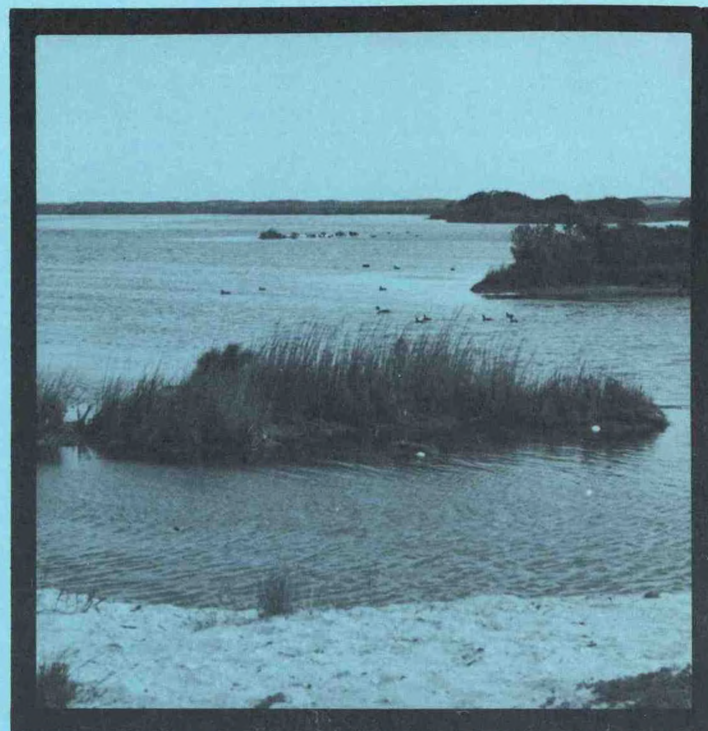
Marine Environmental Assessment

CHESAPEAKE BAY

DEC. 1983–FEB. 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. From September 1981 through March 1982, MAB issued monthly assessments of Chesapeake Bay in the economic sectors of fisheries, recreation, and transportation. The Chesapeake Bay region served as a prototype for assessment development. We now issue quarterly assessments in order to extend the service to other marine areas within existing resource limitations.

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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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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Marine Environmental Assessment Division

Washington, D.C.
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U.S. DEPARTMENT OF COMMERCE
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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 assessment 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 Assessment and Information Services Center 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. Climate impact summary, Chesapeake Bay, December 1983 - February 1984.

IMPACT SECTOR

EVENT	FISHERIES: Finfish harvest activities (general)	FISHERIES: Shellfish harvest activities (general)	FISHERIES: Blue crab dredge harvest	FISHERIES: Juvenile summer flounder, croaker	FISHERIES: Fishing nets	FISHERIES: Wooden-hulled boats	FISHERIES: Docks	RECREATION: Boating	RECREATION: Safety	RECREATION: Fishing piers	RECREATION: State park attendance	RECREATION:	TRANSPORTATION: Port operations	TRANSPORTATION: Vessel traffic (general)	TRANSPORTATION: Safety	TRANSPORTATION: Navigational aids	TRANSPORTATION: Tug and barge traffic	TRANSPORTATION:
Cold water temperature				–														
Ice cover	–	–			–	–	–	–	–	–					–	–	–	
Good 1982 year class			+															
Warm February air temperature								+			+							

[+] Favorable

[–] Unfavorable

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

Chesapeake Bay Marine Environment

1. Highlights - General Events and Impacts

Ice cover disrupted finfish and shellfish harvest activities in late December through January in tributaries and portions of the Upper Bay. The intensity of cold and rapid onset of icing in late December made conditions hazardous for fishing boats and denied watermen access to oyster grounds in many areas of the Upper Bay. Ice also caused damage to wooden-hulled boats, docks, and fishing gear.

Above average blue crab landings in December reflect the very strong 1982 year class, and unseasonably warm water temperatures during the first three weeks of December had no detectable effect on the December 1983 dredge harvest.

Unusually cold water temperatures observed in late December 1983 increased the mortality rate of juvenile summer flounder in the York River coinciding with the peak infection period of a blood parasite. Extensive cold water mortalities of young-of-the-year croaker occurred in Virginia rivers, indicating the loss of most, or all, of the 1983 year class.

Marine recreational activity on Chesapeake Bay is normally extremely low in winter months, though boating activity showed a slight increase in the lower Bay during unusually mild conditions over several weekends in February. State park attendance during the unusually warm February weather was generally higher than during the comparable period in February 1983. Ice caused extensive damage to fishing piers at Hart Island, MD.

Large vessel traffic and port operations proceeded uninterrupted by ice cover, with main shipping channels open at all times. Ice damaged $200,000 in navigational aids in the Middle and Upper Bay. One tugboat was sunk after colliding with an ice floe on January 8 on the Potomac River.

2. Weather and Oceanography Summary

Weather

Bitter cold weather during the second half of December caused early ice formation on Chesapeake Bay, topping off a month of frequent strong winds and heavy rains. Cold weather held until late in January. February brought spring-like temperatures and more heavy rains to the region.

December:

Around Chesapeake Bay (Figure 1) and elsewhere in the country, December will be remembered for the record-breaking cold weather during the second half of the month following a mild and very wet first half. Average temperatures were more typical of January.

A procession of cold fronts and frontal storms passed through the area during December, beginning with a cold front on the 3rd which brought light rain and traces of snow to most of the stations, but little change in temperature. A storm on the 4th and another on the 6th brought strong winds, one to two inch rainfalls, and above normal temperatures to the area.

Temperatures fell over the next several days as a new cold front embedded in the second storm surged through the area. Traces of snow fell as far south as Washington, D.C.

A cold front on the 10th produced light precipitation and little change in temperature, but a storm developed on this front in the Gulf of Mexico and brought heavy rain, temperatures in the 60's, and winds above 25 mph to the Bay region on the 12th and 13th. A second storm brought warm, moist air and light precipitation northward over the 14th and 15th, giving many stations their highest temperatures of the month. Cold air behind this second storm caused temperatures to drop from the 15th until the 21st when another new storm, developing in the Gulf of Mexico, again swept moisture-laded air northward. Temperatures plunged immediately after this storm, establishing new record lows on the 24th, 25th, and 26th at many stations.

Temperatures rose briefly into the 50's at Patuxent and Royal Oak on the 28th as another storm system from the Gulf brought nearly an inch of precipitation to the area. Temperatures fell again following a new surge of cold air on the 29th and remained below freezing through the end of the month.

Precipitation averaged 6.73 inches for the 11 stations, 107 percent above the area normal of 3.26 inches. Departures ranged from 33 percent above normal at Richmond to 159 percent above normal at Wilkes-Barre (Table 2). More than half the stations received more than twice their normal amounts of precipitation, most of which fell as rain. It was the wettest December on record at Wilkes-Barre, Royal Oak, and Norfolk, and the second wettest at Williamsport. Some flooding in the Wilkes-Barre area resulted from the heavy rains of the 12th to the 14th.

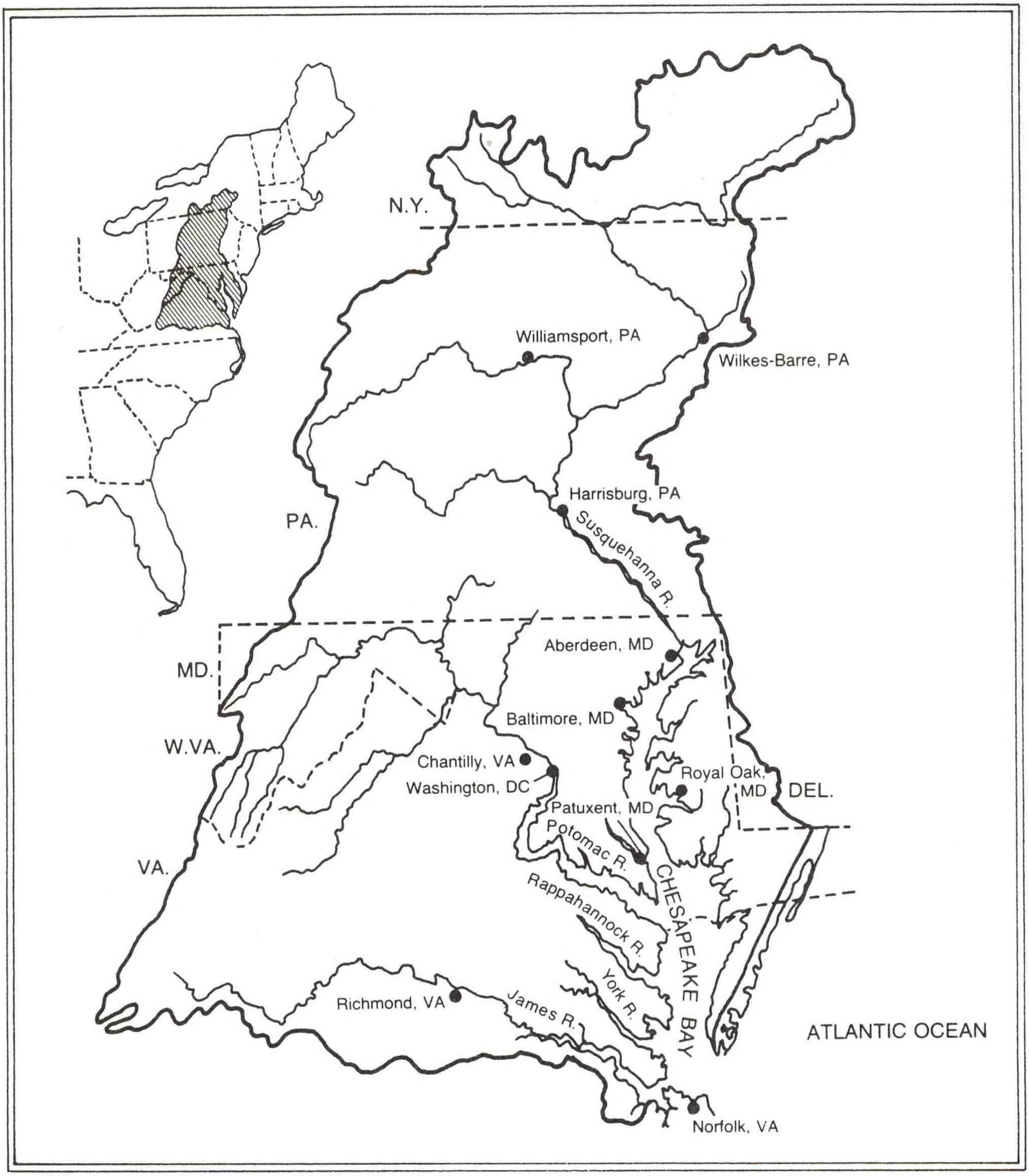


Figure 1. Selected meteorological stations, Chesapeake Bay watershed (Modified EPA map).

