National Coastal Pollutant Discharge Inventory:

Discharge Summaries for New Jersey

May 1986

Ocean Assessments Division
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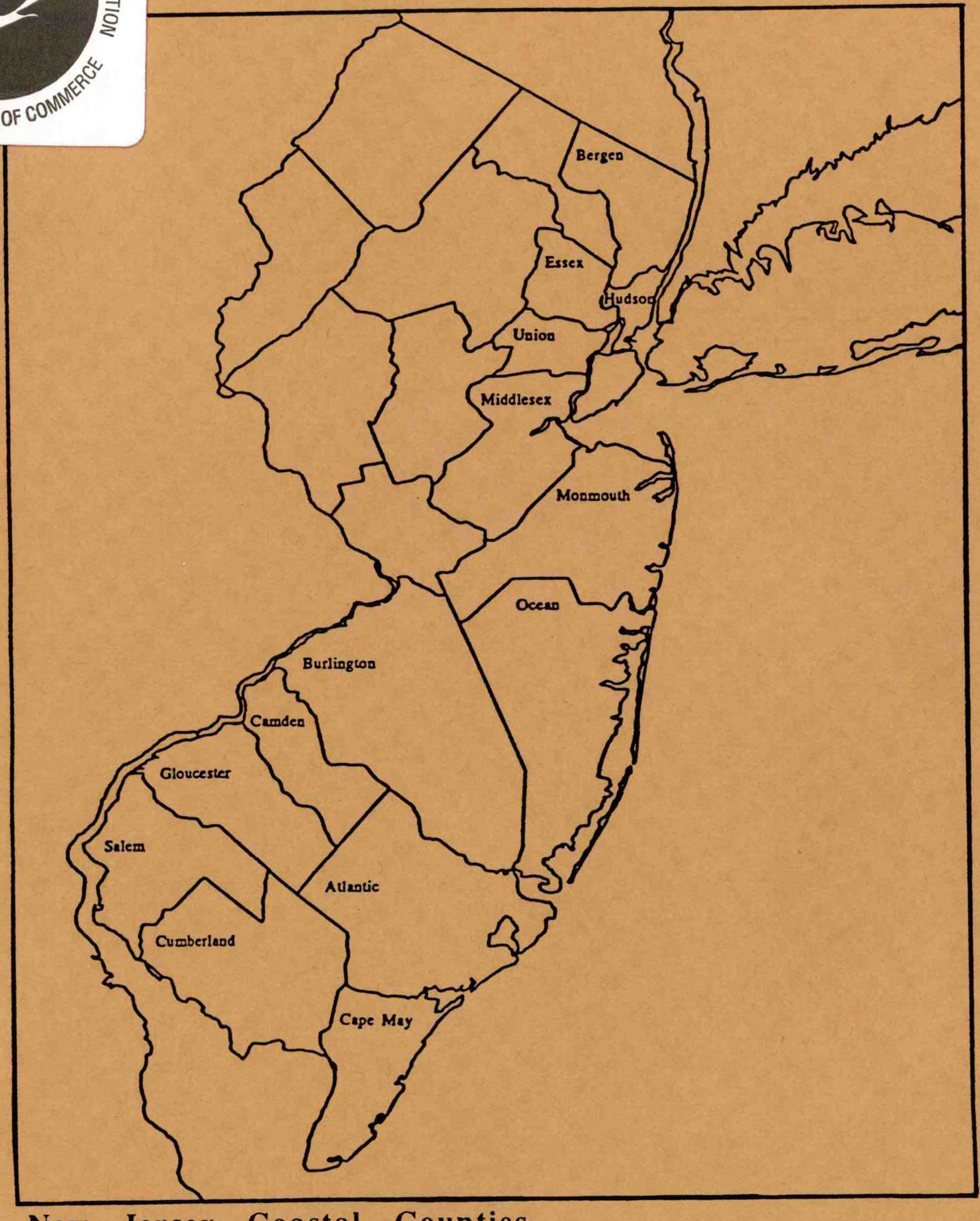

New Jersey Coastal Counties

INTRODUCTION

This report presents a brief summary of pollutant discharge estimates for coastal counties of the State of New Jersey. Included in the summary are pollutant discharge estimates for wastewater treatment plants, for urban runoff, and for nonurban runoff. The reason for presenting this summary is the possible significance of pollutant discharges to an intensive "green tide" phenomenon that New Jersey has experienced the past two summers, particularly in nearshore waters off the southern part of the State.

The National Oceanic and Atmospheric Administration's (NOAA's) program of assessments of the Nation's coastal and estuarine regions is conducted by the Ocean Assessments Division (OAD) of its National Ocean Service. Objectives of the assessments are to identify and evaluate existing and potential conflicts over use of resources in these important areas. These assessments are geographically comprehensive, addressing the entire nation or large regions. Assessment activities within OAD are conducted by both the Strategic Assessment Branch (SAB) and the Coastal and Estuarine Assessment Branch (CEAB).

As a result of it's mission to develop national assessments and syntheses on estuarine and coastal environmental quality issues, the OAD maintains a collection of data and information that is unique within the Federal Government. A part of the collection concerns the New Jersey coastal region and is applicable to an examination of the green tide phenomenon there. The pertinent data and information are of two types. One relates to OAD/CEAB's Water Quality Program that was conducted in the Middle Atlantic Bight from 1980 through 1985, as part of NOAA's Northeast Monitoring Program. The other pertains to the National Coastal Pollutant Discharge Inventory (NCPDI) developed by OAD/SAB. Data and information from the NCPDI that pertain to the green tide problem are addressed in the remainder of this summary. Those associated with the Water Quality Program and other OAD-related efforts will be addressed in subsequent communication.

