Northeast Fisheries Science Center Reference Document 93-27

A Failed Attempt to Re-establish Eelgrass In Raritan Bay (New York/New Jersey)

by

Robert N. Reid, Clyde L. MacKenzie, Jr.,
and Joseph J. Vitaliano

NOAA/National Marine Fisheries Service
Northeast Fisheries Science Center
Environmental Processes Division
James J. Howard Laboratory
Highlands, NJ 07732

December 1993

TABLE OF CONTENTS

List of Figures

ABSTRACT

Where it flourishes, eelgrass (*Zostera marina*) serves important functions such as providing a nursery for fish and shellfish, and reducing erosion and turbidity. Eelgrass was abundant in parts of Raritan Bay before it was decimated by a "wasting disease" in the 1930s. To examine whether eelgrass would grow under the bay's present conditions, we conducted a small-scale transplanting from Barnegat Bay, N.J., to five sites in Raritan Bay in summer 1990. Transplants persisted for varying lengths of time, but none could be found more than 9 months after planting. Turbidity, blanketing by sea lettuce, fouling by epifauna, and wave action probably contributed to the lack of success.

INTRODUCTION

Eelgrass, *Zostera marina*, plays a major ecological role in habitats where it is abundant. It is important as a nursery for resource species, and a nursery/shelter for their prey (Kikuchi 1980; Kenworthy *et al.* 1988). Eelgrass can reduce erosion of shorelines and nearshore sediments (Orth 1977); by trapping suspended materials, it can also reduce water column turbidity (Fonseca and Fisher 1986). Eelgrass competes with phytoplankton for nutrients, and so may help limit blooms and hypoxia associated with excessive phytoplankton growth (Short and Short 1984). Eelgrass itself is sometimes considered a nuisance, *e.g.*, when it interferes with boating or fishing, or washes ashore in windrows that impair bathing and aesthetic values.

Abundance of eelgrass has declined in many areas due to various factors including a widespread "wasting disease" in the 1930s, eutrophication, and physical disturbance (see review by Thayer *et al.* 1984). Techniques for re-establishing eelgrass have been developed, and several restoration efforts in U.S. estuaries have been successful (Fonseca *et al.* 1988). Although there is little information on historical distribution of eelgrass beds in Raritan Bay, clammers reported beds to be widespread, at least along the New Jersey shore of the bay (MacKenzie and Stehlik 1988), before the beds were wiped out by the 1930s wasting disease. To examine whether eelgrass would survive and grow under the Bay's present conditions, we conducted a small-scale transplanting of eelgrass from Barnegat Bay, N.J., to five sites in Raritan Bay in summer 1990. We made qualitative observations on variables such as turbidity, sediment type, and fouling of eelgrass blades at the sites, but did not attempt to quantify physical and chemical characteristics of each site; the experiment was designed to determine only whether the eelgrass survived and grew, rather than what factors were controlling the process. If the pilot transplanting succeeded, it would be repeated on a larger scale, with systematic observations of colonization and use of the grass by resource and other species. Since interest has been expressed in restoring eelgrass to Raritan Bay (J. Lockwood, NMFS, Endangered Species Branch, Portland, Ore., personal communication), we report here the failure of our pilot effort.

METHODS

Eelgrass shoots with attached roots were dug by hand from a bed at the northern end of Island Beach State Park. We used the methods of Fonseca *et al.* (1982) to assemble "planting units" and to anchor them in the sediment. Each unit consisted of approximately 15 individual shoots and roots, from which most sediment had been removed. Twist-ties were used to hold the shoots around L-shaped, 20 cm sections of coat hanger wire that later served to anchor the units in the sediment. The units were held overnight in tanks of flowing Raritan Bay water (salinity approximately 25 ppt) at Sandy Hook.

