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Donald Schwab
Virginia Department of Game and Inland Fisheries

Fairfax H. Settle
Virginia Department of Game and Inland Fisheries

Otto Halstead
Virginia Department of Game and Inland Fisheries

Richard L. Ewell
Virginia Department of Game and Inland Fisheries

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Virginia Department of Game and Inland Fisheries
P.O. Box 847, Suffolk, Virginia 23434

Introduction

Submerged aquatic vegetation (SAV) is an important part of a healthy Back Bay ecosystem. SAV helps to stabilize sediments that enter the system and to deter shoreline erosion. The submerged macrophytes serve as filters, improving the quality of the water column by removing many pollutants and dissolved nutrients (Clark, *et al.*, 1973; and Stevenson, *et al.*, 1979). These aquatic plants provide important habitats for a variety of wildlife species, which use the grass beds for shelter, feeding and breeding areas. SAV is a major primary producer in the food chain associated within the aquatic and adjoining upland habitats. The added physical characteristics of the plants within the aquatic environment allow for a greater diversity of wildlife species, when compared to habitats not supporting SAV (Stevenson & Confer, 1978).

SAV has declined in many areas along the East Coast of the United States. Declines in waters of Virginia are well known: the Chesapeake Bay (Stevenson & Confer, 1978; Stevenson, et al., 1979; and Hurley, 1990), the Potomac River (Carter, et al., 1983), and Back Bay (Sincock, *et al.*, 1965; Settle & Coggin, 1976; and Schwab, 1984). In most waters SAV has fluctuated in density, species composition and frequency. Declines in SAV vary with the body of water and have been reported to be caused by disease, run-off, changes in salinity, turbidity, weather and various natural occurrences (Stevenson & Confer, 1978; Carter, *et al.*, 1983; Hurley, 1990; and Sincock, *et al.*, 1965).

Vegetation sampling transects on Back Bay were established in 1958 (Sincock, *et al.*, 1965) and surveys have been conducted annually except for five years. The survey originally included volumes, however in 1974 the volume measurement was deleted; since then only SAV species and their frequencies have been recorded. (Settle and Coggin, 1975).

Methods

Aquatic vegetation is sampled during the September to November period. SAV frequency and species composition are determined through collection of three two-square-foot bottom samples taken at 500 foot intervals along eight transect lines (Fig. 1). Modified oyster tongs are used to collect a total of 264 samples.

Trends

Prior to Sincock's (1965) data collection, little quantitative data were available. The natural closing of the Currituck Sound Inlet in 1830 changed Back Bay from a saltwater estuary to a brackish to freshwater ecosystem. Waterfield (1951), Chief of Survey Branch, Army Corps of Engineers, Norfolk District, reported that SAV in the years 1923-24 "noticeably began to disappear." In August of 1956 it was reported that SAV was "very scarce" in Back Bay and that in 1955 SAV was "95% more abundant" than in 1956 (Waterfield, 1956). Although there was considerable interest in the Back Bay ecosystem, no large scale surveys were undertaken until 1958.

In 1958 the U. S. Fish and Wildlife Service (then known as the Bureau of Sport Fisheries and Wildlife) and the states of Virginia and North Carolina began an extensive survey of the Back Bay/Currituck Sound ecosystems. The Survey was headed by John L. Sincock, then Chief, Section of Wetland Ecology of the Bureau, and included personnel from the Virginia Commission of Game and Inland Fisheries and the North Carolina Wildlife Resources Commission. The survey on vegetation, waterfowl, fish and environmental parameters from 1958 through 1964 resulted in four volumes of data, little of which has been published.

The focus of this paper is on SAV trends in Back Bay, VA and all the data for 1958 through 1964 have been taken from the Back Bay-Currituck Sound Data Report (Sincock, *et al.*, 1965). The data available after 1964 have been gathered from the Virginia Department of Game and Inland Fisheries (VDGIF) Annual Pittman- Robertson Reports. There were five years (1979, 1981-82 and 1985- 86) when the SAV transects were not surveyed.

The Sincock Data Report (1965) covered a seven year period when SAV frequency in 1958 was 51%, peaked at 81% in 1962 and dropped to 14% in 1964 (Fig. 2). The dominant SAV species

during five years of the survey period was southern naiad (*Najas guadalupensis*) (Sincock, *et al.*, 1965). In 1963, naiad was the second most common species and by 1964 had nearly disappeared from the transects.

The years 1965 and 1966 had the lowest frequencies (12%) recorded for the Bay prior to 1984 (Coggin, 1966; and Schwab, 1985). In 1965 the 36 inch diameter pipe and pump were installed to increase the salinity in Back Bay (Coggin, 1966). Eurasian milfoil (*Myriophyllum spicatum*) was noted in small trace amounts for the first time in 1966, and occurred on 12% of the survey points in 1967 (Coggin, 1968).

Milfoil was the predominate SAV species recorded on all eight transects from 1971 to 1978 and all frequencies were over 50% (Settle and Taylor, 1979). The SAV transect survey was not conducted in 1979 (Settle and Taylor, 1980). SAV frequency dropped from 72% in 1978 to 50% in 1980; milfoil was present on 44% of the points surveyed, and remained the most common SAV species encountered (Settle, 1981).

