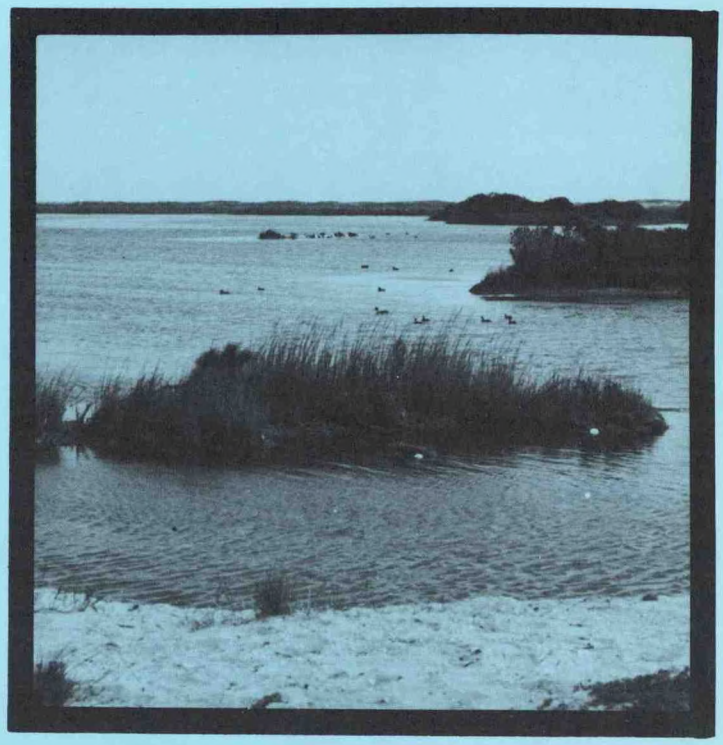
Marine Environmental Assessment

CHESAPEAKE BAY

SEPTEMBER – NOVEMBER 1984



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Assessment and Information Services Center

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 Division

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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, September - November 1984.

EVENT	IMPACT SECTOR: FISHERIES								RECREATION						TRANSPORTATION						
	Finfish harvest activities (general)	Shellfish harvest activities (general)	Oyster population	Blue crab harvest	Striped bass landings	**Normal species distributions**			Park usage	Boating activity	Safety				Port operations	Cost to shippers					
Warm Oct. - mid-Nov. air temps.	+	+							+	+											
Low dissolved oxygen (late summer)			-																		
Above-normal Nov. water temp.				+						+											
Fair 1982 striped bass year class					+																
Strong winds - late Nov.	-	-													-	+					
Return to normal salinities						+															

+ Favorable

- Unfavorable

No identifiable effect, data unavailable, or not applicable

1. Highlights - General Events and Impacts

Unusually warm air temperatures in October through mid-November provided favorable conditions for finfish and shellfish harvest activities. Winds associated with a storm prevented watermen from going out for several days in late November.

Oysters remained scarce in Maryland, leading to intense fishing pressure in remaining productive areas. Oyster prices held at record high levels and quality of meats was good. Anoxic conditions in the Bay spread into shallower depths in 1984, causing mortalities in some oyster beds.

Above-normal water temperatures kept crabbing activity high through the end of November.

Though striped bass landings showed improvements over the record low landings in 1983, landings remained extremely low as striped bass have shown a steady decline in recent years. The improved landings are a result of the fair success of the 1982 striped bass year class.

Return to seasonally normal salinity structures throughout the Bay should contribute to a return to normal distribution patterns for species inhabiting the Bay. Bay stations had shown well-below-normal salinities throughout spring and summer 1984 following record streamflow levels.

Unusually warm weather in October was favorable for recreation in the Bay area. Both park usage and boating activity showed increases over October 1983.

Some minor flooding occurred in low-lying areas near the mouth of the Bay in advance of Hurricane Diana around September 12.

Winds in excess of 40 mph shut down crane operations on three occasions in November resulting in nine hours lost productive time at the Port of Baltimore.

2. Weather and Oceanography Summary

2.1 Weather

The fall quarter began with stations having approximately normal cumulative precipitation through the preceding eight months. During September the entire region experienced a distinct shortage of rain with most stations recording deficits greater than 50 percent of normal (Figure 1 and Table 2). During October the dry trend remained over most of the area with the exception of a central area comprising Aberdeen, Washington, DC, and Patuxent. In November the area finally received normal amounts of rainfall. The close approaches of Hurricanes Diana and Josephine, and Tropical Storm Isidore did not produce much rain in the Chesapeake region.

Temperatures over the region were cooler than normal for September, and much warmer than normal in October. In November the temperature regime was warmer than normal through much of the month until a severe cold snap came during the last week of the month. Record seasonal daily low temperatures occurred in both September and late November, while record seasonal daily high temperatures were common during October. The overall record for the region over the quarter ran: cool and dry; warm and moderate; then cold and wet.

September:

Five cold fronts passed through the area during September. Between the front of the 12th and that of the 16th, Hurricane Diana pushed ashore with a warm front. The two fronts merged near Virginia Beach creating locally heavy downpours, but, precipitation from this event did not offset the severe dryness of much of the month. Large deep cold air masses covered the area behind the fronts on the 6th, 16th, and 27th, setting seasonal daily low temperature records.

Precipitation totals for the month were below-normal for all stations in the Bay area which averaged 53 percent below normal. Individual stations ranged from -22 percent (Washington, DC) to -83 percent (Williamsport). Distribution of rainfall average amounts and percentage departures from normal were very uniform among the 11 Bay area stations.

Temperatures also showed uniform below-normal patterns for September. Average departure for the area was 2.8°F below normal, with stations varying from 1.1°F below normal (Wilkes-Barre) to 4.7°F below normal (Chantilly). New seasonal daily low temperature records occurred at Baltimore, Harrisburg, and Patuxent.

Wind gusts reached or exceeded 30 mph twice and exceeded 25 mph four additional times during the month at Patuxent. Royal Oak reported gusts of 28 mph on the 3rd.

