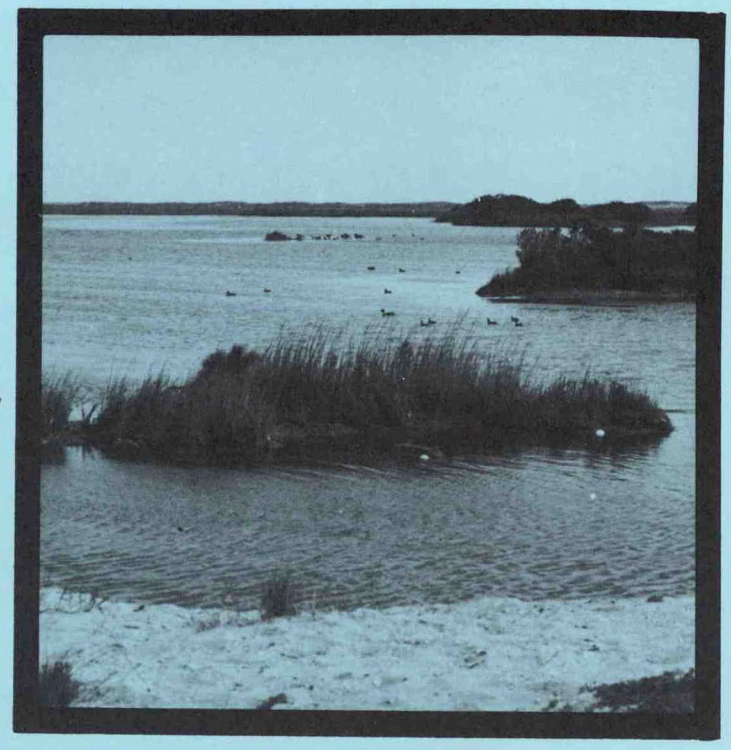
Marine Environmental Assessment

CHESAPEAKE BAY
JUNE –AUGUST 1984



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

CLIMATE IMPACT ASSESSMENT
UNITED STATES

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

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

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JUNE – AUGUST 1984

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Marine Environmental Assessment Division

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CHESAPEAKE BAY MARINE ASSESSMENT

The marine ecosystem exhibits many complex interrelationships which are difficult to measure. Climatic events do not often produce an obvious immediate response in the marine environment. The extended intervals that frequently exist between a climate event and the observed impact present a problem different from the land oriented 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, June-August 1984.

EVENT	IMPACT SECTOR: FISHERIES								RECREATION						TRANSPORTATION					
	Soft shell clam harvest	Blue crab harvest	Oyster population						Boating	Safety	State park usage	Swimming			Port operations	Cost to shippers				
Above normal rainfall	-	-	-						-		-									
Above normal streamflow	-	-	-																	
Below normal salinities	-	-	-																	
Cool air temperatures									-		-									
Low numbers stinging nettles												+								

+ Favorable

- Unfavorable

☐ No identifiable effect, data unavailable, or not applicable

Chesapeake Bay Marine Environment

1. Highlights - General Events and Impacts

Soft shell clam beds in the northern Bay were closed to harvesting by the state of Maryland from July 30 to August 29. Low salinities in spring and summer weakened clams, causing clam mortalities and rapid deterioration once taken out of the water. The reduced clam landings represent a possible loss of over $0.9 million to the Maryland economy.

Blue crabs were in sporadic supply over most of the summer 1984 quarter. Total Bay landings of hard crabs in June - August 1984 from the same period in 1983. High rainfall and lowered salinities may have altered normal crab distributions as seen in the sporadic catches reported by watermen.

Early results of surveys in Maryland and Virginia show poor oyster spatfall. High runoff and low salinities may have provided unfavorable conditions for the survival of oyster young.

Marine recreation showed reduced activity during extended periods of rainfall in July and August. Park attendance and boating figures were below 1983 levels in all three months in the lower Bay, while July figures were lower than 1983 Bay-wide.

Stinging nettles appeared later than normal and were present in very low numbers during summer 1984 in areas of the Maryland portion of Chesapeake Bay, where they normally proliferate in summer months.

2. Weather and Oceanography Summary

2.1 Weather

Temperatures during the summer 1984 quarter in the Bay area were above average over the region in June and August and below average in July. June had a period of almost two weeks of weather with temperatures in the 90's with temperatures in the low to mid 80's for the remainder of the month. July's temperatures were moderate, exceeding 90 degrees Fahrenheit only a few times during the month. August had temperatures near 90 degrees in the first half of the month, followed by more moderate temperatures after mid-month.

Precipitation was below average over the region in June and August and above average in July. Rainfall into the Susquehanna basin was above normal over much of the quarter. In the middle of August the area around Chantilly, VA received very heavy rainfall, resulting in near flood conditions locally, while areas on the eastern shore of Chesapeake Bay had minimal rainfall. No destructive storms affected the area during summer 1984.

June:

The month of June began with cool weather as a deep trough in the upper atmospheric wind field covered the entire East Coast, causing light precipitation in thundershowers. Temperatures rose throughout the area as a warm front crossed eastward through the area on the 3rd. Temperatures rose again on the 6th as another warm front moved through the area, again bringing scattered thunderstorms with little rain to the region. Royal Oak received 0.95 inches of rain in a thunderstorm on the 6th.

From the 7th to the 14th a high pressure system dominated the region bringing continued warm weather and no rain. A cold front on the 14th triggered scattered thundershowers dropping temperatures from the 90's into the 80's. A series of fronts through the 19th brought continued rain and thundershowers over the region until a high pressure system established itself over the area on the 20th. Temperatures under this high pressure area remained cool, however, since the flow in the local region came from the northeast.

On the 24th a warm front and cold front in close succession moved eastward over the area, bringing rain to the region, but particularly in the upper Bay and in Pennsylvania. Aberdeen received more than an inch of rain from this system. A frontal low pressure system from Canada moved into the area on the 28th and 29th and held nearly stationary along the coast on the 30th bringing thunderstorms and rain over a two-day period to most of the stations in Figure 1.

Precipitation during June divided into two sub-areas. The three Pennsylvania stations in Table 2 were above normal (49 percent) by amounts ranging from 1.27 inches at Williamsport to 2.73 inches at Harrisburg. The remaining stations except Royal Oak averaged 43 percent below normal. At Norfolk this was the 10th driest June on record.

