



New York - New Jersey Harbor Estuary Program

The Status of Shellfish Beds in the NY-NJ Harbor Estuary

Final: November 26, 2002

By Cathy Yuhas, NJ Sea Grant College Extension Program/NY-NJ Harbor Estuary Program

General Shellfish Information

Shellfish are a valued economic and natural resource throughout the coastal states as well as in the coastal area of the NY-NJ Harbor. In 1995, 77 million pounds of clams, oysters, and mussels were harvested in the coastal US, which was worth approximately 200 million dollars at dockside (NOAA 1998). Shellfish are filter feeders, which means they pump water through their system and filter it for phytoplankton, but they can accumulate contaminants in the process. The contaminants accumulated in the shellfish can be transmitted to humans when they are consumed (NJDEP 1997) and can cause diseases. The water quality of the waters where shellfish are being harvested is of concern for human health, but also for the growth of the local economy of these coastal areas that rely on the commercial shellfish industry (NJDEP 1997).

In order to determine the status of the water quality in the coastal areas, a sanitary survey is conducted. An intensive sanitary survey of the shellfishing area is completed every 12 years, but interim evaluations are done every 3 years (NJDEP 1998). An annual review is conducted that updates and evaluates water quality data as well as evaluating any changes in actual or potential pollution sources to the area. The sanitary survey report complies with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC) to determine the state of the water quality as well as the classification of the waters. A sanitary survey consists of the most recent shoreline survey as well as evaluates all actual and potential sources of pollution, hydrography of the area, and assesses the water quality (NJDEP 1998).

Depending on the water quality, there are two types of purification processes that are conducted on shellfish that are not directly harvested from their waters. Depuration is a process of purifying shellfish that are coming from waters where direct harvesting is not allowed. The shellfish are transported to a depuration facility and they are held for a minimum of 48-hours (NJDEP 1997). The shellfish are purified through the process of pumping clean water through the holding containers of shellfish. Shellfish tissue is analyzed after the depuration process is complete. Relay is the other purification process, but this requires the shellfish to be transported to clean waters that are certified (approved) for shellfishing (NJDEP 1997). The transplanted shellfish are held in these waters for a minimum of 14 days, which is required by the NSSP. States have different holding requirements for transplanted shellfish. NYS requires a minimum of 21 days and in NJ the minimum is 30 days. Tissue analysis is also conducted for coliform bacteria, pesticides, and heavy metals, but it is done before harvesting.

Final: November 26, 2002

Water quality can be affected by sewage treatment discharges and runoff. An example of this is a study that was conducted by the Interstate Environmental Commission (IEC) in 1986 and 1987 that showed that the coliform levels had decreased and that combined sewer overflows (CSOs) are primarily responsible for high coliform levels in this area (NJDEP 1998; ISC 1986). IEC, effective July 1, 1986, required that New Jersey and New York municipalities conduct year-round effluent disinfection under its Water Quality Regulations Section 2.05(b) in order to improve all Interstate Sanitation (Environmental) District waters including Raritan Bay (NJDEP 1998) and the south shore of Long Island. Before IEC made this a year-round requirement, disinfection was only being conducted during the bathing season.

Brief History

The NSSP was formed in 1925 because of the outbreak of typhoid fever in the early 1920's from eating raw shellfish that were contaminated by sewage (NSSP 1998; NJDEP 1998). In response to this, the local and state public health officials asked the Surgeon General for assistance. The Surgeon General called a conference in 1925. The NSSP guidelines were developed from the 1925 conference and were periodically updated thereafter. ISSC was formed and began annual meetings in 1982 and formally adopted the guidelines of the NSSP in 1983. The ISSC meetings promote uniformity in shellfish sanitation through the cooperation of the federal government, shellfish producing and shipping states, the shellfish industry, and several countries (NSSP 1998). The ISSC developed the guidelines of the NSSP, which are followed by the members. Shellfish for harvesting has to comply with the tagging requirements in Food and Drug Administration's (FDA) Hazard Analysis and Critical Control Point (HACCP) regulations, but these are the only regulations that are issued by the federal government. The FDA annually evaluates state programs for conformity with the NSSP and can take actions such as removal of shellfish shippers from the Interstate Certified Shellfish Shippers List (ICSSL), effectively barring a state's product from interstate commerce, but it has no actual control over harvesting activities. These controls are all through state regulations, which must conform to the NSSP (NSSP 1998).

New York State

General Information

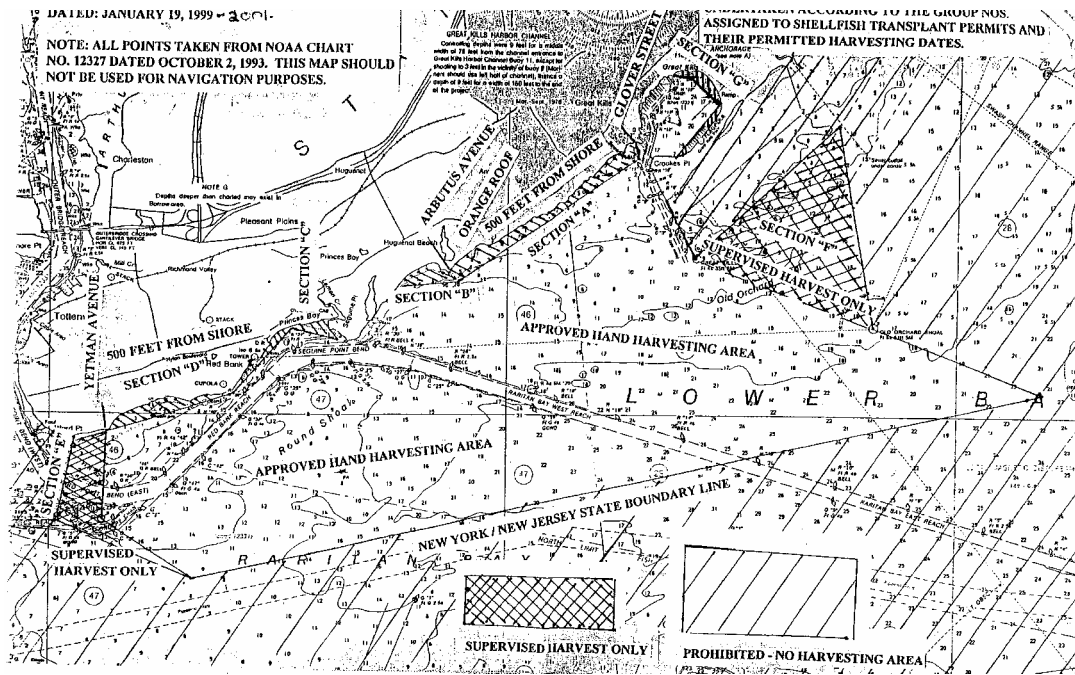
Raritan Bay waters are monitored for total coliform levels under the Adverse Pollution Control Strategy, which is conducted after a minimum of 0.25 inches and a maximum of 3.0 inches of rainfall during one or more days in the previous 96 hours. The Atlantic Ocean is monitored using the Systematic Random Sampling strategy. Although there are bacteriological criteria for classifying shellfish lands using fecal coliform criteria, there are currently no fecal coliform water quality standards for SA classification of waters. The SA water total coliform standard is a median MPN in any series of representative samples not exceeding 70/100mL (NYCRR Title 6, Chapter 10, 703.4). Waters can be classified as certified for shellfishing if the total coliform median or geometric mean MPN shall not exceed 70/100 ml and not more than 10 percent of the samples exceed an MPN of 330/100 ml or the estimated 90th percentile does not exceed an MPN of 330/100 ml for the 3-tube decimal dilution test (C. Hoffman, NYSDEC, personal

communication, 2002). Emergency closure number is 631-444-0480 and is updated at 9:30 am during an emergency. This number can be used for sewage spills that affect the Bight (NYSDEC 2002b; C. deQuilfeldt, NYSDEC, personal communication, 2002). NY classifications are certified (open); uncertified (closed); and special permit, which allows you to harvest in an uncertified area. Changes in classification occur when the water quality data shows that the water has changed significantly to either upgrade or downgrade (NYSDEC 2002b). There are no areas in the NY Harbor that are certified (C. deQuilfeldt, NYSDEC, personal communication, 2002). NYSDEC keeps the commercial shellfisherman informed about the areas that are opened or closed through the harvester-licensing program and through the NYSDEC website (www.dec.state.ny.us) (NYSDEC 2001). NYSDEC also inspects wholesalers to ensure that they handle, process, and ship shellfish under strict sanitary conditions (NYSDEC 2000).