The NCPDI is a data base and computational framework that includes point, nonpoint, and riverine sources of pollutant discharges into estuarine, coastal and oceanic waters of the continental United States. It approximates pollutant discharge conditions for the period from about 1980 to 1985. Major categories of pollutants included are: 1) oxygen-demanding materials; 2) particulate matter; 3) nutrients; 4) heavy metals; 5) petroleum hydrocarbons; 6) chlorinated hydrocarbons; 7) pathogens; 8) sludges; and 9) wastewater. Relative to the green tide situation, data concerning nutrients (in the form of total nitrogen and total phosphorus) and oxygen-demanding materials (in the form of biochemical oxygen demand) are particularly appropriate.

BACKGROUND

Considerable interest has developed recently -- at Federal, State and local levels -- in a phenomenon dubbed "green tide" or "green slime," that has occurred during late summer in the nearshore coastal area off New Jersey. The terms reflect a comparison with the more familiar coastal "red tide." Interest has been considerable -- and increasing -- since the observation of a significant green tide in the region in mid-August 1984. The occurrence lasted until about mid-September. The following summer, there was a similar occurrence of green tide in the New Jersey nearshore area. Locations of occurrence (or at least of observations of occurrence) were, in many cases, the same as for 1984; in other cases, they were quite different. In summer of 1985, initial reports of green tide were made several weeks earlier than in 1984, but the occurrence ended at about the same time as in 1984. In addition to a decrease in aesthetic quality of green tide waters -- associated with decomposition of the most probable causative organism, *Gymnodinum sp.* -- there have been reports of respiratory discomfort and minor irritation to bathers and lifeguards. Beaches have been closed, at times, because of the green tide. Conceivably, dieoff of the organisms, particularly during intensive bloom conditions (when the green tide is observed), could lead locally to decreased levels of dissolved oxygen and associated "fish kills." Biochemical oxygen demand during dieoffs may also exacerbate oxygen depletion over adjacent nearshore areas.

There is concern among the New Jersey coastal communities that the green tide phenomenon could recur this summer. Any such occurrences could have potentially adverse impacts on the tourist and fishing industries which are very important to the State, its residents, and visitors who make use of the New Jersey coastal resources and facilities.

POLLUTANT DISCHARGE ESTIMATES

Attached are six tables and two figures that present information on pollutant discharge estimates for New Jersey coastal counties that may be helpful in assessing the cause of recent green tides. The tables included are:

Table 1. Pollutant Discharges from Wastewater Treatment Plants in New Jersey Coastal Counties - Circa 1982.

Table 2. Pollutant Discharges from Major Wastewater Treatment Plants in New Jersey Coastal Counties - Circa 1982.

Table 3. Pollutant Discharges from Urban Land Uses in New Jersey Coastal Counties - Circa 1982.

Table 4. Pollutant Discharges from Major Urban Areas in New Jersey Coastal Counties - Circa 1982.

Table 5. Pollutant Discharges from Nonurban Land Uses in New Jersey Coastal Counties - Circa 1982.

Table 6. A Summary of Pollutant Discharges from the Four New Jersey Coastal Counties Bordering the Atlantic Ocean - Circa 1982.

The estimates for each pollutant and source category in the tables are presented as total annual loadings. It is possible, however, to disaggregate the data, and present them for each season or by USGS cataloging unit (drainage basin), if appropriate to issues or problems being addressed. In the tables, spatial aggregations shown are by New Jersey coastal counties and major urban areas. When using the data contained in the tables, special consideration should be given to their "overview" nature. They are most applicable to larger-scale assessments, not local problems.

In the National Coastal Pollutant Discharge Inventory, 14 counties of New Jersey have been designated as "coastal". A designation as coastal means that a county has contained within its boundaries a part of the "coastal zone". Under the Coastal Zone Management Act of 1972 (Public Law 92-583), the coastal zone includes "coastal waters" and adjacent shorelands that strongly influence one another, and are in proximity to shorelines of coastal states. The zone extends inland from the shoreline to the extent where uses of the shoreland may have direct and significant impact on coastal waters. Coastal waters are adjacent to shorelines and contain a measurable quantity or percentage of seawater. Examples of coastal waters include, but are not limited to, sounds, bays, lagoons, bayous, ponds and estuaries.

Of the 14 New Jersey coastal counties, six border the Delaware Bay and River system, six border the Hudson-Raritan estuarine system, and four border the Atlantic Ocean. A total of 16 "border counties" results because Cape May County borders both Delaware Bay and the Atlantic Ocean, and Monmouth County borders both the Hudson-Raritan Estuary and the Atlantic Ocean.

A. Wastewater Treatment Plants

In these 14 coastal counties, there are a total of 289 wastewater treatment plants (see Table 1). Of these 289, 56 are considered as major (see Table 2) and 233 are considered as minor. A major wastewater treatment plant is defined as having a discharge of more than a million gallons per day. Of the 56 major wastewater treatment plants, 16 have ocean outfalls. In this report ocean outfalls are considered to be those that discharge directly to the ocean. This means that facilities that discharge to estuarine/bay waters that in turn may lead directly to the ocean are not identified as ocean outfalls. These 16 are located in the four counties that border the Atlantic Ocean: Monmouth, Ocean, Atlantic and Cape May (see Figure 1).

