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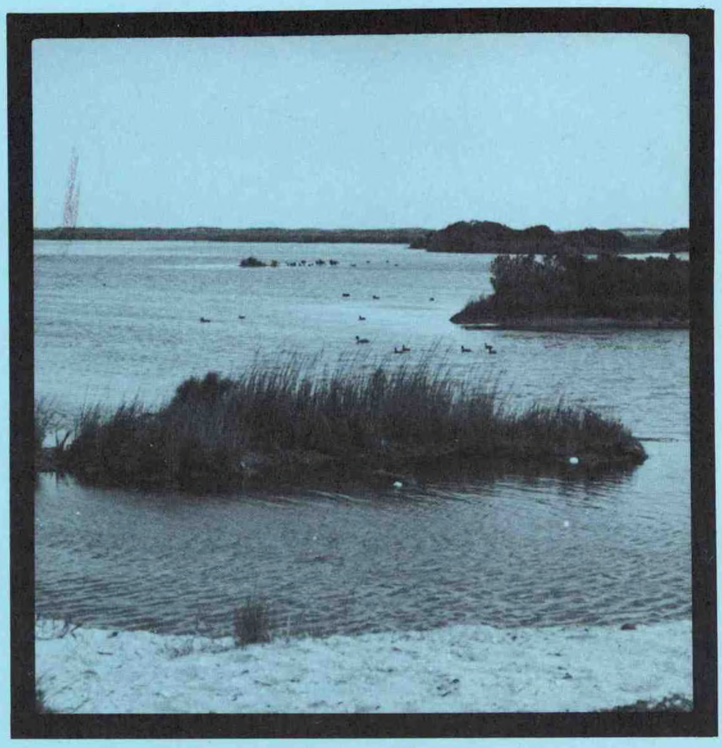
Marine Environmental Assessment

CHESAPEAKE BAY

DEC. 1982 - FEB. 1983



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CLIMATE IMPACT ASSESSMENT
UNITED STATES

The name of the Center for Environmental Assessment Services (CEAS) has been changed to the Assessment and Information Services Center (AISC) because of NOAA reorganization and the consolidation of CEAS with the Environmental Science and Information Center.

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 questions regarding Assessment and Information Services Center marine assessments to the Branch Chief, NOAA/NESDIS/AISC, Marine Environmental Assessment Division, 3300 Whitehaven Street, N.W. Washington, D.C. 20235, or call (202) 634-7379.

Front Cover Photographs

Wave Damaged Coastline - Star News Photo by J. Nesbitt
Beach Scene - EPA Documerica - Hope Alexander
Salt Marsh - NOAA File Photo
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CHESAPEAKE BAY MARINE ASSESSMENT

At present the Assessment and Information Services Center (AISC) limits marine assessment coverage to Chesapeake Bay. 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.

MARCH 1983

Chesapeake Bay Marine Environment

1. Highlights - General Events and Impacts

Warmer-than-normal air temperatures during the 1982-83 winter quarter resulted in less than ten percent Bay icing.

Watermen experienced no interruptions to finfish or shellfish harvest activities due to icing as in recent winters with extensive ice cover.

U.S. Coast Guard stations reported main shipping channels clear of ice at all times. Icing occurred in tributaries and shorelines of the Upper Bay.

Maryland and Virginia monitoring agencies reported unusually low oyster landings during the winter quarter. Although precise relationships between factors affecting the decline in oyster stocks are complex, Bay scientists relate an increase in oyster mortalities to the spread of the oyster disease MSX, especially in the Upper Bay where reduced freshwater inflow has contributed to higher-than-normal salinities during the past two years.

Virginia blue crab landings were abnormally low during the winter quarter due to several factors: the supply of crabs is down from low year class recruitment from the 1981 hatch; adverse weather resulted in reduced harvest effort; and warmer-than-normal water temperatures kept crabs active longer and made dredging less effective.

The Port of Baltimore experienced some short-term delays in outside cargo handling due to the snowstorm of February 11.

Table 1 summarizes impacts of climate events by economic sector.

Table 1. Climate impact summary, Chesapeake Bay, December 1982 - February 1983.

	FISHERIES								RECREATION						TRANSPORTATION					
EVENT	Finfish harvest activities (general)	Shellfish harvest activities (general)	Blue crab dredge harvest	Oyster population (impact of MSX)	Croaker yearclass				Boating	Safety					Port operations	Vessel traffic				
Warm air temperature	+	+																		
Warm water temperature			−		+															
Low streamflow				−																
Low precipitation				−											+					
High salinity				−																
Low ice coverage	+	+	+												+	+				
February snowstorm															−					

LEGEND:

+	Favorable
−	Unfavorable
(blank)	No abnormal effect, data unavailable, or not applicable

2. Weather and Oceanography Summary

A new set of precipitation and air temperature normals is used starting in January 1983. The National Climatic Center issued a new set of normals for 1951-1980 to replace the 1941-1970 normals. The effects of the change in normals is described in a special section at the end of this report.

December 1982:

Monthly air temperatures averaged 7.4°F above normal for the 11 stations in Figure 1. Precipitation totals for these stations averaged below normal for the month (Table 2).

Mild temperatures in the Chesapeake Bay area were maintained by a persistent storm system in the central part of the United States during the first week of December. Temperatures declined after the 6th and averaged below freezing at Baltimore on the 10th. Temperatures averaged below freezing at Baltimore from the 12th through the 14th. An early season snowstorm on the 12th brought 5 to 9 inches of snow to the Bay region. Warming temperatures and rain followed on the 16th and below freezing average temperatures on the 18th and 19th.

Temperatures averaged higher than 7°F above normal for most of December (Table 2). Williamsport recorded the warmest December since 1923 and the 4th warmest December since records began in 1895. December 4th was the warmest December day since records began at the Washington, D.C. station.

Eight stations reported below normal precipitation for the month, continuing a deficit trend which is reflected in Bay streamflow (Figures 2 and 3).

Winds reached 20 MPH or greater at Baltimore on nine days during the month.

January 1983:

January air temperatures for the 11 stations in Figure 1 averaged 2.2°F above normal. Precipitation averaged 1.13 inches below normal (Table 2).

As in December, average temperatures dropped below freezing for several days at most Bay stations during the middle third of the month, producing the high number of freezing degree days during the period January 11-20 (Table 3).

Five storms brought precipitation to the area during January. A coastal storm on the 5th and 6th brought nearly half an inch of precipitation to Royal Oak and Patuxent, and a low pressure system on the 10th brought more than half an inch of precipitation to Baltimore and Aberdeen. On the 15th a storm system moving out of the Midwest brought scattered precipitation and cold air which covered the area from the 17th to the 20th. The highest daily total precipitation came on the 23rd and the area experienced warmer temperatures. A rapidly deepening low pressure system off Cape Hatteras on the 28th brought 0.64 inches

