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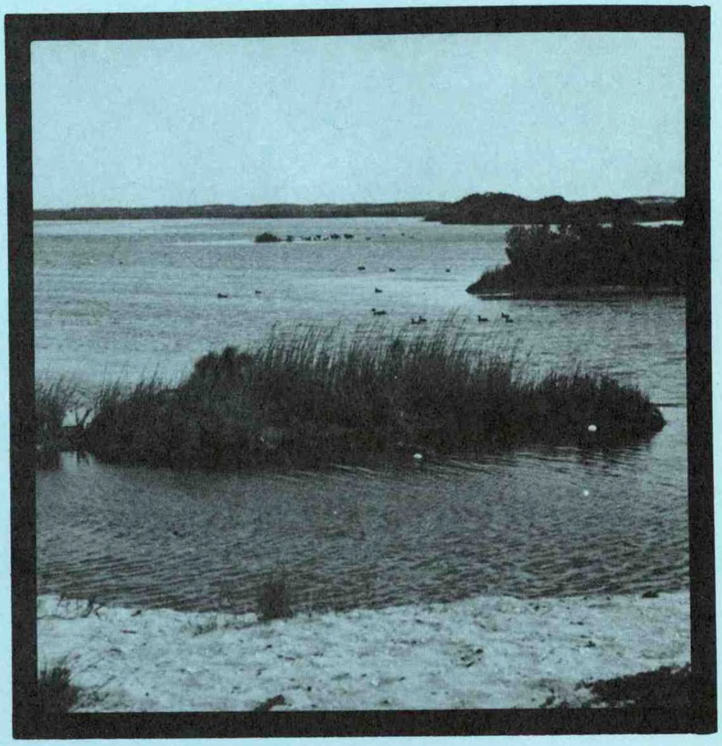
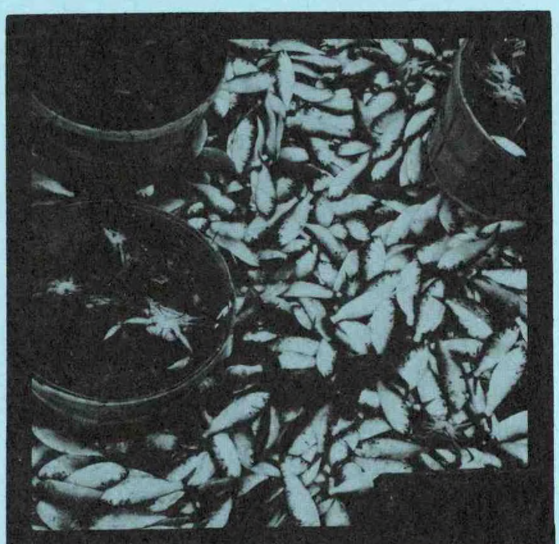
Marine Environmental Assessment

CHESAPEAKE BAY

MARCH – MAY 1985





U.S. DEPARTMENT OF COMMERCE
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CLIMATE IMPACT ASSESSMENT
UNITED STATES

The AISC/Marine Environmental Assessment Division (MEAD), Marine Assessment Branch (MAB), produces periodic assessments of weather impacts on economic sectors of marine environmental activity. The Chesapeake Bay region served as a prototype for assessment development. From September 1981 through March 1982, MAB issued monthly assessments of Chesapeake Bay in the economic sectors of fisheries, recreation, and transportation. We now issue quarterly assessments in order to extend the service to other marine areas within existing resource limitations. Once each year we publish an Annual Summary giving a longer-term perspective of the impacts for the calendar year.

Please send any comments or subscription queries to the Chief, Marine Assessment Branch, Marine Environmental Assessment Division, NOAA/NESDIS/AISC, E/AI32, 3300 Whitehaven Street, NW, Washington, DC 20235, or call (202) 634-7379.

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Marine Environmental Assessment
CHESAPEAKE BAY
MARCH – MAY 1985

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Marine Assessment Branch
Marine Environmental Assessment Division

Washington, D.C.
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CHESAPEAKE BAY MARINE ASSESSMENT

The marine ecosystem exhibits many complex interrelationships which are difficult to measure. Climatic events do not often produce an obvious immediate response in the marine environment. The extended intervals that frequently exist between a climate event and the observed impact present a problem different from the land oriented assessments Assessment and Information Services Center (AISC) produces. This difference necessitates relating changes in climatic variables to marine environmental changes on a quarterly basis. For Chesapeake Bay, June through August covers the warm, relatively stable summer months; September through November covers the dynamic fall period of decreasing temperatures and water column turnover and vertical mixing; December through February covers the cold winter period; and March through May covers the dynamic spring period of increasing temperatures and nutrient enrichment.

The AISC effort in Chesapeake Bay is a first step toward providing operational marine assessments for major water bodies within and adjacent to the United States.

Table 1.--Environmental impact summary, Chesapeake Bay, March - May 1985.

IMPACT SECTOR

EVENT	FISHERIES: Finfish harvest activities (General)	Shellfish harvest activities (General)	Bluefish arrival	Blue crab harvest	Occurrence high salinity species	Shellfish diseases		RECREATION: Park usage	Boating activity	Safety	Stinging nettles		TRANSPORTATION: Port operations	Cost to shippers				
High salinity					+	-					-							
Low rainfall	+	+			+	-					-							
Low streamflow					+	-					-							
High air temperature								+	+									
High water temperature			+	+														
High winds March & April													-	-				

[+] Favorable

[-] Unfavorable

[ ] No identifiable effect, data unavailable, or not applicable

Chesapeake Bay Marine Environment

1. Highlights - General Events and Impacts

Low rainfall over most of the spring 1985 quarter provided favorable conditions for finfish and shellfish harvest activities. Extremely dry conditions and higher-than-normal salinities prevailed in spring 1985, contrasting sharply with the wet spring in 1984. High numbers of cownosed rays, a species which normally prefers higher salinities, were reported in the upper Bay.

The high salinities had no immediate effects on major commercial Bay species, though the increase in salinity may have some effect on distribution and survival of certain species. Scientists are closely monitoring oysters for signs of MSX disease, an organism which has shown severe outbreaks in some past years which had higher salinities.

Bluefish arrived earlier than normal in spring 1985 as water temperatures warmed rapidly. Bluefish closely follow the movement of the 12°-15°C temperature band which moved up the coast to the Bay mouth two weeks earlier than normal in spring 1985.

Warm air temperatures and low rainfall provided favorable conditions for all categories of marine-related recreation. Stinging nettles, which detract from swimming and other activities, are expected in high numbers in summer 1985. High salinities provided favorable conditions for development of the nettles during spring 1985.

Shipping companies incurred increased costs due to productive time lost because of excessive winds at the Port of Baltimore. Shippers may have experienced in excess of $394,880 in costs due to excessive winds from crane down time. Conditions were windier in March and April 1985 than in the same months in 1984.

2. Weather and Oceanography Summary

2.1 Weather

The spring 1985 quarter was dry (32 percent below normal for the quarter) and warm (3°F above normal for the quarter). Precipitation in the first two months was well below-normal, plunging to extremely dry conditions during April. Five Bay area stations showed the driest April conditions ever recorded. (Figure 1 and Table 2). Conditions remained dry until the last half of May when rainfall was above-normal. The dryness of the quarter contrasts sharply with the abundant rainfall throughout the 1984 spring quarter. Temperatures in each month of the 1985 spring quarter were above normal, especially in April when moisture was least, contrasting with lower-than-normal temperatures during all months of the same quarter in 1984. Daily high temperature records were established at several stations during both March and April.

March:

Warmer than normal temperatures and less than normal precipitation prevailed at all stations during the month. Temperatures reached record highs at Patuxent on the 28th and 29th.

Six frontal storms passed through the Chesapeake Bay area during March, the majority of them bring little precipitation. A storm system over the 22nd to the 25th provided most of the month's rain to the region, bringing in excess of one inch of rainfall to most stations, and a storm at the end of the month brought from one half to one inch of rain to many of the stations. Cold fronts moved through the area on the 15th and 20th; warm fronts passed through on the 8th and the 27th.

Precipitation totals for the month were below normal for all stations ranging from -15 percent (Wilkes-Barre), to -62 percent (Aberdeen).

Temperatures averaged 2.9°F above normal for the stations with departures from normal ranging from +1.0°F at Washington to +43.°F above at Aberdeen (Table 2).

Winds gusted to 51 mph at Patuxent during the storm on the 12th. Wind gusts reached or exceeded 30 mph at Patuxent on six occasions.

April:

Weather throughout the Chesapeake Bay area was very warm and extremely dry during April. April 1985 was the driest April of record in the Washington - Baltimore area, and the driest month of record at Washington.

April opened with 3 storms in 8 days but each storm yielded very little precipitation.