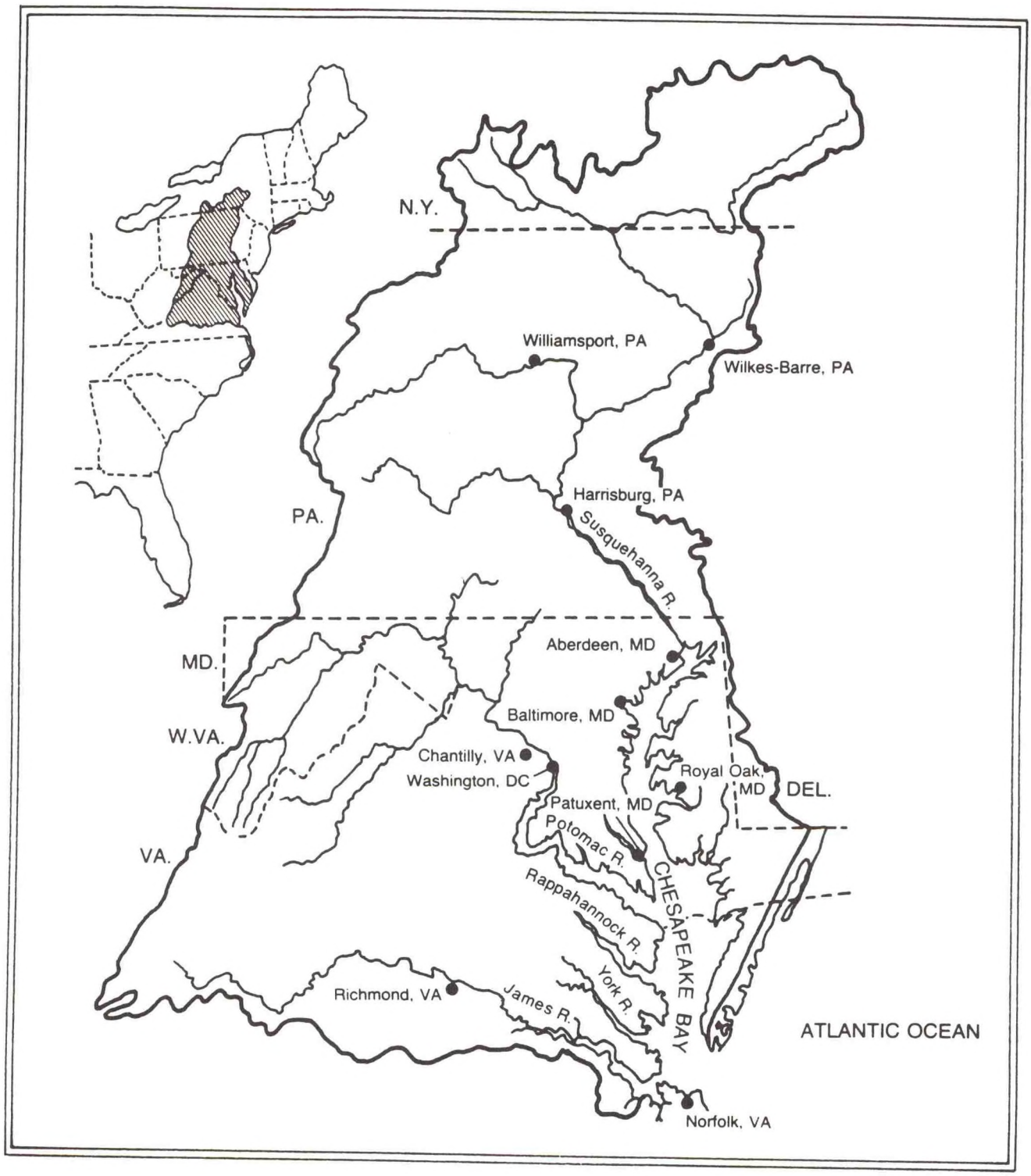

Figure 1. Selected meteorological stations, Chesapeake Bay watershed (Modified EPA map).

Table 2.--Total precipitation, mean air temperatures, and departures from normal for 11 stations, Chesapeake Bay watershed, September - November 1984.

Station	Total Precipitation (inches) and Departure from Normal Observed/*Anomaly (% of normal)			Air Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	September	October	November	September	October	November
Williamsport, PA	0.62/-83%	2.78/-14%	4.76/+31%	60.6/-3.3	56.7/+4.4	40.3/-1.1
Wilkes-Barre,PA	1.36/-60%	2.30/-17%	2.63/-12%	61.7/-1.1	58.0/+6.3	40.8/-0.1
Harrisburg, PA	1.49/-59%	1.98/-27%	3.78/+17%	64.5/-2.5	61.5/+6.5	43.9/0.0
Aberdeen,MD	1.51/-54%	3.67/+32%	3.15/-12%	65.9/-2.5	62.9/+4.9	46.3/0.0
Baltimore, MD	2.38/-31%	1.94/-38%	3.01/-3%	64.8/-4.1	62.2/+5.3	43.9/-2.4
Washington, DC	2.51/-22%	3.18/+10%	3.66/+30%	68.2/-2.9	65.2/+5.9	46.3/-2.4
Chantilly, VA	1.49/-54%	1.73/-43%	3.64/+22%	63.0/-4.7	61.8/+6.5	42.6/-2.2
Royal Oak, MD	1.46/-61%	2.89/-16%	3.30/-12%	67.5/-2.8	64.8/+5.5	47.5/-1.4
Patuxent, MD	1.50/-53%	5.25/+84%	3.65/+19%	68.7/-2.3	64.8/+4.5	46.9/-2.1
Richmond, VA	1.86/-47%	2.14/-43%	3.34/+2%	67.5/-2.7	66.1/+7.5	46.6/-2.3
Norfolk, VA	1.93/-56%	0.57/-83%	2.68/-7%	70.5/-1.7	66.9/+5.6	49.9/-2.0
Average	1.65/-53%	2.58/-16%	3.42/+7%	65.7/-2.8	62.8/+5.7	45.0/-1.5

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

October:

The weather of October was very warm for the season while remaining overall quite dry for the area. The frontal low following Tropical Storm Isidore on the 2nd and cold fronts on the 23rd and 29th brought most of the October precipitation, especially the slow-moving front on the 23rd. Minor amounts of rain came with cold fronts on the 5th, 8th, and 20th, and from a warm front which crossed the area on the 15th. Total precipitation over the area was slightly below normal (average -16 percent) but the stations individually exhibited some spectacular departures between -83 percent (Norfolk) and +84 percent (Patuxent).