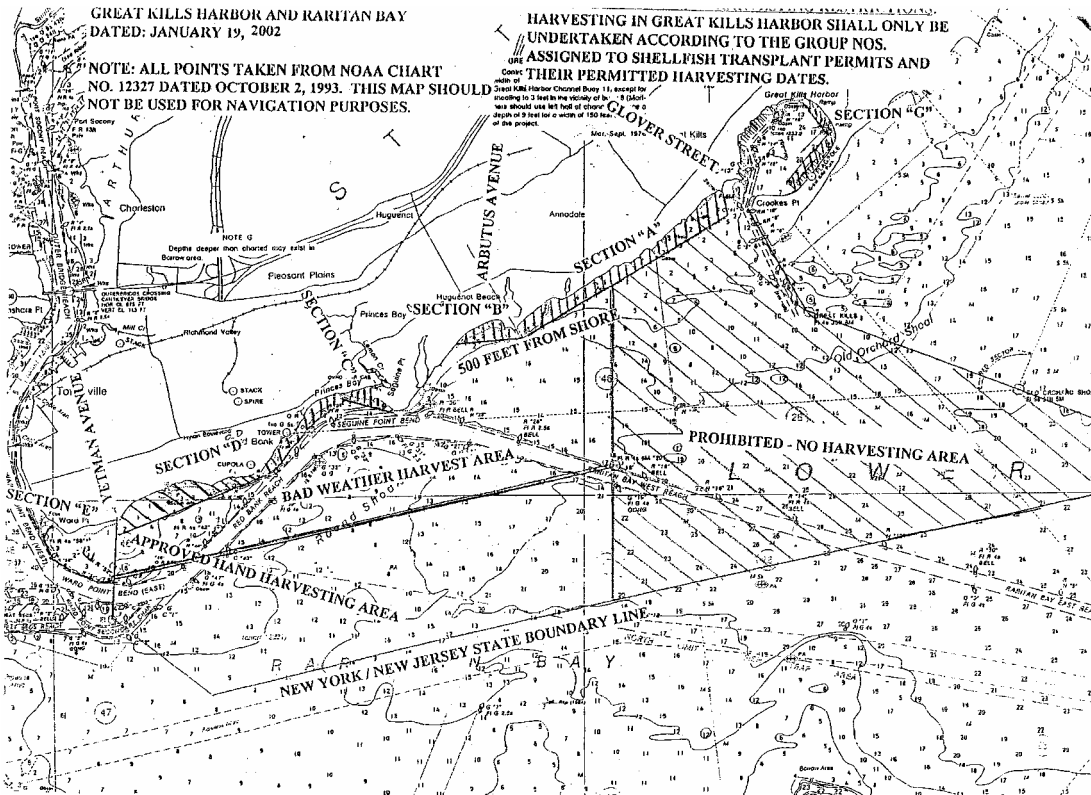
Raritan Bay

In New York, shellfish harvesting is regulated by the NYS Department of Environmental Conservation (NYSDEC), Division of Fish, Wildlife, & Marine Resources, Bureau of Marine Resources, Shellfisheries Section. The NY portion of Raritan Bay is classified as uncertified (closed), but can be used for shellfishing with a special permit (Refer to Maps 1, 2, and 3). All of the waters of NY Harbor inside the Rockaway Point-Sandy Hook Transect are uncertified for shellfish harvesting. There was less acreage being harvested in Raritan Bay in 2002 (Map 2) than there were in 2001 (Map 1). This was caused by a decision from NYSDEC to have land-based supervision instead of supervisors based on the harvest vessels (C. deQuilfeldt, NYSDEC, personal communication, 2002). Direct market harvesting in Raritan Bay may never occur, regardless of improved water quality, due to the potential for CSO discharges in wet weather (NYSDEC 2002a), as well as treatment plant upsets discharging in the immediate vicinity regardless of weather.

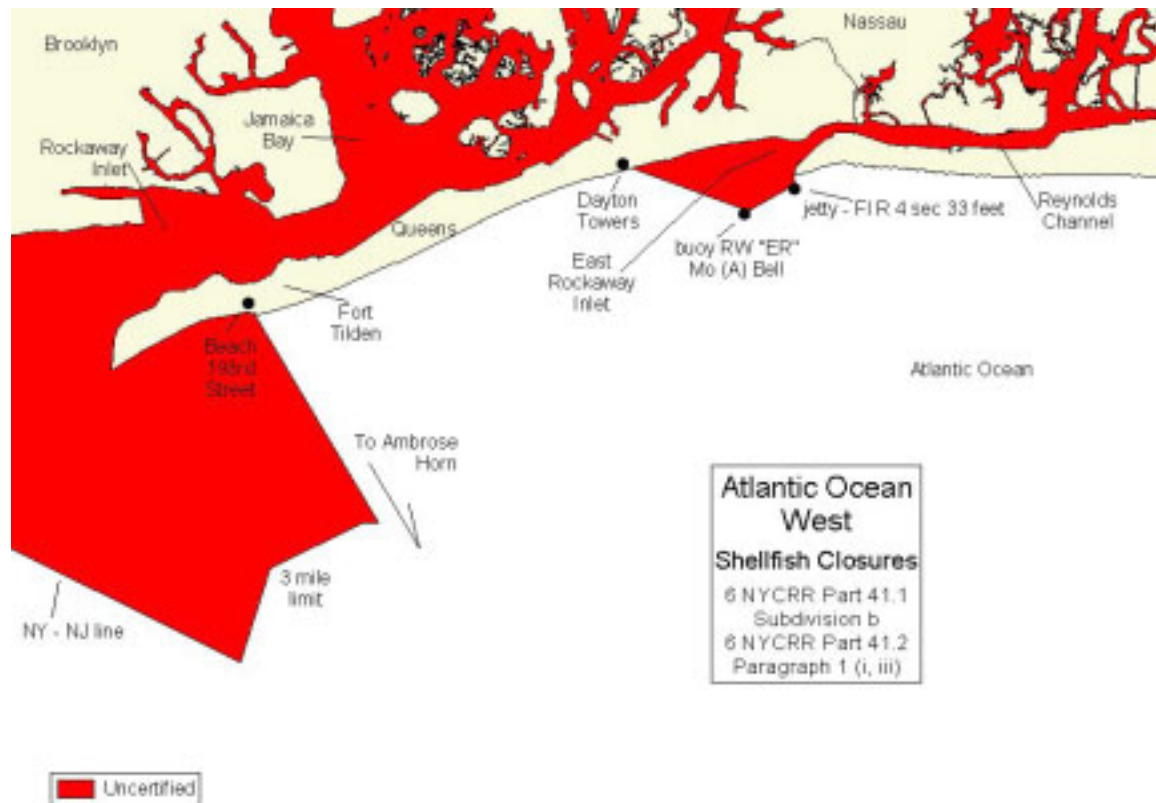
Only hard clams are harvested from portions of Great Kills Harbor and Raritan Bay. A transplant program runs from April to October. Hard clam harvest restrictions are (1) the size limit is 1-inch thickness across the hinge; (2) commercial catch limits is any number; and (3) the gear restrictions are no mechanical means, but tongs and rakes are allowed (NYSDEC 2000). Surf clam harvest restrictions in the Atlantic Ocean are 1 bushel per day and the size limit has to be 3-inches and 4-inches for use as food. Recreational catch limits are 1 bushel. Commercial catch limits have restrictions that can be found in the surf clam mechanical harvesting permit (NYSDEC 2000). Gear restrictions are that a special permit is required for mechanical harvest.



Map 1: NY Classifications- 1999 to 2001
Great Kills and Raritan Bay
Source: NYSDEC



Map 2: NY Classifications- 2002
Great Kills and Raritan Bay
Source: NYSDEC



Map 3: NY Shellfish Classification for the Atlantic Ocean

Source: NYDEC, Bureau of Marine Resources

http://www.dec.state.ny.us/website/dfwmm/marine/shellfish/sfntsh/ao_west.jpg

<http://www.dec.state.ny.us/website/dfwmm/marine/shellfish/sfntsh/counties.htm>

Date: April 25, 2002

NY Bight

The New York Bight is a 39,000-km² sector of the middle Atlantic continental shelf between Montauk Point, NY and Cape May, NJ (Swanson & Sinderman 1979). This area is classified as certified (open). There are closures at Rockaway Inlet, East Rockaway Inlet and surrounding the pipes and outfalls from the Wantagh/Cedar Creek and Southwest Sewer Districts (C. deQuilfeldt, NYSDEC, personal communication, 2002). These are administrative closures due to sewage treatment outfalls.

Available Data

Total bushels of shellfish has increased from 1964 to 2001 (Table 1 and Figure 1) for the NYS shellfish transplant and relay programs, which includes the areas of the NY Harbor as well as areas outside of the Harbor such as Little Neck Bay, Westchester, Hempstead Harbor and others. NYS hard clam production in Raritan Bay has also increased from 1979 to 2001 (Table 2 and Figure 2). When comparing Figure 1 and Table 1 with Figure 2 and Table 2, it is evident that the transplant program in Raritan Bay accounts for most of the recent harvest in NYS. The uncertified acreage of shellfish beds in the NY Harbor and the NY Bight has remained constant

from 1970 to 2000 for Raritan Bay, Lower NY Bay, Upper NY Bay, Jamaica Bay, Hudson River, and East River (Table 3 and Figure 3). As for the Atlantic Ocean, the uncertified acreage of shellfish beds has increased from 1970 to 1986 and then it decreased and remained constant from 1990 to 2000.