Precipitation in April averaged only 0.63 inches, 80 percent below normal, among the 11 stations in the region. Precipitation occurred frequently throughout the month, but amounted to only a trace or a few hundredths of an inch on most of the occasions. Individual totals ranged from 0.03 inches at Washington

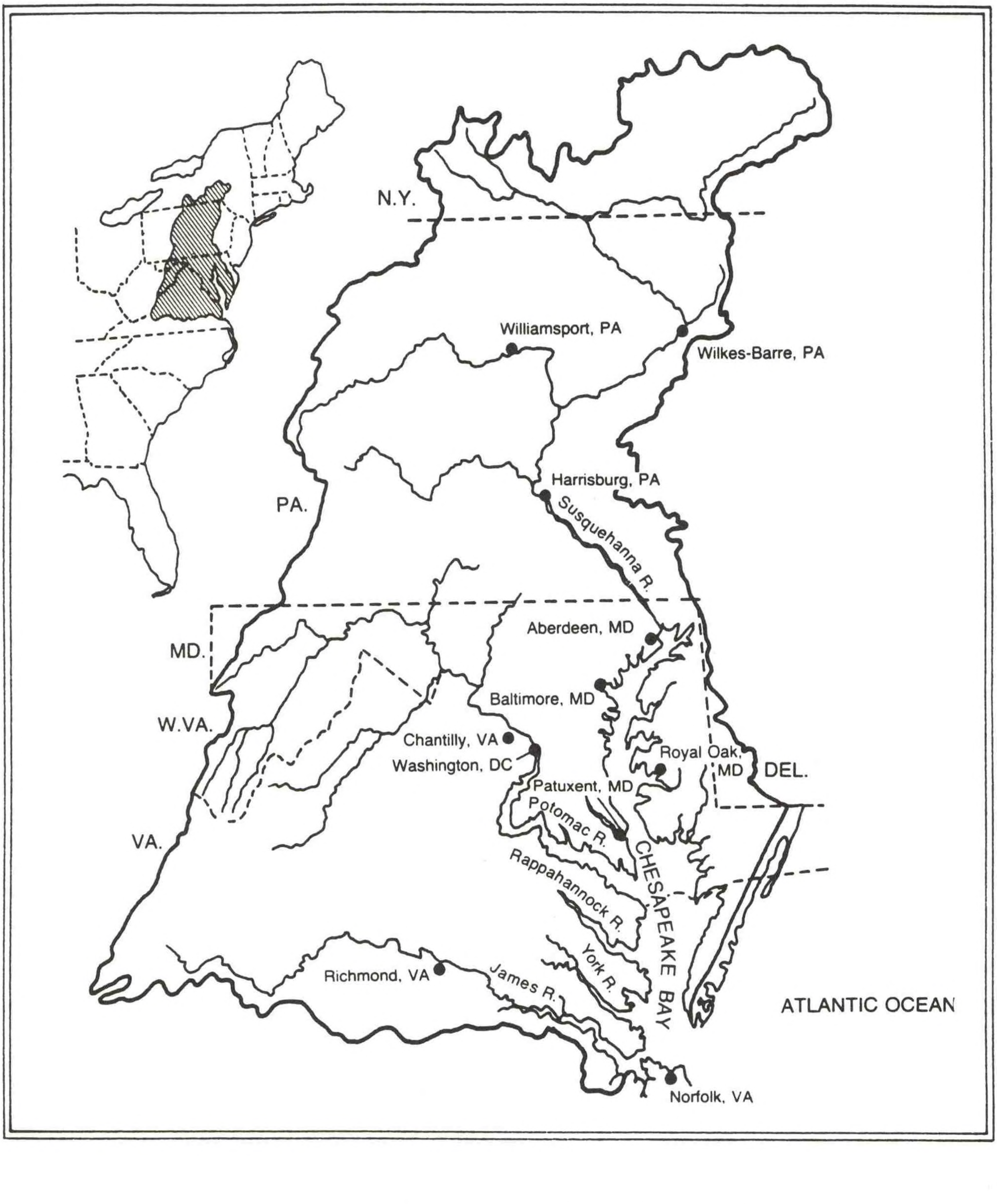


Figure 1. Selected meteorological stations, Chesapeake Bay watershed (Modified EPA map).

Table 2.--Total precipitation, mean air temperatures, and departures from normal for 11 stations, Chesapeake Bay watershed, March - May 1985.

Station	Total Precipitation (inches) and Departure from Normal Observed/*Anomaly (% of normal)			Air Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	March	April	May	March	April	May
Williamsport, PA	2.81/-23%	1.18/-67%	3.98/+9%	40.1/+2.5	53.3/+3.7	61.0/+1.4
Wilkes-Barre, PA	2.24/-15%	2.00/-34%	6.10/+93%	39.1/+3.0	51.4/+3.1	60.6/+2.0
Harrisburg, PA	2.78/-21%	0.45/-86%	6.29/+71%	44.5/+3.9	56.9/+4.7	65.1/+3.1
Aberdeen, MD	1.39/-62%	0.45/-87%	4.25/+21%	47.0/+4.3	58.6/+5.3	66.6/+3.5
Baltimore, MD	2.37/-36%	0.39/-88%	6.01/+75%	46.0/+2.7	57.9/+3.9	65.1/+1.7
Washington, DC	1.88/-46%	0.03/-99%	5.81/+67%	47.7/+1.9	61.6/+4.9	68.1/+2.1
Chantilly, VA	1.70/-50%	0.33/-89%	4.82/+33%	45.0/+2.6	57.1/+3.8	63.8/+1.4
Royal Oak, MD	1.63/-60%	0.57/-83%	4.51/+24%	48.4/+3.2	59.3/+3.5	66.9/+1.7
Patuxent, MD	2.02/-41%	0.42/-85%	4.15/+12%	48.5/+2.5	59.7/+4.7	66.8/+1.8
Richmond, VA	1.80/-50%	0.65/+78%	2.36/-34%	49.7/+2.5	62.0/+4.1	68.0/+1.9
Norfolk, VA	2.02/-48%	0.43/-85%	3.23/-14%	51.8/+3.3	62.0/+3.8	68.8/+2.4
Average	2.06/-42%	0.63/-80%	4.68/+31%	46.2/+2.9	58.2/+4.1	65.5/+2.1

*Anomaly = departure from 30-year average for each month.

(99 percent below normal) to 2.00 inches at Wilkes-Barre (34 percent below normal). April 1985 was the driest April or record at Harrisburg, Baltimore, Washington, Chantilly, and Norfolk, and second driest month on record at Washington, D.C.

Temperatures among the 11 stations showed extreme readings at both high and low scale, but averaged 4.1°F above-normal, ranging from 3.1°F above-normal at Wilkes-Barre to 5.3°F above-normal at Aberdeen. Most stations recorded their lowest temperature for the month on the 10th. Harrisburg and Richmond achieved record daily lows on the 10th, while Patuxent and Richmond each achieved record daily highs on the 19th. Daily high temperature records were set at seven stations on the 22nd.

Wind gusts reached or exceeded 30 mph at Patuxent five times and at Royal Oak twice during April. A peak gust of 39 mph was recorded at Patuxent during the storm on the 6th. Gusts reached 31 mph and 34 mph on the 8th and 9th, respectively at Royal Oak.

May:

May had above-average precipitation at all stations except at the southern Bay area. Temperatures throughout the region were above-normal.

Cold frontal systems passed through the Bay area seven times during May, often in combination with low pressure systems. A cold front reached the area on May 1st and became an elongated low pressure system over the 2nd and 3rd bringing considerable precipitation to much of the area. Precipitation of one inch or more fell at the stations over the 16th and 17th. Another low pressure system over the 23rd and 24th brought precipitation amounts of one inch or more to the area.

Rainfall was heavier in the northern and central part of the region ranging from 93 percent above-normal at Wilkes-Barre, to 34 percent below-normal at Richmond. Baltimore (6.10 inches) and Harrisburg (6.29 inches) had the largest rainfall amounts among the 11 stations. Rainfall was concentrated mainly in the second half of the month for stations in the middle and lower Bay areas while stations in Pennsylvania received most rainfall from the storm of the 2nd and 3rd.

Temperatures were moderate in May, averaging 2.1°F above-normal. Temperature averages ranged from 1.4°F above-normal at Williamsport and Chantilly to 3.5°F above-normal at Aberdeen.

Winds gusted to 38 mph from the north in a thunderstorm at Patuxent on the 28th, and reached 30 mph or higher on the 3rd and 5th.

2.2 Streamflow

Bay streamflow remained below normal in all three months of the spring 1985 quarter (Figure 2). Streamflow has been below normal since September 1984 in all months except December which showed slightly above-average flow. Below-normal streamflow in the spring quarter reflects the extremely dry conditions in the Bay region in March and April. Average precipitation deficits in March and April were -42 percent and -80 percent, respectively (see 2.1 Weather, Table 2). Streamflow remained below normal in May following dry conditions in April. Rainfall in May fell mostly in the latter part of the month, and streamflow averaged well below normal for May. The March 1985 flow of 95,100 cubic feet per second (cfs) was the third lowest during the period of record 1951-1985. Streamflow was lower than April and May 1985 in only four other years in those months since 1951. The cumulative streamflow anomaly reached a deficit of 3.8 trillion gallons following the steady low flow conditions in spring 1985 (Figure 3).