Many stations received most of their precipitation in association with the coastal low pressure system generated by Tropical Storm Isidore on October 1. Although the monthly averages reflect near normal conditions over the region, and at many individual stations, the month was primarily a dry month. Precipitation averages for the stations show a north-south trend of very dry to slightly dry (Norfolk: -83 percent; Richmond: -43 percent; Chantilly: -43 percent; Baltimore: -38 percent; Harrisburg: -27 percent; Wilkes-Barre: -17 percent). Anomalous values for the middle Bay stations reflect strong precipitation from cold fronts on the 22nd and the 29th, especially at Patuxent which received 3.78 inches of rain from these two frontal systems. Norfolk registered one of its driest Octobers on record with just over one-half inch for the month.

Temperatures around the Bay averaged well above normal (+5.7°F) in October with stations consistently in the range of 4.5° to 7.5°F above normal. Temperatures rose from around normal at the beginning of the month to well above normal at the end of the month, with many stations setting new daily high temperature records between the 20th and the 29th. Harrisburg established five new daily minimum temperature records in its warmest October on record. October 1984 was among the warmest on record also for Baltimore-Washington International Airport, Baltimore City, and Wilkes-Barre.

Peak wind speeds exceeded 25 mph several times at Patuxent and both Patuxent and Royal Oak recorded gusts exceeding 30 mph one time during the month.

November:

Weather during the month was seasonally cool but for much of the period drier than normal. Only after near record rainfall late in the month associated with a cold front did precipitation totals approach or exceed normal November totals. Temperatures at most stations were more than a degree below normal for this time of year. A series of cold fronts passed through the region as is normal for the mid-fall regime: on the 2nd, 5th, 11th, 16th, 19th, 28th, and 30th. Strong north or northwesterly winds followed the passage of these fronts. A high pressure system covered the area from late on the 20th to the 27th bringing record daily low temperatures. Temperatures rose gradually from the 23rd to the 28th when a storm along the cold front deposited record amounts of precipitation on sections of the region.

Rainfall occurred with each of the seven fronts, mostly in scarce or moderate amounts. However, rains associated with a storm along the front of the 28th brought heavy rains to most of the area. On the 28th and 29th, Royal Oak,

Chantilly, Aberdeen, and Patuxent each received more than one inch of rain and Harrisburg received 1.84 inches, a new 24-hour precipitation record.

Temperatures among the 11 Bay area stations averaged 1.5°F below normal with only Wilkes-Barre, Harrisburg, and Aberdeen remaining near normal. Between the 20th and the 23rd temperature values achieved new daily low temperature records at Wilkes-Barre (20°F-20th), Baltimore (20°F-20th, 21st, 22nd, 23rd). Patuxent (23°F), Richmond (20°F), and Chantilly (14°F), had new daily low temperatures on the 23rd.

Winds gusted to 37 mph at Patuxent on the 28th and 33 mph on the 29th. Wind speeds reached 34 mph in the storm of the 28th and 29th at Royal Oak. Following the cold front of the 11th, sustained northwest winds over the Bay area reached 33 mph at Patuxent and 30 mph at Royal Oak.

2.2 Streamflow

Bay streamflow was below-normal in all three months of the fall 1984 quarter, following above-normal flow for each of the preceding five months (Figure 2). The quarter's flow reflects lower than normal precipitation over the region. The below-normal streamflow in the fall quarter reduced the large cumulative excess by about 15 percent (Figure 3). The large cumulative excess in 1984, which reached a high of 5.9 trillion gallons in August, contrasts sharply with recent drought years in the Bay area such as 1981, when the cumulative deficit was nearly six trillion gallons.