Table 2. Total precipitation, mean air temperatures, and departures from normal for 11 stations, Chesapeake Bay watershed, December 1983 - February 1984.

Station	Total Precipitation (Inches) and Departure from Normal (Percent of Normal) Observed/*Anomaly			Mean Air Temperature and Departure from Normal Observed/*Anomaly (Deg.F)		
	December	January	February	December	January	February
Williamsport, Pa.	6.54/+102%	1.09/-62%	4.83/+71%	26.7/-4.0	21.0/-5.2	34.7/+6.5
Wilkes-Barre, Pa.	6.58/+159%	1.11/-51%	2.92/+42%	27.1/-2.6	23.0/-2.2	35.8/+9.1
Harrisburg, Pa.	7.53/+134%	1.12/-62%	4.51/+60%	28.7/-4.7	24.8/-4.6	36.7/+5.2
Aberdeen, Md.	8.41/+152%	1.16/-61%	3.98/+42%	33.5/-1.5	28.1/-5.2	41.4/+6.7
Baltimore, Md.	6.72/+98%	1.96/-35%	3.90/+31%	33.3/-3.2	28.5/-4.2	41.7/+7.0
Washington, D.C.	5.91/+86%	1.71/-38%	3.43/+31%	36.0/-2.9	32.2/-3.0	43.8/+6.3
Chantilly, Va.	5.66/+72%	1.42/-50%	4.13/+56%	30.3/-4.8	25.8/-5.6	38.9/+5.3
Royal Oak, Md.	8.95/+139%	2.43/-29%	3.73/+17%	36.7/-2.2	30.2/-4.8	42.7/+6.0
Patuxent, Md.	7.12/+116%	3.23/+11%	4.28/+55%	38.2/-1.4	32.3/-4.7	42.7/+4.7
Richmond, Va.	4.50/+33%	3.98/+23%	3.97/+27%	36.2/-3.7	32.6/-4.0	44.5/+5.6
Norfolk, Va.	6.10/+92%	2.77/-26%	4.66/+42%	41.6/-1.9	35.5/-4.4	46.7/+5.6
Average	6.73/+107%	2.00/-33%	4.03/+42%	33.5/-3.0	28.5/-4.4	40.9/+6.2

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

Monthly temperatures averaged 3.0 degrees below normal (Table 2) for the 11 stations, ranging between 1.4 degrees (Patuxent) and 4.8 degrees (Chantilly) below normal. AISC computed the mean December temperature for Aberdeen using an estimation technique based on temperatures at surrounding stations. The Aberdeen value average is considered to be accurate within 0.2 degrees.

The cold snap from the 24th through the 26th set many daily low temperature records over the area. Chantilly and Norfolk each set records for all three dates. Ice formed on the Susquehanna River at Harrisburg December 21st. Ice formed on tributaries and other parts of the Bay as far south as the mouth of the Choptank River on the 25th causing damage to docks and pilings.

Winds were strong on the Bay during December, averaging 12 mph at Royal Oak, gust of 55 mph from the northwest on the 25th. Peak winds reached 47 mph at Patuxent on the 24th accompanying the surge of cold air behind the storm of the 22nd. The storms of the 6th and the 28th also had peak winds exceeding 40 mph at several stations. Peak winds were frequently above 25 mph during the month.

January:

January weather continued the seasonal trend from the end of December with storm systems moving from west to east. On the 5th a trough crossed the area causing light precipitation. On the 6th a frontal storm moved southeastward out of Canada, again bringing only small amounts of precipitation. Another frontal storm and cold front on the 8th added light precipitation. On the 10th a low pressure system formed in the Gulf of Mexico, moved northward, and combined with the trailing end of the front from the 8th and a new cold front, bringing rainfall amounts ranging from one to two inches in the southern Bay area and more than an inch of snow over portions of the northern Bay. The one-inch snow line on the morning of the 11th covered almost all of Maryland and part of northern Virginia. Temperatures in the low teens occurred in the Maryland portion of the Bay on the morning of the 12th with brisk northerly winds, clear skies, and snow covered ground. Another storm system carrying Gulf air moved through the area the 13th and 14th, raising temperatures and dropping small amounts of precipitation. A frontal wave from the Gulf region on the 15th and another on the 17th produced precipitation over the entire area ranging from 0.2 inches to over 2.0 inches in the southern Bay region. Baltimore and Aberdeen received 4.6 inches and 5.0 inches of snow, respectively, from this storm system. The extensive snow cover provided by this storm set the stage for the rapid decline in temperature. Most stations experienced their lowest values in the month on the 22nd, but weather for the period from the 19th through the 23rd, set new daily low temperature records at Baltimore, Patuxent, Royal Oak, Wilkes-Barre, Harrisburg, and Chantilly. The 18 degrees below zero recorded at Chantilly on the 22nd is the coldest January temperature of record for that station.

After the 22nd, temperatures began to climb quickly as a frontal wave pushed northward and slightly westward along the Atlantic Coast spreading light to moderate rain over the region on the 24th and 25th. The snow line which had advanced across most of Virginia, retreated to northern Maryland. Temperatures soared into the 50's and 60's over the 25th to the 27th. Highest temperature of the month occurred at Norfolk on the 24th and for all the remaining stations on the 26th or the 27th, when temperatures in the 50's and 60's were experienced by most stations. The rise in temperature over the 3 to 5 day period ranged between 50 degrees at Norfolk and 75 degrees at Chantilly. A cold front on the 27th reduced temperatures to seasonal values again. A large frontal storm on the 29th and 30th brought precipitation and a resurgence of cold air on strong northwest winds on the 31st.

January temperatures averaged 4 to 6 degrees colder than those in December among our 11 Bay area stations. Table 2 shows monthly average temperatures ranged from 21 degrees at Williamsport to 35.5 degrees at Norfolk, and departures from station normals ranged between 2.2 degrees below normal at Wilkes-Barre, and 5.6 degrees below normal at Chantilly. All 11 stations experienced below normal temperatures, and generally departures from normal in January exceeded December departures (Table 2). Daily temperatures for five stations in the immediate Bay area exhibited a steady decline in temperature beginning on the 3rd and continuing to the record low temperatures of the 22nd. This decline was succeeded by a rapid rise to above-normal temperatures for the 25th through the 27th and a return to seasonal values thereafter.

Precipitation for the month ranged from 1.09 inches at Williamsport (62 percent below normal) to 3.98 inches at Richmond (23 percent above normal). The 11 Bay area stations averaged 33 percent below normal for the month (Table 2). The major occurrences of precipitation during the month were from storm systems on the 10th, 17th, 24th, and 30th of which the one on the 10th and 11th was dominant. Although snowfall of nearly one inch was associated with the storm of the 10th and 11th, most of the precipitation from this storm was rain. The greatest snowfall of the month in the Bay area came on the 17th and 18th when depths of 3 to 5 inches accumulated in the upper Bay area.

Winds in January were not as strong as in December. Royal Oak reported a peak wind gust of 35 mph on the 31st associated with sustained winds of 15-25 mph from the northwest. Patuxent and Royal Oak recorded peak winds in the 25-30 mph range several times during the month, but mean wind speeds stayed near 8 mph over the region.

February:

Weather during February 1984 was nearly springlike among the eleven stations in Figure 1; temperatures averaged 6.2 degrees warmer than normal and precipitation averaged 42 percent above normal (Table 2). This contrasted sharply with the below normal temperatures and precipitation of December and January.

The month began with cold, northwesterly winds in the wake of a late January storm system. As the system receded, winds became southwesterly and temperatures rose as a new storm system developed in the Midwest. This system, which moved slowly through the Bay region on the 3rd and the 4th, was followed by a new cold front out of Canada on the 5th and a secondary low pressure system along the cold front on the 6th. Rains of about one half inch accompanied by traces of snow resulted from these systems in much of the Bay region, but in Norfolk, more than 5 inches of snow fell. Richmond received nearly 3 inches of snow. Strong northwesterly winds kept temperatures low until the 9th when winds shifted into the west and southwest, and daytime temperatures climbed above freezing.

A warm front on the 10th and the 11th brought light rain and temperatures in the 60's to the immediate Bay area, but cooler temperatures prevailed just to the north. A cold front with a developing low pressure center reached the East Coast on the 14th causing heavy rain in the Bay area. Norfolk received 2.68 inches of rain in 24 hours on the 14th, and other Bay area stations received 2 inches or more of rain over the next two days as secondary low pressure systems developed along the front and passed over the area. Strong southerly winds pushed temperatures into the 60's at most Bay area stations on the 14th. Winds returned to the northwest and brought cooler temperatures on the 15th.

A weak cold front yielded a small amount of precipitation on the 17th, and a front on the 19th brought strong northwest winds, but little precipitation. Cool and breezy weather persisted through the 22nd.

A surface low pressure system moved up the Atlantic Coast from the Gulf of Mexico on the 23rd bringing warm air and rainfall of more than one half inch to Bay area stations. A record daily high temperature of 71 degrees was reached at Washington on the 24th; other Bay area stations had similar high temperatures. Later on the 24th a cold front dropped temperatures into the 50's. Strong northwesterly winds in the rear of the frontal system persisted for the next two days.