To plant the units, trowels or diver's knives were used to make holes in the sediment; the roots and about 12 cm of the wire were inserted in the holes, sediment was added to fill the holes, and the top of the L-shaped wire was also covered with sediment to anchor the unit. Sites chosen for planting were thought to be relatively sheltered from wave action and human activity. At each of four primary sites, Princes Bay, Great Kills, Spermaceti Cove and "Chapel Cove" (Figure 1), 100 to 120 units were planted about 65 cm apart in rectangular plots. [Two to three man-hours per site were required to plant these units; Fonseca *et al.* (1982) report that experienced workers can plant about 150 units/man-hour, and the rate is slightly higher if scuba divers are used.] At a fifth site, Plum Island, only about 15 units were planted. The planting at Plum Island was next to a small existing patch of eelgrass

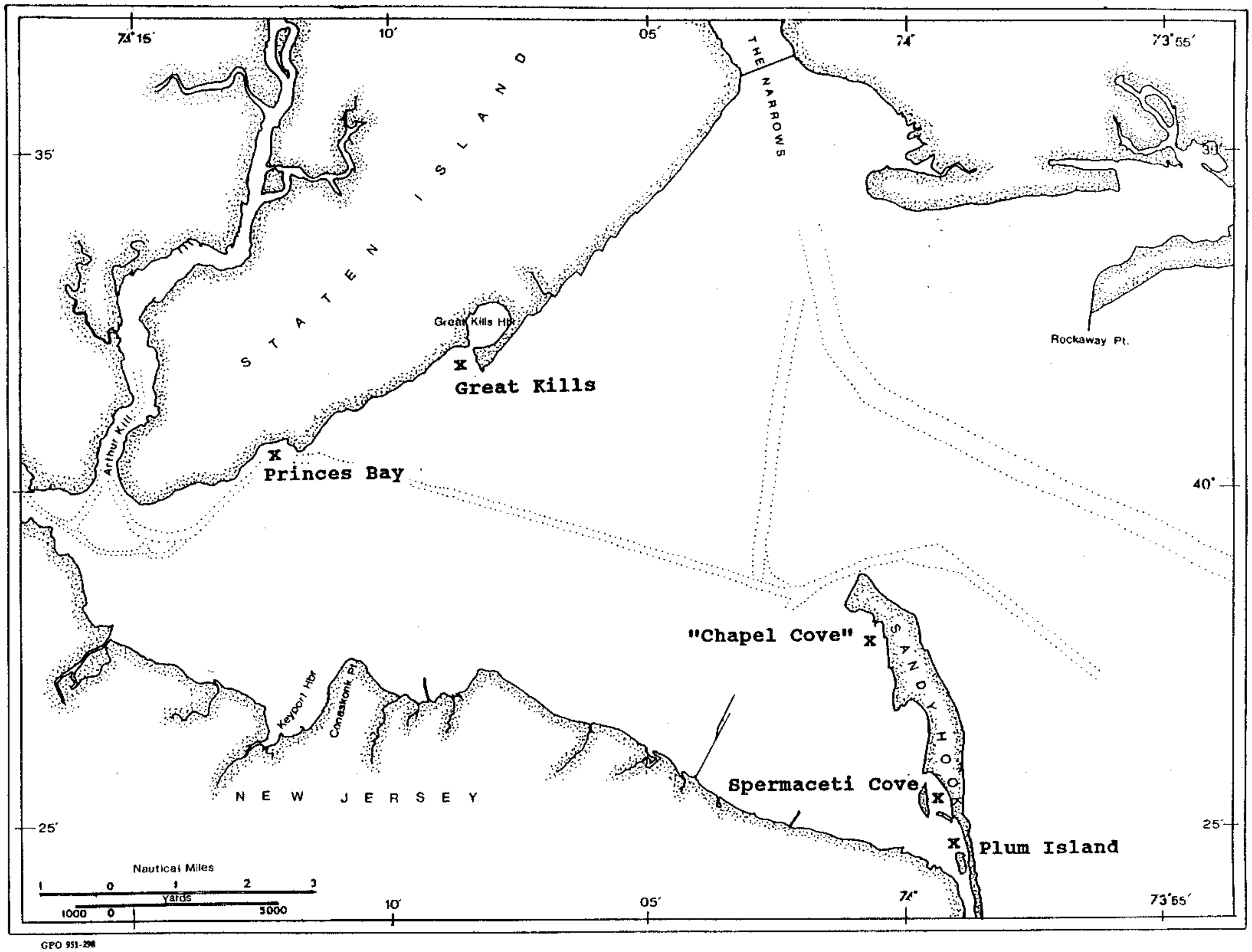

Figure 1. Eelgrass planting sites in Raritan Bay.

