1962

Diatoms from Virginia tidal waters, 1960 and 1961

Richard A. Mulford

Virginia Institute of Marine Science

Follow this and additional works at: https://scholarworks.wm.edu/reports

Part of the Environmental Microbiology and Microbial Ecology Commons, Marine Biology Commons, and the Plant Sciences Commons

Recommended Citation


This Report is brought to you for free and open access by W&M ScholarWorks. It has been accepted for inclusion in Reports by an authorized administrator of W&M ScholarWorks. For more information, please contact scholarworks@wm.edu.
DIATOMS FROM VIRGINIA TIDAL WATERS

1960 and 1961

Richard A. Mulford

Microbiology-Pathology Department

Virginia Institute of Marine Science

Special Scientific Report No. 30

1962
This report contains a list of diatoms collected in Virginia marine waters. The areas sampled include the York River, lower Chesapeake Bay and the continental shelf to a distance of eighty miles offshore.

Perhaps the earliest information dealing with diatoms of this area appeared in 1926 when Wolfe, et al, published their report based on samples collected at intervals from 1915 to 1921 in Chesapeake Bay by the Bureau of Fisheries. This report was then incorporated into Cowles' (1930) biological study of Chesapeake Bay waters. In 1957, additional information became available as a result of a brief survey made in the York River in 1956 by the Limnology Department of the Academy of Natural Science, Philadelphia. Griffith (1961) has brought existing information up-to-date from the unpublished list of contemporary workers.

The diatom literature for the area under consideration has, up to now, been based mainly on occasional samplings. The present work has utilized samples collected at approximately two-week intervals over a two-year period. As a result, it is possible to present a more complete picture of the seasonal distribution of diatoms in Virginia waters than has heretofore been available.

I would like to thank Dr. J. L. Wood, Dr. G. Moskovits and Dr. E. Patten of this laboratory for their assistance and guidance in
making this report possible. Appreciation is expressed to Dr. Ruth
Patrick and Dr. C. W. Reimer of the Academy of Natural Sciences,
Philadelphia, for their valuable assistance in taxonomy and for the
use of the literature and slide collections of the Academy. I am
indebted to the staff of the Ichthyology Department of this laboratory
for their help and experience in the field. The author also wishes
to acknowledge Captain R. J. Hochban (M.M.) of the R/V Pathfinder.

METHODS

In January 1960, five stations were established by the Plank­
tology Research Section (Fig. I and Table I, stations Y-0, Y-7, #3,
#4 and #5). These stations were sampled approximately twice monthly
through January 1961 (Patten, 1961; Patten and Warinner, 1961).

In February, 1961, three stations were established in the York
River by the Microbiology Department (Fig. I and Table I, stations
Y-0, Y-7 and Y-14). These stations were sampled at approximately
two-week intervals through December 1961.

In March 1961, the Ichthyology Department cooperated in
obtaining monthly offshore phytoplankton samples in connection with
their program (Joseph, Massmann and Norcross, 1961). The collec­
tion of offshore samples, with the exception of May and June, was
carried into December 1961.
Plankton tows in the York River were made with a Clarke-Bumpus sampler and a No. 20 net for periods of 15 minutes. At station Y-0, the tows were made across the mouth of the river. Stations Y-7 and Y-14 were sampled diagonally and up or down river depending on the state of the tide. A few samples were obtained by pump from R/V Pathfinder. The continental shelf samples were all obtained with a calibrated pump from a known depth, strained through a No. 20 net. Salinity samples were taken at all stations.

River temperatures were taken with a Fahrenheit thermistor unit. Shelf temperatures were determined with an induction conductivity temperature indicator (Esterson, 1957). The temperatures and salinities reported represent the upper and lower limits observed for the species under consideration.

All samples were preserved in formalin to give a final concentration of 4%. From each of these a well-mixed aliquot was transferred to a slide smeared with adhesive (Johansen, 1940). The slides were allowed to dry, after which they were processed through the following reagents:

1) 70% ethanol for 5 minutes
2) 95% ethanol for 5 minutes
3) Absolute ethanol for 5 minutes
4) Absolute ethanol and xylene (1:1) for 5 minutes
5) Xylene (pure) for 10 minutes
The slides were then mounted in Hyrax (refractive index = 1.65; obtainable from Braun-Knecht-Heimann Co., San Francisco, California, Cat. No. 48209; soluble in xylene and benzene).

For storage the original samples were allowed to settle and the supernatent fluid decanted. The material left in each bottle was then transfered to a 30 ml vial.

In some instances samples were observed raw and then later preserved. All identifications were made under a 97 x objective with a 10 x or 15 x eyepiece in either brightfield or phase.

Distribution of this report does not constitute publication, and the information is subject to correction and/or revision.

Richard A. Mulford
March 15, 1962
TABLE I

SAMPLING STATIONS

The numbers appearing after the letters are mileage indicators (Pritchard, 1952, 1957): "Y-0" represents the York River mouth, "Y-7", seven miles upstream, etc. On the Atlantic Ocean stations, the Roman numeral following the station number represents miles from shore, e.g. 700 II, twenty miles from shore, etc.

***

P-40 - White Oak landing (37° 33' - 76° 53')

Y-25 - Bell Rock lighthouse (37° 28' - 76° 44')

Y-20 - Poropotank (37° 26' - 76° 42')

Y-14 - Pages rock lighthouse (37° 18'30" - 76° 35'30")

Y-7 - York River Bridge (37° 35' - 76° 45')

Y-0 - mouth of York River (37° 14'42" - 76° 23'22") (Pritchard, D. W., 1954)

#3 - Chesapeake Bay, York Spit Light (37° 13' - 76° 16'); 12 ft.

#4 - Chesapeake Bay, off York Spit Channel, (37° 10' - 79° 90'); 25 ft.

#5 - Chesapeake Bay, north of Inner Middle Ground. (37° 08' - 76° 02')

700 II - Atlantic Ocean (37° 00' - 75° 35')

700 IV - " " (37° 00' - 75° 10')

700 VI - " " (37° 00' - 74° 45')

700 VIII - " " (37° 00' - 74° 21')

720 II - " " (37° 20' - 75° 35')

720 IV - " " (37° 20' - 75° 10')

720 VI - " " (37° 20' - 74° 45')

720 VIII - " " (37° 20' - 74° 21')
LIST OF DIATOMS IDENTIFIED

For ease in handling, genera and species are listed alphabetically. A question mark following the species name denotes some doubt concerning its identity. The symbols used after species authorities refer to the description on which identification was based. (See literature cited for complete reference.) Following this list seasonal distribution of the more abundant diatoms is shown graphically (Table II).

Achnanthes Bory

A. brevipes Ag. ? (Cl-Euler, Vol. IV, p. 49)

Once in March 1961 at station Y-7; salinity, 15.6°/oo; temp., 9.0°C.

A. clevei Grun. (Cl-Euler, Vol. IV, p. 18)

March, April and June 1961 at stations Y-0, Y-7 and Y-14; salinity, 15.3 to 16.7°/oo; temp., 8.1 to 23.1°C.

A. curvirostrum Brun ? (Hust, p. 12)

Once in Feb. 1960 at station Y-7; salinity, 20.7°/oo; temp., 5.6°C.

A. hauckiana (Grun.) Cl. (Cl-Euler, Vol. IV, p. 46)

March, April and June 1961 at stations Y-0, Y-7 and Y-14; salinity, 15.3 to 16.7°/oo; temp., 8.1 to 23.1°C.