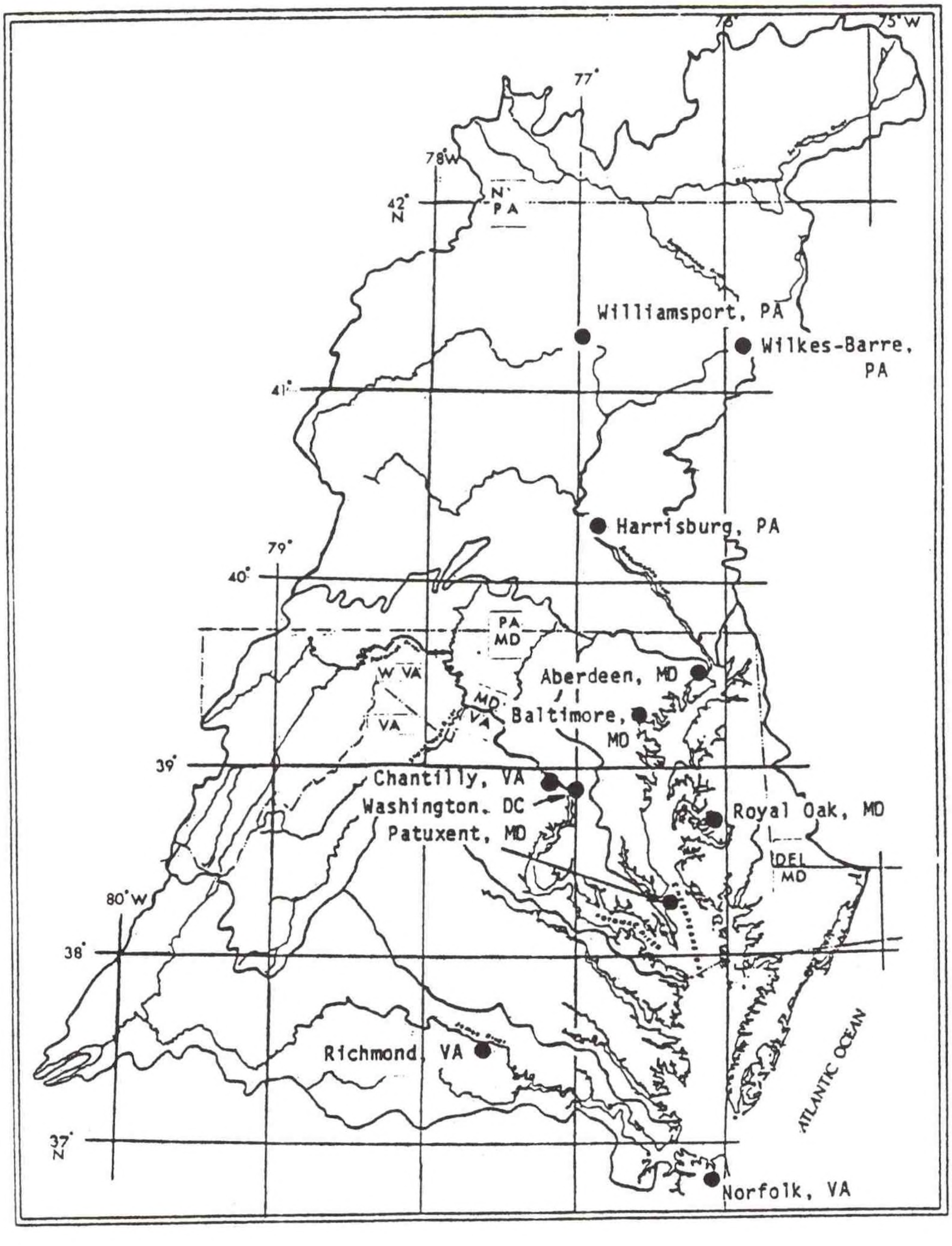


Figure 1. Selected meteorological stations, Chesapeake Bay watershed (Modified EPA map).

Table 2. Precipitation/temperature totals and anomalies, Chesapeake Bay watershed, December 1982 - February 1983.

[December normals are for 1941-70; January and February normals are for 1951-80 except at Aberdeen and Patuxent where 1941-70 normals are used. Refer to special section on pp. 25-29 of this report for a detailed description of the change.]

Station	Total Precipitation and Departure from Normal Observed/*Anomaly (Inches)			Air Temperature and Departure from Normal Observed/*Anomaly (Deg.F)		
	December	January	February	December	January	February
Williamsport, PA	1.35/-1.75	1.79/-1.09	1.87/-0.96	36.9/+6.7	29.3/+3.1	31.5/+3.3
Wilkes-Barre, PA	1.52/-0.99	1.17/-1.10	1.46/-0.59	36.7/+7.6	27.3/+2.1	29.4/+2.6
Harrisburg, PA	1.56/-1.51	2.26/-0.70	3.38/+0.65	41.4/+8.8	33.0/+3.6	33.5/+2.0
Aberdeen, MD	2.17/-1.17	2.60/-0.34	2.47/-0.34	44.2/+9.2	35.7/+2.4	36.8/+2.1
Baltimore, MD	2.39/-0.87	2.21/-0.79	4.81/+1.83	42.0/+6.7	34.6/+1.9	34.2/-0.5
Washington, DC	1.74/-1.30	1.69/-1.07	3.09/+0.47	45.5/+8.1	38.1/+2.9	38.7/+1.2
Chantilly, VA	2.25/-1.22	1.40/-1.43	3.74/+1.10	42.6/+8.6	34.7/+3.3	35.0/+1.4
Royal Oak, MD	4.08/+0.35	1.75/-1.69	3.30/+0.10	45.1/+6.0	37.0/+2.0	37.3/+0.6
Patuxent, MD	2.50/-0.79	1.86/-1.06	3.53/+0.76	46.2/+6.6	38.0/+1.0	38.1/+0.1
Richmond, VA	3.37/+0.15	1.59/-1.64	3.95/+0.82	46.1/+7.1	37.8/+1.2	39.1/+0.2
Norfolk, VA	4.30/+1.19	2.21/-1.51	6.23/+2.95	48.8/+6.5	40.2/+0.3	40.8/-0.3
Average	2.48/-0.72	1.87/-1.13	3.44/+0.62	43.2/+7.4	35.1/+2.2	35.9/+1.2

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

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

	Station											
	Aberdeen			Baltimore			Royal Oak			Patuxent		
Date	1976-77	1981-82	1982-83	1976-77	1981-82	1982-83	1976-77	1981-82	1982-83	1976-77	1981-82	1982-83
December 01-10	27.0	1.0	7.5	31.5	0.0	5.5	19.0	0.0	5.0	12.5	0.0	0.0
December 11-20	9.0	21.5	17.0	5.5	32.0	30.0	4.5	10.5	15.5	0.0	11.5	10.0
December 21-31	42.0	15.5	0.0	53.0	16.0	0.0	25.5	10.0	0.0	13.0	7.0	0.0
January 01-10	56.5	23.0	0.0	73.0	35.0	1.0	54.5	14.0	0.0	53.0	9.0	0.0
January 11-20	143.0	146.0	39.5	137.0	148.0	42.0	112.5	115.0	25.0	140.5	106.5	23.0
January 21-31	75.0	85.5	3.0	77.5	85.0	3.0	65.0	68.5	1.5	63.0	50.5	0.0
February 01-10	58.5	8.5	8.0	48.0	8.0	15.0	42.5	5.0	7.5	41.5	3.0	2.0
February 11-20	25.5	11.5	19.5	24.0	6.0	44.5	19.5	4.0	17.0	17.5	0.0	13.0
February 21-28	1.5	8.0	0.0	1.5	6.0	1.0	0.0	5.0	0.0	0.5	2.5	0.0
TOTALS	438.0	320.5	94.5	451.0	336.0	142.0	343.0	232.0	71.5	341.5	190.0	48.0

The number of freezing degree-days (FDD) is the difference between the mean daily air temperature (°F) and 32°. For example, a mean daily air temperature of 21°F yields 11 FDDs. Freezing degree-days accumulated over continuous periods of time provide a measure of ice thickness through the expression: Ice Thickness (Inches) = accumulated FDDs (°F). Rafting, snowcover, and melting may alter the accuracy of the ice thickness computed by this method. Freezing degree-days apply only for mean daily air temperatures that are less than 32°F.

