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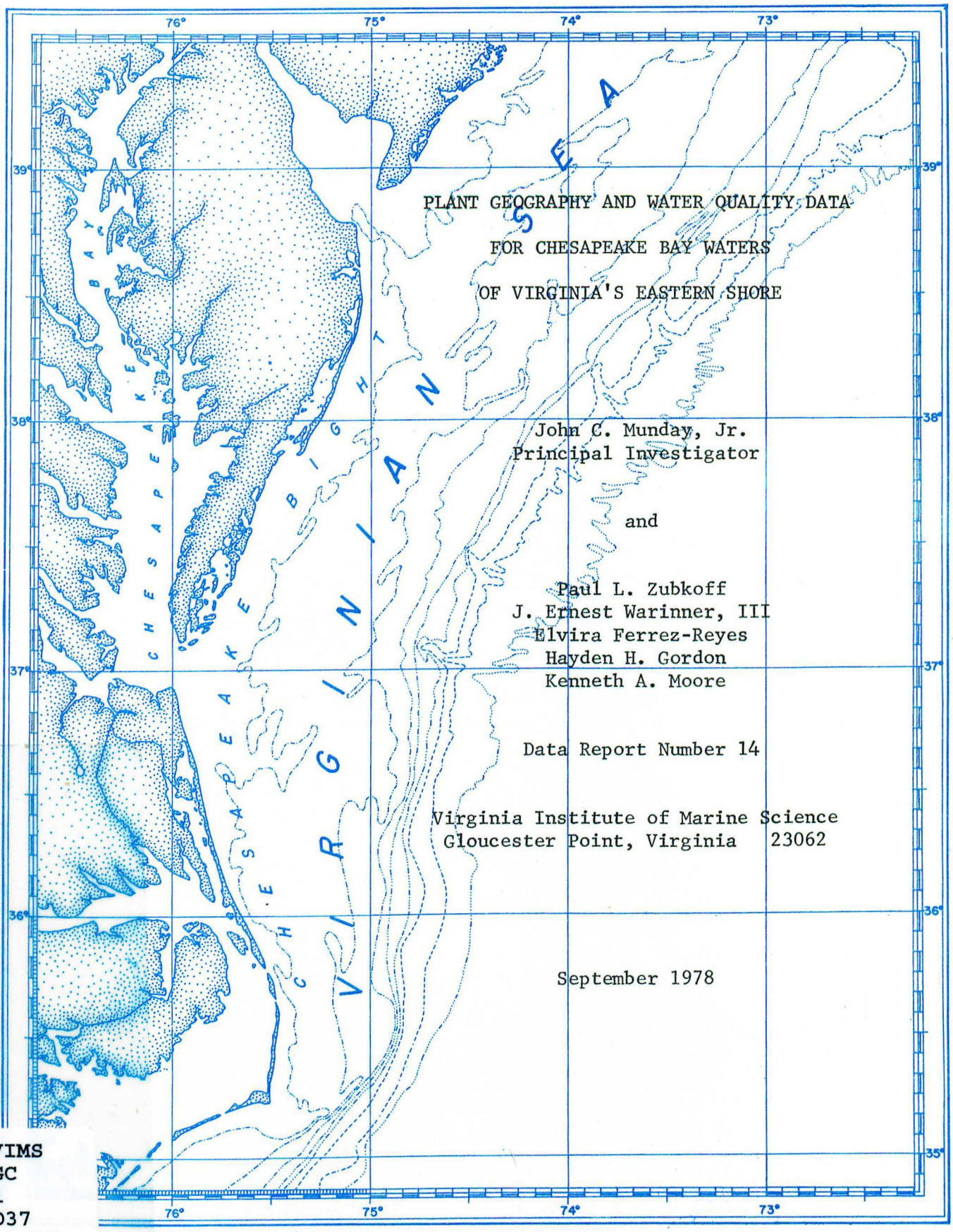

PLANT GEOGRAPHY AND WATER QUALITY DATA FOR CHESAPEAKE BAY WATERS OF VIRGINIA'S EASTERN SHORE

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ABSTRACT

Plant geography and water quality data were collected in shallow water near Cape Charles and Occohannock Creek, Virginia on two occasions. Data from April, 1978 included hydrography, distribution and abundance of submerged aquatic vegetation, phytoplankton census, and water clarity data. Data from May, 1978 included hydrography, phytoplankton census, water clarity, and primary productivity data. The May data collection was coincident with an overflight of the NASA JSC C-130 aircraft (6600 m) acquiring color infrared photography and multispectral scanner data; cell concentrations reached 10^5/ml, chlorophyll _a_ 72 µg/l, and suspended sediment 94 mg/l.

ACKNOWLEDGEMENTS

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INTRODUCTION

This is the first report of studies in nearshore waters of Virginia's Eastern Shore on plant geography and water quality. The studies began as part of the surface data collection effort associated with remote sensing and mapping of Eastern Shore land-use. Mapping is being performed by Mr. Ben Drake of Old Dominion University, Norfolk, Virginia, and Dr. John McFall and Mr. Warren Hypes of NASA Langley Research Center, Hampton.

The operational plan was for the acquisition of color infrared aerial photography (film type 2443 in 9-inch format Zeiss camera, f = 6 in.) and multispectral scanner data from 6,200 m altitude in three flight lines over the Eastern Shore (Northampton and Accomack Counties, Virginia). The aerial data were acquired on 3 May 1978 using the C-130 aircraft of the NASA Johnson Space Center (Houston, Texas). For flight lines see Figure 1.

Surface data are reported here for the areas of Cape Charles and Occohannock Creek (both in Northampton County) for two field efforts. The first one, 13 April 1978, produced data on hydrography, the distribution and abundance of submerged aquatic vegetation (SAV), some census data on phytoplankton, and data on several measures of water clarity. The second study on 3 May 1978 produced phytoplankton census and primary productivity data, hydrographic data, and water clarity data.

Further work in this series of studies will include additional data collection on the seasonal changes in the phytoplankton populations of the Occohannock Creek.

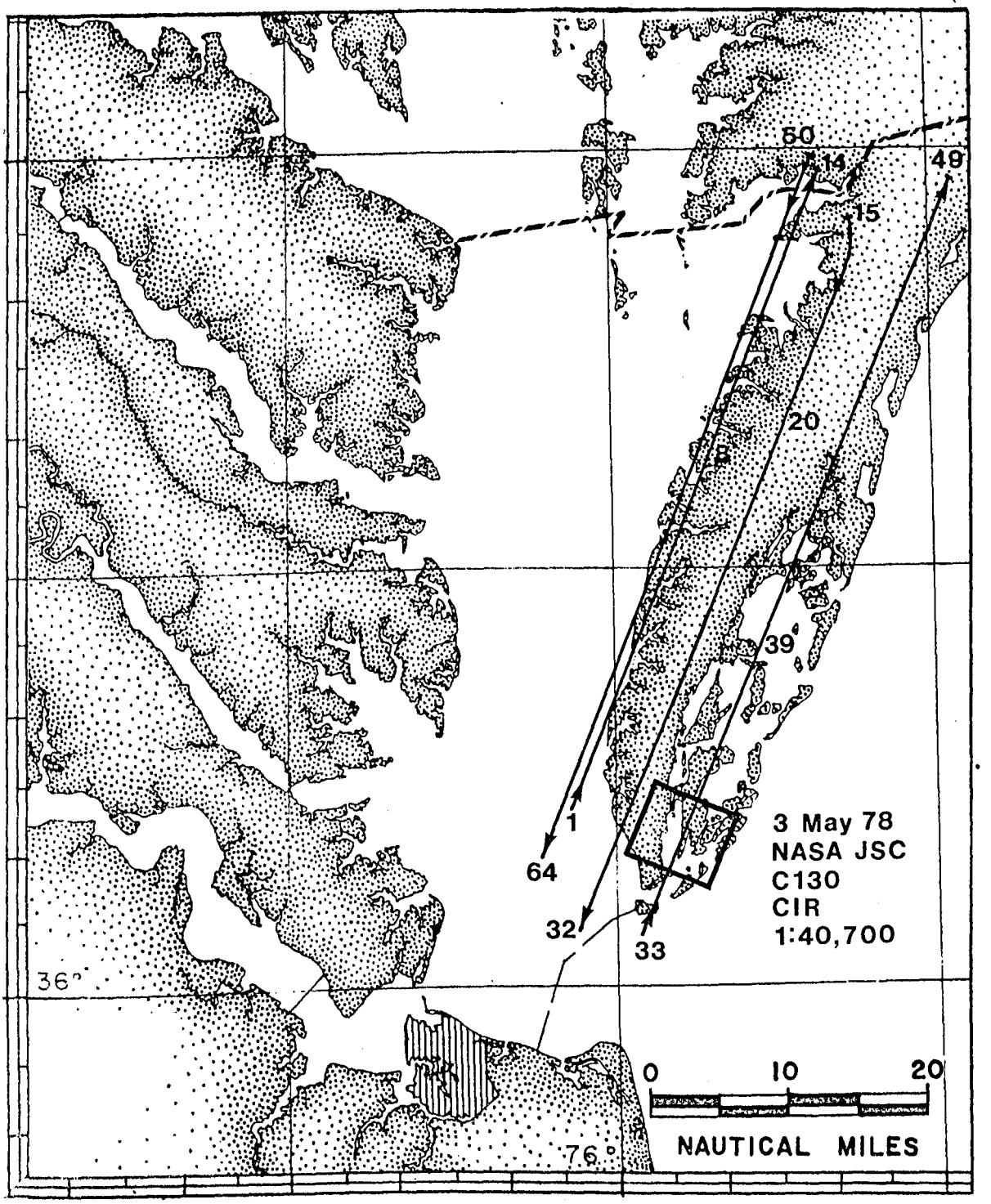


FIGURE 1. Flight lines, NASA JSC C-130, Eastern Shore of Virginia, 3 May 1978. Color infrared film, altitude 6200 m, scale 1:40,700.