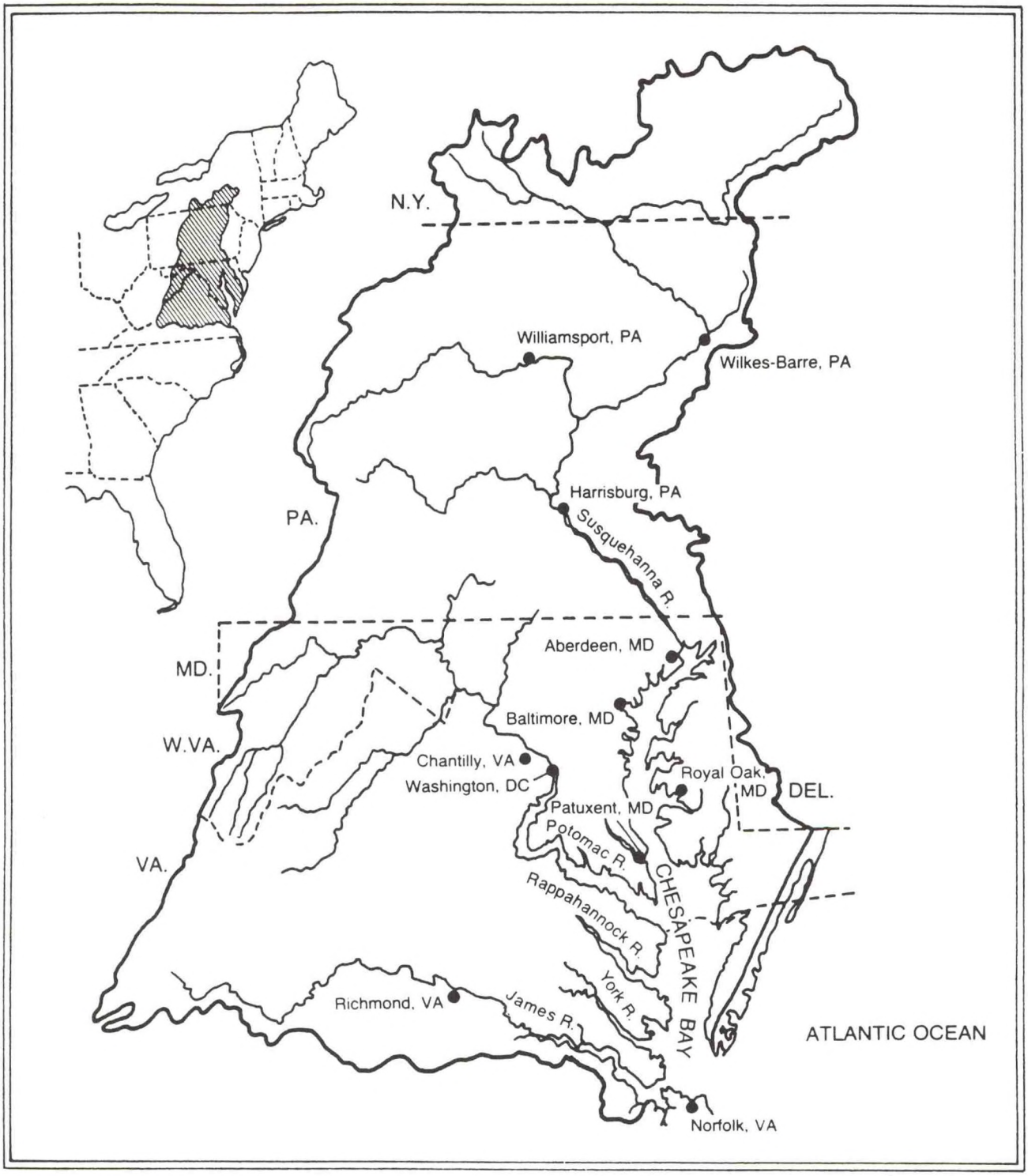


Figure 1. Selected meteorological stations, Chesapeake Bay watershed (Modified EPA map).

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

Station	Total Precipitation and Departure from Normal Observed/*Anomaly (Inches)			Air Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	June	July	August	June	July	August
Williamsport, PA	5.15/+33%	6.42/+64%	3.60/+10%	68.7/+0.4	70.6/-1.9	72.2/+1.1
Wilkes-Barre,PA	4.75/+39%	5.12/+51%	2.81/-19%	69.3/+1.9	71.6/-0.2	72.6/+2.6
Harrisburg, PA	6.36/+75%	3.76/+13%	2.75/-16%	72.9/+1.7	74.3/+1.5	75.8/+1.5
Aberdeen,MD	3.13/-12%	4.28/+1%	1.48/-62%	72.5/+0.0	74.5/-1.9	75.5/+0.7
Baltimore, MD	1.65/-56%	3.27/-16%	4.11/-11%	73.4/+1.2	73.9/-2.9	75.0/-0.6
Washington, DC	2.28/-32%	3.80/-2%	2.30/-48%	76.8/+2.3	76.5/-2.4	77.7/+0.1
Chantilly, VA	2.19/-48%	2.46/-34%	10.71/+157%	71.3/+0.6	72.0/-3.5	74.2/-0.1
Royal Oak, MD	3.71/+ 8%	4.75/+8%	2.67/-48%	74.7/+1.2	75.5/-2.2	76.9/+0.3
Patuxent, MD	1.77/-49%	3.29/-21%	4.49/+3%	74.9/+1.9	75.9/-2.1	77.2/+0.2
Richmond, VA	2.01/-44%	3.55/-31%	4.58/-9%	77.7/+4.2	76.0/-1.8	77.0/+0.2
Norfolk, VA	1.50/-57%	7.66/+49%	2.25/-58%	76.2/+1.9	76.7/-1.7	78.4/+0.7
Average	3.14/-13%	4.40/+7%	3.80/-11%	73.5/+1.6	74.3/-1.7	75.7/+0.6

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

Temperatures for the month averaged above normal at all 11 stations (1.6 degrees above normal) for the region. The lowest temperatures of the month were recorded by all the stations on the 1st, and the highest temperatures of the month were recorded by most stations during the period from the 7th to the 14th, when the area was under the Bermuda high pressure area.

Winds from 15 to 20 mph from the northwest with a peak gust of 29 mph at Royal Oak occurred on the 1st. Thereafter, sustained winds over the Bay area were generally below 15 mph during the month. Royal Oak measured peak gusts of 38 mph from the northwest in a thunderstorm on the 6th, and 27 mph during a thunderstorm associated with the frontal passage on the 14th. Gusts occasionally peaked over 20 mph.

July:

The frontal system which extended along the middle Atlantic Coast at the end of June continued to bring relatively cool, showery weather to the Chesapeake Bay area over the 1st and 2nd of July. On the 3rd the Bermuda High re-established itself over the region, and remained over the 4th and 5th. A cold front on the 7th ushered in a high pressure cell from Canada and caused temperatures to fall to their lowest values for the month at almost all stations on the 8th and the 9th.

A warm front moved northeastward over the region from the 9th to the 11th, triggering thundershowers with light to moderate rainfall and raising daytime high temperatures to their highest values for the month. A weak front on the 12th triggered more thundershowers, but shower activity was minimal for the next several days as high pressure dominated the area.

Two separate cold fronts during the 16th - 18th produced showers and cooler weather. Royal Oak received over 1.5 inches of rain from the system on the 18th.

On the 20th a warm frontal wave moved into the lower Bay area from the southeast. The junction of warm, moist air from the southeast and cool, dry air from the northwest caused showers and thundershowers in a band aligned with the Bay, but heaviest rainfall was in the northern half of the region. Stations with greatest positive departures from normal were Williamsport, which received 6.42 inches (64 percent above normal) and Wilkes-Barre, which received 5.12 inches (51 percent above normal) (Table 2).