Table 1. Pollutant Discharges from Wastewater Treatment Plants in New Jersey Coastal Counties - Circa 1982 a/

Coastal County	Facility Type b/	All Plants in County (100t/y): # of Plants	Flow (100mgy)	BOD_5	TN	TP	Plants with Ocean Outfalls (100t/y): # of Plants	Flow (100mgy)	BOD_5	TN	TP
1. Bergen	Major	4	209.0	62.5	9.9	6.1					
	Minor	23	119.0	10.1	5.5	3.5	-	-	-	-	-
	Total	27	328.0	72.6	15.4	9.6					
2. Essex	Major	2	779.0	1370.0	36.3	22.8					
	Minor	11	42.0	0.0	2.2	1.2	-	-	-	-	-
	Total	13	821.0	1370.0	38.5	24.0					
3. Union	Major	2	228.0	45.1	10.7	6.6					
	Minor	9	12.0	1.4	0.6	0.4	-	-	-	-	-
	Total	11	240.0	46.5	11.3	7.0					
4. Hudson	Major	6	332.0	188.0	15.6	9.7					
	Minor	17	39.0	18.0	1.8	1.1	-	-	-	-	-
	Total	23	371.0	206.0	17.4	10.8					
5. Middlesex	Major	4	427.0	128.0	20.0	12.5					
	Minor	19	39.0	9.0	1.9	1.2	-	-	-	-	-
	Total	23	466.0	137.0	21.9	13.7					
6. Monmouth	Major	9	143.0	16.6	6.7	4.2	8	137.5	15.8	6.5	4.0
	Minor	30	34.0	5.0	1.6	1.1	2	3.4	2.3	0.2	0.2
	Total	39	177.0	21.6	8.3	5.3	10	140.9	18.1	6.7	4.2
7. Ocean	Major	5	72.1	4.2	3.4	2.1	4	68.5	3.9	3.3	2.0
	Minor	10	6.9	1.0	0.3	0.2	1	0.4	0.3	0.0	0.0
	Total	15	79.0	5.2	3.7	2.3	5	68.9	4.2	3.3	2.0
8. Burlington	Major	9	51.8	5.9	2.4	1.5					
	Minor	34	46.9	5.7	2.3	1.5	-	-	-	-	-
	Total	43	98.7	11.6	4.7	3.0					
9. Camden	Major	7	155.6	104.1	7.2	4.4					
	Minor	40	90.0	14.0	4.1	2.7	-	-	-	-	-
	Total	47	245.6	118.1	11.3	7.1					
10. Glouchester	Major	1	47.4	3.4	2.2	1.4					
	Minor	5	4.6	0.5	0.3	0.2	-	-	-	-	-
	Total	6	52.0	3.9	2.5	1.6					
11. Atlantic	Major	1	67.1	4.5	3.1	2.0	1	67.1	4.5	3.1	2.0
	Minor	10	9.2	1.8	0.5	0.4	0	0.0	0.0	0.0	0.0
	Total	11	76.3	6.3	3.6	2.4	1	67.1	4.5	3.1	2.0
12. Salem	Major	0	0.0	0.0	0.0	0.0					
	Minor	9	11.1	5.7	0.5	0.3	-	-	-	-	-
	Total	9	11.1	5.7	0.5	0.3					
13. Cumberland	Major	2	21.4	2.7	1.0	0.6					
	Minor	2	3.9	0.6	0.2	0.1	-	-	-	-	-
	Total	4	25.3	3.3	1.2	0.7					
14. Cape May	Major	4	46.2	7.3	2.2	1.4	3	38.1	7.0	1.7	1.1
	Minor	14	16.3	5.3	0.8	0.5	2	3.8	2.5	0.2	0.2
	Total	18	62.5	12.6	3.0	1.9	5	41.9	9.5	1.9	1.3
Total	Major	56	2579.6	1935.5	120.7	75.3	16	311.2	31.2	14.7	9.1
	Minor	233	473.9	78.1	22.6	14.4	5	7.6	5.1	0.4	0.4
	Total	289	3053.5	2013.6	143.3	89.7	21	318.8	36.3	15.1	9.5

Abbreviations: t/y, tons per year; mgy, million gallons per year; BOD_5, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus.

a/ Pollutant discharges can also be disaggregated by season.

b/ Plants that discharge more than 1 million gallons/day are defined as "major". For a detailed specification of major wastewater treatment plants see Table 2.

Table 2. Pollutant Discharges from Major Wastewater Treatment Plants in New Jersey Coastal Counties - Circa 1982 [a/]

