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AQUATIC PLANT DIE-OFFS IN CHESAPEAKE BAY

Relationship to light penetration and or herbicide pollution

VOLUME I

JULY 1976

FIRST PROGRESS REPORT

(for June, 1976)

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VOLUME I

By

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INTRODUCTION

In the last decade a spectacular die-off of all species of submerged aquatic plants has occurred all over the Chesapeake. Now only small 'pockets' of these plants may be found in the bay. This is also a phenomena observed recently on other east coast estuaries. The suspected results include reduced forage for wintering waterfowl, increased shoreline erosion, and loss of habitat for commercial fisheries species.

The two most popular hypotheses to explain this die-off are increased turbidity due to erosion and phytoplankton blooms and/or increased herbicide pollution levels. This research project was designed to gather preliminary data to test whether either of these hypotheses is correct. A recent conference on No-Till agriculture (held in January 1976 at Hershey, Pennsylvania) pointed out that Maryland leads the nation in the use of agricultural herbicides, and that the levels of use are rising rapidly. Chemical and Engineering News, May 19, 1975, gave data on a national level for the use of herbicides on corn and soybeans, Maryland's principal crops. In 1974, 400 and 280 millions of dollars worth respectively of herbicides were applied in the U.S. to corn and soybean crops and this use rate is predicted to rise to 520 and 480 millions of dollars worth, respectively by 1980. Thus, it is apparent that studies of the relative effects of various herbicides in estuaries are urgently needed, if we are to determine which one(s) may be used without serious damage to aquatic environments

OBJECTIVES

General

To conduct a preliminary research study to test whether higher aquatic plant die-offs are the result of increased turbidity and/or of herbicide pollution from agriculture at the time of year when these factors should be most critical for the plants.

Specific

1. To measure the concentration distribution patterns of herbicides in the spring following agricultural herbicide applications, in two western shore subestuaries of Chesapeake Bay, one with a high and one with a low proportion of agriculture on its watershed.

2. To measure the concentration distribution patterns of herbicides in an area of shallows of the open bay, formerly noted for dense higher aquatic plant beds and in an eastern shore subestuary representative of agricultural watersheds in that region.

3. To measure suspended particulate concentrations and submerged higher aquatic plant distributions in these areas.

4. To determine whether a good correlation exists between higher aquatic plant distributions and turbidity or herbicide levels in the Chesapeake.

SAMPLING STATUS REPORT

Collection of samples at five stations (28, 28.4, 29, 30.2, and 31.5) in the Rhode River was carried on April 13/April 21 (for baseline data), on May 25, and on June 22. On June 10 samples were collected at six stations (91-96) on the Severn River. On June 16 and 17 samples were collected at eight stations (71-78) on the Choptank River. On June 18 samples were collected at four stations (81-84) near the Poplar Islands. Stations were always scattered evenly along the axis of each tidal river from near the upper extent of tidal action to the mouth. Samples taken on station included submerged aquatic plants, turbidity of surface waters, suspended particulates in surface waters, filtered surface water, and bottom sediments. Suspended particulate and bottom sediment samples are being analyzed for partical size distribution, mineralogy, and percent organics. Filtered water, suspended particulates and bottom sediments are being analyzed for the herbicides atrazine, alachlor, linuron, and simazine. Submerged higher aquatic plants were sorted by species, counted, dried, and weighed. In all cases phytoplankton chlorophylla levels were determined in surface waters along transects between stations.

METHODS

Submerged higher aquatic plants:

A common steel garden rake is used to collect plants by scrapping the surface of the bottom sediments in random paths in areas of 0.6 to 1.2 meters depth. Sampling stations are selected in areas of shallows relatively protected from wave action. A total area of bottom of from 10 to 100 square meters per station is sampled, depending upon plant abundance. Samples of plants from each station are sorted by species, counted, dried to constant weight at 60° C in an oven and weighed. On site visual observations are also recorded of presence or absence of plants.

Phytoplankton Chlorophylla concentrations:

Between stations the boat was operated at an even speed and surface waters were pumped continuously from a depth of 0.5m through a flow-thru door (110-880A) on a Turner model 111 flurometer. The flurometer had a F4T4-BL blue excitation lamp, a Corning 5-60 excitation filter, a Corning 2-64 emission filter and a red sensitive photomultiplier tube (R-136). The signal was recorded on a strip chart. A sample of known volume was taken at a marked time position on the chart, filtered through a Millipore HA filter, and the filter was dissolved in 90% acetone saturated with $MgCO_3$ and stored in the dark. The acetone extract was then analyzed for chlorophylla by the method of Loftus, M.E., and Carpenter, J.H.(J. Marine Research 29:319-338;1971). The average invivo fluorometer response was then determined by integration of the transect recording and the concentration of chlorophylla was determined by multiplying times the ug invitro chlorophylla a per invivo response unit.