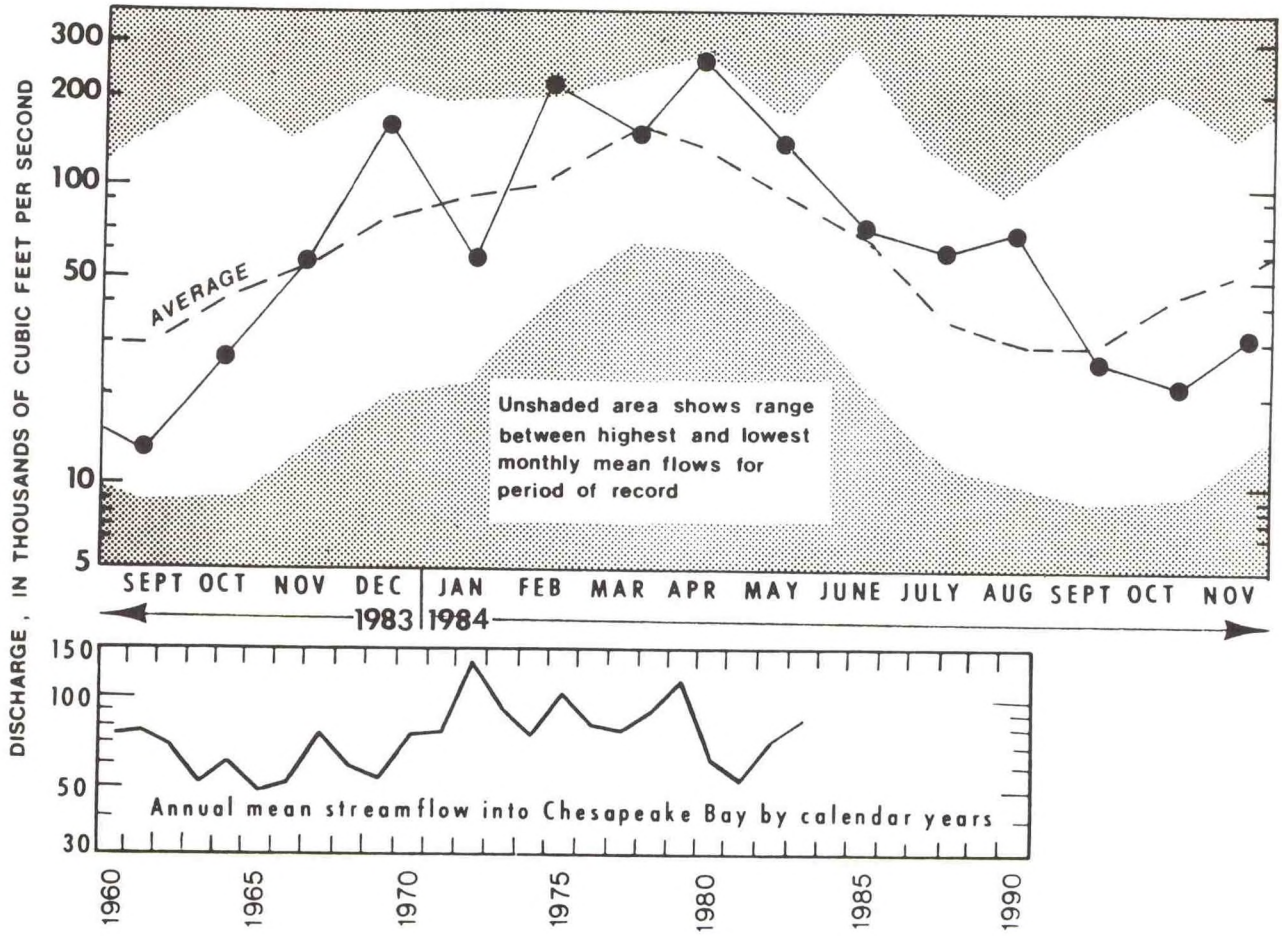

Figure 2. Monthly streamflow into Chesapeake Bay, September-November 1984 and annual mean flow 1960-83. Streamflow was below normal from September through November 1984, following five months of above average streamflow. Data from U.S. Geological Survey.

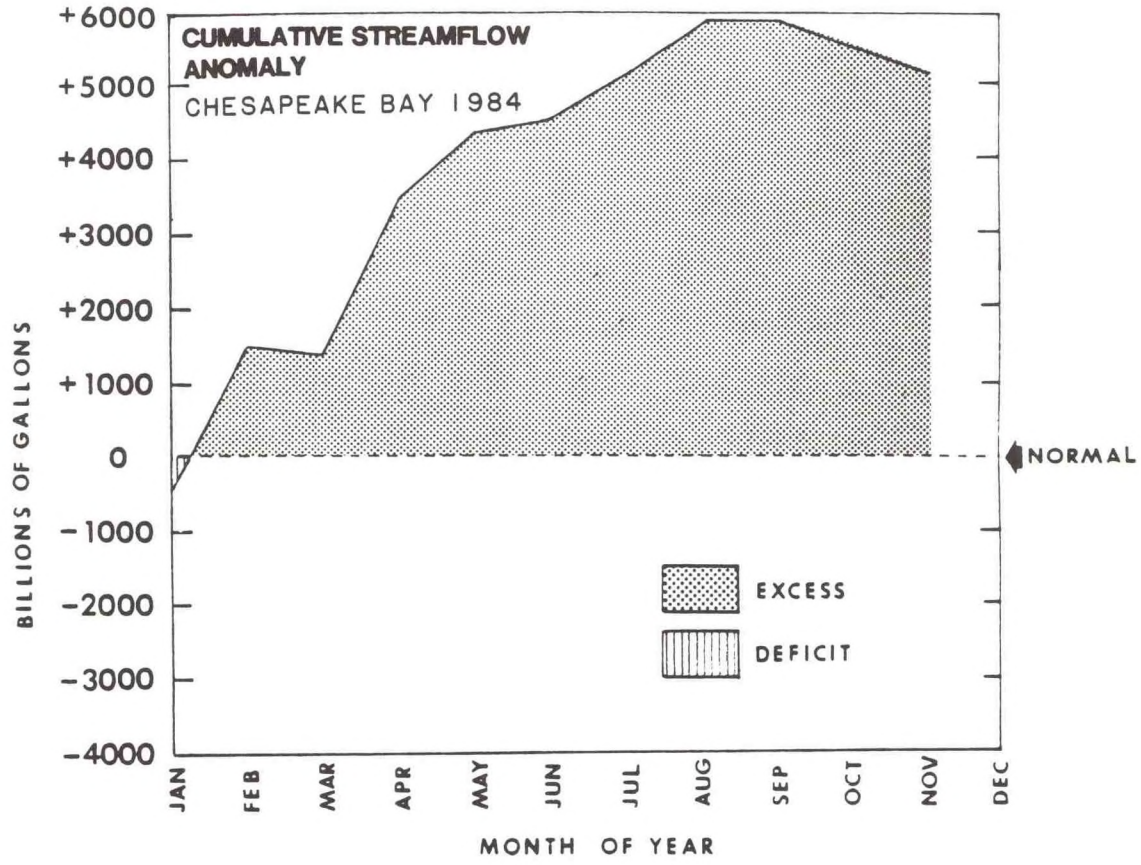

Figure 3.--Cumulative monthly streamflow anomaly, Chesapeake Bay, 1984. The cumulative streamflow anomaly (monthly sum of negative and positive departures from normal by calendar year) for January through November 1984 was an excess of 5.1 trillion gallons. The peak excess in 1984 was reached in August at nearly 6 trillion gallons. Below normal streamflow in the September-November quarter minimally reduced the large excess in 1984. Data from U.S. Geological Survey.

2.3 Oceanography

Stations around the Bay began the fall quarter showing slightly-below-normal salinities at all stations except Baltimore (Table 3 and Figure 4). However, the normal annual cycle of salinity in the Bay appeared to be re-established with salinity values increasing steadily through the fall months in response to lowered streamflow. By the end of November all stations appear to have recovered from a spring and summer of exceptionally low salinities following record streamflow in some months of 1984. Water temperatures were below normal in September but quickly rose to above normal at all stations following a warmer-than-normal fall quarter.

Salinity:

Lower-than-normal rainfall during late August and September heralded a return to near-normal salinities around the Bay. Absolute values ranged from 10 ppt at Baltimore to 27.5 ppt at Kiptopeke, illustrating the normal mixing processes in the Bay. Kiptopeke and Chesapeake-Bay Bridge Tunnel remained below normal until October, then exceeded normal values in November.

Temperature:

Temperature values for surface waters were lower than normal in September in response to a cooler-than-normal month of weather. Temperatures in the estuary did not drop as rapidly as usual in October and November due to unseasonably warm weather yielding positive temperature anomalies around the Bay for those months. Although water temperatures for November edged a little closer to normal, the values do not reflect the severe cold air temperatures of late in the month, since temperatures for most of the month were normal or above.

Table 3.--Bay surface salinities and surface water temperatures, September - November 1984.