METHODS

Field

Two boats and crews were employed in each study, one at Cape Charles and the other in Occohannock Creek:

	April 13th	May 3rd
Cape Charles	K. Moore Alston	Henry Munday
Occohannock Creek	Gordon Warriner J. Moore	Zubkoff Ferrez-Reyes J. Moore Warriner

Stations were established at navigation markers as shown in Figures 2 through 5.

Sampling was pre-arranged to coincide with intended aircraft photographic runs. Bad weather forced cancellation of the run on 13 April. On 3 May, the timing of the aircraft pass was monitored at Cape Charles using an aircraft radio receiver, to ensure that collection of surface data was within 10 minutes of the overpass; state-controlled dual-frequency transceivers were used for boat-to-boat communication.

Underwater downwelling diffuse irradiance values were measured at 50 cm depth intervals with a GM Manufacturing and Instrument Corporation (Long Island, New York) Gemware Submarine Photometer Model 268 WA 310 fitted with Weston selenium photo cells and cosine diffusers but lacking viscor photovisual filters (with the result that values reported here are larger than

FIGURE 2. Sampling stations, Cape Charles, 13 April 1978. Stations K1 through K6 (filled circles) correspond to stations listed in Table 1. Stations K7 (Savage Neck) and K8 (Wilkes Beach) (both off map) were at UTM coordinates (4,130,750 mN; 409,750 mE) and (4,135,123 mN; 412,000 mE). Open circles identify navigation markers.

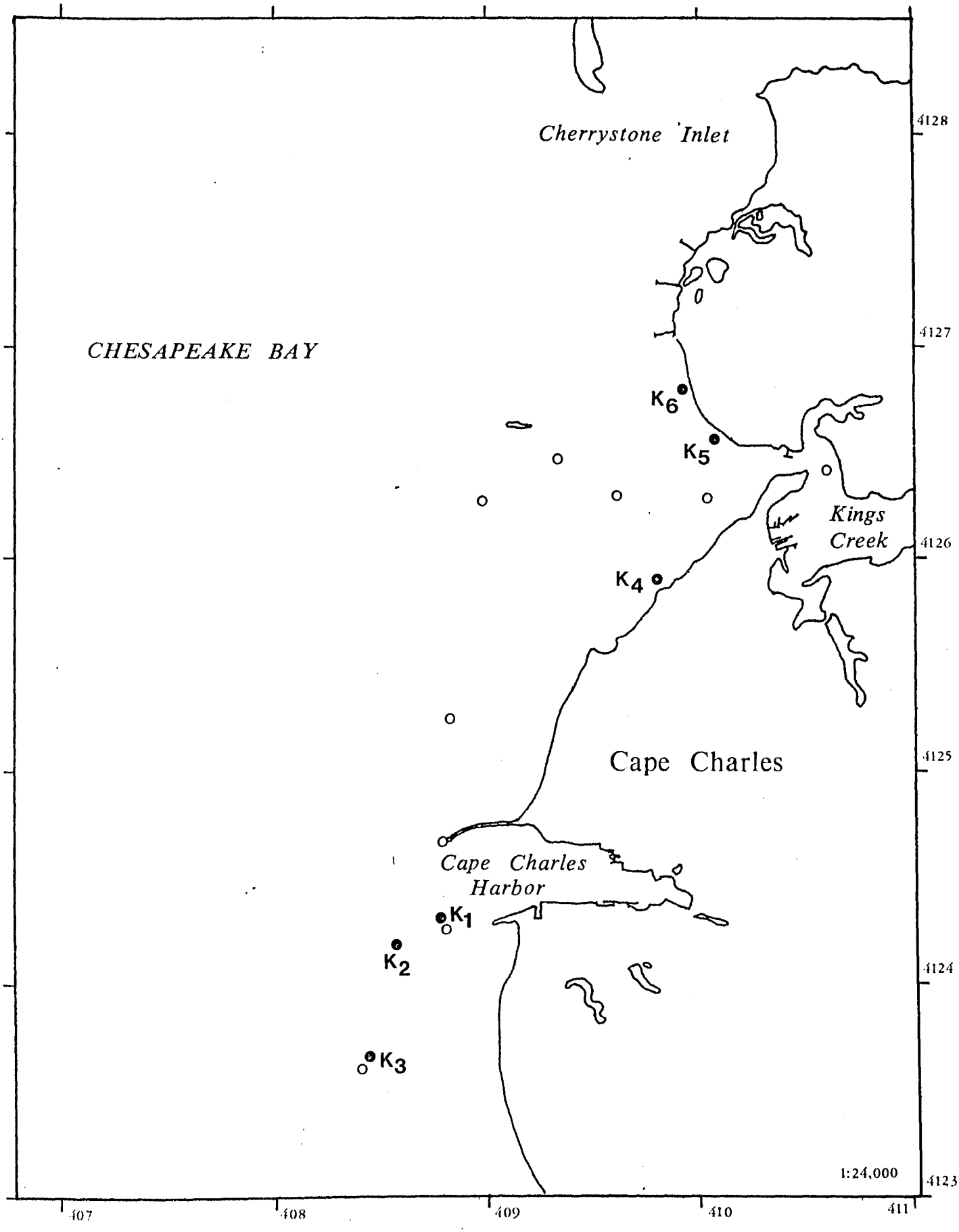
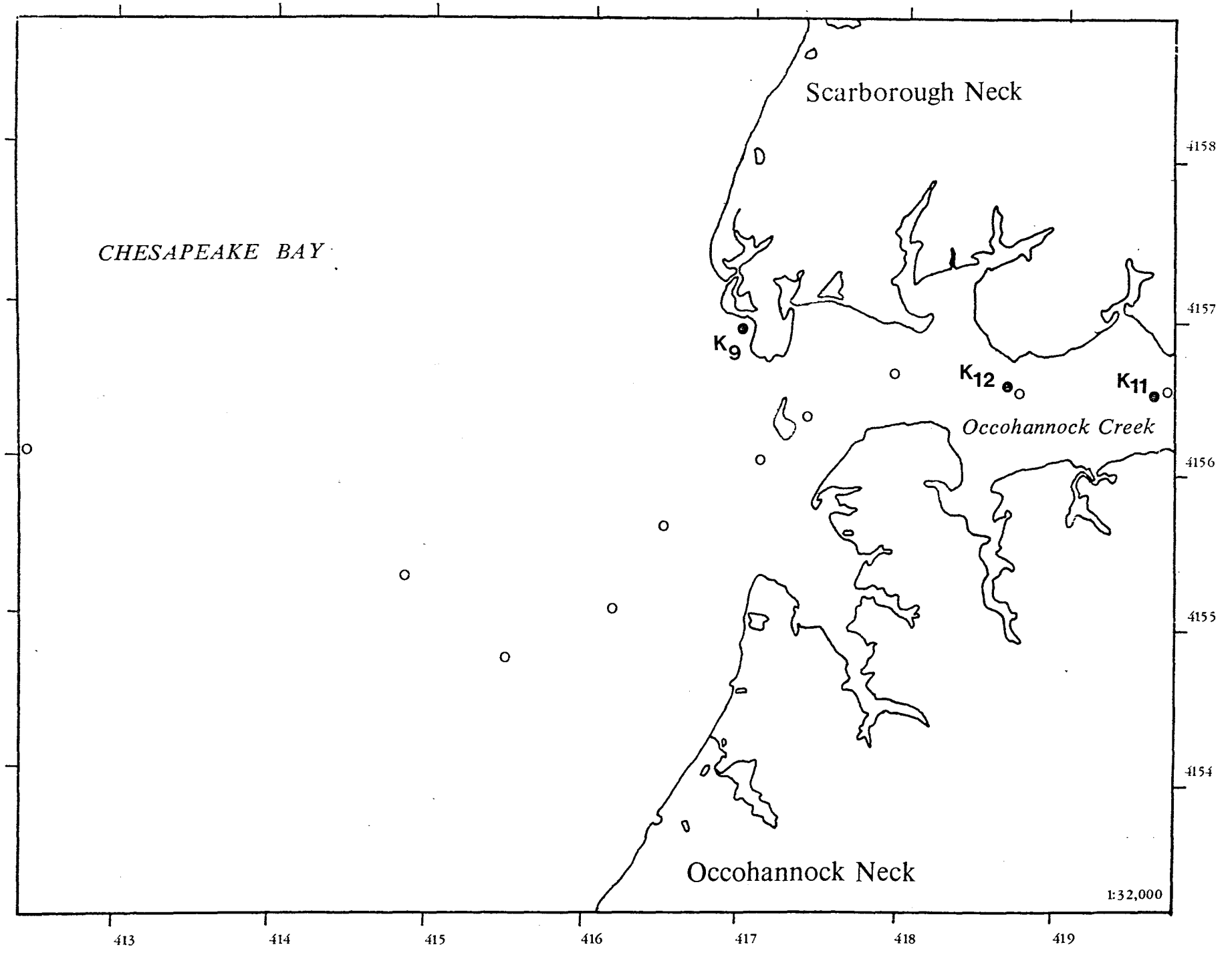

Cherrystone Inlet
CHESAPEAKE BAY
K6
K5
Kings Creek
K4
Cape Charles
Cape Charles Harbor
K1
K2
K3
1:24,000
4128
4127
4126
4125
4124
4123
407
408
409
410
411

FIGURE 3. Sampling stations, Occohannock Creek, 13 April 1978. Stations K9, K11 and K12 (filled circles) correspond to those in Table 1. Open circles identify navigation markers.