Actinocyclus Ehrenberg

A. ehrenbergii Ralfs (Cl-Euler, Vol. I, p. 81)

Every month except Sept. 1961 at all stations except Y-25 and P-40, Oct. 1961 at station 720 VIII; salinity, 13.9 to 29.0°/oo; temp., 2.5 to 29.0°C. From May through early June this species is among the dominant diatoms in the estuary. This species was checked with type slide ANSP*, Boyer collection, P. Klavsen slide I-5-12.

A. ralfsii (W. Sm.) Ralfs (Cupp, p. 67)

Once in March 1961 at station Y-14, March, Aug. and Oct. at stations 700 II and 700 VIII; salinity, 15.8 to 31.0°/oo; temp., 8.1 to 26.0°C.

* Academy of Natural Sciences, Philadelphia
Actinoptychus Ehrenberg

_**A. undulatus** (Bail.) Ralfs (Cupp, p. 67)
All months at all estuary stations, March, April and Oct. 1960 and 1961 at stations 700 II, 700 VI, 720 II, 720 IV and 720 VIII; salinity, 10.8 to 32.0°/oo; temp., 2.5 to 28.5°C. This species is never abundant. All observations have been from surface samples. This species was checked with type slide, ANSP, Boyer, M-I-14.

Amphiprora (Ehrenberg) Cleve

_**A. alata** (Ehr.) Kutz. (Cl-Euler, Vol. II, p. 32)
April, July, Aug., Nov. and Dec. 1960 and 1961 at stations Y-0, Y-7 and #3; salinity, 18.2 to 21.4°/oo; temp., 7.9 to 29.0°C.

_**A. gigantea** O'M. (Cupp, p. 198)
April and Oct. 1961 at stations Y-0 and Y-7; salinity, 16.3 to 20.6°/oo; temp., 9.7 to 22.0°C. This species was checked with type slide ANSP, Cl. and Moll., 154-55.

_**A. paludosa** W. Sm. (Cl-Euler, Vol. II, p. 31)
March, April, June, Aug. and Nov. 1960 and 1961 at stations Y-0, Y-7 and Y-14; salinity, 12.5 to 19.6°/oo; temp., 8.1 to 27.0°C.

_**A. similis** Hust. (Hust, p. 37)
Once in Feb. 1960 at station Y-7; salinity, 19.5°/oo; temp., 3.7°C.

_**A. sulcata** O'M. ? (B, p. 485)
Once in Aug. 1961 at station Y-0; salinity, 19.4°/oo; temp., 3.7°C.

Amphora Ehrenberg

_**A. acutiuscula** Kutz. (Cl-Euler, Vol. IV, p. 98)
Feb. and March 1961 at stations Y-0 and Y-7; salinity, 17.3 to 17.5°/oo; temp., 5.9 to 8.1°C.

_**A. lineolata** Greg. ? (Cl-Euler, Vol. IV, p. 100)
Once in Feb. 1961 at station Y-14; salinity, 16.3°/oo; temp., 4.2°C.
Amphora (continued)

\textit{A. ovalis} Kutz. \textit{(V H, pl. I)}
Feb., March, Nov., and Dec. 1960 and 1961 at stations Y-0, Y-7, Y-14 and #3; salinity, 10.0 to 20.7\textdegree/oo; temp., 5.6 to 9.5\textdegree C.

\textit{A. robusta} Greg. \textit{(B, p. 65)}
Once in June 1961 at station Y-7; salinity, 15.5\textdegree/oo; temp., 24.0\textdegree C.

\textit{A. sublaevis} Hust. \textit{?} \textit{(Hust, p. 41)}
Once in Dec. 1961 at station Y-0; salinity, 22.2\textdegree/oo; temp., 7.9\textdegree C.

\textbf{Asterionella Hassell}

\textit{A. formosa} Hass. \textit{(B\textsuperscript{2}, p. 50)}
Once in June 1961 at station P-40; in fresh water; temp., 24.0\textdegree C.

\textit{A. japonica} Cl. and Moll. \textit{(Cupp, p. 188)}
All months except July 1960 and 1961 at all estuary stations, March, Oct. and Nov. 1961 at stations 700 II, 700 VI and 720 IV; salinity, 4.2 to 32.0\textdegree/oo; temp., 2.5 to 27.0\textdegree C. It remained among the upper three dominant species from Nov. through April being most abundant in Feb. and March. Offshore samples have contained relatively few cells of this species.

\textbf{Aulacodiscus Ehrenberg}

\textit{A. argus} (Ehr.) A. S. \textit{(B\textsuperscript{2}, p. 26)}
Feb., June and Nov. 1960 at stations #4 and #5; salinity, 16.2 to 22.6\textdegree/oo; temp., 4.3 to 22.8\textdegree C.

\textbf{Auliscus Ehrenberg}

\textit{A. caelatus} Bail. \textit{(B\textsuperscript{2}, p. 29)}
Feb., April, May, July, Sept., Oct., Nov. and Dec. 1960 and 1961 at stations Y-0 and #3; salinity, 15.8 to 22.4\textdegree/oo; temp., 5.6 to 28.5\textdegree C.

\textit{A. punctatus} Grun. \textit{?} \textit{(B\textsuperscript{2}, p. 28)}
Once in Nov. 1961 at station Y-14; salinity, 15.8\textdegree/oo; temp., 15.8\textdegree C.
Bacteriastrum Shadbolt

B. delicatulum Cl. (Cupp, p. 96)
Feb., July, Aug., Sept., Oct. and Nov. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5, Oct. and Nov. 1961 at stations 720 IV, 720 VI, 720 VIII and 700 VI; salinity, 13.6 to 32.0°/oo; temp., 5.6 to 28.5°C. This species was among the three dominant diatoms at stations #3, #4 and #5 in July and Aug. In Nov. at station 700 VI it was among the three dominant diatoms.

Bellerochea Van Heurek

B. malleus (Brightw.) V. H. (V W, Vcl. I, p. 43)
Once in Aug. 1960 at station #5; salinity, 29.5°/oo; temp., 15.8°C.

Biddulphia Gray

B. alternans (Bail.) V. H. (Cupp, p. 166)
April, May, June, Aug., Sept., Oct. and Nov. 1960 at stations 720 IV, 720 VI, 720 VIII and 700 IV; salinity, 16.2 to 29.5°/oo; temp., 6.9 to 27.3°C. This species was among the three dominant diatoms in Oct. at station 720 IV.

B. aurita (Lyng.) Breb. and Godey (Cupp, p. 161)
Jan. 1960 at stations Y-0, #4 and #5; salinity, 19.5 to 25.8°/oo; temp., 3.3 to 6.2°C.

B. biddulphiana (Smith) Boyer (B, p. 121)
Once in April 1960 at station #5; salinity, 23.5°/oo; temp., 6.9°C.

B. granulata Roper. (B2, p. 34)
Feb., April, May, June, July, Aug. and Oct. 1960 and 1961 at stations Y-0, Y-14, #3, #4 and #5; salinity, 15.9 to 29.5°/oo; temp., 4.3 to 27.2°C.