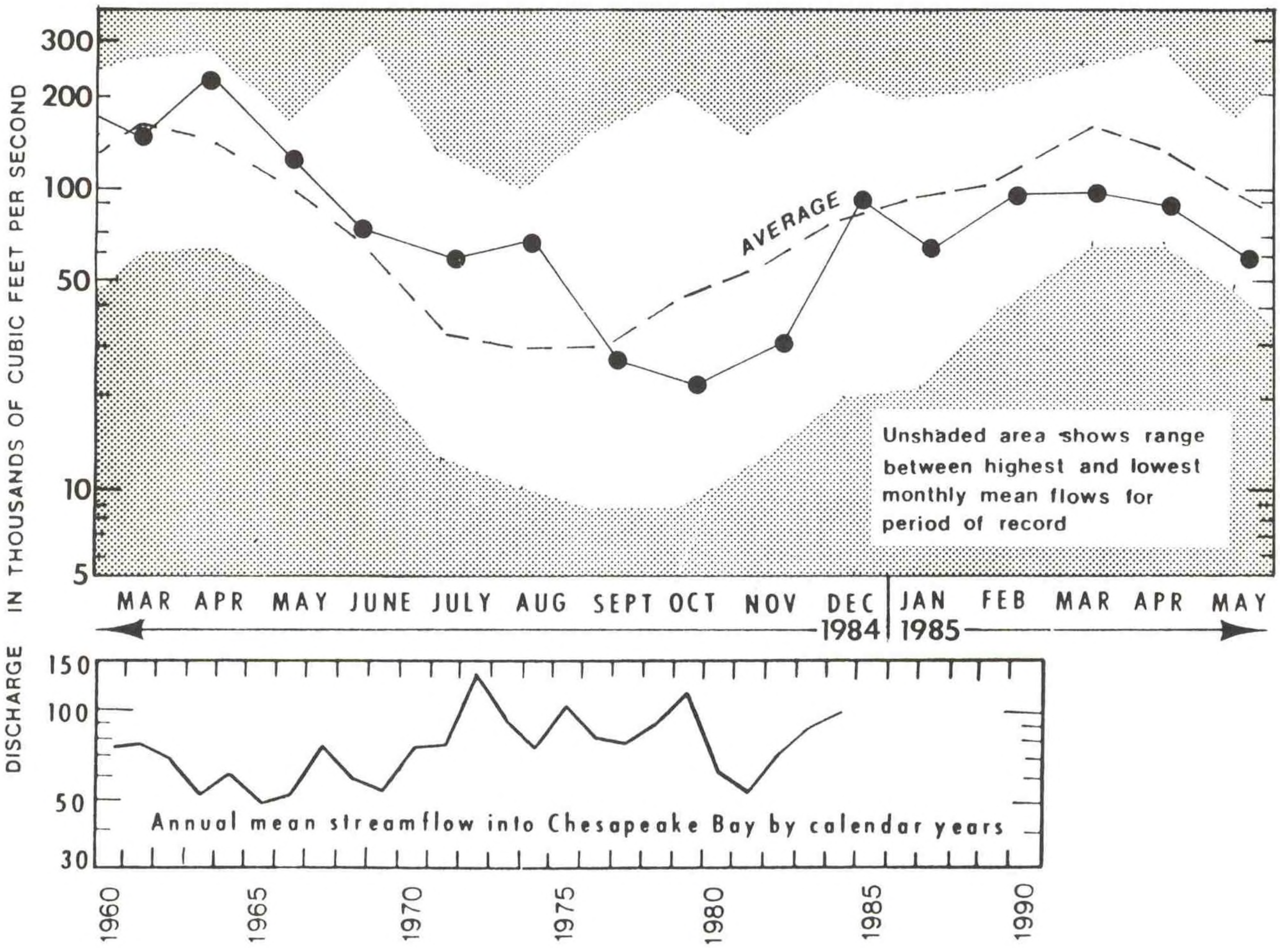


Figure 2.--Monthly streamflow into Chesapeake Bay, March-May 1985 and annual mean flow 1960-1984. Streamflow was below normal in all three months of the spring 1985 quarter. Streamflow averaged 40 percent below normal for the quarter. Data from U.S. Geological Survey.

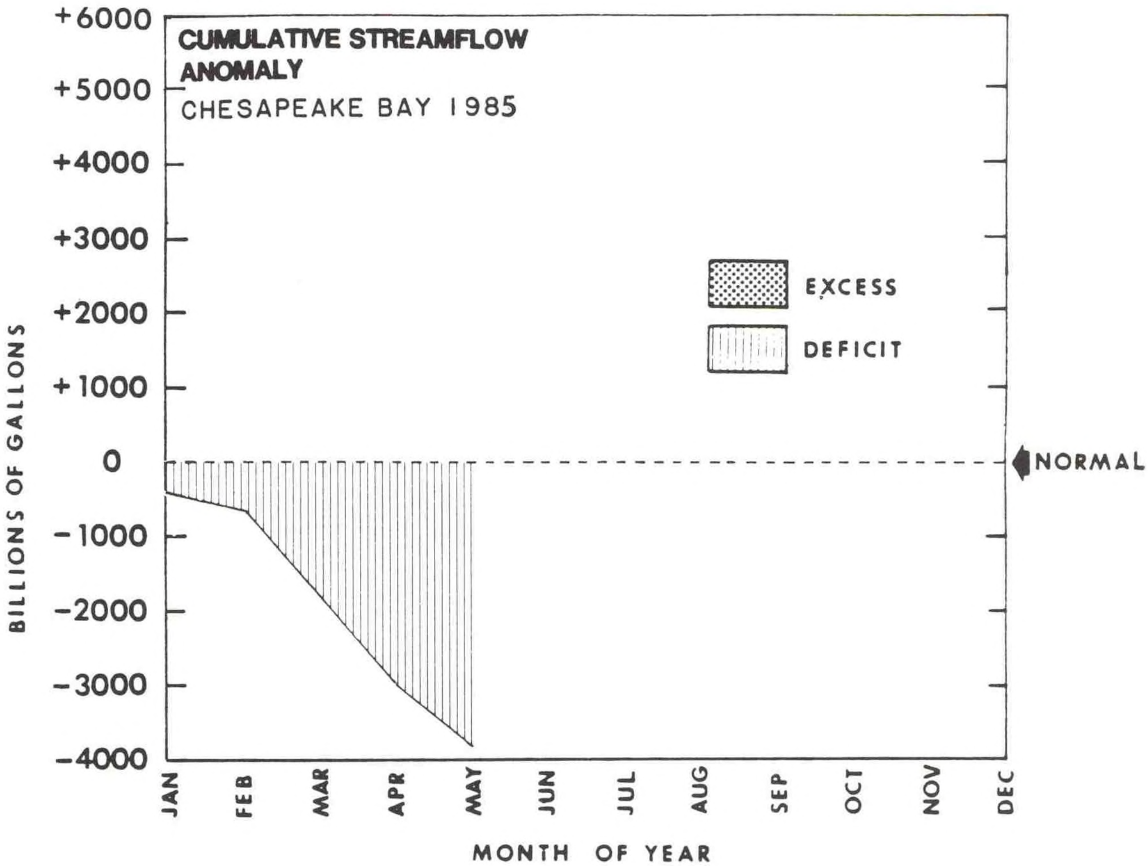


Figure 3.--Cumulative monthly streamflow anomaly, Chesapeake Bay, 1985. The cumulative streamflow anomaly (monthly sum of negative and positive departures from normal by calendar year) for January through May 1985 was a deficit of 3.8 trillion gallons. Data from U.S. Geological Survey.

2.3 Oceanography

The quarter began with above-normal salinities and temperatures at most stations around the Bay (Table 3 and Figure 4). Water temperatures warmed seasonally over the three months.

Salinity:

All stations followed a normal seasonal salinity cycle for March and April but with higher-than-normal values, though Kiptopeke salinity was slightly below normal. Salinity recorded at the Bay Bridge-Tunnel in April far exceeded the seasonal trend at more than five parts per thousand (ppt) above-normal. All stations in May continued to show above-normal salinity.

The Chesapeake Bay area experienced very dry conditions during the 1985 spring quarter and salinities were high (Table 3). The two previous spring quarters in 1983 and 1984 had above-average precipitation and below-normal salinities. Prior to 1983, near-drought conditions prevailed along with higher-than-normal salinities. Higher-than-normal salinities affect distribution and survival of various Bay species and the prevalence of shellfish diseases (see Fisheries, section 3.1).

Table 3.--Comparison of spring quarter area precipitation and Bay salinity, 1981-85.

Year (spring quarter)	Precipitation	Salinity
1981	Very dry	Very high
1982	Dry	High
1983	Wet	Low
1984	Very wet	Very low
1985	Very dry	High

Temperature:

Water temperature around the Bay during the quarter followed normal seasonal warming trends. Water temperatures were above normal at all stations in all three months except at the Bay Bridge-Tunnel in March where temperature was -0.3°F below normal.

Table 4.--Bay surface salinities and surface water temperatures, March - May 1985.

