develop monitoring plans for statewide use. Volunteers attended a one-
day training in target species identification and monitoring techniques,
then on a monthly basis sampled sites and reported their findings to
project administrators.

243.5
Performance of Passive Wastewater Nitrex™ Nitrogen Removal and
Phosphorus Removal Systems for Lake Water Quality Protection.
Lombardo, P., Lombardo Associates, Inc., 49 Edge Hill Rd., Newton, MA
02467, pio@lombardoaasociates.com; W. Robertson and D. Blowes. P. 85.
This abstract discusses the Nitrex™ nitrogen removal technology, a
wood-based reactive material that has been shown to reduce wastewater
nitrogen levels to less than 3 ppm and nitrate levels below 0.10 ppm
nitrogen. Phosphex™ and RID™ are discussed for their ability to reduce
total phosphorus to less than 0.08 ppm.

243.6
Promising Results Using Barley Straw as a Pond Management
Technique. Mayne, C.D., Ecosystem Consulting Service, Inc., P.O. Box
370, Coventry, CT 06238, cmayne@ecosystemconsulting.com. P. 88.
Barley straw was added to one of ten ponds located in a housing de-
velopment that have had chemical treatments to control algal growth in the
past. Mayne reports that the barley straw has successfully controlled algea in this pond. During this study, the other nine ponds at the site
needed chemical treatments to regulate the alga growth.

244
48(1):6-10.
This restoration project in Dearborn, Michigan reconnected a river
oxbow excluded from its course when the river was channelized. Much of
the original floodplain forests existed on the site, but debris and inva-
sive species restricted the understory. A 2,200-foot long channel, 15 to
50 feet wide and 8 feet deep, was created on the site and connected to
the river. Native seed and plants, such as pickerel weed (Pontederia cor-
data), water arum (Calla palustris), water lily (Nymphaea odorata), sedges
(Carex spp.), bulrushes (Scirpus spp.) and marsh milkweed (Asclepias
incarnata), were used in the channel and on 3 acres (1.2 ha) of sur-
rounding wetland. Other native plants, including redosier dogwood
( Cornus stolonifera), silky dogwood ( Cornus americana) and willows (Salix
spp.), were used in bundles and live stakes for slope stabilization. The
article details hydrologic issues, discusses educational opportunities on
the site, and gives a short explanation of the construction procedures.

245
Ave. South, P.O. Box 1197, Fort Dodge, IA 50501; C. Harvey and J.
Loss of riparian vegetation and other factors caused streambank erosion
along the Pit River in northern California. The restoration employed a
number of techniques, such as the use of rocks, willow cuttings, brush
mattresses, and other systems. The authors report the restoration a suc-
cess, despite a willow survival rate as low as 17.5 percent. They advise
using fewer willow cuttings, but spending more time making sure those
harvested for planting receive proper care.

COASTAL COMMUNITIES

246
Diagnostic Tool Sets Water Quality Targets
for Restoring Submerged Aquatic Vegetation
in Chesapeake Bay
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P.O. Box 28, Edgewater, MD 21037, 443/482-2240, Fax: 443/482-2380,
gallegosc@si.edu; and Patrick D. Biber, Institute of
Marine Science, University of North Carolina at Chapel Hill, 3431
Arendell St., Morehead City, NC 28557
Controlling the substances—suspended particulate matter, col-
cored dissolved organic matter, and phytoplankton—that reduce
water clarity is a crucial for restoring highly valued communities
of native submerged aquatic vegetation (SAV) in coastal estuar-
ies. Here, we describe a light penetration model that allows
managers in the Chesapeake Bay watershed to determine suit-
able management practices for improving water clarity and pro-
moting SAV growth in areas where it once flourished.

One of us, Gallegos (2001) developed this light threshold
model to predict the percentage of light reaching the bottom at
some depth (Kd). This model is based on the inherent optical
properties of the three factors related to water quality measure-
ments and which contribute to light attenuation: 1) colored dis-
solved organic matter, 2) phytoplankton pigments (chlorophyll),
and 3) non-pigmented particulates (total suspended solids
(TSS)). By modeling Kd with a range of water quality concen-
trations, we can set threshold water quality criteria that enable SAV
to meet their photosynthetic needs to some depth, usually 1 m
(also called the “light-at-depth” target).