Temperatures averaged 2.0 degrees below normal over the region during the month, ranging from 1.5 degrees above normal at Harrisburg to 3.5 degrees below normal at Chantilly. Almost all stations recorded their lowest temperatures for the month on either the 8th or the 9th, under a cell of cool high pressure. Two days later most stations had their highest temperatures of the month as warm air surged northward ahead of the next cold front. July temperatures this year exceeded 90 degrees only occasionally.

Peak wind speeds reached or exceeded 20 mph 17 times during the month at Patuxent. The highest gust recorded was 35 mph on the 5th.

August:

High pressure covered the Atlantic Coast at the beginning of August. A cold front moved through the area on the 2nd and 3rd, causing showers and thundershowers in much of the area. Chantilly received over 1.5 inches of rain from this frontal system. Hot, humid weather continued over the region under a re-formed high pressure system covering the southeastern United States.

On the 10th an intensification of a weak cold front sent a surge of cool air through the area causing drops in maximum temperatures and very heavy rainfalls in the Potomac River basin. Shower activity from the remains of the front continued through the 14th, while temperatures returned to earlier high values under predominantly southerly flow.

On the 16th and 17th a cold front pushed southward from Canada causing a drop in temperatures but little shower activity. A wave along this front on the 19th triggered light shower activity, coinciding with a further surge of Canadian air. Temperatures reached their lowest values throughout the area on the 21st as the large cell of Canadian air spread over the area. A few showers occurred on the 23rd as the earlier high pressure cell was replaced by another from Canada.

Temperatures remained moderate in the 80's through the remainder of the month and no precipitation occurred from the 23rd through the end of the month.

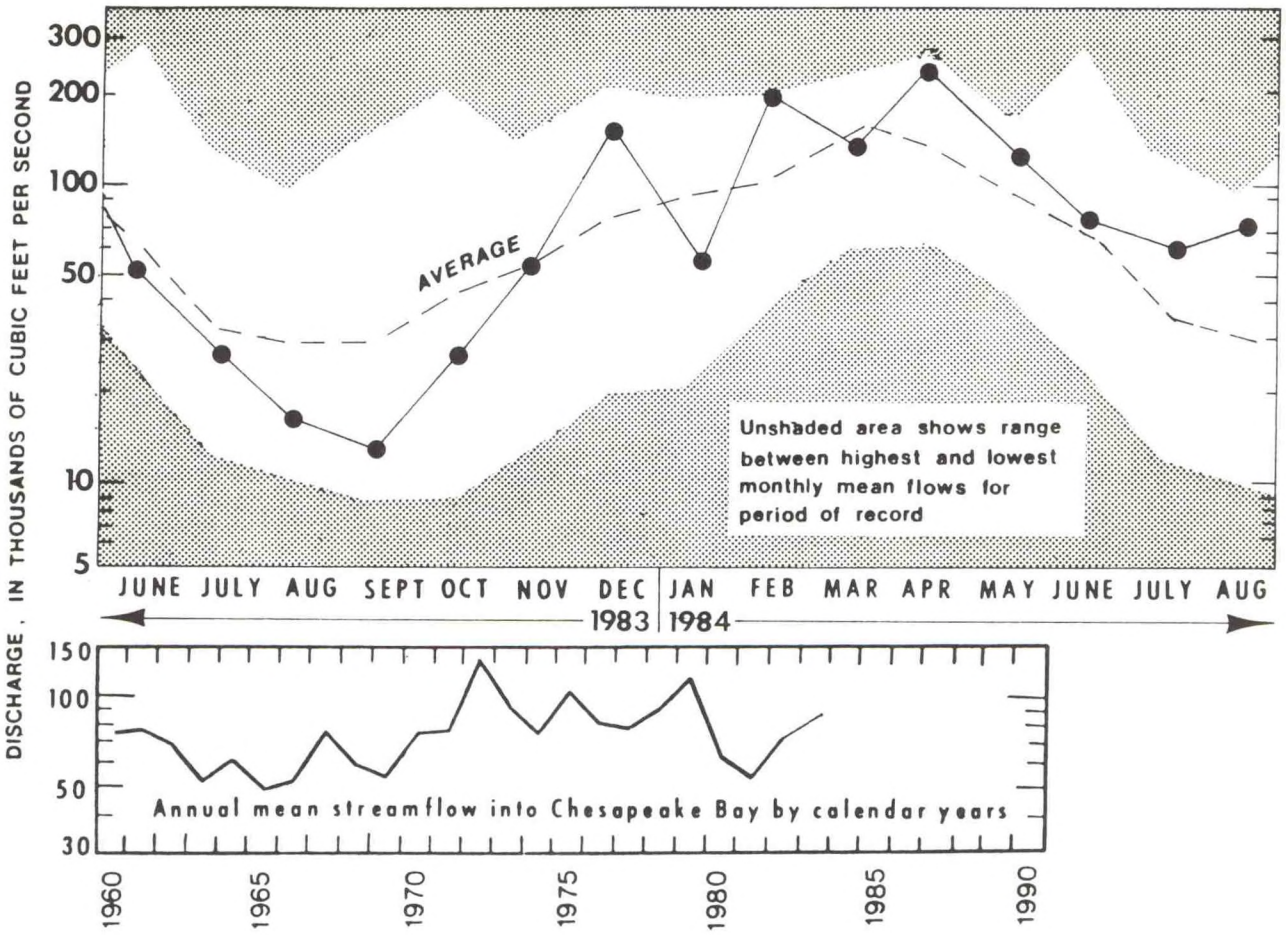
Precipitation totals for August varied east-west with eastern regions well below normal and western areas well above normal for the month. The extreme precipitation at Chantilly (257 percent of normal) helped sustain the continued higher-than-normal streamflow into the Bay. The Potomac River receives all runoff from the Chantilly area (See section 2.2).

Temperatures among the 11 stations averaged 0.6 degrees above normal in August, ranging from 0.6 degrees below normal at Baltimore to 2.6 degrees above normal at Wilkes-Barre. Highest temperatures of the month for most stations occurred from the 7th to the 9th. Stations reported lowest temperatures of the month on either the 21st or 22nd when a cell of Canadian air covered the region.

Winds gusted to 30 mph during a thunderstorm at Royal Oak on the 8th. At Patuxent gusts from the northwest reached 25 mph on the 3rd and 25 mph from the southwest the 23rd. On seven other occasions during the month gusts reached or exceeded 20 mph at Patuxent.