Station	Surface Salinity and Departure from Normal Observed/*Anomaly (ppt)			Surface Water Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	September	October	November	September	October	November
Baltimore, MD	10.1/+1.0	9.4/-1.4	11.4/+0.3	73.8/-1.4	67.2/+1.5	56.1/+2.1
Annapolis, MD	10.5/-1.1	11.9/-1.2	13.5/-0.1	72.8/-2.0	64.9/ 0.0	53.7/+0.8
Solomons, MD	13.8/-1.0	15.3/-0.7	16.3/-0.3	74.6/-1.1	67.0/+1.3	56.4/+1.7
Kiptopeke, VA	25.8/-1.9	27.2/-0.5	28.2/+1.1	74.7/+0.9	66.8/+2.2	54.1/+0.3
Bay Bridge-Tunnel, VA	21.5/-2.6	24.2/+0.1	24.6/+1.3	73.1/-2.3	65.2/-0.6	56.4/+1.2

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

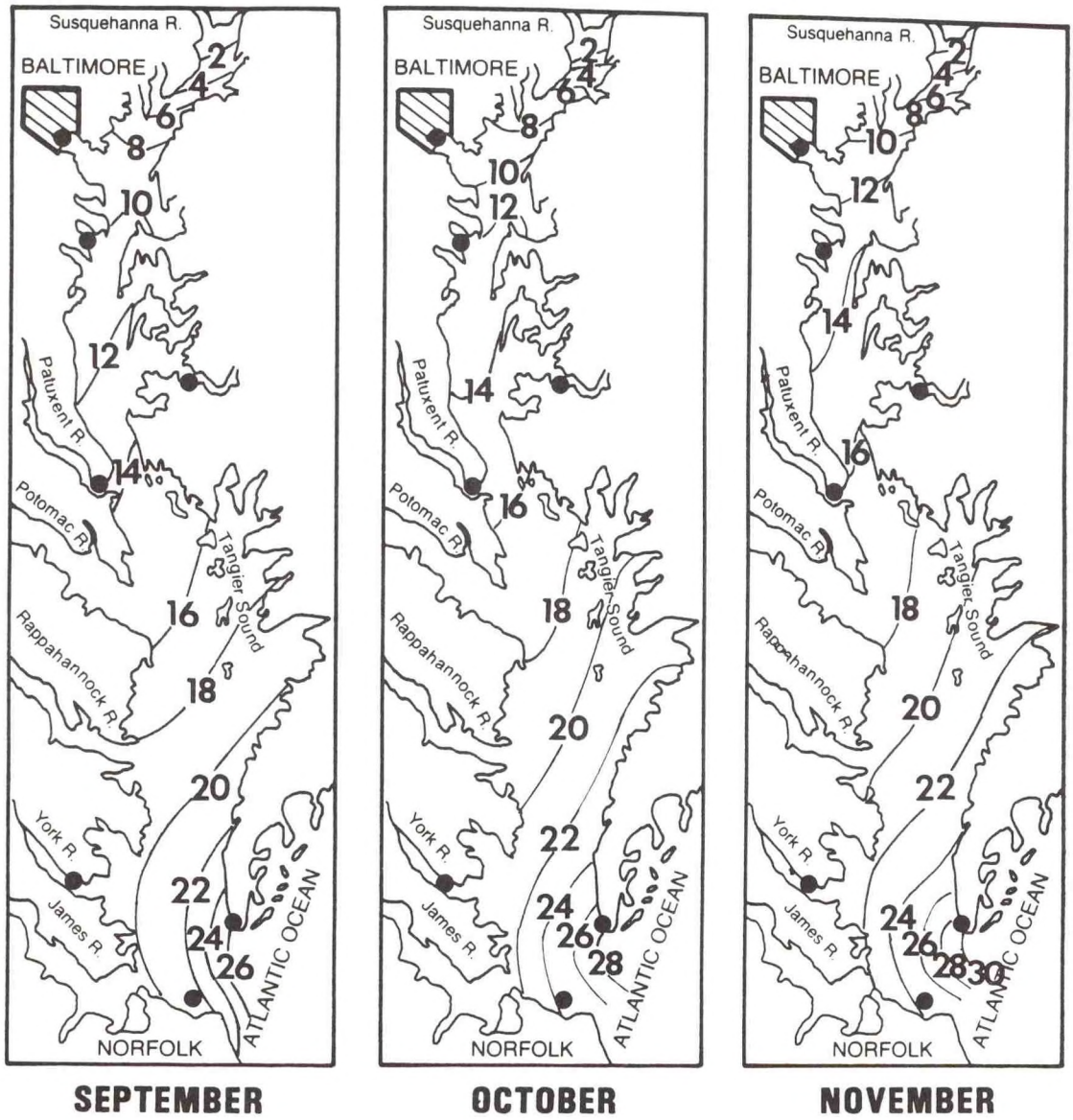

Figure 4.--Mean surface salinity distribution, Chesapeake Bay, September - November 1984. Isohalines (parts per thousand) are linearly interpolated from designated station data. Salinities at most stations were slightly below-normal in September and October following excess streamflow in summer 1984. Salinities showed more positive anomalies at Bay stations toward the end of the fall quarter following below-normal streamflow from September through November. Data from National Ocean Service, NOAA.

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

3.1 Fisheries

The scarcity of oysters in Maryland waters led to intense fishing pressure on remaining productive areas. Prices held at record high levels as quality of oyster meats was good. Blue crabs were in moderate supply, though lower than for the same period in 1983. Striped bass landings in fall 1984 showed improvement over the record low landings in 1983, though landings remained extremely low as striped bass have shown a steady decline in recent years. Extensive algal blooms which occurred in summer and fall of 1983 in the Potomac River did not recur in 1984 as the different 1984 environmental conditions were not conducive to algae growth. The aquatic weed Hydrilla, which rapidly infested areas of the upper Potomac in summer 1984, abated with decreasing fall water temperatures.

Shellfish:

Oysters

Oysters were scarce in Maryland waters during fall 1984, and watermen received high prices for their catch. The quality of oyster meats was good. Prices ranged from $14 to $20 per bushel in Maryland compared to the record high of $20 per bushel in 1983 and a high of $16.25 per bushel in 1982. Virginia landings showed considerable improvements over 1983, while good quality oyster meats and market demand kept prices high.