Station	Surface Salinity and Departure from Normal Observed/*Anomaly (ppt)			Surface Water Temperature and Departure from Normal Observed/Anomaly* (Deg. F)		
	March	April	May	March	April	May
Baltimore, MD	10.3/+1.9	7.6/+1.4	8.4/+2.6	46.0/+3.4	56.2/+3.1	67.7/+3.5
Annapolis, MD	10.2/+0.6	8.9/+1.7	10.6/+3.7	43.6/+1.0	53.8/+0.6	66.6/+1.8
Solomons, MD	14.6/+1.5	13.7/+2.5	14.3/+3.5	44.7/+2.1	55.9/+3.4	67.3/+2.7
Kiptopeke, VA	25.1/-0.3	26.8/+2.4	26.8/+2.2	47.3/+3.1	57.3/+4.2	69.0/+5.9
Bay Bridge-Tunnel, VA	24.1/+4.4	25.4/+5.5	24.6/+4.0	46.6/-0.3	56.4/+1.2	67.1/+1.4

*Anomaly = departure from long-term monthly averages.
All salinity data are provisional. Salinities are based on water densities normalized to 15°C.

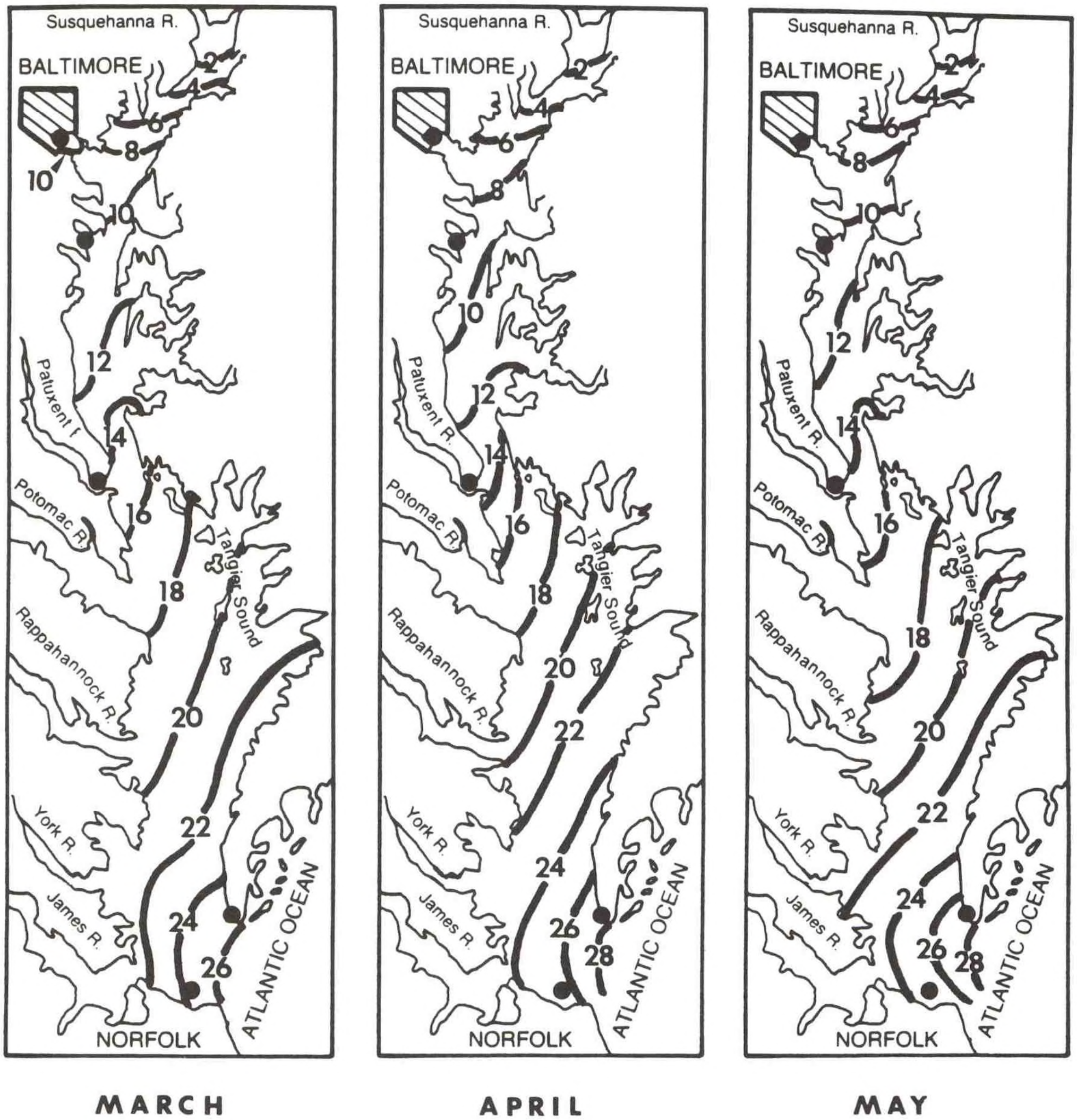


Figure 4.--Mean surface salinity distribution, Chesapeake Bay, March - May 1985. Isohalines (parts per thousand) are linearly interpolated from designated station data. All stations from March to April following below-normal precipitation in both months. From April to May salinity continued to increase at the three northernmost Bay stations but underwent no net change at Kiptopeke and decreased at Chesapeake Bay Bridge-Tunnel. Data from National Ocean Service, NOAA. Cruise data and other sampling stations are used to supplement NOS station data for unusual salinity events.

3. Impact of Climate/Weather on Bay Fisheries, Recreation, and Transportation

3.1 Fisheries

Watermen experienced a good blue crab catch late in the spring 1985 quarter as crabs were abundant from the highly successful 1983 year class. Low rainfall during April and May provided favorable conditions for harvesting, contributing to increased catches of blue crabs. The soft crab season in Virginia began earlier than normal and showed a strong first seasonal production run during a period of warmer-than-normal water temperatures. Bluefish arrived at Chesapeake Bay earlier than normal following the movement of the 15°C isotherm up the coast. Sea nettles should appear earlier and in greater abundance than in previous years. Scientists are closely monitoring oysters for MSX disease following high salinities in spring 1985 though no increase in the disease has been detected.

Shellfish:

The blue crab harvest started slowly in spring 1985, though landings showed large increases later in the quarter over the comparable period in 1984 (Table 4). Maryland landings were 23 percent higher in April 1985 over April 1984 and 135 percent higher in May over the previous year.

Hard crab landings in Virginia in March 1985 were 50 percent lower than March 1984. In April landings were 33 percent higher than the previous year. May 1985 Virginia landings were slighly lower than May 1984 (-10 percent) though the decrease resulted mainly from marketing problems. Watermen received higher prices in May 1984 due to steadier demand for hard crabs. In May 1984, crab buyers from major markets in New York and Philadelphia were able to buy larger crabs from states other than Virginia. Large male crabs in Virginia were smaller and less competitive on the market. Hard crabs remained very abundant in Virginia and prices were depressed over the previous year.

The abundance of crabs during spring 1985 reflected the highly successful 1983 year class of crabs which apparently reached market size in late summer and early fall 1984. These crabs will be the main source of the Bay catch through summer 1985. Crabs from the 1984 spawn should enter the fishery in late summer or early fall 1985. Watermen in Maryland noted the presence of large numbers of smaller crabs in late spring, indicating that these crabs may contribute substantially to the 1985 harvest as they attain market size in late summer and early fall. Unusually warm water temperatures in April 1985 favored the growth of crabs of both the 1983 and 1984 year classes. The spring 1985 quarter contrasts sharply with conditions in spring 1984, when watermen experienced delays in normal springtime catches due to cooler-than-normal water temperatures which delayed crabs from becoming active. Adverse weather conditions including strong winds and heavy rainfall reduced fishery effort in spring 1984. Conditions in 1985 were extremely dry, providing a more favorable situation for watermen to work.

Soft crabs in Virginia showed a very good first seasonal production run in spring 1985. Production began in mid-April, about two to three weeks earlier than normal. Soft crab production in Virginia continued to be unusually good through May 1985. Soft crab landings in Virginia in April 1985 totalled 20,126

Table 5.--Maryland and Virginia hard shell blue crab landings, March - May, 1984-85.

		Maryland		Virginia	
		Pounds	Dollars	Pounds	Dollars
March	1984	*none	*none	837,583	$ 273,201
	1985	*none	*none	415,136	$ 152,903
	1984-85 % change	----	----	-50%	-44%
April	1984	622,482	$ 483,656	2,320,872	$ 869,126
	1985	763,469	$ 497,449	3,078,349	$ 985,348
	1984-85 % change	+23%	+3%	+33%	+13%
May	1984	1,144,375	$1,014,531	4,101,009	$1,144,208
	1985	2,694,404	$2,875,264	3,677,829	$ 917,005
	1984-85 % change	+135%	+183%	-10%	-20%

Data from Maryland Department of Natural Resources and Virginia Marine Resources Commission. All 1985 landings are preliminary. Potomac River landings are not included. (*Maryland crabbing season opens April 1.)

pounds, 20 times higher than the 1,010 pounds reported in April 1984. May 1985 soft crab landings were 416,271 pounds compared to May 1984 landings of 291,496 pounds. Warm water temperatures in spring 1985 may have contributed to the increase in soft crab production in April and May. Soft crab production was delayed about two weeks in spring 1984 during a period of cooler-than-normal water temperatures.