Turbidity:

A Hach, model 2100A, turbidimeter was used to measure the turbidity of

samples in the field. It was calibrated, in Jackson units, with sealed standards before each measurement. Three samples of surface waters were analyzed at each station.

Suspended particulate characterization:

Surface water samples were filtered through prewashed and weighed Millipore HA filters. Weight gain was used to assay for total particulates. Mineral particulates were determined after firing organic matter present in the sample. Size fractions and mineralogy were determined as described by Carroll (Clay Minerals: A Guide to Their X-Ray Identification, Geol. Soc. Amer. Sp. Paper 126, 80pp.; 1970).

Bottom sediment characterization:

At each station 3 Pflueger cores were taken unless the bottom was too hard in which case 3 Ekman Dredge samples were taken. These samples were analyzed for percent organics, mineralogy and mineral particle size distribution. In the case of cores these parameters were measured as vertical profiles.

Herbicide sampling:

At each station 15l of surface waters are taken and 50g $CaCl_2$ are added. The sample is allowed to stand overnight and is then filtered through a Gilman, type A, glass fibre filter. The filter is then treated with anhydrous sodium sulfate and extracted with benzene and methylene dichloride. The filtrate is extracted with benzene and then with methylene dichloride. Sediment cores (3) were taken at each station with a Pflueger corer. In cases of hard bottom conditions, a set of three Ekman dredge samples were taken. These sediment samples were stored on ice until they could be segmented (cores). Subsamples of 10g weight were then mixed with 10g. anhydrous sodium sulfate

and extracted with benzene and methylene dichloride.

Herbicide analyses:

Organic solvent extracts of samples were concentrated in a Kuderna-Danish Evaporator in a water bath. The sample was then chromatographed on a column of alumina, activity grade V, prewashed with petroleum ether and topped with anhydrous sodium sulfate. Samples were eluted with hexane and then hexane/benzene (50:50 by volume) and were concentrated. Samples are then analyzed on a gas chromatograph equipped with an electron capture detector.

RESULTS

This report is an initial progress statement. Since laboratory analyses have not progressed very far and data processing is still under way no final conclusions or detailed results can be reported at this time. As noted in the following milestone chart field sampling is on schedule and nearly complete. Collections are still scheduled in the Rhode River for July and August. Laboratory characterization of suspended particulate and bottom sediments and herbicide analyses of all types are just beginning. Turbidity and chlorophyll data is ready for processing on the completed cruises. Aquatic plant population data is ready for processing for the completed cruises. No significant equipment or field problems have occurred.

Some preliminary observations can be reported. Of the stations sampled, submerged higher aquatic plants were most abundant in the Rhode River, where they were common at all stations. Plants appeared to be totally absent on the Choptank River above Cambridge and at some stations at the Poplar Islands and on the Severn River. Where plants occurred, many were apparently healthy and had flowered. Most of the plants collected were of the following species: Rupia maritima, Zannichellia pallustris, Potamogeton perfoliatus, and Potamogeton pectinatus. Turbidities were lowest on the Poplar Islands, the Severn River and the lower Choptank River and highest on the upper Choptank River. Phytoplankton chlorophylla values were highest on the Severn, especially in Round Bay where higher aquatic plants were also most abundant on the Severn River. Chlorophyll levels were also high in the Rhode River and low in the Choptank River and near the Poplar Islands.

MILESTONE CHART

Activity	Task	Status
Intensive field sampling	1,2,3	near completion
Laboratory analysis of samples	1,2,3	initiated
Processing of field and laboratory data	4	initiated
Analysis of all data	4	not yet initiated

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

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16. ABSTRACT

Samples and data have been collected to begin the determination of whether the distribution and species composition of submerged higher aquatic plants in Chesapeake Bay are related to herbicide concentrations and/or the turbidity and phytoplankton concentrations. The Rhode, Severn and Choptank Rivers and the waters near the Poplar Islands were sampled.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Aquatic Plants Turbidity Phytoplankton Herbicides	Chesapeake Bay Program	Chesapeake Bay

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Figure 2-2. Technical Report Data Page
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