The scarcity of oysters caused intense fishing pressure for available stocks in the most productive oystering areas. Two productive shaft-tonging areas, the Choptank and Tred Avon Rivers, attracted watermen from a wide area of Maryland. Maryland Natural Resources Police counted 250 boats at one time working in the Tred Avon River.

Maryland landings were 16 percent higher in September 1984 over September 1983, showing a 50 percent increase in total value (Table 4). Oyster stocks were greatly reduced by disease-related mortalities in 1982, resulting in a very poor harvest in fall 1983. Preliminary October landings for Maryland in 1984 also show an increase in value. Final total Maryland October landings may be higher than the preliminary figure of 172,416 bushels which shows a slight decline (-8 percent) from October 1983. Virginia landings in October were well above 1983 in quantity (+66 percent) and value (+77 percent). Virginia November landings were up 12 percent in quantity and 18 percent in value from 1983.

Bay oyster stocks have shown a steady decline following years of poor reproduction in the 1970's and intense fishing pressure. Stocks were further reduced by disease-related mortalities in 1982 following a period of higher-than-normal salinities which provided favorable conditions for the oyster pathogens MSX and Dermo. The widespread oyster mortalities from disease as seen in 1982 have abated following greatly increased annual streamflow which reduced salinities in 1983 and 1984. However, reduced salinities, while unfavorable to diseases, are also unfavorable to oyster growth and survival. Oysters close up and stop feeding at very low salinities. This was reported to have occurred in late

Table 4.--Maryland and Virginia oyster landings, September - November 1983-1984.

		Maryland		Virginia	
		Bushels	Dollars	Bushels	Dollars
September	1983	69,218	$724,721	---	---
	1984	79,966	$1,086,384	---	---
	1983-84 % change	+16%	+50%	---	---
October	1983	187,093	$2,372,369	26,589	$319,289
	1984	172,416	$2,653,810	44,143	$563,960
	1983-84 % change	-8%	+12%	+66%	+77%
November	1983	258,508	$3,694,190	65,695	$798,083
	1984	13,453*	$200,887*	73,498	$940,549
	1983-84 % change	---	---	+12%	+18%

Data from Maryland Department of Natural Resources and Virginia Marine Resources Commission. All 1984 landings are preliminary. Potomac River landings are not included. Virginia public oyster-ground harvest begins in October. (*Final Maryland figure may be much higher when complete.)

spring 1984 in Virginia. High streamflow and reduced salinities during summer 1984 may have influenced the low survival rate of young oysters spawned in 1984. Spatset in Maryland waters was almost non-existent except for lower Tangier Sound where light spatset was detected. Summer 1984 shellstring surveys in Virginia indicated a moderate to good level of recruitment potential in some Virginia tributaries, though, initial observations of actual spatset on the bottom indicated a low survival of the young oysters.

Large numbers of ctenophores, commonly known as comb jellies, were present in Chesapeake Bay during summer 1984. The abundance of the ctenophore, which feeds on oyster larvae, may have contributed to the reduced spatset in 1984. Stinging nettles were present in reduced numbers in 1984 during a period of high streamflow and reduced salinities. Low numbers of nettles, which feed on ctenophores, probably allowed the ctenophore population to proliferate in summer 1984. Bay scientists have observed that oyster spatset was high in certain years with high salinities in which nettles were abundant. Although salinity appears to be an overriding factor involved in the survival of oyster larvae, ctenophore predation in 1984 may have been a major contributor to the reduced spatset.

Low dissolved oxygen in late summer in many areas of the Bay was associated with oyster mortality. Anoxic conditions (dissolved oxygen = 0) in Chesapeake Bay were apparently more widespread than usual in 1984. Anoxia in 1984 occurred at shallower depths (15-20 feet) not previously affected. Heavy freshwater inflow coupled with the lack of wind-induced mixing in 1984 caused Bay waters to become strongly stratified, which may have caused an increase in the areal extent of the anoxia. The lack of oxygen causes mortalities of shellfish such as oysters which cannot move. Crabs can move to areas with higher oxygen levels.

Chesapeake Bay Institute studies show that extensive mortalities of market-sized oysters occurred on an oyster bar in the Choptank River in late summer, probably as a result of oxygen depletion. Watermen working in the Maryland portion of Chesapeake Bay also reported mortalities of oysters, particularly on the western shore. Dollar value estimates of damage are not available.

Blue crabs

Blue crab landings were lower than in the same period in 1983 (Table 5), (crabs were very abundant in 1983 following the highly successful 1982 year class). Blue crabs were in sporadic supply in summer 1984 and landings were down 21 percent from summer 1983. More smaller crabs from the 1983 year class were present in summer 1984 because of delayed warming of water temperatures in spring 1984. Apparently, many of the smaller crabs reached market size in fall 1984, and contributed to the September - November 1984 landings.

The quantity of crabs landed in Maryland in September and November was very close to that in the same months in 1983 (Table 5). Maryland October landings, however, showed a 24 percent decline from 1983. Price per pound of Maryland crabs decreased in all three months from 1983. The relationship between price, quantity, and quality of supply is unclear. Virginia landings were down in September by 42 percent, though landings improved later in the quarter. Virginia crabs showed an increase in price per pound in September, while there was no change from 1983 in October.

Table 5.--Maryland and Virginia blue crab landings, September - November 1983-1984.

		Maryland		Virginia	
		Pounds	Dollars	Pounds	Dollars
September	1983	8,843,430	$2,294,325	6,988,293	$1,165,977
	1984	8,675,958	$1,947,121	4,086,694	$766,433
	1983-84 % change	-2%	-15%	-42%	-34%
October	1983	7,260,370	$1,665,056	5,037,526	$840,018
	1984	5,539,537	$1,114,655	4,058,452	$692,930
	1983-84 % change	-24%	-33%	-19%	-18%
November	1983	1,913,546	$568,345	2,470,664	$499,693
	1984	1,854,566	$518,168	1,236,874*	$212,938*
	1983-84 % change	-3%	-9%	---	---

Data from Maryland Department of Natural Resources and Virginia Marine Resources Commission. All 1984 landings are preliminary. Potomac River landings are not included. (*Final Virginia figure may be much higher when complete.)