Scarborough Neck
CHESAPEAKE BAY
K9
K12
K11
Occohannock Creek
Occohannock Neck
1:32,000
4158
4157
4156
4155
4154
413
414
415
416
417
418
419

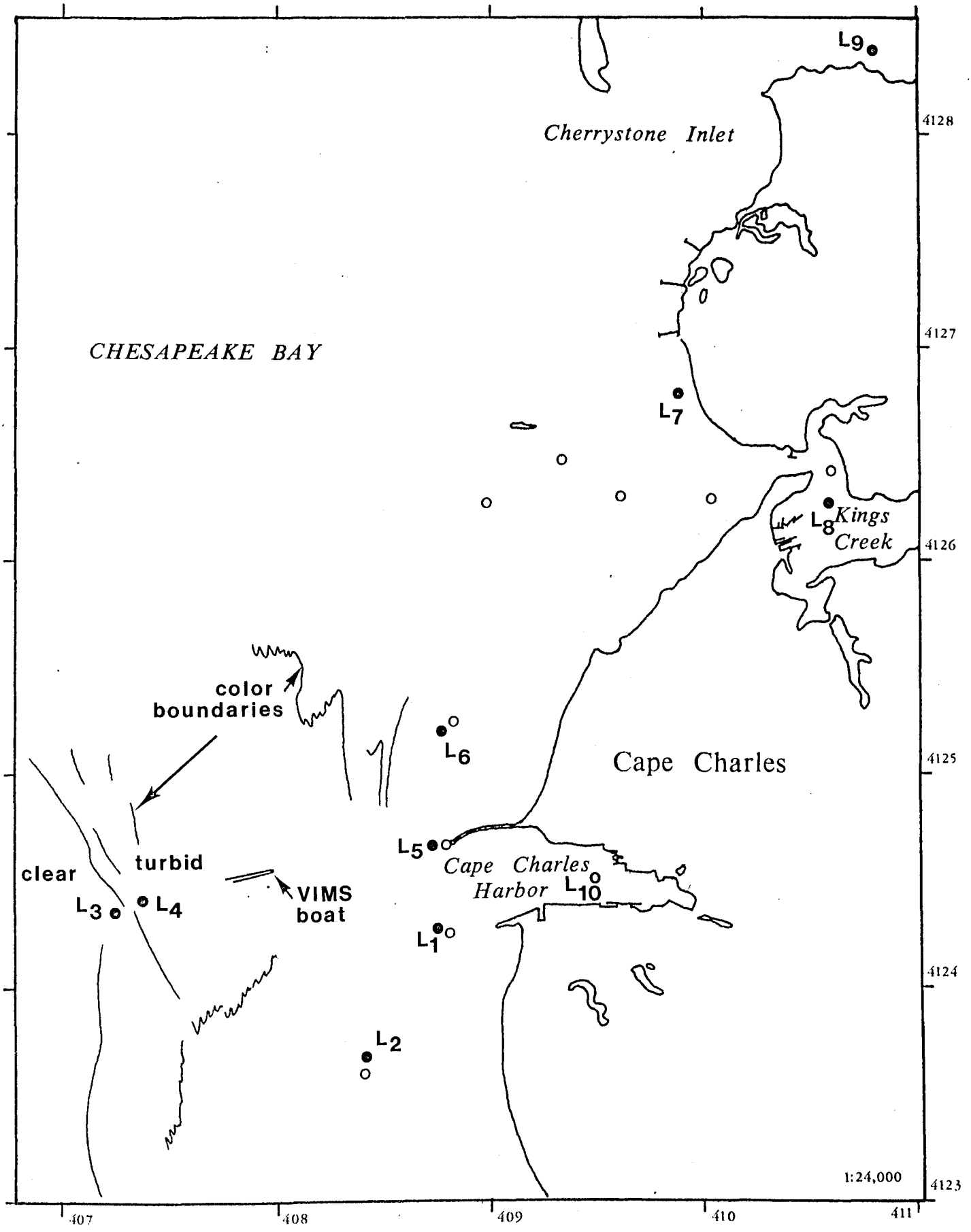
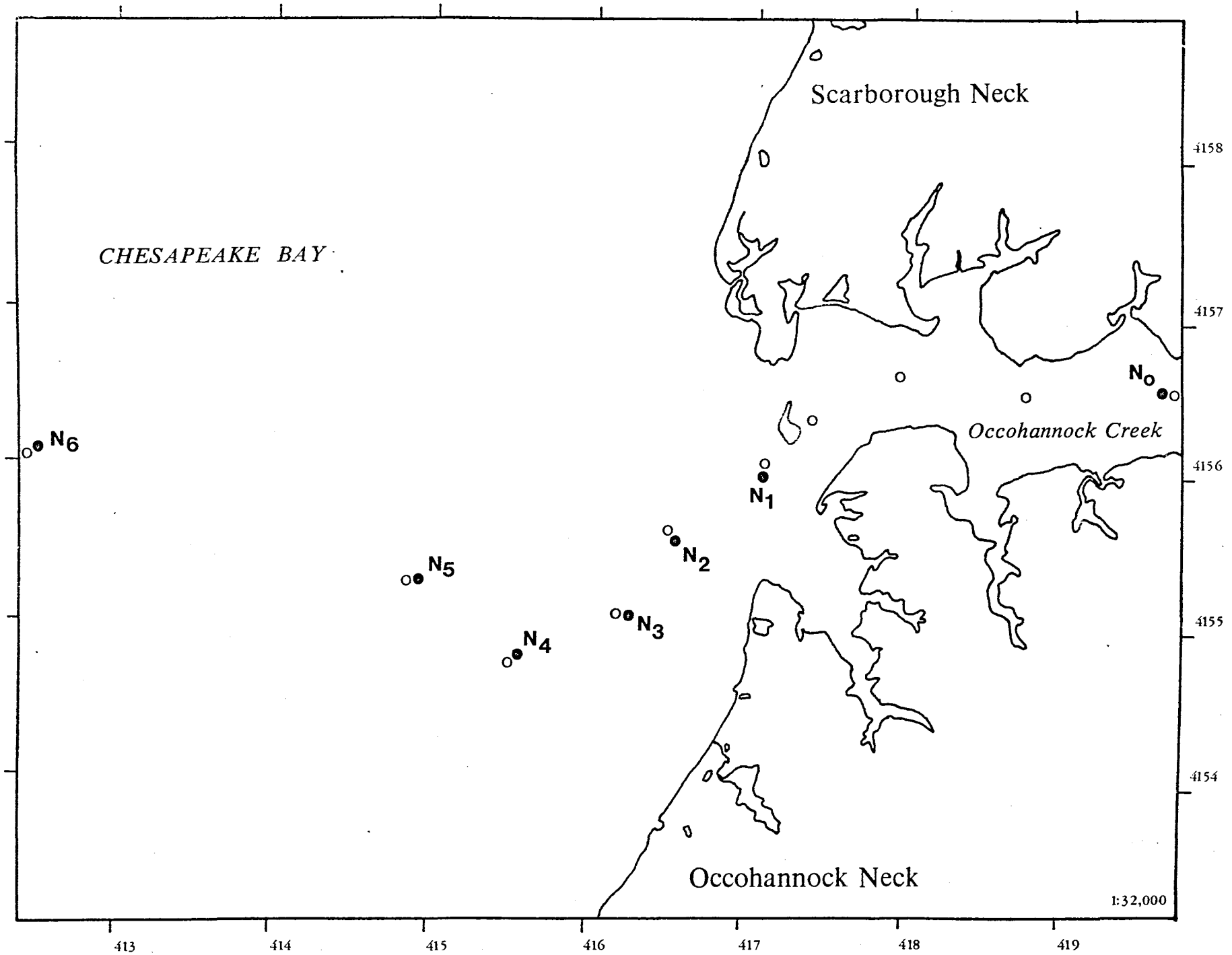

L9
Cherrystone Inlet
4128
CHESAPEAKE BAY
4127
L7
L8
Kings
Creek
4126
color
boundaries
L6
Cape Charles
4125
L5
clear
turbid
Cape Charles
Harbor
L10
VIMS
boat
L3
L4
L1
4124
L2
1:24,000
4123
407
408
409
410
411

FIGURE 5. Sampling stations, Occohannock Creek, 3 May 1978. Stations N0 through N6 (filled circles) correspond to those in Table 5. "N1" was at the same location as N1 but 2.5 hours later.