Table 1: NYS Shellfish Transplant Program Data-1964-2001
 Includes NY Harbor and Areas Outside of the Harbor
 Public and Private Land Relays- All Transplant and Relay Operations

Year	Public to Public (bushels)	Public to Private (bushels)	Private to Private (bushels)	Total BU Cumulative (bushels)
1964	10,933.00			10,933.00
1965	10,627.00	10,049.00		31,609.00
1966	15,310.00	40,366.00		87,285.00
1967	9,029.00	39,323.00		135,637.00
1968	5,970.00	5,116.00		146,723.00
1969	4,921.00	631		152,275.00
1970		655		152,930.00
1971	0	0		152,930.00
1972	13820	686		167,436.00
1973	12579	3611.5	441	184,067.50
1974	27921	2379	526	214,893.50
1975	27380	4334	872	247,479.50
1976	28919	13383.5	1042	290,824.00
1977	31880	7116		329,820.00
1978	17765	8349	509	356,443.00
1979	12508	12601	861	382,413.00
1980	1945	10383.5		394,741.50
1981	816	7879		403,437.00
1982	172	4930		408,539.00
1983	746	5058		414,343.00
1984	1018.5	5465.5	690	421,517.00
1985	14925	5101		441,543.00
1986	7526	27500	1660	478,229.00
1987	913	30547.25		509689.25
1988	2512	24649		536,850.25
1989	2794	72085.5		611,729.75
1990	6479.25	54083.75		672,292.75
1991	3127	32322.5		707,742.25
1992	1584	52280.75		761,607.00
1993	1241	56554.25		819,402.25
1994	253	65062		884,717.25
1995	264.75	36594.25	6440	928,016.25
1996	979.5	57951.5		986947.25
1997	2502	68739		1,058,188.25
1998	337	76256	6025	1,140,806.25
1999	300	82176.5		1,223,282.75
2000		88543.5	100.75	1,311,926.90
2001	46	77814.5		1,389,787.40
Source: NYSDEC				

Table 2: NYS Hard Clam Production-1979-2001
 Raritan Bay, Staten Island

Year	Depuration/Transplant	Quantity (bushels)
1979	Depuration	4168
1980	Depuration	11188
1981	Depuration	18054
1982	Depuration	12864
1983	Depuration	9894
1987	Transplant	3670
1988	Transplant	3155
1989	Transplant	55639
1990	Transplant	47910
1991	Transplant	25185
1992	Transplant	31103
1993	Transplant	40946
1994	Transplant	56463
1995	Transplant	36594
1996	Transplant	57951.5
1997	Transplant	68739
1998	Transplant	76256
1999	Transplant	82176.5
2000	Transplant	88543.5
2001	Transplant	77814.5
Source: NYSDEC		

Table 3: Compilation of Uncertified Acreage in the NYS Marine District-1970-2000

Area #	Area Name	Total Acreage of Bodies of Water	1/1/70	1/1/75	1/1/80	1/1/86	1/1/90	1/1/95	1/1/98	1/1/99	1/1/00
57	Raritan Bay	12410	12410	12410	12410	12410	12410	12410	12410	12410	12410
58	Lower Bay	31400	31400	31400	31400	31400	31400	31400	31400	31400	31400
59	Upper Bay	6740	6740	6740	6740	6740	6740	6740	6740	6740	6740
60	Jamaica Bay	12235	12235	12235	12235	12235	12235	12235	12235	12235	12235
65	Atlantic Ocean	283200	1000	23000	26140	26623	10623	10623	10623	10623	10623
71	Hudson River	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100
72	East River	8860	8860	8860	8860	8860	8860	8860	8860	8860	8860
Source: NYSDEC											

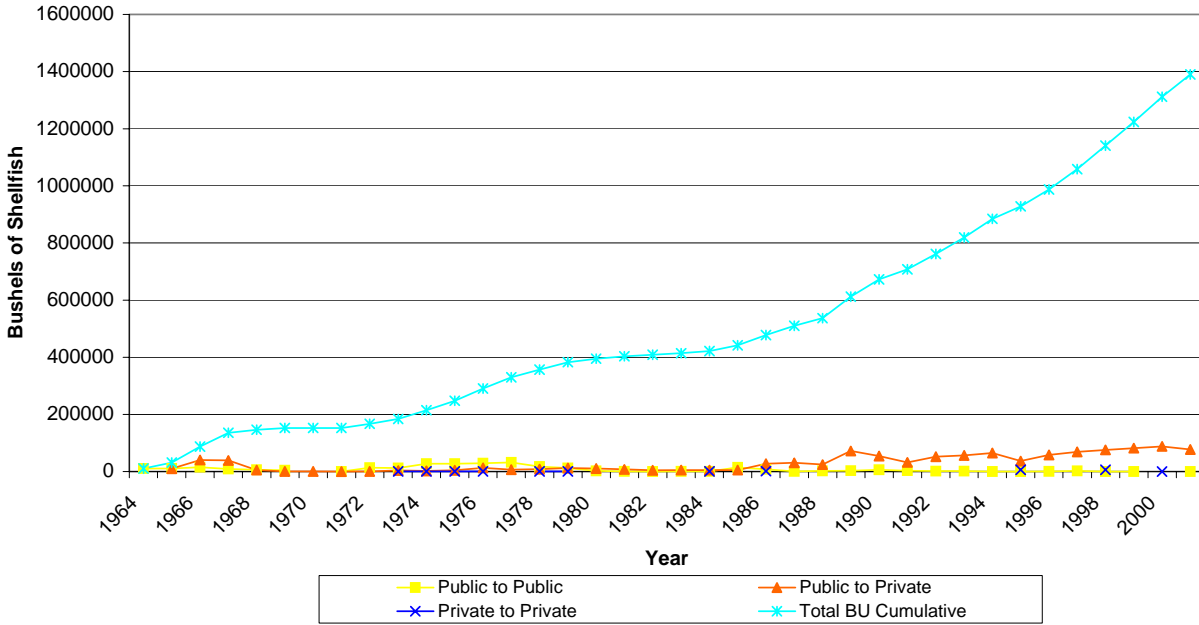


Figure 1: NYS Shellfish Transplant Program Data-1964-2001
 Includes NY Harbor and Areas Outside of the Harbor in NYS
 Public and Private Land Relays
 All Transplant and Relay Operations
 Source: NYSDEC

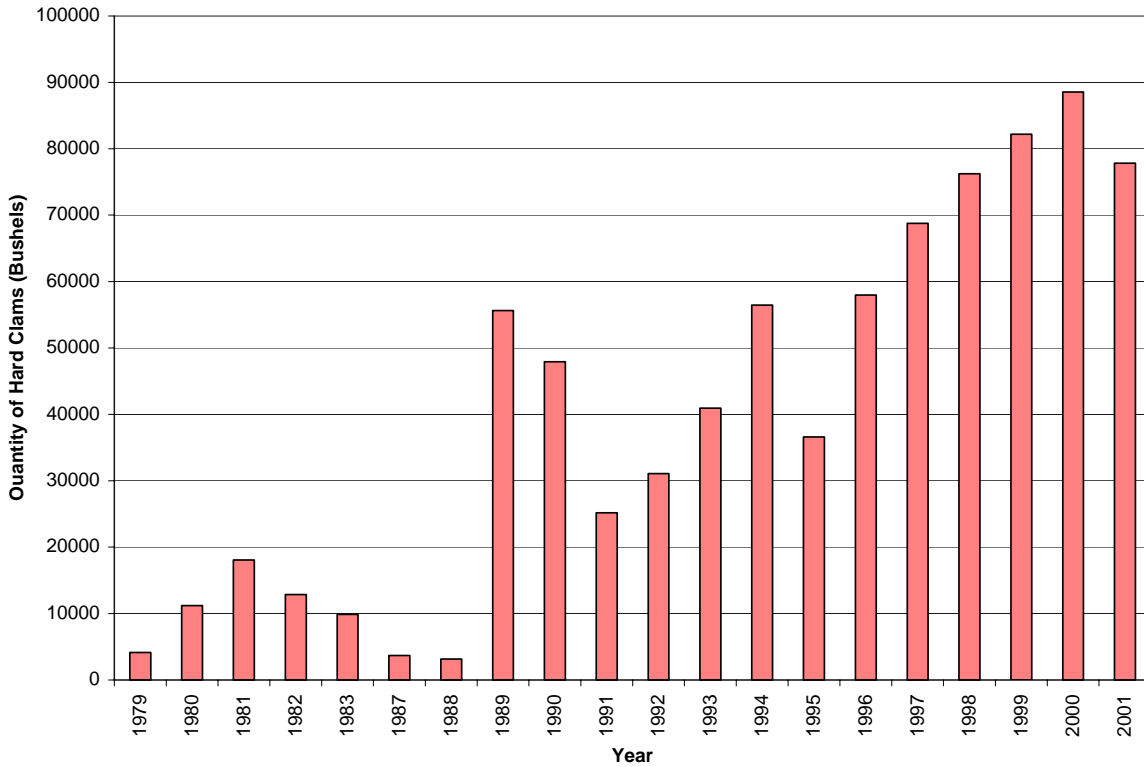


Figure 2: NYS Hard Clam Production-1979-2001
 Raritan Bay, New York
 Source: NYSDEC

