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Evaluating Stationary Blankets and Removable Screens for Macrophyte Control in Lakes

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ABSTRACT

Stationary blankets (Bidim and Typar) and removable screens (Aquascreen) were tested for control of macrophytes in Cox Hollow Lake, Wisconsin. All materials controlled vegetation the first year. They then accumulated sediments and were invaded by rooted plants. The blankets could not be easily removed or cleaned in the lake. New blankets would have to be added each year to control macrophytes. The screens, however, were easily removed. When cleaned each year, the screens prevented new growth in spring and eliminated growing plants in summer. Few plants grew back 1 to 2 months after removing the screens. Most benthos, however, were eliminated beneath the screens. For opening boat lanes across plant beds and controlling plants along shore, removable screens can be a useful technique.

Key words: pondweeds, benthos, algae, plant biomass, shading, sediments, milfoil, elodea.

INTRODUCTION

Synthetic liners are widely used to construct and renovate ponds (7). They stabilize the hydrosoil and seal it against seepage. Bottom liners may also be used to control aquatic macrophytes and even offer advantages over other lake rehabilitation methods. They can be confined to specific areas of a lake, are out of sight, and create no disturbance on shore. Liners can be used in water too deep for harvesting or chemical spraying. They prevent stirring of sediments and seal the bottom against nutrient release. Rooted plants may have difficulty penetrating or attaching to the liners. How long does plant control last, however, and are liners effective against plants without roots?

Conventional polyethylene sheeting easily tears, floats on water, and must be well anchored. Gases generated in the sediments may accumulate beneath the liners and cause them to balloon. Once secured to the lake bottom, the liners may be difficult to remove for cleaning and relocating.

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Bidim, Typar and Aquascreen[2] may overcome some of these shortcomings. Monsanto's Bidim C22 and DuPont's Typar F3201, designed for water filtration, are composed of durable, polymeric fibers forming a variable mesh (Table 1). Cooke and Gorman (3) found Typar to be permeable to gases and not balloon. Like conventional plastic sheeting, both materials are light enough to require considerable weighting and, therefore, cannot be easily removed for cleaning. They also would be difficult to secure over tall plants in summer.

Aquascreen is a polyvinyl-coated fiberglass screen developed specifically for use over plant beds (8). It is supposed to reduce incident sunlight and cause plants to decay. Unlike the other blankets, it is meant to be relocated during the growing season and removed for cleaning in fall. This saves on material, reduces expense, and retards sediment accumulation. Its uniform pore size of 1 mm^2 (64 meshes/cm^2) is meant to permit gases to escape. Because of its high density, it needs less weighting than the other

TABLE 1. CHARACTERISTICS AND COSTS OF THE TYPAR, BIDIM AND AQUASCREEN USED IN THIS STUDY[a]

	Typar F3201	Bidim[b] C22	Aquascreen 400 mesh
Fabric	polyproplyene	polyethylene terephthalate	PVC-coated fiberglass
Specific gravity	0.95	1.3	2.5
Weight (g/m^2)	66	173	205
Thickness (mm)	0.15	1.5	0.33
Pore size (mm)	0.1-0.5	0.05-0.2	1.0
Cost ($\$/m^2$)[c]	0.80	0.79	2.60

[a]Measurements were made by the author; they may differ from manufacturer's specifications.
[b]Bidim C22 is now distributed as Trevira S1115 by Hoechst Fibers Industries, Spartanburg, SC
[c]The cost was based on December 1982 prices.

[2]Reference to trade names or commercial products does not constitute an endorsement by the author or the Department of Natural Resources.

