeks</td>
</tr>
<tr>
<td>Diquat</td>
<td>Short (12-36 hours)</td>
<td>Rapid action, limited drift</td>
<td>Does not affect underground portions</td>
<td>Shoreline, localized treatments, higher exchange rate areas</td>
<td>Broad-spectrum, acts in 7 days</td>
</tr>
<tr>
<td>Endothall</td>
<td>Short (12-36 hours)</td>
<td>Rapid action, limited drift</td>
<td>Does not affect underground portions</td>
<td>Shoreline, localized treatments, higher exchange rate areas</td>
<td>Broad spectrum, acts in 7-14 days</td>
</tr>
<tr>
<td>Fluridone</td>
<td>Very long (30-60 days)</td>
<td>Very low dosage required, few label restrictions, systemic</td>
<td>Very long contact period</td>
<td>Small lakes, slow flowing systems</td>
<td>Broad spectrum, acts in 30-90 days</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Not Applicable</td>
<td>Widely used, few label restrictions, systemic</td>
<td>Very slow action, no submersed control</td>
<td>Nature preserves and refuges; Emergent and floating-leaved plants only</td>
<td>Broad spectrum, acts in 7-10 days, up to 4 weeks</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>Intermediate (12-60 hours)</td>
<td>Selective, systemic</td>
<td>Not currently labeled for general aquatic use</td>
<td>Lakes and slow-flow areas, purple loosestrife</td>
<td>Selective to broad-leaves, acts in 5-7 days, up to 2 weeks</td>
</tr>
</tbody>
</table>
## Characteristics of U.S. Environmental Protection Agency-approved aquatic herbicides.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Trade Name</th>
<th>Company</th>
<th>Formulation; Contact vs. Systemic</th>
<th>Mode of Action</th>
<th>Bluegill 96 hr. LC$_{50}$ (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexed Copper</td>
<td>Cutrine-Plus, Komeen, Koplex, K-Tea</td>
<td>Applied Biochemists (Cutrine), Griffin Corporation</td>
<td>Various complexing agents with copper, superior to CuSO$_4$ Systemic</td>
<td>Plant cell toxicant</td>
<td>1250</td>
</tr>
<tr>
<td>2,4-D</td>
<td>Aqua-Kleen, Weedar-64, Wee-Rhap A-6D, Several Others</td>
<td>Applied Biochemists, Rhone-Poulenc, Inter-Ag</td>
<td>BEE salt, DMA liquid, IEE liquid, Systemic</td>
<td>Selective plant-growth regulator</td>
<td>1.1-1.3 123-230</td>
</tr>
<tr>
<td>Diquat</td>
<td>Reward</td>
<td>Zeneca</td>
<td>Liquid Contact</td>
<td>Disrupts plant cell membrane integrity</td>
<td>10-140</td>
</tr>
<tr>
<td>Endothall</td>
<td>Aquathol K, Hydrothal 191, Aquathol granular</td>
<td>Elf Atochem (All Formulations)</td>
<td>Liquid or granular Contact</td>
<td>Inactivates plant protein synthesis</td>
<td>125 0.06-0.2</td>
</tr>
<tr>
<td>Fluridone</td>
<td>Sonar AS, Sonar SRP</td>
<td>SePRO</td>
<td>Liquid or granular Systemic</td>
<td>Disrupts carotenoid synthesis, causing bleaching of chlorophyll</td>
<td>9-12.5</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Rodeo</td>
<td>Monsanto</td>
<td>Liquid Systemic</td>
<td>Disrupts synthesis of phenylalanine</td>
<td>4.2-14</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>Garlon 3A (EUP), Renovate (EUP)</td>
<td>SePRO</td>
<td>Liquid Systemic</td>
<td>Selective plant growth regulator</td>
<td>148</td>
</tr>
</tbody>
</table>
Application restrictions of US Environmental Protection Agency-approved aquatic herbicides.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Persistence (half-life, in days)</th>
<th>Maximum Application Rate</th>
<th>Maximum water concentration</th>
<th>Safety Factor</th>
<th>Application Notes</th>
<th>WES Recommended for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexed Copper</td>
<td>3</td>
<td>1.5 gal/ft/acre</td>
<td>1.0 mg/L</td>
<td>&gt;50</td>
<td>Algaide / Herbicide</td>
<td>Hydrilla, other submersed spp.</td>
</tr>
<tr>
<td>2,4-D</td>
<td>7.5</td>
<td>0.5 gal/acre</td>
<td>2.0 mg/L</td>
<td>&gt;25</td>
<td>Some formulations for special permits only</td>
<td>Eurasian watermilfoil, water-hyacinth, and others</td>
</tr>
<tr>
<td>Diquat</td>
<td>1-7</td>
<td>2 gal/acre</td>
<td>2 mg/L</td>
<td>5</td>
<td>Binds with particles (suspended solids) in water</td>
<td>All</td>
</tr>
<tr>
<td>Endothall</td>
<td>4-7</td>
<td>13 gal/acre</td>
<td>5.0 mg/L</td>
<td>&gt;10 (Aquathol)</td>
<td>Fish are sensitive to Hydrothal 191 - over 1 mg/L may cause fish kill</td>
<td>All submersed spp.</td>
</tr>
<tr>
<td>Fluridone</td>
<td>21</td>
<td>1.1 qt/acre</td>
<td>0.15 mg/L (150 ppb)</td>
<td>&gt;20</td>
<td>Applications have been successful below 10 ppb</td>
<td>Most submersed spp.</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>14</td>
<td>2 gal/acre</td>
<td>0.2 mg/L</td>
<td>&gt;20</td>
<td>Aerial portions only - not for submersed plants</td>
<td>Most emergent and floating spp.</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>na</td>