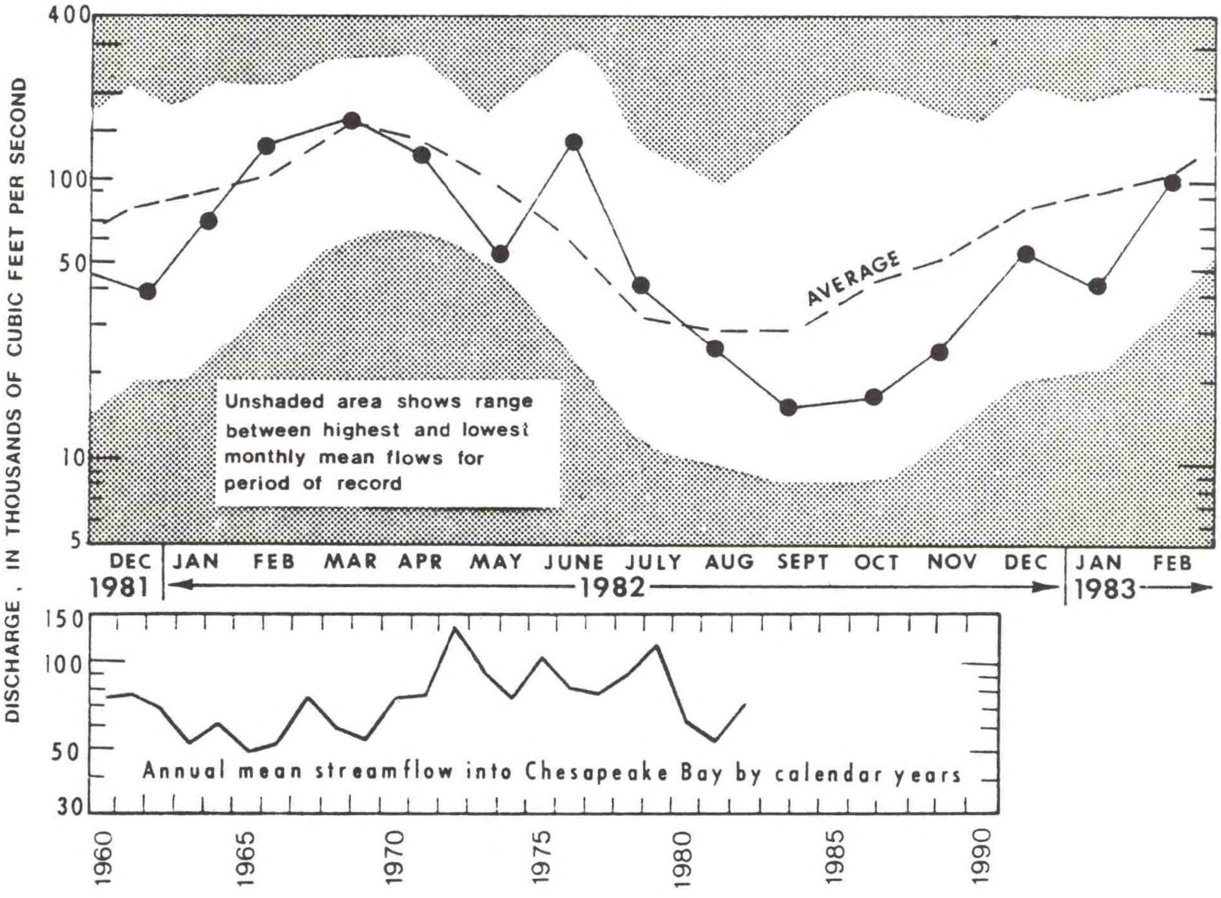


Figure 2. Monthly streamflow into Chesapeake Bay, December 1981 - February 1983, and annual mean flow 1960-1982.

Streamflow is below normal for the winter quarter December 1982-February 1983. Freshwater discharge has remained below normal since July 1982 which reflects an overall precipitation deficit in the Chesapeake Bay drainage basin. (Data from U.S. Geological Survey)

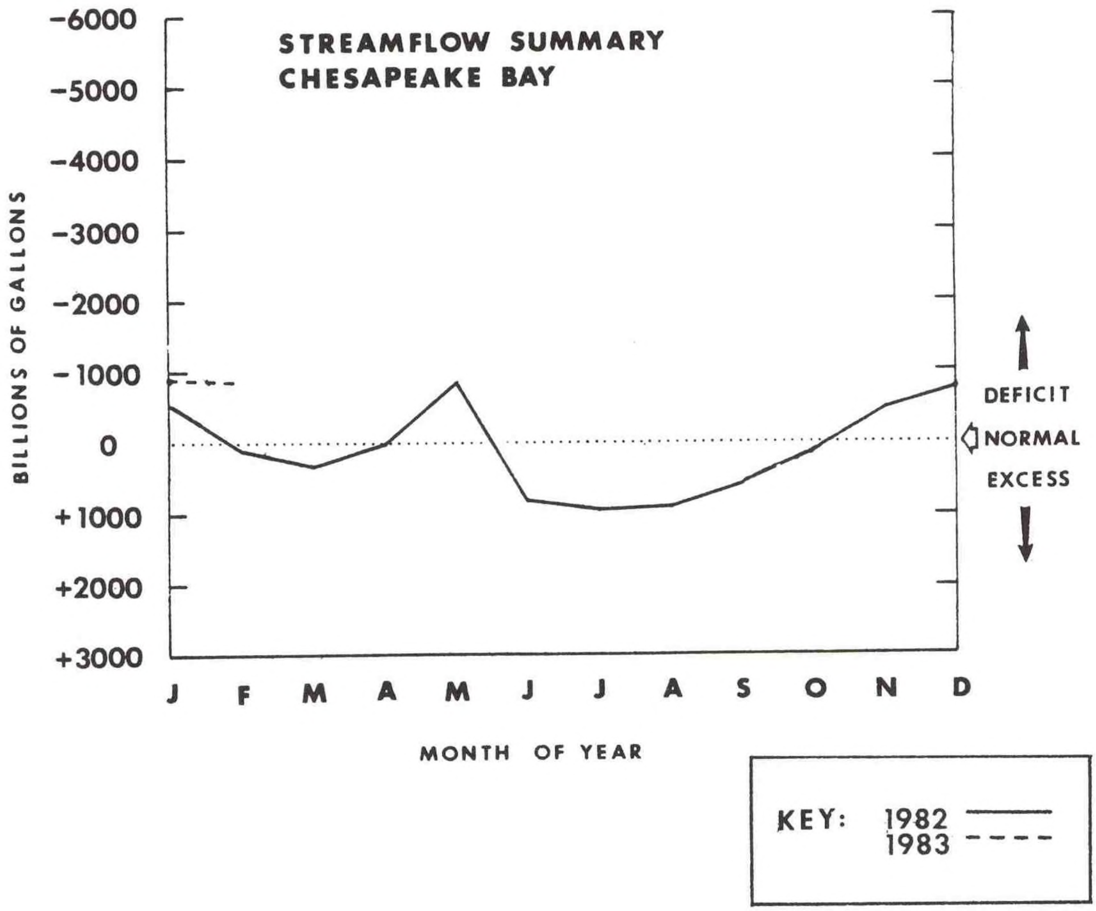


Figure 3. Cumulative monthly streamflow into Chesapeake Bay, 1981-1983.

January and February 1983 cumulative streamflow showed a deficit of approximately nine hundred billion gallons. High June 1982 streamflow reversed a deficit trend which ended the year with a cumulative deficit of less than one trillion gallons, compared with a nearly six trillion gallon deficit at the end of 1981. (Data from U.S. Geological Survey.)

of precipitation to Norfolk. Tides influenced by strong northerly winds created local flooding in low-lying areas.

Northwesterly winds up to 35 MPH accompanied the storm of the 15th and 16th. High winds persisted for several days as the cold air mass following the storm moved across the Bay area.

February 1983:

A near-record snow storm occurred February 11th in the Bay area. Despite the near-record snowstorm of February 11, air temperatures for the 11 stations in Figure 1 averaged only 1.2°F above normal, and precipitation totals averaged only 0.62 inches above normal.

Temperature departures from normal ranged from 0.5°F below normal at Baltimore to 3.3°F above normal at Williamsport (Table 2). Freezing degree-days in Table 3 show the coldest period of the month occurred during the middle third of the month.

Precipitation ranged from 6.23 inches at Norfolk (2.95 inches above normal) to 1.46 inches at Wilkes-Barre (0.59 inches below normal). Both Williamsport and Wilkes-Barre have only negative precipitation departures for the entire quarter. From Harrisburg southward, stations show precipitation amounts greater than normal in February except for Aberdeen. Approximately 24 inches of snow fell at Aberdeen in the storm of the 11th and 12th so the precipitation amount reported might be deficient by more than an inch.