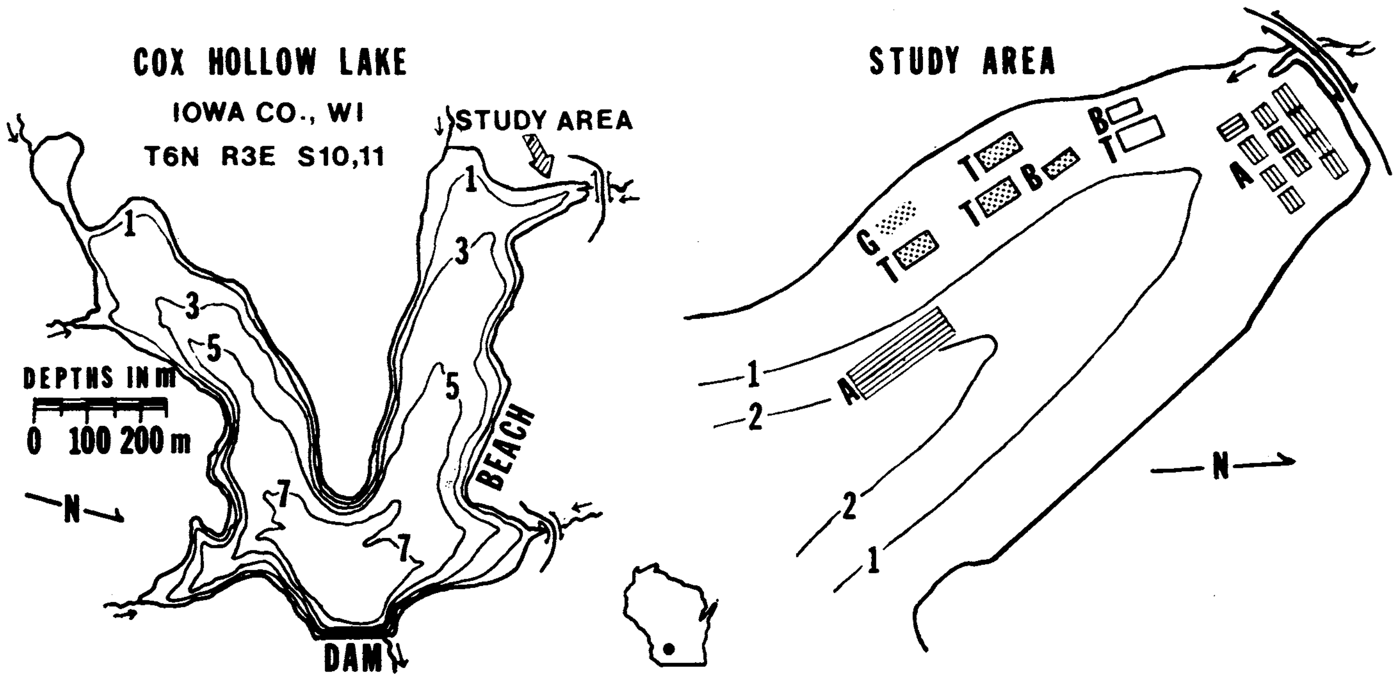

Figure 1. Cox Hollow Lake and study area, showing the arrangement of Aquascreen (A), Bidim (B), the unlined gravel-only area (G), and Typar (T). The gravel cover on some blankets is indicated by a dot screen.