Finfish:

Bluefish arrived in Chesapeake Bay about two weeks earlier than normal in spring 1985. The springtime movement of bluefish up the East Coast is related to the northern extent of 12°C to 15°C water temperatures. The position of the 12-15°C temperature band in April 1985 is well north of its positions along the coast during the same relative time periods of 1983-84. Satellite derived sea surface temperature analyses show the positions of the 15°C isotherm at the mouth of Chesapeake Bay in April 1983-1985 (Figure 5). Satellite imagery for the same approximate time periods show that extensive warming occurred in late April 1985 up to and throughout the Chesapeake Bay area (Figures 6a-6d). Water temperatures in the Bay area were colder than normal in the preceding three Aprils. Field reports indicated bluefish arrived at Chesapeake Bay two weeks later than normal in spring 1983. The positions of the 12-15°C isotherms during late April suggest that bluefish arrived later than normal in all three spring quarters of 1982-84.

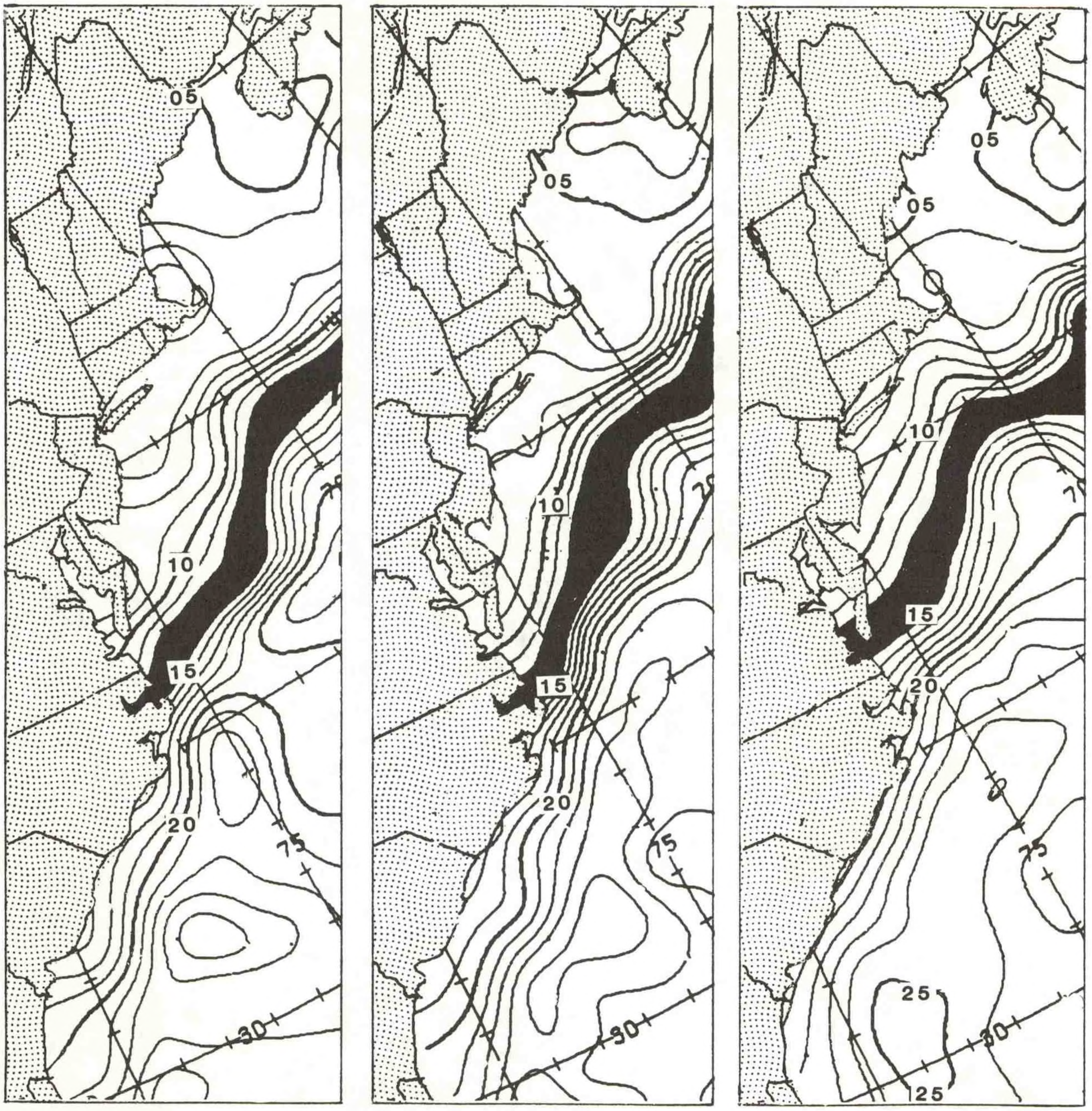
Cownosed rays were reported to be unusually abundant in the upper Bay during the spring quarter. Rays and other species which prefer higher salinities move into northern areas of Chesapeake Bay during high salinity periods such as the spring 1985 quarter when isohalines were shifted as much as 15 km upriver from normal. Higher salinities apparently also reduced the spawning area available to striped bass in upper portions of Virginia rivers according to the Virginia Institute of Marine Science. The effect of the reduction in spawning habitat of striped bass in Virginia on the 1985 year class is unclear at present.

Jellyfishes:

The sea nettle, *Chrysaora quinquecirrha*, should appear earlier than normal and in well above-average abundance in summer 1985, based on spring 1985 sampling by the Chesapeake Biological Laboratory (CBL). May 1985 counts of sea nettle ephyrae (a developmental stage) were very high compared to the previous four-year period when spring ephyrae counts were low. Nettle infestations have been low over the previous four summers compared to the expected abundance in summer 1985, which may be higher than the average abundance of the previous 25-year period.

Higher-than-normal salinities during spring 1985 provided favorable conditions for stinging nettles in the upper Bay. Sea nettles detract from swimming and other water-oriented pursuits along 85 percent of Bay beaches. A high number of stinging nettles in summer 1985 presents an obviously unfavorable situation for water-oriented recreation in the Chesapeake Bay area.

CBL scientists also noted unusually high numbers of the winter jellyfish, *Cyanea capillata*, in the upper Bay. This species is normally more abundant in



23-28 APRIL 1983 **22-27 APRIL 1984** **21-26 APRIL 1985**

Figure 5.--Sea surface isotherms along the Atlantic coast, late April, 1983-1984-1985. The darkened bands in the panels of satellite derived sea surface isotherms cover the temperature region from 12°C to 15°C preferred by migrating bluefish. Note that the position of the band during April 1985 is well north of its positions along the coast during the same relative time periods in 1983 and 1984. Sea surface composite temperature analysis maps from Marine Products Branch, National Meteorological Center, National Weather Service, NOAA.