A large storm system from the Gulf of Mexico covered the area on the 2nd and 3rd with rain and above-normal temperatures. Cold air followed out of Canada bringing average temperatures below freezing on the 5th and 6th. Rain, snow and strong winds occurred on the 6th and 7th around the Bay area. The winter storm on the 11th brought record or near-record snow amounts to the entire Bay region. Average air temperature remained below freezing at Baltimore from the 9th until the 14th. Temperatures moderated after the 14th when a deep coastal storm brought rain and strong winds to stations in the southern part of the Bay. Another coastal storm on the 17th brought rain and brisk winds again to the Southern Bay area. Widespread rain fell from still another storm on the 22nd and 23rd. In the wake of this storm a large cold air mass from Canada surged across the Bay area with brisk northwesterly winds and dropped average temperatures below normal until the last day of the month.

Salinity

Salinity remains higher than normal around the Bay. Since midsummer 1982 when conditions were near normal, the salinity anomaly has shown a general increasing trend (Figure 4). The anomalies have not reached the excesses following the drought of 1981-82 but are strong enough to suggest an unusual circulation regime is present in the Bay. Whether the anomalous pattern is part of a long-period cycle, a temporary anomalous situation, or a permanent adjustment of the Bay to external factors is not evident from available data.

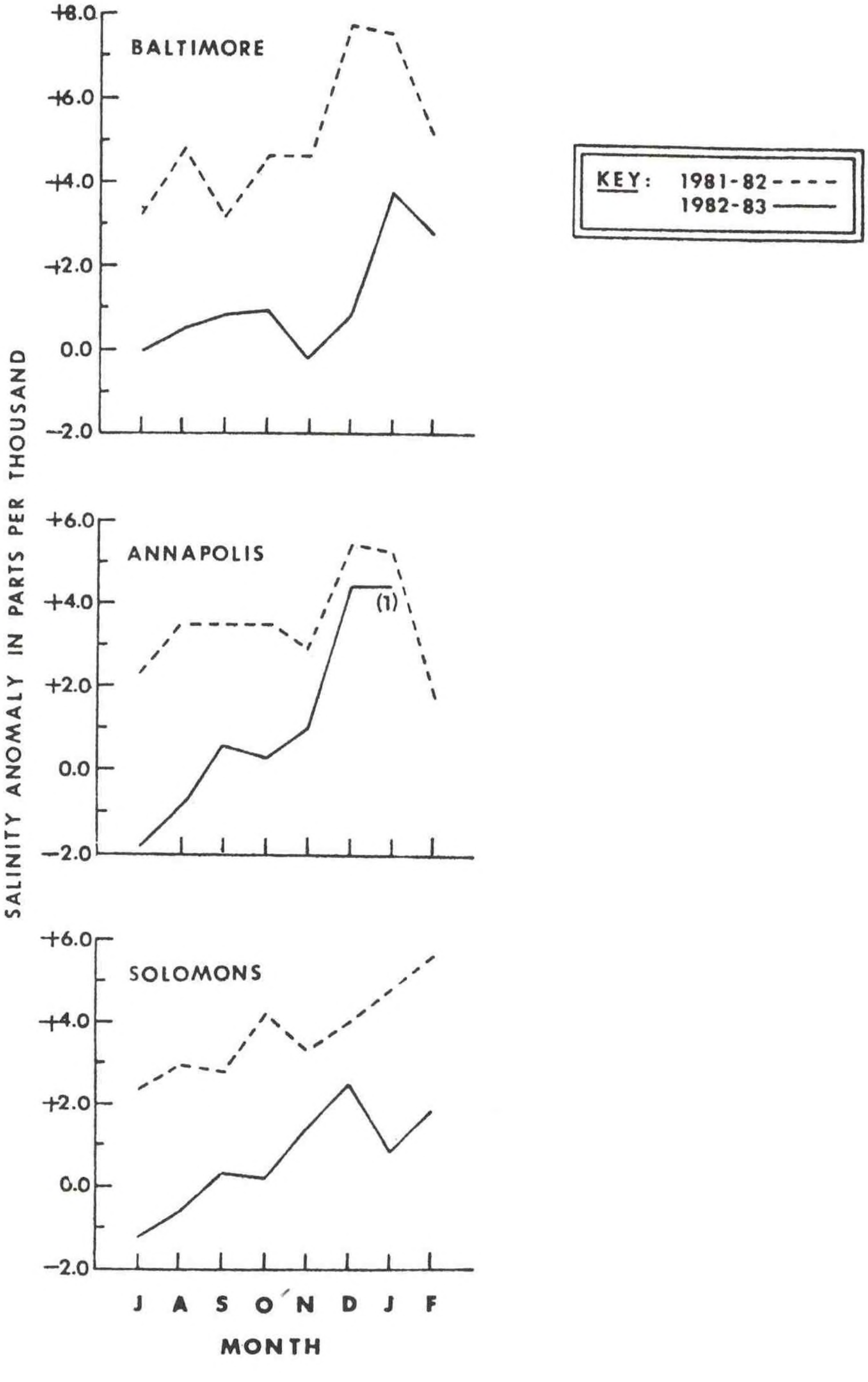


Figure 4. Monthly surface salinity anomaly trend 1981-82 and 1982-83 (summer-winter), selected stations, Chesapeake Bay.

(1) February 1983 data unavailable.

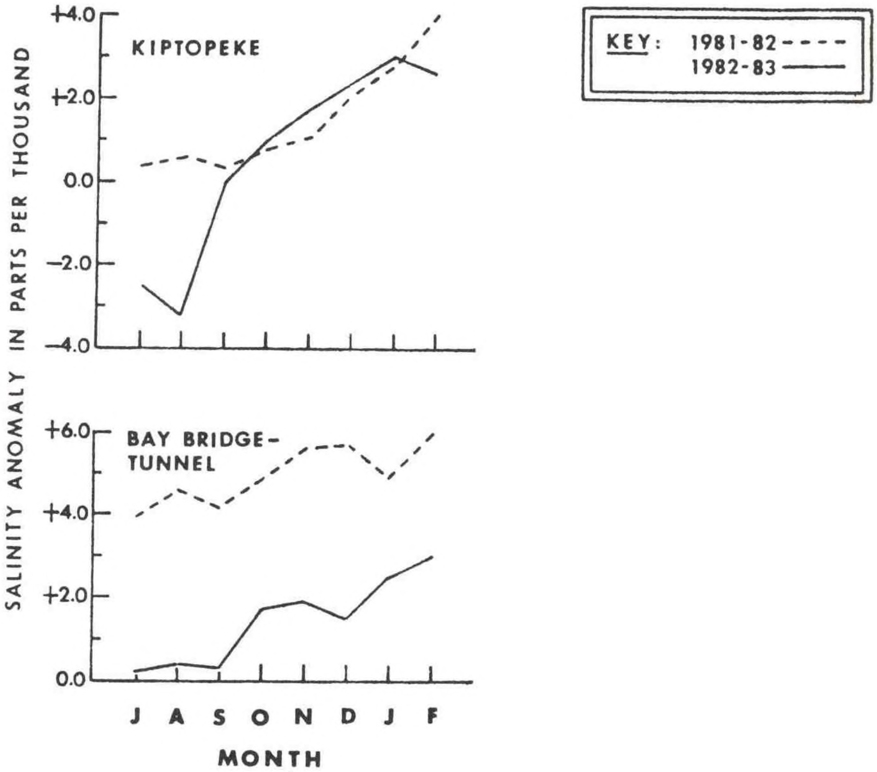


Figure 4 (continued). Monthly surface salinity anomaly trend 1981-82 and 1982-83 (summer winter), selected stations, Chesapeake Bay.

The high surface salinities reflect even higher bottom values and the higher salinity conditions favor spreading of the oyster diseases MSX and dermo. Outbreaks will probably remain more severe on the eastern shore of the Bay where salinity is higher than in the western Bay. Kiptopeke is still experiencing the highest surface values among the stations with values up to 29.7 parts per thousand. Although both Baltimore and Kiptopeke experienced decreases in salinity from January to February, suggesting a break in high values, data are not extensive enough to determine when bottom salinities will begin decreasing (Table 4, Figure 5).