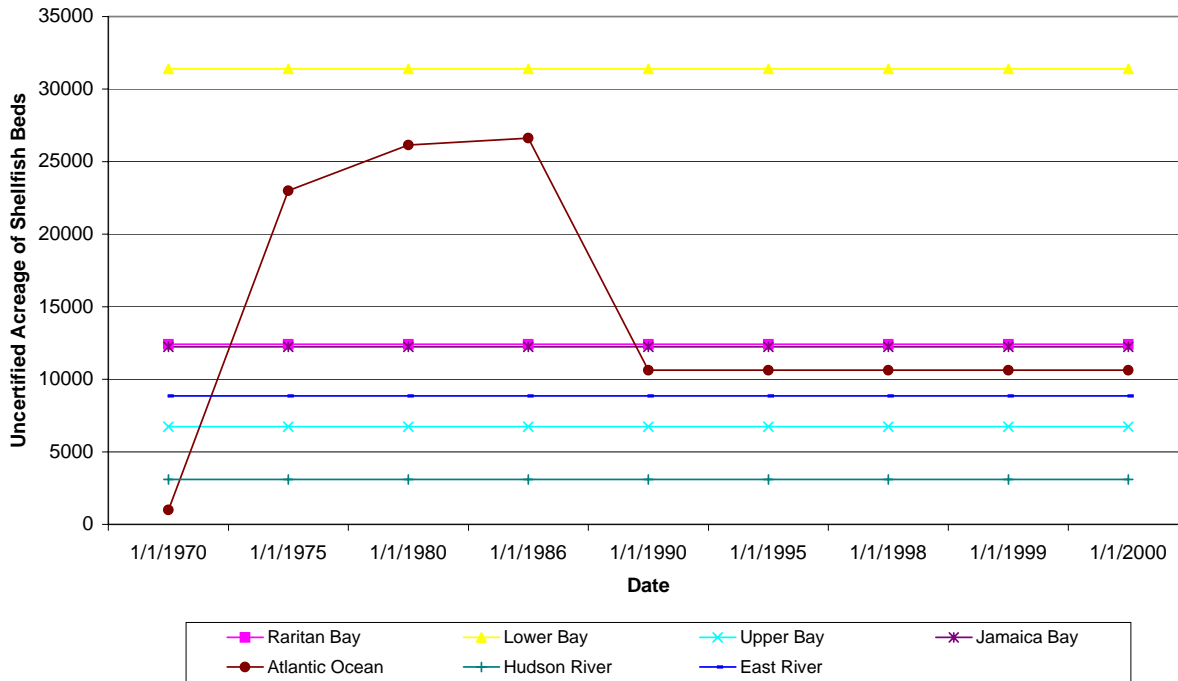


Figure 3: NYS Uncertified Areas in NY Harbor and NY Bight-1970-2000
 Source: NYSDEC

Potential for Opening More Acreage of Shellfish Beds

The potential for opening more shellfish beds is determined through the shellfish beds being evaluated for transplant harvest based on survey information indicating a harvestable resource and industry requests (C. deQuilfeldt, NYSDEC, personal communication, 2002).

New Jersey

General Information

In NJ, there are multiple agencies, such as the Bureau of Marine Water Monitoring, the Bureau of Shellfisheries, and the Marine Enforcement Unit of the NJ Department of Environmental Protection; the Shellfish Program of the Department of Health and Senior Services; and the Marine Bureau of the Department of Law and Public Safety, that take the lead on the shellfish harvesting (Figure 4). The area harvested as well as the classification are as follows: Raritan Bay/special restricted, Sandy Hook Bay/special restricted, Navesink River/special restricted & seasonal from November to April, and Shrewsbury River/special restricted & seasonal from November to April (Map 4).

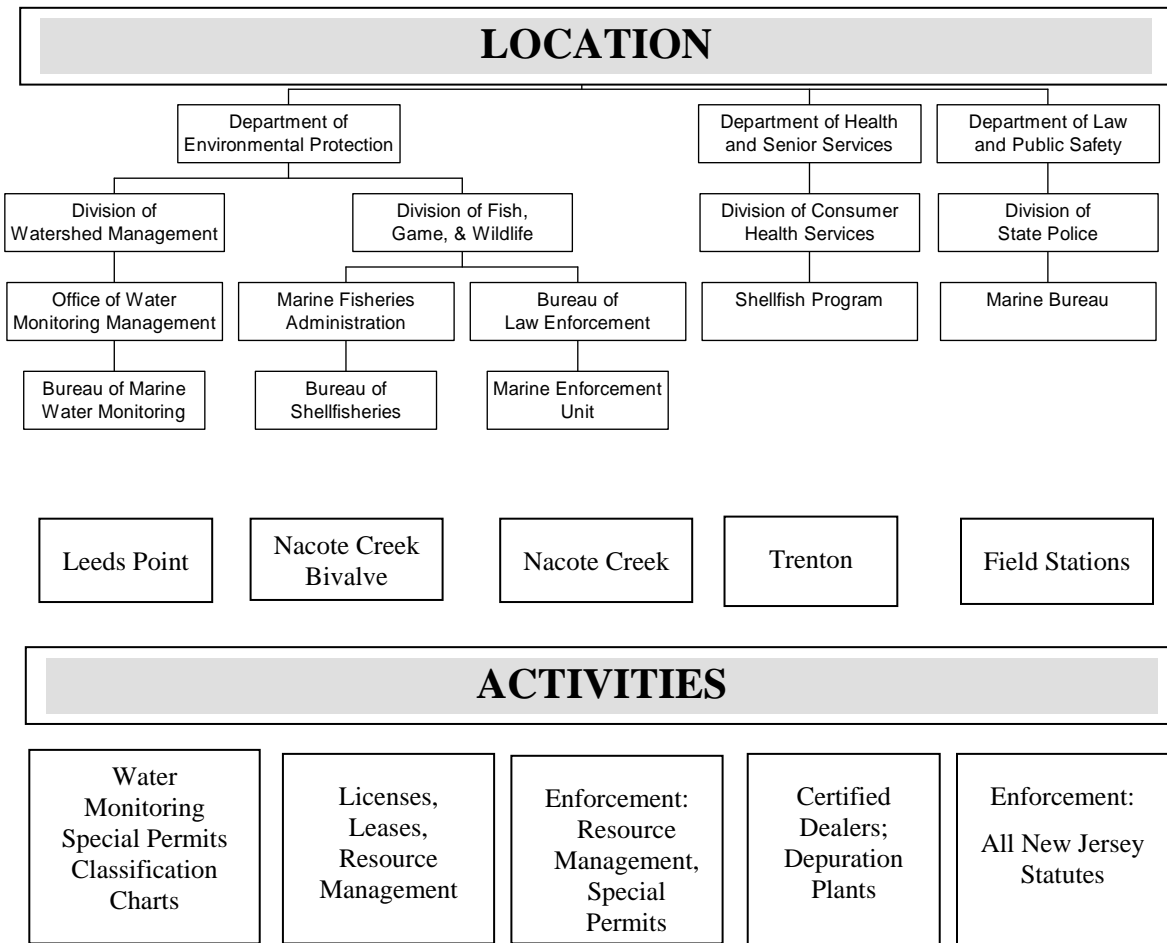
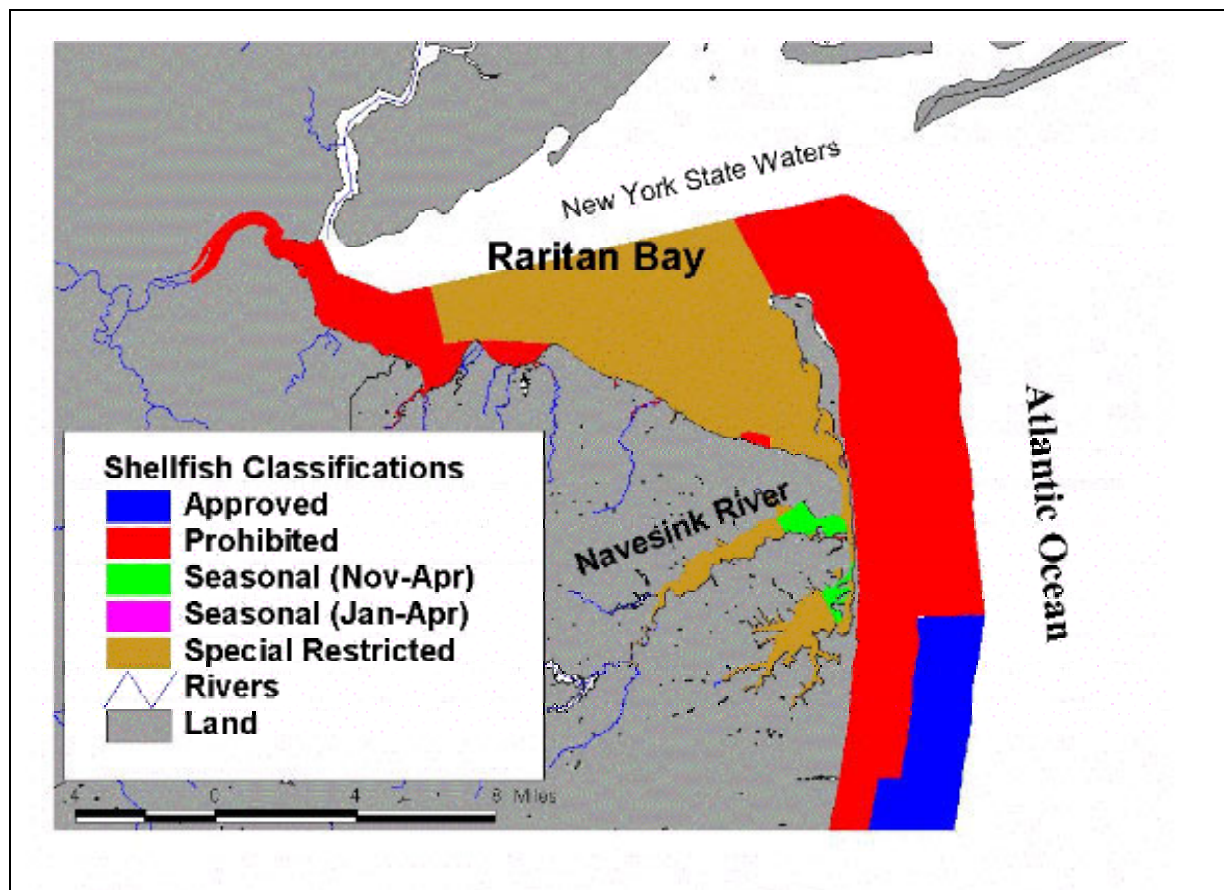