A new storm from the western Gulf region advanced on the Bay area on the 27th and dominated its weather over the 28th and the 29th. Rain in excess of one half inch fell at most Bay locations. Peak winds exceeded 50 mph on both the 28th and the 29th at Norfolk. Wind gusts exceeded 40 mph at Baltimore, and other stations on the Bay had wind gusts of 30 mph or more.

Temperatures among the 11 stations of Figure 1 were above average during February (Table 2). Departures averaged 6.2 degrees above normal, ranging between 4.7 degrees above normal at Patuxent, and 9.1 degrees above normal at Wilkes-Barre. February at Wilkes-Barre ranked as the second warmest February of record, second only to 1954. At Baltimore, only 7 of the 29 days experienced below-normal temperatures, and throughout the area heating degree days (HDD) were 100 to 200 HDD below normal. Most stations experienced highest temperatures for the month on the 24th, although Richmond reached its peak temperature on the 12th and 13th, and Norfolk reached its high of 72 degrees on the 13th. Most stations of the group recorded lowest temperature for the month on either the 1st or the 2nd.

Precipitation among the 11 stations in Figure 1 was above normal, ranging from 17 percent above normal at Royal Oak, to 71 percent above normal at Williamsport (Table 2). Their departures averaged 42 percent above normal (Table 2). The major precipitation within the month occurred on the 14th and 15th in association with a north-south frontal system strongly supported by an upper atmospheric trough. This trough contained a closed cyclone at the 500 millibar level in the upper atmosphere on both the 13th and the 15th and was one of a continuing string of upper atmospheric troughs or cyclones moving west to east across the United States in approximately 6 days. Most stations in the Bay area received more than half their monthly rainfall from this midmonth event. Precipitation occurring during the 3rd-6th, the 22nd-23rd, and the 27th-28th were similar in production of rainfall, while that around the 11th was considerably less. Snow accompanied only the first and the last of the precipitation systems of this month.

Winds were frequently strong during the month. Peak winds over the Bay area ranged from 20 to 25 mph during the first 6 days of the month. Winds reached 39 mph in gusts at Royal Oak on the 7th. Peak winds around the Bay exceeded 30 mph on the 14th and 15th and from the 20th through the end of the month. The strongest wind gust at Baltimore (BWI AP) was 49 mph from the northwest on the 25th. Peak winds exceeded 40 mph at Baltimore on the 29th as well and reached 54 and 55 mph on the 28th and 29th, respectively, at Norfolk.

Icing

Icing occurred on the Bay this winter in response to a series of short, severely cold periods of weather, two in late December, one in early January, and a two-week cold snap in mid-January. The sustained severe cold which created record icing in winter 1976-77 and extensive icing in winter 1978-79 did not occur during the 1983-84 winter. However, the sudden cold which began around December 20 and reached record lows December 24-25 allowed quick formation of ice in the tributaries of the Bay and along the shore. Compact pack ice occurred in the upper Bay in the region of Swan Point to North Point.

Close pack and compact pack ice occurred as early as December 26th on the Potomac River from the 301 bridge north to Alexandria and in the Bay near Swan Point. The Magothy, Back, Gunpowder, Bush, Sassafras, Middle, upper Chester, and lower Susquehanna Rivers all froze to a compact pack by the December 27th. Kent Island Narrows was reported frozen and inaccessible by the 28th of the month. On the 25th, Stillpond Coast Guard station was unable to respond to search and rescue (SAR) requests. One day later, the Taylor's Island station indicated difficulty in responding to SAR due to ice conditions on Slaughter Creek. By the 28th the Taylor's Island station was unable to respond to SAR, and the St. Inigoes station was able to respond only to urgent SAR requests, having to break 200 yards of ice to exit from the station. The stations continued to have to break ice to obtain open water at various periods during January.

The main icing period began near January 12th and reached maximum ice condition on or about the 23rd. Conditions on the 23rd (Figure 2) were these: compact pack on the Bay from the Bay Bridge to C and D Canal; Susquehanna mouth open pack; very close pack ice conditons on the Bay from Cove Point, MD (Western shore, above mouth of Patuxent River) to the South River and in Eastern Bay; Choptank River and Potomac River from the 301 bridge to Washington showed compact pack; Patuxent showed close pack ice; and the lower Potomac showed very close pack, close pack and compact pack dominated by drifting ice floes. During the week of January 16-22 the Coast Guard reported 11 preventative ice breaking patrols and three vessel assistance operations. The upper Potomac required five ice breaking cruises each week between December 26th and January 23rd. Ice cover at peak extent appears to be around 30 percent of the Bay area in compact pack ice conditions.

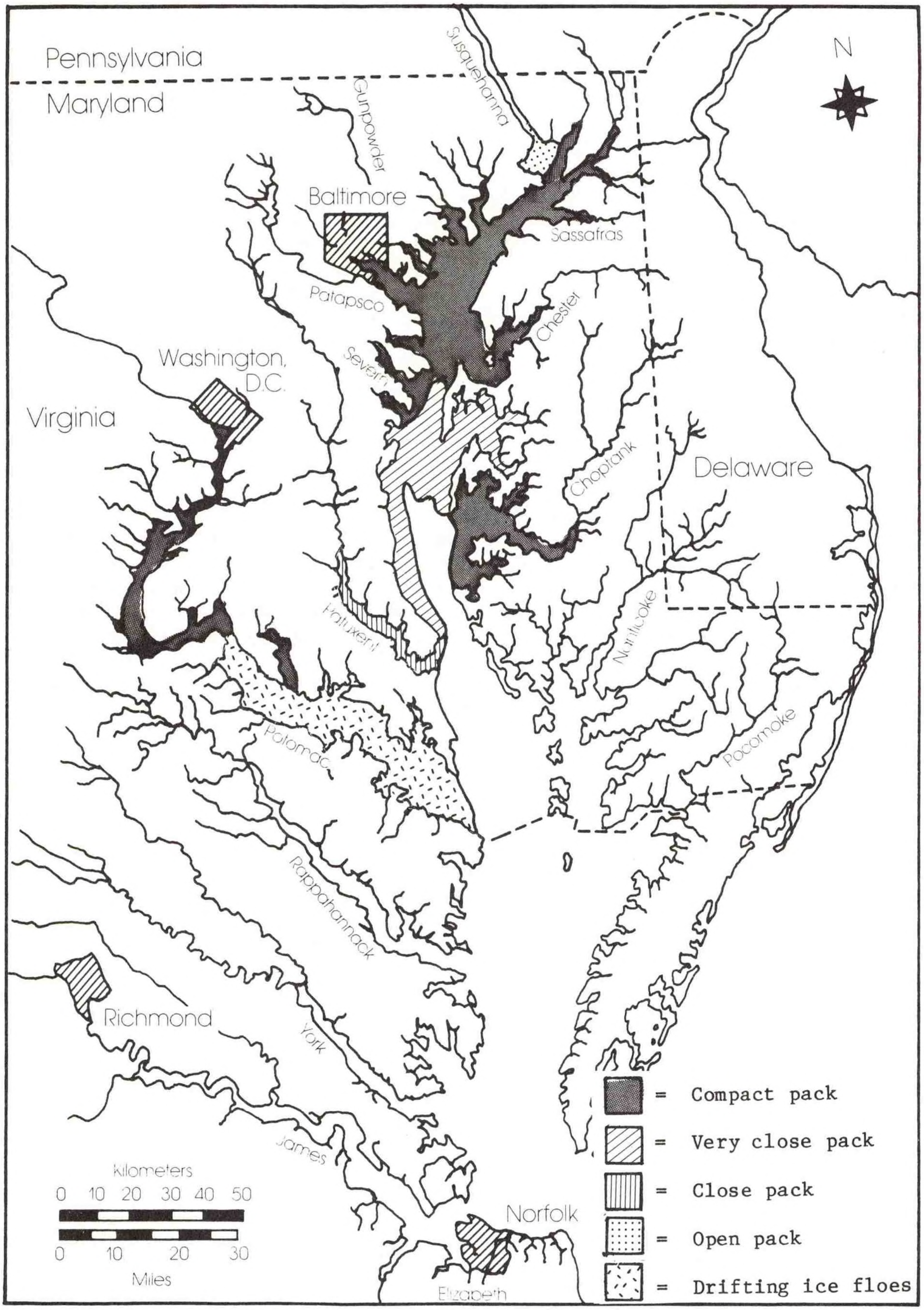


Figure 2.--Conditions at near period of maximum icing on Chesapeake Bay, winter 1983-84.

Figure 3 shows the relationship between cumulative freezing degree-days (FDD) and the local air temperature at Patuxent River station. The relative maxima in FDDs correspond with periods of maximum ice development. The total ice thickness is related to the cumulative FDD total in approximately a square root relation only when the ice is stationary. For example, the cumulative FDD total reached 96 indicating approximately 7 inches of ice (See Table 3 for explanation of FDD calculations). However, at Patuxent, when the ice had been broken and freed to drift developed a total of only 4 inches of ice on the 23rd. On the smaller tributaries and creeks around the Bay, conditions at maximum icing showed closer to the empirical relationship with the following thicknesses: Back River (8"), Middle River (10"), Chester, Gunpowder, Bush Rivers (12"), and Sassafras River (14"). The 14 inches of ice in the Sassafras River reflects the 263 FDD's accumulated by January 23rd at Aberdeen, MD, just across the Bay.

Ice disappeared rapidly around the Bay after January 26th despite a short cold wave in early February. By February 9th, only a few small rivers showed any ice and by February 17th, all stations reported clear water. The Gunpowder and Middle Rivers were the last to report ice on the 16th.

The values in Table 3 indicate a systematic difference in the dates of maximum icing which may depend upon the manner of the accumulation of freezing degree days. The late dates of maximum icing appear in 1977, 78, 79, 80, and 83 when icing developed in response to sustained cooling periods. The icing in 1981, 82, 83, and 84 appear to peak earlier and may be due to the pattern of short severe cold smaps with warming between. More study needs to be done before firm relationships can be delineated. All of the 1984 icing analysis has been done on the basis of Coast Guard reports. The aid of LANDSAT imagery was unavailable for the period due to cloud cover.