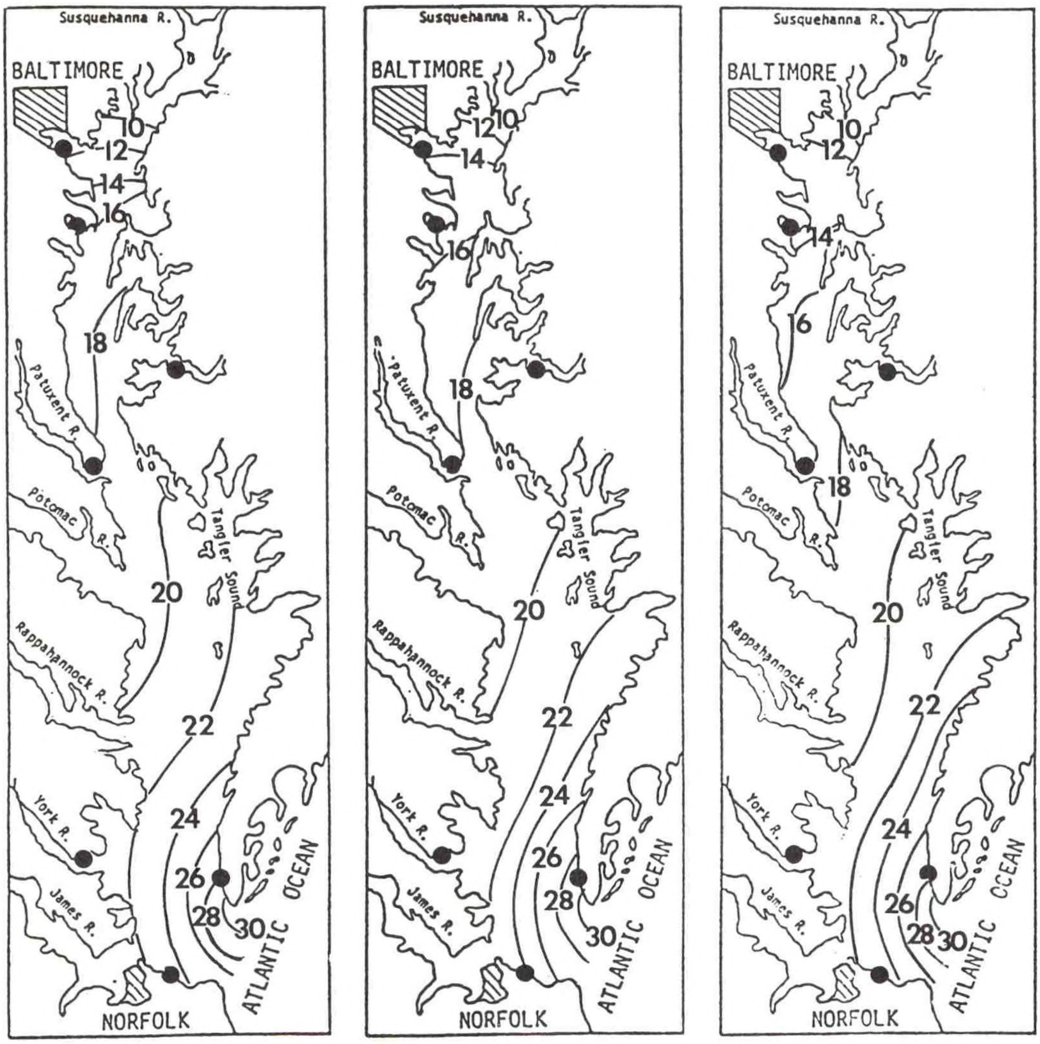
Water Temperature

Bay surface water temperature followed air temperature during the quarter. December water temperature departures averaged 4.8°F above normal, ranging from 3.3°F above normal at the Chesapeake Bay Bridge Tunnel to 5.4°F above normal at Annapolis. January water temperature departures averaged 2.6°F above normal, ranging from 1.4°F above normal at Washington to 4.2°F above normal at Chesapeake Bay Bridge Tunnel. February water temperatures averaged 1.3°F above normal; departures ranged from 0.1°F above normal at Washington to 2.0°F above normal at Chesapeake Bay Bridge Tunnel (Table 4).

Table 4. Bay surface salinities and surface water temperatures, December 1982-February 1983.

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	11.4/+0.8	13.7/+3.8	12.6/+2.8	48.3/+5.3	38.9/+1.5	38.7/+1.7
Annapolis, MD	16.2/ +4.2	15.6/+4.2	----/----	47.1/+5.4	39.6/+2.7	----/----
Solomons, MD	18.3/+2.5	17.9/+2.9	17.5/+3.0	48.4/+5.1	41.0/+3.2	38.2/+0.8
Washington, DC	----/----	1.7/+0.8	1.8/+1.8	----/----	38.3/+1.4	38.2/+0.1
Kiptopeke, VA	28.9/+2.4	29.7/+3.0	28.7/+2.6	49.1/+5.0	41.0/+2.3	40.6/+1.8
Bay Bridge-Tunnel, VA	24.1/+1.5	24.3/+2.5	23.9/+3.0	52.2/+3.3	43.8/+4.2	43.2/+2.0

*Anomaly = departure from long-term averages for each month.
Blank entries indicate data not available.



DECEMBER 1982 **JANUARY 1983** **FEBRUARY 1983**

Figure 5. Mean surface salinity distribution, Chesapeake Bay, December 1982 - February 1983.

Isohalines (parts per thousand) are linearly interpolated from designated station data. Salinities throughout the December 1982 - February 1983 quarter are higher than normal with anomalies up to 4.2 parts per thousand. Data from National Ocean Service, NOAA.

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

Fisheries

Maryland and Virginia monitoring agencies reported an unusually high mortality of oysters during the winter quarter. Oyster stocks, already in low supply from years of poor spawning seasons during 1975-1979, are being reduced further by the parasite MSX. Areas hardest hit by the disease include Eastern Bay, lower portions of the Choptank and Little Choptank Rivers, the Honga River and upper Tangier Sound. Areas less severely infected include the mouth of the Potomac and the lower Patuxent Rivers. High salinities during the past two years contributed to the proliferation of MSX into normally low salinity areas of the Upper Bay. Infestations of MSX are reported up to 40 miles north of oyster beds hit by the last outbreak of MSX in the 1960's. Landings are reduced up to 80 percent in Eastern Bay and up to 40 percent in other hard-hit areas. The Maryland Department of Natural Resources expects landings to be less than 1.5 million bushels for 1982 compared to normal landings in excess of 2 million bushels.

The 1980 and 1981 oyster spawns during periods of high salinities were highly successful. Infestation by MSX in the young oysters spawned in 1980 could seriously deplete next winter's harvest.

Although low salinity might present a barrier to MSX, Bay scientists note high salinity alone does not produce MSX outbreaks. Other factors are involved. Virginia waters, normally more saline than the Upper Bay, experienced pockets of MSX-infested oysterbeds in the 1982-83 season.

The Virginia Marine Resources Commission expects Virginia oyster landings during the 1982-83 winter to be down at least 25 percent from the same period last year based on 1982 October and November figures for public ground harvest. Disease-related mortality, sustained high levels of fishing pressure, and natural fluctuations in abundance may be contributing to the decline in the oyster harvest.

Although MSX appears to be the main source of disease-related mortalities, scientists also report another oyster parasite, Dermocystidium marinum ("dermo") has become more active.

Abnormally mild air and water temperatures resulted in less than ten percent ice cover this winter, the lowest in at least seven years. Table 5 shows Maryland and Virginia oyster landings and total Chesapeake Bay ice cover by winter quarter for years 1976-1983. Icing did not interrupt harvest activities during the 1982-83 winter. Although watermen had unrestricted access to oyster grounds, reduced availability and other factors kept landings below expected amounts.

Warmer than normal water temperatures during the 1982-83 winter may have provided favorable conditions for stocks of overwintering juvenile croakers. Minimal river icing due to warmer than normal water temperatures may also have

Table 5. Maryland and Virginia oyster landings and total Chesapeake Bay ice cover by winter quarter for years 1976-1983.

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
1982-83	<10%	Feb. 14	---	---	---	----	----	----
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;

(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.

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
1982-83	<10%	Feb. 14	---	---	---	----	----	----
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;

(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.

influenced the near absence of striped bass during the 1982-83 winter in the Chesapeake Bay Deep Trough. Striped bass normally move into deeper waters when river systems are covered with ice and low in oxygen. According to Maryland's Department of Natural Resources, partially successful landings by commercial fishermen in the river systems and the absence of landings in the deep trough during the 1982-83 winter suggest striped bass may have remained in the river systems.