FIGURE 4: STATE OF NEW JERSEY SHELLFISH AGENCIES

Source: Raritan and Sandy Hook Bays Sanitary Survey Report 1994-1997. November 1998. NJDEP, Division of Watershed Management, Bureau of Marine Water Monitoring.



MAP 4: NJ SHELLFISH CLASSIFICATIONS

Source: NJDEP, Bureau of Marine Water Monitoring
<http://www.state.nj.us/dep/watershedmgt/bmw/raritan.htm>
 Date: January 23, 2002

Waters are monitored in accordance with the Adverse Pollution Control Strategy for total and fecal coliform bacteria, but NJ uses total coliform levels for classifying waters (NJDEP 1998). To assess the sanitary conditions of the shellfish beds, all ambient water quality monitoring is reactive; i.e., all samples are taken after a storm event of at least 0.25" with a response time of 48 hours. NJ classifications are approved, seasonally approved, special restricted, seasonal special restricted, and prohibited. Waters can be classified as approved if the total coliform median or geometric mean MPN shall not exceed 70/100 ml and not more than 10 percent of the samples exceed an MPN of 330/100 ml for the 3-tube decimal dilution test (NJDEP 1998). A classification of special restricted requires that the total coliform median or geometric mean MPN shall not exceed 700/100 ml and not more than 10 percent of the samples exceed an MPN of 3300/100 ml for the 3-tube decimal dilution test. As for the seasonal classification, the waters must meet the criteria for that time of the year (NJDEP 1998).

Raritan and Sandy Hook Bays

Primarily, *Mercenaria mercenaria* (hard clams) are harvested in Raritan and Sandy Hook Bays (Figure 5) (R. Connell, NJDEP, personal communication, 2002). NJ has relay and depuration programs. Hard clam size limit is 1½-inches in length. The director of the NJDEP, Division of Fish and Wildlife sent a letter to all hard clam depuration participants that listed the hard clam depuration areas open for harvest effective May 1, 2002, and they are 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 10A, 10B, 10C, 10D, 10E, 10F, 11A, 11B, 11C, 11D, 11E, 12A, 12B, 13A, 13B, 13C, 13D, 14 (Figure 6, 7, and 8) (McDowell 2002).

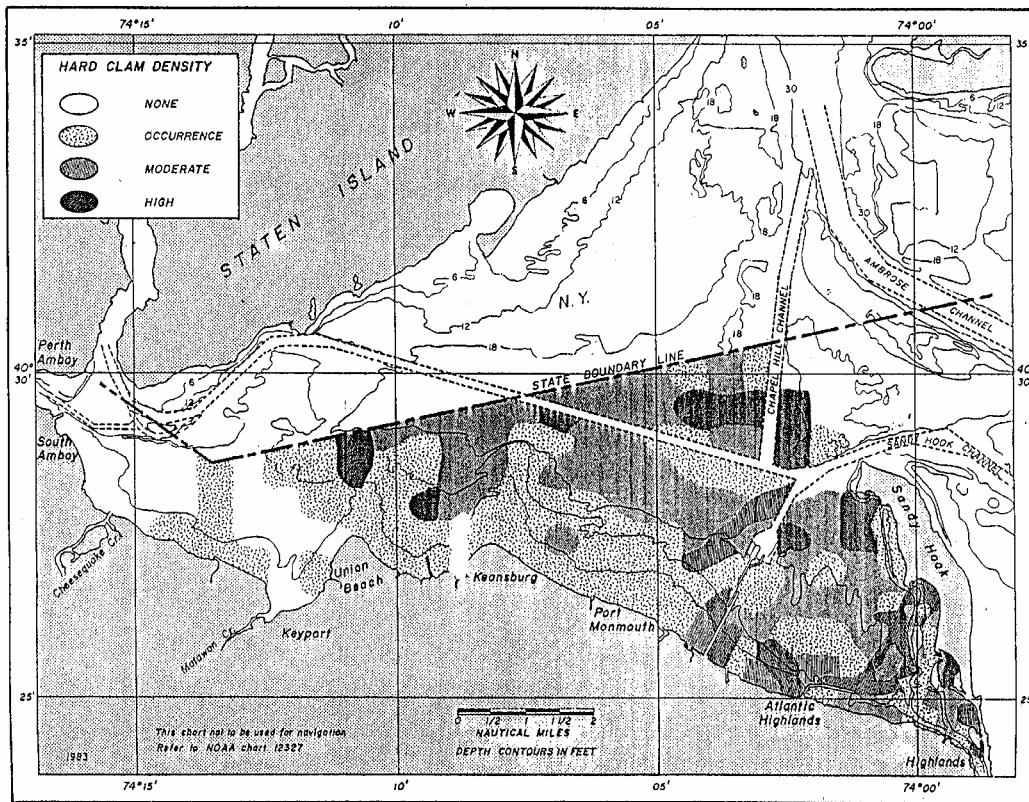


Figure 5: Hard Clam Resources in Raritan/Sandy Hook Bays

Source: Raritan and Sandy Hook Bays Sanitary Survey Report 1994-1997. November 1998. NJDEP, Division of Watershed Management, Bureau of Marine Water Monitoring.