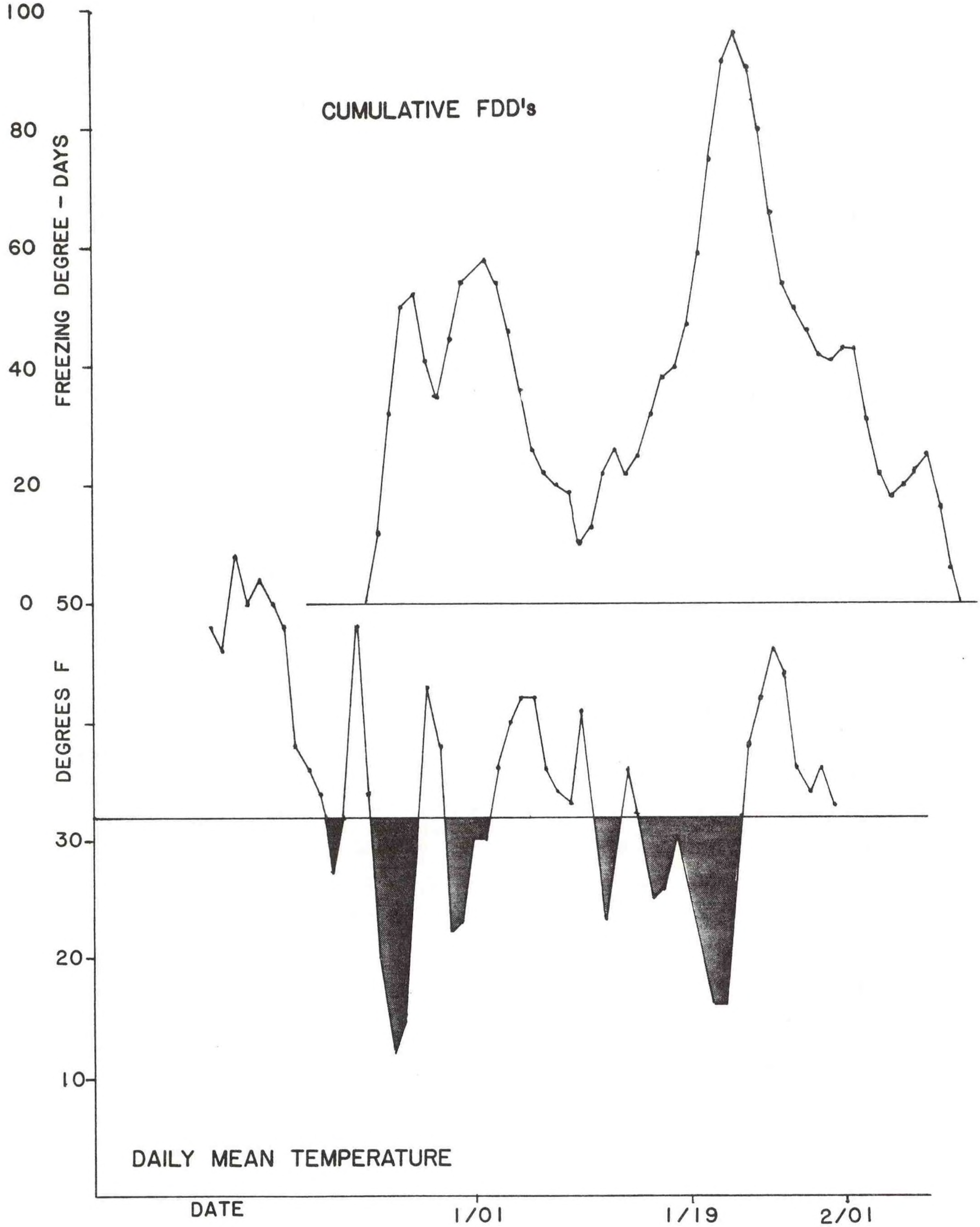


Figure 3.--Relationship between freezing degree-days and mean daily temperature, Patuxent, MD, winter 1983-84

Table 3. Number of freezing degree-days at selected Chesapeake Bay stations, winters of 1976-77, 1981-82, 1982-83, and 1983-84.

	Station							
	Aberdeen				Baltimore			
Date	1976-77	1981-82	1982-83	1983-84	1976-77	1981-82	1982-83	1983-84
December 01-10	27.0	1.0	7.5	1.0	31.5	0.0	5.5	0.5
December 11-20	9.0	21.5	17.0	15.5	5.5	32.0	30.0	12.5
December 21-31	42.0	15.5	0.0	114.0	53.0	16.0	0.0	115.0
January 01-10	56.5	23.0	0.0	18.5	73.0	35.0	1.0	13.5
January 11-20	143.0	146.0	39.0	77.0	137.0	148.0	42.0	91.5
January 21-31	75.0	85.5	3.0	57.0	77.5	85.0	3.0	61.5
February 01-10	58.5	8.5	8.0	20.5	48.0	8.0	15.0	20.5
February 11-20	25.5	11.5	19.5	0.0	24.0	6.0	44.5	0.0
February 21-28	1.5	8.0	0.0	0.0	1.5	6.0	1.0	1.0
TOTALS	438.0	320.5	94.5	303.5	451.0	336.0	142.0	316.0

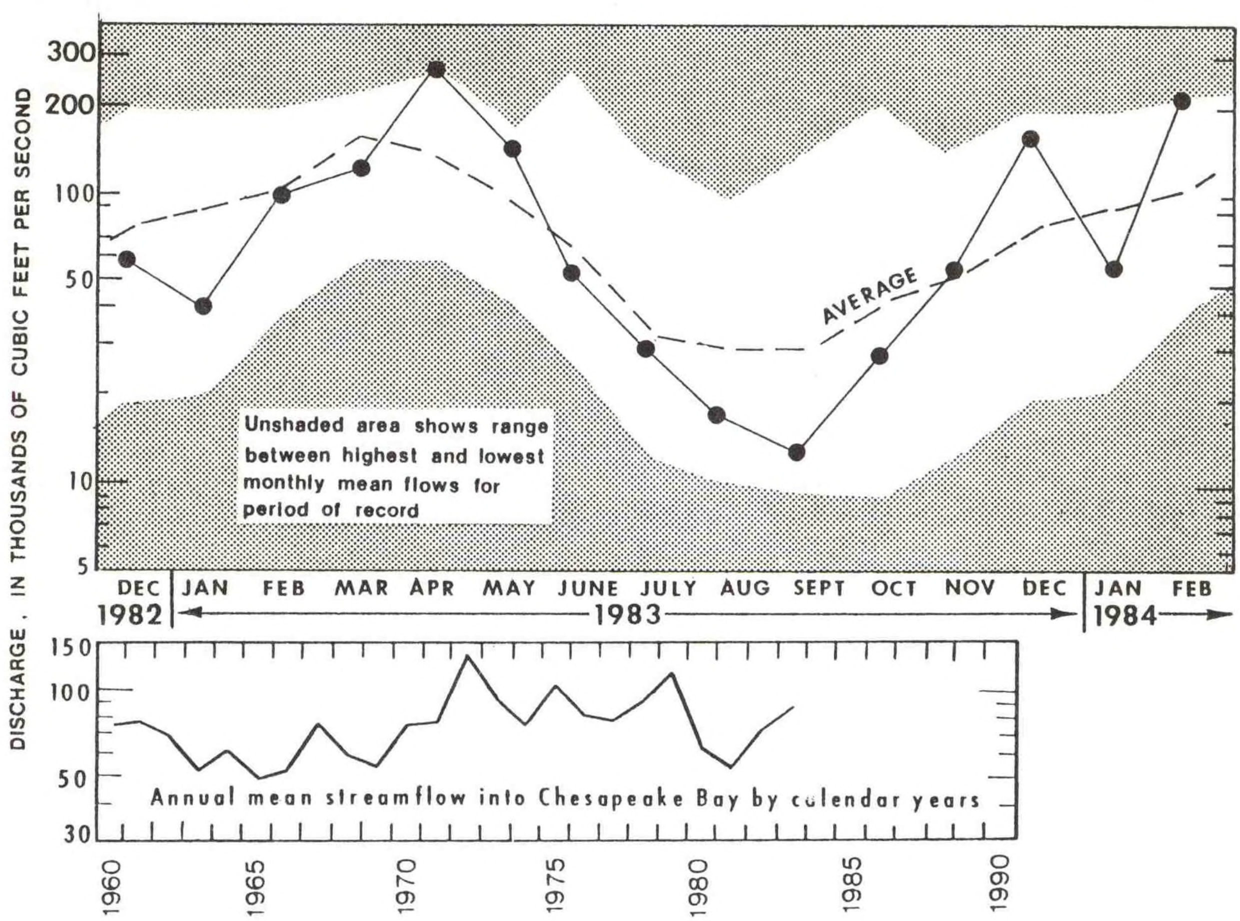
	Station							
	Royal Oak				Patuxent			
Date	1976-77	1981-82	1982-83	1983-84	1976-77	1981-82	1982-83	1983-84
December 01-10	19.0	0.0	5.0	0.0	12.5	0.0	0.0	0.0
December 11-20	4.5	10.5	15.5	8.0	0.0	11.5	10.0	5.0
December 21-31	25.5	10.0	0.0	88.0	13.0	7.0	0.0	71.0
January 01-10	54.5	14.0	0.0	17.5	53.0	9.0	0.0	3.0
January 11-20	112.5	115.0	25.0	59.0	140.5	106.5	23.0	53.5
January 21-31	65.0	68.5	1.5	45.5	63.0	50.5	0.0	37.0
February 01-10	42.5	5.0	7.5	12.5	41.5	3.0	2.0	10.0
February 11-20	19.5	4.0	17.0	0.0	17.5	0.0	13.0	0.0
February 21-28	0.0	5.0	0.0	0.0	0.5	2.5	0.0	0.0
TOTALS	343.0	232.0	71.5	230.5	341.5	190.0	48.0	174.5

The number of freezing degree-days (FDD) is the difference between the mean daily air temperature (°F) and 32°. Example, a mean daily air temperature of 21°F yields 11 FDDs. Freezing degree-days accumulated over periods of continuously freezing temperatures provide a measure of ice thickness through the expression: Ice Thickness (Inches) = 0.7 Accumulated FDDs(°F). The values displayed above may be used to estimate the possible ice generation, but alternating periods of above-freezing temperatures have not been subtracted from the accumulations. Melting, rafting, and snowcover also alter the accuracy of ice thickness computed by this method.