B. longicruris Grev. (Cupp, p. 154)
Aug. 1960 and 1961 at stations Y-0, Y-7 and #5; salinity, 20.0 to 22.9°/oo; temp., 26.2 to 27.0°C.
Biddulphia (continued)

B. mobiliensis (Bail.) Grun. (Cupp, p. 153)
All months at all estuarine stations 1960 and 1961, Oct. 1961 at station 720 VIII; salinity, 15.7 to 28.0°/oo; temp., 3.6 to 28.5°C. This species was among the three dominant diatoms at stations Y-0 and #3 in Sept. and Oct. This species checked with type slide ANSP, Boyer, I-5-9.

B. rhombus (Ehr.) W. Sm. (Cupp, p. 163)
Jan. through April, Aug. through Dec. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5, once in Oct. 1961 at stations 700 II, 720 IV and 720 VIII; salinity, 14.1 to 29.5°/oo; temp., 3.2 to 27.0°C.

B. sinensis Grev. (Cl-Euler, Vol. I, p. 117)

B. turgida Ralfs (Cl-Euler, Vol. I, p. 120)
Feb., April, May, Nov. and Dec. 1960 and 1961 at stations Y-7, Y-14, #3, #4 and #5; salinity, 16.1 to 22.6°/oo; temp., 4.6 to 21.2°C. This species checked with type slide, ANSP, Boyer, L-1-4.

Campylodiscus Ehrenberg

C. echeneis Ehr. (B², p. 130)
May and Dec. 1960 and 1961 at stations Y-14 and #3; salinity, 16.5 to 20.7°/oo; temp., 8.0 to 14.9°C.

Campylosira Grunow

C. cymbelliformis (A. S.) Grun. (Cupp, p. 180)
Feb., May, Oct. and Nov. 1960 and 1961 at stations Y-0 and #5; salinity, 15.2 to 24.8°/oo; temp., 5.6 to 19.7°C.

Cerataulina H. Peragallo

C. bergonii Perag. (Temp, p. 94)
All months except July at all estuarine stations except Y-25 and P-40 1960 and 1961, once in Oct. 1961 at station 720 IV; salinity, 10.6 to 29.5°/oo; temp., 3.5 to 28.5°C. This
Cerataulina (continued)

species in the estuary was among the three dominant diatoms from Feb. through April 1960 and 1961 at stations Y-7, Y-0, #3 and #4. This species in our samples is considerably smaller than the size limits of the true species. Many specimens have been observed with a diameter of 7 to 9 µ. This may possibly be a new variety of the species.

Chaetoceros Ehrenberg

C. affinis Laud. (Cupp, p. 125)
May through Dec. 1960 and 1961 at all estuarine stations except Y-14, Y-20 and P-40, Nov. 1961 at station 700 II; salinity, 15.7 to 29.5/o/oo; temp., 7.9 to 27.0°C. This species in the estuary was among the three dominant diatoms in Dec. 1961 at station Y-0.

C. affinis willei (Gran) Hust. (Cupp, p. 126)
Once in Sept. 1961 at station Y-7, once in Oct. 1961 at station 720 VI; salinity, 20.0 to 29.0/o/oo; temp., 22.0 to 28.5°C.

C. atlanticus Cl. (Cupp, p. 103)
March, April, Aug. and Sept. 1961 at stations Y-0 and Y-7, once in Oct. 1961 at stations 720 II and 720 IV; salinity, 15.6 to 28.0/o/oo; temp., 8.1 to 28.5°C. This species checked with type slide ANSP, Boyer, P. Klavslen slide H-5-13.

C. brevis Schutt. (Cupp, p. 129)
April, Aug., Sept. through Nov. 1961 at stations Y-0 and Y-7; salinity, 16.1 to 21.4/o/oo; temp., 9.7 to 28.5°C.

C. ceratosporus Ostenf. (Cl-Euler, Vol. I, p. 108)
Jan. through April 1960 and 1961 at stations Y-0, Y-7 and #3, salinity, 10.5 to 21.0/o/oo; temp., 2.5 to 10.1°C.

C. compressus Laud. (Cupp, p. 119)
All months throughout the year at stations Y-0, Y-7, Y-14, #3, #4 and #5, March, Oct. and Nov. 1961 at stations 700 II, 700 VI, 720 II and 720 VI; salinity, 10.8 to 32.1/o/oo; temp., 2.5 to 29.0°C. This species in the estuary was among the three dominant diatoms in Aug. and Sept. 1960 and 1961 at stations Y-0 and #3.
Chaetoceros (continued)

C. constrictus Gran (Cupp, p. 122)  
Aug., Sept. and Oct. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5; salinity, 19.4 to 32.1°/oo; temp., 19.7 to 28.5°C.

C. criophilum Cast. (Cl-Euler, Vol. I, p. 96)  
July 1961 at station Y-0; salinity, 18.2°/oo, temp., 29.0°C.

C. curvisetus Cl. (Cupp, p. 137)  
April, July through Nov. 1961 at stations 720 IV, 720 VI, 720 VIII, 700 IV and 700 VI; salinity, 26.0 to 32.0°/oo; temp., 11.5 to 22.0°C. In Nov. 1961 at station 700 VI this diatom was among the three dominant species.

C. danicus Cl. (Cupp, p. 109)  
April, June, July through Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, once in July 1961 at station 720 VI, salinity, 16.3 to 32.1°/oo; temp., 10.1 to 28.7°C. In Nov. 1961 at station Y-0 and Y-7 this species was among the three dominant diatoms.

C. decipiens Cl. (Cupp, p. 115)  
March, July through Oct. at stations Y-0, Y-7, #3, #4 and #5, once in Nov. 1961 at station 700 VI, salinity, 18.2 to 26.0°/oo; temp., 11.9 to 27.0°C. This species is somewhat rare in our samples and can be easily confused with C. lorenzianus Grun.

C. densus Cl. (Leb, p. 115)  
Dec. and Jan. 1960 and 1961 at stations Y-0, Y-7 and #3, Sept. through Dec. 1961 at stations 700 II, 700 IV, 700 VI and 700 VIII; salinity, 21.4 to 34.0°/oo; temp., 3.8 to 27.0°C. This species was among the three dominant diatoms at station 700 VI in Dec. 1961.

C. didymus Ehr. (Cupp, p. 121)  
Jan., April, June through Dec. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5, Oct. through Dec. 1961 at stations 700 II and 700 VI; salinity, 19.4 to 32.0°/oo; temp., 6.0 to 16.0°C. In Nov. 1961 at station 700 II this species was among the three dominant diatoms. This species checked with type slide ANSP, Boyer, P. Klaasen slide H-5-1.

C. eibenii (Grun.) Meunier (Cupp, p. 106)  
Once in Sept. 1961 at station Y-0, March and July at stations 700 II and 700 VI; salinity, 21.2 to 24.0°/oo; temp., 12.0 to 22.0°C.
Chaetoceros (continued)

C. glandazi Mangin (Leb, p. 118)

Oct. through Dec. 1961 at stations 700 IV, 700 VI, 720 IV, 720 VI and 720 VIII; salinity, 31.5 to 32.9/oo; temp., 11.7 to 18.0°C. In Oct. 1961 at station 720 VIII this species was among the three dominant diatoms.

C. gracilis Schutt (Cupp, p. 143)

Feb. through April 1960 and 1961 at stations Y-0 and #3; salinity, 16.3 to 20.7/oo; temp., 4.1 to 9.7°C.

C. laciniosus Schutt (Cupp, p. 128)

Once in Oct. 1961 at station 720 VIII; salinity, 32.9/oo; temp., 18.0°C.