**DESIGNATED HARD/SOFT CLAM DEPURATION AND
HARD CLAM RELAY AREAS**

2002
Effective 5/01/02

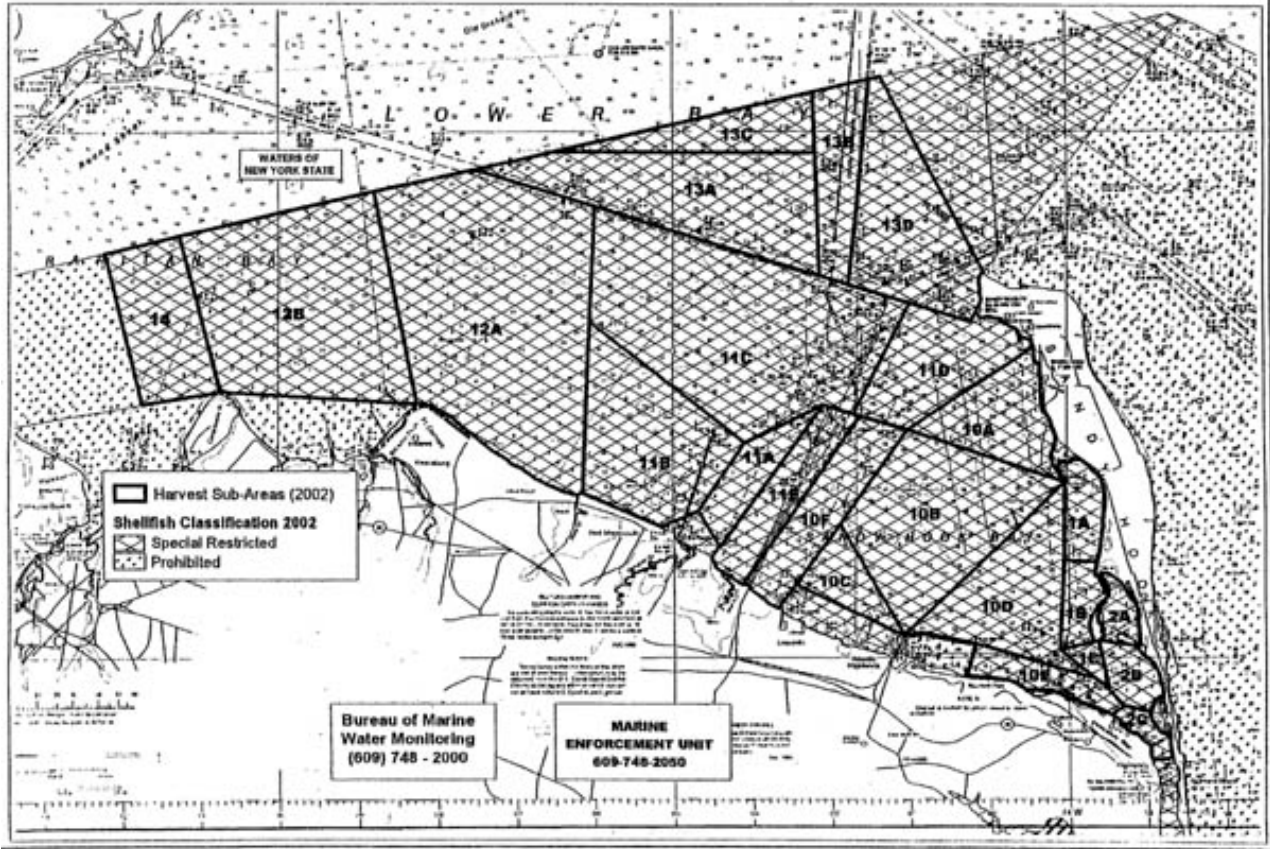


Figure 6: NJ Depuration and Relay Areas-2002
Source: NJDEP

**DESIGNATED HARD/SOFT CLAM DEPORATION AND
HARD CLAM RELAY AREAS
EFFECTIVE MARCH 2001**

2001
Updated 11/21/01

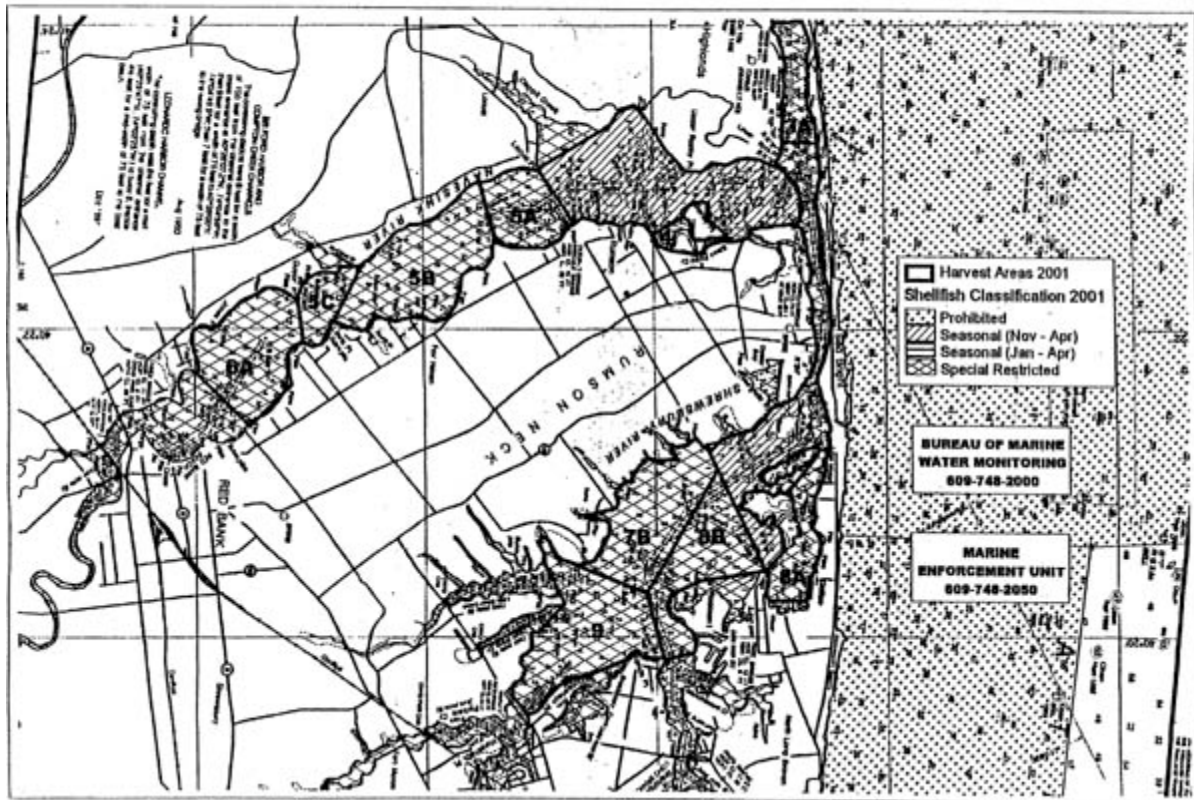


Figure 7: NJ Depuration and Relay Areas-2001
Source: NJDEP



Figure 8: NJ Harvesting Areas

The areas not harvested are the western end of Raritan Bay, which is prohibited because of the federally required buffer around the Middlesex County Utilities Authority discharge (R. Connell, NJDEP, personal communication, 2002). Arthur Kill/Kill van Kull and Newark Bay are prohibited because there is no interest in this area by the shellfish industry due to most likely an insufficient resource (R. Connell, NJDEP, personal communication, 2002). The Bureau of Marine Water Monitoring does not monitor the areas that are not of interest to the shellfish industry and they are prohibited from the activity of shellfishing.

Buffers are established around outfalls and marinas. The NSSP requires that sewage treatment outfalls have a buffer around the areas that are adjacent to the outfalls and it is classified as prohibited from shellfishing (NJDEP 1998). Buffers are associated with permitted and unpermitted discharges along Raritan and Sandy Hook Bays. (Figure 9) The permitted discharges are Middlesex County Utilities Authority outfall (Figure 10), which is at the western end of Raritan Bay, and there is the Monmouth County Bayshore Outfall Authority (MCBOA) outfall, which is located 1-mile offshore in the Atlantic Ocean (NJDEP 1998). The unpermitted discharges were from MCBOA at the Bayshore Regional Sewage Authority in Union Beach, NJ and at the Middletown Sewage Authority in Belford, NJ (Figure 10). At these two locations in 1997 and 1998, there have been discharges of treated and partially treated effluent to the coastal waters of Raritan and Sandy Hook Bays, but this outfall line was rehabilitated in 1999 and during that time, areas were closed for shellfishing (NJDEP 1998). There is also a buffer around East Creek located between Union Beach and Keansburg, NJ, due to a small amount of wastewater discharged from International Flavor and Fragrances to the sanitary sewer line (NJDEP 1998). Storm water outfalls (Figure 11) also have discharges in the Raritan and Sandy Hook Bays. There is a buffer around the mouth of the Waackaack Creek. Stormwater runoff does occur through the 11 creeks that flow into Raritan and Sandy Hook Bays, but the mouths of these are not sampled (NJDEP 1998). Buffers are typically established around marinas, but not in this area because the waters are classified as special restricted.

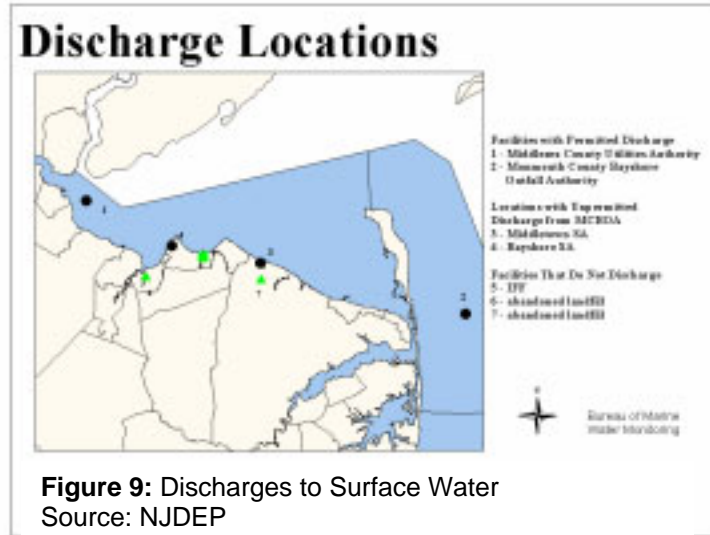


Figure 9: Discharges to Surface Water
Source: NJDEP

At these two locations in 1997 and 1998, there have been discharges of treated and partially treated effluent to the coastal waters of Raritan and Sandy Hook Bays, but this outfall line was rehabilitated in 1999 and during that time, areas were closed for shellfishing (NJDEP 1998). There is also a buffer around East Creek located between Union Beach and Keansburg, NJ, due to a small amount of wastewater discharged from International Flavor and Fragrances to the sanitary sewer line (NJDEP 1998). Storm water outfalls (Figure 11) also have discharges in the Raritan and Sandy Hook Bays. There is a buffer around the mouth of the Waackaack Creek. Stormwater runoff does occur through the 11 creeks that flow into Raritan and Sandy Hook Bays, but the mouths of these are not sampled (NJDEP 1998). Buffers are typically established around marinas, but not in this area because the waters are classified as special restricted.