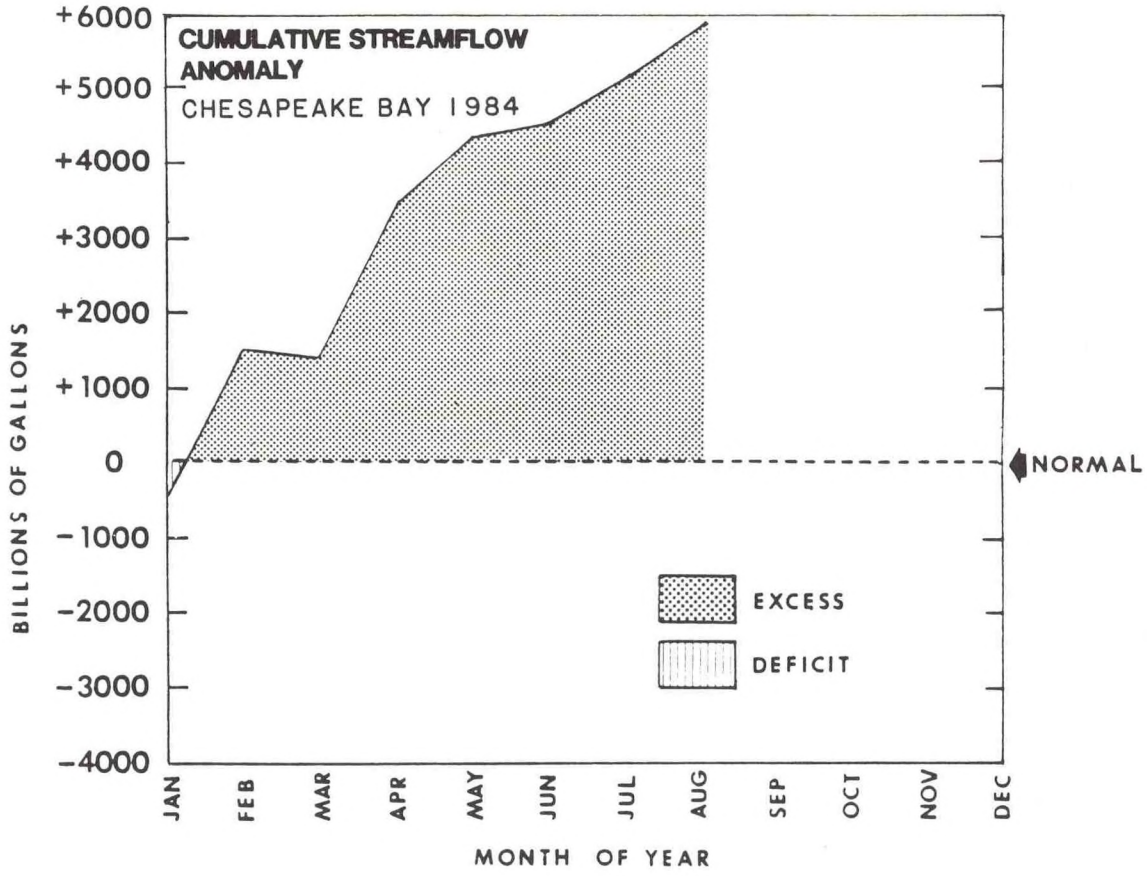
2.2 Streamflow

The above-normal streamflow of April and May was sustained through the summer 1984 quarter (Figure 2). Above-normal rainfall in the Susquehanna region in June and July and in the Potomac basin in August greatly increased the amount of freshwater entering the Bay system. High streamflow in the Susquehanna River contributed to the excess in total Bay streamflow in June and July. Potomac River flow was well above normal in August, contributing to the large excess in Bay streamflow. Excess freshwater diluted Bay waters, keeping salinities below normal from June through August. By August, the cumulative streamflow anomaly for 1984 reached an excess of nearly six trillion gallons (Figure 3).



Bay streamflow was above normal from June through August 1984. July and August streamflows were both well above their long-term monthly averages. August 1984 flow of 73,600 cubic feet per second (cfs) is 44,006 cfs higher than average, and second highest for August during the period of record 1951-present compared to the record high of 93,400 cfs in August 1955. Data from U.S. Geological Survey.

Figure 2.--Monthly streamflow into Chesapeake Bay, June 1983-August 1984 and annual mean flow 1960-1983.



The cumulative streamflow anomaly (monthly sum of negative and positive departures from normal by calendar year) for January through August 1984 reached an excess of nearly six trillion gallons. Above normal streamflow since April contributed to the large excess to date. Data from U.S. Geological Survey.

Figure 3.--Cumulative monthly streamflow anomaly, Chesapeake Bay, 1984.

2.3 Oceanography

The salinities around the Bay remained below normal throughout the quarter at all stations. The negative anomalies appear to have peaked in May in the lower Bay and in June at upper Bay stations in response to the extreme high runoff in late spring and continued higher-than-normal streamflow during the summer months. Bay water temperatures warmed rapidly during June to above-normal values, but failed to attain normal July values following the pattern for the weather of the Bay region. August temperatures were below normal for the month in the upper Bay and above normal in the lower Bay.

Salinity:

Salinities were below normal at all stations on the Bay at beginning of June and averaged 4.5 parts per thousand (ppt) below normal for the month, except at Baltimore (-0.9 ppt) (Table 3). During July the freshwater inflow was well above normal and salinities remained below normal (Figure 4). Salinity anomalies at Baltimore and Annapolis went farthest negative during July. In August salinity values adjusted a little closer to normal, but the average of the five stations remained more than 3.5 ppt below normal for the month. Salinities had been below normal at most stations since January.

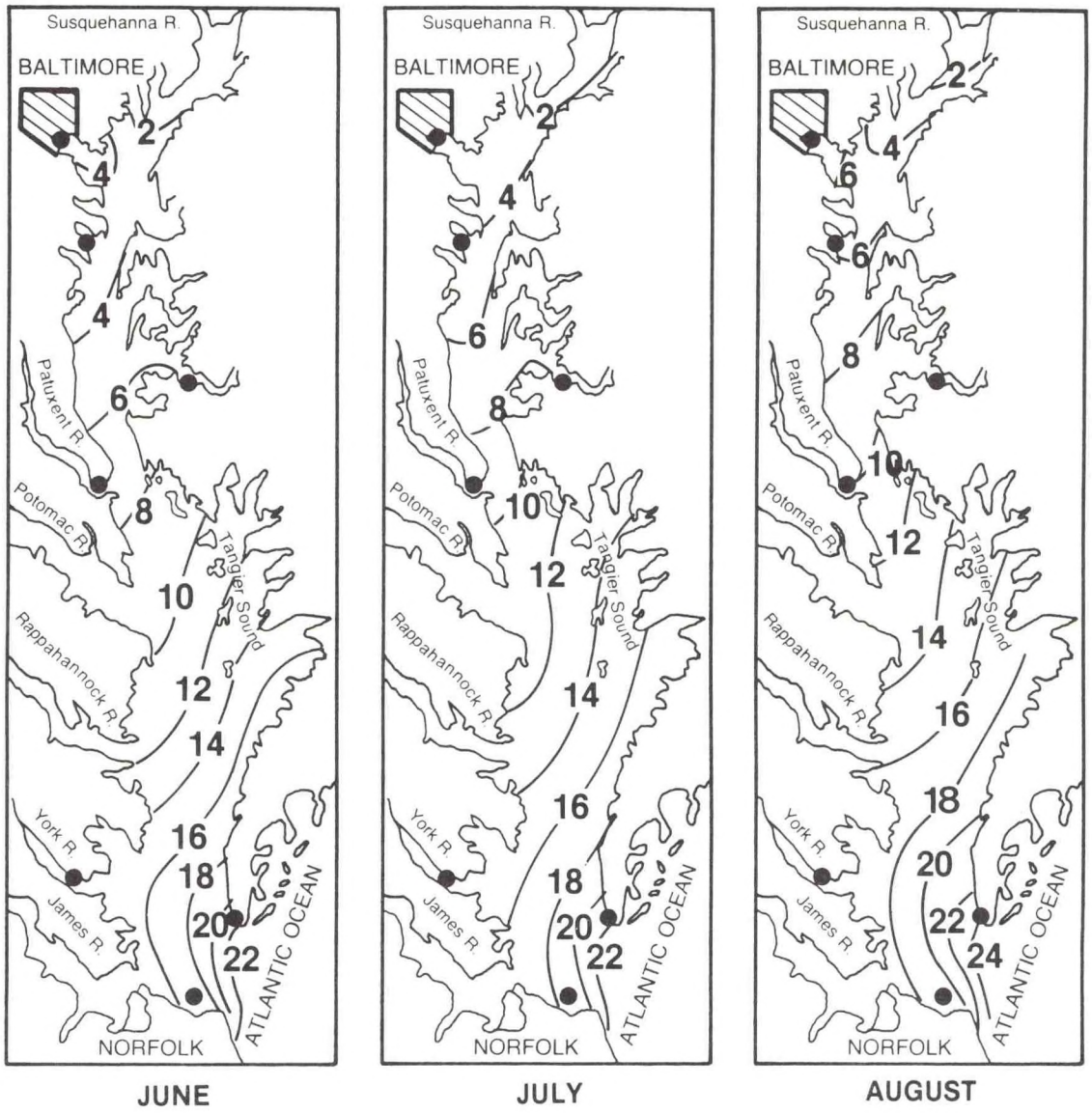
Temperature:

Water temperatures in June were near normal or below in the upper Bay and nearly a degree and a half above normal in the southern Bay (Table 3). Weather in July failed to bring the surface water temperatures to normal, however, and values for the month were below normal over the entire Bay. In August, the surface waters returned to the pattern shown in June with the upper Bay below normal and the southern Bay above normal.

Table 3.--Bay surface salinities and surface water temperatures, June - August 1984.

Station	Surface Salinity and Departure from Normal Observed/*Anomaly (ppt)			Surface Water Temperature and Departure from Normal Observed/*Anomaly (Deg. F)		
	June	July	August	June	July	August
Baltimore,MD	5.1/-0.9	3.8/-3.1	6.4/-1.6	74.4/+0.3	79.2/-0.3	79.2/-0.3
Annapolis,MD	3.4/-4.6	4.3/-4.9	5.9/-4.3	73.5/-1.0	78.1/-2.1	78.9/-0.8
Solomons,MD	7.5/-3.7	9.0/-3.6	10.0/-3.5	74.7/+0.2	79.3/-0.8	81.2/+1.1
Kiptopeke, VA	20.4/-5.4	21.8/-4.6	22.9/-4.4	73.9/+1.8	76.6/-0.6	80.3/+3.1
Bay Bridge-Tunnel, VA	17.7/-4.5	19.1/-5.0	19.1/-5.0	75.9/+1.8	77.5/-1.5	80.5/+0.6

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



Isohalines (parts per thousand) are linearly interpolated from designated station data. Salinities were below normal throughout the summer quarter at all Bay stations. Above normal rainfall and high streamflow has kept salinities below normal at most Bay stations since January. Data from National Ocean Service, NOAA.

Figure 4.--Mean surface salinity distribution, Chesapeake Bay, June-August 1984.

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

3.1 Fisheries

Maryland soft shell clam landings in June - August were only 31,780 bushels, 58 percent less than in the summer 1983 quarter. Low salinities stressed soft shell clams, causing clam mortalities and rapid deterioration of harvested clams. Major soft shell clam beds were closed to harvesting by the state of Maryland July 30 to August 29 because of the potential for contamination of weakened clams once harvested. The June - August blue crab catch was lower than the same period in 1983 and crabs were in sporadic supply. Early results of surveys indicate a poor oyster spatset in Maryland and Virginia.

Shellfish:

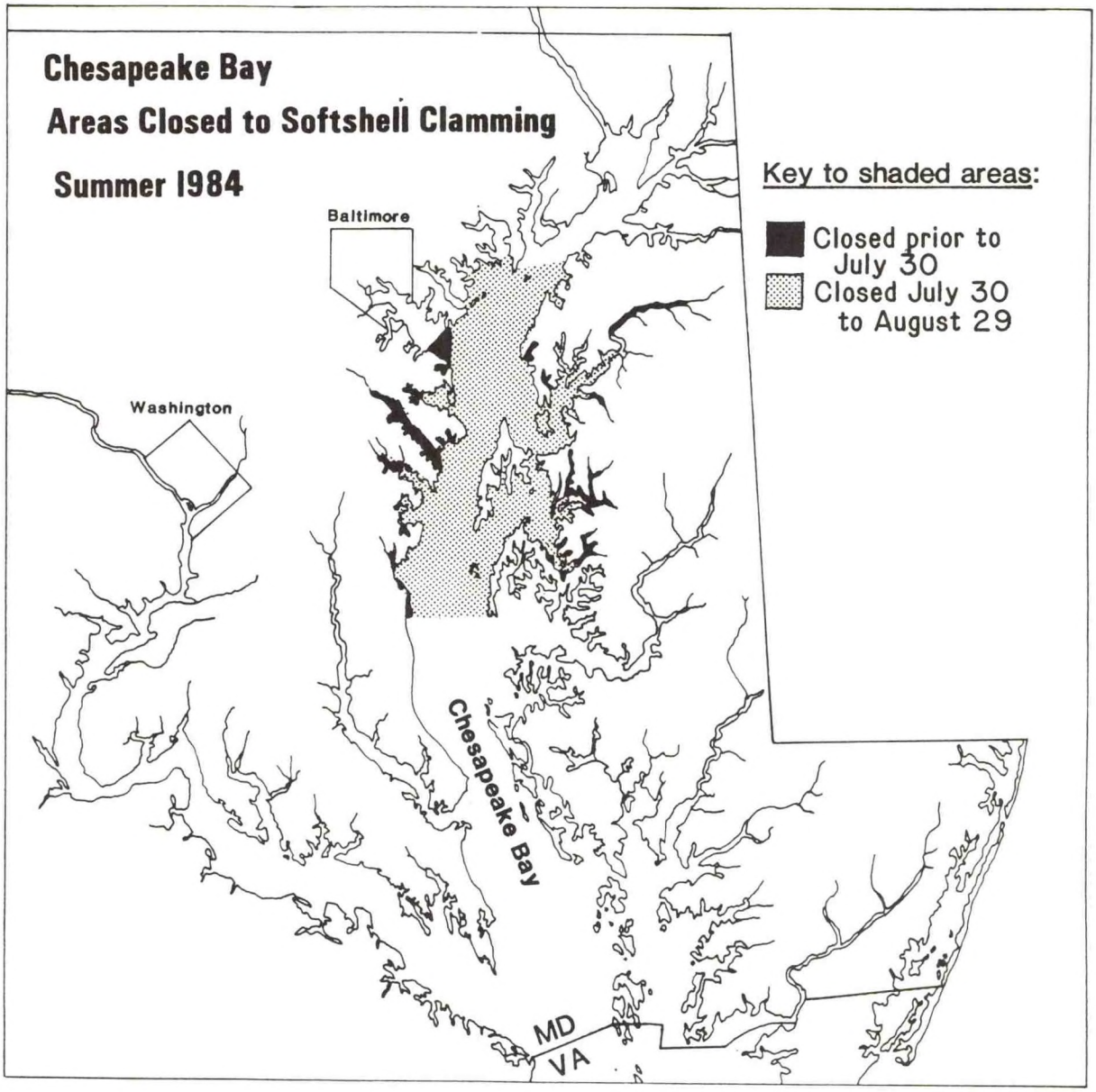
Soft shell clams

Soft shell clam beds in a portion of the northern Bay were closed to harvesting by the state of Maryland from July 30 to August 29. The restriction was in effect in all waters of the Bay and its tributaries north of a line running westerly from Blackwalnut Point on Tilghman Island to Chesapeake Beach (Figure 5).