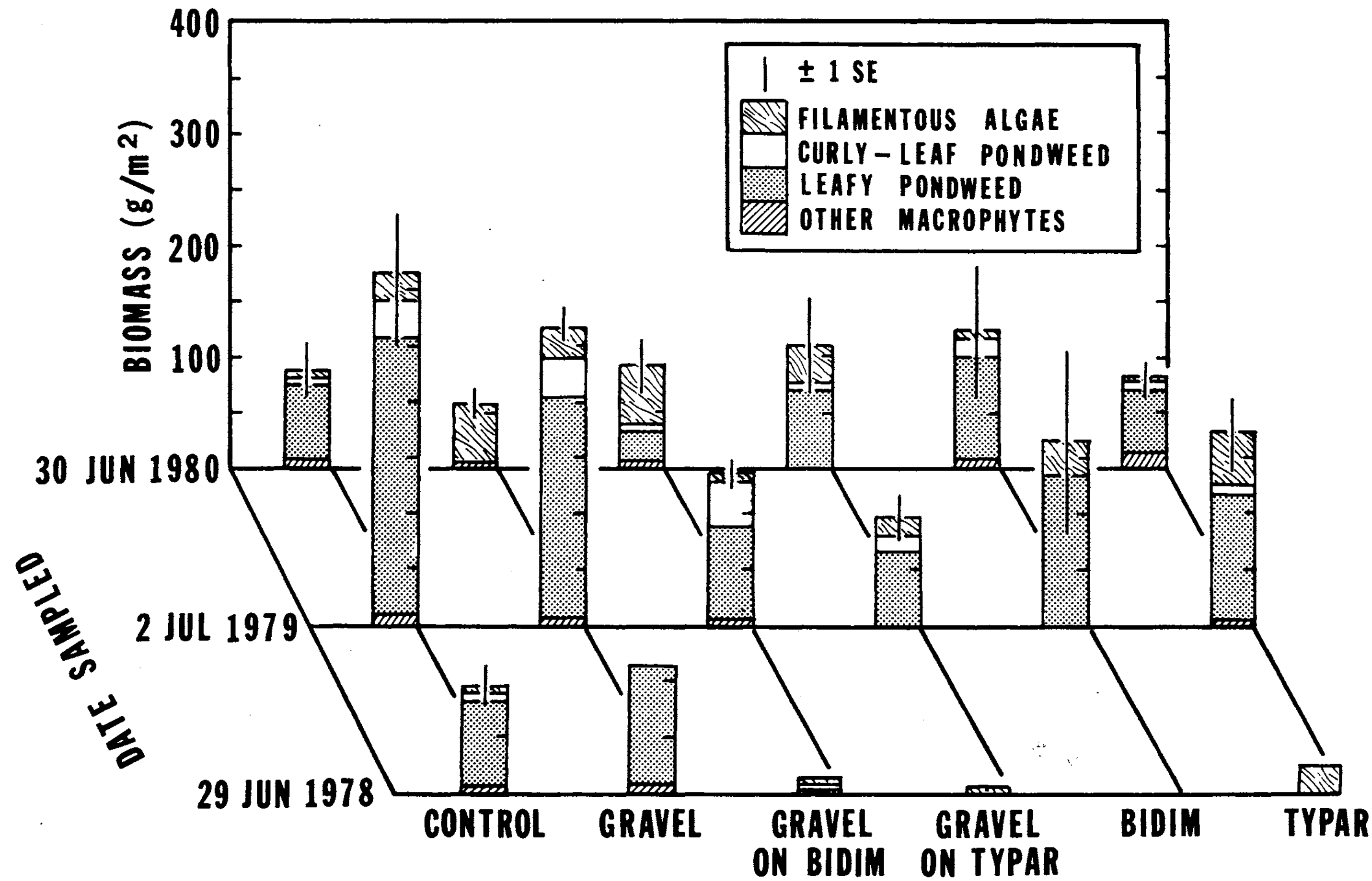

Figure 2. Plant biomass on control sites, the gravel-only area, and Bidim and Typar with and without gravel.

sediment blankets and is not meant to have a sand or gravel cover.

Bidim, Typar and Aquascreen were evaluated for ease of application and effectiveness in controlling vegetation. Gas accumulation and effect of a gravel cover were also observed. Aquascreen was further tested for the effectiveness of a 1, 2, and 3 month cover, invasion of plants after removing the screens for 1 and 2 months, and survival of benthic macroinvertebrates beneath the screens.

STUDY AREA

Cox Hollow Lake is an impoundment built in 1958. It is located in the steep, unglaciated terrain of southwestern Wisconsin. The horseshoe-shaped basin occupies 39 ha, averages 3.7 m deep, and has a maximum depth of nearly 9 m (Figure 1). Its watershed of 1,600 ha contains farmland that contribute nutrients to the lake. The lake water has a pH of 7.5 to 8.5, a total alkalinity of 200 to 250 mg $CaCO_3$/liter, and a specific conductance of about 375 μmhos/cm. Blue-green algae bloom in summer (chlorophyll *a* 70 μg/liter). This restricts the visibility of a Secchi disk to less than 1 m. Submersed macrophytes and floating mats of filamentous algae cover about 20 to 30% of the lake from May to August (11).