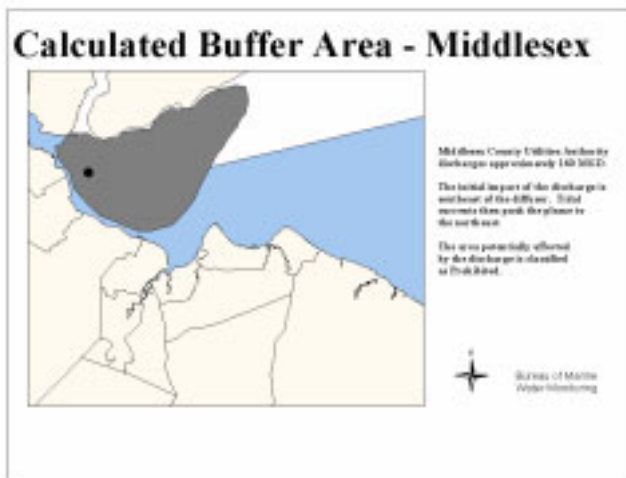


Figure 10: Buffer Zones
Source: NJDEP

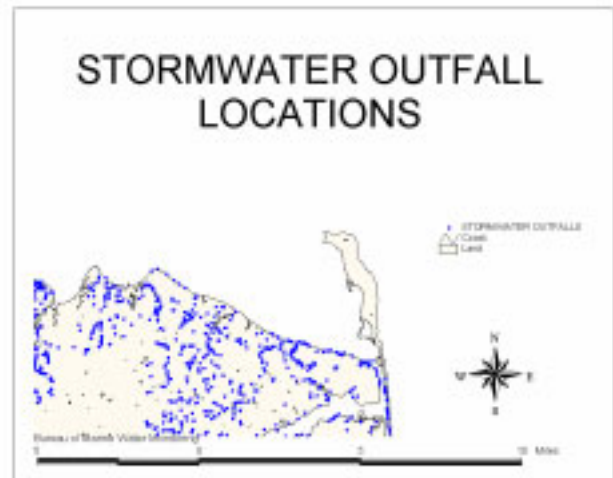


Figure 11: Stormwater Outfall Locations
Source: NJDEP

Toxic substances can also be found in shellfish. At the Atlantic Highlands Municipal Marina, the soft clam, *Mya arenaria*, was found to have elevated levels of lead and chromium in 1984 (NJDEP 1998). Therefore this area was excluded from shellfishing. National Oceanic and Atmospheric Administration runs a Mussel Watch Project in which they analyze mussels and oysters from sites around the coastal US. One of the sites is in Sandy Hook Bay where the waters are prohibited; and this site has high levels of lead in blue mussels.

There are approximately 36 monitoring stations in Raritan and Sandy Hook Bays that are monitored by the Bureau of Marine Water Monitoring. Since 1996, IEC has been collecting winter samples (NJDEP 1998) under worst-case conditions. A Performance Partnership Agreement (PPA) exists between the two agencies and US EPA, Edison, where the collected samples are analyzed. The USEPA has also analyzed samples from two sampling dates in 1997 under the National Environmental Performance Partnership System (NEPPS) agreement. NEPPS evaluates environmental indicators that are associated with environmental regulations (NJDEP 1997).

The Sanitary Survey from 1994 to 1997 shows that the water quality has not changed significantly in Raritan and Sandy Hook Bays and therefore there were no changes in the shellfishing classifications as well. Even though there has not been a significant change in water quality, the water quality in Sandy Hook Bay has improved more so than it has in Raritan Bay (NJDEP 1998). Non-point source pollution and antiquated infrastructure that allows the flow of sanitary sewage into storm drains are the reasons for the lack of improvement in the water quality (NJDEP 1998). Inactive sampling stations need to be sampled. Additional sampling that needs to be conducted is in Sandy Hook Bay after rainfalls during the summer months. The impact of the tidal streams on the bays should be determined. As of January 1, 2002, greater than 5,000 acres of the NY-NJ Harbor were upgraded from prohibited to special restricted (R. Connell, NJDEP, personal communication, 2002). There were 4,441 acres upgraded at the eastern portion of Raritan Bay around Flynn's Knoll (sub-area 13) and another 984 acres were upgraded at the western portion of the Raritan Bay (sub-area 14) (E. Feerst, NJDEP, personal communication, 2002). These sub-areas can be seen in Figure 6. This upgrade was based on acceptable monitoring results for both coliform bacteria and toxics. On January 1, 2003, sub-area 14 in the Raritan Bay will be closed to shellfishing because it is too dangerous at that time of the year for the clammers (Capt. J. Meyer, NJDEP, personal communication, 2002). This closure is not the result of water quality.

Navesink and Shrewsbury Rivers

The Navesink River Watershed consists of the Navesink and Shrewsbury Rivers that are a part of the estuary of the Raritan–Sandy Hook Bay complex (NJDEP 1996). The lower Navesink River was closed to shellfish harvesting for 25 years and was reopened in January 1997 (NJDEP 1997). Hard clams and soft clams are harvested out of the Navesink and Shrewsbury Rivers, which contains 2,290 acres of shellfish growing waters (NJDEP 1996). This area provides almost the entire soft clam fishery in NJ (NJDEP 1996). In 1996, there were relay and depuration programs for the harvesting of hard clams. The relay waters are in the Barnegat Bay and Little Egg Harbor while the depuration plants are in Sea Bright and the Highlands. Water quality data from 1992 to 1995 shows that water quality of the Navesink has improved since

1993 (NJDEP 1996). The reasons for the improvement in water quality are the decrease in non-point source loadings from coastal development, agricultural waste, and marina and boating-related contamination into the Navesink watershed (NJDEP 1986). There are many indirect and direct discharges to the Navesink watershed (Figures 12 and 13). In 1996, the lower Navesink was upgraded from special restricted to seasonally approved. The seasonally approved classification in the Navesink and Shrewsbury Rivers allows direct harvesting from November through April each year (R. Connell, NJDEP, personal communication, 2002). Even though the water quality has improved in this area, the NJDEP, Bureau of Marine Water Monitoring released a Letter to all 4, 5a, 5b, 8, 9, and 10 Special Permit Participants that stated that the sub-areas 5, 6, 7, 8, and 9 (i.e., the Navesink and Shrewsbury Rivers (Figure 7 and 8)) are off limits to shellfishing effective May 1, 2002 (Eisele 2002) because of the shortage of man power and resources to patrol the waters on a daily basis (Capt. J. Meyer, NJDEP, personal communication, 2002). The shortage came about when the 5000 acres in the Raritan and Sandy Hook Bays were upgraded to shellfishing. These areas in the Navesink and Shrewsbury Rivers will re-open on January 1, 2003 in order to provide a sheltered area for the clammers to shellfish (Capt. J. Meyer, NJDEP, personal communication, 2002).