Finfish:

The Maryland Tidewater Administration reports the relative abundance index for striped bass spawning success for 1984 is 4.2, which is higher than the 1.4 value in 1983, but below the long-term average of 9.3. The relative abundance index is based on the average number of young-of-the-year (inch-long fry) captured per seine haul in Bay tributaries. The index has ranged from a low of 1.2 set in 1981 to the record high of 30.4 set in 1970. Maryland Department of Natural Resources preliminary landings data through early fall 1984 suggest that total 1984 striped bass landings will exceed the record low of 359,000 pounds landed in 1983. Striped bass landings in Maryland exceeded 5 million pounds in 1961 and 1969. Landings have shown a steady decline since they last reached 5 million pounds in 1973. The decline in striped bass stocks prompted the State of Maryland to issue a moratorium on striped bass landings beginning January 1, 1985. The rise in landings in 1984 over 1983 is related to the strength of the 1982 year class of striped bass which were of marketable size in 1984. The relative abundance index for striped bass was 8.4 in 1982, higher than each year since 1974, except 1978.

Landings of striped bass from the Potomac River in fall 1984 were considerably higher than the same period of 1983. Landings for the period October-December 1984 exceeded one-half million pounds compared to the same period of 1983 when only 109,375 pounds were reported. Dockside prices fell from $4 per pound in the spring to as low as 60 cents/pound in November as market supplies of striped bass were plentiful. The 1982 relative abundance index for spawning success in the Potomac River was 10.0, higher than the long-term average of 6.6 for the Potomac River.

The 1982 striped bass year class had only recently attained the legal size limit (14 inches total length) in early fall 1984. Apparently fishing pressure for striped bass intensified in the last three months of 1984 as legal sized fish became abundant preceding the upcoming January 1 ban in Maryland and unusually warm air temperatures in October through mid-November provided favorable conditions for harvest activities. Fisheries managers expressed concern that heavy exploitation of the 1982 year class could jeapordize the only abundant source of future broodstock for Chesapeake Bay striped bass.

Blooms, Submerged Aquatic Vegetation:

The extensive blooms of blue-green algae which occurred in the upper Potomac River in summer and fall 1983 did not re-occur in 1984. Environmental conditions in summer 1984 were unfavorable for blooms in the upper Potomac estuary, contrasting sharply with conditions in 1983. The Potomac showed improved water quality in fall 1984 following extensive flooding of the upper estuary from above normal streamflow in spring and summer. Sunshine amounts and temperatures were low, and conditions were windy in summer 1984. All of these factors are unfavorable for high algae concentrations.

The submerged aquatic plant, Hydrilla, which showed heavy infestations in areas of the upper Potomac in summer 1984, apparently died off with the seasonal decline in water temperatures. Hydrilla is considered a threat to navigation and recreation and can rapidly infest large areas. Though heavy infestations have abated, the plant may reappear with warming temperatures later in 1985.

3.2 Recreation

Most Virginia and Maryland parks showed large increases in October 1984 attendance over October 1983 during a period of warmer-than-normal air temperatures.

Three major storm events occurred during the quarter (see Section 2.1 Weather). These storms affected recreation minimally by reducing attendance during short periods of rainfall in some areas.

The National Weather Service marine advisories and warnings for Chesapeake Bay are listed in Table 5. One special marine warning for a tornado was issued during the quarter for the area South of Windmill Point in September. Fewer gale warnings were issued in the fall 1984 quarter than in the 1983 and 1982 fall quarters, indicating less hazardous conditions for boating.

Table 6 contains U.S. Coast Guard Search and Rescue (SAR) data for the fall 1984 quarter. Group Baltimore handled a total of 376 cases compared to 319 in fall 1983. Group Baltimore and Group Eastern Shore reported a slightly higher caseload in October 1984 over October 1983 during a period when the weather was dry and warm. Though November was wet and cool, boating activity associated with waterfowl hunting may have contributed to the higher caseload in 1984 for Group Eastern Shore.

Fifty-one boating accidents occurred in Bay waters in Maryland during the fall quarter, resulting in 5 deaths, 8 injuries, and $75,391 in property damage (Table 7). The cumulative number of boating accidents in 1984 through November (229) is very close to the cumulative total for 1983 through November (219). Cumulatively, the number of injuries was higher (62 in 1984 compared with 53 in 1983), fatalities showed little change (25 in 1984 compared with 26 in 1983), and property damage was greater ($579,319 in 1984 compared with $371,891 in 1983).

Attendance and revenue for selected Maryland and Virginia state parks are listed in Table 8. Attendance at most parks in October 1984 showed large increases over October 1983. Unusually warm weather in October 1984 provided favorable conditions for outdoor recreation in the Bay area. All parks except Sandy Point showed an increase in attendance in October 1984 over October 1983. Seashore had the largest increase in October (up 174 percent), though higher counts from traffic counters (not in use in 1983) contributed to the increase seen in all months in fall 1984 at Seashore.

The warm weather which continued through mid-November contributed to increases in November 1984 attendance over November 1983 at both Maryland parks.