Managers who are attempting to protect or restore SAV can
use this model by downloading an Excel spreadsheet available
on the Chesapeake Bay Program Web site (Factors Contributing
chesapeakebay.net/cims/Diagnost.xls). This tool, which was de-
veloped using optical properties of particulate matter at a mid-
Chesapeake Bay site, requires the user to enter water quality
data measurements, minimum requirements for SAV, and SAV
restoration depths. In turn, the program will predict the levels to
which TSS and chlorophyll should be reduced, if needed, to
ensure the vitality of restored SAV populations.

In a recent study conducted in numerous small tributaries of
the Chesapeake Bay, we found different levels of water quality
thresholds, all of which were dependent on surrounding land
uses (Figure 1). The increased sensitivity of the light-at-depth
target to the concentration of suspended particulate matter
appears to result from a shift in the size of particulate matter—
the smaller organic particles being the most efficient at light
attenuation—along the gradient of land uses from forested-agri-
cultural through heavily developed. We suspect that organic
enrichment from watershed development stimulates the growth
of bacteria and the small, fast-growing plankton that consume them (Azam and others 1983), resulting in an overall reduction in the size of individual organisms within the plankton food web. The greater concentration of smaller individuals leads to more light attenuation than expected with a balanced food web and is one potential mechanism by which eutrophication may be responsible, at least in part, for the observed increased sensitivity of the light threshold to suspended particulates. These findings suggest that more developed watersheds will require lower permissible suspended solids concentration to achieve the same light-at-depth target for seagrass protection and restoration.

The light threshold model can be used to demonstrate this situation. If the progression of thresholds in Figure 1 represents a sequence that occurs during eutrophication, then there are implications both for understanding the causes of SAV loss as well as for implementing management practices (Figure 1). For example, while management action to restore SAV in a developed estuary by reduction of TSS (M1 in Figure 1) would potentially be effective, it would not be a suitable solution if suspended solids were from unmanageable sources, such as wind-induced resuspension. Alternatively, focus on nutrient reduction (M2 in Figure 1) would have the potential of not only reducing ambient chlorophyll and particulate organic matter (through reduction of the plankton population), but could also reduce sensitivity of the threshold to suspended solids by restoration of a more balanced food web.

We hope to continue updating the Diagnostic Tool spreadsheet as our understanding of the variability of threshold concentrations in different locations improves.

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REFERENCES


247

Restoration of Long-spined Sea Urchins: A Possible Strategy to Improve Coral Reef Health (Florida)

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In recent decades, many coral reefs within the Caribbean Sea and western Atlantic Ocean have shifted from a stony coral and crustose coralline algal-dominated substrate to one dominated by macroalgae and algal turfs. This shift has occurred in response to a number of stressors, including a massive die-off of the long-spined sea urchin (Diadema antillarum). Along with herbivorous fish, this species plays an important role as a functional grazer, particularly in shallow reef habitats (up to 33 ft [10 m] in depth). As nursery habitat for many fish species grew scarce during the past several hundred years due to increased fishing pressures, the long-spined sea urchin became the most important grazer on many coral reefs (Carpenter 1981). Tragically, an unknown pathogen killed about 98 percent of the long-spined sea urchin population in the Caribbean basin within a 14-month period beginning in 1983. To this date, herbivory on reefs continues to be low (Lessios 1984).

Recent studies have inferred that restoring herbivory on coral reefs to historic levels will lead to an increase in coral recruitment and decreased mortality of established colonies in areas with a high algal biomass, and ultimately improve coral reef health (Edmunds and Carpenter 2001). Therefore, beginning in 2002, The Nature Conservancy partnered with the University of North Carolina at Wilmington and the University of Miami in Florida to establish a long-spined sea urchin pilot restoration program. Our goals are to 1) establish long-spined...