Coastal County	Facility Identification						Pollutant Discharges (100t/y)			
	Facility Name	NPDES #	Latitude	Longitude	Treatment Level [b/]	Ocean Out fall	Flow (100mgy)	BOD_5	TN	TP
1. Bergen	1. N.Arlington Lyndhurst	NJ0025291	404737	740657	prim.	no	9.5	3.8	0.4	0.3
	2. Joint Meeting STP	NJ0022756	404837	740536	prim.	no	9.8	7.0	0.5	0.3
	3. Edgewater STP	NJ0020591	-	-	prim.	no	9.2	4.8	0.4	0.3
	4. Bergen Co. UASew.Sys.	NJ0020028	405002	740152	sec.	no	181.0	46.9	8.5	5.3
2. Essex	1. County of Essex DPW	NJ0021687	405053	741403	sec.	no	5.7	0.2	0.3	0.2
	2. Passaic Valley T.Plt.	NJ0021016	404254	740342	sec.	no	773.0	1370.0	36.3	22.6
3. Union	1. Jt.Meet.of Esx. & Un.	NJ0024741	403817	741151	sec.	no	190.0	25.3	8.9	5.5
	2. Linden Roselle S.A.	NJ0024953	403631	741307	sec.	no	37.6	19.8	1.8	1.1
4. Hudson	1. N. Bergen Township	NJ0034339	404705	740115	prim.	no	36.5	4.6	1.7	1.1
	2. Eastside STP	NJ0027014	404204	740247	prim.	no	101.0	43.9	4.7	3.0
	3. Hoboken City STP	NJ0026085	404413	740156	prim.	no	54.9	45.8	2.6	1.6
	4. W. New York Mun. CS	NJ0025321	404717	735954	prim.	no	26.7	23.7	1.3	7.8
	5. Westside CS	NJ0027022	404253	740600	prim.	no	72.7	51.5	3.4	2.1
	6. Bayonne STP	NJ0025836	404002	740641	prim.	no	40.6	18.5	1.9	1.2
5. Middlesex	1. Rahway Valley STP	NJ0024643	403400	742000	sec.	no	94.9	6.6	4.5	2.8
	2. Sewaren STP	NJ0020397	403320	741500	prim.	no	23.7	17.7	1.1	0.7
	3. Carteret STP	NJ0024571	403400	741400	prim.	no	9.9	24.0	0.5	0.3
	4. Middlesex Co. S.A.STP	NJ0020141	402813	742353	sec.	no	299.0	79.9	14.0	8.7
6. Monmouth	1. Bayshore Region STP [c/]	NJ0024708	402649	740933	sec.	yes	30.9	3.7	1.5	0.9
	2. Middletown Main STP	NJ0025356	402553	740457	sec.	yes	18.2	0.8	0.9	0.5
	3. S. Monmouth Reg. STP	NJ0024562	401000	740230	sec.	yes	10.7	0.8	0.5	0.3
	4. Neptune TWP Reg. STP	NJ0024872	401125	735922	sec.	yes	14.5	1.0	0.7	0.4
	5. NE Monmouth RSTP	NJ0026735	402005	735756	sec.	yes	24.1	1.7	1.1	0.7
	6. Ocean WPCF	NJ0024520	401519	735912	sec.	yes	13.3	1.1	0.6	0.4
	7. Asbury Park WWTP	NJ0025241	401339	735944	prim.	yes	10.9	5.5	0.5	0.3
	8. Freehold Boro STP	NJ0026565	401530	741530	sec.	no	5.9	0.8	0.3	0.2
	9. Long Branch WWTP	NJ0024783	401844	735907	sec.	yes	14.5	1.2	0.7	0.4
7. Ocean	1. Southern WPCF [d/]	NJ0026018	394019	741543	sec.	yes	16.3	0.5	0.8	0.5
	2. Ortley Beach WWTP [d/]	NJ0024775	395956	740824	sec.	yes	20.4	1.7	1.0	0.6
	3. Seaside Park STP	NJ0027316	395800	740800	sec.	no	3.7	0.3	0.2	0.1
	4. Northern WPCF	NJ0028142	400237	740451	sec.	yes	21.0	1.5	1.0	0.6
	5. Central WPCF	NJ0029408	395412	740341	sec.	yes	10.8	0.2	0.5	0.3
8. Burlington	1. Bordentown SD	NJ0024678	400926	744230	sec.	no	4.7	1.4	0.2	0.1
	2. Florence TWP SEW Dept	NJ0023701	400706	744934	sec.	no	3.8	0.5	0.2	0.1
	3. Moorestown TWP STP	NJ0024996	395735	745913	sec.	no	7.7	1.1	0.4	0.2
	4. Rancocas Road STP	NJ0024015	400015	744812	sec.	no	5.5	0.4	0.3	0.2
	5. Burlington City STP	NJ0024660	400420	745219	sec.	no	4.2	0.4	0.2	0.1
	6. Medford TRT PLT	NJ0026832	395509	744812	sec.	no	4.3	0.2	0.2	0.1
	7. Cinnaminson STP	NJ0024007	400001	745947	sec.	no	4.3	0.6	0.2	0.1
	8. Delran STP	NJ0023507	400217	745839	sec.	no	3.9	0.3	0.2	0.1
	9. Willingboro WPC Plant	NJ0023361	400142	745517	sec.	no	13.5	1.0	0.6	0.4
9. Camden	1. Camden Co. MUA.STP #1	NJ0026182	395521	750742	sec.	no	104.0	90.7	4.9	3.0
	2. Bellmawr Sewerage Pt.	NJ0026743	395210	750709	sec.	no	8.5	2.4	0.4	0.2
	3. Coles Mill Rd.	NJ0024830	395500	750230	sec.	no	5.0	2.5	0.2	0.1
	4. Balwin Run STP #2	NJ0024481	395754	750530	sec.	no	11.7	1.7	0.5	0.3
	5. Pennsauken C.S.	NJ0025348	395840	750415	sec.	no	10.2	3.7	0.5	0.3
	6. Gloucester City Sew.	NJ0026620	395350	750645	sec.	no	7.3	2.7	0.3	0.2
	7. Lindenwold Boro. STP	NJ0026409	393930	745910	sec.	no	8.9	0.4	0.4	0.3
10. Gloucester	1. Gloucester Co.Reg.A.	NJ0024686	395017	751336	sec.	no	47.4	3.4	2.2	1.4
11. Atlantic	1. Atlantic Co. Reg. STP	NJ0024473	392251	742658	sec.	yes	6.7	4.5	3.2	2.0
12. Salem	No Major Facilities	-	-	-	-	-	-	-	-	-
13. Cumberland	1. Bridgeton WWTP	NJ0024651	392512	751407	sec.	no	9.7	1.0	0.5	0.3
	2. Millville STP	NJ0029467	392236	750212	sec.	no	11.7	1.7	0.5	0.3
14. Cape May	1. Ocean City Reg. STP [e/]	NJ0027286	390000	744929	sec.	yes	27.8	2.7	1.3	0.8
	2. Wildwood City STP	NJ0022811	385941	744930	prim.	yes	5.1	1.6	0.2	10.1
	3. Avalon Boro CS	NJ0021385	390530	744351	sec.	yes	5.2	2.7	0.2	0.2
	4. Lower TWP CS	NJ0023809	390017	745607	sec.	no	8.0	0.3	0.4	0.2

Abbreviations: t/y, tons per year; mgy, million gallons per year; BOD_5, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus; NPDES, National Pollutant Discharge Elimination System.

a/ Plants that discharge more than 1 million gallons/day are defined as "major". Pollutant discharges can also be disaggregated by season.

b/ Treatment levels and operating status were verified as of May, 1986.

c/ Effluent from these facilities is pumped to the Monmouth County Bayshore Outfall (NPDES No. NJ0024694). The outfall is a 48-inch diameter pipe; discharge is about 4000 feet offshore near Sandy Hook, NJ.

d/ This facility was abandoned in 1983. Flow was rerouted to the Central WPCF.

e/ This regional treatment facility began operation in 1984. Prior to 1984, wastewater was treated at two smaller primary treatment facilities in Ocean City.