MATERIALS AND METHODS

A Bidim and three Typar blankets were spread on the lake ice in March 1978. They were covered with 25 mm of unpolished pea gravel with stones of 5 to 10 mm diameter. The covered blankets melted through the ice and sank to the bottom. Another Bidim and a Typar blanket remained uncovered. They were placed on the lake bottom after ice-out in April and anchored with bricks. The Bidim blankets measured 3 by 5 m; the Typar blankets were each 4 by 6 m. The blankets were arranged in two parallel rows, 2 to 10 m from shore, in water 0.2 to 1.0 m deep. A nearby area of 4 by 6 m was covered with just the pea gravel.

Aquascreen was tested without a gravel cover. In early May 1979, before macrophyte growth resumed, a screen of 2 by 18 m was anchored with bricks to the lake bed in water less than 1 m deep. A 4.5 m section of this screen was removed in June, July and August, to measure plant regrowth on the exposed sites. The remaining section was left in place until the fall of 1980. As each section was removed it was placed over nearby macrophyte beds that had reached the water surface; it was later anchored with bricks to the bottom when the plants were partly decayed. In early May 1980 a screen of 2 by 18 m was set on the bottom in water less than 1 m deep; another screen of 4 by 30 m was placed in water 1 to 2 m deep. All screens were removed in fall.

Divers collected macrophyte samples of 0.2 m². On each date three random samples were taken on each blanket and screen and on each site that was previously screened; 8 to 16 control plots were randomly sampled from undisturbed areas around the blankets and screens. Each site was sampled only once. Bidim and Typar were sampled in late June or early July of 1978 through 1980, when the potamogetons were at or near their seasonal peak biomass. Aquascreen was sampled in the middle of June, July and August of 1979 and 1980. Samples were cleaned, sorted to species, and identified from Fassett (5). Plant biomass (exclusive of roots) was determined by drying the plants in an oven at 105 C for 48 to 72 hours.

Dissolved oxygen was measured by the azide-modified Winkler method (1). A 300 ml BOD bottle was gently slipped under the screens and filled by hand.

Benthic macroinvertebrates were sampled under the screens and surrounding control areas using an Ekman dredge with sides of 152 mm. A different corner of the screens was gently lifted enough to slip the dredge under to collect the samples. Two grabs were combined for each sample. Samples were collected each month from May through August of 1980. On each date one sample was taken under each screen and 3 to 5 samples on control sites selected at random. The samples were then washed through a No. 60 U.S. Standard Sieve of 250 μm mesh and stored in about 75% ethanol. Most of the organisms were identified to genus, using Eddy and Hodson (4) and Hilsenhoff (6). Rare taxa were totally counted; abundant ones were subsampled. Empty mollusk shells and caddisfly cases were not counted.

RESULTS AND DISCUSSION

Bidim and Typar worked well the first year (Figure 2). Some plant shoots penetrated rips in the uncovered blan-