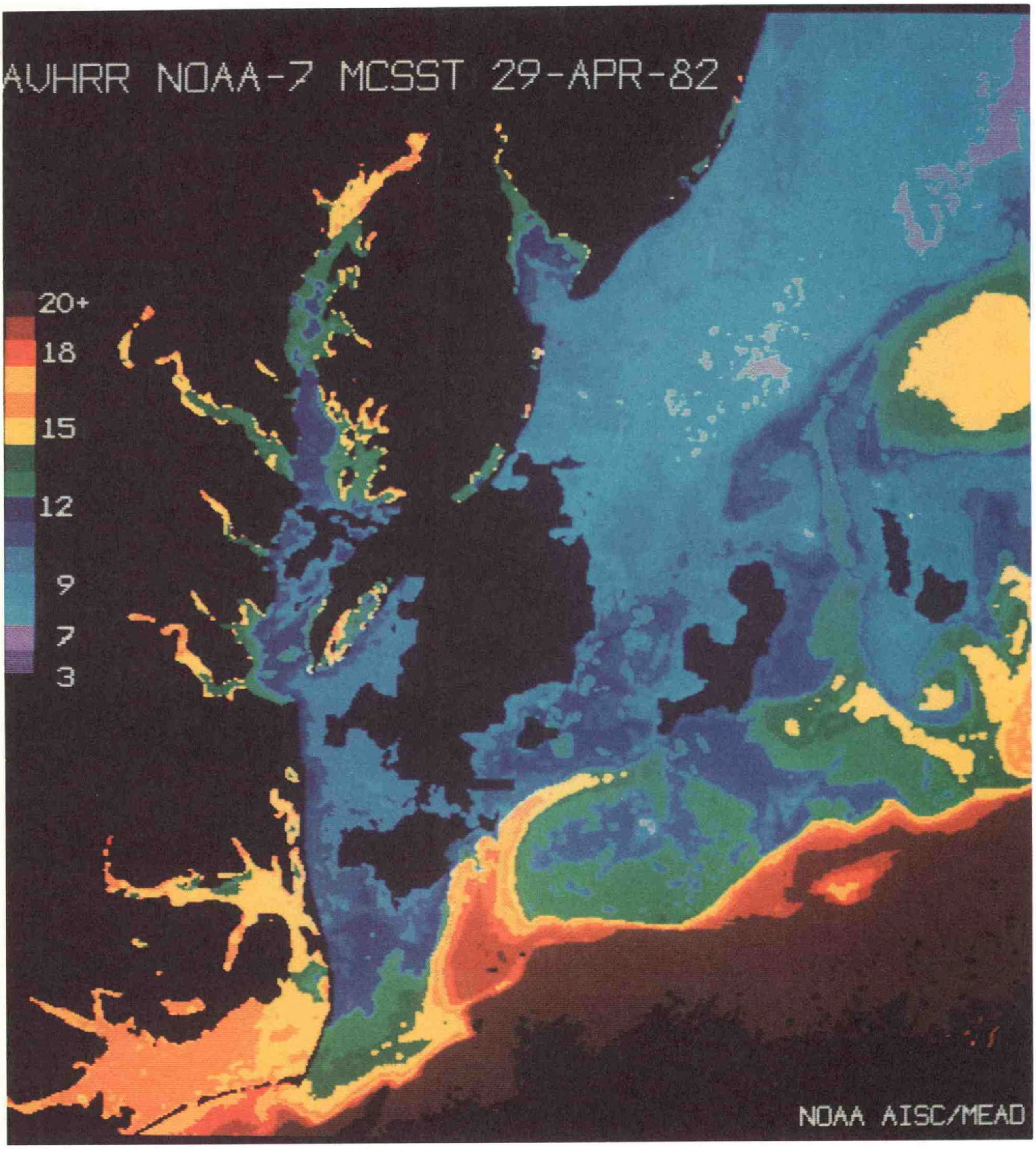


Figure 6a.--Satellite image of the Atlantic coast showing surface water temperatures on April 29, 1982. Conditions in April 1982 were cooler than normal. Black areas over water are cloud cover. Warmer waters in the upper Bay are probably due to surface heating of low density runoff. Note the incipient formation of a Gulf Stream ring southeast of the Bay mouth. The 15°C isotherm (yellow) is at Cape Hatteras.

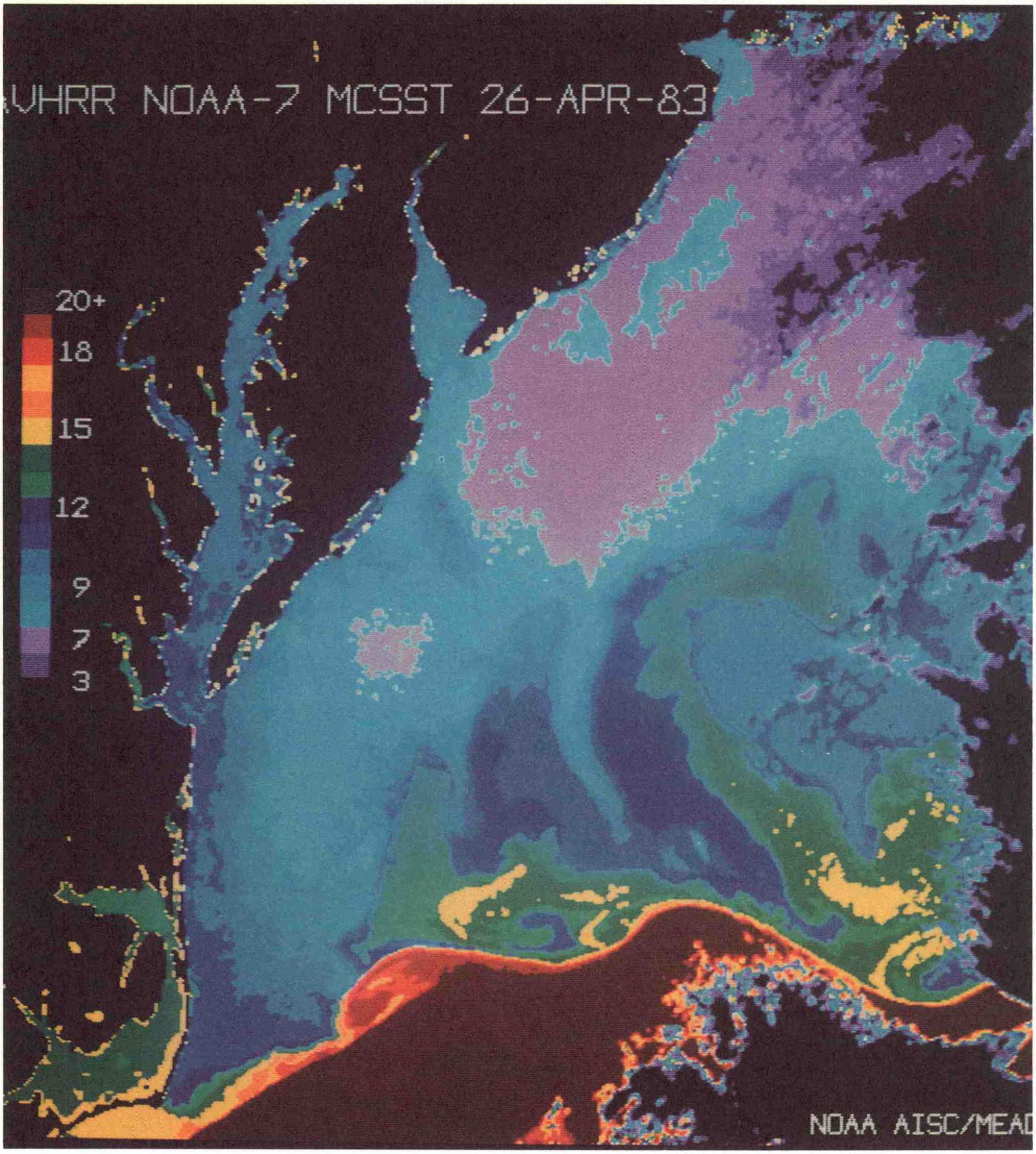


Figure 6b.--Satellite image of the Atlantic coast showing surface water temperatures on April 26, 1983. Temperatures in late April 1983 were unusually cold on the northern Atlantic coast and bluefish arrived at the Chesapeake Bay area about two weeks later than normal. Note the large areas of very cold water (7°C) remaining off Delaware Bay and northward. The 15°C isotherm (yellow) is again at Cape Hatteras and 12°C water (blue) also extends to the Cape. The image clearly depicts some Gulf Stream meandering (red).

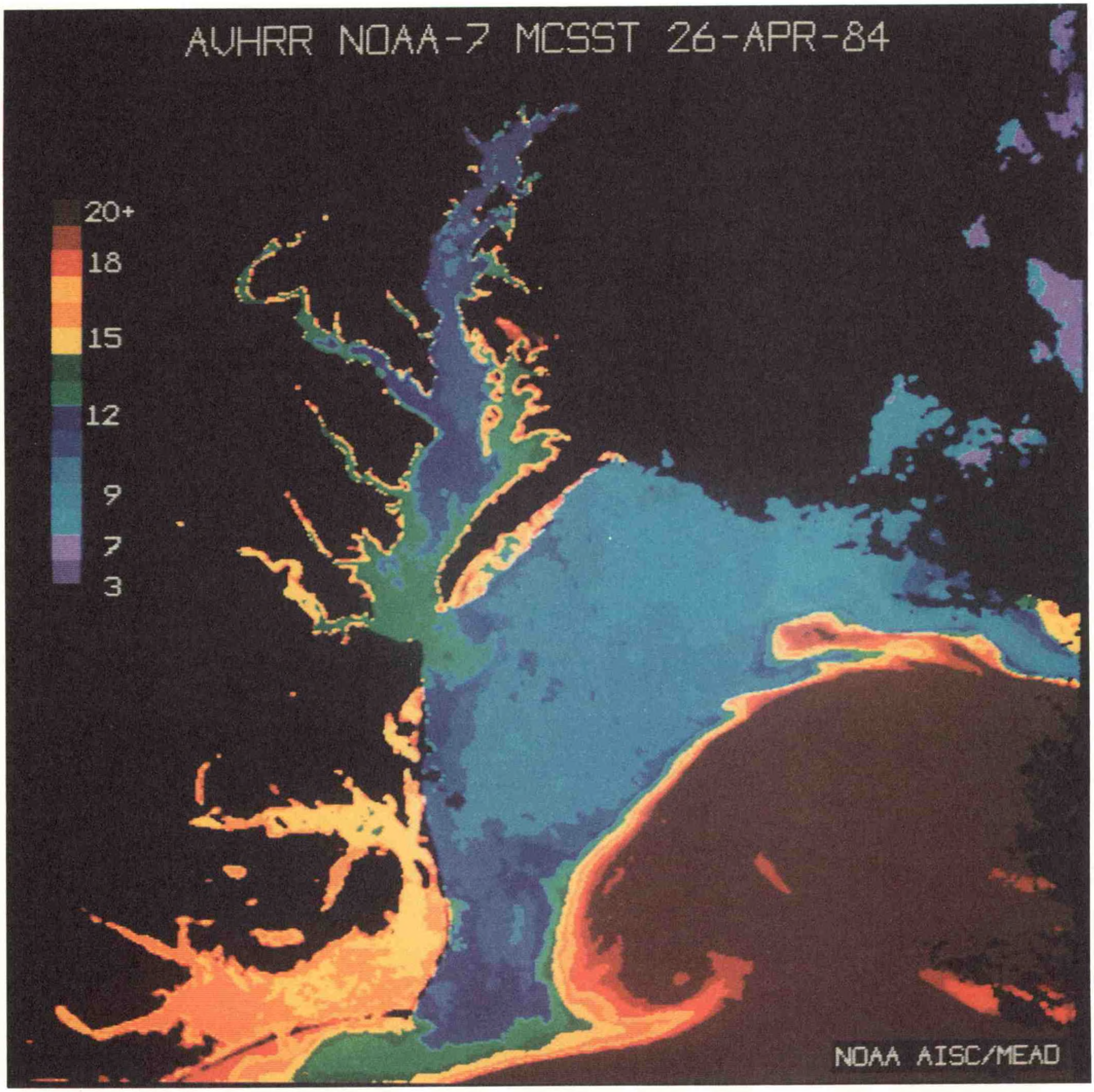


Figure 6c.--Satellite image of the Atlantic coast showing surface water temperatures on April 26, 1984. The spring 1984 quarter was predominantly cooler than normal, though water temperatures were closer to normal than in spring 1983. The 15°C isotherm (yellow) is well south of Cape Hatteras and 12°C water (blue) is also extensive at the surface off of the Cape. The warmer water at the Bay mouth is probably due to superficial heating of surface runoff. This picture gives a view of a large excursion of the Gulf Stream.