A plankton bloom occurred around December 2 in the Potomac River near the mouth of the Wicomico River, in the St. Catherine's River. Also, a heavy dinoflagellate bloom occurred in January in the Morgantown area of the Potomac River.

According to the Virginia Institute of Marine Science (VIMS), Virginia blue crab landings were abnormally low during the winter quarter. Low landings are attributed to three factors: an overall Bay-wide scarcity due to smaller year class recruitment from the 1981 hatch; reduced effort due to fog and heavy seas; and delayed seasonal slowdown in activity of crabs due to higher than normal water temperatures. In winter months a water temperature of approximately 47°F or cooler must occur for crabs to stop feeding and become inactive. VIMS records from 1960-1982 show that December 10 is the average day that the 47°F temperature is reached at the VIMS Gloucester Point, Virginia station. In December 1982 the 47°F temperature was reached on December 19, comparable only to one other year, 1975, during the period of record. Crabs remained active longer due to warmer than normal water temperatures, reducing landings by dredging. The combined effect of low year class recruitment, adverse weather, and warmer than normal water temperatures is less availability and higher prices. VIMS observers reported increases in price per barrel and for retail crab meat.

Recreation

Recreational activities on Chesapeake Bay showed normally low activity during the 1982-83 winter quarter.

Small craft advisories were in effect for 41 days in the quarter and gale warnings for nine days over different areas of the Bay (Table 6). Storm warnings were issued twice in December for the lower Bay.

Maryland Department of Natural Resources Marine Police reported eight boating accidents, four injuries, three deaths and $48,420 property damage for recreational boating (Table 7). The U.S. Coast Guard conducted 126 Search and Rescue (SAR) operations during the quarter (Table 8).

Table 9 lists state parks attendance and revenue at selected Maryland and Virginia facilities during the winter quarter.

Table 6. Marine advisories/warnings, Chesapeake Bay, December 1982-February 1983 (National Weather Service data). For definition of areas see Figure 6.

Date	Condition Report[1]	Location
December 4	A	Entire Bay
6	B	Entire Bay
8	B	South of Windmill Point
8	B	Entire Bay
11	B	South of Windmill Point
12	A	South of Windmill Point
12	A	Entire Bay
12	B	South of Windmill Point
12	B	Bay and Tidal Potomac River
12	C	South of Windmill Point
12	B	Entire Bay
12	C	South of Patuxent River
16	A	Entire Bay
17	A	Tidal Potomac River
17	A	Entire Bay
18	A	Entire Bay
20	A	Entire Bay
21	A	Entire Bay
25	A	Entire Bay
26	A	Entire Bay
28	A	Entire Bay
29	A	Entire Bay
31	A	South of Windmill Point
January 3	A	South of Windmill Point
6	A	South of Windmill Point
7	A	Entire Bay
9	A	South of Windmill Point
10	A	South of Windmill Point
11	A	Entire Bay
12	A	Entire Bay
12	A	Bay and Tidal Potomac River
12	B	South of Windmill Point
14	A	Entire Bay
15	A	Baltimore Harbor northward and south of Windmill Point
15	A	Entire Bay
16	A	Entire Bay
18	A	Entire Bay
19	A	Entire Bay
21	A	South of Windmill Point
22	A	Baltimore Harbor to Patuxent River
27	A	South of Windmill Point
28	A	North of Windmill Point and Tidal Potomac River
28	A	South of Windmill Point
28	B	South of Windmill Point
28	A	Bay and Tidal Potomac River
28	A	South of Windmill Point

(1)Key to Condition Reports:

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

(2)Windmill Point = North side of Rappahannock River

Table 6 (continued). Marine advisories/warnings, Chesapeake Bay, December 1982 - February 1983 (National Weather Service data). For definition of areas see Figure 6.

Date	Condition Report(1)	Location
February 2	A	South of Patuxent River and Tidal Potomac River
3	A	South of Patuxent River and Tidal Potomac River
5	A	South of Patuxent River and Tidal Potomac River
7	A	South of Patuxent River and Tidal Potomac River
9	A	South of Patuxent River and Tidal Potomac River
11	B	Bay and Tidal Potomac River
11	B	South of Windmill Point
11	B	Bay and Tidal Potomac River
12	A	North of Windmill Point and Tidal Potomac River
12	B	South of Windmill Point
12	A	Entire Bay
13	A	South of Windmill Point
14	B	South of Windmill Point
14	B	Entire Bay
14	A	North of Patuxent River
15	A	Entire Bay
17	A	Bay and Tidal Potomac River
23	A	South of Windmill Point
25	A	Bay and Tidal Potomac River
28	A	North of Windmill Point
28	B	South of Windmill Point

(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

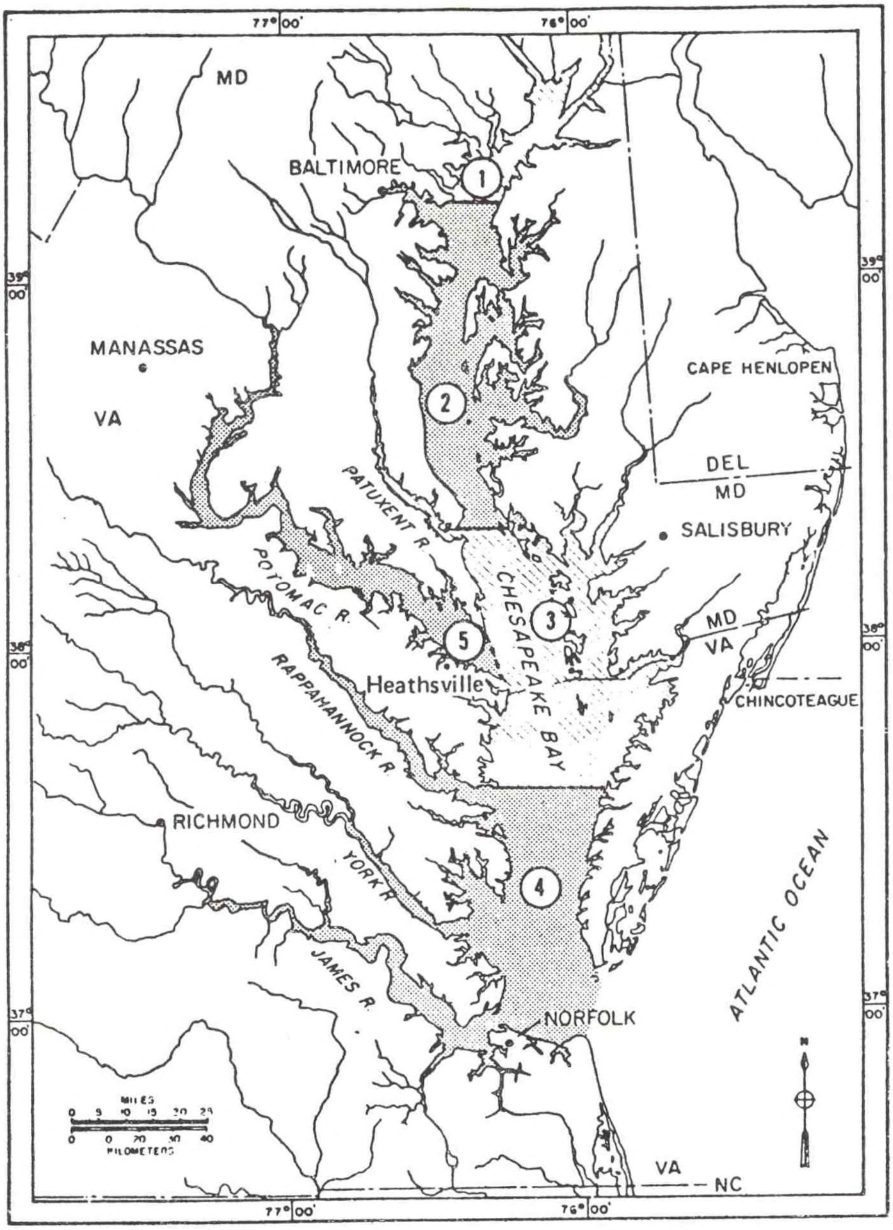


Figure 6. National Weather Service (NWS) forecast areas for Chesapeake Bay.