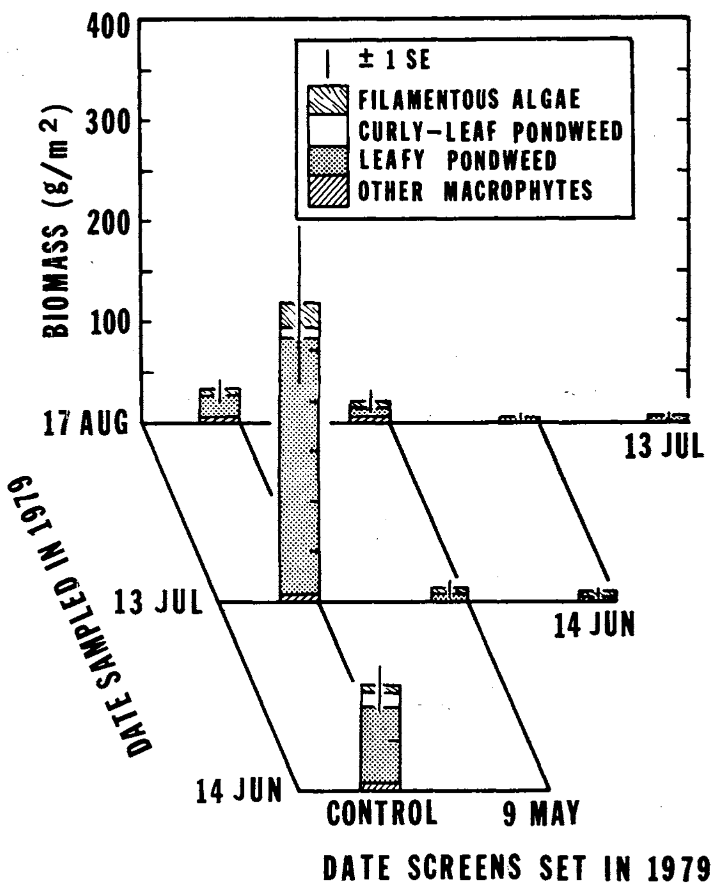

Figure 3. Plant biomass in 1979 on control sites and Aquascreen set in water less than 1 m deep.

supported only 5 to 20% of the total biomass of the control sites. Macrophytes grew slower in deeper water, since the total biomass on deep water control plots was only 47 to 64% of that on control plots in shallow water. Filamentous algae grew much better in deep water, despite the light restriction caused by blue-green algae. Most macrophytes grow poorly beyond 2.5 m in many southern Wisconsin lakes (11), making it unnecessary to place screens deeper.

Aquascreen nearly eliminated most benthic macroinvertebrates (Figure 5). In May 1980, before the screens were set, the composition of organisms was similar among areas and averaged about 21,000 individuals/m². Finger-nail clams (*Sphaerium*), larvae of chironomid and ceratopogonid flies, and caddisfly larvae made up about 90% of all organisms. Oligochaetes, leeches and snails (*Gyraulus, Helisoma* and *Physa*) comprised the remainder. The mean number of individuals/m² in control plots then dropped to 14,000 in June, 16,000 in July, and 7,000 in August. The composition remained similar in all months. Organisms under the screens, however, progressively decreased in mean number/m² to 8,000 in June, 4,000 in July, and 2,000 in August. By August, only one-third of the population of macroinvertebrates was found under the screens. The screen left from the previous May had very few organisms under it. Live chironomid larvae covered the upper surface of all the screens, suggesting that the screens were not toxic to the organisms. Poor water circulation and low dissolved kets, a few others grew on pockets of sediments collecting on the uneven surface, and no plants grew under the blankets. An uncovered Typar blanket had as much as 25 g/m² of filamentous algae (*Cladophora* and *Spirogyra*). Macrophytes, however, reached 94 g/m² on the controls and 114 g/m² on the gravel-only area in 1978. Little difference was found between the controls and the gravel-only area, because enough gravel sank into the sediments to minimize its effect on plant growth.

Plants were no longer controlled after 1978. Plant growth on the blankets reached 95 to 170 g/m² in 1979 and 80 to 125 g/m² in 1980. The plants grew just as well on the gravel-covered blankets as on those without gravel.