(which has since disappeared). All units were planted at low tide, in 30 to 60 cm water depths. The Princes Bay and Chapel Cove plots were established on 19 June, the others on 16 August. Plots were visited approximately biweekly to assess survival and growth of the eelgrass, and other relevant conditions at the sites.

RESULTS

Persistence of the eelgrass varied among sites, but no units were found at any site more than 9 months after planting. Turbidity at all sites, and occasional dense accumulation of sea lettuce, *Ulva lactuca*, made it impossible to accurately count or assess the condition of all planting units. The Staten Island sites (Princes Bay and Great Kills) were considered to offer relatively good potential for success because, due to the prevailing counterclockwise water circulation, that area receives water that is more oceanic and less turbid than most Raritan Bay water. Great Kills was the only primary site at which transplants were observed to persist through the winter; five units which appeared to be healthy and spreading were seen on March 21, 1991 (9 months after planting), but no units could be found after that date. Less fouling of eelgrass blades by epifauna was seen at Great Kills than at the other sites.

At Princes Bay, most planting units were still intact on September 20, 1990 (three months after planting). Several units appeared to have spread; others were the same size as or smaller than when planted. The majority of the blades remained green, but some had turned brown or black. Many blades were densely fouled by hydroids and tube-building amphipods, to the extent that ability to photosynthesize was probably greatly reduced. No evidence was found of eelgrass persisting into the next spring (the final observation was on May 7, 1991).

Transplants at Spermaceti Cove and Chapel Cove on the Bay's eastern shore did not fare well. Spermaceti Cove has relatively clear, sheltered waters, and initial results were promising, with units appearing intact and healthy on September 20, 1990, 34 days after planting. However, by that time the plants were already fouled, mostly by hydroids, almost as heavily as the Princes Bay units were after 3 months. At Chapel Cove, sediments were mostly gravel, as opposed to sand at the other sites. Chapel Cove also had the highest concentrations of sea lettuce, which often formed a layer up to 20 cm thick over the bottom and completely covered the eelgrass. The units did poorly here; by August 3, 1990, 46 days after planting, few intact units could be found and in many cases only the wire anchors remained. On September 21 only two small units were found. There was no evidence that any transplants at Spermaceti or Chapel coves persisted through the winter.

A few units from the smaller Plum Island planting were still present and appeared healthy on April 29, 1991 (8.5 months after planting), but none were found thereafter.

CONCLUSION

Based on these observations, we are not optimistic that re-introducing eelgrass to Raritan Bay is feasible in the near future. Factors such as turbidity, shading and smothering by sea lettuce, fouling of the blades by invertebrates and perhaps by epiphytic algae, and possibly wave action make Raritan Bay a far from optimal habitat for eelgrass. Nitrate enrichment of the water column may also reduce eelgrass survival even in clear water (Burkholder *et al.* 1992), and nitrate concentrations reported for Raritan Bay (Draxler *et al.* 1984) reach levels well above those found to cause harmful effects. Finally, as noted by Kenworthy and Haunert (1991) and Fonseca *et al.* (1992), even in favorable environments the loss of eelgrass is difficult to reverse. Without the sediment stabilization and water column filtration provided by established grass beds, sediments are more easily resuspended and turbidity tends to increase. It is possible that larger-scale transplants, perhaps protected by temporary barriers to reduce erosion and resuspension, would succeed, but our results offer little hope that eelgrass can be restored without significant changes in other environmental factors.

ACKNOWLEDGEMENTS

We thank Linda Arlen, John Sheehan, and Rachel Hochman for helping with the transplanting, and Jeff Lockwood, Andrew Draxler, Linda Stehlik, Robert Pikanowski, Beth Phelan, and Anne Studholme for commenting on the manuscript.