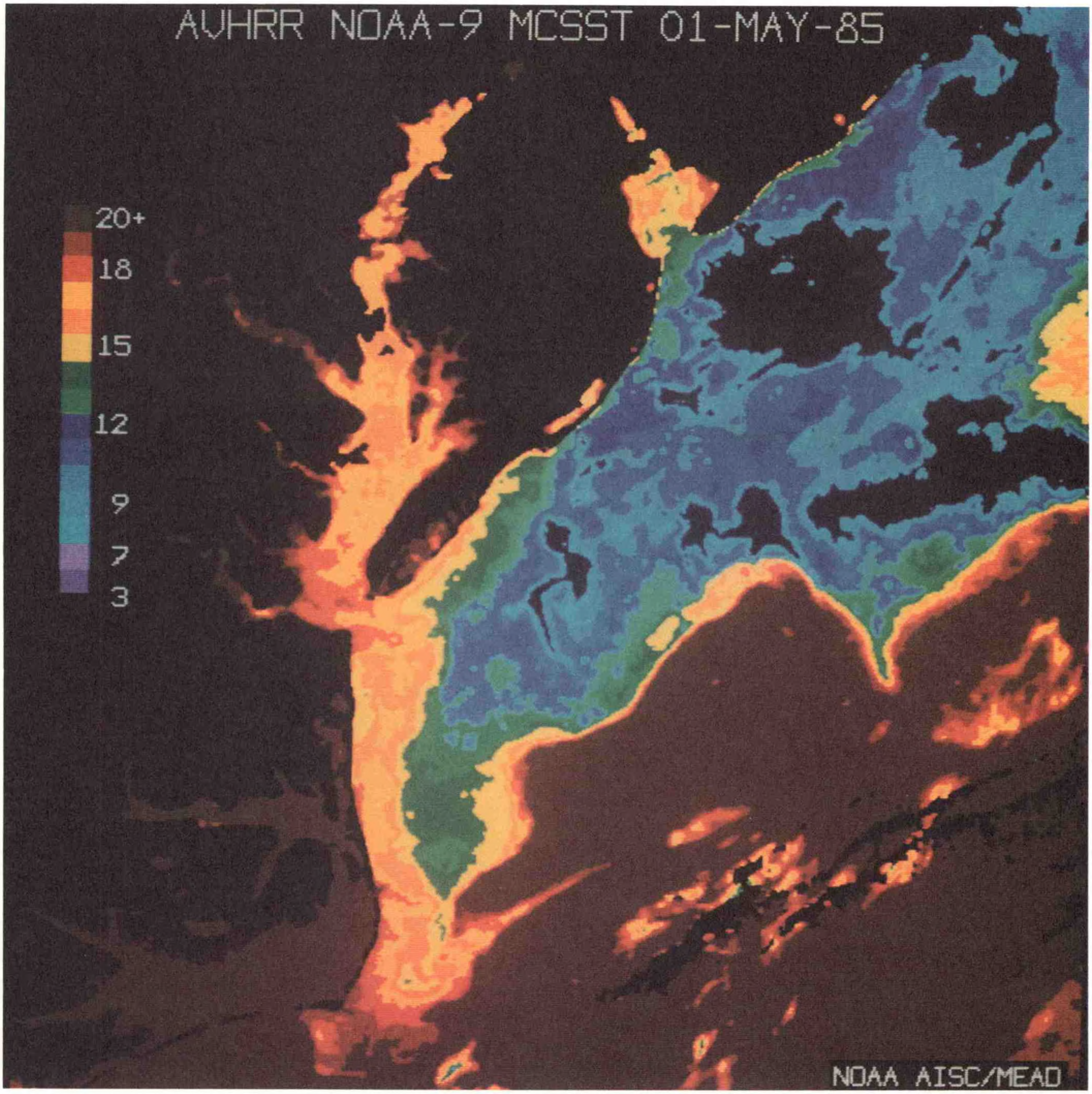


Figure 6d.--Satellite image of the Atlantic coast showing surface water temperatures on May 1, 1985. Water temperatures were above normal during the entire spring 1985 quarter. By the end of April, the 12-15°C temperature range had extended north of Delaware Bay. Larger-sized bluefish arrived at Chesapeake Bay about two weeks earlier than normal in 1985. Note the large extension of 15°C and warmer water up the coast past Assateague and covering a broad part of the shelf. The entire surface of the Chesapeake Bay is very warm for this time of year. This picture gives a view of several large extensions of the Gulf Stream offshore.

the southern Bay. Winter jellyfish, which occur in Chesapeake Bay from early winter to late spring, were observed in upper Bay tributaries through May 1985.

Diseases:

MSX disease showed no outbreaks in Bay oysters following the above-normal salinities in spring 1985. Oysters which are infected by MSX in late summer and early fall can show signs of the disease in the following spring except when salinities drop to 10 parts per thousand or lower. The increase in salinities in spring 1985 shows the potential for MSX activity and oyster mortalities. MSX has moved rapidly up the Bay in past outbreaks and has caused extensive oyster mortalities. Bay scientists are closely monitoring oysters for signs of increased MSX activity.

3.2 Recreation

Bay recreational activities showed large increases in spring 1985 over spring 1984. Dry and warm weather contributed to increased boating activities and park attendance, contrasting sharply with wet and cool weather and lower activity in spring 1984.

National Weather Service marine advisories and warnings for the Chesapeake Bay are listed in Table 5. A total of 34 small craft advisories and warnings were issued for the 1985 spring quarter compared to a total of 41 during the same period of 1984. No special marine warnings for thunderstorms were issued in spring 1985. Thunderstorms are more common later in summer months, though special marine warnings are occasionally issued for thunderstorms in late spring for the Chesapeake Bay area.

The U.S. Coast Guard conducted a total of 649 Search and Rescue (SAR) cases in the Bay area during the 1985 spring quarter (Table 6). During the same period in 1984, 529 SAR cases were handled. The dry and warm conditions which prevailed during spring 1985 contributed to increased boating activity and the increase in SAR cases.

Maryland Department of Natural Resources accident statistics for recreational boating are listed in Table 7. The number of accidents for March through May 1985 far exceeds the total number reported in spring 1984. From March through May 1985, a total of 49 boating accidents, 26 injuries, and 2 fatalities occurred with $79,056 in property damage. Ten accidents occurred during the spring 1984 quarter.

Attendance and revenue for selected Maryland and Virginia state parks are listed in Table 8. Most parks showed large attendance and revenue increases over the 1984 spring quarter. Unseasonably warm weather brought about increased day usage and camping in April which contributed to the increase in attendance and revenue at most of the state parks. Though admission fees at Chippokes had increased from the 1984 quarter, the attendance and revenue showed a very large increase. May attendance at Chippokes was affected by heavy rain and flooding that reduced travel and attendance at Garden Week activities that normally take place during the last week in April. Attendance at Point Lookout was higher during all three months of the spring 1985 than the same months in 1984.