Streamflow

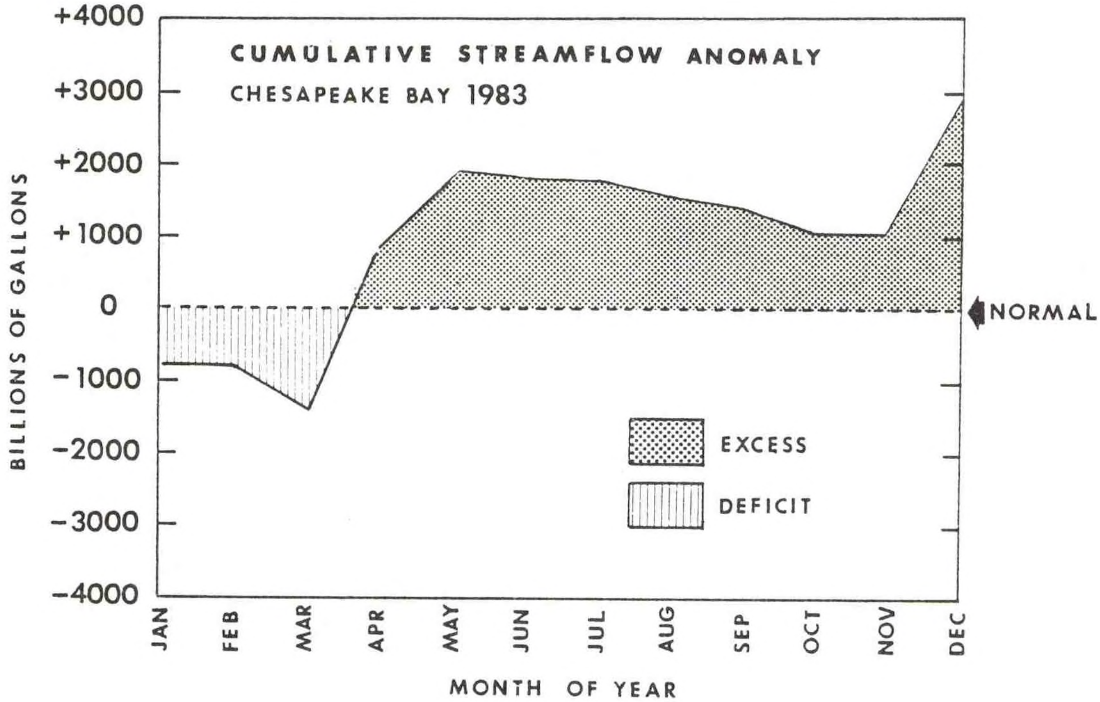
Bay streamflow was well above normal in December and February and below normal in January (Figures 4 and 5). The February streamflow of 216,300 cfs was the highest for that month during the period of record (1951-present). February streamflow was over twice the average value of 104,048 cfs and well above the previous February high of 175,400 cfs. Both the Susquehanna and Potomac river systems, which together account for approximately 73 percent of the total Bay flow, showed higher than average contributions to total Bay streamflow in February 1984. The average February flow during 1951-1983 for the Susquehanna River is 49,764 cfs compared to the February 1984 flow of 111,000 cfs. Average February flow for the Potomac River is 25,964 cfs compared to the February 1984 flow of 48,000 cfs.

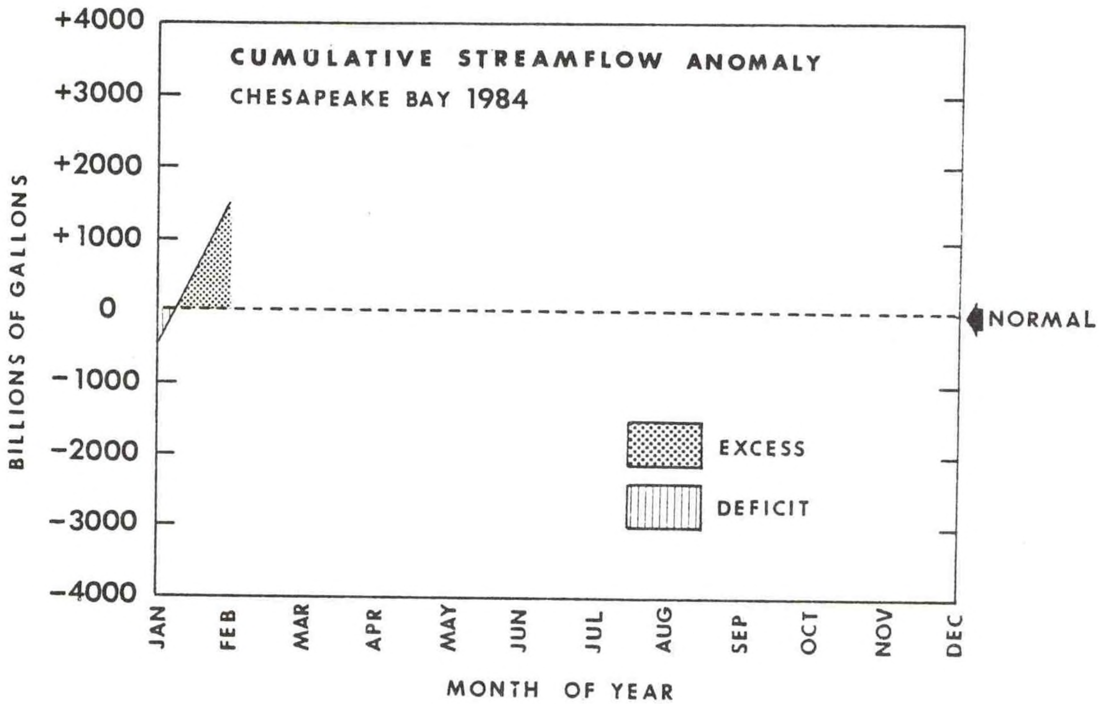
Streamflow during the winter quarter reflects the general pattern of excess precipitation in December and February and deficit precipitation in January (Table 2). The regional average precipitation in February (4.03 inches) was below the average for December (6.73 inches), though heavy rainfall over the short period February 13-15 contributed a large amount of runoff into the Bay system. Frozen and saturated soil conditions during the heavy precipitation in mid-February in the Bay drainage basin resulted in a very high proportion of runoff to tributary streams and rivers, notably in the Potomac drainage basin. The Potomac River reached its highest level since Hurricane Agnes in 1972, flooding hundreds of acres in Maryland and caused extensive damage along the shoreline. Snowmelt was an important contributing factor to streamflow in the Susquehanna region.



Streamflow was above normal in December and February and below normal in January. The record high February 1984 streamflow of 216,300 cfs was well above the average of 104,048 cfs and the previous high of 175,400 cfs during the period of record 1951-1983. Data from U.S. Geological Survey.

Figure 4.--Monthly streamflow into Chesapeake Bay, December 1983-February 1984, and annual mean flow 1960-83.





Unusually high December 1983 streamflow added to the positive cumulative streamflow anomaly (monthly sum of negative and positive departures from normal by calendar year) to end the year with a 2.87 trillion gallon excess. Though 1984 began with below normal streamflow in January, the record high flow in February brought the cumulative anomaly for the first two months of 1984 to a 1.55 trillion gallon excess.

Figure 5.--Cumulative monthly streamflow anomaly, Chesapeake Bay, 1983 and 1984.

Oceanography

Stations around the Bay began the winter quarter showing slightly higher than normal salinities, and most fell below normal following the precipitation in December (Table 4 and Figure 6). All stations followed their main seasonal pattern, with salinities decreasing from the late fall annual maxima. Station water temperatures averaged well above normal for December reflecting a warm fall and warmer than normal early December. Following the very cold weather of late December and January, however, mean water temperatures fell to an average of 3.5°F below normal. Icing was a strong factor in Bay activities during January (See Section 3).

Salinity:

Mean salinities at stations around the Bay indicate the steady mixing processes in the Bay. Beginning in December the higher-than-normal precipitation runoff was reflected by slightly lower than normal salinities at stations in the upper part of the Bay with Baltimore, Annapolis, and Solomons being nearly one part-per-thousand below normal. Kiptopeke at this time was near normal and the Chesapeake Bay Bridge-Tunnel still showed above normal salinity. As the runoff mixed through the Bay, salinities for January were below normal at all stations except Kiptopeke which showed above normal values due to the expected cross-Bay gradient in salinity. Finally in February all stations show salinities more than one part-per-thousand below normal. Nothing unusual is evident in the salt budget of the Bay for this month, just pulses of freshwater runoff in December and February mixing normally throughout the estuarine system.

Temperature:

Water temperatures around the Bay were very warm in early December, then fell precipitously following the sudden extreme cold weather of the 19th and the rest of the month. The station values for the early part of the month averaged 5.5°F above normal. After the 19th of December, the temperatures at each station dropped an average of eight degrees F and remained low through the rest of the month. For the latter part of December station water temperatures averaged 2.6°F below normal. The temperatures shown in Table 4 for December thus represent values which are applicable only for general climatological analysis and do not bear upon local analysis of conditions in the estuarine ecosystem at that time.

January water temperatures remained well below normal averaging almost 3.5°F below normal. Lowest temperatures at the stations were reached around January 23rd, although at both Baltimore and Annapolis, lowest temperatures were recorded as early as the 9th and 10th, respectively. All stations recorded minimum values below 34°F during the month, and both Kiptopeke and Annapolis recorded 32°F as their lowest values.