During the years 1981 and 1982, the SAV transects were not surveyed. The survey was conducted in 1983 and the frequency of aquatic vegetation had dropped to 14%, with milfoil the most frequently found species (Schwab, 1984). In 1984 the Bay was nearly void of SAV species with only 8% (7% milfoil) of the points having any vegetation present (Schwab, 1985). In Buck Island Bay, Major Cove and Horse Island Creek, areas not surveyed by the transects, good growths of milfoil, wildcelery (*Vallisneria americana*) and muskgrass (*Chara* spp.) were noted (Schwab, 1985). Again, the SAV survey was not conducted during 1985 and 1986. In 1986 an attempt to introduce hydrilla (*Hydrilla verticillata*) to Back Bay was undertaken in hopes of establishing some SAV in the system (Schwab, 1987). Hydrilla is an exotic species (as is milfoil) and first appeared in the United States in the 1960s (Hurley, 1990). Though hydrilla is considered a nuisance species by some due to its growth habit of forming surface mats, it can increase carrying capacity for both waterfowl and fish (Montalbano, *et al.*, 1979); Johnson and Montalbano, 1984; Esler, 1990; and Hurley, 1990).

In 1987 the survey was conducted during 8 of the 12 months in an attempt to determine if SAV frequencies fluctuated from month to month (Schwab, *et al.*, 1988). In July of 1987 the SAV frequency was 5%, the November frequency was 1%, and the June, 1988 survey had a coverage of 4%. The 1% reading in November was the lowest for the 12 month period. Milfoil was the predominate species present, with wildcelery and sago pondweed (*Potamogeton pectinatus*) present in only trace amounts (Schwab, *et al.*, 1988). During the 1988 survey period, the frequency of SAV increased over 1987 by 3%, however the 1989 and 1990 survey periods were 1% and 0% respectively (VDGIF unpub. data).

Summary

The SAV in Back Bay, VA has shown two periods of high frequency and two of decline during the years 1954-1990. The transect surveys have been conducted since 1958, with the exception of five years, using a standard method. From 1958 to 1963, a period of high frequencies of SAV, southern naiad and sago pondweed were the predominate species. The 1964-1966 period saw SAV frequencies drop to 12%. In 1966 milfoil was found in trace amounts and from 1967-1989 was the predominate species of SAV on Back Bay, with a peak frequency of 88% in 1973. SAV on Back Bay transects has declined to 0% in 1990, dropping from 50% in 1980.

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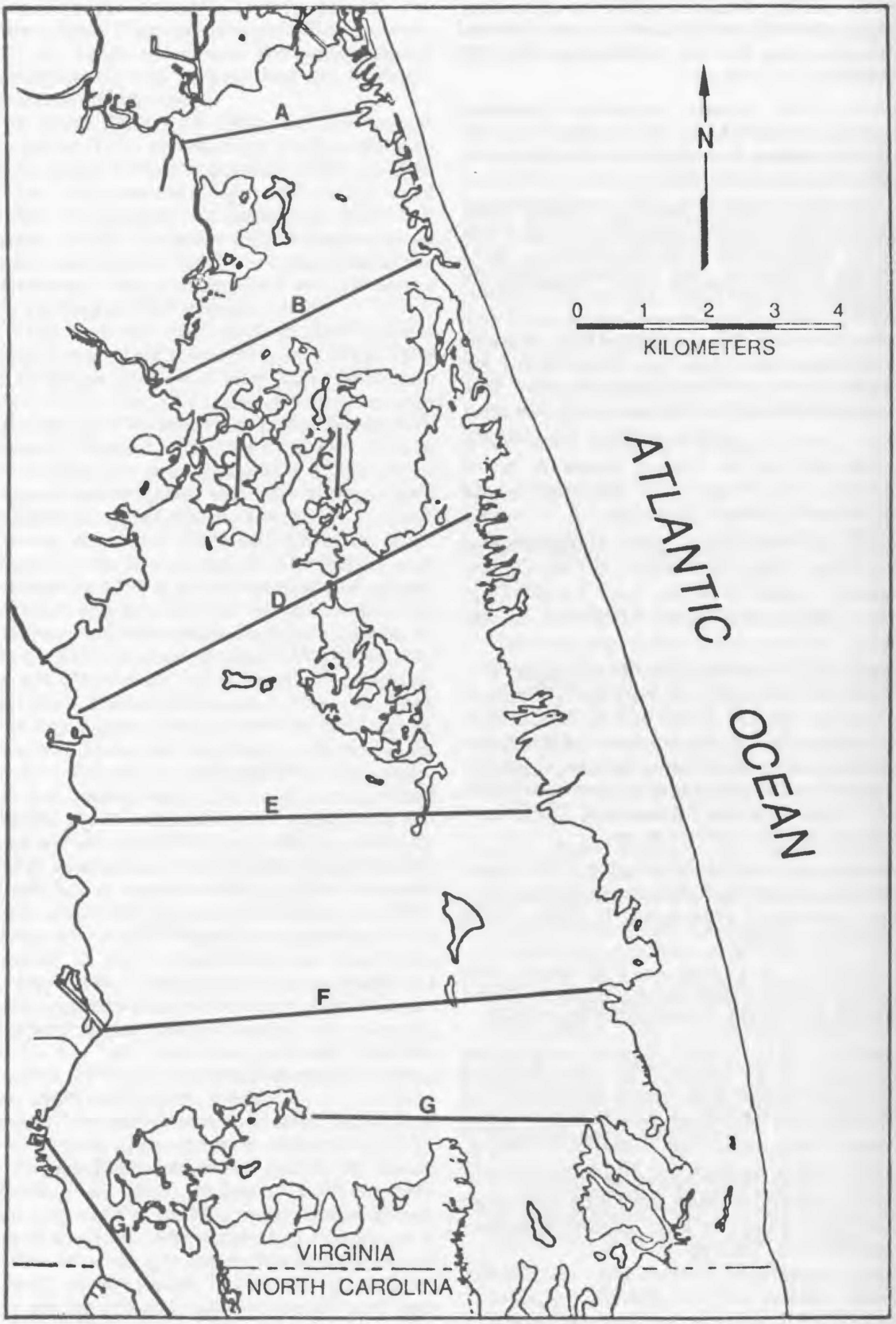