Scarborough Neck
CHESAPEAKE BAY
Occohannock Creek
N0
N1
N2
N3
N4
N5
N6
Occohannock Neck
1:32,000
4158
4157
4156
4155
4154
413
414
415
416
417
418
419

Chesapeake Bay values reported by Ofelt (1976) whose photometer was filtered). Irradiance values were normalized by the subsurface value to produce light transmission data. Beam transmission data were measured at 50 cm depth intervals with a Hydro Products (San Diego, California) Model 612A transmissometer equipped with a blue-green filter.

Visual observations were made of surface features including tidal current, sea state, water color boundaries, and atmospheric conditions. Wind direction was estimated, and wind speed was measured with a Dwyer Instruments (Michigan City, Indiana) hand-held vacuum-scale anemometer. Some 35 mm Ektachrome photographs were taken on the surface at Cape Charles on 13 May, and the VIMS Beaver aircraft acquired 70 mm Ektachrome nadir photographs from 1800 m. The aerial images include dye buoy traces which reveal water currents.

Surface water was grab-sampled for temperature measurement and for laboratory analysis. Samples from depth were collected with Frautschy bottles, transferred to Wirl-pak bags or to opaque 1-litre bottles, and stored in a dark ice-cooler. Samples for phytoplankton census were preserved with Lugol's Iodine. SAV grab samples were obtained for laboratory identification and analysis. Percent cover values were estimated visually in the field. Secchi disk depth values were obtained from an average of downward and upward readings. Water temperatures were measured with mercury stem thermometers immersed in bucket samples for 30 seconds.

Low tide at Cape Charles on 3 May was at 1220 EST. At Occohannock Creek low tide was at 1420 EST.

Laboratory

Plant vigor, leaf length and leaf abundance were analyzed in the laboratory. Salinity was measured with a Beckman Instruments (Fullerton, California) RS-7B conductivity meter. Temperature and salinity data were used to derive water density, reported as

$$\sigma_{s,t,p} = (\rho_{s,t,p} - 1) \times 1000.$$

Chlorophyll *a* and phaeophytin concentrations were measured using a Turner Model 111 fluorometer equipped with a photomultiplier (Strickland and Parsons, 1972). Productivity ($\mu g\ C\ l^{-1}\ h^{-1}$) was measured *in situ* at 50 cm depth using ^{14}C-$NaHCO_3$ (Biological Methods Panel, 1969); counting was by liquid scintillation spectrometry (Pugh, 1973). Alkalinity was determined by titration with H_2SO_4 in the laboratory (Strickland and Parsons, 1972). Suspended sediment was measured gravimetrically after filtration with Millipore® membrane filters (0.45 μm) (Nichols, 1971). Silicon concentrations were measured spectrophotometrically using metol-molybdate reagent (Strickland and Parsons, 1972).

Phytoplankton were preserved with Lugol's iodine and identified and enumerated with an inverted microscope according to the method of Utermöhl (1958).

RESULTS

Study on 13 April 1978

Although the NASA C-130 aircraft flight was canceled because of poor weather, the deployed boat crews proceeded with data collection. The data are summarized in Tables 1 and 2.

In the Cape Charles area, the salinity decreased in the more northern stations (16.5 to 13.8 °/oo) while the surface water temperature increased (11.5 to 17.0 °C). Secchi disk depths in the Cape Charles Channel increased from 1.6 to 2.2 m with distance offshore. The coverage of Zostera throughout the stations was generally patchy or clumped in distribution with percent coverage ranging from sparse to 50-75%. Average length of the Zostera leaves ranged from 10 to 22 cm, while the number of leaves per plant averaged 4 to 5. All collected samples of Zostera appeared to be healthy with well developed root and rhizome systems.

Detailed data by station are found in Table 1. Table 2 contains the phytoplankton census. The phytoplankton were dominated (numerically) by diatoms (centric and pennate diatoms in approximately equal numbers with the microflagellates).

Figure 6 shows light transmission versus depth at Buoy "15" in Occohannock Creek (Station K11). The diffuse attenuation coefficient k_e was 0.54.

Table 1. Water Sampling Data, Eastern Shore of Virginia, 13 April 1978.

Station	Time EST	Measurement Depth m	Secchi Depth m	α-Meter °/o	Photometer °/o	Temperature °C	Salinity °/oo	σ_t	Chlorophyll a μg l^{-1}	Vegetation (Zostera)
K1. Buoy "8", Cape Charles	0830	-	1.6	-	-	12.0	-	-	11.30	-
K2. Buoy "7", C.C.	0835	-	2.1	-	-	12.0	16.5	12.33	8.86	-
K3. Buoy "5", C.C.	0841	-	2.2	-	-	11.5	16.8	12.40	8.40	-
K4. Beach, C.C.	0900	0.8	-	-	-	12.5	-	-	-	Scattered small patches
K5. King's Creek - Mill Point	0910	0.5	-	-	-	14.0	-	-	-	50-75% coverage; length 10 cm; 4 leaves/plant; good root system
K6. King's Creek - Mill Point	0914	0.5	-	-	-	14.0	-	-	-	50-75% coverage; length 16 cm; 5 leaves/plant; good root system
K7. Savage Neck	0935	1.1	-	-	-	13.5	-	-	-	Clumped; 10-20%; average length 14 cm; 4 leaves/plant; good root system
K8. Wilkes Beach	1000	1.3	-	-	-	13.0	13.8	-	-	Clumped; along edge of channel only; length 22 cm; 5 leaves/plant; good root system
K9. Occohannock Creek, Powells Bluff	0930-1030	0.8	-	-	-	17.0	-	-	-	Sand; extremely patchy; length 18 cm; 4 leaves/plant; good root system
K10. Buoy "16", Occohannock Creek	0846	0.5	-	50	40	-	-	-	-	-
K11. Buoy "15", O.C.	0855	0.5-3	-	60-58	32	-	-	-	-	-
K12. Buoy "13", O.C.	0908	0.5	1.2	62	39	16.5	-	-	-	-

Table 2. Phytoplankton in surface waters of Cape Charles Channel, Eastern Shore of Virginia, 13 April 1978.

	Station		
	K1	K2	K3
	Organisms/ml		
1. Diatoms			
A. Centric			
Cerataulina pelagica	3930	3516	1784
Thalassiosira pseudonana	4447	3413	4214
Thalassiosira gravida	-	310	-
Chaetoceros affinis	-	620	517
Chaetoceros sp.	-	207	310
Rhizosolenia fragillissima	1344	1861	543
Skeletonema costatum	620	-	1241
Melosira sulcata	-	517	-
Sub-total	6411	6928	6825
B. Pennate			
Cylindrotheca closterium	-	-	103
Nitzschia longissima	52	-	26
Asterionella japonica	905	595	465
Thalassionema nitzschioides	207	129	103
Diatom pennata (1)	-	-	26
Diatom pennata (2)	207	-	-
Sub-total	1371	724	723
Total Diatoms	7782	7652	7548
2. Dinoflagellates			
Peridinium subinerme	52	103	-
Peridinium sp.	-	28	-
Katodinium sp.	-	103	-
Total Dinoflagellates	52	234	-
3. Microflagellates	7135	2275	4447
4. Cryptomonads	1034	1758	414
5. Cyanophytes			
Gomphosphaeria sp.	1655	-	4136
6. Others			
Silicoflagellates			
Ebrium sp.	-	103	-
Euglenophytes			
Euglena sp.	78	207	-
TOTAL PHYTOPLANKTON, Organisms/ml	17736	12229	16545