Abnormally high streamflow in spring and summer 1984 greatly reduced salinities in the northern Bay. The long duration of low salinities, combined with seasonally higher summer water temperatures and low dissolved oxygen, caused clams to weaken, making them susceptible to rapid deterioration once removed from the water. The potential for bacterial contamination after the clams were harvested prompted the ban on soft shell clamming.

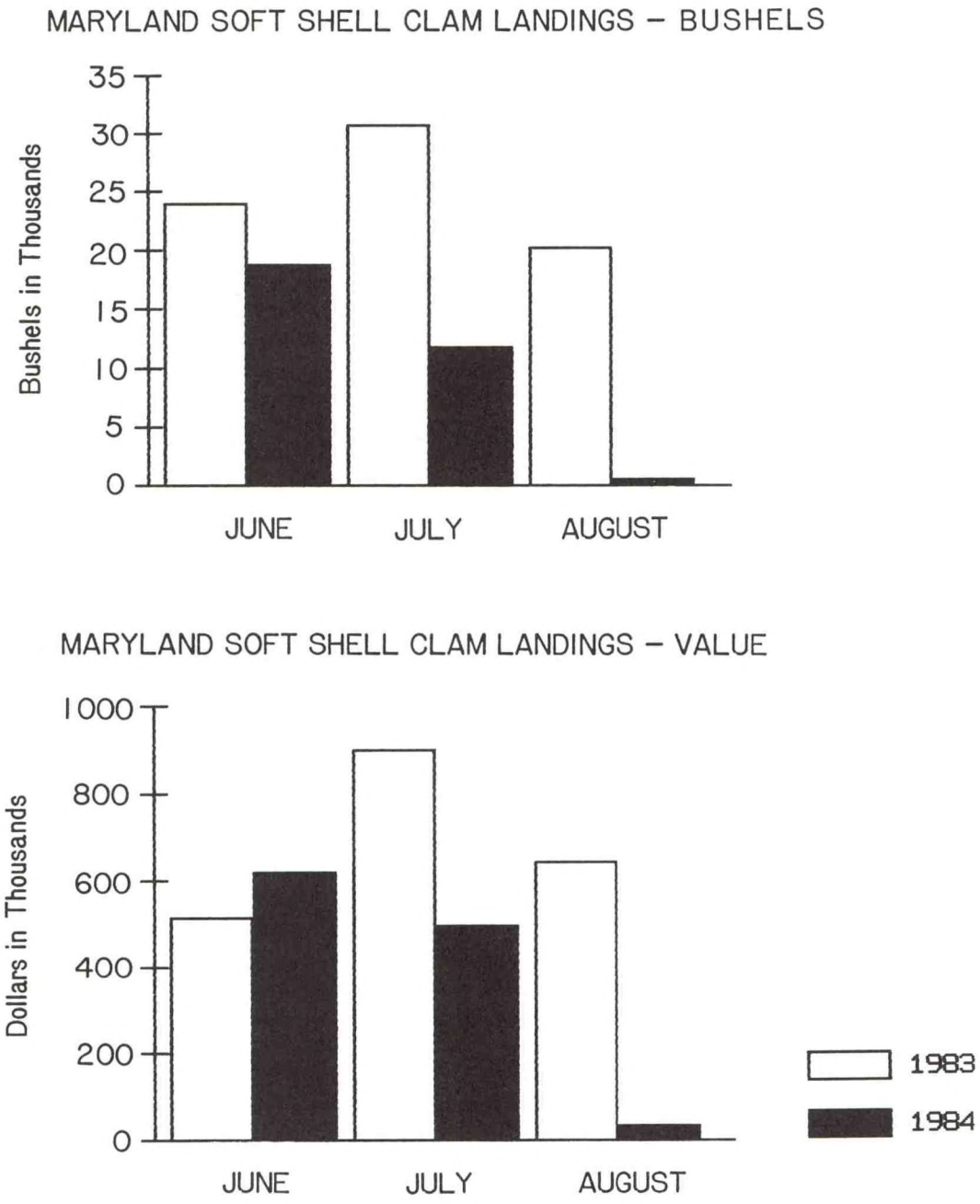
The soft shell clam (*Mya arenaria*) is a cold-water, high-salinity species which prefers salinities between 9-11 parts-per-thousand (ppt) and water temperatures less than 60°F. Soft shell clams are at the southernmost edge of their range in Chesapeake Bay, and are thus highly vulnerable to extreme changes in climate. Salinities in 1984 fell to 5 ppt and below over large soft shell clam areas. Clam mortalities occurred in June off Tilghman Point in Eastern Bay where hundreds of thousands of dead clams were observed by the Maryland Department of Natural Resources. Mortalities up to 30 percent were reported in soft shell clams being transported from harvesting areas to docks.

The effect of low salinities on soft shell clam beds in Maryland during summer 1984 is seen in landings in June, July, and August (Figure 6). Clam mortalities contributed to the lowered landings in June which were 5,040 bushels less than in June 1983. Clam prices were high at $32.89 per bushel in June 1984 compared to $21.65 in June 1983. The combined effect of clam mortalities and the closing of clam beds to harvesting is evident in the July and August landings which fell 61 percent and 96 percent, respectively, below the same months in 1983. If the harvest had been comparable to the same period for 1983, which was close to the 1979-83 average of 75,878 bushels, landings for June - August 1984 may have been as high as 75,219 bushels worth $2.1 million. The actual catch



Soft shell clam beds north of a line from Tilghman Island to Chesapeake Beach were closed to harvesting by the state of Maryland Department of Health and Mental Hygiene July 30 to August 29. High streamflow during spring and summer 1984 caused salinities to become very low in clam harvesting areas. The long duration of low salinities combined with seasonally higher summer water temperatures stressed clam populations and caused clam mortalities in some areas. The ban on soft shell clamming was issued because the weaker condition of the clams made them more susceptible to contamination after harvesting.

Figure 5.--Chesapeake Bay areas closed to soft shell clamming, summer 1984.



The effect of low salinities on soft shell clam beds during summer 1984 is seen in landings in June, July, and August. Clam mortalities were detected in June, and landings were lower than in June 1983. Once beds were closed to harvesting in July and August, landings fell 61 percent and 96 percent, respectively, below the same months in 1983.

Figure 6.--Maryland soft shell clam landings, June, July, and August 1983, 1984.

in June - August 1984 was only 31,780 bushels. The difference, 43,439 bushels, shows a possible loss (dockside value) of over $0.9 million.