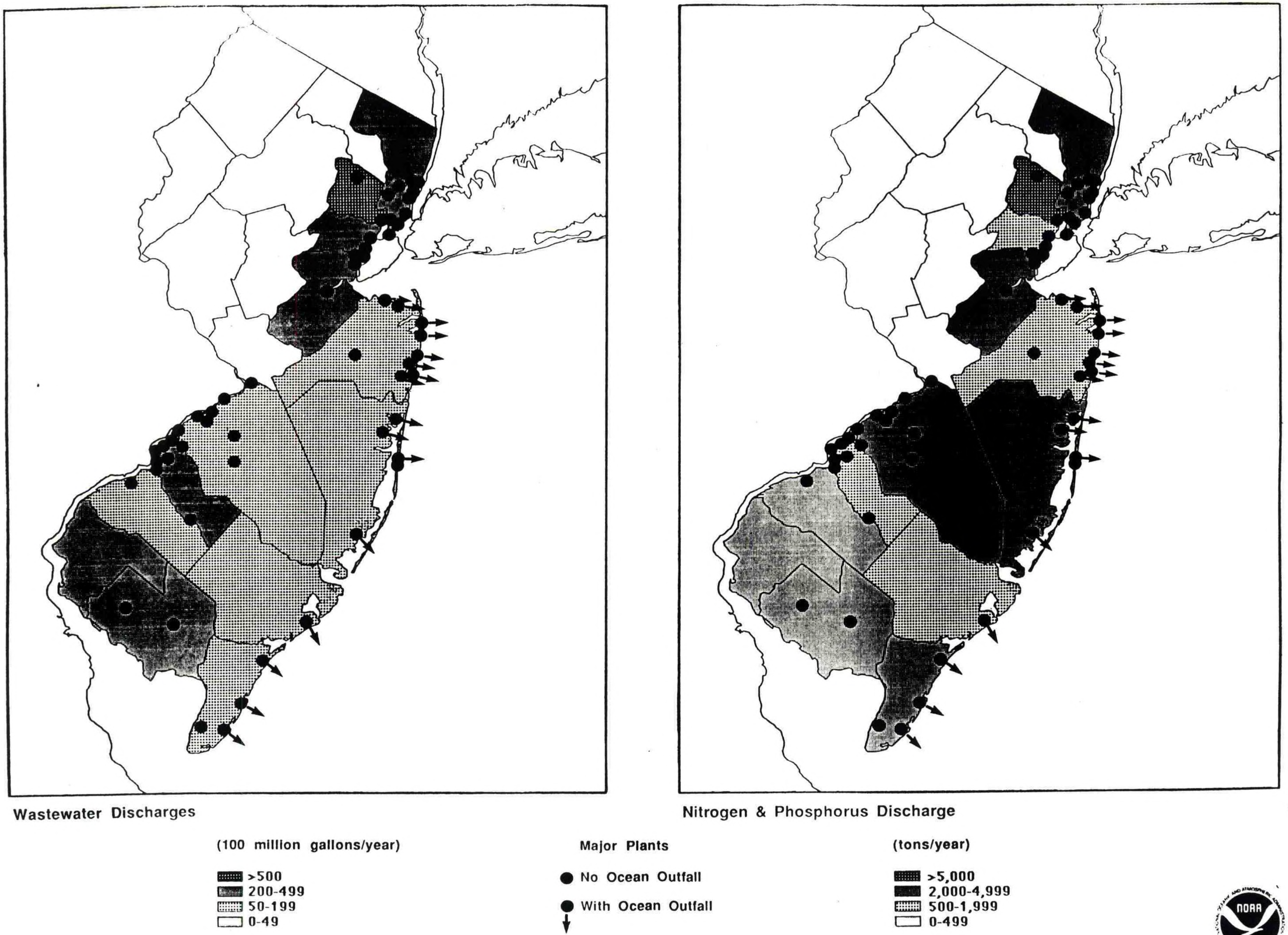

Figure 1. Pollutant Discharges from Major Wastewater Treatment Plants in Coastal Counties, Circa - 1982

Of the 233 minor wastewater treatment plants, five have ocean outfalls. These facilities are not shown on Figure 1. The five are in three of the four counties that border the Atlantic Ocean (Monmouth, Ocean and Cape May).

Two additional points should be made. First, it can be assumed that a significant portion of the pollutant discharges from those major and minor wastewater treatment plants discharging to surface waters upstream of coastal waters also reach the nearshore waters. Second, as shown in Table 1, for the four counties bordering the Atlantic Ocean, most wastewater treatment plant effluent is discharged directly to coastal waters via outfalls.

B. Runoff From Urban Areas

From Table 3 it can be seen that only five New Jersey coastal counties (Bergen, Essex, Union, Hudson, and Middlesex) have combined sewer overflow systems. Related urban land use discharges from all five of the coastal counties enter the Hudson-Raritan estuarine system before exchanging with the New York Bight Apex. These five coastal counties have neither major nor minor wastewater treatment plants with ocean outfalls. None of the four counties bordering the Atlantic Ocean have combined sewer overflow systems. Pollutant discharges from urban land uses enter coastal and estuarine areas directly or via storm drain systems. Examination of both Table 1 and Table 3, for all four counties that border the Atlantic Ocean, for total pollutant discharge from all wastewater treatment plants and for urban land uses, shows that: more BOD_5 is attributed to urban land uses than to wastewater treatment plants; about the same amount of TN comes from both sources; and more TP is provided by wastewater treatment plants than by urban land uses.