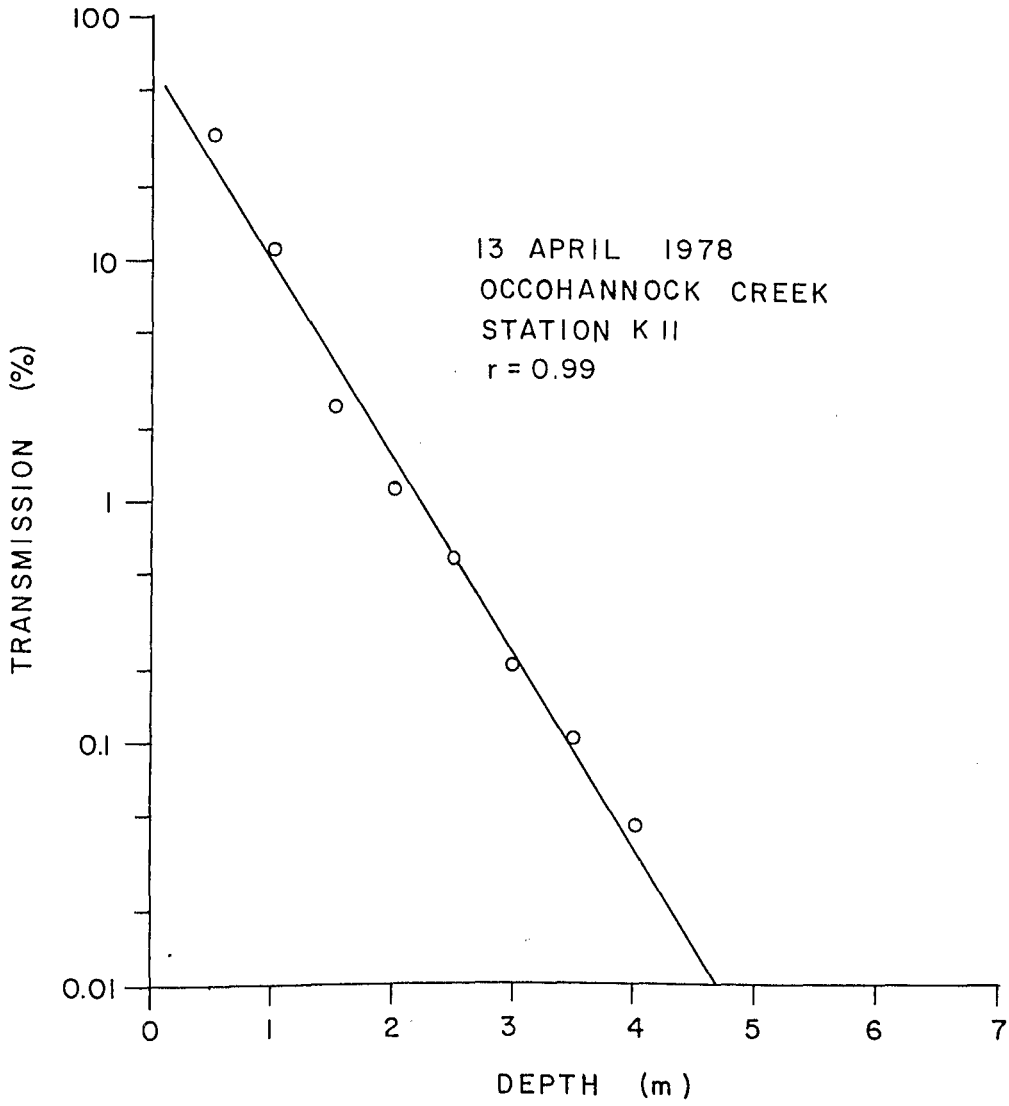


FIGURE 6. Light transmission versus depth, Occohannock Creek, Station K11, 13 April 1978. Attenuation follows an exponential decay to $r = 0.99$ ($p < 0.001$).

Study on 3 May 1978

The NASA aircraft acquired 9-inch photography and multispectral scanner data between 1515 and 1620 EST. The photography is indexed as Mission 379, Site 0632-3-174, Roll 9, film type 2443, Zeiss camera. NASA provided VIMS a duplicate of frames 001 to 064 (80 feet) which is indexed in the VIMS Remote Sensing Center. The VIMS Beaver aircraft acquired several frames of 70 mm photography at 1445. Two boats acquired surface data between 1430 and 1650; the bulk of the data was acquired within 15 minutes of the NASA aircraft overpass (first transect) at 1517 (see Table 3 for list of data acquired). The southern boat is imaged on frame 2 (see Figure 4) and the northern boat (at Station N5) in frame 6 of the NASA photography.

The Cape Charles data are presented in Table 4. Of the 10 surface samples obtained, 3 samples were examined qualitatively for phytoplankton. Although the samples had undergone deterioration because of a refrigeration malfunction in the laboratory, all 3 samples were numerically dominated by microflagellates. The centric diatoms, Cerataulina pelagica and Thalassiosira pseudonana, were also present in these 3 samples.

The Occohannock Creek data are presented in Tables 5, 6, and 7. The hydrographic data (σ_t) acquired through the water columns (Table 5) indicate significant stabilization. The percentage of light reaching the 1-metre depth increased about two-fold from 20.5% at Station N5 to 37.8% further offshore at N6. The suspended sediment and phytopigment loads at Station N6 (offshore) were less than those at Station N5. The high chlorophyll a/phaeophytin ratios for the upstream Stations N0 and N1 indicate very viable phytoplankton communities in the surface waters; productivity

Table 3. Data Acquisition in Support of Aerial Overflight of Eastern Shore, Virginia, on 3 May 1978.

Occohannock Creek:

Vertical profile sampling (through the water column) at 3 stations at 1 meter intervals from surface to bottom:

- water temperature
- water salinity
- chlorophyll a concentration
- suspended solids concentration
- phytoplankton composition and concentration
- downwelling light intensity

Surface sampling at 5 stations coincident with overpass (± 10 minutes):

- secchi disk depth
- water temperature
- water salinity
- chlorophyll a concentration
- phytoplankton composition and concentration
- downwelling light intensity

Cape Charles and Cherrystone Inlet:

Surface sampling at 10 stations (5 of them within 10 minutes of the overpass):

- secchi disk depth
- water temperature
- chlorophyll a concentration
- suspended solids concentration
- phytoplankton composition and concentration
- water salinity
- light attenuation coefficient at 0.5, 1.0, and 1.5 metres

General:

- wind direction and speed
- tide level
- tidal current direction
- general meteorological conditions

Table 4. Water Sampling Data, Cape Charles, Virginia, 3 May 1978

Station	Time EST	Depth m	Temperature °C	Salinity °/oo	Secci Depth m	∝-Meter °/o	Phytopigments Chlorophyll a µg l^{-1}	Phytopigments Phaeophytin µg l^{-1}	Suspended Sediment mg l^{-1}	Wind MPH	Dye Buoy Index, Location, Time; Photo Data; Comments
L1. Buoy "8", Cape Charles Channel	1457	S 0.5 1.0 2.5 1.0 0.5	15.0	17.18	1.55	* 68 64 56 55 62 94(air) 92(cal) 50(current)	32.9	3.2	57.41	11S	A-5, B1, 1453; A-1, B8, 1455 VIMS Beaver buzzed at 1445. NASA C-130 begins Line 1 1515.
L2. Buoy "5"	1503	S 0.5 1.0 1.5 1.0 0.5	14.0	17.92	1.25	* 54 51 45 43 53	49.0	-2.2	51.85	10	?, CB, 1503 Photo 1: f/8, 250
L3. Offshore, Clear Water	1505	S 0.5 1.0 1.5 1.0 0.5	13.8	16.93	1.6	* 76 76 68 70 77	20.2	2.1	58.10	10	?, Offshore, 1509 Photo 2: Offshore
L4. Offshore, Turbid Water	1509	S 0.5 1.0 1.5 1.0 0.5	13.6	17.47	1.05	* 56 55 49 44 54	55.8	6.0	70.10	12	*
L5. Off Jetty	1523	S 0.5 1.0 1.5 1.0 0.5	14.2	17.77	1.2	* 62 61 57 53 55	34.7	5.3	62.38	12SSE	Photo 3: Toward south
L6. Buoy "1"	1527	S 0.5 1.0 1.5 1.0 0.5	14.8	17.34	1.35	* 60 54 50 50 52	35.3	5.3	58.10	8ESE	Photo 4: Toward south B1 Photo 5: Dye Marker NASA C-130 begins Line 2 1534.
L7. Mill Point, King's Creek	1550	S 0.5 1.0 hit bottom	15.0	18.00	hit bottom 1 m	* 52 50	47.4	12.6	70.21	12	NASA C-130 begins Line 3 1550. 50 yards offshore, 50 yards south of dock. Water too turbid to see SAV.
L8. Buoy "15", King's Creek	1604	S 0.5 1.0 1.5 1.0 0.5	17.0	17.77	0.8	* 32 32 40 40 36	54.9	8.6	68.37	10	Photos 6 & 7: King's Creek, 1617 Flood tide. NASA C-130 begins repeat Line 1 1620. Thin clouds from west.
L9. Cherrystone Inlet, east of Mill Point	1624	S 0.5 1.0 hit bottom	17.4	16.74	hit bottom 1 m	* 46 46	49.0	4.6	61.54	11SE	Photos 8 & 9: Toward north and south
L10. Cape Charles Inlet	1634	S 0.5 1.0 1.5 1.0 0.5	15.0	17.83	1.2	* 58 55 54 54 54	32.2	3.9	76.00	10SE	*
Dock	1650	*	*	*	*	84(cal) 46(current)	*	*	*	*	Tide up 2 to 3 feet at dock.

Table 5. Water Sampling Data, Occohannock Creek, Eastern Shore of Virginia, 3 May 1978: Depth Profiles.