C. lorenzianus Grun. (Cupp, p. 118)

April, July through Dec. 1960 and 1961 at stations Y-0, #3, #4 and #5, Oct. and Nov. 1961 at stations 700 II, 700 VI, 720 IV, 720 VI and 720 VIII; salinity, 13.6 to 32.1/oo; temp., 6.9 to 28.5°C. In Oct. and Nov. 1960 and 1961 at stations Y-0, #3 and #5 this species was among the three dominant diatoms.

C. pendulus Karsten (Cupp, p. 114)

March and April at stations Y-0 and Y-7; salinity, 15.6 to 16.3/oo; temp., 8.1 to 10.1°C.

C. peruvianus Brightw. (Cupp, p. 113)

All months at all estuarine stations except Y-25 and P-40, Oct and Nov. 1961 at stations 700 II and 720 II; salinity, 7.3 to 24.1/oo; temp., 2.5 to 29.0°C. This species is never among the dominant forms but is rarely absent from any sample.

C. pseudocurvisetus Mangin (Cupp, p. 138)

Once in Oct. 1961 at stations 720 IV and 720 VI; salinity, 31.5 to 32.4/oo; temp., 16.1 to 16.8°C.

C. septentrionalis Oestrup (Leb, p. 169)

Jan. through April 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5; salinity, 7.5 to 26.3/oo; temp., 5.7 to 12.5°C. This species was among the three dominant diatoms in Jan. 1961 at station Y-0.
Chaetoceros (continued)

*C. similis* Cl. (Cupp, p. 135)
Feb., March, July and Nov. 1960 and 1961 at stations Y-0, Y-7, Y-14 and #5, once in Oct. 1961 at station 720 II; salinity, 13.9 to 30.9°/oo; temp., 5.7 to 20.0°C. This species checked with type slide ANSP, Boyer, P. Klavsen slide G-5-17.

*C. socialis* Laud. (Cupp, p. 143)

*C. subtilis* Cl. (Cl-Euler, Vol. I, p. 107)
Feb., Mar., June through Dec. 1960 and 1961 at all estuarine stations except Y-20, Y-25 and P-40, once in Oct. 1961 at station 720 II; salinity, 13.9 to 31.0°/oo; temp., 5.6 to 29.0°C. This species was among the three dominant diatoms from June through Aug. 1961 at station Y-0.

*C. teres* Cl. ? (Cupp, p. 118)
Once in Nov. 1961 at station 700 II; salinity, 31.0°/oo; temp., 20.0°C.

Climacodium Grunow

*C. frauenfeldianum* Grun. (Cupp, p. 147)
Aug. through Oct. 1961 at stations 700 IV, 700 VI, 700 VIII and 720 VIII; salinity, 18.6 to 33.0°/oo; temp., 18.0 to 26.8°C.

Cocconeis Ehrenberg

Once in April 1961 at station Y-0; salinity, 16.3°/oo; temp., 10.1°C.

*C. scutellum* Ehr. (Cl-Euler, Vol. IV, p. 6)
All months except Sept. 1960 and 1961 at all estuarine stations except P-40, Oct. 1961 at station 720 IV; salinity, 7.3 to 31.5°/oo; temp., 2.5 to 29.0°C.

*C. thomasiana* Brun ? (Cl-Euler, Vol. IV, p. 10)
Once in March 1961 at station Y-14; salinity, 7.3°/oo; temp., 12.8°C.
Corethron Castracane

_C. hystrix_ Hensen (Cupp, p. 70)
Nov. and Dec. 1960 and 1961 at stations Y-0, Y-7, #3 and #5, once in Oct. 1961 at stations 720 II, 720 IV and 720 VI; salinity, 18.1 to 32.4°/oo; temp., 8.2 to 16.8°C. This species in Oct. 1961 was among the three dominant diatoms at station 700 II.

Coscinodiscus Ehrenberg

_C. asteromphalus_ Ehr. (B², p. 23)
All months at all estuarine stations except Y-25 and P-40, Oct. and Nov. 1961 at stations 720 II and 700 II; salinity, 10.6 to 31.0°/oo; temp., 2.5 to 29.0°C. This species is among the three dominant diatoms from late April through June, then again in Aug. and Oct. through early Dec. in the lower estuary and Bay.

_C. concinnus_ W. Sm. (Cupp, p. 58)
Sept. through Dec. 1960 and 1961 at stations Y-0, #3, #4 and #5, once in Oct. 1961 at station 720 IV; salinity, 19.6 to 31.5°/oo; temp., 7.9 to 23.5°C.

_C. excentricus_ Ehr. (Cupp, p. 52)
March, April, June, Aug. and Oct. 1960 and 1961 at stations Y-0, Y-7, #3 and #4; salinity, 15.3 to 21.4°/oo; temp., 8.1 to 27.0°C.

_C. granii_ Gough (Cupp, p. 56)
April and June 1961 at stations Y-7 and Y-14; salinity, 12.5 to 15.3°/oo; temp., 9.8 to 23.0°C.

_C. lineatus_ Ehr. (Cupp, p. 53)
April, June and Aug. 1961 at stations Y-0 and Y-7, March and April at stations 700 II, 700 VI and 720 IV; salinity, 15.3 to 31.2°/oo; temp., 7.4 to 28.5°C.

_C. marginatus_ Ehr. (Cupp, p. 55)
Once in Feb. 1961 at station Y-0; salinity, 19.0°/oo; temp., 5.6°C.

_C. oculus iridis_ Ehr. (Cupp, p. 62)
Jan. through May, Aug. and Sept. 1960 and 1961 at all estuarine stations except Y-25 and P-40; salinity, 10.8 to 21.4°/oo; temp., 2.5 to 28.5°C.
**Coscinodiscus** (continued)

*C. perforatus* Ehr. (Cupp, p. 61)
All months except July and Dec. 1960 and 1961 at all estuarine stations except P-40; salinity, 9.9 to 24.1%/oo, temp., 2.5 to 28.1°C. This species was among the three dominant diatoms in June and Sept. 1961 at stations Y-7 and Y-0. This species checked with type slide ANSP, Boyer, Q-4-25.

*C. radiatus* Ehr. (Cupp, p. 56)
June, Sept. and Nov. 1961 at stations Y-0, Y-7 and Y-14; salinity, 12.5 to 19.9%/oo; temp., 11.5 to 23.0°C.

*C. wailesii* Gran (Cupp, p. 58)
April, Sept. through Dec. 1961 at stations Y-0, Y-7 and Y-14, March and Dec. 1961 at stations 700 II, 700 IV and 700 VI; salinity, 10.5 to 32.5%/oo; temp., 11.7 to 23.2°C.

**Coscinosira** Gran

*C. polychorda* Gran (Cupp, p. 44)
March 1961 at station Y-0; salinity, 9.7°C/oo; temp., 8.1°C.

**Cyclotella** (Kutzing) Brebessoon

*C. meneghiniana* Kutz. (Cl-Euler, Vol. I, p. 48)
March through Aug. at stations Y-0, Y-7, Y-14, Y-20 and Y-25; salinity, 4.2 to 20.2%/oo; temp., 8.1 to 29.0°C.

*C. stelligera* Cl. and Grun. (Cl-Euler, Vol. I, p. 43)
Once in March 1961 at station Y-0; salinity, 17.9%/oo; temp., 8.5°C.