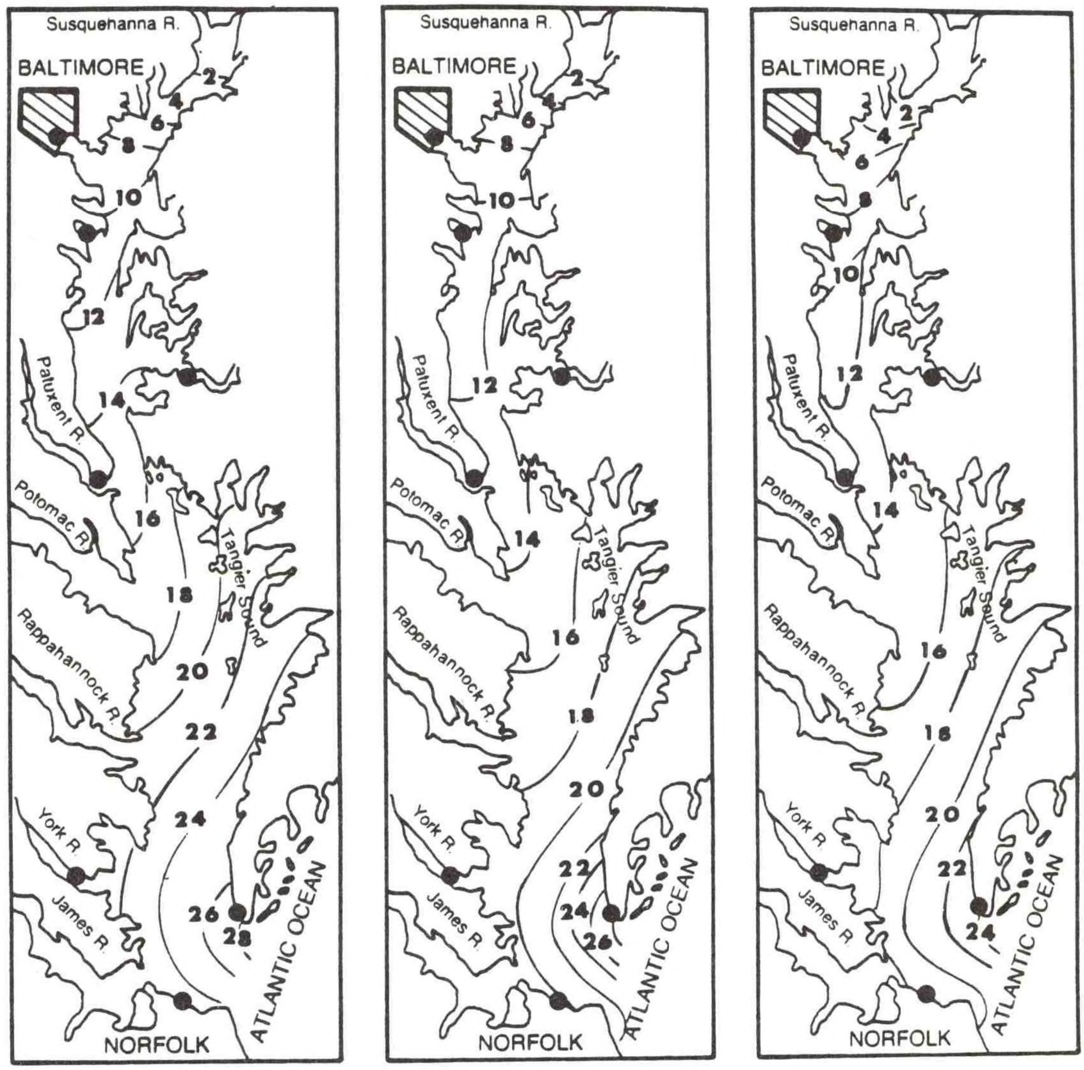
The milder weather in February brought water temperatures back to near or above-normal values except at the Chesapeake Bay Bridge-Tunnel where the water remained more than 2.5°F below the normal February value.

Table 4. Bay surface salinities and surface water temperatures, December - February 1984.

Station	Surface Salinity and Departure from Normal Observed/*Anomaly (ppt)			Surface Water Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	December	January	February	December	January	February
Baltimore, MD	9.7/-0.9	9.1/-0.8	N/A	44.3/+1.3	34.1/-3.3	N/A
Annapolis, MD	10.9/-1.1	10.7/-0.7	9.4/-1.4	44.8/+3.1	32.9/-4.0	37.0/+0.3
Solomons, MD	---/---	12.7/-2.3	13.5/-1.0	46.9/+3.6	34.6/-3.2	38.3/+0.9
Kiptopeke, VA	26.7/+0.2	27.1/+0.4	23.7/-2.4	46.2/+2.1	34.9/-3.8	40.8/+2.7
Bay Bridge-Tunnel, Va.	24.0/+1.4	21.2/-0.6	19.5/-1.4	48.6/+3.5	36.9/-2.7	38.6/-2.6

*Anomaly = departure from long-term monthly averages.

All salinity data are provisional. Cruise data are used to supplement Solomons, Md. station which experienced instrument malfunction in December. Salinities are based on water densities normalized to 15°C.



DECEMBER **JANUARY** **FEBRUARY**

Isohalines (parts per thousand) are linearly interpolated from designated station data. Stations around the Bay began the winter quarter showing slightly higher than normal salinities and fell further below normal following high streamflow in December. All stations followed their main seasonal pattern, with salinities decreasing from the late fall annual maxima. Data from National Ocean Service, NOAA.

Figure 6.--Mean surface salinity distribution, Chesapeake Bay, December 1983-February 1984.

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

Fisheries

Icing in late December and early January interrupted oyster and finfish harvest activities and caused damage to fishing gear, wooden-hulled boats, and docks. The Virginia blue crab dredge harvest in December showed above average landings, due primarily to the strong 1982 year class. Intense cold in late December 1983 and early January 1984 coincided with high mortalities of juvenile summer flounder in the York River. Cold water temperatures also caused extensive mortalities of young-of-the-year croaker of the 1983 year class.

Shellfish:

Ice cover in late December denied many watermen access to oyster grounds and damaged fishing gear, wooden-hulled boats, and docks. Cold weather in late December onset quickly and was intense. Ice began forming in Upper Bay tributaries and along the Eastern Shore approximately December 20. By December 25, ice completely covered over upper portions of tributaries. Ice thicknesses of up to 12" were reported on January 1.

Oystermen in some areas lost up to four weeks of working time due to ice cover. Ice locked boats in creek and tributary harbors and many productive oystering areas were ice covered. In Maryland, the Governor extended the oyster season for two additional weeks because of lost working time due to icing and the generally poor harvest of the 1983-84 season. Tonging and diving were extended through April 14 and dredging through March 29.

Widespread mortality from MSX disease during the 1982-83 season, poor oyster reproduction during the 1970s, and sustained high levels of fishing pressure contributed to an overall decline in oyster stocks. Oyster landings in Maryland and Virginia which were very low during the 1982-83 season were even lower during winter 1983-84 (Table 5). The shortage of oysters and inaccessibility to oyster beds during peak icing affected oyster prices, which were unusually high throughout the winter 1983-84 quarter.

The Maryland Department of Natural Resources estimates the total 1983-84 oyster harvest to be down approximately 40 percent in landings (bushels) from the previous year. Value of landings declined only 20 percent, reflecting the increase in price per bushel due to the overall scarcity of oysters. The ex-vessel price per bushel (price paid to the harvester at dockside) reached an average of approximately $13.50 during the 1983-84 season in Maryland compared to $9.40 in the 1982-83 season.

Some oysters of the good 1980 year class reached the 3-inch harvest size, though the introduction of oysters just attaining legal size contributed only a small portion of winter 1983-84 landings.

Oysters from the Gulf of Mexico supplemented the Maryland market, though some areas in the Gulf were closed early to oystering due to increased harvesting effort. The demand for Gulf oysters has increased following the steady decline of Chesapeake Bay stocks.

Table 5. Maryland and Virginia oyster landings and total Chesapeake Bay ice cover by winter quarter for years 1976-1984.

Year	Ice Cover (1)		Maryland Oyster Landings (2)					
			Month					
			December		January		February	
Winter of	Maximum ice cover	Date of maximum ice cover	Bushels	Dollars	Bushels	Dollars	Bushels	Dollars
1983-84	30%	Jan. 23	N/A	N/A	N/A	N/A	N/A	N/A
1982-83	<10%	Feb. 14	264,779	2,866,463	171,704	1,699,835	134,405	1,276,832
1981-82	55%	Jan. 27	402,127	3,898,151	123,401	1,228,415	251,778	2,319,330
1980-81	50%	Jan. 18	442,172	3,662,949	217,632	2,023,641	253,868	2,056,193
1979-80	15%	Mar. 2	363,076	3,181,805	302,390	2,554,738	194,377	1,595,119
1978-79	60%	Feb. 20	419,384	2,846,756	271,639	1,897,385	75,006	603,108
1977-78	30%	Feb. 17	411,283	2,880,563	219,352	1,616,819	198,180	1,509,357
1976-77	85%	Feb. 10	374,954	2,982,744	68,690	657,112	127,320	1,238,809

Data Sources: (1) NASA - Goddard Space Flight Center and U.S. Coast Guard.

(2) Maryland Department of Natural Resources, Tidewater Administration. Data are for total Maryland public and private ground oyster harvest. For the Potomac River, landings include the main portion and tributaries to the river on the Maryland side.

Table 5. (Continued). Maryland and Virginia oyster landings and total Chesapeake Bay ice cover by winter quarter for years 1976-1984.

Year	Ice Cover (1)		Virginia Oyster Landings (2)					
			Month					
			December		January		February	
Winter of	Maximum ice cover	Date of maximum ice cover	Bushels	Dollars	Bushels	Dollars	Bushels	Dollars
1983-84	30%	Jan. 23	44,507	565,395	41,108	526,660	N/A	N/A
1982-83	<10%	Feb. 14	78,130	864,971	46,799	440,687	41,118	357,329
1981-82	55%	Jan. 27	128,368	1,189,551	52,257	416,708	93,119	736,986
1980-81	50%	Jan. 18	173,933	1,159,837	51,414	606,959	62,956	454,632
1979-80	15%	Mar. 2	168,983	1,199,439	125,515	946,845	69,865	378,620
1978-79	60%	Feb. 20	183,999	972,161	120,188	780,498	38,508	240,067
1977-78	30%	Feb. 17	163,775	927,368	84,028	499,581	66,090	453,727
1976-77	85%	Feb. 10	138,698	625,590	43,796	5,890	31,078	206,780

Data Sources: (1)NASA - Goddard Space Flight Center and U.S. Coast Guard.