Station	Time EST	Depth m	Temperature °C	Salinity o/oo	σ_t	$\Delta\sigma_t$	Secchi Depth m	K_e m^{-1}	Down welling Light Intensity Lumens m^{-2}	%	Phytopigments Chlorophyll a $\mu g\ l^{-1}$	Phaeophytin $\mu g\ l^{-1}$	Productivity $\mu g\ C\ l^{-1}h^{-1}$	Suspended Sediment $mg\ \ell^{-1}$	Silicon $\mu g\text{-at Si}\ \ell^{-1}$
N_0	1335-	S	*	*	*						71.6	2.9	21.92	55.67	1.83
	1355	1	16.2	12.4	8.46	0	0.9	2.33	23222	32.1					
		2	15.8	13.1	9.07	0.61				20.5	24.2	3.7			
		3	15.3	13.8	9.70	0.63			4260	5.8					
		4	15.2	13.8	9.72	0.02			897	1.2					
		5	14.9	14.0	9.92	0.20			292	0.4					
		6	14.7	14.3	10.19	0.27			224	0.03					
		7	14.7	14.4	10.26	0.07					55.8	0.1			
		8	14.6	14.5	10.45	0.19					53.0	8.8	5.88	73.75	*
N_1	1415-	S	16.2	15.3	10.67	0	0.9	2.33	22425	33.3	21.7	1.7	14.78	52.63	1.08
	1445	1	15.8	14.8	10.37	-0.30			17043	25.3	34.4	10.4	10.98		2.16
		2	15.7	15.1	10.61	0.24			5651	8.1	36.0	10.8	7.43		1.08
		3	15.7	15.3	10.77	0.16			2377	3.4	25.1	4.5	2.56	*	*
		4	15.7	15.3	10.77	0.00			426	0.6	34.1	9.6			1.30
		4.5	15.2	15.3	10.86	0.19			278	0.4	36.3	12.0			1.62
N_5	1515-	S	15.0	15.3	10.89	0	1.3	1.62	24219	45.8	35.3	10.4		39.46	3.57
	1525	1	13.2	17.8	13.13	2.24			14890	28.1	39.1	10.0		60.00	1.85
		2	12.8	18.5	13.74	0.61			4709	8.9	56.7	12.7		85.86	1.31
		2.5	12.6	18.5	13.78	0.04			2242	4.2	*	*		*	1.83
N_6	1535-	S	13.5	16.5	12.09	0	2.8	0.75	26551	52.4	19.8	3.8		32.14	1.08
	1605	1	13.8	16.2	11.80	-0.29			19016	37.8					
		2	13.0	16.6	12.24	0.44			10046	20.0				83.93	1.85
		3	12.8	17.0	12.58	0.34			5158	10.2					
		4	12.3	17.2	12.83	0.25			1794	3.6	66.0	8.4		94.44	1.41
		5	12.2	17.4	12.99	0.16			529	1.1					
		6	12.2	17.8	13.29	0.30			233	0.5					
		7	11.8	19.8	14.90	1.61			85	0.2				66.98	1.20
		8	11.6	20.7	15.63	0.72			46	0.1					
		9	11.5	21.0	15.86	0.24			22	0.04					
		10	11.5	21.4	16.17	0.31					53.0	7.1		53.06	1.10
"N_1"	1650	S	15.2	15.8	11.24	0	0.9	2.33	8073	30.0	*	*		*	*
		1	15.5	15.9	11.27	-0.03			3767	14.0					
		2	15.6	15.9	11.24	0.03			830	3.2					
		3	15.7	15.9	11.22	0.02			215	0.8					

*not determined

Table 6. Water Sampling Data, Occohannock Creek, Eastern Shore of Virginia, 3 May 1978: Surface Samples.

Station	Time EST	Depth*** m	Temperature °C	Salinity o/oo	σ_t	Secchi Depth m	K ** m^{-1}	Down Welling Light Intensity Lumens m^{-2} Air	Sea***	%	K_e*** m^{-1}	Phytopigments Chlorophyll *a* $\mu g\ l^{-1}$	Phaeophytin $\mu g\ l^{-1}$	Suspended Sediment $mg\ l^{-1}$	Silicon μg at Si ℓ^{-1}
N_1	1450	S	17.2	14.5	9.86	0.9	2.33	56062	20631	36.8	0.938	21.7	1.7	52.63	1.08
								56062	8073	14.0					
N_2	1455	S	17.2	14.0	9.48	0.9	2.33	60547	22066	36.4	1.175	54.9	5.2	54.08	4.42
								59650	6817	11.4					
N_3	1500	S	16.0	15.3	10.71	0.7	3.00	58305	19734	33.8	1.235	63.2	5.3	58.65	2.27
								57408	5741	10.0					
N_4	1505	S	13.1	16.1	11.84	1.1	1.91	56062	26511	47.4	1.729	29.9	5.8	51.85	1.19
								56511	4709	8.3					
N_5	1510	S	14.7	16.0	11.49	1.3	1.62	56511	26013	46.1	1.535	35.3	10.4	39.46	3.57
								56511	5606	9.9					
N_0	1335-1355	S	*	*	*	0.9	2.33	23222		32.1		71.6	2.9	55.67	1.83
N_6	1535-1605	S	13.5	16.5	12.09	2.8	0.75	26551		52.4		19.8	3.8	32.14	1.08
"N_1"	1650	S	15.2	15.8	11.24	0.9	2.33	8073		30.0		*	*	*	*

*not determined

**K = 2.1/D

***Light measurements at 0.5 and 1.5 m

K = extinction coefficient
D = Secchi depth

Table 7. Phytoplankton in surface waters of Occohannock Creek, Eastern Shore of Virginia, 3 May 1978.

	N_0	N_1	N_2	N_4	N_5	N_6
			Organisms $m\ell^{-1}$			
1. Diatoms						
A. Centric						
Cerataulina pelagica	8893	6101	5171	4550	12306	4447
Chaetoceros peruvianus	*	*	*	*	*	26
Coscinodiscus sp.	26	26	*	26	*	26
Cyclotella sp.	26	*	*	78	26	207
Melosira sulcata	*	*	*	*	*	207
Rhizosolenia fragilissima	931	827	414	1758	1861	1034
Rhizosolenia setigera	*	*	*	*	*	26
Rhizosolenia stolterfothii	310	*	310	517	1448	827
Thalassiosira gravida	*	52	*	*	*	*
Thalassiosira pseudonana	3516	2378	2792	2172	2689	3309
Sub-Total	13702	9384	8687	9101	18330	10109
B. Pennate						
Asterionella japonica	*	*	*	78	*	155
Cylindrotheca closterium	*	*	*	103	*	*
Diatom pennata (3)	*	620	*	*	515	*
Nitzschia longissima	*	*	*	*	310	*
Nitzschia seriata	*	*	*	*	*	52
Nitzschia sp.	26	*	*	*	*	*
Pleurosigma sp.	*	26	*	26	*	*
Thalassionema nitzschioides	*	26	103	*	52	*
Sub-Total	26	672	103	207	877	207
Total Diatoms	13728	10056	8790	9308	19207	10316
2. Dinoflagellates						
Diplopsalis lenticula	*	103	*	*	*	*
Katodinium sp.	620	1138	207		1138	103
Peridinium sp.	103	*	*	*	*	*
Peridinium subinerme	*	*	103	*	*	*
Peridinium triquetrum	*	*	26	*	*	*
Prorocentrum minima	620	1034	1034	52	1138	26
Total Dinoflagellates	1343	2275	1370	52	2276	129
3. Microflagellates	82314	65872	42191	4860	92862	4239
4. Cryptomonads	414	310	*	310	827	207
5. Cyanophytes						
Gomphosphaeria sp.	1758	1448	724	1344	3930	1138
6. Others						
Euglenophytes						
Euglena sp.	26	*	*	26	*	26
Eutreptia sp.	*	52	*	*	26	207
Total Others	26	52	*	26	26	233
TOTAL PHYTOPLANKTON, Organisms/$m\ell$	99583	80013	53075	15900	119128	16262

values for these surface waters (21.92 and 14.78 $\mu g\ C\ l^{-1}\ h^{-1}$, respectively) also indicate viable phytoplankton communities. The species information in Table 7 clearly indicates that the phytoplankton communities were numerically dominated by microflagellates, with smaller, approximately equal, numbers of centric and pennate diatoms; dinoflagellates and cyanophytes were much less abundant, and cryptomonads and others were in low abundance.

Temperature and salinity profile data from Table 5 are shown in Figures 7a, b, and c. The cooler temperatures and higher salinities were found in the offshore stations N5 and N6. With depth, temperatures decreased and salinities increased; these changes reflect increasing water density with depth, as indicated in the density data σ_t in Table 5.

Chlorophyll and suspended sediment data from Tables 4 and 6 are shown in Figures 8 and 9. Both variables had moderately high values.