*C. striata* (Kutz.) Grun. (Cl-Euler, Vol. I, p. 42)
Feb., March, June, Aug., Sept. and Oct. 1960 and 1961 at stations Y-0, Y-14, Y-20, #3, #4 and #5; salinity, 4.2 to 20.0%/oo; temp., 5.6 to 28.5°C.

**Dactyliosolen** Castracane

*D. mediterraneus* Perag. (Cupp, p. 77)
Once in Oct. 1961 at station 720 VIII; salinity, 32.9°C/oo; temp., 18.0°C. At this occurrence the chains had large quantities of a flagellate attached to the girdle-band zone, possibly *Solenicola setigera* (Cupp 1943).
Diatoma DeCandolle

D. hiemale (Lyng.) Heib. (Cl-Euler, Vol. III, p. 20)
Jan. through April 1960 and 1961 at stations Y-0, Y-7, Y-14 and #5; salinity, 4.2 to 25.8°/oo; temp., 1.7 to 10.1°C.

Diploneis Ehrenberg

D. bombus minor (Ehr.) Cl. (Cl-Euler, Vol. IV, p. 72)
Feb., April and Aug. 1960 and 1961 at stations Y-0, Y-7 and #4; salinity, 16.3 to 20.2°/oo; temp., 4.5 to 27.0°C.

D. puella (Schum.) Cl. (Cl-Euler, Vol. IV, p. 69)
Jan. through June, Aug. and Sept. 1960 and 1961 at stations Y-0, Y-7, Y-14, Y-20, #3, #4 and #5; salinity, 4.2 to 21.0°/oo; temp., 1.7 to 27.0°C.

D. suborbicularis intermedia (Greg.) Cl. (Cl-Euler, Vol. IV, p. 69)
Aug. and Dec. 1961 at stations Y-0 and Y-14; salinity, 19.3 to 22.2°/oo; temp., 7.9 to 27.0°C.

Ditylum (West) Grunow

D. brightwellii (West) Grun. (Cupp, p. 148)
All months at all estuarine stations below Y-25, once in Nov. 1961 at station 700 II; salinity, 7.5 to 28.6°/oo; temp., 1.7 to 28.5°C. In Jan., Aug., Sept., Oct. and Nov. 1960 at stations Y-0, #3, #4 and #5 this species was among the three dominant diatoms. This species checked with type slide ANSP, Boyer, P. Klavsen slide F-5-20.

Eucampia Ehrenberg

E. cornuta (Cl.) Grun. (Cupp, p. 146)
Aug. and Sept. 1960 at stations #3, #4 and #5; salinity, 20.4 to 29.5°/oo; temp., 23.6 to 27.3°C.

E. zoodiacus Ehr. (Cupp, p. 145)
Fragilaria Lyngbye

*F. pinnata* Ehr. (Cl-Euler, Vol. III, p. 37)
Once in March 1961 at station Y-0; salinity, 17.9°/oo; temp., 8.5°C.

Frustulia Agardh

*F. vulgaris* (Thw.) DeToni (B2, p. 72)
Once in June 1961 at station Y-0; salinity, 16.7°/oo; temp., 20.5°C.

Grammatophora Ehrenberg

*G. marina* Kutz. (Cupp, p. 174)
Jan., Feb., March, Aug. and Oct. 1960 and 1961 at stations Y-7, Y-0 and #4; salinity, 15.9 to 32.0°/oo; temp., 2.0 to 24.9°C.

Guinardia H. Peragallo

*G. flaccida* (Cast.) Perag. (Cupp, p. 78)
Jan. through June, Sept., Oct. and Dec. 1960 and 1961 at stations Y-7, Y-0, #3, #4 and #5, March, April and Oct. at stations 700 II, 700 VI, 720 IV, 720 VI and 720 VIII; salinity, 14.3 to 32.9°/oo; temp., 2.0 to 27.0°C. In May and June 1960 at stations #3, #4 and #5 and then in April 1961 at station 720 IV this species was among the three dominant diatoms.

Gyrosigma Hassall

*G. balticum* (Ehr.) Cl. (Cl-Euler, Vol. II, p. 11)
All months except July 1960 and 1961 at stations Y-0, Y-7, Y-14, Y-20, #3, #4 and #5; salinity, 4.1 to 23.1°/oo; temp., 1.7 to 28.5°C.

*G. diaphanum* Cl. (Cl-Euler, Vol. II, p. 12)
April and June 1961 at stations Y-0 and Y-7; salinity, 15.3 to 16.7°/oo; temp., 9.7 to 23.1°C.

*G. fasciola* (Ehr.) Cl. (Per, p. 173)
Feb. through July, Sept. and Dec. 1960 and 1961 at all stations except #3, #5, Y-25 and P-40; salinity, 4.1 to 22.2°/oo; temp., 2.0 to 28.5°C.
Gyrosigma (continued)

**G. simile** Grun. (B², p. 76)
May, June, Aug., Sept. and Dec. 1960 and 1961 at stations Y-0, Y-14, #3 and #5; salinity, 16.5 to 24.1°/oo; temp., 7.9 to 27.0°C.

**G. spenceri** (Quekett) Cl. (Cupp, p. 194)
Feb., March, April, May and Aug. 1960 and 1961 at stations Y-0, Y-7, Y-14 and #5; salinity, 4.1 to 22.3°/oo; temp., 4.5 to 27.3°C.

**G. wansbeckii** (Donk.) Cl. ? (Cl-Euler, Vol. II, p. 11)
Once in March 1961 at station Y-0; salinity, 17.9°/oo; temp., 8.5°C.

**Hemiaulus** Ehrenberg

**H. hauckii** Grun. (Cupp, p. 168)
Aug. and Sept. 1960 at stations #3, #4 and #5; salinity, 20.4 to 28.00°/oo; temp., 23.7 to 26.5°C.

**H. sinensis** Grev. ? (Cupp, p. 168)
Aug. 1960 at station #5; salinity, 28.00°/oo; temp., 26.5°C.

**Lauderia** Cleve

**L. borealis** Gran (Cupp, p. 74)
Sept. 1960 at stations #3, #4 and #5, Oct. and Nov 1961 at stations 700 II, 720 IV, 720 VI and 720 VIII; salinity, 20.4 to 32.9°/oo; temp., 16.0 to 24.2°C.

**Leptocylindrus** Cleve

**L. danicus** Cl. (Cupp, p. 78)
All months except May, June and Dec. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5, March, Oct. and Nov. 1961 at stations 700 II, 700 VI and 720 VIII; salinity, 10.8 to 32.9°/oo; temp., 2.5 to 28.5°C.
Licmophora Agardh

L. abbreviata Ag. (Cupp, p. 177)
Feb. through Aug. 1960 and 1961 at stations Y-0, Y-7 and Y-14; salinity, 4.2 to 21.0/oo; temp., 5.6 to 29.0°C.

L. lyngbyei (Kutz.) Grun. (VH, pl. 47)
Jan., Feb., April, May, Oct., Nov. and Dec. 1960 and 1961 at stations Y-0, Y-7 and Y-14; salinity, 7.5 to 21.0/oo; temp., 2.5 to 22.0°C.

Lithodesmium Ehrenberg

L. undulatum Ehr. (Cupp, p. 151)
March through June, Aug. through Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, Oct. and Dec. 1961 at stations 720 II, 720 IV and 700 II; salinity, 17.9 to 31.5/oo; temp., 8.1 to 26.0°C.