(2)Virginia Marine Resources Commission.
Data are for total Virginia public ground oyster harvest.
For the Virginia section of the Potomac River, landings include only tributaries to the river on the Virginia side. Landings for 1983-84 are preliminary.

The Virginia December 1983 commercial hard blue crab dredge harvest of 4.269 million pounds was above the previous 23-year average of 4.002 million pounds. The high December 1983 landings reflect the abundance of blue crabs which were in good supply since late summer 1983, the result of the good hatch and excellent survival of the 1982 year class.

Table 6 lists Virginia December commercial hard crab landings for 1960 - 1983 and the December date when water temperatures at the Virginia Institute of Marine Sciences (VIMS) pier at Gloucester Point dropped to 47°F or lower. VIMS laboratory studies indicate a water temperature of approximately 47°F or cooler must occur for crabs to stop feeding and become inactive. Though landings primarily reflect year class strength, other factors may also influence the amount of crabs caught. This was the case in December 1982 when adverse weather reduced fishing effort and unseasonably warm water temperatures caused crabs to remain active, making dredging less effective. The effect of factors other than year class strength on December landings is less obvious during years when unusually good blue crab stocks are present. The VIMS pier water temperature dropped to 47°F on December 21 in 1983 compared to the 23-year average date (December 10) on which the water temperature drops to 47°F. Above average landings in December reflect the very strong 1982 year class and unseasonably warm water temperatures had a no detectable effect on the December 1983 dredge harvest.

Finfish:

Ice cover in late December and up to three weeks of January prevented many fishing boats from working in the Maryland portion of Chesapeake Bay. Finfishing activities were curtailed even longer in upper Bay tributaries where thicker ice persisted longer into the winter quarter. Ice damaged fishing gear such as anchor gill nets which were set during the onset of the ice cover, though precise damage estimates were unavailable. A substantial portion of the gill netting set in the winter of 1981-82 was damaged by ice.

Several species which normally prefer the higher salinities of the lower Bay and coastal ocean were noted in catches by the Maryland Department of Natural Resources in the Deep Trough. Harvest fish, squid, hake (3 species), and weakfish (Cynoscion regalis) were caught in Deep Trough sampling in December during a period of higher than normal salinities. None of the higher salinity species were observed in February sampling following the above normal precipitation in December and lowered salinities in January and February. High salinity species were observed in Deep Trough sampling December through February in winter 1982-83, coinciding with the higher-than-normal salinities of that period.

Table 6. Virginia December commercial hard blue crab landings (millions of pounds) 1960-1983, and December date when water temperature dropped to 47°F or lower.

Year	December date when water temperature dropped to 47°F or lower	Virginia December blue crab landings, millions of pounds
1960	9	4.448
1961	9	4.464
1962	7	4.626
1963	10	4.969
1964	16	4.746
1965	5	5.389
1966	4	6.028
1967	1 (Nov. 29)	3.650
1968	6	3.358
1969	2	3.878
1970	8	3.769
1971	2,20	6.056
1972	17	4.338
1973	17	3.301
1974	10	3.580
1975	19	1.885
1976	1 (Nov. 13)	3.023
1977	8	4.085
1978	18	2.510
1979	18	4.161
1980	1 (Nov. 30)	4.186
1981	5	3.771
1982	19	1.837
1983	21	4.269

Landings data from National Marine Fisheries Service, Current Fisheries Statistics, Annual Summaries, 1960-1979; Virginia Marine Resources Commission, 1980-83. Pier water temperatures from the Virginia Institute of Marine Sciences at Gloucester Point, Virginia. Data compiled by Virginia Institute of Marine Sciences. Landings primarily reflect year class strength, but other factors such as water temperature may have some influence on landings in different years.

Blooms, Fish Kills, and Diseases:

The summer flounder provides a highly valuable fishery in Chesapeake Bay and adjacent coastal waters. Sampling by the Virginia Institute of Marine Sciences (VIMS) in the York River indicated an above normal mortality rate of juvenile summer flounder in late December. Juvenile summer flounder (approximately 15 to 23 cm size range) are parasitized by the blood parasite or hemoflagellate, Trypanoplasma bullocki. VIMS studies over the last several years show up to 100 percent of a juvenile summer flounder population may be infested by T. bullocki. The blood parasite is transferred from fish to fish by a marine leech (Calliobdella vivida) in summer flounder nursery areas in Chesapeake Bay and nearshore ocean waters. Infection intensities peak in late December through early January, resulting in mortalities of juvenile summer flounder which vary in rate from year to year. Unusually cold water temperatures may increase mortalities of summer flounder weakened by the blood parasite during the peak infestation period. VIMS sampling in the severely cold winter in January 1981 showed a 100 percent mortality of trawl-caught juvenile summer flounder in the York River. Previous sampling during the very mild winter of 1982-83 showed no large-scale mortalities. Intense cold in late December 1983 and early January 1984 coincided with the peak infection intensity of T. bullocki, and VIMS trawl survey data show high mortalities of juvenile summer flounder in the York River.

Extensive cold water mortalities of young-of-the-year croaker occurred in Virginia rivers, indicating the loss of most, or all, of the 1983 year class. Sampling by the Maryland Department of Natural Resources in the Chesapeake Bay Deep Trough in December 1983 showed the presence of the 1982 and 1983 year classes of croaker. Further sampling in February 1984 in the Deep Trough showed no croaker present. The absence of croaker in the Deep Trough and water temperatures below the croaker tolerance limit of 4°C during the 1983-84 winter suggested the possibility of a major croaker kill. This situation was confirmed in observed croaker kills in Viginia rivers by the Virginia Institute of Marine Sciences. However, croaker of the 1982 year class survived the 1983-84 winter due to their movement out of Chesapeake Bay and into waters warmer than 4°C. Croaker of the highly successful 1982 year class survived the very mild winter of 1982-83 and are now of marketable size, projecting very good catches of croaker during 1984.

Recreation

Recreation on Chesapeake Bay showed normally low seasonal activity during the 1983-84 winter quarter, though boating and state park attendance showed increases during unusually warm weather in February.

Marine advisories and warnings issued by the National Weather Service for Chesapeake Bay (Figure 7) during December 1983 - February 1984 are listed in Table 7. Nine gale warnings were issued compared to nine during the winter 1982-83 quarter. Gale warnings (wind 34-47 knots) were issued only in December and February during the 1983-84 quarter. Small craft advisories were in effect for 30 days in the quarter, compared to 41 in the 1982-83 quarter. No storm warnings were issued in the 1983-84 quarter, compared to two in winter 1982-83 for the lower Bay.

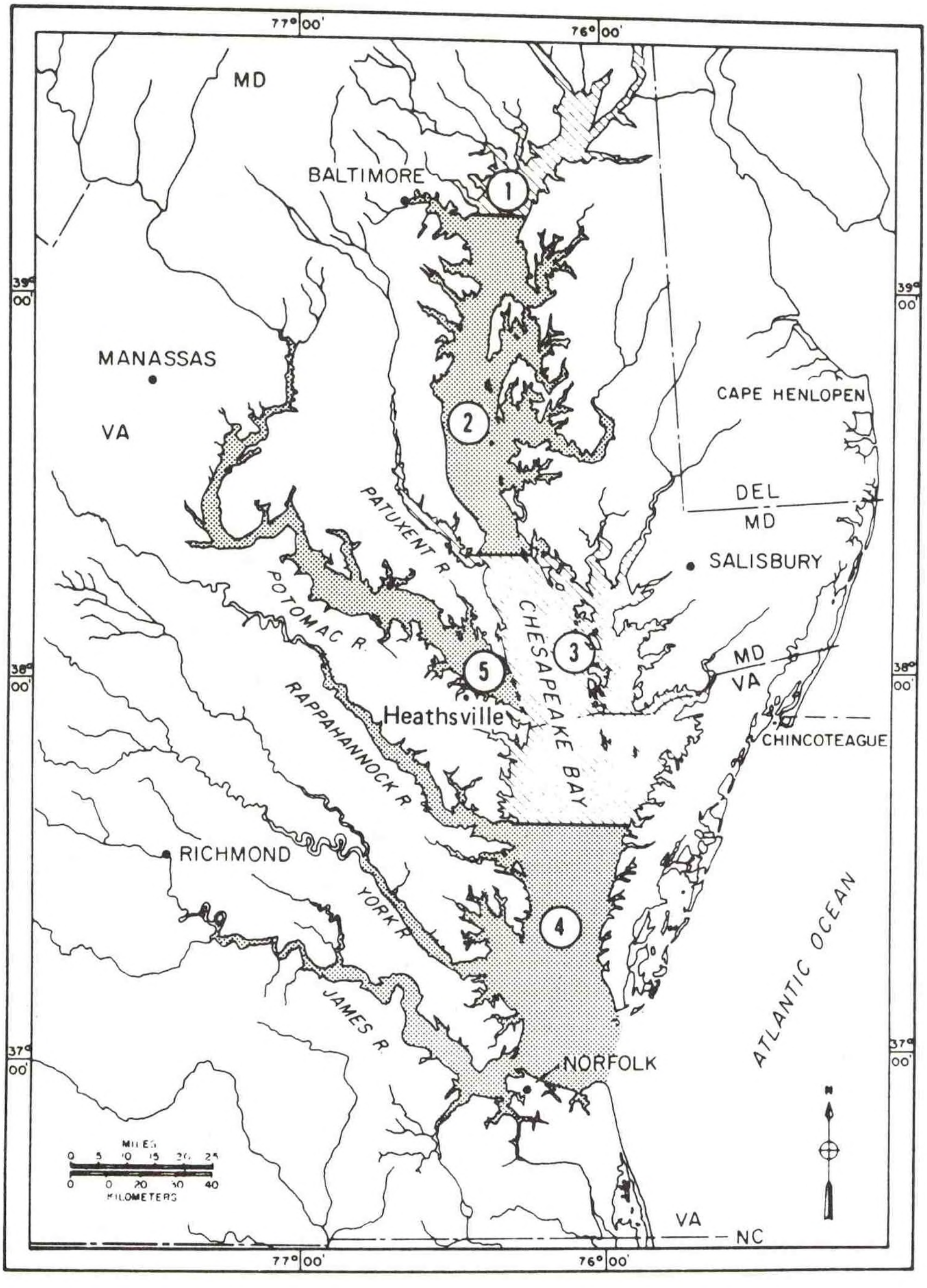


Figure 7.--National Weather Service (NWS) forecast areas for Chesapeake Bay.