The July 30 to August 29 ban on harvesting soft shell clams is not pollution related. The extreme stress on the northern Bay soft shell clam population in summer 1984 is a natural phenomena which has occurred several times in past years. Low salinity conditions in 1954 and 1968 contributed to high mortalities of soft shell clams in Chesapeake Bay, though there was no need to restrict harvesting because at that time soft shell clams were used primarily for fishing chum. After a market developed for soft shell clams as a food product in the 1970's, the first ban on clamming was issued in 1973 when low salinity conditions occurred in the Bay.

Blue crabs

Blue crabs were in sporadic supply in summer 1984. Total Chesapeake Bay blue crab landings of 40.5 million pounds were down 21 percent in June - August 1984 from the 51.2 million pounds landed in June - August 1983. Total value was down 23 percent, reflecting a $4.7 million decline in the June - August catch.

Hard crab landings were lower than 1983 in all three months except in June in Virginia where landings were 50 percent higher than 1983 (Table 4). However, the hard crab catch in Virginia fell much further below summer 1983 as the 1984 harvest proceeded through August. Spot checks of market conditions in late summer 1984 showed high variability in the supply of crabs according to location. Hard crabs showed a decrease in price per pound from June through August, reflecting the seasonal increase in abundance of market-sized crabs.

Soft and peeler crabs also showed reduced landings in summer 1984 compared to 1983. However, 1983 was a bumper soft and peeler crab year. The supply of soft and peeler crabs held closer to 1983 levels in Virginia than in Maryland. Landings of soft and peeler crabs were below 1983 in all months in both states except July in Virginia when landings were up 35 percent. Maryland landings in July were down 70 percent. Prices were highest in both states in July.

Abundant juvenile blue crabs in spring 1984 surveys by Maryland and Virginia agencies and a large number of adult crabs remaining from the previous season projected an excellent harvest in summer 1984. Some of the juvenile crab population attained market size in summer 1984, but apparently more smaller crabs were present because of delayed warming of water temperatures in spring 1984. Reduced salinities Bay-wide may have altered normal crab distributions, as seen in the sporadic catches reported by watermen.

Oysters

Summer 1984 oyster spatset was poor in Chesapeake Bay, according to reports received from Maryland and Virginia agencies. Spatset in Maryland waters was almost non-existent except for Tangier Sound where light spatset was detected.

Table 4.--Blue crab landings, hard, soft and peeler, Maryland and Virginia, June - August 1983-1984.

		Maryland				Virginia			
		Hard		Soft and peeler		Hard		Soft and peeler	
		Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
June	1983	7,066	3,078	921	1,455	5,514	1,668	149	200
	1984	4,502	2,465	441	824	8,264	2,276	121	121
	1983-84 % change	-36%	-20%	-52%	-43%	+50%	+59%	-19%	-40%
July	1983	9,162	3,479	1,240	1,712	6,596	1,285	104	104
	1984	6,226	2,611	371	910	5,729	1,090	140	152
	1983-84 % change	-32%	-25%	-70%	-47%	-13%	-15%	+35%	+46%
August	1983	11,470	4,617	546	814	8,179	1,474	205	235
	1984	9,397	2,917	517	1,076	4,567	827	177	179
	1983-84 % change	-18%	-37%	-5%	+32%	-44%	-44%	-14%	-24%

Data from Maryland Department of Natural Resources and Virginia Marine Resources Commission. Landings for Potomac River proper are not included. All 1984 landings are preliminary.

Virginia shellstring surveys, a measure of the amount of oyster larvae in the water column, indicated a moderate-to-good level of recruitment potential in some Virginia tributaries. However, initial observations of actual spatset on the bottom indicated a low survival of the young oysters.

High streamflow and reduced salinities during summer 1984 may have provided unfavorable conditions for the survival of young oysters. Closer estimates of the extent of survival of the oyster spat will be seen in fall 1984 surveys.

Finfish:

Finfish harvest activities proceeded uninterrupted by weather during the summer 1984 quarter, though some watermen reported reduced pound net catches in upper portions of rivers. Low salinities may have contributed to the reduced pound net catches by limiting the upstream distribution of some species.

Stinging nettles:

Stinging nettles appeared later than normal and were present in very low numbers during summer 1984 in areas of the Maryland portion of Chesapeake Bay. Nettles were first observed in Maryland Bay waters about July 8. Site counts by the Chesapeake Biological Laboratory (CBL) at Solomons, MD were well below the long-term average (1960-present). The average daily count did not exceed 5 per day in summer 1984 in the CBL observation area. The 24 year average daily count (July - September) is 100. Below-normal salinities and cooler-than-normal water temperatures during spring 1984 provided unfavorable conditions for stinging nettles in the upper Bay.

Sea nettles detract from swimming and other water-contact pursuits along 85 percent of all Bay beaches. The low number of stinging nettles presents an obviously favorable situation for water-oriented recreation in the Chesapeake Bay area. The fluctuation in abundance of the nettles from year to year is also important in the Bay food web. Scientists at the CBL noted an unusually large number of ctenophores during summer 1984. The ctenophore, a smaller species of jellyfish without tentacles, is a major food item of nettles. Reduced numbers of nettles feeding on ctenophores probably allowed the ctenophore population to proliferate in summer 1984.

3.2 Recreation

Marine recreational activity during the summer 1984 quarter around Chesapeake Bay showed reduced activity during extended periods of rainfall in many areas. Park attendance and boating figures were below 1983 levels in all three months in the lower Bay, while July figures were lower than 1983 Bay-wide.

Marine advisories and warnings issued by the National Weather Service for Chesapeake Bay (Figure 7) from June through August 1984 are listed in Table 5. Ten special marine warnings for thunderstorms, all in the Tidal Potomac River, and three small craft advisories were issued during the summer 1984 quarter. In the same period of 1983, 11 small craft advisories were issued with no thunderstorm warnings.

The U.S. Coast Guard conducted a total of 1,296 Search and Rescue (SAR) operations in the Bay area during the 1984 summer quarter (Table 6). During the same period in 1983, 1,442 SAR cases were handled. No pattern is evident from the summer 1984 SAR data, though boating activity in summer 1984 was probably lower than during the exceptional nearly rain-free July and August 1983.

The number of boating accidents decreased slightly in Maryland from 139 in 1983 to 136 in 1984. Thirty-nine injuries, 19 deaths, and over $259,609 in property damage were associated with these accidents (Table 7). The highest number of accidents (55) in 1984 occurred in July. This figure was 22 fewer than in July 1983.

Table 8 lists state park attendance and revenue at selected Maryland and Virginia facilities during the summer quarter. Attendance at Westmoreland, Chippokes, and York River State Parks in Virginia was lower in summer 1984 than in 1983. Rainfall over many weekends contributed to the reduced summer 1984 attendance. Attendance in July, normally the peak month for park visitations, was further reduced in 1984 due to the occurrence of the July 4 holiday on a weekday. Attendance at Seashore State Park showed increases in all months of the 1984 summer quarter over summer 1983. Increased daily usage and higher counts from newly installed traffic counters contributed to the increase seen in summer 1984.