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. Maryland marine accident statistics, December 1982 - February 1983.

Month	No. of Boating Accidents	No. of Injuries	No. of Deaths	Property Damage
December	3	1	3	$23,420
January	2	2	0	10,000
February	3	1	0	15,000
TOTALS	8	4	3	$48,420

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

Table 8. U.S. Coast Guard Search and Rescue (SAR) caseload. December 1982 - February 1983.

Month	Number of Search and Rescues		
	Group Baltimore	Group Eastern Shore	Group Norfolk
December	20	3	37
January	10	3	26
February	9	3	15
TOTALS	39	9	78

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

Table 9. State parks attendance and revenue, selected Maryland and Virginia facilities, December 1982 - February 1983.

Month	Maryland State Parks				Virginia State Parks			
	Sandy Point		Point Lookout		Seashore		Chippokes Plantation	
	Usage	Revenue	Usage	Revenue	Usage	Revenue	Usage	Revenue
December	4,447	$ ----	1,688	$ 1,387	6,872	$ 173	1,969	$ ----
January	6,692	398	2,139	869	3,225	28	765	----
February	7,340	452	4,291	970	4,560	62	793	----
Totals	18,479	$ 850	8,118	$ 3,226	14,657	$ 263	3,527	$ ----

Data Source: Maryland Department of Natural Resources, Forest and Park Services; and Virginia Department of Conservation and Economic Development, Division of State Parks.

Transportation

Shipping and related shore activities at Maryland and Virginia ports proceeded normally during the quarter. Ports were accessible throughout the quarter and loading and unloading activities proceeded normally. Main shipping channels were clear of ice at all times with ice limited to the tributaries and shoreline of the Upper Bay.

The Port of Baltimore experienced short-term delays in outside cargo handling due to the snowstorm of February 11.

The Maryland Port Administration reported high winds at the Port of Baltimore shut down crane operations five times during the quarter. Total loss of productive time was 24 hours and 47 mintues.

New Air Temperature and Precipitation Normals

In January 1983 the National Climatic Data Center (NCDC), Asheville, North Carolina, issued a new set of climatological normals for most stations in the United States. The new normals derive from the period 1951-1980. NCDC establishes normals according to World Meteorological Organization standards (30 years) and under the assumption that the most recent 30-year period of data is the best quality and most representative for current use.

The old normals derive from data 1941-1970. Previous Chesapeake Bay assessments are computed using the old (1941-70) set of normals. Temperature or precipitation variations listed in previous assessments considered with data in the present (or future) assessments must be adjusted for the differences in the sets of normals used. NCDC has issued new normals for 3500 temperature and 5000 precipitation datasets from a total of 8000 stations in the U.S. New normals for Patuxent and Aberdeen will be adopted in the assessment when available. Old and new normals for precipitation and air temperature appear in Table 10 and 11, respectively.

Temperature

Individual monthly normals changed between -1.1°F (Royal Oak in January; Harrisburg in May) and +1.5°F (Washington, DC, in December). Several stations experienced changes of normals of a degree or more (Williamsport in January; Williamsport in October; Baltimore, Chantilly, Norfolk in December). Harrisburg experienced the greatest negative change with a normal decreasing 0.4°F for the year. Washington, DC, showed the greatest annual total increase, 0.3°F.

The changes of normals are similar station to station. All stations have cooler January normals. March temperature normals increase at all stations except Harrisburg, and April normals increase except at stations north of Baltimore. The May-June-July new normals tend cooler than old normals; August and September new normals are warmer than old normals. October's temperature normals decreased strongly over the region but December normals exhibited the strongest increase over the old normals.

Precipitation

Individual monthly precipitation normals experienced adjustments between a 35-percent increase (Harrisburg in September) and unchanged (Royal Oak in March, September, December; Chantilly in January). Scranton experienced a 17-percent decline in normal July precipitation. Normal monthly values increased by 10 percent or more at several stations (Williamsport, Scranton, Harrisburg, Richmond, Norfolk in January; Williamsport, Harrisburg in February; Norfolk in March; Norfolk in May; Williamsport, Harrisburg, Chantilly in June; Scranton, Harrisburg in July; Williamsport, Scranton, Harrisburg, Baltimore in September; Baltimore, Chantilly, Richmond, Norfolk in October).

In general over the area the normals changed seasonally. December through April normals show increased normal precipitation except at Chantilly, which is different from most of the stations. September and October also show a regional increase over previous normal precipitation. May through August normals show decreases from 1941-70 averages indicating a drier summer regime during the last 30 years. November normals remain nearly unchanged over the region.

During May through September, the changes in normals exhibit a bimodal pattern. The more landward and northerly stations integrate to much increased normal precipitation in May, June, and September with decreased normals only in July. The more eastward and southerly stations show definitely decreased normal precipitation for May through August and a slight increase for September.

Application of New Normals

The new normals exhibit a wetter and cooler winter, a cooler and drier spring, a warmer and drier summer and a wetter fall season (wetter, cooler October; wetter, warmer December) over the entire region. Analysis of the impact, if any, of this slight redistribution of rainfall and temperature must await development of further data. This note simply allows the user to intercompare anomalies published in previous Chesapeake Bay Assessments with the present and future assessments.

The differences in normals shown in Table 12 can be applied directly by subtracting algebraically from anomalies listed in previous assessments to obtain anomaly values comparable to those listed in the present assessment.

Examples:

From the Chesapeake Bay Assessment for June-August 1982 (Table 2, p. 5) we obtain the July precipitation anomaly of -0.80 inches for Harrisburg. The correction for Harrisburg for July from Table 12A in the present publication is -0.38. Subtracting this correction from the previous anomaly, we obtain -0.42 inches, which can then be directly compared with the January Harrisburg anomaly of -0.70 inches in the present publication (Table 2, p. 6).

Similarly for the December temperature anomaly given for 1981 for Richmond in the Chesapeake Bay 1981 Annual Summary (Table 5, p. 15) we obtain -1.0°F. The correction for application of new normals given in Table 12B in the present publication is +0.9°F. Subtracting this correction shows the new anomaly for Richmond in December 1981 to be -1.9°F. Note that compared to older normals, the month was a degree colder than normal while under consideration of the new set of normals, December 1981 was nearly two degrees cooler than normal in Richmond.

The extent to which the change of normals will affect a specific comparison or calculation depends upon the type of comparison, absolute magnitudes of the temperature or precipitation value and the amount of change between the specific normal values used. Users should be careful to adjust data from previous assessments. The caution is especially pertinent when applying further processing to the anomalies for computation of indexes or integrated values.

Table 10. Average monthly total precipitation reference values 1941-1970 and 1951-1980 (Inches).