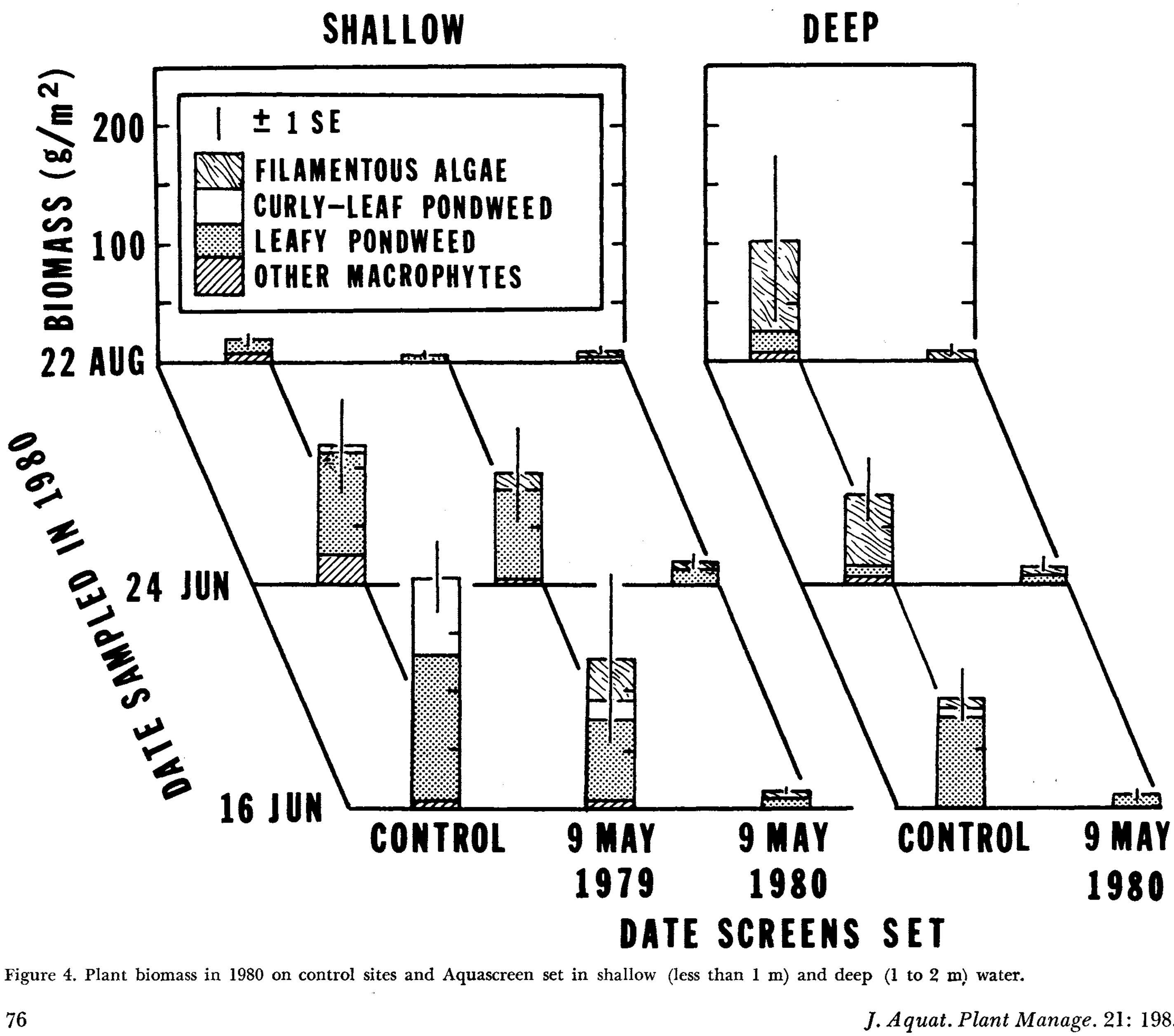

Figure 4. Plant biomass in 1980 on control sites and Aquascreen set in shallow (less than 1 m) and deep (1 to 2 m) water.

Enough sediment accumulated on the blankets to encourage attachment by rooted plants. Leafy pondweed (*Potamogeton foliosus* Raf.) comprised 63 to 76% of the total biomass on the blankets and 76 to 79% on the controls. The other species present were mainly curly-leaf pondweed (*P. crispus* L.) and coontail (*Ceratophyllum demersum* L.).