Mastogloia Thwaites

M. brauni Grun. ? (B2, p. 87)
Once in Feb. 1960 at station #3; salinity, 18.4/oo; temp., 5.6°C.

M. lanceolata Thw. ? (B2, p. 87)
Once in Aug. 1961 at station Y-0; salinity, 19.4/oo; temp., 26.0°C.

Melosira Agardh

M. borreri Grev. (B2, p. 17)
Aug. and Oct. 1960 and 1961 at stations Y-0 and Y-7; salinity, 16.3 to 32.0/oo; temp., 18.8 to 27.4°C.

M. jurgensii (Grun.) Schutt (CI-Euler, Vol. I, p. 30)
All months 1960 and 1961 at stations Y-0, Y-7, Y-14, Y-20, #3 and #4, once in Aug. 1961 at station 700 IV; salinity, 7.5 to 30.2/oo; temp., 2.0 to 29.0°C.

M. lineata (Dillw.) Ag. (CI-Euler, Vol. I, p. 29)
Once in Aug. 1961 at stations Y-7 and Y-14; salinity, 19.3 to 20.2/oo; temp., 27.0°C.
Melosira (continued)

M. lirata (Ehr.) Grun. (Cl-Euler, Vol. I, p. 23)
Once in Jan. 1960 at station #5; salinity, 26.2°/oo; temp., 4.5°C.

M. nummuloides (Dillw.) Ag. (Cl-Euler, Vol. I, p. 32)
Once in Sept. 1961 at station Y-7; salinity, 20.0°/oo; temp., 22.0°C.

M. sulcata (Ehr.) Kutz. (Cupp, p. 40)
All months 1960 and 1961 at all stations except Y-25 and P-40, March, April and Dec. at stations 700 II, 700 VI and 720 IV; salinity, 7.5 to 32.9°/oo; temp., 2.5 to 29.0°C.

Navicula Bory

N. inflexa Greg. (B, p. 387)
March 1960 at stations #3 and #5; salinity, 17.9 to 22.2°/oo; temp., 2.5 to 29.0°C.

N. irrorata W. Sm. (Hust, p. 24)
March and May 1960 at stations Y-7 and #3, once in Oct. 1961 at station 720 IV; salinity, 15.9 to 31.4°/oo; temp., 3.9 to 21.2°C.

N. lyra dilatata A. S. (B2, p. 93)
May, Aug. and Oct. 1960 at stations #4 and #5; salinity, 18.4 to 23.1°/oo; temp., 19.7 to 27.2°C.

N. maculata (Bail.) Cl. (B2, p. 90)
Once in Feb. 1960 at station Y-0; salinity, 19.5°/oo; temp., 3.8°C.

N. punctata W. Sm. (B, p. 385)
Once in March 1960 at station Y-7; salinity, 19.5°/oo; temp., 3.9°C.

N. spicula (Hickis) Cl. (Cl-Euler, Vol. II, p. 17)
Jan., Feb., March, April, June and July 1960 and 1961 at stations Y-0, Y-14, Y-25, #3 and #5; salinity, 4.2 to 22.6°/oo; temp., 2.5 to 28.5°C. This species checked with type slide ANSP, Van Heurck, 368.

N. tuscula Ehr. (B, p. 385)
Once in April 1961 at station Y-0; salinity, 16.3°/oo; temp., 9.7°C.
Navicula (continued)

N. yarrensis Grun. (B², p. 101)
Feb. 1961 at station Y-14; salinity, 4.2/oo; temp., 9.8°C.

Nitzschia Hassell

N. acicularis (Kutz.) W. Sm. ? (B², p. 123)
Once in March 1961 at station Y-7; salinity, 15.3/oo; temp., 9.0°C.

N. adducta Hust. ? (Hust, p. 43)
Once in Feb. 1960 at station Y-7; salinity, 19.5/oo; temp., 3.9°C.

N. circumsuta (Bail.) Grun. (B², p. 118)
Feb., Nov., and Dec. 1960 and 1961 at stations Y-7, Y-14 and Y-0; salinity, 17.3 to 20.7/oo; temp., 3.9 to 11.0°C.

N. closterium (Ehr.) W. Sm. (Cupp, p. 200)
All months except July 1960 and 1961 at all stations except P-40, once in Oct. 1961 at station 720 IV; salinity, 4.2 to 31.5/oo; temp., 2.5 to 28.5°C.

N. litoralis delawarensis Grun. ? (B², p. 118)
Once in Feb. 1961 at station Y-0 and Y-14; salinity, 14.0 to 19.0/oo; temp., 5.6 to 6.2°C.

N. longissima (Brebi.) Ralfs (Cupp, p. 200)
All months except Jan. and Oct. 1960 and 1961 at stations Y-14, Y-7, Y-0 and #4; salinity, 4.2 to 21.4/oo; temp., 5.6 to 29.0°C.

N. panduriformis Greg. (V H, pl. 58)
April and July 1961 at stations Y-7 and Y-14; salinity, 12.5 to 12.7/oo; temp., 9.7 to 29.0°C.

N. paradoxa Gmel. (Cupp, p. 207)
All months 1960 and 1961 at all stations except P-40; salinity, 4.2 to 23.6/oo; temp., 2.5 to 28.5°C.

N. punctata (W. Sm.) Grun. (B², p. 116)
Once in Dec. 1961 at station Y-0; salinity, 22.2/oo; temp., 7.9°C.
Nitzschia (continued)

N. pungens atlantica Cl. (Cupp, p. 202)
All months 1960 and 1961 at all estuarine stations except P-40, Oct., Nov. and Dec. 1961 at stations 700 II, 700 IV, 700 VI, 720 II and 720 IV; salinity, 7.5 to 33.8/o/o; temp., 2.5 to 23.1°C. This species was among the three dominant diatoms from Jan., through June 1960 and 1961. It is much like Pseudonitzschia seriata but is more spindle-shaped with finer striae and greater overlap of frustules.

N. sigma (Kutz.) W. Sm. (B2, p. 121)
Feb., March, April and June 1960 at stations Y-7, #3, #4 and #5; salinity, 16.0 to 22.3/o/o; temp., 4.7 to 24.5°C.

N. sigmoidea Ehr. (Cl-Euler, Vol. II, p. 72)
Nov. through April and Aug. 1960 and 1961 at stations Y-0, Y-7 and Y-14; salinity, 16.3 to 21.2/o/o; temp., 2.5 to 25.9°C.

Plagiogramma Greville

P. vanheurckii Grun. (Cupp, p. 180)
Feb., March, April and June 1961 at stations Y-0, Y-7 and Y-14; salinity, 14.0 to 21.0/o/o; temp., 5.6 to 23.1°C.

Planktoniella Schutt

P. sol (Wallich) Schutt (Cupp, p. 63)
Aug. 1960 at station #5; salinity, 29.5/o/o; temp., 23.8°C.

Pleurosigma W. Smith

P. angulatum W. Sm. (Cl-Euler, Vol. II, p. 23)
All months 1960 and 1961 at all estuarine stations except P-40, March, April, Oct. and Dec. 1961 at stations 700 II, 700 IV and 720 IV; salinity, 4.2 to 32.9/o/o; temp., 2.5 to 29.0°C.

P. formosum W. Sm. (Cl-Euler, Vol. II, p. 20)
Jan. through July 1960 and 1961 at stations Y-7, Y-0 and #5; salinity, 15.8 to 26.2/o/o; temp., 3.8 to 29.0°C.