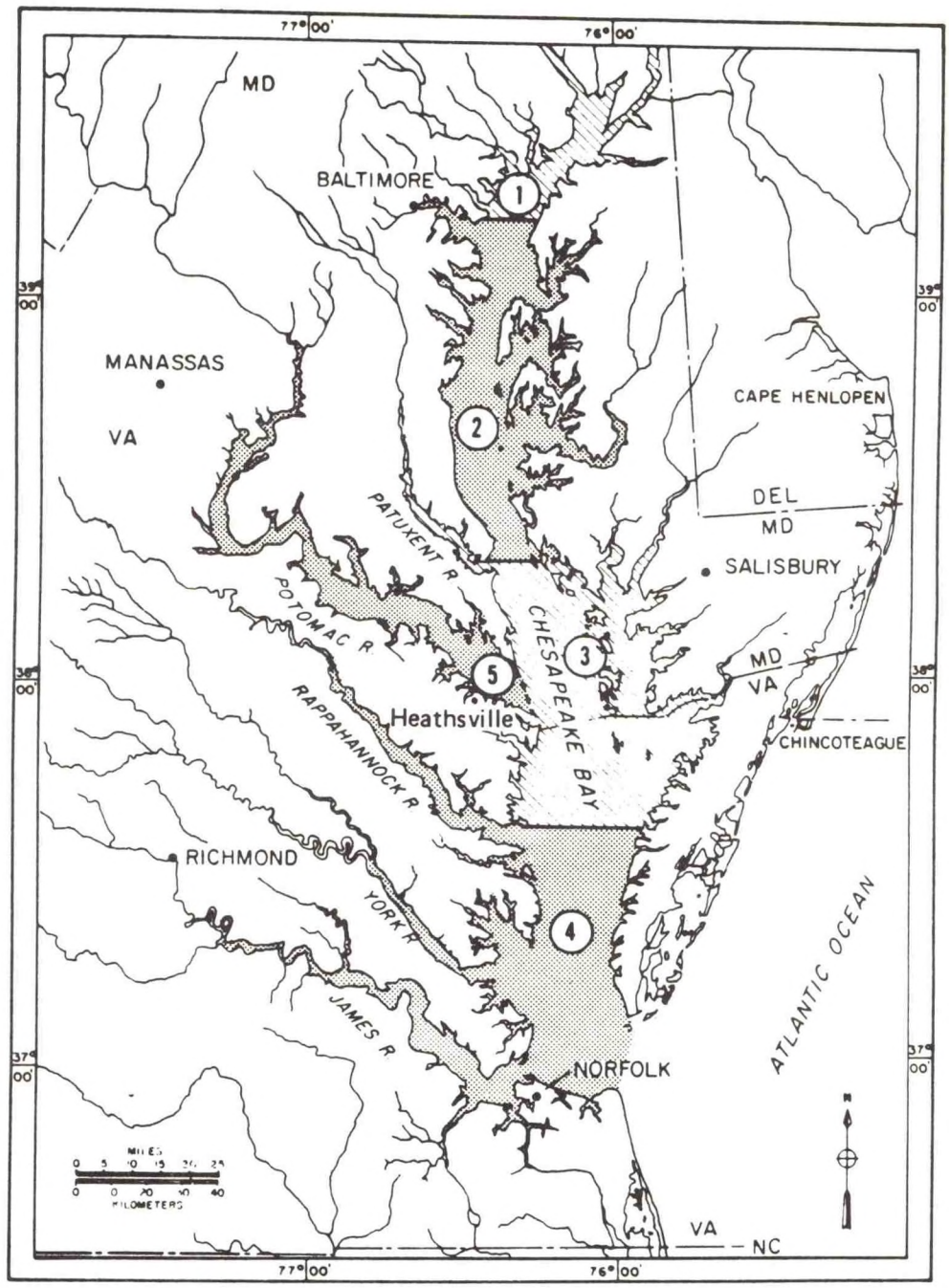

Figure 5.--National Weather Service (NWS) forecast areas for Chesapeake Bay.

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, September - November 1984 (National Weather Service data). See Figure 5 for locations of forecast areas.

	Date	Condition Report[1]	Location[2]
September	4	A	Windmill Point to Mouth of Bay
	11	D	Windmill Point to Mouth of Bay
	14	A	Windmill Point to Mouth of Bay
	15	A	Entire Bay and Tidal Potomac River
	26	A	Entire Bay and Tidal Potomac River
	29	A	Windmill Point to Mouth of Bay
	30	A	Windmill Point to Mouth of Bay
October	1	A	Head of Bay to Windmill Point and Tidal Potomac River
	2	A	Windmill Point to Mouth of Bay
	11	A	Windmill Point to Mouth of Bay
	13	A	Head of Bay to Windmill Point and Tidal Potomac River
	13	B	Mouth of Bay
	21	B	Patuxent River to Mouth of Bay
November	2	A	Entire Bay and Tidal Potomac River
	5	A	Entire Bay and Tidal Potomac River
	10	A	Entire Bay
	11	A	Tidal Potomac River
	12	A	Entire Bay and Tidal Potomac River
	15	A	Entire Bay
	16	A	Tidal Potomac River
	17	A	Head of Bay to Patuxent River
	19	A	Entire Bay and Tidal Potomac River
	21	A	Windmill Point to Mouth of Bay
	28	A	Entire Bay and Tidal Potomac River
	29	A	Baltimore Harbor to Mouth of 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, September - November 1984.

Month	Number of Search and Rescues					
	Group Baltimore		Group Eastern Shore		Group Hampton Roads	
	1984	1983	1984	1983	1984	1983
September	157	128	5	15	140	175
October	142	139	14	10	97	120
November	77	52	7	4	51	59
TOTALS	376	319	26	29	288	354

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, September - November 1984.

Month	No. of Boating Accidents		No. of Injuries		No. of Deaths		Property Damage	
	1984	1983	1974	1983	1984	1983	1984	1983
September	32	23	8	3	4	1	$153,925	$14,780
October	14	13	0	2	0	3	$ 39,816	9,231
November	5	3	0	0	1	0	$ 21,650	N/A
TOTALS	51	39	8	5	5	4	$ 75,391	$24,011

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, September - November 1984.

Facility	Month					
	September		October		November	
Maryland	Attendance	Revenue	Attendance	Revenue	Attendance	Revenue
Sandy Point	94,339	$3,250	56,345	$3,000	15,047	$ 0
Point Lookout	32,874	$19,435	23,400	$5,800	3,700	$3,191
Virginia						
Westmoreland	12,373	$7,561	3,520	$3,591	854	$300
Chippokes	2,865	$1,700	2,277	$ 521	808	$ 0
York River	3,973	$ 314	2,669	$ 211	2,669	$ 43
Seashore	107,826	$28,570	93,516	$10,267	67,642	$2,101

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. Most parks charge no admission fees after Labor Day.

3.3 Transportation

Winds in excess of 40 mph shut down crane operations three times at the Port of Baltimore for a total of eight hours and 59 minutes (Table 10). During the same period in 1983, winds shut down operations two times for a total of six hours and 55 minutes. Winds associated with storm activity in late November 1984 resulted in the shutdowns on the 28th and 29th. The amount of lost productive time due to wind in November 1984 (8 hours, 59 minutes) was much higher than in November 1983 (3 hours, 35 minutes).

Losses incurring to 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 November down time, shippers may have experienced in excess of $30,000 in costs due to excessive winds.

Table 10.--Number of crane shutdowns and productive time lost due to wind at Port of Baltimore, September-November 1984.

Date	Number of Shutdowns	Productive Time Lost (Hours:Minutes)
September	0	0
October	0	0
November 13	1	4:34
28	1	:45
29	1	3:40
Totals	3	8:59

Data from Maryland Port Administration.

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