A. 1941-1970

STATION	MONTH												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Williamsport, PA	2.52	2.58	3.53	3.42	3.99	3.25	4.19	3.44	3.03	3.20	3.74	3.10	39.99
Wilkes-Barre, PA	2.04	1.96	2.50	3.06	3.51	3.40	4.09	3.21	2.82	2.71	3.01	2.51	34.81
Harrisburg, PA	2.57	2.42	3.22	2.98	3.76	3.11	3.70	3.22	2.66	2.57	3.19	3.07	36.47
Baltimore, MD	2.91	2.81	3.69	3.07	3.61	3.77	4.07	4.21	3.12	2.81	3.13	3.26	40.46
Washington, DC	2.62	2.45	3.33	2.86	3.68	3.48	4.12	4.67	3.08	2.66	2.90	3.04	38.89
Chantilly, VA	2.84	2.61	3.48	2.96	3.68	3.61	4.12	4.25	3.29	2.74	3.06	3.47	40.11
Royal Oak, MD	3.29	3.12	4.06	3.43	3.83	3.77	4.68	4.88	3.72	3.17	3.68	3.73	45.36
Richmond, VA	2.86	3.01	3.38	2.77	3.42	3.52	5.63	5.06	3.58	2.94	3.20	3.22	42.59
Norfolk, VA	3.35	3.31	3.42	2.71	3.42	3.62	5.70	5.92	4.20	3.06	2.94	3.11	45.30

B. 1951-1980

STATION	MONTH												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Williamsport, PA	2.88	2.83	3.66	3.53	3.66	3.88	3.92	3.26	3.57	3.22	3.63	3.24	41.28
Wilkes-Barre, PA	2.27	2.05	2.63	3.01	3.16	3.42	3.39	3.47	3.36	2.78	2.98	2.54	35.08
Harrisburg, PA	2.96	2.73	3.50	3.19	3.67	3.63	3.32	3.29	3.60	2.73	3.24	3.23	39.09
Baltimore, MD	3.00	2.98	3.72	3.35	3.44	3.76	3.89	4.62	3.46	3.11	3.11	3.40	41.84
Washington, DC	2.76	2.62	3.46	2.93	3.48	3.35	3.88	4.40	3.22	2.90	2.82	3.18	39.00
Chantilly, VA	2.83	2.64	3.43	3.14	3.62	4.23	3.75	4.16	3.26	3.01	2.99	3.29	40.35
Royal Oak, MD	3.44	3.20	4.07	3.41	3.36	3.43	4.39	5.09	3.72	3.46	3.73	3.74	45.31
Richmond, VA	3.23	3.13	3.57	2.90	3.55	3.60	5.14	5.01	3.52	3.74	3.29	3.39	44.07
Norfolk, VA	3.72	3.28	3.86	2.87	3.75	3.45	5.15	5.33	4.35	3.41	2.88	3.17	45.22

Table 11. Average monthly air temperature reference values 1941-1970 and 1951-1980 (Deg. F).

A. 1941-1970

STATION	MONTH												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Williamsport, PA	27.2	28.6	37.5	49.8	60.1	68.8	72.9	70.9	64.0	53.3	41.5	30.2	50.4
Wilkes-Barre, PA	26.0	27.3	36.0	48.5	58.9	67.9	72.2	70.0	62.9	52.6	40.8	29.1	49.4
Harrisburg, PA	30.1	32.3	41.0	52.8	63.1	72.0	76.1	73.9	67.0	55.8	43.8	32.6	53.4
Baltimore, MD	33.4	34.8	42.8	53.8	63.7	72.4	76.6	74.9	68.5	57.4	46.1	35.3	55.0
Washington, DC	35.6	37.3	45.1	56.4	66.2	74.6	78.7	77.1	70.6	59.8	48.0	37.4	57.2
Chantilly, VA	32.1	33.8	41.8	53.1	62.6	71.1	75.3	73.6	66.9	55.9	44.7	34.0	53.7
Royal Oak, MD	36.1	37.6	44.8	55.1	64.9	73.8	78.0	75.7	69.7	59.8	49.1	39.1	57.0
Richmond, VA	37.5	39.4	46.9	57.8	66.5	74.2	77.9	76.3	70.0	59.3	49.0	39.0	57.8
Norfolk, VA	40.5	41.4	48.1	57.8	66.7	74.5	78.3	76.9	71.8	61.7	51.6	42.3	59.3

B. 1951-1980

STATION	MONTH												ANNUAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Williamsport, PA	26.2	28.2	37.6	49.6	59.6	68.3	72.5	71.1	63.9	52.3	41.4	30.7	50.1
Wilkes-Barre, PA	25.2	26.8	36.1	48.3	58.6	67.4	71.8	70.0	62.8	51.7	40.9	29.7	49.1
Harrisburg, PA	29.4	31.5	40.6	52.2	62.0	71.2	75.8	74.3	66.9	55.0	43.9	33.4	53.0
Baltimore, MD	32.7	34.7	43.3	54.0	63.4	72.2	76.8	75.6	68.9	56.9	46.3	36.5	55.1
Washington, DC	35.2	37.5	45.8	56.7	66.0	74.5	78.9	77.6	71.1	59.3	48.7	38.9	57.5
Chantilly, VA	31.4	33.6	42.4	53.3	62.4	70.7	75.5	74.3	67.4	55.3	44.8	35.1	53.9
Royal Oak, MD	35.0	36.7	45.2	55.8	65.2	73.5	77.7	76.6	70.3	59.3	48.9	38.9	56.9
Richmond, VA	36.6	38.9	47.2	57.9	66.1	73.5	77.8	76.8	70.2	58.6	48.9	39.9	57.7
Norfolk, VA	39.9	41.1	48.5	58.2	66.4	74.3	78.4	77.7	72.2	61.3	51.9	43.5	59.5

Table 12. Difference between new (1951-1980) and old (1941-1970) reference values for precipitaton and air temperature. Difference is NEW - OLD.

A. Precipitation (Inches)

STATION	MONTH												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Williamsport, PA	+0.36	+0.25	+0.13	+0.11	-0.33	+0.63	-0.27	-0.18	+0.54	+0.02	-0.11	+0.14	+1.29
Wilkes-Barre, PA	+0.24	+0.09	+0.13	-0.05	-0.34	+0.02	-0.70	+0.26	+0.54	+0.07	-0.03	+0.03	+0.27
Harrisburg, PA	+0.39	+0.31	+0.28	+0.21	-0.09	+0.52	-0.38	+0.07	+0.94	+0.16	+0.05	+0.16	+2.62
Baltimore, MD	-0.09	+0.17	+0.03	+0.28	-0.17	-0.01	-0.18	+0.41	+0.34	+0.30	-0.02	+0.14	+1.38
Washington, DC	+0.14	+0.17	+0.13	+0.07	-0.20	-0.13	-0.24	-0.27	+0.14	+0.24	-0.08	+0.14	+0.11
Chantilly, VA	-0.01	+0.03	-0.05	+0.18	-0.06	+0.62	-0.37	-0.09	-0.03	+0.27	-0.07	-0.18	+0.24
Royal Oak, MD	+0.15	+0.08	+0.01	-0.02	-0.20	-0.34	-0.29	+0.21	0.00	+0.29	+0.05	+0.01	-0.05
Richmond, VA	-0.37	+0.12	+0.19	+0.13	+0.13	+0.08	-0.49	-0.05	-0.06	+0.80	+0.09	+0.17	+1.48
Norfolk, VA	+0.37	-0.03	+0.44	+0.16	+0.33	-0.17	-0.55	-0.59	+1.53	+0.35	-0.06	+0.06	-0.08

B. Air temperature (Deg. F)

STATION	MONTH												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Williamsport, PA	-1.0	-0.4	+0.1	-0.2	-0.5	-0.5	-0.4	+0.2	-0.1	-1.0	-0.1	+0.5	-0.3
Wilkes-Barre, PA	-0.8	-0.5	+0.1	-0.2	-0.3	-0.5	-0.4	0.0	-0.1	-0.9	+0.1	+0.6	-0.3
Harrisburg, PA	-0.7	-0.8	-0.4	-0.6	-1.1	-0.8	-0.3	+0.4	-0.1	-0.8	+0.1	+0.8	-0.4
Baltimore, MD	-0.7	-0.1	+0.5	+0.2	-0.3	-0.2	+0.2	+0.7	+0.4	-0.5	+0.2	+1.2	+0.1
Washington, DC	-0.4	+0.2	+0.7	+0.3	-0.2	-0.1	+0.2	+0.5	+0.5	-0.5	+0.7	+1.5	+0.3
Chantilly, VA	-0.7	-0.2	+0.6	+0.2	-0.2	-0.4	+0.2	+0.7	+0.5	-0.6	+0.1	+1.1	+0.2
Royal Oak, MD	-1.1	-0.9	+0.4	+0.7	+0.3	-0.3	-0.3	+0.9	+0.6	-0.5	-0.2	-0.2	-0.1
Richmond, VA	-0.9	-0.5	+0.3	+0.1	-0.4	-0.7	-0.1	+0.5	+0.2	-0.7	-0.1	+0.9	-0.1
Norfolk, VA	-0.6	-0.3	+0.4	+0.5	-0.3	-0.2	+0.1	+0.8	+2.2	-0.4	+0.3	+1.2	+0.2