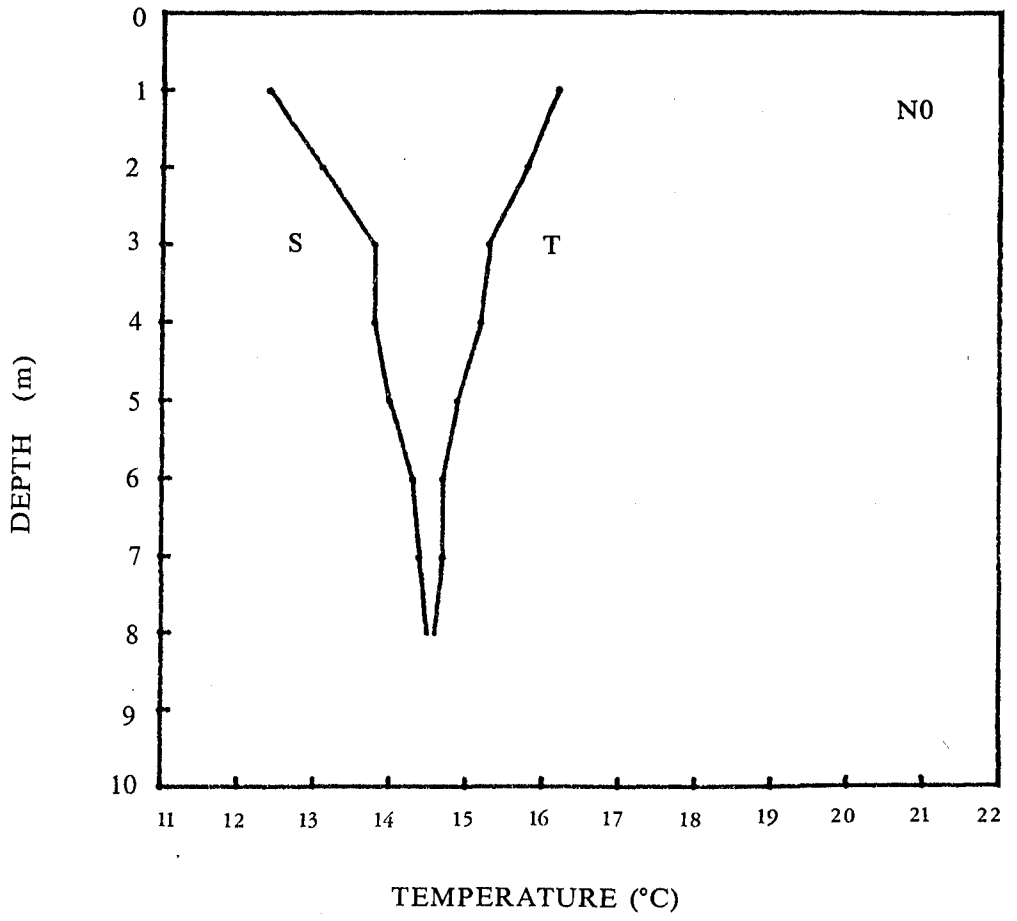


FIGURE 7a. Temperature and salinity profiles with depth at Station N0, Occohannock Creek, 3 May 1978. Data from Table 5.

FIGURE 7b. Temperature and salinity profiles at Station N1 2.5 hours apart, Occohannock Creek, 3 May 1978. Data from Table 5.

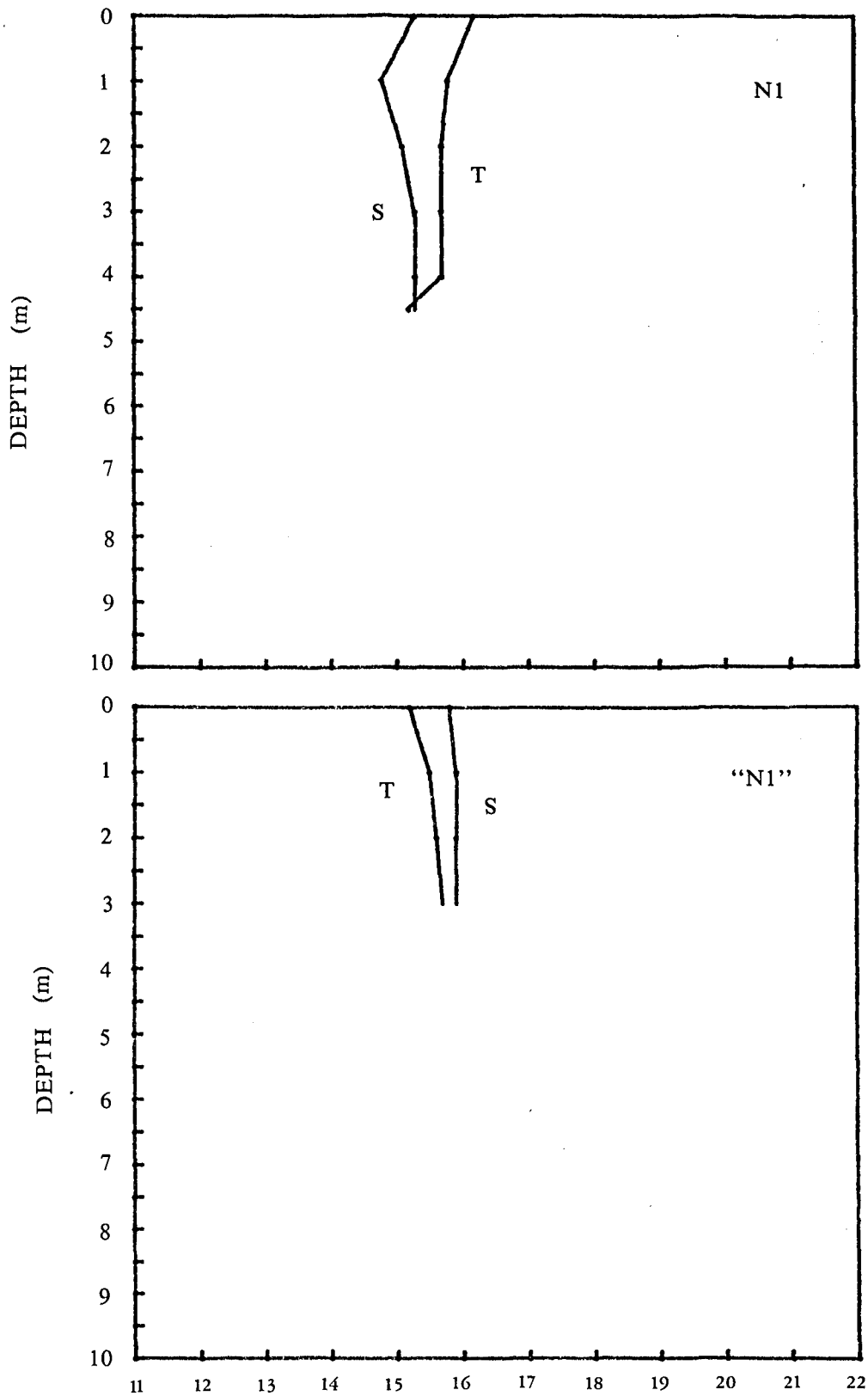
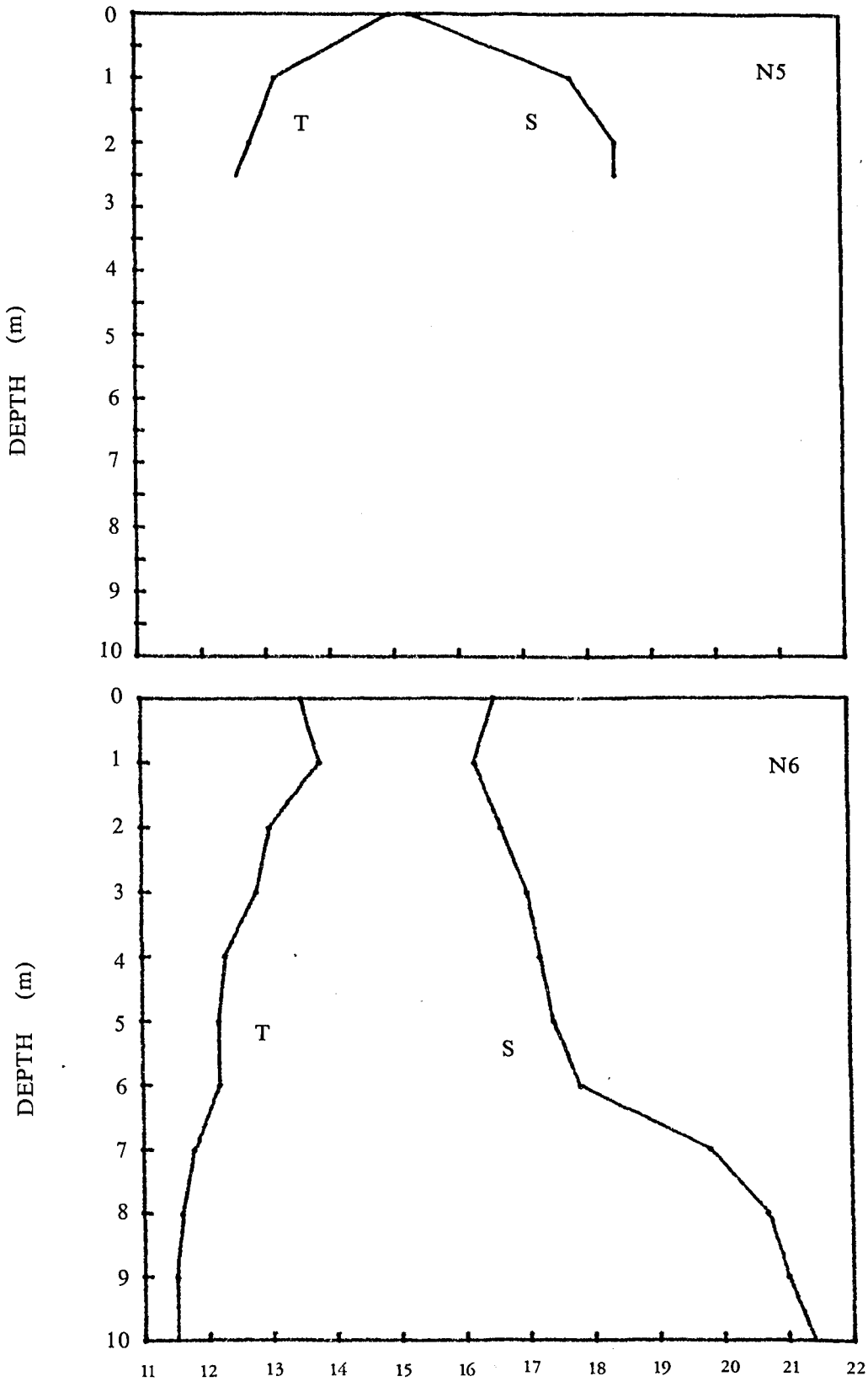

N1
T
S
DEPTH (m)
0
1
2
3
4
5
6
7
8
9
10
"N1"
T
S
DEPTH (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
TEMPERATURE (°C)
SALINITY (o/oo)

FIGURE 7c. Temperature and salinity profiles at Stations N5 and N6, Occohannock Creek, 3 May 1978. Data from Table 5.