Table 4 introduces some additional means for looking at pollutant discharges from urban land uses by focusing on just the major urban areas in the New Jersey coastal counties. All or a portion of six major urbanized areas are located in the coastal counties under consideration. Schematic representations of these areas are shown in Figure 2. An urbanized area is defined by the Bureau of Census as an incorporated place and adjacent densely settled surrounding area that together have a minimum population of 50,000. A densely settled surrounding area consists of an area having a population density greater than 1,000 persons per square mile. The land areas, population estimates, and pollutant discharges shown are only for the portion of the urbanized area in the coastal counties. Comparison of Table 3 and Table 4 shows that more than 80 percent of the TP, and more than 90 percent of the TN and BOD_5 from urban land uses come from these six major urban areas.

C. Runoff From Nonurban Areas

From Table 5 it can be seen that, overall, the pollutant discharges from nonurban land uses in the 14 New Jersey coastal counties are quite significant, but are less than those from wastewater treatment plants or from urban land uses. For the four counties bordering the Atlantic

Table 3. Pollutant Discharges from Urban Land Uses in New Jersey Coastal Counties - Circa 1982 a/

Coastal County	Type of Sewers b/	Urban Area (mi^2)	Population in Urban Areas (Persons)	Pollutant Discharges (100t/y) Runoff Volume (100mgy)	BOD_5	TN	TP
1. Bergen	CSO	33.7		8.1	1.6	0.2	0.0
	Non-CSO	207.5		419.0	21.0	5.3	0.8
	Total	241.2	823,753	427.1	22.6	5.5	0.8
2. Essex	CSO	62.8		38.3	7.6	0.8	0.2
	Non-CSO	64.3		135.0	6.7	1.7	0.3
	Total	127.1	851,304	173.3	14.3	2.5	0.5
3. Union	CSO	8.6		7.9	1.6	0.2	0.0
	Non-CSO	92.0		208.0	10.4	2.6	0.4
	Total	100.6	504,094	215.9	12.0	2.8	0.4
4. Hudson	CSO	46.1		3.1	0.6	0.0	0.0
	Non-CSO	14.0		41.3	2.1	0.5	0.0
	Total	60.1	787,844	44.4	2.7	0.5	0.0
5. Middlesex	CSO	7.2		5.8	1.1	0.1	0.0
	Non-CSO	311.8		792.0	39.5	9.3	1.6
	Total	319.0	539,435	797.8	40.6	9.4	1.6
6. Monmouth	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	252.6		540.0	27.2	6.7	1.1
	Total	252.6	443,262	540.0	27.2	6.7	1.1
7. Ocean	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	300.9		632.0	31.6	7.8	1.3
	Total	300.9	251,637	632.0	31.6	7.8	1.3
8. Burlington	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	196.3		399.0	20.0	5.0	0.8
	Total	196.3	298,784	399.0	20.0	5.0	0.8
9. Camden	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	128.9		229.0	11.5	2.9	0.5
	Total	128.9	448,534	229.0	11.5	2.9	0.5
10. Glouchester	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	77.0		153.0	7.7	1.9	0.3
	Total	77.0	156,092	153.0	7.7	1.9	0.3
11. Atlantic	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	130.7		236.0	11.8	3.0	0.5
	Total	130.7	167,327	236.0	11.8	3.0	0.5
12. Salem	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	29.8		60.7	3.0	0.8	0.1
	Total	29.8	37,171	60.7	3.0	0.8	0.1
13. Cumberland	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	124.9		251.0	12.5	3.1	0.5
	Total	124.9	98,886	251.0	12.5	3.1	0.5
14. Cape May	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	37.7		62.7	3.2	0.8	0.1
	Total	37.7	52,338	62.7	3.2	0.8	0.1
Total	CSO	158.4		63.2	12.5	1.3	0.2
	Non-CSO	1968.4		4158.7	208.2	51.4	8.3
	Total	2126.8	5,460,461	4221.9	220.7	52.7	8.5

Abbreviations: mi^2, square miles; t/y, tons per year; mgy, million gallons per year; BOD_5, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus; CSO, Combined Sewer Overflow.

a/ Pollutant discharges can also be disaggregated by season.

b/ Combined sewers convey both sanitary sewage and stormwater runoff. When the capacity of these combined sewers is exceeded, the resultant overflow becomes an important discharge.

Table 4. Pollutant Discharges from Major Urban Areas in New Jersey Coastal Counties - Circa 1982 [a/]

Major Urban Area	Type of Sewers [b/]	Urban Area (mi^2)	Population in Urban Areas (persons)	Pollutant Discharges (100t/y) Runoff Volume (100mgy)	BOD$_5$	TN	TP
1. New York	CSO	158.5		63.2	12.5	1.3	0.3
	Non-CSO	1220.0		2720.0	136.0	33.3	5.5
	Total	1378.5	4,156,916	2783.2	148.5	34.6	5.8
2. Philadelphia	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	293.9		560.0	28.1	7.0	0.1
	Total	293.9	842,899	560.0	28.1	7.0	0.1
3. Trenton	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	85.0		175.0	8.7	2.2	0.3
	Total	85.0	13,703	175.0	8.7	2.2	0.3
4. Vineland-Millville	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	130.0		259.0	13.0	3.2	0.5
	Total	130.0	85,679	259.0	13.0	3.2	0.5
5. Atlantic City	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	78.0		136.0	6.8	1.7	0.3
	Total	78.0	183,639	136.0	6.8	1.7	0.3
6. Wilmington	CSO	0.0		0.0	0.0	0.0	0.0
	Non-CSO	23.5		48.4	2.4	0.6	0.1
	Total	23.5	26,579	48.4	2.4	0.6	0.1
Total	CSO	158.5		63.2	12.5	1.3	0.3
	Non-CSO	1830.4		3898.4	195.0	48.0	6.8
	Total	1988.9	5,309,415	3961.6	207.5	49.3	7.1

Abbreviations: mi^2, square miles; t/y, tons per year; mgy, million gallons per year; BOD$_5$, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus; CSO, Combined Sewer Overflow.

a/ A major urban area is a densely settled area with a minimum population of 50,000 people. Pollutant discharges can also be disaggregated by season.

b/ Combined sewers convey both sanitary sewage and stormwater runoff. When the capacity of these combined sewers is exceeded, the resultant overflow becomes an important discharge.