Key to forecast areas:

1 = North of Baltimore Harbor
2 = Baltimore Harbor to Patuxent River
3 = Patuxent River to Windmill Point
4 = South of Windmill Point
5 = Tidal Potomac River

Table 7. Marine advisories/warnings, Chesapeake Bay, December 1983 - January 1983 (National Weather Service data). For definition of areas see Figure 7.

	Date	Condition Report(1)	Location(2)
December	3	A	Patuxent River to Windmill Point and South of Windmill Point
	4	A	North of Baltimore Harbor and Baltimore Harbor to Patuxent River and Tidal Potomac River
	6	A	Entire Bay and Tidal Potomac River
	6	B	South of Windmill Point
	7	B	North of Baltimore Harbor to Windmill Point
	7	A	Entire Bay
	11	A	Entire Bay and Tidal Potomac River
	12	A	Entire Bay and Tidal Potomac River
	18	A	South of Windmill Point
	19	A	North of Baltimore Harbor to Windmill Point and Tidal Potomac River
	21	A	South of Windmill Point
	22	A	Entire Bay and Tidal Potomac River
	24	B	Entire Bay and Tidal Potomac River
	25	A	Entire Bay and Tidal Potomac River
	28	A	South of Windmill Point
	29	A	North of Baltimore Harbor to Windmill Point and Tidal Potomac River
	29	B	South of Windmill Point
	30	A	South of Windmill Point
	30	A	Entire Bay and Tidal Potomac River
	31	A	South of Windmill Point
January	10	A	Entire Bay and Tidal Potomac River
	19	A	Entire Bay and Tidal Potomac River
	21	A	South of Windmill Point
	30	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. (Continued) Marine advisories/warnings, Chesapeake Bay, February 1984 (National Weather Service data). For definition of area see Figure 7.

	Date	Condition Report (1)	Location (2)
February	3	A	Entire Bay and Tidal Potomac River
	5	A	Entire Bay and Tidal Potomac River
	6	A	South of Windmill Point
	14	A	Patuxent River to Windmill Point and South of Windmill Point
	20	A	Entire Bay and Tidal Potomac River
	23	A	South of Windmill Point
	23	B	South of Windmill Point
	24	A	Entire Bay and Tidal Potomac River
	25	A	Entire Bay and Tidal Potomac River
	27	B	South of Windmill Point
	27	A	Baltimore Harbor to Windmill Point and Tidal Potomac River
	27	A	North of Baltimore Harbor
	28	B	South of Windmill Point
	29	B	North of Baltimore Harbor to Windmill Point
	29	B	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

The U.S. Coast Guard conducted 148 Search and Rescue (SAR) operations during the quarter (Table 8). February 1984 totals are nearly twice the 1983 totals (48 in 1984 and 27 in 1983). The higher number of SAR cases in February 1984 coincided with unusually mild conditions in that month which probably attracted a higher number of boaters.

Maryland Department of Natural Resources Marine Police reported two boating accidents, one injury, one death, and $450 property damage for recreational boating (Table 9). During the comparable quarter 1982-83, eight boating accidents, four injuries, three deaths, and $48,420 property damage were reported. Though the number of boats involved were few, the unusually mild conditions and absence of Coast Guard ice restrictions during winter 1982-83 may have contributed to a higher number of boaters. Much colder conditions and extended periods with Coast Guard ice restrictions restricted most recreational boating activities during winter 1983-84.

Table 10 lists state parks attendance and revenue at selected Maryland and Virginia facilities during the winter quarter. Park attendance during very mild conditions in February 1984 was generally higher than during the comparable period in February 1983. Sandy Point State Park and Seashore State Park showed especially large increases during the unusually warm weather in February 1984 compared to the same period in 1983.

Recreational fishing piers at Hart Island, MD on the west side of Chesapeake Bay (near Baltimore Harbor) were extensively damaged by ice. Preliminary total loss estimates are near $400,000 from the ice cover which reached thicknesses of 6 1/2" to 8" in the Hart Island area.

Table 8. U.S. Coast Guard Search and Rescue (SAR) caseload, December - February 1984.

Month	Number of Search and Rescues		
	Group Baltimore	Group Eastern Shore	Group Norfolk
December	23	1	32
January	14	1	29
February	16	1	31
TOTALS	53	3	92

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

Table 9. Maryland marine accident statistics, December 1983 - February 1984

Month	No. of Boating Accidents	No. of Injuries	No. of Deaths	Property Damage
December	1	0	1	$ 0
January	1	1	0	450
February	0	0	0	0
TOTALS	2	1	1	$ 450

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 10. State parks attendance and revenue, selected Maryland and Virginia facilities, December 1983 - February 1984.

Facility	Month					
	December		January		February	
Maryland	Attendance	Revenue	Attendance	Revenue	Attendance	Revenue
Sandy Point	3,939	$123	6,320	$ 165	10,590	$145
Point Lookout	2,515	77	3,303	1,863	4,520	991
Virginia						
Westmoreland	1,864	$900	3,321	$ 0	4,263	$ 20
Chippokes	1,260	312	392	165	861	0
York River	2,575	0	1,090	0	1,075	0
Seashore	17,050	64	13,125	0	20,750	10

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.

Transportation

Winds in excess of 40 mph shut down crane operations three times at the Port of Baltimore during the winter 1983-84 quarter for a total of 34 hours and 40 minutes (Table 11). During the same period in 1982-83, winds shut down operations five times for a total of 24 hours and 47 minutes productive time lost.

Table 11. Number of crane shutdowns and productive time lost due to wind in excess of 40 mph at Port of Baltimore, December 1983 - February 1984.

Date	Number of Shutdowns	Productive Time lost (Hours:Minutes)
February 25	1	12:30
February 26	1	11:32
February 29	1	10:38
Totals	3	34:40

Data from Maryland Port Administration.

Movement of large commercial vessels throughout Chesapeake Bay during the winter months of December 1983 through February 1984 was unimpeded by ice, and main shipping channels remained open at all times.

Marker buoys in the Wicomico river were covered and dislocated by ice on December 25. As a result, the Coast Guard relocated them so that fuel barges could safely navigate. Careful planning and anticipation of the fuel needs prior to the severe cold around Christmas prevented any hardship because of ice delays. A tug towing barges on the Potomac River along the Charles County shore on January 8th collided with an ice floe and sank. This part of the Potomac River was included in a Regulated Navigation Area requiring all vessels to check in with the Coast Guard prior to movement within the area. Table 12 lists the chronology of hull type and horse power restrictions applicable in parts of the Upper Chesapeake Bay and the Potomac River from the end of December to the end of February.

Table 12. U.S. Coast Guard ice restrictions summary, winter 1983-84.

January 1:

Vessels limited to 500 shaft horsepower (SHP), steel hull only in the Upper Chesapeake Bay north of a line from North Point to Swan Point to and including the Chesapeake and Delaware Canal, and in the Potomac River from Quantico, VA to Washington, D.C.

January 5:

Regulated Navigation Area in effect. All vessels checking with Coast Guard. Vessels limited to 500 SHP, steel hull only in the Potomac River from Dalgren, VA to Washington, D.C. and in the upper Chesapeake Bay north of a line from North Point to Swan Point. Later on this date the horsepower restriction was removed for all areas.

January 18:

The area of restriction to steel hull only in the upper Chesapeake Bay is extended southward to include all parts of the Bay and its tributaries north of the William P. Lane, Jr. Memorial Bridge (Bay Bridge).

January 20:

In addition to steel hull, at least 500 SHP is required in all areas previously named except in the part of the Chesapeake Bay from the William P. Lane, Jr. Memorial Bridge to the line from North Point to Swan Point where steel hull only is required.

January 26:

Steel hull only in all areas already named.

January 30:

Steel hull required only north of Woodrow Wilson Memorial Bridge on Potomac River. Vessels in all other areas of the Chesapeake Bay are to exercise caution because of residual ice floes.

February 13:

No restrictions.

February 21:

End of Ice Season.

Note: Coast Guard Ice Restrictions Summary is a chronological listing of regulations issued during icing on Chesapeake Bay. This summary is condensed from information provided by the Coast Guard Marine Safety Office, Public Affairs Division at Baltimore, Maryland.

Though the restrictions to steel hulled vessels with at least 500 shaft horsepower (SHP) applied in the upper Bay from the beginning of January, several days of thaw occurred during early January so major vessels were unaffected. Lower temperatures from the 10th of January through the 23rd brought continued ice growth so the restrictions continued. Rafting of ice up to 2 feet was present in the Potomac River around Maryland Point. The 500 SHP restriction was lifted on January 26th following a strong melting trend, and the steel hull restriction was gradually removed until on January 30th it applied only north of the Woodrow Wilson Bridge on the Potomac. From February 1st until the 13th only the Regulated Navigation Area restriction applied.

Cost of repairs for damages to navigation aids on the Chesapeake Bay are estimated to be about $200,000. Most of the damage was to single wooden piling markers, some 3-pile markers, and steel pilings. Total equipment damage is estimated at about $138,000 though cost for buoys is still unknown. Damage cost this winter was about three times the damage cost of the previous winter. Factors which contribute to damage costs include the following: the timing of freeze-up and break-up of the ice, wind directions, tides, and the orientation of river mouths, along with the age of the equipment involved.