P. nubecula W. Sm. ? (B, p. 473)
Once in March 1961 at station Y-14; salinity, 13.2/o/o; temp., 9.1°C.
Pseudonitzschia Cleve

P. seriata Cl. (Cupp, p. 201)
Jan. through April, June and Aug. 1960 and 1961 at stations Y-0, Y-7, Y-14 and #3, Oct. and Nov. 1961 at stations 700 IV, 720 IV, 720 VI and 720 VIII; salinity, 10.8 to 32.9‰; temp., 2.5 to 27.0°C. This species checked with type slide ANSP, Boyer, P. Klavsen slide, F-5-22.

Rhabdonema Kutzing

R. adriaticum Kutz. (Cl-Euler, Vol. III, p. 6)
Feb. through Aug., Oct. and Nov. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5; salinity, 12.7 to 23.5‰; temp., 3.8 to 28.0°C.

Rhaphoneis Ehrenberg

R. amphiceros Ehr. (Per, p. 329)
Jan. through May and Aug. through Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, once in Oct. 1961 at station 720 II; salinity, 16.3 to 29.5‰; temp., 1.7 to 17.2°C.

R. belgica Grun. (B, p. 190)
Feb., June, Aug., Oct., Nov. and Dec. 1960 and 1961 at stations Y-0, #3, #4 and #5; salinity, 16.2 to 28.0‰; temp., 4.3 to 26.5°C.

Rhizosolenia (Ehrenberg) Brightwell

R. alata Brightw. (Cupp, p. 92)
All months except Dec. 1960 and 1961 at all estuarine stations except Y-25 and P-40, March, April and July through Dec. at all offshore stations; salinity, 10.8 to 32.9‰; temp., 3.8 to 23.2°C. This species in the ocean samples was among the three dominant diatoms from July through Sept. at all stations and again in Dec. at stations 700 II and 700 IV. It was among the three dominant diatoms in the estuary only in Jan. 1961 at station Y-0.
Rhizosolenia (continued)

**R. calcar avis** Schultze (Cupp, p. 89)
All months except July 1960 and 1961 at all estuarine stations except Y-25 and P-40, Sept. and Oct. 1961 at stations 700 VIII, 720 VI and 720 VIII; salinity, 10.8 to 32.9°/oo; temp., 1.7 to 26.8°C. This species was among the three dominant diatoms in the estuary in Feb., March and April 1960.

**R. cylindrus** Cl. (Cupp, p. 80)
Oct. 1961 at station 720 VIII; salinity, 32.9°/oo; temp., 18.0°C.

**R. delicatula** Cl. (Cupp, p. 83)
March and April 1961 at stations Y-0 and Y-7; salinity, 12.8 to 17.9°/oo; temp., 8.1 to 10.1°C.

**R. fragilissima** Bergon. (Cupp, p. 80)
Feb., March, April and Nov. 1960 and 1961 at stations Y-0, Y-7, #3 and #5; salinity, 10.8 to 18.4°/oo; temp., 5.6 to 10.1°C. This species in the estuary was among the three dominant diatoms in March 1961 at station Y-0.

**R. imbricata** Brightw. (Cl-Euler, Vol. I, p. 89)
Jan. through April and Aug. through Nov. 1960 and 1961 at stations Y-0, Y-7, Y-14, #3, #4 and #5, March, April, Oct. and Nov at stations 700 II, 700 VI, 720 II, 720 IV, 720 VI and 720 VIII; salinity, 10.8 to 33.3°/oo; temp., 1.7 to 18.0°C. This species in the estuary was among the three dominant diatoms from Jan. through April 1960 and 1961 at stations Y-0 and #4.

**R. imbricata shrubsolei** (Cl.) Schroder (Cupp, p. 84)
Jan. through March 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5; salinity, 15.6 to 27.2°/oo; temp., 3.8 to 6.3°C.

**R. setigera** Brightw. (Cupp, p. 88)
All months 1960 and 1961 at all estuarine stations except Y-25 and P-40, March, July, Oct., Nov. and Dec. 1961 at stations 700 II, 700 IV, 700 VI, 720 IV, 720 VI and 720 VIII; salinity, 10.8 to 33.4°/oo; temp., 2.5 to 29.0°C. This species was among the three dominant diatoms in the estuary 1960 and 1961 at stations Y-14, Y-7, Y-0 and #3 from Jan. through April and Oct. through Dec.

**R. stolterfothii** Perag. (Cupp, p. 83)
Jan., March, July through Oct. at stations #3, #4 and #5; salinity, 20.0 to 28.0°/oo; temp., 2.4 to 27.2°C.
Rhizosolenia (continued)

*R. styliformis* Brightw. (Cupp, p. 87)
Jan., Feb., March, May and Sept. 1960 and 1961 at stations Y-0, Y-7, #3 and #5, Sept., Oct. and Dec. at stations 700 VI, 700 VIII, 720 II, 720 VI and 720 VIII; salinity, 15.6 to 32.9/o/o; temp., 2.5 to 28.5°C.

Rhopalodia O'Muller

*R. gibberula* Ehr. (Cl-Euler, Vol. II, p. 32)
Feb. and March 1960 and 1961 at stations Y-0 and Y-7; salinity, 10.8 to 21.0/o/o; temp., 5.4 to 9.5°C.

Schroderella Pavillard

*S. delicatula* Perag. (Cupp, p. 76)
Jan., Feb., March, Oct., Nov. and Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, Nov. 1961 at station 700 II; salinity, 21.4 to 30.9/o/o; temp., 4.2 to 19.7°C.

Skeletonema Greville

*S. costatum* (Grev.) Cl. (Cupp, p. 43)
All months 1960 and 1961 at all estuarine stations except P-40, Sept. through Dec. 1961 at all offshore stations except 720 II; salinity, 10.8 to 33.8/o/o; temp., 1.7 to 29.0°C. This species in the estuary is among the three dominant diatoms from Jan. through Dec. with the exception of Nov., offshore it becomes abundant in Oct. and Nov. It checked with type slide ANSP, Boyer, P. Klavsen slide F-5-25.

*S. subsalsum* (Cl.) Bethge. ? (Cl-Euler, Vol. I, p. 40)
March and Dec. 1961 at stations Y-0 and Y-7; salinity, 15.6 to 22.2/o/o; temp., 7.9 to 9.7°C. The author was unsure of the validity of this species.

Stephanodiscus Ehrenberg

*S. astraea* (Ehr.) Grun. ? (V H, pl. 95)
Once in May 1961 at station Y-0; salinity, 15.2/o/o; temp., 13.5°C.
Stephanopyxis Ehrenberg

*S. turris* (Grev. and Arn.) Ralfs (Cupp, p. 40)
April, Aug., Oct., Nov. and Dec. 1960 and 1961 at stations Y-0, #3, #4 and #5. Oct., Nov. and Dec. at stations 700 II, 700 VI, 720 II, 720 IV, 720 VI and 720 VIII; salinity, 16.3 to 32.9‰; temp., 10.1 to 18.0°C. Offshore this species was among the three dominant diatoms in Nov. at station 700 VI.

Striatella Agardh

*S. interrupta* Ehr. (Cl-Euler, Vol. III, p. 8)
Feb., April, July and Aug. at stations Y-0, Y-7 and Y-14; salinity, 12.1 to 19.4‰; temp., 5.6 to 29.0°C.