Aquascreen remained nearly free of macrophytes, regardless of when they were installed in 1979 (Figure 3). In spring, the screens prevented new plant growth. In summer, they pushed tall pondweeds to the lake bed, where they decomposed in a few weeks. A few stems penetrated the screen's mesh, but most plants grew on pockets of sediment. Some plants remained alive beneath screens that were not firmly anchored. These plants were mostly leafy pondweed, which comprised 80 to 87% of the total biomass on control plots. Plant biomass on controls reached a peak of 270 g/m² in mid-July and then declined. Few plants regrew after screens were removed, partly because of the short growing season in Wisconsin.

Screens placed on the lake bed in May 1980 again worked well, but a screen held over from the previous May gave poor results (Figure 4). Its species composition and total biomass were similar to those of the control plots. Screens added in 1980 to both shallow and deep water, however, oxygen under the screens best explain the decreased number of benthic organisms.

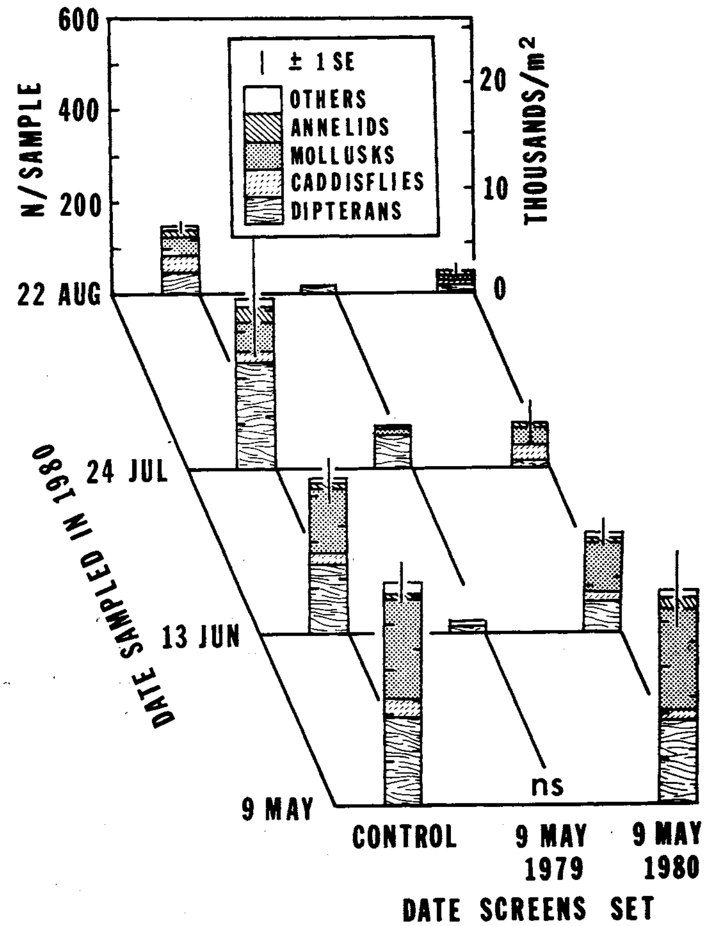

Figure 5. The number of benthic macroinvertebrates sampled in 1980 on control sites and under Aquascreen set in May of 1979 or 1980. No samples (ns) were collected on one date under the May 1979 screen.

Despite their open meshwork, the blankets and screens trapped gases beneath them. At times, a portion of a blanket or screen would balloon and require reanchoring.

Accumulation of sediments on stationary blankets of various materials (2) seem to limit their usefulness for controlling aquatic macrophytes. Removable screens can avoid this problem, but are expensive and have met with varied success in other studies. Algae growth and trapped gases were a problem on Aquascreen in southern ponds.[3] Eurasian watermilfoil (*Myriophyllum spicatum* L.) continued to grow under screens that were not firmly pressed against the lake bed (9). *Elodea canadensis* L., a shade-tolerant plant, failed to decompose under Aquascreen (10). The longer growing season in southern waters may necessitate leaving the screens in place for much of the year.

Blanketing and screening lake beds for plant control are relatively new strategies for lake rehabilitation. They offer promise of controlling macrophytes in limited areas of lakes, but considerably more research and refinement is needed.

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