<td>na</td>
<td>2.5 mg/L</td>
<td>&gt;50</td>
<td>EUP/Special Needs only - US EPA label expected in 1997</td>
<td>Eurasian watermilfoil, water-hyacinth, others</td>
</tr>
</tbody>
</table>
## Characteristics of physical management techniques.

<table>
<thead>
<tr>
<th>Management Method</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Systems where used effectively</th>
<th>Plant Species Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredging/ Sediment Removal</td>
<td>Use mechanical sediment dredge to remove sediments, deepen water</td>
<td>Creates deeper water, very long-term results</td>
<td>Very expensive, must deal with dredge sediment</td>
<td>Shallow ponds and lakes, particularly those filled in by sedimentation</td>
<td>Often creates large usable areas of lake, not selective</td>
</tr>
<tr>
<td>Drawdown</td>
<td>&quot;De-water&quot; a lake or river for an extended period of time</td>
<td>Inexpensive, very effective, moderate-term</td>
<td>Can have severe environmental impacts, severe recreational/ riparian user effects</td>
<td>Only useful for manmade lakes or regulated rivers with a dam or water control structure</td>
<td>Selective based on perennation strategy; effective on evergreen perennials, less effective on herbaceous perennials</td>
</tr>
<tr>
<td>Benthic Barrier</td>
<td>Use natural or synthetic materials to cover plants</td>
<td>Direct and effective, may last several seasons</td>
<td>Expensive and small-scale, nonselective</td>
<td>Around docks, boat launches, swimming areas, and other small, intensive use areas</td>
<td>Nonselective, plant mortality within one month underneath barrier</td>
</tr>
<tr>
<td>Shading / Light Attenuation</td>
<td>Reduce light levels by one of several means: dyes, shade cloth, plant trees (rivers)</td>
<td>Generally inexpensive, effective</td>
<td>Nonselective, controls all plants, may not be aesthetically pleasing</td>
<td>Smaller ponds, manmade waterbodies, small streams</td>
<td>Nonselective, but may be long-term</td>
</tr>
<tr>
<td>Nutrient Inactivation</td>
<td>Inactivate phosphorus (in particular) using alum</td>
<td>Theoretically possible</td>
<td>Impractical for rooted plants limited by nitrogen</td>
<td>Most useful for controlling phytoplankton by inactivating water column P</td>
<td>Variable</td>
</tr>
</tbody>
</table>
## Characteristics of mechanical management techniques.

<table>
<thead>
<tr>
<th>Management Method</th>
<th>Description</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Systems where used effectively</th>
<th>Plant species response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand- Cutting/ Pulling</td>
<td>Direct hand pulling or use of hand tools</td>
<td>Low-technology, affordable, can be selective</td>
<td>Labor-intensive, cost is labor-based</td>
<td>Most of the undeveloped world, volunteer labor pools</td>
<td>Very effective in very localized areas</td>
</tr>
<tr>
<td>Cutting</td>
<td>Cut weeds with mechanical device (typically boat-mounted sickle bar) without collection</td>
<td>More rapid than harvesting</td>
<td>Large mats of cut weeds may become a health and environmental problem, may spread infestation</td>
<td>Heavily-infested systems</td>
<td>Nonselective, short-term</td>
</tr>
<tr>
<td>Harvesting (Cut and Remove)</td>
<td>Mechanical cutting with plant removal</td>
<td>Removes plant biomass</td>
<td>Slower and more expensive than cutting; resuspension of sediments</td>
<td>Widespread use with chronic plant problems</td>
<td>Like cutting, it is cosmetic, non-selective short-term</td>
</tr>
<tr>
<td>Grinder or &quot;Juicer&quot; (Cut and Grind)</td>
<td>Mechanical cutting with grinding of plant material and in-lake disposal</td>
<td>Immediate relief of plant nuisance, no disposal</td>
<td>Resuspension of sediments, decomposition of plants in lake, floating plant material</td>
<td>Useful for chronic plant problems where disposal of plants is problematic</td>
<td>Like cutting and harvesting, it is cosmetic, non-selective short-term</td>
</tr>
<tr>
<td>Diver-Operated Suction Harvester</td>
<td>Vacuum lift used to remove plant stems, roots, leaves, sediment left in place</td>
<td>Moderately selective (based on visibility and operator), longer-term</td>
<td>Slow and cost-intensive</td>
<td>Useful for smaller nuisance plant populations in which plant density is moderate</td>
<td>Typically have minimal regrowth for Eurasian watermilfoil; not effective for tuber-setting hydrilla</td>
</tr>
<tr>
<td>Rotovating</td>
<td>Cultivator on long arm for tilling aquatic sediments</td>
<td>Disrupts Eurasian watermilfoil stem bases, intermediate-term results</td>
<td>May spread large numbers of fragments; resuspension of sediments</td>
<td>Used extensively in the Pacific Northwest and British Columbia, with mixed results</td>
<td>Effective in disrupting Eurasian watermilfoil dense stands; not selective and only intermediate-term</td>
</tr>
</tbody>
</table>