*S. unipunctata* (Lyng.) Ag. ? (Cupp, p. 173)
March, Nov. and Dec. 1960 and 1961 at stations Y-0, Y-7 and #3; salinity, 19.5 to 21.4‰; temp., 3.9 to 8.2°C.

Surirella Turpin

*S. gemma* Ehr. (Cl-Euler, Vol. II, p. 177)
Jan., Feb., April, May, June, July, Aug. and Nov. 1960 and 1961 at stations Y-0, Y-7, Y-14 and #5; salinity, 4.2 to 22.6‰; temp., 2.5 to 27.0°C.

*S. litoralis* Hust. (Hust, p. 48)
Feb. and March 1960 and 1961 at stations Y-0 and Y-7; salinity, 15.4 to 17.3‰; temp., 1.7 to 5.9°C.

*S. robusta marginata* (Ehr.) Cl. (Cl-Euler, Vol. II, p. 102)
Feb., March and April 1961 at stations Y-7 and Y-14; salinity, 7.5 to 16.3‰; temp., 9.0 to 10.1°C.

Terpsinoe Ehrenberg

*T. americana* (Bail.) Ralfs ? (B2, p. 34)
Once in June 1961 at station Y-7; salinity, 15.5‰; temp., 23.4°C.
**Thalassionema** Grunow

*T. nitzschioides* Grun. (Cupp, p. 182)
All months at all estuarine stations except P-40, March, Oct.
and Dec. 1961 at stations 700 II, 700 VI, 720 IV, 720 VI and
720 VIII; salinity, 10.8 to 32.9°/oo; temp., 2.5 to 29.0°C.
This species was among the three dominant diatoms from Jan.
through May then in Aug. and Dec. at stations Y-7, Y-0 and
#3.

**Thalassiosira** Cleve

*T. aestivalis* Gran and Angst. (Cupp, p. 47)
Feb., March and April 1960 and 1961 at stations Y-7, #3 and
#4; salinity, 16.6 to 20.4°/oo; temp., 2.2 to 10.8°C.

*T. balticus* Grun. (Cl-Euler, Vol. I, p. 73)
stations Y-0, Y-7, Y-14, #3 and #4; salinity, 10.8 to 21.2°/oo;
 temp., 2.5 to 29.0°C.

*T. decipiens* (Grun.) Jorg. (Cupp, p. 48)
March and Dec. 1960 and 1961 at stations Y-0, Y-7 and Y-14;
salinity, 15.2 to 22.2°/oo; temp., 7.9 to 9.5°C.

*T. kryophila* (Grun.) Jorg. (Cl-Euler, Vol. I, p. 73)
Jan. through April 1960 and 1961 at stations Y-7, Y-0, #4 and
#5; salinity, 10.8 to 21.2°/oo; temp., 2.5 to 10.1°C.

*T. nordenskioldii* Cl. (Cupp, p. 46)
Jan., March, April and Oct. 1960 and 1961 at stations Y-0,
Y-7, #3, #4 and #5, once in March 1961 at station 700 VI;
salinity, 16.9 to 35.2°/oo; temp., 10.7 to 19.2°C. This species
was among the three dominant diatoms in March at station 700 VI.
It checked with type slide ANSP, Boyer, P. Klavsen slide G-5-18
and G-5-21.

*T. rotula* Muenier (Cupp, p. 49)
at all estuarine stations except Y-20, Y-25 and P-40, once in
Oct. at station 720 VI; salinity, 10.8 to 22.2°/oo; temp., 2.5
to 27.0°C.

*T. subtilis* (Ostenf.) Gran ? (Cupp, p. 49)
Oct. and Nov. 1961 at station 700 II; salinity, 28.6 to 31.0°/oo;
temp., 16.0 to 20.0°C.
Thalassiothrix Cleve and Grunow

*Thalassiothrix frauenfeldii* (Grun.) Cl. (Cupp, p. 184)

Jan., Feb., March, Aug., Oct. and Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, March, April, Aug. and Dec. 1961 at stations 700 II, 700 IV, 700 VI and 720 VI, salinity, 15.8 to 35.2°/oo; temp., 2.5 to 27.0°C.

Triceratium Ehrenberg

*Triceratium favus* Ehr. (Cl-Euler, Vol. I, p. 113)

Feb. through Dec. 1960 and 1961 at stations Y-0, Y-7, #3, #4 and #5, once in Oct. 1961 at stations 700 II, 720 II and 720 IV; salinity, 12.1 to 31.5°/oo; temp., 7.9 to 27.0°C.

Tropidoneis Cleve

*Tropidoneis lipidoptera* (Greg.) Cl. (Cupp, p. 197)

Once in March 1961 at station Y-14; salinity, 13.2°/oo; temp., 9.1°C.
From the prepared slides of the net phytoplankton the three most abundant diatoms were selected for each station and date sampled. The following list is a compilation of these species for a two-year period and the months in which they appeared abundantly. The "x" represents most abundant species inshore only, the asterisk "*" most abundant species offshore only. Both symbols indicate most abundant species both offshore and inshore.

<table>
<thead>
<tr>
<th>DIATOMS</th>
<th>MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletonema costatum (Grev.) Cl.</td>
<td></td>
</tr>
<tr>
<td>Nitzschia pungens atlantica Cl.</td>
<td></td>
</tr>
<tr>
<td>Asterionella japonica Cl. and Moll.</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia setigera Brightw.</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia imbricata Brightw.</td>
<td></td>
</tr>
<tr>
<td>Thalassionema nitzschioides Grun.</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia alata Brightw.</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia styliformis Brightw.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros septentrionalis Oestrup</td>
<td></td>
</tr>
<tr>
<td>Ditylum brightwellii (West) Grun.</td>
<td></td>
</tr>
<tr>
<td>Cerataulina bergonii Perag.</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia calcar avis Schultze</td>
<td></td>
</tr>
<tr>
<td>Rhizosolenia fragilissima Bergon</td>
<td></td>
</tr>
<tr>
<td>Thalassiosira nordensioidii Cl.</td>
<td></td>
</tr>
<tr>
<td>Guinardia flaccida (Cast.) Perag.</td>
<td></td>
</tr>
<tr>
<td>Coscinodiscus asteromphalus Ehr.</td>
<td></td>
</tr>
<tr>
<td>Coscinodiscus perforatus Ehr.</td>
<td></td>
</tr>
<tr>
<td>Actinocyclus ehrenbergii Ralfs</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros subtilis Cl.</td>
<td></td>
</tr>
<tr>
<td>Bacteriastrium delicatulum Cl.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros compressus Laud.</td>
<td></td>
</tr>
<tr>
<td>Biddulphia mobiliensis (Bail.) Grun.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros danicus Cl.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros lorenzianus Grun.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros didymus Ehr.</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros glandazi Mangin</td>
<td></td>
</tr>
<tr>
<td>Corethron hystrix Hensen</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros curvisetus Cl.</td>
<td></td>
</tr>
<tr>
<td>Stephanopyxis turris (Grev. and Arn.) Ralfs</td>
<td></td>
</tr>
<tr>
<td>Chaetoceros affinis Laud.</td>
<td></td>
</tr>
</tbody>
</table>


* Abbreviations in parentheses before author's name refers to taxonomic references in text.


(Temp) Tempere, J. 1890-1893. Le Diatomiste.