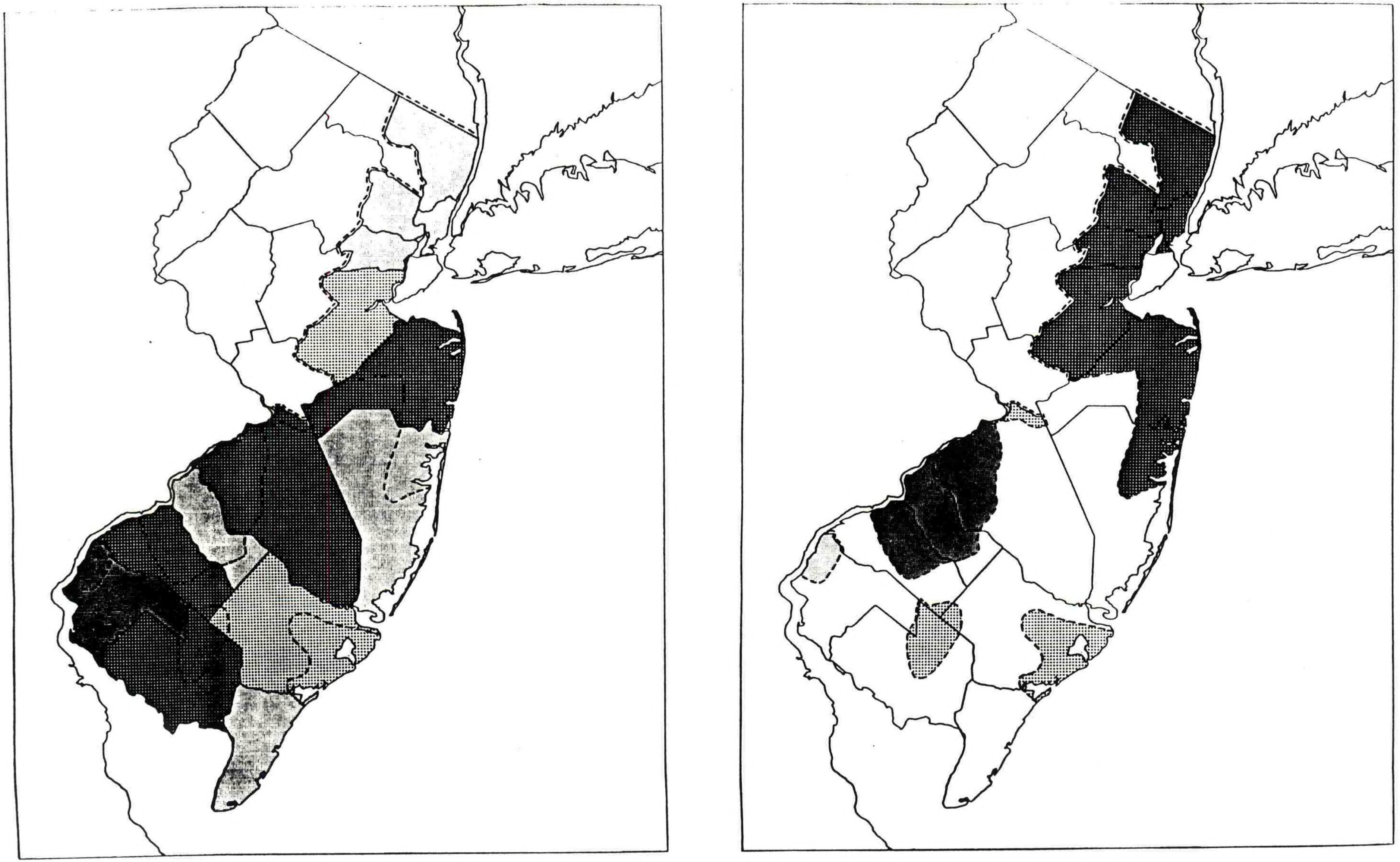

Figure 2. Estimated Nitrogen and Phosphorus Discharges in Runoff from Nonpoint sources in New Jersey Coastal Counties, Circa - 1982

Table 5. Pollutant Discharges from Nonurban Land Uses in New Jersey Coastal Counties - Circa 1982 a/

Coastal County	Land Use Type (mi²)				Fertilizer Application (100t/y)		Pollutant Discharges (100t/y)			
	Agri.	Range	Forest	Other	N	P	Runoff Volume (100mgy)	BOD_5	TN	TP
1. Bergen	1.5	0.0	40.0	21.6	0.4	0.1	0.0	0.0	0.0	0.0
2. Essex	0.8	0.0	14.7	10.2	0.2	0.1	0.0	0.0	0.0	0.0
3. Union	0.5	0.0	4.7	5.9	0.1	0.0	0.0	0.0	0.0	0.0
4. Hudson	0.0	0.0	0.0	24.2	0.0	0.0	0.0	0.0	0.0	0.0
5. Middlesex	68.5	0.0	73.6	32.4	11.9	3.5	80.1	0.0	0.9	0.1
6. Monmouth	153.8	0.0	148.0	27.1	21.4	6.3	88.0	3.4	3.4	0.3
7. Ocean	24.6	0.0	332.0	276.3	1.7	0.5	14.4	0.0	0.1	0.0
8. Burlington	224.5	0.0	322.9	152.9	32.8	9.6	133.0	1.4	3.1	0.3
9. Camden	34.1	0.0	63.5	26.1	4.1	1.2	22.5	0.3	0.5	0.0
10. Glouchester	137.0	0.0	81.3	49.2	22.2	6.5	71.8	3.1	3.3	0.3
11. Atlantic	59.9	0.0	255.7	212.9	7.5	2.2	54.4	1.0	1.1	0.1
12. Salem	175.6	0.0	71.8	75.3	32.2	9.5	87.2	0.7	2.4	0.3
13. Cumberland	133.8	0.0	180.9	132.3	25.1	7.4	121.0	1.4	2.7	0.3
14. Cape May	23.2	0.0	84.1	140.7	3.5	1.0	15.0	0.1	0.3	0.0
Total	1037.8	0.0	1672.0	1187.1	163.1	47.9	687.4	11.6	17.8	1.7

Abbreviations: mi^2, square miles; t/y, tons per year; mgy, million gallons per year; BOD_5, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus.

a/ Pollutant discharges can also be disaggregated by season.