Figure 1. Submerged Aquatic Vegetation Transects, established 1958.

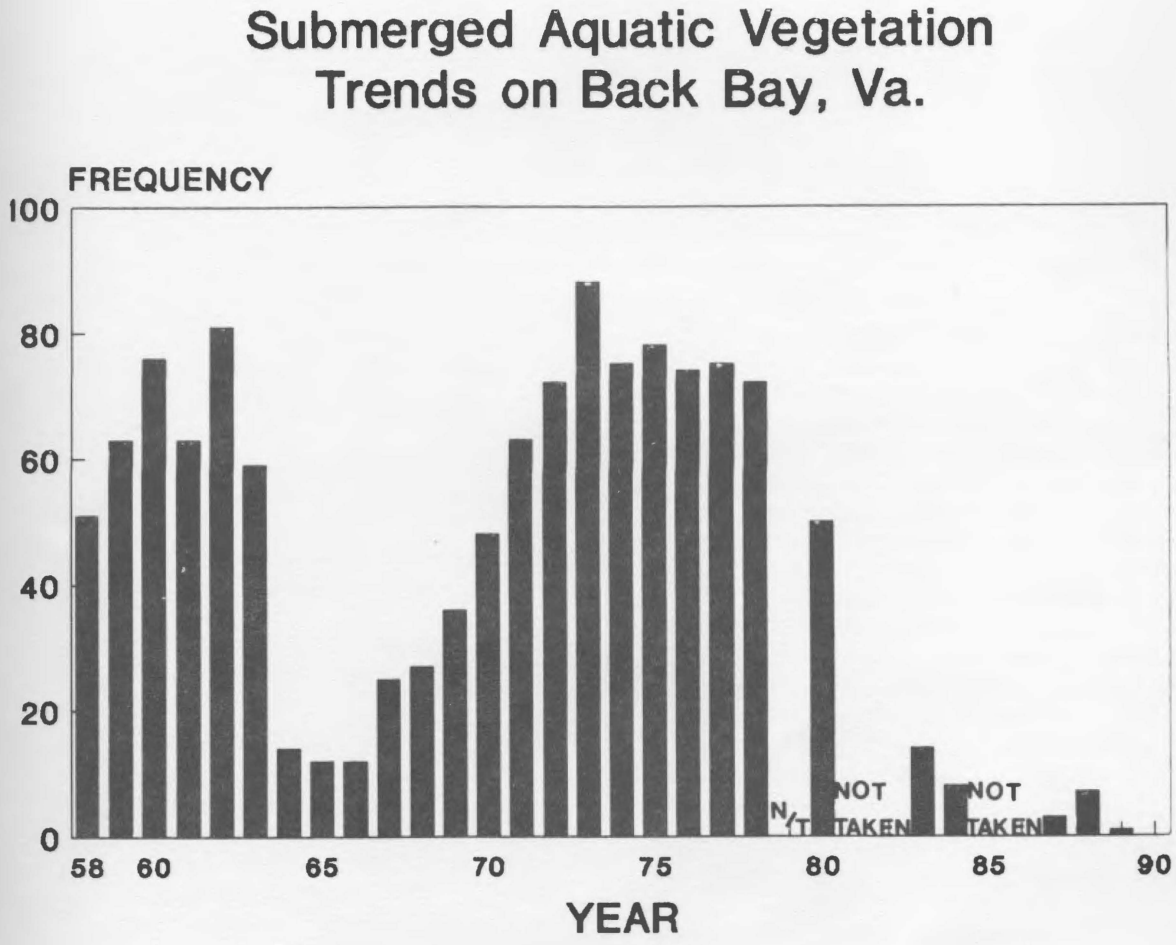

Figure 2. Frequency of Submerged Aquatic Vegetation on Back Bay, Va. 1958-1990.