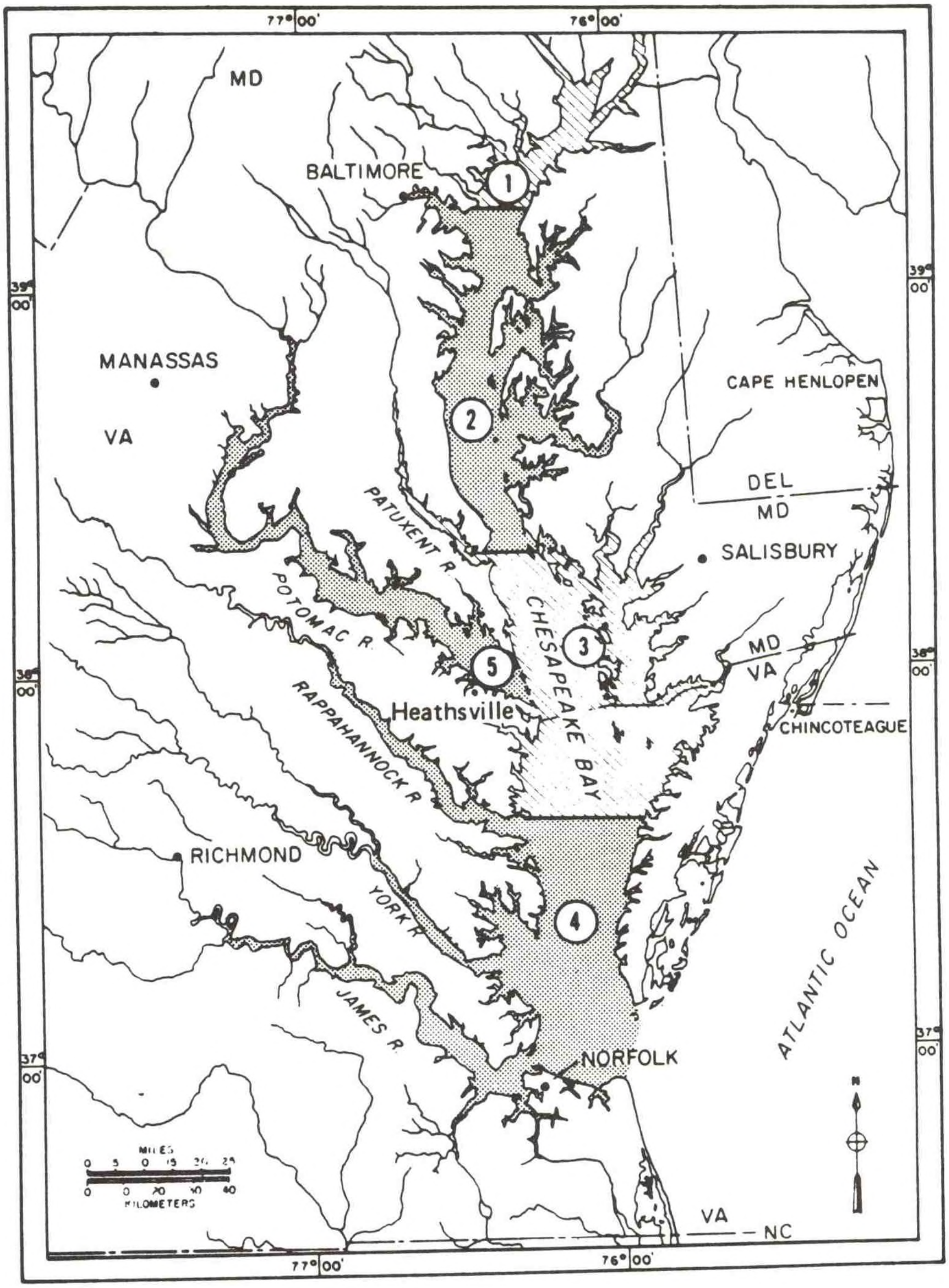


Figure 7.--National Weather Service (NWS) forecast areas for Chesapeake Bay.

Key to forecast areas:

1 = Head of Bay to Baltimore Harbor
2 = Baltimore Harbor to Patuxent River
3 = Patuxent River to Windmill Point
4 = Windmill Point to Mouth of Bay
5 = Tidal Potomac River

Table 6.--Marine advisories/warnings, Chesapeake Bay, March - May 1985 (National Weather Service data). For definition of areas see Figure 5.

	Date	Condition Report[1]	Location[2]
March	4	A	Entire Bay and Tidal Potomac River
	8	A	Head of Bay to Patuxent River
	8	A	South of Patuxent River to South of Windmill Point
	8	A	Tidal Potomac River
	12	A	Entire Bay and Tidal Potomac River
	12	B	Entire Bay
	12	A	South of Patuxent River to South of Windmill Point
	13	A	Head of Bay to Patuxent River
	15	A	Head of Bay to Patuxent River
	15	A	South of Patuxent River to South of Windmill Point
	17	A	Entire Bay and Tidal Potomac River
	21	A	South of Windmill Point
	22	B	South of Windmill Point
	22	A	Patuxent River to Windmill Point
	25	A	South of Patuxent River
	28	A	Entire Bay and Tidal Potomac River
	30	A	South of Windmill Point
April	1	A	Entire Bay and Tidal Potomac River
	2	A	Entire Bay and Tidal Potomac River
	3	A	Entire Bay and Tidal Potomac River
	4	A	Entire Bay and Tidal Potomac River
	6	B	Entire Bay and Tidal Potomac River
	8	A	Entire Bay and Tidal Potomac River
	9	A	Head of Bay to Patuxent River
	9	A	Patuxent River to Mouth of Bay and Tidal Potomac River
	15	A	South of Windmill Point
	16	A	Entire Bay and Tidal Potomac River
	29	A	Entire Bay and Tidal Potomac River
May	3	A	Entire Bay and Tidal Potomac River
	3	B	Mouth of Bay
	5	A	Entire Bay and Tidal Potomac River

1 Key to Condition Reports:

A = Small Craft Advisory (Wind 25-34 knots)
B = Gale Warning (Wind 34-47 knots)
C = Storm (Wind 47-64 knots)
D = Special Marine Warning (Unusual weather phenomena)

2 Windmill Point = North side of Rappahannock River

Table 6.--(Continued). Marine advisories/warnings, Chesapeake Bay, March - May 1985 (National Weather Service data). For definition of areas see Figure 5.

	Date	Condition Report[1]	Location[2]
May	6	A	Head of Bay to Windmill Point and Tidal Potomac River
	7	A	Entire Bay and Tidal Potomac River
	15	A	Mouth of Bay
	18	A	Entire Bay and Tidal Potomac River
	23	A	Mouth of Bay
	29	A	Entire Bay and Tidal Potomac River
	31	A	Entire Bay and Tidal Potomac River

[1] Key to Condition Reports:

A = Small Craft Advisory (Wind 25-34 knots)
B = Gale Warning (Wind 34-47 knots)
C = Storm (Wind 47-64 knots)
D = Special Marine Warning (Unusual weather phenomena)

[2] Windmill Point = North side of Rappahannock River

Table 7.--U.S. Coast Guard Search and Rescue (SAR) caseload, March - May 1985.

Month	Number of Search and Rescues		
	Group Baltimore	Group Eastern Shore	Group Norfolk
March	36	6	36
April	100	7	88
May	215	17	144
TOTALS	351	30	268

Group Baltimore - most of Upper Bay
Group Eastern Shore - lower central portion of Eastern Shore
Group Norfolk - most of Lower Bay

Table 8.--Maryland marine accident statistics, March - May 1985.

Month	No. of Boating Accidents		No. of Injuries		No. of Deaths		Property Damage	
	1984	1985	1984	1985	1984	1985	1984	1985
March	4	2	0	0	0	1	$81,500	10,050
April	2	10	1	6	1	0	$30,000	41,250
May	4	37	0	20	0	1	$ 5,350	27,756
TOTALS	10	49	1	26	1	2	$116,850	79,056

Data Source: Maryland Department of Natural Resources Marine Police. All categories are for recreational boating. Includes Potomac River to Virginia shoreline. Data are preliminary.

Table 9.--State parks attendance and revenue, selected Maryland and Virginia facilities, March 1985 - May 1985.

Facility	March		April		May	
Maryland	Attendance	Revenue	Attendance	Revenue	Attendance	Revenue
Sandy Point	7,470	$ 0	5,068	$ 0	9,585	$ 0
Point Lookout	11,634	$ 519	25,316	$ 4,868	33,352	$14,355
Virginia						
Westmoreland	2,120	$ 635	9,993	$ 3,933	21,228	$ 8,863
Chippokes	1,284	$ 50	1,782	$ 384	2,300	$ 600
York River	5,487	$ 0	5,985	$ 229	10,254	$ 1,060
Seashore	67,355	$1,653	131,797	$19,015	108,142	$35,461

Data from Maryland Department of Natural Resources, Forest, Park, and Wildlife Service; and Virginia Department of Conservation and Economic Development, Division of State Parks. Revenue does not always reflect usage levels. Special scheduled activities, seasonal revenue changes, and equipment breakdown influence total revenue amounts.

3.3 Transportation

Winds

Winds in excess of 40 mph shut down crane operations 17 times at the Port of Baltimore for a total of 98 hours and 43 minutes (Table 9). During the same period in spring 1984, winds shut down crane operations 18 times for a total of 47 hours and 21 minutes. Windier conditions in March and April were responsible for the increase in productive time lost in spring 1985 over spring 1984.

Table 10.--Number of crane shutdowns and productive time lost due to wind in excess of 40 mph at Port of Baltimore, March - May 1985.

Date		Number of Shutdowns	Productive Time Lost (Hours:Minutes)
March	5	1	14:40
	6	1	1:15
	12	1	14:24
	13	1	0:45
	15	1	7:50
	18	1	5:28
	20	1	2:44
	29	1	2:10
April	1	1	8:01
	3	1	9:50
	6	1	12:48
	8	1	4:34
	9	1	4:51
May	2	1	1:35
	12	1	2:57
	18	1	2:40
	28	1	2:11
Totals		17	98:43

Data from Maryland Port Administration.

Losses incurred by individual container-line shippers from crane down time includes pay to stevedore crews at $1500 per hour and vessel down time at $2500 per hour. Based on the total downtime, shippers may have experienced in excess of $394,880 in costs due to excessive winds.

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