Both Maryland parks showed lower attendance in July 1984 than in July 1983. August 1984 attendance was higher than August 1983 at the Maryland parks. Point Lookout had more park visitations in August than in any other month due to increased crabbing and fishing activities.

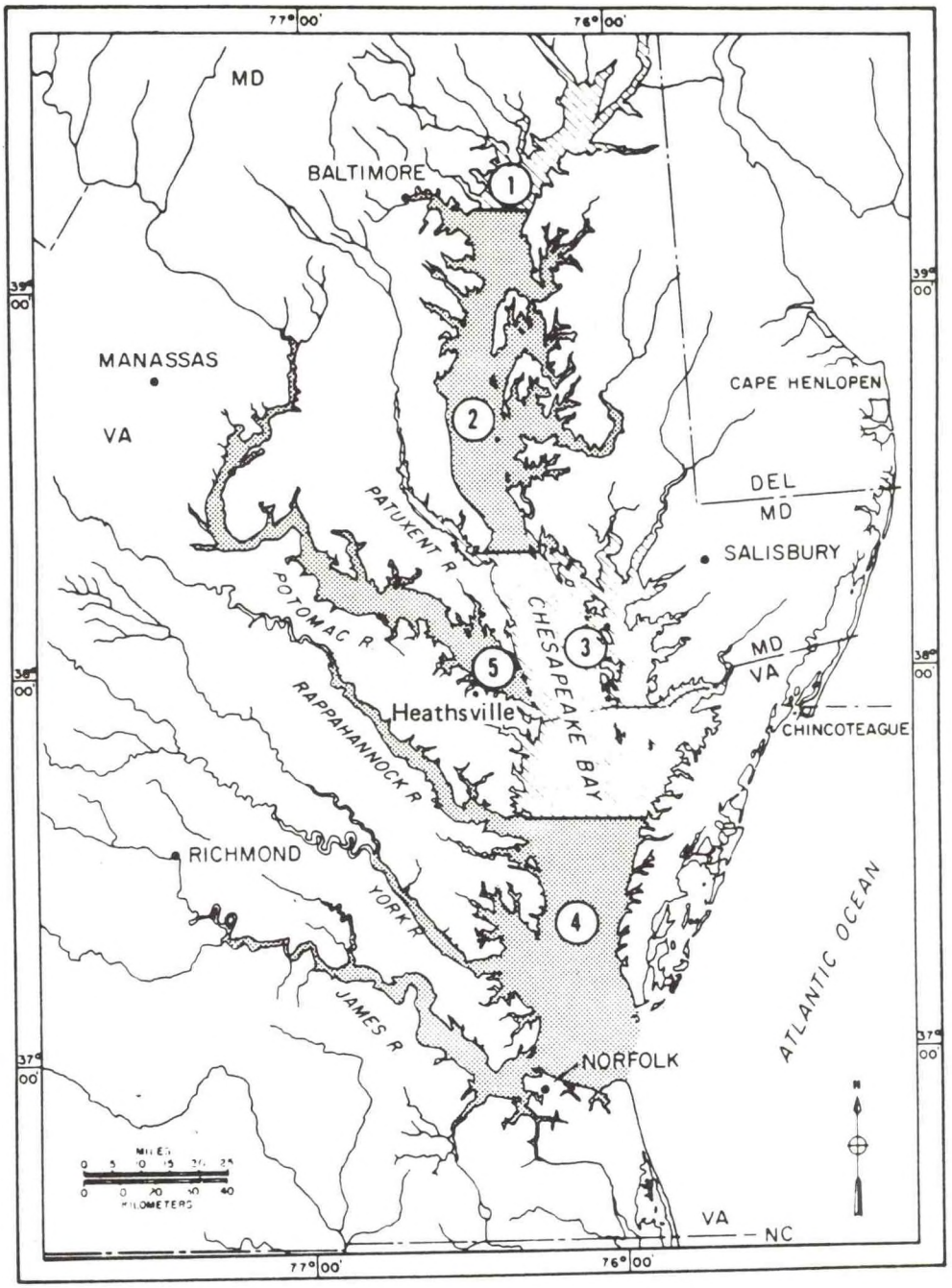


Figure 7.--National Weather Service (NWS) forecast areas for Chesapeake Bay.

Key to forecast areas:

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

Table 5.--Marine advisories/warnings, Chesapeake Bay, June-August 1984 (National Weather Service data). For definition of areas see Figure 7.

	Date	Condition Report(1)	Location(2)
June	2	A	Entire Bay and Tidal Potomac River
July	2	D	Tidal Potomac River
	5	D	Tidal Potomac River
	5	A	Entire Bay and Tidal Potomac River
	10	D	Tidal Potomac River
	11	D	Tidal Potomac River
	11	A	Head of Bay to Windmill Point and Tidal Potomac River
	18	D	Tidal Potomac River
	18	D	Tidal Potomac River
August	2	D	Tidal Potomac River
	3	D	Tidal Potomac River
	7	D	Tidal Potomac River
	19	D	Tidal Potomac River

(1)Key to Condition Reports:

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

(2)Windmill Point = North side of Rappahannock River

Table 6.--U.S. Coast Guard Search and Rescue (SAR) caseload, June - August 1984.

Month	Number of Search and Rescues		
	Group Baltimore	Group Eastern Shore	Group Hampton Roads
June	215	10	210
July	216	20	239
August	203	23	160
TOTALS	634	53	609

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

Table 7.--Maryland marine accident statistics, June - August 1984.

Month	No. of Boating Accidents	No. of Injuries	No. of Deaths	Property Damage
June	37	12	4	$82,342
July	55	16	5	$54,168
August	44	11	0	$123,099
TOTALS	136	39	9	$259,609

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 8.--State parks attendance and revenue, selected Maryland and Virginia facilities, June - August 1984.

Facility	Month					
	June		July		August	
Maryland	Attendance	Revenue	Attendance	Revenue	Attendance	Revenue
Sandy Point	78,438	$74,500	85,641	$85,700	74,212	$76,061
Point Lookout	32,354	$31,288	41,865	$19,136	56,573	$25,248
Virginia						
Westmoreland	19,147	$10,204	23,140	$13,761	23,012	$16,441
Chippokes	1,142	$1,180	1,702	$ 5,803	1,060	$ 2,936
York River	5,578	$ 843	5,309	$ 731	6,695	$ 898
Seashore	115,802	$26,367	147,028	$30,600	136,180	$28,248

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

3.3 Transportation

Loading and unloading operations proceeded normally at Maryland and Virginia ports during June - August 1984.

Winds in excess of 40 mph shut down crane operations 6 times at the Port of Baltimore for a total of 14 hours and 13 minutes (Table 9). During the same period in 1983, winds shut down operations 7 times over 6 days for a total of 20 hours and 31 minutes productive time lost.

Table 9.--Number of crane shutdowns and productive time lost due to wind at Port of Baltimore, June - August 1984.

Date	Number of Shutdowns	Productive Time Lost (Hours:Minutes)
June 2	1	6:05
13	1	1:35
25	1	1:40
July 5	1	1:43
11	1	2:30
18	1	:40

Data from Maryland Port Administration.

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