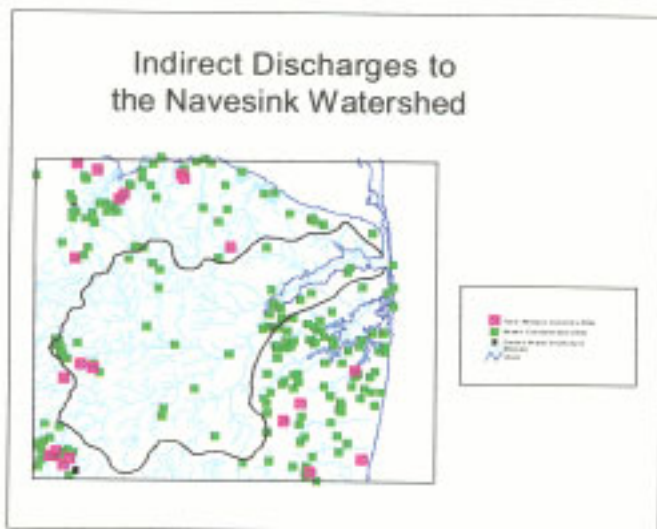


Figure 12: Indirect Discharges to the Navesink River Watershed
Source: NJDEP

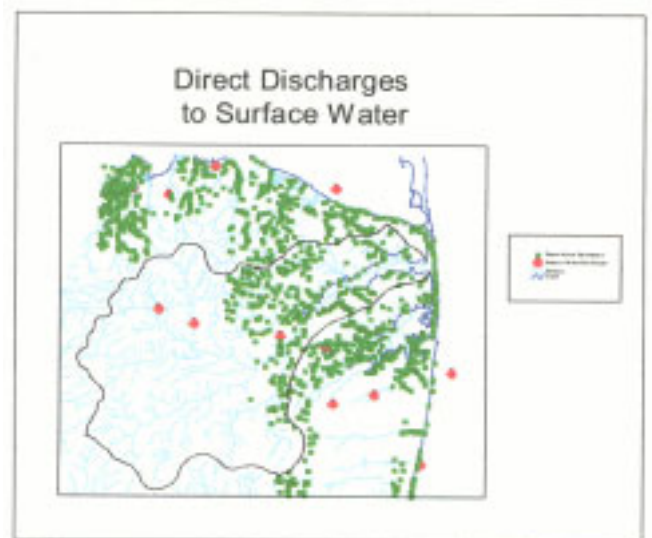


Figure 13: Direct Discharges to the Navesink River Watershed
Source: NJDEP

NY Bight

The harvesting of surf clams is conducted along the Atlantic Ocean off the coast of NJ. The offshore shellfish resources from Asbury Park to Monmouth Beach and from Sea Bright to Sandy Hook are possibly affected by the waters in Raritan Bay (NJDEP 1997). From Sandy Hook to Sea Bright, the waters are classified as prohibited and the last sanitary survey was completed in 1979. This area is sampled under the adverse pollution control strategy during the summer and near wastewater treatment plants. The Bureau of Marine Water Monitoring last conducted sampling here in 1993, but the USEPA is sampling here at this time (NJDEP 1997). It is classified as prohibited because of Raritan Bay and Hudson River complex waters and the MCBOA outfall. The other area of the Bight that is affected by the Harbor is from Monmouth Beach to Asbury Park. The last sanitary survey conducted there was in 1986, but there was a reevaluation of this area in 1995 (NJDEP 1997). This area is sampled under the adverse pollution control strategy near wastewater treatment plants. The classification of half of this area is prohibited, but some of the area can be considered for an upgrade since some of the samples meet the criteria for approved waters. The prohibited area has non-point sources of pollution and four wastewater treatment plant discharges (NJDEP 1997).

Available Data

The available data from NJ is the number of clams harvested in the Raritan and Sandy Hook Bays (Table 4) from 1994 to 1997. In Raritan Bay, the number of clams has increased from 1994 to 1997 with only a slight increase from 1996 to 1997 (Figure 14). During the same time period, the catch per effort in Raritan Bay has also increased. In Sandy Hook Bay, the number of clams harvested and the catch per effort has increased from 1994 to 1995 and then dropped in 1996, but increased again in 1997 (Figure 15).

**Table 4: Combined Relay and Depuration Harvest, Effort, and Catch per Effort-1994-1997
New Jersey Waters**

Year	Area	Harvest (# of clams)	Effort (man days)	Catch/Effort (clams/man/day)
1997	Raritan Bay	15,469,663	5,444.50	6,049
	Sandy Hook Bay	16,395,934	6,191.00	4,882
1996	Raritan Bay	15,447,631	5,639.70	5,014
	Sandy Hook Bay	15,371,153	6,154.00	4,105
1995	Raritan Bay	3,624,564	1,290.00	5,230
	Sandy Hook Bay	18,781,304	8,581.00	4,186
1994	Raritan Bay	303,952	115	2,643
	Sandy Hook Bay	4,285,650	2,011.50	2,131

Source: Raritan and Sandy Hook Bays Sanitary Survey Report 1994-1997.

November 1998. NJDEP, Division of Watershed Management, Bureau of Marine Water Monitoring.

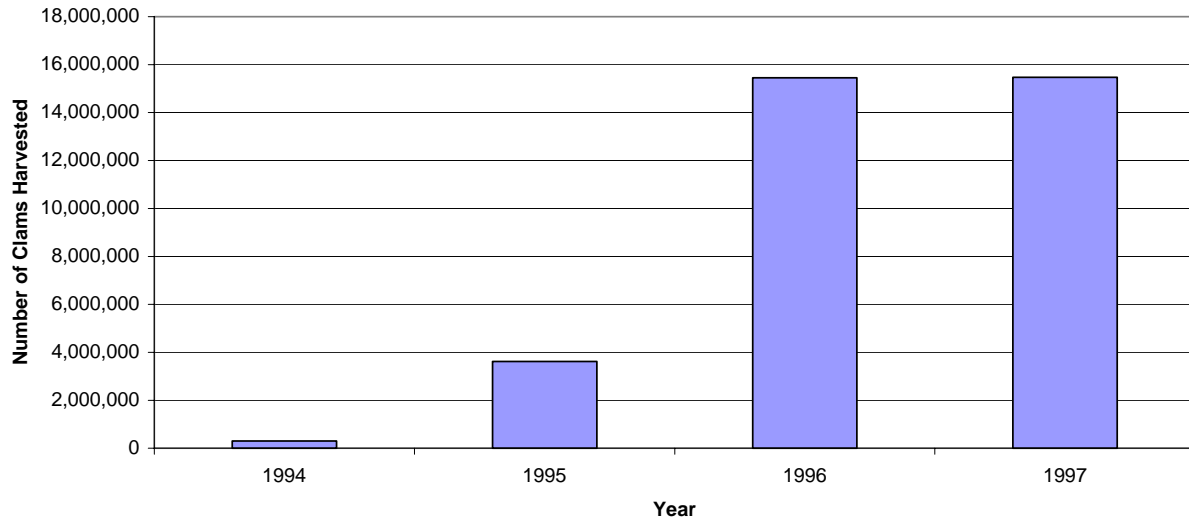


Figure 14: Combined Relay and Depuration Harvest of Clams-1994-1997
 Raritan Bay, New Jersey
 Source: Raritan and Sandy Hook Bays Sanitary Survey Report 1994-1997.
 November 1998. NJDEP, Division of Watershed Management, Bureau of Marine
 Water Monitoring.

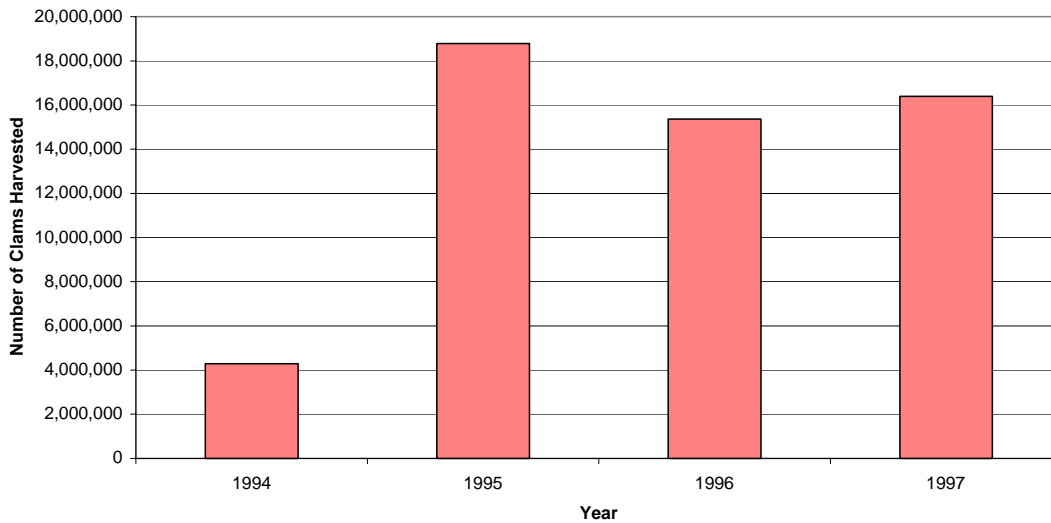


Figure 15: Combined Relay and Depuration Harvest of Clams-1994-1997
 Sandy Hook Bay, New Jersey
 Source: Raritan and Sandy Hook Bays Sanitary Survey Report 1994-1997.
 November 1998. NJDEP, Division of Watershed Management, Bureau of Marine
 Water Monitoring.

Potential for Opening More Acreage of Shellfish Beds

Approximately 1,000 acres may be upgraded north of Sandy Hook in the next few years based on more data being collected in the next few years by NJDEP and USEPA, Region 2 (R. Connell, NJDEP, personal communication, 2002).

Conclusions

Water quality, shellfish resource, and the economics of the shellfishing industry determine the acres of shellfish beds that are open in NY and NJ. Discharges from outfalls are also of concern and may determine if an area will be open to shellfishing. The shellfishing industry may never see direct harvesting harbor-wide in the NY-NJ Harbor due to the potential discharge from sewage treatment outfalls that can increase the bacteria levels in the Harbor that are harmful to human health. The only direct harvesting that exists in the NY-NJ Harbor is conducted seasonally in the Navesink and Shrewsbury Rivers from November to April. Even though shellfish cannot be directly harvested from all of the waters of the NY-NJ Harbor, there is a viable shellfishing industry in the Harbor through depuration and relay programs.

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