Ocean, however, the pollutant discharges from nonurban land uses (in terms of BOD_5, TN and TP) are considerably less than those from wastewater treatment plants or from urban land uses.

CONCLUDING COMMENTS

From Tables 1, 3 and 5, a summary of pollutant discharges can be made for the four coastal counties that border the Atlantic Ocean. In preparing such a summary, it is assumed that: all Monmouth County pollutant discharges enter the Atlantic Ocean directly (rather than some of them entering via the Hudson-Raritan Estuary); and all Cape May County pollutant discharges enter the Atlantic Ocean directly (rather than some of them entering via Delaware Bay). The summary (Table 6) shows that there is a decrease, county by county, in total discharges of pollutants to the Atlantic Ocean from north to south. The decrease is such that there is 30 percent as much BOD_5, 22 percent as much TN, and 30 percent as much TP discharged from Cape May County as from Monmouth County. However, care should be taken in making inferences based on the estimates presented by county. Aggregating the estimates by drainage basin may show a somewhat different distribution of loadings to coastal waters.

This and other information in this report raise a number of questions concerning the factors potentially contributing to the green tides:

- If pollutant discharges are important to the green tide phenomenon, why is the green tide found mostly off Atlantic County and Cape May County, where the total pollutant discharges (BOD_5, TN, and TP) are relatively small, and not found off Monmouth County and Ocean County, where total pollutant discharges are relatively large?

- To what extent is the ocean outfall for the Ocean City Regional treatment plant (located near Great Egg Harbor Inlet and the border with Atlantic County) contributing to the green tide phenomenon? The outfall began operating in 1984, the first year substantial amounts of green tide were observed off Atlantic County and Cape May County. Is there a causative link between discharges from the outfall and the green tides, or is the startup of the outfall and the appearance of the green tide a coincidence?

- Does the coastal geography of New Jersey play a role in the green tide phenomenon? Comparison of the geography of the New Jersey coastline -- from the tip of Sandy Hook to the southern tip of Long Beach Island (that borders Beach Haven Inlet), and from the southern tip of Long Beach Island to Cape May -- shows a considerable difference. In the northern sector, there are relatively few inlets. The two sizeable ones are Manasquan Inlet and Barnegat Inlet. In the southern sector, there are nine sizeable inlets -- for a coastline that is only

Table 6. A Summary of Pollutant Discharges from the Four New Jersey Coastal Counties Bordering the Atlantic Ocean - Circa 1982

Coastal County	Wastewater Treatment Plants (100t/y)			Urban Land Uses (100t/y)			Nonurban Land Uses (100t/y)			Total (100t/y)		
	BOD_5	TN	TP	BOD_5	TN	TP	BOD_5	TN	TP	BOD_5	TN	TP
Monmouth	21.6	8.3	5.3	27.2	6.7	1.1	3.4	3.4	0.3	52.2	18.4	6.7
Ocean	5.2	3.7	2.3	31.6	7.8	1.3	0.0	0.1	0.0	36.8	11.6	3.6
Atlantic	6.3	3.6	2.4	11.8	3.0	0.5	1.0	1.1	0.1	19.1	7.7	3.0
Cape May	12.6	3.0	1.9	3.2	0.8	0.1	0.1	0.3	0.0	15.9	4.1	2.0
Total	45.7	18.6	11.9	73.8	18.3	3.0	4.5	4.9	0.4	124.0	41.8	15.3

Abbreviations: t/y, tons per year; BOD_5, 5-Day Biochemical Oxygen Demand; TN, Total Nitrogen; TP, Total Phosphorus.

about three-quarters as long: Beach Haven Inlet, Little Egg Inlet, Brigantine Inlet, Absecon Inlet, Great Egg Harbor Inlet, Corson's Inlet, Townsend's Inlet, Hereford Inlet, and Cold Spring Inlet. These nine inlets are spaced rather evenly along the entire southern sector. It is along the southern sector, particularly that part from around Absecon Inlet to Cape May, that the green tide phenomenon is most pronounced. Is there a connection between the level of nutrient loads in these inlet waters and the green tide phenomenon?

- What is the influence of the Delaware Bay Plume on the southern sector of the New Jersey coastline? Evidence exists that the Delaware Bay Plume extends northward along the southern sector of the New Jersey coast during various times of the year rather than southward along the state of Delaware. What is the impact of the plume on the occurrences of the green tide.

- Is it important that the species of dinoflagellate that apparently causes green tide has been found in other waters of the New York Bight, for example, off Long Island, New York last year? Does this indicate that the green tide problem is more widespread and that the causative factors may be regional rather than local?

- What effect does the wind velocity and direction and the amount of precipitation before and during the phenomenon -- which relates to runoff and discharge of nutrients in nearshore surface waters -- have on the green tide?

Answers to these and other questions will require more work and study. For example, assessing the potential effects on the green tide phenomenon of nutrient loading to coastal inlets and movements of the Delaware Bay Plume will be the subject of subsequent analyses conducted by the Ocean Assessments Division.

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