N5
T
S
DEPTH (m)
0
1
2
3
4
5
6
7
8
9
10
N6
T
S
DEPTH (m)
11
12
13
14
15
16
17
18
19
20
21
22
TEMPERATURE (°C)
SALINITY (o/oo)

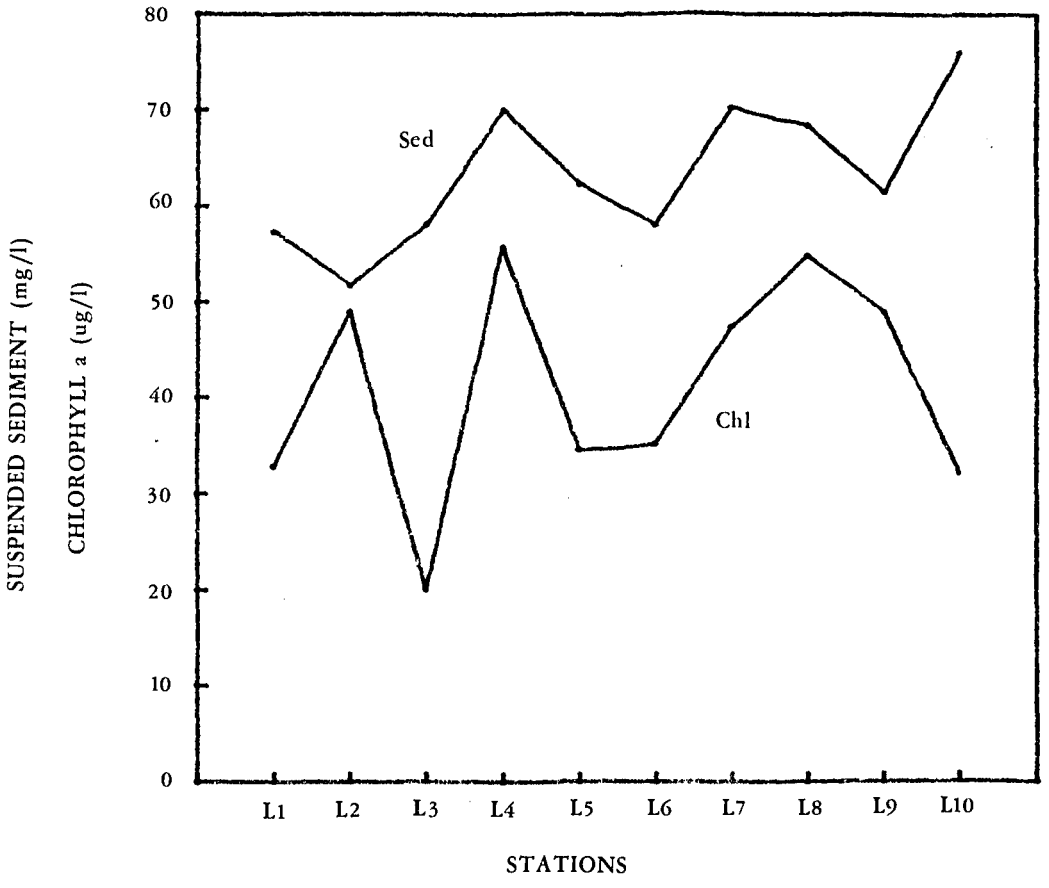


FIGURE 8. Chlorophyll a and suspended sediment distributions, Cape Charles, 3 May 1978. Stations and data from Table 4.

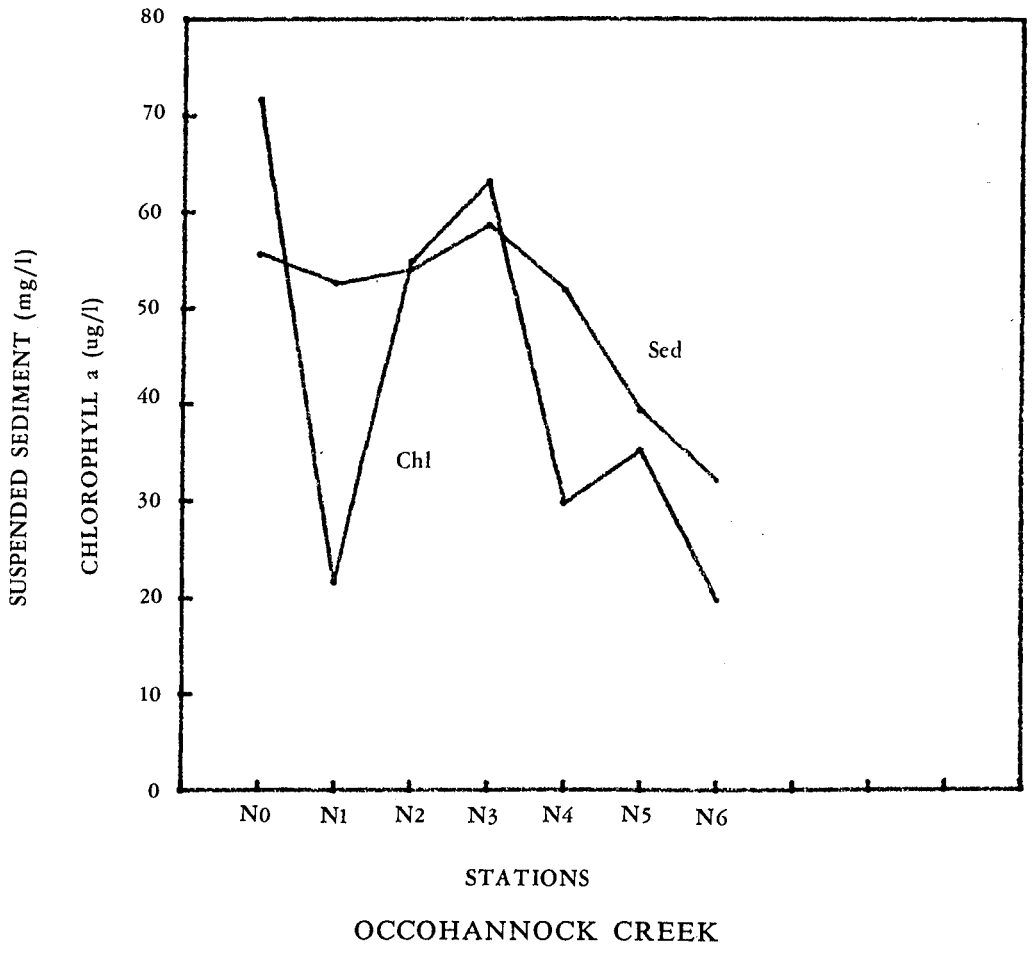


FIGURE 9. Chlorophyll a and suspended sediment distributions, Occohannock Creek, 3 May 1978. Stations and data from Table 6.

RECOMMENDATIONS

On 3 May, the ratio of surface concentrations of suspended sediment to chlorophyll varied widely, by a factor of three. The chlorophyll concentration reached the high value of 72 μg/l, and the suspended sediment concentration reached 59 mg/l. There were a total of 17 points of surface data. These data should be used to test the power of the multispectral scanner to discriminate between suspended sediment concentration and chlorophyll concentration.

There were large variations in cell density at the Occohannock Creek stations on 3 May. The scanner data should be examined for possible spectral effects caused by these variations.

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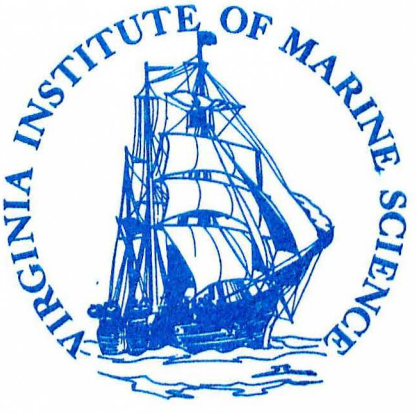
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